Microvolt

Monthly newsletter of the Utah Amateur Radio Club

January 2025

Transmission lines

A *transmission line* is a conductor that's used as a path for electrical energy. To an electrician or a commercial utility worker, it's a wire that carries electricity to our homes and businesses over long distances. In the circle of amateur radio, our discussions about transmission lines usually surround the pair of conductors that carry a radio signal from the transceiver to the antenna and back. In this issue, let's explore how understanding those conductors can be meaningful to us beyond being a simple pair of wires.

Cover – Transmission lines

In the RF (radio frequency) world, transmission line pairs carrying electrical signals are much more than just wires. Their physical characteristics have been studied extensively, but due in part to their deeply technical nature with respect to radio signal behavior, they've been the subject of a large amount of myths and misunderstanding.

Because we use a transmission line to "feed" RF electrical signals to an antenna, we call it a ***feed line***. In today's amateur radio world, the feed line of choice is overwhelmingly ***coax*** (coaxial cable), because of its low cost and high immunity to noise, although others are available.

Impedance is the opposition to current flow, is frequency-dependent, and its value is expressed as a complex number, with the units *ohms*. Each transmission line pair possesses a ***characteristic impedance***, which is a property that's derived from the wire material, geometry, and insulation that separates the conductors. The characteristic impedance of most coax used in amateur radio is 50 ohms.

If you were to measure the resistance between the conductors of a coax cable alone, the meter will likely read infinite, or like an open circuit, because the two conductors are not physically in contact with each other. Properly measuring transmission line properties requires a VNA (vector network analyzer), although many antenna analyzers can perform the measurement.

The transmission line characteristic impedance is important because it's the value that must be presented by the load at the end of the line, to provide for the most signal power transferred by the line to the load. In our case, the applicable load is the antenna, so to allow for *maximum power transfer*, the antenna must also ***match*** the feed line characteristic impedance by presenting an impedance of 50 ohms itself. When an RF signal traveling on a feed line reaches the load, and the load impedance does not match that of the feed line, a portion of the signal is ***reflected*** by the load onto the feed line back toward its source, the transceiver.

A common misconception about feed line reflections is that the reflected signal is lost. It's true that, reflected or not, some of the signal is lost as heat as it travels in the transmission line, and a tiny bit in other things (tuner, meter, connectors) that are connected in between. But the signal that's reflected back from the antenna and reaches the transceiver is not lost, but is re-reflected by the transceiver and sent back to the antenna. Hence, the term "return loss" referenced by some is a misleading misnomer.

The signal losses in the transmission line can therefore be reduced if the signal does not need to travel down the line more than once. Again, to achieve this "single-trip" operation requires an antenna whose feed point impedance matches that of the transmission line. Unfortunately, even the most carefully crafted antenna often does not exhibit a 50-ohm impedance at the antenna ***feed point***, the location where the feed line meets the antenna.

Antenna makers often take steps to correct, or at least minimize the mis-match between the antenna and the feed line by applying some sort of circuit that will transform the antenna impedance into something close to the feed line impedance. One way is through a passive matching network, and another popular way is by an active (requires power to perform its function) device called a ***tuner***.

Finally, unique to coax is the fact that a completely balanced RF signal will travel on the outside of the center conductor and inside the braid or outer conductor through the skin effect. However, if an RF signal returns to the coax in an unbalanced fashion, such as from an off-center-fed or end-fed antenna, some of the return signal will also flow on the outside of the braid, an undesirable condition known as ***common-mode current***, which can be reduced by an RF choke or isolator.

So, an otherwise innocent-looking pair of wires can perform like a very complex device, and that's the nature of transmission lines.

Microvolt editorial staff

Editorial – Feed line variety

A ***feed line*** is any pair of conductors used for conveying an RF (radio frequency) signal from a transceiver to a component (antenna, tuner, meter, amplifier, etc.) in an antenna system. Through the years, amateurs have used a variety of feed line types, and the two most common categories can be generalized as *balanced* and *unbalanced*. Balanced means the two conductors are of identical material, geometry, and size, where unbalanced means the two conductors differ in any of these respects. Let's explore the two classifications, by popularity.

