FEEDBACK

The OFFICIAL Newsletter of the
Georgian Bay Amateur Radio Club Inc.

Sponsoring
VE3OSR FM REPEATER 146.940- OWEN SOUND
VE3IJD PACKET BBS 145.630 KEADY

October 1996

REGULAR EVENTS

GBARC MEETINGS: 4th Tuesday of each month at the Billy Bishop Airport 7:30 P.M.
BREAKFAST MEETINGS: 2nd and last Saturday of each month at the Rockford Esso , 9:30 A.M.
GBARC INFORMATION: Information regarding membership should be directed to VE3NEM Tom Merner RR#4 Owen Sound, N4K5N6 371-0655
FEEDBACK: Submissions or letters to the editor should be directed to VE3TSA Tom St.Amand, 1232 3rd Ave . East, Owen Sound N4K2L5

MINUTES OF THE MEETING OF SEPTEMBER 24, 1996:

The September meeting was opened by President Bob with twenty members present. The moments of the June 25th. meeting were reviewed and moved for acceptance by Henry VE3UWD and seconded by John VE3TXB and passed. Tom VE3NEM reviewed the financial report that he had prepared for the club. The club's bank balance as of August was $944.35. Concerns regarding service fees and location of the club's bank account were discussed. Tom VE3NEM has expressed that he would care to change the bank that we deal with and will report back on other banks and their fees. Upcoming expenditures for the club include insurance and Tom VE3NEM will be reviewing with Cowlings and Kearns our current policy and report back to the club. Tom has requested that the club statements be audited at the calendar year end by Dave VE3DXO. Acceptance of the financial statement as of August was moved by Bill VE3HMZ and seconded by John VA3JRF and passed.

Bob reviewed the club's successful participation in the Terry Fox run on September 22nd. The organizers of the event were very pleased with the club's ability to provide communication along the route. There was discussion of the advance class in Markdale and the successful graduation to advance of all attending Brad's class. A review and update on the Wiarton Airport proposal was discussed and the club is now waiting for approval to use the tower located on site for the 146.290 repeater. The Wiarton airport has been chosen for this years JOTA and the club has been asked for our participation by the scout leadership and we have agreed. Bob indicated that we may see over one hundred scouts for this event.

Discussion of the current and future repeater locations and configurations was given. A tower location in Markdale is waiting on confirmation as well as the Wiarton location. Both of these sites will be linked back to Owen Sound when installed. It was agreed that the club asset inventory be updated by the club executive. Bob VE3XOX has donated to the club an e-mail address membership with a local bbs in Sauble Beach. Changes to the yearly membership fee, feedback circulation and 1997 hobbymarket were discussed and tabled for the October 22nd. meeting.

Adjournment of the general meeting was moved by Bill VE3HMZ and seconded by Marv VA3ACI and passed. The 50/50 draw was won by Tom VA3TAB...*minutes by Norm ve3nbj*

AVERAGE, PEAK, AND RMS VALUES

What is meant by the various ways of specifying ac potentials and currents.

BY HECTOR FRENCH.

WHEN dealing with dc potentials, there is no ambiguity about what *kind* of voltage is meant. A dc volt is a dc volt. When it comes to ac voltage, however, the picture is very different and often confusing. For example, a potential specified as 100 volts ac has little or no meaning unless it is followed by an identifier like "peak," "rms," "average," or "effective," each of which has a different meaning from the others.

To illustrate what we mean, consider your common 117-volt ac power-line potential. This figure specifies the rms voltage of the power line. The peak potential is actually 164.66 volts, which is 39.8% greater than the rms potential. The average potential, at 11% lower than the rms potential, is 104.52 volts.

The peak voltage is the maximum potential of the entire waveform. This voltage is extremely important for designing the insulation of high-voltage ac circuits. An 11,500-volt (rms) line, for example, has a peak potential of 11,500 + 4577 = 16,077 volts. That difference of more than 4500 volts must be considered when specifying components.

The peak potential is easy to find with the circuit shown in Fig. 1.

The capacitor charges up to the peak voltage during the first positive alternation of the ac input. The charge then slowly drains off through the resistor until the next positive alternation comes along. (For a negative output, the diode and capacitor are simply reversed.)

