HAM HUM

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March 1971

Vol. XXI
No. 3

NEXT MEETING

WHEN: FRIDAY, MARCH 12, 1971

TIME: 8:00 P.M.

WHERE: RED CROSS CHAPTER HOUSE
432 South 39th Street, Omaha

WHAT: PROGRAM by Alan H. McMillan, W0JJK
WORLD RADIO LAB, COUNCIL BLUFFS, IOWA

What happens in your ham shack when your equipment doesn't work? Where do you begin to find the trouble? When you cannot find it, how do you record the symptoms so your friendly repairman will not have to spend so much of his time, which is your money, just to find out what your equipment does or does not do?

Come to the March meeting and find out from Al McMillan who will tell us the experience of WRL repair department. So bring your questions!

EYEBALL QSOs – REFRESHMENTS

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HAM HUM is the official organ of the Ak-Sar-Ben Radio Club, Inc., of Omaha, Nebraska, mailed monthly to all members and to others upon request.

Next copy deadline: March 26th

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TVI – or, MEET THY NEIGHBOR

Submitted by Byron Jay,
K8WGJ, DARA TVI Chr.

I have warned many times, at the meeting, of placing the SWR bridge between the transmitter and the filter to the coaxial cable going to the antenna. The diodes are rich in harmonics and can radiate into the air.

Recently, I ran into another problem that caused me a little difficulty in finding. There was no RF radiating in the receiver thru the mixing tubes or the detector tubes, and I isolated the trouble in the home-brewed power supply of the receiver and transmitter. It was caused by the Power Diodes in the bridge rectifier circuit. The RF harmonic radiation was getting into the first stage of the audio amplifier and the connectors for the antenna. To cure it, a .01 microfarad, 600 volt capacitor was connected across the four diodes and a piece of metal from a tin can was cut to make a shield around the bridge.

Placing the power supply in its own metal shield box would have helped the situation and could have been the complete solution.

de RF Carrier –
Dayton, Ohio

****

NEWS NOTE

Nebraska Day was held in San Benito, Texas. 136 Nebraskans attended the festivities. W0KPA Clint Darnell and W0EWF Pete Piotrowski were also present.

Antennas are mostly whips or sm
inverted V's not more than 15 fee
high in the Rio Grande Valley.

73,
Pete, W0EWF

****

FEBRUARY MEETING

We had excellent attendance at our February 12th meeting and fine participation in "gadgetry." Our thanks to all who took part and to W0PHW and Northwestern Bell for the film "ESS—A Touch of Tomorrow" which was outstanding.

Photos taken at the meeting and comments follow:

President James Droege, W0YCP, opens the meeting. Other photos on this page are of new members.

William F. Boeckenhaupt, WB0BMB

Ernest A. Bowerman, W0CES

Malcolm E. Reed, Jr., WA0RPW

Don Henderson, WA0ZKW

(new member)
John L. Lutter, WA0TNC

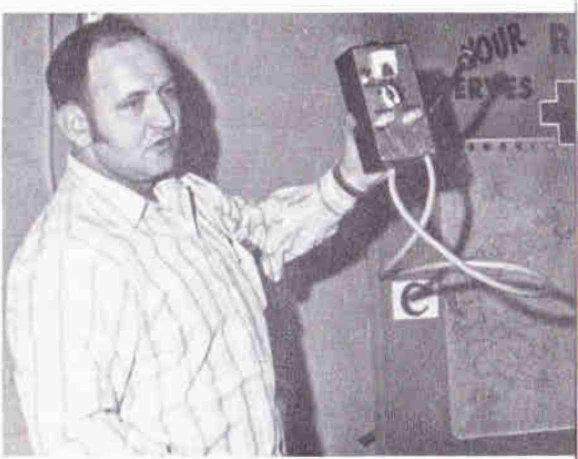
Cecil DeWitt, W0RMB, demonstrates control head.

John Snyder, W0WRT, shows a code practice oscillator.

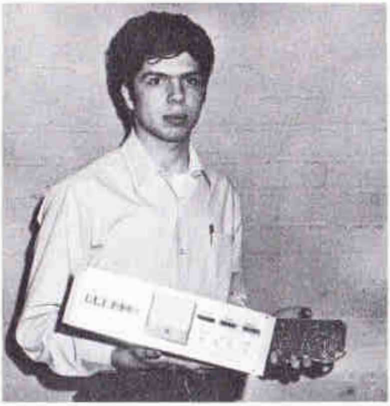
Bill Snyder, John's son, with a transistor radio that will get strong local stations like KOIL, but no Council Bluffs DX.

Crowd shot.

Charles Michel, K0QVL, with a computer lab kit from Pop. Electronics.

