Issue #303

OUR 25th ANNIVERSARY YEAR!

December 1985
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73 for Radio Amateurs®

A CWC/P Publication

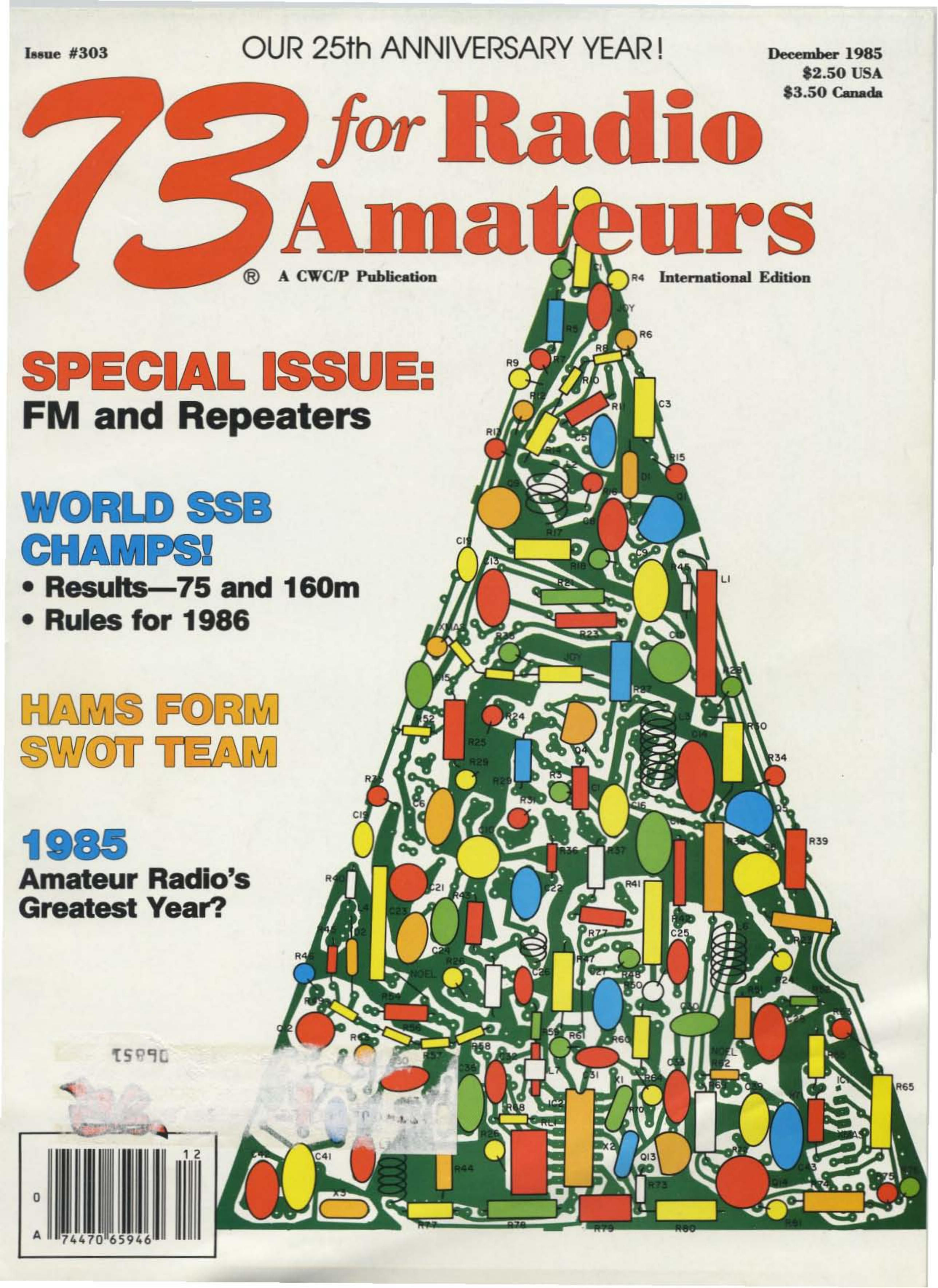
International Edition

SPECIAL ISSUE:
FM and Repeaters

WORLD SSB CHAMPS!
- Results—75 and 160m
- Rules for 1986

HAMS FORM SWOT TEAM

1985
Amateur Radio's Greatest Year?



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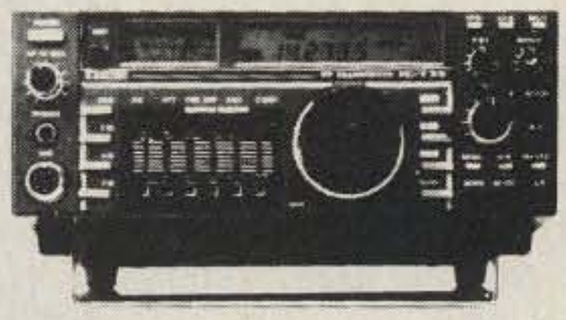

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Prices, specifications, descriptions subject to change without notice Calif and Arizona residents please add sales tax

THINGS TO LOOK FOR *(AND LOOK OUT FOR)* IN A PHONE PATCH

- A patch should work with any radio. AM, FM, ACSB, relay switched or synthesized.
- Patch performance should not be dependent on the T/R speed of your radio.
- Your patch should sound just like your home phone.
- There should not be any sampling noises to distract you and rob important syllables. The best phone patches do not use the cheap sampling method. (Did you know that the competition uses VOX rather than sampling in their $1000 commercial model?)
- A patch should disconnect automatically if the number dialed is busy.
- A patch should be flexible. You should be able to use it simplex, repeater aided simplex, or semi-duplex.
- A patch should allow you to manually connect any mobile or HT on your local repeater to the phone system for a fully automatic conversation. Someone may need to report an emergency!
- A patch should not become erratic when the mobile is noisy.
- You should be able to use a power amplifier on your base to extend range.
- You should be able to connect a patch to the MIC and EXT. speaker jack of your radio for a quick and effortless interface.
- You should be able to connect a patch to three points inside your radio (VOL high side, PTT, MIC) so that the patch does not interfere with the use of the radio and the VOL. and SQ. settings do not affect the patch.
- A patch should have MOV lightning protectors.
- Your patch should be made in the USA where consultation and factory service are immediately available.

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GIVES YOU ALL
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PRIVATE PATCH III
SIMPLEX SEMI-DUPLEX INTERCONNECT

NEW

With an amazingly low price, the all new PRIVATE PATCH III is the most powerful personal phone patch system available. You can use it simplex, repeater aided simplex (from your base) or semi-duplex (at the repeater). That's right, you will never have to buy another patch. PRIVATE PATCH III does it all! There are many new and important features which were formerly only available in our top commercial models.

With a flick of the new connect switch you can patch your friends on the repeater into the phone system. One of them may need to report an emergency!

No hassles with busy signals! If you call a number that is busy, just put your MIC down and relax. PRIVATE PATCH III will disconnect automatically.

The new CW ID keeps you completely informed as to patch status. ID occurs when you access and again when you disconnect. ID is also sent after toll call attempts, all automatic disconnects, manual disconnect and when timeout is imminent. And of course your CW ID chip is free.

PRIVATE PATCH III does not interfere with the normal use of your base radio. A new audio pre-amp permits audio take off before the VOL. control. As a result, the VOL. and squelch settings do not affect patch operation. Of course you can also connect PRIVATE PATCH III to the MIC and EXT speaker jacks as before.

A new digit counting system makes the toll restrict positive even in areas where you do not have to dial "1" first. A secret five digit code disables the toll restrict for one toll call. Re-arm is automatic.

Additional new features: MOV lightning protection — Three digit access code (eg.*93) — Spare relay position on board — Plus former features: 3/6 minute timeout timer — Digital fast VOX (pat. pend.) — 115 VAC supply — Modular Jack and cord plus much more!

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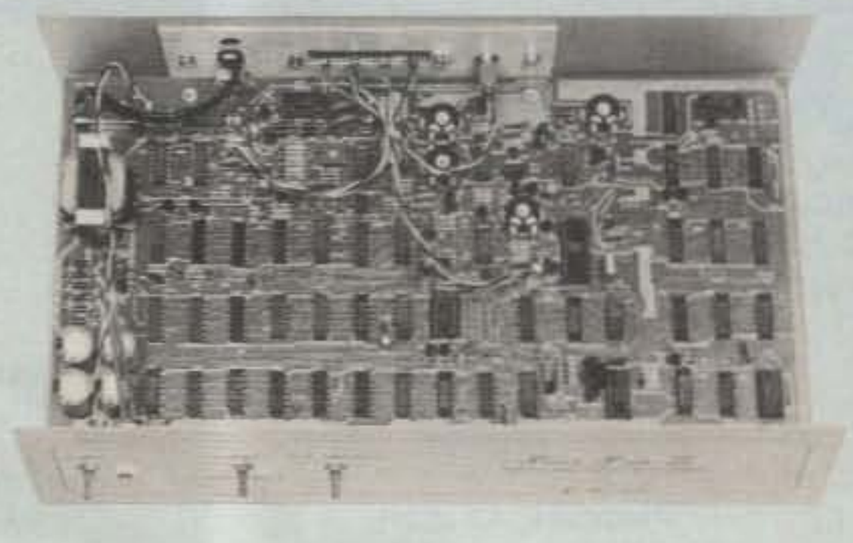

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73® for Radio Amateurs

ISSUE #303 DECEMBER 1985

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Our holiday "construction project" was designed by Dianne Ritson and Sue Hays. Parts placement diagram by Techart Associates, Amherst NH.

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WHAT?

News from the Publisher

The results of our poetry (questionable in some cases!) contest are in. Honorable mentions go to Peter Strauss KO6R (Oakland CA), Paul Danzer N1II (Norwalk CT), Brian Tandrow KR6B (Simi Valley CA), Terry Russ N8ATZ (Massillon OH), Casey Cassin KC7DY (Seattle WA), Verne Smith KA1NAV (Bath ME), and Ed Scallon KA1JSN (Providence RI).

Our $100 prize-winner was written by William Templin KA0DYI (North Liberty IA), who gives special thanks to his wife Susan and his two friends named Steve. Here it is (with our apologies to Clement Clarke Moore), along with our very best wishes for a safe and happy holiday season...

'Twas the night before Christmas, when all
through the town
The snowstorm was raging, the phone lines
were down;
The wind it did howl, the tree limbs did crack,
I hope that St. Nick isn't forced to turn back.
The wife making cookies, the kids making noise,
While away in the shack, by my rig I was poised.
The finals were glowing, the mike gain was set,
I was chasing DX to see what I could get.
The bands were all empty, the frequencies clear,
Except one lone station that sounded quite near.
He was calling CQ and my interest did pique,
When he ended transmission with the words,
"Old St. Nick."
I answered back quickly, I used great dispatch,
If this were St. Nicholas, good God, what a catch!
We exchanged information, it was really
quite graphic,
Then he came back and said,
"I've emergency traffic!"
His reindeer were tired, his elves in a grump,
If he didn't land soon, then his sleigh
he would dump.
I thought very carefully, I thought very hard,
Then I gave him directions to my
snow-covered yard.
As he flew past my window, his hair like a mane,
He reined in his chargers and called them
by name:
"Whoa, Anode! Whoa, Cathode! Whoa, Zener!
Whoa, Diode!
Stop, Heater! Stop, Grid Leak! Stop, Bias!
Stop, Triode!
You're flying too low! You're flying too fast!
Look out, you dumb reindeer, his antenna mast!"
So into the backyard the reindeer did drop,
St. Nick, the elves, and the sleigh went kerplop!
Then at the back door, I heard this loud knocking,
"Open up in there, or I won't fill your stocking!"
As I turned off the light and was leaving the shack,
Into the house Saint Nicholas came from the back—
His two-meter rig held to his hip with a strap,
"Hams Do It In The Shack" on the front of his cap.
The sack that he carried made his aged
brow furrow,
And he handed me a card that read,
"QSL Via Bureau."
His clothes were all sooty, from his shoes
to his vest;
I felt like a Novice taking his test.
His fingers were calloused and from what
I could tell,
This came from a straight key that I'll bet
he used well.
I offered him coffee, I offered him smokes,
I tried easing the tension by telling ham jokes.
Then he nodded his head and raised up his thumb,
He smiled like an Elmer; did I ever feel dumb.
He grabbed up his sack and went straight
for the tree,
And placed in the pile a large present for me.
When he finished his work he stood up,
took a bow,
Then out the back door to his team he did plow.
But I heard him exclaim as he flew o'er the land,
"Beware the FCC, friend, we were both
out of band!"

Jack Burnett

73 for Radio Amateurs is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 57 computer publications in more than 20 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: Argentina's *Computerworld/Argentina;* Asia's *The Asian Computerworld;* Australia's *Computerworld Australia, Australian PC World, Macworld* and *Directories;* Brazil's *DataNews* and *MicroMundo;* China's *China Computerworld;* Denmark's *Computerworld/Danmark, PC World* and *RUN* (Commodore); Finland's *Mikro;* France's *Le Monde Informatique, Golden* (Apple), *OPC* (IBM) and *Distributique;* Germany's *Computerwoche, Microcomputerwelt, PC Welt, SoftwareMarkt, CW Edition/Seminar, Computer Business, RUN* and *Apple's;* Italy's *Computerworld Italia* and *PC Magazine;* Japan's *Computerworld Japan;* Mexico's *Computerworld/Mexico* and *CompuMundo;* The Netherland's *Computerworld Benelux* and *PC World Benelux;* Norway's *Computerworld Norge, PC World* and *RUN* (Commodore); Saudi Arabia's *Saudi Computerworld;* Spain's *Computerworld Espana, Microsistemas/PC World, Commodore World;* Sweden's *ComputerSweden, Mikrodatorn* and *Svenska PC;* the UK's *Computer Management, Computer News, PC Business World* and *Computer Business Europe;* Venezuela's *Computerworld Venezuela;* the US's *Computerworld, Hot CoCo, inCider, Infoworld, MacWorld, Micro Marketworld, PC World, RUN, 73, 80 Micro, Focus Publications* and *On Communications.*

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- **Simple to operate**
  Functional design is "user friendly." Built-in 16-key autopatch encoder, TX STOP switch, REVerse switch, KEYboard LOCK switch, high efficiency speaker.
- **Large LCD**
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- **Extended frequency coverage**
  Allows operation on most MARS and CAP frequencies. Receive frequency range is 140-160 MHz. (TR-3600A covers 440-450 MHz.)
- **Programmable scan**
  Channel scan or band scan, search for open or busy channels.
- **SLIDE-LOC battery case**
- **10 Channels**
  10 memories, one for non-standard repeater offsets.
- **2.5 watts high power, 350 mW low**
  TR-3600A has 1.5 watts high or 300 mW low.

The Kenwood TR-2600A and the TR-3600A pack "big rig" features into the palm of your hand. It's really a "handy handful"!

Optional accessories:

- TU-35B built in programmable sub-tone encoder
- VB-2530 2-m 25 W RF power amp.
- ST-2 base stand/charger
- MS-1 mobile stand/charger
- PB-26 Ni-Cd battery
- DC-26 DC-DC converter
- HMC-1 headset with VOX
- SMC-30 speaker microphone
- LH-3 deluxe leather case
- SC-9 soft case with belt hook
- BT-3 AA manganese/alkaline battery case
- EB-3 external C manganese/ alkaline battery case
- RA-3 2-m telescoping antenna
- RA-5 2-m/70-cm telescoping antenna
- AX-2 shoulder strap w/ant. base
- CD-10 call sign display
- BH-2A belt hook

More TR-2600A and TR-3600A information is available from authorized Kenwood dealers.

TR-2600A shown. TR-3600A is available for 70 cm operation.
Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.
Specifications and prices are subject to change without notice or obligation.

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If you 've read about packet, or are already into it, you know how exciting it is. With the hot new Pakratt PK-64 we've just brought a new dimension to packet. The Pakratt PK-64 is a complete, fully assembled and tested packet radio controller which, together with a Commodore 64 or 128 computer, can convert your shack into a packet operations center.
And we've included a new version of our advanced MBA-TOR™ software to make it the first packet controller with AMTOR, Baudot, ASCII and Morse. But an even more exciting part of the Pakratt controller is its great price.

Incredibly Simple To Set Up

Just plug the Pakratt controller into the C-64's game cartridge slot, add a mic connector for connecting to your particular transceiver, and you're set.
If you're anxious to try it out, our new "quickstart" manual section can get you on the air in under ½ hour.

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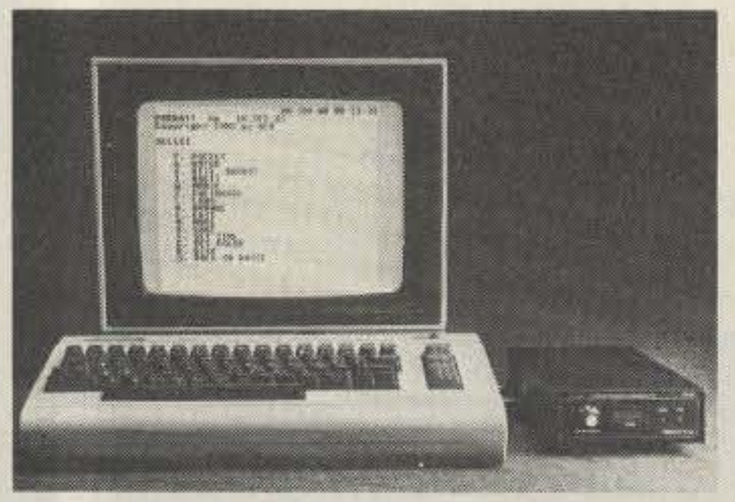
The versatile Pakratt controller shows messages and connect status simultaneously on your Commodore with a unique split-screen display. And it lets you



PK-64 shown with HF modem option.
Computer not included.

send letter-perfect text from the text editor software while monitoring incoming messages. The 20K byte QSO buffer stores more than 20 video screens of text! Disk commands let you save specific operating parameters for quick set-up for emergency services, clubs, and multiple frequency use. And the Pakratt controller's standard, TAPR style modem gives you 300 and 1200 baud operation with great HF/VHF performance.

We can't possibly list all of the important features of Pakratt here. But the absolutely best part of the Pakratt PK-64 is that it's at your dealer now. So stop reading, run down to your local dealer, and check Pakratt out. Because the real challenge will be to find one after the other hams see it.

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QRX. . .

EDITED BY PERRY DONHAM KW1O

Earthquake

MEXICO CITY was shaken to its knees on the morning of September 20, 1985, when a savage earthquake struck near the resort city of Acapulco. The quake, measuring 7.8 on the Richter scale (followed by an aftershock measuring 7.5), was the worst in Mexican history. For nearly a week the only communication in or out of the country was supplied by ham-radio operators. Almost immediately, an emergency network sprung up on 20 meters, using five channels for incoming traffic and one channel for outgoing messages, including regular news bulletins. Although the US State Department set up a hotline for concerned relatives, it was quickly overloaded and ineffectual. Health-and-welfare messages were forwarded either via the National Traffic System or through independent clearinghouse nets to Mexico. Hams in Mexico would attempt to locate persons over the telephone (when it was working) or through word of mouth. At the peak of the disaster, it took an amazing three days to get word out of the stricken area.

Probably the most significant effect of the earthquake has been the changed relationship between commercial broadcast stations and ham radio. It was readily apparent that all of the major networks were using ham stations for news gathering. In an interview with Fred Maia W5YI, Roy Neal K6DUE of NBC News stressed that using amateurs for commercial message handling was "condoned because there [were] no commercial facilities available. The criterion is 'no commercial facilities available.' " The problem stems from a recent FCC decision which states that in certain cases commercial stations may use hams for news gathering. The Radio and Television News Directors Association (RTNDA) interpreted this action in a rather liberal way, taking advantage of a clause which provides for a "common sense" approach to its use. What's worse, each network has come up with its own way of looking at the rule. The result is a mishmash of conflicting actions and confusion among ham-radio operators. In a telephone interview with *73* Associate Bill Pasternak WA6ITF, FCC Private Radio Bureau Chief John Johnston W3BE claimed that all of the media-related ham activity was illegal. Another FCC staffer said, however, that no measures would be taken against the networks unless a formal complaint was filed with the FCC enforcement branch. Gordon West WB6NOA noted that newsmen were using amateur radio for setting up logistics and discussing union pay scales for their crews while refusing to handle health-and-welfare traffic into the area. Clearly there is a serious problem here. Have the broadcasters gone too far? Or was there a justifiable need for the use of ham radio to conduct their business? Apparently it depends on whom you ask.

Commercialism

IN A RELATED STORY, the FCC has released PRB-2, in which Lee Shoblom K6ADA, President and General Manager of London Bridge Broadcasting, Inc., has asked for direct access to a portion of the 435-MHz band for "noncommercial" news gathering. Shoblom has requested a waiver of the amateur rules to allow him to use fast-scan television on 435 MHz to feed news of community interest to his low-power television station for rebroadcast. The television station has a range of about 10 miles. The main reason for the request is that the cost of microwave relay equipment is too high—and amateur gear is so inexpensive. Incredibly, about 40 hams in the area fully support the idea! ARRL Executive Vice-President Dave Sumner K1ZZ, when notified of the petition, said the matter must be taken under consideration before an official League position could be taken. We here at *73* need no "consideration period"—we are *dead set against* any commercial use of amateur radio, at any time, for any reason.

Oh No, Mr. Bill!

CALIFORNIA SENATE BILL 1431 was defeated in a rather unorthodox manner. Sponsored by Senator Herschel Rosenthal, Bill 1431 would have made it a criminal offense to own, purchase, or listen to any form of radio capable of monitoring the 800-MHz cellular-radio band. Joe Merdler N6AHU met with Senator Rosenthal to explain his fear that law-enforcement officers unfamiliar with radio equipment would not be able to tell the difference between legal amateur gear and illegal scanners. To prove his point, Merdler produced a Yaesu FT-709 and a similar-looking Regency scanner on the table and asked the Senator to pick the "illegal" unit. He couldn't. Merdler emphasized that more harm than good would be done by this law in the hands of untrained enforcement officers. Senator Rosenthal told Merdler that the bill was not meant to encroach on the rights of ham operators, and that he had the utmost respect for amateurs. As a result, what could have been a disaster to hams in California and a dangerous precedent for the rest of the states was averted.

Fire Friends

LOS ANGELES POLICE AND FIRE officials have gone on record as desiring greater access to amateur radio during times of emergency. The recent Baldwin Hills brush fires graphically demonstrated that ham radio could play a key role in the preservation of life and property. In the Baldwin Hills incident, the Fire Department found that they had no way of telling what was happening on the other side of the hill from where they were fighting a blaze. Amateur radio, with its trained corps of skilled communicators, gave the department the eyes and ears they desperately needed.

Academy Hams

NINE HAMS from Los Angeles television station KTTV were recently commended by the National Academy of Television Arts and Sciences (the Emmy people). For their role in KTTV's "10 O'Clock News," which won four Emmys, a Certificate of Commendation was presented to Engineers Tim Gaskins KA6INW, Mert Garlick N6AWE, Dave Hallmark N6DKI, Bert Hicks WB6MQV, Don Halloway WB7ADU, Howard Lang WA6UFM, Bill Pasternak WA6ITF, Charles Rozner WB6SKM, and the station's Technical Operations Supervisor, Robert S. Sudock WB6FDF. KTTV won Emmys for Best Independent News Program, Best Independent Mini-Documentary Series, and Best Spot Coverage of a Same-Day Breaking Story.

FAR Out

THE FOUNDATION FOR AMATEUR RADIO has announced the winners of this year's FAR scholarships: the John W. Gore Memorial Scholarship ($900) to James H. Baker KI4YN; the Richard G. Chichester Memorial Scholarship ($900) to Eugene S. Reilly KA8JIG; the Edwin S. VanDusen Memorial Scholarship ($350) to Richard K. Soper KA2IKV; the QCWA Memorial Scholarships ($600) to Frances P. Horan KA3CJR, Hai T. Nguyen KA0ALZ, Carl H. Puckett KA7BWC, John E. Schnupp N3CNL, David J. Schmocker KJ9I, and John G. Sullivan N2DYC; the QCWA Robert S. Cresap Memorial Scholarship ($500) to Douglas Swiatlowski KA2KMT; the Radio Club of America Scholarship ($500) to

James W. Healy NJ2L; the L.R.L. Scholarship ($500) to Diane E. Willemin N8CAY; the A.R.N.S. Scholarship ($500) to Michael Krensavage KA3CUP; the Columbia MD ARA Scholarship ($650) to Christine L. Gray KA3NAK; the Baltimore MD Scholarship ($500) to Eric J. Smith KA3KJO; the Dade Radio Tropical Hamboree Scholarships ($500) to Christopher A. Atkins KA2QWC and David R. German N4FAD; the Lewis W. Wilkinson Memorial Scholarship ($500) to Wayne F. Poole KC4XL. You can get information about next year's scholarships by contacting the Foundation for Amateur Radio, 6903 Rhode Island Avenue, College Park MD 20740.

1985

A PREDICTION: 1985 will go down in ham history as the greatest year ever for amateur radio. Not since incentive licensing was implemented have so many regulatory changes been made to the Service. 1985 also saw the opening of new bands, the emergence of new modes, and the birth of a new DXCC country. This month we'll look back at the events of 1985 that will shape the future of ham radio in years to come.

● **PRB-1**—In October the FCC ruled in favor of amateur radio in the matter of restrictive antenna ordinances by passing PRB-1. In response to a petition filed in July of 1984, the Commission affirmed its commitment to ham radio and issued a declaratory ruling preempting all local regulations which preclude or significantly inhibit amateur communications. Specifically, the Order stated that such regulations are "in direct conflict with federal objectives and must be preempted."

● **Novice Enhancement**—Probably the most significant proposal to change the Amateur Service came mid-year when the American Radio Relay League submitted a petition aimed at increasing the privileges of Novice licensees. Designated RM-5038, the plan called for an expansion of the Novice ten-meter allocation to include CW, SSB, and data from 28.1 to 28.5 MHz. On 220 and 1296 MHz, Novices would use all emissions with a power limit of 25 and 5 Watts, respectively. The Element 2 examination would be increased from 20 to 30 questions to reflect the new privileges. Action is expected on RM-5038 early in 1986.

● **WARC Bands**—Twelve meters became an amateur band this year. 24.890–24.990 was opened to hams earlier than expected on a secondary, non-interference basis. The first day on the new band became a frenzy of state-working, as many stations garnered WAS-12 Meters in just a few days! Things are a bit quieter now, but the activity level is still substantial. In the same Order, the Commission made the 10-MHz WARC allocation a permanent amateur band.

● **Don't Be A Problem**—Speaking at the 1985 Dayton Hamvention, FCC Commissioner Ray Kowalski cautioned amateurs not to bother the government with all of their petty problems. He pointed out that hams use valuable spectrum, and that the pressures from commercial radio users for that spectrum had become greater than ever. Kowalski reminded those in attendance that the easiest way for the FCC to deal with a "problem Service" would be to simply eliminate that Service.

● **Spread-Spectrum**—Amateur radio's newest mode is spread-spectrum. While the Commission approved its use on 420 MHz and above, a one-year moratorium was placed on spread-spectrum use so that adequate time would be available for the development of amateur standards. Several stations, in conjunction with the Amateur Radio Research and Development Corporation (AMRAD), are experimenting with various systems under an STA.

● **160 Meters**—June was a busy month for the Commissioners. Apparently approving the new WARC band put them in a good mood, and they began to look for other things to approve. Docket 84-874 happened to be on top of a desk, so hams can now use RTTY, FAX, and SSTV on 160 meters. The FCC felt that the limit imposed to protect the LORAN-A radionavigation system was no longer necessary.

● **ZC4 Cyprus**—Early in the year the ARRL approved ZC4, British Sovereign Bases on Cyprus, as a separate DXCC country, nearly 25 years after a treaty establishing the Republic of Cyprus. Contacts with ZC4 made after August 16, 1960, will be accepted for the new country, but only if proof can be made that the ZC4 station was actually on a Sovereign Base (not all were).

It took months to train her but it sure solved the bird problem!

● **Turkey**—Amateur radio in Turkey took off when the Turkish parliament passed a bill allowing hams back on the air for the first time in many years. Four hams came up on 15 and 20 meters almost immediately, and license exams are being given regularly.

● **KL7 Pribilof**—The ARRL Awards Committee overturned the DX Advisory Committee's recommendation to add the Pribilof Islands to the DXCC list. It was the culmination of a ten-year effort to get the islands onto the list.

● **Clipperton**—The biggest DXpedition of 1985 had to be FO0XX Clipperton Island. Primarily supported by the Northern California DX Foundation, the six-day operations netted over 30,000 contacts on 160–10 meters and nearly 100 satellite QSOs. The expedition cost about $60,000.

● ***73* Magazine**—The October, 1985, issue of *73* marked our Silver Anniversary. The event was highlighted by the Silver Eagle Awards, a special "thank you" to the 25 people who most helped *73* in the past 25 years. Each award winner received a chrome-plated Astatic Silver Eagle microphone and our undying gratitude. Also, 52 readers (50 states, one DX, and one District of Columbia) were selected at random to receive copies of the 1986 *Callbook* set. Here's to another 25 years!

● **Dick Bash**—The publisher of *The Final Exam* series of study guides closed the doors on his business this year. His study guides were infamous in the ham community for containing verbatim questions and answers from the FCC amateur license tests. Once the VEC program got under steam and all of the questions were released to the public domain, Dick had nothing to sell.

Auld Lang Syne

YEAR'S END is a good time to thank all of the people who have contributed to "QRX" during the past twelve months. These folks volunteer their time and skills to keep you informed about your hobby: Bill Pasternak WA6ITF and the *Westlink* crew, Fred Maia W5YI of *The W5YI Report*, Paul Courson WA3VJB and the entire staff of the ARRL (including *Gateway* and the *ARRL Letter*), Gus Browning and his *DX'ers Magazine*, Vern Riportella WA2LQQ and AMSAT, and hundreds of hams who have phoned, sent letters, and called the *73* computer with their tales of hamdom. You all are much appreciated.

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To: Alinco Dealers
From: Everett L. Gracey, President

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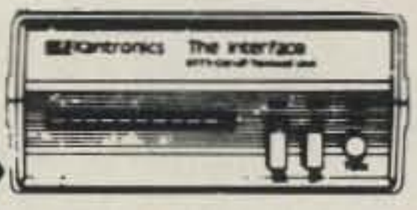

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For many hams, the ICOM IC-730, by virtue of its compact size, light weight, and many built-in features, is perhaps the ideal HF rig for both mobile and base operation on today's crowded bands. One desirable feature, however, is missing—10-meter FM capability.

A simple FM modulator-detector board can be added to the IC-730 for under $30.00 with no modification whatsoever to the rig. When you are through, you will have an 80-Watt FM transceiver with dual-vfo capabilities, allowing duplex operation for 10-meter FM repeaters and switchable to simplex on any frequency at the push of a button. The circuit described below also includes an option which allows you to maintain the AM operation, if so desired.

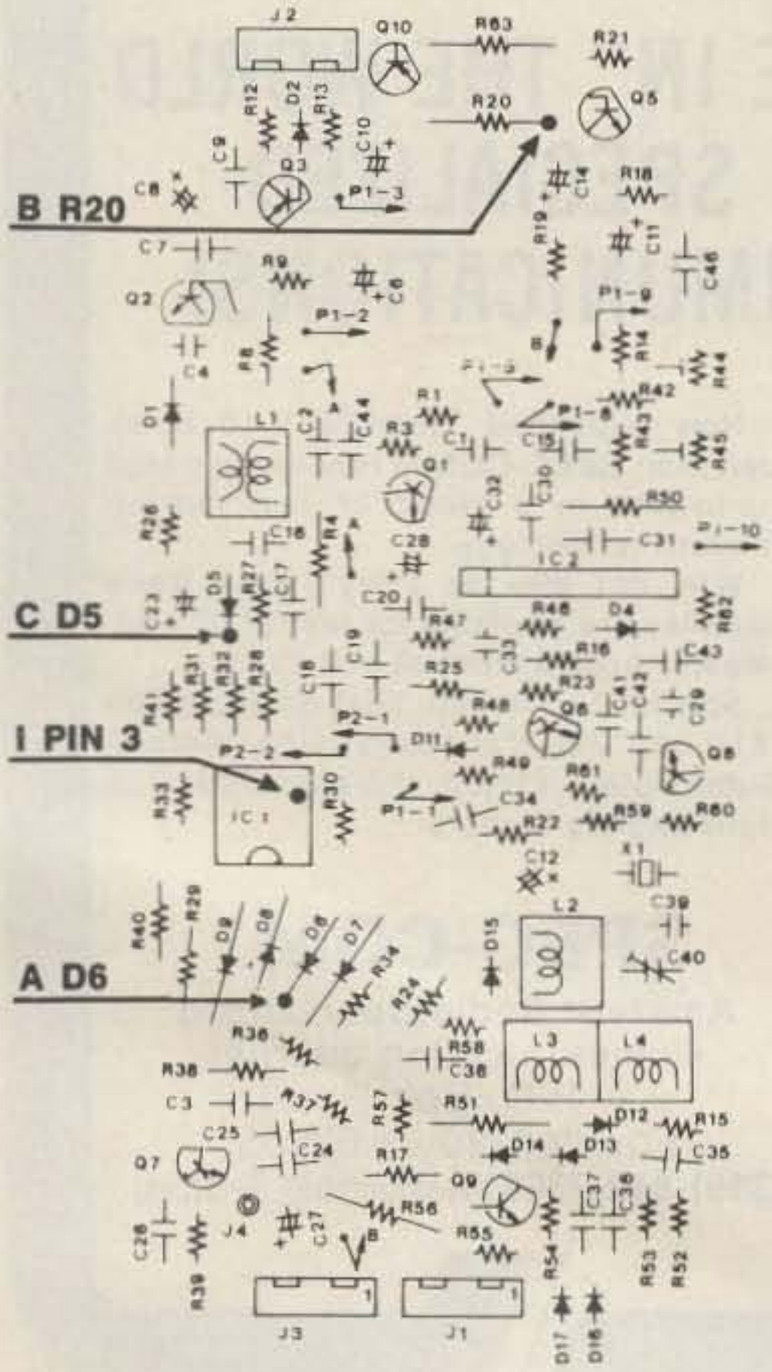

Fig. 1. Detector unit.

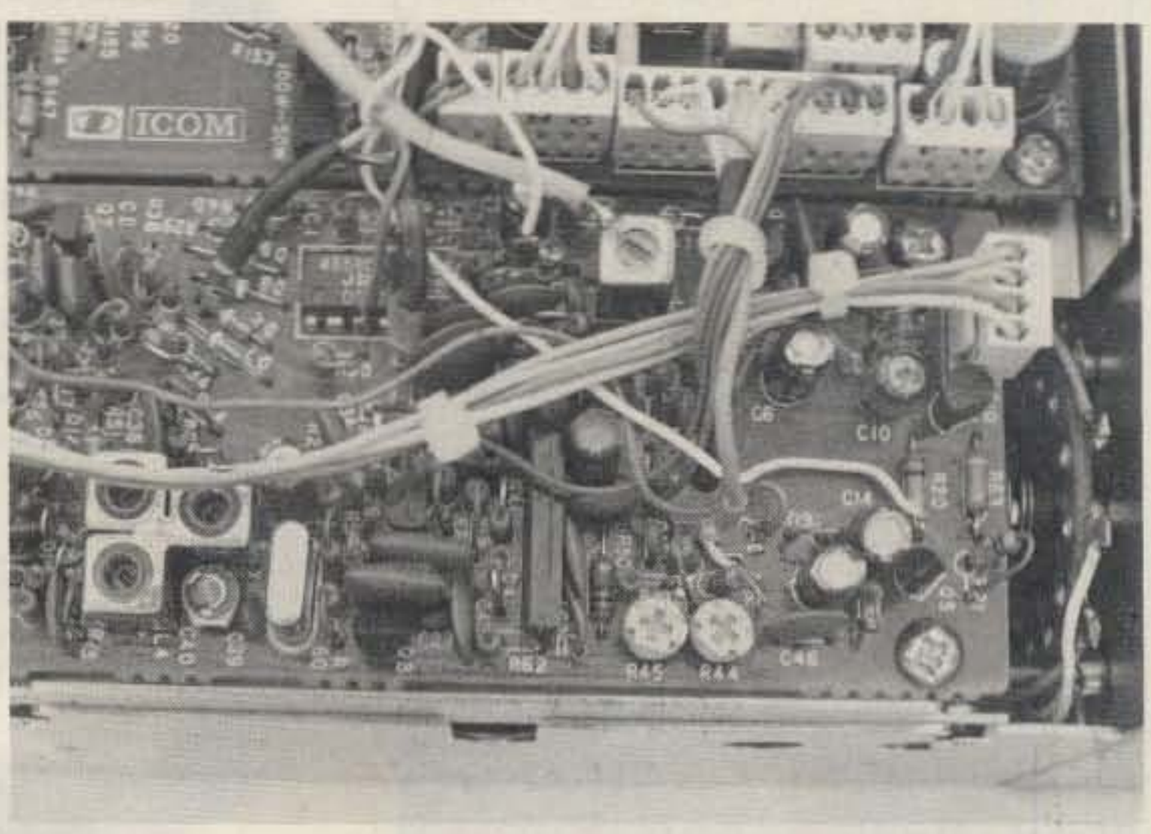

Photo A. Modifications to the detector unit.