The average voltage is important for two different reasons. First, it is easy to find with simple circuits. Second, it is reliably close to the rms voltage with sine waves. The basic circuit for finding the average ac voltage is illustrated in Fig. 2.

In this case the output is a series of half-waves of the same polarity. (Again, to change the output voltage polarity, simply reverse the diodes.) A meter placed between the output point and ground provides the reading and is usually calibrated with a scale that is compressed just the right amount to give a relatively accurate rms reading with sine-wave signals. This is the type of circuit used in most ac voltmeters ranging from inexpensive portable to expensive laboratory instruments.

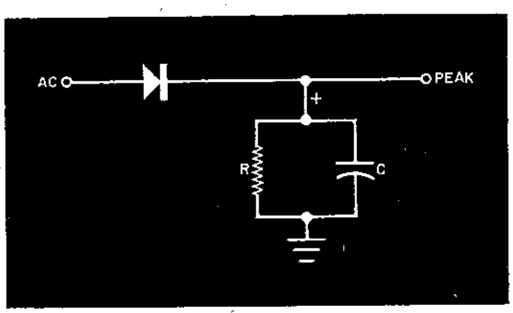

Fig. 1. Simple RC and diode circuit is used to find peak potential.

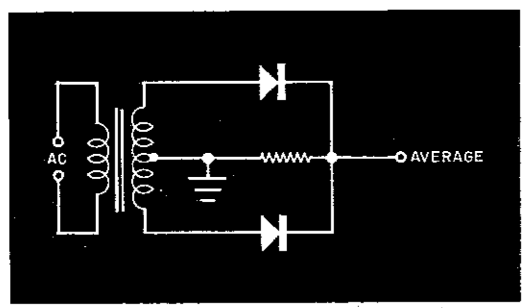

Fig. 2. Series of half waves is measured to find average value.

At this point, you are probably wondering where rms voltage comes into the picture. Well, the purpose of the rms measurement is to specify the dc voltage that has the same power capacity as the ac voltage it represents. "Rms" stands for "root mean squared," which is shorthand for saying that to find the rms voltage, you must square the ac waveform, find the average of the squared waveform, and find the square root of that average. About the only simple way of showing an rms detector system is as in Fig. 3.

The average-law circuit gives an output in terms of rms with sine waves. What about nonsinusoidal waveforms? If we take a 117-volt sine wave and allow only one alternation in 10 to come through, the peak potential is still 164.66 volts. Since only a half wave out of every 10 cycles comes through, our average potential would be divided by 10 (104.52/10 = 10.452 volts).

If we allow only one alternation in 10 cycles to come through for a 117-volt ac rms waveform, we cannot simply divide by 10 to find the new rms potential. First, we must square 117, which yields 13,689. Then, we find the average by dividing 13,689 by 10, yielding 1368.9. Finally, we must find the square root of 1368.9, which results in 37 volts rms. This last figure is a long way from the average reading of this one-in-10 waveform, even when the average scale is compressed to indicate in make-believe rms. Using the compressed scale, the indicated reading would be almost 70% low!

As you can see from the foregoing, when dealing with pure sinusoidal waveforms, you can use a peak-, average-, or rms-indicating circuit to convert from one type of ac voltage to another without introducing errors. But when you are dealing with nonsinusoidal waveforms, watch out. All your readings might be so grossly inaccurate as to be useless for anything other than to indicate the presence or absence of a potential. ◇

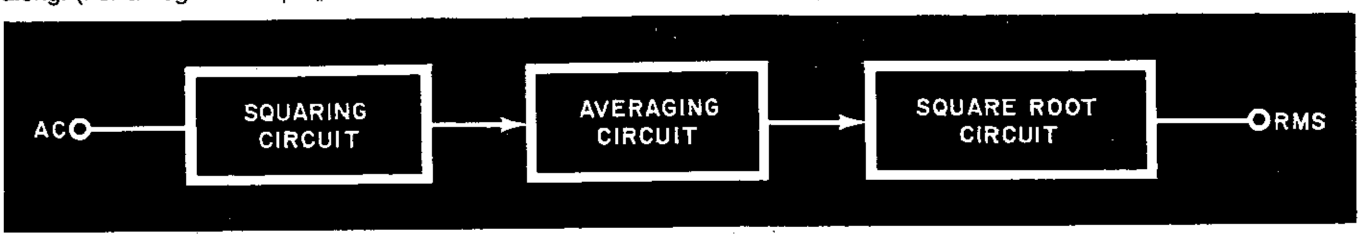

Fig. 3. Simple block diagram of an rms detector circuit.

