

The Skeleton Sleeve Fed Monopole

Operates on the same principal as a J-Pole...But works better!

BY DAN RICHARDSON, K6MHE

The skeleton sleeve fed monopole (SSFM) works on the same principal of a j-pole but performs better. This antenna has an excellent omni-directional pattern, exhibits a good match to 50-Ohm coax and can be constructed at a low cost in about an hour from easily obtainable materials.

The Problem of a Standard J-pole

The j-pole is a comparatively easy antenna to construct in the home workshop and, if certain precautions are followed, provides good performance. However, the j-pole does not produce a true omni-directional pattern due to radiation from the $\frac{1}{4}$ -wavelength stub (matching) section.

J-poles are usually built using one of two popular configurations. The lower $\frac{1}{4}$ -wave matching section of the antenna may be fashioned using either open or shorted

base technique as shown in Figure 1. However, whichever arrangement (open or shorted base) is used, the j-pole's skewed omni-directional pattern (Figure 2) remains accentually the same.

The Solution

There is another approach, though not widely published, for making the $\frac{1}{4}$ -wave matching section. This technique replaces the $\frac{1}{4}$ -wave element with a cylinder surrounding the center element forming a $\frac{1}{4}$ -wave coaxial section as shown in Figure 3. Although the antenna can longer truly be called a J-pole, as it does not resemble the letter J, it does operate on the same theory as

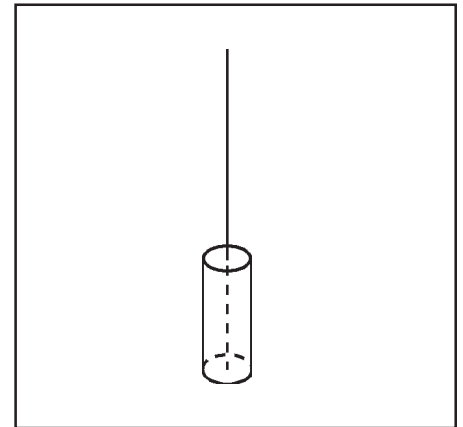


Figure 3 — Coaxial stub fed monopole

the open base type j-pole but it will render a true omni-directional pattern.

An obstacle using this technique is the difficulty in constructing and mechanically supporting the outer sleeve segment. Indeed, fabricating a solid

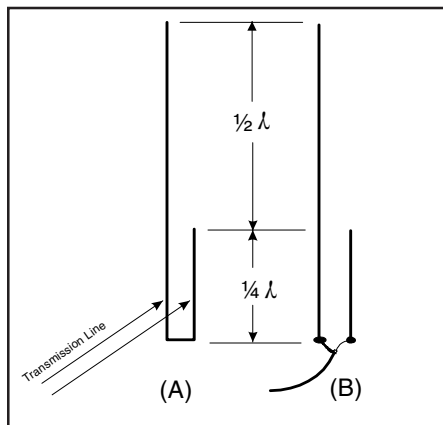


Figure 1— The two methods used for constructing j-poles (A) shorted base and (B) open base.