Coax

Coax (coaxial cable) is so-called because its two conductors are typically cylindrical in shape and share the same axis (co-axial). It's the most common type of amateur radio transmission line in use today, because of its low cost and high resistance to coupling and RFI (radio frequency interference) noise. These characteristics make coax easy to work with, since it relieves the operator from the concern of routing it near metal or even near other signal sources, such as household mains current. Here are the most common models of 50-ohm coax in amateur use today, not in any particular order:

- **RG-8X** : highly recommended for HF under 100 feet and VHF under 50 feet (lossy)
- **RG-8** : highly recommended for HF and VHF under 100 feet (mildly lossy)
- **LMR-400** : highly recommended for HF and VHF under 200 feet (expensive)
- **LMR-240** : highly recommended for HF under 100 feet and VHF under 50 feet (mildly lossy)
- **RG-213** : recommended for HF under 200 feet and VHF under 100 feet (mildly lossy and expensive)
- **RG-174** : recommended for mobile installations under 20 feet (very lossy)
- **RG-58** : only recommended for lengths under 20 feet (very lossy)

Hardline coax

One type of coax that's used on repeater, broadcast, and other high-power or loss-critical installations is ***hardline***, so-called because it uses a solid (often corrugated) shield around the dielectric instead of a braid. One hardline model known as *Heliax* contains an air dielectric, whose center conductor is held in place by a plastic spiral.

75-ohm alternatives

Most modern amateur radio transceivers and components require an attachment to transmission lines that exhibit a 50-ohm impedance. But 75-ohm coax (used primarily for cable TV) can also be used for amateur radio feed lines, provided the operator understands how it affects the antenna system.

- **RG-6**
- **RG-59**

Coax designations

Most coax cables are marked with prefixes, suffixes, or other lettering that identifies properties of the particular model, especially of the outer jacket. Unfortunately, there is not a standard designation agreed upon by different manufacturers, but among the more common suffixes are /U ("utility"), DB (direct burial), UF (ultra-flexible), and more. Other jacket types include some that are rodent-resistant (distasteful to rodents) and fire-resistant.

Parallel line

A set of two parallel wires can also make up a transmission line pair, and is called *balanced* because both of its conductors are identical in material, shape, length, and density. It typically exhibits lower loss than does coax, but is very susceptible to coupling with (and interference from) nearby conductive objects. These include

- **Ladder line / window line** (300-ohm and 450-ohm varieties are the most common)
- **Twin-lead / ribbon** (once common on TV sets, typically 300 ohms)
- **Open wire line** (OWL) (typically 600 ohms)
- **Twisted pair** (impedance varies between 100 ohms and 150 ohms)

Anything to add? Email ***editor@utaharc.org***

Letters to the editor

Dear Editor:

What's the best way to route my coax around a corner without damaging it by bending?

EJ in Stansbury Park

Dear EJ:

Great question! I recommend using two lengths of coax on either side of a **right-angle connector** that has an SO-239 connector on both ends. With an insertion loss of 0.1 dB at 2 meters, it'll only cost you $1 - 10^{(-0.1/10)} = 2.3\%$ of your signal, and at HF frequencies, much less than that.

Dear Editor:

So, how did the club do at Field Day? I heard the results are out, but I didn't see where they're posted.

Steve in Holladay

Dear Steve:

The Field Day results are posted in *QRZ* magazine (available to ARRL members) annually around November or December. Here are the 2024 results for the top nine Utah entries (we are W7SP):

Call	GOTA Call	Final Score	Category	Section
K7UVA	K7GSL	7901	3A	UT
W7SP		4060	3A	UT
K7KC		3962	3D	UT
W7RCH		2916	1F	UT
W7BAR	KG7VYS	2891	4A	UT
W7CXX		2440	1D	UT
WI7P		2114	2E	UT
W7SU	KZ7O	1962	2A	UT
K7EA		1950	1F	UT

Dear Editor:

HTs (handheld transceivers) seem to be rather useless to me. It seems like people always have a hard time hearing me, and people often complain that I'm not holding the repeater when I'm using one. What good are they?

Jill in Sandy

Dear Jill:

I have a close friend who has a J-pole mounted on his house roof, and a Diamond antenna mounted on his car roof. He keeps his HT in the charging cradle 24/7, and when he needs to use it in the house, he removes the HT from its charging cradle and attaches it to the coax going to his J-pole. When he drives to some place, he again removes the HT and attaches it to his car antenna. In both cases, people rarely complain about his signal or his audio.

Dear Editor:

Are phonetics required by law to be used on the air?

