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The Incredible Antenna Mark 2

—a complete HF allbander in a very small space

Seven years ago I wrote an article titled "The Incredible 18-Inch Allband Antenna" (*73 Magazine*, March, 1975). Since that time there have been many variations built. The original antenna had some severe intermodulation problems which made extra signals appear just where you did not want them. My project was satisfactory for locations far from other radio stations, but not good for cities. The Incredible Antenna Mark 2 solves these problems.

The antenna is remarkable because it covers the entire shortwave band from the AM broadcast band up through the 10-meter band and is compact enough to sit on top of any receiver.

This antenna functions very differently from ordinary antennas. Imagine for a moment that any two conductors in the universe form the plates of a capacitor. If they are an inch apart they form a capacitor, and if they are 1,000 miles apart they still form a capacitor. Naturally, the impedance of a capacitor with a 1,000-mile spacing is going to be very, very high. So what we want to do is build a very, very high input-impedance, active-circuit transformer to convert down to normal transmission-line impedances. If a little amplification is done at the same time, so much the better.

Photos by Carroll Haugh

Fig. 1. Schematic for the 18" allband antenna.

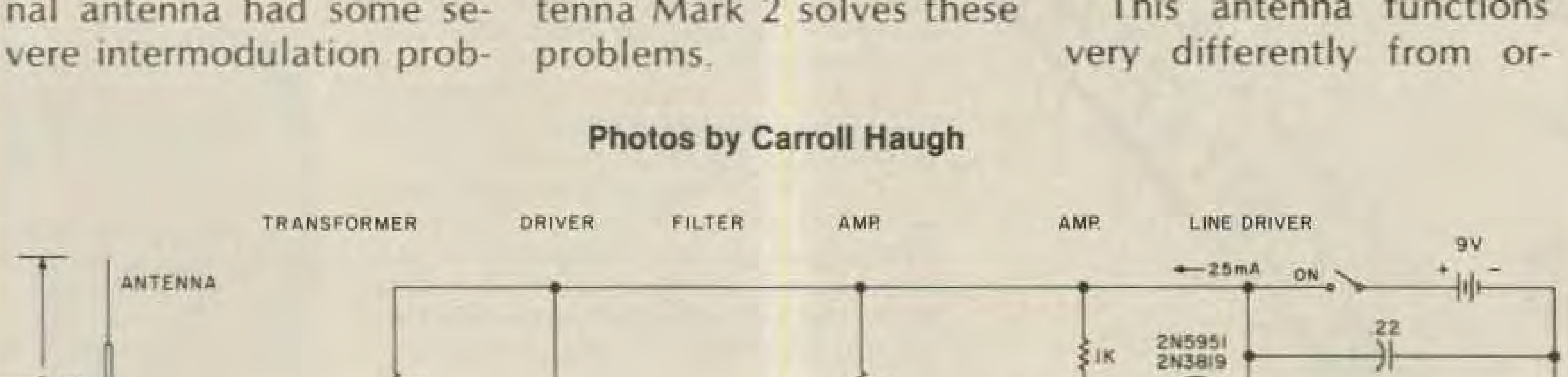

Fig. 2. QRM filters. All coils are ¼" diameter and ¼" long. Use #30 or smaller enamel wire.

The amplification of the improved antenna system shown in Fig. 1 is done by common rf field-effect transistors. Using FETs made a great improvement in the spurious signals. Note the terminals marked A, B, and C. These are for insertion of filters to remove local broadcast stations. Try jumpering A and B together first. If interference shows up, then add the appropriate filter from Fig. 2.

As for building the Mark 2, I used all common disc-ceramic or mylar™ capaci-

Photo A.

Photo B.

tors, carbon-film resistors, and FETs purchased from the local Radio Shack store. (I recommend 2N5951 FETs if you can get them, but 2N3819s do work.) All of this is mounted on perforated phenolic board. Leads should be kept short as is conventional in rf practice, and I used a number 18 AWG wire to form the ground bus. Make sure that there is as little capacity between the antenna rod and ground as possible. Don't use coax between the board and the rod; use an old-style ceramic feedthrough insulator for the rod or at least a large plastic support to keep the ground capacity low. I found that a replacement-type antenna designed for a transistor radio was ideal because it allowed me to adjust antenna length to reduce local interference.

If you are wondering about adding a power supply, watch out for electrostatically-induced hum. The voltage can be anywhere between 9 and 14 volts, but it is necessary to bypass the ac line to the antenna ground or, even better, use a wall-mount, calculator-style power supply. Internal power supplies will require that you shield the transformer and power line. If this is not done, then you will have CW signals modulated by ac hum. The easiest power supply is a good 9-volt battery.

Last time I wrote about the antenna, some low-frequency SWLs wanted to know if this would work all the way down to 10 kHz. The answer is yes, but only if the .002-uF capacitors are changed to 1 uF. Naturally, it becomes much more prone to power-line noise when you do this, and I don't recommend it unless you need the additional coverage. Using a very narrow-band receiver, I have been able to receive a Ft. Collins, Colorado, audio frequency station, but it was only marginal on an 8-foot rod.

I figure this project will cost $25 and two evenings, one to get the parts and another to build the antenna. It will open the lower frequency ham bands and the international shortwave bands to everyone with a receiver. I'm already working on the next version for use in my car with an integral noise blanker. ■

Parts List

1—1 megohm, ¼ W
2—22k Ohm, ¼ W
4—1k Ohm, ¼ W
4—470 Ohm, ¼ W

1—47 pF ceramic
1—470 pF ceramic
4—.005 μF ceramic
2—.22 μF (272-1070)

5—2N5951 (preferred), or 2N3819 (276-2035)
4—1N914 (276-1620)

1—Switch, SPST (275-324)
1—9 V battery or power supply
1—Battery holder (270-326)
1—Perfboard (276-158)
1—Battery snaps (270-325)
1—Box, plastic (270-218)
1—Antenna replacement (15-232)

(Radio Shack numbers given.)

If you really want to figure out how much capacitance there is between two identical rod antennas, then solve the following simplistic equation for a 10-cm spacing, and then for a 100-km spacing. For the academically inclined, the results are worth the effort. With L = length of wires in meters, D = spacing in meters, r = wire radius in meters, and C = capacity in pF, then

$$C = 17.7\pi L \left\{ \mathrm{Cosh}^{-1}\left[\frac{D^2 - 2r^2}{44}\right] \right\} - 1$$

Where: $\mathrm{Cosh}^{-1}x = 1n\,[x + (x^2 - 1)^{1/2}]$