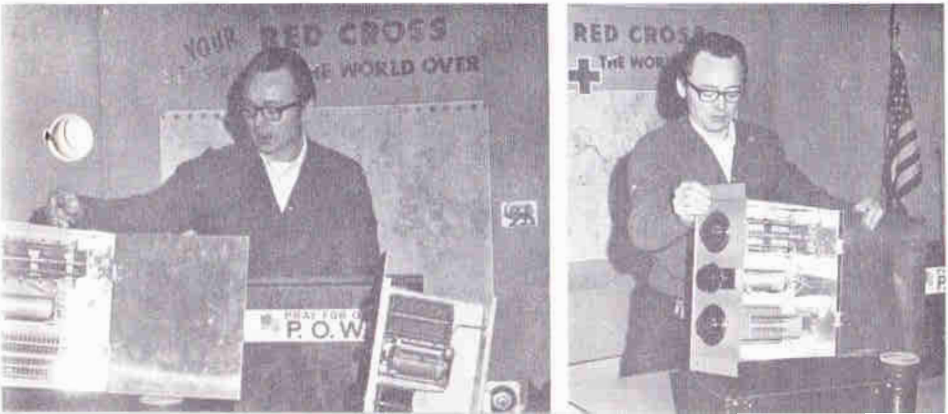


Ray Kydney, WA0WOT, with a Motorola 2-meter FM test set.



Neil Johnson with a RTTY terminal unit (guest of Club).

Bob Andrus, K0LUG, demonstrates two antenna tuners for high power HF applications.



SOLID STATUS – GRAND FINALE

By Dick Blasco, WA4DHU 2

This final article of the Solid Status [illegible]es is intended to take the information of the first 5 articles and "put it all together" in the form of a final example. Remember our description of amplification as control of a large current with a smaller one. Remember also our three assumptions, which are included in the Ohm's Law and Transistor Formula entries on the figure. In previous articles it was mentioned that parameter gm (transconductance) was not useful for biasing. It was also mentioned that biasing information (desired collector voltage and current) was obtained from other considerations.

All of these and other concepts are tied together by examining one AC amplifier scheme–the common emitter amplifier. The first thing to notice from the figure is that the circuit is the same as the vacuum tube equivalent, except for the extra biasing resistor R1. Design of the circuit is simplified due to gm being constant for transistors (it varies with tube type). Voltage gain of the transistor circuit is exactly the same as the tube equivalent: u (stage voltage gain) – gm x R, where R here is the parallel combination of the stage output impedance and the load impedance. Using the voltage divider relation of Ohm's Law for the input signal, overall [illegible]ge gain can be obtained by noting that the divider network is the source resistance and the stage input impedance.

Without boring you with the mathematics, applying the rules of circuit theory, and assuming that impedances are matched (stage output impedance equals load impedance, etc.), the simplified procedure in the figure is obtained.

Notice in the procedure that the stage is designed by STARTING AT THE OUTPUT AND WORKING BACKWARDS. This is a general procedure for design of cascaded stages. Load and desired stage gain are specified. The parameters hoe and hie can be obtained from transistor manuals. Rough values for these are .0001 for hoe and 2000 for hie. Beta is also available from the transistor manual. It is listed as hfe.

Following the procedure step-by-step as indicated will yield a design. The biasing procedure is also shown on the figure for your convenience. You start out obtaining Rc and Ic. Then you do the biasing to get the other resistors. You then compute input and output impedances for the stage. The coupling and emitter bypass capacitors are sized to give good gain down to f(low), which is a lower cutoff frequency. Using Rin as the load impedance, you duplicate the procedure for the source stage until you have designed all the stages. This procedure is quite similar to that used for tubes.

You must check your design by noting if Vc is smaller than Ve + 1.4 V(load) RMS. Vload is usually specified. If so, the check fails, and you must *reduce* stage gain and try again.

The formula for Rc in the DC case is repeated in the figure for reference. It is useful when designing flip-flops and similar digital circuits.

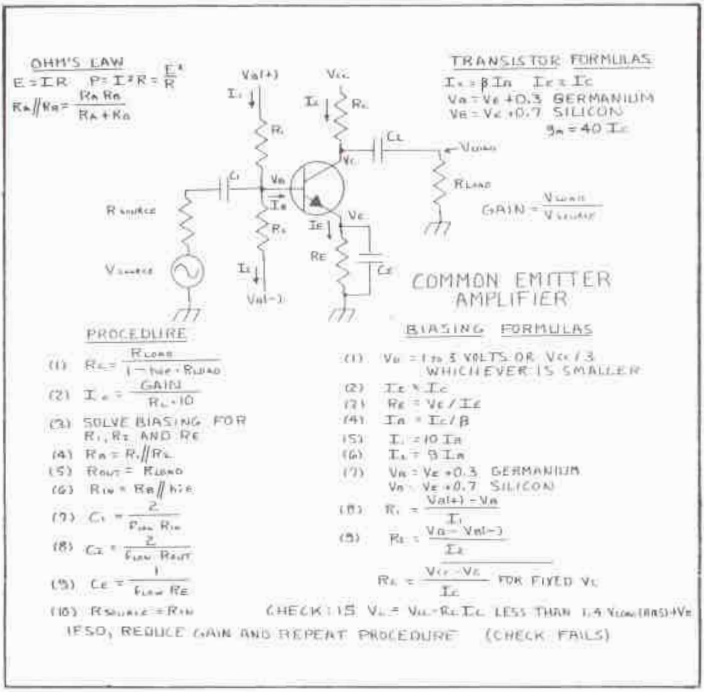
It is highly recommended that you

make up values for transistor parameters, and desired load impedance, voltage, and stage gain, and work out your own example following the procedure shown. You might even want to build it and see if it works! This should make all of the information fit together for you.

