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

MAR 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 February 28 1995:

The meeting was opened by president Ken with 30 members and visitors present. Most of the visitors were new hams from the course. Tom VE3TSA pointed out that last months minutes were a little misleading, course materials are expensive but course fees cover all course expenses and also provide some much needed funds for the club. The minutes were accepted with this clarification. A beginners packet course has been planed for saturday April 22 starting at 9:00AM at the airport, the fee will be $25.00. It was decided that the club will spend about $110.00 on a TNC for the BBS system, there were no objections. Ken VA3KMS said that there is still a noise problem on the Barrow Bay repeater, and that the patch is still being tested at Ricks place, Rick plans to add some memory dial numbers to it yet. Dan VE3DQC mentioned that he thinks it is a great idea having phone patch on the club repeaters. Brad VE3RHJ suggested that since we have a lot of new hams in the area we should start a two meter net, we decided to try it on thursdays at 8:00PM on the club repeaters. Brad also suggested that when we don't have a speaker lined up we should have members discuss various topics such as computers, antennas, packet, ham satelites, circuit design and various others. We then discussed emergency communication and Canwarn. Field day will be the last weekend of June. A date will be set for our flea market this spring and the building at the fair ground will be reserved. Cy Cole VE3CC died on February 22 1995. Cy had mentioned that he would like the club to take over his call as a club call. Brad plans to contact Industry Canada to find out how this can be done. Our treasurer reports that we have $1322.88 in the bank account. The meeting was closed at 8:50PM.. The 50/50 draw was won by Dave VE3DXO...

Trivia Question... We all know what a QSO is, some of us even have them once in a while. The BBS counts, right? I have come across another definition of a QSO, does anyone know what it is? Clue.....It does have something to do with radio. .....73 de VE3MWU.....

A QSO is a Quasi Stellar Object, also known as a Quasi Stellar Radio Source or more commonly a Quasar. Quasars are the most powerful and the most distant objects known in the universe. Some quasars emit over 100 trillion times as much energy as the sun. The light and radio signals from quasars has traveled at 9.46 trillion kilometres per year for 12 to 14 billion years to reach Earth. The most distant quasars that have been detected are moving away at almost the speed of light. More distant quasars may be moving away at more than the speed of light so they can never be detected because their energy will never reach Earth.....73 de VE3MWU.....

Microwave Reception by GM4IHJ 25 Feb 95

Most signal reception from satellites now occurs at microwave frequencies. This is generally assumed to require conspicuous dish antennas. But, while it is conceded that a dish antenna may be highly desirable, it is often the case that it is not a practical proposition , because of, local laws, the XYLs firm exclusion of anything ugly or mechanical, or , high winds and adverse weather conditions.

So what can a flat dweller, or igloo owner do ? First it must be said that the dish need not be out of doors. It can be inside a building provided that it can view the sky through single thickness glass (further obscured if necessary by a thin curtain). Double glazing can produce substantial attenuation and refraction, but a dish located half a metre behind a single glass pane and gauze curtain can receive 3 GHz to 12 GHz signals with only minimal attenuation, even when the signal is coming in at a relatively low incident angle to the glass of say 30 degrees. You can do a simple test for attenuation by checking your antenna and receiver using Sun noise as your target, window open versus window closed if in doubt.

However , She who must be obeyed, may simply not allow a dish indoors. In which case you can try putting a diffraction grating (marking ink circles on thin plastic) on the inside of the glass, with the LNB located at the focus further back from the window and suitably disguised as a pot plant or other room decoration. Equally possible you can put the diffraction grating outside on a suitable garden wall and site the disguised LNB in front of it.

A quite different alternative particularly when the satellite you want to receive is at high elevation is to receive the signal through a roof sky light. GM4IHJ has two big windows in the roof, one facing south , the other facing north, providing good viewing (and a warm sheltered indoor position out of the Scottish winter), with reception of Oscar 13 , and CIS Molniyas, via a collection of helical antennas for the various microwave frequencies. Originally single helixes were used, but these were unwieldy and have been replaced by neater, shorter, double and quad helix combinations.

Different yet again and not yet seen on the Amateur radio scene, is an outdoor type of antenna which uses a flat metal plate which has milled dipole slots in it suitably coupled to form a broadside array. BSB an now defunct UK satellite TV broadcaster produced a few antennas of this type for 12 GHz. Those that passed the specification worked well, and can be very inconspicuous. But unfortunately these antennas require extremely precise antenna pattern tolerances, which are not easy to mass produce. However a radio amateur with plenty of time and a good machine shop should be able to produce something useful in this line if none of the other solutions advocated here will suffice. 73 de GM4IHJ @ GB7SAN or gm4ihj@delphi.com +

FOR SALE

VE3TFQ, JIM, 369-6596

HF-5B BUTTERNT BUTTERFLY ANTENNA $200.

