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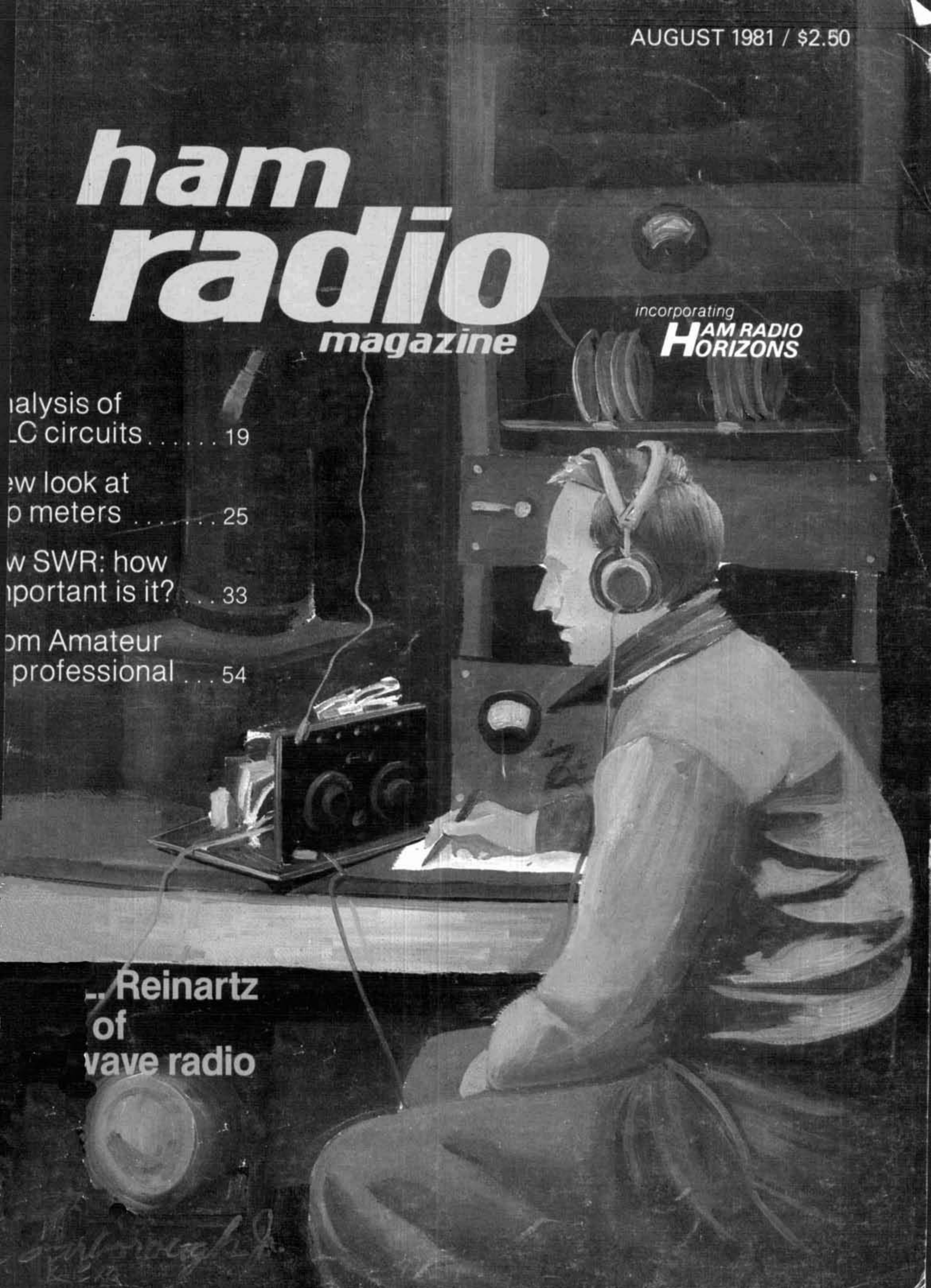
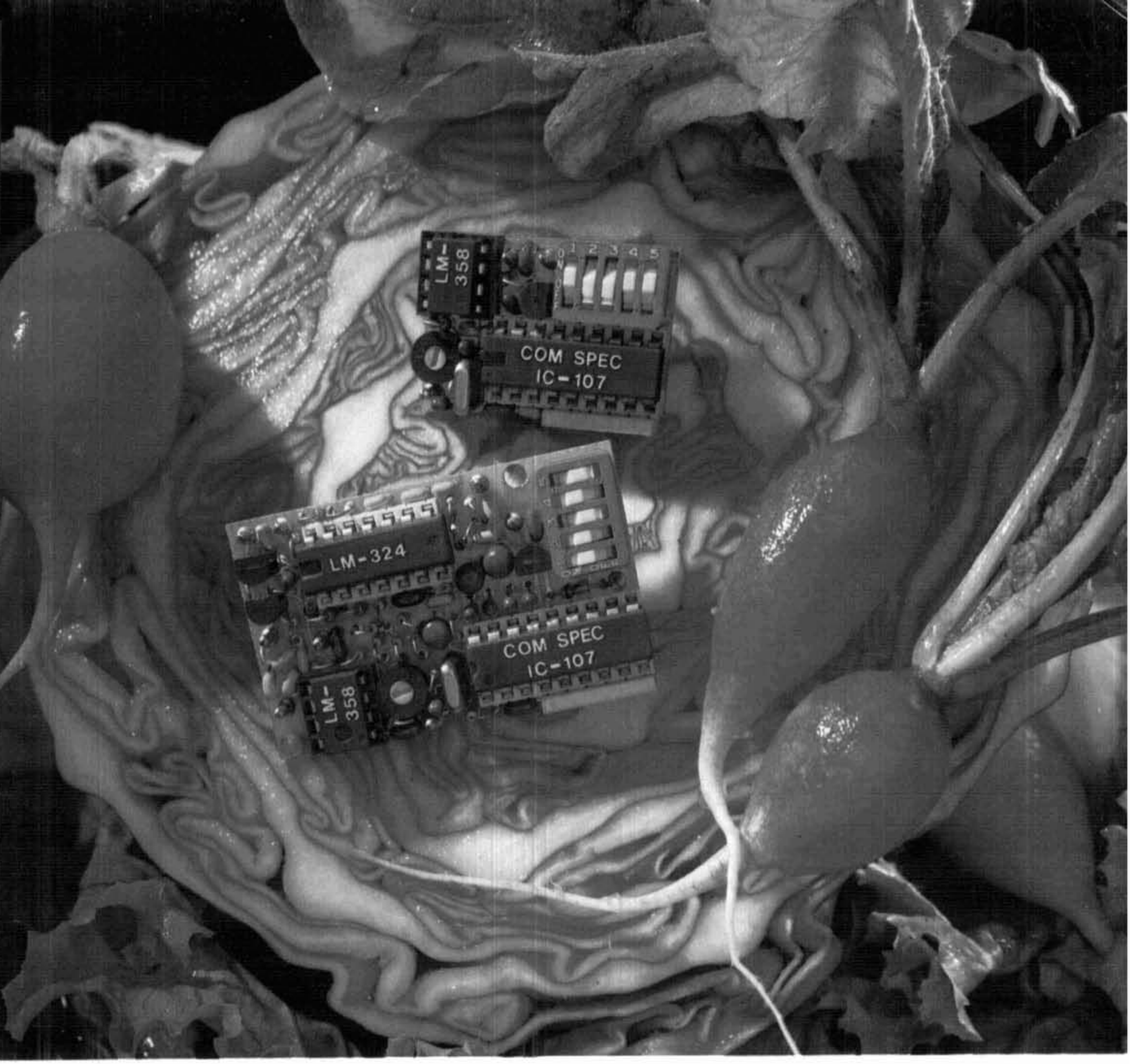


.. Reinartz
of
vave radio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MFJ Super Keyboards

5 MODES: *CW, Baudot, ASCII, memory keyer, Morse code practice.* TWO MODELS: *MFJ-496, $339.95.* *256 character buffer, 256 character message memory, automatic messages, serial numbering, repeat/delay.* ***MFJ-494, $279.95.*** *50 character buffer, 30 character memory, automatic messages.*

MFJ brings you a pair of 5 Mode Super Keyboards that gives you more features per dollar than any other keyboard available. You can send CW, Baudot, ASCII. Use it as a memory keyer and for MORSE code practice.

You get text buffer, programmable and automatic message memories, error deletion, buffer preload, buffer hold, plus much more.

MODE 1: CW

The 256 character (50 for 494) **text buffer** makes sending perfect CW effortless even if you "hunt and peck."

You can preload a message into the buffer and transmit when ready. For break-in, you can stop the buffer, send comments on key paddles and then resume sending the buffer content.

Delete errors by backspacing.

A meter gives buffer remaining or speed. Two characters before buffer full the meter lights up red and the sidetone changes pitch.

Four programmable message memories (2 for 494) give a total of 256 characters (30 for 494). Each message starts after one ends for no wasted memory. Delete errors by backspacing.

To use the **automatic messages,** type your call into message A. Then by pressing the CQ button you send CQ CQ DE (message A).

The other automatic messages work the same way: CQ TEST DE, DE, QRZ.

Special keys for KN, SK, BT, AS, AA and AR.

A lot of thought has gone into human engineering these MFJ Super Keyboards.

For example, you press only a one or two key sequence to execute any command.

All controls and keys are positioned logically and labeled clearly for instant recognition.

Pots are used for speed, volume, tone, and weight because they are more human oriented than keystroke sequences and they remember your settings when power is off.

Weight control makes your signal distinctive to penetrate QRM.

MODE 2 & 3 (RTTY): BAUDOT & ASCII

5 level Baudot is transmitted at 60 WPM. Both RTTY and CW ID are provided.

Carriage return, line feed, and "LTRS" are sent automatically on the first space after 63 characters on a line. This gives unbroken words at the receiving end and frees you from sending the carriage return. After 70 characters the function is initiated without a space.

All up and down shift is done automatically. A downshift occurs on every space to quickly clear garbled reception.

The buffer, programmable and automatic messages, backspace delete and PTT control (keys your rig) are included.

The ASCII mode includes all the features of Baudot. Transmission speed is 110 baud. Both upper and lower case are generated.

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Plug in a paddle to use it as a deluxe full feature memory keyer with automatic and programmable memories, iambic operation, dot-dash memories, and all the features of the CW mode.

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There are two Morse code practice modes. Mode 1: random length groups of random characters. Mode 2: pseudo random 5 character groups in 8 separate repeatable lists (with answers).

Insert space between characters and groups to form high speed characters at slower speed for easy character recognition.

Select alphabetic or alphanumeric plus punctuation. You can even pause and then resume.

MORE FEATURES

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Two key lockout operation prevents lost characters during typing speed bursts.

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MFJ-494 is like MFJ-496 less sequencial numbering, repeat/delay functions. Has 50 character buffer, 30 character message memory. Clock option not available for MFJ-494.

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AUGUST 1981

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contents

Observation & Opinion

Automatic Load Control (ALC) was discussed briefly in last month's "Questions and Answers" column. Judging from some of the illegal SSB signals on the air, it seems that ALC is still a mystery to some and should be explored a little more thoroughly. Our guest editorial is by the author of just such an article, which appears in this issue. I'd like to introduce John Weber, K4JW.

Alf Wilson, W6NIF, Editor

To me, it's becoming more and more apparent that some of our phone bands are becoming impossible to enjoy, especially on weekends, because of heavy QRM. Being a "professional loafer," I can enjoy most of my phone operation during the week, usually keeping schedules with old friends around the country.

We have to keep some of these schedules in the General portion of 20 meters because some of our group are restricted to this portion of the band (not to say that the rest of the band is much different!), and many times we are forced to use our linears to plow through the adjacent QRM; thus we too add to the overall QRM level. Although ours is a technical hobby, it gives old friends a chance to meet and talk — no earth-shattering technical or philosophical discussions, just friendly get-togethers. But, when somebody "buckshots" from 4 to 7 kHz away, the enjoyment rapidly disappears.

Just think what a mess we would have if this were still a-m instead of SSB! While NBVM (which hasn't caught on) might help, and future spread-spectrum techniques will allow us to hop, skip, and jump all over the band with minimum QRM, I am afraid we must still deal with the situation as it is today.

One of our problems has been receiver design: old receivers cannot survive alongside present-day linears and high-gain directive antennas, with IMD being the problem usually impeding copy. Fortunately, manufacturers have made considerable improvements to contemporary receivers; with passband shifters, variable passband, and high-performance filters, it is possible to copy signals that would have been impossible to read on older receivers. I hope we all enhance the ability of our receivers to reject or minimize adjacent QRM by using the rf attenuator and backing off on the rf gain when conditions warrant.

Even so, when an Amateur runs his rig "wide-open," fails to monitor his signal output, and shouts into the mike, it gets pretty rough to tweak him out. For some reason, otherwise clean signals get very broad when the operator is running phone patches, suggesting somebody is not paying attention to modulation levels. Of course, these are operator-control problems. One problem it's possible to have and not be aware of is an incompatibility of ALC characteristics between the exciter and linear amplifier. This can occur because the exciter and linear were made by different manufacturers, or because they are of different generations: the 15-year-old linear and the 1981 transceiver. And, of course, maybe the ALC line isn't even connected — that's really an operator-control problem.

I have been using a term not well understood by some Amateurs — ALC. Somebody said it is not even mentioned any more in the *ARRL Handbook*. I think if you look under "Speech Processing" in the chapter on SSB you will find it; it did disappear from the index for some reason. ALC is a form of speech processing.

Now, if you would like to know more about ALC, I suggest you read the article entitled, "An Analysis of ALC Circuits" in this issue. With luck, it will help reduce splatter on the bands, and perhaps it will prod manufacturers into paying more attention to the design problem and into providing us with meaningful numbers so at least we know whether or not a "compatibility" problem exists.

John P. Weber, Jr., K4JW

comments

intruder watch

Dear HR:

In regard to W5SAD's letter on Amateur band intruders (October, 1980), W5SAD and others may find, as I have, that the following message sent in CW on the frequency that Russian intruders are using will often get them to shift out of the band:

*UI*TA *OE*ASTOTA *OE*ASTX
MEVDUNARODNOJ
L*IM*BITELXSKOJ POLOSY
*OE*ASTOT POVALUJSTA QSY
TOT*OE*ASVE

The italicized OE's, UI, and IM are run together to form the additional Cyrillic alphabet characters.

This message when taken down in Cyrillic script reads, "This frequency is part of the International Amateur band — please QSY immediately."

Whether or not you sign the message with your callsign will depend on your local rules. Here in ZL, Amateurs are not permitted to communicate with non-Amateur stations. This legal problem has been overcome by the issue of a special call of ZL6IW. I use this callsign to ask intruders to shift and this works in many cases, although it is sometimes necessary to keep on asking for long periods before they "get the message."

A fact that most Amateurs choose to ignore, whilst still bemoaning the presence of intruders, is that most of the intruders into our exclusive bands are there only because we allow them to be. Given the numbers and geographic spread of Amateur stations around the world, it is within our power to deny an intruder the use of any of our frequencies. Do not move aside for intruders when they come onto your frequency; you are the legitimate user of the Amateur band, not them. Protest the intrusion and continue to protest it in any way you can. Number 115 of the I.T.U. Regulations reads: "Administrations . . . shall not assign to a station any frequency in derogation of . . . the Table of Frequency Allocations given in this chapter . . . except on the express condition that harmful interference shall not be caused to services carried on by stations operating in accordance with the provisions . . . of these regulations." It follows that, unless an intrusion is protested, the intruders' administration has the right to assume that its stations are not causing harmful interference.

In addition to any protest you may make, your intruder watch should be advised of the date, time, frequency, and nature of the intrusion, along with any relevant information you may have, such as I.D., bearing, and so forth. It is my opinion that Amateurs generally have allowed the present chaotic situation regarding intruders to develop by "leaving it to the other guy" to do something about it while they chased off "up the band" looking for a clear frequency. Unless and until Amateurs as a whole are prepared to act, either through their intruder watch or personally, the situation will not improve.

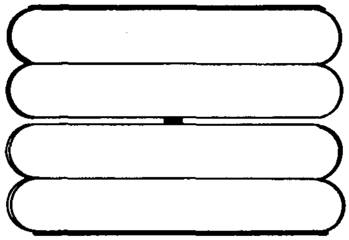
R.E. Knowles, ZL6IW/ZL1BAD
N.Z.A.R.T.
Intruder Watch Coordinator
Papakura, New Zealand

instant balun

Dear HR:

Here is some pleasant news, an addition to the fourth in the series of fine articles by W6GGV on transmission-line circuit design (March, 1981, *ham radio*). Last year I went through Wheeler's 1978 MTT paper (reference 1 in W6GGV's article) of constructing a 4:1 balun for the K2RIW 432 antenna. The results were pleasant indeed.

We have all seen Paul Shuch, N6TX, exploit the fact that a 0.1-inch stripline on the standard G-10 glass epoxy board with groundplane has a characteristic impedance of 50 ohms. What Wheeler's equations show is that a 0.1-inch stripline centered between two parallel plates, constructed of our G-10 boards, is also 50 ohms! (See sketch.) You'll need four one-sided boards. Etch a 0.1-inch-stripline on one using the standard tape. Etch a second board free of copper, then epoxy all four boards together. Instant balun.



A sandwich of four G-10 glass epoxy boards make an instant 50-ohm balun.

C.R. MacCluer, W8MQW
East Lansing, Michigan

ten-second call swaps

Dear HR:

As a newcomer to DX, I find myself dismayed when, after exchanging callsigns with a DX station, the other operator rushes off to make another contact. While I realize that he is trying to give other operators in the window a chance to make contact, I feel that these ten-second QSOs should be limited to Field Day and similar contests. It is my opinion that, in order to qualify for a DX award, the operator should acquire some minimum information regarding power, antenna, or even atmospheric conditions. This would add possibly another ten seconds to each QSO, which I don't think would be excessive or prohibitive.

Part 95 states that one of the fundamental purposes for the Amateur Radio Service is to advance radio technology. A call-swap QSO does not help to accurately evaluate a new antenna or an experimental matching network. Armed with the information I suggest to be exchanged, some reasonable judgments can be made and conclusions drawn concerning a stations performance.

I am aware that the system I propose is not perfect, and some modifications would have to be made but I can see nothing constructive or creative coming from the current DX practices, and I think that it is time for a change.

Bill Marinara, WB1FJE
Hamden, Connecticut

MORE KEYER FEATURES FOR LESS COST

AEA Invites You to Compare the AEA Keyer Features to Other Popular Keyers on the Market.

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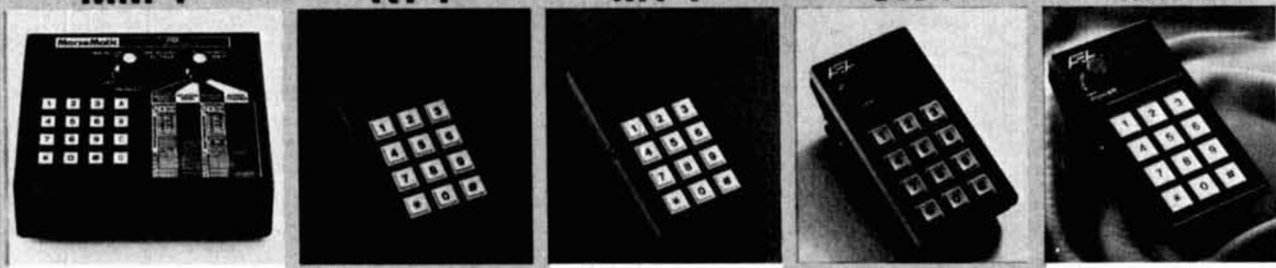

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Speed Range (WPM)	2-99	1-99	1-99	1-99	2-99	8-50	5-50+	?	8-50
Memory Capacity (Total Characters)	500			500		400	100/400	400	
Message Partitioning	Soft			Soft		Hard	Hard	Hard	
Automatic Contest Serial Number	Yes			Yes		No	No	No	
Selectable Dot and Dash Memory	Yes	Yes		Yes	Yes	No	No	No	No
Independent Dot & Dash (Full) Weighting	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Calibrated Speed, 1 WPM Resolution	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No
Calibrated Beacon Mode	Yes			No		No	No	No	
Repeat Message Mode	Yes			No		Yes	Yes	Yes	
Front Panel Variable Monitor Frequency	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Message Resume After Paddle Interrupt	Yes			Yes		No	No	Yes	
Semi-Automatic (Bug) Mode	Yes	Yes		Yes	Yes	No	No	No	No
Real-Time Memory Loading Mode	Yes			Yes		Yes	Yes	No	
Automatic Word Space Memory Load	Yes			Yes		No	No	Yes	
Instant Start From Memory	Yes			Yes		No	No	Yes	
Message Editing	Yes			Yes		No	No	No	
Automatic Stepped Variable Speed	No	No	No	Yes	No	No	No	No	No
2 Presettable Speeds, Instant Recall	No	No	No	Yes	No	No	No	No	No
Automatic Trainer Speed Increase	Yes	Yes	Yes						No
Five Letter or Random Word Length	Yes	Yes	Yes						No
Test Mode With Answers	Yes	Yes	Yes						No
Random Practice Mode	Yes	Yes	Yes						Yes
Standard Letters, Numbers, Punctuation	Yes	Yes	Yes						Yes
All Morse Characters	Yes	Yes	Yes						No
Advertised Price	$199.95	$129.95	$99.95	$129.95	$79.95	$139.95	$ 99.50/ $139.50	$229.00	$129.95

OPTIONS:

- **MT-1P** (portable version of MT-1) with batteries, charger, earphone — $139.95
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More Details? CHECK—OFF Page 94

presstop

ALL 1.8-1.9 MHZ POWER LIMITS WERE LIFTED on June 10, when the Commission also reduced restrictions on the top half of the 160-meter band. The remaining restrictions, listed here by state, are:

States	1900-1925 & 1975-2000 MHz	1925-1975 MHz
ME, MA, NH, RI	100W day/25W night	no operation
CT, DE, MD, NJ, NY, PA, VT	200W day/50W night	no operation
KY, NC, OH, SC, TN, VA, WV	500W day/100W night	no operation
FL, GA, IL, IN, MI, WI	500W day/100W night	100W day/25W night
AL, AR, IA, MN, MS, MO	1000W day/200W night	200W day/50W night
All remaining states	1000W day/200W night, entire 1900-2000 kHz	

The FCC Also Warned, in its announcement of the relaxation, that new limits could be imposed at the end of 1982 at which time the WARC agreements go into effect. However, 1.8-1.9 should not be affected.

ARRL Deserves A Big Vote of thanks from all Amateurs for its leadership of the effort to restore 160 meter privileges.

PROHIBITIONS AGAINST 420-430 MHZ USE by U.S. Amateurs near the Canadian border, a change in 220-225 MHz status, and a new 902-928 MHz band are all included in the FCC's just-out General Docket 80-739. In this "Second Notice of Inquiry in the Matter of Implementation of the Final Acts of the World Administrative Radio Conference," the Commission reviews the spectrum from 28 through 1215 MHz with no changes proposed for 10, 6, or 2 meters.

However, 220-225 Is To Go from its present Radiolocation-Primary, Amateur Radio-Secondary status to one with Amateur, Fixed, and Mobile all sharing primary status. In accordance with the WARC Region 2 allocation, this would leave the door open for later FCC allocation of part of the band to one of the other services.

Operation Between 420 And 430 MHz would be forbidden to Amateurs located in a strip of the northern U.S. stretching from the Atlantic to the Pacific, to prevent interference with Canadian commercial users of that segment formally assigned worldwide for the Fixed and Mobile services at WARC. Among the Amateurs affected are those in or near such major cities as Seattle, Detroit, Toledo, Cleveland, Buffalo, and Bangor. A precise description of the area affected appears in Part 1.955 of the Commission's rules.

A New Band At 902-928 MHz is the good news, with Amateur Radio a secondary allocation to Radiolocation. The only part of the country that won't have use of this new band is in Colorado, in an area that unfortunately includes Denver.

Reply Comments on this Notice of Inquiry are due at the FCC by July 30.

ROBERT W. STANKUS (KESWICK SALES) WAS INDICTED on 22 counts of using the U.S. mails to defraud by a Federal grand jury in Roanoke, Virginia, June 10. He'd advertised new Kenwood TS-520SEs in the Ham Trader for $369.95 last fall, and though he'd even delivered a couple (purchased from legitimate dealers at near list prices), more than 50 Amateurs had eventually filed complaints with the Postal Service over his failure to deliver rigs as promised.

Eleven Of The Complaining Amateurs were selected for the indictments, with two indictments returned for each complainant. Stankus, N1AAR, was to have been arraigned July 1 and will probably go to trial this fall. If convicted, he faces a maximum fine of $1000 and five years in prison on each of the 22 counts.

PROPOSED PLAIN-LANGUAGE AMATEUR RULES, PR Docket 80-729, has received a last-minute two-month extension on the due date for Comments. Acting on a request from the ARRL, the Commissioners agreed June 15 on an August 22 due date for Comments, with Reply Comments due on or before October 21.

OSCAR 7 IS PROBABLY DEAD FOR GOOD, following a sudden failure June 12. Thermal stress induced by the solar eclipse it began experiencing on each orbit after May 22 may have triggered the failure. The current theory is that the battery pack (which had been open since a cell failed in 1978) has shorted and pulled the power bus down. KA9Q, whose calculations predicted the solar eclipse, estimates the spacecraft will return to full sunlight about July 12. There is a possibility, considered remote, that it could recover then. Users are asked to monitor OSCAR 7's beacon frequencies, 29.502 and 145.972, and to report any signs of life to AMSAT.

OSCAR 7 Has Been An Exemplary Satellite. Launched November 15, 1974, with a design life of three years, it has provided Amateurs throughout the world with literally millions of contacts during more than six and a half years of operation. OSCAR 6, with a one-year design life, lasted over four and a half years.

The Ariane Launch June 19 from French Guiana was a complete success, reinforcing expectations that the Phase 3B spacecraft will go up next year as scheduled. Two satellites, each weighing about 1500 pounds, were launched into orbit by the French rocket. One, the experimental Indian "Apple" satellite, is reported to be having problems extending its solar panels. W6VIO at the Jet Propulsion Laboratory joined WA3NAN and WA2LQQ in reporting the 1203Z launch to listening Amateurs worldwide.

John L. Reinartz
Father of Shortwave Radio

By Leonard Spencer, WA6CBQ

As a Novice-class Amateur attending one of my first radio-club meetings, I was recruited to help the guest speaker with his demonstration of a "tuna-fish-can rf bridge." It was the Monterey Bay Radio Club in Salinas, California, during September of 1959, and that speaker was John L. Reinartz. Little did I realize at the time the scope of his electronic accomplishments.

We met again when I served as president of the same club and invited him to furnish a program. He was accompanied by Mrs. Reinartz, who was a true helpmate and at that time also an Amateur with the call K6MJH. She was an observer and participant in much of the pioneer experimentation which brought about shortwave communications. It is with her cooperation that facts pertaining to these events have been obtained for this article.

Between the years 1921 and 1925, John L. Reinartz led the Amateur Radio experimenters of that time in development of shortwave communications below 200 meters wavelength. Recognized engineers and scientists of that time considered these wavelengths useless.

Reinartz engineered the receiving and transmitting circuits, developed tune-up procedures, and did the research necessary to explain how the shortwaves performed as they did. For this Amateur Radio accomplishment, he truly earned recognition as the *father of shortwave radio*. He upset many of the accepted theories of fundamental radio communications and probably for this reason did not get the recognition he deserved at that time.

greatest contribution

In 1964, Herbert Hoover, Jr., W6ZH, then president of the American Radio Relay League, awarded Mr. Reinartz the first Hiram Percy Maxim Gold Medal for the greatest contribution to Amateur Radio in the past 50 years. The ceremony took place on the 50th anniversary of *QST*, at the Pacific Division Convention in Sacramento, California. Actual presentation was made later at the Fort Ord Hospital, as Reinartz was unable to attend the convention.

Mr. Hoover summed up his address with this tribute to Reinartz, then retired and living in Aptos, California, and using the call K6BJ:

"In the immediate scramble for shortwaves that followed his basic concepts, Reinartz' pioneering work became strangely overlooked. Perhaps the fact that he was an obscure electrician in a New England textile mill, who had overturned the accepted theories of the scientific authorities of the day, had something to do with it.

"But John Reinartz should not be forgotten. Quiet, modest, and unassuming as he may be, he — perhaps more than any other individual — is the father of shortwave radio. When we realize that today, 40 (now 57) years later, the great bulk of the world's long distance radio communications — broadcast, point-to-point, marine, aviation and all others — still takes place on these same shortwaves that were first demonstrated by Reinartz, we can justly be proud of his Amateur accomplishment."

When Mr. Hoover's activities at that time are considered, these statements give more perspective to

Reinartz was radio operator on board Bowdoin *for MacMillan's 1925 Arctic Expedition using WNP (Wireless North Pole). Many firsts occurred that summer when shortwave radio provided daily communications from the far north in the daytime. Commander MacMillan wrote in a National Geographic story, "Much of the success of the Expedition's radio work depended upon the eager cooperation of Reinartz' associates of the American Radio Relay League in transmitting messages. More than 30,000 words of news dispatches alone were sent out from* Bowdoin *addressed to the National Geographic Society and released by it, day and night, to the press associations." All without financial remuneration — remember the regulations!*

events in early-day radio. With the call 3ZH he had a kilowatt tube-type transmitter in Washington, D.C., and during the 1922 transatlantic tests his station was heard in Switzerland and elsewhere in Europe. He was trying to communicate across the Atlantic at much the same time as Reinartz. It was the shorter wavelength 100-meter equipment used by Reinartz that made the accomplishment possible, using a 100-watt transmitter with 400 watts input. As Reinartz said in a magazine article at the time, "I didn't give a darn whether I burnt up the tubes or not."

honored as a professional engineer

More professional recognition was given Mr. Reinartz in January, 1958, when he was named a Fellow of the Institute of Radio Engineers for his early work on radio-wave propagation. He had 28 patents in the electronics field, but his early circuits were not controlled, as he wished everyone to make use of them, even to the extent of letting commercial enterprises manufacture them.

Reinartz received a bronze-plaque life membership in the Institute of Electrical and Electronics Engineers, Inc. A medal was awarded him by the Manchester, Connecticut, Chamber of Commerce on May 14, 1925. Manchester was his home town. The 1960 session of the California Legislature passed a resolution, dated March 8, commending Mr. Reinartz for his contributions to microwave radar. A beautiful plaque from the Central California Radio Council was presented to Reinartz, K6BJ, on April 6, 1960, in recognition of his many years of service to Amateur Radio. Among his other honors he was a member of the Explorers Club of New York, the American Polar Society, an original member of the American Radio Relay League, and an associate member of the Naval Institute.

spark station in 1908

John's youthful interest in radio started in 1908 when he bought an issue of *The Electrical Experimenter* at a magazine counter near school. He bought the secondary of a one-inch spark coil he saw advertised there by saving the 10 cents a day he earned working for a blacksmith. The transformer was completed by using iron wire for the core and bell wire for the primary winding. He made the electrolytic interrupter for the spark coil, and fashioned a coherer from a quarter-inch glass tube filled with filings from nickel coins. Using his initials, JL, as his call (as was done in the days before controls), he connected his spark transmitter to a 600-foot antenna installed between some trees and went on the air.

By 1921, Reinartz, using the call 1QP and working as superintendent of the local power company, published a magazine, *How to Build Receivers and Transmitters at Low Cost*. It was distributed free, and it was at this time that his famous tuner was developed. These circuits were reproduced and information on construction reprinted in the radio magazines of nearly every country in the world. Because of this wide publicity, thousands of his tuners were built.

QST in October, 1922, carried a symposium of further improvements on the Reinartz tuner. An editor's note states: "It is impossible for us to keep up with this man Reinartz. Since preparing the foregoing for publication he has dropped around with another 'trigger circuit' that knocks its predecessors cold."

first across Atlantic on 100 meters

Reinartz participated in the planning of, and designed the circuits used for transmitting, the first transatlantic two-way radio communications. Monsieur Leon Deloy, f8AB, of Nice, France, had been in the United States to attend the 1923 ARRL National Convention in Chicago. At that time, Deloy visited the Reinartz home in South Manchester, Connecticut, where he was given the circuits and construction details of the famous transmitters at a session that lasted until 3 AM. Together, they arranged for the transatlantic tests on 100 meters. Reinartz had developed a single tuner for receiving which was variable from 200 meters down to 28 meters, along with the technique of setting the transmitting and receiving equipment to precisely the desired frequencies so each station was compatible with the others.

This great event in shortwave radio took place the night before Thanksgiving Eve at exactly 10:30 EST, the time at which the restrictions on Amateurs, to prevent interference with broadcast listening, were lifted.

F.H. Schnell, a1MO, traffic manager for the ARRL in Hartford, Connecticut, had secured special permission from the Supervisor of Radio in Boston to use the 100-meter wavelength for these experiments.

Deloy, f8AB, on the night of November 27, 1923, called America and sent two messages prior to the 10:30 schedule. Both of these messages were copied by Reinartz at his home station in South Manchester.

At 10:30 long calls to France by a1XAM, the special experimental call assigned to John Reinartz, and a1MO, the call of the station owned jointly by Schnell and Kenneth B. Warner, secretary of the

ARRL, were heard "QSA vy one foot from phones," across the Atlantic. Steady and reliable communications were carried on for two hours and five minutes that night, which was until 6:35 AM in France.

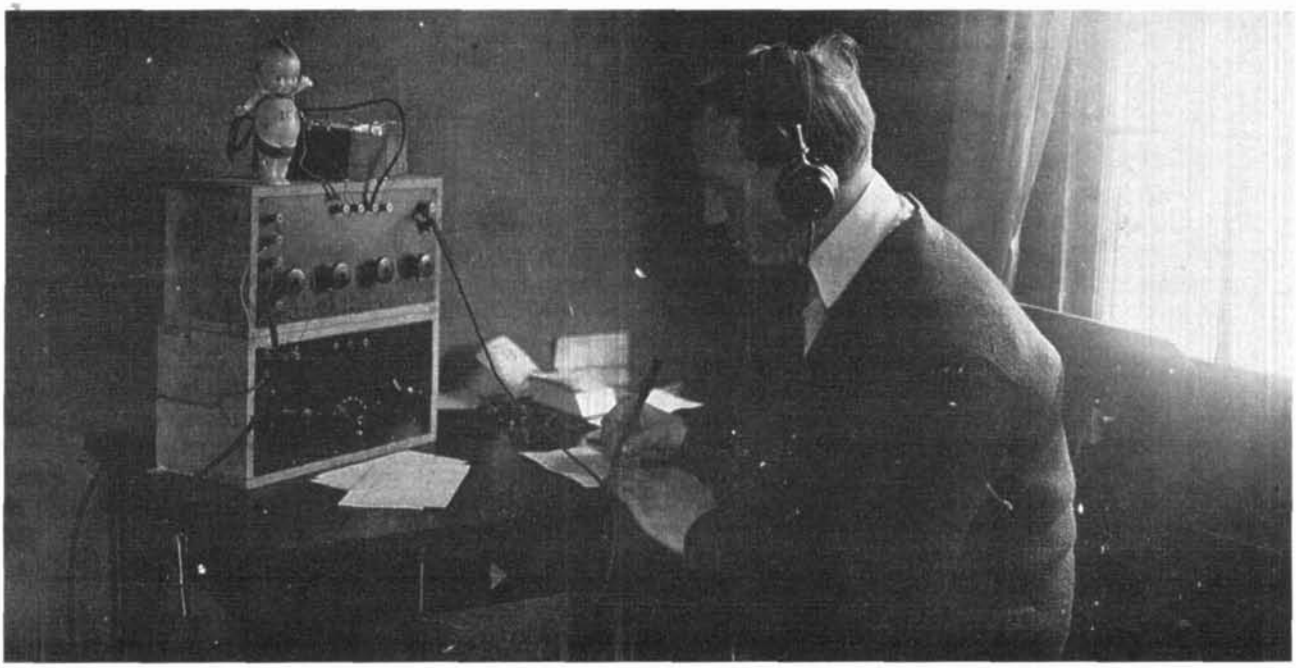
Message number one from America was addressed to General Ferrie, Director of Telegraphs for the French government, which was acknowledged at 11:06, and read as follows:

"America greets you for the first time by Amateur Radio across the ocean on 100 meters." Signed ARRL.

long-wave communications

Another sidelight to the problems of this era was that very little commercial equipment was available for use below 200 meters. Reinartz' circuits accomplished this, making the short waves practical for experimentation.