This concludes the series. Please notice that many simplifications have been made, and much circuit theory bypassed in order to keep the series simple. Further theory and information can be obtained in a good transistor manual or even the ARRL Handbook. You should find these sources much more readable, now that you have achieved "solid status"!

73 and good luck.

de Florida Skip



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AUCTION REMINDER

Don't forget that our annual auction will be held at the April meeting. Get your excess gear ready! Details in next issue.

****

Two motorists met on a bridge too narrow for two cars to pass. "I never back up for an Idiot," shouted one driver.

"That's all right," said the other one. "I always do!"

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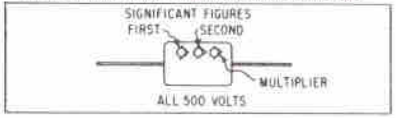
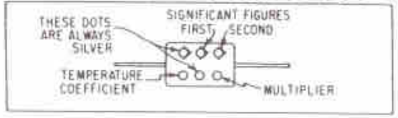
RESISTOR AND CAPACITOR COLOR CODE

CAPACITOR COLOR CODES

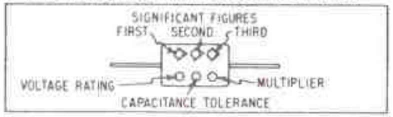
EIA 3-DOT COLOR CODE FOR MICA DIELECTRIC CAPACITORS



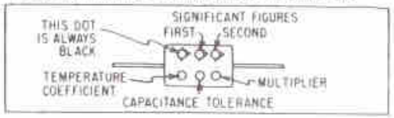
MIL 6-DOT COLOR CODE FOR PAPER DIELECTRIC CAPACITORS



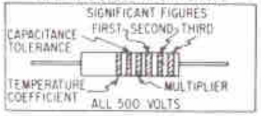
EIA 6-DOT COLOR CODE FOR MICA DIELECTRIC CAPACITORS



MIL 6-DOT COLOR CODE FOR MICA DIELECTRIC CAPACITORS



EIA COLOR CODE FOR TUBULAR CERAMIC DIELECTRIC CAPACITORS



MIL COLOR CODE FOR FIXED CERAMIC DIELECTRIC CAPACITORS


RADIAL TYPE NON-INSULATED

AXIAL TYPE INSULATED

MIL MILITARY STANDARD

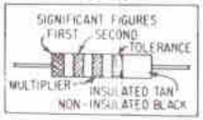
EIA ELECTRONIC INDUSTRIES

RESISTORS				CAPACITORS				
				MULTIPLIER				
TOLERANCE	MULTIPLIER	SIGNIFICANT FIGURE	COLOR	EIA MICA AND CERAMIC DIELECTRIC	MIA MICA AND PAPER DIELECTRIC	MIA CERAMIC DIELECTRIC	VOLTAGE RATING	TEMP COEFFICIENT
	1	0	BLACK	1	1	1		A
	10	1	BROWN	10	10	10	100	B
	100	2	RED	100	100	100	200	C
	1000	3	ORANGE	1000	1000	1000	300	D
	10,000	4	YELLOW	10,000			400	E
	100,000	5	GREEN	100,000			500	F
	1,000,000	6	BLUE	1,000,000			600	G
	10,000,000	7	VIOLET	10,000,000			700	
	100,000,000	8	GRAY	100,000,000		0.01	800	
	1,000,000,000	9	WHITE	1,000,000,000		0.1	900	
5	0.1		GOLD	0.1	0.1		1000	
10	0.01		SILVER	0.01	0.01		2000	
20			NO COLOR				500	