40 FEET OF DELHI HD TOWER $300

TELEX HY-GAIN 14AVQ/WB-S TRAP VERTICAL, COVERS 40-20-15-10 $50

Please keep me updated about your forsale items........ editor

RESOURCES for Georgian Bay amateurs

2m FM REPEATERS

call	freq	regular net	link	location	(tone)
VE3OST	145.290-	Thu 8:00pm	OST	Owen Sound	
VE3OSR	146.940-	" "	OST	Barrow Bay	
VE3GBT	146.895-	" "	OST	Markdale	
VE3XTX	146.730-			Woodford	
VE3RAN	146.640-			Proton Station	(97.4 Hz)
VE3PER	146.820-	Sun 9:00pm	ULR	Port Elgin	
VE3RBT	145.110-	Mon 8:30pm		Walkerton	
VE3MTR	146.790-	Tue 7:30pm	ULR	Collingwood	(77 Hz) swap net afterwards
VE3TIV	146.610-	Wed ????pm		Kincardine	
VE3ZAP	146.685-		ULR	Shelburne	

OST link: the three GBARC repeaters are linked full-time, so anything received by one is transmitted by all three.

ULR link: these repeaters are part of the VE3ULR Repeater Association, and on demand can link to VE3ULR (Aurora) and from there to Toronto, Hamilton, London, Kingston, etc. For info: VE3ULR Repeater Assoc., P.O. Box 1026, Station "F", Toronto, Ontario M4Y 2T7.

HF PHONE NETS

daily	7am-6pm	3.755 MHz	ONTARS (Ontario Amateur Radio Service)
Sat	10:00 am	7.055 MHz	TransProvincial Net Swap Shop
Sun	9:30 am	3.783 MHz	Georgian Bay Amateur Radio Club
Sun	12 noon	3.750 MHz	London ARC Swap Shop
Sun	7:30 pm	3.755 MHz	Ontario Swap Shop

PACKET BBSs & NODES

VE3IJD	145.630	Keady	1200 baud BBS
VE3XOX	145.630	Owen Sound	1200 baud node

Send additions/corrections to this list to VE3RHJ @ VE3IJD.

A reminder -- starting March 2nd, we're going to run a 2m FM net every Thursday at 8 pm on the three linked GBARC repeaters. See you there! 73, Brad VE3RHJ

Voyager Status Report
February 1, 1995

Both spacecraft are healthy and are continuing to make observations of their interplanetary environment. They are using their ultraviolet spectrometers to map the heliosphere and study the incoming interstellar wind. The cosmic ray detectors are seeing the energy spectra of interstellar cosmic rays in the outer heliosphere. The magnetometer sensors are still measuring the strength and direction of the solar magnetic field. The plasma detectors looking back at the Sun record the solar wind parameters. The low energy charged particle experiment studies the energy spectra of particles coming from the Sun. The plasma wave instrument is studying the incoming signals from the direction of the heliosphere.

Voyager 1 is currently 8.8 billion kilometers (5.5 billion miles) from Earth and is traveling at a speed of 61,200 kilometers per hour (39,000 miles per hour). Voyager 2 is 6.8 billion kilometers (4.3 billion miles) from Earth and is traveling at a speed of 57,600 kilometers per hour (36,000 miles per hour).

Subject: March Meeting,Solar power

I've lined up a guest speaker for the March 28 meeting of GBARC.She's Judy Kitto of SPS,Solar Power Systems. John and Judy started the hobby of solar power years ago when they bought 25 acres of land just north of Keady.John,who passed away from cancer last year was a fireman in Brampton. They loved coming up here to "GOD's" country.Because they were so far off the main road,th hydro company wanted mega bucks to install the lines. So they built thei cottage (now her home) using a generator to run the saws etc.Next they...... come out to the meeting and find out , she'll have a great display on hand ..

from VE3IJD

From VE3IJD
This is the second bulletin pertaining to the PACKET RADIO COURSE that the Georgian Bay Amateur Radio Club is hosting. We have passed the minimum number of trainees so its a definite "go". All proceeds will be put back into the link system between the VE3IJD bbs and the VE3XOX node.For information,contact Gene McDonald, VE3IJD @ VE3IJD packet, or 519-934-2380 .You don't need to send money but you must register in advance. This will ensure that you receive a manual.Because of the location,bag lunches are recommended.Coffee and pop are available.

DATE: Saturday April 22/95
LOCATION: Billy Bishop Airport,Highway 26 4kms east of OwenSound
TIME: 09:00 AM start,,probable finish 4:30 PM
LUNCH: Bring your own lunch, drinks available
COST: $25 per student, no need to be on packet yet
REGISTRATION: You MUST be registered to receive a manual (worth every penny)
TOPICS: area packet history
: whats a tnc ?
: FBB commands A to Z and everything in between
: how to properly read and send mail both personal and bulletins
: when to ask the SYSOP for help
: Servers,REQDIR,REQFIL,FNDFIL,REQQTH,REQDSK,AUTO7P,INFO,PREFIX,LOOK4, QTH, and CI
: A look at the files area of USERS,lots of stuff to read
: the "CD" rom
: A close look at the TPK program, copies will be available,bring a 3.5" DISK.

This should keep you out of trouble for a couple of hours.The seating is about 1/3 full so get your name in early...All the best...

message created 04:01Z 14-Mar 73,good packets,Mr.Sysop

****

The 21st Annual
CENTRAL ONTARIO
AMATEUR RADIO FLEAMARKET

****

Jointly Sponsored by

Guelph Amateur Radio Club

Kitchener-Waterloo Amateur Radio Club Inc.

Saturday, June 3rd, 1995
Open 8:00 A.M. to 2:00 P.M.
Public Snack Bar and Rest Area Available From 6:00 A.M.