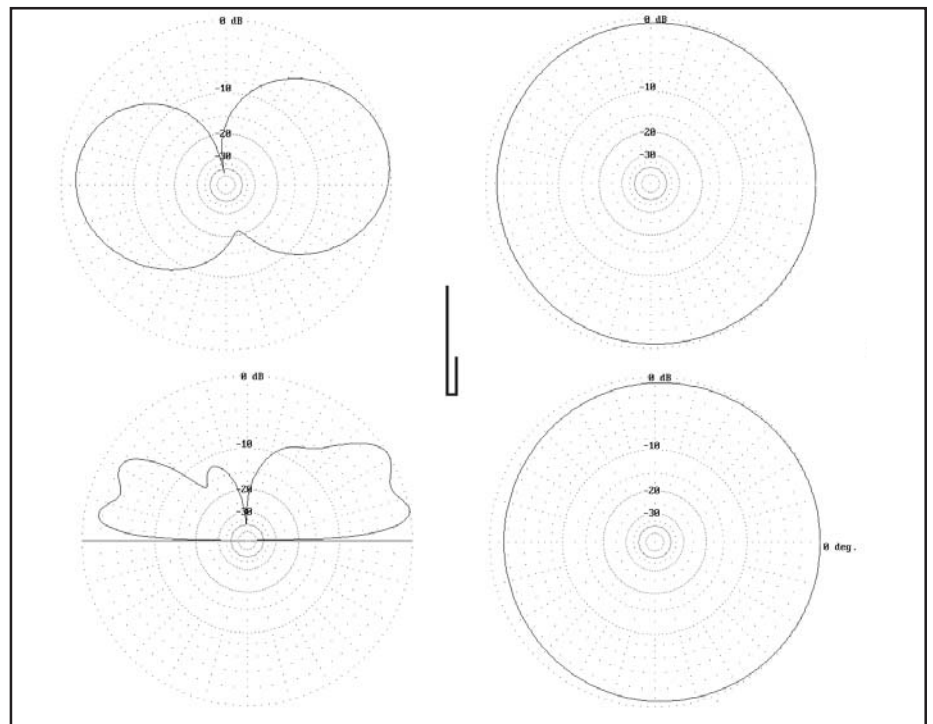


Figure 2 — Computer plots of a standard J-pole. Upper plots are free space and lower plots are over average ground.

sleeve would be a demanding task for those of us who have limited tools and shop facilities at our disposal.

That difficulty can be overcome by replacing the solid outer sleeve with a skeleton like structure that is much easier to build and yields the results. The outcome is the skeleton sleeve fed monopole (SSFM) shown in Photo 1.

NEC generated plots for the SSFM are shown in Figure 4. Note the antenna's improved omni-directional performance when compared to the j-pole's plots on the preceding page (Figure 2).

Construction

The antenna assembly information and material list shown on the last page (Figure 7) should be self-explanatory. The layout and dimensions for base mounting plate are in given in Figure 5, which I made from a scrap piece of 1/8" thick aluminum panel stock. The remainder of the materials were purchased at total cost less

