FEEDBACK

THE OFFICIAL NEWSLETTER OF THE

GEORGIAN BAY AMATEUR RADIO CLUB INC.

Sponsoring

VE3OSR FM REPEATER	146.940- Mhz	BARROW BAY
VE3OST FM REPEATER	145.290- Mhz	OWEN SOUND
VE3GBT FM REPEATER	146.895- Mhz	MARKDALE
VE3IJD PACKET BBS	145.630 Mhz	KEADY

APR 1995

REGULAR EVENTS

GBARC MEETINGS:
FOURTH TUESDAY OF EACH MONTH

BREAKFAST MEETINGS:
SECOND AND LAST SATURDAY OF EACH MONTH

GBARC INFORMATION:
INFORMATION REGARDING MEMBERSHIP SHOULD BE DIRECTED TO TOM VE3NEM 519-371-9499

Minutes of the meeting of March 28, 1995:

The meeting started with a presentation on solar energy by Judy Kitto of Solar Power Systems near Keady.

The minutes of the last meeting were accepted as published. Ken VA3KMS called for volunteers to help run the flea market which will be either on May 27 or on June 10 at the fairground.

Ken read a motion from Gene VE3IJD that GBARC implement a packet users group. Gene moves that the packet users form a digital users group, dues of which will be set at $25.00 this year and subject to change each year here after. This group will have the GBARC vice president as its administrator and the GBARC treasurer would look after funds in a seperate bank account, a membership list will be kept on the BBS and will expire each year on May 1st. Money raised would be spent as the GBARC executive sees fit, to upgrade and expand the local packet system. This groups members need not necessarily be GBARC members but would be encouraged to take part in GBARC events and use club repeaters. Some BBS users live outside the area and don't benefit from full GBARC membership. The $25.00 allows them to use the packet system but does not give them a say in GBARC business, nor does it allow them to tell GBARC how to spend the $25.00. If it is done right the GBARC insurance should also cover this part of the club. This will be discussed further at the next meeting when Gene should be there to answer questions.

Tom VE3NEM has been looking at the cost of new club crests, they would be quite expensive, there was not much interest. There may be more interest in a club jacket or hat.

The 50/50 draw was won by Tom VE3NEM...

Original from VE3XOX to ALL@ALLONT

HI GUYS..
ITS THAT TIME OF THE YEAR AGAIN HERE IN THE CITY OF OWEN SOUND....
FLEA MARKET TIME.... BOOK THOSE TABLES NOW...DATE: JUNE 10TH 1995
LOCATION: SAME AS LAST YEAR...VICTORIA PARK OWEN SOUND
FREQ CALL IN: 146.895, 146.940, AND 145.290.
DOORS OPEN TO THE VENDORS AT 8:00 A.M. AND TO THE PUBLIC AT 9:00 A.M. ...
CALL ME, BOB AT 519-376-8060...IF IM NOT THERE , PLEASE LEAVE MESSAGE
AND WE WILL GET BACK TO YOU ... THANKS AND HAPPY BARGAIN HUNTING...

VENDORS ...DOORS OPEN AT 8 AM PUBLIC ...DOORS AT 9 AM
THAT GIVES YOU A CHANCE TO SLEEP A BIT LONGER! CONTACT ME "BOB" AT
519-376-8060 FOR BOOKING OF TABLES... LAST DAY TO BOOK TABLES WILL BE
JUNE 7, 1995. PLEASE DONT LEAVE IT TILL THE END.... IF YOU ARE INTERESTED
IN HEADING THIS WAY ... ZAP ME A PACKET TO GIVE US A IDEA HOW MUCH FREE
COFFEE WE ARE GOING TO HAVE ON HAND...HI
IF INTERESTED IN TABLE SEND ME A NOTE AND WE WILL WRITE YOU DOWN IN THE
BOOK FOR THE TABLE.... TABLES ARE 7.50 AND THAT INCLUDES ONE ADMISSION TO
THE MARKET.. DOOR ADMISSION IS 2.00 DOLLARS PER ADULT..KIDS UNDER 13 ARE FREE
HOPE TO HEAR FROM YOU....
73 BOB VE3XOX