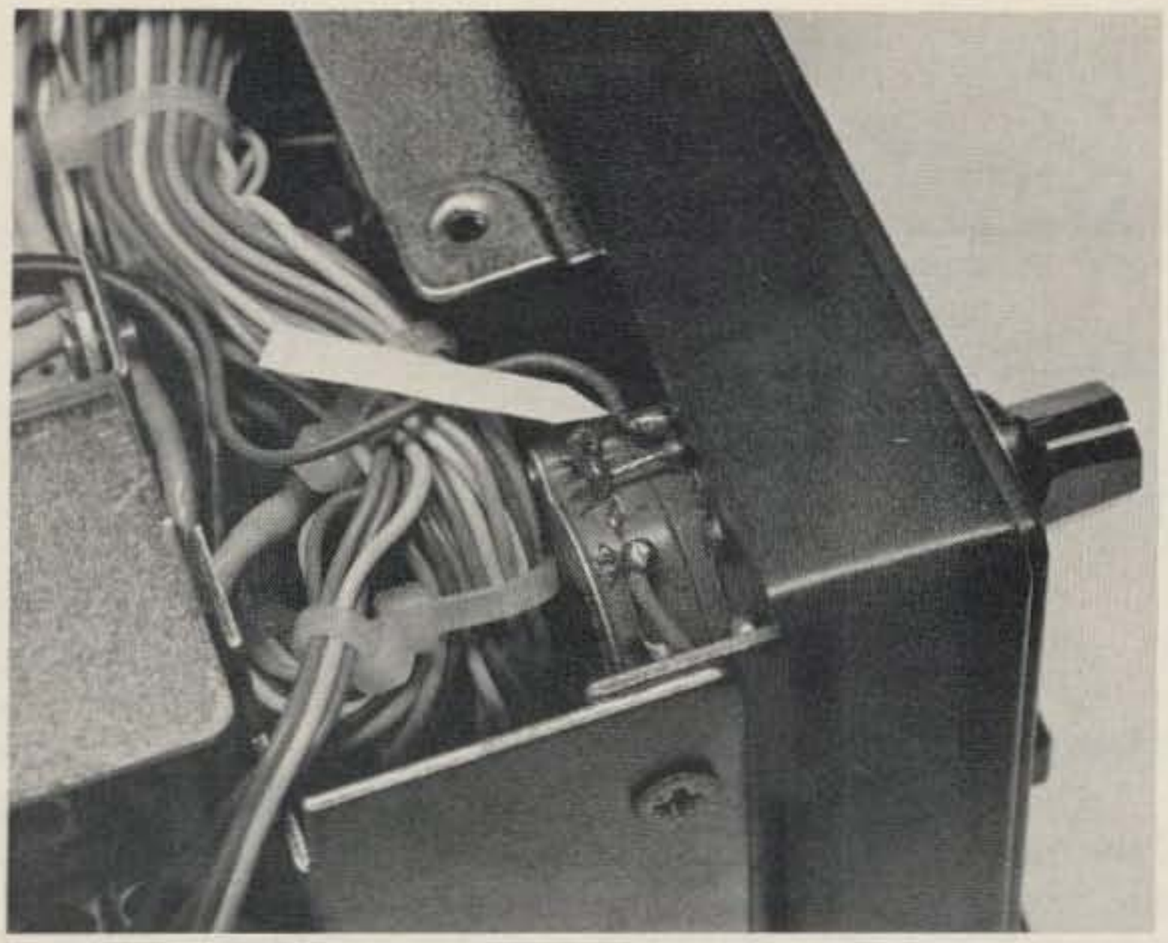

Photo B. Mode switch with AM 8-V wire connected.

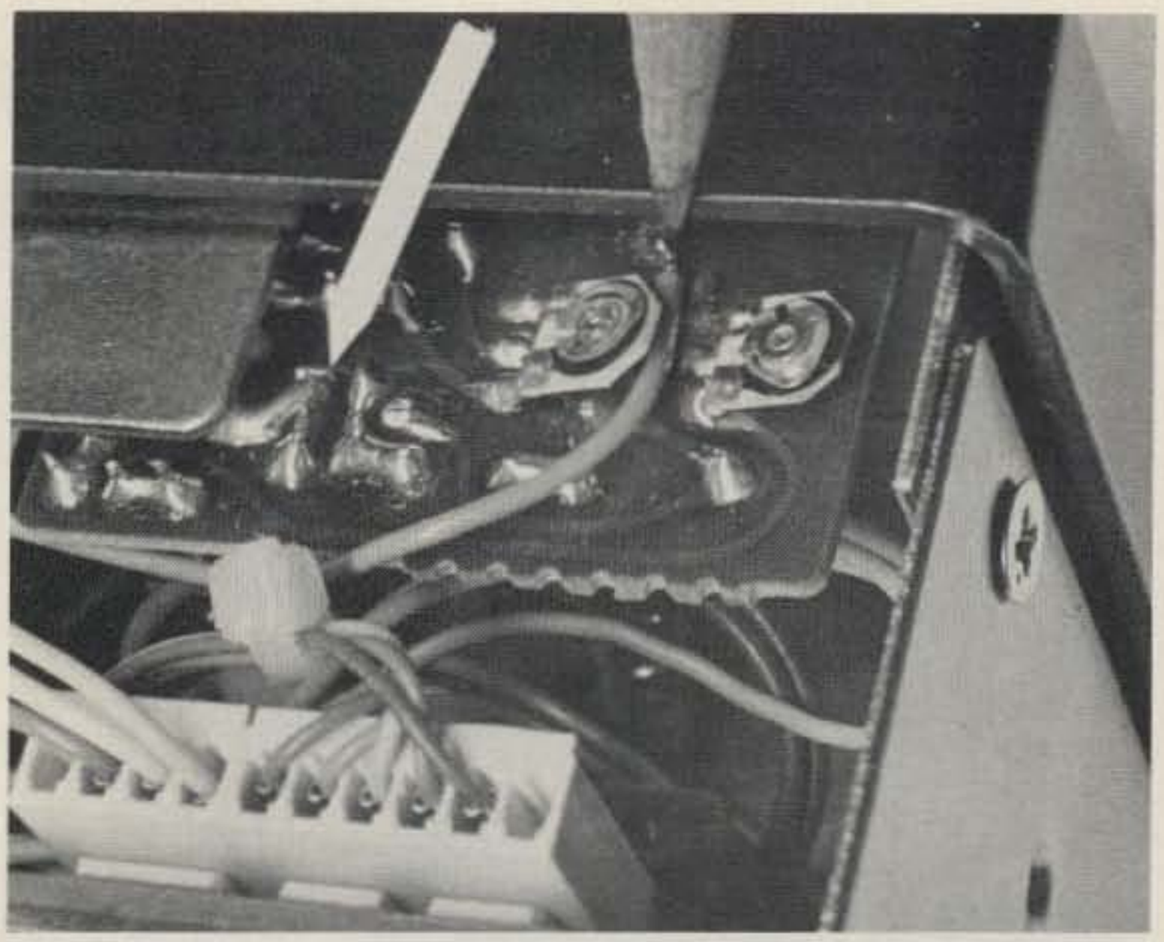

Photo C. RIT board. Arrow shows where REC 8-V wire should be connected. Between the two capacitors, green wire SQ is soldered to the board.

This module can be installed in most HF rigs and Citizens Band radios with excellent results.

The Circuit

The FM detector uses a Motorola quadrature detector, an RCA limiting amplifier, and one transistor as active devices. To receive the FM carrier, an MC3359P high-gain, low-power FM i-f chip was used. This chip was chosen because it was designed for narrowband FM communication and data link and uses a 455-kHz i-f, the same i-f as the 730. It also has a squelch built in so that no added circuitry is necessary.

The 455-kHz i-f from the IC-730 is fed through a ceramic filter 5 kHz or 7.5 kHz wide directly into pin 5 of the 6-stage, limiting i-f (IC1). The 7.5 kHz is recommended for better received-signal fidelity. The i-f has a 3-dB limiting sensitivity of approximately 100 microvolts.

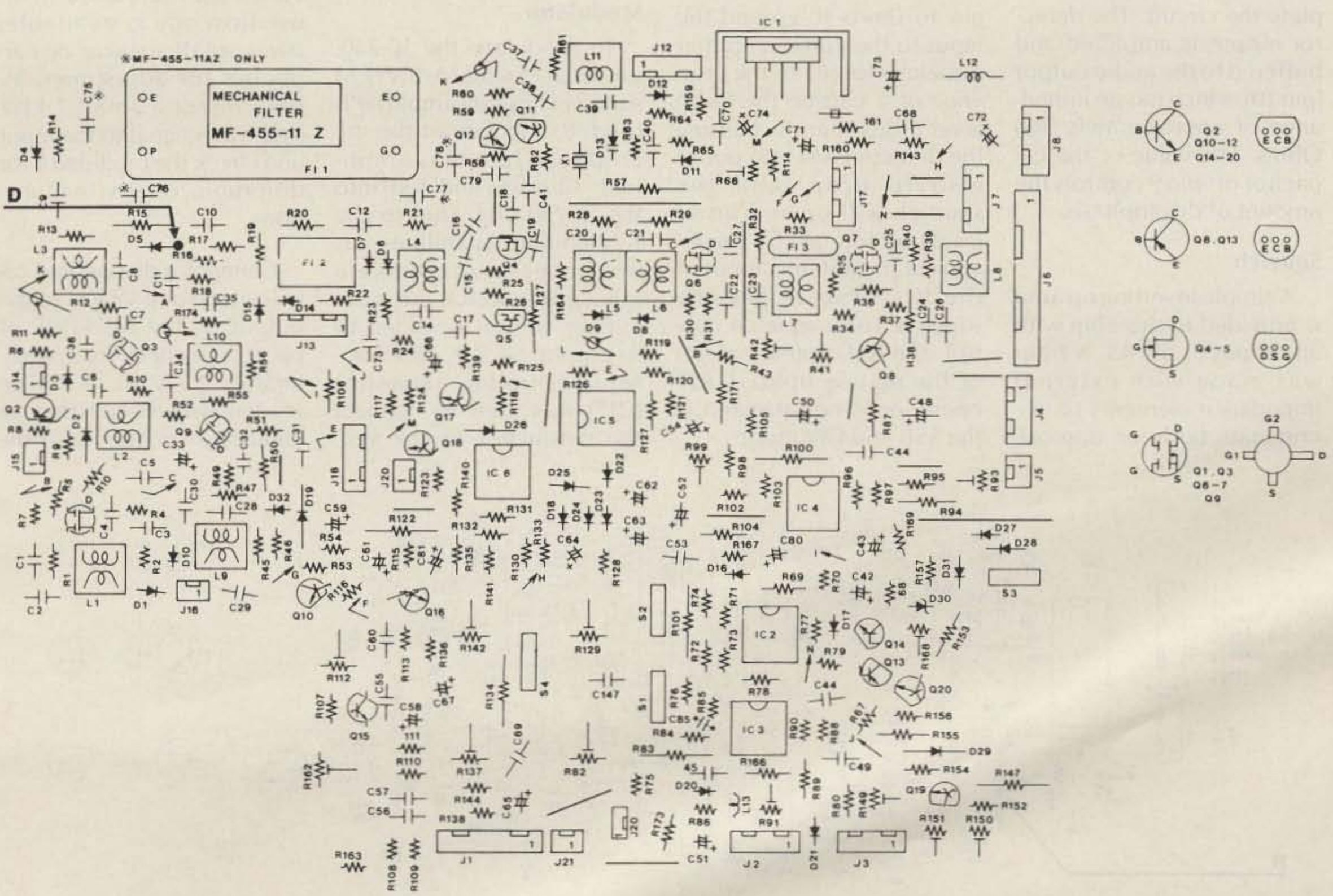

Fig. 2. Main unit.

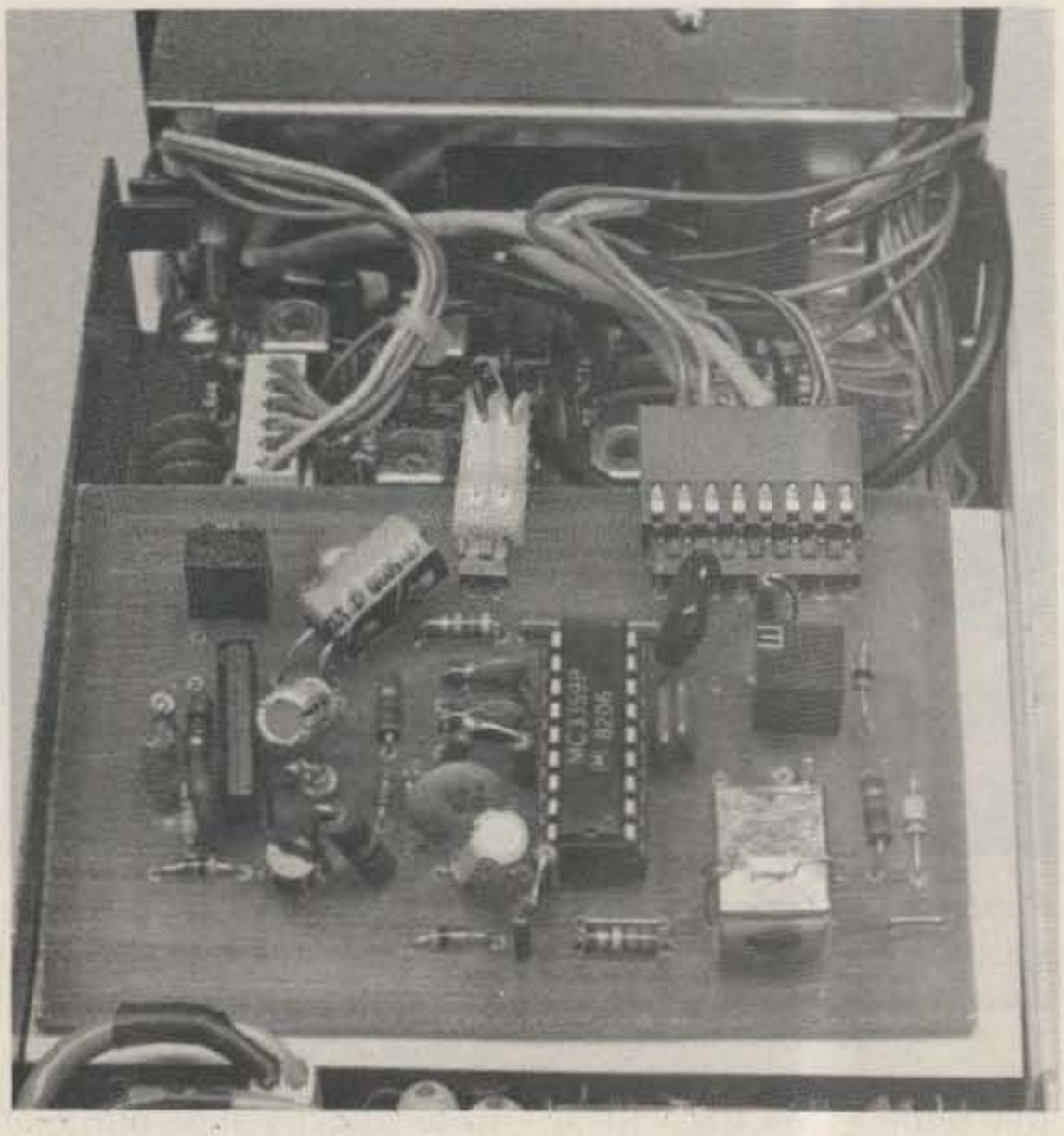

Photo D. Cable routing to converter board.

The output of the limiter is internally connected to the quadrature detector; only a parallel LC network is needed externally to complete the circuit. The detector output is amplified and buffered to the audio output (pin 10), which has an impedance of approximately 300 Ohms. The value of the capacitor off pin 9 controls the amount of de-emphasis.

Squelch

A simple inverting op amp is provided in this chip with an output at pin 13. A filter was made with external impedance elements to discriminate between approximately 7.5 kHz and 8.5 kHz. An external AM detector was used to check the presence of noise above the normal audio, at which point pin 16 shorts to ground the input to the audio amplifier (squelch closed). In the presence of a carrier, the noise level drops sharply, causing the detected AM into pin 14 also to drop, and the squelch will open. Carrier levels as low as .01 microvolts at the antenna input of the IC-730 will open the squelch. For a squelch control, the RIT potentiometer of the rig was utilized. RIT operation is not affected in the SSB and CW modes.

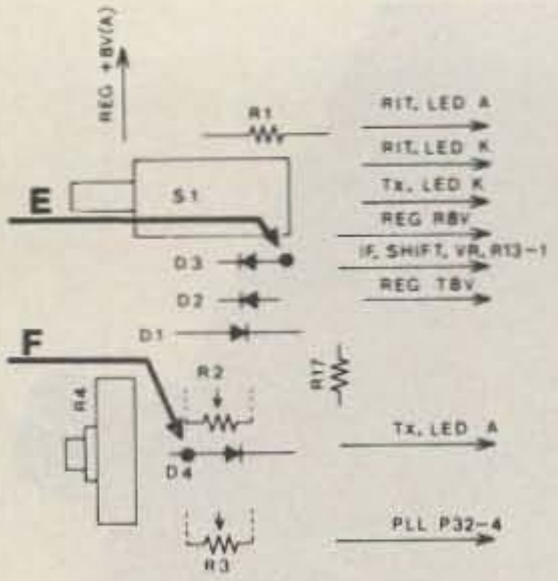

Fig. 3. RIT.

Power-Supply Switch

The only transistor used in the power-supply circuit is to switch the voltage to the modulator chip, SK3223 (IC2). Voltage to power the FM board is taken from the 730's AM circuit (AM 8 V). A 5.6-V zener is used to keep power to the MC3359P constant and in its operating range. Another voltage signal (REC 8 V) is used to switch Q1 off during receive so that any extraneous noise in the shack or mobile will not modulate the vco.

Modulator

To modulate the IC-730, an RCA SK3223 TV/FM sound i-f limiting amplifier is used. Its input from the microphone (pin 6) is amplified, filtered, and fed into the IC-730 vco. Due to the IC's limiting capabilities, it is not necessary to make a mike gain control, but a deviation control is added to its output, pin 3. A .01-microfarad coupling capacitor (C17) was used to connect the modulator to the vco.

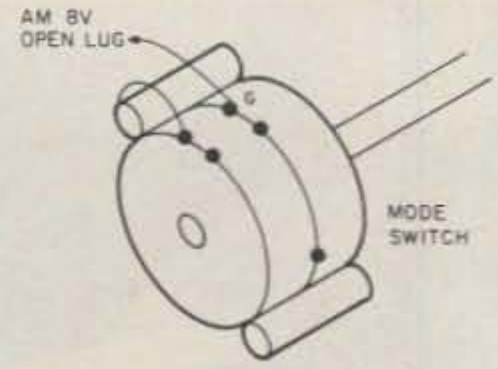

Fig. 4. Mode switch.

The quality of this capacitor, which is also the preemphasis capacitor, will affect the modulation quality. (Increasing its value will produce more bass in the audio; decreasing its value makes the audio sound tinny.) An rf choke is added so that rf from the vco will not be fed back into the SK3223.

The Modification

After the board is completed, it is a good idea to pretest it to make sure it is working properly. Apply 8 V to the board (a 9-V alkaline battery will do). Connect an oscilloscope to the output of the modulator on the $SF2 + $SF1 side of C8. (If no oscilloscope is available, use a small speaker or earphones for adjustment by ear.) Inject a small 1-kHz sine-wave signal to the input and check the modulator for distortions or any malfunctions.

Connect a dc-coupled oscilloscope or a VTVM to the output of the MC3359P at pin 10 and check for approximately 2.5 V dc. A 5-V-dc reading will indicate that oscillation is occurring in the

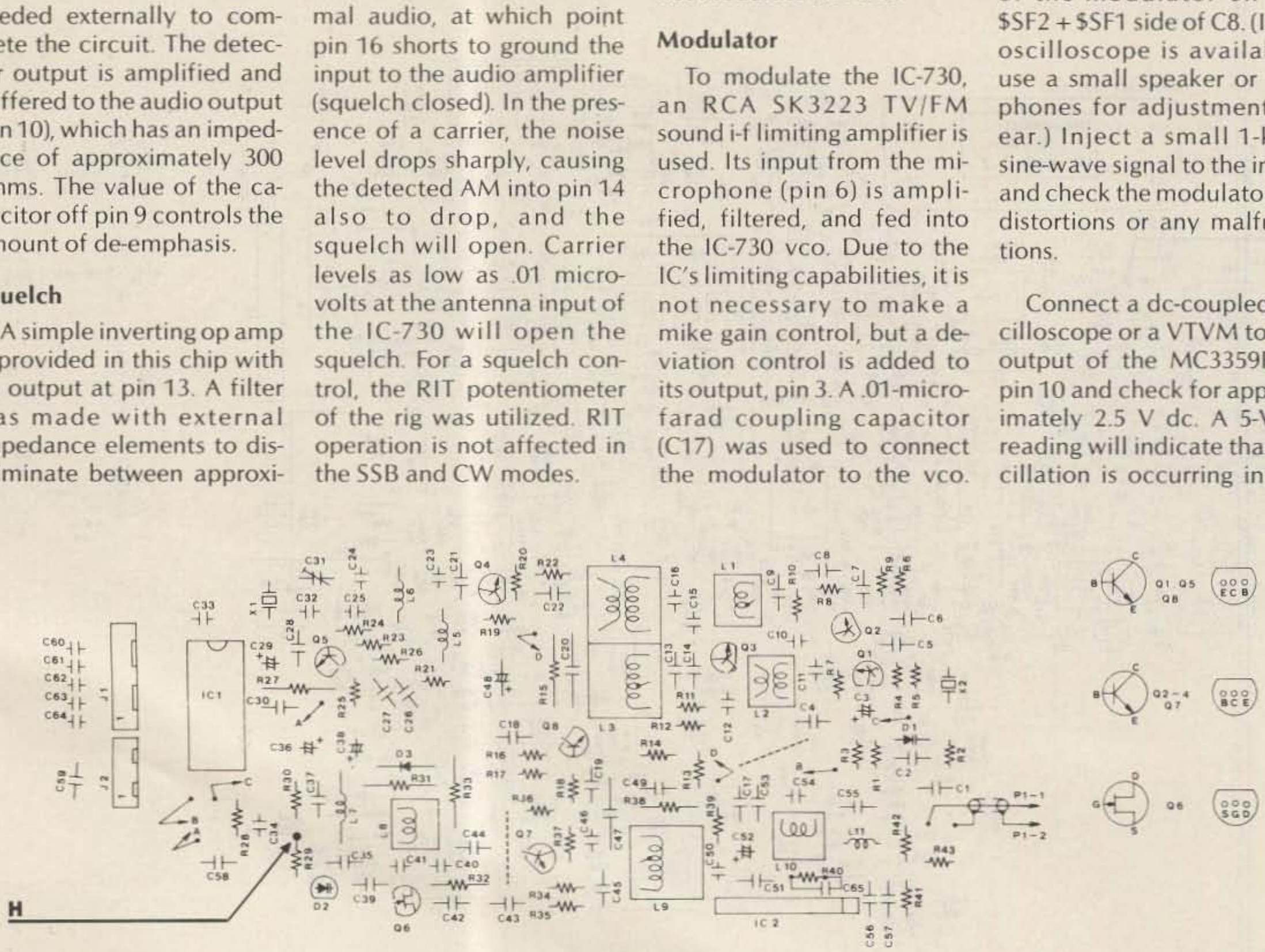

Fig. 5. PLL unit.

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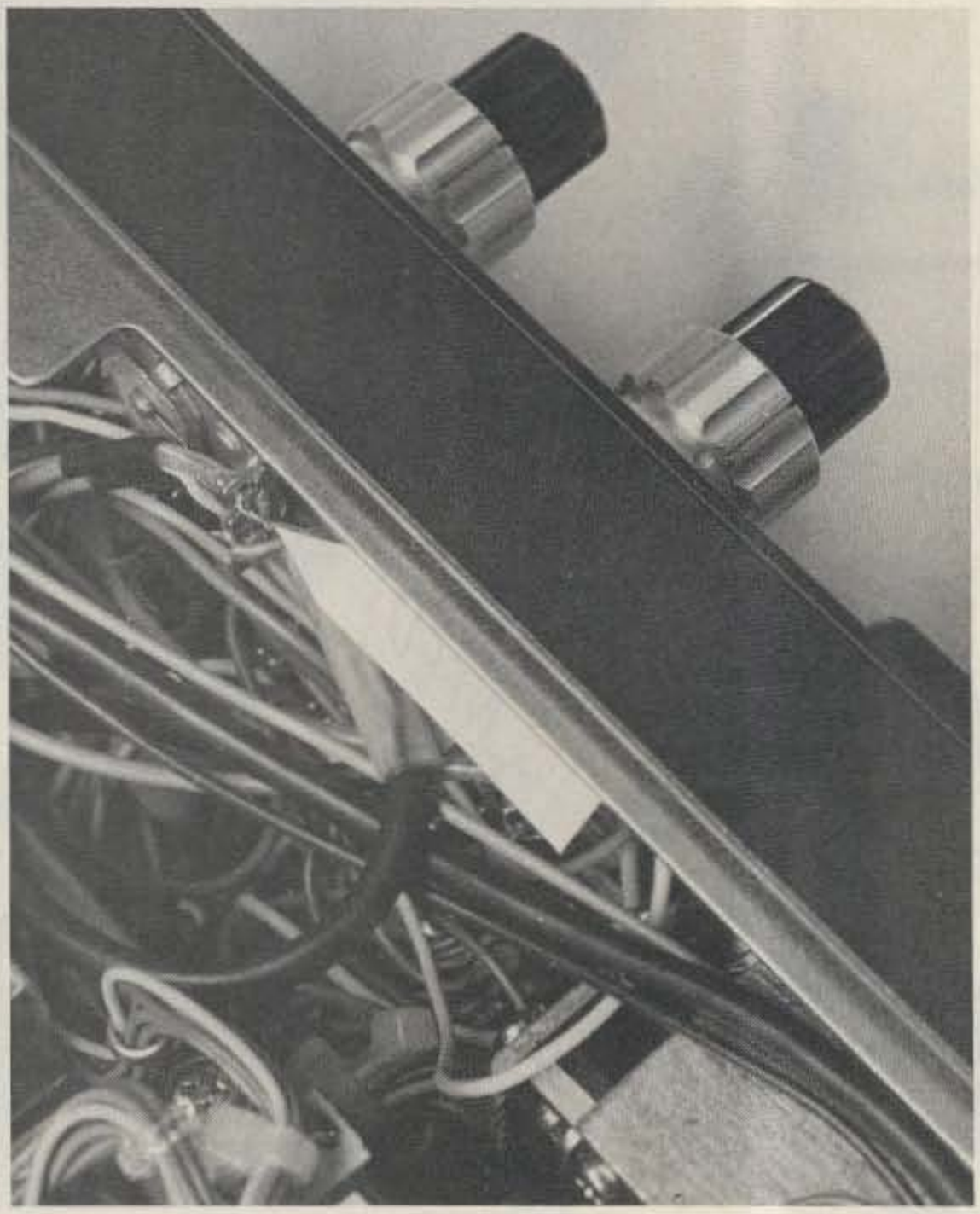

Photo E. Connection to mike gain control.

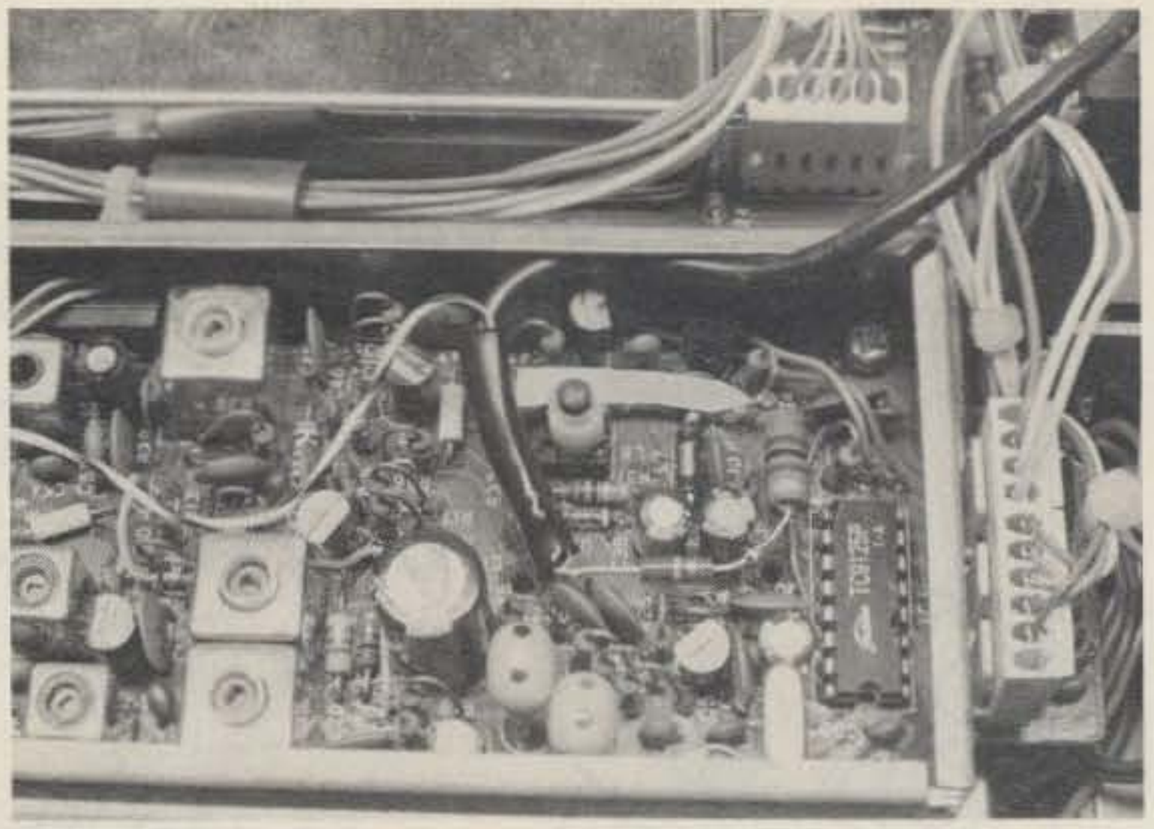

Photo F. Rf choke and resistor soldered to R28.

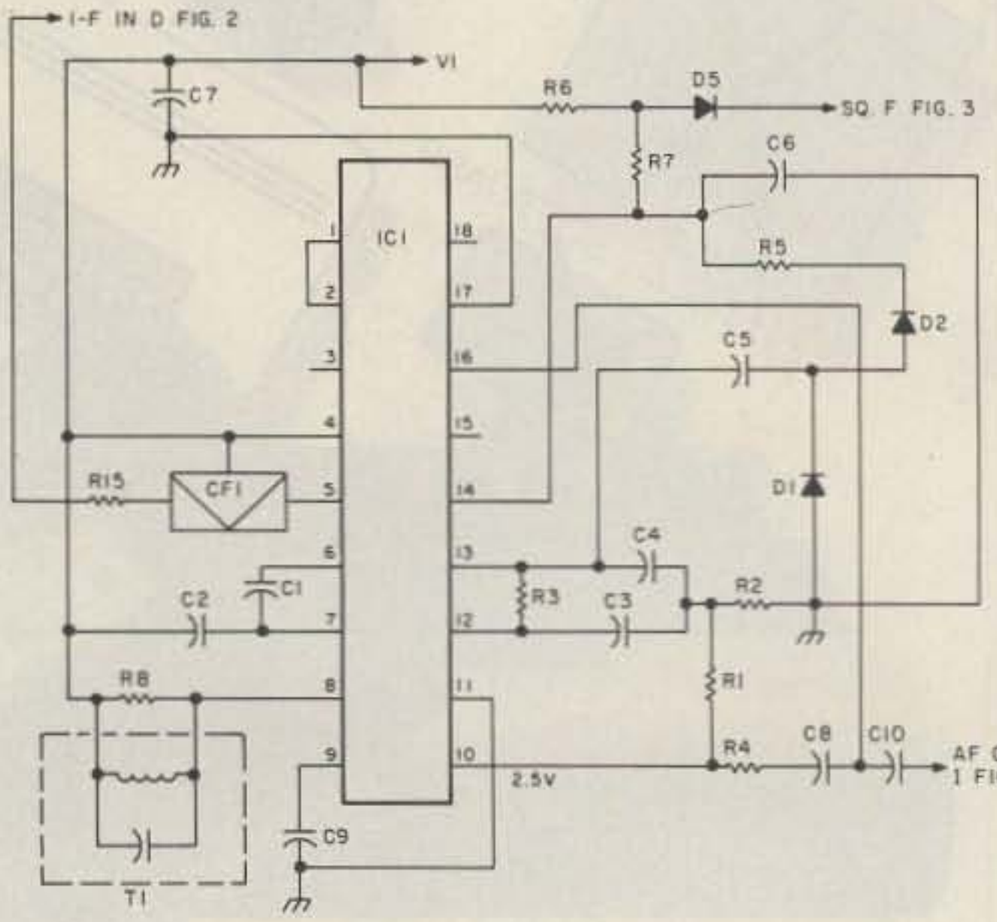

Fig. 6. FM detector.

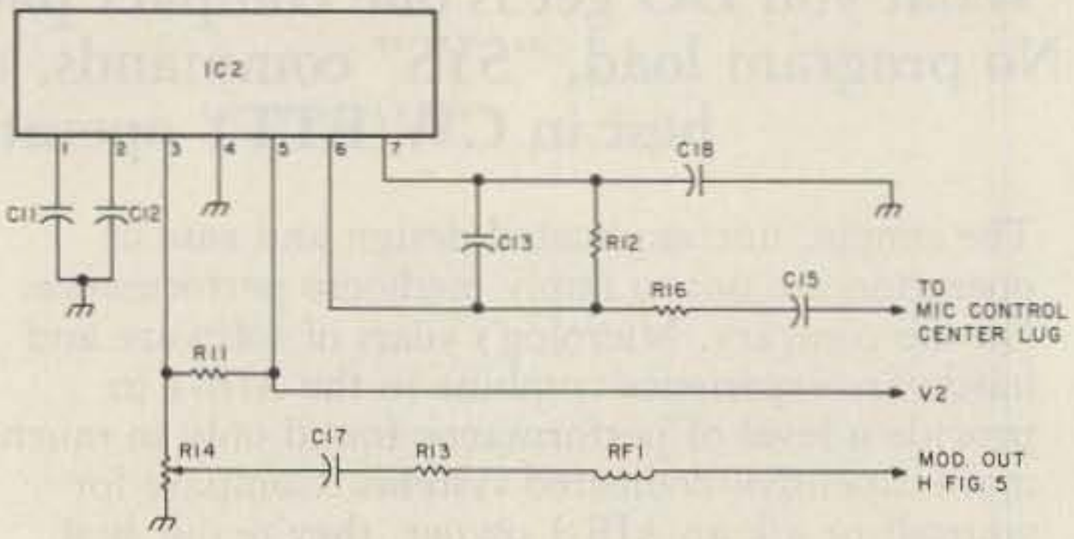

Fig. 7. Limiting FM modulator.

