Accurate Low Cost VSWR Meter

Convert this CB accessory for 1.8-450 MHz operation.

by Phil Salas AD5X

Nothing beats a good VSWR meter when it comes to playing around with new antenna designs. Unfortunately, meters that work up to 450 MHz can be quite expensive. This article describes simple modifications that can be made to popular CB-style VSWR meters to enable them to accurately perform up through the 3/4-meter ham band.

The Meter

Figure 1 shows a popular CB-type VSWR meter. Made by many different manufacturers, they use an internal directional coaxial coupler. They were very popular up until a few years ago when the transformer type VSWR meter became more popular (undoubtedly due to their lower manufacturing cost). The CB-type meter is widely available at swap fests, and can be had for very little money. I paid $5 for mine at one of our local electronic sidewalk sales.

Upon getting home with this unit, I opened it up and was very impressed with the quality of the coaxial coupler itself. The total internal coupler length measured five inches. For best performance, a directional coupler should be less than a quarter wavelength at the highest frequency used. A quarter wavelength at 450 MHz is about six inches, so it appeared there was some potential here. Unfortunately, the internal components had very long lead lengths and were poorly dressed. Sure enough, a precision 50 ohm load measured with this meter showed a 2:1 VSWR at 146 MHz, and a 2.8:1 VSWR at 445 MHz. Obviously, this would not do.

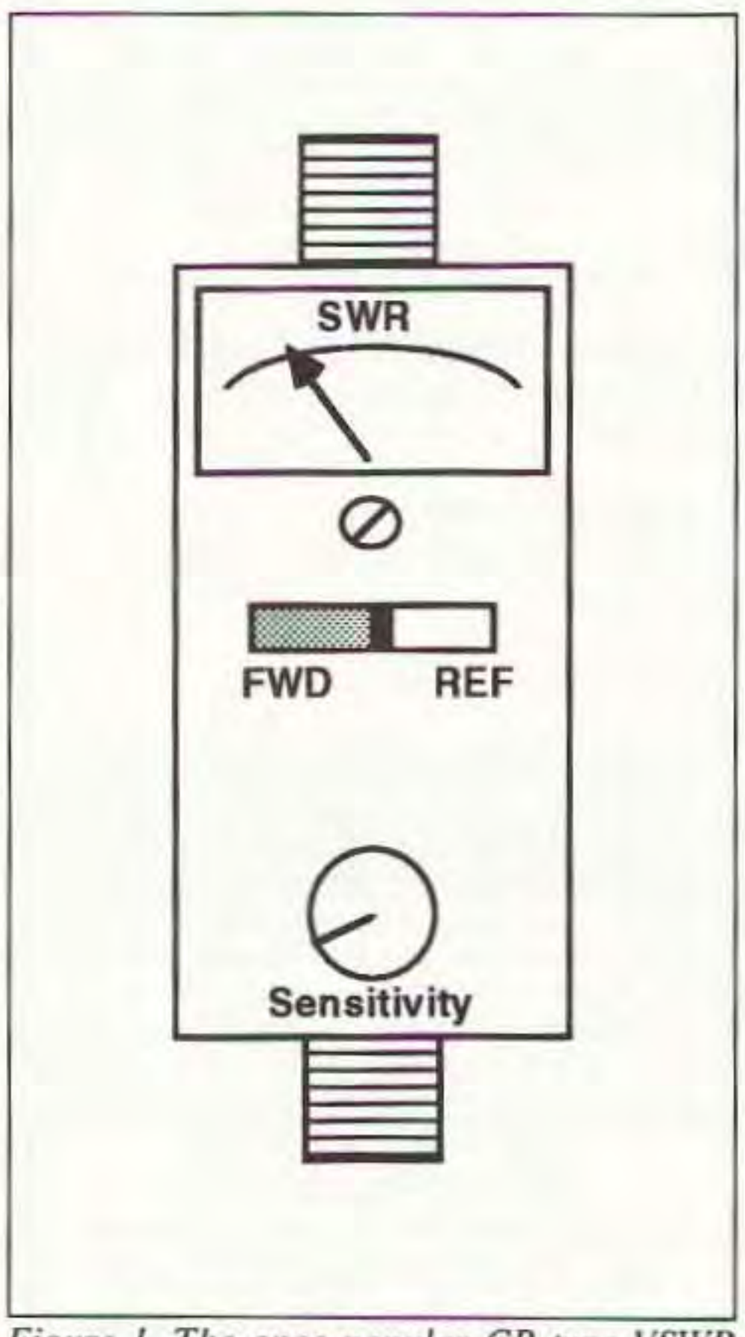

Figure 1. The once-popular CB-type VSWR meter.

