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Ollie's Folly

Circular polarization on HF? A forty-meter helix with oil-drum forms? W1ZB's signal runs rings around the rest. Folly, indeed!

Circular polarization is very old, almost as old as radio itself. In 1953, I was working for the leading radar antenna company and was hired by the US Government to evaluate circular polarization. After two years of extensive field tests, circular polarization was found to be superior for transmission and reception over mountains and through rainstorms. When satellite tracking stations came into existence in the late 1950s, circular polarization was used exclusively for Doppler-effect receivers and is still in use today.

Twenty years later, I wondered why not use this same principle on high-frequency receivers and transmitters. If it works well on VHF, it will work well on HF. The only limiting factor is the size of the array for HF. After many years of experimenting in the Mojave Desert and on my antenna farm at Otter Creek, Maine, we have working models for most of the HF bands.

VHF antennas have always used one wavelength for the circumference of the helix. After much trial and error, we have found that HF, circularly-polarized antennas will work very well with a circumference of one-half wavelength. The tuning is very broad and will cover two bands.

The author and his 20-meter helix.

Construction

The best thing to use for

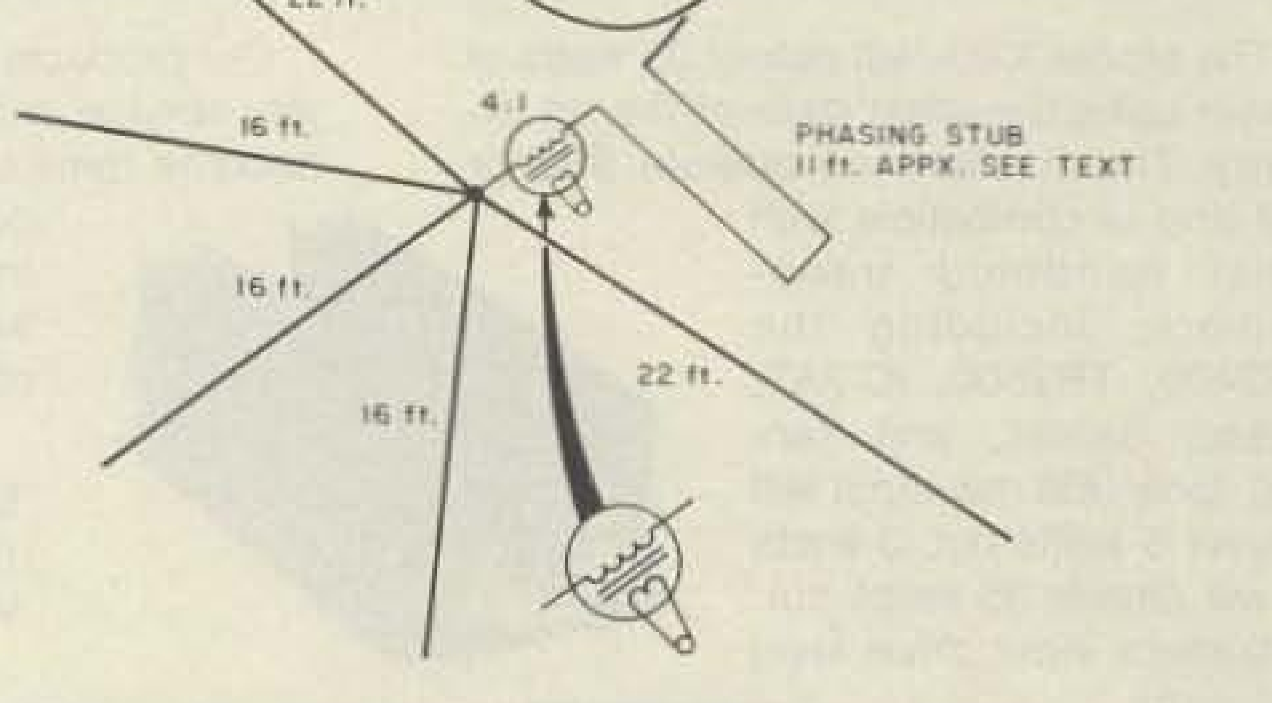

Fig. 1. Circularly-polarized, ground-mounted antenna for ten and fifteen meters.

the helix is a 3/4" rigid or semi-rigid coax of the type used for cable TV, available in most parts of the US. Only the outside conductor is hooked up during operation. The helix can be mounted with two wooden supports, 2" × 2" or 2" × 4" studs, for top and bottom. Pipe clamps are used to hold the coax onto the wood. It can also be hung on a slanting rope between trees. The wire used for the reflectors can be #18, #16, or #14 copper wire, covered or uncovered. The phasing section is a one-half wavelength of TV line (300 Ohms) resonated (dipped) with a MOSFET dipper or grid dipper to the frequency. The line is then coated with two coats of varnish to protect it from the weather.

In winding the helix, I used a big oil drum and a big water tank to wind it into shape. We had quite a search all over town to find something big enough to wind it around. Working the two sections of the antenna in phase results in a superior field pattern with a narrow beam of high intensity. Gain is 2 dB per turn. Use seven turns if possible, although a three-turn helix will work well.

The helix must be tilted at a 30-degree angle, otherwise all your power will go into the ground. A balun or tuned feeders work fine. The antenna is ground-mounted, with the base of the helix a few feet off the ground. The reflectors are a few inches off the ground with the center one slanted backwards in an almost vertical position. Two wooden posts are used to hold the front end of the helix at the proper angle of 30 degrees.

Tuning

When the antenna is completed, couple the grid dipper or noise bridge to the balun with two turns of wire. The balun ratio is 4:1. Adjust the stub at the end of the helix for resonance. It should be very broad. Tune it for 21.4 MHz and it should work on 10 and 15 meters. Coax/balun feed and tuned feeders have both worked well.

After eight years of testing, I can safely say it outperforms any yagi or quad of the same size. A 10-ft.-diameter helix works well on 20 meters.

Band	Diameter of Helix	Approximate Phasing Stub Length
40m	20 ft.	32 ft.
20m	10 ft.	16 ft.
15m	7 ft.	11 ft.
10m	5 ft.	8 ft.

Table 1. Construction dimensions for circularly-polarized antennas.

$$L = n\sqrt{c^2 + s^2}$$

$$L = \sqrt{a^2 + (n\pi d)^2}$$

where:
n = number of turns
c = circumference of each turn
s = lead or spacing of turns
a = length of the helix
d = diameter of the helix
L = length of rigid coax

Fig. 2. Formulas used to determine the optimum dimensions for circularly-polarized antennas.

No matter what kind of antenna you have, the polarization of the received signal a thousand or more miles away will be different from the one sent out by your antenna. Extensive testing of dipoles and beams over a path of 500 miles has shown the signals to be coming in at a 45-degree angle on most HF bands. The circularly-polarized antenna was better able to cope with this phenomenon and showed a remarkable gain over any conventional antenna. ■

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