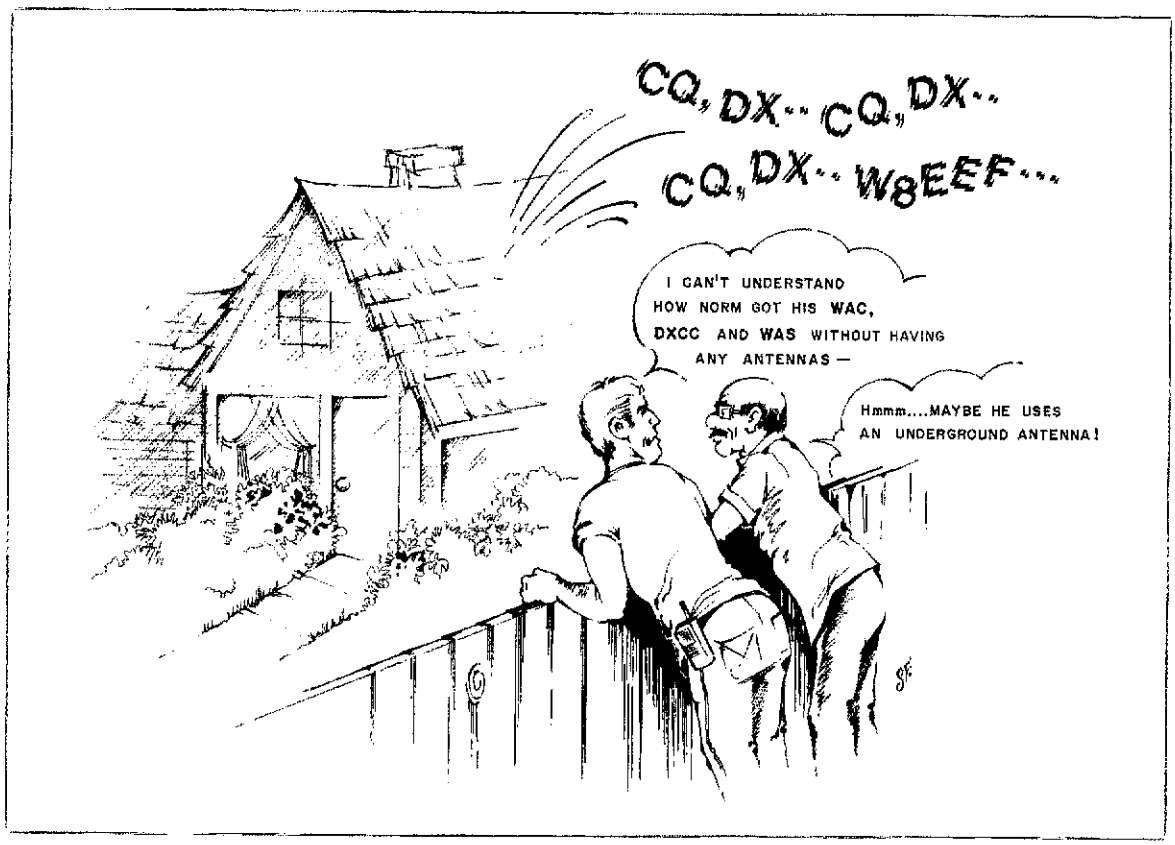
Antennas for Those Who Can't Have Antennas!

Radio amateurs don't engage in covert activities, but there are times in all of our lives when hidden or "invisible" antennas are necessary if we are to get on the air.

By Doug DeMaw,* W1FB



The unfortunate fact of the matter is that some radio amateurs dwell where antennas are prohibited. In other situations the operator may not want to erect outdoor antennas for fear of neighborhood opinions that he or she is destroying the beauty of the residential area. We amateurs don't regard our antennas as eyesores; in fact, we almost always regard them as works of art! But there are occasions when having an outdoor or visible antenna can present problems, especially for those who live in apartments.