Tom in Jackson Hole

Dear Tom:

The law does not require anybody to use phonetics, on the radio or elsewhere. Some groups, such as local nets, an ARES team, special event, or a club activity might have leaders that require phonetics be used for call signs and names, but those requirements are imposed by their own group, and not by any legal or widely recognized organization.

Dear Editor:

Is there a list of foul or obscene words that are forbidden on the radio?

Lily in Murray

Dear Lily:

There is not a published list that I'm aware of; the FCC asks us to use good judgment.

Send your thoughts to ***editor@utaharc.org***

Club news

Cycle 25 propagation

Even though he had to leave town early the following morning, Carl Luetzelschwab K9LA of Fort Wayne, Indiana, was gracious enough to present a fabulous discussion on ham radio propagation due to solar Cycle 25 over Zoom.

Carl engaged us with a knowledge of the basics of skywave propagation using LF, MF, and HF, plus tropospheric ducting on 2 meters.

Elections

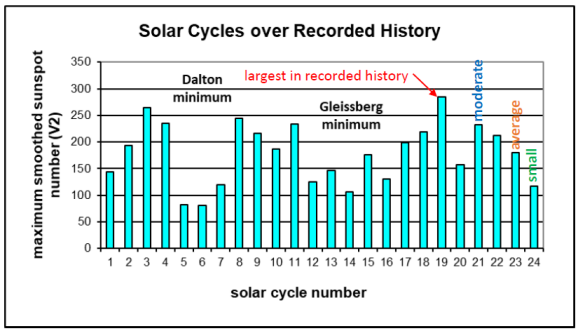
We held perhaps the most boring and uneventful elections ever held in club history. All the 2024 UARC Board officers tossed in their hats for re-election, and within twenty seconds, all were subsequently re-elected to their respective roles without contest. They are listed on the last page of each *Microvolt* issue for 2025.

You can see the video presentation here.
Visit the club YouTube channel to view past club meeting presentations.

(Photo courtesy Mike McAinsh KI7MTI, et al)

All Previous Solar Cycles

- Cycle 1 began in 1755
  - Maunder Minimum (few sunspots) occurred from 1645-1715
- We've gone through 3 periods of big solar cycles and 2 periods of small solar cycles
  - We appear to be in a third period of small solar cycles
- Cycle 24 was the smallest in our lifetimes
  - 4th smallest in recorded history



Will Cycle 25 get us out of this apparent third period of small solar cycles?

Utah ARC - K9LA - December 2024 3

UARC is NOT hosting Winter Field Day for 2025

We tossed around the idea of whether we should join the rest of the nation and put together a Winter Field Day event for the first time in many years. In the end, there was just too much to do in such a short amount of time, that we decided to recommend that our membership participate with another club who has already organized a WFD event, such as BARC or DCARC or UVARC.

For your information

Information title placeholder

Awaiting information placeholder

Winter Field Day 2025

UARC does NOT plan to participate in Winter Field Day this year, but encourages you to get involved with another club that's participating. WFD takes place from noon Saturday January 25 through noon Sunday January 26.

Field Day 2025

Saturday noon 28 June through Sunday noon 29 June **near Payson Lakes**. We plan to start setting up Thursday night about 6:00 pm.

License classes

Salt Lake:

General : Tuesdays 7:00 pm to 9:00 pm
147.160+ MHz (127.3 Hz tone)

Orem:

Technician : 4 Tuesdays, 6:30 to 8:30 pm
Jan 21, Jan 28, Feb 4, Feb 11
Visit **psclass.orem.org** to register ($10)
Orem Traffic Training Room, 95 E Center St
HamStudy.org account required
Email **nojiratz@hotmail.com** for info

Eagle Mountain:

Technician : 5 Thursdays, 7 to 9 pm
Feb 6, Feb 13, Feb 20, Feb 27, Mar 6
Email **ki6oss6365@gmail.com** to register (free)
Eagle Mountain City Hall, 1650 Stagecoach Run

Exam sessions

Salt Lake County:

- Email Garth Wiscombe W7PS **w7ps@arrl.net**
  May 20, Jun 24, Jul 29, Aug 25, Sep 30, Oct 28, Nov 25
- Email Rick Morrison W7RIK **w7rik@arrl.net**

Utah County:

- Wed 19 Jun 7:00 pm : **Provo** : **signup**
- Wed 17 Jun 7:00 pm : **Provo** : **signup**
- Sat 22 Jun 10:00 am : **Eagle Mtn** : **signup**

