The J-pole antenna uses a half-wave radiator fed by a quarter-wave matching stub and is very popular on the 2 meter band. K6MHE explores problems with the J-antenna and offers his solutions.

The Skeleton-Sleeve-Fed Monopole

BY DAN RICHARDSON,* K6MHE

The Skeleton-Sleeve-Fed Monopole (SSFM) is really a J-pole antenna with improved performance characteristics. This antenna has an excellent omnidirectional pattern, exhibits a good match to 50 ohm coax, and can be constructed in about an hour at a low cost and from easily obtainable materials.

The Problem of a Standard J-pole Antenna

The J-pole is an easy antenna to construct, and if certain precautions are followed, it provides good performance. However, the J-pole does not produce a true omnidirectional pattern due to radiation from the 1/4-wavelength stub (matching) section (see "The J-pole Revisited, " by K6MHE, *CQ*, March 1998).

J-poles usually are built using one of the two popular configurations shown in fig. 1—the shorted-base technique fed by open-wire feed lines, or the open-stub-fed antenna fed by coax. However, whichever arrangement (open or shorted base) is used, the J-pole's skewed omnidirectional pattern remains essentially the same.

The Solution

The directional pattern can be improved by modifying the 1/4-wave matching section. This technique entails replacement of the 1/4-wave element with a cylinder surrounding the radiator to form the 1/4-wave coaxial section shown in fig. 2. Although the antenna can no longer truly be called a J-pole, because it does not resemble the letter "J," it operates on the same theory as the J-pole, but with a true omnidirectional pattern.

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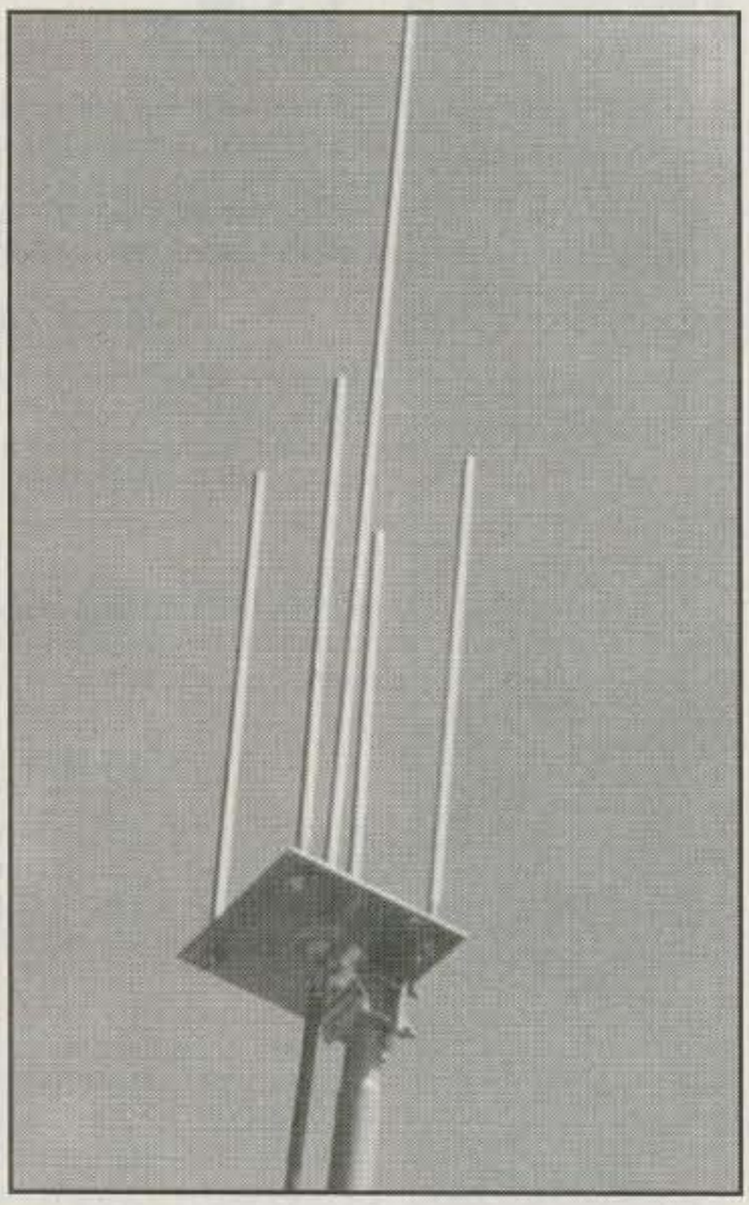


The Skeleton-Sleeve-Fed Monopole (SSFM) mounted to a vertical pole using the RadioShack mounting bracket.

