Radio FUNdamentals

BY BILL ORR, W6SAI

THINGS TO LEARN, PROJECTS TO BUILD, AND GEAR TO USE

The Open Sleeve Dipole

The "Open Sleeve Dipole" has been around for a long time, but it is not a household word in amateur radio. This simple antenna is composed of two or more adjacent dipoles—only one fed—and each is resonant at a different frequency (see fig. 1). I first ran across this design about 1946 when it was incorporated in a television antenna for the lower VHF channels. The antenna was invented either at Stanford Research Institute (now SRI, Inc.) or at the U.S. Naval Postgraduate School (Monterey, California), or maybe somebody else invented it. A cursory search of the records reveals no less than six separate patents on the scheme, all issued between 1946 and 1950. The earliest patent covers three monopoles for use on a jet aircraft. Although not specified, the range covered was probably 100 to 156 MHz.

The bone of contention was the use of the sleeve dipole in broadband TV antennas for home use. The concept was modified and improved for harmonic operation, the goal being to preserve the bidirectional pattern over a 3-to-1 frequency range, suitable for low-band TV.

No doubt the lawyers grew rich as the squabble over patents dragged on. The matter was finally resolved about 1953. I am indebted to George Kearse, W5AWU, who was head of the Antenna Laboratory at Amphenol, Inc. for copies of the early patents and a summary of the litigation.

While useful in TV antennas and in certain log-periodic designs, as far as amateur radio is concerned, the primary use of the sleeve dipole is in multiple-band HF operation.

The 17th edition of *The ARRL Antenna Book* has a good write-up on this antenna (section 7-4) and provides insight into the design of various "multiband" open-sleeve dipoles. And finally, it should be noted that the open-sleeve design is used in the radiator portion of the Hy-Gain Explorer 14 triband Yagi beam.

A Practical Three-Band Sleeve Dipole

The November 1994 issue of *RF Design* magazine[1] has an article by Gary Breed, K9AY, covering the theory of the sleeve antenna in detail, calling it a "Closely-coupled Resonator." Ah, well. A rose by any other name would smell as sweet.

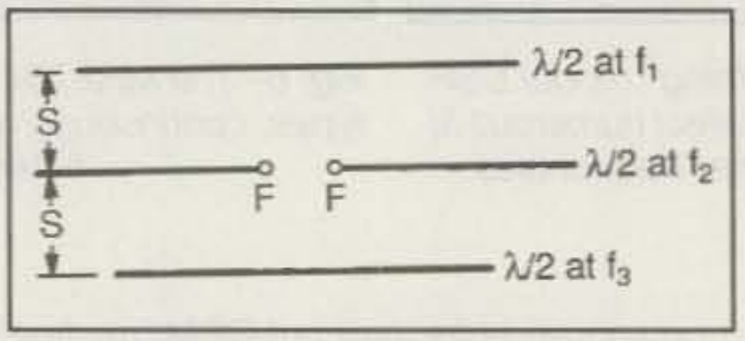

Fig. 1– The three frequency system is composed of a fed dipole plus closely spaced conductors resonant at higher frequencies. Spacing S is small compared to element lengths. The feed point is F-F.

Gary's article is of great interest to amateurs, as it provides know-how to build a multiband dipole antenna, including the technique of controlling the feedpoint resistance and reactance on each band.

In brief, Gary's multiple resonant antenna consists of a driven dipole, resonant on the lowest band of choice, with additional conductors around it placed at appropriate distances. These are resonant on higher bands. When properly built, the antenna provides a near unity match at the resonant frequency on each of the chosen bands. The result is a triband dipole having no traps, decoupling networks, or tuned stubs.

An Open-Sleeve Dipole For 10, 18, and 24 MHz

The K9AY dipole provides operation on the three WARC bands of 10.1, 18.1, and 24.9 MHz without traps, coils, or switching. The assembly is shown in fig. 2. The driven dipole is resonant on the lowest frequency band, and the additional wire resonators are tuned to 18.1 and 24.9 MHz. There is no direct connection between the driven dipole and parasitic resonators.