GBARC EXECUTIVE 96/97
(WELL SOME OF THEM ANYWAY)

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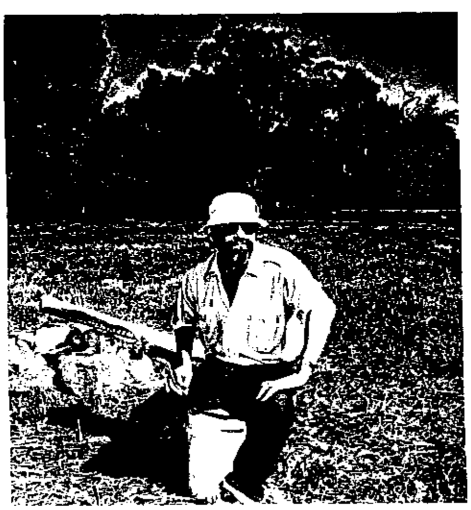
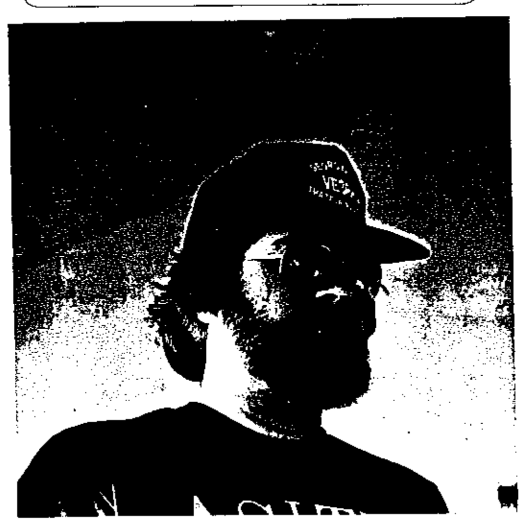


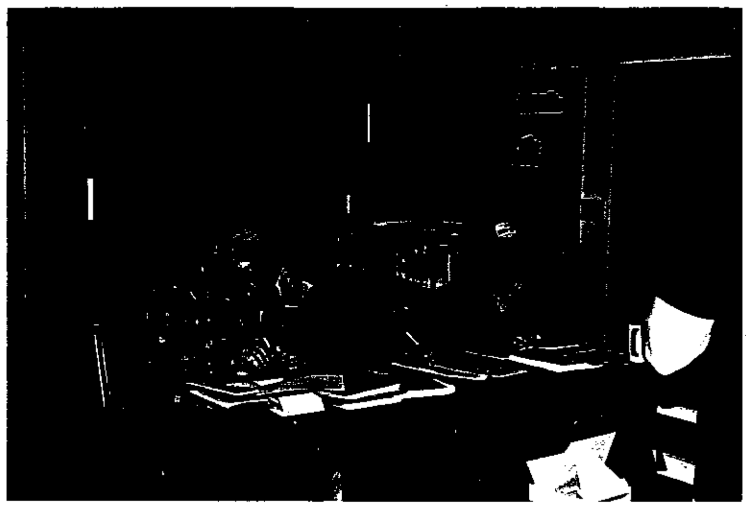
2 metre NET CO-ORDINATOR
Gary Bell VE3IOD