Club repeaters

Farnsworth Peak : 146.620– MHz (no tone)
Scott Hill : 146.620– MHz (no tone)
Lake Mountain : 146.760– MHz (no tone)

SDRs and beacons

Northern Utah WebSDR : **sdrutah.org**
KK7AVS SDR : **k7xrd.club**
N7RIX SDR : **https://sdr.n7rix.com**
K7JL beacon 28.2493 MHz

HF remote and club transceiver stations

If you'd like to learn how to get started using the remote stations, visit the **HF Remotes link** on **the club website**:
https://user.xmission.com/~uarc/HFRemote.html

How can I help?

Reach out to the club leadership by sending an email to **uarc@xmission.com**. Also, add to this page by emailing **editor@utaharc.org**

Spotlight – Dan Lundwall N7XDL

In 1980, while serving a 2-year mission for the Church of Jesus Christ of Latter-day Saints in Concepcion, Chile, Dan Lundwall and his companion chanced upon the home of a ham radio operator with a tall antenna on his property. The man explained that one can communicate far away, and used his setup to demonstrate a phone patch connection, by which Dan was able to talk with his family back in the US. *Every sentence ended in an "over...", which took a little getting used to. But after that, I was hooked!*

The Morse code requirement was such a stumbling block for Dan, that he had to lay aside amateur radio until the requirement was lifted. In 2015, he began studying the Gordon West materials in earnest, and soon received his Technician Class license. In 2017, Dan upgraded the General Class, and started the Murray Amateur Radio Club (MARC), which is sponsored by the Murray City Fire Department, and of which he is currently the president. Today Dan is N7XDL.

I enjoy the hobby now because it enables me to always find a great group of people wherever I travel. I love to participate in any activity that lets me use my radios, like UtahSAG for example. There's nothing better than for me to ride my Goldwing (ham radio equipped), assisting the bicyclists in the various rides throughout the year.

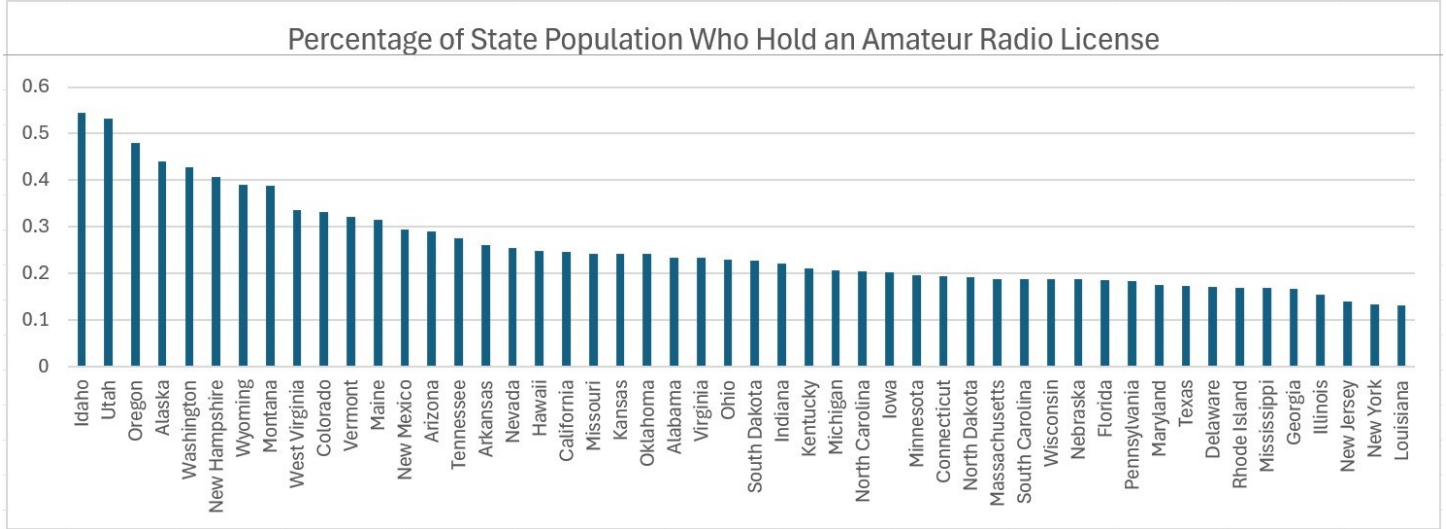
Dan is also a member of UARC, SLCOARES, UVARC, as well as an amateur radio club in Minnesota, and is the Salt Lake County Emergency Coordinator. He currently works as a software engineer, but he says he's ready to retire. Dan and his wife Jill have four kids. He enjoys photography, skating, and is a Kung Fu instructor.