When we are confronted with restrictions, self-imposed or otherwise, we can take advantage of a number of options toward getting on the air and radiating at least a moderately effective signal. In this context, a poor antenna is certainly better than no antenna at all! A number of techniques enable us to use indoor antennas or "invisible" antennas out of doors. Many of these systems will yield good to excellent results for local and DX contacts, depending on band conditions at any given time. *Don't erect any antenna that can present a hazard (physical or electrical) to humans, animals or buildings. Safety first!*

*Senior Technical Editor, ARRL

Invisible Antennas

In some areas, clotheslines are attached to pulleys (Fig. 1) so that the user can load the line and retrieve the laundry from a back porch. Laundry lines of this variety are accepted parts of the neighborhood "scenery," and can be used handily as amateur antennas by simply insulating the pulleys from their support points. This calls for the use of a conducting type of clothesline, such as heavy-gauge stranded electrical wire with Teflon or vinyl insulation. A high-quality, flexible steel cable (stranded) is suitable as a substitute if one doesn't mind cleaning it each time clothing is hung on it.

A jumper wire can be brought from one end of the line to the ham shack when the station is being operated. If a good electrical connection exists between the wire clothesline and the pulley, a permanent

connection can be made by connecting the lead-in wire between the pulley and its insulator. A Transmatch can be used to match the "invisible" random-length wire to the transmitter and receiver.

Invisible "Long Wire"

In reality, an antenna is not a classic "long wire" unless it is one wavelength (or greater) long. Yet, many amateurs refer to all relatively long spans of conductor as "long wires." For the purpose of this article we will assume we have a fairly long span of wire, and refer to it as an "end-fed wire."

If we use small-diameter enameled wire for our end-fed antenna, chances are that it will be very difficult to see against the sky and neighborhood scenery. The higher the wire gauge, the more "invisible" the antenna will be. The limiting factor with very fine wire is fragility. A good compromise can be realized by using no. 24 or no. 26 magnet wire for spans up to 130 feet (m = ft × 0.3048). Lighter-gauge wire can be used for shorter spans, such as 30 or 60 feet. The major threat to the longevity of fine wire is icing; also, birds may fly into the wire and break it. Therefore, this style of antenna may require frequent service or replacement.

Fig. 2 illustrates how we might install an invisible end-fed wire. It is important that the insulators also be lacking in prominence. Tiny Plexiglas blocks work well, as do small-diameter, clear plastic medical vials. Some amateurs simply use rubber bands for end insulators, but they will deteriorate rapidly from sun and air pollutants. They are entirely adequate for short-term operation with an invisible antenna, however.

The invisibility of the antenna can be carried even further if one is willing to use camouflaging techniques. This can be achieved by spraying the antenna wire with green, tan, brown, black and light blue paint at 1-foot intervals. In some instances, a single layer of gray or medium-blue paint will help to disguise the antenna. The wire must be free of grease and dirt if paint is applied, and the paint should be of "exterior" grade. This camouflaging effect can also be realized by dipping sections of the wire into cans of paint of the appropriate colors, assuming that spray paint is not available or desired.

Rain-Gutter or TV Antennas

A great number of amateurs have taken advantage of standard house fixtures when contriving inconspicuous antennas. A very old technique is the use of the gutter and downspout system on the building. This can be seen in Fig. 3: A lead wire is routed to the shack from one end of the gutter trough. We must assume that the wood on which the gutter is affixed is dry and of good quality in order to provide a reasonable insulation factor. The rain-gutter antenna may perform quite poorly during wet weather or when there is ice and snow on it and the house roof.

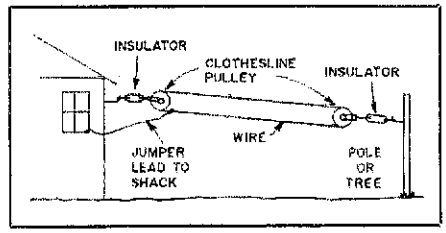


Fig. 1 — One form of hidden antenna is shown in this drawing: The antenna performs double duty as a radiator and a wash line. Large-diameter insulated wire (flexible) can be used as the line, or a clothesline with a wire center may be employed. The pulleys are insulated from the house and the pole.

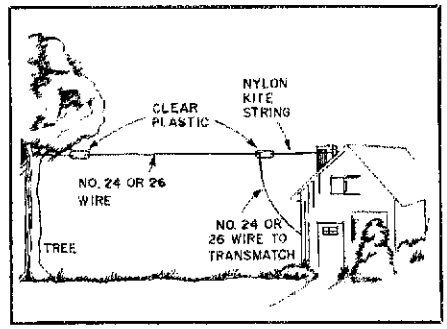


Fig. 2 — Light-gauge enamel-covered wire works nicely as a hard-to-see antenna. Although a bird may knock it down from time to time, re-erecting it beats having no antenna at all!