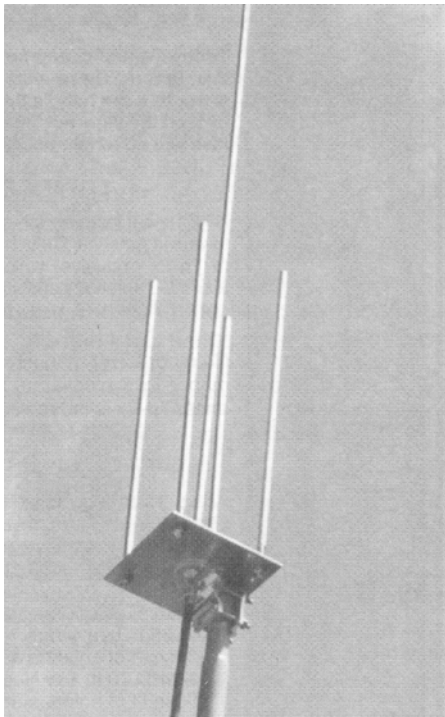


Photo. 1 — Skeleton Sleeve Fed Monopole

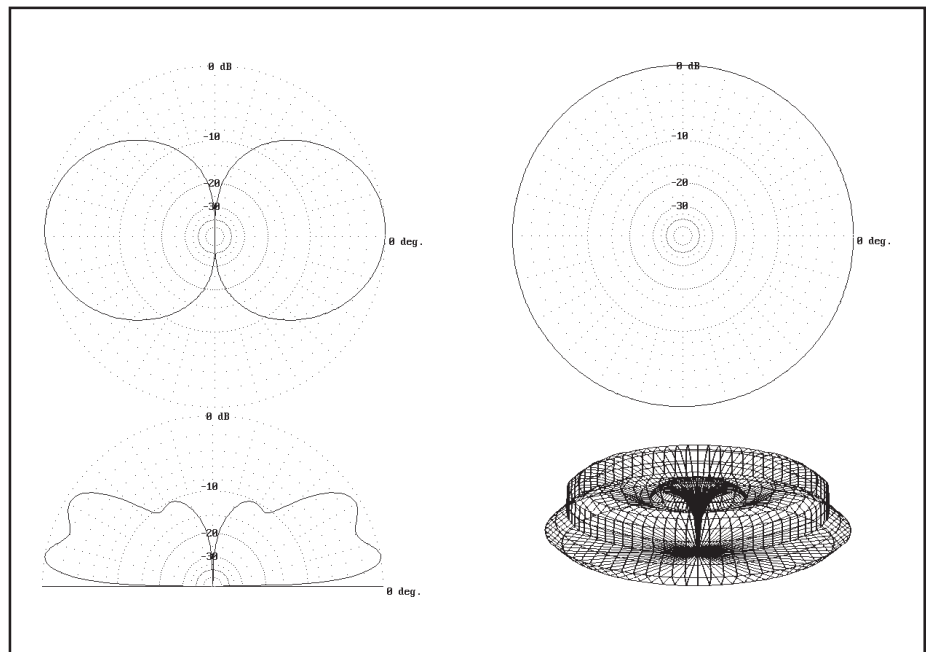


Figure 4 — Computer plots of SSFM. Upper left free space elevation, upper right free space azimuth, the lower elevation and 3-D plots are over ground.

than \$30.00. The aluminum rod and stainless steel hardware were acquired at the local home supply emporium. The center element support and mounting bracket assembly is an inexpensive mobile antenna-mounting bracket obtained at Radio Shack (catalogue # 21-937B).