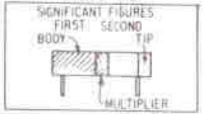
RESISTOR COLOR CODES

COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE

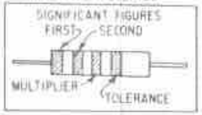


RADIAL TYPE

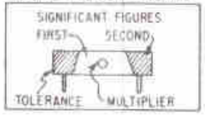


MIL COLOR CODE FOR FIXED COMPOSITION RESISTORS

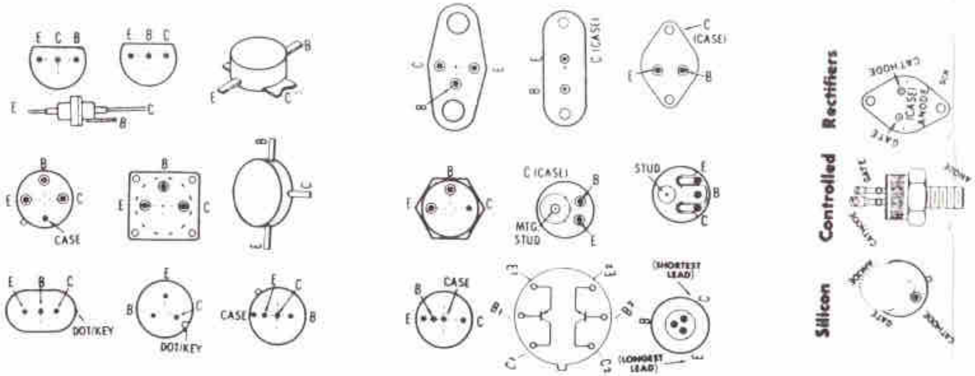
AXIAL TYPE INSULATED



RADIAL TYPE NON-INSULATED



TRANSISTOR WITH CONTROLLED SWITCH OUTLINE DRAWINGS



SERIES RESISTORS

$$R = R_1 + R_2 + R_3 + R_n$$

TWO RESISTORS IN PARALLEL

$$R = \frac{R_1 \cdot R_2}{R_1 + R_2}$$

MORE THAN TWO RESISTORS IN PARALLEL

$$R = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_n}}$$

PARALLEL CAPACITORS

$$C\ (\text{Total}) = C_1 + C_2 + C_3 + C_n$$

TWO CAPACITORS IN SERIES

$$C = \frac{C_1 \cdot C_2}{C_1 + C_2}$$

MORE THAN TWO CAPACITORS IN SERIES

$$C = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \frac{1}{C_n}}$$

TIME CONSTANT

$$T = CR \qquad T = \frac{L}{R}$$

T = TIME IN SECONDS

C = CAPACITANCE IN FARADS

R = RESISTANCE IN OHMS

L = INDUCTANCE IN HENRYS

CAPACITIVE REACTANCE

$X_C = \frac{1}{2\pi FC}$ OR LET $\frac{1}{2\pi} = .159$ AND $X_C = \frac{.159}{FC}$

INDUCTIVE REACTANCE

$X_L = 2\pi FL$

RESONANT FREQUENCY

FREQ. = $\frac{1}{2\pi\sqrt{LC}}$ OR $\frac{.159}{\sqrt{LC}}$

F = frequency in hz

C = capacity in farads

L = inductance in henrys

SPEED OF LIGHT

186,000 MILES PER SECOND

300,000,000 METERS PER SECOND

SERIES INDUCTORS

$L = L_1 + L_2 + L_3 + L_n$

TWO INDUCTORS IN PARALLEL

$L = \frac{L_1 \cdot L_2}{L_1 + L_2}$

MORE THAN TWO INDUCTORS IN PARALLEL

$L = \frac{1}{\frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \frac{1}{L_n}}$

IMPEDANCE MATCHING

$N = \sqrt{\frac{Z_p}{Z_s}}$

N = TURNS RATIO, PRIMARY TO SECONDARY

Z_p = PRIMARY IMPEDANCE

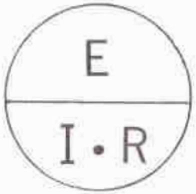
Z_s = SECONDARY IMPEDANCE

ANTENNA LENGTH

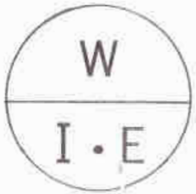
$L'' = \frac{5540}{F_{Mhz}}$ = 1/2 WAVE IN INCHES

