

A Uniquely-tuned 2M T-hunting Loop

This compact, inexpensive, easy-to-build loop is ideal for close-in DFing and T-hunting. The coaxial tuning capacitor is unconventional.

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Surprisingly, one of the hidden joys of T-hunting is home brew. As a new participant in this radio sport I found myself constructing antennas I would never have considered. This little loop is a perfect example, Figure 1. It's inexpensive, convenient, educational and an excellent radio club build-it project.

Figure 1: Left to right, loop, coupling loop, balun, attenuator and HT mount (behind attenuator).

The Basic Dynamics of T-hunting

At the starting point of a T-hunt, one needs high gain – a yagi or quad and a sensitive receiver. Near the hidden transmitter, the ball game changes dramatically. Now you need a portable antenna and an attenuator. This is the realm of this loop or a hand-held yagi. I prefer the loop. It's handier and in most cases just as effective.

Loop Sensitivity

However, compared to a yagi or a quad a small loop has down sides, even though it does have equally good directivity. The first is its size, which does not let it capture as much signal, particularly when not tuned to the frequency of the T-hunt. Commercially-manufactured DF loops are often not tuned. They do this to permit them to be used on more than one band.

I preferred to increase this loop's ability to receive by tuning it to 2 meters with a variable capacitor at the loop's ends. Untuned it's resonant at roughly 450 MHz and inefficient on 2

meters. For DFing wild animals, finding Alzheimers patients or locating a VHF aviation beacon, it is easy to re-tune the capacitor for another VHF band.

I chose a somewhat unconventional variable capacitor simply because common rotary and compression mica variables are awkward to add to a loop. Furthermore they are becoming hard to find. But at first I did not know what kind of variable capacitor to use? Then lightning struck.

Don't use a discrete capacitor at all? Let the loop itself be one of the plates of a variable capacitor by constructing it of tubing as opposed to solid rod or wire. The other plate of the capacitor is 11½ in. of the center conductor and dielectric from mini RG-8X coax, with the plastic jacket and shield removed. It's inserted inside the tubing of the loop, figure 2.

Figure 2: T-hunt loop. Note that a tuning capacitor is formed by the tubing of loop itself and an inserted length of the inner conductor and dielectric from mini RG-8X coax.

Notice that this forms two capacitors in series. One is to the right of the gap, the other to the left. As illustrated, figure 3, when the sides are equal, total capacitance is maximum. To either side, capacitance decreases. Note the equivalent circuit of the two capacitors.

Figure 3, Cross sections of the loop with coax inner conductor and dielectric from mini RG-8x coax in two different positions. Maximum capacitance is on the left.

Therefore to adjust the frequency of the loop you merely slide the coax inner conductor and dielectric with your fingernail, at the gap in the top end of the boom. See figure 4.

Figure 4: Loop from the top end. Tune the loop by sliding the coax inner conductor and dielectric with your fingernail.

It's very stable? I've never needed to retune my loop. I did though have to experiment, using an antenna analyzer, with tubing size and inner conductor length to find the right combination. Just duplicate the dimensions and you will have no trouble tuning the loop.

The Small Coupling Loop

Next, there are several possible ways to match the loop to 50 Ohm coax, here RG-58. From practical experience with small loops I have found that an inductive coupling loop is the easiest. This one is 1 in. in diameter, made from 14AWG solid copper wire. Note that there is a gap in it inside the boom. Solder the feed coax, as shown, to the coupling loop just outside of the boom. There is no electrical connection to the main loop. The two constitute an RF transformer. Energy passes purely by field induction.

Also, as this antenna is used only for receiving, a perfect match isn't particularly important. Sensitivity and directivity change little over a wide frequency range. I do, however, use this same design for my hidden T-hunt transmitter. The peaks and nulls add zest to the hunts. So for transmitting, I tweaked the size, shape and position of the coupling loop for a good match. They are the dimensions shown.

Tuning the Antenna

The easiest way to tune up the antenna is with an antenna analyzer such as an MFJ-259 or similar. Begin by centering the coax inner conductor. Next find the resonant frequency by sweeping across the VHF band with the antenna analyzer connected to the feed coax, looking for the SWR dip. It will be below the 2 meter band at first. Again, don't concern yourself with SWR. If you later want to use the loop for transmitting, you can then fine tune the coupling loop for a better match. For receiving, the dimensions shown are entirely adequate.

Slide the coax inner conductor with your fingernail in small increments. Each time again find the dip. Gap-length

increments work fine. Repeat the process until you reach the desired frequency. I easily tuned up a dozen new loops this way one afternoon at a radio club build-it session.

Building the loop

The vertical boom is a length of common ½ in PVC water pipe, figure 2. The one shown is actually the handle of a dust pan purchased at a local dollar store. It is a little lighter and has a nice handle. That's only window dressing, however.

Construction is very straight forward. Cut and bend the loops with your fingers. A form is not necessary. Then drill the holes in the boom for the loops and balun. Next rotate the loops into place through the holes and add the coax, forming the balun as you do. Finally solder the ends of the coax to the coupling loop and attach a connector.

An Attenuator

Basic to the radio sport of T-hunting is an attenuator. It cuts down the strong signal close to the hidden transmitter. Without it, your receiver will saturate and you will lose the peaks and nulls.

Two types of attenuator are common. One operates with the receiver "on channel" and attenuates with switchable resistive pads and/or potentiometers. The other, called an off-set attenuator, mixes the incoming signal with a local crystal oscillator, typically at 2 or 4 MHz. Hence you now listen high or low. With a resistive on-channel attenuator your receiver needs to be shielded to prevent direct pickup through the case. An off-set attenuator is much simpler.

I also made the boom long enough to accept glued-on rectangles of PVC, cut from a blank 120 VAC duplex PVC outlet box cover plate. One attaches the attenuator and 2m HT to these with stick-on Velcro squares.

The Balun

Also “absolutely” essential to all T-hunt antennas is a balun. If omitted, the antenna will not point straight at the transmitter but will be skewed. I came in last on my first T-hunt by not using a balun. As above, drill four additional holes in the boom to secure it. This type of balun is an RF choke formed of five turns of the feed coax. VHF ferrite beads may also be used.

Using the Loop

The only special operating instructions one needs is to know how to overcome the other down side of a loop compared to a yagi or quad – two nulls and two peaks. The peaks occur when the loop is in line with the hidden transmitter, the nulls when it is broadside. Therefore you have two indistinguishable in opposite directions. To resolve this all you need is a very elementary T-hunting technique called body fade.

Figure 5: KG6VLG, Carol, using body fade. Note the placement and orientation of the loop. She is facing the hidden transmitter.

See figure 5. With the loop held close to your chest, and also in line with the transmitter, turn your body in a full circle. You will still get two peaks (and two nulls). But with your body present the correct and stronger peak will be when you are facing the hidden transmitter. Once you know the right way, hold the loop high above your head. The peaks and nulls will be more evident.

Many good construction and use tips for T-hunting may be found on our radio club’s web site: satellitearc.com. Of particular value is an audible S-meter that we dub “the screamer,” developed by veteran T-hunter KA6BFB. A variable tone eliminates the need of having to look at the S-meter on your HT. Also, the screamer has a much wider signal strength range.

Try this inexpensive little loop at your next T-hunt, with an HT and an attenuator. You will be pleased. Also consider it as a radio club build-it project. It was a big hit at mine.

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