Vendors only 6:00-8:00 A.M.
(No Outside Vendors)

at
Bingeman Park
1380 Victoria Street North
Kitchener, Ontario

Smith-Chart Calculations for the Radio Amateur

Graphical Solutions of Transmission-Line Problems

PART I

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

This article reviews the basic use of the Smith Chart and, in addition, discusses the external scales now provided on most versions of the Chart. These scales greatly simplify the calculations involved in line-loss considerations.

Because of the length of the article, it is divided into two parts. The second part will appear in an early issue.

An earlier *QST* article by K6CRT [1] has created considerable interest among amateurs in the use of the Smith Chart. Now that the measurement of the resistive and reactive components of a complex impedance has been brought into the realm of possibility, even for an amateur with a limited budget,[2] still greater amateur interest in the Chart will undoubtedly develop.

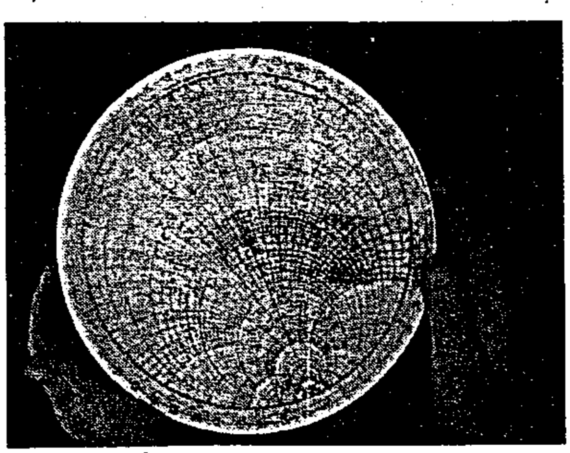
The Smith Radio Transmission-Line Calculator is named after its inventor, Phillip H. Smith, and was originally described in *Electronics* for January, 1939, where it was presented in cutout form. Radio development, during and since the war, has promoted considerable interest in this calculator among engineers and research workers, particularly in the field of u.h.f. where electrical measurements must be made indirectly. The Calculator has also proven itself useful in h.f. and v.h.f. work, because it eliminates the need for complex mathematical calculations in solving most transmission-line problems. Although its appearance may at first seem somewhat formidable, the use of the Smith Chart is quite similar to the use of a graph. In fact, the Chart might be considered as a specialized type of graph, with curved, rather than rectangular, coordinate lines.

When a transmission line is not terminated in its characteristic impedance, standing waves will result, and the input impedance of the line will vary depending on the line's length. If the terminating impedance is known, it is a simple matter to determine the input impedance of the line for any length by means of the Smith Chart or Calculator. Conversely, with a given line length and a known (or measured) input impedance, the load impedance may be determined by means of the Chart or Calculator — a convenient method of remotely determining an antenna impedance, for example.

* Hopkins St., Wilmington, Mass. 01887.

[1] Cholewski, "Some Amateur Applications of the Smith Chart," *QST*, January, 1960.

[2] Strandlund, "Amateur Measurement of $R + jX$," *QST*, June, 1965.



The Smith Transmission-Line Calculator.

Impedance Coordinate System

The Calculator is fundamentally a special kind of impedance coordinate system, mechanically arranged with respect to a set of movable scales, to show the relationship of impedance at any point along a uniform open-wire or coaxial transmission line to the impedance at any other point, and to several other electrical characteristics. The true Calculator assumes a form similar in appearance to a circular slide rule, but with different scales, of course. The Smith Calculator is available in durable plastic for a few dollars from the Emeloid Company, 1239 Central Ave., Hillside, N. J.

A perhaps more common form of the Calculator is the Smith Transmission-Line Chart, or merely Smith Chart, which is a printed copy of the Calculator coordinate system and its various scales. The fact that the scales are not movable on the printed charts offers only slight inconvenience over the true Calculator. An advantage of the printed Chart is that actual calculations may be kept for record or later checking — a feat which is impossible with the Calculator version. Smith Charts are available at most college bookstores for a few cents each, or from General Radio Company, West Concord, Mass.

The Smith Chart coordinate system consists simply of two families of circles — the resistance family and the reactance family. The *resistance circles* (Fig. 1) are centered on the *resistance axis* (the only straight line on the Chart), and are tangent to the outer circle at the bottom of the Chart. Each circle is assigned a value of resistance, which is indicated at the point where the circle crosses the resistance axis. All points along any one circle have the same resistance value.

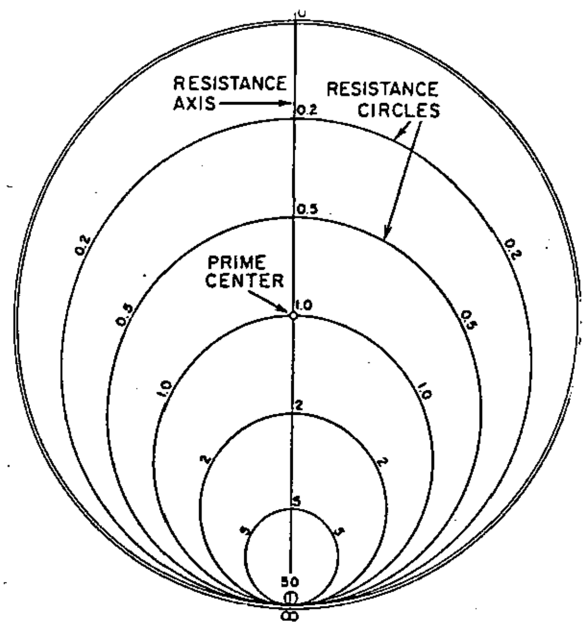


Fig. 1.