Early transmitting circuits were not shielded. They were of open breadboard construction, so rf potentials were prevalent pretty much everywhere. Reinartz seems to have been the first to establish a nodal



This operating position shows John L. Reinartz in 1921 with his famous tuner of that era in use, with three stages of audio amplification in the top cabinet. The spark transmitter, located in the cellar, was remotely controlled from this upstairs room. The Kewpie doll on top of the receiver was sent to him by a Canadian Amateur as a mascot — he had the famous 1QP call at that time and signed some of his message traffic "Kewpie."

Two nights later, Reinartz' station, 1XAM, succeeded in connecting with Deloy's f8AB in France twice, and at 10:40 asked Deloy to change his wavelength as he was being interfered with by station KDKA at about 103 meters. Deloy was not heard after that.

A complication arose when international DX became possible, that of identifying call letters for the various countries. Assignment of calls specified a district by number and a suffix of alphabetical characters, but no prefix to the call. The early DX workers added prefix "u" for United States, "a" for America, or "y" for Yankee, to establish country of origin as the United States of America. Great Britain used "g" and France "f" to do the same.

point, or point of zero rf potential, at the filament tap on the oscillating circuit. He did this by connecting an rf choke from filament to ground and tuning the circuit until no current flowed through the choke. This later became part of the standard technique.

A really practical shortwave transmitting circuit designed by Reinartz was published in an Amateur Radio magazine, *The Modulator*, in May of 1923. This was the official organ of the Executive Radio Council, Second District, published in New York City.

The story was tied in with another article concerning the failure of two-way transatlantic work between the American and English Amateurs. Because of the great amount of interference, anything in the

Here is a panel view of 1922 version of the Reinartz shortwave tuner, built by W. W. "Woody" Wilson, WA6KVW, from an early magazine article. He used authentic parts of that period from his extensive antique wireless collection. Switch points picked up progressive taps on the coils — an early version of band switching, you might say.

way of continuous reception had been prevented when stations were operating between 180 and 350 meters. Most of the transmitting and receiving equipment was designed to function somewhere in that part of the spectrum.

shortwave experimentation

Following are quoted paragraphs from *The Modulator*:

". . . real shortwave transmission did not exist until the recent ARRL tests between stations 3ALN, 1HX and 1AW, in cooperation with 1QP were consummated.

"The results of these tests were of great interest to the Amateur world. They proved that *transmission on 100 meters was a practical proposition*. It was carried on for several weeks before the officials would commit themselves.

"And now, with the announcement of the Hoover Conference recommendations, we find that *we may have to transmit on those shorter waves*! The study, therefore, of a successful transmitter will be of immediate interest.

"One of the best shortwave transmitters used in the preliminary tests was that of station 1QP, John L. Reinartz, of Tuner fame, located in South Manchester, Connecticut. Reinartz developed for these tests a type of transmitting circuit which is not less remarkable than his receiving circuit. With it, he reached the low limit of 100 meters, with mighty good radiation.

"Reinartz tells us that the success of his transmitter depends on the adjusting of the counterpoise and antenna current so that there is equal amount of current flowing through both. To obtain this, both the antenna and counterpoise are tuned separately with a radiation meter, and the adjustment of the helix (coil) turns in both circuits. At this adjustment, the plate current is lowest. To further regulate the circuit, the grid condenser is adjusted so that the plate current falls no further.

"Now that the Amateur has proved his efficiency on what were considered 'useless' waves, he will have the opportunity to show what he can do on the lower ranges and limits. Here is the field — some of the pioneer work has been done — so let's get at it. The field is large in its opportunities, and if the Amateur's skill is equal to it, he will contribute many things to the science and art of communication on the shorter waves."

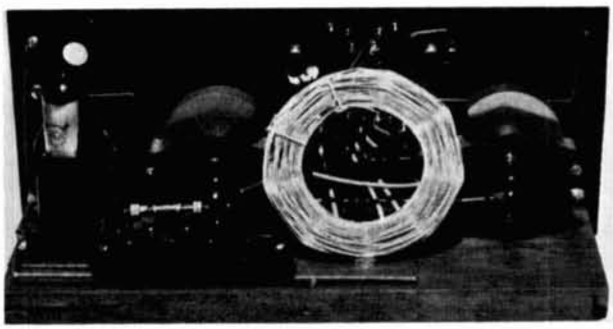
Reinartz' station on 100 meters, 1XAM, determined a new principle in antenna operation. For the first time, he used a counterpoise as the other half of a balanced antenna system instead of a capacity ground connection as had been common practice.

explains shortwave propagation

During 1923 and 1924, Reinartz compiled statistics on the stations he worked and those which reported hearing his experimental shortwave transmissions, some 5,000 in number. He hoped to determine why the shortwaves performed as they did. Experiments were carried on during an eclipse of sun to prove that sunshine made shortwave communications possible.

From his experiments, he came up with a "skip distance" theory, based on reflection or refraction from the ionized Kennelly-Heaviside layer, to explain the shortwave phenomena, and he predicted that communications would be possible across the nation in the daytime hours, which was an entirely new concept at that time.

Reinartz had schedules with stations NKF (call of Naval Research Laboratory at Bellevue, D.C.), 8XC, and 2EB on wavelengths below 40 meters in 1924. Tests were made at night, with three miles or so being the only completed QSOs.



Inside view of the Reinartz tuner with spiderweb inductance, which was an improvement over the original version in June, 1921 QST. The tube is a UV-199. Gridleak resistor was in clip holder for easy changing. Note hole in panel to check on tube filament glow, controlled by varying rheostat on front panel.

Then daylight tests were made on December 21. At 3:25 PM CST, 9EK, Hoffman, called 1XAM, Reinartz. They had been hearing each other for some time and suspected they could work together easily. This they did on 21 meters until 4:30 PM when signals suddenly dropped out. As usual with this band, darkness had changed the transmission pattern. The most important part of this QSO was that 6AJF, Frank C. Jones, at Berkeley, California, copied both stations — 9EK in Madison, Wisconsin, and 1XAM in South Manchester, Connecticut!

daytime transcontinental signals

Two-way communications on 21 meters were conducted between Reinartz, 1XAM, from South Manchester, Connecticut, and Ed N. Willis, 6TS, Santa Monica, California, at noon on January 22, 1925. They maintained continuous communications for 25 minutes and had to stop so Reinartz could get back to work as electrician at the silk mills.

The April, 1925, issue of *QST* contained "The Reflection of Short Waves," by John L. Reinartz, 1XAM, in which the editor said: "We consider this article one of the most important contributions made to radio literature." This evaluation proved to be true.

The article explains with drawings and text how the shortwaves propagated, providing the theories for the Maximum Usable Frequency and Lowest Usable Frequency as we know them today. These theories contradicted the then-accepted action of reflection by the Kennelly-Heaviside layer surrounding the earth. Reinartz' theory of "skip" is now scientific fact.

There was a controversy as to who was first to work across the Atlantic Ocean on 20 meters during daylight, but credit is given to Reinartz, u1XAM, and Secretan, g5LF, in England, for being the first to accomplish the feat.

On May 3, 1925, communication was made on 20 meters between British Amateur station g2OD and Australian a2CM, following planned experiments, so the use of shortwaves for DX rapidly became popular once the Amateurs could make the equipment work on these wavelengths. (Notice that frequency is not mentioned in the early days of radio. It was always wavelength in meters — metric units from the start!)

In 1923, Amateur Don Mix, 1TS, was assigned as radio operator with the MacMillan Expedition to the Arctic. His equipment was built to work in the 180 to 220 meter range, and this proved to be unreliable for consistent communications from the north because of the long period of daylight during the summertime. This was the eighth polar exploration of which MacMillan had been a part — and the first to use Amateur Radio to maintain contact with civilization.

Arctic expedition of 1925

John Reinartz' participation in the Navy-MacMillan Arctic Expedition of 1925 began when he received a letter from Hiram Percy Maxim, president of the ARRL, inviting him to cooperate with Commander Donald B. MacMillan, USNR, and E.F. McDonald, Jr., president of Zenith Radio, which was to supply the radio equipment. Reinartz helped to design and construct the shortwave station installed on *Bowdoin*, a schooner with an auxiliary oil-burning engine, commanded by MacMillan.

Captain McDonald, USNR, was in command of *Peary*, a coal-burning steamship, on the expedition. Lieutenant Commander Richard E. Byrd, Jr., on active duty in U.S. Navy, was in command of the Naval Aviation Detachment with the expedition in his first attempt to fly over the North Pole.

This expedition was organized under auspices of the National Geographic Society and the U.S. Navy. Here is a quotation from the *National Geographic* magazine of that time:

"Airplanes will explore in days icy areas of the Arctic which would take months to traverse by dog sleds. Radio is telling the daily program of work which in years past would be shrouded in silence for months. For the first time in Arctic history, color photographers are recording, for members in early issues of their *Geographic*, the surprising tints of the far north, the native life, birds and many beautiful Arctic flowers.

"These new aids to travel and communication enable the expedition to engage upon a program perhaps of broader exploration and scientific study than any expedition heretofore has attempted.

"The flying of the U.S. Navy airplanes under the direction of Lieutenant Commander Richard E. Byrd, Jr., and his splendid personnel, not only is epochmaking, but marks an important experiment in aviation that will focus the world's attention."

First date of the personal radio log kept by Reinartz on the Arctic expedition is June 16, 1925, while the crew was preparing to depart from Wiscasset, Maine. Amateur calls worked on 40 meters are entered in the record for several days and the *National Geographic* message of the day was transmitted using Amateur Radio for relay. Some of the interesting entries follow:

"June 26 — Left Sydney (Nova Scotia) at 9:15 AM. During radio watches, worked NKF and 1QP (his home station in Connecticut), 1MY (a personal friend), and several other Amateurs in 40-meter band.

"June 28 — At sea bound for Battle Harbor. Gave 1MY a message by voice at 7:20 PM in the 40-meter band.

"July 1 — At Battle Harbor. Met Stanley W. Brazil who operates the northernmost Marconi radio station on Labrador coast. Made him a transmitter and receiver operated entirely from dry batteries and expected that he would be able to keep in touch with me on the trip north, which he did!

"July 2 — Don't forget to learn the code better please — I want to hear you on the air when we are up north." (This was in a letter from John to Mrs. Reinartz mailed from the last post office on the way north, Battle Harbor, Labrador.)

"July 5 — Left Battle Harbor at 12:30 AM aboard *Peary* for Hopedale (Labrador). Sailed on *Peary* in order to put their defunct radio equipment in commission. Was necessary to tear out all the radio equipment and rebuild more compactly.

"July 6 — Left *Peary* after fixing radio equipment and reboarded *Bowdoin* when she stopped on account of fog.

"July 23 — From WNP to 1MY 6 PM via f8QQ. Have Gertie (Mrs. Reinartz — Gertrude) keep 1XAM going on 20-meter band with bug 8 AM to 8 PM Saturday and Sunday. Sig. Kewpie." (This was for experiments in determining time when 20 meters would be open to the United States from the northern end of Greenland. Reinartz had an automatic code sending device at his home station, which he had used earlier in his experiments on shortwaves. The keyer was made by John from a clock mechanism and the spring had to be wound up every half hour. Code signals were made by timing from a revolving disk attached to the clock.)

"August 2 — Etah at last. Had a great time today. Heard many 20-meter Amateur stations and worked 9CXX, Cedar Rapids, Iowa, on 16 meters. Gave him message number 218 to Mrs. QP."

Quote
Am well and happy. Love via 20 meters from Etah the first time in history of radio at 3:40 PM.
Kewpie
Unquote

This message was telegraphed to Mrs. John L. Reinartz that same day by Arthur Collins, and several other Amateur stations who received it, and was the first message ever to be sent on short wavelengths from the frozen north in the daytime.

Etah, Greenland, was the ship base from which the planes explored the uncharted regions of the North Pole. WNP (Wireless North Pole) operated by Reinartz, was aboard *Bowdoin* at Etah. (9CXX was the station of Arthur A. Collins, then a student in high school. He cut classes to get back to his rig to handle these communications. He was to become famous for the manufacture of quality electronic equipment, and Collins Radio is now part of Rockwell International conglomerate.)

"August 11 — The three planes off to Ellesmere Island at 10:47 AM. The NA-3 back at 2:15 PM, the NA-2 back at 2:30 PM, and the NA-1 back at 2:44 PM. They could not land due to fog. Was in radio communication with Washington, D.C., through Cedar Rapids, Iowa, and gave notification the instant the planes returned. Newspapers had news within 15 minutes of their return.

"August 12 — It is evident that planes are not going to be useful up here. The Los Angeles (dirigible) would be much better. A drop means certain death. Looks as if the flyers knew it too well.

"August 15 — Made world's record by using radio telephone to Cedar Rapids at 12:30 PM.

"August 17 — Not much doing. Planes having hard time finding landing place on Ellesmere Island. Again talked with Cedar Rapids at 2 PM. It was noon at Cedar Rapids.

"August 18 — Same old story. Planes not suited for job." (These single engine Loening biplanes were specifically equipped with dry-battery-operated receivers and transmitters capable of operating between 37 and 42 meters wavelength, plus standard Navy aircraft equipment operating on 500 meters.)

"August 20 — Bad weather. Packing up to go home.

"August 21 — Left Etah at 6:29 AM for home.

"September 14-20 — At Godthaab (Greenland). While there visited the Norse ruins, going to the ruins on September 15 at 7 AM and returning on the 16th. The ruins are about 15 miles from Godthaab, at the end of the fjord.

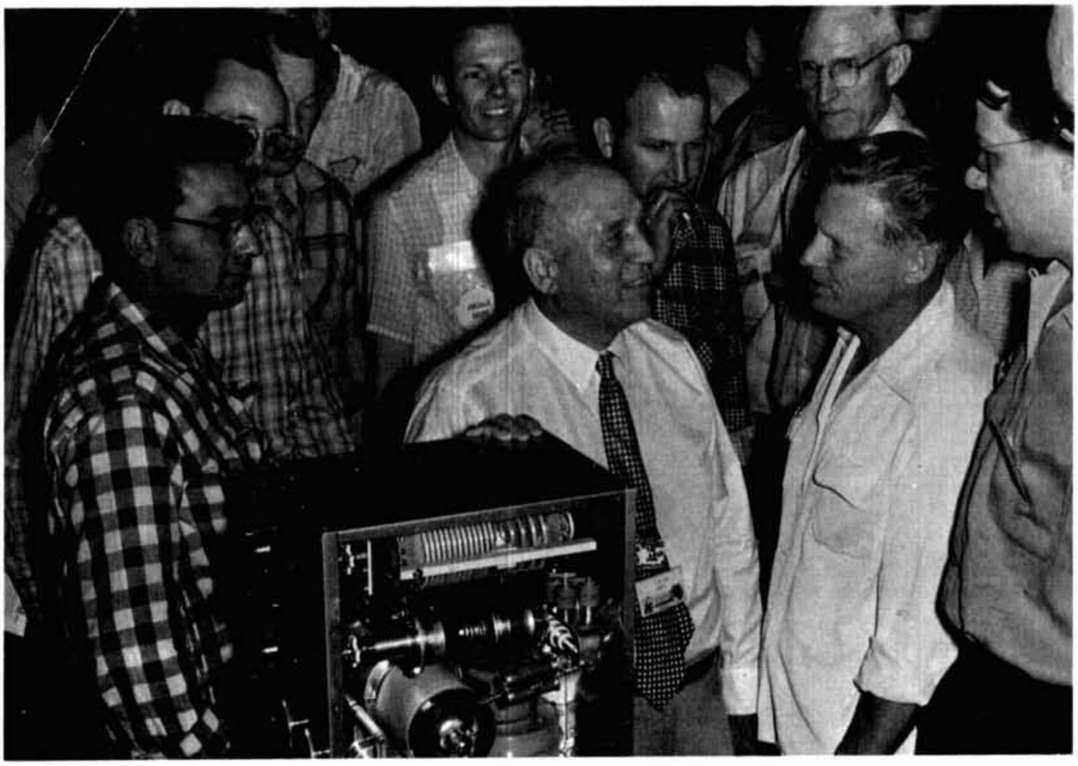
"October 10 — stayed at Monhegan due to storm until Monday morning when *Bowdoin* left for Wiscasset. The end of the journey."

The next year, after the expedition of which Reinartz was a part, Lieutenant Commander Richard E. Byrd and his pilot, Floyd Bennett, flew over the North Pole in a commercial type Fokker three-motor plane, *Josephine Ford*. Bennett had been a Navy Pilot with the 1925 MacMillan Expedition. The flight left from Kings Bay, Spitsbergen, May 9, 1926, making a 15-hour, 1500-mile trip over the pole, returning to Spitsbergen.

Three days later, May 11, 1926, the Amundsen-

Ellsworth-Nobile flight, leaving from the same place, using a dirigible 347 feet long, dropped Norwegian, American, and Italian flags over the North Pole and continued on to Teller, Alaska. Each expedition added more knowledge about the Arctic region, making it easier for other explorers to follow them.

After the Arctic expedition, Reinartz did further experimentation for the Navy, and worked on measurement of voltages produced by growing plants at what is now the University of Connecticut. He was commissioned a lieutenant in the Naval Reserve in 1929 and conducted weekly classes via radio for Third Naval District personnel.



At the 1955 ARRL Pacific Division Convention in Fresno, California, the tecnnical discussion topic was "Your Future One-kW SSB Final." Here John L. Reinartz shows the finished transmitter to very interested Amateurs at the conclusion of the lecture. About his work he said, "I'm not selling anything, but basically these hams are the men who eventually move into places of prominence as operators of the big commercial stations, engineers in the telephone industry, ship operators, executives in the communications field, and military signal transmission experts. They have the know-how for the important jobs."

Reinartz' formal education ended at the eighth grade level. He took correspondence courses and attended evening school classes to keep learning. In 1930, he decided on a college education. He attended Connecticut University for two years, majoring in radio and mathematics, but received a job offer from Radio Corporation of America that was too good to turn down, so went to work for RCA in 1933. Twenty-three Reinartz patents were assigned to RCA in this five-year period, some of them on methods of simplifying fm radio.

Professional engineering status was earned in the State of Connecticut, July, 1936, when he was issued Certificate of Registration number 947.

active Navy duty

In 1938, Reinartz was called to active duty in the Navy as a personnel officer, assigned to assemble eligible, experienced radio personnel for training and research. By the time of Pearl Harbor, he had assembled a list of 720 reserve officers and 3500 enlisted reserves who were quickly assigned to communications duties.

His initial job done, Reinartz was assigned to other Washington duties, including a tour as head of the Radio and Radar Division of the Naval Research Laboratories, at which time he supervised the work of 1200 physicists.

As a member of the Joint Chiefs of Staff communications setup, he had a lot to do with the vital nerve system which meant so much to Allied victory. He was assigned to the office of the Chief of Naval Operations.

Reinartz was a member of the Defense Communi-

John L. Reinartz
Father of Shortwave Radio

Here Mrs. Reinartz points to an entry in the personal log kept by John L. Reinartz while he was radio operator of station WNP on board Bowdoin *during 1925 Arctic Expedition to North Pole regions. Captain Reinartz is in photograph beside replica of 1922 version of his famous tuner. Scrapbook behind photo is of Arctic trip and larger book contains clippings and programs of events in which John participated while with the* EIMAC *firm.*

This portrait was taken while Reinartz worked for EIMAC. *Shortly after World War II, many photos showed him in his Captain's uniform in advance publicity of his many tours thoughout the United States, giving lectures and demonstrations before professional engineering, Amateur Radio, and public services groups.*

cations Board at its formative meeting January 6, 1941. For a time, he was on the West Coast in charge of modification of all airborne radar for the Pacific areas.

In 1946, Reinartz rejoined RCA, and in 1949 moved west to become part of the Eitel-McCullough, Inc., organization at San Bruno, California, in a similar capacity, as field engineer and manager of the Amateur Radio Service Department, until retirement January 30, 1960. (The Eimac transmitting-tube manufacturing firm was founded in 1934 by two Amateurs, W.W. "Bill" Eitel, W6UF, and Jack A. McCullough, W6CHE.)

honored in retirement

His retirement prompted a John Reinartz Testimonial Amateur Radio Banquet February 1, 1960, in San Mateo, California. Seventeen speakers praised John for his pioneer accomplishments in the field of electronics. Two hundred invited guests paid him tribute by their attendance at the banquet, almost all of them with Amateur Radio calls.

Check your QSL cards to see if you have worked John L. Reinartz on the air. Calls he held and used were JL, 1QP, 1XT (a special land station call issued by Bureau of Navigation, U.S. Department of Commerce), 1XAM (special shortwave experimentation call), NDF, WNP, N1QP, W3RB, W3IBS, and K6BJ. The Santa Cruz County Amateur Radio Club now uses the K6BJ call for its John L. Reinartz Memorial Station in the Santa Cruz, California, area, so listen for it Field Day, and work it.

This quotation comes from an interview with John Reinartz published in the Augusta, Georgia, *Chronicle* of Thursday, May 3, 1956:

" 'It's a wonderful hobby — radio,' he says. 'I can't recommend it too highly. A normal lad can build himself a receiver for as little as $10 — and a transmitter for only $25. If he uses the right frequencies he can cover a good part of the world with such a rig. And experience in radio can stand him in mighty good stead in this Atomic Age.' "

ham radio

an analysis of ALC circuits

Automatic load control circuits are investigated as a means for avoiding distortion in SSB transmitters

This article dispels the mystery of the ALC circuit used in Amateur SSB transmitters and addresses problems encountered when using linear amplifiers made by one manufacturer with exciters made by another manufacturer. Such problems include splatter, which may occur even though the ALC line is connected between the two pieces of equipment.

ALC defined

ALC is an acronym for *automatic load control* when used with SSB transmitters. The term goes back to the days when Bell Labs made a high-frequency SSB transmitter whose output was in four channels. The term *loading* in telephone work indicated the number of channels in a multichannel system that were in use at any given time. Their automatic load control kept the peak envelope power from the SSB transmitter about the same, regardless of whether only one or all four channels were in use. Probably there would be less confusion as to the function of automatic load control if it had meant automatic level control.* Even automatic gain control might be appropriate, except for the fact that it would be confused with the system used in receivers.

So in terms of today's technology, what is ALC? What does it do? Why use it? These questions are explored in this article, which includes a discussion of the principles of ALC and why, if used properly, it helps to eliminate interference on the Amateur bands by reducing spurious products in SSB transmitters.

some background information

In a-m communications systems it was common to use speech compressors and clippers, so that the power amplifier could operate near its maximum power-output capability without excessive distortion products. As used in single-sideband, ALC is part of a system that is intended to maintain the distortion products of a *linear* amplifier within acceptable limits.

ALC may be thought of as an rf compressor. You might ask, Why not use audio compression to hold

*To add to the confusion, automatic level control has been used in Broadcast engineering to define a method for taming speech amplifiers. **Editor**

My thanks to Professor Charles Gould, W4LZO, for reviewing this manuscript — John P. Weber.

By John P. Weber, Jr., K4JW, 102 Southgate Boulevard, Melbourne, Florida 32901

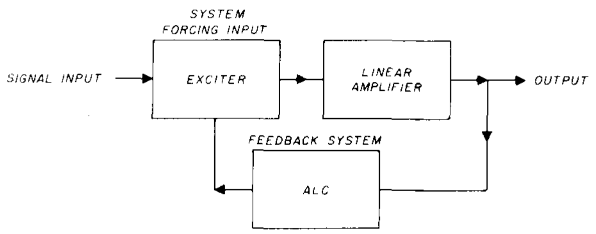


fig. 1. Block diagram of linear-amplifier control system. The device being acted upon is the linear amplifier; the stimulus, or system-forcing function is from the exciter. Thus a control-system feedback loop is formed, which prevents the amplifier from being overdriven and producing distortion products on audio peaks.

the transmitter output to an acceptable maximum? Well, the peak levels of the SSB signal don't always correspond to those of the audio signal. So the method referred to as ALC in SSB controls the drive power from the exciter (input to the linear amplifier) by sampling the rf output of the linear amplifier, rectifying this output signal to obtain an audio signal, and feeding the filtered dc back to a stage in the exciter that controls the exciter's gain. It is similar in operation to the AGC circuit in a receiver.

The point is that we are trying to maintain a *linear* input-output relationship for the amplifier over the range we're using. Of course, if the linear amplifier could maintain its linearity over the desired operating range by its design, ALC would not be needed. But in today's world, it's possible to overdrive the linear amplifier, which creates splatter.

Now if you don't care about your signal quality or what you're doing to the hams 7 kHz away, stop here! When contacting manufacturers for technical information, an engineer at one company replied, "It is our considered opinion that most DXers do not use the ALC feature inasmuch as they wish to obtain maximum power output, splatter or no splatter." While I don't think it applies only to DXers, this gentleman's observation is borne out by listening on the Amateur phone bands. I'm interested in the ham who has his ALC line hooked up and is *still* splattering.

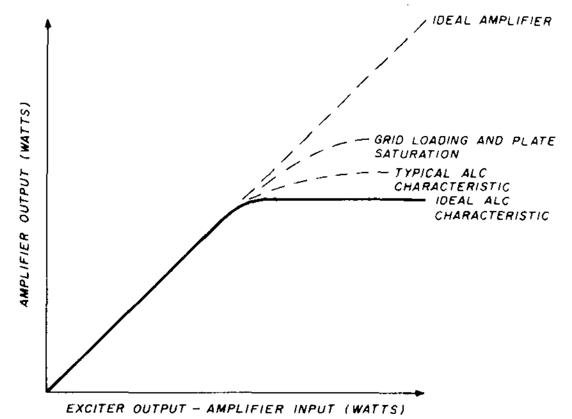


fig. 2. Amplifier transfer function, showing the relationship between linear and nonlinear characteristics; the latter caused by plate saturation and grid loading.

analysis

For a thorough discussion of linear distortion mechanisms and measurements, I refer you to the article by Warren B. Bruene;[1] this is must reading. References 2, 3, and 4 are excellent material, not only on ALC circuits, but on all facets of SSB. They may not, however, be easy to obtain.

Fig. 1 is a block diagram of a basic ALC system, from the standpoint of control-system design. The device being acted upon is the *linear amplifier*; the stimulus, or system-forcing input, is the exciter. The linear amplifier has a transfer characteristic; that is, its output related to its input stimulus. If we sample the amplifier output, process it, feed it back to control the stimulus (or exciter), we have a closed-loop control system. Why this roundabout approach? I've found that some hams get confused if I use the term *feedback*, relating it only to an audio amplifier; but they seem to understand the control system concept.

What we are trying to accomplish is shown in the curves of **fig. 2**. We see the ideal linear transfer characteristic that is linear over the entire range, regardless of the input. Then we see a nonlinear condition occur as we go over a certain value of input. In a practical grounded-grid SSB vacuum-tube linear amplifier, this is usually the result of two effects:

1. *Plate voltage saturation* — the output of the tubes tries to exceed twice the value of the supply voltage.

2. *Grid loading* — as the grids begin to draw current, they present a varying load to the exciter, and because of the exciter's regulation, the exciter will drop its output, generate harmonics, and the power output from the linear will decrease.

Ideally, we want to cut the output power at a point where further exciter drive will not result in additional amplifier output that is distorted. Our compressor would have a curve that suddenly flattens off at the threshold point; but practically, we will get some further increase in output, as shown.

basic circuit

A basic ALC circuit is shown in **fig. 3**. The output rf voltage of the amplifier is sampled, divided by a capacitive divider consisting of C1 and C2, rectified by diode CR1, and fed into a filter consisting of R1, C3, and R2. This ALC voltage is fed *into* the exciter.

Most modern exciters have an *internal* ALC system that works from the exciter's output stage back into earlier stages to control its linearity. We can take the ALC from the power linear amplifier and feed it into the internal loop of the exciter to reduce its output to prevent overdrive of the linear amplifier.

In the case of this simple form of ALC system, the threshold point at which ALC action starts is determined by the exciter's ALC circuitry. Many times, this takes the form of a zener or biased diode arrangement. Since the exciter controls the point where the threshold is, how do we know we have the right voltage from the linear amplifier to initiate this action? If both designs were by the same person, he could ensure that these points coincide. But, if the linear amplifier comes from one company and the exciter from another, how can we assume that the ALC action is optimum, or even exists?

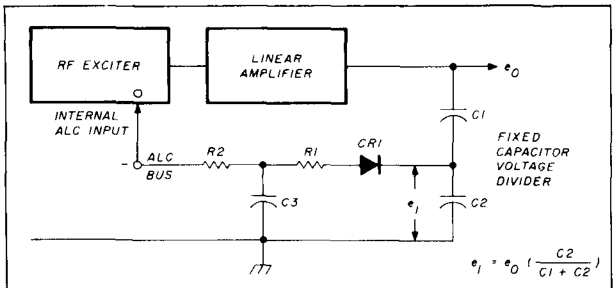


fig. 3. Basic automatic load control (ALC) system. Amplifier output rf voltage is sampled, divided by a capacitive divider, rectified, and filtered. This voltage is then fed to the exciter. Compatibility between exciter and amplifier is necessary for effective control of the amplifier.

examples of ALC circuits

Now let's look at some circuits. The sampling was from 24 models made by nine manufacturers. Examining **fig. 4** we see the first step above the basic circuit. In **fig. 4-A**, again we have the capacitive voltage divider, this time across the cathode or input circuit of the grounded-grid linear amplifier. Why sample the cathode rf voltage? Well, the power gain of the tube or tubes is very nearly equal to the ratio of rf plate voltage to the rf cathode voltage, since the tubes' plate current is common to both the input and output circuit. Actually, it's a little different because of the power absorbed by the grid(s) and input- and output-circuit losses; but it is a convenient low-voltage point in which to work. This divided voltage is rectified by CR1, filtered by R1, C1, and R2, then fed to the high side of a pot, R3. This pot enables adjustment of the output voltage (ALC) to match the requirements of the particular exciter with which it's being used. However, the threshold is still controlled by the exciter's internal circuitry.

the most common ALC circuit

Fig. 4B shows the most common ALC circuit in use, according to my study of manufacturers' diagrams and also from knowing which are the most popular units by on-the-air listening.

The components are all established by the designer and probably are intended for use with exciters manufactured by his company — remember, he has extensive knowledge of the exciter.

Again, a capacitive divider is in the cathode circuit; a diode is used to rectify this rf voltage. However the diode is biased so that it will not conduct — this bias is usually derived from a resistor tap in the high-voltage supply bleeder circuit; or, in some cases, from a separate low-voltage power supply that is used to energize relays and pilot lights.

Since the diode is biased, no ALC voltage appears from the linear amplifier until the amplifier reaches a power level where this bias is overcome and the diode conducts.

In effect, the designer has set the threshold point in the linear amplifier. But if that point is below the required threshold voltage needed by your exciter's ALC bus, no ALC action will occur until you overdrive the linear sufficiently to start ALC action. The older exciters needed −2.0 to −4.0 volts for threshold; some of the newer ones need −6.0 to −10.0 volts. For ultra-conservatives, who are safety conscious, examine this circuit in terms of the bleeder resistor tap-to-ground opening up!

biased diode, variable threshold circuit

Fig. 4C is a circuit that allows you to overcome the restrictions mentioned above. Simply stated, the threshold point is made variable by using a pot to set the diode bias. If you note the curves shown beside each circuit, it becomes apparent that the most flexibility to work with different exciters is afforded by this circuit.

This convenience is negated, however, if the ALC control is put inside the linear or on its back panel. The control should be placed on the front panel of the linear — it is an operating control. Why? Well, first (and please don't laugh), so you can set the linear to 1 kW legal limit while in the CW-TUNE position. Second, as we've been discussing, different exciters require different values of ALC voltage. Third, the ALC setting can vary from band to band, the extent depending on its gain variation. Fourth, the input impedance of the linear can vary from band to band, changing the loading on the exciter.

The input impedance of a grounded-grid amplifier is a function of the tube design and the plate load impedance presented to the tube. This plate load impedance is determined by the characteristic of the load (antenna plus line) and how the output network is tuned. (Is loading accomplished by plate current tuned for dip or for maximum output?) Unfortunately, only one currently available unit (two-piece) has this facility; an older unit is no longer in production, and a yet-to-be-proved unit has just appeared on the market.

ALC using grid and plate detection

A unique circuit bears discussion and is shown in **fig. 5**. Unfortunately, to the best of my knowledge, it was never exported to this country. This circuit is unique in that it samples both the grid and plate signals of the amplifier. The detector connected to the grid circuit senses the pulses of grid current when the grid is driven into the positive voltage region. This voltage is doubled and fed along with the sensed plate signal to the ALC bus. A balance between these signals can be achieved by individual pot settings. The thing about this circuit that struck me was the similarity to the method of measuring linearity described by Bruene in 1954. His linearity tracer sampled the input and output of the amplifier and portrayed them on a scope; why not use them to generate an error signal for the ALC function?

time constants

The discussion above has dealt with static operating conditions: measurements made on a point-by-point basis. The amplifier, however, is operated in a dynamic condition with the stimulus being voice excitation. Now we must deal with additional considerations — the transient behavior of the system. First, there's attack time; the time for the ALC system to respond to the stimulus, or voice peaks. If this attack time is too long, the system will overshoot and "buckshot" will result. Second, the release time must be considered; this is how long it takes the ALC system to recover or return to normal gain. If release time is too long, the amplifier gain is unnecessarily reduced, especially after a loud blast into the microphone — it can result in an unpleasant pumping effect if too short.

what can be done

I've painted a gloomy picture for those who don't

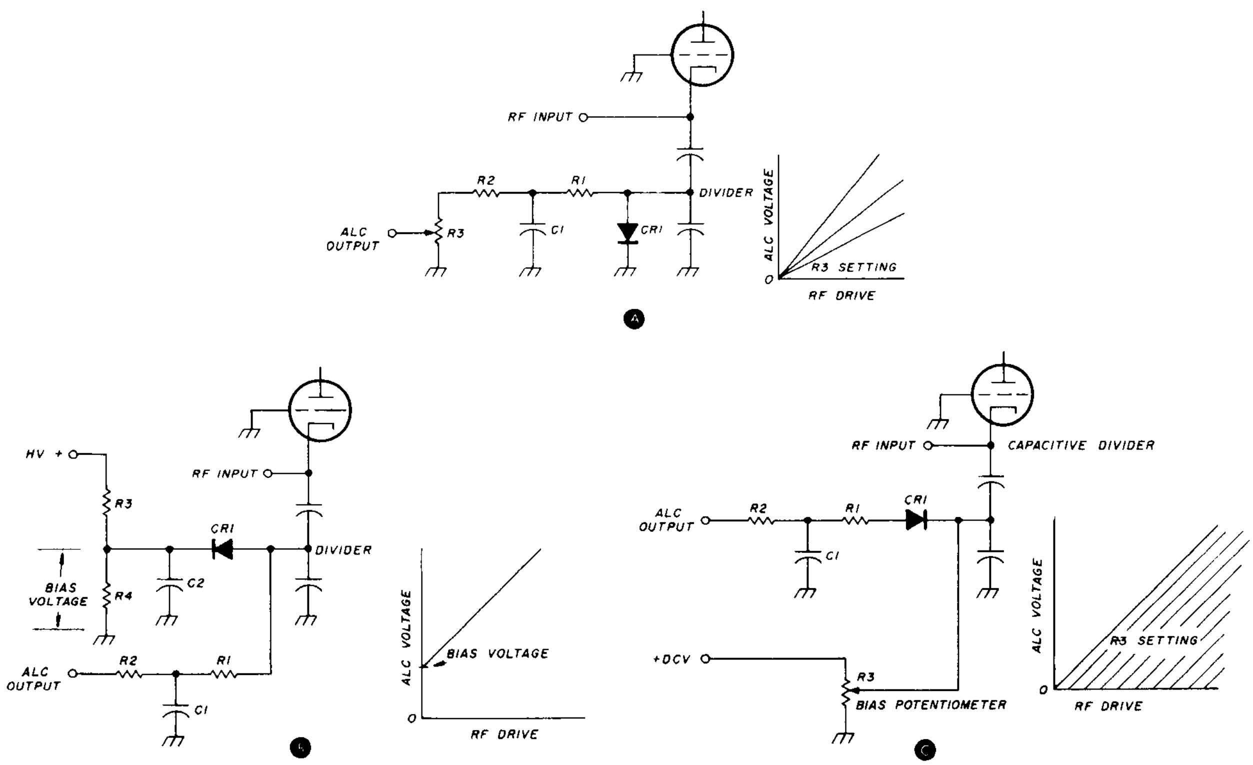


fig. 4. Examples of practical ALC circuits. Circuit at (A) is a simple system with no threshold and is adjustable by potentiometer R3. The most common ALC circuit is shown in (B), a system using a biased diode to determine the threshold point at which ALC action begins. In (C), the threshold point is made variable by using the potentiometer (R3) to set the bias to the diode.

