An Inexpensive Multiband VHF Antenna

A low-cost discone antenna, usable on 144, 220 and 420 MHz.

By David Geiser,* WA2ANU

When I brought my new 2-meter transceiver home, I wanted to get on the air quickly to try it out. Needing an antenna, I tried a quarter-wavelength rod. It worked, but after a few contacts I began to worry about high SWR and the effect it might have on the transmitter PA transistor. Remembering some work I'd done several years ago, I decided to build a discone, or discone antenna. While my antenna was made cheaply and simply, and intended for installation in the attic, I've given some hints to help you ruggedize your discone for outdoor mounting. If you think you might want to use a single vhf antenna on more than one band, or if you just want to try something different, you may decide to build a discone, too.

How It Works

The discone antenna functions as a wide-bandwidth, impedance-matching transformer, coupling a low-impedance transmission line to the higher impedance of free space. In the process, it radiates with a pattern similar to that of a quarter-wavelength vertical antenna above a groundplane. Waves form at the feed point (cone apex) and travel on the antenna surface to the edges of the cone and disk. The dimensions and geometry of the antenna are chosen so as to make the impedance at the edges similar to that of free space. We know that maximum energy transfer occurs when impedances are matched, so the antenna radiates. A discone antenna acts like a high-pass filter. Below some cutoff frequency, the SWR will increase rapidly. Above this frequency, the antenna SWR remains low up to a maximum of 10 times the cutoff value, depending on the design

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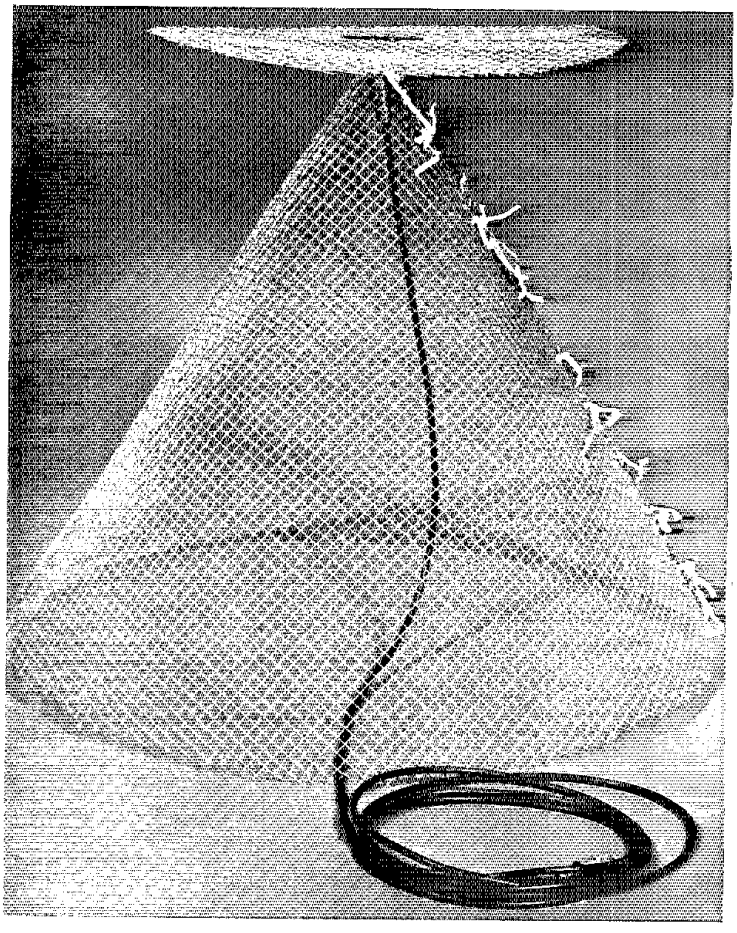
A completed discone antenna suitable for use on the 144-, 220- and 420-MHz bands. This antenna wouldn't last long in the outdoors, but is fine for indoor use. For outside installation a more robust construction is required.



proportions. The unit described here shows less than 2:1 SWR from 140 to 450 MHz. At 1300 MHz, the SWR measured 5:1. Fig. 1 gives dimensional information for the antenna. The slant height and diameter of the cone are the same, about 110 percent of a quarter wavelength at the lowest operating frequency. Diameter of the disk is about 66 percent of a quarter wavelength.

Construction

At first I planned to use roofing copper to build the antenna, but quickly dropped that idea when I found that material would cost nearly $30. I spotted a roll of hardware cloth, sometimes called "chicken wire," and decided to use that instead. It cost less than $5 for a five-foot-long piece of two-foot-wide (1.5 × 0.6-m) material. The galvanized-steel wire that makes up the hardware cloth is spaced 1/4 inch (approximately 6 mm).