The values assigned to these circles vary from zero at the top of the chart to infinity at the bottom, and actually represent a ratio with respect to the impedance value assigned to the center point of the Chart, indicated 1.0. This center point is called *prime center.* If prime center is assigned a value of 100 ohms, then 200 ohms resistance is represented by the 2.0 circle, 50 ohms by the 0.5 circle, 20 ohms by the 0.2 circle, and so on. If a value of 50 is assigned to prime center, the 2.0 circle now represents 100 ohms, the 0.5 circle 25 ohms, and the 0.2 circle 10 ohms. In each case, it may be seen that the value on the Chart is determined by dividing the actual resistance by the number assigned to prime center. This process is called *normalizing.* Conversely, values from the Chart are converted back to actual resistance values by multiplying the Chart value times the value assigned to prime center. This feature permits the use of the Smith Chart for any impedance values, and therefore with any type of uniform transmission line, whatever its impedance may be. Specialized versions of the Smith Chart may be found with a value of 50 or 75 at prime center. These are intended primarily for use with 50- and 75-ohm lines, respectively.

Now consider the *reactance circles* (Fig. 2) which appear as curved lines on the Chart because only segments of the complete circles are drawn. These circles are tangent to the resistance axis, which itself is a member of the reactance family (with a radius of infinity). The centers are displaced to the right or left on a line tangent to the bottom of the chart. The large outer circle bounding the coordinate portion of the Chart is the reactance axis.

Each reactance circle segment is assigned a value of reactance, indicated near the point where the circle touches the reactance axis. All points along any one segment have the same reactance value. As with the resistance circles, the values assigned to each reactance circle are normalized with respect to the value assigned to prime center. Values to the right of the resistance axis are positive (inductive), and those to the left of the reactance axis are negative (capacitive).

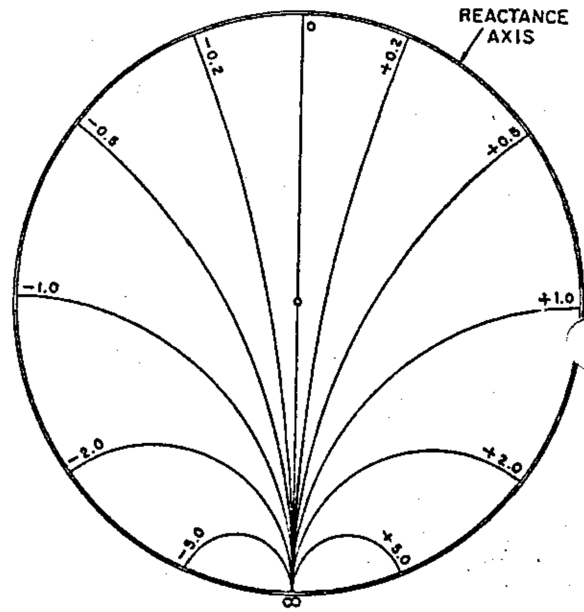


Fig. 2.

When the resistance family and the reactance family of circles are combined, the coordinate system of the Smith Chart results, as shown in Fig. 3. Complex series impedances can be plotted on this coordinate system.

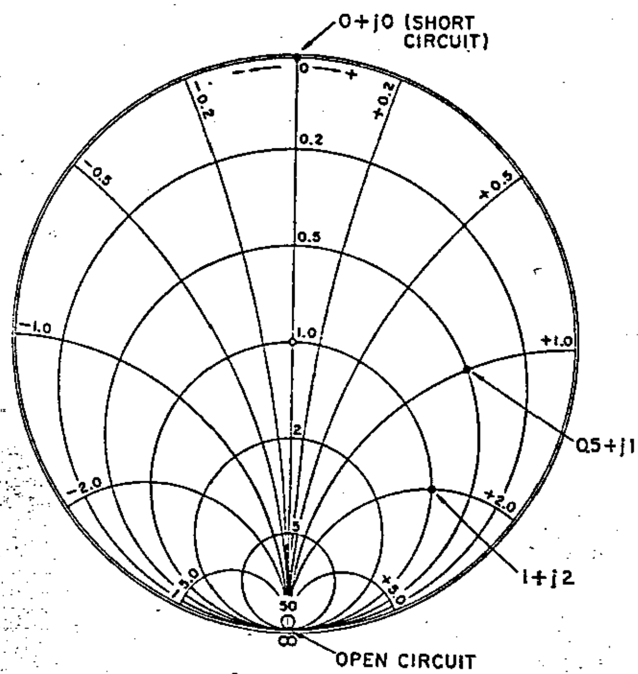


Fig. 3.