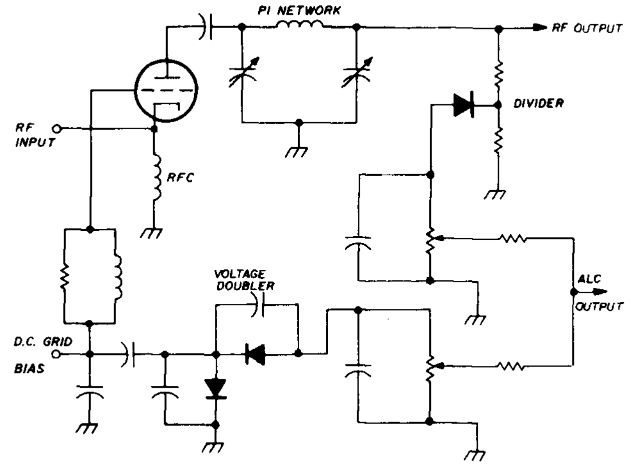


fig. 5. A unique ALC circuit using both grid and plate detection. When the grid is driven into the positive-voltage region, this voltage is doubled and fed together with the sensed plate signal to the ALC bus. The two voltages are balanced by individual potentiometer settings.

know the characteristics of their exciter or linear ALC systems — don't feel bad, neither do I! For those who say, "I watch my grid-current meter and keep the gain down until the meter just kicks," I ask, Do you know the ballistic characteristics of your meter? For those who say, "I watch my monitor scope pattern for signs of flat-topping," I ask, Do you know how much distortion is represented by how much flattening on the small pattern as it moves across the screen?

I think the same applies to those who use a trapezoidal scope pattern, although I feel it gives a fair indication of linearity. The correct method is to use a spectrum analyzer for a monitor; but I can neither afford one nor do I want to stare at scope patterns while I am talking!

If you're beginning to have reservations about using your 10-year old linear with your new exciter, or vice-versa, with ALC incompatibility problems, why not compare the manufacturer's specs on the ALC system constants? Can't find them? Neither can I!

What's needed is standardization in the industry — ALC voltage polarity, magnitude, intended load impedance, attack and release times. Having sat in on many industry standardization committee meetings, I can't give you much hope that this will happen. If military procurement or industrial safety requirements prevailed, it might happen. I don't find anything in FCC type-acceptance procedures that will help. As a matter of fact, examining one such submittal I find no mention of ALC connection, and the harmonic analysis was run with single, rather than two-tone, input and at a 50-watt input level!

Perhaps manufacturers will publish the ALC characteristics of their current and older models; it sure would be helpful. In the meantime, you can measure the voltage required to decrease your exciter's output by using a variable low-voltage dc supply, or batteries and a pot. You can a) measure your amplifier's ALC capability by terminating its ALC output with a resistor equal to your estimate of your exciter's ALC input impedance, b) excite the linear with a two-tone generator into the exciter with the linear amplifier terminated by a dummy load, and, c) measure the ALC voltage available (beware of meter loading) at the point where nonlinearity of the trapezoid scope pattern begins. At least you'll know if you need more or less ALC voltage from the linear amplifier. If you're lucky enough to have too much ALC voltage, you can add a pot on the front panel (or in a separate but accessible box) and attenuate the ALC voltage until you obtain the desired results.

final remarks

The problems of connecting ALC circuits in equipment of different manufacture have been discussed. Perhaps we can get more comprehensive data from the equipment manufacturers to assist us in properly interfacing our equipment. Consider measuring your equipment's ALC characteristics, putting a threshold control where you can get at it, and using a monitor scope. And remember, when you have that speech processor working full bore and your ALC line disconnected, you are *not* making many friends a few kHz up or down the band.

references

1. Warren B. Bruene, "Distortion in Single-Sideband Linear Amplifier," *QST*, November, 1954, page 122.
2. *Amateur Single Sideband*, Collins Radio Co., 1962. Available from The Ham Radio Publishing Group, Greenville, NH 03048.
3. *Fundamentals of Single Sideband*, Collins Radio Co., 2nd edition, 1959.
4. *Single Sideband Principles and Circuits*, Pappenfus, *et al.*, McGraw Hill Book Co., New York, New York.

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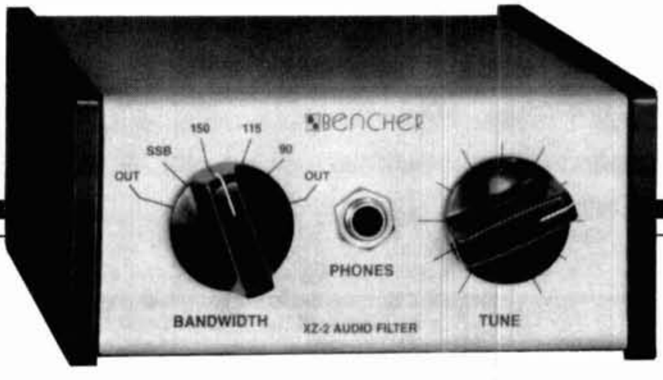

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a new look at dip meters

Some updated versions of that most useful tool — the grid-dip meter

One of the most useful accessories in the Amateur station is the grid-dip oscillator, grid-dip meter, or just plain dip meter. It can help solve many problems associated with resonant circuits. With proper calibration the dip meter can be used to determine the frequency of resonant circuits and, with capacitors and inductors of known values, it can be used to measure unknown inductances and capacitances. VHF parasitic oscillations can be detected in rf amplifiers, and antennas and transmission lines can be checked for resonance if proper precautions are used to determine harmonic responses with respect to fundamental resonant frequency.

The original grid-dip meter used a tube-type, class-C oscillator with a meter in its grid circuit. An external resonant circuit coupled to the oscillator's tank caused a decrease, or dip, in grid current; hence the name of the instrument. If this external circuit was a high-*Q* tuned circuit, the dip in grid current was noticed at a rather sharply defined frequency as the oscillator was tuned. It is precisely because the grid-cathode diode of the tube rectifies rf voltage that the oscillator operates in a stable class-C mode; and this rectified rf provides the dc grid current to operate a conventional dc current meter. A typical grid-dip meter is shown in **fig. 1**.

Historically, the oldest Amateur reference to grid-dip oscillators was that made by Bud Bane, W6WB, in the March, 1947, issue of *CQ* magazine. W6WB's meter used a 3A5 for battery operation, and covered 80 through 10 meters with three coils. Still earlier use of the grid-dip oscillator is discussed in the "Zero

By Hank Olson, W6GXN, P. O. Box 339, Menlo Park, California 94025

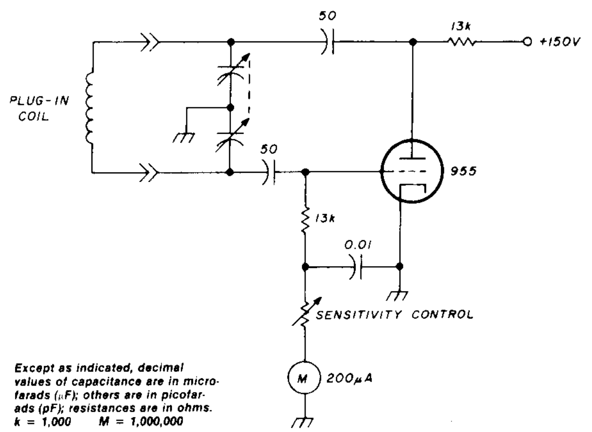

fig. 1. Basic grid-dip meter using a triode vacuum-tube (9002 and 6C4 also commonly used).

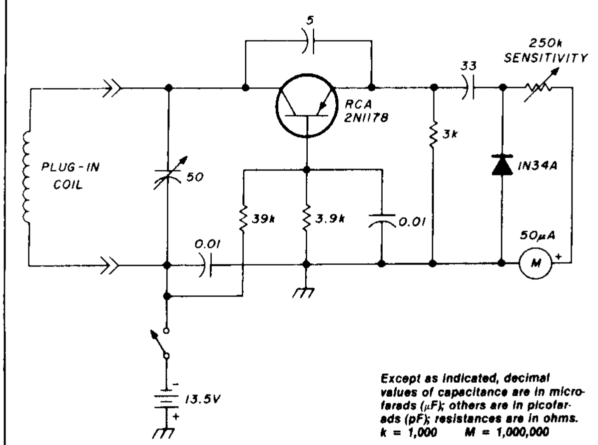

fig. 2. Typical dip meter using germanium PNP bipolar transistor with separate diode detector.

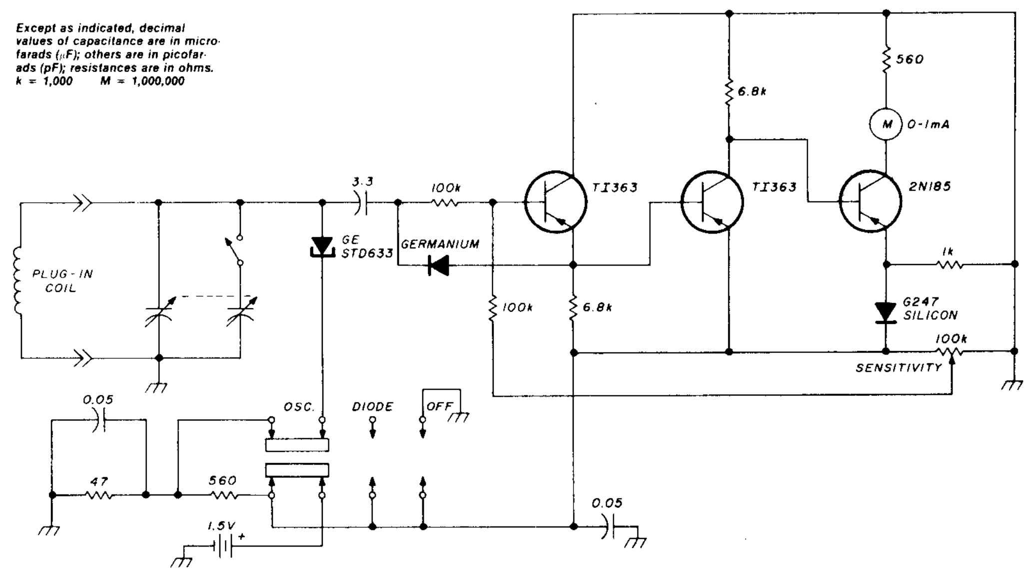

fig. 3. A dip meter using a tunnel diode as an oscillator (Heathkit HM-10A tunnel dipper).

Bias" column of *CQ*, April, 1979, and in "Our Readers Say," *CQ*, October, 1979.

When bipolar transistors became available, they were almost immediately applied as the active elements in rf oscillators — and also applied in dip meters. The term *grid-dip* had to be shortened to *dip* since, of course, there are no grids in bipolar transistors. The bipolar transistor (whether NPN or PNP) is unlike the tube in a number of ways. The bipolar transistor is a current-operated device; that is, it requires base current to control collector current. This generally means that it is a lower impedance active device, and that the base has dc current flowing in it whether oscillation is present or not. Even though the base-emitter junction of a bipolar transistor is a diode, the base current is not a very sensitive indicator of oscillation level because a good portion of the base current is dc bias current.

So we find, that, although a number of dip meters have been built using bipolar transistors, all of them make use of a separate diode detector to provide dc current for the meter.[1,2] Most of these circuits use a 1N34A or some other germanium point-contact diode as the diode detector, and might be updated by use of one of the newer (silicon) Schottky diodes. A typical bipolar dip meter is shown in **fig. 2**.

It is even possible (and one was commercially built by Heathkit for a time) to use a two-terminal form of oscillator: a tunnel-diode. In the Heath HM-10A Tunnel Dipper, a tunnel-diode was used as the oscillator and a standard diode detector was used as the rf detector to provide dc meter current. The Tunnel-Dipper is shown in **fig. 3** (reprinting is by permission of the Heath Company).

junction field effect transistors

The junction field effect transistor (JFET) is the first solid-state device to come along that really behaves in a "dip-meter" circuit the way tubes used to behave. Like a tube, the JFET requires voltage on the gate (grid) to control current in the drain (plate), and the gate-source junction operates like a "grid-leak" diode. So, with a lower supply voltage, an N-channel JFET can be put in an old tube-type dip-meter circuit and it will usually work immediately.[3] Early silicon JFETs had rather limited performance at VHF, and it was not until the arrival of the TIS34/2N3823 (Texas Instruments) that a good, cheap, silicon JFET was available for Amateur dip-meter construction. Subsequently, the Motorola MPF102, Union-Carbide 2N4416, Siliconix 2N5197, and other excellent N-channel, silicon JFETs became available inexpensively; these too fit dip-meter service quite well. An example of a dip-meter using an N-channel JFET is shown in **fig. 4**.[4]

the MOSFET

The MOSFET, unlike the JFET, does not have an inherent gate-source diode, and there are many MOSFETs that operate very well up through the VHF range. RCA and Motorola have a number of N-channel (depletion mode) MOSFETs that were designed for TV tuner service and are therefore inexpensive enough for Amateur dip-meter service. The 3N128 is a favorite in Amateur designs, and has been incorporated into at least one dip-meter design (see **fig. 5**).[5] Since there is no gate-source diode in a MOSFET, rectification of the rf is accomplished by adding a diode. It is even feasible to use one of the dual-gate MOSFETs, using the No. 2 gate as an oscillation level control (see **fig. 6**).[6]

Note that in **figs. 1** through **6** some of the oscillators use the Colpitts configuration and some use the Hartley circuit. Either form of oscillator will work, or any other form will do, as demonstrated in **fig. 3**. The Colpitts circuit has the advantage over the Hartley that only two leads must be provided for the plug-in coils.

It is possible to build a dip meter without plug-in coils. This has the advantage that the accessory coils don't get misplaced. One author has written at least two articles on bandswitching dip meters.[7,8] In reference 8, Fred Brown adds two worthwhile innovations to dip-meter technology: 1) a broadband 50-ohm output for driving a frequency counter, and 2) a square-wave modulation system which amplitude modulates at 1 kHz without fm.

With frequency counters now available for less than $200.00 that cover the range 0 to 1000 MHz, the

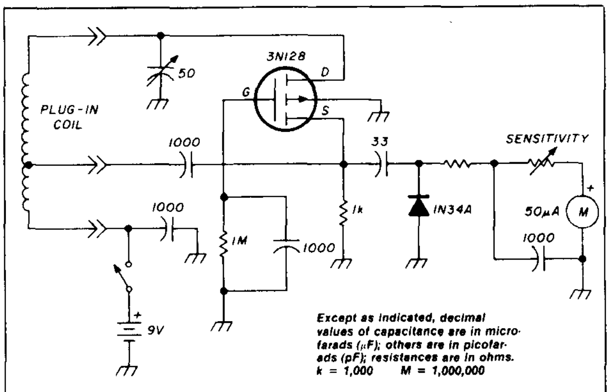

fig. 5. Dip meter using N-channel IG FET (MOSFET) and separate diode detector.

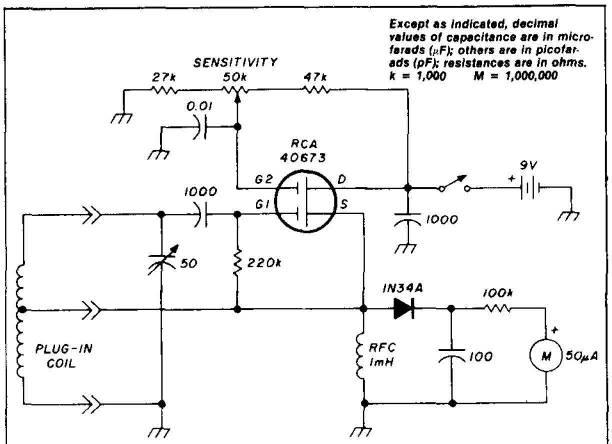

fig. 6. Dip meter using dual-gate IG FET (MOSFET) where No. 2 gate is used to adjust oscillation level.

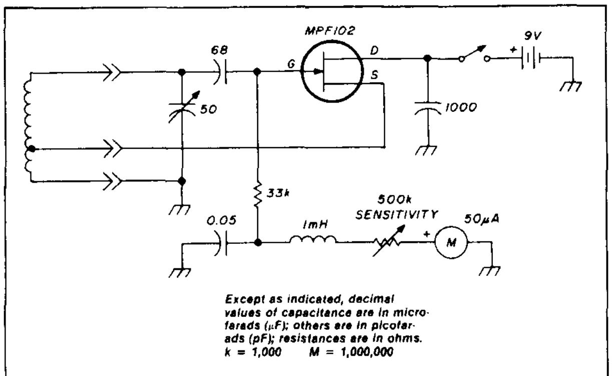

fig. 4. Dip meter using silicon junction FET.

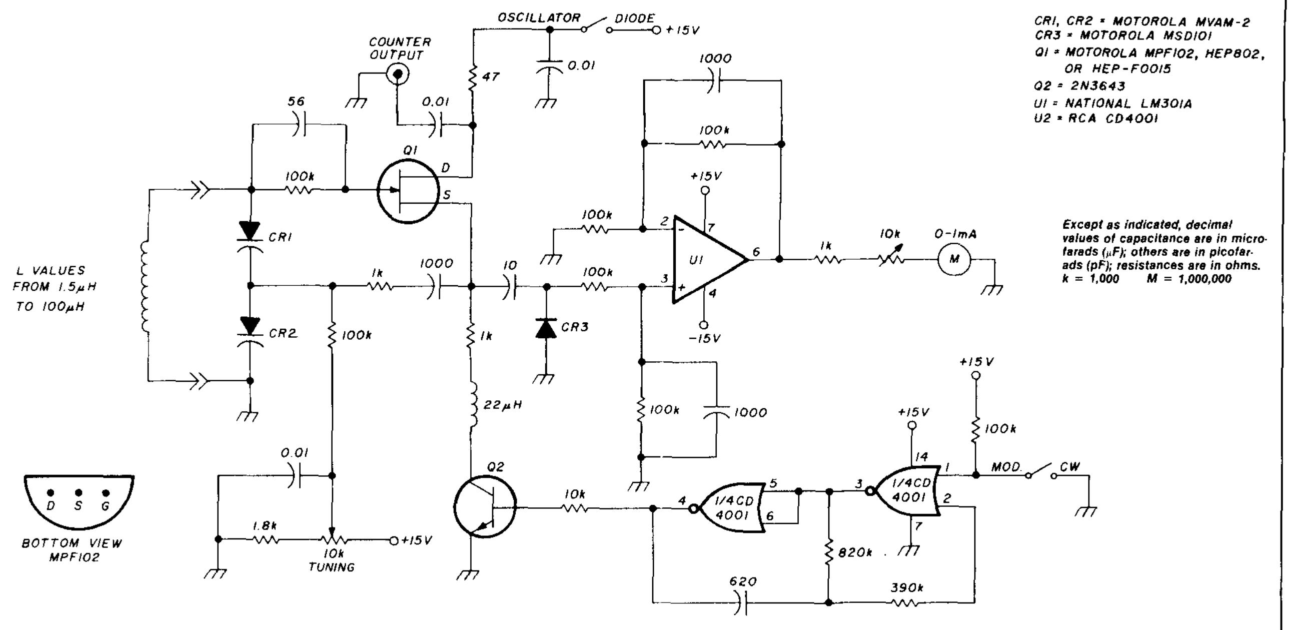

fig. 7. Varicap-Tuned FET-dip meter with 1-kHz modulation.

time is perhaps right to dispense with the calibration dial on the modern dip meter. Once this step has been taken, it is only a logical, short jump to replace the tuning capacitor with varicaps and use a remote dc pot to tune the dip oscillator, since no calibration scales are now needed. If the counter is not desired, the dc pot can be calibrated just as well as could the traditional tuning capacitor dial.

One tempting way to combine voltage-tuning the dip meter and using a frequency counter as a readout would be a microcomputer-controlled dipper. The oscillator varicap input would be a ramp (sawtooth) generated by the microprocessor; the detected dc output of the oscillator would be A to D converted and fed to the microprocessor. The program would sense a point of minimum detection voltage (where the dc slope changes from negative-going to positive-going) and remember the frequency counter digital reading at that point. This system could then simply be placed near the resonant circuit to be measured and the frequency would be read out digitally. The details of oscillator design, programming, integration with a frequency-counter, and provision for multiple dips could be a big development job; but it's certainly a system that seems feasible.

a simple dip meter

As a simple example of how one might build up a voltage-tuned, counter read-out dip meter, the circuit of **fig. 7** is shown. It was built to accept plug-in coils with banana-pins with 3/4 inch spacing; the coils were borrowed for this breadboard circuit from an old tube-type grid-dip meter.

As shown, the circuit operates over the 2-32 MHz range with each coil covering about an octave of frequency. It would probably be worthwhile to have coil units made up with three terminals, so that varicaps are changed with the plug-in coil, to allow for lower minimum capacitance at the higher frequencies, a 2N5197 or other similar VHF FET might also improve things above 32 MHz.

Look at the circuit of **fig. 7**. The 1-kHz square-wave oscillator has been redesigned around a CMOS IC, and the meter's dc amplifier redesigned around an LM301A op amp IC.

references

1. "Grid Dip Meter," *RCA Transistor, Thyristor, and Diode Manual*, SC-15, 1971, section 15-22, page 736.
2. P.A. Lovelock, "Solid State Conversion of the G.D.O.," *ham radio*, June, 1970, page 20.
3. P.A. Lovelock, "Solid State Conversion of the G.D.O.," *ham radio*, June 1970, page 22.
4. C.G. Miller, "Gate Dip Meter That Really Dips," *ham radio*, June, 1977, page 42.
5. L.G. McCoy, "A Field Effect Transistor Dipper," *QST*, February, 1968, page 24.
6. Frans Bruin, "A Dual Gain MOSFET Dip Meter," *QST*, January, 1977, page 16.
7. Fred Brown, "A Band-Switching Grid-Dip Meter," *CQ*, February, 1966, page 60.
8. Fred Brown, "A 1980 Dipper," *QST*, March, 1980, page 11.

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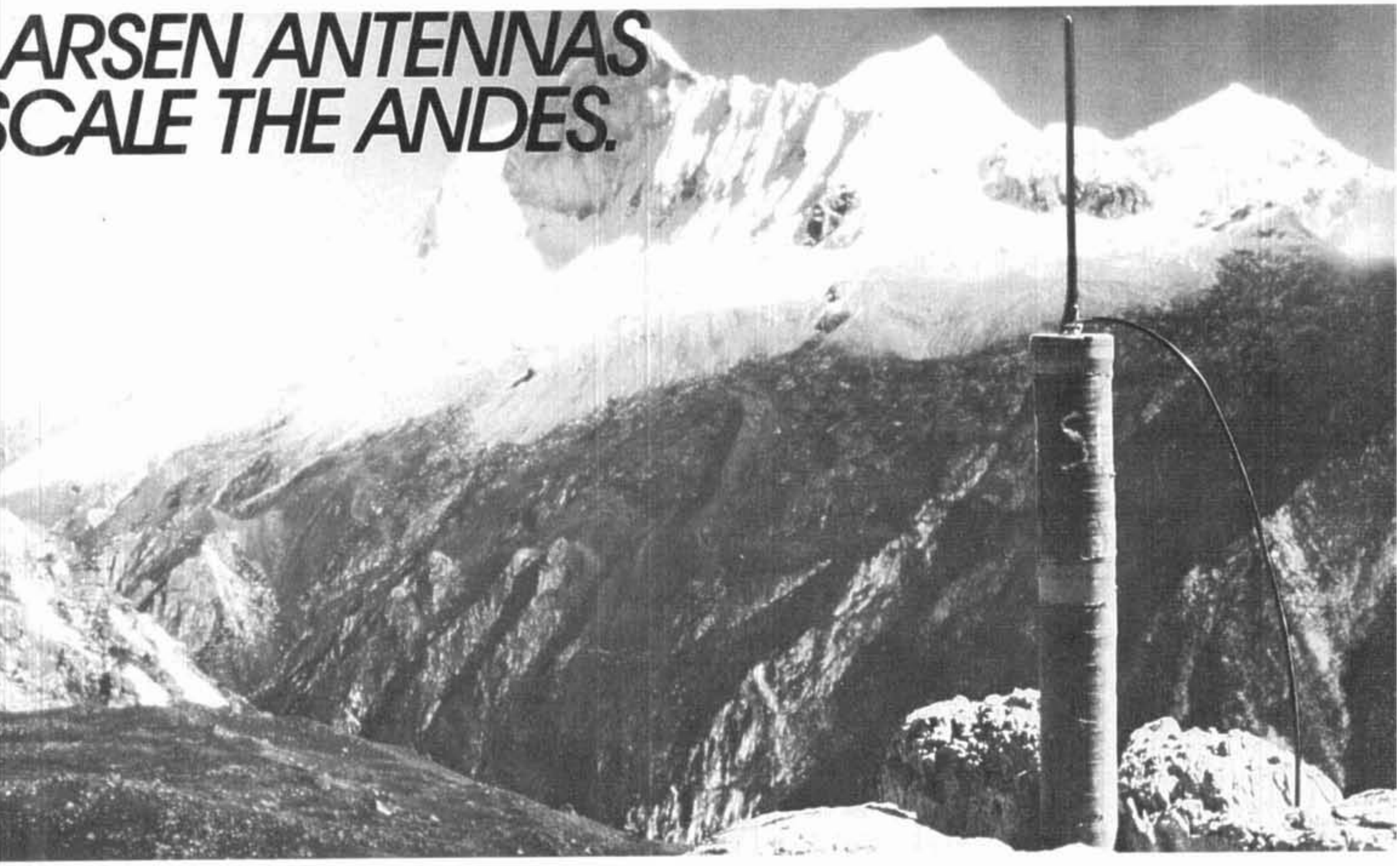

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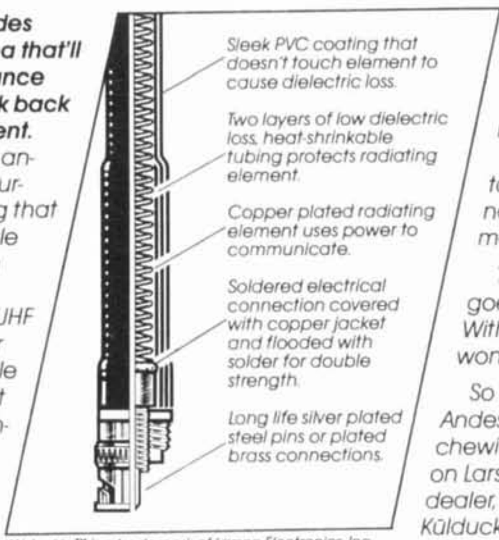

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ham radio TECHNIQUES

Bill Orr W6SAI

The first contact on the air. The first DX contact. The first QSL card. Every Radio Amateur remembers these outstanding events long after other early memories of ham radio are blurred. Sometimes one particular event stands out in the memory, signaling a turn of fortune, a change in the pattern of life — or even a turn in history.

For thousands of Amateurs, the following story is typical of what might have happened some years ago on a date "that will live in infamy."

the greatest DXer in the world

The streetcar gave a long wheeze, as if it were dying, and slowly ground to a halt at the corner. The accordian door creaked open and I jumped out, to be greeted by a swirl of dust and dead leaves stirred up by the ancient vehicle. With a clang of the bell it slowly resumed its journey down the cobblestone street.

Dodging a new Pierce-Arrow, I reached the curb and headed down a sidestreet. I could see Pendergast's house ahead and noted that he'd put up a brand-new Zepp antenna. It ran from the high chimney over to a tree in the back yard. The new copper wires gleamed in the winter sun.

I hadn't seen my friend for over a year. We had both been away at college, and this was the first time we both found ourselves home together. I knew from the few quick notes I'd received from him that he was working on a new DX-type transmitter. Now, he'd gotten home a few days ahead of me and possibly was already on the air.

I hastened my steps and trotted up the gravel walk. It was only a few steps to the wooden porch, which looked cold and empty. The summer lawn swing and folding chairs had long ago been put away for the winter and the storm windows were already up, even though the weather had been unusually warm for early winter.

Through the glass door I saw Pendergast's sister. She was sitting on the davenport, listening to a symphony on the radio. She was wearing an angora sweater, plaid skirt, bobby sox, and white loafers. I thought to myself, "Little sister is growing up."

"Hi, Miriam, long time no see," I said as she answered the door.

Miriam was going to be a knockout in a few years, I mentally noted. It would be fun to date the sister of a fellow Radio Amateur.

After a few pleasantries, Miriam motioned for me to go upstairs to the radio room, and she returned to the symphony, curling up once again on the davenport.

"Come on up," yelled Pendergast from the rear bedroom. I bounded up the stairs, two at a time, and saw my friend. He looked quite a bit older and had grown a mustache. He had on a white sweater with a big letter *C* on it. He looked very collegiate.

"Good to see you," said Pendergast, shaking my hand warmly. "Come into the shack and bring me up to date . . . and, incidentally, look at my new DX rock crusher."

I followed Pendergast into what had once been his bedroom. How things had changed! Gone was the push-pull 210 TNT oscillator on 40 meters. Gone was the National SW-3. Down from the wall were all of Pendergast's cherished QSL cards from the stations he had worked while he was in high school. The wall was blank now.

Replacing all of the old gear was a brand-new National HRO receiver on the operating table and a new, gleaming transmitter sitting to one side on a small table. And there was a chromium-plated bug key on the table next to the receiver.

"You look older," said Pendergast, giving me a penetrating glance.

"I feel older," I replied. "That damned course in Descriptive Geometry last semester nearly finished me off. I pulled a *D* in it."

"I don't know why we have to study that stuff for an Electrical Engineering degree," Pendergast said. "Anyway, I'm running a good B-plus average so I can't complain."

Pendergast sat down in his operating chair and sighed.

"Is the transmitter ready to play?" I asked.

Pendergast smiled. "Yep," he said. "And 20 meters seems to be pretty good. I heard Guam this morning. Boy, could I use a KB6!"

"You have plenty of room on the wall for DX QSLs," I noted. "Now, suppose you tell me about this transmitter. It looks beautiful."

"Doesn't it?" said Pendergast. "I've worked on it night and day for two weeks to get it going in time for this vacation. Here's the circuit." (See **fig. 1.**) He handed me a large, white sheet with a carefully drawn schematic on it.

"Watch my lips as I explain everything and you'll understand all," he joked.

My friend flipped a switch and the filaments of the transmitting tubes lit up.

"O.K. Now, over here is a 6F6 metal-tube crystal oscillator on 7199.75 kilocycles. I am using a variable crystal so I can QSY from 14,390 to about 14,405 kilocycles."

"Plenty of DX to work outside the band edge," I remarked.

"No, no!" said Pendergast. "I have the band edge marked on the knob of the crystal with ink. No problem, there. Anyway, after the oscillator stage I have an 807 doubler to 20 meters."

"Were you able to tame the 807? It's a tricky tube," I remarked doubtfully.

"No problem. My double-E lab instructor is a ham and he told me to place a parasitic choke in the plate lead. It's a new idea and it really works."

I examined the tiny choke hanging

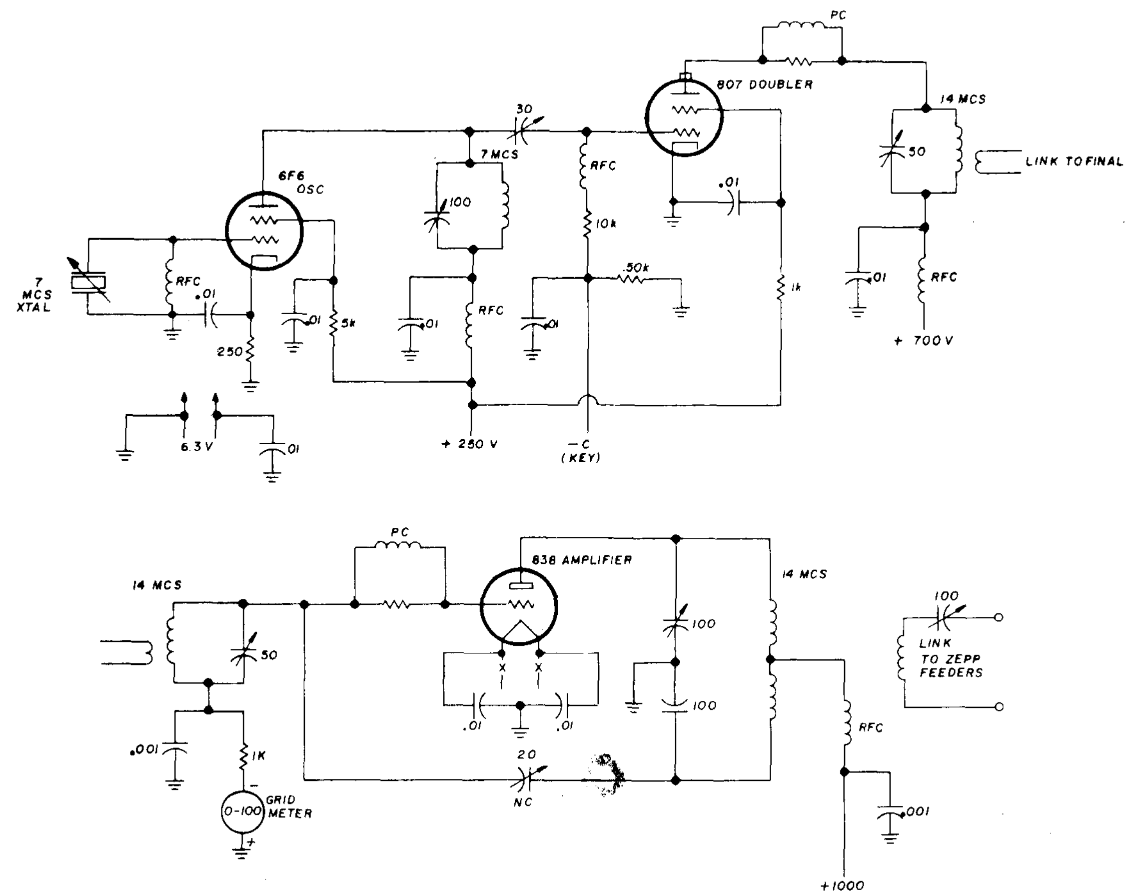

fig. 1. The 1941-model 20-meter DX transmitter. This transmitter delivers over 100 watts CW crystal controlled, on 20 meters. Representative component values are marked on the schematic. Pendergast built his transmitter in two sections. The 6F6 oscillator and 807 doubler were built on a small aluminum chassis. A variable crystal was used for quick frequency change. This was accomplished by a special crystal holder that had a variable air gap between the crystal blank and one holder plate. Adjusting the top plate changed crystal frequency. The 807 was keyed in the bias circuit. Cutoff bias was applied to the 807 and was removed when the key was closed. Pendergast soon found that a more complex keying system that reduced screen voltage under key-up conditions was required — otherwise a small back wave was heard in the keying intervals between characters.

The exciter was link coupled to the final amplifier stage, which was built on a separate aluminum chassis. Coaxial cable was generally unavailable in the 1940s, so Pendergast used twisted lamp cord for his link line. The 838 zero-bias triode was a forerunner of today's modern "grounded grid" tubes, such as the 3-500Z and the 8877. In this circuit, it was grid driven and plate neutralized. The split-stator tank circuit was coupled to a simple series-tuned circuit in the open-wire feeders to the end-fed Zepp antenna mounted high atop Pendergast's roof.

Want to build an old-time DX transmitter? This circuit will work today for you!

from the plate cap of the 807.

"Maybe the reason the 807 has such a bad reputation is that it goes into a parasitic oscillation," I guessed.

