How do I?

An occasional series

This week: Choosing the "right" coax for your station

A look at coax cable, what it is, what it does and how to choose the best for your application.

I recently spent some time with "adventurous learner"-AL for short. AL is in the process of getting his amateur radio station set up. AL needed 2 lengths of coax cable; a run for his high frequency-HF antenna and one for his Very High Frequency-VHF antenna.

If you pick up an amateur radio catalog, you may be stymied by the myriad brands and specifications. I know I was.

First off, what is a coaxial cable?

Coaxial cable is an electrical cable that carries radio frequency signals.

I think most people are familiar with the American Wire Gauge: It is a way of communicating wire sizes. A #2 or #4 AWG cable may be used in very heavy duty uses such as car battery or jumper cables. #12 is common house wiring and extension cords. #14 and 16 are also used in appliance cords and extension cords. The higher the number, the thinner and less heavy duty the wire is.

Coax cable is rated by its Radio Guide or RG number. The higher the number, the thinner the center conductor is.

From https://uk.rs-online.com/web/generalDisplay.html?id=ideas-and-advice/coaxial-cable-guide

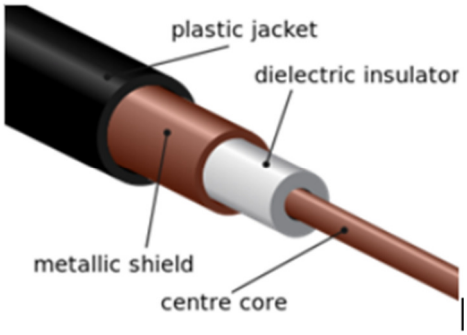
Coaxial cables are mainly built up of these four different layers:

1. A center conductor which is usually a copper wire, which data and video travels through
2. Surrounding the copper wire is a dielectric plastic insulator
3. A braided mesh made from copper then helps to shield the cable from electromagnetic interference (EMI)
4. The external layer is a plastic coating which protects the internal layers from damage

Coaxial cable works by carrying data in the center conductor, while the surrounding layers of shielding stop any signal loss (also called attenuation loss) and help reduce EMI.

The first layer, called the dielectric, provides distance between the core conductor and the outer layers, as well as some insulation.

The next layers, collectively referred to as the shield, keep electrical impulses and radio transmissions out. The different layers of a coaxial cable are shown in the image below:



Many of us are familiar with 75 Ohm coax cable used for television and video applications. These typically have a Type F connector. RG-6 and RG-11 and RG 59 are common sizes. We will confine our coax discussion to commonly used radio type cables.

Radio applications typically use 50 Ohm cable and have many more connector options.

Way back when I was shopping for cable for my station, I knew I need 50 Ohm coax. I knew what PL 259 and BNC connectors were, but not much else. The friendly folks at Ham Radio Outlet https://www.hamradio.com/ sent me a catalog when I was initially licensed and they were very helpful when I called. Even though I deal with other vendors, I still buy all of my longer coax cables from them.

Why?

1.) I believe in partnerships and they have been very good.

2.) This may seem trivial, but they always include plastic rubber caps to protect the connectors. Other vendors rarely do.

3.) HRO has, in my opinion, the best cable shopping guide in their catalog. It has been compressed over the years, but is still good.

What do I look for in a cable?

1.) What will it be used for? HF or VHF.UHF?

2.) Is it a primary run (say a 100' from antenna to house entry? Or a short jumper to say connect a SWR meter to a radio?

3.) Are there restrictions or needs? Do I need to bury it? Does it have to go through the weather seal on a car door?

Once I know the above, I can begin shopping. This is where the HRO catalog charts are very handy. They describe the various cable types and uses.

Radio Coax Types

RG8 is a “standard” outdoor cable. RG8U is often sold as direct burial, meaning the cable can be in direct contact with the ground and does not need run inside a liner. It can be used for HF or VHF, but often has variants that are better for one or the other.

RG 213, or RG 213U is usually best for HF and may be buried.

RG 58 is best for short runs, like jumper cables.