$L' = \frac{468}{F_{Mhz}}$ = 1/2 WAVE IN FEET

OHM'S LAW



POWER LAW



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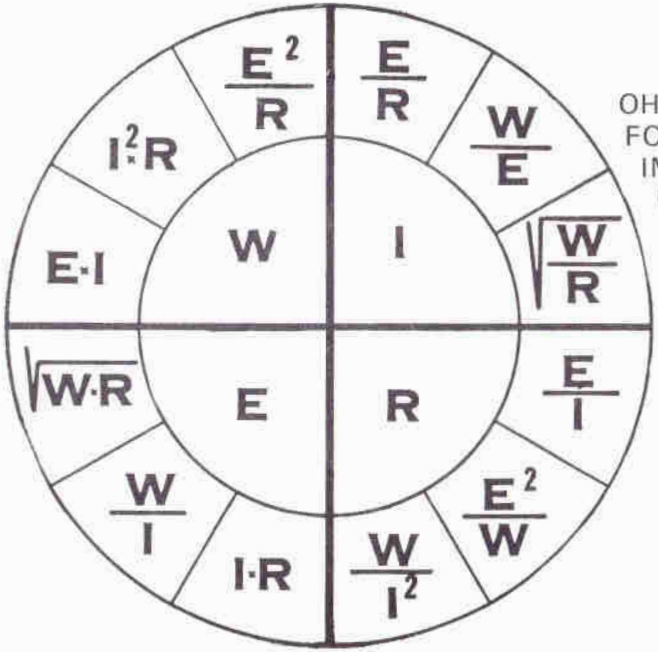
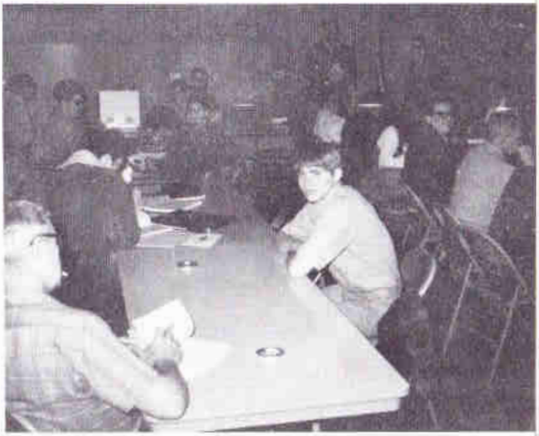
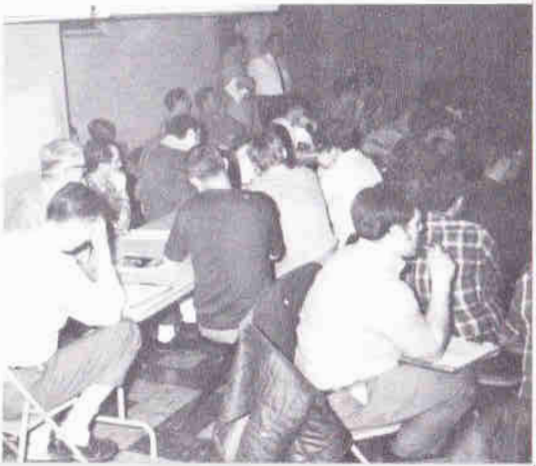


OHM'S LAW FOR IMPEDANCE USE Z TO REPLACE R

REPORT ON CODE AND THEORY CLASSES

By Bob Lockwood, WA0DHU





Even though we have had two cancellations due to snowstorms, the Code and Theory Classes of the Ak-Sar-Ben Radio Club, Inc. are proceeding very well. Total enrollment is around 60 students, with about half going for their novice privilege. It is obvious that many have the incentive to work hard for more knowledge in electronics and for the purpose of upgrading.

A good example of a typical theory class was the meeting of February 15th. The subject was "Power Supplies." Cecil DeWitt, W0RMB, and Bill Terwilliger, WA0FPB, led the group with a well organized lecture on the many items of subject matter which should be covered. Bob Serlet, WA0ZPW, came up with an excellent demonstration on half wave, full wave, and bridge rectifier systems coupled with capacitor and choke input filter systems. A scope was used in conjunction with the demonstration d the demo incorporated both tube and solid state rectifiers. A real good lecture along with a good demonstration is unbeatable in providing a class with a better understanding of the subject matter.

The novice code class ramrodded by Bob Lockwood, WA0DHU, with the help of WA0FPB Bill, WB0BMV Mike, WA0WRI Joe, and W0RMB Cecil, is doing great with only two characters to learn – X and Z. It is hoped the entire class of 30 will pass the novice test.

The advanced class ramrodded by WA0WRI Ray, with the help of WA0ZPW Bob, is already proceeding at around 13 w.p.m. with a class of guys who are really putting forth great effort to be ready for the big test in April. It is a sure bet that the entire class stands a good chance of achieving its goals.

Yes, we have a swell group of people attending the classes and a staff of instructors working hard to increase the chances of the classes in achieving their goals.

Another report on progress of the Code and Theory classes will appear in the April issue of HAM HUM.

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FOR SALE

HEATH TWOER with microphone	$25.00
EICO Grid dip meter	20.00
MOSLEY TA31jr antenna with HY-GAIN balun and 35-foot mast	35.00
Two meter FR rig	100.00

Mel, WA5TYY
TSgt. Melvin D. Amick
83 Bonner Rd. (Wherry Hsg.)
Offutt AFB, Nebraska 68113
Phone: 291-8942

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ANYONE INTERESTED?

I wonder if there is an interested VHFer in the area who would like to have all of the copies of the PRP News (stands for Propagation Research Pro ect). These were published during 195 and possibly have some material of historic interest to anyone engaged in serious VHF DX work.

Contact John Snyder, W0WRT.
Home Phone: 556-1538.

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Two can live as cheaply as one, but nowadays it takes both to earn enough to do it. – Service

****

CAPSULE COURSE IN HUMAN RELATIONS

Five most important words: "I am proud of you."

Four most important words: "What is your opinion?"

Three most important words: "If you please."

Two most important words: "Thank you."

Least important word: "I."