RADIO-COURSE CO-ORDINATOR
Brad Rodriguez VE3RHJ

ADVANCED RADIO COURSE 1996

PHOTOS BY JOHN VE3TXB



POT QUIZ

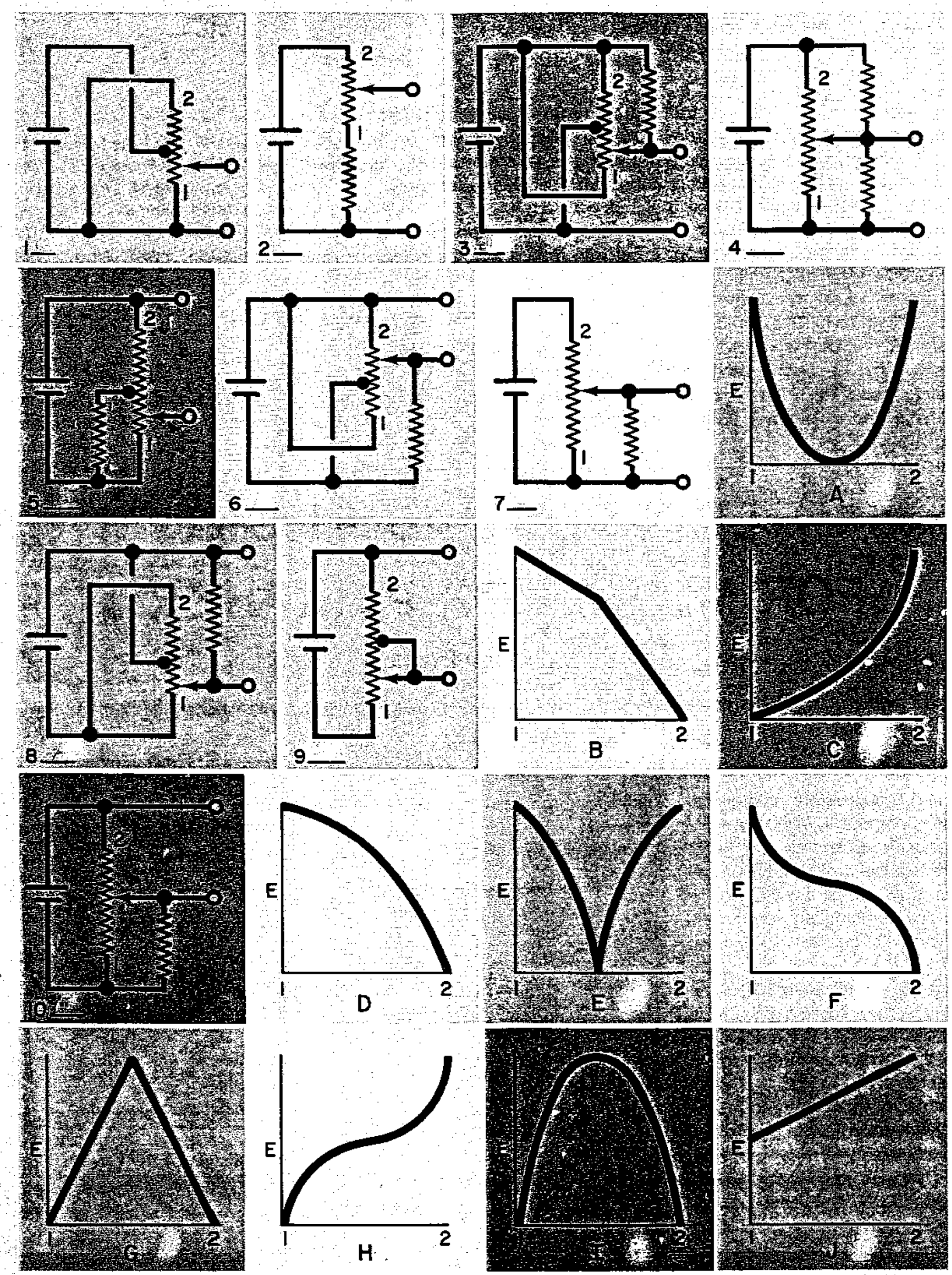
BY ROBERT P. BALIN

THE taper of a potentiometer can be easily changed to suit a particular application by the simple addition of one or more resistors. The new curve is easily predictable if you carefully observe the locations of the output terminals and which parts of a centertapped potentiometers are shunted by fixed resistors.

See if you can match the pot circuits (1-10) with their corresponding output voltage curves (A-J) produced when the wiper arm is moved from point 1 to point 2 in the circuit in each case.

Assume that all resistors and linear pots, some of which are center-tapped, have the same total resistance values.

(Answers on page 85)



Non-Etched Swr Bridge

Measure antenna swr—from 7 to 435 MHz—with this simple, cheap afternoon project.