Times Microwave is an old and well-established coax manufacturer. They are well known for the LMR cables. They are described as LMR 200,LMR 240 and LMR 400. The higher the number, the less RF loss, but generally speaking, the cable becomes heavier and less flexible as the LMR number increases. You typically see articles stating the author used LMR 400 in their antenna run, particularly for base station VHF antennas.

What to look for in a coaxial cable:

Is it able to be buried directly in the soil?
Is it UV resistant?
What is the attenuation (signal loss) per 100 feet of cable in the bands I want to use it for?
What is the efficiency at the frequencies I want?
What does the manufacturer recommend it for?

Let's say I have an outdoor HF antenna and I am looking for a 100 foot coax cable to get from the feed point to the entry point to my station.

I see Cable X-Perts has several options:

Option 1

Attenuation (dB @100 feet)

- 50 MHz 1.1
- 150 MHz 1.9
- 450 MHz 3.3

Efficiency 84%

Direct Burial Yes

UV resistant Yes

Option 2

Attenuation (dB @100 feet)

- 10 MHz 0.51
- 30 MHz 0.9
- 50 Mhz 1.2

Efficiency 78%

Direct Burial No

UV resistant Yes

Option 3

Attenuation (dB @100 feet)

- 10 MHz 0.62
- 30 MHz 1.2

Efficiency 66%

Direct Burial Yes

UV resistant Yes

There are more options, but let's look at these three cables.

If I need to bury the cable, I am buying option 3. This is an HF run, In Option #1 the seller is giving numbers for 6 meters and higher frequencies.

In option 3, I am trading efficiency and a smidge of loss for the ability to bury it. If I do not need to bury, then I will chose option 2.

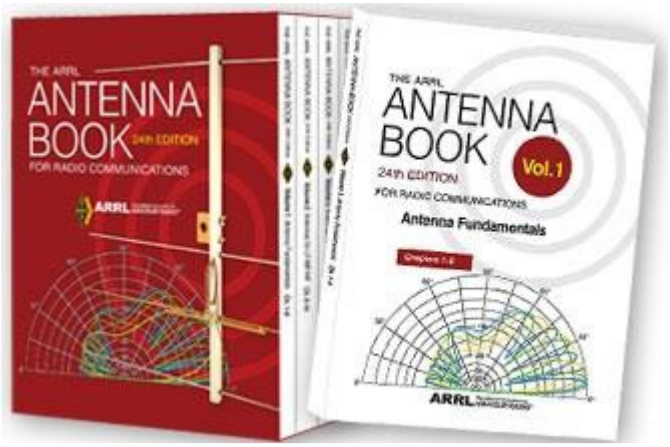
Connectors. This topic could be expanded into its own article or articles. The PL-259 and SO-239 are the standard male and female connectors found on HF and many VHF/UHF radios. For VHF work, the N connector is often found as they are tighter fitting and less lossy than the PL259/SO 239. In hand-held radios you may encounter BNC or SMA connectors. When buying cables, if buying pre-installed connectors, make sure they are the correct type and gender. You may find it is more cost effective to buy coax cable and install your own connectors. Historically, this required soldering, but in the last few years the compression connector has gone from reviled to mainstream.

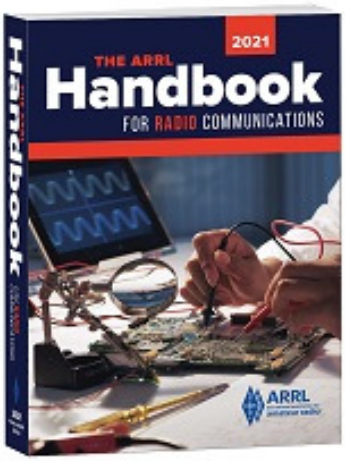
Tip: when running coax, always make a coil of 6 turns or so in the cable near the antenna feed point. Theoretically, the number of coils matters depending on cable length and frequency. I have found if I loop the coax cable around my elbow a half dozen times, like I am coiling electric fence wire, that seems to work. This helps keeps unwanted RF off the cable. Always allow some slack in the line. This helps reduce pressure on connectors and can help keep the cable from breaking internally.

For more information:

http://www.arrl.org/arrl-antenna-book

https://www.arrl.org/shop/ARRL-Handbook-2021-Softcover/





Choosing the right coax for your station doesn’t have to be challenging.