2025-09-09 Hamlet Net - Coax

Announcements:

- Test Session Info
    - Next VE session is Saturday, September 27th in the Clover Building at the Boulder County Fairgrounds, and starts at 9 am. It is a PVET session, so there is no fee to test. For more info, and to pre-register, see the Licensing/Testing page on the club web site, https://w0eno.org/, under the Education menu.
- Club Activities
    - Breakfast Saturday at 7:30 - 8:00 am at the Hidden Cafe.
    - LARC Members can now check out Club equipment via the Club web page at: https://w0eno.org/ - click on the 'LARC Equipment Check Out Form" link on the "LARC Equipment" menu item at the top of the web page once you log in.
- Upcoming General Meeting Topics
    - This month's General Meeting will be held on September 17th at the Clover Building at the Boulder County Fairgrounds. LARC equipment that is available to be checked out will be exhibited. We will be having food (hotdogs and hamburgers). Please bring a dish to share if you like. Please contact elmer@w0eno.org if you need a ride and would like to come socialize with other club members.
    - Elections for the Board will also be held. Your current Board has offered to stay on if the club wishes. If you would like to run for a Board position, please let one of the current board members know.
    - Proxy voting forms are up on the web site. If you are not able to vote in person at the September meeting, please vote via proxy as this will help us meet our quorum requirements. Proxy voting will be available starting the second week in September.
- Upcoming Club Volunteer Opportunities:
    - September 20th is Miner's Day in Fredrick. Looking for volunteers to help run a table at the event and also support the Burro race. For help at the table, contact Chuck (k0itp@w0eno.org). For the Burro race, contact Bob Henderson at wb0nrv@yahoo.com.
    - BARCFest is October 5th. LARC will have a table there, so if you can help staff it, please get in touch with him.

    - Foxhunt in October - Chuck is looking for someone to help find a location, place the fox, etc.
    - HAMCON Colorado 2025 for Rocky Mountain Division is October 23-26, 2025 in Grand Junction. For more information and to register, see their web site at: hamconcolorado.com They are also looking for presenters.
- Upcoming Radio Activities
    -
- If you are interested in find out more about the Amateur Radio Emergency Services (or ARES) in the local area, check out the Boulder County ARES web site at https://bouldercountyares.org/

  They have a VHF net on Monday nights at 8:00pm, as well as a DMR net on the 2nd, 3rd, and 4th Mondays at 8:30pm.
- If you are an ARRL member, remember that you have digital access to four magazines - QST, On the Air, QEX, and National Contest Journal.
- We have a new net on the LARC repeaters. It's run by Timothy Moss, KFØLAR, on the 22nd of every month at 6pm. The 22nd was chosen to highlight the average of 22 vets who commit suicide each day. While the purpose of the net is to connect veterans, non-vets are welcome to participate as most all of us have friends or family who are or have served.
- The ARRL Colorado Section Net occurs on the second Monday of the month from 7 to 8pm. The net is run by Amanda Alden, K1DDN, our Colorado ARRL section manager, and is open to hams and non-hams alike. This net is a place where Colorado hams can ask questions of ARRL leadership and request help, guidance, club support, and technical support. This net meets on the second Monday of each month at 7:00 pm Mountain time. The net is on the Colorado Connection, Rocky Mountain Ham Radio DMR Talk Group 700, The Fun Machine, WE0FUN, and the NCARC Buckhorn Repeater 447.700 – with 100 Hz tone.
- We have some volunteer opportunities available where you can help out LARC:
    - Photographer / videographer - record team activities and upload to web site / YouTube
    - Newsletter Editor - put together the monthly Splatter newsletter
    - Event Coordinator

- Time's up for this year, but you can earn your 2026 membership or future renewal by acting as NCS for at least 5 nets next year. You can run either this Tuesday night net or the Thursday night net (or both). We have scripts available for both, so all you need is a good connection into the repeater, and somewhere to keep track of names and call signs as people check in. If you're going to be on the net anyway, why not save some dough at the same time!

- Chuck has set a goal for the Club of running at least one activity a month. This can be a hands-on construction activity, an operating activity like Field Day, a fox hunt, or a special event station. The goal is to get people together to have fun with amateur radio! We have multiple locations at our disposal, as well as lots of Club equipment, so if you have an idea for something you think others hams would like to do, please let us know, and if you're willing to run it, even better!

- The Club is also looking for presentation topics for 2025. If you have any ideas, or better yet, would like to present, please let Chuck know and we'll get you on the schedule! We would like to get some presentations from club members on stuff they've been doing, projects they're working on, or just things that interest them.