The antenna is made of #12 AWG enameled wire. Spacing between the wires is two inches. The overall antenna length is 46.7 feet. The antenna wires are held in position by insulated spacers placed every couple of feet along the antenna. The insulators can be made of 3/8 inch square material such as Lexan or polystyrene. Any good RF-insulating material will do the job.

The best way to build the antenna is to stretch the wires between two fixed points, about shoulder high. With the wires under tension, the insulators can be fixed in position and the end bridles aligned to place equal tension on all wires.

The feedpoint demands attention. Gary fed his antenna directly with coax. I would prefer the use of a 1-to-1 current balun at this point. This helps to keep RF current off the outside shield of the transmission line. However, the weight of the balun causes the center dipole wire to sag, unless additional spacers are used at the center point to keep everything shipshape and in Bristol fashion.

The radiation on all bands is the familiar figure-8 pattern. Gary recommends the antenna be placed about 45 feet above ground for best results.

The SWR response is a function of wire lengths, spacing, and wire diameter. The K9AY article provides equations for those who wish to experiment with this design.

Use the antenna as an inverted-V? That may be a little tricky unless you can arrange the mechanical layout to keep all wires taut. It might be worth a try.

The G3EAY Antenna Farm

My good friend Doug DeMaw, W1FB,

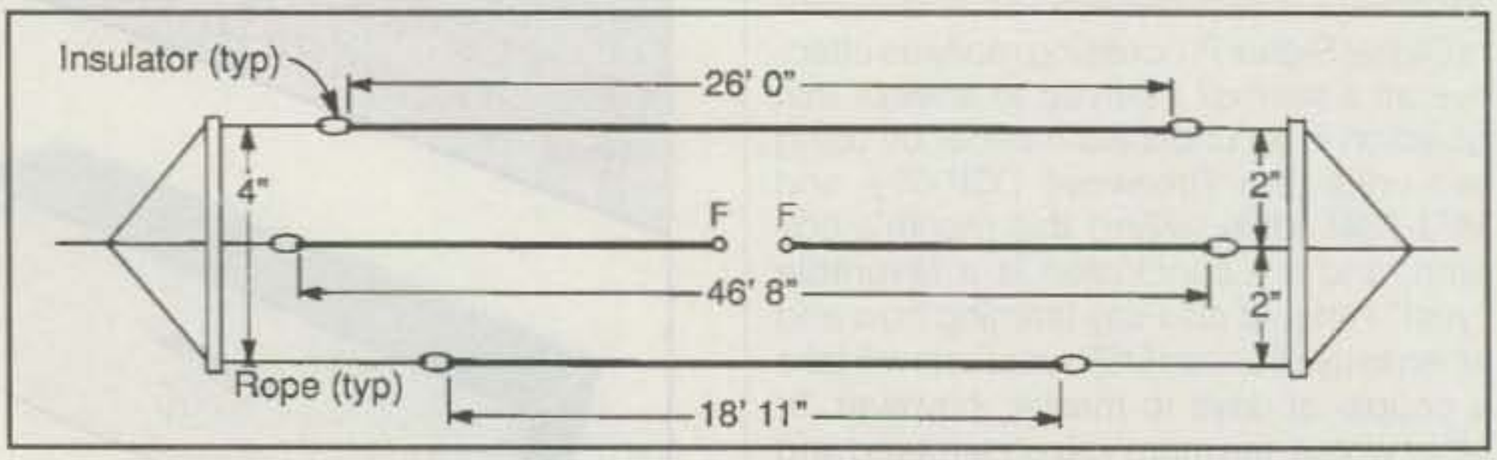

Fig. 2– The open-sleeve dipole for the 10, 18, and 24.9 MHz bands. The antenna is made of No. 12 AWG. The design height used for computer analysis is 45 feet. Insulated spacers keep wires in alignment.