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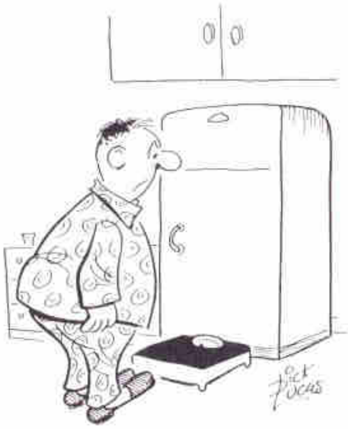


CONCLUSION OF SERIES OF ARTICLES BY
DON GRIFFIN, W0EWO, NORTH PLATTE, NEBRASKA.

GROUP AND PHASE VELOCITY

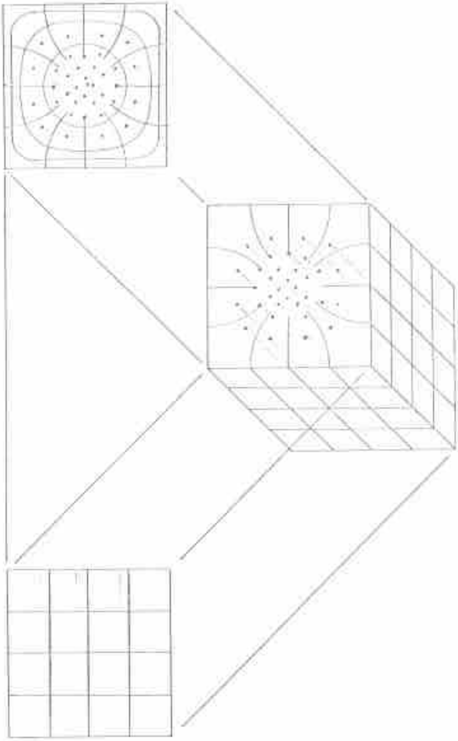
The velocity of propagation inside the guide is somewhat slower than the velocity in free space, due to the zig-zag path that the wave takes when traveling down the guide; free space velocity would be impossible. This velocity of propagation is known as the group velocity, as it is the speed which the groups of electric and magnetic lines travel down the guide. The group velocity of a TEO,1 wave is:

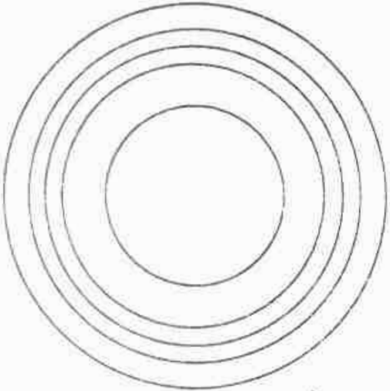
$$v_g = c\sqrt{1-\left(\frac{\lambda e}{2b}\right)^2}$$

The apparent velocity due to the longer wavelength inside the guide is known as the phase velocity. This velocity is useful only in determining the phase shift per unit length of guide the wave encounters when traveling down the guide. Phase velocity for a TEO,1 wave is:

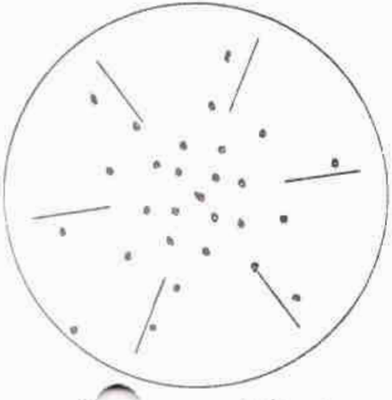
$$v_\phi = \frac{c}{\sqrt{1-\left(\frac{\lambda e}{2b}\right)^2}}$$

Looking at the two formulae as the group velocity approaches zero, the phase velocity approaches infinity.





Between decks



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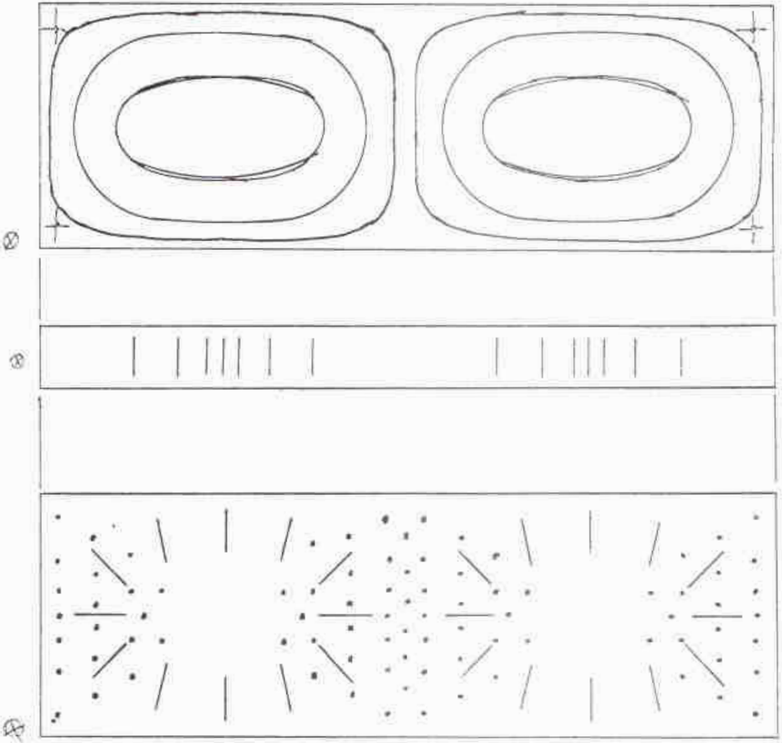