For exception of the hole diameters the base plate dimensions are not critical, however, attention should be given in maintaining

equal distance between the center element mounting hole and each of the four stub element mounting holes in order to maintain good balance. Additionally, care should be taken when threading the aluminum rods. Maintain the die straight and perpendicular to the rod when cutting the treads otherwise you may have the elements leaning every-which-way when the antenna is assembled.

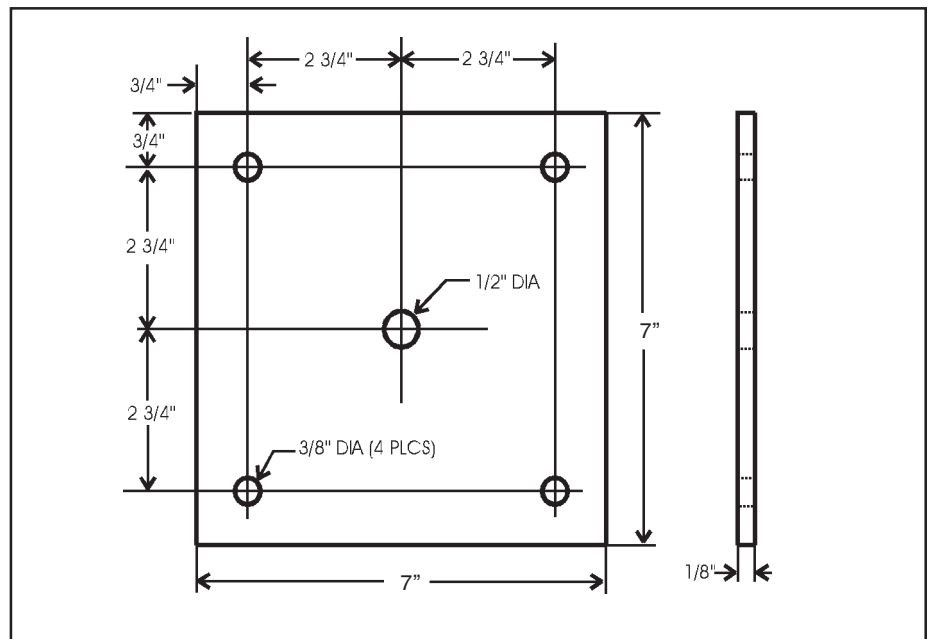
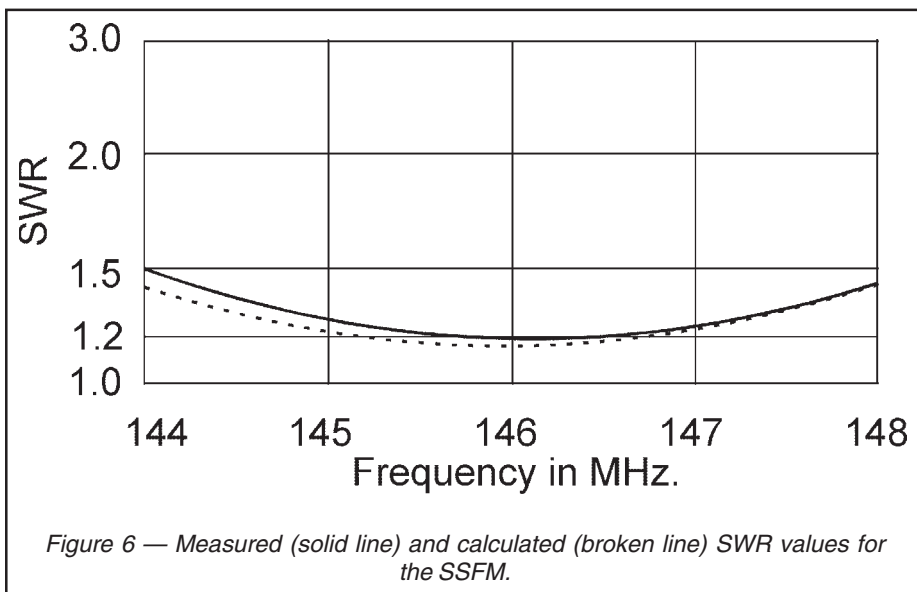