Pendergast ignored my remark and hurried on. "I have link coupled the 807 to the final amplifier, which is an 838 tube, one of those new zero-bias triodes. A really great tube. No bias required at all. So I key the 807 and the 838 goes along for the ride."

"Look at it!" said Pendergast with pride. "The 838 has 100 watts of plate dissipation. I run it at 1000 volts and nearly 200 mils plate current. Just about 200 watts input. And with the link coupling to the 807 I get plenty of grid drive."

"How is it to neutralize?" I asked.

"No problem. I just apply excitation with plate voltage off and watch the grid meter as I increase neutralizing capacity. When I can turn the plate tank condenser all the way around without a kick in the grid current, it is completely neutralized."

"Very good," I admitted. "I see you are using a split-stator tank circuit."

"Yep," said Pendergast. "And now I think it's about time to fire up and work some DX before the band goes dead for the evening."

Pendergast turned on the receiver and soon I could hear the crystal note of the oscillator's harmonic on 20 meters. He closed the side contact on the bug and quickly tuned the 807 to resonance. The note in the receiver grew intolerably loud. Pendergast flicked the rf gain control and my ears returned to normal.

I noticed my friend tuned his transmitter like a pro. Now, he quickly neutralized the final and adjusted the variable link coupling. Then he reached down and threw another switch. With a growl the power supply came to life, the 866s casting a blue tint across the lower portion of the panel. Pendergast retuned a bit, fussed with the antenna coupling and then said, proudly, "We're on the air. How about a little DX now?"

"Suits me fine," I replied. "What do you hear?"

Pendergast gestured to a second pair of headphones. "Let's tune the band," he said.

I donned the extra phones and listened. It had been almost a year since I had been on the air, and I was sure my CW was rusty. Pendergast tuned through a bunch of W9s and W6s as he approached the edge of the band.

"Listen!" Pendergast whispered to me. I closed my eyes to concentrate better.

"CQ . . . CQ . . . CQ . . ." Who was it? I opened my eyes and looked at my friend. "Certainly sounds DX-y," I said. "Listen to that fade on him."

The station faded into the noise and then started to come up again. It was a chirpy note, with a bit of an echo on it. Finally after an interminable wait, it signed:

"CQ de KF6ROV . . . KF6ROV . . . KF6ROV"

Pendergast grabbed a late copy of *QST* and rapidly flipped the pages until he came to the DX column.

"KF6 . . . KF6," he muttered to himself. "Who is *that*? Almost instantly he answered his own question.

"KF6 . . . that's *Baker Island*! Baker Island in the *Pacific*!"

"What a long CQ," I muttered. "By the time he signs, every ham in the world will be here."

"CQ de KF6ROV . . . KF6ROV . . . KF6ROV . . . K"

"Go get him, buddy-boy," I yelled.

Pendergast fired up the rig and reached for his key.

Out of the corner of my ear I heard a commotion downstairs. Miriam was calling something to us. There were excited voices talking back and forth. Hurried voices on the radio.

I looked at Pendergast. He was calling the KF6 now with his left hand and writing in the log with his right. Now, he was standing by. The earphones came to life.

We listened to the background noise for a second. Pendergast frowned as he heard his sister calling loudly to him as she ran up the stairs. Suddenly, there was the KF6. Calling Pendergast.

My friend let out a whoop and started to write in the log as Miriam burst into the room. Her face was white and she shook Pendergast by the shoulder as he wrote. I glanced in the log. Pendergast had just written: *December 7, 1941*.

The Japanese attack came just about sunrise, Hawaiian time, or about 1 o'clock EST. One of the first radio announcements was made by breaking into the New York Philharmonic Orchestra broadcast to announce the news flash.

Amateur Radio operation continued for a day or so. Many ham contacts were made with Hawaii, and confused reports of the raid filtered back via Amateur Radio and were picked up in the newspapers. On Monday, the FCC met in a special session and issued the following:

Order No. 87

At a session of the Federal Communications Commission held at its offices in Washington, D.C., on the 8th day of December, 1941;

Whereas a state of war exists between the United States and the Imperial Japanese Government, and the withdrawal from private use of all Amateur frequencies is required for the purpose of the National Defense;

IT IS ORDERED, that except as may hereafter be specifically authorized by the Commission, no person shall engage in any Amateur Radio operation in the Continental United States, its territories and possessions, and that all frequencies heretofore allocated to Amateur Radio stations under Part 12 of the Rules and regulations, BE, AND THEY ARE HEREBY, WITHDRAWN from use by any person except as may hereafter be authorized by the Commission.

By order of the Commission:
T.J. Slowie, Secretary

ham radio

how important is low SWR?

This controversy is put to rest once and for all

What, exactly, is the meaning of SWR? What significance does SWR have in Amateur Radio applications? Is a low SWR important?

This subject has always been a popular topic for discussion, and one ham may tell you something completely different from another. This article is written to tell you the facts about SWR. Then, you should be able to determine whether or not you should try to improve the SWR of your antenna system, or perhaps change to a better feed line. (Chances are quite good that you won't have to do anything at all to your present system!)

definition of SWR

When asked exactly what SWR is, many people will answer with something like, "Well, SWR is what you get a reading of when you hook up an SWR meter to your feed line." Then, although they have just admitted they don't know what SWR is, they'll probably add, "If it's more than 1.5:1, it's bad."

SWR is the relationship, or ratio, between the maximum and minimum currents and voltages along a transmission line; hence its name: standing-wave ratio. Ideally, the current and voltage are constant all along a transmission line. This ideal condition occurs when, and only when, the load (antenna) and the line have *equal impedances*. However, this ideal situation is seldom the case in this imperfect world of ours. More often than not, the load and line have impedances that are different — sometimes by quite a lot.

When the load and the line have *different impedances*, the current and voltage distribution along the line is not uniform. In some places the voltage will be high, and in other places it will be low; the same is true of the current. The VSWR (voltage *standing-wave ratio) is the ratio of the highest voltage on the line to the lowest voltage on the line.* When talking about SWR, it is generally understood that we are talking about VSWR, although the current standing-wave ratio is theoretically the same.

The SWR is also the relationship between the antenna, or load, impedance, Z_L, and the characteristic impedance of the line, Z_O. Mathematically it gets rather complicated, but if the load is resistive, SWR is the ratio Z_L/Z_O or Z_O/Z_L (whichever is greater than 1).

Often, you'll see SWR given as a ratio, such as 3:1. However, since 3:1 simply means 3/1, mathematically we might just as well do away with the "1" and say that the SWR is 3. (Any number divided by 1 is just the number, right?)

reflected power

Nowhere is the SWR misconception more widespread than with respect to "reflected power."[1] To understand what this really is, we must first know what power is. Power is defined as the rate at which energy is expended. Direction has nothing to do with power. Power is just dissipated someplace or places. In an antenna system, most of the power is dissipat-

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ed, one hopes, as radiation. Some power is dissipated as heat in the transmitter final-amplifier tank coil, some is dissipated in the feed line, and some is dissipated in objects surrounding the antenna.

Reflected power is, literally, what a directional wattmeter reads when put in the reflected power mode! Reflected power is *not* a force (expended energy) moving toward your rig from your antenna.

Even though reflected power is somewhat fictitious, being caused as a wattmeter reading only because of certain phase relationships and ratios between feed-line currents and voltages,[1] it is very useful in certain antenna calculations. That is, *if* it is properly interpreted.

forward power

If reflected power is a fictitious invention because power has no direction, the same is true of "forward power." The reading on a directional wattmeter in the forward-power mode is the sum of the actual transmitter output power and the "reflected power."

If you have ever used a directional wattmeter and observed that your transmitter was putting out 170 watts for a dc plate input of 200 watts, did you conclude that your rig was 85 percent efficient? If you did, you were probably wrong. (You know, of course, that 85-percent efficiency is virtually unheard of, even with class-C amplifiers.) Most likely, your SWR was high, causing an inflated "forward-power" reading. The actual output of the transmitter is the difference between the "forward power" and the "reflected power." (Think about it!)*

The relationship between the forward and reflected readings on a directional wattmeter is a function of the SWR. **Fig. 1** illustrates this function.

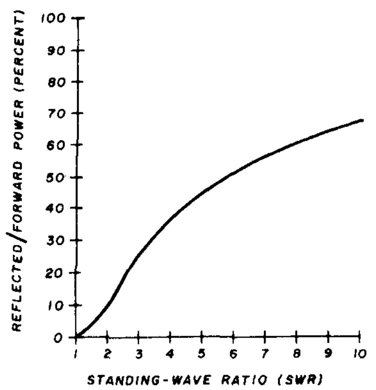

fig. 1. Relationship between SWR and the percentage of "forward power" that is "reflected."

problems a high SWR may cause

A high SWR can, and sometimes does, cause certain problems. These problems include damage to the feed line, damage to transmitter components, reduced transmitter power output, and increased harmonic output. Let's discuss these one at a time.

The transmission line. Coaxial feed line in particular, and also certain other types such as TV ribbon line, can withstand only so much current and voltage. If the current becomes too high, the conductors will get so hot that they melt the dielectric material. If the voltage gets too high, arcing may occur between the conductors, again damaging the dielectric. This kind of problem rarely happens with power input levels of under 200 watts; but if you plan on using a kilowatt, you had better consider this possibility. For a given power level, the higher the SWR, the higher the observed current and voltage will be. If you're using RG-58/U or TV-type twin lead, *don't* use a power input over 200 watts. If you're using RG-8U with a kilowatt, beware if the SWR is more than 5.

Depending on the exact length of the transmission line, you might have a current or voltage maximum at your transmitter. Excessive current can cause the transmitter tank coil to overheat and become damaged. Excessive voltage can cause arcing in the output loading capacitor. Usually this problem occurs only with transmitters that have wide-range pi networks with components that aren't sufficiently rugged. It's also quite rare for SWR values of less than about 4; but it can still happen.

Components. Solid-state transmitters are often designed to work into a 50-ohm nonreactive load and have no matching circuits to compensate for other loads. With some of these rigs, there is an "SWR pro-

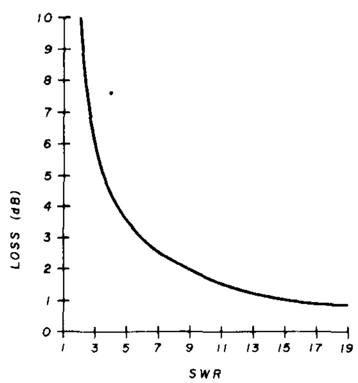

fig. 2. Determining the matched-line loss for old transmission line. Short circuit the far end of the line and measure the SWR at the input. The graph shows the relationship between SWR and matched-line loss.

*The power from the transmitter into the line is the sum of a) the power lost in and from the line and in any additional matching or other devices inserted into the line and b) the power delivered to the antenna (from reference 1).

table 1. Loss per foot, under perfectly matched conditions (SWR = 1), of various types of transmission lines commonly used by Amateurs. Accuracy is to two significant digits. (*1 foot = 3.05 meters.*)

cable type	characteristic impedance (ohms)	loss per foot, (dB) frequency (MHz) 3.5	7	14	21	28
RG-58/U*	52	0.0070	0.0100	0.0150	0.0190	0.0230
RG-59/U*	75	0.0065	0.0090	0.0130	0.0160	0.0180
RG-62/U*	93	0.0050	0.0072	0.0100	0.0130	0.0150
RG-11/U*	75	0.0038	0.0055	0.0080	0.0100	0.0120
RG-8/U*	52	0.0031	0.0045	0.0065	0.0081	0.0095
TV ribbon lead	300	0.0020	0.0030	0.0042	0.0054	0.0061

*Values are nominal since there are no set standards for commercial coax.

tection" circuit built in, but with many solid-state final amplifiers, damage can occur with an antenna system that presents a high SWR. If you have a solid-state rig, check your instruction manual to see if the final is "SWR protected." If it is not, check to see how high the SWR can be without risking damage to the output transistor(s), and be sure the SWR *is not above this limit*!

Output. Most commercially manufactured rigs will function all right if the SWR is less than 2 or 3. Some, with no output loading network, may tolerate an SWR of only 1.5 before power output is degraded. Certain of the older-vintage radios will compensate for SWR levels up to 5 or even 10. The radio's instruction manual should tell you how high the SWR can get before power output is degraded. If the SWR is beyond this limit, the final amplifier will not operate at full efficiency because the impedance mismatch will be too severe. If your loading control must be set to one extreme or the other to get a semblance of proper final-amplifier tuning, the SWR is too high for the circuit.

Harmonics. If the loading capacitor must be set all the way to maximum and you still can't get the transmitter to tune to the required power input level, you're being forced to under-load the transmitter. This can cause increased harmonic output, because under-loading causes nonlinearity in the final amplifier.

Of these problems, three can be eliminated by using a transmatch at the transmitter output. A "perfect" impedance match will then be presented to the transmitter. The transmatch will normalize the currents and voltages in the transmitter tank circuit, thus maximizing energy transfer and preventing under loading. The possibility of feed-line damage still remains, however, (as explained previously) unless the transmatch is placed at the point where the line feeds the antenna. This is generally not very convenient.

problems a high SWR doesn't cause

A high SWR, by itself, will *not* make a feed line radiate, and will *not* make an antenna less efficient. A perfectly matched feed line may radiate, and may be terminated by a grossly inefficient antenna (for example, a dummy load!). These problems are *not* related to SWR. If the transmitter can be properly loaded, a high SWR will *not* cause radio-frequency interference (RFI) that would not otherwise occur.

Surprisingly enough, at high frequency, a high SWR will generally not cause very much loss of signal. With several hundred feet of RG-58/U at 28 MHz and an SWR of, say 20, there will admittedly be a lot of loss because of the SWR. But this is an extreme case. In ordinary applications, the SWR can be surprisingly high before serious signal loss occurs.*

We will now investigate this phenomenon quantitatively. With the following information, you will be able to:

1. Determine how much signal loss your SWR is causing.

2. Find out whether or not it is significant.

3. Tell whether changing the feed line type, such as from RG-58/U to RG-8/U, is worth it, and perhaps

4. Save a lot of time, energy, money, and grief.

matched-line loss

Table 1 shows the loss in dB per foot for the most common types of transmission lines used by Amateurs. The numbers in **table 1** are based on perfectly matched systems; thus the antenna must have a pure resistance of 52 ohms for RG-8/U and RG-58/U, 75 ohms for RG-59/U, and 300 ohms for TV ribbon, for these data to be correct. However, the

*Consider the end-fed Zepp antenna of 50 years ago. These antennas were efficient even with an SWR of 10 or more. **Editor** table 2. Actual SWR as a function of matched-line loss (vertical) and the apparent SWR (horizontal). SWR values greater than 10 are indicated by x. SWR values above 6 are accurate to about ±0.5.

line loss matched (dB)	apparent SWR (at transmitter) 1.0	1.2	1.4	1.6	1.8	2.0	2.5	3.0	4.0	5.0	6.0	7.0
0	1.0	1.2	1.4	1.6	1.8	2.0	2.5	3.0	4.0	5.0	6.0	7.0
0.2	1.0	1.2	1.4	1.6	1.9	2.1	2.6	3.1	4.2	5.5	6.8	8.0
0.4	1.0	1.2	1.4	1.7	1.9	2.1	2.7	3.4	4.7	6.3	8.0	9.5
0.6	1.0	1.2	1.5	1.7	2.0	2.2	2.9	3.7	5.2	7.6	10.0	x
0.8	1.0	1.2	1.5	1.7	2.0	2.3	3.1	4.0	6.0	9.0	x	x
1.0	1.0	1.2	1.5	1.8	2.1	2.4	3.3	4.3	7.0	x	x	x
1.2	1.0	1.3	1.5	1.9	2.2	2.6	3.6	4.8	8.3	x	x	x
1.4	1.0	1.3	1.6	1.9	2.3	2.8	4.0	5.5	9.9	x	x	x
1.7	1.0	1.3	1.6	2.0	2.5	3.0	4.3	6.5	x	x	x	x
2.0	1.0	1.3	1.7	2.1	2.8	3.3	5.3	8.4	x	x	x	x
2.5	1.0	1.4	1.8	2.4	3.2	4.0	8.0	x	x	x	x	x
3.0	1.0	1.4	1.9	2.7	3.7	4.9	9.8	x	x	x	x	x
3.5	1.0	1.4	2.1	3.1	4.6	6.9	x	x	x	x	x	x
4.0	1.0	1.5	2.3	3.7	6.0	10.0	x	x	x	x	x	x
4.5	1.0	1.6	2.6	4.7	7.9	x	x	x	x	x	x	x
5.0	1.0	1.8	3.0	6.0	x	x	x	x	x	x	x	x
5.5	1.0	2.0	3.4	8.5	x	x	x	x	x	x	x	x

information in **table 1** is essential for determining the SWR loss in your system — so get it down.

For example, suppose you are using 60 feet of RG-58/U at 7 MHz. The loss is 0.01 dB per foot, so the total loss under perfectly matched conditions is 0.01 x 60 or 0.60 dB.

If your SWR happens to be 1, then you already know what the feed line loss is. You thus have no use for **tables 2** and **3**. But if the SWR is not 1, there will be additional loss in the line. This additional loss is *sometimes called "SWR loss."*

Incidentally, the data in **table 1** are for brand-new cable. Coaxial cable gets lossier with age. Some types are better in this regard than others. Generally *the foam dielectric type deteriorates faster than the* solid dielectric type. There is a way to check old transmission line to find out what the loss really is. Short-circuit the far end of the line and place an SWR

table 3. Additional loss caused by standing waves. Find the line loss when perfectly matched in the vertical column; read across for the actual SWR. Find the figures *that are closest to yours if yours are not exactly represented.* Conditions above and to the left of the heavy line indicate an SWR loss of less than 1 dB.

line loss matched (dB)	actual SWR (at antenna) 1.0	1.5	2.0	2.5	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
0	0	0	0	0	0	0	0	0	0	0	0	.0
0.2	0	0	0.1	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.7
0.4	0	0	0.1	0.2	0.2	0.4	0.5	0.7	0.8	1.0	1.1	1.3
0.6	0	0	0.1	0.2	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.7
0.8	0	0	0.2	0.3	0.4	0.7	0.9	1.2	1.5	1.7	1.9	2.1
1.0	0	0	0.2	0.3	0.5	0.8	1.2	1.4	1.7	1.9	2.2	2.5
1.2	0	0	0.2	0.4	0.6	1.0	1.3	1.7	1.9	2.2	2.5	2.8
1.4	0	0	0.3	0.4	0.6	1.1	1.5	1.8	2.1	2.4	2.7	3.0
1.7	0	0	0.3	0.5	0.7	1.3	1.7	2.0	2.3	2.6	3.0	3.3
2.0	0	0.1	0.3	0.5	0.8	1.3	1.8	2.1	2.5	2.8	3.2	3.6
2.5	0	0.1	0.3	0.6	0.9	1.5	1.9	2.3	2.8	3.1	3.5	3.7
3.0	0	0.1	0.4	0.6	1.0	1.5	2.0	2.5	2.9	3.2	3.7	4.0
3.5	0	0.1	0.4	0.7	1.1	1.6	2.1	2.6	3.1	3.4	3.8	4.1
4.0	0	0.1	0.4	0.7	1.1	1.7	2.2	2.7	3.2	3.5	3.9	4.2
4.5	0	0.1	0.4	0.7	1.1	1.7	2.3	2.8	3.2	3.6	4.0	4.3
5.0	0	0.1	0.4	0.8	1.2	1.8	2.3	2.9	3.3	3.7	4.1	4.4
5.5	0	0.1	0.5	0.8	1.2	1.8	2.4	2.9	3.3	3.8	4.2	4.5

meter at the transmitter output. Measure the SWR with a small amount of power. **Fig. 2** shows the relationship between SWR and perfectly matched line loss for this method.

The concept of reflected power is useful for obtaining the data for **fig. 2**. With a short circuit at the antenna end of the line, we may assume that 100 percent of the power is reflected, since a short circuit cannot dissipate power. Then, based on the SWR versus reflected power function, we can figure out what proportion of the power "came back" to the SWR meter to be registered as reflected power. The remainder was dissipated as heat in the line.

actual and apparent SWR

Most hams measure their SWR in the station at the transmitter output. However, measuring it at this point does not give an accurate reading. The *actual* SWR, the quality of the match between the antenna and the feed line, must be measured at the antenna if an SWR indicator is to give accurate results. The reading you get in the station is the *apparent* SWR, and is always less than the actual SWR. Sometimes the difference is considerable.

To accurately determine the SWR loss in your feed line, you need to know the actual SWR. This can be found out, of course, by climbing your tower or renting a "cherry picker" and physically placing an SWR indicator at the proper point. But there is an easier way.

If you know the line loss under perfectly matched conditions (from **table 1** or **fig. 2**), **table 2** will give you the actual SWR as a function of the apparent SWR.

Once you know the actual SWR as well as the line loss under perfectly matched conditions, you are ready to find the SWR *loss* — the extra feed line loss caused by standing waves on the line.

is it significant?

Use **table 3** to determine the SWR loss in your feed line. Does the result surprise you? How do you know whether or not it is significant?

In general, if the SWR loss is less than 1 dB, you are wasting your time by striving for a perfect match. A change in signal strength of 1 dB is recognized as the smallest detectable change; therefore, in practice, anything less is nothing. A gain of less than 1 dB will not be detected by the other station under any conditions. In **table 3**, the heavy black line differentiates between significant SWR losses (lower right) and those that are not significant (upper left).

Just because you have an SWR loss of less than 1 dB does not mean that you have a good antenna. It simply means there is no point in trying to get a better match with the existing feed line. A 2000-foot (*1 foot = 0.305 meter*) run of RG-58/U at 21 MHz will be very lossy even if the SWR is 1. A 3-foot loaded vertical without radials at 3.5 MHz will have a lot of inductor and ground losses, even if it displays an SWR of 1. A small SWR loss does not make up for a poor antenna or feed line system.

The data here can be used to determine whether or not it is a good idea to change your feed line. Suppose, for example, that you are using 300 feet of RG-59/U with an antenna having a pure resistive impedance of 75 ohms, so the SWR is 1. At 21 MHz there will be 4.8-dB loss in the line (**table 1**), although none of it is attributable to the SWR. Would it be worthwhile to change to RG-8/U, which has a 52-ohm characteristic impedance?

Using **table 1**, note that 300 feet of RG-8/U has 2.4 dB loss at 21 MHz. The SWR using this cable will be 1.5 (75/52), so there will be some SWR loss. How much? **Table 3** tells us it will be only 0.1 dB, giving an overall feed-line loss of 2.5 dB. This is an improvement of 2.3 dB over the perfectly matched run of RG-59/U! A change of 2.3 dB is fairly significant. If money is no object, this change would be worthwhile.

The above is a rather unusual example, but in addition to showing you how to use these data, it illustrates another point as well: feed line loss is not a simple direct function of SWR.

conclusion

For all practical purposes, an actual SWR of 2.5 or better is just as good as a perfect match, as far as loss is concerned. This is apparent from examining **table 3**. So next time you try out a new antenna, don't throw your hands up in dismay and declare that it is no good just because your SWR meter reads 1.7!

The data presented here are primarily intended for the DXer or contester, since optimum antenna performance is especially important for them. Actually, a good antenna is important in any ham station. Of course we should try to optimize antenna systems. But there is a point of diminishing returns. The fear of an SWR that's not perfect or near perfect can take the fun out of hamming — not because there is anything actually wrong, but because you *think* there is. Now you know the real story. If your SWR loss is less than 1 dB and you're using the best grade of feed line you can, you have no more excuse not to get on the air and start operating!

reference

1. For a detailed discussion of reflected power, see: Hubert Woods, "Power in Reflected Waves," *ham radio*, October, 1971, page 49. Also see "Comments," *ham radio*, December, 1972, page 76.

ham radio

Amateur Radio equipment survey: synthesized 2-meter hand-helds

High-frequency rigs have received all of the attention in the *ham radio* equipment surveys thus far, and so the editors have decided that it's about time to let VHFers have a voice. This month, *ham radio* is surveying its readers' opinions of five of the most popular 2-meter hand-helds. The five are the Santec HT-1200, Tempo S-1 and S-5, ICOM IC-2A and 2AT, Yaesu FT-407, and Kenwood TR-2400.

All of these radios are frequency-synthesized, and all of them have now been around long enough for Amateurs to have had a chance to put them through their paces and come up with a fair appraisal. Two-meter portables have become enormously popular in recent years, thanks mostly to the technological innovations that have made possible PLL synthesizers, multi-channel memories, and — just as important — reasonable prices. Attend any ham convention and you'll see just how well-liked these hand-helds really are: they're everywhere.

The information that we're requesting is designed to help us get the clearest picture possible of what the owners of these radios think about them — what kind of problems they've had, what they think the best features are and what the worst. If you own or have owned one of these radios, please take the time to fill out the questionnaire. Only that way will other Amateurs be able to take advantage of your experiences.

The results of this survey will be published as soon as all of the results have been received and tabulated. It is not mandatory that you give your name and call, although we like to know who has replied. By checking the box marked *Yes* underneath your signature, you will be giving *ham radio* permission to quote from your comments and use your callsign. If you choose to check *No*, your wishes will be respected and your callsign will not be used. Those who do not wish to remove pages from their magazine are urged to photocopy the questionnaire, or send a stamped, self-addressed envelope to *ham radio*, Greenville, New Hampshire 03048; we will send you a copy.

Please mail in your completed form, one for each radio you want to report on, no later than September 30. Questionnaires received after that date may not be used. The readers of *ham radio* have always, in past surveys, been eager to let other hams in on their experiences with Amateur equipment — to let a fellow ham in on a good deal or warn him away from a bad one. Here is another chance to lend a hand to a fellow Amateur.

ham radio

Owner's Report on 2-Meter Synthesized Hand-helds

(Please report only from your own experience. Type or print clearly. If you own more than one of these hand-helds, please use a separate report form for each.)

1. Make and Model (please circle the exact unit you are reporting on).

   SANTEC HT-1200 — TEMPO S-1, S-5 — ICOM IC-2AT, IC-2A — YAESU FT-207 — KENWOOD TR-2400

2. What year did you buy it? ________ New? ________ Used? ________
3. Where did you buy it? Dealer________ Mail Order________ Individual________ Flea Market________

   800 Number________ Other________

4. Would you buy from the same source again?________
5. Amount of use: Daily________ Often________ Occasional________ Seldom________
6. Is this your primary________or backup________2-meter fm rig?
7. What is the rig's best feature?________
8. Worst feature? ________
9. Have you had any problems?________ Explain ________
10. Have you had the rig serviced?________ Where? Manufacturer________ Dealer________ Other________
11. Was the service satisfactory? Yes________ No________
12. What accessories have you purchased for this rig? ________
13. Have you been able to obtain all the accessories and parts you need? ________
14. Have you been satisfied with these accessories? Yes________ No________
15. If not, why? ________

16. Additional features you would like to see built into a rig of this type ______________________

____

____

____

17. Give the equipment a score from 1 to 10 (with 1 being poorest, 4 to 6 average, and 10 perfect).

Ease of operation ______________

Reliability ______________

Durability
(in continuous use) ______________

Instruction Book ______________

Factory/Dealer Service ______________

Quality of Workmanship ______________

Performance ______________

Maintenance ______________

Parts Availability ______________

Accessories
(ease of connection) ______________

Price ______________

Flexibility ______________

18. Would you buy this same rig again? ______________

19. What rig would you like to see reported on in the future? ______________

20. How long have you been licensed? __________ Your Age __________ License Class ______________

21. (Optional: fill in the following only if you wish.)

Submitted by: Name ______________ Call ______________

Address ______________

City ______________ State ______________ Zip ______________

____
(Signature)

(Your signature authorizes *ham radio* to quote portions of your comments in our report.) May we use your name and/or call?

Yes __________ No __________

Completed survey forms must be returned no later than September 30, 1981, to be included in our report.

Mail To: Ham Radio Owner's Report on 2-Meter Hand-helds, Greenville, NH 03048

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by Bob Heil, K9EID

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the weekender

dual voltage surge-protection circuit for high-voltage power supplies

The circuit described here features dual output voltages with current surge protection. I developed the circuit so I could obtain, from one dc source, 2000 volts dc for my 3-500Z and 4000 volts dc for a 4-1000A linear amplifier conveniently and at minimum cost.

circuit description

Because of the very large secondary filter capacitor (or capacitors) in a linear amplifier power supply, it's necessary to apply voltage *slowly* to this capacitor to prevent tremendous current surges, which could destroy the power supply components. See **fig. 1**.

When the high-voltage power supply is first turned on, the filter capacitor presents a short circuit. This low impedance is reflected back through the high-voltage power transformer, T, and short circuits the coils of relays RY1 and RY2. The contacts of these relays are normally open, and resistors R1 and R2 decrease the 110 volts. As the filter capacitor charges, the voltage drop across resistors R1 and R2 decreases. When the voltage across the relay coils reaches the pickup voltage of the relays, the contacts of these relays close, shorting out resistors R1 and R2, which applies full voltage to the primary winding of the power-supply transformer.

When the output voltage switch, S2, is set for low voltage (position 1), the same process applies, but only relay RY2 operates. When switching the supply from low to high voltage, the voltage applied to the filter capacitor must again be increased slowly. This action is accomplished by components CR1, C1, R5, and relay RY3. When the power supply is switched from low to high voltage, capacitor C1 retains a voltage across the coil of relay RY3 for a time determined by C1 and the internal dc resistance of the relay coil. (Time constant = RC.)

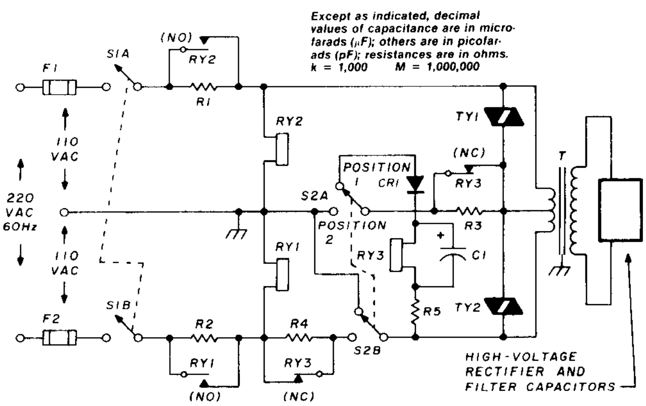


fig. 1. Schematic of the high-voltage primary circuit. Surge protection for power-supply components is provided during the instant of turn-on.

C1	approximately 1000 μF. Adjust value of C1 to set relay dropout time at approximately 2.5 seconds (see text)
CR1	2.5 amp, 1000 V (HEP 170 or equivalent)
f1, f2	fuse according to your supply requirements
R1	25 ohms 40 watts
R2	25 ohms 40 watts
R3	25 ohms 40 watts
R4	25 ohms 40 watts
RY1, RY2	120 V ac relay, SPST, with 25-amp contacts
RY3	dc relay, DPST, with 25-amp contacts
S1	DPST, 15 A contacts; 30 A for 2 kW linear amplifier supply
S2	DPDT, 15 A contacts; 30 A for 2 kW linear amplifier supply
T	high-voltage transformer with 220 Vac c.t. primary, or two 110 Vac primary-winding high-voltage transformers in series. Secondary voltage for your high-voltage requirements
TY1, TY2	6RS20SP5B5 thyrector

parallel combinations can be used. Example: two 50-ohm 20 watts

Since the contacts of RY3 are normally closed, resistors R3 and R4 are short circuited when the voltage across C1 decreases below the dropout voltage of the relay. This action brings the voltage of the filter capacitor to the high output-voltage value. An additional feature of the circuit is that, if a voltage breakdown short circuit should occur in the linear amplifier during operation, relay RY2 and/or RY1 will drop out and provide limited current surge protection.

This circuit has given excellent service. Components for the circuit are not critical as long as each has an adequate current and voltage rating.

bibliography

Marcellino, F.T., W3BYM, "Inrush Current Protection for the SB-220 Linear," (*Weekender*), *ham radio*, December, 1980, page 66.

ham radio

By Edwin Hartz, K8VIR, 108 Hartz Drive, Holly, Michigan 48442

Questions and Answers

Entries must be by letter or post card *only. No telephone requests will be accepted. All entries will be acknowledged when received. Those judged to be most informative to the most Amateurs will be published. Questions must relate to Amateur Radio.*

Readers are invited to send a card naming the question they feel is most useful that appears in each issue. Each month's winner will receive a prize. In addition we will have a drawing of all the voters each month, and that winner will receive a prize. We will also give a prize for the most popular question of the year. In the case of two or more questions on the same subject, the one arriving the earliest will be used.

radio propagation

In the "DX Forecaster" column, mention is made of the terms solar-flux values and geomagnetic-field disturbances. I recognize these as the same as those I hear on WWV at 18 minutes after the hour. Could you explain these and other terms (A index, K index) and how they affect radio-frequency propagation? — Kathleen N. Freeman, KL7IFF

These terms were discussed by Jim Gray, W2EUQ (now W1XU), in the September, 1977, issue of *Ham Radio HORIZONS*. We have had other inquiries on this subject, so it seems worthwhile to explain these terms again.

solar flux and geomagnetic A indexes

For best propagation of radio signals on the high-frequency bands, a relatively high solar flux and low geomagnetic A index are desirable. The solar flux is measured at 2800 MHz and consists of radio noise whose magnitude has proven to be analogous to the magnitude of the energies that excite the E and F layers of the ionosphere. Solar-flux magnitudes range from about 65 to 150 and can be roughly equated to smoothed sunspot numbers and Maximum Usable Frequencies (MUF).

geomagnetic activity A index

This number tells how well the ionosphere has performed with respect to the reflection and absorption of radio signals, or both, particularly in the polar regions. An **A** index of 0-7 means excellent reflection of signals from the ionosphere, whereas an **A** index of 50 or more would indicate that a major magnetic storm is occurring, with severely disturbed, if not disrupted, radio-propagation conditions. Intermediate values indicate the relative condition of the earth's electromagnetic field.

solar K index

Also broadcast from WWV at 18 minutes past the hour, this data is updated every six hours. The **K** index ranges from 0 to 9 and corresponds to the **A** index of from 0 to 50 respectively. **Fig. 1** shows how the various indexes relate to expected radio-propagation conditions.

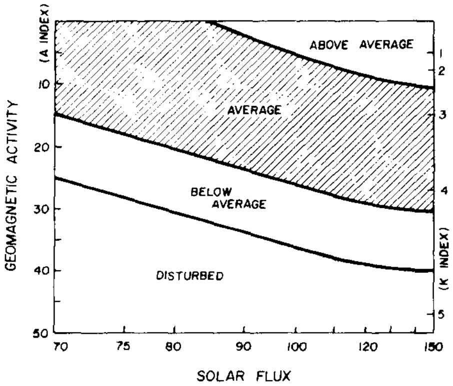


fig. 1. Relationship between geomagnetic and solar flux indexes and their combined effect on ionospheric propagation of radio signals.

tube or solid-state finals?

Would you please outline the primary advantages and disadvantages of tubes versus solid-state final amplifiers? — Lewis I. Hegyi, N2BPO

First, let's talk about power. Tubes are being used in most of today's high-powered linears. Solid-state technology, however, is beginning to produce devices that are capable of furnishing large amounts (several hundred watts) of rf energy. At least three manufacturers of Amateur equipment are now producing solid-state linear amplifiers that are capable of running at or near the Amateur legal limit. But it's probable that tubes will still be around for a while.

One of the advantages of tubes is that they are much more forgiving of mismatched loads. It's pretty hard to damage a tube amplifier when trying to make it work into a load presenting a high standing-wave ratio. A transistor amplifier, on the other hand, will almost certainly be damaged under these conditions unless it has built-in overload protection. Also, tubes are easier to replace than transistors, especially in modern high-density solid-state circuits.

An advantage of solid-state finals is that transistors are smaller than tubes, which allows a lot of radio to be packaged into a small volume.

There's a difference in power-supply requirements for the two types of amplifiers. Solid-state amplifiers require supplies that produce large amounts of current at low voltage, while the opposite is true of tube rigs. An advantage of the solid-state amplifier in this case, of course, is that the danger of high voltages is eliminated.

selecting equipment

Having had no previous experience in Amateur Radio, I find myself drawing blanks when reading ads for ham gear. What are all those switches, dials, knobs, bells and whistles for anyway? How do I go about selecting ham gear when I have no idea what everything is or does? What are my options? — Dr. Crosby Pulliam.

