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A 2m Antenna For The Perfectionist

—with considerable details

Having recently received my Technician license, I started my ham station with a 2 meter Heathkit 202 transceiver. I decided to build my own aerial and, after comparing the many different 2 meter aerial designs, settled for the vertical 5/8-wavelength ground plane antenna. This setup gives a power gain of almost 3 dB, as opposed to the 1/4-wavelength vertical, and is easy to construct, allowing omnidirectional communication.

Many articles have been published in amateur journals on antenna construction, but many just supply cookbook construction recipes, often without telling you how the various measurements of wire, etc., were obtained. Furthermore, you are at the mercy of the author's parts list. Because of this, I designed my own 5/8 antenna and, through the equations presented here, modified my construction to go with the materials I had on hand. You, too, can build this (design it) around *your* junk box, modifying things to suit your own list of materials for construction.

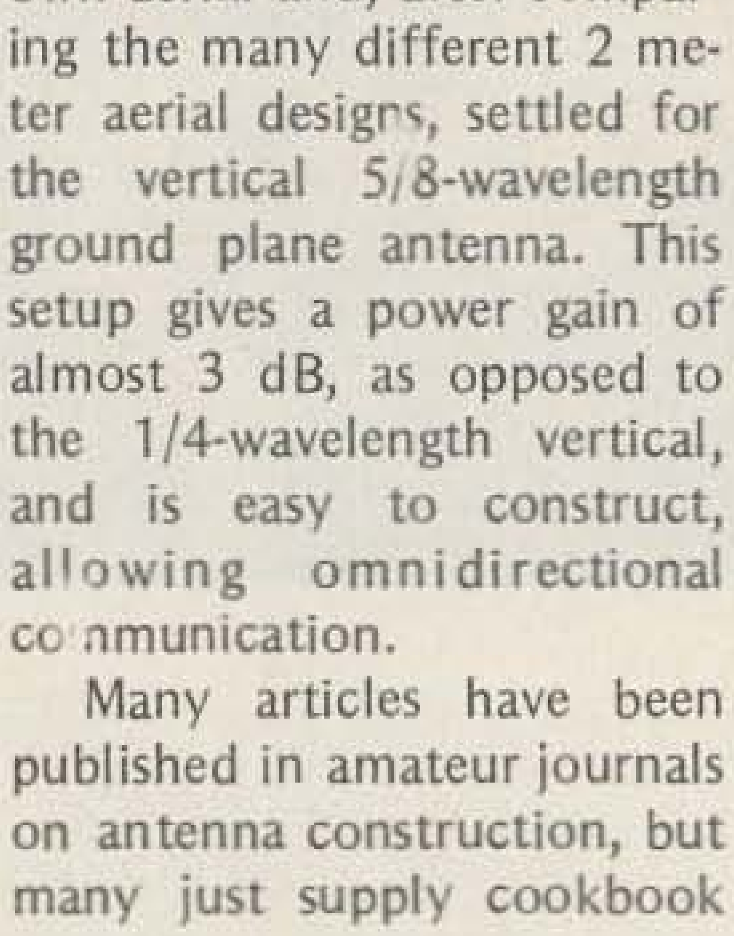

Fig. 1.

Where the Numbers Come From

Since $1/2\ \lambda = 468/\text{fMHz}$,[1] by simple ratios, $5/8\ \lambda = 585/\text{fMHz}$. For 147 MHz, $\lambda = 3.979$ ft. or 47.75 in. This is the vertical radiator length.

The ground plane reflectors are $1/4\ \lambda$ at the lowest frequency.[1] Since $1/4\ \lambda = 234/\text{fMHz}$, for 147 MHz, $1/4\ \lambda = 1.5918$ ft. or 19.1 in. This is the horizontal reflector length.

Since we are matching the antenna to an RG-58/U coaxial cable (transmission line), we need a loading coil to match this impedance (approximately 52Ω). Then $X_L = 52\Omega$, or, at 147 MHz, $X_L = 2\pi\ (\text{fMHz})(L) = 52\Omega$; $L = 52\Omega/2\pi\ (147\ \text{MHz}) = .05629$ uH. Note: Make the coil inductance .06 uH to allow for trimming.

Using the equation for a free-air solenoid coil, $L = a^2 n^2/9a + 10b$, where a = coil radius in., b = coil length in., n = coil turns/b. Solving for n: $n = \sqrt{L(9a + 10b)}/a^2$.

Here is where one can modify the coil to any desired specification. Since I had a lucite rod of a = .75 in. and b = 2 in., my design proceeded with n being calculated to equal 2.25 turns/2 in. Again, for adjustment and trimming, I made n = 2.5 turns/2 in. and picked #14 AWG enameled copper wire for the coil, although almost any large gauge wire will do (10-15 AWG).

My design followed that shown in Fig. 1. Construction is not critical, since final trimming gives the lowest swr. Incidentally, adjustment of the coil will compensate for slight variations in the radiator length, but don't exceed the calculated maximum value.