Figure 5 — Base Mounting Plate Layout



Adjustment

If the antenna is built to the specifications as shown the assembly drawing (Figure 7) it should be resonant at or near 146 MHz. and provides a good match to 50-Ohm coax. The antenna measured less than 1.2:1 SWR at center of the two-meter band (146 MHz.) and was not greater than 1.5:1 at the band edges. Calculated and measured SWR curves for the SSFM are shown in Figure 6.

If adjustment is needed, the long $1\frac{3}{4}$ -inch thread length on the $\frac{1}{4}$ -wave elements should provide enough range for adjusting the antenna to resonance at 146 MHz. However, if you wish to move the resonate point near the band edges some adjusting of the $\frac{3}{4}$ -wavelength element may be required. Remember, when building self-resonant antennas, the practice of making antenna elements slightly longer and then trimming them for the desired frequency is always a good practice.

Installation Note

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 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 to that of the antenna produces an increase in the signal being launched at higher takeoff angles. Unless you are primarily interested in talking to airplanes a common mode choke should be employed for better performance of any antenna fed with a coaxial transmission line and 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 will only help.

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

A word of caution

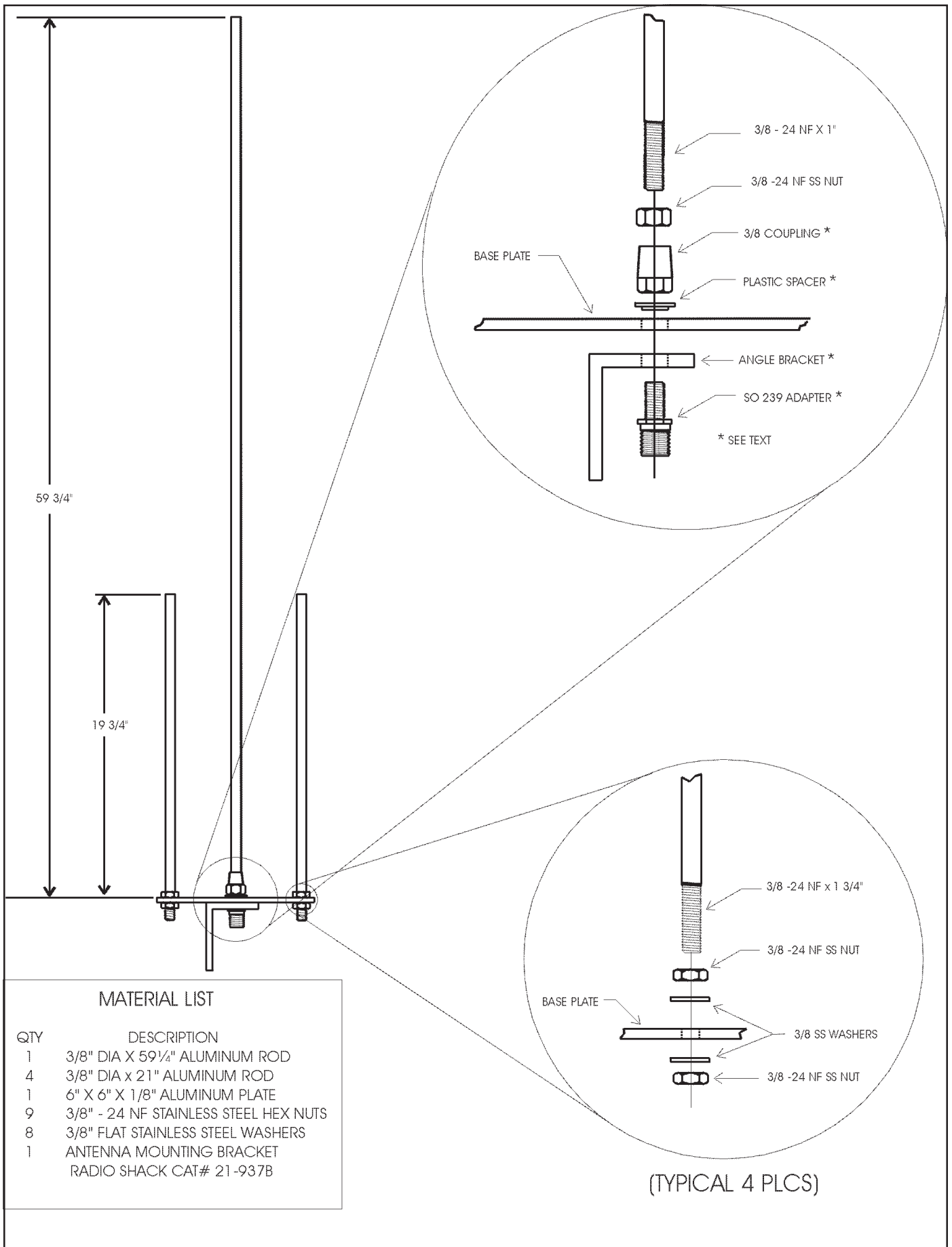
Not all VHF connectors are created equal! When I first constructed this antenna I used a cheap CB mobile antenna adapter, obtained at a flea market,

for the mounting of the center $\frac{3}{4}$ -wavelength element. When measuring the SWR of the SSFM utilizing this adapter I obtain readings of almost 1:1 at resonance and less than 1.2:1 across the entire two-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 frequencies. Which in turn lowered the Q of the antenna giving lower SWR readings. Although the SWR values appeared great the antenna was not operating as efficient as it should have been. It has been said "To low of a SWR can kill you"... It almost did!

Conclusion

The skeleton sleeve fed monopole (SSFM) is relatively easy to construct, can be made with simple tools, at low cost, and it provides improved performance over a standard j-pole. Like the J-pole the SSFM does not require any additional ground system thereby an excellent candidate for operation on a boats or fiberglass motor homes.





MATERIAL LIST

QTY	DESCRIPTION
1	3/8" DIA X 59 1/4" 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

(TYPICAL 4 PLCS)

Fig. 7 - SSFM Assembly Drawing and Materials List.