[1] 48 Campbell Lane, Menlo Park, CA 94025

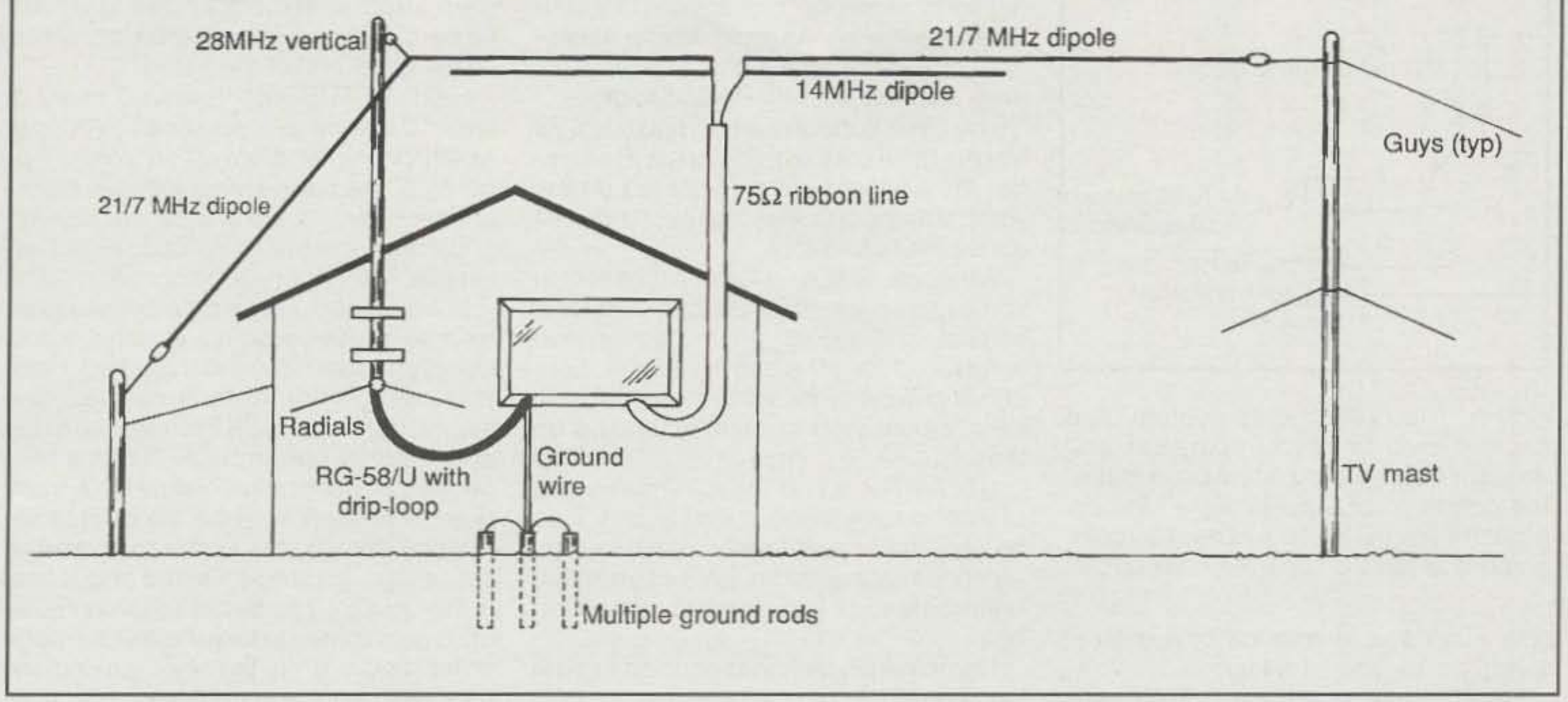

Fig. 3– G3EAY's solution to 5-band operation on a small lot. An old CB vertical is cut for 10 meters and also serves as support for 40 and 15 meter dipoles. The 40 meter antenna works as a Marconi on 80 meters using antenna tuners.

sent me a copy of an article in the British *Practical Wireless* magazine (November 1994). The article is "Five Band Antenna—No ATU," by Dennis Wood, G3EAY.

The problem facing G3EAY was to obtain 5-band operation on a very small lot without covering the property with a maze of wires and masts. His solution is shown in fig. 3. The principal antenna is a 7/14 MHz dipole which is also near-resonant at the third harmonic, 21 MHz.