- All club activities are open to anyone - members and non-members. If you have questions, ask them on a net or **send email to elmer@w0eno.org**

Presenter: Bryan, AFØW

Topic: Coax Cable

- After radios and antennas, coax cable is probably the next most-used item in amateur radio

- "Coax" is short for "coaxial" and refers to the design of the cable itself

    a. In the case of amateur radio, coax cable typically consists of a center conductor surrounded by a tubular dielectric insulator, which itself is surrounded by a tubular, metallic shield and finally a plastic jacket

    b. The term "coaxial" refers to the fact that each of these "layers" share the same geometric axis

- Normally, the outside of the shield is kept at ground potential and the signal-carrying voltage is applied to the center conductor

- Coaxial cable is a type of transmission line which is designed to carry high-frequency electrical signals with low losses

- If you've not had experience with coax cable in amateur radio, you may have used it when connecting an antenna or cable system to your TV

- It is typically a round, black or white cable with some sort of connector installed at each end
- Let's look at each of these pieces in detail

Center Conductor

- The center conductor is typically made of copper for amateur radio uses
- It can be either solid or made up of multiple strands of small wire
- Cables with solid center conductors are less flexible than those with stranded conductors

Dielectric Insulator

- To maintain the proper physical properties of the cable, the center and shield conductors must be separated electrically by a certain distance along the entire cable
- The dielectric insulator is responsible for this task
- Different materials may be used, such as solid plastic, foam plastic, or air
    a. Solid polyethylene, or PE, is used in some lower-loss cables, but does not have much flexibility
    b. In some larger cables, the dielectric is air. There is a spiral-wrapped plastic spreader that is used to maintain the correct physical separation along the cable
    c. Pressurized air or nitrogen is sometimes used in cables where there is a need to monitor cable integrity (against damage or attempts to surreptitiously tap into the cable)
    d. There are also cables designed to use a vacuum instead of air
- A typical dielectric used in amateur radio coaxial cables is polyethylene foam, sometimes listed as "PF," which is more flexible than the solid polyethylene insulators
    a. As a foam, it also contains air or some other gas, further improving its dielectric properties

Shield

- Frequently referred to in amateur radio as the "braid," the shield of a coax cable is the second conductor
- It is typically constructed of braided copper wire to allow the cable to flex
- This does result in gaps in the shield layer

    a. Many coax suppliers actually list the percent of coverage as part of their cable specifications

    b. For example, DX Engineering sells RG-8X coax with a shield coverage of 96-97%

    c. Cheaper coax such as from Radio Shack has a reputation of having a thin shield with a loose weave which results in low coverage, and while it may be acceptable for HF, it's not good for VHF and above

- Interestingly enough, there is actually a real-world use for "lossy" coaxial cables

    a. They are used in underground mines to enable the use of radios to communicate throughout the underground tunnels as well as to the surface

    b. They are called "leaky feeder cables"

Cable Jacket

- The outer shield serves multiple purposes
- One is to physically protect the shield (and other cable components) from abrasion
- It also protects against moisture, which can severely compromise the cable
- Some jackets also protect against ultraviolet light, which is important for cables used outdoors, such as for feedlines to antennas
- Some cables are also rated for direct burial in the ground - again, the jacket is the primary protection for the cable in these cases
- The jacketing can also affect the flexibility of the cable
- A common jacket material is PVC, but this is not UV-resistant

Transmission Lines

- One other important property of a coax is the characteristic impedance of the cable
- In electrical engineering, a "transmission line" is a specialized cable designed to conduct electromagnetic waves in a contained manner
- This happens when the conductors are long enough that the wave nature of the transmission line must be taken into account
- Some of the major benefits of using coaxial cable as a feedline in an amateur station
    - Nearly all the electromagnetic wave is confined to the area inside the cable

    - Another big one is that the cable can be bent without negative effects
    - It can also be mounted to or run near conductive materials, such as metal antenna masts, rain gutters, and metal-framed windows
- Coaxial cables are not the only types of transmission lines - in amateur radio, we also have open-wire, window line and twin lead, to name a few
- As 50 ohms is used for amateur radio, a cable with a characteristic impedance of 50 ohms will "match" this impedance - using a cable with a different characteristic impedance can result in reflections when connected to a 50 ohm radio or antenna
- The coax used for cable TV and video applications typically has a 75 ohm characteristic impedance
    - This does not mean that it cannot be used for amateur applications - only that you must take this impedance mismatch into account