One problem using this technique is the difficulty in constructing and mechanically supporting the outer sleeve segment. This problem can be overcome by replacing the solid outer sleeve with four vertical stubs. The result is the Skeleton-Sleeve-Fed Monopole depicted in fig. 3. The antenna's excellent omnidirectional performance can be seen in the computer-generated plots shown in fig. 4.

Construction

Fig. 5 shows the antenna assembly information and materials list. The layout and dimensions for the base mount-

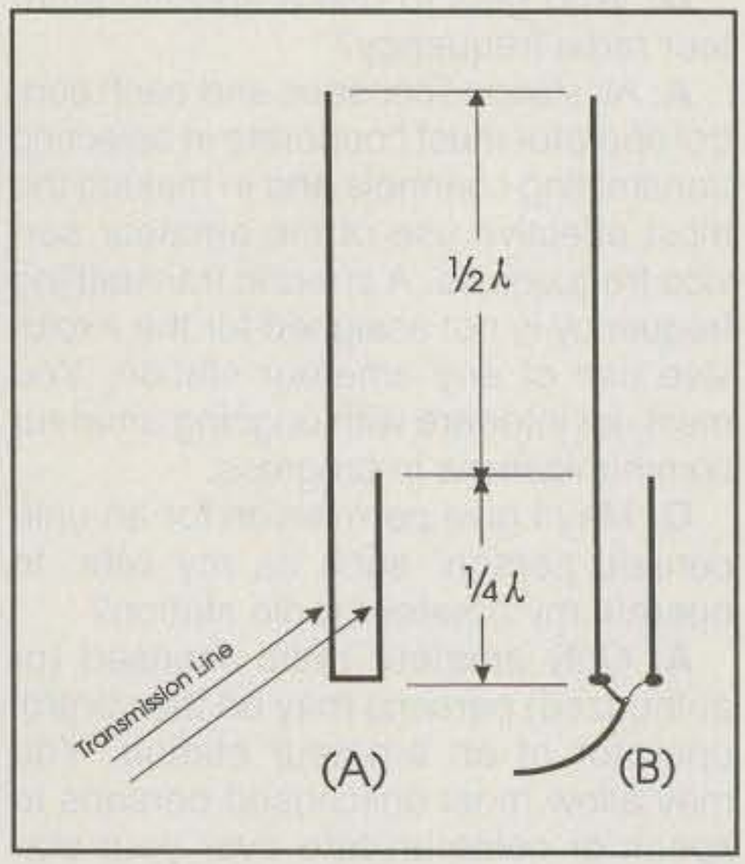


Fig. 1– Two possible J-pole configurations: (A) shorted base and (B) open base.

