Turnstile Antennas

A budget antenna for HF–UHF.

by John B. Dillon, M.D. KH6FMT

The turnstile is one of many useful antenna designs. I have used it as an omnidirectional antenna on 435 and 146 MHz for low-orbiting satellites. It's also good for the RS 10/11 satellites on the 10 and 15 meter bands, as well as for general use on those frequencies, and for local UHF and VHF operation. The best description on turnstile construction is in *The Satellite Experimenter's Handbook,* published by the ARRL in 1984. However, there is an error in Fig. 6-28 on page 6-21; the shields of the 50 and 92 ohm coaxes should be soldered at their point of contact.

CORIAN® by Dupont, used to line countertops and shower stalls, facilitates construction of the turnstile. It is expensive, but scraps are available. *[Ed. Note: Call 1-800-426-7426 to find your local CORIAN dealer.]* CORIAN is resistant to heat and very strong. You can saw, drill, or turn it. It is a totally satisfactory insulating material at all frequencies, at least through 435 MHz.

To make the disc, you can use a 2" hole cutter on CORIAN that is ¼" to 5/16" thick (see Figure 1). The center hole is for mounting the antenna on a ¼" wooden dowel. I used #10 house wire for the dipoles on 435 MHz and ⅛" brazing rod for 2 meters. I have not tried the antenna on 220 MHz, but it should work satisfactorily. These antennas require a reference ground plane. On 10 and 15 meters, I use dipoles mounted on the roof, drooping at 45 degrees, without any specific reference ground.

DXing with the Turnstile

When OSCAR 12 was available, I received

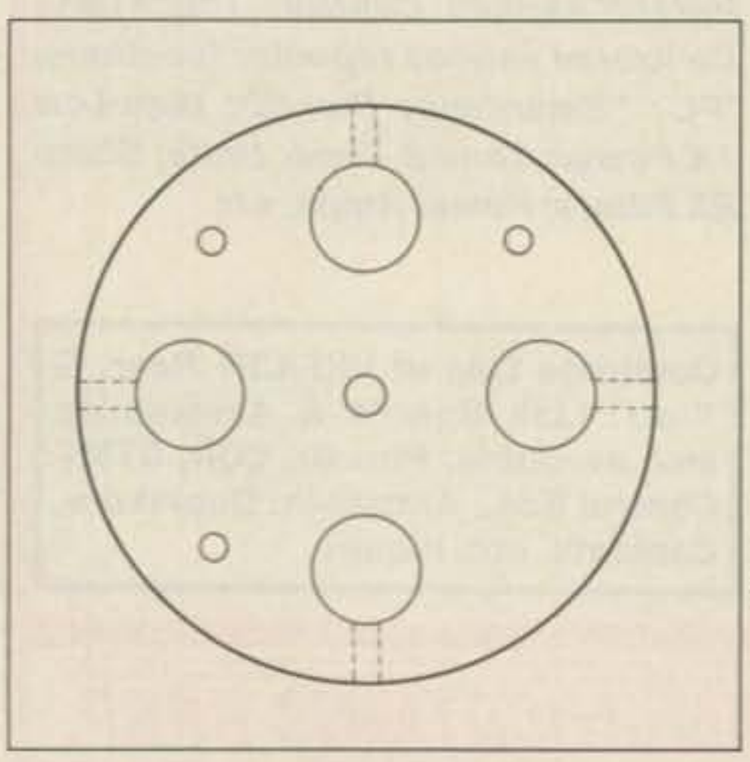

Figure 1. Hole pattern for the CORIAN mounting disc.