The dipole is made of 300 ohm ribbon line. One wire of the line is cut for 7 MHz, and the other wire is cut for 14 MHz. The lines are tied in parallel at the center feed-

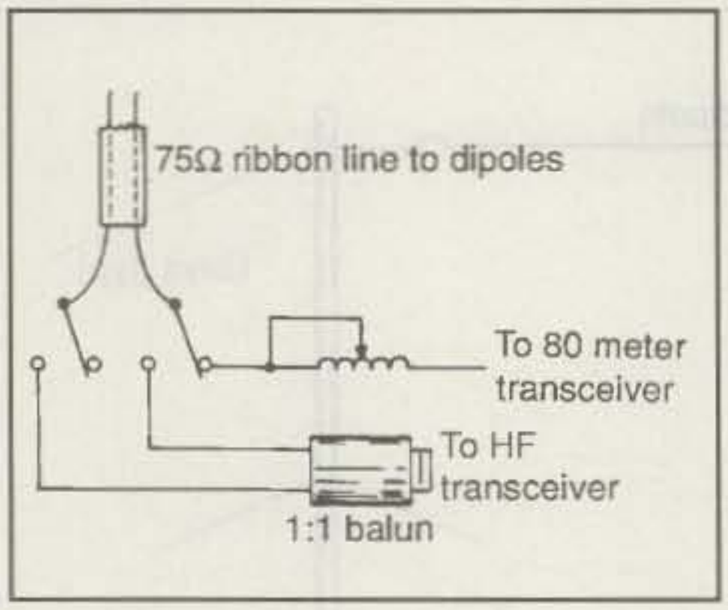

Fig. 4– The G3EAY feed system. The balun is used for normal operation, and an adjustable loading coil is used to permit operation of dipoles as a Marconi antenna for 80 meters. The 10 meter antenna is fed via separate coax cable.

point. This simple antenna covers three bands (7, 14, and 21 MHz).

For 80 meter operation G3EAY uses half of the 7 MHz dipole as an end-fed Marconi. To achieve resonance, a simple loading coil is included in the feeder arrangement (fig. 4).

G3EAY uses 75 ohm twin-lead feeder for the multiband dipole and a 1-to-1 balun at the shack. A double-pole, double-throw switch makes the changeover for 80 meter operation.

The support mast at the far end of the dipole is made up of sections of scrap steel water pipe. An inexpensive substitute for this material is the aluminum TV mast sections sold by Radio Shack.

The other support for the dipole is a 28 MHz vertical cut from a defunct CB antenna. An insulated pulley mounted on the vertical supports the multiband dipole above the house roof.

Although G3EAY doesn't mention it, some radials are required for the 28 MHz vertical, and a good ground connection is required for 80 meter operation. Four or five ground rods, about three feet long each, connected in parallel, should do the job.

G3EAY has found the maximum value of SWR on any band is less than 1.5, so he uses no antenna tuner. Trimming the antennas for minimum SWR at your favorite operating frequency should be a big help.

Combination antennas such as this are very handy for cramped spaces. The user may not be the biggest signal on the band, but general operation on a number of bands is very satisfying, regardless of signal strength!

Voodoo Telephone Calls

Well, it looks as if one culprit who initiates "voodoo" telephone calls has been found. These are the annoying calls that often arrive when you are eating dinner. When the phone is answered, no one is on the other end of the line!

Reid, W6MTF, has received many of these calls on his personal FAX line, which he never answers in voice. Apparently, the calling machine tries several times over a period of a few weeks. After a certain number of unsuccessful attempts, it abandons the number.

Scott, N6NXI, had a different situation. He had a device on his line that would identify a mysterious caller. He had a voodoo call, got the caller's number, and suprised the pants off the speaker at the other end by calling back. It was a telephone call solicitation company. A computer was used to make the calls in sequence. When the party answered, it connected the solicitor to the phone line. If the solicitor ran behind the computer and wasn't ready to take the call, the computer would drop the line, leaving the recipient angry and confused.

Scott found out the outfit that purchased the services of the call solicitation company was the legal defense fund of a large California environmental group! They were out to raise money. I won't embarass the environmental group by mentioning their name, but they aren't making any friends by this annoying scheme.