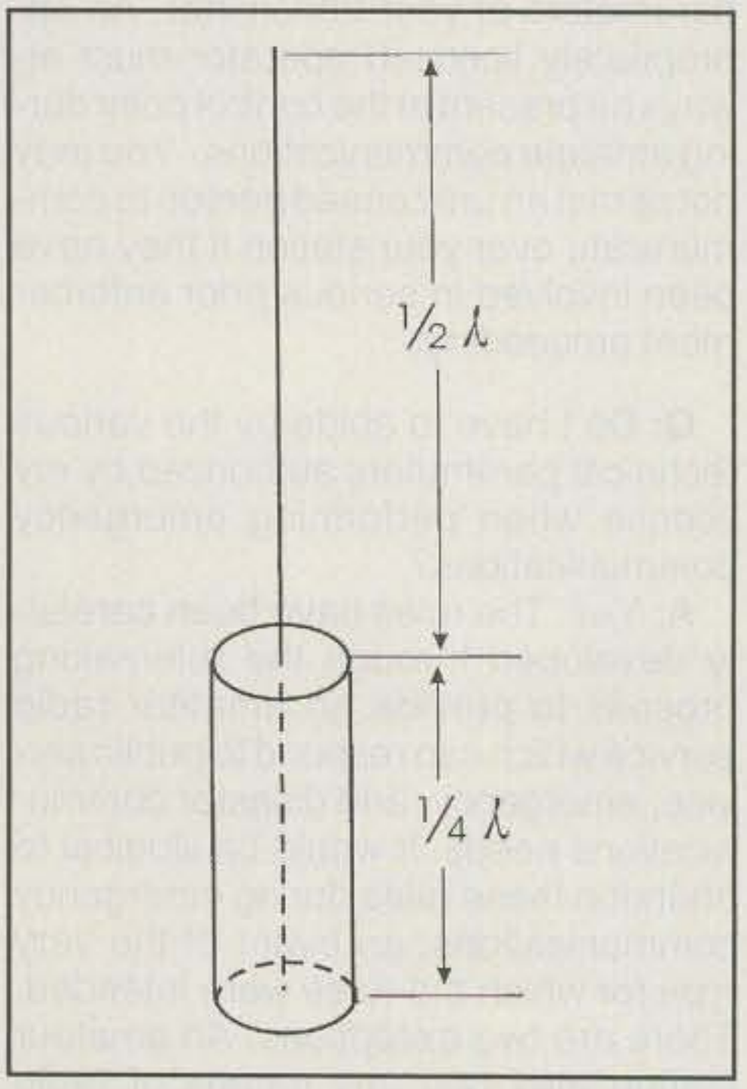


Fig. 2– A coaxial-sleeve-fed monopole.

