An-Ten-Ten-nas

INFORMATION
To help you decide
On the best
Antenna for you

L. B. Cebik SK
W4RNL #41159

In each issue of the News, we shall try to clarify a significant cluster of ideas in antenna work. Our object is to help you make the best decisions about the antennas you buy or build without imposing our own prejudices on you. The more you understand, the better your choices will be.

10-Meter LUV in the Attic

As the sunspots continue to improve band conditions in the new cycle, communications with simple antennas becomes easier. However, modern houses, condominiums, and apartments—and all of the restrictions that go along with them—continue to make the ten-meter operator's job more challenging. In many cases, outdoor antennas are not feasible. In the days of standard construction that goes under names like the ranch, the colonial, or simply the box, the attic was a relatively large usable space for 10-meter (and sometimes larger) wire antennas. However, townhouses and even 1-family residences now have small attic spaces. Evan a large house may have many small attic spaces rather than a single large one. Nevertheless, an attic antenna is possible with a little ingenuity.

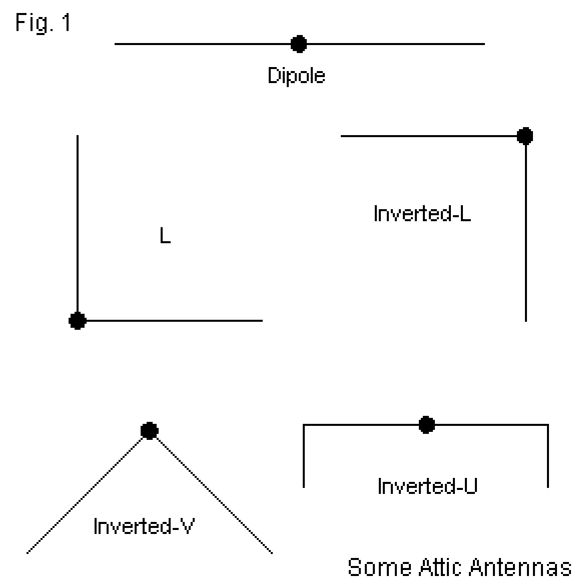
Step 1: Analyze Your Space. To see if you can create an attic antenna, you need to take stock of the highest attic or attic-like spaces in your home. Measure the floor space and also measure the maximum available height. We shall look at those dimensions shortly.

Analyzing your space also requires that you take stock of the contents and the construction. The ideal attic is empty except for wood framing and sheathing. Nails and small truss brackets tend to have no effect on 10-meter antennas. However, there are a number of construction techniques—mostly dating from 1970 to the present—that might make a space unusable. For example, metal foil backed insulation between the roofing-framing members above or around where the antenna will go generally marks an unusable are. Some attic spaces are filled with air handlers and metal ductwork. Even foil-wrapped ducts or ducts with a spiral wire support are problems when it comes to attics.

Step 2: Create an Antenna to Fit Your Space. Now let's go back to the dimensions that you carefully recorded. In an attic, we expect a simple antenna, and the simplest of the all is the basic dipole, shown at the top of Fig. 1. A 10-meter dipole is about 200" long or 16-2/3 feet. Allow a foot or so at each end for supports. If the attic space is not 20' long, we have to call on the alphabet for help.

Fig. 1 shows several common simple antennas that we can use out of doors. We can also adapt them to the attic. All of them involve a bit of folding. The total wire lengths will not change much, but the required space to install them will change. Consider the L and inverted-L. In most cases, the inverted-L is better for lower heights such as attic spaces, Either version of the L will lower the feedpoint impedance relative to a dipole, but the results should be usable with coxial cable.

FIG. 1



In each sketch, the big dot represents the feedpoint. The Ls only need about 8-9 feet of floor space, but they do require about 9' of vertical space. If the inverted-L is the best choice for the space, bring the feedline down to the ceiling joists at an angle that bisects the angle formed by the wires.

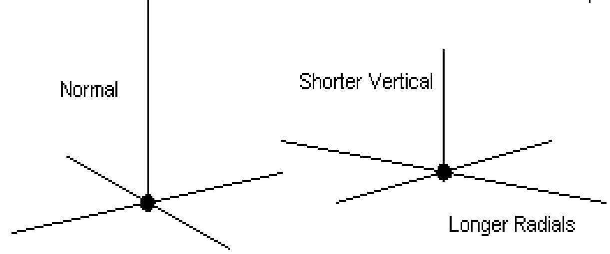
If you have a bit more floor space by not quite as much space to the roof peak, consider the inverted-V. It requires about 12' of floor space, but only a little over 6' of vertical space. Alternatively, you can create an inverted-U. This antenna is simply a dipole with the ends drooped downward to fit the space. The advantage of the inverted-U is that you can keep the wire at the maximum usable height in the attic, and the drooping ends do not come down as far as the legs of the inverted-V. In most attics, you will be able to find room for an L, a U, or a V antenna.

If the attic height will not support even an inverted-V or an inverted-L, then set both legs horizontally. This requires about 9' of floor space and each direction, but lift the antenna as far above the attic floor as possible. The antenna you have created by this move is sometimes called a quadrant antenna.

I have not given precise dimensions for the antenna for a very good reason. Even though non-metallic roofing structures are fairly transparent to RF at 10 meters, the close proximity of the structure will alter the exact length required for a low SWR. So start with an extra 5-10 inches of wire (beyond the general idea that a dipole is about 200" long) and prune to resonance.