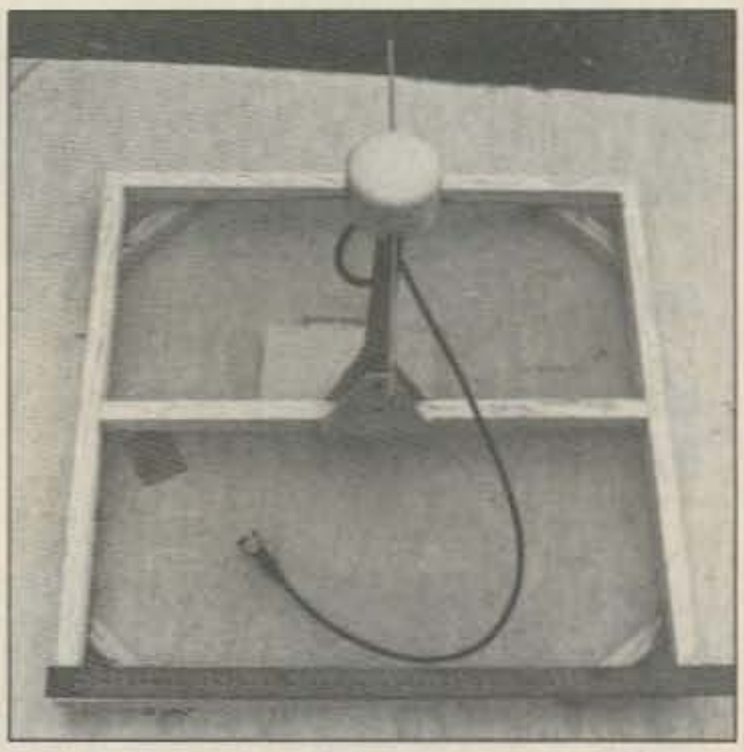

Photo A. 435 MHz turnstile antenna.

its beacon at the 1500 km maximum limit of acquisition as calculated on the Graftrak II program by my computer. On 10 and 15 meters I have worked both the US and Australia. The 10 meter unit would seem particularly attractive for the Novice. This works well with the new Microsats and should be an excellent choice for WEFAX reception on 137 Mhz. It has even been used to work through OSCAR 13.

These are not gain antennas, but my location here in Hawaii is ideal: thousands of miles from any large body of land, surrounded by salt water.

Cutting and Trimming the Coax

RG-62 (92 ohm impedance) is used as the quarter-wave delay line between the dipoles. Amateurs don't generally use this type of coax, but it is advertised by and available from most suppliers. Its velocity factor is 0.84. In Figure 2, you will find the lengths of RG-62 for the various frequencies. Trim the dipoles for best VSWR at the frequency of

FREQUENCY	MATCHING SECTION	DIPOLE
435	5.4 INCHES	6.4 INCHES
220	10.72	12.76
146	16.1	19.25
28.5	82.76	98.5
21.5	109.7	130.6

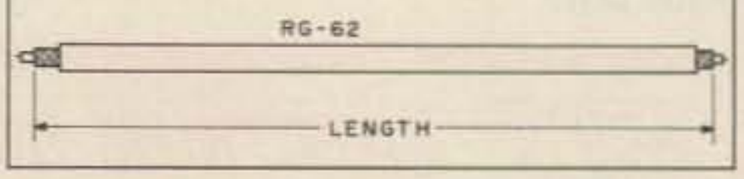

Figure 2. RG-62 matching section and dipole lengths for the various frequencies.

interest, although the antenna is moderately broadbanded. Cut the RG-62 for the center of each band. Calculate the lengths using the standard formula of 468/F(MHz).