We wish you the best in all you do, Dan!

– 73 from Linda Reeder N7HVF

2024 per-capita numbers of amateurs

It seems in Utah, that amateur radio has enjoyed a relatively strong heyday. Knowing of the active involvement of many people in our hobby in this area, we began to wonder whether our state is unique in terms of how many licensed radio amateurs reside here. In order to answer this question, we analyzed the number of licensed operators residing in each state compared with the overall state population and examined the data. It turns out that Utah does indeed harbor more hams per capita than almost any other state, with only Idaho being ahead by a narrow margin, one ten-thousandth of a percentage point – essentially identical. Following Idaho and Utah, Oregon, Alaska, and Washington round off the top five. Although the lowest of them, Washington, comes out at 0.428 %, the Idaho-Utah number of 0.54 % is still substantially higher.



It's curious to note that not only are we in Utah seemingly ahead, but also by a large margin. We've included a histogram (next page) that shows the frequency of states that fall within set ranges of operators per capita. Between all states, there is an average of 0.256 % of the population being licensed, whereas Utah clocks in at 0.532 %, a difference of almost three standard deviations above the mean of the data set (for all you statisticians out there, this number would be more useful if the data followed a "normal distribution", but we do like the sound of 3 sigma above the mean). In fact, 76 % of the states in the US have 0.2 % licensed hams or less. It seems that in Utah, we're well ahead of the curve, we would love even more come and join us.

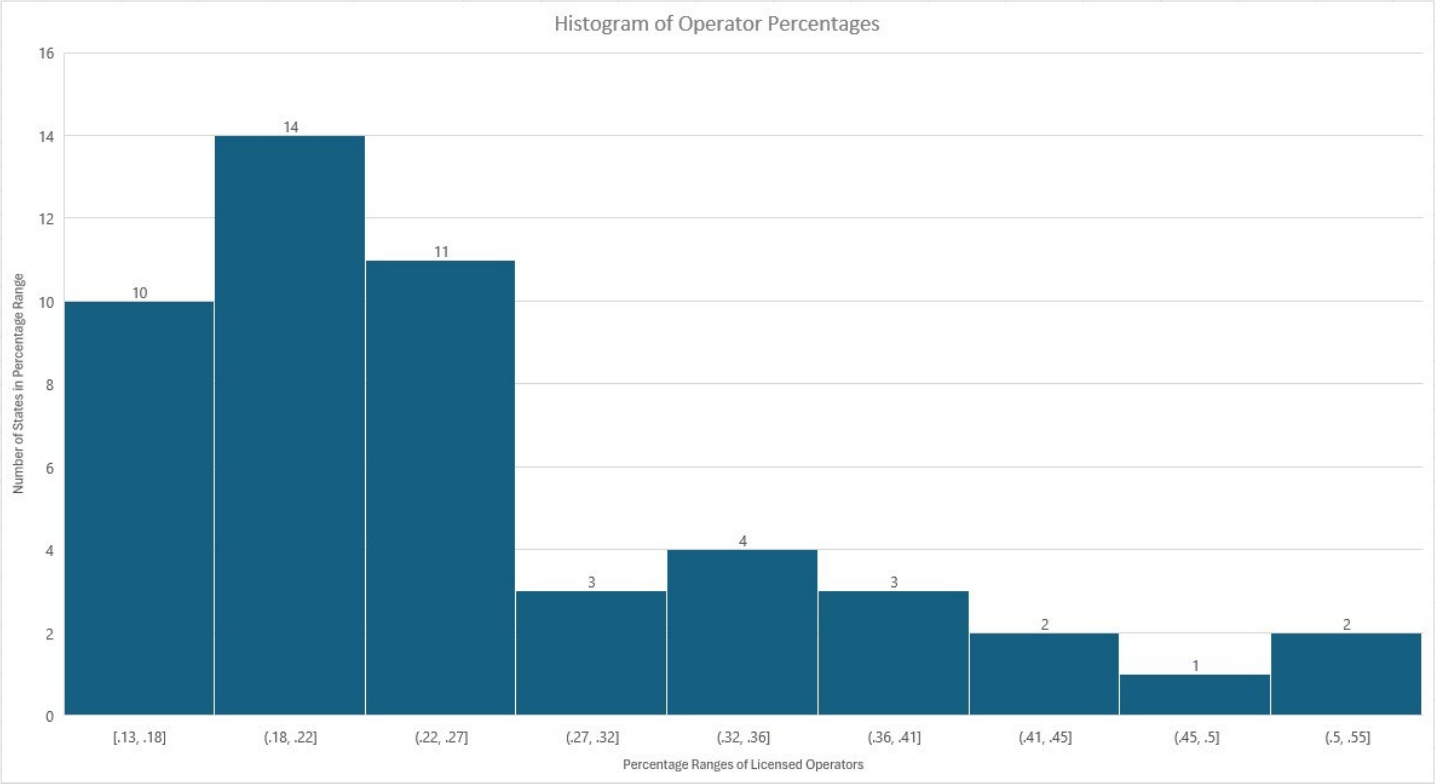
There are other interesting facts in the data, as well. Of the top twenty states, eleven of them (thirteen if you count Alaska and Hawaii) are in the west: Idaho, Utah, Oregon, Alaska, Washington, Wyoming, Montana, Colorado, New Mexico, Arizona, Nevada, Hawaii, and California. (This means ***every*** state in the West – no more, no less.) Of the lower twenty states, eight are from the Northeast (Connecticut, Massachusetts, Pennsylvania, Maryland, Delaware, Rhode Island, New Jersey, and New York), six are from the South (South Carolina, Florida, Texas, Mississippi, Georgia, and Louisiana), and six are from the Midwest (Iowa, Minnesota, North Dakota, Wisconsin, Nebraska, and Illinois).