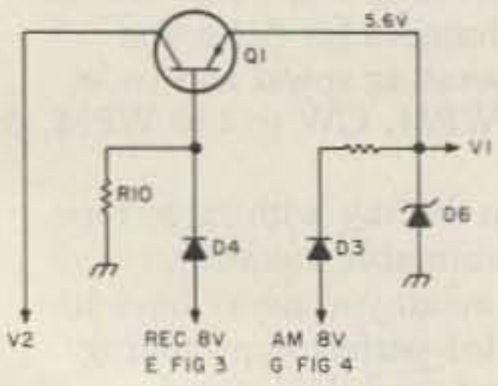

Fig. 8. Power supply.

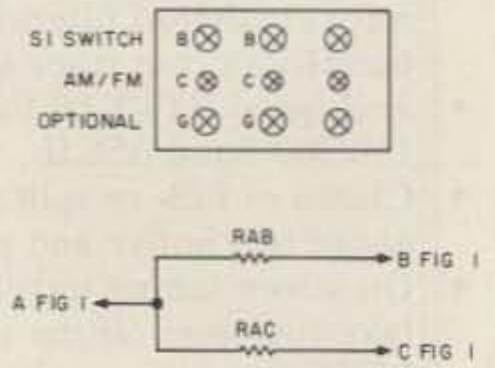

Fig. 9. Optional AM/FM switch.

circuit. If this occurs, it is due to lack of shielding on the input side of the chip. It is very important that the 0.1-uF capacitor at pin 6 and 7 be installed as close as possible to the chip.

A ground plane should be provided on that side of the chip, pin 1 through pin 9. A bypass capacitor (C7) can be installed directly across pin 17 (ground) and pin 7, on the foil side of the board.

If an FM signal generator is available, inject a 455-kHz signal to the input of the 455-kHz ceramic filter through the 470-Ohm resistor (R15), modulate the generator with a 1-kHz signal, and you should see a clean 1-kHz at pin 10. If such a generator is not available, make sure there is no dc at the i-f input side of the filter.

Installation and Calibration

Remove all power and cables to the unit. Put a towel on the bench so you don't scratch the cabinet. With the operating manual in hand, familiarize yourself with the layout of the unit. Open it, removing top and bottom covers (don't lose the screws). Find and identify the main unit (top view), manual page 23, Fig. 7-1, rf unit (left side of the rig), page 23, Fig. 7-2, and PLL unit (bottom view), page 24, Fig. 7-3.

1) Install a 150k from D6 cathode to D5 cathode (Photo A).

1a) Install a 10k resistor from D6 cathode to R20 (Fig. 1).

1b) A relay or switch can be installed to open this resistor for AM operations.

2) Solder cable from audio output of MC3359P to pin 3 of IC1 (Fig. 1).

3) Solder cable (i-f signal to MC3359P) center to R17 or D5 anode and shield to L3 can (Fig. 2).

4) Solder AM 8-V wire to mode switch (Fig. 4) open lug (Photo B).

5) Solder REC 8-V wire to RIT board, Fig. 3(E). Photo C, arrow.

6) Route cables to rf unit compartment. Photo D.

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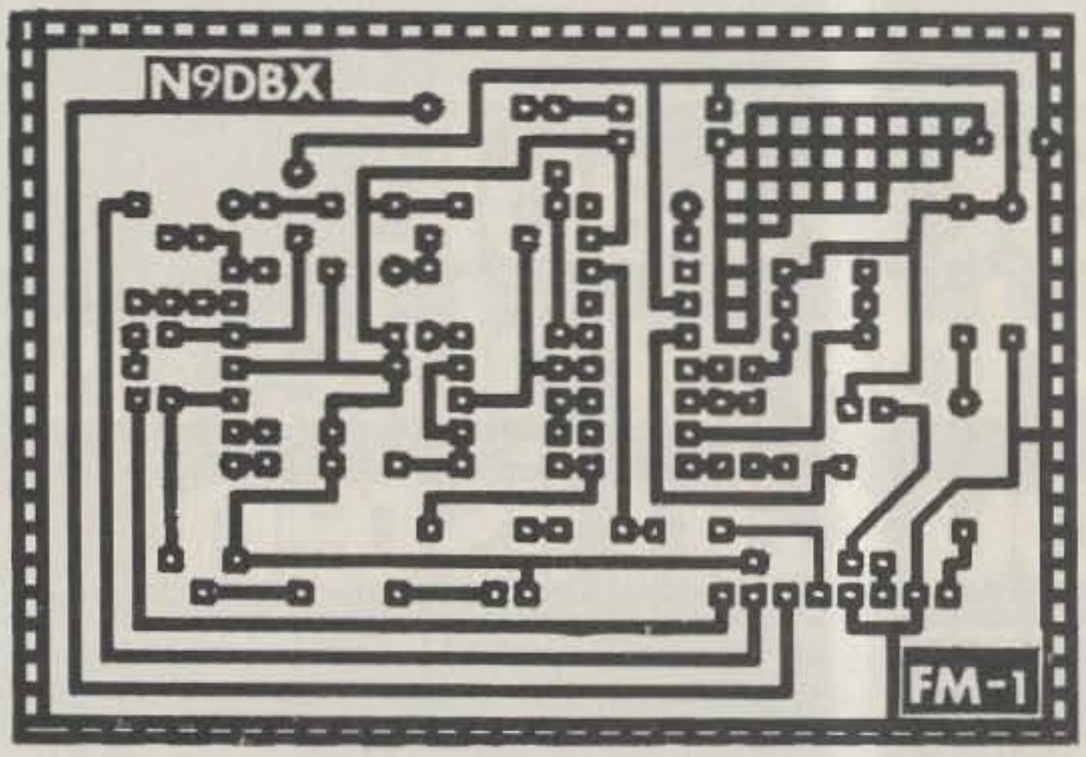

Fig. 10. PC board (foil side).

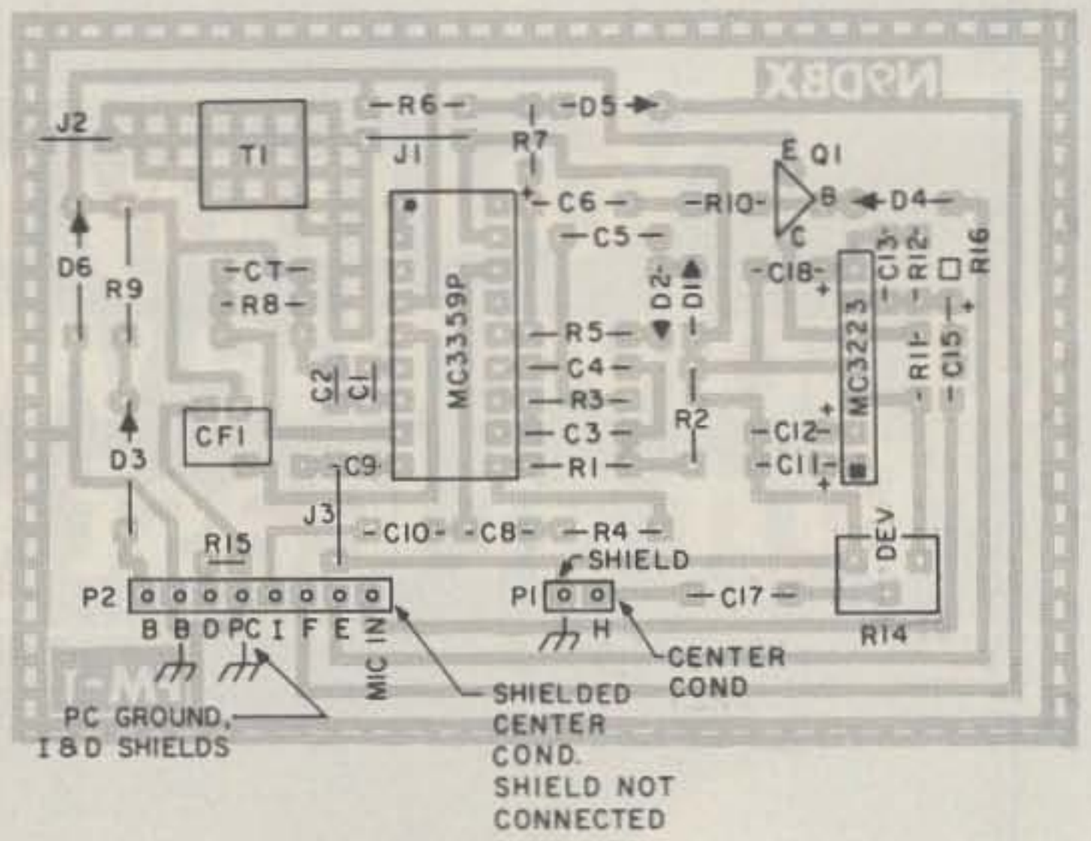

Fig. 11. PC board (component side).

7) Solder cable (audio input to SK3223) to mike gain control. Photo E.

8) Solder wire SQ to RIT board, Fig. 3(F).

9) Solder an rf resistor at the junction of R28, R29, C34, and R30. See schematic, PLL unit; add a 22k resistor to the choke and solder shield to nearest can, solder center of cable to resistor, route the cable and replace shield cover, Fig. 5(H); Photo F.

10) Drill two holes in the chassis at the rf unit compartment (top of unit); be careful with the metal chips—the rig does not like them at all! Cut a piece of cardboard and cover the rf unit. Install the board on top of the rf unit and plug cable to the board. (Holes are not required, but a two-sided tape is recommended to secure the FM board.)

11) Take a break, get a cup of coffee, and relax a bit.

12) Now that you are cooled off and relaxed, let's check the work by starting at the beginning (Step 1). Make sure there are no solder pieces running around, bad connections, or shorts anywhere.

13) Put some tape on the top and bottom covers to prevent the board from shorting to it.

14) Connect the power supply and make sure RIT is off and CCW and speaker are connected. Turn it on and select AM mode. You should hear a hiss at the speaker. Turn RIT squelch CW till speaker goes dead.

15) If you have an rf generator, feed a signal to the antenna input of about 100 FM at 1 kHz with 4-kHz deviation and adjust quad coil for best sound or best 1 kHz on the scope, connected at the speaker. It is a very sharp adjustment. Connect the rig to a dummy load, feed a loud signal to the mike from the CW keyer, and adjust the deviation pot for 5-kHz deviation. If you don't have a meter, adjust the pot to center and get on the air with someone to help you adjust the deviation.

16) One relay is used to preserve AM—do connect the supply voltage to it before any regulator of 730, because it may not regulate properly with the additional current drain.

That's all there is to it. You're all set to explore the fun of 29.5–29.7 MHz. Tune first to 29.6 MHz, the international simplex calling frequency. Next listen for repeater outputs in 10-kHz jumps from 29.61–29.69. Inputs are 100 kHz below output frequencies.

Best DX!

I would like to thank all of you who helped me with this modification article, and a special thanks to the Crystal Lake Repeater Group, AE9F, KN9N, WD9DRC, N9KC, KC9XU, Fred Palmer from ICOM, and N9DP for their direct help in the design.

Notes: To adjust squelch to your taste, lift R5 and change R6 so RIT pot is positioned to your taste (squelch closed); then change R5 to adjust squelch tail; R5 can be as high as 500k. The board can be obtained from the author for $15.00, the tested module and harness for $75.00, or installation of the module in your radio for $110.00 plus shipping cost. All mail and questions will be answered—please send an SASE. ■

Parts List

Component	Value; ID		Source	Unit Price
D1–5	1N914 or 1N4148		RS or Motorola	$ .20
D6	1N4734A		Motorola	1.20
C1, 2, 5, 7	.1 uF (104)	CY20C104M	Centralab	.50
C3, 4, 13	.001 uF (102)	CY15C102M	Centralab	.25
C6	4.7 uF	ECEA1EV4R7S	Panasonic	.25
C8, 10, 17	.01 uF (103)	CY15C103M	Centralab	.25
C9	100 pF	CD15FD101J3	CDE	.35
C11, 12	10 uF	ECEA1EV100S	Panasonic	.50
C15	1 uF	ECEA1HV010S	Panasonic	.70
C18	2.2 uF	ECEA1HV2R2S	Panasonic	.50
All resistors ¼ W, 5%				.20
Rac	150k			
R1	8.2k			
R2	1.5k			
R3	330k			
R4	47k			
R5, 16	200k			
R9	120 Ohms			
R10, ab	10k			
R7	18k			
R8	470k			
R11, 12	1k			
R13	22k			
R14	10k pot (Dev)	EUNK0AA00B14	Panasonic	.30
R15	470 Ohms			
R6	180k			
Q1	2SA1015 or 2N3906 (PNP)			.25
IC1	MC3359P		Motorola	4.00
CF1	CFU455F (filter)		Murata	4.00
IC2	TA7061 or SK3223			4.00
T1	455 Quad coil—RCM-2A6597HM—Toko			2.00
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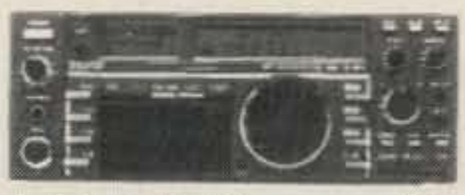

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Join the SWOT Team!

2m FM is fun, but using a repeater won't challenge your skill. Turn the switch to SSB and find out what ham radio is really *about!*

Photo A. Here is the author as DA2AL in the Hunsruck Mountains of West Germany during a Region I VHF Contest, putting a scarce grid square on the air. Although mountaintopping isn't as popular in the US as it is in Europe, it is no longer rare to see American hams heading for the hills.

Even as little as fifteen years ago, 2-meter SSB was basically considered a barren no-man's-land with only a handful of operators occupying the band. Activity was slight, even in heavily-populated areas such as the Northeast, with numerous band openings going unnoticed. However, the status of 2-meter SSB has changed dramatically since then, especially over the last decade.

With the advent of fully-synthesized multimode rigs and affordable power amplifiers, receive preamplifiers, and antennas, 2-meter-SSB capability is readily available at modest cost and is no longer the mode once inhabited almost entirely by the home-brewer and experimenter. Even so, there are many amateurs who underestimate its potential in terms of DX and reliable communication over appreciable distances. For the Technician-class licensee who yearns to work some interesting DX or for the old-timer who has had it with crowded repeaters, 2-meter SSB may be a ticket to fun and enjoyment.

Let me point out that the main intent of this article is basically to inform the reader that there is an abundance of 2-meter SSB/CW activity taking place and to introduce the "Sidewinders On Two" organization, otherwise known as SWOT, which caters to the SSB/CW enthusiast. To fully cover areas such as antennas and radiowave propagation would be almost impossible, as books have been written on these subjects. Therefore, I will make generalizations which can be researched through further reading.

Getting on the Air

Unlike years gone by, 2-meter multimode transceivers are readily available as either large base-station units with built-in ac power supplies or as smaller base/mobile rigs which require an external dc power supply if they are to be used at the home station. Whatever way you decide to go, remember that the cost of a multimode rig is not much more than that of an FM transceiver.

Two features which now are standard on most of the newer rigs have made life easier for the sidebander: scanning and squelch on

sideband. Besides having the transceiver scan for signals during slow periods, listening to receiver white noise for hours on end is a thing of the past. As for power outputs, most rigs now on the market run anywhere from 10 to 30 Watts, which is sufficient to work DX in most cases.

Transverters. If it is not feasible to purchase a separate multimode rig, then a transverter would be an alternative to get on the band.

If you currently maintain an HF station that was manufactured in the mid 1970s or later, there's a good chance that the manufacturer of the rig has a 2-meter transverter which is compatible. The cost of a transverter, even if it requires modifications for use on your HF rig, is well below that of a separate multimode transceiver.

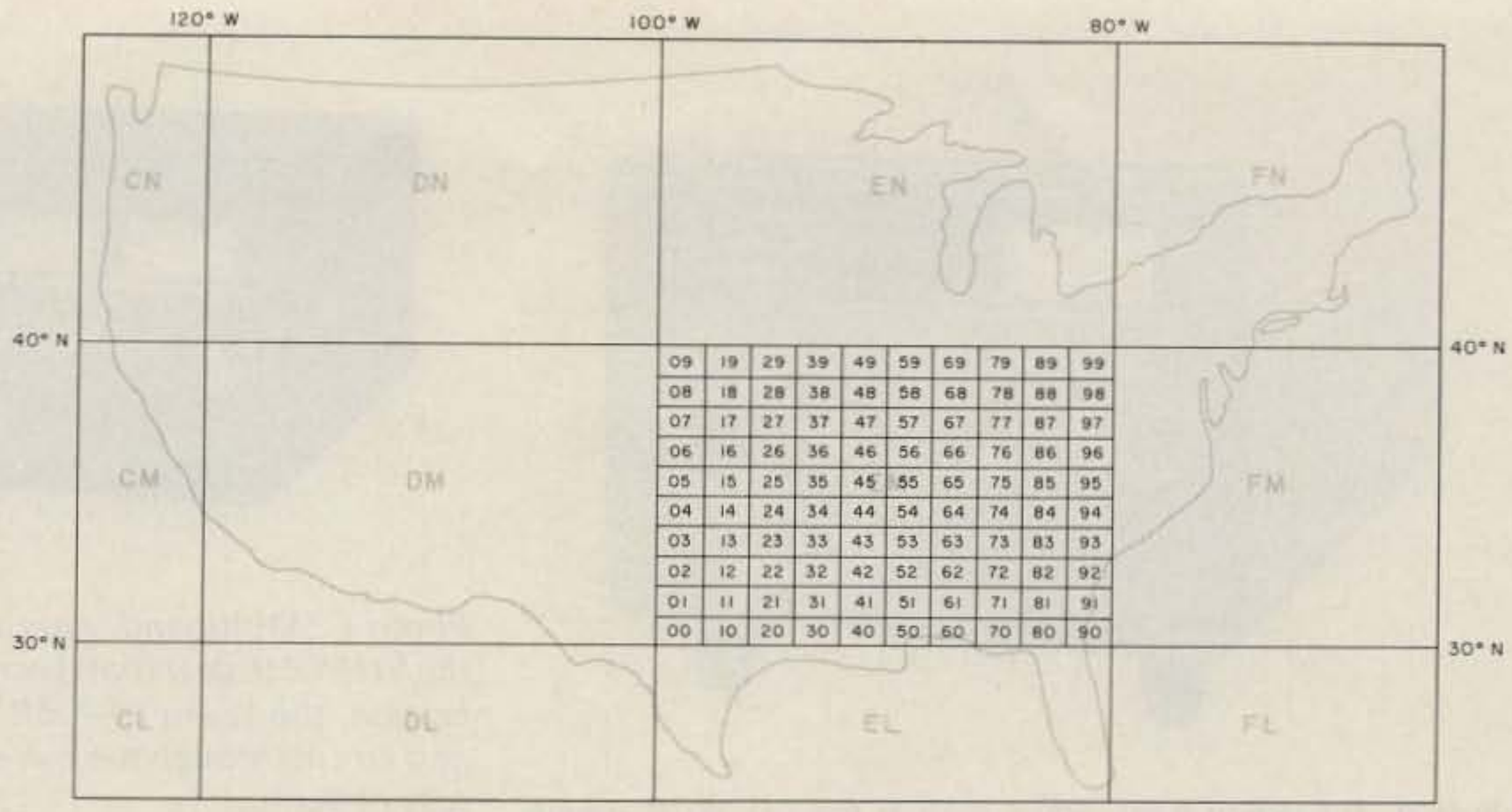

Fig. 1. Shown above is the grid-square layout for the United States under the Maidenhead Locator. Each field is broken down into 100 2° × 1° grid squares measuring approximately 100 × 70 miles in size, and numbered exactly like the Echo Mike field in the diagram. To figure out your own grid-square locator number, refer to the article on page 49 of the January, 1983, QST *or the October, 1982, issue of the* Lunar Letter, *edited by KI7D.*

Antennas

Polarization. Some amateurs who purchase multimode rigs are disappointed when they venture into the low end of 144 MHz in hopes of finding someone to talk to, but hear nothing but receiver white noise instead. Although it is no fault of their own, a common mistake made by newcomers to the band is to start tuning around using a vertically-polarized antenna. Unless they are in a heavily populated area with many stations active on the band, chances are that they will hear absolutely nothing.

On 2-meter SSB, just about everyone is horizontally polarized, and because of this, vertical antennas do not perform well. The cross-polarization loss between a station running vertical and a station running horizontal is debatable. However, most agree that it is in the area of 20 dB. With a loss figure this high, even local stations can sometimes be very weak, with severe fading if two stations are cross-polarized.

Horizontal polarization is preferred because signals that are polarized in this fashion are more consistent over greater distances, with less fading and flutter. Also, since most man-made electrical noise is vertically polarized, a horizontal antenna exhibits a nulling effect which greatly reduces static noise levels.

The yagi. Just as ground planes are used widely for FM work, yagis are the workhorse of the SSB operator. Most operators utilize a single long-boom yagi mounted high enough to clear any serious obstructions. Even if the antenna is 30 feet off the ground, if it's clear of nearby buildings, trees, or power lines, it should work flawlessly. Long-boom yagis are generally 15 to 20 feet in length with forward-gain figures of roughly 12 to 16 dB.

Being relatively small compared to its HF counterparts, the main advantage of the yagi is that it is lightweight; it can be turned easily with a small TV-type antenna rotator. A single yagi will work quite well even with 10 Watts, but usually the more serious operators or EME (moonbounce) enthusiasts stack their yagis in large arrays for greater gain and directivity. Besides the yagi, other antennas which are used on SSB to a lesser extent are collinear arrays and quads.

Omnidirectional antennas. If it is not feasible to erect a beam antenna due to space limitations, then a compromise would be a halo. The halo is an omnidirectional, horizontally-polarized antenna which exhibits less than unity gain. Halos are quite popular with 2-meter-SSB mobile operators because they are relatively small.

Another choice would be the squalo, which is actually a square halo. Back in the 1960s Cushcraft Corporation manufactured a squalo, and at times they can still be found at hamfests and electronics flea markets.

Probably the best horizontally-polarized omnidirectional antenna that one could use would be the Big Wheel. As with the squalo, the Big Wheel was manufactured by Cushcraft back in the 1960s. It was very popular due to the fact that it was rated at 3-dB gain, making it that much better than the unity-gain halo and squalo. Also, Big Wheels could be stacked for even greater gain, making them that much more desirable for those who cannot erect beams. Shaped like a three-leaf clover, Big Wheel construction articles are quite common in VHF antenna books under names like the cloverleaf and the turnstile.

Power

As noted before, 10 to 30 Watts is an adequate power level for working most types of DX on 2 meters. However, when it comes to attempting contacts on meteor scatter or aurora, a higher output power will prove beneficial. I don't mean to imply that it can't be done with 10 Watts...it can! But due to the nature of these propagation modes, a higher power level is required for optimum results. Most newcomers to the band soon find out that the average station runs somewhere in the area of 80 to 170 Watts. And just like the HF bands, 2 meters has its share of those who run the full legal limit, especially where moonbounce is concerned.

Amps and Preamps

As with multimode rigs, there is a wide variety of solid-state amplifiers avail-

Photo B. The use of transverters such as the FTV-901R, which is compatible with the Yaesu 901 series, is a cost-effective way of getting on 2-meter SSB.

Photo C. Multiband, multimode capability is available in the VHF/UHF gear that is now available. Besides 2-meter operation, the Yaesu FT-726R is also operational on 6 meters and 70 cm through the use of plug-in modules. (Photo courtesy of Yaesu.)

able on the market. Most of these amplifiers require anywhere from 1 to 30 Watts of drive and will deliver anywhere from 80 to 160 Watts, depending on the model. Besides being switchable for SSB or FM use, most of these amps are also supplied with receiving preamplifiers which greatly improve the signal-to-noise ratio of the received signal. For those operators who desire even higher output, there are many amplifier kits available for the home-brewer, and to a lesser degree commercially available units which will provide a solid kW.

Contrary to popular belief, most of the rigs today do not have hot receivers. Anyone who has been involved with the band for any length of time will tell you that the addition of a receive preamplifier is a must. For communications within a few hundred miles, a stock receiver may work just fine, but for weak-signal work or during marginal band openings, most rigs can't cut the mustard. The addition of a receive preamplifier can make the difference between getting a Q5 copy on a signal or not hearing it at all.

Preamplifiers can be purchased as small circuit boards which can be internally mounted to your existing transceiver, as separate enclosed units with BNC or SO-239 connectors for quick and easy installation, or as the highly sensitive mast-mounted GaAsFETs.

Propagation

Radio-wave propagation on 2 meters falls basically into two categories, these being tropospheric and ionospheric. The troposphere is a region which extends from the ground up to about eight miles. It is here that most VHF propagation takes place and also where our weather is formed. Because of this, 2-meter signals are greatly affected by temperature, water vapor, pressure, and, in general, the movement of air masses and weather systems. Two types of tropospheric propagation that occur quite frequently are: thermal inversions which can extend signals beyond 500 miles, and tropospheric ducting which has the ability to carry signals in excess of 2000 miles.

Temperature inversions. Also known as thermal inversions, this mode of propagation is most common to the 2-meter band. Temperature inversions are formed when there is a reversal of the atmosphere's height-to-temperature relationship, which in turn affects its refractive index. Under normal atmospheric conditions, there is a temperature decrease with ascending altitude. However, there are times when the temperature at some point stabilizes or even rises with increased height when a layer of warm air is trapped between two layers of cooler air. This warm air constitutes a thermal inversion and with it, the refractive index is increased.

Inversions can propagate VHF and UHF signals up to three times the normal range and, depending on their intensity, signals will be either weak with some flutter or rock solid with very little fading. This phenomenon is prevalent along coastal areas, especially in the spring and fall. This is the result of a greater temperature difference between land and water. Although inversions are primarily a nighttime effect, smaller inversions often occur just after dawn and after sunset, when some enhancement of the signal can usually be noticed.

Tropospheric ducting. The causes of tropospheric ducting cannot be explained easily, but most scientists and propagation experts seem to agree that they are the product of wind shears, which are high velocity winds that are blowing in opposite directions to each other. The boundary area between these winds has the ability to propagate VHF and UHF signals thousands of miles. Ducts can be very selective to various geographical areas, with other stations at points in between not being aware of its existence. In other words, if a duct were to form between New England and Texas, stations in places such as Tennessee and Kentucky, which are along the duct's path, may not necessarily be able to take part in the opening.

Ducting can continue anywhere from a few minutes to a few days. It is this propagation mode which has made possible QSOs between stations in Hawaii and California, which is a distance of approximately 2500 miles.

Ionospheric propagation. Sporadic E, aurora, meteor scatter, and transequatorial propagation (otherwise known as TE) are propagation modes that fall into the ionospheric or solar-related category.

Sporadic E. Sporadic E gets its name from heavily ionized clouds that form in the E-region of the ionosphere, which is about 60 miles above the earth. It is rare for these clouds to reflect 144-MHz signals, but when they do, E-skip contacts can be made up to approximately 1200 miles. The formation of these E-clouds is the result of wind shears and, to a cer-

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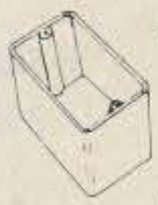

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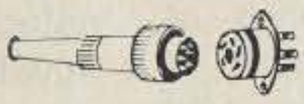

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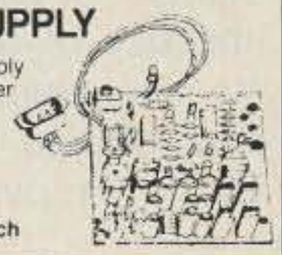

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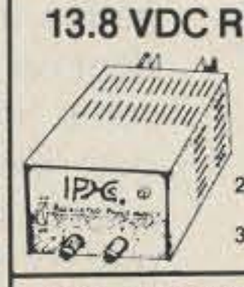

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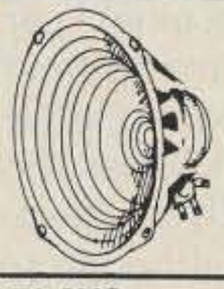

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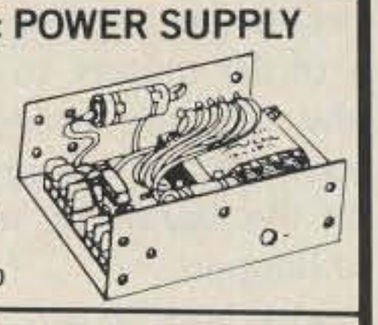

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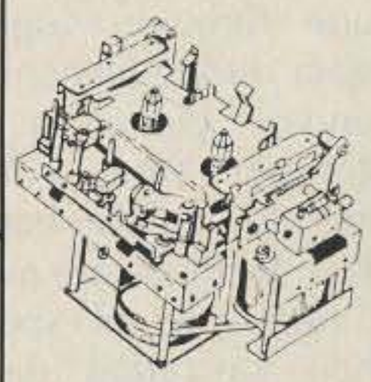

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5 volt operation
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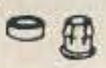

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tain extent, intense thunderstorm activity, which produces very high cloud tops.

Excellent indicators for a possible E-skip opening on 2 meters are TV channels 4, 5, 6, and especially the FM broadcast band, which ranges from 88 to 108 MHz. Also, when skip conditions become extremely short on 6 or 10 meters to within a few hundred miles, it is a good idea to begin looking on the band for something to happen.

Although E-skip can occur at any time, seasonal peaks do take place from June through August and again during December and January. Openings can last anywhere from a few minutes to a few hours, but since E-clouds are moving at a high rate of speed and their ionization density is critical for supporting 144-MHz signals, conditions change very rapidly.

Finally, double-hop E-skip is rarer still, but it has been done, with contacts made in excess of 2000 miles.

Aurora. Intense ionization of the polar regions following disturbed periods on the sun allows amateurs to reflect their signals off heavily ionized patches or auroral curtains. Curtains are formed when solar disturbances emit particles which arrive at Earth a few days after the storm is first observed. These particles then congregate at the polar regions and form what is known as an aurora.

Since the aurora is a culmination of numerous patches of intense ionization which are in constant motion, VHF and sometimes UHF signals are reflected back in different phases. This multi-path reception or phase difference causes the received SSB signal to have a whispery or sometimes garbled effect and CW signals to sound like a hiss instead of a pure note.

Auroras are common during the winter and summer equinoctial periods, with peaks generally taking place from 4:00 pm to 8:00 pm local time. For obvious reasons, the mid- and high-latitude states experience many auroral openings per year, but from time to time its effects can be felt as far south as the Gulf states. Contacts are normally on the order of 800 miles, although some of over 1200 miles have taken place.

Auroral contacts. By pointing the antenna towards the north a few days after a solar disturbance, auroral contacts are possible. Normally, CW signals are the only ones to be heard, but if the aurora is intense enough, SSB can be copied with signals sometimes well over S9.

When calling CQ on CW it is customary to send "CQ A" or "CQ AU." On sideband, the call is simply "CQ Aurora." One important thing to remember is that since SSB is received as whispers or even garbles, it is imperative that one speak slowly, using phonetics and trying to enunciate words properly. Unless conditions are near perfect, E's, T's, C's, D's, etc., sound an awful lot alike. With pure notes not being received on CW, reports are given as 59A instead of 599.

Since the aurora is in constant motion, signal strength will vary from time to time during the course of a QSO. Therefore, it is sometimes necessary to peak for maximum signal by moving the antenna a few degrees either way. At times, a movement of 10 degrees can make the difference between Q5 copy and not hearing the station at all.

Meteor scatter. As mentioned before, sporadic-E and auroral propagation are possible through the direct result of intense ionization. This holds true with meteor scatter also. Meteors which enter the Earth's atmosphere burn up, leaving trails of ionization which at times have the ability to reflect radio waves, permitting contacts in excess of 1500 miles. The length of time that an ionization trail remains intact and intense enough to support 2-meter signals is dependent upon the size of the meteor and its orientation to the amateur station. Most meteor bursts (or *pings*) last a few seconds, with a rare few exceeding 15 seconds. Thus, high-speed CW is the preferred mode although SSB is being used more and more.

Meteor-scatter DXing. With most contacts being arranged through predetermined schedules with other stations, attempting to work meteor-scatter DX requires patience and perseverance. Since working through random meteors is time consuming, almost all contacts are attempted during major meteor showers such as the Perseids in late July and early August, where the hourly rate of meteors entering the atmosphere is very high.

The operating procedures for working meteor-scatter DX are too extensive to list here. However, the basic format is for one station to transmit during the first and third quarter of each minute while the other station transmits on the alternate 15-second periods. It may go on like this for hours until both stations acknowledge callsigns and signal reports. Most important, though, is that phrases such as "this is" and "your signal is" be eliminated, as most bursts are relatively short. As far as output power is concerned, 80 Watts is sufficient for making contacts without too much trouble. Surprisingly, many amateurs have made successful QSOs with as little as 10 Watts.

Transequatorial propagation. Transequatorial propagation (or TE) has been evident on the 6-meter band for some time, but just recently over the last decade has its presence been felt on 2 meters. TE takes place in the F2

144.000–144.050 MHz	EME (Moonbounce) CW
144.050–144.060 MHz	Beacons
144.060–144.100 MHz	General CW and weak signals
144.100–144.200 MHz	EME (Moonbounce) and weak-signal SSB
144.200 MHz	National calling frequency
144.200–144.300 MHz	General SSB operation

Note: Upper sideband (USB) mode is used.

Table 4. 144-MHz SSB/CW band plan.

Year	Tropo	E-Skip
1976	4	2
1977	10	6
1978	5	1
1979	6	6
1980	5	2
1981	8	7
1982	7	11
Total	45	35

Table 1. Annual breakdown of observed band openings into the Fort Worth, Texas, area over a seven-year period.

Month	Tropo	E-Skip
Jan	0	1
Feb	1	0
Mar	1	0
Apr	3	0
May	5	0
Jun	21	11
Jul	0	10
Aug	7	9
Sep	2	4
Oct	3	0
Nov	0	0
Dec	3	1

Table 2. Monthly breakdown of observed band openings into the Fort Worth, Texas, area over a seven-year period.

Season	Tropo	E-Skip
Summer	9	23
Fall	6	1
Winter	2	1
Spring	29	11

Table 3. Seasonal breakdown of observed band openings into the Fort Worth, Texas, area over a seven-year period.

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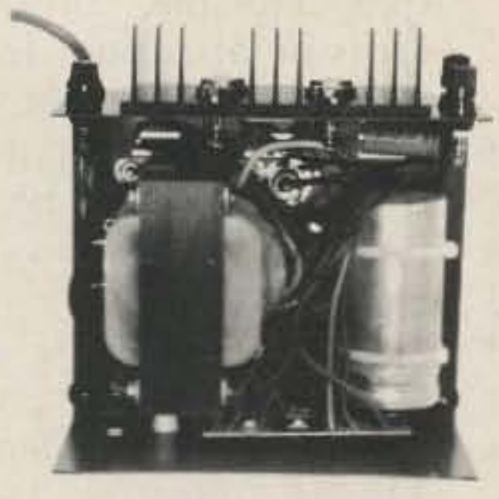

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MODEL RS-50M

MODEL VS-50M

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RM-50A	37	50	5¼ × 19 × 12½	50
• SEPARATE VOLT & AMP METERS				
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W X D	Shipping Wt (lbs)
RS-4A	3	4	3¾ x 6½ x 9	5
RS-7A	5	7	3¾ x 6½ x 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 x 7½ x 10¾	11
RS-12A	9	12	4½ x 8 x 9	13
RS-20A	16	20	5 x 9 x 10½	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13¾ x 11	46

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MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt (lbs)
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RS-20M	16	20	5 x 9 x 10½	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13¾ x 11	46

VS-M SERIES

MODEL VS-20M

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- Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt (lbs)
VS-20M	16	9	4	20	5 x 9 x 10½	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13¾ x 11	46

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Continous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt (lbs)
RS-7S	5	7	4 x 7½ x 10¾	10
RS-10S	7.5	10	4 x 7½ x 10¾	12
RS-10L(For LTR)	7.5	10	4 × 9 × 13	13
RS-12S	9	12	4½ x 8 x 9	13
RS-20S	16	20	5 x 9 x 10½	18

region of the ionosphere and, as far as it is known, is accessible to stations centered at equal distances on both sides of the geomagnetic equator. For example, contacts of close to 5000 miles have been made between Europe and South Africa and between Puerto Rico and Argentina.