Impedance Plotting

Suppose we have an impedance consisting of 50 ohms resistance and 100 ohms inductive reactance ($Z = 50 + j100$). If we assign a value of 100 ohms to prime center, we normalize the above impedance by dividing each component of the impedance by 100. The normalized impedance would then be $\frac{50}{100} + j\frac{100}{100} = 0.5 + j1.0$. This impedance would be plotted on the Smith Chart

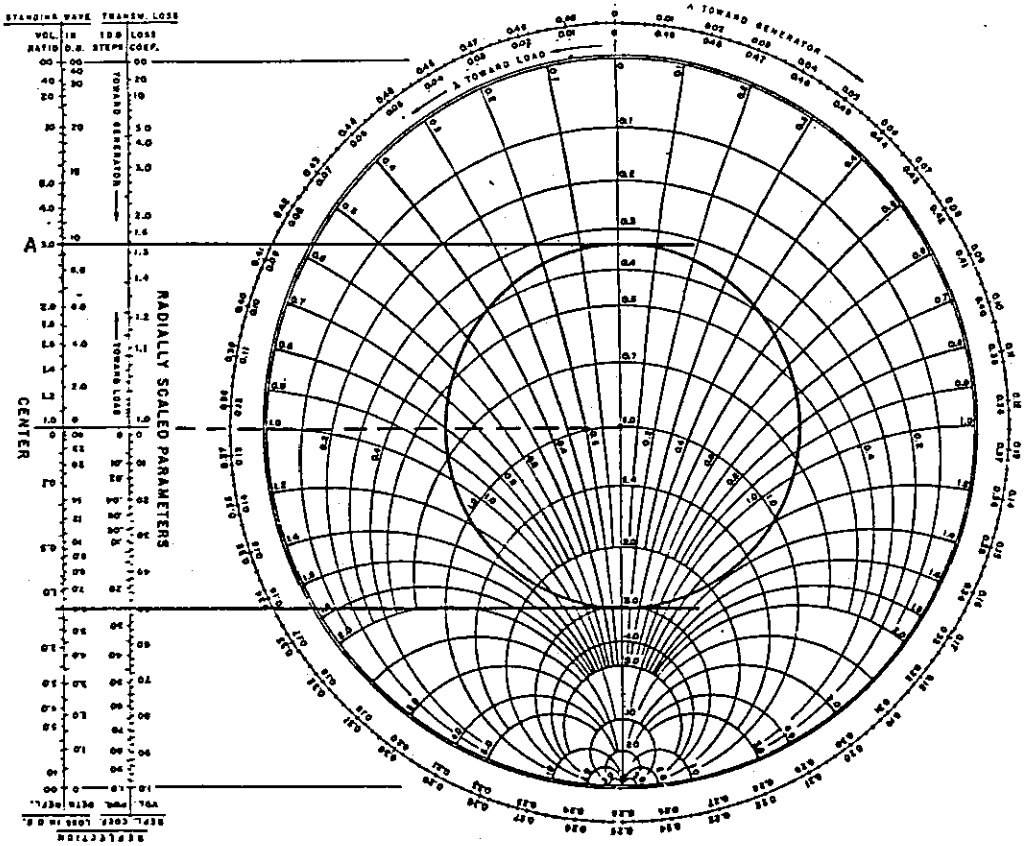


Fig. 5.

at the intersection of the 0.5 resistance circle and the +1.0 reactance circle, as indicated in Fig. 3. If a value of 50 ohms had been assigned to prime center, as for 50-ohm coaxial line, the same impedance would be plotted at the intersection of the $\frac{50}{50} = 1.0$ resistance circle, and the $\frac{100}{50} = 2.0$ positive reactance circle, or at $1 + j2$ (also indicated in Fig. 3). From these examples, it may be seen that the same impedance may be plotted at different points on the Chart, depending upon the value assigned to prime center. It is customary when solving transmission-line problems to assign to prime center a value equal to the characteristic impedance, or Z_0, of the line being used. This value should always be recorded at the start of calculations, to avoid possible confusion later.

In using the specialized charts with the value of 50 at prime center, it is, of course, not necessary to normalize impedances when working with 50-ohm line. The resistance and reactance values may be plotted directly.

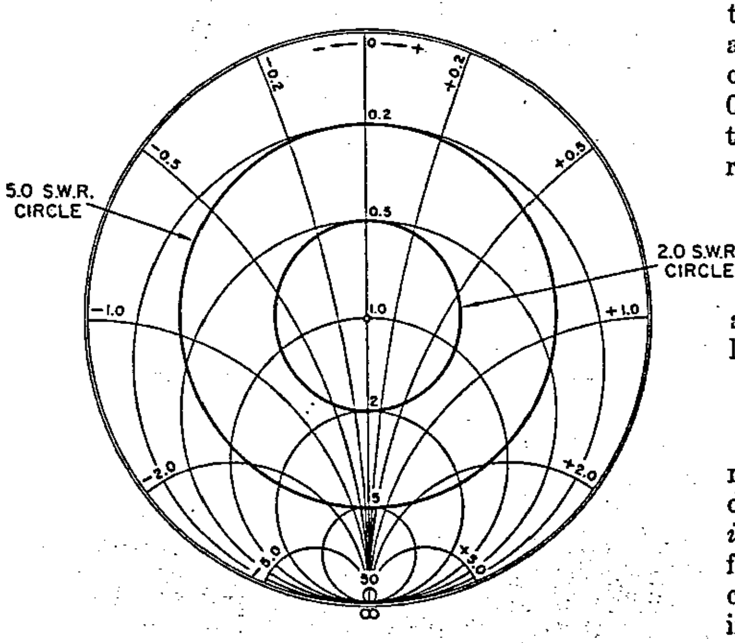


Fig. 4.