LOOKS LIKE IT MIGHT COST US 75 DOLLARS FOR THE HALL FOR THE FLEA MARKET THIS YEAR.....WE MAY HAVE COMPANY NEXT DOOR TO US ON THE TRACK, BIG BROTHERS ORGINIZED A MEET UP THERE AT THE SAME TIME. WE WILL NEED EXTRA PEOPLE AT THE DOOR AND EXTRA HELP ALL AROUND....TABLES SHOULD GO FOR $7.50 PER TABLE AND EACH TABLE INCLUDES ONE ADMISSION....TABLES WILL BE PAID FOR AFTER THEY ARE ALL SET UP AT 9 A.M...... THIS YEAR THERE HAS TO BE SOMEONE ON THE RADIO AT ALL TIMES AND THAT IS THEIR DUTY FOR THE FIRST TWO HOURS OF THE MARKET...I WILL HAVE THE DOORS OPEN AT 7:15 A.M. AND WILL NEED HELP ON RADIO SET UP AND ADMISSION TABLE... THERE SHOULD BE SOME ONE ON THE RADIO THAT KNOWS THE SURROUNDING AREA AND THE RADIO SHOULD BE UP AND RUNNING BY 7:30 A.M. TABLES WILL HAVE TO BE SET UP THE DAY BEFORE AND WE HAVE THE KITCHEN THIS YEAR SO WE NEED PEOPLE FOR THAT...COFFEE AND THAT GOOD STUFF....IF THE MEMBERS MADE UP SOME SANDWICHES AND PACK THEM IN SANDWICH BAGS , WE COULD SELL THEM AND A COFFEE FOR A DOLLAR....
LETS HEAR YOUR THOUGHTS...
BOB XOX

Antenna Nightmares

There is a story in the Chilliwack Amateur Radio Club Bulletin about a Vancouver Amateur who learned the hard way how tough it can be to get an antenna erected in some communities. His plan was to erect a tower sufficient to support a 20 foot dish for EME (earth-moon-earth) communications. He ran into local requirements for a building permit if the antenna was higher than six feet above the ground. The building standards he was required to meet resulted in the construction of two concrete pads one 10'x10'x6' and the other 8'x8'x6' to support his tower.

FM Mode Amateur Satellites

Of the 18 available Amateur satellites presently in orbit, four offer, at various times, transponders for general use. Two of these, AO-21 and AO-27 operate on 2m and 70cm. Being low earth orbit satellites, both are overhead for short periods, usually ten to fifteen minutes per pass. There are about six passes per day, three morning to mid-day and three at night.

OSCAR-21, or AO-21 has a unique repeater that lets you input on 435.016 and output on 145.987. To copy tune 145.990 or 145.985. When you listen for AO-21 you will soon notice that at the first part of the pass you can hear it better on 145.990, then as the pass progresses hear it better on 145.985. All you need to listen is a rubber-duckie equipped handheld.

This quick introduction to AMSAT was condensed from a more complete article written by Art Rae VA3RAE, in the Windsor Border City Radio Club Newsletter.

Smith-Chart Calculations for the Radio Amateur

PART II[1]

BY GERALD L. HALL,* K1PLP, EX-KH6EGL

Determining Actual Antenna Impedances

To determine an actual antenna impedance from the Smith Chart, the procedure is similar. The electrical length of the feed line must be known, and the impedance value at the input end of the line must be determined through measurement. In this case, the antenna is connected to the far end of the line and becomes the load for the line. Whether the antenna is intended purely for transmission of energy, or purely for reception makes no difference; the antenna is still the terminating or load impedance on the line as far as these measurements are concerned. The *input* or *generator* end of the line would be that end connected to the device for measurement of the impedance. In this type of problem, the measured impedance is plotted on the Chart, and the TOWARD-LOAD wavelengths scale is used in conjunction with the electrical line length to determine the actual antenna impedance.