DX: What to Expect

As with any phenomenon, the mechanisms which facilitate VHF DX are at times unpredictable. Although there are exceptions to almost every rule of propagation, long-term statistical analysis of band openings does prove certain things.

Len Hoops KC5IJ provided me with a computerized list of band openings into the Fort Worth, Texas, area over a seven-year period from 1976 to 1982. Once I categorized these openings according to year, month, and season, it was evident that everything I had ever read concerning VHF propagation was basically true. The numbers didn't lie.

Keep in mind that some parts of the country experience more band openings, especially where tropo is concerned. As mentioned earlier, this is due to geographical location (tropo is more prevalent along coastal areas). Despite this, the numbers are still indicative of seasonal peaks.

Looking at the annual breakdown of observed band openings, it is interesting to note that the number of tropo-DX openings was about the same each year, whereas E-skip DX varied quite a bit. On the average, KC5IJ experienced 6 tropo and 5 E-skip openings per year. (See Table 1.)

The monthly breakdown shows that June is by far the most active month in terms of DX. This is true just about everywhere. Spring and fall show an increase in tropo DX which was noted earlier, and the summer months clearly reveal that this time of year is the best for working E-skip. (See Table 2.)

SSB/CW Band Plan

Table 4 shows the band plan for the low end of 144 MHz. For the most part, this particular plan has gained acceptance and is adhered to on a nationwide basis. As you can see, 144.200 MHz is the national calling frequency, and most of the activity is centered here.

Making Contact

On SSB it is perfectly all right to call CQ just as you would on the HF bands. As a matter of fact, this is standard operating procedure. When calling CQ, it is generally a good idea to give your callsign phonetically, your location, and in which direction you are beaming (if a directional antenna is being used). If a vertical antenna is being utilized, say so during your CQ. This will be very helpful because almost everyone is horizontally polarized and the subsequent cross-polarization loss is around 20 dB. That weak signal that one may think is DX can sometimes be a station 10 miles away on a ground plane.

Once contact is established with another station, a move up in frequency to 144.210, 144.220, 144.230, etc., is recommended. Ragchewing on or very near the calling frequency is frowned upon, so it's best to QSY once contact is made. As for CW buffs, it is OK to call CQ on CW on 144.200 MHz. But once again, it is recommended to QSY once contact is made.

Activity

When it comes to the level of activity on 2-meter SSB, it is no different than

Day	UTC	Time	Area	Name	Freq.	NCS
ALL	LOCAL	TIME	IS IN	STANDARD	TIME	EFF. OCT. 27, 85
Sun	1500Z	10:00 AM	NYC	East Coast	144.250	WA2SLY/WA2FXB/WA2PJZ
Sun	0415Z	8:15 PM	Nevada	NV Activity	144.225	WA7JUO
Sun	1530Z	8:30 AM	Tucson	Arizona-Tucson	144.300	N7WS/W5DXN
Sun	0300Z	8:00 PM	Orlando	Sunshine State	144.250	WA4GPF WD4FAB KA4WWL
Sun	0200Z	8:00 PM	Arkansas	Razorback	144.250	NR5A, WB5JAR, WB5PNZ
Sun	0300Z	9:00 PM	Twin Cities	Minnesota	144.250	W0KRX
Sun	0330Z	7:30 PM	So. Calif.	SOCAL	144.250	WB6NOA/KF6ZB/K6PVS
Mon	0230Z	8:30 PM	INDIANA	SE Indiana	144.250	KA8MRI
Mon	0300Z	9:00 PM	So. Tex.	So. Texas	144.250	KD5CB NB5O
Mon	0400Z	8:00 PM	Spokane	Inland Empire	144.250	KB7N
Mon	0400Z	9:00 PM	Salt Lake	Mtn. States	144.250	N7BHC
Tue	0230Z	9:30 PM	Greensboro	N. C. SWOT	144.250	KA1LMN/4
Tue	0300Z	9:00 PM	Rio Grande	Republic of Rio G	144.250	N5DQD/WB5YVD
Tue		9:00 PM	Anchorage	Alaska	144.200	KL7JAI/KL7IKV/KL7QS/
Tue	0230Z	8:30 PM	So. Ill.	"Little Egypt"	144.250	N5AFL/KA9HDZ
Tue	0300Z	8:00 PM	Phoenix	Arizona-Phoenix	144.300	KB7CH
Tue	0400Z	8:00 PM	North Count	NORCAL	144.250	WA6ZJF
Wed	0100Z	8:00 PM	Cleveland	N. Central States	144.255	K8RAQ/WD8PKQ/W8FQK
Wed.	0200Z	9:00 PM	East PA	Delaware Valley	144.250	WB2BJH/WA2ADS/N3BHS
Wed	0300Z	9:00 PM	IA/MO/IL	Tri-State	144.250	WB0SWD/WB9WMM/N9CXO
Wed	0300Z	9:00 PM	N. Texas	Hdqrtrs	144.250	WD5DJT KA5NGG
Thu	0200Z	8:00 PM	Chicago	INDY	144.250	KA9EJJ/KA(MXF
Thu	0200Z	9:00 PM	West VA	Triple-States	144.150	WB8ZTV/KJ8J
Thu	0400Z	8:00 PM	South Count	NORCAL	144.250	N6EIO, K9TGT, K6HXW,
Sat	1300Z	7:00 AM	North Texas	Hdqrtrs	144.250	WA5DBY/K5ASZ
Sat	1600Z	8:00 AM	WA-ID-MT	Inland Empire	144.110	W7HAH/N7ART
Tue	0145Z	8:45 PM	MD to OH	Activity group	144.170	W3WN
Fri	0145Z	8:45 PM	MD to OH	Activity Group	144.170	W3WN
Sun	0145Z	8:45 PM	MD to OH	Activity Group	144.170	W3WN

Table 5. SWOT nets currently active.

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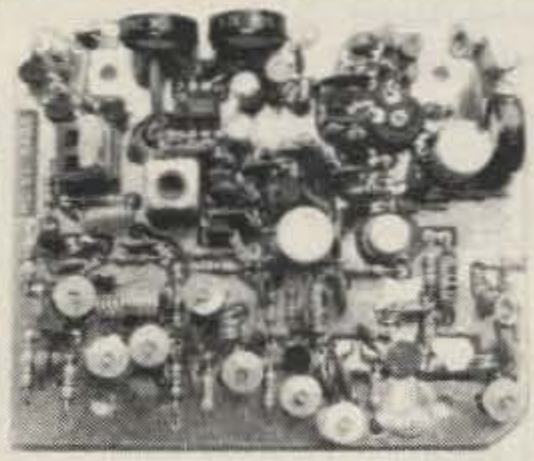

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3200uf 50V (Ideal For Power Supplies)-1.00
5600uf 25V (Comp Grade 3-5/8" × 1)-3/1.00
.1uf 50V Monolithics 10/1.00
.22uf 50V Monolithics 20/1.00
Chip Caps-Set of 4, 2 Each 2.7 & 3.3pf-1.00
.33uf 100V Dip Mylar 10/1.00
1,000 PC Resistor Ass't (30 Values) 1/2W-$3
Pots-1 Meg, Linear Taper 5/1.00
Motion Detector Bds (Inc IC-$2) 7/10.00
Mot Det (IC Only-ULN2232A) 3/$2-20/10.00
Project Box/Lid For Detector 1.95
Miniature Speaker For Detector ..... .25
Extensive Construction Article For Det. $1
TV Knobs 15/1.00
Ammeter (0-15 A.C. Amperes) 4.95
Volt/OHM Meter MVMNT (0-1K OHM, 0-300V) 2.95
6V Miniature Gear Motor ..... .50
RF Chokes-1.8uh, 8.2uh, 12uh, 22uh-10/1.00
22/44 Pin Edge Card Connector ..... .50
34 Pin Connector (For Drives) W/Hood ..... .75
BNC "T" Connector (UG-274) ..... .95
Mixed Connector Ass't 10/1.00
1.5AMP 50V Bridge (GI, TO-5 Pkg) ..... .50
25AMP 200V Bridge (Solder Lug Term) 1.50
Zenith TV Replacement IC Special $1 Each
221-42, 221-43, 221-45, 221-48, 221-69, 221-79, 221-87, 221-96, 221-104, 221-105, 221-106, 221-140
2SD900 (Horiz Output W/Damper Diode)-2.95
2SC1172B (Toshib-Horiz Output Trans)-1.95
Winegard 4 Bay Bowtie UHF Antenna-19.50
IC Storage (Bug) Box (Holds) 30 IC's-1.75
Precision (Multi-Turn) Trim Pots (Copal), 100 OHM, 500 OHM, 1K, 2K, 5K, 10K, 20K, 50K, 100K, 200K, 500K, 1M-.85 Each-3/$2
Piher PT-10V Hor Mt (Single Turn) Trimmers 100 OHM, 1K, 10K, 25K, 50K, 100K ..... 4/$1
Heat Sensitive Switch/150° C 10/1.00
Mixed Coil Ass't 10/1.00
Buzzers 3/1.00
Chip Resistor (6.8K) 20/1.00
Chip Resistor (470K) 20/1.00
Chip Cap (330pf) 20/1.00
Jumbo Red LED W/Built In Resistor-30/$1
MRF 901 (Hobby Grade-60% Good) 10/1.00
IC Ass't (Hobby Grade, Some Marked)-30/$1

20 Cent (.20) 74SCXX Series Special

- **Octal Interface Circuits**
- **Equivalent To 74LSXX Series**
- **Low Power ISO-CMOS Technology**
- **Short Propagation Delay**
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74SC137-1 Of 8 Inverted Decoder, Latched
74SC138-1 Of 8 Inverted Decoder
74SC139-1 Of 4 Inverted Decoder
74SC237-1 Of 8 Non-Inverted, Latched
74SC238-1 Of 8 Non-Inverted
74SC239-1 Of 4 Non-Inverted
74SC240-Octal Buffer/Line Driver-Inv
74SC241-Octal Buffer/Line Driver-N/I
74SC244-Octal Buffer/Line Driver-N/I
74SC245-Octal Bus Transceiver-Non'I
74SC373-Transparent Latch-Non/Inv
74SC374-D Type Flip-Flop, Non/Inv
74SC533-Transparent Latch-Inverted
74SC534-D Type Flip-Flop, Inverted
74SC540-Octal Buffer/Line Driver-Inv
74SC541-Octal Buffer/Line Driver-N/I
74SC563-Transparent Latch, Inverted
74SC564-D Type Flip-Flop, Inverted
74SC573-Transparent Latch, Non/Inv
74SC574-D Type Flip-Flop, Non/Inv
Data Book For All Above #'s 2.50

Cypher IV Micro-Controller Kit- $129.50
- 4 MHz, 8-Bit Microprocessor (NAT 1NS8073)
- Control Basic Interpreter On-Chip
- Auto-Start Operation At Power-On
- Fast 16-Bit Multiply And Divide
- RS-232, Supports CRT & Serial Link
- 24 Bi-Directional I/O Lines (8255A)
- RAM Memory-2K Expandable To 16K
- Eprom Memory Expandable To 16K
- Built In Eprom Programmer
- Parr (Centronix) Printer Interface
- Optional Real-Time Clock W/Backup

Pay TV Hardware Installation Kit Blow Out As Low As $2.95 + $3.50 Shipping Per Unit
All Kits Contain 5 F Connectors, 300 to 75 OHM Balun, 300 OHM Terminal Block, 2 Ft 75 OHM Patch Cord, 2 Ft 300 OHM Twin Lead, Nylon Cable Ties, And UHF Antenna
Model #4124-$2.95 Includes All Of The Above Plus 25 Feet Coaxial Cable And Mounting Hardware For Indoor Wall/Ceiling Installation
Model #4880-$2.95 Includes All Of The Above Plus 25 Feet Coaxial Cable And Attractive Expandable Pole/U-Bolt For Easy Indoor Installation
Model #4845-$3.95 Includes All Of The Above Plus 65 Feet Coaxial Cable And All Necessary U-Bolt Hardware

MODEL 705 Digital Multimeter

DC Voltage	100µV to 1000V	$51.95
AC Voltage	100µV to 750V	
DC Current	0.1µA to 10A	
AC Current	0.1µA to 10A	
Hi-Lo Resistance	0.1Ω to 20MΩ	
Capacitance	1pF to 20µF	
Diode Test	forward voltage testing	
Hfe test	transistor testing	

UHF-TV PREAMP

(As featured in Radio Electronics March/May articles, 1982)

This inexpensive antenna mounted pre-amp can add more than 25 dB of gain to your system. Lots of satisfied customers and repeat orders for this high quality kit, which includes all component parts, PC BD, Case, Power Supply and Balun $34.50
Assembled Version $57.50

Terms: MICRO-MART accepts Visa, MC and telephone COD's. Minimum order $10.00. Shipping—U.S. orders, $2.00. Canada and other countries $3.50 (includes ins.). Shipping rate adjusted where applicable. NJ residents add 6% sales tax.

MICRO-MART • 508 CENTRAL AVE., WESTFIELD, NJ 07090 • (201) 654-6008

Antennas

Cushcraft Corporation
PO Box 4680
Manchester NH 03108

Jaybeams from:
JASCO International
PO Box 29184
Lincoln NE 68529

KLM
PO Box 816
Morgan Hill CA 95037

Austin Custom Antennas
RFD #1, Tenney Road
Sandown NH 03873

F9FT (Tonna from France) by:
N&G Distributing Corporation
7201 NW 12th St.
Miami FL 33126

Amplifiers

V-J Products, Inc.
505 E. Shaw
Pasadena TX 77506

Daiwa USA, Inc.
1908A Del Amo Blvd.
Torrance Ca 90501

Arcos (kits)
Harold Bramstedt
6104 Egg Lake Road
Hugo MN 55038

Henry Radio
2050 S. Bundy Drive
Los Angeles CA 90025

TE Systems
PO Box 25845
Los Angeles CA 90025

Communications Concepts
2648 N. Aragon Ave.
Dayton OH 45420

Mirage Communication Equipment
PO Box 1000
Morgan Hill CA 95037

Tokyo Hi-Power Labs by:
ENCOMM Inc.
2000 Avenue G, Suite 800
Plano TX 75074

Preamps

Janel Laboratories
33890 Eastgate Cir.
Corvallis OR 97333

Radiokit
PO Box 4115
Greenville NH 03048

Advanced Receiver Research
PO Box 1242
Burlington CT 06013

Hamtronics, Inc.
65 Moul Road
Hilton NY 14468

Table 6. Some of the major manufacturers of 2-meter SSB equipment. Brochures and catalogs are available upon request.

any other ham band—it has its up and down periods. Generally speaking, 90% of all activity occurs between 6:00 pm and midnight local time, and to a lesser degree from 8:00 am to 11:00 am local time. But don't be fooled! Unfortunately, many operators leave their rigs sitting on 144.200 MHz and listen to white noise when the band may be open. Whether it's three in the morning or three in the afternoon, one cannot assume that the band is dead. You have to make calls to get results.

In addition to the SWOT nets listed in Table 5, there are many localized VHF clubs which sponsor activity nights with nets open to all amateurs. One of the nicer things about the SSB portion of the band is that there is an even mix between rag-chewers, VHF DXers, experimenters, home-brewers, and the like. It is basically a band of moderate activity with plenty of elbow room for everyone. Splatter and QRM are almost nonexistent except for the busy periods of VHF contests, when everyone seems to come out of the woodwork. And when the band cooperates with a good E-skip or tropo opening, 2 meters sounds much like 20 meters, minus the foreign DX of course.

Referring to the seasonal breakdown, it is evident that spring is the best season for DX. Although the numbers of band openings for fall and winter are much lower, they do prove that tropo and E-skip can occur at any time. (See Table 3.)

Over this seven-year period, KC5IJ worked 32 states via E-skip and 20 states via tropo for a total of 35 different states worked. His equipment varied over the years, but generally speaking he ran about 200 Watts of power with antennas that included an F9FT yagi and a 20-element collinear array.

Normal Range

The normal range of 2-meter SSB and CW depends upon many factors such as terrain, antenna height, antenna gain, power, etc. However, most will find that their range under normal band conditions is on the order of 150 to 200 miles. DX contacts are usually referred to as those exceeding 500 miles.

Propagation Beacons

As is the case with 6 meters and 10 meters, beacons are operational to assist amateurs in determining band conditions and to aid the beacon's operators in the study of radio-wave propagation, which is dependent on listeners' reports. There are currently three operational beacons in the US, with more in the planning stages. Amateurs are encouraged to monitor the beacon frequencies from 144.050 MHz to 144.060 MHz and to submit reception reports which will in turn allow propagation phenomena to be better understood.

The W3VD beacon. The W3VD beacon is operational 24 hours a day on 144.052 MHz. The beacon, which is located between Baltimore, Maryland, and Washington, DC, in grid square FM 19, runs 25 Watts to a halo antenna at 30 feet. W3VD is operated by Johns Hopkins University's Applied Physics Laboratory in Laurel, Maryland.

The WB2IEY beacon. Sponsored by Tom Richmond WB2IEY and the Rochester, New York, VHF Group, this beacon is also operational 24 hours a day on 144.051 MHz. Located in Naples, New York, in grid square FN 12, the beacon runs 3 Watts to a pair of Big Wheels.

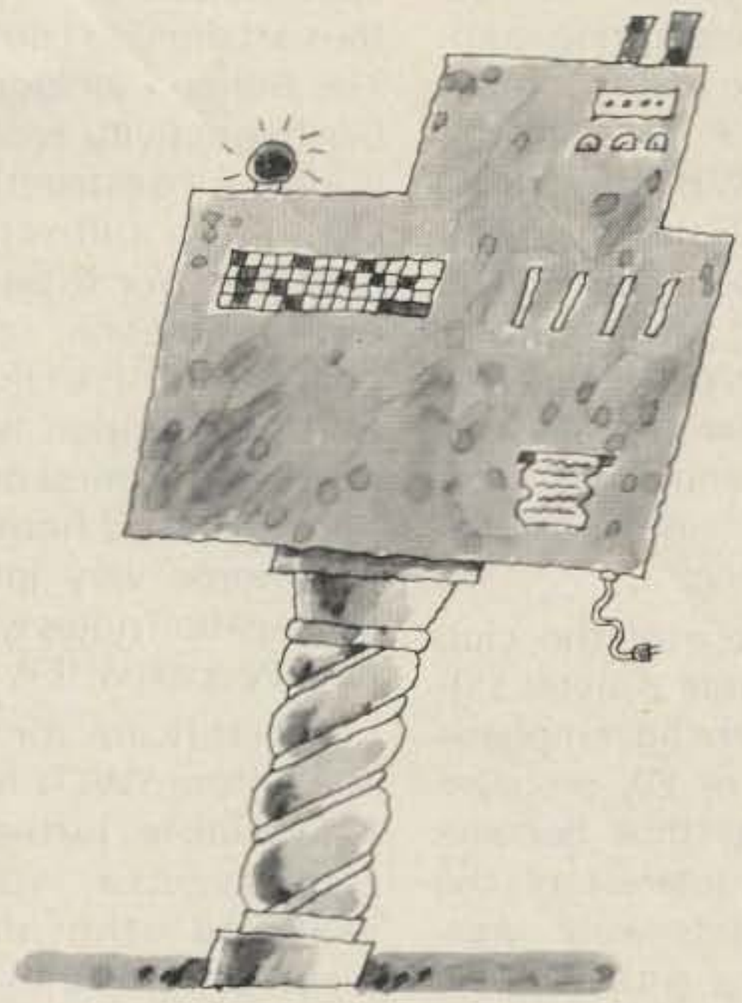
The WB2RJL beacon. The WB2RJL beacon has been in operation since August, 1984. It is a 24-hour-a-day beacon on 144.055 MHz. The beacon is located in downtown Winter Park, Florida, a suburb of Orlando, in grid square EL 98, and runs 20 Watts to a pair of stacked Big Wheels. Reception reports can be sent to Chris Johnson WB2RJL.

Sidewinders On Two

In 1976, the need for an organization to promote 2-meter activity on SSB and CW became evident, much like the SMIRK organization for 6 meters and 10–10 International for 10 meters. Two-meter FM repeaters were threatening to encroach upon areas that were being used by SSB operators. The frequency used back then was 145.100 MHz, and a new section above this frequency was being authorized for more repeaters. The opening of the band below 145 MHz to 144 MHz to Technician-class licensees caused the national calling frequency to be moved from 145.100 to 144.200 MHz. Prior to this, only higher-grade licensees were allowed to work in the area around 144.100 being used for DX work on SSB and CW.

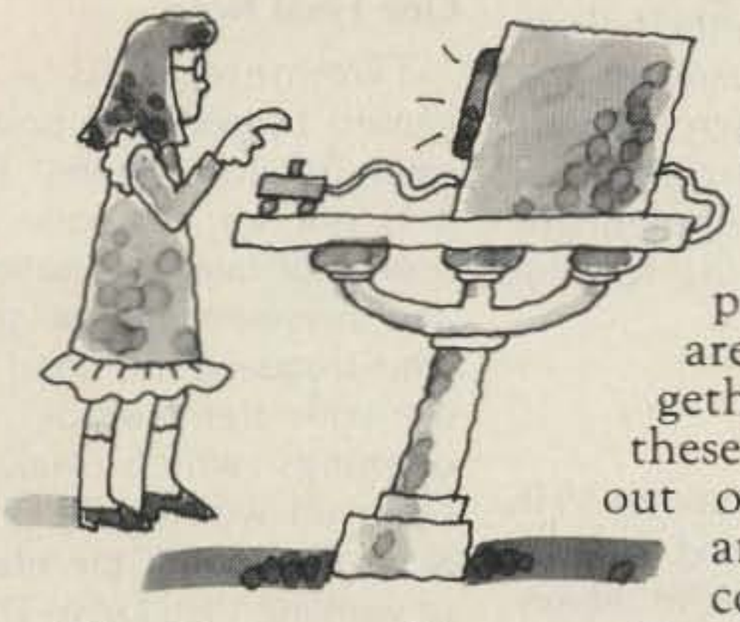
The SWOT organization was formed March 28, 1976, by four Fort Worth, Texas, amateurs: K5ASZ, WB5MEV (now KB5SV), W5ARR, and W5JTA (now KC5IJ). The charter members signing at this time were given num-

WANTED: OLD THINKER TOYS.

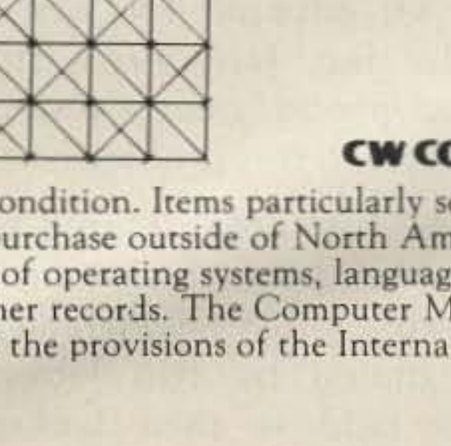


CW Communications, ComputerLand and The Computer Museum invite you to send in your early personal computers, software, and memorabilia — you could win a free trip to The Computer Museum in Boston

Your old, dusty "thinker toy" may now be ready to become a treasured museum piece. The Computer Museum in downtown Boston — an international museum dedicated entirely to computing — is searching for the very best and most unique relics of the personal computer revolution.



ComputerLand, CW Communications, and The Computer Museum are working together to bring these early relics out of your attic and into the collection of The Computer Museum. The museum is especially looking for kit machines, prototypes, programs, output, newsletters and memorabilia of early computing from around the world. A selection of the finest items will be used to create an exhibit on the evolution of personal computers and a catalog highlighting the Museum's collections. If your submission is accepted for addition to the Museum collection, you will be invited to the grand opening of the exhibit and will receive a bound edition of the catalog. If your item is selected as one of the five best "finds", you will also receive an all-expense-paid trip to Boston for the grand opening party.



So, get up to the attic, down to the cellar and into your closets, and tell us what you find! Call or write the Museum for an official entry form, or send a photo and description of your items by March 1, 1986 to: The Computer Museum, Personal Computer Competition, 300 Congress St., Museum Wharf, Boston, Massachusetts USA 02110, (617) 426-2800, Telex: 62792318.

ComputerLand®

The Computer Museum

CW COMMUNICATIONS/INC.

Entries will be judged on significance, rarity, date, completness and condition. Items particularly sought include pre-1980 machines, early serial numbers (get those number 1's out), machines made for purchase outside of North America (even modern machines are sought in this category); first releases of software such as first releases of operating systems, languages and mass-marketed and original applications; and pre-1980 photographs, newsletters, manuals and other records. The Computer Museum is a private non-profit educational institution. All donations are tax-deductible according to the provisions of the Internal Revenue Service. Thinker Toys is a registered trademark of George Murrow & Murrow Designs, Inc.

bers 1 through 26, with lots cast by the organizing committee for the first four numbers. W5ARR was to be chairman, WB5MEV treasurer, K5ASZ net manager, and W5JTA secretary. W5JTA also started a newsletter called the *SWOT Bulletin*; the first issue appeared in April, 1976, and it has been published at least 10 times a year ever since.

The purpose of the club was to promote 2-meter SSB and CW with an emphasis on a study of DX propagation. DX has thus become the leading interest of the members. Nets were organized starting with the Fort Worth area managed by K5ASZ, and W5JTA (KC5IJ) extended the nets nationwide. SWOT now has nets coast to coast, some with only a few members and others with as many as 50 check-ins per meeting. (See Table 5.)

Membership in the SWOT organization is open to any 2-meter operator authorized to use the band. Those who have worked two SWOT members become full members, while others may also join and become full members upon furnishing the callsigns and SWOT numbers of two members worked. Application forms appear in each issue of the *SWOT Bulletin*, although this form is not required.

The dues are $5.00 without the *Bulletin* and $10.00 with it. Renewals are the same except that family members, where extra membership lists are not needed, will be $5.00. Applications can be sent to Howard Hallman WD5DJT, 3230 Springfield, Lancaster TX 75134. The current membership in SWOT is over 2700—with Canada, Bermuda, Europe, and all of the USA represented.

The *SWOT Bulletin*, which is now edited by Harry A. Arsenault K1PLR, 704 Curtiss Drive, Garner NC 27529, is a very informative publication that the SSB/CW enthusiast shouldn't do without. The *Bulletin* includes membership activity reports, net updates, construction articles, swap and sell items, new member listings, beacon information, upcoming contests, VHF/UHF conference information, schedule requests for meteor-scatter operators, and from time to time some very interesting propagation notes written by Emil Pocock W3EP.

A certificate for working 10 or more SWOT members is available. Fifteen more contacts gets a "Worked 25" seal and other endorsements are made in steps of 25. Some members have qualified for over 350 SWOT members worked.

Each year a contest is set up for working other SSB/CW stations, the rules of which are published ahead of time in the major ham-radio magazines. Jerome Doerrie K5IS of Booker, Texas, is the awards and contests manager.

Grid Squares

In order to stimulate activity on the VHF and UHF bands, some years back Europeans devised a *QTH Kenner System*, whereby the continent was divided up into grids which were determined by longitude and latitude. With each grid and specific geographical location within the grid having its own alphanumeric designators, the exact location of a station could be determined. In time, collecting different grid squares became a popular competition on the bands.

Unfortunately, the numbering scheme utilized in this particular system could not be adopted for worldwide use. However, the *Maidenhead Locator* system has solved this problem.

The first area defined by the Maidenhead system is the 20° × 10° *field* which is designated by two letters. This field is then broken down into 100 2° × 1° *grid squares* which measure approximately 100 × 70 miles in size and are indicated by two numbers. To indicate location more precisely, two additional letters are used to indicate the 5′ × 2.5′ *subsquare* which is roughly 4 × 3 miles in area.

For example, the full locator number for my QTH in South Philadelphia is FM 29 JW. For on-the-air exchanges, it is general practice to give only the first four characters, or in my case FM 29.

On January 1, 1983, the ARRL introduced an awards program called the VHF/UHF Century Club Award (or VUCC) which involves the Maidenhead Locator. For 2-meter operators, it is required to confirm 100 different grid squares to qualify for the award. (See Fig. 1.)

Mountaintopping

Except for contest weekends, mountaintopping hasn't really caught fire here in the United States as it has in Europe. Heading to the hills to put new grid squares on the air is commonplace amongst the VHFers abroad. It is hoped that more Americans will start heading for the hills, too.

Contests

There are four major VHF contests sponsored by the ARRL that generate heavy activity on the SSB and CW portions of 2 meters. These are the VHF Sweepstakes in January, the June VHF QSO Party, the September VHF QSO Party, and the 2-Meter Spring Sprint which was held for the first time in April of 1983. With many stations heading to hills and mountaintops for that extra edge, contests are the perfect time to go hunting for those needed states, counties, grid squares, etc. Rarely does a contest go by without some sort of opening taking place which turns the band into a frenzy that is unlike anything you've ever heard.

Suggested Reading

As noted earlier, my main intention was to inform the reader that there is activity on the SSB and CW portions of 2 meters and to introduce the Sidewinders On Two organization. It was not my plan to delve into the technical aspects of equipment, antennas, and propagation, but instead to give a very brief overview on these subjects. I hope I have succeeded. As for further reading and research, there are many excellent books on the market that the 2-meter enthusiast shouldn't do without.

A few of these are the *VHF Handbook for Radio Amateurs* by W9EGQ and W6SAI, the ARRL *Radio Amateur's Handbook*, the ARRL *Operating Manual*, and the Radio Society of Great Britain *VHF/UHF Operating Manual* by G3RPE and G6JP.

One Final Note

Two-meter SSB is regarded by some as uninteresting or even boring. True, it is not for everyone. But sooner or later the patience and perseverance of those who frequent the band pay off with tremendous band openings which make it seem all worthwhile. There is no comparing the elation of working VHF DX to DXing on the HF bands, as the propagation on HF is just too predictable.

Just ask any 2-meter SSB convert. It is much more satisfying to crack the pileup for the South Dakota station on 1000-mile E-skip than it is to work that HV on twenty. If you don't work the HV from the Vatican, he may be back again tomorrow. But if you don't work the South Dakota station on 2-meter E-skip. . .well, you get the picture! ■

Gary Sargent WB8TPD
4227 Willow Run Drive
Dayton OH 45430

One-Chip Facsimile

We all talk *about the weather; now you can see it on your Atari. You'll be amazed at how simple it is.*

Have you ever been tuning the shortwave bands and encountered the distinctive "screech screech" sound of a facsimile signal and wondered what type of information was being transmitted? Very interesting weather charts and satellite photographs are transmitted by various services continuously. These charts will allow you to answer pertinent questions such as: Will it snow on Kamchatka today?, Is the Gulf Stream changing its path?, or Should I take my umbrella to work tomorrow?

If you happen to have an Atari computer system available, using the circuit and computer program described here you will be able to receive and display these facsimile signals. The received charts are displayed on the computer's monitor or TV screen and are roughly two displays wide and three displays long. A joystick is used to scroll the screen around the chart.

The components of this system are: a good-quality communications receiver with SSB capability, a simple tone-detector circuit, an Atari 800 computer system, and the computer program, VISIFAX.

Capabilities

This system will properly display facsimile signals sent at a rate of 120 or 60 lines per minute (LPM). These rates (particularly 120 LPM) are used by most commonly heard stations.

The computer samples each received line a nominal 480 times and can display 512 lines horizontally. While this resolution can give good results, it is less than 50% of the resolution transmitted. Also, gray tones are not used. Thus this system is more suitable for high-contrast, large-format weather charts than for satellite pictures and similar charts with much fine detail.

Figs. 2 through 4 are samples of charts that I have received at my location and are representative of the system's capabilities.

Receiver Requirements

The receiver that you use should be a stable, good-quality general-coverage receiver with SSB capability. If your receiver provides acceptable ease of tuning and frequency stability for SSB voice signals, it should be usable for facsimile reception. I have used a Yaesu FRG-7 and a Sony ICF6500W with good results.

The Tone Detector

The tone detector is a simple circuit that connects between the receiver audio output and joystick port 2 of the computer. The detector converts the facsimile tones to TTL pulses that the computer can use. The circuit is shown in Fig. 1.

The circuit is based on the XR2211 integrated circuit used as a tone detector. R1 and C1 determine the detector's frequency, and R2 is used to adjust for the sharpest detail as a chart is being received. The LED serves as a simple but effective tuning indicator. The circuit requires only 5 volts of power, which is taken from the computer.

The parts may all be obtained from local outlets. The construction methods used are not critical. I eventually added a few components to allow me to use the same basic circuit for CW reception.

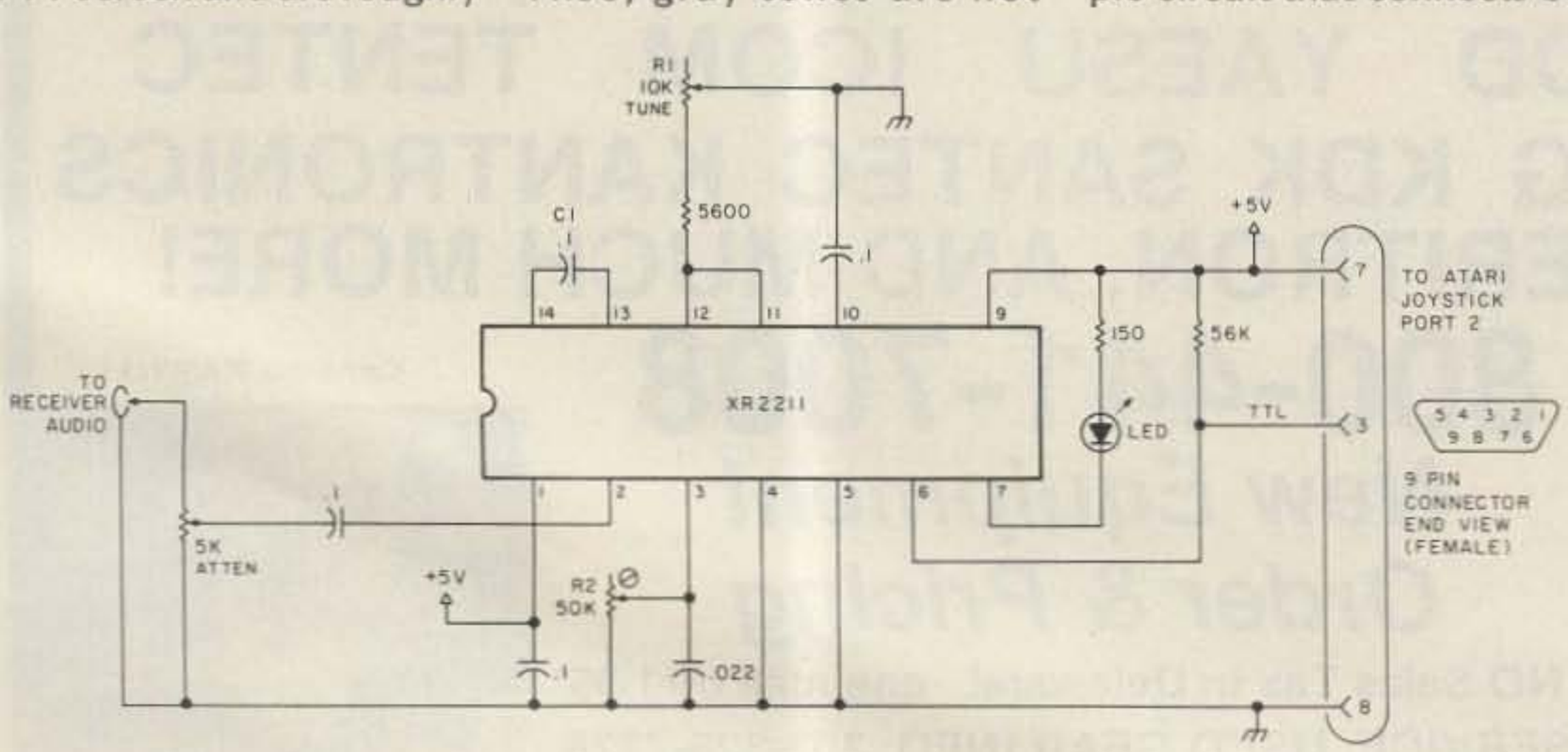


Fig. 1. Tone-detector schematic.