The averages for each general USA region (not call district) (Note also that these are not the National Geographic Society regions of 1948, which are much less intuitive):

- The West: Idaho, Utah, Oregon, Alaska, Washington, Wyoming, Montana, Colorado, New Mexico, Arizona, Nevada, Hawaii, and California: 0.3748 %

2024 per-capita, continued

- The South: Tennessee, Arkansas, Missouri, Oklahoma, Alabama, Virginia, Kentucky, North Carolina, South Carolina, Florida, Texas, Mississippi, Georgia, and Louisiana: 0.2087 %
- The Northeast: New Hampshire, Vermont, Maine, West Virginia, Connecticut, Massachusetts, Pennsylvania, Maryland, Delaware, Rhode Island, New Jersey, and New York: 0.2279 %
- The Midwest: Kansas, Ohio, South Dakota, Indiana, Michigan, Iowa, Minnesota, North Dakota, Wisconsin, Nebraska, and Illinois): 0.2046 %



The medians for each USA region:

- The West: 0.3888%
- The South: 0.2081%
- The Northeast: 0.1864%
- The Midwest: 0.2032%

References

US population by state, 2024 : https://worldpopulationreview.com/states

Ham population by state, 2024 : https://www.arrl.org/fcc-license-counts

– James Edwards AB7XT and Shon Edwards KK1JX

Tech corner – Coax continuity tester

Have you ever suspected that your coax had a break in its center conductor or that your coax shield and center might be shorted? Couple that with the fact that the leads of your ohmmeter were not long enough to reach between one end of your coax and the other end outside on your roof. Well, here's an easy solution, but it's still going to require your ohmmeter.

It's nothing more than a 100-ohm resistor soldered between the center pin and the flange of an SO-239 "bulkhead" (chassis-mount) connector. The idea is to install it on one end of your coax and measure the resistance at the other end. If both the shield and the center conductor of your coax are continuous, the ohmmeter should read about 100 ohms, give or take.

This works for most common coax types, such as RG-58, RG-8X, LMR-400, RG-213, LMR-240, RG-8, and others. And it works for coax lengths up to 300 feet. What it won't tell you is which side (the center or the shield) is broken, if the resistance reads infinite. And it won't tell you where the short is, if it reads zero ohms, but at least you'll be *aware* of some of its limitations.

Parts list

One SO-239 "bulkhead" connector

One 100-ohm 1/4-watt 1% resistor

SO-239 "bulkheads"

Construction

Attach the PL-259 connector of one end of any coaxial cable onto the SO-239 bulkhead. This provides for both a heat sink and a center stabilizer, in case you get the Teflon dielectric too hot. Cut both ends of the 100-ohm resistor to leave about ¾″ of wire on each end. Solder one wire of the 100-ohm resistor to the inside cup of the center pin of the SO-239 bulkhead, and allow it to cool.