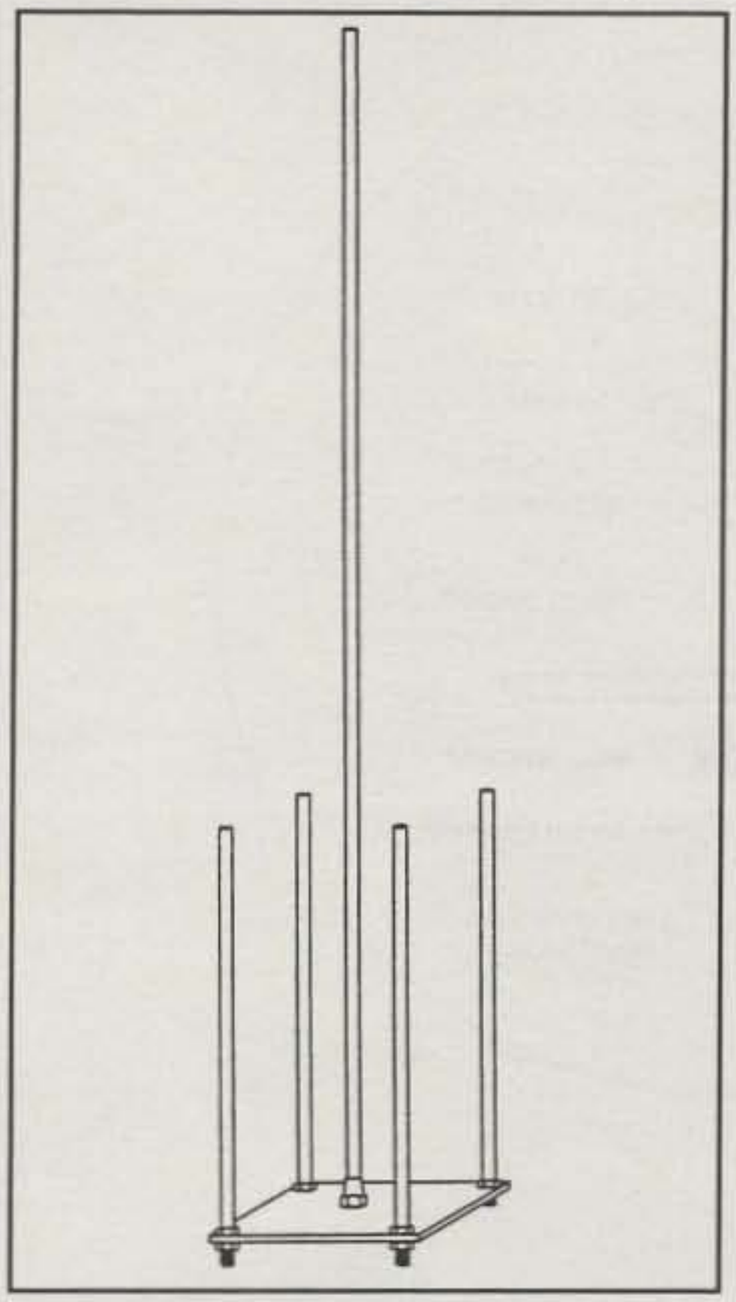


Fig. 3– The Skeleton-Sleeve-Fed Monopole.

ing plate (which was made from a scrap piece of 1/8 inch thick aluminum panel stock) are given in fig. 6. The total cost of the required materials was less than $30. The aluminum rod and stainless-steel hardware were acquired at my local home-supply store. The center element support and mounting bracket assembly is an inexpensive mobile antenna-mounting bracket obtained at RadioShack (catalog #21-937B).

With the exception of the hole diameters, the base-plate dimensions (fig. 6) are not critical. However, be sure to drill the five holes in the base plate perfectly vertical and maintain equal distances between the center-element mounting hole and each of the four stub-element mounting holes to retain good balance. Carefully cut threads into one end of each of the aluminum rods as shown in fig. 5. Keep the thread cutting die perpendicular to the rod when cutting the threads to assure that all of the elements are perpendicular after the antenna is assembled.

The 59 1/4 inch length given for the driven element in the materials list is correct. Attaching the antenna mounting bracket to this element adds the 1/2 inch required to yield the proper length (59 3/4 inches) of the radiating element.

Adjustment

If the antenna is built to the specifications shown in figs. 5 and 6, it should be resonant at approximately 146 MHz and should provide a good match to 50 ohm coax. The antenna measured less than 1.2:1 SWR at resonance (146 MHz) and not greater than 1.5:1 at the band edges. Calculated and measured SWR curves for the SSFM are shown in fig. 7.

The long 1 3/4 inch thread length on the 1/4-wave stub elements should provide enough range to adjust the antenna to resonance within the 2 meter band. In addition, the length of the 3/4-wavelength radiator element may also require adjustment. Remember, when building self-resonant antennas, making antenna elements slightly longer and then trimming them for the desired frequency is always good practice.

Installation Notes

The effect of common mode current on the transmission line can be very detrimental to any antenna's operation, especially at VHF/UHF frequencies. At