We need to ensure that all joints between gutter and downspout sections are bonded with straps of braid or flashing copper to provide good continuity in the system. Poor joints can cause rectification and subsequent TVI and other harmonic interference. Also, it is prudent to insert a section of plastic downspout about 8 ft above ground. This will prevent humans from receiving rf shocks or burns while the antenna is being used. Improved performance may result if the front and back gutters of the house are joined by a jumper wire to increase the area of the antenna.

Fig. 3 also shows a TV or fm antenna that can be employed as an invisible amateur antenna. Many of these antennas can be modified easily to accommodate the 144- or 220-MHz bands, thereby permitting the use of the 300-Ω line as a feeder system. Some fm antennas can be used on 6 meters by adding no. 10 buswire extensions to the ends of the elements and adjusting them for a VSWR of 1:1. If 300-Ω line is used it will require a balun or Transmatch to interface the line with the station equipment.

For operation in the hf bands we can tie the TV- or fm-antenna feeders together at the transmitter end of the span and treat the overall system as a random-length wire. If this is done, the 300-Ω line will have to be on TV standoff insulators and spaced well away from phone and power company service-entrance lines. The TV or fm radio must of course be disconnected from the system when it is used for amateur work! Similarly, masthead amplifiers and splitters must be removed from the line if the system is to be used for amateur operation.

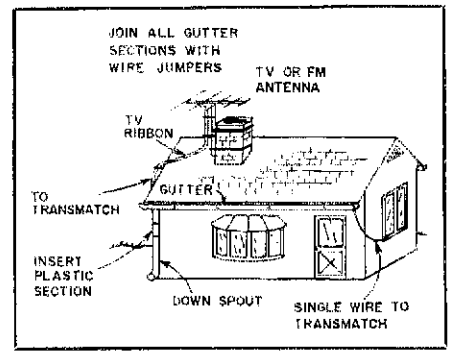


Fig. 3 — Some amateurs have had success when using the rain gutter as a random-length, end-fed radiator. The lower portion should be insulated from the remainder of the gutter and downspout to prevent rf hazards to animals and people. The TV or fm antenna-lead wire also can be used as a random-length antenna, as shown here.

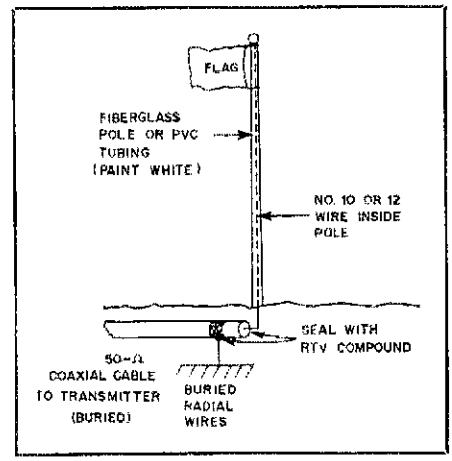


Fig. 4 — One can be patriotic while using a disguised antenna. The flagpole also serves as a vertical antenna in this illustration. Insulation should be used over the lower part of the antenna to prevent shock hazard to people and animals.

Flagpole Antenna

We can exhibit our patriotism and have an invisible amateur antenna at the same time by disguising our radiator as shown in Fig. 4. The vertical antenna is a wire that has been placed inside a plastic or fiberglass pole.

As shown, the flagpole antenna is structured for a single amateur band, and it is assumed that the height of the pole corresponds to a quarter wavelength for the chosen band. The radials and feed line can be buried in the ground as shown. In a practical installation, the sealed end of the

coax cable would protrude slightly into the lower end of the plastic pole.

If a large-diameter, fiberglass pole were available, we might be able to conceal a four-band trap vertical inside it. Alternatively, we might use a metal pole and bury at its base a water-tight box that contained fixed-tuned matching networks for the bands of interest. The networks could be selected remotely by means of a stepping relay inside the box. A 30-ft flagpole would provide good results in this kind of system, provided it was used with a buried radial system. At least one commercial antenna (from Delta Corp.) is used in this manner, but with an elaborate, continuously adjustable matching network (and VSWR indicator) that is operated remotely.

Still another technique uses a wooden flagpole. A small-diameter wire can be stapled to the pole and routed underground to the coax feeder or the matching box. The halyard could by itself constitute the antenna wire if it were made from heavy-duty insulated hookup wire. There are countless variations for this type of antenna, and they are limited only by the imagination of the amateur.