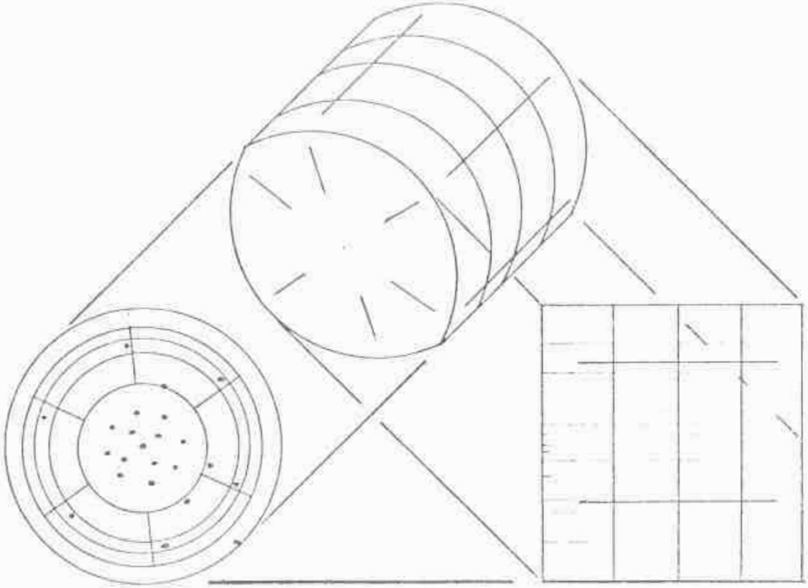

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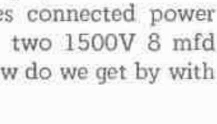
HERESY DEPARTMENT

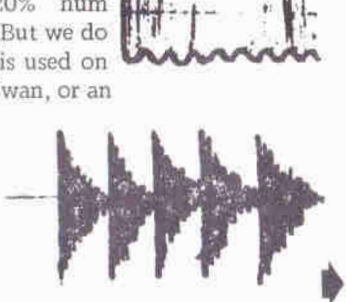
by W5EYB

This section is not for the purists, those who measure 3d order distortion products in tenths of a db, or the affluent. This is for the hundreds of us who need a linear amplifier with reasonably good SSB voice characteristics, but who cannot afford 20 to 100 mfd filter in a 3000V power supply. For example, let's consider a supply using 2600V, obtained from a pair of surplus, series connected power transformers in a voltage doubling circuit, which uses only two 1500V 8 mfd capacitors in series, no choke, effective capacitance *4 mfd!* How do we get by with it?

If you remember your AM theory, inadequate filter causes hum, and on the scope our power supply wave form would look like this, indicating approximately 15-20% hum modulation, an intolerable condition on AM or CW. But we do not operate AM or CW with this power supply. It is used on SSB. Who needs a linear amplifier with a TR-4, a Swan, or an SB-101, on CW?



As we know, a properly adjusted SSB signal, with the well-known HELLLLLLOOOOO fed into the mike looks like the diagram to the right. Notice that only one line reaches peak output, and the duration of this 'pulse' is extremely short, only a small fraction of a second.



The remainder of the voice syllable is progressively downward. Too far down to be affected by the 20% or so of 120 cycle hum modulation. For this reason, any hum of this magnitude that would be present under sustained key down conditions (even CW), is not transmitted to the antenna when using SSB, unless the linear amplifier is over-driven. So, if you can afford a good filter, by all means use it. Otherwise, borrow a scope and see for yourself.

de W5KR, Brownsville, Tex

****

SINGLE SIDEBAND

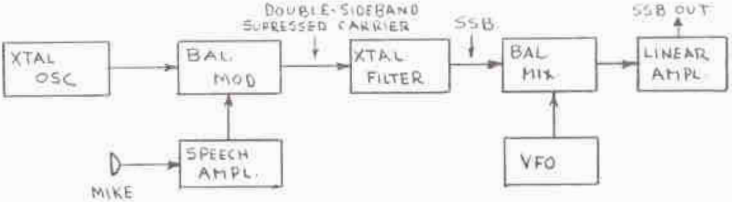
By Bob Spain, WB2RVE

As hams most of us have worked a SSB station at one time or another. But how many really know how SSB is generated?