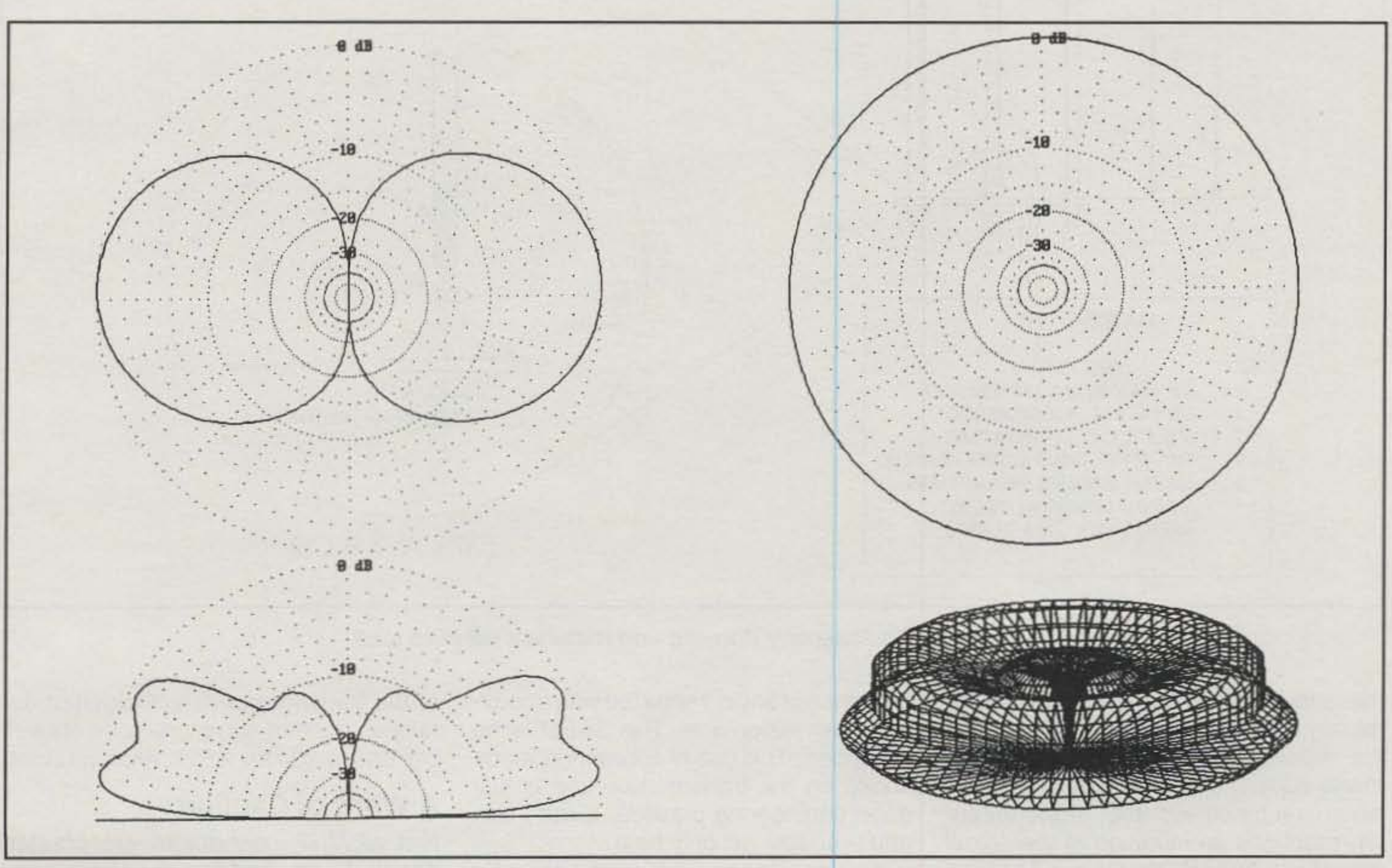