John Reed W6IOJ
770 La Buena Tierra
Santa Barbara CA 93111

For over fifty years I have been matching my home-brew antennas to my radio, using makeshift field-strength meters, lamps, pencils (arc), or finger (ouch). My solid-state amplifiers have complained about this treatment, however, forcing me to consider methods that really define the matching in terms of standing-wave ratio (swr). The effort resulted in a very simple device that measures swr to better than 1:1 in all the bands I am interested in, 7 to 435 MHz. It can be built in a few hours for less than five dollars.

The basic method is a stripline-type directional coupler. The operating principle is that a properly terminated line parallel to, and coupled to, the transmission line will pick up energy traveling in one direction. The detected signal from this coupled line will represent either the forward or reflected energy depending upon which end is terminated. Fig. 1 gives the schematic.

Swr values are determined from the forward and reflected peak-voltage outputs:

$$V(FWD) + V(REFL) \,/\, V(FWD) - V(REFL)$$

The outputs can also be calibrated in terms of power. However, the output-voltage sensitivity of this type of directional coupler is

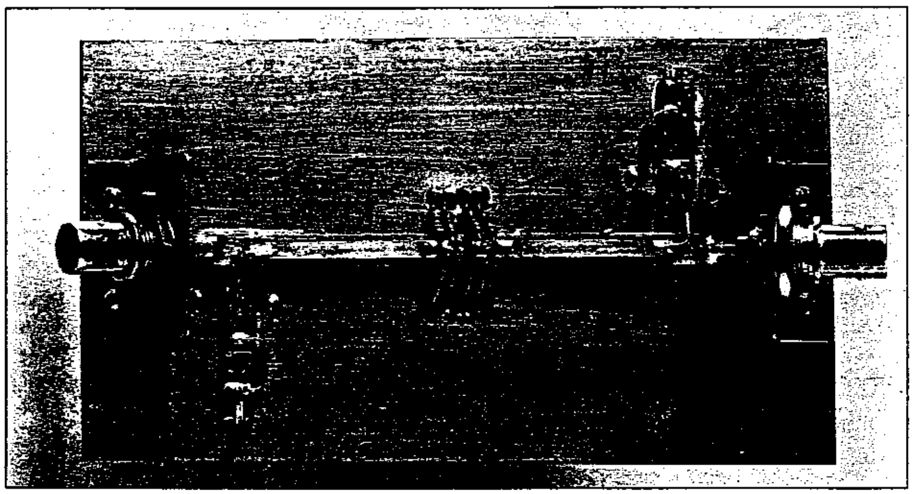


Photo A. Top view of the swr bridge.

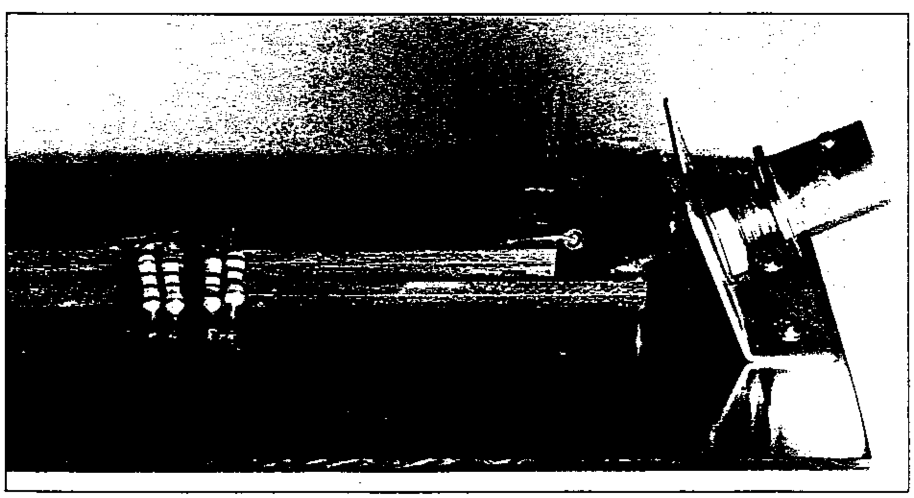


Photo B. Side view of the bridge. Note the stripline mounting.