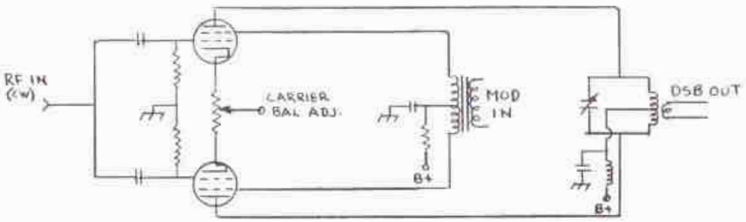
Let's start with the basics. A full carrier AM signal is composed of a carrier, with modulation sidebands above and below the carrier frequency. The carrier serves no useful purpose in transmission, and may be removed by suitable means. We now have a double-sideband, suppressed carrier signal.

Since we only need one modulation sideband to establish communication, we may filter out the unwanted sideband, thus conserving frequency spectrum and power. We now are the proud owners of a single-sideband, suppressed carrier signal. In actual practice, the modulation would be applied and the *carrier suppressed in the same step or stage.*

The approach described above is known as the filter method of producing SSB. A block diagram of a filter SSB exciter is shown below.

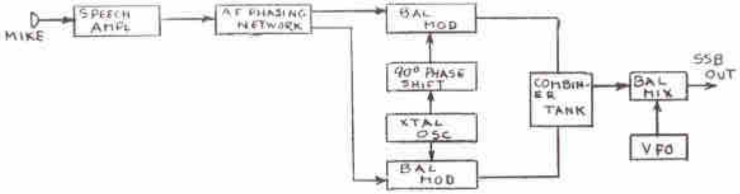


The balanced modulator is simply a mixer/amplifier, which appears as a push-pull circuit to the incoming audio, and a push-push circuit to the incoming RF. A simplified version of a balanced modulator is shown below.

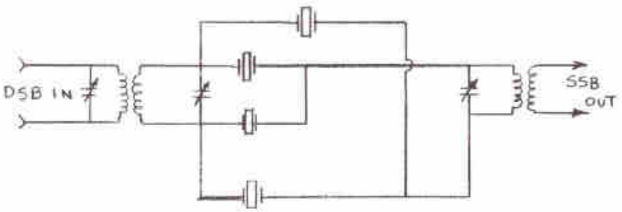


SCREEN–GRID BALANCED MODULATOR

Single-sideband signals may also be generated by the phasing method. Of the two techniques, the filter method is used most often. Shown below is a block diagram of a phasing SSB exciter. The two audio signals coming out of the AF PHASING NETWORK are 90 degrees out of phase with each other.



The types of unwanted sideband filters used in filter-type SSB exciters are many and varied. If the frequency being used is very low, (in the neighborhood of 100 kc.) a mechanical filter may be used. As we progress higher in the frequency, mechanical filters become impractical due to design and manufacturing problems, and are replaced by crystal filters. Since a single quartz crystal would have a very high Q and thus a narrow bandpass, a lattice network must be used. A simple single full crystal lattice filter is shown below.



Note— Series and shunt XTAL. Filters tuned 1.5 – 2.5 kc apart.

de Crosstalk

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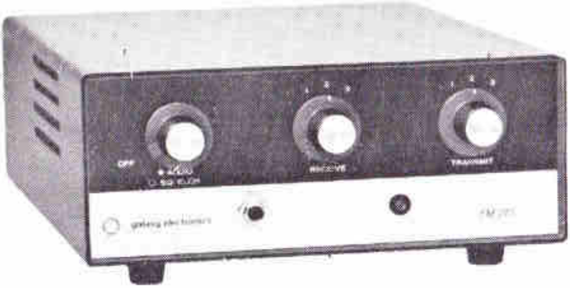

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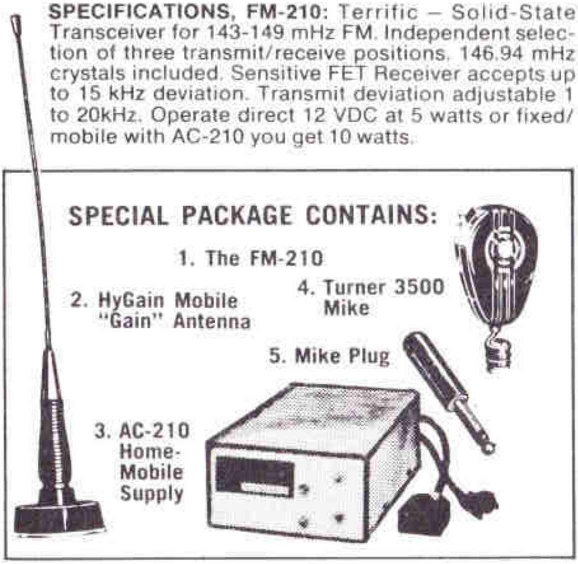

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