Cutting information for the discone may be ascertained from Fig. 1. A felt-tip marking pen is useful for drawing a pattern on the hardware cloth. Forming the cone may require some help. Leather-palmed gloves will protect your hands from the sharp ends of the wire. While my wife held the cone in position, I used bread-wrapper ties to hold the edges together. To make sure it stayed in place, I soldered the seam in a few locations. This was only for mechanical reasons — current flows down the cone, not around it, so electrical continuity isn't required. I found it easier to use the bread-wrapper ties if I formed them into the shape of a J, pushed the bent end through from the outside, then pulled it back out so that the loop formed around the wire. After the seam is soldered, the ties should be removed.

A 1 × 3-inch (25 × 76-mm) piece of sheet copper is supported by the SO-239 connector, and is soldered to the disk. The connector is soldered to the cone with its threaded end pointed down. The disk is supported about 1/2 inch (12 mm) above the cone.

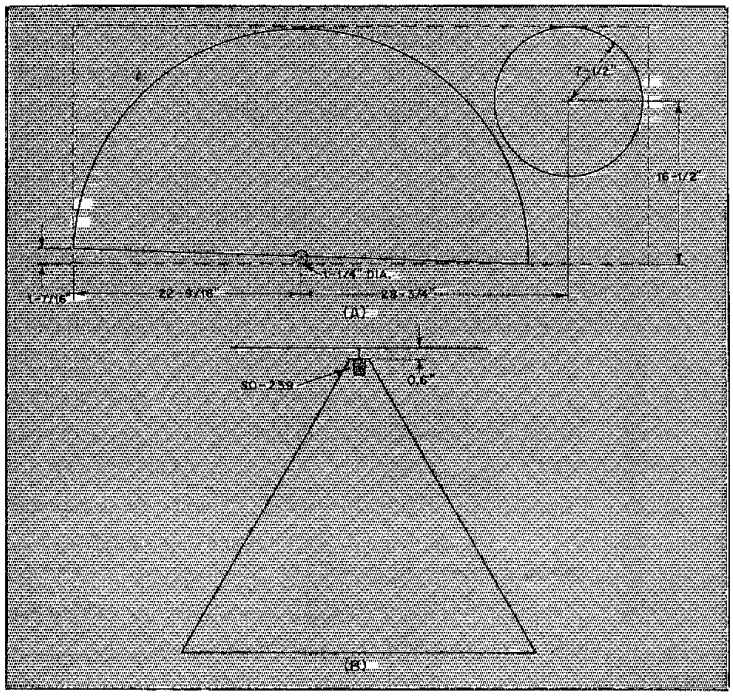


Fig. 1 — At A, cutting dimensions for the 140- to 450-MHz discone. At B, placement of the disk above the cone. Dimensions given may be scaled for other frequencies. Inches × 25.4 = mm.

It Works!

Naturally, as soon as I'd finished building the discone I placed it on a table, hooked up the rig and tried it out. From my rural location I could key three repeaters (it helps to live on a hill). The next day I took the antenna to work and measured its SWR in the lab. At 146 MHz it measured 1.6:1, rising to only 2:1 at 440 MHz. That night I took the antenna home and installed it in my attic. Now that it's up higher and above the aluminum siding, it works very well. The lower edge of the cone is at the same potential all the way around, allowing the antenna to be mounted on a metal surface, although this will change the radiation pattern somewhat. A support mast that extends into the cone will have little effect on the antenna performance. Lower frequency discones may be built using a number of individual wires to make the cone and disk. The disk may be approximated with metal rods if desired. If necessary, thin, nonconductive insulators may be used to support the disk. QST

Strays

***QST* congratulates . . .**

☐ Phil Goetz, N6ZZ (ex-W6DQX), who has been promoted to methods and procedures manager of the Transamerica Insurance Group, Los Angeles.

OOTC PRESIDENT

☐ Ray Meyers, W6MLZ, former Southwestern Division director, assumed duties as president of the Old Old-Timers Club recently, as Col. Fred Elser, KH6CZ, resigned to pursue a doctoral degree at the University of Hawaii at Manoa.

I would like to get in touch with . . .

☐ judges who are radio amateurs, especially other federal judges. J. Foy Guin, Jr., W4RLS, 354 Federal Courthouse, Birmingham, AL 35203.

SOCAL FAST SCAN

☐ Southern California amateurs who are interested in uhf ATV may obtain information from the Southern California ATV Club, c/o John Ruckert, WB6ZPN, Secretary, 953 S. Beacon Ave., Los Angeles, CA 90015, or call the club station, WA6EVQ, on 146.43 MHz.

ROBERT E. FOX, WA6TXI

☐ Among those involved in the September 25 midair collision over San Diego was the PSA copilot, Robert E. Fox, WA6TXI. Licensed as a General since 1973, he had lived in nearby La Mesa.

KA6-TO-KA6 TRANSPACIFIC

☐ KA6AKF/California and KA6DX/Okinawa report what they believe to be the first KA6-to-KA6 QSO across the Pacific.