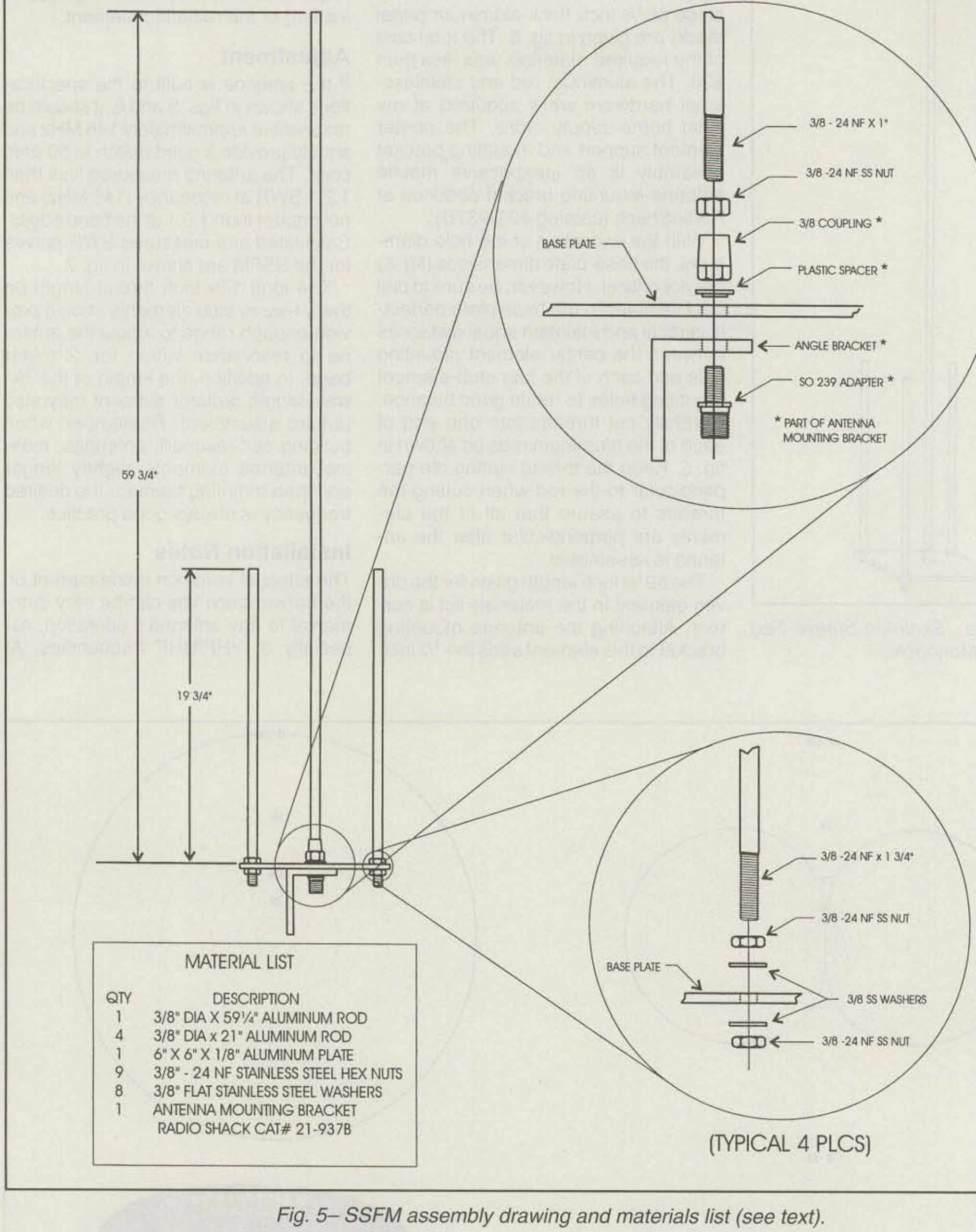