Short and Open Circuits

While on the subject of plotting impedances, two special cases deserve consideration. These are short circuits and open circuits. A true short circuit has zero resistance and zero reactance, or $0 + j0$. This impedance would be plotted at the top of the Chart, at the intersection of the resistance and the reactance axes. An open circuit has infinite resistance, and would therefore be plotted at the bottom of the Chart, at the intersection of the resistance and reactance axes. These two special cases are sometimes used in determining line lengths, line losses, and line impedances.

Standing-Wave Ratio Circles

Members of a third family of circles, which are not printed on the chart but which are added during the process of solving problems, are *standing-wave-ratio*, or *s.w.r., circles*. See Fig. 4. This family is centered on prime center, and appears as concentric circles inside the reactance axis. During calculations, one or more of these circles may be added with a drawing compass. Each circle

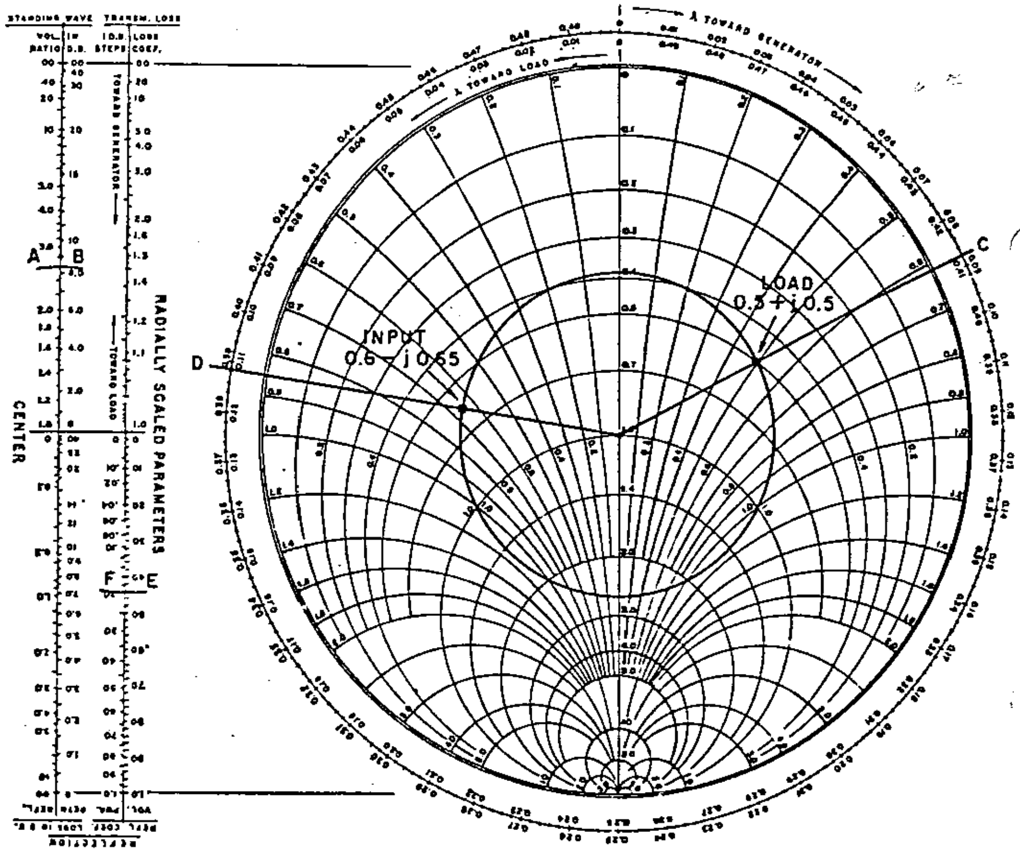


Fig. 6.

represents a value of s.w.r., every point on a given circle representing the same s.w.r. The s.w.r. value for a given circle may be determined directly from the chart coordinate system, by reading the resistance value where the s.w.r. circle crosses the resistance axis, below prime center. (The reading where the circle crosses the resistance axis above prime center indicates the inverse ratio.)

Consider the situation where a load mismatch in a length of line causes a 3-to-1 standing-wave ratio to exist. If we temporarily disregard line losses, we may state that the s.w.r. remains constant throughout the entire length of this line. This is represented on the Smith Chart by drawing a 3:1 constant-s.w.r. circle (a circle with a radius of 3 on the resistance axis), as in Fig. 5. The design of the Chart is such that any impedance encountered anywhere along the length of this mismatched line will fall on the s.w.r. circle, and may be read from the coordinates merely by progressing around the s.w.r. circle by an amount corresponding to the length of the line involved.

This brings into use the *wavelength scales*, which appear, in Fig. 5, near the outer perimeter of the Smith Chart. These scales are calibrated in terms of portions of an electrical wavelength along a transmission line. One scale, running counterclockwise, starts at the generator or input end of the line and progresses toward the load, while the other scale starts at the load and proceeds toward the generator in a clockwise direction. The complete circle represents one half wavelength. Progressing once around the perimeter of these scales corresponds to progressing along a transmission line for a half wavelength. Because impedances will repeat themselves every half wavelength along a piece of line, the Chart may be used for any length of line by disregarding or subtracting from the line's total length an integral, or whole number, of half wavelengths.