For example, assume we have a measured input impedance to a 50-ohm line of $70 - j25$ ohms. The line is 2.35 wavelengths long, and is terminated in an antenna. We desire to determine the actual antenna impedance. Normalize the input impedance with respect to 50 ohms, which comes out $1.4 - j0.5$, and plot this value on the Chart. See Fig. 7. Draw a constant-s.w.r. circle through the point, and transfer the radius to the external scales. The s.w.r. of 1.7 may be read from the S.W.V.R. scale (at A). Now draw a radial line from prime center through this plotted point to the wavelengths scale, and read a reference value, which is 0.195 (at B), on the TOWARD-LOAD scale. Remember, we are starting at the *generator* end of the transmission line.

To locate the load impedance on the s.w.r. circle, we add the line length, 2.35 wavelengths, to the reference value from the wavelengths scale, and locate the new value on the TOWARD-LOAD scale; $2.35 + 0.195 = 2.545$. However, the calibrations extend only from 0 to 0.5, so we must subtract a whole number of half wavelengths from this value and use only the remaining value. In this situation, the largest integral number of half wavelengths that can be subtracted is 5, or 2.5 wavelengths. Thus, $2.545 - 2.5 = 0.045$, and the 0.045 value is located on the TOWARD-LOAD scale (at C). A radial line is then drawn from this value to prime center, and the coordinates at the intersection of the second radial line and the s.w.r. circle represent the load impedance. To read this value closely, some interpolation between the printed coordinate lines must be made, and the value of $0.62 - j0.18$ is read. Multiplying by 50, the actual load or antenna impedance is $31 - j9$ ohms, or 31 ohms resistance with 9 ohms capacitive reactance.

Problems may be entered on the chart in yet another manner. Suppose we have a length of 50-ohm line feeding a resonant quarter-wave vertical ground-plane antenna. Further, suppose we have an s.w.r. monitor in the line, and that it indicates an s.w.r. of 1.7 to 1. The line is known to be 0.95 wavelength long. We desire to know both the input and the antenna impedances.

From the data given, we have no impedances to enter onto the chart. We may, however, draw a circle representing the 1.7 s.w.r. See Fig. 8. We also know, from the definition of resonance, that the antenna presents a purely-resistive load to the line; i.e., no reactive component. Thus, the antenna impedance must lie on the resistance axis. By observing the Chart with only the s.w.r. circle drawn, we see two points which satisfy this requirement in Fig. 8. These points are $0.59 + j0$ and $1.7 + j0$. Multiplying by 50, these values represent 29.5 and 85 ohms resistance. This may sound familiar, because the *ARRL Handbook* tells us that when a line is terminated in a pure resistance, the s.w.r. in the line equals Z_R/Z_0 or Z_0/Z_R, where Z_R = load resistance and Z_0 = line impedance.

If we consider antenna fundamentals, we know that the theoretical impedance of the ground-plane antenna is approximately 36 ohms. We therefore can quite logically discard the 85-ohm impedance figure in favor of the 29.5-ohm value. This is then taken as the actual load-impedance value for the Smith Chart calculations. The line input impedance is found to be $0.64 - j0.21$, or $32 - j10.5$ ohms, after subtracting 0.5 wavelength from 0.95, and finding 0.45 wavelength on the TOWARD-GENERATOR scale. (The wavelength reference in this case is 0.)

Determination of Line Length

In the example problems given so far, the line length has conveniently been stated in wavelengths. The electrical length of a piece of line depends upon its physical length, the radio frequency under consideration, and the velocity of propagation in the line. If an impedance-measurement bridge is capable of quite reliable readings at high line-s.w.r. values, the line length may be determined through line input-impedance measurements with short- or open-circuit terminations. A more direct method is to measure the line's physical length and apply the value to a formula. The formula is:

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[1] Part I of this article appeared in the January issue.