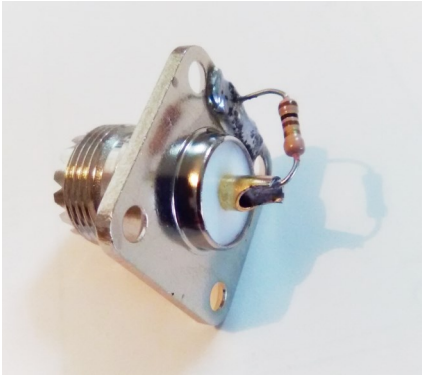
PL-259 heat sink

Using a hot (60 watts or greater) soldering iron, solder the other wire of the 100-ohm resistor to the flange of the SO-239 bulkhead. The flange is a terrific heat sink, and will require lots of heat, so this step must be done as hotly and as quickly as possible. Furthermore, what this joint will need is a lot of solder flux, rather than just solder, to get the solder to bond with the flange.

Conclusion

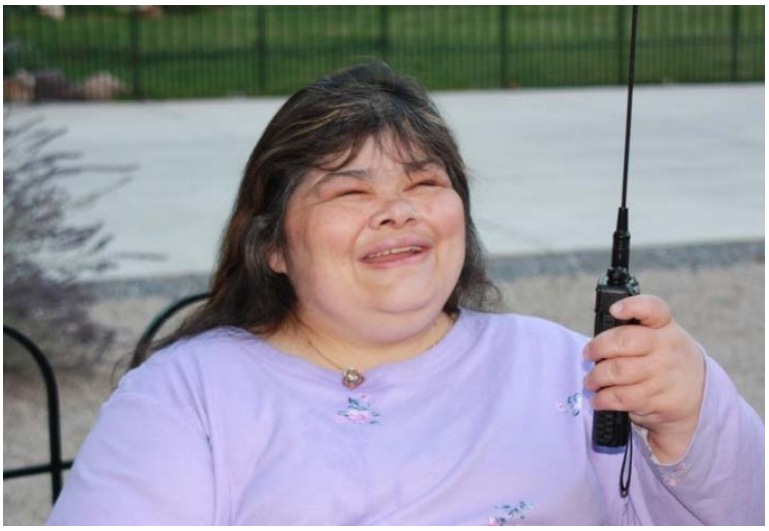
Alright, this was a rather simple project for a *Tech Corner* column in the newsletter. Ideally, I could provide beeping circuitry to replace the ohmmeter. But I've used this so often, I figured I might as well share one of my simple, secret tools, to help make my amateur life a bit easier.

Noji Ratzlaff KNØJI



The finished product

Silent key – Cindi Vega KJ7ZLJ



Just a few days before Thanksgiving 2024, our friend Cindi Vega KJ7ZLJ returned home to her maker.

Having been born blind in 1971, Cindi had attended schools for the blind in Ogden and Salt Lake City, and eventually became an advocate for individuals with disabilities during much of her life. She even read braille during masses at St. Thomas More Parish in Cottonwood Heights. Cindi graduated from Brighton High School in 1991, and with a bachelor's degree from Weber State University in 1997.

While at Weber State, Cindi encountered Bill Mullett AB7MO (now SK), who helped her study for and obtain her Technician Class license. Once she graduated and started on her career path, amateur radio dropped off her radar, and Cindi allowed her license to lapse.

Fast-forward to 2021, when Cindi met Mike McAinsh KI7MTI, who helped her study for her license exam all over again. She subsequently passed the Technician exam in Eagle Mountain and became active in amateur radio once more, this time as part of the Salt Lake Crossroads club. Along with her roommate Missie VanCampen KC7FMW, Cindi served as net control operator for them during regular nets and public service events, such as parades.

You can read more about Cindi in her obituary and in a *Microvolt* September 2021 article on her.

73, Cindi. We hope some day we'll meet again.

With her guide dog Pringle

Strays – Artificially low SWR

A lossy transmission line, such as coax, can lead you to believe your antenna exhibits lower SWR (standing wave ratio) than it really does. How can that be? Antenna characteristics such as SWR are unique to an antenna, without regard to its transmission line, right? Perhaps, but the results from measuring those properties without taking your tools into account can be misleading.