Also shown in Fig. 5 is a means of transferring the radius of the s.w.r. circle to the external scales of the chart, by drawing lines tangent to the circle. Or, the radius of the s.w.r. circle may be simply transferred to the external scale by placing the point of a drawing compass at the center, or 0, line and inscribing a short arc across the appropriate scale. It will be noted that when this is done in Fig. 5, the external STANDING-WAVE VOLTAGE-RATIO scale indicates the s.w.r. to be 3.0 (at A) — our condition for intially drawing the circle on the Chart (and the same as the s.w.r. reading on the resistance axis).

Solving Problems with the Smith Chart

Suppose we have a transmission line with a characteristic impedance of 50 ohms, and an electrical length of 0.3 wavelength. Also, suppose we terminate this line with an impedance having a resistive component of 25 ohms and an inductive reactance of 25 ohms ($Z = 25 + j25$), and desire to determine the input impedance to the line. Because the line is not terminated in its characteristic impedance, we know that standing waves will be present on the line, and that, therefore, the input impedance to the line will not be exactly 50 ohms. We proceed as follows: First, normalize the load impedance by dividing both the resistive and reactive components by 50 (Z_0 of the line being used). The normalized impedance in this case is 0.5 + j0.5. This is plotted on the Chart at the intersection of the 0.5 resistance and +0.5 reactance circles, as in Fig. 6. Then draw a constant-s.w.r. circle passing through this plotted point. The radius of this circle may then be transferred to the external scales with the drawing compass. From the external S.W.V.R. scale, it may be seen (at A), that the voltage ratio of 2.6 exists for this radius, indicating that our line is operating with an s.w.r. of 2.6 to 1. This figure is converted to decibels in the adjacent scale, where 8.4 db. may be read (at B), indicating that the ratio of the voltage maximum to the voltage minimum along the line is 8.4 db.

Next, with a straightedge, draw a radial line from prime center through the plotted point to intersect the wavelengths scale, and read a value from the wavelengths scale. Because we are starting from the load, we use the TOWARD-GENERATOR or outermost calibration, and read 0.088 wavelength (at C). To obtain the line input impedance, we merely find the point on the s.w.r. circle which is 0.3 wavelengths toward the generator from the plotted load impedance. This is accomplished by adding 0.3 (the length of the line in wavelengths) to the reference or starting point, 0.088; 0.3 + 0.088 = 0.388. Locate 0.388 on the TOWARD-GENERATOR scale (at D), and draw a second radial line from this point to prime center. The intersection of the new radial line with the s.w.r. circle represents the line input impedance, in this case 0.6 − j0.65. To find the actual line input impedance, multiply by 50 — the value assigned to prime center, which equals 30 − j32.5, or 30 ohms resistance and 32.5 ohms capacitive reactance. This is the impedance which a transmitter must match if such a system were a combination of antenna and transmission line, or is the impedance which would be measured on an impedance bridge if the measurement were taken at the line input.

In addition to the line input impedance and the s.w.r., the Chart reveals several other operating characteristics of the above system of line and load, if a closer look is desired. For example, the voltage reflection coefficient, both magnitude and phase angle, for this particular load is given. The phase angle is read under the radial line draw through the plot of the load impedance where the line intersects the ANGLE-OF-REFLECTION-COEFFICIENT scale. This scale is not included in Fig. 6, but will be found on the Smith Chart, just inside the wavelengths scales. In this example, the reading would be about 116.5 degrees. This indicates the angle by which the reflected voltage wave lags the incident wave at the load. It will be noted that angles on the left half, or capacitive-reactance side, of the Chart are negative angles, a "negative" lag indicating that the reflected voltage wave actually leads the incident wave.

The magnitude of the voltage-reflection-coefficient may be read from the external REFLECTION-COEFFICIENT-VOLTAGE scale, and is seen to be approximately 0.44 (at E) for this example, meaning 44 per cent of the incident voltage is reflected. Adjacent to this scale on the POWER calibration, it is noted (at F) that the power reflection coefficient is 0.20, indicating that 20 per cent of the incident power would be reflected. QST

A Five-Component Wideband Amplifier for Your Receiver

by J.S. "Stu" Gurske K9EYY

Imagine a very wideband amplifier which covers a range of from about 100 MHz to 2,000 MHz, and requires only four other components to make it work. The Mini Circuits catalog lists just such a device, called a MAR-8. It is extremely small, measuring about 0.078 (5/64) inch in diameter by about 0.62 (1/16) inch thick. It has a gain of about 33 dB at 100 MHz, pretty impressive for such a small device.

Getting It Together

I needed a preamplifier for one of my VHF receivers and decided to try this device. I obtained a MAR-8, two 100 pF chip capacitors, a 120 ohm 1/4 watt resistor, and a ferrite bead and hooked it all up. The amplifier worked very well. I heard signals which I had never heard before. The old marginal signals were now fully quiet. This amplifier makes a nice weekend project.

The amplifier uses chip capacitors so, while some care must be taken when soldering them into the circuit, constructing the amplifier was easy. Here is how I did it.