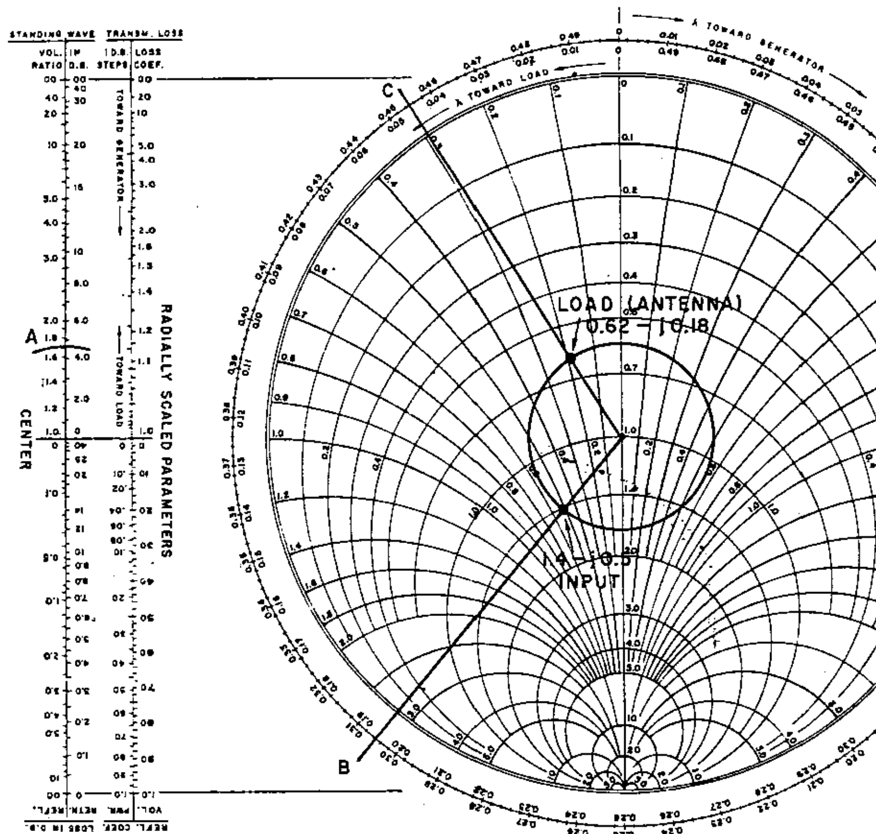

Fig. 7.

$$N = \frac{LF}{984K}$$

where

N = Number of electrical wavelengths in the line,

L = Line length in feet,

F = Frequency in megacycles, and

K = Velocity or propagation factor of the line.

The factor K may be obtained from transmission-line-data tables, such as appear in the *Handbook* in the chapter on transmission lines. Common coaxial cables with solid dielectric, such as RG-8, 9, 11, 17, 19, 58, 59 and 83 have a velocity or K factor of 66.9 per cent. Teflon-dielectric, or combination solid- and air-dielectric lines, have a higher velocity factor — up to 93 per cent for some special types of coaxial line. Most 300-ohm receiving-type balanced Twin-Lead has a velocity factor of 82 per cent; 75-ohm receiving-type ribbon line 68 per cent, transmitting type 71 per cent. Open-wire lines and ladder-type TV lines will exhibit a velocity factor of 97 to 97.5 per cent. All types of line having a solid dielectric can vary in velocity factor from the values given here, depending on the age and condition of the dielectric material. As the dielectric deteriorates, the velocity factor will become lower, and usually the associated dielectric losses will become higher. This is especially true of ribbon-type lines, where the dielectric material is exposed directly to the weather in most installations. In applying the velocity factor to the formula, the percentages must be converted to their decimal equivalent.