Other Invisible Antennas

Some amateurs have used the metal fence on apartment verandas as antennas, and have had good results on the higher hf bands (20, 15 and 10 meters). We must presume that the fences were not connected to the steel framework of the building, but rather were insulated by the concrete floor to which they were affixed. These veranda fences have also been used effectively as ground systems (counterpoises) for hf-band vertical antennas that were put in place temporarily after darkness fell.

One New York City amateur used the fire escape on his apartment building as a 40-meter antenna, and reported high success in working DX stations with it. Another apartment dweller made use of the aluminum frame on his living-room picture window as an antenna for 10 and 15 meters. He worked it against the metal conductors of the baseboard heater in the same room.

There have been many jokes told over the past decades about "bed-spring antennas." The idea is by no means absurd. Bed springs and metal end boards have been used to advantage by many apartment dwellers as 20-, 15- and 10-meter radiators. A counterpoise ground can be routed along the baseboard of the bedroom and used in combination with the bed spring. It is important to remember that any independent (insulated) metal object of reasonable size can serve as an antenna if the transmitter can be matched to it. An amateur in Detroit, Michigan, once used his Shopsmith craft machine (about 5 feet tall) as a 10-meter antenna. He worked a number of DX stations with it when band conditions were good.

A number of operators have used metal curtain rods and window screens for vhf work, and found them to be quite acceptable for local communications. You'll have best results with any of these makeshift antennas when the "antennas" are kept well away from house wiring and other conductive objects.

Strays

FINISH

N9CGC (left), WB9MVC (center) and KB9MU of the McHenry Co. (Illinois) Wireless Association helped members of the Schaumburg RC monitor a 10-km race sponsored by the Lake Zurich Jaycees. During the race, the hams radioed runners' times and medical information to race officials from checkpoints along the course. *(KA9HAO photo)*

W4KFC TO SPEAK NATIONWIDE ON REPEATER NET

☐ Radio amateurs are invited to listen and speak to ARRL President Vic Clark, W4KFC, when he discusses "The Future of Amateur Radio" on the Teleconference Radio Net, March 3, at 7:15 P.M. CST. Amateurs can participate on the following repeater frequencies:

Phoenix, AZ — 147.36
Avon, CT — 224.78
Roswell, GA — 145.47
Wichita, KS — 146.82
Minneapolis, MN — 146.64
Long Island, NY — 147.375
Beaverton, OR — 147.32
San Antonio, TX — 146.70
Los Angeles, CA — 224.04
Washington, DC — 147.21
Chicago, IL — 147.15
Billerica, MA — 147.12
Cherry Hill, NJ — 147.375
Rochester, NY — 145.11
Dallas, TX — 146.97
Madison, WI — 146.76

If you're not within range of one of these repeaters, it is still possible that a repeater in your area will be tied into the net. Watch for local publicity or check the local repeaters at net time.

Also, mark June 2, 1983, 7:15 P.M., on the calendar. Joe Reisert, W1JR, a nationally recognized expert on EME communications, antennas and TVI, will be the featured speaker on TRN.

The Teleconference Radio Net uses the latest multipoint teleconferencing technology to tie together repeaters across the U.S. The objective is to allow hams to listen and talk to leaders and experts from the Amateur Radio, scientific and electronics communities. The net is organized by the Honeywell ARCs of Minneapolis, Billerica and Phoenix as a service to all amateurs. For further information, contact Rick Whiting, WØTN, national net manager, 4749 Diane Dr., Minnetonka, MN 55343, tel. 612-870-2071.

ANOTHER CLAY HEARD FROM

☐ In November 1982 *QST*, there is a Stray about the Clay family of Connecticut with five hams. Well, we are the Clay family of Louisiana with *seven* hams: Roy, Jr., KB5IG; Annie, N5AYU; Sacha, N5DUX; Roy, III, WB5HVS; Eugene, WD5HGD; Timothy, KA5DBK; and Robert, KA5DFJ.

Next Month in QST

Ah, spring, when hams from Las Vegas to Labrador begin to think antennas. March *QST* will bring you details of X Beams and Delta Loops, along with a beginner's look at impedances and an in-depth discussion of baluns. In addition, you'll read about

- an easy-to-build receiving converter for 435, just in time for the Phase IIIB launch, and
- AMSAT-OSCAR 8, perhaps the most successful OSCAR of all, as it celebrates its fifth anniversary.