Selecting ham gear pretty much depends on your sphere of interest, such as high-frequency communications, VHF/UHF, microwaves, or whatever. If you decide to work the high-frequency bands and want to select a commercially manufactured receiver, transmitter, or transceiver, you can write to the manufacturer of the radio of your choice and order an instruction manual. The manual will provide details of the radio's features, both from a theoretical and operating standpoint.

Or you can enlist the aid of a reputable ham-equipment dealer. Many have radios set up and operating, complete with antennas. Visit a dealer and ask for help in selecting a radio, then try it out (assuming you're licensed, of course). You'll find salespeople helpful and ready to answer your questions.

An alternative is to ask a ham friend to demonstrate his equipment. Some of the features you'll like, others perhaps not, depending on how you plan to operate. The controls and switches on today's equipment look mighty impressive to a beginner, but each one considered separately is not all that mysterious.

A good idea is to ask still another ham friend to demonstrate *his* equipment and explain its features. Keep in mind that your friends are partial to their equipment. Features that may appeal to one person may not appeal to others. Take a notebook and jot down your likes and dislikes.

For example, suppose you're interested in CW DX operating and want a receiver that will fit these requirements. You'll want a receiver with excellent mechanical and electrical stability as well as good sensitivity and selectivity.

Choose a receiver that has passband tuning, a notch control, and a sharp CW filter. With these three features you can virtually eliminate strong interfering signals and hear the desired DX signal, which would otherwise be inaudible. Passband tuning allows you to move the interfering signal around within the receiver's i-f passband. Then, by varying the notch control, you can null out the interfering signal or at least reduce its amplitude until you can hear the desired signal. Now, with the CW filter switched into the circuit, you'll have just about the best selectivity anyone could want.

A recommended book to help the beginner become acquainted with Amateur equipment is the ARRL's *Understanding Amateur Radio*, available from Ham Radio's Bookstore for $5.00 plus $1.00 postage and handling.

off-the-air tune up

I dislike the possible annoyance I might cause to other stations by putting a signal on the air when matching my antenna to my radio. Is there a way to match my set to my antenna without causing interference? — Donald G. Ramras, M.D., KD6GR.

It would be great if others had your unselfish attitude toward this problem. Some hams are conscientious and take steps to tune their antennas without radiating an interfering signal. They use accepted methods for tune up and keep charts to indicate control settings for their equipment for different frequencies and bands. Others use the brute-force method and tune their rigs while on the air — never mind the interference!

dummy load

First of all, you'll want to tune your transmitter to resonance without an antenna. A dummy load, representing the impedance into which your transmitter works, is the best device. A dummy load can be one of the many commercially available versions, consisting of a 50-ohm nonreactive resistor immersed in a cooling liquid, such as transformer oil. Most Amateur transmitters want to see a 50-ohm nonreactive load. After you've tuned up your transmitter into a dummy load of this impedance, you're ready to match the transmitter to your antenna.

Amateur antennas have an input impedance varying from 50 ohms (dipole or Yagi beam) to several-hundred ohms (extended double Zepp, multiple-band dipole, long-wire). For antennas such as these, you'll need an impedance-matching device (sometimes referred to as a transmatch). This apparatus is designed to help you match your antenna impedance to that of your transmitter.

For complete off-the-air tune up you'll need, in addition to the dummy load and transmatch, a receiver with good frequency calibration, and an antenna noise bridge. The noise bridge will help you determine the resonant frequency of whatever antenna you are using.

the noise bridge

This instrument consists of two basic elements: a bridge circuit and a noise source, usually a diode. Connect the bridge to your receiver, and connect the receiver to your antenna. When the bridge is balanced, a null will occur in your receiver, indicating the resonant frequency of your antenna.

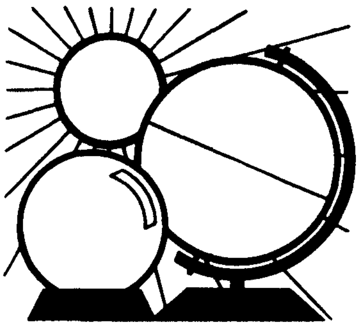
One arm of a typical bridge consists of a potentiometer and dial that indicates resistance. When you obtain a null, the potentiometer dial will indicate the resistance of the tuned circuit (antenna). The resonant frequency of the antenna will be indicated by your calibrated receiver.

Ideally, the null will occur only when the antenna input impedance is a pure resistance. Some noise bridges include a "reactance" control; others do not. If your noise bridge does contain a reactance control, this control should be adjusted, along with the other controls, to obtain a null. Noise bridges that do not contain a "reactance" control may or may not include a reactive component in their indication of antenna impedance.

When using the antenna noise bridge with your receiver, you'll probably have to adjust your antenna-matching network (transmatch) to obtain a sharp null in the receiver and a resistance of 50 ohms, as indicated by the antenna noise bridge. Once these adjustments have been made, you can be sure that your antenna system is resonant and ready to take power from your transmitter.

Before connecting your transmitter to the antenna, however, the transmitter *should have been tuned to resonance* with its output connected to a dummy load. When this condition has been met, you know the transmitter is working into a nonreactive 50-ohm load. You can then disconnect the dummy load from the transmitter and connect the transmitter to your antenna, which has been tuned to resonance, as described previously.

ham radio



DX FORECASTER

Garth Stonehocker, KØRYW

last-minute forecast

The higher frequency bands are expected to provide good DX openings during the first week of the month. Then DX conditions will probably wilt like a DXer in the August heat, while the nighttime DX will have the better openings. Of course, the QRN may take some of the joy out of that unless you're game for the early-morning, pre-dawn hours. The higher bands should again come into their own with good DX toward the end of the month. Disturbed propagation conditions may appear around the 8th and 25th for short, solar-flare-related periods of a one or two days' duration, then around the 17th for a coronal hole period of three to five days' duration.

The lunar perigee is on the 22nd and full moon on the 15th this month. The Perseids meteor shower occurs from the 10th to 14th, with its maximum the 11th and 12th at better than fifty meteors per hour.

August is a good month for short-skip openings by Sporadic-E (Es), but one of the last this Es season. The long hours of daylight will begin to fade noticeably by the end of the month.

forecasting

In the June DX Forecaster I gave some basic ideas on how propagation predictions are usually made. Here is some more shop talk about forecasting. Rather than trying to increase the accuracy of predictions by more closely defining variations of the ionosphere, better we shorten the length of the time in advance of when the prediction is needed — that is, until the day or hour before. We can of course try to keep track of the geophysical factors that could alter the prediction. This is like using low or high pressure areas, fronts, and winds in weather forecasting to say what the weather is going to be like. The geophysical factors found to be best for forecasting the ionosphere are the solar flux (in place of sunspot numbers) for predictions days in advance and the magnetic field variability within three hours (K figure) or daily (A figure) for predictions hours in advance.

As the solar radio flux goes up, expect the mid-latitude maximum usable frequency (MUF) to go up, after a two- to three-day delay. Or, as the geomagnetic field increases its variability (A or K becomes larger), the MUF will drop overnight. The amount of drop is a function of geomagnetic latitude, varying inversely from 30 degrees to the auroral zone (about 60 degrees). The MUF increases directly with geomagnetic latitude everywhere else. So you can forecast how the ionosphere propagation is going to behave from day to day or hour to hour by checking the daily solar flux value and geomagnetic A and K values from radio station WWV at 18 minutes after each hour.

Alternative to keeping track of the ionospheric propagation, you can plot signal strength for your favorite DX QSOs to a particular location. Plot each QSO signal strength at a point on a linear graph with abscissas of solar flux (70-200 units) and ordinates of the geomagnetic A value (0-50 units). As the number of QSOs plotted grows, a family of similar signal strengths builds so as to be usable for forecasting signal strengths from solar flux and A values. For more detail and examples of this method see articles in *CQ* magazine for September, 1974, by Cohen; March, 1975, by Jacobs and Cohen; August, 1979, by Cohen and Jacobs; and in *QST* magazine for September, 1977, by Sartoni. It works! The North Atlantic forecast on radio station WWV over the years was done essentially by this method on a six-hour forecast period using the past two measured geomagnetic K values.

band-by-band forecast

Ten and fifteen meters should provide excellent daytime openings. The hours of daylight should begin to be noticeably shorter particularly toward the end of the month. Watch for the best openings during periods of high solar flux. They should be north-south paths to Africa, South America, and the South Pacific. A sun-following sequence of Africa in the AM local time, South America in the early PM, and South Pacific in the late afternoon is usually seen from most QTHs in the U.S.A. Fifteen will be open a little before ten and will last a little longer in the evening.

Twenty meters will be open around the clock on most days and will be the long-skip/short-skip workhorse of the high-frequency DX bands. Signals will peak in the morning and afternoon hours, but will be readable to one area or another all the day and night.

Forty meters is going to start coming back strong, except for the high QRN levels during local thunderstorms.

Eighty and one-sixty meters will become active once again for DX during the nighttime hours, with strong openings into the south. High QRN levels will still be a problem generally, but they will be almost usable between local thunderstorms.

ham radio

WESTERN USA

GMT	PDT	N ASIA FAR EAST	NE EUROPE	E S. AFRICA	SE S. AMERICA	S ANTARCTICA	SW NEW ZEALAND	W OCEANIA AUSTRALIA	NW JAPAN
0000	5:00	15	—	20*	15*	—	10	10	15
0100	6:00	15	—	20*	15*	15	10	10	15
0200	7:00	15	—	20*	15*	15	10	10	15
0300	8:00	15	—	20	15	15	10	10	15
0400	9:00	15	—	20	15	15	10	10	15
0500	10:00	20	—	20	15	20*	10	10	15
0600	11:00	20	—	20	15	20	15	15	20
0700	12:00	—	—	20	20	20	15	15	20
0800	1:00	—	—	20	20	20	15	15	20
0900	2:00	—	—	—	20	20	15	15	20
1000	3:00	—	—	—	20	20	20	15	20
1100	4:00	—	—	—	—	—	20	15	40*
1200	5:00	—	—	—	—	—	20	20	40*
1300	6:00	—	20	—	—	—	40*	20	40
1400	7:00	20	20	15	—	—	20	20	40*
1500	8:00	20	20	15	15*	20	20	20	20
1600	9:00	20	20*	15	10	20	—	20	20
1700	10:00	20	15	15	10	15	—	20	20
1800	11:00	15	15	15	10	15	—	—	—
1900	12:00	15	15	15	10	15	10	—	—
2000	1:00	20	15	15	10	15	10	—	—
2100	2:00	—	15	15	15*	15	10	10	15
2200	3:00	—	20	15	15	15	10	10	15
2300	4:00	—	20	20	15	15	10	10	15

MID USA

GMT	MDT	N ASIA FAR EAST	NE EUROPE	E S. AFRICA	SE S. AMERICA	S ANTARCTICA	SW NEW ZEALAND	W OCEANIA AUSTRALIA	NW JAPAN	CDT
0000	6:00	15	20	20*	15	—	10	10	15	7:00
0100	7:00	15	20	20*	15	15	10	10	15	8:00
0200	8:00	15	20	20	15	15	10	15	15	9:00
0300	9:00	20	20	20	15	15	10	15	15	10:00
0400	10:00	20	20	20	20	20	15	15	15	11:00
0500	11:00	20	20	20	20	20	15	15	20	12:00
0600	12:00	20	20	20	20	20	15	15	20	1:00
0700	1:00	20	20	20	20	20	15	20	20	2:00
0800	2:00	20	20	—	20	20	20	20	20	3:00
0900	3:00	20	—	—	20	20	20	20	40*	4:00
1000	4:00	—	—	—	20	20	20	20	—	5:00
1100	5:00	—	20	—	—	—	20	20	—	6:00
1200	6:00	—	20	—	—	—	20	20	—	7:00
1300	7:00	—	20	15	15*	—	20	20	—	8:00
1400	8:00	20	20	15	10	—	20	20	—	9:00
1500	9:00	20	20	15	10	—	20	20	—	10:00
1600	10:00	20	15	15	10	—	—	—	—	11:00
1700	11:00	20	15	15	10	15	—	—	—	12:00
1800	12:00	15	15	15	10	15	—	—	—	1:00
1900	1:00	15	15	15	10	15	10	—	—	2:00
2000	2:00	20	15	15	10	15	10	—	15	3:00
2100	3:00	20	15	15	10	15	10	10	15	4:00
2200	4:00	20*	20*	15	10	15	10	10	15	5:00
2300	5:00	—	20	15	10	15	10	10	15	6:00

EASTERN USA

GMT	EDT	N ASIA FAR EAST	NE EUROPE	E S. AFRICA	SE CARIBBEAN S. AMERICA	S ANTARCTICA	SW NEW ZEALAND	W OCEANIA AUSTRALIA	NW JAPAN
0000	8:00	15	20	20	15	20	15*	15*	15
0100	9:00	15	20	20	15	20	15	15	15
0200	10:00	20	20	20	15	20	15	15	20
0300	11:00	20	20	20	15	20	20	15	20
0400	12:00	20	40	20	15	20	20	20*	20
0500	1:00	20	40	20	20	20	20	20	20
0600	2:00	20	40	20	20	20	20	20	20
0700	3:00	—	—	—	20	20	20	20	20
0800	4:00	—	—	—	20	20	20	20	20
0900	5:00	—	—	—	20	20	20	20	—
1000	6:00	—	—	—	20	—	40*	20	—
1100	7:00	—	20	—	—	—	40*	20	—
1200	8:00	20	20	15	15*	—	20	20	—
1300	9:00	20	15	15	10	—	20	20	—
1400	10:00	20	15	15	10	—	—	20	—
1500	11:00	20	15	15*	10	20	—	—	—
1600	12:00	20	15	15*	10	20	—	—	—
1700	1:00	15	15	15*	10	15	—	—	—
1800	2:00	15	15	15*	10	15	—	—	—
1900	3:00	—	15	15	10	15	—	—	—
2000	4:00	—	15	15	10	15*	15*	15*	20
2100	5:00	—	20*	15	10	15	10	15*	15
2200	6:00	15	20	15	10	15	10	15*	15
2300	7:00	15	20	20	15	15*	15*	15*	15

AUGUST

*Look at next **higher** band for possible openings.

Hear there and everywhere.

Easy tuning, digital display, professional quality

R-1000

The R-1000 is an amazingly easy-to-operate, high-performance, communications receiver, covering 200 kHz to 30 MHz in 30 bands. This PLL synthesized receiver features a digital frequency display and analog dial, plus a quartz digital clock and timer. Its easy-single-knob tuning and high sensitivity, selectivity, and stability make the R-1000 a favorite amongst Radio Amateurs, shortwave listeners, engineers, maritime communicators, and others who demand high quality in a general-coverage communications receiver.

R-1000 FEATURES:

- **Continuous frequency coverage from 200 kHz to 30 MHz**
  Receives shortwave, medium-wave, and long-wave bands.
- **30 bands, each 1 MHz wide**
  Easy-to-use band switch with large knob.
- **Five-digit frequency display and analog dial**
  Accurate digital display with 1-kHz resolution and illuminated analog dial with precise gear dial mechanism.
- **Built-in quartz digital clock with timer**
  Precise 12-hour clock with AM and PM indicators. Timer turns on radio for scheduled listening, and even controls a recorder through remote terminal.
- **Up-conversion PLL, wideband RF circuits**
  Provide exceptional performance and easy operation without the need for band-spread, preselector, or antenna tuning. Excellent sensitivity, selectivity, and stability.
- **Step attenuator**
  0-60 dB in 20-dB steps. Prevents overload.
- **Three IF filters for optimum AM, SSB, CW**
  12-kHz and 6-kHz (adaptable to 6-kHz and 2.7-kHz) filters for AM wide and narrow, and 2.7-kHz filter for high-quality SSB (USB and LSB) and CW reception.
- **Communications-type noise blanker**
  Eliminates ignition and other pulse-type noise. Superior to noise limiter.
- **Recording terminal**
  For external tape recorder.
- **Tone control**
  For desired audio response.
- **Built-in 4-inch speaker**
  For quality sound reproduction.
- **Dimmer switch**
  Controls S-meter and other panel lights and digital-display intensity.
- **Three antenna terminals**
  Wire terminals for 200 kHz to 2 MHz and 2 MHz to 30 MHz. Coax (SO-239) terminal for 2 MHz to 30 MHz.
- **Selectable operating voltage**
  AC voltage selector for 100, 120, 220 and 240 VAC. Also adaptable to operate on 13.8 VDC (with optional DCK-1 kit).

More information on the R-1000 is available from all authorized dealers of Trio-Kenwood Communications, Inc., 1111 West Walnut Street, Compton, California 90220.

HC-10 Digital World Clock

- **Two 24-hour displays with quartz time base**
  Right display: local (or UTC) hour, minute, second, day. Left display: month, date, world time in various cities, memory time (QSO starting time), and time difference (in hours from UTC).
- **Time in 10 cities around the world**
  Plus two additional programmable time zones.
- **"TOMORROW" and "YESTERDAY" indicators**
- **Memorizes present time**
  And recalls later, for logging purposes.
- **High accuracy**
  ±10 seconds/month

KENWOOD
...pacesetter in amateur radio

Matching accessories:
- SP-100 external speaker
- HS-5 deluxe headphones

Other accessories not shown:
- HS-4 headphones
- DCK-1 easy-to-install modification kit for 12-VDC operation

Specifications and prices are subject to change without notice or obligation.

New 2-meter direction.

A compact transceiver with FM/SSB/CW plus...

TR-9000

The exciting TR-9000 2-meter all-mode transceiver combines the convenience of FM with long-distance SSB and CW in a very compact, affordable package, ideal for mobile installation. With its fixed-station accessories it becomes the obvious choice for your ham shack.

TR-9000 FEATURES:

- **FM, USB, LSB, and CW**
  All the popular 2-meter modes.
- **Extended frequency range**
  Covers all 2-meter Amateur frequencies as well as MARS and CAP frequencies (simplex and any repeater split) between 143.9000 and 148.9999 MHz.
- **Digital dual VFOs**
  With selectable tuning steps of 100 Hz, 5 kHz, and 10 kHz, convenient for each mode of operation.
- **Digital frequency display**
  Five, four, or three digits, depending on selected tuning step.
- **Scan of entire band**
  Automatic busy stop and free scan.
- **Five memories**
  M1-M4... for simplex or ±600 kHz repeater offset. M5... for nonstandard offset (memorizes transmit and receive frequency independently).
- **SSB/CW search**
  Sweeps between 0 and 9.9 kHz around the selected frequency in 100-Hz steps, while the main knob selects in 10-kHz steps. Easy way to find SSB or CW activity.
- **UP/DOWN microphone**
  "Beep" sounds with each frequency step. (Supplied with TR-9000.)
- **Effective noise blanker**
  Suppresses pulse-type noise on SSB and CW.
- **Improved receiver front-end characteristics**
  Low-noise, dual-gate MOSFET and two-stage monolithic crystal filter.
- **RIT control**
  Receiver incremental tuning, to tune only the receiver slightly off frequency in the SSB/CW mode. Functions on memory, also.
- **RF gain control**
  Threshold-type control, permitting accurate S-meter readings on SSB/CW and FM modes.
- **CW sidetone**
  Enables monitoring of keying during CW operation.
- **Automatic AGC selection**
  AGC time constant selected automatically with MODE switch (slow for SSB and fast for CW).
- **HI/LOW power switch**
  10 watts/1 watt RF output on FM/CW. Always 10 watts on SSB. Improved power module for reliable and stable linear RF output.
- **LED indicators**
  VFO A/B, RIT, ON AIR, and BUSY.
- **Rear-panel accessory terminals**
  Key, memory back-up voltage, tone input, standby, external speaker, DC supply voltage, and antenna.
- **Compact size**
  Only 6-11/16 inches wide by 2-21/32 inches high by 9-7/32 inches deep.
- **Adjustable-angle mobile mount**
  With quick-release levers for easy removal.

More information on the TR-9000 is available from all authorized dealers of Trio-Kenwood Communications, Inc., 1111 West Walnut Street, Compton, California 90220.

KENWOOD
...pacesetter in amateur radio

Matching accessories for fixed-station operation:

- PS-20 power supply
- SP-120 external speaker
- BO-9 System Base... with power switch, SEND/RECEIVE switch for CW operation, backup power supply for memory retention (BC-1 backup power adaptor may also be used for this application), and headphone jack
- MC-46 16-button autopatch (DTMF) UP/DOWN microphone

Specifications and prices are subject to change without notice or obligation.

two delta loops fed in phase

Another version of this popular antenna eliminates the suspension boom

Many months ago Ken Bale, W7VCB, sent me a copy of an antenna article describing a "ZF Special" antenna by ZF1MA in Grand Cayman, B.W.I. It used a pair of connected delta loops suspended from a 20-foot boom, as in **fig. 1**. Once in a while I would look at this idea and discard it, because 20-foot booms are pretty difficult to come by, not to mention to erect.

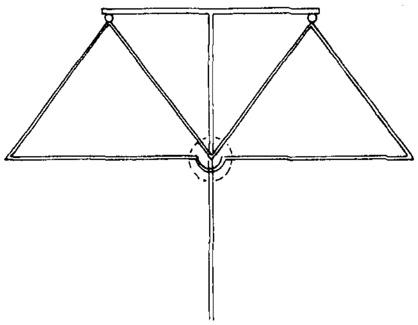


fig. 1. The "ZF Special uses pair of delta loops suspended from a 20-foot boom. Antenna is vertically polarized, since it is fed at one corner.

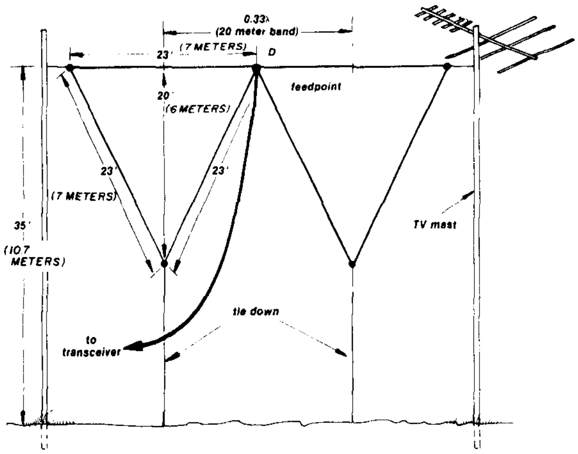


fig. 2. The improved phased delta-loop array is suspended by nylon line, thus eliminating the boom. Antenna is fed at the top, which keeps the high-current point as high as possible.

Then one day I said to myself, "Why a boom?" I turned the page upside down and mentally suspended the antenna from a nylon rope running from my 50-foot TV tower to a mast 48 feet away. It looked interesting. I'd often used both 20-meter and 15-meter loops suspended this way, but never two of them at a time.

I decided that what ZF1MA had was two full waves in phase, and that the array was vertically polarized, since they were fed at a corner.

improved phased delta-loop array

Fig. 2 shows the result of my efforts. I changed the feed point to the flat top to keep the high-current point at the top. Feed-point detail is shown in **fig. 3**.

So what do we have? A single delta loop has a gain of close to 2 dB referenced to a dipole. A pair of them at the close spacing shown will add another 2 dB. The pattern will be as in **fig. 4**.

If the antenna is oriented so that one lobe is toward Europe, the other lobe will be toward the South Pacific. Or you can orient the antenna so that Japan and the South Atlantic are covered.

My antenna is aimed at Antarctica in one direction and European USSR and the Persian Gulf in the other. It has provided excellent results with phone-patch traffic between my location and McMurdo Station, Antarctica. It has also performed well with many other DX stations on the 20-meter band.

If I had more space, I'd use the feed system in **fig. 5**, which provides horizontal polarization. (Incidentally, Bill Orr's *Antenna Handbook* shows that a delta loop fed in this manner yields a substantial, low-angle, vertically polarized signal.)

element-spacing considerations

Although the elements of my antenna are spaced as closely as possible without overlap (0.33 wavelength, or 23 feet, center-to-center, for the 20-meter band), wider spacing would increase gain, as shown below.

For two elements (20-meter band):

spacing wavelength	feet	(meters)	gain (dB)
0.33	23	(7)	2.0
0.40	27	(8)	2.8
0.50	34	(10)	4.0
0.65	44	(13)	4.8

The gain numbers shown are in *addition* to the 2-dB gain for a delta loop over a dipole.

By Jerrold A. Swank, W8HXR, 657 Willabar Drive, Washington Court House, Ohio 43160

For more than two elements, with half- and three-quarter wavelength spacing, here are the gain figures (from the ARRL *Antenna Book*):

number of parallel elements	half wave-length spacing gain (dB)	3/4 wave-length spacing gain (dB)
3	5	7.0
4	6	8.5
5	7	10.0
6	8	11.0

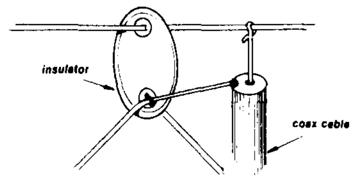


fig. 3. Feed-point detail of the phased delta-loop array.

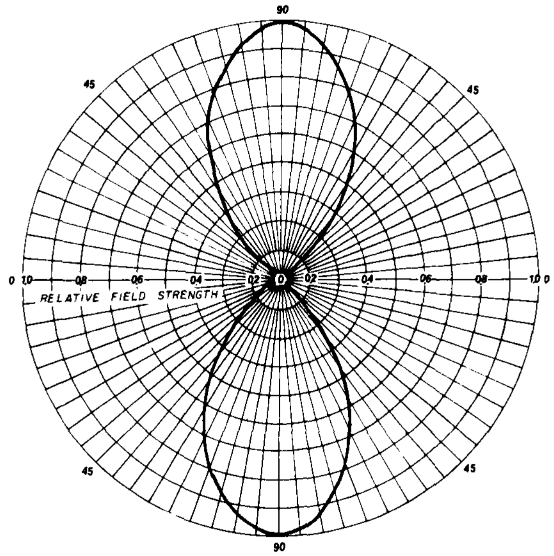


fig. 4. Radiation pattern of two collinear elements.

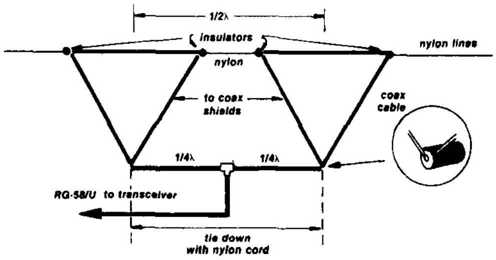


fig. 5. Another version of the phased delta array using one-half wavelength spacing.

other arrangements

I can picture some lucky ham who lives on a farm and who could stretch out a series of six elements with half-wavelength spacing for 10-dB total gain; or with 3/4-wavelength spacing for 13-dB gain, suspended from trees or a row of telephone poles. Or how about two arrays at right angles to each other, with the intersection at a cross point of two fence rows, using no farmland space?

With an antenna gain of 13 dB, you'd have a power gain of 20, which would make a 2 kW PEP signal sound like 40 kW!

For two band operation, spacing for the 15-meter band at 3/4 wavelength would be the same as half-wavelength spacing for the 20-meter band. And you could suspend the 15-meter-band loops inside each 20-meter-band loop.

Each delta loop has a feed-point impedance of about 120 ohms, so a pair is about 60 ohms, which is what mine measure. For more loops, the impedance should be as follows, with each feed line being the same length:

Four loops, 30 ohms with an SWR of 1.7:1 and six loops with a 2.5:1 SWR. None of these will be difficult to match.

It would probably be well to use a 1:1 balun at each feedpoint.

concluding remarks

Stations from the South Atlantic, the Caribbean, and South America really pound in here during the day, with many pinning my meter at 60 dB over S9. At night, the Antarctic stations are often over S9 and are easy phone-patch quality both ways.

Oh, yes — if you want to make a unidirectional beam, you can stretch a director or reflector element, or both, about 8 feet from the center of the array. Use a single wire 31 feet, 2 inches for the director and 34 feet, 6 inches for the reflector. This arrangement will, of course, reduce the feed point impedance, making some sort of tuner or matching section necessary to reduce the SWR. This is especially important if you have one of the new solid-state rigs, which are intolerant of high SWR.

Antennas are great fun. They are much more inexpensive than amplifiers. Let me know how you make out — I'm always interested in what my antenna ideas do for others.

One caution: if you use a really high-gain array, a polar map is essential for pointing directions. I read about a ham who put up a ten-element Bruce array, and used a regular orthogonal map and completely missed his objective.

ham radio

BARKER & WILLIAMSON

VERTICAL ANTENNAS

MODEL 370-31 Slim Line Vertical designed for 10, 15, 20 and 40 meters. All traps pretuned. Overall height 21 feet. Can be used with or without ground radials. Model 370-33 — 75 meter add on kit. 75 and 80 meter operation optional with model 370-33 add on kit. Power rating 1 KW-2 KW P.E.P.

MODEL 370-30 Economy model vertical for 10, 15, 20 and 40 meter operation. High Q factory tuned traps. Overall height 21 feet. Can be used with or without ground radials. Model 370-32 — 75 meter add on kit. 75 and 80 meter operation optional with model 370-32 add on kit. Power rating 1 KW-2 KW P.E.P.

MODEL 370-34 Radial Kit. Radial Kit for Models 370-30 and 370-31 Vertical antennas. All necessary wire and hardware for two ground plane radials. Write for more details and other antenna products.

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How to use your
Amateur Radio experience
to gain a career
in the professional world

from Amateur to professional

The Federal Communications Commission is quite explicit on the following point:

United States Amateur Regulations: 97.112 a) An amateur station shall not be used to transmit or receive messages for hire, nor for communication for material compensation, direct or indirect, paid or promised.

In other words, you can't make money from Amateur Radio. Or can you? Well, you can't charge fees for passing traffic, and running commercials is strictly *verboten*. However, there are legal ways of earning money indirectly from your hobby. As a matter of fact, the FCC says, in another part of its rules (*Section 97.1*), that the aims of the Amateur service are to provide an *expansion of the existing reservoir...of trained operators, technicians and electronics experts.* In the past, this section of the Amateur regulations has been interpreted by many as meaning a pool of experts available to the military in time of war, but it's obvious that such people can serve private industry as well. And Amateurs serving private industry means *jobs for hams*.

cashing in on Amateur Radio

Perhaps like no other hobby or pastime, Amateur Radio provides its participants with a real opportunity

By John Edwards, KI2U, 78-56 86th Street, Glendale, New York 11385

to acquire skills immensely useful in the world of time clocks and paychecks. The fact that this training can also be lots of fun is an extra benefit. Just think of some recent ham-radio contacts you've had. Odds are that half (probably more) of the people you spoke to were employed in some type of radio or electronics-related field. Now, whether ham radio got these people interested in their jobs or vice versa is subject to debate. But the fact of the matter is that ham radio and professional electronics go hand in hand.

What this means to you is that all those hours spent poring over electronics theory books and attending licensing classes didn't go to waste the moment you received your ticket. Depending on how high up the Amateur licensing ladder you've progressed, you may be qualified for scores of jobs with only a little extra training. Other, more advanced positions, may require additional formal study; but with an Amateur Radio head start, you'll probably jump to the top of your class in no time. Whether you're a high-school student looking for a career, a person in mid life frustrated with your present job, or retired and in need of some extra income, Amateur Radio may be the pathway to your financial goal.

types of jobs

There are many types of occupations open to job-seeking Amateurs. The FCC, in a published list,* has counted more than 65 different career categories covering radio alone. So, contrary to public opinion, not all hams professionally employed in electronics are electrical engineers (although many are), but run the full gamut of occupations within the industry. For the purpose of this article, I've narrowed the list down to five specific fields: broadcasting, television repair, electrical engineering, computing, and two-way radio servicing. While this compilation doesn't cover the entire spectrum of jobs having an Amateur-Radio connection, it should give you a rough idea of the choices available and show how you can match your skills and interests to a specific radio-electronics career.

broadcasting

Although nearly everyone seems to have forgotten by now, at one time Amateur and broadcast radio were one and the same. Stations such as Pittsburgh's KDKA and New York's WQXR (originally, experimental station W2XR), among others, were pioneered by Amateurs fascinated with the concept of radiotelephone communications. Only when advertisers realized the potential of mass electronic communications, and began pouring money into the broadcast radio service, did Amateur and professional radio enthusiasts part ways.

*A publication called "Careers in Broadcasting," routinely sent to those writing the FCC for job information.

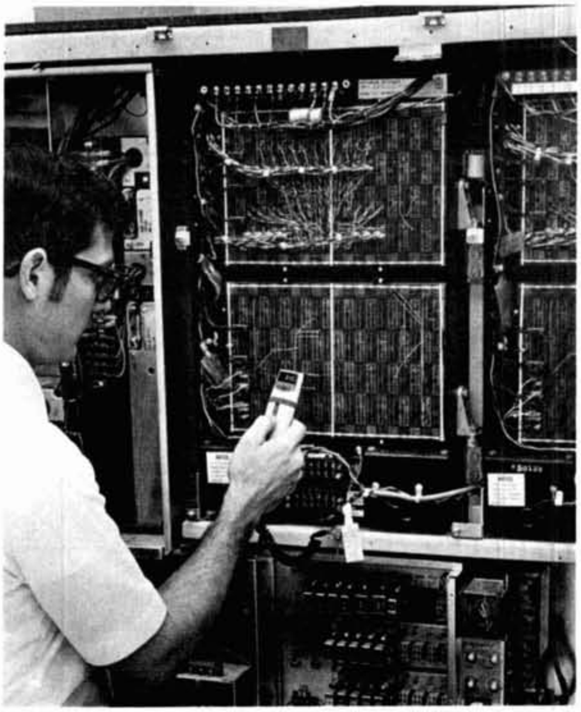
Television repair, either as a full or part-time job, has long been a traditional field for Amateurs. (*Photo courtesy Hewlett-Packard.*)

Practical experience. Even though the gap between Amateur and professional radio is now large, the distance separating the two isn't all that far. For instance, if you know how to build and operate an Amateur am transmitter, chances are you can do the same with a commercial rig. And, of course, when it comes to troubleshooting a circuit, it makes no difference whether the rig you're working

From technicians to engineers — as sex barriers continue to fall, more jobs in all areas of the electronics industry will open to women. (*Photo courtesy Hewlett-Packard.*)

on is Amateur or commercial. Actually, the greatest barrier separating technical people in the two services is the FCC. Just as the Commission has an incentive licensing ladder for hams, a similar structure also exists for broadcast engineers. To operate or service any type of commercial equipment within the United States, you must hold one of three levels of commercial radiotelephone licenses, which are designated as First, Second, and Third Class tickets. A First, in most cases, is required for broadcast station technical employment.

Technical requirements. The examinations for these licenses are rigorous (although there is some disagreement on whether the Amateur Extra or First-Class Radiotelephone is tougher), but not beyond the comprehension of most Amateurs. While the material in these tests is much too detailed to cover here, your local FCC field office can provide you with the latest syllabus together with an examination time schedule for your area.



The computer, two-way radio, broadcast and many other industries have a real need for trained technicians. And many newcomers will come from the ranks of Amateur Radio. (*Photo courtesy Hewlett-Packard.*)

While a radiotelephone ticket is necessary to get your foot into broadcasting's door, you'll probably need some outside education, too. This can include technical school, junior college and even, in some lucky cases, on-the-job training. These days, in a switch from the past, many prospective broadcast engineers are also going the four-year college route. An extra benefit here is that most schools offering a broadcasting or communications major will have a radio station and television studio available for students for hands-on experience. Such practice, besides training the student, also gives him or her a chance to decide which specific area of broadcast engineering to enter.

Compensation. Pay for broadcast engineers is good, from about $9,000 a year for a beginner at a small-town station to over $35,000 for a chief engineer at a "Top 10" market outlet. In a middle-level position, pay ranges between $15,000 and $20,000 – somewhat higher at larger, unionized stations, and, of course, the networks.* In addition, scanning the want ads in *Broadcasting* magazine (available at most larger libraries) will give you a good idea of job opportunities around the country.

television repair

The receiving end of the broadcasting industry also has ample job opportunities for Amateurs. Although being a television service technician may not sound as glamorous as working at a radio or TV station, it's still an excellent field in which to make an adequate, steady income.

Independent shop or salaried employee? There are two traditional ways to earn money from television repairs. You can either open your own shop and be your own boss, or you can become someone else's salaried employee. If you operate your own shop, there's really no simple way of telling how much income you'll make in a year. You might hit the big time and decide to start a chain of television service centers in shopping malls across the nation, or you could fail and lose everything.