Line-Loss Considerations

The problems presented so far have ignored attenuation, or line losses. Quite frequently it is not even necessary to consider losses when making calculations; any difference in readings obtained would be almost imperceptible on the Smith Chart. When the line losses become appreciable, as with very long lines in terms of wavelengths, or with high s.w.r. values, loss considerations may be warranted. This involves only one simple step, in addition to the procedures previously presented.

Because of line losses, the s.w.r. does not remain constant throughout the length of the line. Power reflected from a mismatched load is attenuated as the wave travels toward the generator. As a result, there is a decrease in s.w.r. as one progresses away from the load. To truly represent this situation on the Smith Chart, instead of drawing a constant s.w.r. circle, it would be necessary to draw a spiral inward and clockwise from the load impedance toward the generator. The rate at which the curve spirals toward prime center is related to the attenuation in the line. Rather than drawing spiral curves, a simpler method is used in solving line-loss problems, by means of the external scale TRANSMISSION-LOSS, 1-DB. STEPS in Fig. 9. Because this is only a relative scale, the db. steps are not numbered.

If we start at the top end of this external scale and proceed in the direction indicated toward generator, the first db. step is seen to occur at a radius from center corresponding to an s.w.r. of about 9 (at A); the second db. step falls at an s.w.r. of about 4.5 (at B), the third at 3.0 (at C), and so forth, until the 15th db. step falls at an s.w.r. of about 1.05 to 1. This means that a line terminated in a short or open circuit (infinite s.w.r.) and having an attenuation of 15 db., would exhibit an s.w.r. of only 1.05 at its input.

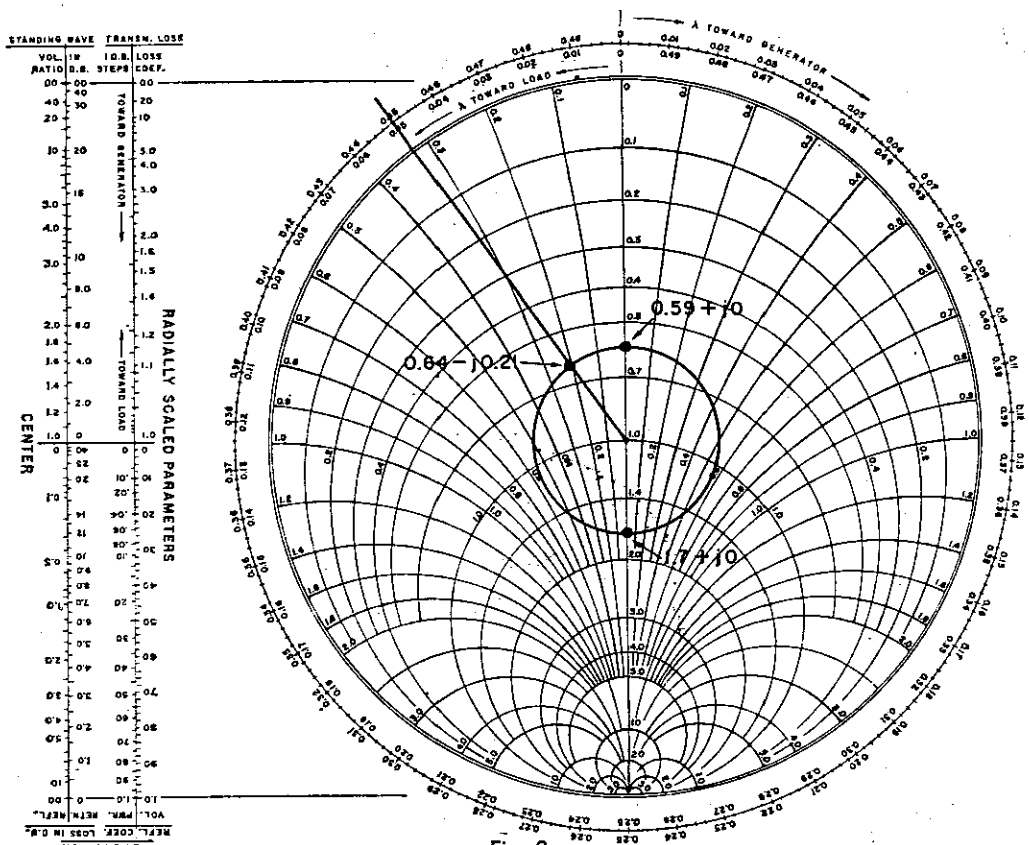

Fig. 8.

