

2023-11-07 Hamlet Net - Magnetic Loop Antennas

Announcements:

- Test Session Info
 - Next VE session is this Saturday, November 11th in the Clover Building at the Boulder County Fairgrounds, and starts at 9 am. For more info, and to pre-register, see the Licensing/Testing page on the club web site, <https://w0eno.org/>, under the Education menu.
- We have some volunteer opportunities available where you can help out LARC:
 - Photographer / videographer - record team activities and upload to web site / YouTube
 - LARC Fest Coordinator -
 - Newsletter Editor - put together the monthly Splatter newsletter
 - Activities Chairperson - member of the Board of Directors
- LARC is running our annual Santa on the Air event again this year, with help from the Northern Colorado Amateur Radio Club. We are planning to have Santa, Mrs. Claus, and Santa's elves operate from Monday, November 27th through Sunday, December 10th.

Our "professional Santa" has retired this year, so we are in need of some help! We currently have one Mrs. Claus and one Elf, so we need some volunteers to round out our team.

The only requirement is that you can get into the LARC repeater or the NCARC 447.700 repeater on Mount Buckhorn - you can also use Echolink to get into the LARC repeater.

I believe Chuck has some material put together by our old Santa on how to play the part, so if you are available, please help us out!

Contact Chuck, K0ITP, at k0itp@w0eno.org to see how you can assist.

- If you are interested in DMR, or Digital Mobile Radio, RMHAM is hosting Mike Lozano, K0NGA, for his "Basic DMR, Theory, Operation, and how it works" presentation this Saturday, November 11th. It will be live at the Cherry Creek Schools Educational Services Center (4700 South Yosemite Street, Greenwood Village, CO) and via zoom, For more information, go to their web site at: <https://www.rmham.org/> and see the RMHAM UNIVERSITY link on the menu.

- Our sister club up in Nederland is looking for some help with events they are running. They have a weekly Monday night net with no predetermined agenda, so you can lead it however you want. They are also planning a Field Day site at Golden Gate State Park and are welcoming anyone who wants to participate. Finally, they are looking for operators for the Ned Gravel run on July 8th. They have signup links for all these events, so head over to their web site <https://w0ned.org/> for more information!
- You can start earning your 2024 membership or future renewal by acting as NCS for at least 5 nets this 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! There are four free memberships available for 2023, so don't wait to get started!
- 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 2023. If you have any ideas, or better yet, would like to present, please let Chuck know and we'll get you on the schedule!
- 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, AF0W

ARRL Field Day Results

- The December 2023 QST magazine has results from the 2023 ARRL Field Day
- There were a total of 31,300 participants and 4,445 entries
- There were slightly more Phone QSOs than CW (481,710 versus 378,463), and 289,513 digital QSOs
- While participation is up over 5%, total entries are down 11% and total QSOs are down 2% from 2022
- There were 92 entries in Colorado out of 4,555 total in the US and Canada
- The full Field Day site statistics are not yet available on the ARRL web page.

Topic: Magnetic Loop Antennas

- Loop antennas are closed-circuit antennas - unlike dipoles where you have two conductors or elements that are not attached to anything at one end
 - a. A conductor is formed into one or more turns so that the two ends are close together
- There are at least two broad categories of antennas involving loops: Electrically-small loop antennas and electrically-large loop antennas
 - a. An electrically-large loop antenna is close to a full wavelength in length, and is frequently constructed in a rectangular or triangular form, called quad and delta loops, respectively
 - Multiple loop antennas can be arrayed similar to Yagi antennas to increase gain
 - b. An electrically-small loop is typically less than one-tenth of a wavelength in length, which results in a uniform current in the loop - these are frequently referred to as "magnetic loop" antennas
- Some advantages of magnetic loop antennas are:
 - a. They function independent of a ground - no radial system or counterpoise is required
 - b. They are relatively small for HF - and can even be relatively portable
 - Commercial HF magnetic loops are generally around 3 feet in diameter
 - c. Their directionality allows noise sources to be nulled out
 - d. For lower frequencies like 160, 80 and 40 meters, they radiate equally across all elevations, both vertically and horizontally, allowing use for local and DX contacts
 - e. Their narrow bandwidth allows a high signal-to-noise ratio - it only hears signal (and noise) across a very narrow range of frequencies
 - This also provides one of the benefits of such an antenna - it increases the selectivity of the antenna before the signals reach the receiver
 - Selectivity is the ability of a receiver to receive only the desired signal on the wanted frequency and to reject others
- Of course, there are also some disadvantages:
 - a. As they are directional, a rotator is likely needed

- b. The narrow bandwidth means that the antenna must constantly be retuned as you move across frequencies
 - Some antennas have automatic tuners to help with this
- c. They do have a lower efficiency when transmitting than other antennas
 - Magnetic loops have roughly a 1.5 dBi gain - dipoles mounted at an ideal height have a gain of approximately 2.15 dBi
- d. The lower bandwidth may limit the modes that may be used with the antenna
- Receive-only loops are non-resonant and do not require tuning - they also frequently contain a high-gain amplifier
- Small loops are tuned by connecting a capacitor across the antenna terminals - this results in a tuned circuit
- Loops are also directional with deep nulls - this can be useful for direction finding or for nulling out sources of interference

- a. The reduction in signal strength of the unwanted signal can be upwards of 60 dB (10 S units)

- b. Arrow Antennas make both a VHF and UHF loop antenna, intended for fox hunting use by finding the minimum signal in the null of the antenna.