Factors affecting your chances for success will hinge on the size of your shop's community, potential competition and, certainly, your own business sense and technical acumen. On the other hand, working as a technician in someone else's business offers the comforting prospects of a weekly paycheck and job security. As a tradeoff, many TV technicians with an eye toward opening their own business will opt to put in at least five years work as a service shop employee before setting off on their own. This trial period gives the budding entrepreneur time to acquire the skills of the trade while simultaneously learning from his boss's mistakes. The average $11,000-$15,000 a year such an employee can expect to earn should also help to provide at least some of the nest egg for his eventual business.

*For more information about careers in broadcast engineering, write to the National Association of Broadcast Employees and Technicians (NABET), 135 West 50th Street, New York, New York 10019.

Free lancing. Besides the two ways mentioned above, there's also a third path to making a TV servicing income that's especially appealing to part-timers — free lancing. With this method you can use your own ham-radio workbench to service TVs on a small scale in your own home. Of course, you'll have to scrounge your own customers; but by advertising in local newspapers and undercutting the high-overhead competition, you should be able to make more than a few bucks. Just be sure to fine out *in advance* if your community has any laws regulating TV repair shops.

Shoddy practices by a minority of TV technicians have forced severe crackdowns by some localities, and you'll want to be sure that you're operating within the law. But whichever route you take, if you're good at troubleshooting and perhaps have a year or two of technical-school training, TV servicing may be your answer.

electrical engineering

"If you've got the degree, we've got the job." That seems to be the rallying cry for EEs springing from virtually every major newspaper's employment pages these days. Whether you want to be a design engineer, technical writer, or consultant, it's certainly a job hunter's market with companies literally all over each other to get qualified applicants. So tight is the current EE job squeeze that many firms in California's "Silicon Valley" have even taken to building on-site tennis courts and swimming pools to attract workers.

What's available. Needless to say, with some employers even going so far as to fly applicants across the country at no charge just to look over the facilities, many EEs can almost write their own ticket. It's not unusual for someone in such especially desirable fields as microprocessor and energy work having say, five years' experience, to be earning upwards of $30,000. Not bad. But there is a price to pay for such a rosy picture; and the cost here is education — the more the better.

While a bachelor's degree is a must, the ever-increasing flood of technical information swamping the industry is making engineers holding masters degrees and even doctorates especially sought-after. Of course, you'll have to pay to get that education; but with the salaries currently being offered, you should be able to make the money back quickly. Many firms will even refund your education costs as a bonus for signing up.

Using your ham experience. Obviously, a ham ticket isn't as important here as it might be in broadcast engineering or TV servicing. Just because you passed a few FCC exams doesn't mean you can design an aircraft radar system. Yet, Amateur experience can be a big boost to your education. The mere fact that you hold an Amateur license is evidence of your interest in the field. While it may not be your only key to success, it will give you a leg up on the competition. And when it comes to the tough schooling an EE needs, every bit of an advantage helps. Anyway, who knows? With your Amateur Radio background, someday you may even get a job designing ham rigs!*

computing

As in electrical engineering, the job situation here is pretty wild. Although employers won't go to quite the same lengths to get qualified computer people as they do for EEs, the money is tops, the job market very open and, perhaps best of all, you won't have to spend six or more years at college to get started.

Depending on the exact area of computing you're contemplating, you may be able to get away with as little as a year or two at a technical school or junior college. Data processing and computer maintenance are just a couple of areas open to applicants with as little as a few months of classroom training. Of course, for higher-level positions in such areas as programming or analysis, you'll need a four-year college degree; but, as in electrical engineering, the financial rewards are substantial, so an educational investment can be most worthwhile.

Although the computer field isn't directly related to Amateur Radio, many hams do manage to combine the two. Just ask your friend who spends his weekends swapping programs, through ASCII RTTY, on 2 meters.

So, if you're the type of person who can't enjoy getting on the air without a keyboard at hand, you may be able to enter the computer field without any additional schooling at all — or you can finance your advanced education by working at a part-time computer job.

Depending on your exact skills, many openings exist for computer operators and program troubleshooters with virtually no knowledge of computer electronics but requiring a deep understanding of computer languages, something many advanced computer hobbyists seem to possess almost by second nature. Also, most companies specializing in games and other personal-computer software are constantly searching for people who can supply them with new and interesting software. So take a look around! If you regularly operate a home computer, chances are there's a job waiting for you somewhere.

*For more information on electrical-engineering careers, drop a line to the Institute of Electrical and Electronics Engineers (IEEE), 345 East 47th Street, New York, New York 10017.

two-way radio servicing

A long-time career choice for many Amateurs, the two-way radio servicing business is experiencing something of a renaissance. An explosion in two-way radio use, combined with a serious drought of expert technicians, has created an ever-widening demand for skilled people to repair everything from police radios to CB sets.

Since two-way radio technicians (like their broadcasting counterparts) must make transmitter repairs, workers here are required to hold an FCC radiotelephone license. On the brighter side, however, only a Second-Class ticket is usually needed for most two-way equipment servicing.

Pay for these radio technicians is superb, especially when you consider that a reasonably intelligent Amateur holding a Second-Class commercial license doesn't need anything more than a basic high-school diploma to begin his career. Such a person can expect to make around $10,000 a year to start, with salary prospects going as high as $25,000 for a supervisory position, and even more for repair-department heads for such major employers as the airlines and government.

Uncle Sam

Speaking of the government, many good opportunities exist within Civil Service for radio technicians. Federal, state and local governments are in almost constant need of qualified people to repair and maintain radios for police, fire, safety, and other public services. For the latest line on government jobs in your area, write to your state or local Civil Service department.*

By the way, if you feel you can't drag your interests too far away from Amateur Radio, the U.S. Office of Personnel Management will also send you information on how to apply for a job with the FCC. Now, there's a job with a real Amateur-Radio connection!

final comments

So put your Amateur-Radio skills to work. There's a big, wide world out there crying for people with your technical knowledge, and they're willing to pay good money for what you learned from those study manuals. One last word: when applying for a job, be sure to mention *Amateur Radio* on your resume or application. More than one ham has been pleasantly surprised when that imposing person interviewing him or her for a job suddenly looked up from the form, smiled, and said, "Say, I'm a ham, too."

*If you're interested in working for the federal government, contact the U.S. Office of Personnel Management, 1900 E. Street Northwest, Washington, D.C. 20415, for details on Civil Service applications and examinations.

ham radio

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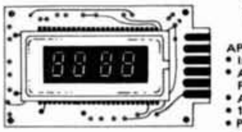

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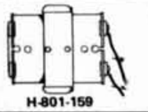

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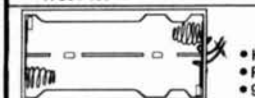

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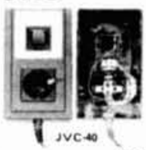

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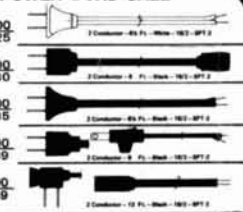

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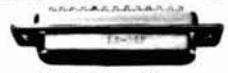

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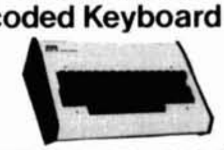

The JE610 ASCII Keyboard Kit can be interfaced into most any computer system. The kit comes complete with an industrial grade keyboard switch assembly (62-keys), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and −12V @ 10 mA for operation. Features: 60 keys generate the 126 characters, upper and lower case ASCII set. Fully buffered. Two user-define keys provided for custom applications. Caps lock for upper-case-only alpha characters. Utilizes a 2376 (40-pin) encoder read-only memory chip. Outputs directly compatible with TTL/DTL or MOS logic arrays. Easy interfacing with a 16-pin dip or 18-pin edge connector. Size: 3½"H x 14¾"W x 8¾"D

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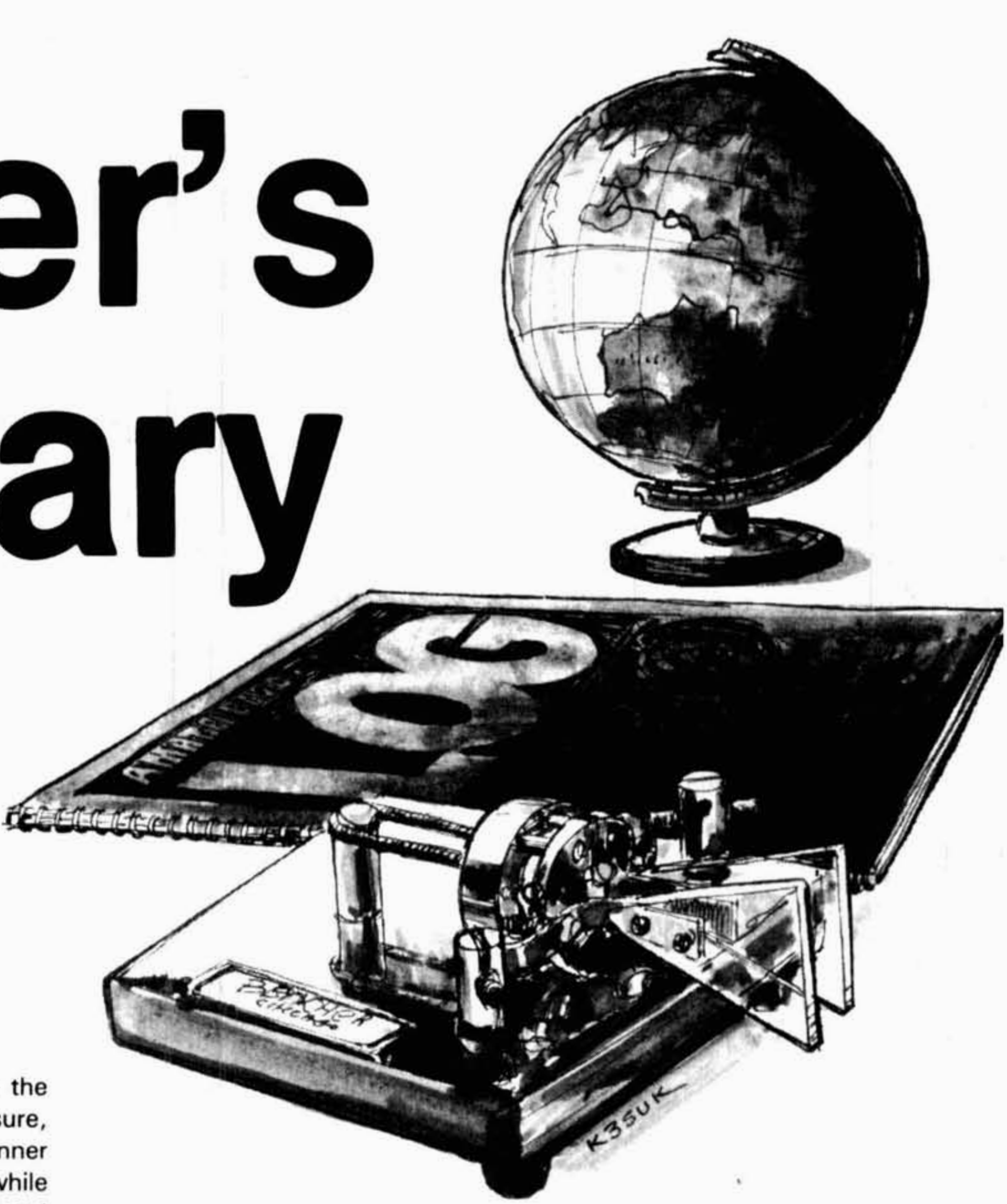
DXer's diary



By Bob Locher W9KNI

I arrive home from work at the usual time. It was a full day for sure, and I'm a bit tired. But a good dinner — and a chance to relax a bit while reading the paper — refresh me and I'm ready to go. By 0030 Zulu, 7:30 Central Daylight Saving Time, I'm easing into the operating chair.

I flip the switches to turn on the gear and move the bandswitches to 15 meters. With the elevated sunspot count these days, 15 is queen of the DX bands during late summer. Usable during the day for DX, it really comes alive in the late afternoon and early evening, and probably will stay open all night if conditions are any good at all.

I'm hoping that LU3ZY will show up again tonight. This station is run by the Argentine Navy from the exceedingly rare South Sandwich Islands. Until this station became operational recently there had been no activity from these islands for over ten years, the last operation having been put on by a British VP8 station.

The islands harbor an environment hostile to man. The small group is actively volcanic, and a volcanic eruption in fact caused the emergency evacuation of a scientific team a few years ago. The island group is claimed by both Argentina and the United Kingdom, but neither party seemed too concerned about the matter until international law developed the concept of 200-mile zones of economic control around islands such as the South Sandwiches. Suddenly, these deserted, remote, Antarctic islands became the sacred soil of the motherland, with both Argentina and Great Britain heatedly arguing their claims.

But the DXCC program recognizes operation from either country, and I will be perfectly content to receive a QSL from either LU3ZY or a VP8, as long as it says, "South Sandwich Islands" on it.

I bring the antenna around to 151 degrees, the bearing my *Second Op* says is correct for the American Midwest bearing to the South Sandwiches, and I begin tuning the band.

LU3ZY is proving to be an elusive catch. I have heard him twice this summer, once on that memorable night when I snagged the A51 in Bhutan (the thought still brings a grin to my face — sure hope the QSL shows up soon), and I heard him again three weeks later, again on 15 CW. A YV station told me that he was often on

10 meters, but that won't do us much good in the Northern Hemisphere in summer. Openings are possible, but unlikely that far into the Antarctic.

The *DX Tip Sheet* shows that he has been operating a little on 20 meters: at 5 AM local one night, 2 AM another. I'd get up and watch for him if he would ever show a pattern; and I did stay up till 2 AM one night with insomnia. Sure enough, not only did he get on at 5 AM that morning, but when he did, he QSO'd VK9NV, the Norfolk islander that I still need. Aggh!

I just have not been able to get a pattern on him. And maybe there isn't one. Most DX stations have a pattern, and if you can get enough data, it usually is pretty easy to find the fellow, often requiring nothing more than a little bookkeeping and a little lost sleep. Of course, working him after you find him can be another thing, especially if lots of other hungry DXers also know the DX station's pattern.

But some fellows just don't follow a pattern, and they are the kind that give you grey hair. I've got a bit of help lined up: K6NA and I have a pact to call each other if we hear the LU3. Glenn is two hours behind us, so he'll be up later, which helps; and besides, I don't think he ever sleeps. With the score that he's got, he couldn't.

The band tonight seems in good shape. As I tune up from the bottom, strong signals from South America seem everywhere. There aren't all that many CW stations in South America but the ones you do find are superb operators, almost to a man.

But it's not South Americans that I'm after, it's the Antarctic islands. I keep tuning, listening especially for signals that are a little weaker. Of course, most of the signals that are a little weaker are from stations using low power and simple antennas, or they are stations coming in off the back or the sides of my antenna. But, in any case, there are lots and lots of South and Central American signals to filter through, and always the necessity of watching them to be sure one isn't a CE9 or an LU/Z station.

I tune the band slowly and carefully, but without result. I hear VP8s; all in the Falklands. I hear one of the Russian 4K1 stations in the Antarctic. There's a pretty good pileup on a PYØ, but it's Fernando de Noronha, an island off the Brazilian coast and one I don't need.

Almost before I know it, it's 0300Z, 10 PM local, time to close up shop. I muse on the evening's DXing as I head up the stairs to catch the news. Nothing at all to show, really — which, of course, is the way it is most of the time. But it was still enjoyable, listening to the world talking. And I'll be back tomorrow.

August 8th

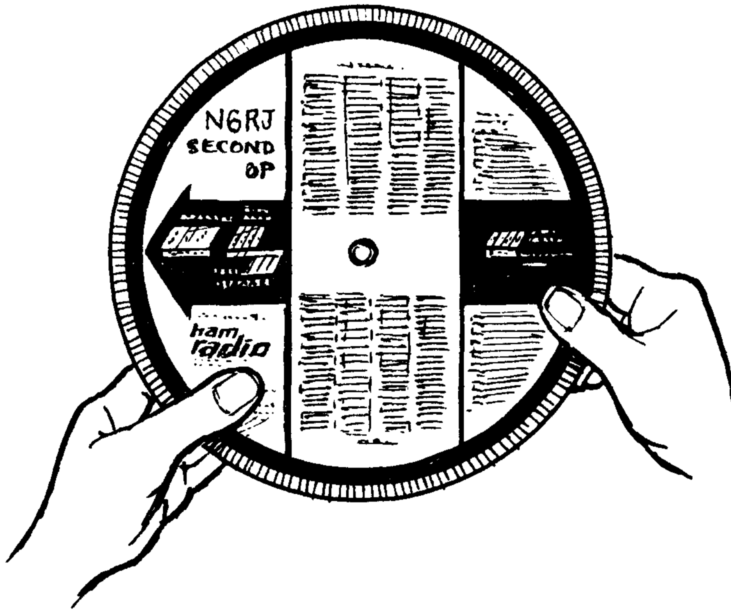
I start tuning about the same time as last night, with the same results as last night too. Lots of South Americans; little else. Band conditions don't seem to be as good. Maybe tomorrow.

August 10th

I couldn't get on the band last night. I had to stay late at work and got home late. Got to watching the game on TV during dinner and decided to stay with it, since it was already 9:30. The Cubs won again; their sixth straight on the road. LU3ZY was probably working all comers and having to call CQ to raise a little action, the way my luck runs. But the 2-meter DX net was quiet, and no phone calls. Maybe it's tonight instead. I can always hope.

The band sounds a little better tonight. I barely lift the receiver above 21,000 when I hear FB8YC calling CQ. FB8Y is the French Antarctic, a curiosity station. A lot of DXers would given up next year's vacation for FB8W, which is Crozet, and FB8X and FB8Z are almost as rare; FB8Y counts as Antarctica, which is fairly common. But again, the station is on the Indian Ocean side of the Antarctic continent, so it is a long shot over a transpolar path to a station whose existence is widely know, but one that is rarely heard.

I bring the VFO up on him. He signs, and, pausing a second, I hear several stations start calling him. I call, but when I open the receiver again, I hear him calling W1FB. Regretfully, I decide to move on. I



don't need him for a country counter, and I do need the LU3ZY QSO. If I could have nailed him quick and easy, I would have, but I can't. Maybe later, after I've had a look across the band, I'll find him without a pileup. If I do, I'll try again.

With that behind me, I continue tuning up the band. It quickly becomes apparent that conditions are pretty good, with lots and lots of signals. Hey, there's a bit of a pileup. OK, it's 8R1G. And the pileup on him is mostly JA stations; some of them are pretty loud, and off the back of my antenna at that.

At 21,033 kHz, I run across ZD8TC negotiating his way through a crowd of admirers in contest style. And three kHz above him is VP5FM. And everywhere are South Americans; PYs, LUs, plus the occasional CE, ZP, and CX.

There's a weak signal calling a CQ. OK, another JA. And there's KC4AAF, one of the American scientific stations in the Antarctic. Well, the band's open, for sure. I decide to speed up my tuning for a few minutes, and use that old Novice technique, "tune for the pileup."

Normally, I never use this technique on purpose. I much prefer to crawl up a band, listening to every signal at least for a moment. It's a heck of a lot more productive, and frankly, a lot less boring. In fact, it's fun, even if I don't catch a new one. A good open band is a dynamic, living thing, with a possible surprise at every kHz: to hear a band, to explore it, to hear signals from everywhere on different paths, to eavesdrop on old friends chatting or people making new friends.

Careful tuning brings other thrills, too. Digging a really rare one out, getting him in a one-on-one situation, having a nice ragchew with liberal use of his callsign — and then the enormous pileup on him when you sign clear with your 100 watts — it's *heady stuff.*

Tuning for pileups is a great way to run up an SWL DXCC, but getting the QSO can be tough, really tough. Especially when you're after a rare one. Still, suppose that the LU3ZY station is already on the band? A half hour's careful tuning from the bottom up that leads to finding him at 21,080 with a horrendous pileup isn't necessarily the right way to do it either.

I start tuning higher, but much more rapidly. Instead of individual signals, I look for concentrations of signals; in a word, for pileups.

At 21,057, I find one. I should say centered on 057. This one's huge; hundreds of stations frantically calling; but calling whom? The calling stations seem to be spread out a bit, over at least five kHz. That's a pretty good sign that whomever they are chasing is working split frequency. And yes, they all start calling at once, and they all stop calling at almost the same time.

Whoever's running this pileup is a real pro; he's got everyone marching to his drumbeat. And the way they are calling so neatly in unison suggests that he has a pretty loud signal. He's probably lower in frequency; I drop back to 21,050 and have a look.

Almost immediately I find him; a good 579 signal, really pounding it out:

"W1DA 5NN K" . . . "R TU"

"4SMX ? 5NN K" . . . "R K4SMX EE"

"N4AR HI BILL 5NN K" . . . "CU E E"

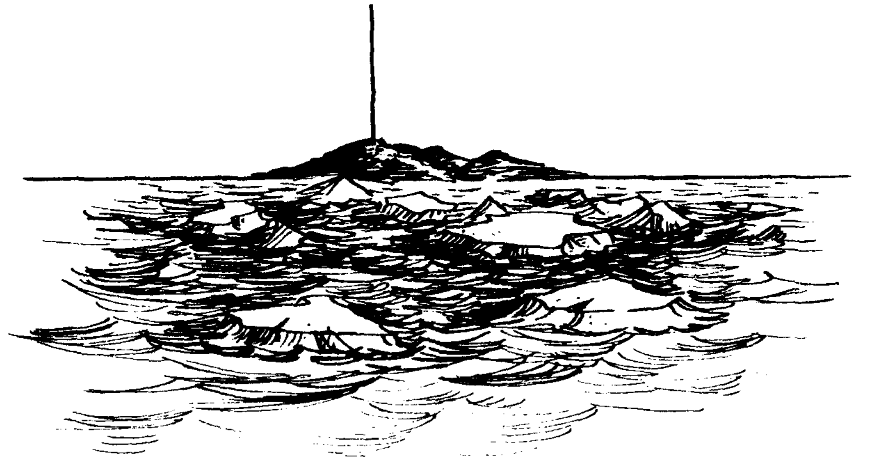
"PY7PO 5NN K" . . . "R QSL VIA KØHGB QTH SO GEORGIA 73 DE VP8MU QRZ UP8"

South Georgia. A real goody indeed, and one I don't need, but that's another story. I call it on 2 meters; "VP8MU, that's Victor Pappa Eight Mexico Uniform, South Georgia, twenty one oh five oh, South Georgia, twenty one oh five oh, listening up eight, he's got a good signal, here's W9KNI."

I get a terse response: "All right!" Hmm. Whoever that was really should sign a call. Oh well.

Anyhow, it's time to keep moving. I'm soon up to 21,150 and, as I suspected after hearing the South Georgian pileup, no LU3ZY. In a non-contest situation, it's rare to have two or more huge pileups on a band. If nothing else, two rare stations split the band population between them, limiting the size of either pileup.

Anyhow, it's back to slow, careful tuning for me, now that I'm pretty confident that the LU3ZY station isn't a featured guest in a pileup. I move the receiver back down to the bottom of the band and start tuning up higher again. My interest is heightened now, helping me to keep the concentration needed for the job at hand. Hearing that VP8 on South Georgia has gotten my fires lit, even though I don't



need him. After all, South Georgia and the South Sandwich isles are neighbors in that frozen part of the globe. Maybe there is hope. The band is open, at least, and that pileup is so huge that there can't be too many people after LU3ZY if he does show.

Another factor is in my favor. It's summer here and winter there: the long night of the polar regions, and so cold that the personnel at the station have to pretty well stay inside. Maybe there's a shortage of entertainment; operating 15-meter CW could be an ideal pastime.

I tune much more carefully this time, more the way I prefer to tune. If I didn't have a specific target (that is, the LU3) I would tune through 100 kHz, then rotate the antenna 90 degrees and do it again. If the band is open at all, it can be a fascinating exercise, listening to the world. I listen to this signal, "QTH HR BUENOS AIRES," and that signal, "QSL SURE VIA BUREAU," obviously a statesider with backscatter, and if he is going to QSL via the bureau he obviously isn't too excited.

Then, another backscatter statesider, "OK ISIDRO QSL VIA LU2CN TNX NEW ONE ES 73 . . ." That almost has to be him! The right name, the right manager, and a new country for whoever's in QSO. I punch the switch to turn on the linear. Bzzzt — zap — the surge relay drops out, and it's operational. It's already tuned on 15; I only need to trim the drive level from the exciter. I back off the drive control on the exciter; I will advance it to the proper level as I start my call.

There — the other station is signing — sure enough, "LU3ZY DE W3KT SK." I listen intently. There he is, almost dead on 3KT's frequency.

"R W3KT DE LU3ZY OK OM TNX ES 73 MUST QRT FOR DUTY W3KT DE LU3ZY SK CL EE."

Arrrhhhgh! Ohhhhgh!

I call, desperately, a one by two. I listen. Nothing. Absolutely nothing; no competition and no QSO. I call again, but I know I'm dead. I listen. I'm right.

After a pause, I hear, "SRI HOPE U GET HIM NEXT TIME W9KNI 73 DE W3KT" That KT's a gentleman, a class act.

I respond, "R TNX JESSE ES CONGRATS UR FINE CATCH 73 ES GL W3KT DE W9KNI EE."

Gad. Maybe I should go back to stamp collecting.

But even as I consider such options, I make notes on my little chalk board, "LU3ZY 21032 0154Z." I make a mental note as well that the slight chirp he appeared to have last time I heard him seems to be gone; his signal was nice and clean this time. Hmmm. The time is interesting. Obviously his watch must change at 0200 Zulu, so that he has to go on duty, and QRT. I'm pretty sure that he could not have been on the band long, or there would have been a terrific pileup on him. I wonder how W3KT caught him? On a CQ maybe? Or hunting? 3KT's a sharp old fox, and his QSO with the LU3 was probably no accident. He knew what he was doing.

Well, I don't really have enough data to mark any kind of a trend, although I have a good deal more than I did yesterday at this time. But you better believe one thing — I'm going to be watching tomorrow around 21,032 at 0130Z like a hawk.

I turn off the gear and head up the stairs. Might as well go for a walk.

August 11

I had to work late again tonight, but still, I managed to get home in good time. My wife, sympathetic to the cause, has dinner ready when I get home, and I'm in front of the rig with a few minutes to spare against my self-appointed schedule.

OK. Antenna south-southeast. Check. Linear tuned for 15. Check. Attenuator out. Check. I settle the headphones into place, bring up the receiver gain — and there he is, square in the middle of the passband.

"CQ CQ DE LU3ZY LU3ZY AR K.

Bzzzt. Snap, the linear's on. I pause a moment as I back down the exciter drive level control. Ahh, no one else seems to be calling, as I yank the VFO dead on him. I start calling him and quickly bring the drive up as I go. I can't believe it; this is all happening so fast I haven't even had time to get excited or get butterflies yet. "LU3ZY DE W9KNI W9KNI AR K." I open the receiver without yet having to touch the receiver dial from where I left it last night.

Huh! There are two signals calling me! Hah! Yes, one is the LU3ZY station. OK, the other's an LU2. Guess he thought I was signing from a CQ. I ignore him.

"KNI DE LU3ZY R GE OC ES TNX QSO UR RST 589 589 NAME HR ISIDRO ISIDRO QSL VIA LU2CN LU2CN HW CPY W9KNI DE LU3ZY KN."

How sweet it is! "R LU3ZY DE W9KNI FB DR ISIDRO ES TNX NEW COUNTRY RST 579 579 HR NR CHICAGO NR CHICAGO ES NAME BOB BOB QSL SURE LU2CN OK? LU3ZY DE W9KNI AR."

"R FB BOB QSL SURE ES GLD BE NEW FOR U 73 ES GOOD DX W9KNI DE LU3ZY SK QRZ? K."

As he starts the QRZ, I shove the headset back, grab the telephone, and start punching digits. Let's see. It's almost 7 PM out there on the Coast; Glenn should be home by now. The phone rings, but no answer. I pull the headphone jack out to activate the speaker, and desperately start dialing again.

But wait! "HOW CPY? K6NA DE LU3ZY AR KN." Hah! No wonder the phone went unanswered.

"OK GLENN TNX QSO MUST QRT FOR DUTY 73 ES GL K6NA DE LU3ZY SK CL EE."

I keep listening. Sure enough, a couple of stations are calling, but I know how well that is going to work out. I swing the antenna around to the west. "K6NA UP 2 DE W9KNI." Glenn responds with a brief "R" and we go up for a very happy ragchew.

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The cubical quad antenna is considered by many to be the best DX antenna because of its simple, lightweight design and high performance. In Bill Orr's latest edition of this well known book, you'll find quad designs for everything from the single element to the multi-element monster quad, plus a new, higher gain expanded quad (X-Q) design. There's a wealth of supplementary data on construction, feeding, tuning, and mounting quad antennas. It's the most comprehensive single edition on the cubical quad available. 112 pages. ©1977.

☐ **RP-CQ** **Softbound $4.75**

THE RADIO AMATEUR ANTENNA HANDBOOK

by William I. Orr, W6SAI and Stuart Cowan, W2LX

If you are pondering what new antennas to put up, we recommend you read this very popular book. It contains lots of well illustrated construction projects for vertical, long wire, and HF/VHF beam antennas. But, you'll also get information not usually found in antenna books. There is an honest judgment of antenna gain figures, information on the best and worst antenna locations and heights, a long look at the quad vs. the yagi antenna, information on baluns and how to use them, and some new information on the increasingly popular Sloper and Delta Loop antennas. The text is based on proven data plus practical, on-the-air experience. We don't expect you'll agree with everything Orr and Cowan have to say, but we are convinced that **The Radio Amateur Antenna Handbook** will make a valuable and often consulted addition to any Ham's library. 190 pages. ©1978.

☐ **RP-AH** **Softbound $6.95**

BEAM ANTENNA HANDBOOK

Here's recommended reading for anyone thinking about putting up a yagi beam this year. It answers a lot of commonly asked questions like: What is the best element spacing? Can different yagi antennas be stacked without losing performance? Do monoband beams outperform tribanders? Lots of construction projects, diagrams, and photos make reading a pleasurable and informative experience. 198 pages. ©1977.

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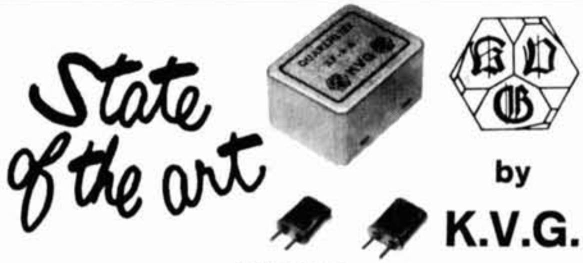
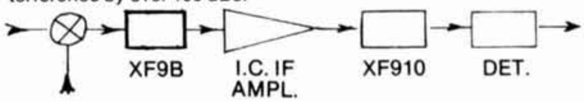


XF-9B

Reduce QRM with improved IF selectivity

The XF-9B crystal filter is the heart of good, modern receiver (and transceiver) designs. It is used between the mixer stage and the IC IF amplifier stage to suppress adjacent channel interference by over 100 dBs.



The XF-9B can also be used to upgrade older receiver designs which use vacuum tube or discrete transistor IF amplifier stages. **PRICE $68.60** plus shipping.

Specification XF-9B

Center Frequency	9.0 MHz	Shape Factor 6:60 dB	1.8
Bandwidth	2.4 KHz	6:80 dB	2.2
Passband Ripple	◄2.0 dB	Ultimate Attenuation	100 dB
Insertion Loss	◄3.5 dB	Terminations:	500 ohms 30 pF

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Prices start at $199.95 plus $6.50 shipping.

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Output Power	10 W
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Receiver Gain	30 dB typ.
Prime Power	12V DC

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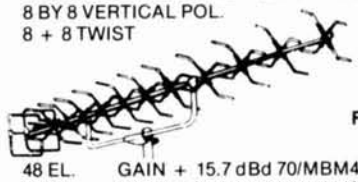

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48 EL.	GAIN + 15.7 dBd 70/MBM48	**$75.75**
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More Details? CHECK—OFF Page 94

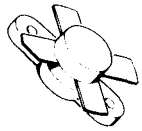
MHz electronics

MOTOROLA Semiconductor The RF Line

MRF454 $21.83

NPN SILICON RF POWER TRANSISTORS

. . . designed for power amplifier applications in industrial, commercial and amateur radio equipment to 30 MHz.



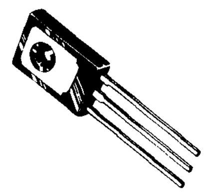
- Specified 12.5 Volt, 30 MHz Characteristics –
  Output Power = 80 Watts
  Minimum Gain = 12 dB
  Efficiency = 50%

MRF458 $20.68

NPN SILICON RF POWER TRANSISTOR

. . . designed for power amplifier applications in industrial, commerical and amateur radio equipment to 30 MHz.

- Specified 12.5 Volt, 30 MHz Characteristics –
  Output Power = 80 Watts
  Minimum Gain = 12 dB
  Efficiency = 50%
- Capable of Withstanding 30:1 Load VSWR @ Rated P_{out} and V_{CC}



MRF472

$2.50

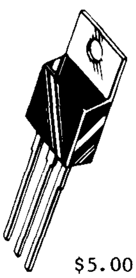
NPN SILICON RF POWER TRANSISTOR

. . . designed primarily for use in large-signal output amplifier stages. Intended for use in Citizen-Band communications equipment operating at 27 MHz. High breakdown voltages allow a high percentage of up-modulation in AM circuits.

- Specified 12.5 V, 27 MHz Characteristics –
  Power Output = 4.0 Watts
  Power Gain = 10 dB Minimum
  Efficiency = 65% Typical

MRF475

NPN SILICON RF POWER TRANSISTOR



$5.00

. . . designed primarily for use in single sideband linear amplifier output applications in citizens band and other communications equipment operating to 30 MHz.

- Characterized for Single Sideband and Large-Signal Amplifier Applications Utilizing Low-Level Modulation.
- Specified 13.6 V, 30 MHz Characteristics –
  Output Power = 12 W (PEP)
  Minimum Efficiency = 40% (SSB)
  Output Power = 4.0 W (CW)
  Minimum Efficiency = 50% (CW)
  Minimum Power Gain = 10 dB (PEP & CW)
- Common Collector Characterization

MHW710 - 2

$46.45
440 to 470MC

UHF POWER AMPLIFIER MODULE

. . . designed for 12.5 volt UHF power amplifier applications in industrial and commercial FM equipment operating from 400 to 512 MHz.