Choosing the Right Cable

- So with all the different combinations of components that can be used in a coax cable, how do you go about selecting one?
- When selecting a coax cable, there are a number of things you should take into account:
    a. The characteristic impedance of the cable - typically 50 ohms for amateur use
    b. The signal loss at the frequency at which you are operating
    c. The power handling capability of the cable
    d. The diameter and weight of the cable
    e. The flexibility of the cable
    f. Any required environmental resistance of the cable
- As with many things in amateur radio, the cable you select may end up being a compromise between features, requirements, and cost
- Signal loss at operating frequencies becomes a concern at higher frequencies
    a. Cable that has acceptable losses for HF may be too lossy for UHF use, for example
    b. The loss per length (frequently either 100 meters or 100 feet) is typically specified

    c. Cables used for short runs, such as between components in your shack, will experience less overall loss than long cables such as feedlines to an outdoor antenna

    d. There are also many online references and calculators to help you make an informed choice - I've included some in the notes for this presentation

    e. A common coax, RG-8X has a loss at HF frequencies of around 1 dB per foot and 8 dB per foot at VHF frequencies.

- There isn't really a naming convention for all the different varieties of coaxial cable

    a. The "RG" nomenclature, as in "RG-58" stands for "Radio Guide" and is the original military specification for coaxial cables that dates back to World War II and is now referred to by the Mil-C-17 standard (https://nepp.nasa.gov/docuploads/96D38FB4-6F63-45A5-8CB5ABCA633430EB/MIL-C-17.pdf). Here is a web site with a table to characteristics: https://www.rfcafe.com/references/electrical/coax-chart.htm

    b. The numbers in the designation are somewhat arbitrary and are not always indicative of the specific form and function of the cable itself, so make sure you examine the specifications of any major coax purchases

- Different coax cables have different power-handling capabilities

    a. A cable that works for connecting your HT to a tape measure Yagi may not be able to handle connecting your 1500 watt amplifier to your antenna tuner!

    b. For receive-only or low-power QRP use, coax power rating is not an issue

- Coax cable comes in many different diameters - obviously, larger-diameter cable is going to weigh more

    a. This may matter if you are putting together a GoBox or QRP setup for a backpack

    b. Larger diameter cable is also likely to be less flexible - a larger-diameter, lower-loss cable may look good on paper, but not practical to use with an HT

    c. Some commonly-used coax cables are RG-8X which has a diameter of .242 inches, and LMR-400, which has an outer diameter of 0.405 inches.

- Cable flexibility is important - you don't want an inflexible cable if you need to make short jumpers between devices, if you frequency rearrange your operating position, or for use with antenna rotators

    a. One thing to keep in mind is that solid core conductors are easier to terminate if you plan on installing the cable connectors yourself

- Environmental resistance was mentioned briefly when discussion cable jackets

    a. Probably the biggest concern is to make sure you have UV-resistant cable if you plan to use it for permanent outdoor runs

Coax Cable Info

- Here are some typical coax cable types used in amateur radio:
- RG-58 (and LMR-200) is a lightweight cable with an outside diameter of 0.194 inches and is a standard cable for mobile installations.

    a. RG-58 is good for 1000 watts at 10 MHz, around 200 watts for VHF, and 135 watts for UHF

- RG-8X (and LMR-240) is a larger cable with a diameter of 0.242 inches, with lower loss than RG-58

    a. A rule of thumb is that it is good for runs up to 50 feet at 50 MHz and below

    b. Up to 146 MHz, it is good for runs up to 25 feet

    c. RG-8X is good for 1500 watts at 10 MHz, but only around 550 watts for VHF and 250 watts for UHF

- RG-8U (and LMR-400) in larger yet, with a diameter of 0.405 inches, and is a good general-purpose cable, especially for long cable runs

    a. It is good for up to 3500 watts at 10 MHz, 975 watts at VHF and 450 watts at UHF

- Another thing to keep in mind when you are sourcing cables is whether you want to buy unterminated bulk cable and cut it and install your own connectors, or whether you want pre-terminated cables

Where to Buy

- So where do you buy coax cable?
- If you typically order online from places like Amazon or eBay, you need to be very careful and make sure you are ordering from a reputable vendor and are actually getting what you are ordering

    a. As with everything nowadays, there are many knockoffs with dubious quality

b. These sites also have a lot of "no-name" cable

    - Sticking to a known good manufacturer such as Times Microwave, Belden, Davis RF, ABR Industries, Cable Experts and Messi & Paoloni will help ensure you have a good experience

c. Your antenna system is a major component of your amateur station - you don't want to unknowingly buy inadequate cable as it can affect your station performance significantly