The Computer System

The Atari 800 computer and the VISIFAX program are the heart of the system and control all aspects of reading and displaying facsimile charts. The program is written entirely in assembly language and is not shown here because of its length (about 30 pages). It is a complex program that uses several of the Atari's sophisticated capabilities to do the job at hand. The computer is required to have 48K of RAM because of the size of

Fig. 2. GOES satellite picture as copied on 8080 kHz. Major cloud cover areas and fronts are readily observed.

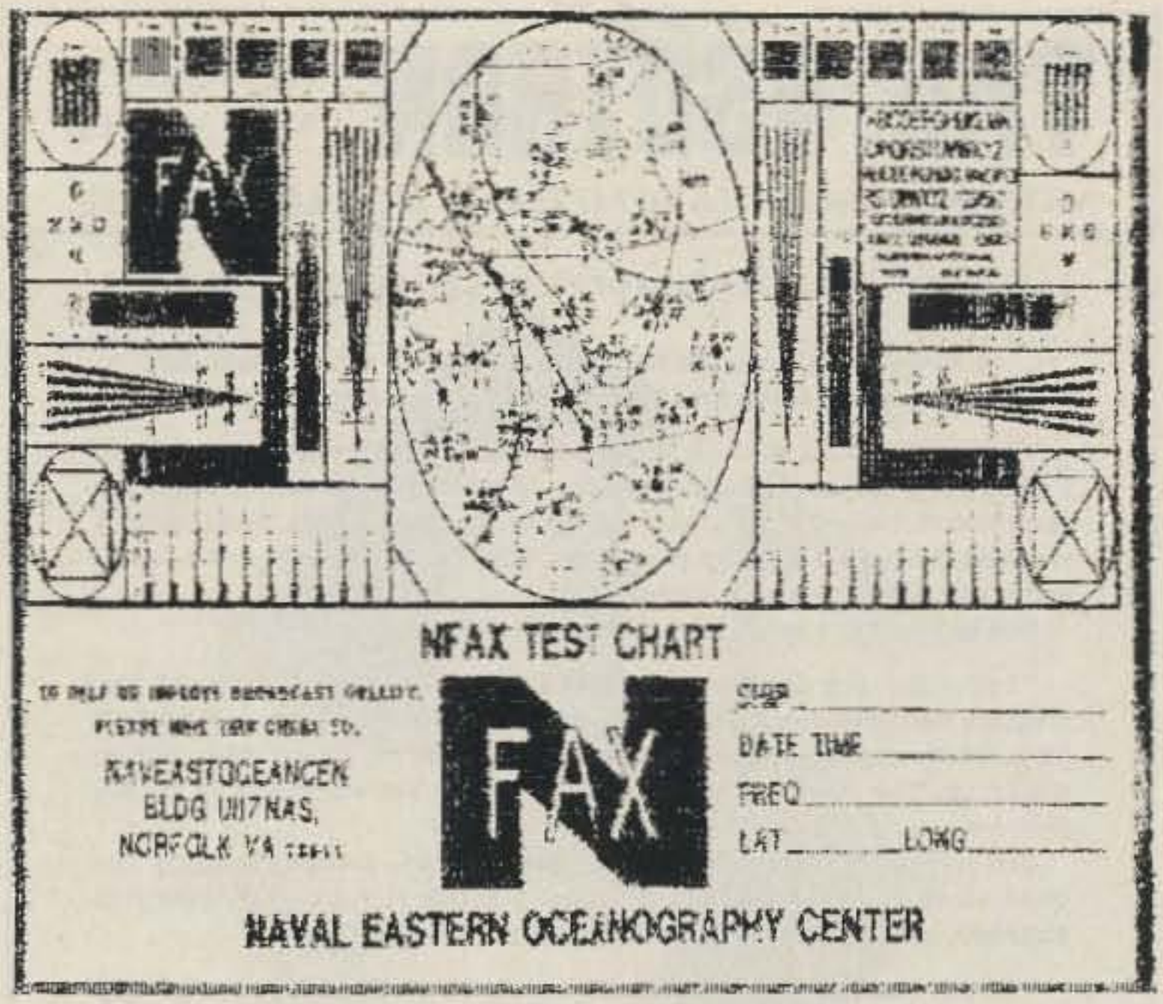


Fig. 3. Test chart copied from NAM on 8080 kHz. A good example of the resolution capabilities of this system.

the chart. A disk is required only to load in the program. An optional printer may be used to produce a hard copy of the received chart and was used to produce the charts that accompany this article.

VISIFAX At Work

VISIFAX begins by initialing for operation, which includes setting up the Atari's hardware timer #4 to interrupt to sample line data and plot it 480 times per line or 960 times per second.

Next, the program will check the joystick plugged into port one of the computer to see if the displayed chart is to be scrolled on the screen. The scrolling effect is accomplished by manipulating the computer's display list.

Finally, the program checks to see if a keyboard key has been pressed. If so, its corresponding command is performed.

The computer screen includes two lines of text at the bottom. These two lines display the available commands and certain status information. To invoke a particular command, only its first letter must be pressed. Any command may be used at any time. The commands are:

RESET: An R will start the process of displaying a chart. The chart is displayed as received from left to right and from the bottom to the top (so most charts are viewed normally...without your having to stand on your head!). Pressing the R again will reset the displayed chart to the left of the screen without altering the synchronization.

SYNC: An S will have the effect of displaying subsequent received lines down the display about one-half inch. This command should be used as required to properly center the received chart. Most stations precede charts with a short period of synchronizing lines that may be used for centering.

LINE-SKIP: An L will increment the number of received lines to skip between displayed lines. This feature will allow compressing of the received chart horizontally, fitting more of it onto the computer's screen. I find that a LINE-SKIP count of 1 is used most often.

MODE: An M will step through the three possible modes of operation. The present mode is shown on the screen's bottom line. Mode "one" indicates that the chart will be received and the process will complete when the right-most line is displayed. Mode "cont" allows the continuous display of charts, with one overlapping the last. Mode "wait" halts the display of any more received lines but does maintain synchronization. This feature may be useful to eliminate unwanted sections of a known chart.

PRINT: A P may be used to print a copy of the present chart on a Gemini 10X printer. The eight-by-eight-inch chart will require about three minutes to print. To abort the printing process, enter another P.

LPM: A 1 or 2 may be entered to select the desired received LPM rate. A 1 will select one line per second (60 LPM), while a 2 will select two lines per second (120 LPM).

Finally, the right portion of the bottom line of the screen indicates the present number of rows (or pixels per received line) and the amount of time between samples, both shown as hexadecimal numbers. The <, >, +, or − keys may be used to increment or decrement these values. This may be required to fine tune your computer to synchronize with the received chart.

How To Use the System

Before starting up your computer, make sure all cartridges are removed. If you have an 800XL computer, hold down the OPTION button while powering on to make sure that Basic is out of the way. 800XL owners will also have to load in the TRANSLATOR disk before loading in VISIFAX. After booting, use Atari DOS option L to load and start your copy of VISIFAX.

Fire up your receiver and then connect its audio output to the tone detector's input and the tone detector's output to joystick port 2 on the computer. Tune in a strong facsimile signal until its characteristic "screech screech" sound is of a medium pitch. Then adjust the detector's TUNE control until the tuning LED blinks in time with the audio.

Press R on the keyboard to start displaying the chart. Use the S and R keys as required to properly position the chart vertically on the display. Fine tune to get the sharpest picture.

Except when printing a chart, the joystick may be used at all times to scroll the received chart around the display.

Where To Tune

By far the best facsimile signals at my location are from the Naval Eastern Oceanography Center (NAM) on 3357, 8080, 10,865, 16,410, and 20,225 kHz. Weather charts and satellite photographs of all types are

broadcast nearly continuously.

Canadian station CFH out of Halifax, Nova Scotia, on 4217, 6330, 10,536, and 13,520 kHz also puts out good facsimile signals. CFH usually broadcasts one or two charts for the first 15 to 30 minutes of each hour.

I have also heard and printed charts from a number of other stations. Try 7640, 7670, 9400, 10,400, 12,125, 14,435, 14,5[illegible] 14,610, and 14,737 kHz.

Where To From Here

Several improvements to VISIFAX jump to mind. A nice feature would be saving and restoring charts from disk. Sometimes a chart is received without proper synchronization, resulting in a chart that is split horizontally, vertically, or both. An option could be provided that would allow manipulating a received chart to straighten out the chart. A more sophisticated tone detector and program changes could result in improved charts. There is a lot of room for experimentation and improvements. I would enjoy hearing from anyone who has made any of these, or other, modifications.

The Atari Editor/Assembler cartridge was used to develop VISIFAX. The source-code file should be compatible (with a few minor modifications) with any 6502 assembler you might happen to have.

Where To Get the Program

For a fee of $5.00 to cover my expenses, I will send you an Atari DOS 2.0S formatted diskette (containing the VISIFAX program in source, object, and listing forms), the tone-detector schematic, and other various notes. I cannot accept any CODs or credit cards. The package is available from me at the address given at the beginning of this article.■

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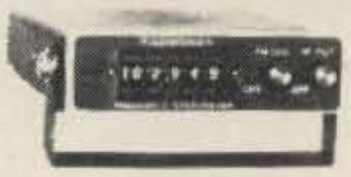

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NOAA's 2m UFO

Your weather radio is a great signal source on 145.8 MHz. K9POX explains why.

No, not the kind that shuttled ET to Earth, but Unidentified Formidable Oscillations that can cause your synthesized scanning transceiver to always stop at a certain frequency. There's a strong carrier present with no modulation, and it can't be heard at your friend's house just a block away! With all of the gadgets and gizmos available today ready and willing to present potential interference problems on our ham bands (computers, video games, VCRs, etc.), I recently ran across yet another very strong source, right in the middle of our precious two-meter band. I don't know if anything has been previously written on this one; if so, I've not seen it anywhere, so here goes!

As most hams are no doubt aware, our federal government sponsors a network of very useful VHF radio stations in the 162-MHz portion of the spectrum known as the NOAA weather radio system. The National Oceanic and Atmospheric Administration (NOAA) supports these stations with staff and funding to provide excellent, up-to-date weather information 24 hours a day for a given geographical area.

The stations are very helpful to private pilots, boaters, the farming community, out-of-doors tradesmen, and much of the remaining public in general. For a while there was some talk of terminating NOAA weather radio for reasons of economy (budget cutting), but the latest word seems to be that the service will continue as it has in the past...thank goodness.

NOAA weather radio provides another service for those who wish to avail themselves of it, i.e., an automatic-tone-alerting feature during times of potentially dangerous conditions. NOAA will transmit a steady audio tone of 1,050 Hz (for 10 seconds or so) to automatically trigger a siren-like signal and/or turn up the volume on an "alerting" model receiver to warn the owner of dangerous conditions and allow him or her time to "batten down the hatches." This is obviously a very useful feature to have, but you must leave the radio on and in stand-by at all times, which is not a particular problem today with very low-current-drain, reliable, solid-state receivers.

Now that the background has been sketched in, let's take a look at the problem that was promised in the beginning of the article. Most of the better weather radios (especially those with the alerting feature) are quartz-crystal-controlled units. Many have more than one switch-selectable channel, each crystal controlled, with two i-fs (high and low) each with crystal-controlled local oscillators, and all done with *one* crystal.

Being the curious type that I am, I had to find out how they did all of this with just one silly crystal, and Fig. 1 is the block diagram of what I found out. Three of the weather radios that I have (each of different manufacture) use the very clever scheme of Fig. 1 and offer three switch-selectable channels on 162.55, 162.475, and 162.40 MHz. Beginning with the middle channel of 162.475 MHz, a 16.2020-MHz crystal is used to control oscillator Q3 by grounding the "low" end of the crystal itself. This 16.2020-

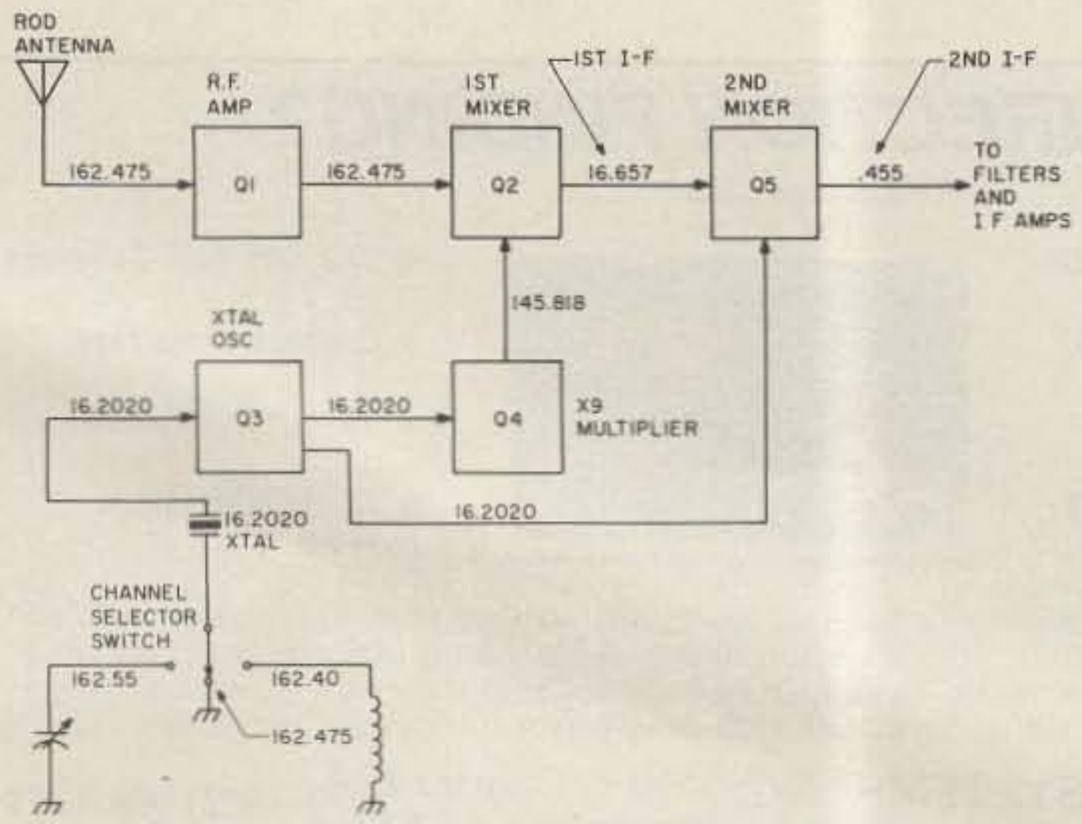

Fig. 1. Inside a weather radio.

MHz signal is then multiplied by 9 to 145.8180 MHz and mixed in Q2 with the amplified incoming NOAA frequency of 162.475 MHz. The difference signal of 16.6570 MHz (1st i-f) is then mixed with the original 16.2020-MHz crystal frequency in Q5 to produce a difference frequency of .455 MHz or the 455-kHz 2nd i-f. The 455-kHz 2nd i-f is then further filtered, amplified, and de-modulated to produce an audio output from the receiver. . . clever, eh?

A similar scheme is used for the 162.55-MHz channel, but in this case the 16.2020 crystal has a trimmer capacitor inserted between its "low" end and ground. This has the effect of raising the natural resonant frequency of the crystal from 16.2020 to 16.2095 MHz, which when multiplied by 9 produces 145.8855 MHz, which is beat with the incoming 162.55 MHz to produce a 1st i-f of 16.6645 MHz, which is beat again with 16.2095 MHz to produce a 455-kHz 2nd i-f.

The last channel (NOAA frequency 162.40 MHz) has an inductance between the "low" end of the 16.2020-MHz crystal and ground, which lowers the natural frequency. The crystal now puts out 16.1945 MHz, times 9 to 145.7505 MHz, beat with 162.40 MHz to produce a 1st i-f of 16.6495 MHz, beat again with 16.1945 MHz to produce a 2nd i-f of 455 kHz once again. Notice that the 2nd i-f is always 455 kHz, but that the 1st i-f is 16.657, 16.6645, or 16.6495 MHz. The 1st i-f is a single stage and is rather broadly tuned to accommodate this spread of frequencies. Very clever, indeed!

You've undoubtedly already noticed that the 1st i-f local-oscillator output falls in the high 145-MHz region. . . right in the middle of our 2-meter ham band! That, of course, is the problem. Fig. 2 shows the various possible NOAA weather channels (1 to 7), their actual frequencies, the fundamental crystal 16-MHz frequency, and the 145-MHz product of multiplying that frequency by nine.

NOAA Channel	NOAA Frequency	Crystal Fundamental	Multiplied Frequency
1	162.550	16.2095	145.8855
2	162.400	16.1945	145.7505
3	162.475	16.2020	145.8180
4	162.425	16.1970	145.7730
5	162.450	16.1995	145.7955
6	162.500	16.2045	145.8405
7	162.525	16.2070	145.8630

All frequencies shown are in MHz.

Fig. 2. NOAA frequencies.

As can be seen, the 2-meter product can range anywhere from 145.773 to 145.8855 MHz, depending upon which channel the weather radio is tuned to, theoretically. I say theoretically because the *actual* frequency depends entirely upon how accurately the crystal at 16 MHz is tuned in the individual weather radio. I've found the crystal fundamental to be off by as much as 1 kHz, which would translate into a 9-kHz difference from the 145-MHz frequencies shown in Fig. 2. Don't be too surprised at this, because the error can be compensated for by detuning the i-f stages in the weather radio from the "standard" shown without much loss of sensitivity.

As an example, suppose that the 16.2020-MHz crystal for receiving NOAA on 162.475 MHz was actually 16.2021 MHz (1 kHz higher). The 16.2021 multiplied by 9 would yield 145.809 MHz, which, subtracted from 162.475 MHz, gives a 1st i-f of 16.666 MHz; subtracting 16.2021 results in a 2nd i-f of 465 kHz instead of 455 kHz. If the 2nd i-f chain were detuned slightly somewhere between 455 and 465 kHz, the sensitivity of the weather radio would still be quite acceptable, but the 2-meter band product would be 9 kHz down from where you might expect to find it. You're welcome to calculate the rest of the possibilities for yourself if you wish. By the way, the formula for determining the crystal frequency is: Crystal Frequency = (Receive Frequency − .455)/10. All frequencies are, of course, in MHz.

Now you might be wondering how the 1st i-f local-oscillator (X9) product can cause any trouble at 145 MHz more than a few inches away from the weather radio. It shouldn't, of course, but after all, this is the *real* world!

I invite you to try it if you're at all skeptical. Just go into a store that sells weather radios, armed with your nifty synthesized HT, and ask to demo one of the sets. The Radio Shack 12-154 is a good candidate. I'm not picking on this receiver. In fact, I'm very pleased with the sensitivity and performance of mine, but it does put out a very formidable oscillation on 145 MHz; so do other brands.

Radio Shack stores are located all over the country and are usually very willing to give a demo of their products to the customer. So there, no excuse! I haven't really tried to "clean up" a weather radio to reduce this formidable oscillation in the 2-meter band (it's no longer unidentified), but I would suspect that it could be at least reduced if someone wants to try (and hopefully write a follow-up article to this one).

A good place to start would be to install a series-resonant trap right in the antenna lead close to the rf amp input and tuned to 145.80 MHz. I suspect that there is a fair amount of local-oscillator leakage around the rf amp and up the antenna itself. This idea worked quite well on a cordless telephone whose local-oscillator 2nd harmonic, 39.130 MHz × 2 (78.26 MHz), was creating a good bit of TVI on TV Channel 5 (76 to 82 MHz) and interfering with any nearby TV sets.

Other approaches to the weather-radio radiation problem might include better rf bypassing (with .001-uF disc caps) on the dc lines, ferrite beads on the various unshielded wires inside to discourage them from being "antennas," painting a conductive coating on the inside of the plastic cabinet, etc. All of these suggestions will most probably help to some extent, and the sum total could be surprisingly effective.

Of course, you can always unplug the weather radio (a sure cure) if it's yours. If it's in a neighbor's home, then it's time to become a diplomat. Let us all know your negotiating secrets. Then there is always the bright side of the picture: The 145.8855-MHz signal makes a dandy marker for a quick check of your 2-meter receiver's sensitivity. In fact, you can put your battery-operated (most have this feature) weather radio out in the backyard with a metal pail over it for a pretty decent "weak signal" source for tuning up your 2-meter receiver (adjust pail for desired signal strength). It's best to do this after dark so that no one will question your actions.

I haven't yet mentioned the fourth weather radio that I have that uses a 49.990-MHz crystal and makes a great 6-meter lower-band-edge marker with just a slight retuning.

Maybe some clouds actually do have silver linings. I guess it all depends upon your objectives and approach. ■

Marc Stern N1BLH
c/o 73 Magazine
Peterborough NH 03458

Secrets of Cellular Radio

Take a guided tour behind the scenes of our newest repeater technology.

What would happen if you set up a network of transceivers, linked them via a twisted-pair loop, controlled the whole setup with a master station, used polling and diversity reception, relied on FM capture and low power, and put it all at UHF?

Would you be: (A) establishing a sophisticated repeater network; (B) establishing a sophisticated auxiliary system; (C) establishing a cellular phone system, or (D) none of the above?

Fig. 1. The NYNEX Mobile Communications™ mobile telephone. (Courtesy of NYNEX)

The answer to this question is (C) although it does sound as if you are setting up either a sophisticated repeater or auxiliary communications system because that's essentially what the newest mobile-telecommunications system actually is. The nationwide network of commercial mobile-cellular systems now rapidly being established is little more than a series of UHF repeaters tied together by a twisted-pair loop and controlled by a computerized master station or mobile-telephone switching office.

Today's cellular communications system grew out of a test which was set up in Chicago in the 1970s. That system, called the Advance Mobile Phone System, was a test bed where the concepts now central to the cellular phone system were proven. Using a special Federal Communications Commission authorization, American Telephone & Telegraph (which controlled the Chicago-area telephone-operating company at the time) used frequencies in the 800-MHz spectrum to prove a cellular system would work.

The aim of the system was to end the overcrowding and limited access to the conventional VHF mobile-phone system which could accommodate only 1,200 users per market and which created long waiting lists for new subscribers. (The conventional system relies on one high-powered transmitter and receiver at a central location; all the mobile phones in an area talk through it. Because the number of frequencies available was limited, there was little room for more than a few conversations. The cellular system ends this.)

Cellular mobile communication takes advantage of two concepts which have been known in amateur radio circles for a number of years: capture effect and low power. Both interplay in the cellular system, so spectrum is much more efficiently reused and the number of users on a typical system can increase dramatically—by a factor of 100 or more.

The way this works is simple. The typical cellular mobile phone puts out somewhere between one and five Watts, depending on conditions. A microprocessor inside the phone unit communicates digitally with a computer at a cell site's fixed transceiver to determine the output needed for reliable communication. Typically, this output is somewhere around three Watts, although it can drop dramatically as the mobile unit approaches the fixed site. Whatever the amount of power, though, it is enough to capture the front end of the fixed transceiver on whatever frequency pair may be accessed by the computers. (The actual choice of frequencies is left to the microprocessors. They search their particular range of transmit and receive frequencies for an open pair and then establish a link between the mobile unit and the cell site.)

Because the front end of the cell-site transceiver is captured, the radio "hears" only the particular radio with which it is communicating and no others. Here's where the interplay between capture and low power takes place. Because the

unit is operating on low power, neighboring cell sites—more about that in a few minutes—will not hear the conversation which is going on between the mobile and the fixed site. This enables the same pair of frequencies to be reused in a neighboring cell site, where another mobile unit will capture and hold them. All this is done without the user knowing it's going on.

(Actually, this is a simplified picture of what is going on with the cellular mobile phone system, but it does show how concepts we know about are applied in other radio services, of which the cellular system is one.)

To define the exact nature of the cellular phone system, picture a map of your city and then overlay a honeycomb pattern of six-sided cells on that map. This is the cellular system. Each cell has a fixed transceiver site at its center. The fixed-site transceivers are, in turn, connected by wireline link to a computerized master site—the mobile-telephone switching office (MTSO). The entire system is linked by the MTSO to the rest of the phone system.

Why were six-sided cells chosen? It was an arbitrary decision made when the system was under development in Chicago. The actual shape of a cell can be just about anything and is as much guided by local terrain as anything else. The size of a typical cell is also arbitrary and will change over time as the system gains more and more users. The reason the size will change is another of the advantages of the cellular system.

To accommodate a growing number of users, the size of a cell pattern can be cut and more cell-site transceivers added. As this is happening, the power levels used throughout the system will be cut accordingly so that more units can use the system without interfering with one another.

Since there is so much spectrum available and since the power levels will be very low, there will be little or no interference between units. Units which may be attempting to access a frequency pair that is in use and which may be on the fringes of a cell just won't be heard by the cellular system because stronger units will have captured it. These units will have to wait until their signals are at quality levels where the system will accept them. As you can see, then, the cellular system is designed to collapse in on itself to be able to increase the number of users.

This system works on frequencies in the 800-MHz spectrum. The FCC allocated about 40 MHz of band space, so this service can provide as many as 666 channels for full-duplex communication in a given area. Thanks to low power and FM capture effect, one cell can support 333 calls at any one moment, as a neighboring cell also handles 333 calls.

To understand better how this system works, let's suppose that you are the person using a cellular phone and you are placing a call. When you first pick up the handset, a digital signal is sent from a microprocessor in the mobile unit to the nearest cell's central transceiver. That signal says, in effect, "Hey, wake up, I want to make a call." Within milliseconds, the cell site says, "Okay, wait a minute," and the microcomputers begin searching for an open frequency pair. The lower frequency (845 MHz, for instance) is used for transmit and the upper frequency (872.3 MHz, or whatever) is used for receive. When open frequencies are found, the cell-site transceiver sends a signal back to the mobile unit telling it to begin the call.

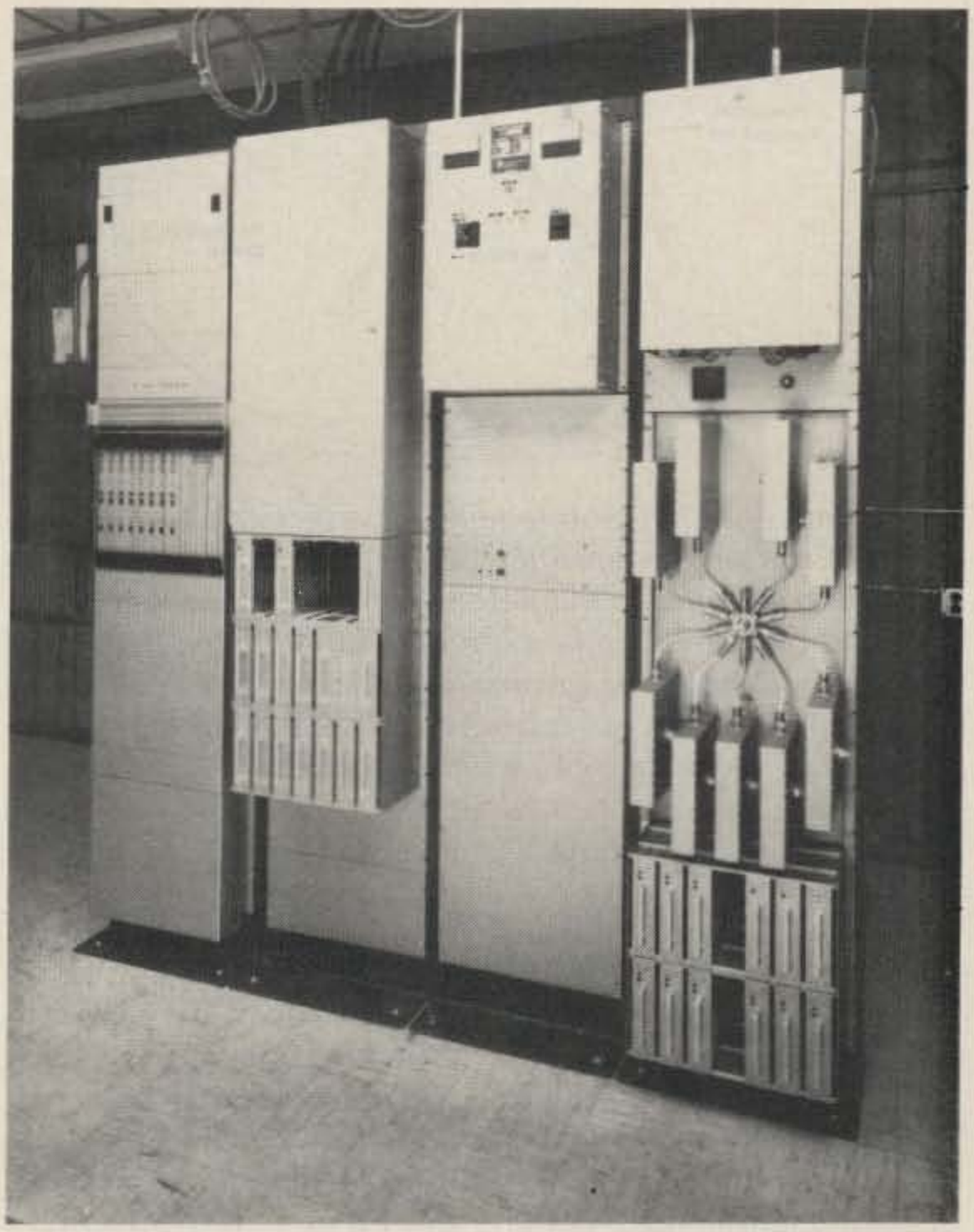

Fig. 2. Motorola's Dyna T•A•C base station. (Courtesy of Motorola)

The next thing you hear in the handset is the dial tone; you can dial the number you want, and the call is placed. As the call progresses, both the cell-site transceiver and the mobile unit are in constant communication, well below the carrier, in a digital mode. Some of this communication is regarding billing,

Fig. 3. The Boston Cellular Geographic Service Area (CGSA), where NYNEX Mobile Communications Company initially provides cellular mobile phone service. The area covers about 1,800 square miles, has an estimated population of 3.6 million, and services area code 617. NYNEX plans to expand the coverage area to include New Bedford, Worcester, and Springfield, Massachusetts, and Providence, Rhode Island.

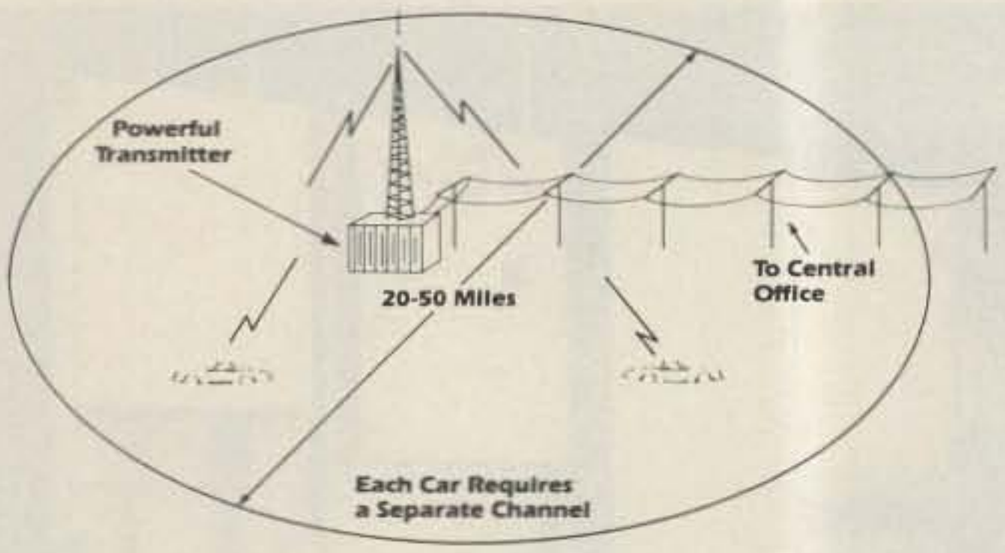

Fig. 4. Conventional mobile-telephone service uses one central base station to transmit a powerful radio signal over an area up to 50 miles in diameter. Only one two-way conversation at one time can be conducted over a given channel anywhere in the coverage area, and the number of channels is limited. This process restricts service availability and increases chances that a call will be blocked.

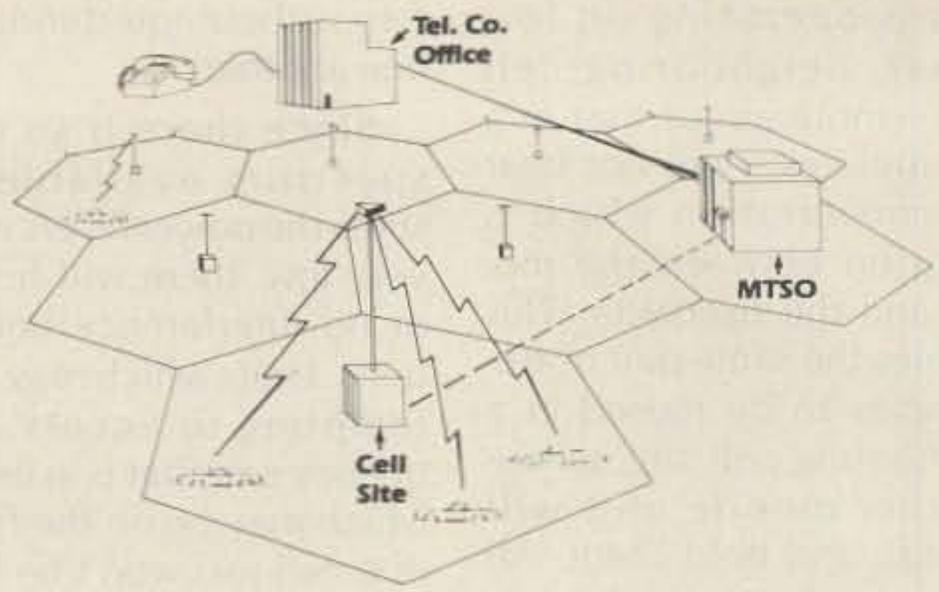

Fig. 5. Cellular mobile-telephone service is provided through a system composed of three major elements: cell sites, a mobile-telephone switching office (MTSO), and dedicated interconnecting circuits. The cellular system is divided into smaller geographic areas called cells. Adjacent cells are assigned different sets of frequencies. Cells sufficiently far apart can use the same frequencies simultaneously. This permits the reuse of a single channel many times within a given service area, allowing hundreds of conversations to occur at once.

while much of it is about signal strength and quality.

Let's say you are moving away from the cell-site transceiver. As you do, the cell-site transceiver, which is watching the signal strength, senses that the gap is widening between the mobile unit and the central site. As the gap widens, it sends a command to the mobile unit to increase its power output, to which the mobile unit responds. The system tries to maintain a quality ratio of 17-dB C/I and a signal quality level of 18-dB C/N. As the gap widens further, the cell site orders the mobile unit to further increase its power, to which the mobile unit responds again. This will continue happening until the cell site learns the mobile unit is transmitting at full power.

Now let's say you continue moving away from the cell site, and even with maximum power the signal quality begins to drop. At this point, the cell site performs another of its chores. The entire cellular system is polled digitally as a new path is sought for your call. When that path is found the call is switched within 50 milliseconds. The switch is so fast that the normal user will never know it has happened.

The handoff, the switch from cell A to cell B, is actually more complicated than it looks—on a digital level, at least. The mobile unit must not only switch from cell A to cell B while keeping the signal quality up, but also it may have to switch frequencies to a new pair because the original pair on which the call was established in cell A may be in use in cell B. The transceiver may not only make the jump between sites but also between frequencies. The microprocessor inside the phone is usually extremely busy, therefore, at all times.

As you can see, frequency agility is built into this system; it is a function of the digital electronics used for control. But the cellular system isn't totally digital in nature because it relies on radio-frequency basics with which we are familiar. We've already noted how the UHF cellular system takes advantage of capture effect and low power, but we haven't noted how it takes advantage of diversity reception.

If you were to look at the typical cell-site antenna tower, you would see not one antenna but three, six, or more, arranged in a triangle. These antennas are handling not only transmission but also reception, and the cell site monitors all of them. As you travel through a cell during your call, the cell-site transceiver watches the received signal strength on all its antennas. It routinely polls those antennas to see where the strongest signal is, and when it finds the strongest signal it uses that antenna for operation.