Modifying the CB-type Meter

Figure 2 is an internal drawing of the VSWR meter. The first thing I did was remove the detector diodes, 150 ohm terminating resistors, and bypass capacitors. I then cleaned out all excess solder. Next, I made new bypass capacitors by paralleling good rectangular ceramic 0.001 and 0.01 µF capacitors, as shown in Figure 3. The 0.01 µF capacitor is a good bypass at lower frequencies, and the 0.001 µF capacitor is a good bypass at higher frequencies. Mount these capacitors directly to the terminal strips at either end of the coupler, attempting to make the lead lengths as close to zero as possible.

Then I put in new 1/4 watt 150 ohm resistors, as shown in Figure 2. Orient these resistors so as to minimize lead length. Also, position the resistors so that the lead lengths are identical on both resistors. It doesn't matter too much if there is some lead inductance, but it's important that the lead inductance on both resistors be the same.

Next, I put in two new 1N34A detector diodes (available from Radio Shack) as shown. Again, orient the diodes for minimum lead length and ensure that the lead length on both diodes is the same.

That's all there is to it. Now for some measurements.

The Results

For my test loads, I again used my 50-ohm precision termination, a 75 ohm F-type termination with a F-to-PL-259 adapter, a home-built 100 ohm termination, and the Radio Shack RS 21-506 15 watt DC-500 MHz dummy load. The 100 ohm termination was built by sliding a 1 watt 100 ohm metal oxide resistor (RS 271-152) into a RG-6 F-

Results at 445 MHz

	Measured VSWR	Expected VSWR
50 ohm precision load	1.05:1	1:1
50 ohm 15 watt RS load	1.10:1	1:1
75 ohm TV termination	1.50:1	1.5:1
100 ohm termination	1.80:1	2:1