It will be noted that the db. steps near the lower end of the scale are very close together, and a line attenuation of 1 or 2 db. in this area will have only slight effect on the s.w.r. But near the upper end of the scale, 1- or 2-db. loss has considerable effect on the s.w.r.

In solving a problem utilizing line-loss information, it is necessary only to modify the radius of the s.w.r. circle by an amount indicated on the TRANSMISSION-LOSS, 1-DB.-STEPS scale. This is accomplished by drawing a second s.w.r. circle, of either greater or lesser radius than the first, as the case may be.

Assume that we have a 50-ohm line 0.282 wavelength long, with 1-db. inherent attenuation.

The line input impedance is measured as $60 + j35$ ohms. We desire to know the s.w.r. at the input and at the load, and the load impedance. As before, we normalize the $60 + j35$-ohm impedance, plot it on the Chart, and draw a constant-s.w.r. circle and a radial line through the point. In this case, the normalized impedance is $1.2 + j0.7$. From Fig. 9, the s.w.r. at the line input is seen to be 1.9 (at D), and the radial line is seen to cross the TOWARD-LOAD scale at 0.328 (at E). To the 0.328 we add the line length, 0.282, and arrive at a value of 0.610. To locate this point on the TOWARD-LOAD scale, first subtract 0.500, and locate 0.110 (at F); then draw a radial line from this point to prime center.

To account for line losses, transfer the radius of the s.w.r. circle to the external 1-DB.-STEPS scale. This radius will cross the external scale at G, the fifth db. mark from the top. Since the line loss was given as 1 db., we strike a new radius (at H), one "tick mark" higher (toward load) on the same scale. (This will be the fourth db. tick mark from the top of the scale.) Now transfer this new radius back to the main chart, and scribe a new s.w.r. circle of this radius. This new radius represents the s.w.r. at the load, and is read as about 2.3 on the external S.W.V.R. scale. At the intersection of the new circle and the load radial line, we read $0.65 - j0.6$ as the normalized load impedance. Multiplying by 50, the actual load impedance is $32.5 - j30$ ohms. The s.w.r. in this problem was seen to increase from 1.9 at the line input to 2.3 (at I) at the load, with the 1-db. line loss taken into consideration.

In the example above, values were chosen to fall conveniently on or very near the "tick marks" on the 1-DB. scale. Actually, it is a simple matter to interpolate between these marks when making a radius correction. When this is necessary, the relative distance between marks for each db. step should be maintained while counting off the proper number of steps.

The total losses in a given piece of transmission line are dependent upon several factors, primarily frequency, line length, and s.w.r. Transmission-line data tables show "matched-line" losses for various types of lines at various frequencies, usually expressed in decibels per hundred feet. RG-8/U, for example, has an attenuation of 0.28 db. per hundred feet at 3.5 Mc., 0.65 db. at 14 Mc., 0.98 db. at 28 Mc., 2.65 db. at 150 Mc., and so on. The *A.R.R.L. Antenna Book* has quite complete tables of common transmission-line data. Attenuation for a given piece of line may be computed from table data; the attenuation in db. is directly proportional to the line length.