If you were to watch the cell site as you move along, you would see the signal moving from antenna to antenna as your position changed. From this you can see that although digital polling is used the system is still turning to the best antenna among many for reception, for "diversity reception." I grant you that it may not be total diversity reception since only one receiver is used and digital electronics takes the place of the others needed, but it's a modern equivalent, to say the least.

By now you probably have noticed that both the mobile unit and the cell-site transceiver are very capable units. Not only must they handle such mundane chores as identification and billing information, but they also must handle establishing the proper frequencies and setting proper power levels. The system is made up of a number of frequency-agile units. The cell-site transceiver is even more capable because it must not only handle these functions but also monitor the mobile unit's location, bearing, and direction from the cell site, to determine which antenna is best or whether it's time to ask for a handoff to the next site. It's quite a system, and it wouldn't have been possible without the modern microprocessor.

The system does suffer from the various problems long known to avid VHF and UHFers, of course, signal loss, multipath, and reflection. However, the microcomputers in the system are programmed to handle this. Further, since the frequency spectrum where the system is located is very much line-of-sight, its range can be limited if the cell site's antenna isn't in an optimum location. Still, it manages to overcome these obstacles to provide reliable communications to hundreds of thousands of users across the country. No longer is a mobile radiotelephone a symbol of an elite class of users, because cellular radiotelephone opens this realm to just about anyone.

What does this all mean for us? For one thing, it likely points to the route equipment will be following during the next few years. Looking at the cellular system from strictly a mobile standpoint, you will find the units to be frequency-agile

FM transceivers which are capable of increasing or decreasing their power levels automatically. Some of the units on the market also have memory-dialing capability, being able to store 10 or more commonly-called numbers, and most of them can be programmed with security passwords and other goodies. And, you will find as you look at the equipment available, that not only are more traditional mobile phones available, but there also are hand-held portables available.

Imagine, then, what will happen when local repeaters are able to control power-output levels and when you can store needed information in your mobile rig! Levels of local splatter and QRM will certainly come down, and it will make the mobile rig more convenient to operate, especially through the phone patch. Further, imagine what it will mean when we can link a network of repeaters into a cellular format routinely. Mobile units will be able to carry on reliable communications not just for 50 miles, but, potentially, for hundreds of miles. Also, imagine if we tap the direction-finding capabilities of a cellular system. It will help us keep our own spectrum cleaner, also. And these are just a few of the possible uses of cellular technology. It's quite likely our experimentation will lead to many more.

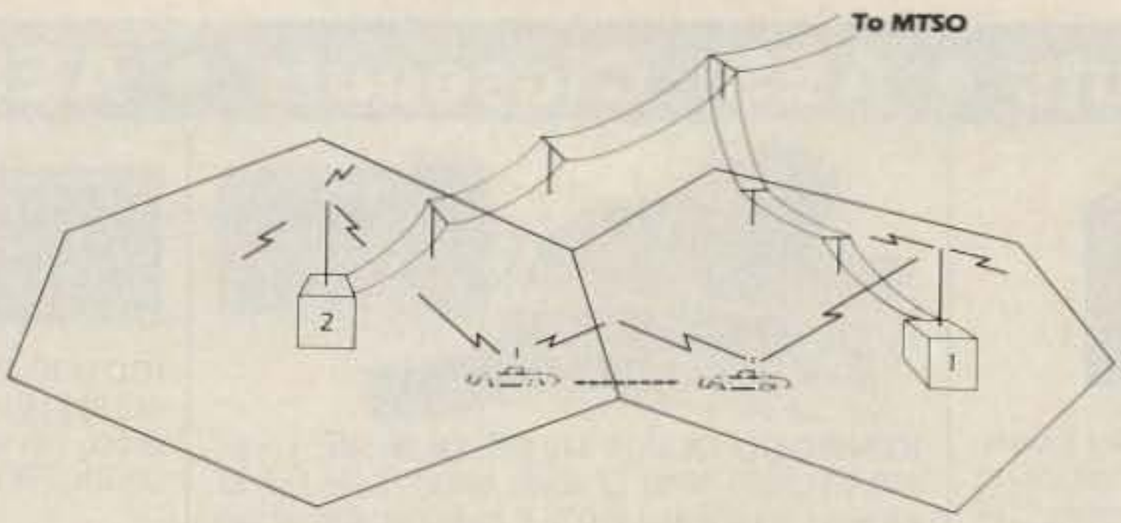

Fig. 6. Cellular handoff makes mobile communications possible and helps ensure service quality. As a customer with a call in progress moves from cell to cell, electronic equipment in the mobile-telephone switching office automatically transfers or "hands off" the call to the next cell site. There are no apparent changes in voice transmission quality, and the call continues uninterrupted.

In the near term, though, the cellular radiotelephone system has immediate impact on the 900-MHz band which will be opening to us. If you look through the pages of any current amateur publication, you will see rigs for 2 meters, 220 MHz, 440 MHz, and even 1296—but not for 902-928. Since the cellular system operates just below our spectrum—it tops out at about 895 MHz—it won't be too hard to retune cellular mobile units for our own use and it won't be hard to retune base-site units for repeater use. Of course, it will be some time before these units are available in traditional used-equipment channels, but when they are it will mean an exciting new technological opportunity.

Finally, the cellular radio, with its emphasis on low power and spectrum reuse, will likely mean some new concepts for us. Instead of using QRO all the time we'll need only the amount of power, at any given moment, for reliable communications. If a cellular-like repeater system is built, imagine how many people it will be able to support!

Cellular technology is here now and its possibilities are exciting. It remains only for us to pick up on them.■

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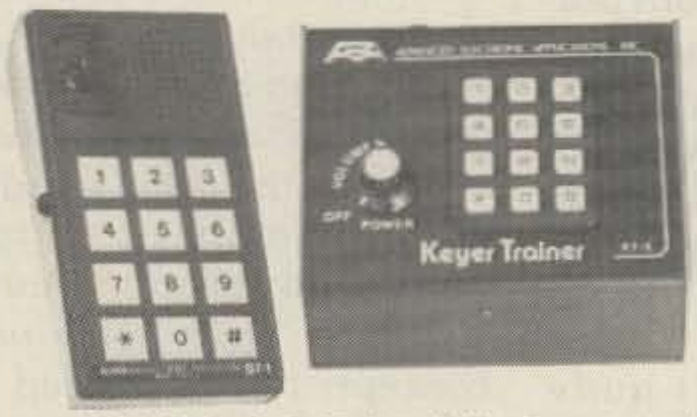

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The Santec Spectacular

Is your Santec becoming forgetful? Are its batteries going soft? No more! Here are two quick mods that bring your hand-held to within an inch of perfection.

In the October, 1983, issue of *73*, I described in detail the virtues and vices (only one vice, actually) of the Santec ST-144, -220, and -440/uP hand-held radios. Good as they are, there is room for improvement. This article describes two battery-related ideas. The first prevents a loss of memory when the main battery is removed (or is dead) for extended periods of time. The second is a simple method of avoiding nicad "memory," the bane of the rechargeable-battery user. Both will work on the new ST-142, -222, and -442 also. Let's go.

Lithium-Battery Backup

The memory backup system in the ST-/uP radios is 440 uF of capacitance which is kept charged as long as the battery is connected (and kept at a reasonable charge level). Disconnect the battery and you have about thirty seconds to connect a new one, otherwise all is lost (meaning the memories, the scan interval, and the clock time). The addition of a 3-volt lithium battery and a 1N914-type diode will provide many hours of memory backup.

The ideal battery is available from Allied Electronics, catalog number 884-0435. It is made in Japan by Matsushita (Panasonic here), designated BR-435, and says it is "for electronic fish float." It is a small cylinder, 4.19 mm (0.165 inches) in diameter by 35.89 mm (1.413 inches) long, with a short wire terminal at one end. The case is positive and the protruding wire terminal is negative. Both the case and the negative terminal are made of aluminum, so you will need some Sal-Met™ flux or other aluminum soldering aid. *Caution:* Lithium batteries, like a number of others, can explode if subjected to high heat. Don't use a high-wattage iron or gun. A small pencil-tip soldering iron is all you need for this job. Fig. 1 shows the connections to make. The series diode prevents the lithium battery from being charged by the main battery.

The lithium battery fits inside the front cover. To open the cover, remove the two screws under the back cover in the empty space below the battery, and the front cover can be swung aside on its flexible PC connector. The connector is pretty durable, but care should be used in handling the separated pieces of the radio. You can pull the end of the flexible connector from its socket on the main PC board, but be careful not to crease it when removing or reinserting.

The lithium battery will rest above the microprocessor PC board, in the slot between the PC board and the top of the cover. Photo A shows the placement, with the wires toward the center of the cover. In order to have the battery fit properly, a small amount of material needs to be removed from the plastic boss that retains the top of the loudspeaker. This is easily done with the tip of a small soldering iron. Use a tip that is close to the same diameter as the battery. The battery case needs to be insulated (shrink tubing is fine, but again, watch the heat).

It is best to connect the lithium battery while the main battery is in the circuit; this avoids possible "crashing" of the microprocessor. Here's how you do it. First, connect the positive lead of the lithium battery (actually the cathode of its series diode) to the cathode end of D209. To find D209, remove the four small Phillips screws holding the microprocessor board and tilt the board up on the flexible connector. Locate C5 (component identification is on the top side of the board, and C5 is one of the two 220-uF miniature electrolytic capacitors near the upper end). D209 is the diode that is connected underneath the board to the positive side of

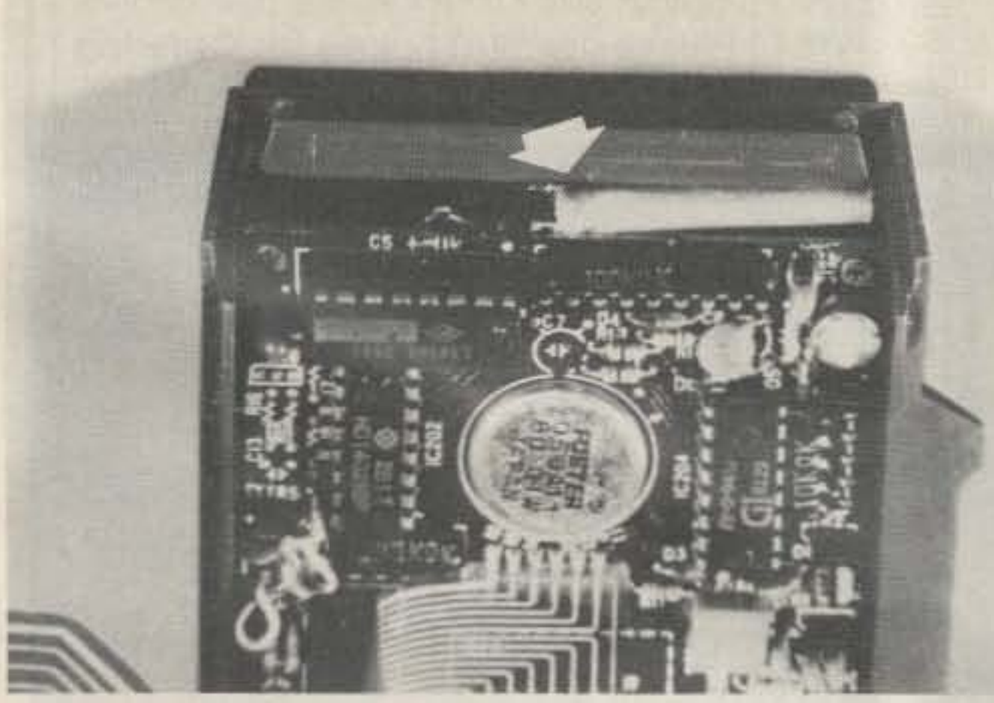


Photo A. Backup lithium cell installed in the front cover. Connections are made to the leads of C5.

C5; in most radios there is 10k of resistance in parallel with D209. You want the end of the diode that is *not* connected to C5, that is, the end nearest the loudspeaker clearance hole. Some radios may have neither D209 nor the parallel resistor installed. If yours is one of them, just connect the positive lithium-battery lead to the positive lead of C5. Don't connect the negative lithium-battery lead yet.

Now, if you unplugged the flexible PC from the main board, plug it back in. Turn on the radio and make sure you get the "cold-start" frequency (146.520, 223.500, or 446.000 MHz, depending on the radio). If you don't, disconnect the main battery for at least 60 seconds, replace it, and check again. Now turn the radio off (but leave the main battery connected) and connect the negative lead (case) of the lithium battery to the negative side of C5. The battery lead can be soldered to the capacitor lead just where it enters the board from below (using a micro-tip iron). This placement will allow you to disconnect it (using a fine-tip soldering iron) in case there is ever a microprocessor crash. Turn the radio on once more to check for the cold-start frequency. Now put any frequency other than the cold-start into memory 1. Once more disconnect the main battery for at least 60 seconds. Reconnect it and you should still see your stored frequency (if the cold-start frequency comes back, check your lithium-battery connection). Replace the microprocessor board into the front cover.

In operation with the main battery inserted, C5 and its companion are charged to about 6 volts. The diode prevents the lithium battery from being charged at the same time. When the main battery is disconnected and the capacitors discharge below about 2.5 volts, the lithium

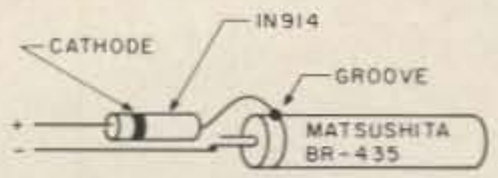


Fig. 1. Connections to Matsushita BR-435 lithium back-up battery.

battery takes over. So far, mine has maintained the memories for periods of up to 24 hours with a fully discharged main battery. There isn't any reason to think it won't last longer; I just haven't experimented.

One final word: Should the microprocessor ever crash or lock up, simply remove the main battery, open the front cover, and disconnect the negative side of the lithium battery from C5 (which you can do easily with a small soldering iron). Leave it disconnected long enough for memory erasure to occur (60 seconds is plenty), then check for the cold-start frequency display at turn-on. Reconnect the lithium battery.

Battery Discharger

That's right, *discharger*. This one is for the main battery. Many articles about nicad batteries describe the "memory" effect that results from repeated recharging after only partial discharging. After a few months of operating the ST-/uP radios, I noted a distinct shortening of useful life attributable to my tendency to put the batteries on charge as soon as the low-battery indicator on the radio began to flash. Discharging a fully-charged battery into a resistor load confirmed my suspicion; at a 500-mA discharge rate, typical battery life was 40 minutes to a cell voltage of 1.0 volt. A new battery took more than 60 minutes to reach the same point!

The same articles point out that the cure for nicad memory is several full discharge/charge cycles. Sure enough, after five or six of these, battery life increased to 62 minutes for one of the original batteries and 70 minutes for the other.

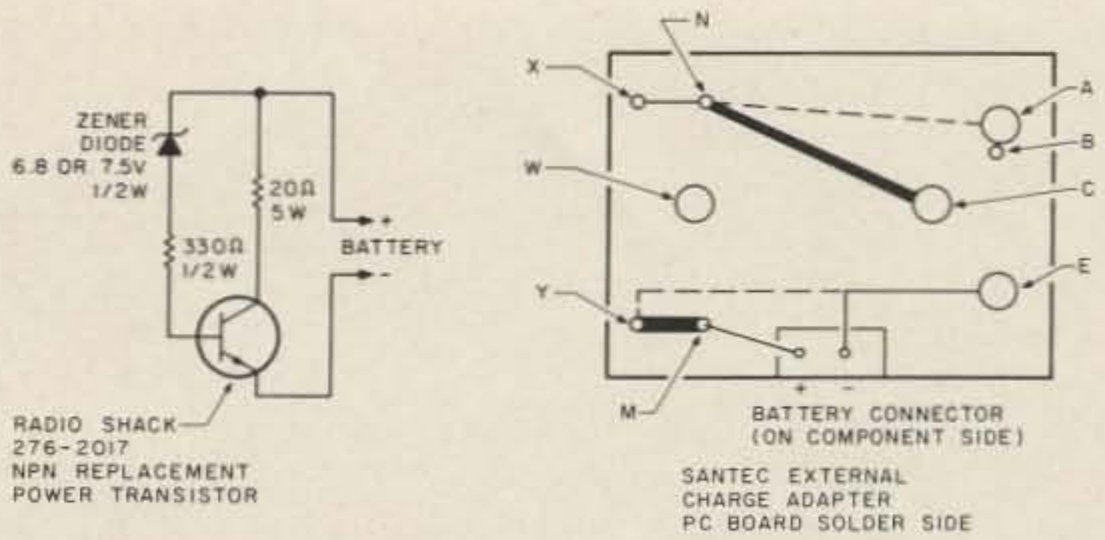


Fig. 2. Schematic and layout drawings for battery discharger (K5VOU version). Dotted lines on the layout diagram indicate removed foils; heavy solid lines are added jumpers.

To maintain battery "forgetfulness," I constructed a simple discharger using the "external charge adapter" manufactured by Santec (designated ST-EC). This is a small PC board containing a male dc power jack, a series diode, and a battery connector. The power jack and diode are removed and, in the simplest possible version, a 20-Ohm, 5-Watt resistor is placed across the battery connector. I added a subminiature metering jack (with 200 or 300 Ohms of series resistance to prevent shorts when a meter is plugged in) for easier reading of the battery voltage.

If you leave the simple discharger connected for too long a time, there is a risk of reverse-charging one or more of the cells, although I have not had this happen to any of my four batteries. To eliminate that risk, Tom Gentry K5VOU, who is President of Encomm, the Santec importer, suggested the circuit shown in Fig. 2. I constructed this on the external charge-adapter PC board, using Radio Shack parts and the layout in Fig. 2. The circuit stops discharging the battery when the zener voltage is reached. Referring to Fig. 2, remove the diode from holes M and N and the plastic battery-charger socket from A, C, and E. Leave the white plastic battery connector and its pins. Cut away the foils as shown by the dotted lines and add the jumpers indicated by the two heavy lines. Drill hole W (diameter 3.2 mm or 1/8") for mounting the transistor, being sure to place it so as to leave enough lead length for the transistor leads to reach holes B, C, and E. Mount the transistor on the component side and connect its B, C, and E leads to holes B, C, and E. Connect a 20-Ohm, 5-Watt resistor between X and Y. Solder a 6.8- or 7.5-volt, 1/2-Watt zener diode in series with a 330-Ohm, 1/2-Watt resistor, with the diode anode toward the resistor. Insulate the combination and connect it on the foil side with the diode cathode going to hole M and the free end of the resistor to hole A. That's it.

When the ST-/uP radio's battery indicator begins flashing, replace the battery and plug the used one into the discharger for an hour or so before recharging. This will fully dishcarge the battery and prevent memorization. Caution: the discharge resistor and the transistor in Gentry's circuit get hot for a while; don't let the discharger touch anything flammable.

The battery-related modifications described in this article will add to your Santec operating pleasure. The time between battery rechargings will stay at its original figure, and if you overdo it and absolutely kill the battery, at least you won't lose all the memory information. Have fun! ■

Saga of the Willie Wand

W5RRH learned a new technique while building this 6-element 2m beam. It's called cut and try and try and try.

Ed Mahoney W5RRH
3008 S. Norwood
Tulsa OK 74114

It probably would be better to name this article "Willie," since it contains as much information about him as it does about his antenna, which I named the "Willie Wand Special."

Willie W5FXP is one of those unique individuals that you have the pleasure of knowing only once in a lifetime. He first entered my circle of awareness as an instructor at the technical school I decided to attend about 35 years ago. One of the subjects he taught was antennas. It was hard not to absorb some of his theoretical and practical knowledge about antennas, since he entered into the task of beating some smarts into those dumb students with his usual enthusiasm.

It was at this time that I managed to become an amateur-radio operator—again largely due to Willie's enthusiasm for the hobby. Willie had been a ham for 15 years, having acquired his ticket back in 1935.

After graduation, I kind of lost touch with Willie, partially because the technical school folded, but mostly because I drifted away from ham radio. As I found out later, Willie went to work for one of the major aircraft manufacturers, migrating eventually to their radiation laboratory, designing and testing antennas, naturally.

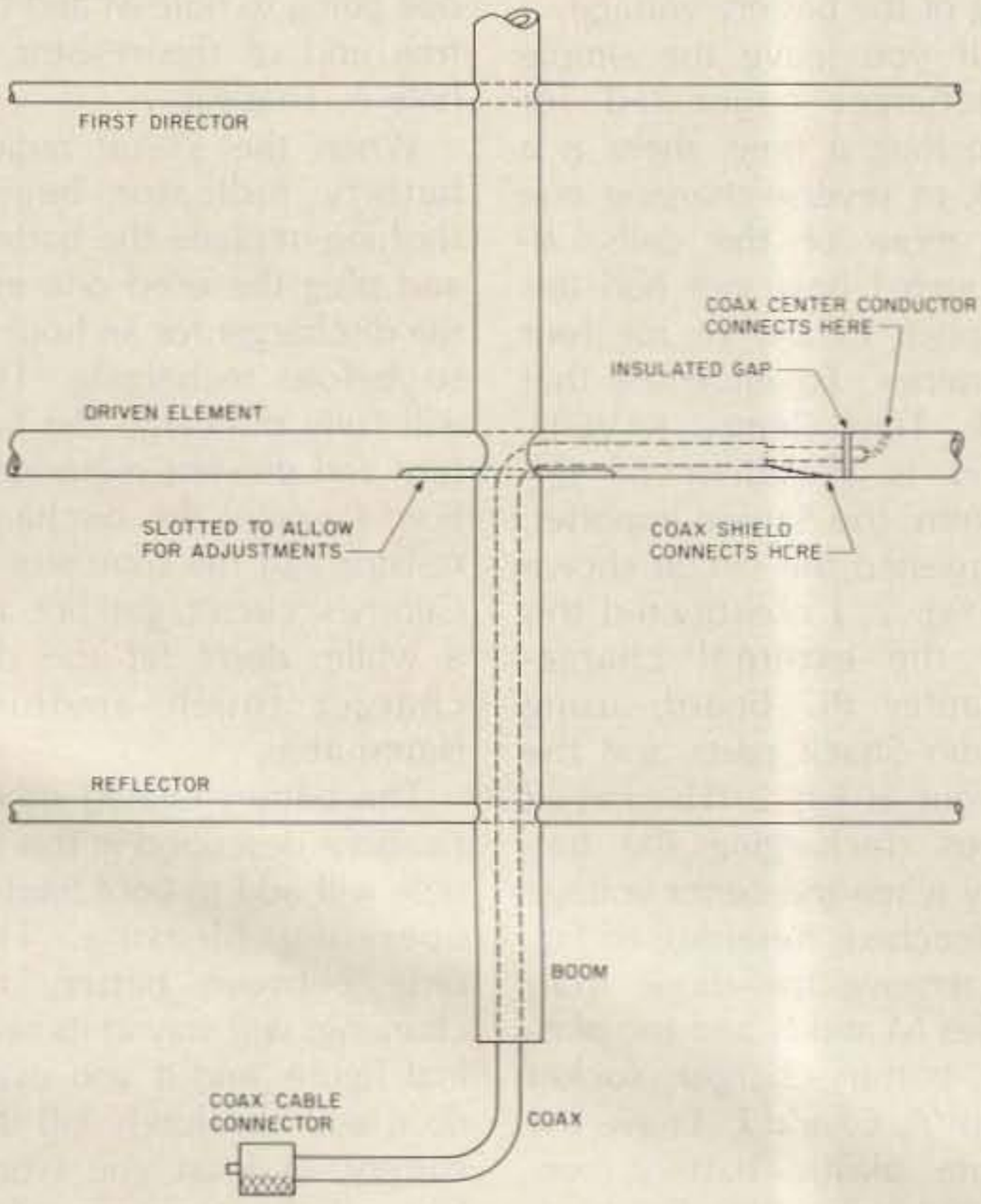
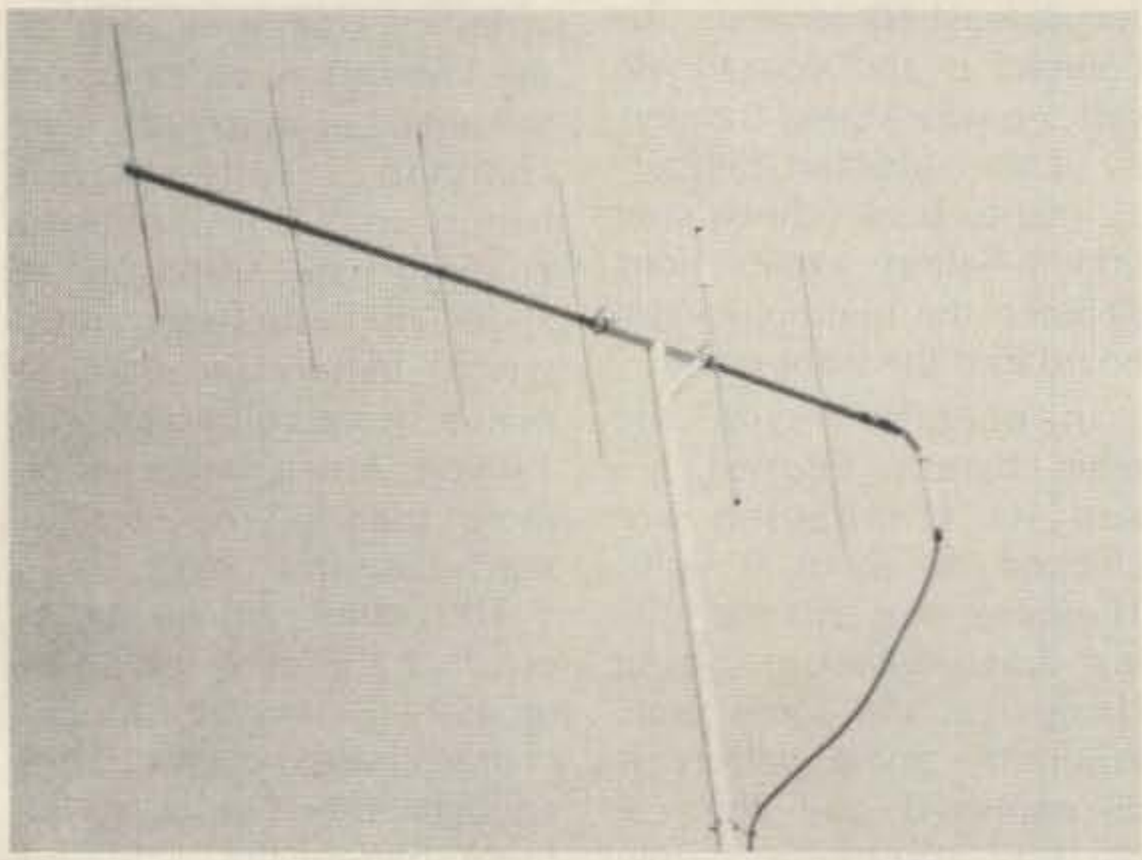


Fig. 1. Coax connections.



The Willie Wand Special.

About 33 years later, when I was just messing around with a 2-meter handie-talkie, I flipped it over to 5-2 simplex and there was Willie's unmistakable voice. As a result of this accidental QSO, I became an enthusiastic reborn ham-radio operator, acquiring the necessary equipment to get on 2 meters and chew the rag with Willie and his friends. This was timely, however, since I retired shortly thereafter and was needing something to fill the 8-hour-a-day void.

One of Willie's daily routines consists of getting on 2 meters at precisely 8:00 am every (and I do mean *every*) morning to chew the rag with his lifetime friend Clarence W5FDP, who lives in Muskogee, Oklahoma. These morning sessions were (and are) quite informative and entertaining. Quite a few hams just monitor these QSOs, reluctant to join in because of the long-winded transmissions, some sorely stretching the 10-minute ID time limit. In fact, they have their own exclusive simplex frequency since most of their transmissions would time-out just about any repeater.

I gradually became a member of this "Social Security" net. Initially, my 2-meter antenna system consisted of a well-known commercial collinear vertical (Willie called it an inverted ground rod). This worked fine for local QSOs, but sometimes it wouldn't quite hit Muskogee, about 40 miles away. Finally, out of exasperation, Willie offered to build me a beam antenna. Knowing that anything Willie built would be almost perfect, I accepted the offer before he had a chance to back out.

Naturally, this antenna became the main topic of quite a few 8:00-am SS nets, every aspect being thoroughly reviewed by all participants. During one of these sessions, the matching network became one of the topics, most methods being thoroughly discussed. As a side note, Willie mentioned a matching technique that he had successfully used previously on a vertical antenna. This caught my attention, so I suggested that we try it out on my antenna. Willie jumped at the chance.

Basically, this matching method consists of a series-fed driven element, with the coax cable entering the reflector end of the boom, then going on into the driven element through a slot located in the center of the driven element (where it passes through the boom), continuing on out to an insulated gap on one end of the driven element. The coax shield is then connected to the boom side of the driven element while the coax center conductor passes through an insulator and then connects to the end stub (see Fig. 1). If the insulated gap is properly located, the impedance will be 50 Ohms—a perfect match.

Willie decided that my antenna should consist of six elements with a fiberglass boom. After scrounging around, I managed to come up with enough 5/16-inch-diameter aluminum tubing for the directors and reflector. The boom was to be constructed of 1¼-inch fiberglass tubing (which Willie already had). To allow room for the coax cable and fitting, we decided to use ⅝-inch aluminum tubing for the driven element (which Willie also had).

After several more SS net sessions, most parties favored using a hoodless PL-259 connector to terminate the coax cable (Willie's idea). With a little refinement in Willie's vertical mill (drill press), the PL-259 connector was turned down to be a snug fit in the end of the ⅝-inch driven element. The fitting was then permanently fixed in place with a short setscrew, the hole drilled and tapped through both the tubing and the meaty part of the PL-259 connector. Naturally, the coax cable was properly attached and strung through the boom and driven element before everything was connected permanently. RG-142 coax was used since it is small in diameter (approximately the size of RG-58) and has a Teflon™ dielectric.

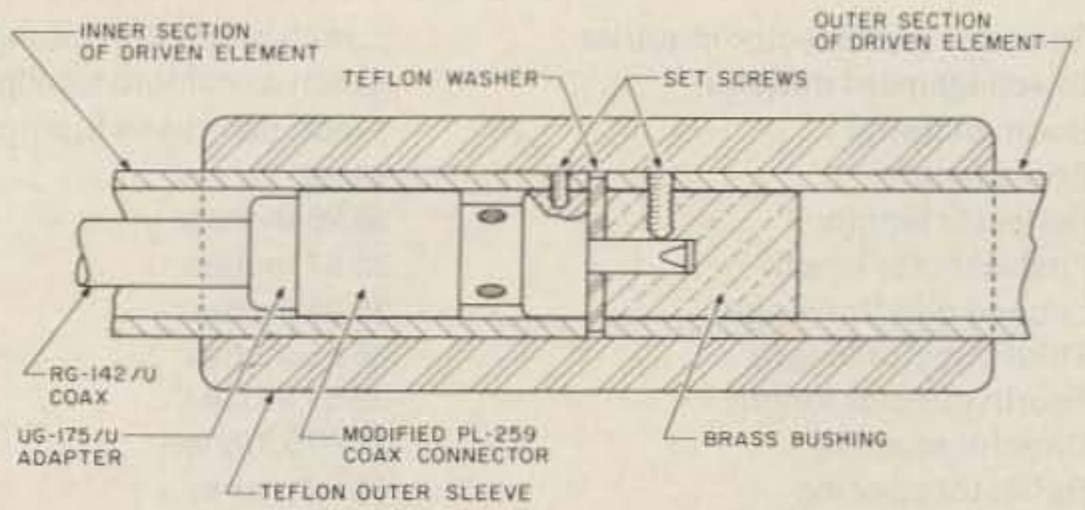


Fig. 2. Detail of coax connection.

For attaching the PL-259 center conductor, a brass bushing was likewise milled to the right size on the vertical mill, the hole in the bushing drilled out to fit the PL-259 pin. Again, a setscrew made this a permanent connection, the screw passing through the ⅝-inch tubing and brass bushing and making contact with the PL-259 center pin. Before this was assembled, however, a Teflon washer was slid onto the PL-259 center pin, providing an insulating barrier between the two pieces of the driven element (see Fig. 2).

The basic antenna design was acquired from the NBS Circular, *Technical Notes For Yagi Antenna Design* (NBS-TN-688). Willie didn't know where to place the feedpoint, so for the initial try we decided to try it approximately ⅛ wavelength from the center—this being about 9½ inches.

Willie had the antenna assembled and ready for testing practically overnight (at least it seemed that way to me). As usual, he did an exceptional job, the elements firmly attached to the boom, straight and spaced within 1/64 inch of perfection. Next to come was the tuning and feedpoint adjustment.

Now, Willie doesn't settle for measuring swr down to 0.1 resolution. He has his own special swr meter which reads 2 to 1 at full scale. Added refinements include a dummy load, an attenuator, and calibration load resistors for exact calibration. With the dummy load and attenuator, measurements and tuning adjustments can

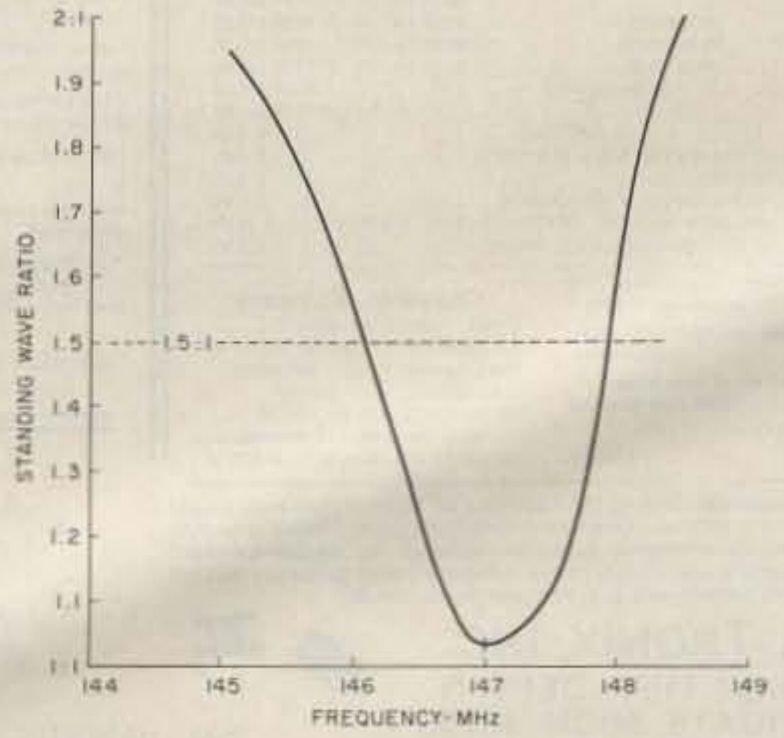


Fig. 3.

Reflector and director material	7/16-inch aluminum tubing
Driven-element material	5/8-inch aluminum tubing
Boom material	1-inch fiberglass tubing
Boom length	9 feet
Reflector length	38.95 inches
First director length	35.57 inches
Second director length	35.05 inches
Third director length	35.05 inches
Fourth director length	35.57 inches
Director spacing	20.075 inches
Reflector spacing	16.06 inches
Driven-element total length	35.688 inches
Driven element, center to feedpoint	11.91 inches
Driven element, feedpoint to end	5.938 inches
Estimated gain	10.25 dB

Table 1. Specs for 147-MHz, 6-element beam antenna.

be accomplished without worrying about the transmitter mismatch.

The initial tuning and alignment session didn't pan out too well. The antenna was resonant at about 145 MHz (target frequency was 147 MHz), and the feedpoint impedance wasn't even close. After much trimming, we managed to get the length about right, but the feedpoint impedance was still off. The length of the driven element had to be reduced to 35 11/16 inches in order to achieve resonance at 147 MHz.

The next tuning session consisted of cutting short pieces off the end stub, reattaching these pieces to the opposite end of the driven element (on the other side of the boom), then re-centering the whole element. This in effect moved the feedpoint out from the boom. This continued for several sessions, the final result being a feedpoint 11 29/32 inches out from the center with a 5 15/16-inch end stub. To achieve an swr which met Willie's approval (1.03 to 1), pieces as short as 1/16 inch had to be moved from the stub end to the opposite end. These pieces were later replaced with a single piece firmly attached by means of an inside sleeve pinned in place.