Construction

Since construction is not critical, parts are either your own junk-box variety or those listed in the parts list.

The construction of the

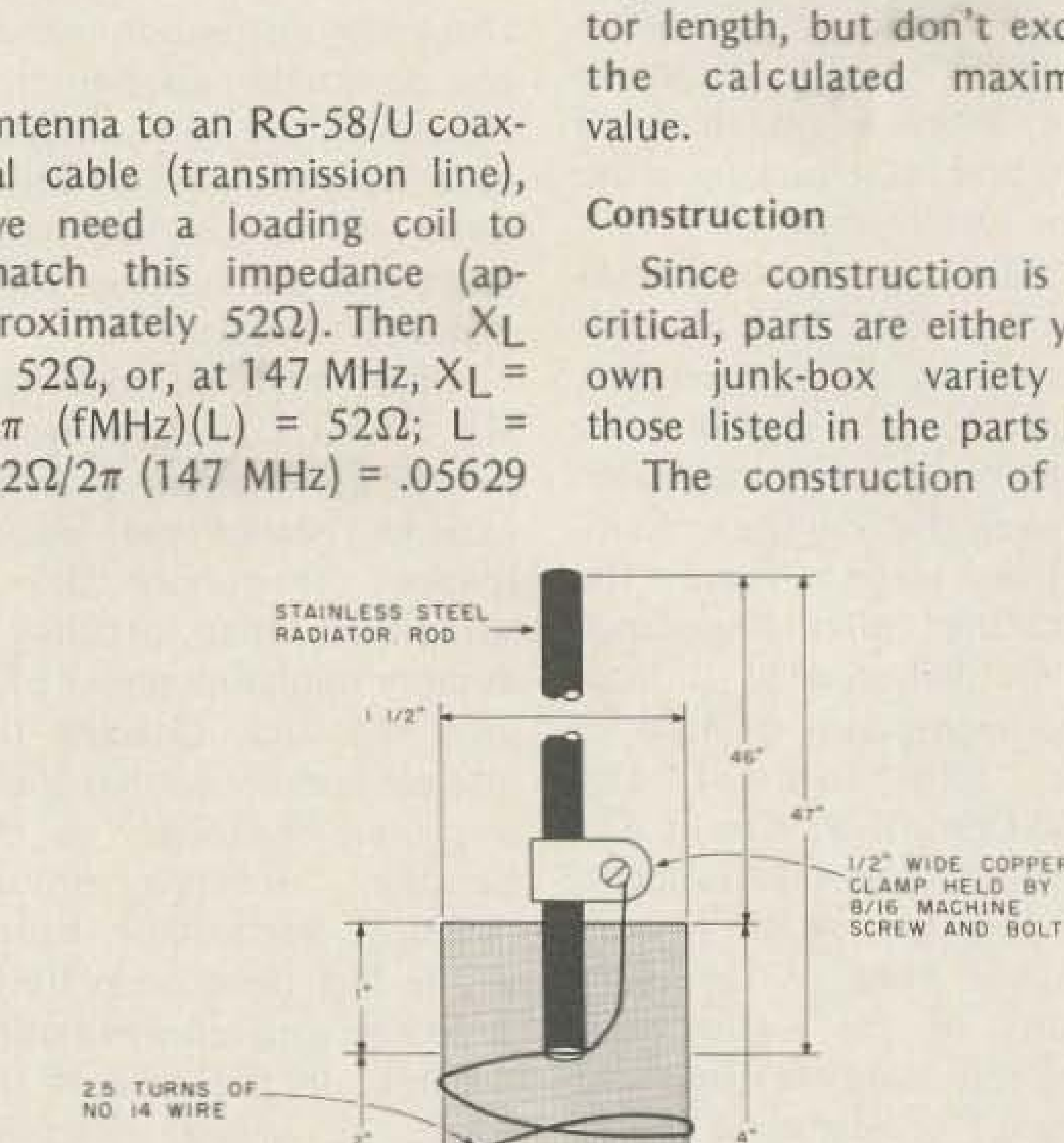

Fig. 2.

antenna is shown in Figs. 2 and 3. Details of the construction will not be given here, since construction always depends on materials on hand and the ingenuity of the person doing the building. However, complete details of this construction and parts availability will be gladly furnished on request.

Tuning

I used a Clegg FM-DX 2m transceiver for final tuning and a Heathkit HW-2102 VHF wattmeter to adjust the antenna to the lowest swr. Tuning was accomplished by adjusting the spacing between the coil windings until an swr of about 1:1 was obtained. In some cases, 1/2 to 1 turn of the coil wire may be needed to be added or subtracted from the original coil winding to achieve the lowest possible swr.

In a ground plane installation, the position of the reflectors will affect the swr obtained. Therefore, if necessary, the reflectors may be bent down at about a 45° angle and slowly moved upward to again obtain the lowest swr reading possible.

Final Comments

In my construction, it turned out to be unnecessary to bend the reflectors down on an angle. Also, a clear dope was used to seal the coils in place, once they were adjusted for the lowest swr reading.