Fig. 4– Computer-generated plots for the SSFM. The upper two plots are free-space patterns, and the lower plots (elevation and 3-D) are above-average ground. Computer plots were produced using EZNEC antenna software (by Roy Lewallen, W7EL, P.O. Box 6658, Beaverton, OR 97007).



MATERIAL LIST

QTY	DESCRIPTION
1	3/8" DIA X 59¼" ALUMINUM ROD
4	3/8" DIA x 21" ALUMINUM ROD
1	6" X 6" X 1/8" ALUMINUM PLATE
9	3/8" - 24 NF STAINLESS STEEL HEX NUTS
8	3/8" FLAT STAINLESS STEEL WASHERS
1	ANTENNA MOUNTING BRACKET RADIO SHACK CAT# 21-937B

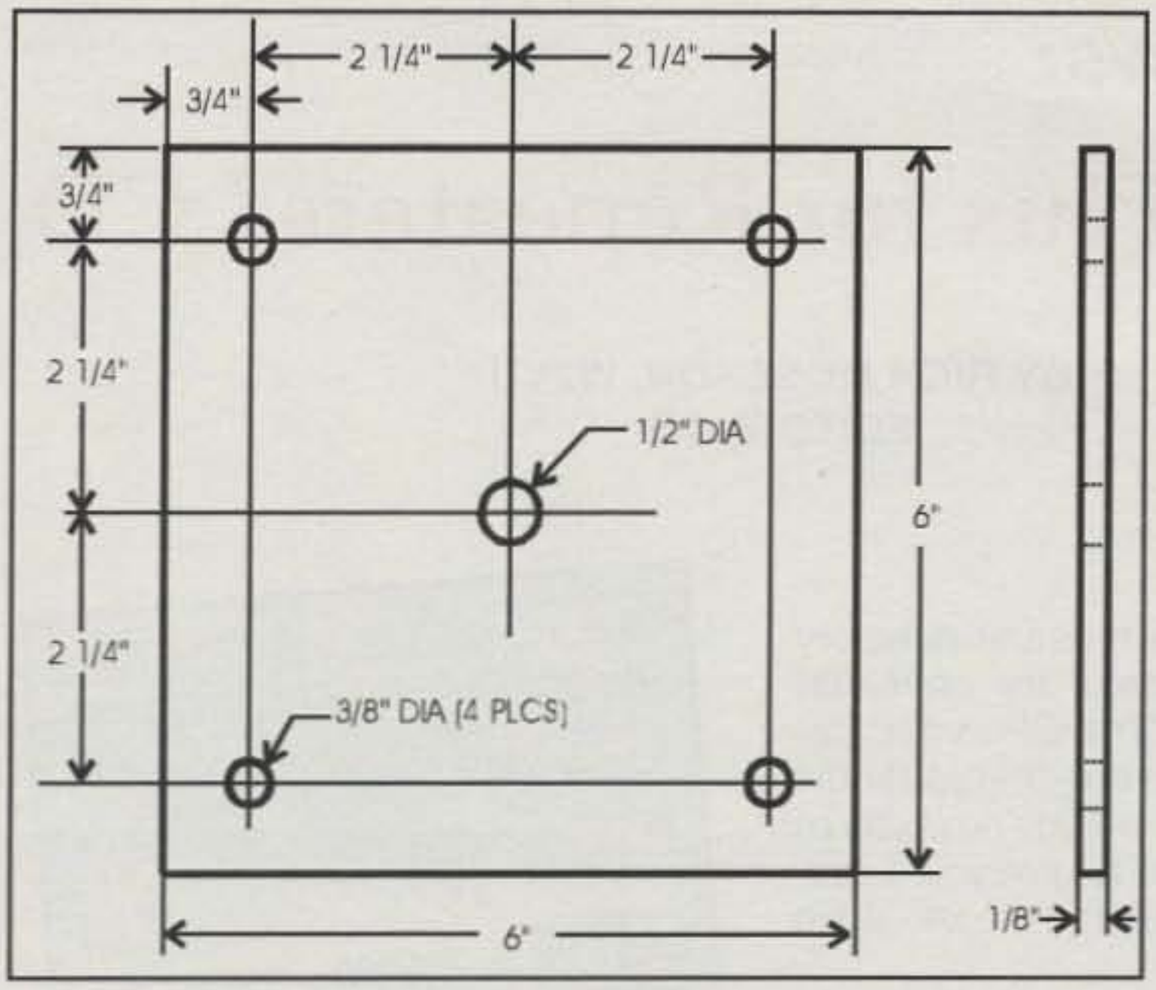
Fig. 5– SSFM assembly drawing and materials list (see text).

these frequencies the transmission line usually is several wavelengths long, and the radiation resulting from the common mode current on the transmission line, when combined with that of the antenna, produces an increase in the signal being launched at higher take-off angles. Unless you primarily are interested in talking to airplanes, a common mode choke should be employed for better performance of any antenna fed with a coaxial transmission line. The SSFM is no exception. The use of a common mode choke on the transmission line is just good engineering practice. It can't hurt and probably will only help.

You can make your own choke by coiling up a few turns of the coax, or better yet, by installing ferrite beads (W2DU type balun) at the antenna end of the transmission line. Complete details on making common mode chokes can be found in the *ARRL Antenna Book.*