- Specified 12.5 Volt, UHF Characteristics –
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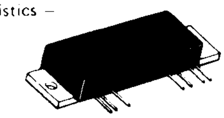
- 50 Ω Input/Output Impedance
- Guaranteed Stability and Ruggedness
- Gain Control Pin for Manual or Automatic Output Level Control
- Thin Film Hybrid Construction Gives Consistent Performance and Reliability



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B	Wideband High Gain Plug In	$ 51.00
CA	Dual Trace Plug In	120.00
K	Fast Rise DC Plug In	63.00
N	Sampling Plug In	200.00
R	Transistor Risetime Plug In	116.00
W	High Gain Differential Comparator Plug In	283.00
TU-2	Test Load Plug In for 530/540/550 Main Frames	50.00
1A2	Wideband Dual Trace Plug In	216.00
1S1	Sampling Unit With 350PS Risetime DC to 1GHZ	730.00
2A61	AC Differential Plug In	133.00
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131	Current Probe Amplifier	50.00
184	Time Mark Generator	363.00
R240	Program Control Unit	150.00
280	Trigger Countdown Unit	84.00
535A	DC to 15MHZ Scope Rack Mount	263.00
543	DC to 33MHZ Scope	300.00
561	DC to 10MHZ Scope Rack Mount	150.00
561A	DC to 10MHZ Scope Rack Mount	200.00

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561A	DC to 10MHZ Scope with a 3S76 Dual Trace DC to 875MHZ Sampling Plug In and a 3T77A Sweep Plug In. Rack Mount	600.00
565	DC to 10MHZ Dual Beam Scope with a 2A63 Diff. and a 2A61 Diff. Plug In's	900.00
581	DC to 80MHZ Scope with a 82 Dual Trace High Gain Plug In	650.00

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4CX250F/G	55.00	813	29.00	8226	127.70
4CX250K	113.00	5894/A	42.00	8295/PL172	328.00
4CX250R	92.00	6146	5.00	8458	25.75
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MHz electronics

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3614-60	Variable Attenuator 0 to 60 dB	75.00
KU520A	Variable Attenuator 18 to 26.5 GHz	100.00
4684-20C	Variable Attenuator 0 to 180 dB	100.00
6684-20F	Variable Attenuator 0 to 180 dB	100.00

General Microwave

Directional Coupler 2 to 4 GHz 20 dB Type N	75.00

Hewlett Packard

H487B	100 ohms Neg. Thermistor Mount (NEW)	150.00
H487B	100 ohms Neg. Thermistor Mount (USED)	100.00
477B	200 ohms Neg. Thermistor Mount (USED)	100.00
X487A	100 ohms Neg. Thermistor Mount (USED)	100.00
X487B	100 ohms Neg. Thermistor Mount (USED)	125.00
J468A	100 ohms Neg. Thermistor Mount (USED)	150.00
478A	200 ohms Neg. Thermistor Mount (USED)	150.00
J382	5.85 to 8.2 GHz Variable Attenuator 0 to 50 dB	250.00
X382A	8.2 to 12.4 GHz Variable Attenuator 0 to 50 dB	250.00
NK292A	Waveguide Adapter	65.00
8436A	Bandpass Filter 8 to 12.4 GHz	75.00
8471A	RF Detector	50.00
H532A	7.05 to 10 GHz Frequency Meter	300.00
G532A	3.95 to 5.85 GHz Frequency Meter	300.00
J532A	5.85 to 8.2 GHz Frequency Meter	300.00
809A	Carriage with a 444A Slotted Line Untuned Detector Probe and 809B Coaxial Slotted Section 2.6 to 18 GHz	175.00
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S347A	2.6 to 3.95 GHz Noise Source	600.00
G347A	3.95 to 5.85 GHz Noise Source	500.00
J347A	5.85 to 8.2 GHz Noise Source	500.00
H347A	7.05 to 10 GHz Noise Source	540.00
349A	400 to 4000 MHz Noise Source	310.00
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M532A	Frequency Meter	500.00
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11660A	Tracking Generator Shunt	50.00
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Microlab/FXR

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Narda

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720-6	Fixed Attenuator 8.2 to 14.4 GHz 6 dB	50.00
3503	Waveguide	25.00

PRD

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C101	Variable Attenuator 0 to 60 dB	200.00
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196C	8.2 to 12.4 GHz Variable Attenuator 0 to 45 dB	100.00
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2114L3	1K x 4 Static RAM 350ns	7.99
4027	4K x 1 Dynamic RAM	3.99
4060/2107	4K x 1 Dynamic RAM	3.99
4050/9050	4K x 1 Dynamic RAM	3.99
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2112A-2	256 x 4 Static RAM	3.99
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MCM6641L20	4K x 2 Static RAM 200ns	14.99
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MC14409	Binary To Phone Pulse Converter	12.99
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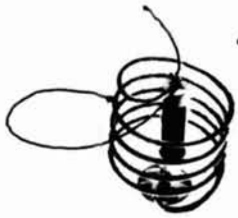

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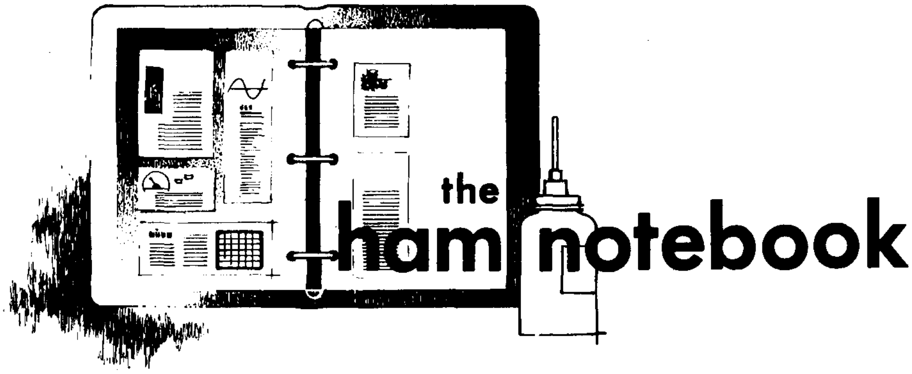

squirrel-cage motors make field-day power supplies

One of the perrenial deterrents to portable and field Amateur Radio operation is the cost of a suitable energy source. Small gasoline engines can be had quite reasonably priced from lawnmower shops and Goodwill as-is stores, to name but two of many sources, but generators that produce 115 volts at 60 Hz are a scarce and expensive commodity. Or are they?

Used washing-machine and dryer motors are easy to come by. Goodwill, Salvation Army, and other used-merchandise stores, or scrap-yards, sell such motors for from $2 to $5; most often you have to take the washing machine and do the salvaging yourself. Motors? But it's an alternator we need for the field power unit, not an electric motor!

the motor as a generator

Fractional and multi-horsepower motors operate quite well as ac generators. Coupled to a suitable gasoline engine and driven at approximately the same speed at which they run as a motor, they will deliver alternating current power almost as well as an alternator designed for the job, and without any rewinding whatsoever. All that is needed is a little know-how and a willingness to tinker, plus a careful curbing of the standard ham tendency to overload equipment.

Washing-machine motors are generally rated at 1/4 to 1/3 hp and an occasional one may be found at 1/2 hp. These are supplied with resistance-starting, phase-splitting windings. **Fig. 1** shows a typical example. Dryer motors are rated from 1/6 to 1/3 hp, and are as likely as not to be capacitor split-phased, sometimes just for starting, but occasionally for

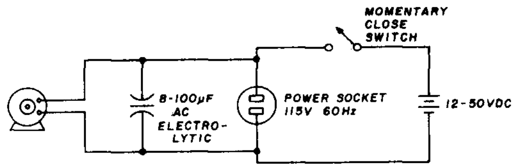

fig. 1. Split-phase-start motor.

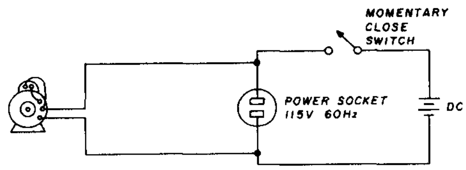

fig. 2. Capacitor-run motor. Additional capacitor is not needed.

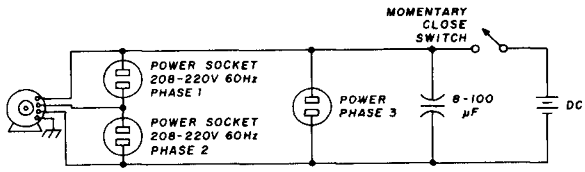

fig. 3. Three-phase, 3-wire delta motor. If this motor is used as an alternator in this manner, keep in mind that 220 V exists between two pieces of equipment plugged into the three-phase outlets! Even though 120° out of phase, it can deliver an unpleasant shock and can cause undesirable ground loops.

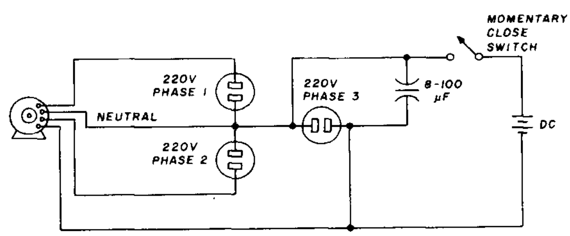

fig. 4. Three-phase, 4-wire star-connected motor. The note in *fig. 3* applies to this alternator as well.

unning as well. The key to coaxing a squirrel-cage motor (virtually all large-appliance, fractional-hp motors are his type) to perform as an alternator s in the use of capacitance to supply a field voltage.

split-phase-start motor

Without going too deeply into motor theory, a capacitor placed across the power leads of a motor creates a split-phase condition in the motor windings, which produces a resonance between the inductance of the winding and the induced current n the rotating squirrel-cage armature. Within certain power limits, the motor will perform as an alternator. Because such motors are "induction" motors with a 5 per cent slippage factor, the squirrel-cage must rotate about 5 per cent faster than synchronous speed to produce 60 Hz: a motor rated at 1750 RPM would have to be turned at 1890 RPM to obtain 60 Hz (synchronous speed: 1800 plus 5 per cent).

Sometimes such a motor used as a power source will start to deliver current by itself as it comes up to speed. Frequently, however, it is necessary to supply a momentary dc pulse to the motor windings to induce magnetic-field poles into the soft-iron armature. This pulse may be applied either before starting the engine, or after the motor has come up to speed. If the latter, it is obvious that the pulse should be just that — a *pulse*, because the dc source becomes a short circuit to the alternator output the moment power generation begins.

Such an alternator will not produce as much power as the labeled motor rating, for two or more reasons: efficiency losses, power-factor losses, and perversity. The latter, which seems somewhat facetious, will be found to hold quite true in practice.

capacitor-run motor

A split-phase, capacitor-run motor *will not need an additional capacitor* (**fig. 2**). It is ready to operate as an alternator with only the occasional need for a momentary dc starting pulse. A resistance-start, split-phase motor will require from 8 to 100 μF across the power terminals; final size *to be determined by cut-and-try.* Ac-rated electrolytic capacitors should be used, obtainable from motor-rewinding shops, although standard dc electrolytics may be used by connecting them in series, back-to-back. Choose at least 300-volt ratings, as electrolytics must be derated for use in power ac circuits. The capacitance of a back-to-back combination is the capacitance of one — they are not additive or subtractive in this circuit. The momentary starting pulse may be applied through a simple touch-switch circuit from a 12-volt automobile battery.

three-phase machines

Larger squirrel-cage motors are sometimes available from discarded power-shop equipment. Table saws, planes, and sanders use motors rated from 3/4 to 2 hp, usually capacitor-run variety. Even larger motors are used for water pumping and many industrial demands, but usually are three-phase types (**figs. 3** and **4**). These are equally useful as alternators, but the output is three phase, although single phase across any two legs (except when four wires — see **fig. 4**). The voltage, however, is usually either 208 or 220 volts across each leg. When used as an alternator, it is necessary to parallel only one leg of the three with a capacitor.

It is almost impossible to burn out a squirrel-cage motor operating as an alternator. An overload will null the rotating field, and the alternator will simply cease to generate. Generation can be started again by a pulse of dc across the output leads. It may therefore be advisable to breadboard a power supply before building it into a fancy metal frame, to make sure that the motor (alternator) is large enough to supply the rig plus a small-wattage bulb for nighttime log-keeping or whatever. For test, parallel a number of bulb sockets and screw in one bulb at a time. Add to the load until the alternator suddenly ceases to function. The sum of the bulb wattages is your absolute top output power.

Walt Boyd, K6DZY

glossary of terms

induction motor — An ac motor featuring a primary power winding (usually the stator) and a unique "squirrel-cage" secondary (usually the armature). Currents, and therefore magnetic poles, are *induced* into the secondary by the rotating primary magnetic field; thus the armature rotates at slightly slower than synchronous speed, called "slip." The amount of slip increases with an increase in mechanical loading.

split-phase motor — Single-phase induction motors are not self-starting. They are momentarily converted to two-phase (polyphase, self-starting) motors by inclusion of additional primary power windings displaced 90° from the main windings. Occasionally the auxiliary windings are designed to operate full time rather than momentarily.

resistance-start motor — A split-phase induction motor employing a resistive auxiliary starting winding (copper alloy or iron wire) to shift the phase angle approximately 90°. Used almost exclusively for low-starting-power requirements, this winding is switched out of the circuit when the armature approaches near-synchronous speed.

capacitor-start motor — When greater starting torque is required for a split-phase induction motor, a capacitor is used in series with the auxiliary starting winding to provide a leading current vector of 90°, which momentarily converts the motor to a polyphase induction motor.

capacitor-run motor — A single-phase induction motor using a capacitor in series with a second primary winding displaced 90° from the first. This winding remains in the circuit full time, converting the machine to polyphase operation.

three-phase motor — A true polyphase induction motor with three or more power windings designed specifically to operate from a three-phase power source. It is self-starting.

synchronous motor — A motor that runs at a speed in step with the power-station frequency (fundamental or harmonic of the alternator speed). Often started as an induction motor and converted to synchronous operation as it approaches synchronous speed.

universal motor — A motor with wound field and armature, with commutator to make dc operation possible. When all windings are connected in series-aiding, it will operate on ac as well as dc, although the higher the ac frequency the more carefully the iron must be laminated to prevent excess eddy-current heating loss.

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MAKE HAM RADIO FUN! Supplement your learning programs with a motivational hypnosis cassette. *Tape #3*, Learning the Code; *Tape #4*, Breaking the Speed Barrier; *Tape #7*, Electronic Theory. Free catalog. For tapes, $10.95 each to Gem Publishing, 3306 North 6th St., Coeur d-Alene, ID 83814.

VERY in-ter-est-ing! Next 5 issues $2. Ham Trader "Yellow Sheets", POB356, Wheaton, IL 60187.

CB TO 10 METER PROFESSIONALS: Your rig or buy ours — AM/SSB/CW. Certified Communications, 4138 So. Ferris, Fremont, Michigan 49412; (616) 924-4561.

NEED HELP for your Novice or General ticket? Recorded audio-visual theory instruction. No electronic background required. *Free information*. Amateur License, P.O. Box 6015, Norfolk, VA 23508.

More Details? CHECK—OFF Page 94

CASH for December 1915 to June 1920 QST's for personal collection. Kenn Miller, K6IR, 16904 George Washington, Rockville, Maryland 20853 (301) 774-7709.

HAMS FOR CHRIST — Reach other Hams with a Gospel Tract sure to please. Clyde Stanfield, WA6HEG, 1570 N. Albright, Upland, CA 91786.

FREE SAMPLE Ham Radio Insider Newsletter! Send large S.A.S.E.. W5YI, Box #10101-H, Dallas, Texas 75207.

MOBILE ANTENNAS 30-50 MHz. Baseloaded hole mount. Four ranges. First quality by Avanti. $15.00 prepaid. H. C. Van Valzah, 1140 Hickory Trail, Downers Grove, IL 60515 (312) 852-0472.

BUY-SELL-TRADE Send $1.00 for catalog. Give name address and call letters. Complete stock of major brands new and reconditioned amateur radio equipment. Call for best deals. We buy Collins, Drake, Swan, etc. Associated Radio, 8012 Conser, Overland Park, KS 66204. (913) 381-5900.

Coming Events

ACTIVITIES

"Places to go..."

ALABAMA: The Central Alabama Amateur Radio Association's 4th Annual Hamfest, Sunday, September 13, Civic Center, downtown Montgomery. Free admission; free parking. Air-conditioned Flea Market. Set-up 0600. Doors open from 0800-1500. Prize drawing 1400 CDST. Restaurants and motels within walking distance of Civic Center. Refreshments available. Talk-in on 146.04/.64 or 146.52/S. For information or reservations: Hamfest Committee, PO Box 3141, Montgomery, AL 36109.

ALABAMA: The Huntsville Hamfest (formerly the North Alabama Hamfest), Saturday and Sunday, August 15 and 16, Von Braun Civic Center, Huntsville. Free admission. Prizes, exhibits, forums, air-conditioned indoor flea market and ladies' activities. Flea market tables $3.00/day. Family tours of the Alabama Space & Rocket Center available. Limited camp sites with hookups. Talk in on 3.965 and 34/94. For information: Huntsville Hamfest, PO Box 4563, Huntsville, AL 35802.

ARIZONA: The Scottsdale Amateur Radio Club, Inc. will host the 1981 Southwestern Division ARRL Regional Convention, October 9-11, Ramada Safari Resort in Scottsdale. Talk-in on 146.52 and 147.84/24 MHz. Further information: S.A.R.C. Convention Committee, PO Box 3073, Scottsdale, AZ 85257.

CALIFORNIA: The Tri-County Amateur Radio Association's annual Hamfest, Saturday, August 8, 9 AM to 3 PM, Los Angeles County Fairgrounds (Thummer's Patio). No charge. Bring a picnic lunch. Refreshments available. A noon raffle is featured. Grand Prizes: Quasar 10" TV; Tempo S-1 Hand-Held. Winner must be licensed Ham but need not be present. Donation: $1.00. Talk in on 146.34/94. For information: TCARA, PO Box 142, Pomona, CA 91767.

DELAWARE: The Sixth annual New Delmarva Hamfest, Sunday, August 16, Gloryland Park, Bear. 8 AM to 4 PM. Admission: $2.25 advance; $2.75 gate. YL and jr ops free. Tailgating or covered table space $3.50. Refreshments available. First prize: ICOM IC-2A and many other prizes. Talk-in on 52 and 13/73. For tickets, map, info: SASE to Stephen J. Momot, K3HBP, 14 Balsam Rd., Wilmington, DE 19804.

GEORGIA: Augusta Amateur Radio Club's annual Hamfest will be held September 20, 1981, at the Julian Smith Casino. Prizes will be a DenTron Clipperton L, a Cushcraft A4 Tribander, and an Icom IC2A. Bingo for the family. Talk-in 34-94. Tailgating $3.00 includes one ticket. Tickets $1.00 each. Further information call Diane, WB4YHT, (404) 860-3700.

ILLINOIS: Illiana Repeater Systems 12th annual Danville area Hamfest, September 5 and 6, Georgetown, Illinois, Fairgrounds. Flea market, free parking, forums, family entertainment, many prizes and more. Gates open at 6:30 AM. Talk in 22/82 and 146.52. Tickets: $1.50 advance, $2.00 gate. For more info: Lowell Wells, WD9AFG, Hamfest Chairman, RR 3, Box 215, Danville, IL 61832. (217) 759-7560.

ILLINOIS: Radio Expo '81 sponsored by the Chicago FM Club will be held, rain or shine, on September 19th and 20th at the Lake County Fair Grounds, routes 45 and 120 in Grayslake. Grayslake is 30 minutes north of Chicago and 45 minutes south of Milwaukee. This year we will have a super large flea market with plenty of indoor and outdoor space, free with a gate ticket. Just bring your own table and chair or tailgate it. Parking is free. We will also have new camping sites complete with power hookups. There will be Ham seminars both Saturday and Sunday. YL's have a ladies program and door prizes both days. Only the best manufacturers of Ham and computer equipment and their distributors will be at our huge display building for you to meet and buy from. As in the past, Expo will be giving out thousands of dollars worth of prizes and admission tickets are good for both days. For advanced registration, send $3.00 per person and a #10 S.A.S.E. to Radio Expo Tickets, P.O. Box 1532, Evanston, Illinois. Tickets at the gate are $4.00 each. Kids under seven are free. For more information call (312) BST-EXPO. Talk-in on 146.16/.76, 146.52, and 222.5/224.10.

ILLINOIS: State ARRL Convention and annual Hamfest sponsored by the Fox River Radio League, Sunday, August 23, Kane County Fairgrounds, St. Charles. Forums on antennas, DX and ARRL operations, contests and demonstrations. Advance tickets $1.50, $2.00 at gate. For tickets and information: SASE to Jerry Frieders, W9ZGP, 1501 Molitor Rd., Aurora, IL 60505. Commercial exhibitors contact Mike Pittard, KA9EVT, (312) 896-7383. Talk-in on 146.940 MHz.

ILLINOIS: Peoria Area Amateur Radio Club's Peoria Superfest '81, September 19 and 20, Exposition Gardens, W. Northmoor Rd., Peoria. Gate opens 6 AM, commercial building 9 AM. Admission: $2.00 advance, $3.00 gate. Forums, Amateur/ computer product displays, flea market, Ladies and children's programs, camping facilities. Saturday night smorgasbord, Heritage House, 8209 N. Mt. Hawley Rd. Movies at hamfest site. Talk-in on 146.16/76, call W9UVI. For information and reservations: Superfest '81, 5808 N. Andover Ct., Peoria, IL 61615.

SOUTHERN ILLINOIS: Shawnee Amateur Radio Association's 25th anniversity Silver Jubilee Hamfest will be August 30 at JOHN A. LOGAN College in Cartersville, Illinois. Offerings include Air Conditioned Flea Market — Prizes — Forums — Computers — Food — Refreshments — Contests. For details QSL Bill May, KB9QY, 800 Hilldale, Herrin, IL 62948 or (618) 942-2511 days.

INDIANA: The Bloomington Area Amateur Radio Hams will hold their 4th annual "Hoosier Backyard Hamfest," Sunday, September 6, 7 AM to 5 PM, 2335 Vernal Pike, Bloomington. Admission: $2.00. Door prizes, swap'n'shop, vendors, free set-ups, balloon rides, 50/50 drawing, refreshments, ATV demonstrations. Grand prize: Aptron Lab ATV Converter. Rain or shine. Talk-in 7.78/18, 04/64, 233.26/224.86. For information: Bob Myers, K9KTH at above address or call (812) 332-2433.

INDIANA: The Tippecanoe Amateur Radio Association's 12th annual Hamfest, Sunday, August 16, Tippecanoe County Fairgrounds, Teal Rd. and 18th Street, Lafayette. Grounds open 7 AM. Talk-in on 146.13/73 or 146.52. Flea market, dealers, fun and prizes. For tickets and information: J.B. Van Sickle, K9KRE, RR 1, Box 63, Westpoint, IN 47992.

MINNESOTA: The St. Cloud Amateur Radio Club's Hamfest, August 9, 8 AM to 4 PM, Whitney Senior Center, St. Cloud. Swapfest, prizes, refreshments. Talk-in on 146.34/94. For information: Mike Lynch, KAØHQS, 2115 First Street South, St. Cloud, MN 56301. (612) 251-2297.

MISSOURI: The St. Charles Amateur Radio Club's Hamfest '81, August 23, Wentzville Community Club. Admission $1.00 per car. Advance tickets: $1.00 each/ 4 for $3.00. At door: $1.50 each/ 4 for $5.00. Prizes, contests, flea market, fun for all. Air conditioned exhibition building. For tickets and information: SCARC Hamfest '81, c/o Bill Graham, 512 Bermuda Dr., O'Fallon, MO 63366.

NEW JERSEY: The Sussex County Amateur Radio Club's third annual hamfest, SCARC 81, Saturday, September 12, Sussex County Farm and Horse Show grounds, Plains Rd. off US Highway 206, Augusta. Outdoor flea market sellers: $4.00 pre-registered, $5.00 gate. Indoor sellers: $5.00 pre-registered, $6.00 gate. Registration: $2.00. Door prizes. For information: Sussex County Amateur Radio Club, P.O. Box 11, Newton, NJ 07860 or Lloyd Buchholtz, WA2LHX, 10 Black Oak Drive, Vernon, NJ 07462. Talk-in on 147.90/30 and 146.52.

NEW YORK: The Suffolk County Radio Club's ARRL supported 4th annual electronic flea market, Sunday, September 13, (rain date — September 20) Odd Fellows Hall, Jayne Blvd., Port Jefferson, L.I. Gates open 7 AM. Sellers — $3.00 — one car, one driver. Walk-ins $1.50. No charge for XYL's and Harmonics of attending Hams. Bargains, prizes, food and Hamship. Talk-in on 2 meters .52 and .94, 223.5 MHz. For details: Floyd Davis, 516-234-9376.

NEW YORK: HAM-O-RAMA 81, Friday, September 18, 6 PM to 9 PM, Saturday, September 19, 7 AM to 5 PM, Erie County Fairgrounds, south of Buffalo. Outside/inside Flea Markets, Equipment displays, technical programs, women's programs and more! General admission for both days: $3.00 Advance, $4.00 gate. Refreshments available. Talk in on W2EUP/R 146.31/91. For information: Nelson Oldfield, 126 Greenway Blvd., Cheektowaga, NY 14225, 634-6394 or Mike Merrick, 419 Sommerville Avenue, Tonawanda, NY 14150, 835-0866.

NEW YORK: The Seaway Valley Hamfest, Saturday, September 12, Municipal Arena, Louisville, near Massena and the St. Lawrence Seaway. Activities include flea market, commercial exhibitors, movies, magic show, snack bar and more. For information: Louis G. Ierlan, WA2RXO, Secretary, Seaway Valley Hamfest Committee, 725 Proctor Avenue, Ogdensburg, NY 13669.

NEW YORK: The Hall of Science ARC's Sixth annual Hamfest, September 13, from 9 to 4, Municipal Parking Garage, one block north of Queens Boulevard, 80-25 — 126th Street, Kew Gardens. Sellers, $3.00; Buyers $1.00. Refreshments, free parking. Talk-in on .52. For information: Tom Doyle, KA2DTB (212) 738-8887 or (212) 641-1700.

OHIO: The Original Forty-fourth Annual Hamfest, Sunday, September 20, 1981, at Stricker's Grove on State Route 128, one mile west of Venice (Ross) Ohio. Exhibits, prizes, food and refreshments available. Flea Market (radio related products only), music, talks, hidden transmitter hunt and sensational air show. Admission and registration $4.00. For information: Lillian Abbott, K8CKI, 317 Greenwell Road, Cincinnati, Ohio 45238.

OHIO: The 24th Annual Warren Hamfest, August 16, Kent State Branch, Trumbull County, Warren. Major prizes include: Ten-Tec Omni C with power supply; Ten-Tec Delta: Icom 2ATs. Tickets $2.50 advance; $3.00 gate. Banquet Saturday evening, August 15, tickets $10.00. For information and tickets: Warren Hamfest, PO Box 809, Warren, Ohio 44482.

OREGON: The Willametta Valley DX Club's 1981 Northwest DX Convention, August 8 and 9, Greenwood Inn, Beaverton, just west of Portland. Speakers, WA4ZNH/WB4FVU. Grand prize: ICOM-730. For information: Willamette Valley DX Club, PO Box 555, Portland, OR 97207.

RHODE ISLAND: The Bristol County Amateur Radio Association's annual indoor/outdoor flea market, Sunday, September 13, V.F.W. Hall, Tiverton. 12 noon til 4 PM. Flea market spaces, $6.50. Admission: $1.00. Talk-in on 147.63/03 and .52 direct. Door prizes. For info and maps: SASE to Ann M. Carro, KA1DNB, 652 Old Colony Terrace, Tiverton, RI 02878.

SOUTH DAKOTA: The 15th annul CSVHF Society Conference, July 30, 31 and August 1, Holiday Inn-Airport, Sioux Falls. Fun and activities for the entire family. For details: WØSD.

VIRGINIA: ARRL Roanoke Division Convention September 26 and 27 in the Virginia Beach, Virginia Pavillion. Free transportation to the oceanfront where the Neptune Festival is also taking place. FCC Amateur Exams given to those sending form 610 request in advance. Admission $3.50. Advance ticket drawing for FM transceiver. Flea market tables, $5 day, $7 both days. TRC PO Box 7101, Portsmouth, Virginia 23707. 804-587-1695.

WEST VIRGINIA: The East River Amateur Radio Club's Hamfest '81 on Sunday, August 23, Bluefield, Armory-Civic Center, one mile north of Bluefield on US 52. Admission: $2.00 advance, $3.00 gate, includes prize ticket. Tables $5.00 ($4.00 each for 3 or more). Tailgaters $2.00. Food, dealers, flea market, forums, entertainment — something for the whole family. Talk-in 89/49, 52/52. For info: Bluefield Hamfest '81, 2113 Hemlock Hill, Bluefield, WV 24701.

QUEBEC: RAQI, Radio Amateur du Quebec's annual convention, August 1 and 2, CEGEP Levis-Lauzon, 205 mgr Bourget, Lauzon, near Quebec City. Inquiries to Jean-Marc Labarre, VE2BZL.

OPERATING EVENTS

"Things to do..."

JULY 27 - AUGUST 4: Amateur Radio Station K2BSA will operate from the 1981 Boy Scout Jamboree at Fort A.P. Hill. Operation will be on 80-10 meters. See August QST for frequencies. No formal schedule. Best bet evenings. QSL card and SASE to K2BSA/4, c/o ARRL HQ, 225 Main St., Newington, CT 06111.

AUGUST 1 & 2: Micro-expedition to Forest County, Pennsylvania. Call WB3IQE/3. Mode: CW only. Frequencies: 80, 40 and 15 meters. Will operate in bottom 50 kHz of each of two bands, exact frequencies depending on conditions. Time will be spent outside the extra-only subbands. QSL to WB3IQE, Rt. 1, 3 ox 297, Brockway, PA 15824. US/Canadian stations, send SASE. DX stations, 1 IRC for QSL via ship, 2 IRCs for QSL via air.

AUGUST 15: The Englewood Amateur Radio Association's 22nd annual New Jersey QSO party. Time: 2000 UTC Saturday, August 15 to 0700 UTC Sunday, August 16; 1300 UTC Sunday, August 16 to 0200 UTC Monday, August 17. Phone and CW are considered same contest. General call "CQ NEW JERSEY" or "CQ NJ." Suggested frequencies: 1810, 3535, 3900, 7035, 7135, 7235, 14035, 14280, 21100, 21355, 28100, 28610, 50-50.5 and 144-146. Phone activity on even hours; 15 meters on odd hours

(1500 to 2100 UTC); 160 meters 0500 UTC. Logs with #10 SASE to Englewood Amateur Radio Association, Inc., PO Box 528, Englewood, NJ 07631.

AUGUST 22: TMI FUN DXpedition: The Central Pennsylvania DX Club will hold the world's first DXpedition to Three Mile Island, the site of the Nuclear Power Facility made famous in news recently, from 1200Z Saturday August 22 until 2100Z, Sunday, August 23. Tentative frequencies: Phone - 3900, 7240, 14260, 14290, 21325, 21375, 28625 and 146.58. CW - 21125 and 7125. For an attractive photo QSL card for contacts, send SASE or IRCs to: CPDXC, c/o WB3DNA, T. Fanus, 6140 Chambers Hill Road, Harrisburg, PA 17111.

AUGUST 27: The Pend Oreille Amateur Radio Club's "Special Event Station" will be operating August 27, 28, 29 and 30 from 1600Z to 0500Z each day during the Pend Oreille County Fair at Cusick, Washington, using the Newport High School's ARC call WB7TBN. Frequencies: 14.340, 21.400, 28.700, 39.45, 37.15 CW. RTTY 28.090, 21.090, 14.080, 36.50. For a special commemorative QSL card SASE to: Mike Bice, WB7SGU, Star Rt., Box 251, Spirit Lake, Idaho 83869.

SEPTEMBER 9: "CQ YL" Howdy Days. Wednesday, September 9 at 1800 UTC through Friday, September 11 at 1800 UTC. All bands and modes of emission may be used. YLRL member or non-YLRL member. All licensed women operators world-wide are invited to participate. For information: Kay Eyman, WAØWOF, RR2, Garnett, Kansas 66032.

SEPTEMBER 12: "FIRE MUSTER," a special events station NØARUØ, will be on the air September 12 from 1400-2200 UTC, commemorating Burnsville, Minnesota's third annual Fire Muster. Amateur Radio in Public Service is this year's theme. Operating frequencies: 7.260, 14.285, 21.285, 28.550 MHz ± 5 kHz. Local 2 meter contacts will be on 16/76. For a commemorative QSL certificate SASE to: NØARU, c/o David L. Justis, 14129 Frontier Lane, Burnsville, MN 55337 or via the ARRL DX Bureau.

SEPTEMBER 12 & 13: The Albuquerque, New Mexico, DX Association will sponsor a QSO party. Suggested frequencies: CW - 63 kHz from the low end of each band. SSB - 3900, 7265, 14285, 21365, and 28650 kHz. Novice — 3705, 7105, 21105, 28105 kHz. Entries must be postmarked no later than October 15, 1981. SASE to Albuquerque DX Association, PO Box 997, Corrales, NM 87048 for complete results.

More Details? CHECK—OFF Page 94

Johnson AIR Variables

1/4 x 2 1/2" shaft
$2.50 each

193-10-6	2.2 to 34 pF
193-	1.5 to 27.5pF
193-	.6 to 6.4pF

$1.00 each

160-107-16	.5 to 12 pF
193-10-9	2.2 to 34 pF
193-10-104	2.2 to 34 pF
193-4-5	3 to 30 pF

RF Power Device

MRF454 Same as MRF458
12.5 VDC, 3-30 MHz
80Watts output, 12dB gain
$17.95 ea.

E.F. JOHNSON TUBE SOCKETS

#124-0311-100........ 6.99 each
For 8072 etc.

#124-0107-001....... 13.99 each
For 4CX250B/R, 4X150A etc.

#124-0111-001........ 4.99 each
Chimney for 4CX250B/R and 4X150

#124-0113-001 and 124-0113-021
$12.99 each
Capacitor for #124-0107-001

#123-209-33 Sockets....6.99 each
For 811A, 572B, 866, etc.