Suppose that the insulation above the living-space ceiling has a foil backing. Or perhaps the space between ceiling joists is filled with metal ductwork. Then you may wish to consider a rather standard ground-plane monopole, such as shown in **Fig. 2**. The ground-plane wires will form an effective shield from the metal below the antenna.

Fig. 2 The Modified Attic Ground-Plane Monopole



The monopole is actually a type of dipole. The lower half is divided into 4 wires arranged symmetrically and horizontally. Hence, the radiation from these legs self-cancels. The effective radiation comes from the upper vertical leg. Normally, this leg is about half the length of a dipole. In an at6tic, you can use wire and hang it from the peak of the roof.

If you roof height will not support a full vertical leg for the monopole, you have two main choices. First, you can bend over the top of the vertical without harming performance by any detectable amount. Alternatively, you can shorten the vertical section and elongate the radials. Like the earlier antennas we have discussed, the presence of the wood structure and other attic “stuff” will require that you start long and prune to resonance or minimum SWR. If you have the space, droop the radials for a better match to your coaxial cable. If you end up just a bit shy on the floor space, bend the ends of the radials. It is useful to maintain symmetry by bending each radial end by the same amount and in the same direction.

We can alter the structure of the vertical monopole within limits but with relative impunity. In fact, we can do the same for the inverted-L, as suggested by **Fig. 3**. The normal version has the feedpoint in the corner, which is also the center of the total length of wire. Since the inverted-L is simply a modified dipole, we can move the feedpoint up to plus or minus 10% from center and still obtain just about the same feedpoint impedance and performance. So we may use either of the two indicated feedpoint position (corner or wire-length center) shown in the sketch on the right.

The modified inverted-L may allow you to fit the antenna into the available space. In fact, that is the main message of these notes. Do not be afraid to modify the basic dipole to fit the space. An inverted-V should have an included angle of at least 90 degrees-more if possible. The inverted-U should be 70% of the length of a full size dipole or more, if fessible. At 10 meters, you should be able to fit at least one of these antennas in your attic space.

Step 3: Guard Against Common-Mode Currents. All of the attic antenna suggestions involve antennas that should match the standard 50-Ω coaxial cable adequately (but rarely perfectly). Some of the antennas use feedpoints that are not truly centered.

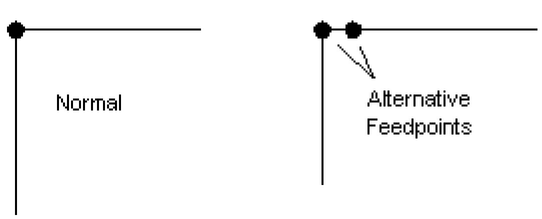


Fig. 3 The Modified Attic Inverted-L

Other antennas involve routing the cable at angle between wires. All of the antennas are in close proximity to materials that may be slightly conductive. Even wood is a semiconductor unless very dry. One result of the combination of antenna designs and environmental factors is the strong potential for the braid of the coax to carry common-mode currents down to the station and into other wiring in the house.

The best protection is a choke installed at the feedpoint. Perhaps the best device to attenuate common-mode currents is the ferrite bead choke, some referred to as the W2DU choke or balun. We do not need balun (balanced-to-unbalance) effects as much as we need the protection from common mode currents, so the choking effect is most important. For any of these (and other) attic installations, installing a ferrite bead choke is normally very effective. You can find inexpensive kits or finished chokes through the Wireman of South Carolina at perhaps the lowest prices—even though the units use the materials originally specified by Walt Maxwell, W2DU. The same design is available from other sources as well.

Step 4: Begin with Available Materials. An attic antenna is free of nearly all of the weather conditions that tend to ruin antennas out of doors. About the only weathering experienced by an attic antenna is a wide range of temperatures. As a result, you can use almost any material for the antenna legs, so long as it is highly conductive, non-magnetic, and able to support its own weight in the attic.

Among the good materials is house wiring. House wiring uses AWG #12 wires in an insulating sheath. A 10’ section of scrap house wiring—when pulled apart, gives you two insulated legs for a dipole or one of the lettered variation. AWG #14 will work as well. If you have a bunch of stranded wire, it will also work. You can also use old section of TV lead-in. Cut the sections and simple solder or twist the ends together to simulate a fatter wire than the AWG #20 conductors typical of TV twin-lead.

Equally usable are sections of aluminum stock, whatever its profile. L-stock, channel-stock, square stock, and strapping will all work for attic antennas. Because these materials are usually self-supporting, the installation may be simpler, since you may not need insulators and rope as a wire element might require.

Holding the antenna in place will require that you analyze your own attic and the best means of support. In all cases, use non-conductive materials for the support work. For this wire, a simple set of loops from the dipole ends to the rope that goes to a rafter may work well. For a rigid element, you can run ropes from the roof peak down to the element. You can support a vertical monopole with a short rope and a pair of loops—one on the monopole and one on the rope.

I shall not try to give any guidance on routing the feedline to from the antenna down to the station. There are too many variations in their relative positions to be able to say anything useful.

An attic antenna may not be as good as an outdoor antenna, but it can be quite effective if the attic is not enclosed with metal. In most cases, it will outperform a mobile antenna and allow indoor 10-meter operation in all kinds of weather. When the sunspots are favorable, it will do a very good job.

The best attic antenna is one that combines careful analysis of the available attic space, careful installation, and not much money at all.