Obviously, the feedpoint gap had to be covered somehow, desirably with some rigid insulating sleeve that would support the end stub. Here I was able to come up with a solution. A machinist friend made me a Teflon sleeve approximately 3 inches long, 1 inch in diameter, and bored out to be a press fit onto the 5/8-inch driven element. Properly greased with DC-4, this sleeve was forced into place. As a final touch, Willie had two pretty red plastic caps that perfectly fit the ends of the driven element. Since this was to be a vertically polarized antenna (with the feed gap being on top), a hole was bored through the bottom cap to allow moisture to escape.

The performance of this antenna was exceptional. When fed with 20 feet of coax, the swr was less than 2 to 1 over a frequency range of 145 to 148.4 MHz, and less than 1.5 to 1 from 146 to 147.9 MHz (see Fig. 3). This matching method should be very efficient (minimum connections), and it should be less susceptible to moisture since there are no reactive tuning components.

I could hardly wait to get this Willie Wand Special antenna mounted on top of my house and hooked up to my rig. Willie kept prodding me, of course, asking me every day "When are you going to get that antenna up?" As quickly as possible, therefore, I acquired a rotator, roof-mount tower, insulated mast (1¼-inch fiberglass tubing), rotator cable, and coax cable. Starting early one Saturday morning, I really got with it. By late afternoon, I had it all up and went into the house to give it a try. I just got through hooking it up to the rig and was trying out the rotator when the doorbell rang. Of course, there stood Willie with his head tilted back, admiring his Willie Wand Special.

This antenna has proved to be every bit as good as Willie predicted. If anyone wants to copy it, however, be prepared to go through a similar adjustment procedure. You will, however, have the benefit of Willie's experience, starting with the feedpoint about 11¾ inches from the center (for a 147-MHz center frequency). See Table 1 for material and dimensional specifications.

Willie has since assembled a second version of this antenna for another of his SS net buddies, George W5KQD. As expected, it is not constructed exactly the same, the driven element being built out of 5/8-inch thin-wall copper pipe. The dimensions did, however, come out to be very similar to mine.

The coax and coax fitting on George's antenna also are different, the coax being RG-115 (about the size of RG-8), and the coax fitting constructed out of a pipe-to-copper-tubing adaptor (again milled into shape by the vertical mill). Since this adaptor was brass, the coax shield was soldered directly to it, and the complete fitting was soldered to the driven element. A similar brass insert and Teflon washer were used to insulate and attach the coax center conductor to the outer stub. Again, a Teflon sleeve was used to insulate and add rigidity to the feedpoint gap.

If you happen to be within a 40-mile radius of Tulsa between the hours of 8 and 10 am, give a listen on 146.46 simplex. No doubt you will hear a strong signal being radiated from a Willie Wand Special. ■

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Tune In the TU-1000	K9EUI	low-budget RTTY modem	Jun	14

Test Equipment

Broken Ox Blues	W7RXV	new coils for your gdo	Jul	56
Build the Dixie Whistler	WB5IPM	two-tone SSB tester	Apr	36
Conjure An Rf Genie	K1BQT	simple signal generator	Nov	32
Harmonic-Free QRP?	ZS6UP	measure harmonic power	Aug	29
Probe the Unknown	Bailey	no-load active rf probe	Nov	46
Scope That Signal	KD6VP	home-brew station monitor	Aug	56
The Incredible Digiohm	Rich	the ultimate resistance box	Mar	34
The Incredible Inducto-Gauge	Ketchledge	coil measurer	Jul	34
The Texas Trans-Tester	KG5B	small-gain transistor checker	Feb	60
Through the Looking Glass	KN4L	software RTTY monitor	Jun	34
What You See Is Where You're At	WA8YKN	add-on digital frequency display	Jul	40
Wheatstones Are Not Crackers!	K4KI	Nuller Bridge for swr woes	Sep	50

Theory

A New Angle for Dipoles	W1GV	the case for vertical dipoles	Sep	54
Build a Better Box	W4RNL	how-to project enclosures	Feb	44
Don't Fall for Swr Fraud	W1GV	check your feedline	Sep	40
Exponential Potential	W6TYH	exponential line matching	Sep	44
Future Schlock	KA5S	experiments in time	Feb	30
Give Your Disks a Physical	Kraska	quality-inspection tips	Oct	56
Harmonic-Free QRP?	ZS6UP	measure harmonic power	Aug	29
Is Ham Radio Baking Us?	VE3KSP	dangers of rf exposure	Jun	28
QRI?	W2OZH	replacement for RST	Nov	28
Secrets of Cellular Radio	N1BLH	behind-the-scenes tour	Dec	44
Surviving the Unthinkable: Part III	WA8YKN	EMP precautions	Aug	52
Swr: A Modern Myth?	W6YUY	improve your antenna system	Feb	32
Takin' It to the Streets: Part I	WA6AXX	ShackMaster introduction	Sep	32
Takin' It to the Streets: Part II	WA6AXX	using the ACC ShackMaster	Oct	32
Talk Is Cheap	WB6NQK	affordable voice synthesis	Oct	22
Toss Out Your Tubes!	OA4KO	use FETs instead	Nov	22
Transistor: A Biased Approach	KC0EW	transistor design tutoria	Jan	26
TVRO Trivia	W6SMJ	satellite-television primer	Mar	14
Wheatstones Are Not Crackers!	K4KI	Nuller Bridge for swr woes	Sep	50
Zounds! Grounds!	K4IPV	install the perfect ground	Apr	30

Transmitters

Build the Dixie Whistler	WB5IPM	two-tone SSB tester	Apr	36
Cheap Heath Help	K6YB	HW-101 transmit offset	Mar	48
FM Your IC-730	N9DBX	quick add-on	Dec	18
Home-Brew the Blockbuster	WB2WIK	2-kW 6-meter linear	Jul	50
ICOM's Extended Play	KS4B	full .1 to 30 MHz transmit	Jul	12
Instant ATV!	W8CHK	plug-in fast-scan TV	Aug	36
Modification Mania!	AI7C	15 HW-101 perk-ups	Aug	42
Operate OSCAR on 10 Meters?	W6IOJ	145/435-MHz converter	Nov	36
QSK for Your Vintage Vfo	KA3GCQ	easy break-in keying	Jun	54
Satellite Supremacy	W2GEF	60-Watt UHF amplifier	Feb	18
Super Surplus Surprise	K9RLF	rejuvenate the GRC-9	Feb	54
That Glorious Gonset	KT2B	rebuild a Gonset 972	Jan	34
The Dayton Downlink	W9JD/8	optimizing your OSCAR setup	Jul	24
There and Back Again	KC7O	band-scan for the TS-930S	Jul	44

VHF/UHF

America's Dream Array	AJ0N	National Radio Astronomy Observatory	Jul	18
Brew a Coffee Ground Plane	WA2OVG	easy 440-MHz antenna	Sep	30
Build a 1296 Stripper	WB6IGP	ATV downconverter	Oct	40
CB to Six	DA1GY	Hy-Gain CB on 50 MHz	Feb	22
Hear, Hear!	W6IOJ	OSCAR downlink preamp	Apr	20
Home-Brew the Blockbuster	WB2WIK	2-kW 6-meter linear	Jul	50
How Good Is Six?	KL7GLK	home-brew 6-meter rig	Jan	57
Hunt the Auto-Fox	WB6GTM	automatic fox identifier	Aug	48
Instant ATV!	W8CHK	plug-in fast-scan TV	Aug	36
Join the SWOT Team!	KA3B	alternate 2m activities	Dec	26
Just Leave Me Here To Die!	KT2B	UHF contesting at 4200 feet	Nov	14
Operate OSCAR on 10 Meters?	W6IOJ	145/435-MHz converter	Nov	36
Saga of the Willie Wand	W5RRH	6-element 2m beam	Dec	52
Satellite Supremacy	W2GEF	60-Watt UHF amplifier	Feb	18
Secrets of Cellular Radio	N1BLH	behind-the-scenes tour	Dec	44
Six for Two	KA8RCJ	6-element 2m delta loop	Sep	58
That Glorious Gonset	KT2B	rebuild a Gonset 972	Jan	34
The Dayton Downlink	W9JD/8	optimizing your OSCAR setup	Jul	24
The Downunda Project: Part I	Simpson	Dick Smith 2m transceiver	Aug	14
The Downunda Project: Part II	Simpson	assembly and alignment	Sep	17
The Rubber Duck Debunked	W4NVK	10 dB gain over a duck	May	42
The Santec Spectacular	W2IVS	two simple mods	Dec	50
Two for Two	WA4BLC	pair of 2m antennas	May	22
Zuper Zepp for VHF	WA4UZM	simple extended zepp	May	52

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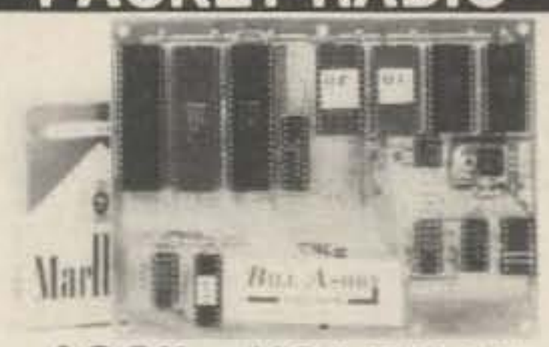

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SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine *by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.*

OAK PARK MI
DEC 1

The Oak Park High School Electronics Club will sponsor its 16th annual Swap 'N' Shop on Thanksgiving Sunday, December 1, 1985, from 8:00 am to 4:00 pm, at Oak Park High School, 13701 Oak Park Boulevard, Oak Park MI. Donation is $2.50 per person; after 12:00 noon, $1.50. 8-foot tables will cost $8.00. Refreshments will be available. For further information, send an SASE to Herman Gardner, Oak Park High School, 13701 Oak Park Boulevard, Oak Park MI 48237; (313)-968-2675.

FARIBAULT MN
DEC 7

The Handi-Ham Winter Hamfest will be held on Saturday, December 7, 1985, beginning at 9:00 am, at the Eagles Club in Faribault MN. Talk-in on .19/.79. For more information, contact Don Franz W0FIT, 1114 Frank Avenue, Albert Lea MN 56007.

SOUTH BEND IN
JAN 5

A hamfest will be held on January 5, 1986, at Century Center, on US 33 North between the St. Joseph Bank Building and the river, downtown South Bend IN. Table space is $1.00 per foot. Talk-in on .52/.52, .99/.39, .93/.33, .69/.09, and 145.29. For more information, contact Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616; (219)-233-5307.

WAUKESHA COUNTY WI
JAN 11

The West Allis Radio Amateur Club will sponsor the Midwinter Swapfest on Saturday, January 11, 1986, beginning at 8:00 am, at the Waukesha County Expo Center Forum. Take I-94 to Co. F, south to FT, and west to Expo. Admission is $2.00 in advance and $3.00 at the door. Four-foot tables are $3.00 in advance, $4.00 at the door. For tickets or more information, send an SASE to WARAC Swapfest, PO Box 1072, Milwaukee, WI 53201.

VA STATE FAIRGROUNDS
JAN 12

The Richmond Amateur Telecommunications Society will sponsor the ninth annual Richmond Frostfest on Sunday, January 12, 1986, from 8:30 am to 3:30 pm, at the Virginia State Fairgrounds. Admission is $4.00. Flea-market spaces are $4.00; $8.00 with an 8-foot table. VEC exams will be held on Saturday. For more information, write the Richmond Frostfest, PO Box 1070, Richmond VA 23208, or call Bill Scruggs N4DDM at (804)-272-8206.

YONKERS NY
JAN 26

The Yonkers Amateur Radio Club will hold an electronics auction on Sunday, January 26, 1986, from 9:00 am to 3:00 pm, at Lemko Hall, 556 Yonkers Avenue, Yonkers NY. Admission is $3.00; children under 8 are free. Inspection is from 9:00 am to 10:00 am and the auction will begin at 10:00 am. Talk-in on 146.865/R, 440.150/R, and 146.52. For more information, contact the YARC, 53 Hayward Avenue, Yonkers NY 10704; (914)-969-1053.

SOUTHFIELD MI
JAN 26

The Southfield High School ARC will hold its 20th annual Swap and Shop on January 26, 1986, from 8:00 am to 3:00 pm, at Southfield High School, 24675 Lahser, Southfield MI. Admission is $2.50. Two 8-foot reserved tables are $20.00. Each additional table is $10.00. For more information, write Robert Younker, Southfield High School, 24675 Lahser, Southfield MI 48034.

TEACHER IN SPACE
JANUARY

The Concord Brasspounders ARC will operate W1OC to commemorate Christa McAuliffe's teacher-in-space flight of the space shuttle. Operation will be from 1300 UTC on Saturday to 1259 UTC Sunday during the first weekend following the launch of the shuttle with Christa aboard. Anticipated launch date is January 22, 1986. Suggested frequencies are: phone—7.285, 14.285, 21.385; CW—7.050, 14.050, 21.050; Novice—7.105. For a certificate, send an SASE to W1OC, PO Box 2214, Concord NH 03301.

BATTLE OF
KWAJALEIN AND ROI-NAMUR
FEB 1-10

The Kwajalein Amateur Radio Club will operate special-event station KX6BU from 0600 UTC on February 1, 1986, until 0600 UTC on February 10, 1986, to commemorate the 42nd anniversary of the Battle of Kwajalein and Roi-Namur. Frequencies will be: SSB—28.550, 21.350, and 14.250; CW—28.050, 21.050, 14.050, and 7.025. For $6.00, stations working KX6BU will be issued a certificate, a QSL, and a 64-page book describing the Battle of Kwajalein and Roi-Namur. $3.00 will bring a QSL and a certificate. All requests should be sent to: KX6BU, Box 444, APO San Francisco 96555-008.

DAVENPORT IA
FEB 23

The Davenport Radio Amateur Club will hold its 15th annual hamfest at the Davenport Masonic Temple, Brady Street (Highway 61) and 7th Street, Davenport IA, on Sunday, February 23, 1986, from 8:00 am to 4:00 pm. Admission is $2.00 in advance; $3.00 at the door. Tables are available by reservation for $7.00, with $2.00 extra for ac hookup. Table setup begins at 7:00 am. Talk-in on 146.28/.88 (W0BXR). For reservations, advance tickets, or more information, contact Dave Johannsen, 2131 Myrtle Street, Davenport IA 52804.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

COMMENTS

This month's contest information is a little spare as everyone is deciding on what dates to use for the 1986 season. Shown in the calendar are the tentative ARRL contest dates for the first six months of 1986, following the usual December and January contests that have been confirmed so far. Note the addition of five new "sprints" for 50 MHz and above, by the ARRL.

One final reminder to contest sponsors, since everyone seems to be forgetting. *Please send your contest announcements, plus appropriate rules, directly to my home address, shown here.* Material addressed to the magazine is only delayed and may not make the appropriate issue. This is especially important for overseas mail, which usually arrives at the last minute.

While on the subject, all material should be mailed *as far in advance as possible*. Believe it or not, my deadline for submission of material to the magazine is the 20th of the month, three months prior to the issue date. For example, this material for the December, 1985, issue was due at the magazine on September 20th. So please mail early; don't forget that I need a few extra days to type everything, too.

If you pick a contest date early in the year (even if you're still deciding on rules), at least let me know the date once it's firm. That way it can be listed in the calendar as early as possible and we can help avoid overlapping and duplications with other contests. I'll also know whether or not you're sending more materials and can try to track it down if it doesn't arrive on time.

That's it for now. Good luck in the coming year!

ARRL 160-METER CONTEST
Starts: 2200 UTC December 7
Ends: 1600 UTC December 8

The object is for amateurs worldwide to exchange QSO information with W/VE amateurs on 1.8 MHz, CW only. DX-to-DX QSOs are not permitted for contest credit. Operating categories include single operator and multi-operator (single transmitter only). Remember that W/VE stations may transmit only in the 1.800–1.825- and 1.830–1.850-MHz segments in conformance to the ARRL band plan. Please refrain from using the 1.825–1.830-MHz DX window.

EXCHANGE:

RST and ARRL section, DXCC country name, or ITU region if maritime or aeronautical mobile.

SCORING:

Count 2 points per QSO with amateurs in an ARRL section. W/VE stations count 5 points for DX QSOs. Multiply QSO points by total number of ARRL sections (74 maximum) and DXCC countries (W/VE stations only).

ENTRIES:

Official forms and logs are recommended and are available from ARRL headquarters for an SASE or 2 IRCs. Logs must indicate time in UTC, call, and exchange. Multipliers should be clearly marked in the log the first time worked. Entries with more than 200 QSOs must include cross-check sheets. Entries must be postmarked by January 4th and addressed to ARRL, 225 Main St., Newington CT 06111.

Certificates will be awarded the top-scoring single operator in each ARRL section and DXCC country and to the top-scoring multi-operator stations in each ARRL division and continent. Usual ARRL conditions of entry and disqualification apply.

ARRL 10-METER CONTEST
Starts: 0000 UTC December 14
Ends: 2400 UTC December 15

Contact as many stations as possible on the 28-MHz band using no more than 36 hours of the 48-hour contest period. Listening time counts as operating time! Entry categories include: single operator mixed mode (phone and CW), phone only, or CW only. Multi-operator class is for single transmitter, mixed mode only.

No crossmode contacts are allowed. Mixed-mode, single-operator, and all multi-operator stations may work stations once on CW and once on SSB. One operator may not use more than one callsign from any given location during the contest period. All entrants may transmit only one signal on the air at any given time.

EXCHANGE:

W/VE stations (including KH6/KL7) send RS(T) and state or province. DX stations send RS(T) and serial number starting with

1985 RESULTS
75-METER WORLD SSB CHAMPIONSHIP CONTEST

Callsign, QTH, QSOs, multipliers, total score
**World Champion *State, Provincial, or Country Champion

W/VE Single Operator

**K4JPD	GA	1,153	117	754,650
* N7DF/0	KS	1,265	91	596,505
N0XA	KS	888	84	396,060
* VE3CYX	ONT	681	86	317,770
* N4KMY	NC	747	75	291,000
* KC8P	MI	627	76	248,140
* AK1A	NH	709	66	239,910
* KV0I	NE	720	56	202,720
KB8LM	MI	553	63	177,345
* K9JF/7	WA	476	64	168,960
* KQ3V	PA	422	74	167,980
* N4TG	TN	563	58	164,430
* KB9S	WI	453	64	149,120
* KA2AEV	NY	462	60	143,100
* W1BR	MA	421	61	133,895
KB8PK	MI	471	55	129,525
* KA1SR	RI	401	62	129,270
* AA4UE	VA	454	55	127,875
* KK0L	CO	458	55	125,950
N2BJX	NY	456	54	124,740
* KD7SP	NV	404	56	115,640
WA1UJU	WI	463	49	113,925
W4TMR	NC	366	60	113,400
* KS7T	MT	361	55	104,225
* KB0C/9	IN	386	49	96,050
WA1BBB	NY	349	51	88,995
N4KWX	VA	354	42	75,180
* W9UCW	IL	266	53	70,755
WB9NUL op.				
* WR4F	KY	238	56	69,440
* AE5H	MS	270	48	65,280
AF1T	MA	242	51	64,515
* KI4RE	GA	234	49	58,555
* N3AHA	DE	231	45	52,650
* KD8PT	WV	216	44	51,480
* VE2YU	QUE	196	47	47,940
* K5GOE	AR	175	50	44,000
* VE1BDT	NS	191	44	43,780
KW2J	NY	190	45	43,200
* WA6FGV	CA	209	39	41,340
W9LYN	IL	158	50	41,000
* KQ7Y	AZ	175	46	40,940
* KB8KW/7	WY	162	47	39,010
W8VEN	WV	155	48	38,400
W3ARK	PA	208	35	36,400
KA2CDJ/4	NC	127	48	31,920
W3KHQ	PA	108	49	28,420
KQ1F	MA	115	46	27,600
N0CLV	KS	133	40	26,600
* W4WIJ	FL	113	44	25,520
KG6MO	CA	103	45	24,525
N7RO	WA	122	39	23,790
WA4BSN	GA	180	42	23,140
* KT1J	VT	116	38	22,420
WK4F	FL	95	42	21,630
* VE7AO	BC	102	39	21,450
KB7M	WY	115	34	19,550
VE2DTI	QUE	103	37	19,240
N4UH	NC	83	43	19,135
WB2TKD	NY	95	36	17,820
* WB0BHF	IA	102	33	16,500
K5GN	TX	84	36	15,660
K8CV	MI	74	40	14,800
WD9IFS	IL	69	37	12,765
NA8W	OH	70	35	12,600
NE6I	CA	73	33	12,210
K8KUH	MI	89	27	12,015
WB8YEW	OH	68	33	11,385
W8SWN	MI	74	30	11,100
W4TWW	SC	49	38	10,070
KB7WN	WY	57	32	9,120
KC3LV	PA	60	27	8,100
N5AFV	OK	48	31	7,440
K2SCU/5	TX	44	31	6,975
NJ8L	OH	49	27	6,750
WA8GLF	OH	54	23	6,440
W0NGB	MN	43	22	4,730
K0UK	CO	35	25	4,500
WA1NCN	CT	46	18	4,050
N8CEO	MI	28	18	2,610
AF0S	CO	17	15	1,425
W1LUG/4	VA	8	7	240

DX Single Operator

**NP4CC	Puerto Rico	512	97	288,090
* OH1RY	Finland	296	65	189,150
* DF9ZP	West Germany	246	79	123,240
* VK6DU	Australia	199	50	99,550
* K3WGR/VP2M	Montserrat	282	61	94,855
* AH2U	Guam	179	27	46,575
* HC1OT	Equador	126	50	34,500
* HR1FC	Honduras	105	48	31,200
* KF7S/KL7	Alaska	231	26	30,030
JF2DQJ	Japan	61	24	12,960
JA2YKA	Japan	61	24	12,960
EA3CCN	Spain	28	12	3,360
YU3PG	Yugoslavia	25	14	1,850
LZ1KOZ	Bulgaria	22	11	1,210
YU4EZC	Yugoslavia	14	11	770
OZ3ZK	Denmark	7	4	280

W/VE Multi-Operator

**K3TUP	PA	1,180	97	614,495
* W8LT	OH	1,120	92	530,380
* W9WI	WI	1,025	76	400,520
* NO4R	KY	964	75	369,375
* KY0S	CO	892	76	364,420
* KS9O	IL	757	77	303,380
* WA6PVA/7	OR	737	67	278,385
* WA5VVT	AR	558	64	181,760
* W9QVE	IL	197	50	49,250

DX Multi-Operator

**OK3KFF	Czechoslovakia	138	27	18,900
JA9YBA	Japan	3	3	90

Check Logs: ZF2GO, K3OX, N0BQW, LZ1L73

Multi-Op Participants

K3TUP	K3TUP, KJ3L, N3BJ, AI8S
OK3KFF	OK3KFF, OK3CQA, OK3-27147
NO4R	NO4R, NC9C, KI4DC
WA5VVT	WA5VVT, WB5LRP, KA5NLY, WB5GFA
WA6PVA	WA6PVA, NI7I, N7GPO
W8LT	W8LT, K3JT, WD8LXX, WD8IXE, NZ4K, KD8NS
JA9YBA	JA9YBA, JA9LNJ, JA9VDA
KS9O	KS9O, NB9T, KA9DVY
W9WI	W9WI, K9BC, AC9C, NA9D
KY0S	KY0S, AD0O, N0EBM

RESULTS

75-meter single-op World Champion K4JPD.

DF9ZP recovers from the 1985 75-meter test.

The ops at 75-meter multi-op runner-up W8LT. (Left to right: WD8IXE, NZ4K, WD8LXX, KD8NS, and K3JT.)

K4JPD, K3TUP, NP4CC, AND OK3KFF WORLD 75-METER SSB CHAMPIONS

With a smashing total of 117 multipliers and 1153 QSOs, K4JPD is the 1985 World 75-Meter Champion in the W/VE single-operator class. K3TUP (three-time 40-Meter Champion) has become the World Champion in the 75-Meter W/VE multi-operator class with 1180 QSOs and 97 multipliers.

NP4CC earned World Championship honors by capturing the top slot for DX single-operator stations. With 512 Qs and 97 multipliers, NP4CC's score totaled 288,090 contest points.

In the DX multi-operator class, OK3KFF has the distinction of becoming the 1985 World Champion in that category.

New champions sometimes breed new world records. This year's 75-meter event is no exception. N7DF and three fellow competitors broke the standing World QSO Record established in 1984. Including this year's accomplishments, the following are the top ten QSO totals:

75-Meter QSO Records

N7DF	1985	1,265	W9WI	1985	1,025
K3TUP	1985	1,180	NO4R	1985	964
K4JPD	1985	1,153	N4BAA	1984	894
W8LT	1985	1,120	KY0S	1985	892
N7DF	1984	1,076	N0XA	1985	888

Can you imagine over 1000 Qs on 75 meters in 24 hours or less? Unbelievable, huh? In the 1985 contest, stations making 500 or more contacts included: N7DF (1265), K3TUP (1180), K4JPD (1153), W8LT (1120), W9WI (1025), NO4R (964), KY0S (892), N0XA (888), KS9O (757), N4KMY (747), WA6PVA (737), KV0I (720), AK1A (709), VE3CYX (681), KC8P (627), N4TG (563), WA5VVT (558), KB8LM (553), and NP4CC (512).

Stations compiling 70 or more multipliers included: K4JPD (117), K3TUP (97), NP4CC (97), W8LT (92), N7DF (91), VE3CYX (86), N0XA (84), DF9ZP (79), KS9O (77), KC8P (76), W9WI (76), KY0S (76), NO4R (75), N4KMY (75), and KQ3V (74).

One of the advantages of grading contest entries is the opportunity to learn what fellow competitors are using to radiate their signals. From this year's logs, here is an extract of what we learned:

Antennas Used (%) in the 75-Meter Contest

Inverted vee/dipole	57.5
Slopers	19.8
Trapped vertical	8.5
Delta loop	8.5
Wire beam	3.8
2-element yagi	0.9
Collins cage	0.9

Looking to the top stations in each operator class, here are half the ingredients to this year's championship stations:

Single Op:

K4JPD	GA	FT-102	2-el yagi
N7DF	KS	FT-901/FT-902	Collins discage
K9JF	WA	TS-830S	Vertical
N4TG	TN	IC-720	Tilted delta loop
KB8PK	MI	TS-430S	Inverted vee

Multi-Op:

K3TUP	PA	TS-930	???? (a secret?)
W8LT	OH	TS-830S/TS-930S	Dipole and longwire
W9WI	WI	TS-830S	Zepp, inv. vee, verticals
NO4R	KY	Drake C-line	Dipole
WA4JXI	FL	TS-830	Phased ¼-wave slopers

If only a new, compact, 80-meter 2-element beam design would hit the market. Then next year we could all share the success enjoyed by K4JPD. Hey, Steve, how about sending me (KE7C) the plans for your new array? Seriously, Buck (WB7OJV) and I would like to put one up!

As the many cards and letters state, everyone is looking forward to the 1986 event. The summer of 85 was busy here at the QTH, getting an array set up for 75. How about your QTH? Are you ready for January?

Mark it down on your calendar. The 5th annual 75-Meter World SSB Championship will be held from 0000-2400 UTC on January 12, 1986. Send for your paperwork right now. It's printed and ready for mailing to you!

Forward an SASE to our new rules and forms address. We'll send you not only the information for the 75-Meter contest, but also the rules and forms for our other contests as well. Address your SASE to: *1986 Contest Rules and Forms, Billy Maddox KA6JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.* See you in January!—*Bill Gosney KE7C.*

75-Meter Soapbox

N4BAA	Sorry I didn't get to operate! Really missed hearing K4JPD's new KLM beam. Everyone has been talking about it. Good job, Steve.
W4TWW	Very nice contest.
KE7C	Couldn't operate but sure look forward to next season. Lots of 75m antenna work this summer. Maybe KLM will ship a 2-element yagi my way just for me to test out. . .pssst, hint, hint.
N7DF	Got to get a computer! Duping by hand is for the birds! Great contest, fellas. Lots of fun.
DF9ZP	Jose, best to you and the contest committee. Very nice contest. See you next year.
JF2DQS	Conditions were very bad. Not many East Coast stations. Of course, see you in 86.
ZF2GO	Waste of time. Nobody listened in the DX window. *(Hopefully the new DX-window rules for 86 will improve the situation. . .let's hope so—Ed.)*

001. Maritime- and aeronautical-mobile stations send RS(T) and ITU region (1, 2, 3). Novice and Technician stations sign /N or /T as appropriate.

SCORING:

Count 2 points per phone QSO, 4 points per CW QSO, and 8 points for QSOs with US Novice or Technician stations. Multiply the QSO points by the total number of US states, Canadian call areas, DXCC countries (except US and Canada), and ITU regions (maritime and aeronautical mobiles only).

ENTRIES:

Official logs and entry forms are recommended and are available from ARRL headquarters for an SASE or 2 IRCs. Logs must indicate time in UTC, mode, call, and exchange for each QSO. Multipliers should be clearly marked in the log the first time worked. Entries with more than 500 QSOs must include cross-check sheets. Entries must be postmarked by January 11th and addressed to ARRL, 225 Main St., Newington CT 06111.

Certificates will be awarded to the highest-scoring single-operator station in each category from each ARRL section and DXCC country, top multi-operator entries in each ARRL division and each continent, and additional entries as participation warrants. Usual ARRL entry conditions and disqualification rules apply.

G-QRP-CLUB WINTER SPORTS

Daily from 0900 to 2300 UTC, December 26th to January 1st. All radio amateurs interested in QRP are invited to take part in the club's activity. No special exchange information was mentioned in the information provided by the club. The operating schedule for each day is as follows:

0900–1100 = 14.060, 21.060, 28.060
1100–1300 = 3.560, 7.030
1300–1400 = 10.106
1400–1700 = 14.060, 21.060, 28.060
1700–1900 = 3.560, 7.030
1900–2100 = 14.060
2100–2300 = 3.560, 7.030

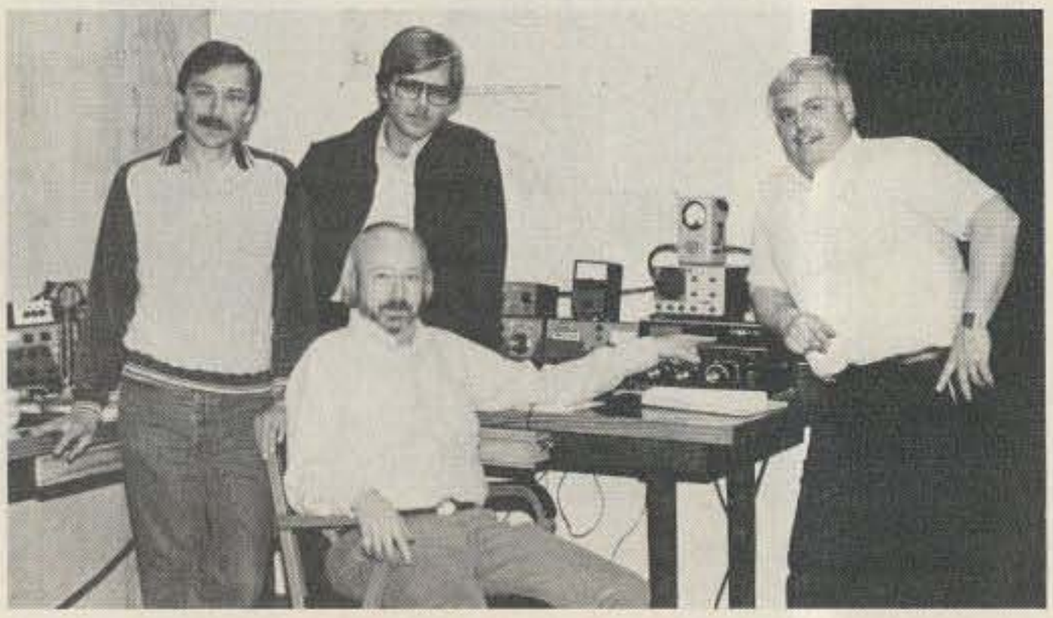
Reports on the Winter Sports Activity should be sent to Fred Garratt G4HOM, 47 Tilshead Close, Druids Heath, Birmingham B14 5LT, England.

CANADA CONTEST
Starts: 0000 UTC December 29
Ends: 2400 UTC December 29

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all amateurs and everybody works everybody. Entry classes include single operator allband, single operator single band, and multi-operator allband.

Use all bands from 160 to 2 meters on CW and phone combined. All contacts with amateur stations are valid. Stations may be worked twice on each band, once

RESULTS



The 160-meter multi-op World Champions at WB8IFP. (Left to right: WD8ROD, KC8CP, WB8IFP; WA8PRA sitting.)

N7DF, WB8IFP, I4OUT, AND G6HH WORLD 160-METER SSB CHAMPIONS

A difference of 24 contacts determined this year's World Champion for single-operator stations. It has to be a heartbreak for W0EJ, who placed second behind World Champ N7DF. Both stations worked 56 states/provinces and 13 DX countries. Both stations beat N7DF's 1984 World QSO Record!

The multi-operator category was just as exciting. WB8IFP became the World Champion by less than 8,000 points. Second-place station W0CEM managed 30 contacts more than the champ, however the multiplier count was 3 less. Here again, it was a fine line between the two. Scores that close must be very, very frustrating.

In DX, the competition was more relaxed. I4OUT nearly doubled the score of runner-up YV2IF. He compiled 367 Qs, 10 states/provinces, and 43 DX countries to earn the title for single-op DX stations.

In the multi-operator category for DX stations, G6HH was unchallenged with a score of 25,680 contest points.

Speaking of world champions and record-breaking scores, let's review the history of this event:

	1981	1982	1983	1984	1985
W/VE Single Op	W8LRL	W9RE	KC8JH	WA2SPL	N7DF
W/VE Multi-Op	W4CN	W8NGO	K8ND	K9ZUH	WB8IFP
DX Single Op	C6ADV	VP9BO	YV3AZC	EA3CCN	I4OUT
DX Multi-Op	ZF2DX		YU7JDE	LZ2CJ	G6HH

1985 meant new world records. With the sunspot cycle favoring 160, QSO counts have reached new horizons. Let's look at the top ten to date:

160-Meter QSO Records

N7DF	1985	1,177	W0CEM	1985	1,084
W0EJ	1985	1,152	WB8IFP	1985	1,054
N7DF	1984	1,125	KC8P	1985	1,048
W9RE	1982	1,118	VE3CDX	1984	1,003
WA2SPL	1984	1,098	K0HA	1984	991

During the 1985 contest, stations achieving 500 or more QSOs included: N7DF (1,177), W0EJ (1,152), W0CEM (1,084), WB8IFP (1,054), WB9NUL (885), NO4R (871), K1ZM (841), W8KA (754), W3TS (743), WA1UJU (737), N8ATR (721), W4TMR (720), W1ODY (690), KC8P (645), WD4KXB (639), NK7U (622), N4FNB (607), K3MO (590), W0IJR (550), and N4DDS (509).

Stations with 50 or more states/provinces included: WB8IFP (57), W0CEM (56), W8KA (56), N7DF (56), K7QQ (56), W0EJ (56), WB9NUL (55), W0IJR (54), WA4JXI (54), NK7U (54), K1ZM (54), K3MO (54), NO4R (53), K7LXC (53), WD4KXB (53), W3TS (53), WA1UJU (53), KC8P (52), W4TMR (52), WB1GQR (52), KA1SR (52), W8SVT (52), N4ICS (52), N8ATR (51), N4BNO (51), and VE5RA (50).

In Europe, DX activity was fairly good. The following stations worked 20 or more DX countries: I4OUT (43), EA3CCN (36), SP5INQ (33), OK1JDX (31), LZ1KOZ (30), C31OF (27), I4CSB (23), G6HH (22), and YV2IF (21).

On the North American continent, the following stations worked 10 or more DX countries: WA4JXI (33), K1ZM (27), W1ODY (15), W8KA (15), KA1SR (14), N7DF (13), W0EJ (13), WD4KXB (12), NK7U (11), KQ1F (11), and N8ATR (10).

For years operators have claimed they couldn't put up a 160 antenna on a city lot. Each year we analyze the 160-meter entries just to disprove this myth. Here's what contestants used in the 1985 event:

Antennas Used (%) in the 160-Meter Contest

Longwire	38.9
Slopers	33.3
Inverted vee/dipole	11.1
Other	11.1
Vertical	5.6

35.7% of the participants used a Beverage or series of Beverage antennas for receive.