- Amateur radio related businesses are a much better place to look - some examples are:

    a. Ham Radio Outlet, or HRO (https://www.hamradio.com/), is a great choice as you can drive down to Denver and actually look over the product before purchasing (as well as getting assistance and opinions from other hams on what to buy)

        - If you would rather order online, you can do that as well

    b. DX Engineering (https://www.dxengineering.com/) sells many brands of coax cable, including their own

        - They also have a custom cable service where you select your cable type and manufacturer, length, and connectors at each end, and they will assemble and ship you a finished cable

    c. Gigaparts (https://www.gigaparts.com/) is another vendor with a good reputation

- eHam.net has a review section specifically for feedlines

    a. If you want to see what others think of a specific cable type, this can be a place to get some information

- Another source of coax cable are hamfests or silent-key sales

    a. You do need to be careful about the condition of the cable anytime you purchase used from any source

    b. One the primary threats to coaxial cables is moisture

        - Water enters the cable via a damaged outer jacket or the connector and causes corrosion on the metallic conductors inside the cable, resulting in a defective cable

        - If the cable is brand new and unused, it's probably a safe buy, but still check to make sure there hasn't been any degradation in the jacket

Summary

- Hopefully this has given you some insight into coaxial cable, and given you information that will help when selecting it for your own station

Questions:

- **The question for the week is:** Do you have different types of coax in your station, and how did you go about selecting them?
- **In my case,** I've got a bunch of different types of coax:
    a. The first that I purchased was from HRO, and I just went with the salesman's suggestion. It was 75 (or 100) feet of pre-terminated coax - I don't remember the manufacturer. I'm still using it for the feedline to my G5RV Jr. wire antenna in my backyard.
    b. I have a bunch of short jumper cables that I use between the equipment in my shack. I think a lot of this may be the "no-name coax" from Amazon/eBay I mentioned earlier.
    c. I also terminated a few pieces of coax myself.
    d. I have two eggbeater antennas in my attic for satellite use - one for VHF and one for UHF. I have 50 foot runs of Times Microwave LMR-400 for these antennas
    e. I also have an Ed Fong dual-band antenna connected to 50 feet of RG-8X coax that I ordered from Ed along with the antenna

More Info:

- Coaxial Cable (Wikipedia): https://en.wikipedia.org/wiki/Coaxial_cable
- Coaxial Cable Characteristics and Data Used in Amateur Radio Stations: https://www.hamuniverse.com/coaxdata.html
- Leaky Feeder Cable (Wikipedia): https://en.wikipedia.org/wiki/Leaky_feeder
- Transmission Line (Wikipedia): https://en.wikipedia.org/wiki/Transmission_line
- Cable Attenuation and Power Calculator: https://timesmicrowave.com/calculator/?productId=121#form
- Times Microwave Systems LMR-400 Coax Specifications: https://timesmicrowave.com/wp-content/uploads/2022/06/lmr-400-datasheet-1.pdf
- RG-58 (Wikipedia): https://en.wikipedia.org/wiki/RG-58
- eHam Feedline Reviews: https://eham.net/reviews/view-category?id=7

Email to elmer@w0eno.org

- If you have ideas for net topics or general meeting topics / presenters, please let us know! Tell us on a net, or send email to k0itp@w0eno.org

Email to elmer@w0eno.org

1. KØDBL - Don - Boulder
2. KØITP - Chuck - Firestone
3. KFØUSF - David - Longmont
4. AFØW - Bryan - Longmont
5. AFØXS - John - Thornton
6. ADØUF - David - Loveland
7. WØMYK - Mike - Longmont

End: 7:55pm

- David's setup is a great idea - Use a thin, flexible cable to your radio, so you don't have a thick cable putting strain on your antenna connector.

- I came across a cool ham map web site: https://haminfo.tetranz.com/ You enter a callsign, grid square, zip code or address, and it displays a map centered around that area with pins for licensed amateurs. There are more people around in my area than I expected! It does seem to have some limitations if you try to zoom out too wide, however.

- QRZ has a new "real time QSO manager" feature that they're beta testing.

    - From their description, it sounds a bit like a spotting network, but instead of relying on other operators to post your information, you do it yourself. They suggest that you can then either call CQ or just sit back and wait for a call to come in (since you've essentially already called CQ using the RTQM").

    - You use the system by entering your location, frequency and mode which are then represented by a pin on a world map. Users can use this information to make QSOs. The pin is automatically removed after 30 minutes unless refreshed by you or someone working you. This is done to keep the information on the map fresh.

For more info, see: https://forums.qrz.com/index.php?threads/qrzs-newest-feature-rtqm.965277/