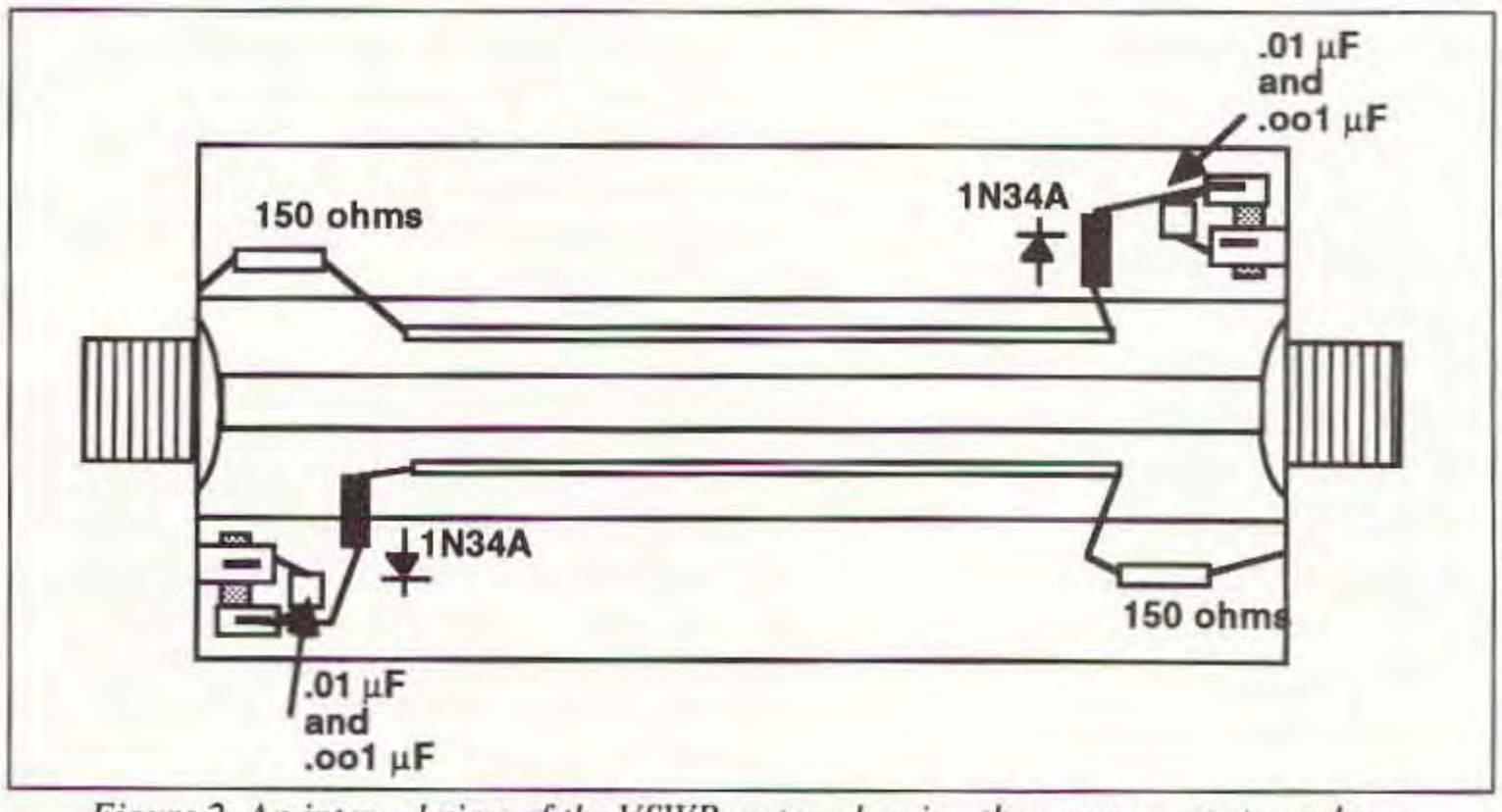

Figure 2. An internal view of the VSWR meter, showing the components to replace.

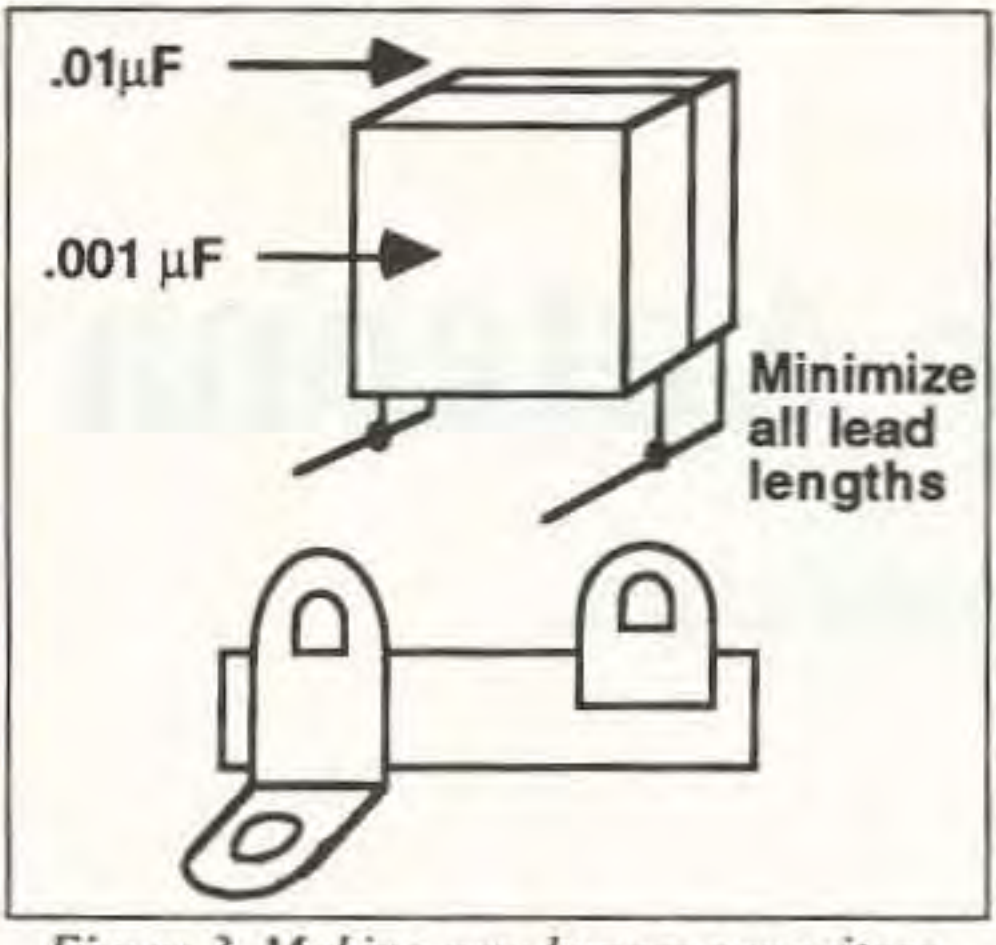

Figure 3. Making new bypass capacitors.

56 connector (RS 278-214). A 1 watt resistor fits perfectly into this connector, and a 1/2 watt resistor fits perfectly into the RG-59 F-59 connector (RS 278-211). The measured results at 445 MHz were as shown in the table.

Not bad! These results are certainly accurate enough for virtually anything most hams would want to do. Also, I was able to get a full-scale forward meter deflection at 450 MHz with only a quarter watt of transmit power.

I have described a means of modifying a common variety CB-style VSWR meter such that it becomes virtually a precision VSWR meter up through 450 MHz. The price is right and you'll have a piece of test equipment you'll be proud of.