Adjacent to the 1-DB.-STEPS scale lies a LOSS-COEFFICIENT scale. This scale provides a factor

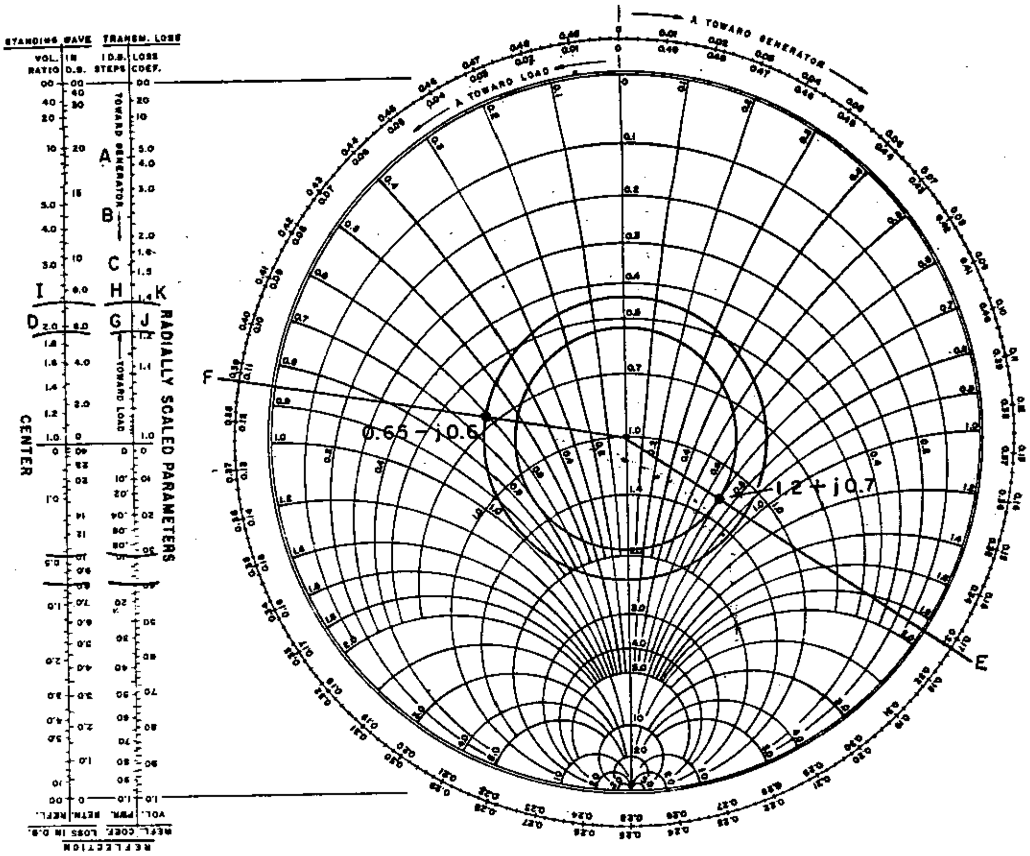

Fig. 9.

by which the matched-line loss in db. should be multiplied to account for the increased losses in the line when standing waves are present. These added losses do not affect the standing-wave ratio or impedance calculations; they are merely the additional dielectric and copper losses of the line caused by the fact that the line conducts more average current and must withstand more average voltage in the presence of standing waves. In the above example and in Fig. 9, the loss coefficient at the input end is seen to be 1.21 (at J), and 1.39 (at K) at the load. As a good approximation, the loss coefficient may be averaged over the length of line under consideration; in this case, the average is 1.3. This means that the total losses in the line are 1.3 times the matched loss of the line (1 db.), or 1.3 db.

Two additional external scales may find limited use in amateur applications. These are the REFLECTION-LOSS IN DB. scales. Both of these scales are related to the REFLECTION COEFFICIENT OF POWER scale, but express values in db., rather than in a power ratio. The RETURN scale expresses the ratio of total forward power to reflected power in db. This is sometimes called the *reflection loss*, although it does not necessarily represent an actual loss of power. If an impedance match is made at the sending end of the transmission line with a generator or a transmitter, a "reflection gain" takes place which neutralizes the "loss" at the load end. The REFLECTED scale expresses the ratio of total forward power to nonreflected power in db. This would represent the power consumed in the load (or power radiated by an antenna, plus ohmic losses), referenced to the total forward power in the line.