Note that these particular antennas are receive-only and not meant for transmitting!

- Magnetic loop antennas in general are not just for receiving - they can be used for transmitting as well, but this requires some modifications to the construction
- The losses in a magnetic loop antenna are highly dependent on the materials used to construct the loop
- One typical construction material is copper tubing of at least three-quarter inch diameter
- High-frequency AC current flows on the surface of a conductor due to the skin effect, so solid copper is not required
- There must also be some way of feeding the RF signal to the antenna
- Many magnetic loop designs use a smaller feed loop, typically placed at the opposite side of the loop from the tuning capacitor - this actually forms a sort of transformer, which is one method of matching feed point impedances

- a. This smaller loop is typically one-fifth the circumference of the main loop
- The tuning capacitor must handle extremely high voltages while also having a low resistance, both internally and when connecting to the loop itself
- Transmitting with 100 watts into a magnetic loop antenna can result in currents in the loop of tens of amps, and voltages across the tuning capacitor in excess of 10 kV
 - a. Many transmitting loops are limited to lower power because of this - if the voltage limit of the tuning capacitor is exceeded, electricity can "arc over" between the plates of the capacitor
 - b. Even with low power (say, 20 W), the low takeoff angle of magnetic loops can perform as well as 100W on a less-than-optimal larger antenna
 - c. A receive-only loop can be paired with another transmitting antenna (for example, an end-fed wire antenna)
- Many designs use vacuum variable capacitors, which are constructed with the capacitor plates in a glass container, similar to a light bulb or vacuum tube. This is to prevent arcing at high voltages.
 - a. As a side note, Nikola Tesla filed a patent in 1896 for a vacuum capacitor
- The bandwidth of magnetic loop antennas is fairly small - this refers to the frequency range of the antenna which has a 2:1 SWR or lower
- This requires them to be retuned as the operating frequency changes - sometimes as little as a 5 kHz change may require retuning
- This is accomplished through the use of a somewhat large variable capacitor across the loop ends
- These capacitors may be adjusted manually, or more commonly, are connected to a motor or servo to allow for remote adjustment
 - a. The bandwidth of the antennas is so narrow that touching the capacitor to tune it will affect the tuning. An insulated tool must be used to prevent this.
- In the shack, an SWR meter is typically used to watch for a sharp dip when the antenna is tuned properly
 - a. This is where an SWR meter using one or two analog needles is preferable to one that reads the SWR in a digital format, as it is easier to see the narrow null

- MFJ makes a couple of magnetic loop antenna systems - one interesting characteristic is that they send the capacitor control signal over the feedline coax, so you don't have to run an individual cable for controlling the loop
- Some other manufacturers are Alpha Antenna and DX Engineering, and there are also numerous articles and web pages devoted to building your own antenna
- As their name implies, magnetic loop antennas are sensitive to the magnetic component of the electromagnetic RF wave, while a wire antenna is sensitive to both the electrical and magnetic components
- In the lower-frequency HF bands, external man-made, seasonal, atmospheric, and solar-cycle noise is dominant and contains strong electric components, making magnetic loop antennas a good choice for improving signal to noise ratios
- Magnetic loop antennas are small and function well mounted close to the ground (as compared to traditional wire antennas)
 - a. This is because the loop is relatively free from dependence on a ground plane and the earth as opposed to a full or quarter-wave vertical antenna
- This, along with their reduced size, makes them useful for antenna-restricted sites, or even for indoor use, although radiation limits must be observed
- I did find some web pages where hams had experimented with magnetic loops for 2m use, but I wonder how much the tuning of the antenna will be affected by your body when holding your HT, so not sure how practical they'd be

Questions:

- **The question for the week is:** Have you considered using a magnetic or other loop antenna (or have you actually used one)?
- **In my case,** I have two HF magnetic loop antennas. One is an MFJ antenna, and the other is the antenna Ron built - he did not want to take it with him when he moved.

I've used the MFJ antenna a few times, but not really enough to form an opinion on it. It has a manually-operated tuner, and did require a lot of retuning

Backup Questions:

1. What hobbies do you have other than ham radio? Do you (or could you) use ham radio in these hobbies?
2. Share an "a-ha" moment you had with amateur radio?

More Info:

- Arrow Antenna Fox Hunt Loop Antennas: <https://www.arrowantennas.com/main/fhl.html>
- Experimenting with magnetic loop antennas (shows a 2m antenna): <https://m0ukd.com/homebrew/antennas/magnetic-loop-antennas/>
- 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

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1. W0PPC - Steve - Lyons -