The ground references on UHF and VHF are made with metal screening and chicken

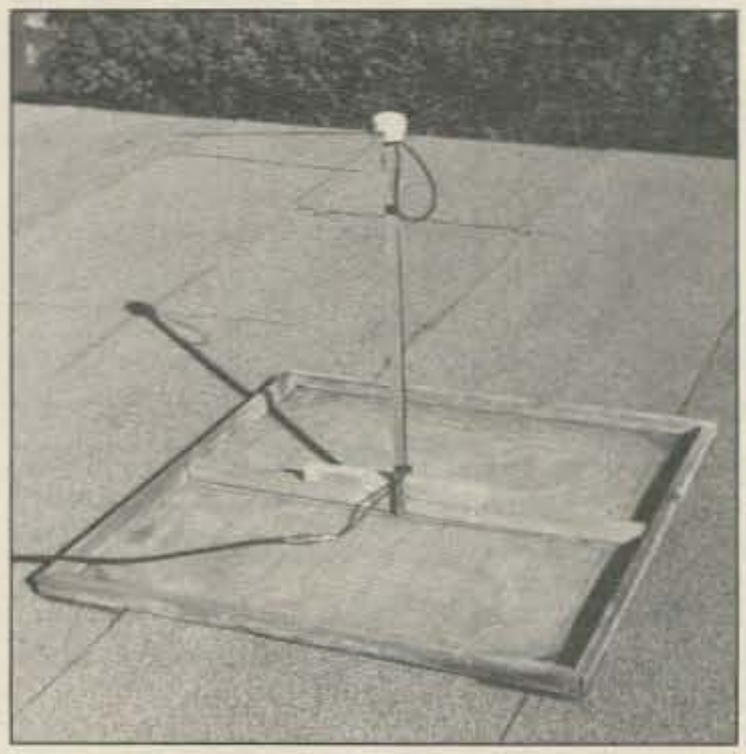

Photo B. Two meter turnstile antenna.

Photo C. Detail of the disc cover on the 10 meter unit.

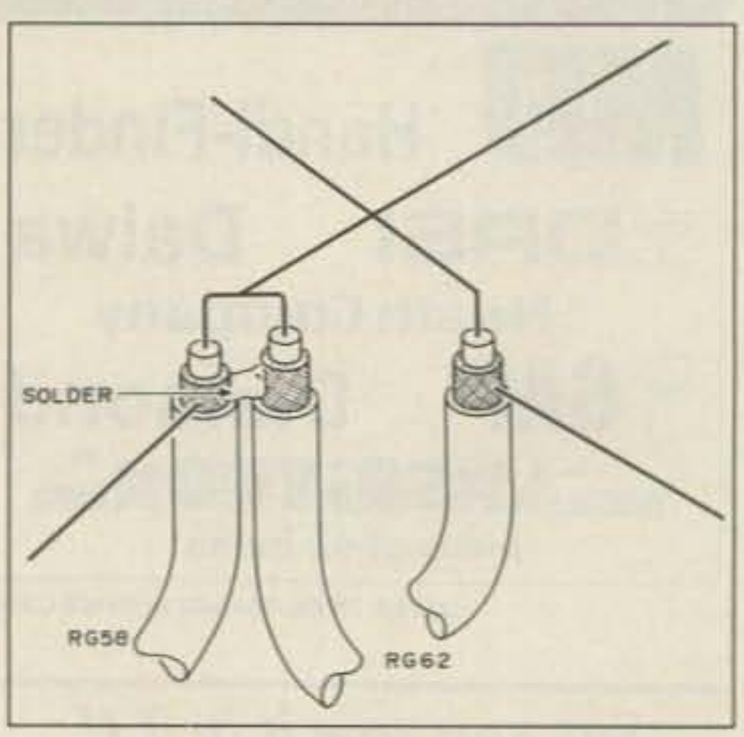

Figure 3. Feedline configuration of the turnstile.

wire. The 435 frame is 20″ square and the 2 meter is 48 inches. Thirty-six inches would be fine for 220 MHz. Experimenting, I found the distance of the dipoles from the ground planes optimal at around 3/7 of a wavelength as recommended by K2UBC. A spacing of 13-¾″ was optimum for 435 MHz and 35-½″ worked best for 2 meters.

I used a length of RG-58 from the dipole junction to the main coax. Do not use foam type RG-58, as soldering this to the elements is very unsatisfactory.

Photo A shows the completed 435 unit. I used a PVC 2″ cap over the disk for weather protection, and filled the holes with white liquid rubber. In a 2 meter antenna, the holes could be filled with epoxy cement for additional strength because of the longer dipoles. Using care, it is possible to get close to a 1:1 SWR with these units. However, to do this with a Bird meter at the junction of the RG-58 and the main line, you have to stand at least 10 feet from the UHF and VHF antennas to read the meter. Minimum SWR can be obtained with the VHF and UHF versions by slightly adjusting the element height above the ground plane. I use the meter in the shack on 10 and 15. A ground plane framework is not necessary for the 10 and 15 meter turnstiles. These dipoles are set with the 15 meter unit about four feet above the 10 meter unit on the same wooden mast, and rotated at 45 degrees. It looks somewhat like umbrella spokes or a discone. 73

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