As I originally stated, the main purpose of this article was to show you where some of the numbers came from in the design of a 5/8-wavelength antenna. Thus, this allows you the freedom to modify the design to the materials you have at hand. ■

References

[1] *ARRL Handbook*, 1975.

[2] "A 5/8 Wave Vertical For 2," Herbert S. Brier W9EGQ, *CQ*, February, 1964.

[3] "5/8 Wavelength Vertical Antenna For Two Meters," Ed Spadoni W1RHN, *Ham Radio*, March, 1976.

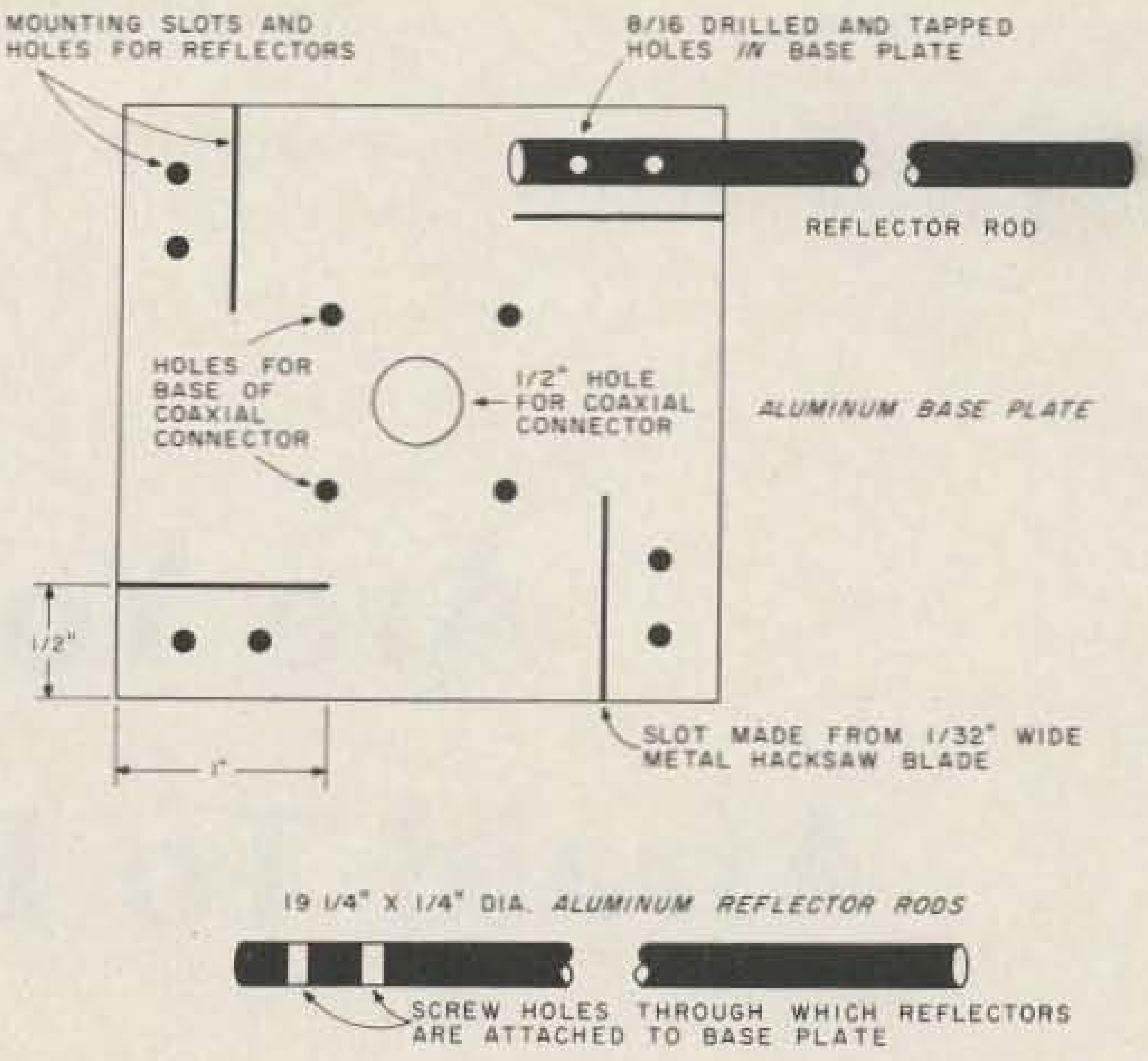

Fig. 3.

Parts List

1	47" stainless steel rod for the vertical radiator (or ¼"-diameter aluminum rod)
4	19¼"-long x ¼"-diameter aluminum rods for the reflectors
1	4" x 4" x 1/8" base plate of aluminum
1	1½"-diameter x 4"-long rod of lucite (or equivalent)
	#14 AWG copper enameled wire
1	female SO-239 coaxial connector
	assorted self-tapping screws
1	5" x 1" x 1/8" aluminum support bracket