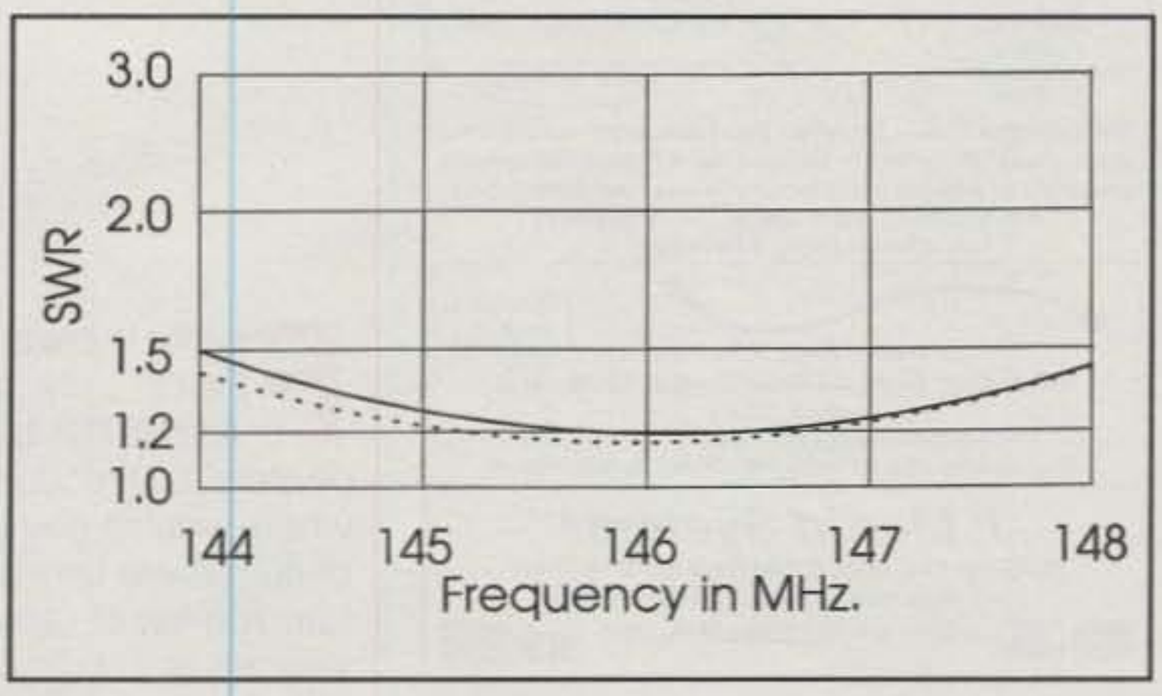
A Word of Caution

Not all VHF connectors are created equal! When I first constructed this antenna, I used a cheap CB mobile antenna adapter, obtained at a fleamarket, for the mounting of the center 3/4-wave-



← *Fig. 6– SSFM base mounting plate layout (see text).*

Fig. 7– Measured (solid line) and calculated (broken line) SWR values for the SSFM. ↓



length element. When measuring the SWR of the SSFM utilizing this adapter, I obtained readings of almost 1:1 at resonance and less than 1.2:1 across the entire 2 meter band. That seemed too good to be true—and it was!

On further investigation I found that the bargain antenna mounting assembly was no bargain at all. The unit had been constructed in such a manner that it had high losses at VHF, which in turn lowered the Q of the antenna, giving lower (and incorrect) SWR values. Although the SWR values appeared great, the antenna was not operating as efficiently as it should have been. It has been said, "Too low an SWR can kill you." It almost did in this case!

Conclusion

The Skeleton-Sleeve-Fed Monopole is relatively easy to construct, can be made with simple tools at low cost, and provides improved performance over a standard J-pole. Like the J-pole, the SSFM does not require any additional ground system, thereby making it an excellent candidate for operation on boats or on fiberglass motor homes. ■

KT4XA
2000 Young Ham of the Year

Christopher S. Arthur, KT4XA, of Russellville, Alabama, has been named the 2000 Newsline Young Ham of the Year. The award is co-sponsored by Amateur Radio Newsline, *CQ* magazine, and Yaesu USA. A senior at Russellville High School, Chris, 17, has been licensed since 1996.

Chris has been active in many aspects of ham radio, including traffic-handling and public-service communications. He is a co-founder of both the League of Young Radio Amateurs, a national club for young hams with over 100 members, and the International Youth Communications Council, a group designed to help young hams in other countries start their own amateur radio organizations. He is also webmaster of both groups' internet websites, as well as "ringmaster" of the Young Amateur Radio Operators Webring, a system that links more than two dozen websites and pages created by young hams.

The 1999 Young Ham of the Year, Michelle Swann, KE4EZI, presents the 2000 Young Ham of the Year plaque to her successor, Christopher Arthur, KT4XA, at the Huntsville (AL) Hamfest. (WA2OJK photo)

At the 2000 Huntsville Hamfest Chris was presented with his award, along with a Yaesu FT-847 transceiver (courtesy Yaesu USA), and a one-week trip to SpaceCamp (courtesy *CQ*), which he chose to donate to the Make-a-Wish Foundation. The presentation ceremony was covered by news crews from two Huntsville TV stations. Congratulations, Chris, from all of us at *CQ*.