Let's say you have a transceiver that's set to transmit on 2 meters at 100 watts, it's connected by 67 feet of RG-8X without a tuner to your poorly matched antenna that exhibits a 3.0:1 SWR at the feed point. According to the **coax loss chart**, RG-8X exhibits 4.5 dB loss per 100 feet at 2 meters, or 4.5 dB × (67 ft / 100 ft) = 3.0 dB loss.

After losing 3 dB (half) of its power in the coax, your 100-watt signal reduces to 50 watts by the time it reaches your antenna. Once at your antenna, the 3.0:1 SWR means some of its signal power is reflected back toward your transceiver, as determined by the *reflected power versus forward power ratio*, a derivation of the well-known *reflection coefficient*:

$$\frac{P_{reflected}}{P_{forward}} = \frac{P_r}{P_f} = \left(\frac{SWR - 1}{SWR + 1}\right)^2$$

Then, solving for SWR, you get

$$SWR = \frac{1 + \sqrt{P_r / P_f}}{1 - \sqrt{P_r / P_f}}$$

According to the first equation above, the reflected signal from the 50 watts at the moment it arrives at your 3.0:1 SWR antenna results in a reflected signal strength of

$$P_r = \left(\frac{3-1}{3+1}\right)^2 (50 \text{ watts}) = 12.5 \text{ watts}$$

at that point. This 12.5-watt signal now returns to your transceiver by the same cable and so again loses 3 dB (half), leaving 6.25 watts incident upon your transceiver.

By the second equation, the resulting SWR measured at your transceiver will now be

$$SWR = \frac{1 + \sqrt{\frac{6.25\ W}{100\ W}}}{1 - \sqrt{\frac{6.25\ W}{100\ W}}} = 1.67 : 1$$

which makes your antenna ***appear*** better-matched than the 3.0:1 you had originally measured for it at the feed point. Just for comparison, if your coax was LMR-400 (1.5 dB loss per 100 feet, much lower loss) instead, the apparent SWR from the same antenna would then have been

$$SWR = \frac{1 + \sqrt{\frac{16\ W}{100\ W}}}{1 - \sqrt{\frac{16\ W}{100\ W}}} = 2.33 : 1$$

a little closer to reality. Based on what we're seeing here, it seems that SWR is a fairly important property to address when considering antennas and transmission lines. But if that's the case, then why didn't the old timers 60-plus years ago ever worry or even talk much about SWR? It's because *they didn't use coax*.

Noji Ratzlaff KNØJI

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We encourage you to submit original pictures (highest resolution), articles, software and hardware descriptions, appropriate humor, and responses to editorials. Email the content, pictures attached, to the editor at **editor@utaharc.org** by the 24th just prior to the target month.

The **Utah Amateur Radio Club** was organized under its present name in 1927, although its beginnings may date back as early as 1909. In 1928, it became affiliated with the American Radio Relay League (club #1602) and is now a 501(c)(3) non-profit organization. It holds a club station license with the call sign W7SP, a memorial to Leonard "Zim" Zimmerman, amateur radio pioneer in the Salt Lake City area.

The club meets each month except July and August. The meetings are usually held on the second Thursday of the month at 7:30 PM in the University of Utah's Warnock Engineering Building, room 2230.

Club membership is open to anybody interested in amateur radio; a current license is not required. Dues are $20 per year. Send dues to club secretary James Bennett, 4960 W 5400 S, Kearns, Utah 84118. Email address changes to **kk7avs@gmail.com**

Tax-deductible monetary contributions are gladly accepted. Send directly to club treasurer Shawn Evans, 1338 S Foothill Dr, #265, Salt Lake City, Utah 84108-2321. For in-kind contributions, please contact **uarc@xmission.com** to make arrangements.

UARC maintains the 146.620– and 146.760– repeaters, which are administered by the UARC Repeater Committee. Direct comments and questions to any committee member. The 146.760– repeater is on IRLP node 3352.

Call the **UARC Ham Hotline** at **801-583-3002** for amateur radio information, including club, testing, meeting, and membership information. Leave a message, and we'll make an effort to return your call.

UARC 2025 Board

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Vice President: Bruce Fereday, KF7OZK
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For-late breaking news listen to the UARC Information Net, Sundays at 8:30 pm on 146.620– or visit the announcement page.

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