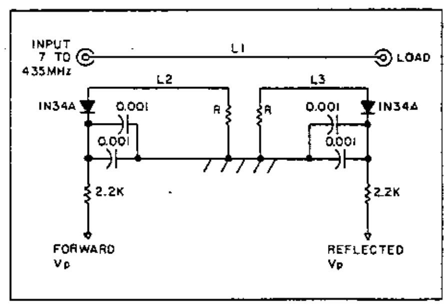


Fig. 1. Schematic for the non-etched swr bridge.

Vp In	Vp Out	Factor
5.00	4.88	1.02
4.0	3.90	1.03
3.0	2.87	1.04
2.0	1.89	1.06
1.0	0.92	1.09
0.8	0.72	1.11
0.6	0.52	1.15
0.5	0.43	1.16
0.4	0.33	1.21
0.3	0.24	1.25
0.2	0.15	1.33
0.1	0.06	1.67
0.05	0.02	2.5

Fig. 2. Peak voltmeter readout. The two columns are input readout characteristics and correction factors.

directly proportional to frequency. As an example, using this particular device at 7 MHz, 100 Watts is required to detect an swr of 1:1, while at 146 MHz, less than 250 mW will make an equivalent measurement. This power/frequency relationship is a limitation.

The effect is in the right direction, however. HF higher power is more likely available than at the VHF/UHF frequencies. Power-handling ability is also frequency related, and it is limited by the coupling-stripline termination resistors. Examples are about 4 W at 435 MHz, 35 W at 146 MHz, and 1 kW at 28 MHz. Total power dissipated at maximum power input is less than one Watt.

This project has been simplified by using a glue-down stripline technique that I have employed successfully in a number of previous projects. Striplines are cut from double-sided glass-epoxy PC board having the same dimensions that you would choose using the etched-PC board method. One side of the stripline is smeared with glue and pressed firmly against the common-base PC board. Changes can be made within minutes by lifting the glue-down stripline with a knife and replacing it with one having the altered dimensions. No dc connection is required between the glue-line foils.

In this project, two striplines are glued together to effectively double the dielectric thickness. This results in a wider stripline for a given impedance, making fabrication and handling easier.

Matching the directional coupler-line impedance with that of the transmission line is a critical parameter, significant differences resulting in a self-generated swr error. Optimum stripline width was calculated using conventional stripline theory. Assuming a 50-Ohm Z_0 (line impedance), the calculations resulted in a 0.219-inch width when using two sandwiched 0.062-inch thick glass-epoxy PC strips having 1.5-ml foils (net 0.118-inch dielectric). A dielectric constant of 4.5 was assumed for the glass-epoxy material. Tests indicate that the floating center foils have no effect.

The pickup lines, glued to the top of the 50-Ohm conducting stripline, are 0.125-inch wide. Although their calculated impedance is 69 Ohms, the termination resistance in this special configuration is about 60 Ohms. This resistance is experimentally pruned to null for zero output when the pickup is in a position to detect reflected energy and when the transmission line is terminated with a non-reflective load (50 Ohms). Pruning is accomplished easily using parallel 4-W resistors.

My assembly required four: two 150s, a 330, and a 2.2k-Ohm resistor. The resistor connections are with minimum lead lengths (approximately 1/32nd inch). The assembly is reverse-connected in the transmission line to enable the pruning procedure for both pickup lines in an identical manner. Lack of fabricating symmetry will result in slightly different resistor values for the two pickup lines.