It's easy to make a printed circuit board, but I chose to hard wire the device instead. I mounted five small standoff insulators on a piece of copper-clad board (i.e. double-sided printed circuit board material) as shown in Figure 2. The circuit board material measured approximately 1/2" wide by 1-1/2" long. After mounting BNC connec-

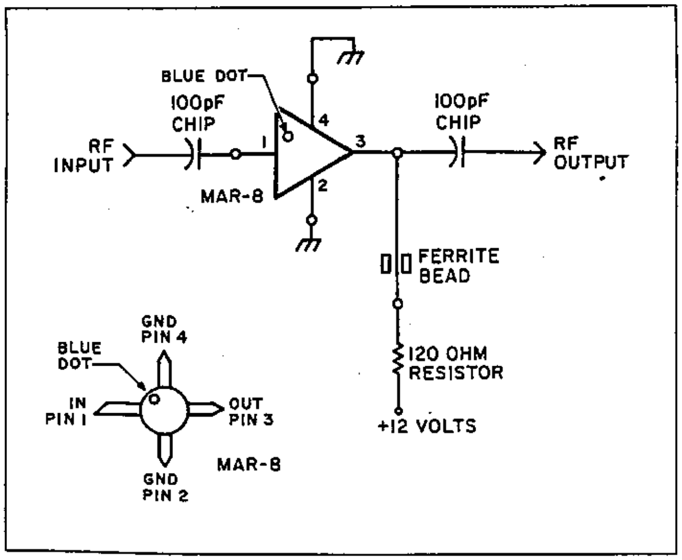


Figure 1. Schematic for the 5-component RF amplifier.

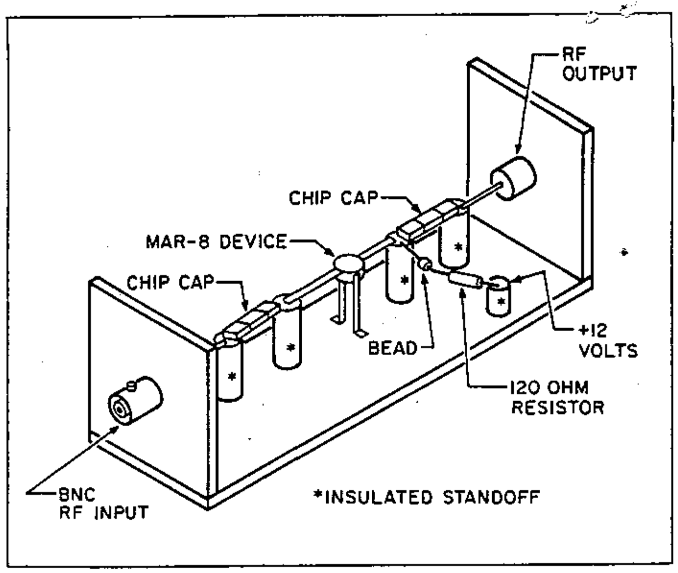


Figure 2. Parts placement for the RF amplifier assembly.

tors at each end of the board, I installed the standoff insulators. I then soldered the chip capacitors in place with great care—they are small.

Next, I mounted the MAR-8. First I bent pins 2 and 4 down so they touched the copper-clad board (ground), then I soldered them to the board. Pins 1 and 3 were bent straight out to span between the standoff insulators which support the input and output capacitors. Then they were soldered in place.

After this, I slipped the ferrite (or powdered iron) bead over the resistor lead nearest to pin 3 of the MAR-8. I soldered this lead to the standoff insulator connected to pin 3 of the MAR-8. The other end of this resistor was connected to another standoff insulator and became the attachment point for the +12 volt supply. Incidentally, the size of the resistor is chosen to provide approximately 36 mA to the MAR-8. The data sheets recommend 111 ohms, but I used 120 ohms because that is what I had on hand. The data sheets also recommend a 1 µF capacitor from the +12 volt point to ground if erratic behavior is experienced. My amplifier did not need this capacitor.

Figure 1 shows the schematic for the amplifier. Figure 2 gives a pictorial representation of how the amplifier was assembled.

Photo A is a close-up picture of the device. The length of the little enclosure is about 1-1/2" inside of the box. It is about 1/2" wide and about 5/8" deep. In this view the sides of the box have been removed to show the components. MAR-8 can be seen in the center.

After I tested the amplifier, I cut three more pieces of copper-clad board and enclosed the device by soldering the three pieces together to form a box. I have used the amplifier for about six months now with good results. ■

Parts List

Qty.	Device
1	MAR-8
2	100 pF chip capacitors
1	120 ohm resistor
1	ferrite bead
2	chassis mount female BNC connectors
5	insulated standoffs
Misc:	Box (made out of PC board material).

Parts Sources

MAR-8: Mini-Circuits, Box 350166, Brooklyn NY 11235-0003; phone (718) 332-4661.

100 pF chip capacitors & resistor: Mini Circuits, or Digi-Key, 701 Brooks Ave. South, P.O. Box 677, Thief River Falls MN; (800) 344-4539.

RF Bead: Amidon Associates, P.O. Box 956, Torrance CA 90508; phone (213) 763-5770.

BNC connectors: Radio Shack stores.

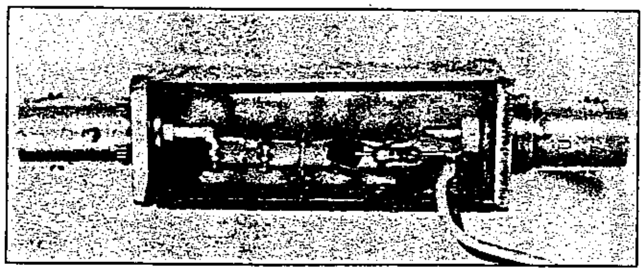


Photo A. Close-up of the finished amplifier: MAR-8 (center), chip caps, resistor, stand-off insulator bead on the resistor lead, BNC connectors and 12 volt wires.