Summary

To summarize briefly, any calculations made on the Smith Chart are performed in four basic steps, although not necessarily in the order listed.

1) Normalizing and plotting a line input (or load) impedance, and constructing a constant s.w.r. circle.

2) Applying the line length to the wavelengths scales.

3) Determining attenuation or loss, if required, by means of a second s.w.r. circle.

4) Reading normalized load (or input) impedance, and converting to impedance in ohms.

The Smith Chart may be used for many types of problems other than those presented as examples. The transformer action of a length of line — to transform a high impedance (with perhaps high reactance) to a purely resistive impedance of low value — was not mentioned. This is known as "tuning the line," for which the Chart is very helpful, eliminating the need for cut-and-try procedures. The Chart may also be used to calculate lengths for shorted or open matching stubs in a system. In fact, in any application where a transmission line is not perfectly matched, the Smith Chart can be of value.

The Chart can also be used in solving other types of problems which were not brought into the scope of this article. Such problems include the use of the Chart for admittance, conductance, and susceptance calculations, or the computation of equivalent series or parallel components of an impedance or admittance. In short, the Smith Transmission Line Calculator or Chart is a very versatile tool for either amateur or professional use.

1.GBARC Questionaire

From VE3TSA 11 April 95

I would like to get some input from the membership with regards to the content of FEEDBACK. Would you please fill out this questionaire and return it to me. This will help me determine if the newsletter meets the needs of our members. At the same time I can sneak in a few questions about the club in general HI.

2. OPERATING HABITS:

What transceivers do you have? ie: TS-120 HF rig, FT-227 VHF fm rig ____________________

Do your rigs operate on battery power? ____________________

OPERATING- WHICH BANDS/MODES DO YOU USE? JUST Check IN THE SQUARE.

	160	80	40	20	15	10	6	2	.70	OTHER
SSB										
CW										
FM										
AM										
PACKET										
AMTOR										
RTTY										
SATELLITE										
AURORA										
OTHER										

What ham-related skills do you have?

operating procedures _____ setting up a station _____ fixing HF gear _____ fixing VHF gear ____

setting up computers _____ setting up packet _____ making antennas _____ fixing computers ___

circuit design _____ climbing towers _____

OTHER ____________________

I'm new at this but eager to learn. ________

Would you be willing to help other club members with your skills at times? Yes/No ________

Would you be willing to just "lend a hand" when needed? Yes/no ________

3. ASSOCIATIONS:

Are you a member of... RAC__ ARRL__ AMSAT__ OTHER____________________

Do you subscribe to ... TCA__ QST__ 73__ OTHER____________________

Are you a member of another local club ? ____________________

4. ACTIVITIES:

Which club activities interest you? (check more than one if you want)

Meetings ____ Breakfasts ____ 2m net____ 80m net____ Field Day ____ Hamfest ____

Santa Claus parade ____ Tours ____ Radio Course ____ Fox Hunt ____

Other ____

Would you be willing to help out with a club activity? Y/N ____ Preferences? ______________

Would you be willing to talk at a club meeting? Y/N ____ Topic? ______________

Are you willing to run a net? Sunday morning HF net____ Thurs night 2mtr net ____

What is your favourite club activity? ______________________________

What is your least favourite club activity? ______________________________

5. FEEDBACK:

Do you like the style and content of Feedback as it has been? ______________________

Would you rather not receive Feedback? Yes I would ____ No thanks ____

What other topics would you like to see covered in Feedback? ______________________

Comments? (good or bad)____

6. CLUB MEETINGS:

If you could set up the meeting as you saw fit, what would you do? ______________________

____

____

____

____

____

What kind of programs would you like to see at club meetings? ______________________

____

What kind of educational programs would you like to see? ______________________

____

Anythingelse????____

____

____

____

____

Your Callsign ________________ (optional) Mail to: Tom St.Amand
1232 3rd Ave E
Owen Sound,On
N4K2L5