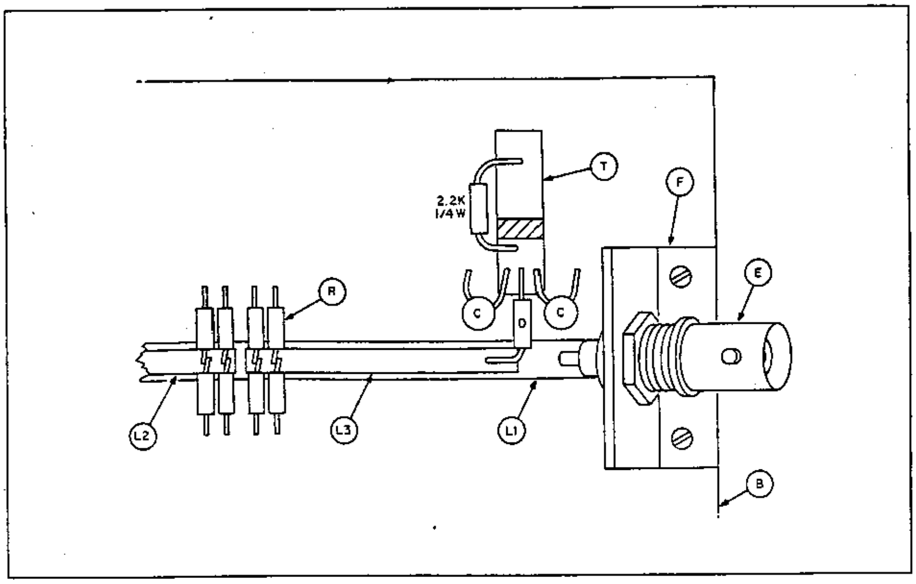


Fig. 3. Fabrication details.

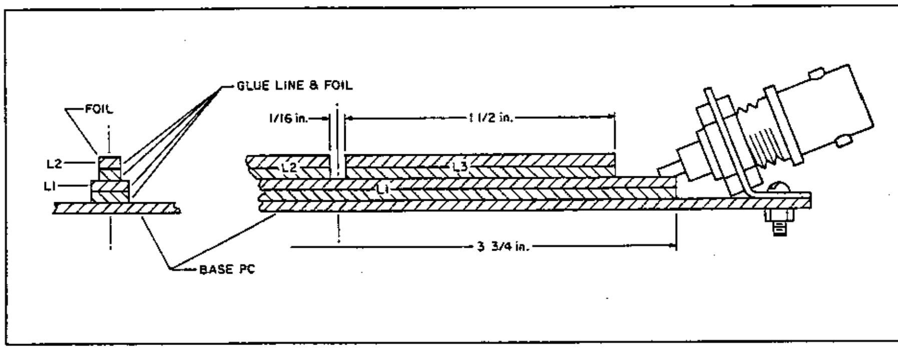


Fig. 4. Stripline cross-section drawing.

A large output-readout dynamic range enhances the usefulness of the device. As an example, only 1.2 V is indicated in the forward direction when used with my 7-MHz, 100-W transmitter. This means that to read a 1:1 swr, it is necessary to detect a reflected voltage of 0.057 V. I have found that selected 1N34As will reliably meet this requirement. In a typical package of ten diodes from Radio Shack, over half of them had a back resistance of more than 10 Megohm (less than 1 uA at 10 V).

Using these selected diodes in the peak-detection circuit together with a high-impedance (10 Megohm) digital voltmeter permits reliable readings down to 0.05 V. The table in Fig. 2 shows input readout characteristics and the correction factors. The required readout sensitivity is a trade-off of how much power is available at a particular frequency and the desired swr- measurement accuracy. The usual ham shack VOM-multimeter will be adequate for most applications.

Fabrication details are shown in the Fig. 3 layout, and the stripline cross-section drawing in Fig. 4. It is best to start by cementing the stripline sandwich and then finish trimming the edges to the required width. A file works fine, however—as does a sandpaper block, which will save dulling your file with the glass epoxy material.

The primary stripline width should be held

R	435 MHz Swr	146 MHz Swr
25	1.7	1.9
50	1.0	1.0
100	1.8	1.7
220	3.9	3.9
330	6.0	6.3
470	9.6	9.5

Fig. 5. Plotting data.

to 0.219 inch, ± 0.005 inches. I used calipers to size the striplines, but a ruler would be satisfactory if used with considerable care. Maintaining symmetry through the assembly is important. When mounting the BNC chassis connector, use a double nut so that it can be fastened in a position for minimum common-return inductance.

Final alignment is simply pruning the pickup-line termination resistors in the manner mentioned earlier (multiple 1/4-W resistors). It is best to do this procedure at the highest frequency you intend to use the swr device—I used 435 MHz. One thing required is an accurate 50-Ohm termination. I used a fifty-foot section of RG-58/U terminated with two 100-Ohm, 1/4-W resistors. The 7.5-dB cable loss reduces the estimated worst-case resistor reactance swr from a value of 1.2 to 1.03.