UNELCO CAPS

6.8pF	47pF
8.2pF	62pF
10pF	100pF
12pF	160pF
13pF	180pF
14pF	200pF
20pF	240pF
24pF	380pF
33pF	470pF
36pF	1000pF
43pF	

350V $1.00 each

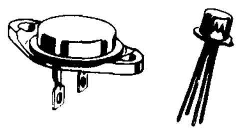
86 Pin Motorola Bus Edge Connectors

Gold plated contacts
Dual 43/86 pin .156 spacing
Soldertail for PCB..............$3.00 each

110VAC MUFFIN FANS

New $11.95
Used $5.95

Transistors



		2N3960JANTX	10.00	2N5645	10.00
		2N4072	1.60	2N5842	8.00
		2N4427	1.10	2N5849	20.00
		2N4429	7.00	2N5942	40.00
		2N4877	1.00	2N5946	14.00
		2N4959	2.00	2N5862	50.00
		2N4976	15.00	2N6080	7.00
2N2857JAN	2.50	2N5070	8.00	2N6081	10.00
2N2949	3.60	2N5071	15.00	2N6082	11.00
2N2947	15.00	2N5108	4.00	2N6083	13.00
2N2950	4.60	2N5109	1.50	2N6084	14.00
2N3375	8.00	2N5179	1.00	2N6095	11.00
2N3553	1.57	2N5583	4.00	2N6096	20.00
2N3818	5.00	2N5589	6.00	2N6097	28.00
2N3866	1.00	2N5590	8.00	2N6166	38.00
2N3866JAN	2.50	2N5591	11.00	2N6368	22.99
2N3866JANTX	4.00	2N5635	5.44	A210/MRF517	2.00
2N3925	10.00	2N5636	11.60	BLY38	5.00
2N3948	2.00	2N5637	20.00	40280/2N4427	1.10
2N3950	25.00	2N5641	5.00	40281/2N3920	7.00
2N3959	3.00	2N5643	14.00	40282/2N3927	10.48

CRYSTALS

$4.95 each

5.120	7.4825	9.565	10.150	11.155	11.905	17.315
7.3435	7.4865	9.575	10.160	11.275	11.955	17.355
7.4585	7.4925	9.585	10.170	11.700	12.000	17.365
7.4615	7.4985	10.000	10.180	11.705	12.050	37.600
7.4625	7.5015	10.010	10.240	11.730	12.100	37.650
7.4665	7.5025	10.020	10.245	11.750	16.965	37.700
7.4685	7.5065	10.030	10.595	11.755	17.015	37.750
7.4715	7.7985	10.040	10.605	11.800	17.065	37.800
7.4725	7.8025	10.0525	10.615	11.850	17.165	37.850
7.4765	9.545	10.130	10.625	11.855	17.215	37.900
7.4785	9.555	10.140	10.635	11.900	17.265	37.950
7.4815						38.000

High Voltage Caps

30 MFD @ 500 VDC	1.69
22 MFD @ 500 VDC	1.69
100 MFD @ 450 VDC	2.29
150 MFD @ 450 VDC	3.29
225 MFD @ 450 VDC	4.29
.001/1000pF @ 10 KV	.89
.001 @ 3 KV	4/1.00
.0015 @ 3 KV	3/1.00
.01 @ 4 KV	.79
.01 @ 1.6KV	4/1.00
.02 @ 8 KV	2.00
.01 @ 1 KV	6/1.00

NEW 2" ROUND SPEAKERS
100 Ohm coil $.99 each

PLASTIC TO-3 SOCKETS
4/$1.00

CRYSTAL FILTERS
Tyco 001-19880 Same as 2194F
10.7 MHz narrow band
3 dB bandwidth 15 KHz min.
20 dB bandwidth 60 KHz min.
40 dB bandwidth 150 KHz min.
Ultimate 50 dB insertion loss 1 dB max.
Ripple 1 dB max. Ct. 0+/-5 pF 3600 Ohms
$3.99 each

78MO5
Same as 7805 but only 1/2 Amp
5 VDC .49 each or 10/$3.00

TRIMMER CAPS

Sprague. Stable Polypropylene.
.50 each or 10/4.00
not sold mixed
1.2 to 13pF
2 to 30pF
3.9 to 18pF
3.9 to 40pF
3.9 to 55pF

Carbide Circuit Board Drill Bits
for PCB Boards
5 mix for $5.00

J-Fet

J310 N-CHANNEL J-FET 450 MHz
Good for VHF/UHF Amplifier,
Oscillator and Mixers 3/$1.00

MURATA CERAMIC FILTERS

SFD 455D	455 KHz	2.00
SFB 455D	455 KHz	1.60
CFM455E	455 KHz	5.50
CFU455H	455 KHz	3.00
SFE 10.7MA	10.7 MHz	2.99

TEXAS INSTRUMENT TIL-305P
5 x 7 array alphanumeric display
$3.85 each

More Details? CHECK—OFF Page 94

SEMICONDUCTORS SURPLUS

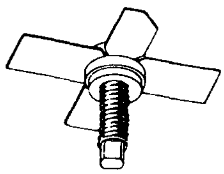
ARCO CAPS

304	100-550pF	1.50	469	170-780pF	1.40
400	.9-7pF	1.00	4615	390-1400pF	2.02
402	1.5-20pF	1.00	404	8-60pF	1.00
420	1-12pF	1.00	405	10-80pF	1.00
423	7-100pF	1.00	422	4-40pF	1.00
426	37-250pF	1.01	424	16-150pF	1.00
464	25-280pF	1.00	427	55-300pF	1.00
465	50-380pF	1.39	462	5-80pF	1.50
467	110-580pF	1.03			

TUBES

6KD6	5.00	6939	7.99
6LQ6/6JE6	6.00	6146	5.00
6MJ6/6LQ6/6JE6C	6.00	6146A	5.69
6LF6/6MH6	5.00	6146B/8298	7.95
12BY7A	4.00	6146W	12.00
2E26	4.69	6550A	8.00
4X150A	29.99	8908	9.00
4CX250B	45.00	8950	9.00
4CX250R	69.00	4-400A	145.00
4CX300A	109.99	4-400C	145.00
4CX350A/8321	100.00	572B/T160L	44.00
4CX350F/J/8904	100.00	7289	9.95
4CX1500B/8660	300.00	3-1000Z	229.00
811A	20.00	3-500Z	141.00
6360	4.69		

RF Transistors



		MRF449	12.65	BFR91	1.25
		MRF449A	12.65	BFR96	1.50
		MRF450	11.00	BFW92A	1.00
		MRF450A	11.77	BFW92	.79
		MRF452	15.00	MMCM918	14.30
		MRF453	13.72	MMCM2222	15.65
MRF203	P.O.R.	MRF454A	21.83	MMCM2369	15.00
MRF216	19.47	MRF455	14.08	MMCM2484	15.25
MRF221	8.73	MRF455A	14.08	MMCM3960A	24.30
MRF226	10.20	MRF474	3.00	MWA120	7.80
MRF227	2.13	MRF475	2.90	MWA130	8.08
MRF238	10.00	MRF476	2.25	MWA210	7.46
MRF240	14.62	MRF477	10.00	MWA220	8.08
MRF245	28.87	MRF485	3.00	MWA230	8.62
MRF247	28.87	MRF492	20.40	MWA310	8.08
MRF262	6.25	MRF502	.93		
MRF314	12.20	MRF604	2.00		
MRF406	11.33	MRF629	3.00		
MRF412	20.65	MRF648	26.87		
MRF421	27.45	MRF901	3.99		
MRF422A	38.25	MRF902	9.41		
MRF422	38.25	MRF904	3.00		
MRF428	38.25	MRF911	4.29		
MRF428A	38.25	MRF5176	11.73		
MRF426	8.87	MRF8004	1.39		
MRF426A	8.87	BFR90	1.00		

NEW MRF472
12.5 VDC, 27 MHz
4 Watts output
10 dB gain
1.69 ea.
10/9.50
100/69.00
1000/480.00

TO-3 TRANSISTOR SOCKETS
Phenolic type............6/$1.00

NEW SIMPSON 260-7 $99.99

RG174/U - $15.00 per 100 ft.
Factory new

PL259 TERMINATION
52 Ohm 5 Watts $1.50 each

TORIN TA700 FANS NEW $29.99 each
Model A30340
230 VAC @ .78 Amps
Will also work on 115 VAC

CRYSTAL FILTERS

EFCL455K13E	3.99
EFCL455K40B2	2.99
FX-07800L, 7.8 MHz	12.99
FHA103-4, 10.7 MHz	12.99

CB type crystals

$4.95 each

51-T

T1	T15	T28
T2	T16	T29
T3	T17	T30
T4	T18	T31
T5	T19	T32
T6	T20	T33
T7	T21	T34
T8	T22	T35
T9	T23	T36
T10	T24	T37
T11	T25	T38
T12	T26	T39
T13	T27	T40
T14		

51-R

R1	R15	R28
R2	R16	R29
R3	R17	R30
R4	R18	R31
R5	R19	R32
R6	R20	R33
R7	R21	R34
R8	R22	R35
R9	R23	R36
R10	R24	R37
R11	R25	R38
R12	R26	R39
R13	R27	R40
R14		

NEW CHERRY BCD SWITCH
New end plates
Type T-20............ 1.29 each

Johnson AIR Variables

$1.00 each

T-3-5	1 to 5 pF
T-6-5	1.7 to 11 pF
T-9-5	2 to 15 pF
189-6-1	.1 to 10 pF
189-502-Y	1.3 to 6.7pF
189-503-105	1.4 to 9.2pF
189-504-5	1.5 to 11.6pF
189-505-5	1.7 to 14.1pF
189-505-107	1.7 to 14.1pF
189-506-103	1.8 to 16.7pF
189-507-105	2 to 19.3pF
189-508-5	2.1 to 22.9pF
189-509-5	2.4 to 24.5pF
545-043	1.8 to 11.4pF

1.9-2.5G CONVERTERS

1900 MHz to 2500 MHz DOWNCONVERTERS
Intended for amateur radio use.
Tunable from channel 2 thru 6.
34 dB gain 2.5 to 3 dB noise.
Warranty for 6 months Model HMR 11
Complete Receiver and Power Supply
(does not include coax)............. $225.00

4 foot Yagi antenna only............. $39.99
Downconverter Kit - PCB and parts.. $69.95
Power Supply Kit -
Box, PCB and parts................ $49.99
Downconverter assembled........... $79.99
Power Supply assembled............ $59.99
Complete Kit form $109.99
(includes Yagi antenna and instructions)

REPLACEMENT PARTS

MRF901	$ 3.99
MBD101	1.29
.001 Chip Caps	1.00
Power Supply PCB	4.99
Downconverter PCB	19.99
Instructions for any separate item	10.00

NEW TRANSFORMERS

		Price each
F-18X	6.3 VCT @ 6Amps	6.99
F-46X	24V @ 1Amp	5.99
F41X	25.2VCT @ 2Amps	6.99
P-8380	10VCT @ 3Amps	7.99
P-8604	20VCT @ 1Amp	4.99
K-32B	28VCT @ 100 MA	4.99
E30554	Dual 17V @ 1Amp	6.99

DIODES

HEP 170
3.5 A, 1000 PIV
.20 ea., 100 for $15.00

D61005
1.5 A, 1000 PIV
.15 ea., 100 for $12.00

HVK 1153
25 mA, 20,000 PIV
$1.00 ea., 10 for $8.00

Fairchild LEDs
FLV 5007 & 5009 red.
Case type TO-92.
6/$1.00

SCMS 10K
15 mA, 10,000 PIV
$1.69 ea., 10 for $12.50

High-voltage diode EK500
5000 Volts, 50 mA
.99 each

Motorola SCR
TO-92 Case, 0.8 Amp, 30 V.
Igt 0.2 Vgt 0.8.
Same as #N5060.
4/$1.00 or 100/$15.00

Dialco Type 555-2003
LED 5 VDC with built-in resistor.
.69 each

Motorola MA 752 Rectifier
6 Amps, 200 PIV
4/$1.29

NEW BCD SWITCH

8 switch with end plates
Model TSM200-1011 (CDI) $16.87

CONTINUOUS TONE BUZZERS

12VDC............... $2.00 each

EIMAC FINGER STOCK #Y-302

36 in. long x 1/2 in. $4.99 each

MAGNET WIRE

$22.50 per spool

#24	A.W.G.	9 lb.
#26	A.W.G.	9 lb.
#25	A.W.G.	9 lb.
#30	A.W.G.	8 3/4 lb.
#31	A.W.G.	6 lb.

CORES

4/1.00

T20-12	T30-6	T37-6
T25-6	T30-12	T37-10
T30-2	T37-2	T44-6

CABLE TIES

#/T-18R 100 per bag
mil. spec. #MS-3368S, 4"
Made by Tyton Corp.
$2.50 per bag
100 bags - $20.00

Miniature Ceramic Trimmers

.50 each or 10/$4.00

CV31D350	2 to 8 pF
HM00-4075-03	3.5 to 11 pF
300425	3.5 to 13 pF
E5-25A	5 to 25 pF
	5.1 to 40 pF
	3.5 to 15 pF
	5.2 to 40 pF
	2.5 to 6 pF

CERAMIC STAND OFFS

#CNP-5	3/8 x 5/8"	.29 each
	7/16 x 1 1/4"	.39 each
#N54W0112	3/8 x 1 1/2"	.49 each
#NL523W03-010	3/4 x 1 1/4"	.79 each

CORES AND BEADS

#43	Shield Bead	4/1.00
#61	Toroid	3/1.00
#43	Balun	10/1.00
#61	Balun	8/1.00
#61	Balun	6/1.00
#61	Balun	4/1.00
#61	Beads	10/1.00
Ferrite Rod 1/4 x 7 1/2		2.99
Ferrite Beads 1/8" long		12/1.00
Ferrite Beads 3/8" long		6/1.00
Ferrite Beads 1/16" long		12/1.00

DOOR KNOB CAPS

470 pF @ 15 KV	$3.99 each
Dual 500 pF @ 15 KV	5.99 each
680 pF @ 6 KV	3.99 each
800 pF @ 15 KV	3.99 each
2700 pF @ 40 KV	5.99 each

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26.8 VCT @ 660 MA
21.9 VCT @ 1.1 Amps

$1.99 each
#18000711P
24 V @ 100 MA

$12.99 each
#2099459-00
28 V @ 1.5 Amps
9.6 V @ 9 Amps
16.8 V @ 300 MA

JUMBO LED'S

Red	8/$1.00
Clear	6/$1.00
Yellow	6/$1.00
Green	6/$1.00
Amber	6/$1.00

MEDIUM LED'S

Red	6/$1.00
Green	6/$1.00

NE555V TIMERS

.39 each or 10/$5.00

NEW DUAL COLON LED

.69 each or 10/$5.00

PLATE CHOKES

75 uH	3.00
.94 mH	3.99

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Motorola MHW 252 VHF power amplifier.
Frequency range: 144-148 MHz.
Output power: 25W.
Minimum gain: 19.2 dB.
$29.67 each

Motorola MC 1316P.
House no. same as HEP C6073 & EC9814.
2-W audio amplifier.
$1.29 ea., 10 for $9.50

Fairchild 007-03 IC.
ECG no. 707 Chroma demodulator.
$1.29 ea., 10 for $8.50

Motorola rf transistors.
Selection Guide & Cross-Reference Catalog.
43 pgs.
$1.99 each

RCA Triacs.
Type T2310A.
TO-5 Case with heat sinks.
1.6 Amp, 100 VDC, Igt 3mA.
Sensitive gate.
$1.00 each

RCA power transistors.
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Vceo 60 NFE 5mA.
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RCA Triacs.
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Stud type.
$3.69 each

RCA Triacs.
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30 Amps, 400 VDC.
$5.00 each

Motorola rf amplifier.
544-4001-002, similar to type MHW 401-2.
1.5 Watts output. 440-512 MHz.
15 dB gain min. $19.99 each

ORDERING INSTRUCTIONS

Check, money order, or credit cards welcome. (Master Charge and VISA only.) No personal checks or certified personal checks for foreign countries accepted. Money order or cashiers check in U.S. funds only. Letters of credit are not acceptable.

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More Details? CHECK—OFF Page 94

HAM CALENDAR

August

Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday

1

CENTRAL STATES VHF SOCIETY'S 15TH ANNUAL CONFERENCE — Holiday Inn Airport, Sioux Falls, SD — W0SO 1.

ILLINOIS QSO PARTY 1-2.

MICRO-EXPEDITION to Forest County, PA. Call WB3IQE/3, Mode CW only. Frequencies 30, 40, and 15 meters — WB3IQE 1-2.

33RD ANNUAL UPPER PENISULA HAMFEST (MICHIGAN) — Delta County Repeater Assoc., Flat Rock Township Hall, Escanaba, MI — WA8DHB 1-2.

JACKSONVILLE HAMFEST & NORTHERN FLORIDA ARRL CONVENTION — Orange Park Kennel Club, I-295 & U.S. 17 south of Jacksonville 1-2.

RADIO AMATEUR DE QUEBEC — Annual convention at CEGEP Levis-Lauzon, 205 Mgr. Bourget, Lauzon near Quebec City. Call VE2BZL 418-871-2850 1-2.

2

23RD ANNUAL CROOKED LAKE FM PICNIC & HAMFEST - by Steuben County Radio Amateurs, Angola, IN - WB9YIT 2

NORTHWEST KANSAS 1ST AMATEUR RADIO SWAP MEET — Community Bldg, Colby, KS — WA0GBN or KA0FBQ 2.

ILLINOIS BELVIDERE BIG THUNDER ARC ANNUAL HAMFEST — Boone County Fairgrounds, Hwy 76 - K9DGG 2.

3RD ANNUAL NORTH CENTRAL MISSOURI HAMFEST Municipal Auditorium, Moberly, MO — WB0ENV 2.

3

WEST COAST BULLETIN 8 PM PST (0400 UTC) 3540 kHz, A 1 22 WPM 3

4

AMSAT Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning)

AMSAT Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning)

AMSAT Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning)

5

6

WEST COAST QUALIFYING RUN 6.

7

8

EUROPEAN C.W. CONTEST 8-9.*

UHF CONTEST — Begins 1900 UTC Sat. and ends at 1900 UTC on Sun 8-9.

NORTHWEST DX CONVENTION — by Willamette Valley DX Club, The Greenwood Inn, Beaverton, OR. Write POB 555, Portland, OR 97207 8-9.

BURLINGTON ARC ANNUAL INTERNATIONAL HAMFEST — Old Lantern Campground, off route 7, Charlotte, VT — W1VSA 8-9.

TRI-COUNTY AMATEUR RADIO ASSN. ANNUAL HAMFEST — Los Angeles County Fairgrounds, Thummer's Patio. Write TCARA, POB 142, Pomona, CA 91767 8.

9

ST. CLOUD AMATEUR RADIO CLUB HAMFEST — Whitney Sr. Center, St. Cloud, MN. Contact Mike Lynch, KA0HQS 9.

CENTRAL KENTUCKY ARRL HAMFEST — by the Bluegrass Amateur Radio Society at Tates Creek Jr. H.S., Centre Parkway, Lexington, KY — K4DHN 9.

HAMFESTERS RADIO CLUB'S 47TH ANNUAL HAMFEST Santa Fe Park, 91st & Wolf Rd., Willow Springs, IL N9BIA 9.

10

11

AMSAT Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning)

AMSAT Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning)

AMSAT Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning)

12

13

W1AW QUALIFYING RUN 13

14

TEXAS VHF FM SOCIETY STATE CONVENTION & 2ND ANNUAL SUPER CENTRAL TEXAS SWAPFEST — Hilton Inn, Austin, TX. Contact VHF '81, POB 13473, Capital Sta., Austin, TX 78711 14-16.

15

ALL ASIAN CW CONTEST 22-23*.

RHODE ISLAND QSO PARTY 15-17.

RADIO CLUB OF TACOMA ANNUAL HAMFAIR — Pacific Lutheran University, Tacoma, WA — WB7QNS 15-16.

NEW JERSEY QSO PARTY 15-17.

16

SIXTH ANNUAL NEW DELMARVA HAMFEST — Gloryland Park, Bear, DE. Contact K3HBP, 14 Balsam Rd., Wilmington, DE 19804 16.

10TH ANNUAL LAFAYETTE HAMFEST — Tippecanoe County Fairgrounds in Lafayette, IN 16.

17

WEST COAST BULLETIN — 8 PM PST (0400 UTC) 3540 kHz, A-1 22WPM 17.

18

AMSAT Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning)

AMSAT Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning)

AMSAT Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning)

19

20

21

22

OHIO QSO PARTY — 22-23.

TMI FUN DXEDITION — Central PA DX Club's first DXpedition to Three Mile Island. QSL to CPDXC, c/o WB3DNA 22-23.

23

W1AW QUALIFYING RUN 23.

ST CHARLES ARC HAMFEST — Wentzville Missouri Community Club. Contact SCARC Hamfest 81, c/o Bill Graham, 512 Bermuda Dr., O'Fallon, MO 63366 23.

BLUEFIELD HAMFEST 81 — by East River ARC at Bluefield Army-Civic Center, 1 mi north of Bluefield, WV on US 52. Write Bluefield Hamfest, 2113 Hemlock Hill, Bluefield, WV 24701 23.

1981 ILLINOIS STATE ARRL CONVENTION — by Fox River Radio League, Kane County Fairgrounds in St. Charles, IL 23.

IOWA 75 METER NET PICNIC & SWAPFEST - Ewing park in southeast Des Moines, IA. Contact WB0JFF 23.

24

25

AMSAT Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning)

AMSAT Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning)

AMSAT Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning)

26

27

PEND OREILLE ARC "SPECIAL EVENT STATION" — from Pend Oreille County Fairgrounds at Cusick, WA, on 1600Z to 0500Z using call WB7TBN 27-30.

28

29

30

SHAWNEE AMATEUR RADIO ASSOC. 25TH ANNUAL HAMFEST — At John A. Logan College west of Carterville, IL on State Rt. 13. 30.

GLOUCESTER COUNTRY ARC HAMFEST — at Gloucester Country College, Tanyard, Rd., Sewell, NJ. Contact Hamfest Committee, POB 370, Pitman, NJ 08071 30.

LAPORTE COUNTY HAMFEST — County Fairgrounds on Hwy 2 west of LaPorte, IN 30.

31

W1AW Schedule
April 26-October 25, 1981

UTC	Slow Code Practice	MWF: 0200, 1300, 2300; TThSSn: 2000; S: 0200
	Fast Code Practice	MWF: 2000; TTh: 0200, 1300; TThSSn: 2300; S: 0200
	CW Bulletins	Dy: 0000, 0300, 2100; MTWThF: 1400

Code practice and CW bulletin frequencies: 1.835, 3.58, 7.08, 14.08, 21.08, 28.08, 50.08, 147.555 MHz.

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ALL ABOVE MODELS WITH COAX FITTINGS IN & OUT AND WITH WEATHER-PROOFED DIE CAST HOUSINGS.
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POWER SUPPLY KIT FOR ABOVE **$24.95**
FACTORY WIRED & TESTED **$34.95**

COMPLETE KITS: CONSISTING OF EVERY ESSENTIAL PART NEEDED TO MAKE YOUR COUNTER COMPLETE. **HAL-600A** 7-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 600 MHz. FEATURES TWO INPUTS: ONE FOR LOW FREQUENCY AND ONE FOR HIGH FREQUENCY; AUTOMATIC ZERO SUPPRESSION. TIME BASE IS 1.0 SEC OR .1 SEC GATE WITH OPTIONAL 10 SEC GATE AVAILABLE. ACCURACY ± .001%, UTILIZES 10-MHz CRYSTAL 5 PPM. **COMPLETE KIT $129**

HAL-300A 7-DIGIT COUNTER (SIMILAR TO 600A) WITH FREQUENCY RANGE OF 0-300 MHz. **COMPLETE KIT $109**

HAL-50A 8-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 50 MHz OR BETTER. AUTOMATIC DECIMAL POINT, ZERO SUPPRESSION UPON DEMAND. FEATURES TWO INPUTS: ONE FOR LOW FREQUENCY INPUT, AND ONE ON PANEL FOR USE WITH ANY INTERNALLY MOUNTED HALTRONIX PRE-SCALER FOR WHICH PROVISIONS HAVE ALREADY BEEN MADE. 1.0 SEC AND .1 SEC TIME GATES. ACCURACY ± .001%. UTILIZES 10-MHz CRYSTAL 5 PPM. **COMPLETE KIT $109**

FREE: HAL-79 CLOCK KIT PLUS AN INLINE RF PROBE WITH PURCHASE OF ANY FREQUENCY COUNTER.

PRE-SCALER KITS

HAL 300 PRE ..... (Pre-drilled G-10 board and all components) **$14.95**
HAL 300 A/PRE .... (Same as above but with preamp) **$24.95**
HAL 600 PRE ..... (Pre-drilled G-10 board and all components) **$29.95**
HAL 600 A/PRE .... (Same as above but with preamp) **$39.95**

NEW!

HAL-1 GHz PRESCALER, VHF & UHF INPUT & OUTPUT, DIVIDES BY 1000. OPERATES ON A SINGLE 5 VOLT SUPPLY. **PREBUILT & TESTED $79.95**

TOUCH TONE DECODER KIT

HIGHLY STABLE DECODER KIT. COMES WITH 2 SIDED, PLATED THRU AND SOLDER FLOWED G-10 PC BOARD, 7-567's, 2-7402, AND ALL ELECTRONIC COMPONENTS. BOARD MEASURES 3-1/2 x 5-1/2 INCHES. HAS 12 LINES OUT. ONLY **$39.95**

DELUXE 12-BUTTON TOUCHTONE ENCODER KIT UTILIZING THE NEW ICM 7206 CHIP. PROVIDES BOTH **VISUAL** AND **AUDIO** INDICATIONS! COMES WITH ITS OWN TWO-TONE ANODIZED ALUMINUM CABINET. MEASURES ONLY 2-3/4" x 3-3/4". COMPLETE WITH TOUCH-TONE PAD, BOARD, CRYSTAL, CHIP AND ALL NECESSARY COMPONENTS TO FINISH THE KIT. **PRICED AT $29.95**

FOR THOSE WHO WISH TO MOUNT THE ENCODER IN A HAND-HELD UNIT, THE PC BOARD MEASURES ONLY 9/16" x 1-3/4". THIS PARTIAL KIT WITH PC BOARD, CRYSTAL, CHIP AND COMPONENTS. **PRICED AT $14.95**

ACCUKEYER (KIT) THIS ACCUKEYER IS A REVISED VERSION OF THE VERY POPULAR WB4VVF ACCUKEYER ORIGINALLY DESCRIBED BY JAMES GARRETT, IN QST MAGAZINE AND THE 1975 RADIO AMATEUR'S HANDBOOK. **$16.95**

ACCUKEYER — MEMORY OPTION KIT PROVIDES A SIMPLE, LOW COST METHOD OF ADDING MEMORY CAPABILITY TO THE WB4VVF ACCUKEYER. WHILE DESIGNED FOR DIRECT ATTACHMENT TO THE ABOVE ACCUKEYER, IT CAN ALSO BE ATTACHED TO ANY STANDARD ACCUKEYER BOARD WITH LITTLE DIFFICULTY. **$16.95**

PRE-AMPLIFIER

HAL-PA-19 WIDE BAND PRE-AMPLIFIER, 2-200 MHz BANDWIDTH (−3dB POINTS), 19 dB GAIN. **FULLY ASSEMBLED AND TESTED $8.95**

NEW!

CLOCK KIT — HAL 79 FOUR-DIGIT SPECIAL — $7.95. OPERATES ON 12-VOLT AC (NOT SUPPLIED). PROVISIONS FOR DC AND ALARM OPERATION.

6-DIGIT CLOCK • 12/24 HOUR

COMPLETE KIT CONSISTING OF 2 PC G-10 PRE-DRILLED PC BOARDS, 1 CLOCK CHIP, 6 FND COMM. CATH. READOUTS, 13 TRANS., 3 CAPS, 9 RESISTORS, 5 DIODES, 3 PUSH-BUTTON SWITCHES, POWER TRANSFORMER AND INSTRUCTIONS. DON'T BE FOOLED BY PARTIAL KITS WHERE YOU HAVE TO BUY EVERYTHING EXTRA. **PRICED AT $12.95**

CLOCK CASE AVAILABLE AND WILL FIT ANY ONE OF THE ABOVE CLOCKS. REGULAR PRICE ... $6.50 **BUT ONLY $4.50 WHEN BOUGHT WITH CLOCK.**

SIX-DIGIT ALARM CLOCK KIT FOR HOME, CAMPER, RV, OR FIELD-DAY USE. OPERATES ON 12-VOLT AC OR DC, AND HAS ITS OWN 60-Hz TIME BASE ON THE BOARD. COMPLETE WITH ALL ELECTRONIC COMPONENTS AND TWO-PIECE, PRE-DRILLED PC BOARDS. BOARD SIZE 4" x 3". COMPLETE WITH SPEAKER AND SWITCHES. IF OPERATED ON DC, THERE IS NOTHING MORE TO BUY.* **PRICED AT $16.95**

*TWELVE-VOLT AC LINE CORD FOR THOSE WHO WISH TO OPERATE THE CLOCK FROM 110-VOLT AC. **$2.50**

SHIPPING INFORMATION — ORDERS OVER $20.00 WILL BE SHIPPED POSTPAID EXCEPT ON ITEMS WHERE ADDITIONAL CHARGES ARE REQUESTED. ON ORDERS LESS THAN $20.00 PLEASE INCLUDE ADDITIONAL $1.50 FOR HANDLING AND MAILING CHARGES. SEND SASE FOR FREE FLYER.

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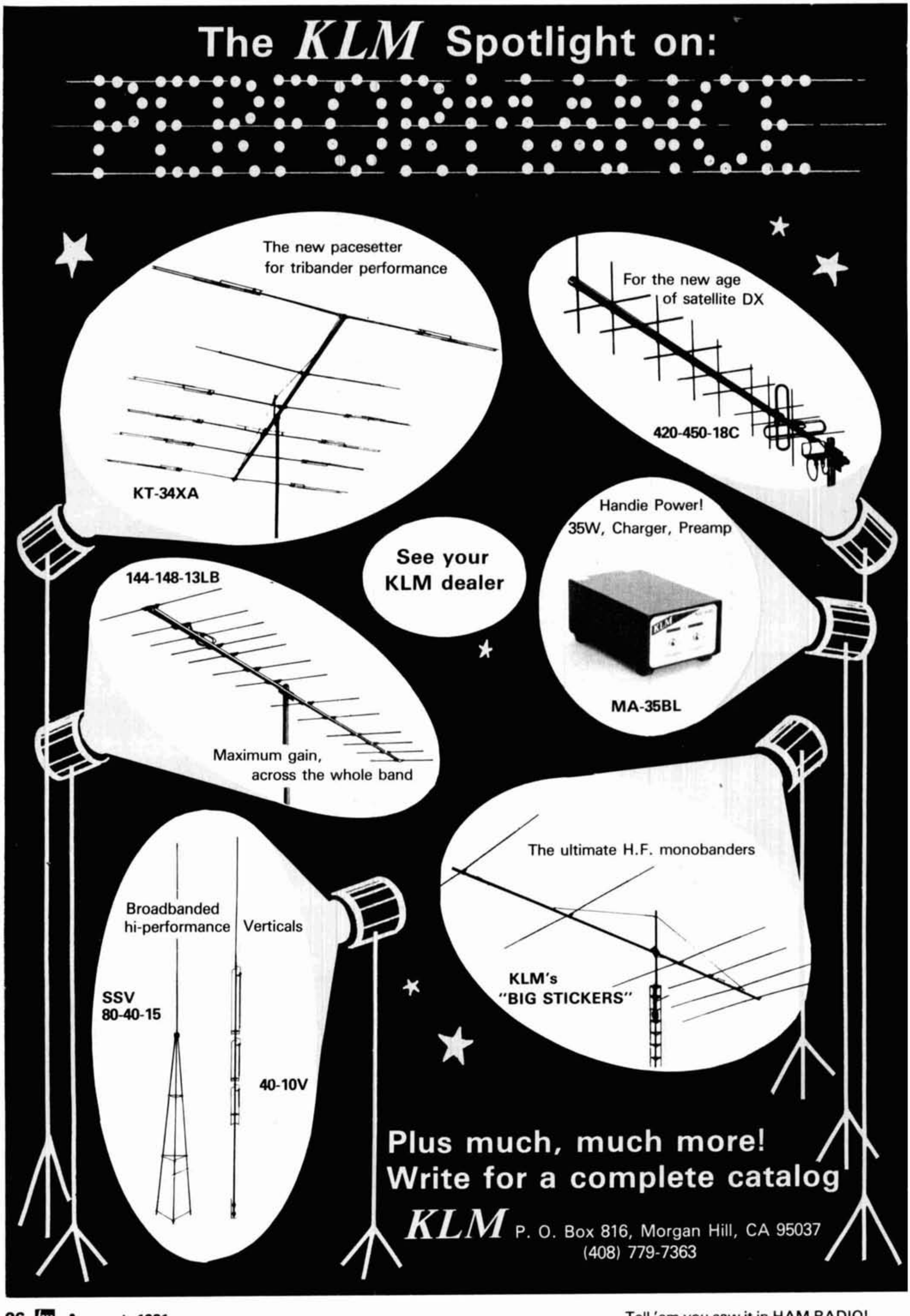
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THE FT-707 "WAYFARER"

The introduction of the "WAYFARER" by Yaesu is the beginning of a new era in compact solid state transceivers. The FT-707 "WAYFARER" offers you a full 100 watts output on 80-10 meters and operates SSB, CW, and AM modes. Don't let the small size fool you! Though it is not much larger than a book, this is a full-featured transceiver which is ideally suited for your home station or as a traveling companion for mobile or portable operation.

The receiver offers sensitivity of .25 uV/10 dB SN as well as a degree of selectivity previously unavailable in a package this small. The "WAYFARER" comes equipped with 16 poles of IF filtering, variable bandwidth and optional crystal filters for 600 Hz or 350 Hz. Just look at these additional features:

FT-707 with Standard Features

- Fast/slow AGC selection
- Advanced noise blanker
- Built-in calibrator
- WWV/JJY Band
- Bright Digital Readout
- Fixed crystal position
- 2 auxiliary bands for future expansion
- Unique multi-color bar metering—monitors signal strength, power output, and ALC voltage.

FT-707 with Optional FV-707DM & Scanning Microphone

- Choice of 2 rates of scan
- Remote scanning from microphone
- Scans in 10 cycle steps
- Synthesized VFO
- Selection of receiver/transmitter functions from either front panel or external VFO
- "DMS" (Digital Memory Shift)

Impressive as the "WAYFARER" is its versatility can be greatly increased by the addition of the FV-707DM (optional). The FV-707DM, though only one inch high, allows the storage of 13 discrete frequencies and with the use of "DMS" (Digital Memory Shift) each memory can be band-spread 500 KHz. These 500 KHz bands may be remotely scanned from the microphone at the very smooth rate of 10 Hz steps.

The FT-707 "WAYFARER" is a truly unique rig.
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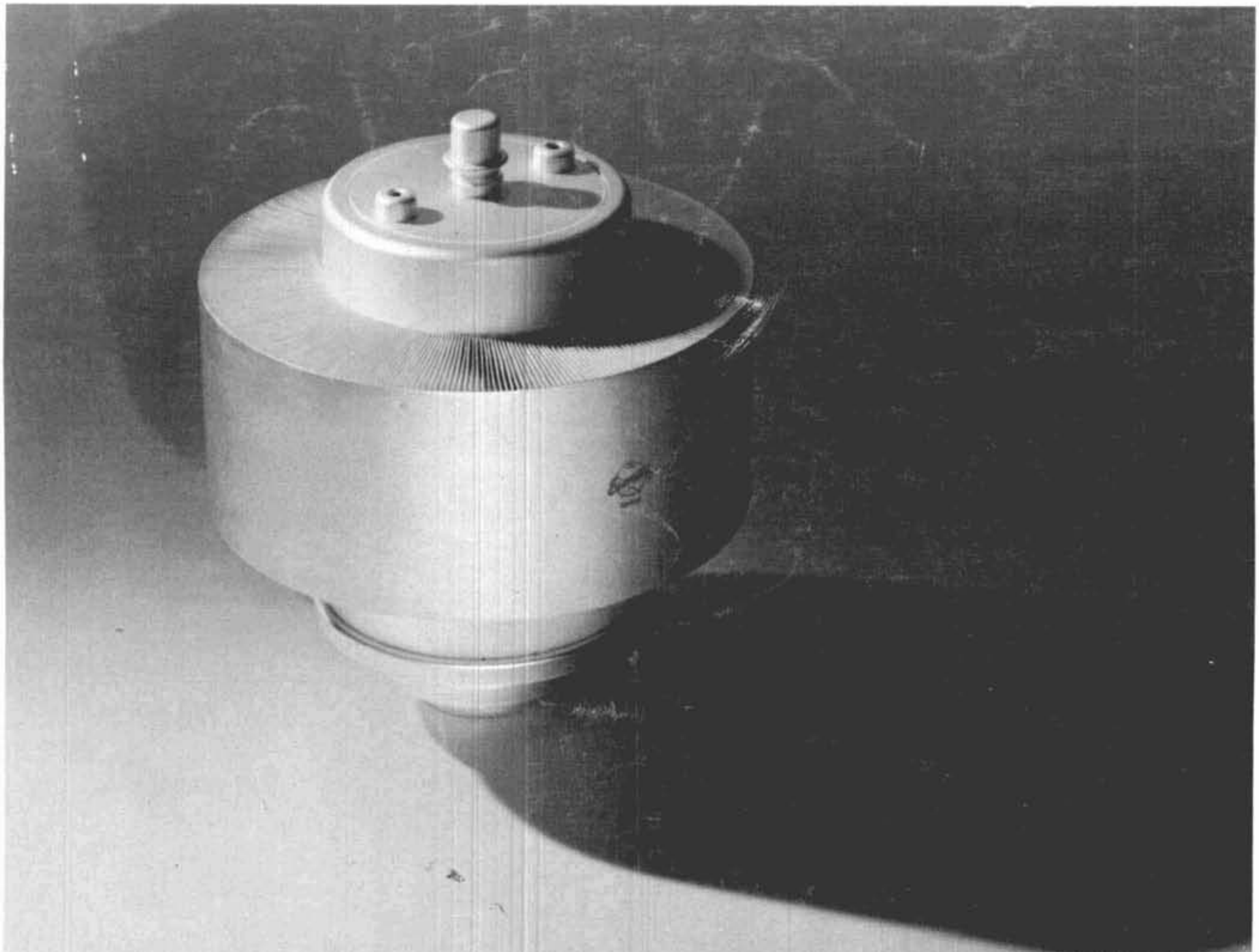
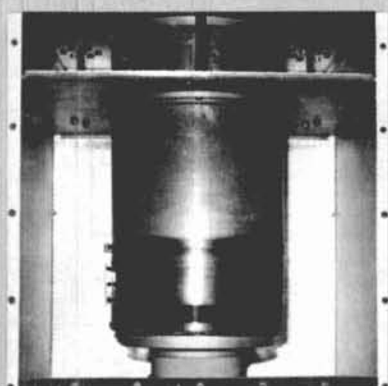


50 kW VHF power, greater efficiency. 4CX40,000G tetrode and cavities from Eimac.

Eimac's new CV-2200 series of practical, low-cost cavities are available now. Combined with Eimac's 4CX40,000G VHF tetrode, this efficient, compact package is recommended for FM broadcast service, VHF-television, particle acceleration and VHF radar.

Generating a measured power output of 60 kW, the 4CX40,000G tetrode offers power gains of 20 dB up to 218 MHz. High stability is achieved with the pyrolytic graphite grid structure. And a highly efficient, economical and quiet anode cooling system is inherent in its design.

Eimac supplies cavity and tube to match your requirements. We back it up with know-how and application engineering information.



50 kW FM broadcast cavity CV-2200 with 4CX40,000G tetrode.

More information is available from Varian Eimac Division. Or the nearest Varian Electron Device Group sales office. Call or write today.

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