After pruning the terminations of both pickup striplines for minimum reflected indication (less than 1:1 swr), the device is ready to measure any swr of less than 10. The calibration results were made by terminating a short section of RG-58/U with various values of 1/4 W resistors.

Inability to null the swr device may be the result of an error in the primary stripline impedance. This could be caused by a different glass-epoxy dielectric constant. Try alternate striplines differing in widths of about 0.010 inches.

Spurious responses in the transmitted source can cause a measurement error. As an example, a −30 dB spurious signal is likely to result in a significant error when making a 1.1 swr measurement. Also, reflected signals from a reactive source will result in an error. This error will be particularly evident with large swr values.

Connectors also can be a suspect source of error. For example, I have used RG-59/U connectors (75 Ohm) for RG-8M cable (an RG-8 minifoam), and measurements indicate that they contribute to the swr.

How did my home-brew antennas measure? The 435-MHz, 15-element antenna swr was 1.2, the 2m 5-element was 1.4, the 2m J antenna was 1.4, and the 20m flat-top with a tuned antenna coupler at the transmitter was 1.5. That makes sense. I spent more time matching the UHF antenna.

In summation: You can match antennas adequately without an swr instrument, but it's a lot easier if you have this simple gadget. Besides, it's a good way to become acquainted with directional couplers. ■

Notes

1. Microstrip Design Techniques for UHF Amplifiers, Motorola RF Device Data—AN-548A.
2. PCB source (PCB-33), John J. Meshna Jr., Inc., 19 Allerton St., Lynn MA 01904.

POTENTIOMETER QUIZ ANSWERS

1-G - E is between wiper and negative.
At 1 and 2, E=0
At center tap, E=input
At ½ and ¾, E=½ x input

2-J - E is between wiper and positive.
At 1, E=½ x input
At 2, E=input

3-E - E is between wiper and C.T.
At 1 and 2, E=input
At C. T., E=0
At ½ and ¾. E is more than ½ x input
E is not shunted, hence is more than linear value.

4-H - E is between wiper and positive.
At 1, E=0
At 2, E=input
At center tap, E= ½ x input
At ¼, E is more than ¼ x input
At ¾, E is less than ¾ x input

5-B - E is between wiper and positive.
At 1, E= input
At 2, E=0
At center tap, E is more than ½ x input

6-I - E is between wiper and positive.
At 1 and 2, E=0
At center tap, E=input
At ¼ and ¾. E is more than ½ x input
E is not shunted, hence is larger than linear value.

7-C - E is between wiper and negative.
At 1, E=0
At 2, E=input
E is shunted, hence is always smaller than linear value.

8-A - E is between wiper and C.T.
At 1 and 2, E=input
At center tap, E=0
At ¼ and ¾, E is less than ½ x input
E is shunted, hence is smaller than linear value.

9-F - E is between wiper and positive.
At 1, E=input
At 2, E=0
At ¼, E= 2/3 x input
At C. T., E= ½ x input
At ¾, E= 1/3 x input

10-D - E is between wiper and positive.
At 1, E=input
At 2, E=0
Between 1 and 2, E is not shunted, hence always larger than linear.

Membership List Update

Please make corrections to your membership lists as follows:

Ken Slack
556 3rd Ave E. Apt#2
Owen Sound,On
N4K2J8
371-7669

Hammond Antique Radio Museum

The Bruce Amateur Radio Club is planning a visit to Fred Hammonds Radio Museum on Saturday October 26th at 1:30 P.M. They are planning to meet at the corner of county road 86 and Hwy 7 on the west side of Guelph. For more information contact Ray Lelievre @ 396-2051

Welcome to Fergus a new group of Hams

HI , COME JOIN US FOR COFFEE ANY SATURDAY MORNING, AT THE DIPPITY DONUTS HWY 6 NORTH OF TOWN ON YOUR RIGHT AS YOU LEAVE THE LAST SET OF TRAFFIC LIGHTS TIME= 10AM TO 11AM.
BRIAN VE3TJE @ VE3INF or 843 5562

JOTA From:VE3XOX

On the 19 and 20th of this month is the scout JOTA in Wiarton.. We are going to need club members to man the stations . Lets make the 1996 JOTA in Wiarton a success.. 73 Bob

FIELD DAY 1996 PHOTOS BY JOHN VE3TXB