As far as the top five stations are concerned, you'll find a blend of state-of-the-art equipment and a variation of antenna designs that have appeared in radio journals the past few years. A bit of effort, yes, but think of the signal:

Single Op:

N7DF	KS	FT-901/FT-902	Discage, Beverages
W0EJ	IA	KWM-380	¼-wave sloper, Beverages
K1ZM	NY	TS-830	136′ vertical
WB9NUL	IL	????	????
W1ODY	CT	????	????

Multi-Op:

WB8IFP	OH	Drake C-line	¼-wave vertical, Beverages
W0CEM	KS	TS-830S	Phased verticals, Rx loop
W8RA	MI	TS-830S	130′ folded unipole, Beverage
NO4R	KY	Drake C-line	Shunt-fed tower
WA4JXI	FL	TS-830	115′ shunt-fed tower, Beverages

160-meter contesting is at its very best. This event has become the unchallenged favorite of SSB contesters worldwide.

Plan now to reserve the 1986 contest weekend. The 7th annual 160-Meter World SSB Championship will be held from 0000 UTC January 18, to 2400 UTC January 19, 1986.

Send an SASE to the address below and obtain your own personal copy of the new and revised rules and forms. Once your SASE is received, we'll not only send you the forms and rules for the 160-meter event, but also the information for all of the SSB championship events: *1986 Contest Rules and Forms, Billy Maddox KA6JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.*

My thanks to Harry K1PLR. Harry has been our contest chairman for the past several years. We owe our gratitude to Harry for handling all the details without a flaw. He managed the 1985 event right in the middle of moving from Pennsylvania to North Carolina. Great job, Harry, and our thanks again!

To the contestants, you're special people. On 160, we call it the gentleman's band and rightly so! *73* appreciates your dedication and looks forward to your annual support. Be sure to share your contesting excitement with your 160 friends. Fine-tune that antenna and let's do it again in 1986, okay!—*Bill Gosney KE7C.*

160-Meter Soapbox

KE7C	Only sorry I couldn't stay around longer. Was nice to contact old friends and meet many new ones! Hats off to Harry K1PLR, who chairs this event each year!
KC7PA	Noise plague again. Utah is still considered rare, however.
KS7T	Rough on this end. Ran barefoot. Need either a tape recorder or a linear.
KC8P	Snow static was S9 + 40 at times. Decided to pull the plug and go to bed.
W0CEM	We all had a good time. When the temp is −20 outside, the best thing to do is to contest on 160!
KC0QO	Big effort + low score = lots of fun!

on CW and once on phone. Neither cross-mode contacts nor CW contacts in the phone bands are allowed.

EXCHANGE:

Signal report and consecutive serial number starting with 001, plus province.

SCORING:

Score 10 points for each contact with Canada, 4 points for contacts with other countries. VE0 counts as Canada and one multiplier. Score 20 points for each contact with any CARF official news station using the suffix TCA or VCA. Multipliers are the number of Canadian provinces/territories worked on each band, on each mode. Contacts with stations outside Canada count for points but not multipliers.

FREQUENCIES:

1.810/1.840, 3.525/3.775, 7.025/7.070/7.155, 14.025/14.150, 21.025/21.250, 28.025/28.500, 50.040/50.110, and 14.4090/14.6520. Suggest phone on the hour, CW on the half hour. Since this is a Canadian-sponsored contest, remember to stay within the legal frequencies for your country!

AWARDS:

Trophies will be awarded to the highest-scoring single- and multi-operator allband entries. Certificates will be awarded to the highest scorer in each category in each province/territory, US call area, and DX country.

ENTRIES:

A valid entry must contain log sheets, dupe sheets or statement, a cover sheet showing claimed QSO points, a list of multipliers, and a calculation of final claimed score. Cover sheets and multiplier checklists are available. Entries should be mailed within one month of the contest with your comments, photos, etc., to CARF, c/o N. Waltho VE6VW, Box 1890, Morinville, AB, T0G 1P0, Canada.

Results will be published in *TCA*, the Canadian amateur magazine, prior to the next contest. Nonmembers of CARF may include an SASE for a copy of the results. The decision of the contest committee shall be final in all cases of dispute.

WORLD SSB CHAMPIONSHIPS

Announcing the January Classics—the 1986 running of the World SSB Championships! The first and only contests of their kind, these five (5) individual single-band events are world-renowned and amongst the most challenging events on the bands today. Winners of each contest determine the World Champion for 15-, 20-, 40-, 75-, and 160-meter single sideband:

January 11, 1986
0000–2400 UTC
5th 40-Meter World SSB Championship

January 12, 1986
0000–2400 UTC
5th 75-Meter World SSB Championship

0000 UTC January 18, 1986,
through 2400 UTC January 19, 1986
7th 160-Meter World SSB Championship

January 25, 1986
0000–2400 UTC
2nd 15-Meter World SSB Championship

January 26, 1986
0000–2400 UTC
2nd 20-Meter World SSB Championship

Stations may be worked only *once per event*. All contacts must be two-way SSB. All stations, regardless of operating class, may operate the entire contest period.

OPERATOR CLASS:

(a) single operator, single transmitter, SSB only; (b) multi-operator, single transmitter, SSB only.

EXCHANGE:

Stations within the 48 continental US states and 13 Canadian provinces or territories transmit RS report and state, province, or territory. All others, including Alaska and Hawaii, transmit RS report and ARRL DXCC country.

QSO POINTS:

5 QSO points for contacts *within* your own *continent*.

10 QSO points for contacts *outside* your own *continent*.

MULTIPLIERS:

1 multiplier point is earned for each continental US state (48 max.), Canadian province or territory (13 max.), or ARRL DXCC country (excluding the United States and Canada).

SUGGESTED FREQUENCIES:

21,250–21,350; 14,175–14,250; 7,050–7,080 (DX); 7,175–7,250 (W/VE); 3,760–3,790; 3,805–3,875; 1,830–1,850; 1,855–1,900 MHz.

DX WINDOW:

For the purpose of this event, DX window frequencies are reserved for *split-band operation only*. W/VE stations are *not* to transmit in the window at all. DX stations *may* transmit but *must* receive outside the window frequencies. DX windows include 7,080–7,090, 3,790–3,805, 1,825–1,830, 1,850–1,855, and 1,907–1,913 MHz.

FINAL SCORE:

Total QSO points × multiplier points = claimed score.

ENTRIES:

Entries *must* include (1) a contest log, (2) a dupe sheet for 100 or more contacts, (3) a list of multipliers, and (4) a summary sheet as outlined below. Be sure to *include* your *soapbox comments* and a black and white *photo* for possible publication.

SUMMARY SHEET:

Summary sheets must contain (1) contest callsign, (2) your state, province, territory, or ARRL DXCC country, (3) station owner's name and mailing address, (4) a list of station equipment and antenna(s), (5) the operator class, (6) total QSOs, (7) total QSO points earned, (8) total US states worked, (9) Canadian provinces and territories worked, (10) the total of ARRL DXCC countries worked, (11) total multiplier points, and (12) your claimed contest score.

ENTRY DEADLINE:

Entries should be mailed to the appropriate contest chairman listed below. Entries must be *POSTMARKED NO LATER THAN FEBRUARY 20, 1986*. Late entries will be registered as check logs.

DISQUALIFICATION:

Contestants may be disqualified if they run illegal power, cause deliberate interference, fail to comply with the rules for the DX window, attempt to achieve a scoring advantage, or if duplicate contacts not cancelled exceed more than 3% of the total contacts made. Decisions of the contest committee are final. Disqualified stations will be barred from these events for one year thereafter.

PENALTIES:

A penalty of 100 QSO points will be as-

1985 RESULTS
160-METER WORLD SSB CHAMPIONSHIP CONTEST

Callsign, QTH, QSOs, State/Provinces, DX, total score
** World Champion *State, Provincial, or Country Champion

W/VE Single Operator

**N7DF	KS	1,177	56	13	411,240
* W0EJ	IA	1,152	56	13	401,580
* K1ZM	NY	841	54	27	363,690
* WB9NUL	IL	885	55	9	282,880
* W1ODY	CT	690	47	15	228,690
* N8ATR	OH	721	51	10	223,260
* WD4KXB	VA	639	53	12	211,575
* W3TS	PA	743	53	3	208,880
* KC8P	MI	645	52	7	195,900
* WA1UJU	WI	737	53	0	195,305
* W4TMR	NC	720	52	5	193,230
K3MO	PA	590	54	5	176,705
N4BNO	NC	466	51	9	142,800
* WB1GQR	VT	436	52	9	139,690
* KA1SR	RI	385	52	14	133,650
W8SVT	OH	400	52	7	120,075
* K6HNZ	CA	440	46	5	115,515
* W7AWA	WA	403	44	7	104,550
K7QQ	WA	345	56	0	98,560
* KQ1F	MA	359	41	11	93,600
* K4JPD	GA	318	45	6	84,960
AF1T	NH	337	46	0	77,510
* N4ICS	KY	288	52	1	76,055
W8ILC	OH	287	48	3	73,950
KB3MI	PA	271	47	5	71,760
WA1BBB	NY	317	42	1	69,015
* N5GDO	MS	282	47	1	68,160
KA8T	MI	291	41	0	59,655
K8WW	OH	282	41	0	57,810
* VE5RA	SASK	209	50	4	57,510
KR9G	IL	165	48	2	41,750
N4NX	GA	170	40	7	41,595
* KV0I	NE	191	36	0	34,390
* W2CVW	NJ	152	37	4	31,980
N4UH	NC	166	37	1	31,730
* W4TWW	SC	132	39	4	31,020
* KS7T	MT	139	42	0	29,610
WI4R	GA	159	36	0	28,980
* W8VEN	WV	143	37	2	28,275
KG9D	IL	139	40	0	27,800
* VE7ERY	BC	141	38	1	27,690
N5DSK	MS	129	38	4	26,250
N3ADQ	MA	184	28	0	25,760
* KC7PA	UT	133	32	1	22,110
* VE4WR	MAN	107	41	0	21,935
* KA7T	ID	123	33	1	21,250
N8AXA/QRP	OH	126	33	0	20,795
* VE3IHB	ONT	122	33	0	20,135
WB6JMS	CA	113	34	1	20,125
* N4BSN	TN	108	35	1	19,650
KC3LV	PA	109	35	0	19,075
KI4UJ	KY	121	31	0	18,755
* WB5WAK	LA	107	35	0	18,725
WA8MJY	MI	100	36	0	18,000
VE2DTI	QUE	102	34	0	17,340
NA2Q	NY	105	33	3	16,920
AA4NA	FL	92	32	1	15,345
K9ZMI	IL	88	33	0	14,520
VE5AFY	SASK	116	27	0	14,500
K4JLD	PA	105	26	1	14,310
W0RSG	CO	83	34	0	14,110
K8CV	MI	88	25	0	12,760
N9KS	WI	73	29	0	10,585
WB2TKD	NY	65	29	2	10,385
KB7M	WY	74	28	0	10,360
K1KI	CT	62	28	0	8,680
N3AOE	MD	70	24	0	7,680
WA6FGV	CA	102	13	1	7,210
N6JM	CA	65	20	1	7,035
KC0QO	MO	54	22	0	5,940
W1LUG/4	VA	41	23	0	4,715
K5GN	TX	42	22	0	4,620
N3RC	VA	33	17	0	2,805
AA6EE	CA	21	13	0	1,365
W0IZV	CO	18	12	0	1,080

DX Single Operator

**I4OUT	Italy	367	10	43	188,415
* YV2IF	Venezuela	180	40	21	109,800
* EA3CCN	Spain	193	2	36	72,580
* OK1JDX	Czechoslovakia	178	5	31	31,320
* C31OF	Andorra	108	1	27	30,100
* SP5INQ	Poland	151	2	33	28,525
* 4U1UN	UN HQ	205	25	0	25,625
* LZ1KOZ	Bulgaria	115	1	30	20,150
I4CSB	Italy	53	0	23	6,440
G3SJX	England	24	0	16	3,840
OK1DVK	Czechoslovakia	31	0	15	2,400
LZ1KKZ	Bulgaria	25	0	14	2,030
DL7MAE	West Germany	23	0	10	1,150
SP6DVR	Poland	23	0	9	1,035
KL7XO	Alaska	14	6	2	840

W/VE Multi-Operator

**WB8IFP	OH	1,054	57	7	340,160
* W0CEM	KS	1,084	56	5	332,450
* W8KA	MI	754	56	15	272,995
* NO4R	KY	871	53	8	268,095
* WA4JXI	FL	536	54	33	250,995
* NK7U	OR	622	54	11	207,675
* N4FNB	TN	607	48	4	158,860
* W0IJR	CO	550	54	3	157,605
N4DDS	TN	509	47	1	122,400
* K7LXC	WA	303	53	1	82,080
* WA2ZXS	NY	317	47	4	81,855
* WB4UUE	VA	264	42	5	63,215
KA7IXH	OR	154	27	1	21,840

DX Multi-Operator

**G6HH	England	109	2	22	25,680

Multi-Op Participants

WA2ZXS	KB3RG, N2FEC, N3DLL, KO2H, KA2NIL, KA2TYR
N4DDS	N4DDS, N4DRL
N4FNB	N4FNB, KA4UEU, WD4PRQ, WD4EOX
WA4JXI	WA4JXI, WA4SVO
NO4R	NO4R, NC9L, N4JXI, KI4DC
WB4UUE	WB4UUE, W4JVN
KA7IXH	KA7IXH, KA7TXF, KD7UX
K7LXC	K7LXC, ?????
NK7U	NK7U, NI7T
WB8IFP	WB8IFP, N8EZM, KC8CP, WB8KXV, WD8ROD
W8KA	W8KA, NF8C
W0CEM	W0CEM, WA0TKJ, AB0S, K0WA, WB0JHD
G6HH	G3SVL, G6HVY, G6WKL, G1ICB, G0ARY, G6ZRL, G4KMJ, G4NVQ, G4WCP
W0IJR	W0IJR, KD0OZ, KA0CDN

160-meter single-op runner-up W0EJ.

160-meter multi-op runner-up W0CEM.

CALENDAR

Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest
Dec 26-Jan 1	QRP Winter Sports—CW
Dec 29	CARF Canada Contest
Jan 1	ARRL Straight Key Night
Jan 11	*73* 40-Meter World SSB Championship
Jan 11-12	Hunting Lions In The Air Contest
Jan 11-12	QRP CW Contest
Jan 11-12	ARRL VHF Sweepstakes
Jan 12	*73* 75-Meter World SSB Championship
Jan 18	*73* 160-Meter World SSB Championship
Jan 24-Feb 2	ARRL Novice Roundup
Jan 25	*73* 15-Meter World SSB Championship
Jan 26	*73* 20-Meter World SSB Championship
Feb 8-9	Dutch PACC Contest
Feb 15-16	ARRL International DX Contest—CW
Mar 1-2	ARRL International DX Contest—Phone
Apr 12-13	CARF Commonwealth Phone Contest
Apr 14	ARRL 144-MHz Sprint
Apr 22	ARRL 220-MHz Sprint
Apr 30	ARRL 432-MHz Sprint
May 8	ARRL 1296-MHz Sprint
May 17	ARRL 50-MHz Sprint
Jun 7-8	ARRL VHF QSO Party
Jun 28-29	ARRL Field Day

sessed for each duplicate contact counted in a contestant's claimed score.

AWARDS:

A minimum of 100 QSOs must be worked in an event to be eligible for a contest award. Plaques will be issued to the World Championship Stations. Awards will be issued in each operator class, in each continental US state, Canadian province and territory, and ARRL DXCC country represented.

RULES AND FORMS:

Contestants are encouraged to use official contest forms. To obtain your own copy of the rules and each contest form, send an *SASE* to: ***Contest Rules and Forms, Billy Maddox KA6JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.***

Mail Your Entry To:
15-Meter Contest Chairman
Gary Vest WA3KCY
Star Route, Box 34
Holliday TX 76366

40-Meter Contest Chairman
Dennis Younker NE6I
43261 6th Street East
Lancaster CA 93535

160-Meter Contest Chairman
Harry Arsenault K1PLR/4
704 Curtiss Drive
Garner NC 27529

20-Meter Contest Chairman
Chuck Ingram WA6R
44720 N. 11th Street East
Lancaster CA 93535

75-Meter Contest Chairman
Ron Johnson KC7PA
68 South 300 West
Brigham City UT 84302

THE AM PRESS/EXCHANGE

NEWSLETTER OF THE MONTH

This month's winner, *The AM Press/Exchange*, isn't the publication of a single club. Rather, it's a newsletter that ties together hams who love the fun and fidelity of AM communication.

Edited and published by Don Chester K4KYV, Roger Frith N4IBF, and Pete Curry KA2TTU, the *AM P/X* covers the entire spectrum of AM radio, from the restoration of antique gear to current legislation affecting AMers. The *Exchange* part of the title comes from the free classified ads available to hams wanting to buy and sell AM equipment.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

As I mentioned last month, one of the primary obstacles to operation on 220 MHz—especially SSB and CW weak-signal modes—is the lack of equipment. As of this date, there is only one manufacturer of 220 linear transverters, with another manufacturer about to introduce a model in the next month. (No, it's *not* ICOM!) As far as the selection of preamplifiers goes, there's no problem there. I know of at least 4 sources for preamplifiers, and there are several sources for amplifiers, most of which are commercially made.

The catch, as usual, is initial cost vs. return on investment. How likely is the 220-MHz gear to be used frequently? The costs of outfitting a modest station aren't excessive, but more operating enjoyment might be had on 432 for the given cost. The problem appears to be that everybody (well, most of the licensed hams in the US and Canada) is playing this waiting game: If there's enough activity, then I'll buy some equipment and get on the band. A sort of Catch 22.

One of the ways I hope to be of use to readers is to suggest options that will yield more use and enjoyment from your equipment, or any equipment you are now contemplating buying. If you're an avid VHF/UHF nut, then you may already have dabbled on 220, and you can skip this column. But if you have a transverter, or some homemade gear, or are about to lay out the cash for a piece of 220-MHz equipment, then the rest of this column might just interest you.

One of the given factors regarding successful VHF and UHF operation is that it can never hurt to run more power. A typical 220 station might use a transverter to drive a 60- or 120-Watt solid-state amplifier, feeding a single yagi. Not a bad setup, but there are times when it would be nice to have about 3 dB more power going up the feedline to snag that rare grid or make a scatter contact. Are you in luck!

Fair Radio Sales, in Lima, Ohio, has long offered the answer to the VHF operator who is long on enthusiasm but short on cash. A glance in their 1985 catalog will reveal a strange-looking box called an "AM-6155/GRT-22" UHF power amplifier. And for $159.50, you get about 80 pounds of gear in two boxes, with a self-contained ac power supply. What is this monstrosity? Well, it's a surplus FAA-type amplifier for who knows what communications in the 225-400-MHz band, and Fair Radio has come up with quite a full warehouse. Best of all, with little modification it becomes a 400-500-Watt power amplifier for 144 and 220 MHz. The mods are simple and the parts are easy to come by. Interested? Read on.

The AM-6155 uses an Eimac-type 8930 tetrode in a grounded-cathode grid-driven configuration. Such a tube in this mode ought to have about 20 dB of gain or so, but these amplifiers are only rated at 50 Watts output. The reason is simple: Since the units were intended for continuous duty in FAA service, the input to the 8930 grid is undercoupled. Hence, 10 Watts provides about 50-60 Watts output in the unmodified mode. But there's no reason at all why, in the intermittent duty operation that hams require, the tube couldn't make more power. The only limiting factor is the power supply, which is stiff enough to provide the extra Watts.

If you have one of these beasties or have rushed to the phone and whipped out your charge card to order one, follow the instructions carefully. First, make sure the internal plunger for the input cavity is set to UHF and not VHF. Refer to Fig. 1. The input connector, J1, feeds a 1.8-pF variable at the input of the shunt cavity. Obtain a 2-pF, 250-volt or better silver-mica capacitor and shunt it across this tuning capacitor. (It's labeled "input coupling.") Then locate the input-tuning capacitor, and again, shunt it with an 18-pF, 250-volt or better silver-mica capacitor. When these modifications are complete, replace the covers and turn the power supply on. Connect your driving source (no more than 5 Watts), wattmeter, dummy load/antenna, and set the plate idling current at 50 mA. (This is accessible through the top cover.)

After you've set the idling current, key your driving source. Adjust the input-coupling and input-tuning capacitors for maximum output. You should see about 400-500 Watts with 4-5 Watts of drive. Not bad, eh? One additional thought: The connection from the amplifier output to the rear antenna jack goes through a Bird-type directional coupler, which will self-destruct at this power level. Remove it and replace it with a double-female N adapter. Use a good wattmeter and slug to make these measurements. Incidentally, this is about all the power this amplifier can make, and driving it harder will just suck the plate voltage down as the tube tries to draw more current. Set your driving source for the *minimum* amount of power needed to obtain full output, and the tube won't go into saturation.

Next, you may wish to add some means of keying the tube. One very effective way is to tie a 56-volt, 5-Watt zener from the bias line to ground through a 100-Ohm, 5-Watt resistor. By grounding the resistor/zener junction, the operating bias can be obtained. When the resistor is in the circuit, set the bias control for full cutoff, or so that no idling plate current is measured. Typically, this voltage will be around 130-140 volts negative. See Fig. 2 for this modification. Fig. 3 shows yet another way to key the amplifier, using a voltage doubler and relay to break the screen-voltage line. All you'll need is a small 12-volt relay, a pair of 1N4002/3/4 diodes, and two 200-uF, 25-V-dc electrolytics. The RCA jack is useful for keying. Merely locate and break the

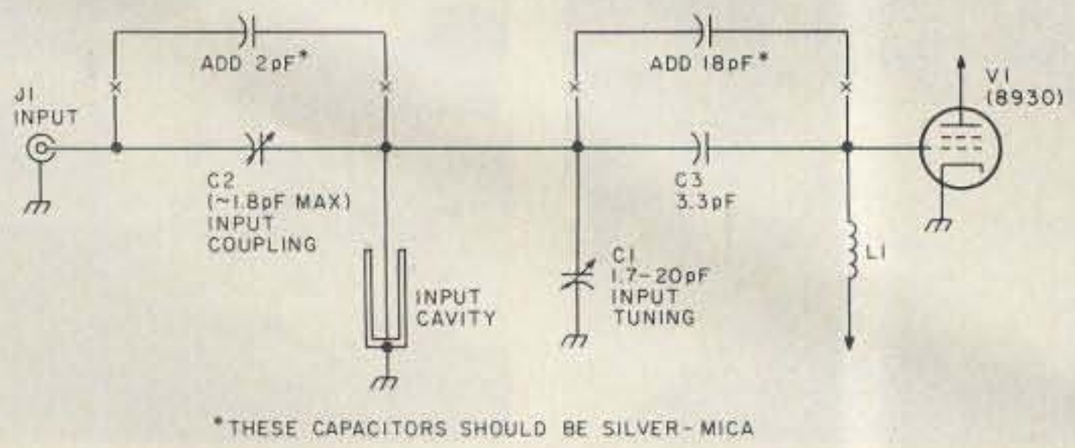


Fig. 1. The AM-6155 input circuit.

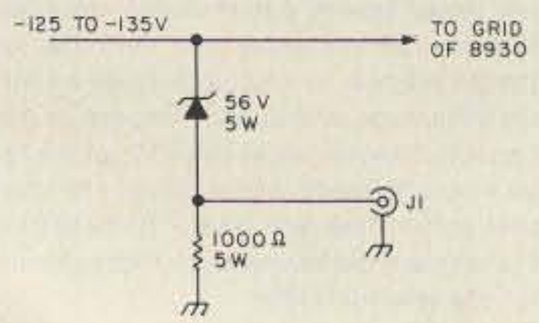


Fig. 2. Use this to set the operating bias on the 8930 by grounding J1.

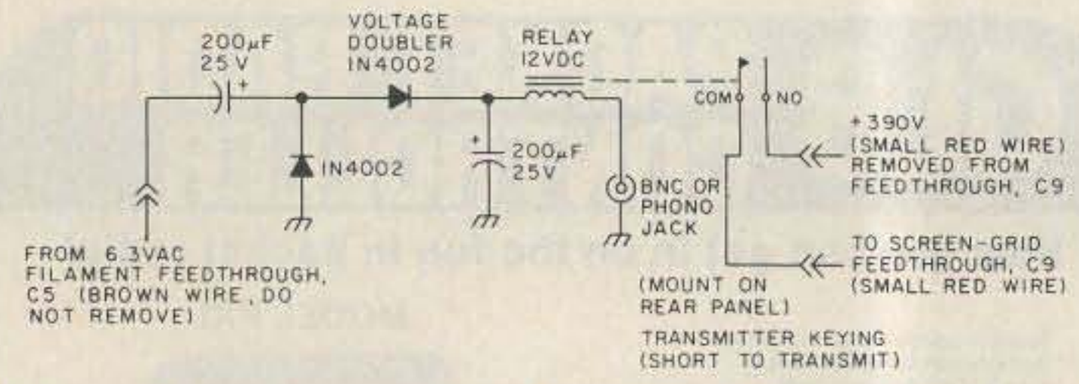


Fig. 3. One method of keying the amp. The voltage doubler will not be needed if a 6.3-V-ac relay can be located.

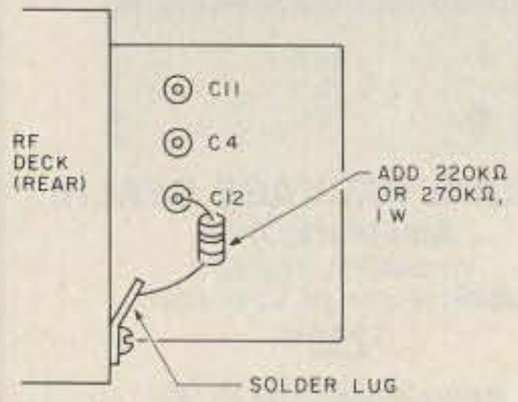


Fig. 4. Don't forget to add this resistor.

screen lead from feedthrough C9 on the tube enclosure, and install this circuit in series. Finally, add a 270k-Ohm, 1-Watt resistor from feedthrough C12 to ground on the tube enclosure. This will ensure that the screen does not take on the potential of the 2000-volt power supply when not connected. (See Fig. 4.)

There you have it! It couldn't be much easier. The unit measures 7 inches by 19 inches by 18.5 inches and will fit on a good sturdy operating table. The blower might be a bit noisy, but it's a small price to pay. From all reports, these units are fast disappearing from the Fair Radio warehouse in Ohio, and although I'm sure they have a large stock, it can't last forever. Note that a similar amplifier, designated type AM-6154, is also offered, but for more money. This unit, while offering similar performance at 144 MHz, will not cover 220 MHz. The AM-6155, while intended to operate on 220 MHz, will actually cover 144 MHz, provided that the internal cavity plunger is set to VHF. You'll need to experiment with the values of the shunt capacitors on the input, but a finished unit will behave as well as the 220 amplifier. Now there's no excuse for not working the 220-MHz tropo openings!

It would appear that grid-square mania has caught up with us all. The past ARRL September VHF QSO Party featured more stations operating portable than I can recall in a long time. Some went out of their way to put such rare grids as FN 51 in Cape Cod on the air on 144, 220, 432, and 1296 MHz. Other operations surfaced from EM 85, (Tennessee/North Carolina border), FM 08 (West Virginia), and FN 25 (Quebec). Conditions were generally mediocre, except for some sporadic openings on tropo on 432 and 1296 MHz, and a fairly good tropo opening on 144 MHz Sunday night towards the end of the contest. What a far cry from last September, when the storm lashing South and North Carolina created such intense tropo conditions that stations in Massachusetts worked Georgia on 1296 MHz! Such conditions are not likely to be seen again for a while.

As I write this, Hurricane Gloria is churning up the Atlantic Coast; she will be a memory (unpleasant for some readers, no doubt) by the time you read this. It will be interesting to see if a storm of this magnitude—Level 4, approaching 5—will create major disturbances in propagation on the higher UHF bands. Perhaps the Massachusetts-Georgia path will open again. There is certainly going to be unusual propagation observed on 144 MHz as a result of the storm, no matter where it comes ashore.

Incidentally, one easy way to set up a "beacon" monitor is to get ahold of a rudimentary secondhand television with UHF coverage and pick a station about 50–100 air miles from your QTH. Fasten a UHF high-gain antenna to your tower or mast in a fixed position towards that station. During periods of possible enhanced propagation, leave the set on while operating other bands or working around the house. You can be tipped off by increasing signal strength from the distant station. For indications of openings on lower bands, select a station in the range of channels 11, 12, or 13 about the same distance away. Use the same method of fixing a beam to your mast. Try to use a narrowband beam, and if necessary, make one. A 220 beam will do the trick if needed. You don't need to see the picture, just hear the audio. For that matter, a radio receiver with TV sound would be adequate.

Let's wrap up this column and our discussion of 220 by publishing a circuit for a dual-gate GaAsFET preamplifier for 220, courtesy of Kent Britain WA5VJB and *220 Notes* for August, 1985. The TI S-3030 is a relatively new device but should be available shortly. It is claimed to have 25 to 27 dB of gain with a noise figure of .5 to .7 dB. Impressive! See Fig. 5.

Coil specifications are as follows: L1, 5 turns, 3/16" diameter. L2 is identical but tapped at 1-1/2 turns from the feedthrough-capacitor end. C2 is a 10-pF trimmer. The entire unit can be assembled on a piece of G10 board with the foil side *up* using standoffs, feedthroughs, and piston trimmers to support the components. One thing to remember is that GaAsFETs are susceptible to high rf fields! It's best to use some sort of sequencing device and make sure that the power to the preamp and relay drop out before the 220 transmitter and amplifier are energized, otherwise you'll have a barbecued GaAsFET. A simple way to avoid this problem is to use two feedlines—one on transmit and one on receive—and employ a tower-mounted SPDT relay, such as a Dow Key or similar model. The relay should be energized in the receive mode and de-energized in the transmit mode. This will ensure that your investment in a good preamp survives your operation habits. One additional benefit of this method is that when you shut your station down, the mast-mounted preamp is taken out of the line, so that lightning or other hostile forces of nature don't send the preamplifier to an early grave.

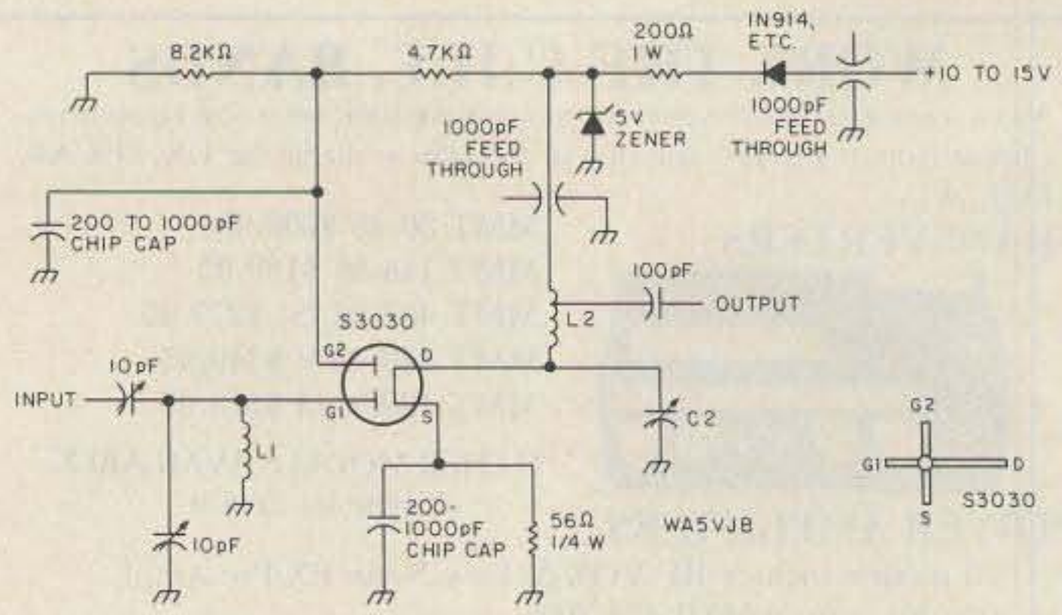


Fig. 5. A 220-MHz preamp using a TI S-3030 GaAsFET (courtesy of 220 Notes).

A typical noise figure for a 220 receive converter or transverter is likely to be about 2 dB or so. Using the GaAsFET on the tower may be worthwhile if your feedline run is 50 feet or more. Note that your S-meter readings will now be out of whack, as the idling receiver noise level might go as high as S7 or S9! A good way to correct for this is to obtain an in-line 10- or 20-dB attenuator good for UHF and microwave frequencies. I use two of them in my station: one at the receiver i-f output from my 432-MHz Microwave Module, correcting the S-meter readings back to S2 on receive when no signal is present, and one at the output of a 220-MHz MOSFET preamplifier to prevent overdriving the rf amplifier in my 220-MHz Microwave Module. Failure to add such a pad led to all kinds of intermod whenever I was beaming east towards New York City and channel 13.

These pads are easy to obtain. I bought five for 10 dollars from a local surplus house, and they are silver-plated with a female BNC connector at one end and a male BNC at the other. They show up at flea markets as well and can be useful for a variety of applications. One of the best applications is reducing the drive from a low-band exciter (such as the Kenwood TS-430S) to the associated transverter, cutting the output from 10 Watts to about 1 Watt. This is necessary when using a tetrode grid-driven amplifier. Don't put the attenuator at the output of the 10-Watt exciter or you'll blow it up. These devices are only rated for about 100 milliwatts or so of power dissipation.

Thanks to Dale Clement AF1T for his notes on converting the AM-6155. Thanks also to *220 Notes* for the preamp circuit.

CORRECTIONS

A few gremlins crept into OA4KO's article, "Toss Out Your Tubes," which appeared in the November, 1985, issue of *73*.

In Figs. 1 and 7, capacitors marked nF should be marked pF. Variable capacitors C1, C4, C6, and C12 are 1–8 pF. In Fig. 7, C7 is 500 pF.

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye." and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I have a Radio Shack PC-2 computer with a cassette interface, printer, and RS-232C interface. Can someone give me advice on how to use this computer for RTTY or as a code reader? My HF rig is an ICOM IC-745.

Ron Frank K3WJL
1660 Sturbridge Drive
Sewickley PA 15143
(412)-366-6063 evenings

I'm looking for information about an IT805/GRC panadapter.

Jim Ashworth K4DSJ
Route 2, Box 218
Chunchula AL 36521

I need a manual for an Ampex SP-300 instrumentation recorder and an original R-390A manual. I'm also looking for an R-389, and I have R-392 parts available for just shipping charges (sorry, no tubes!).

Terry O'Laughlin WB9GVB
169 Ohio Avenue
Madison WI 53704

I am looking for schematics or a service manual for an HP AN/USN-105A oscilloscope.

J. Crockett
Route 2, Box 143
Walla Walla WA 99362

I need a schematic diagram or service manual for an Okidata Microline 82A printer.

Marvin Moss W4UXJ
Box 28601
Atlanta GA 30358

I need schematics and service information for a BC-1068 and a BC-1068/A receiver.

Elizabeth Sheehan
PO Box 246
Pembroke MA 02359

Does anyone have any ham-radio programs for the Hewlett Packard HP87 or HP75 computer?

Dr. Len Fishman KC2EW
305 Halton Rd.
Dewitt NY 13224

I need service information and a schematic for an FDK 750-A 2-meter all-mode, made by Fuku Yama Electronics Co. Ltd.

Mark Edwards N8EGJ
3204 Walnut Street
Port Huron MI 48060

I'm looking for a set of relays for a Swan 1011, a manual for a Tempo S-1 HT, and accessories for a Kenwood TS-520.

Tony Byrum KA0VFN
2009 West 5th
Ottumwa IA 52501

I am looking for information on using an Apple II+ to receive weather facsimile.

De Alcorn KA6COE
741 East Grandview Ave.
Sierra Madre CA 91024

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

This is a crazy month. On the one hand, I have been planning the content of this month's column for months; we have been taking a look at the material you all have sent in about various computer RTTY programs. On the other hand, kind of a tradition has arisen with the December issue where we take a walk through the marketplace, so to speak. Then again, *73* blew my mind with the Silver Anniversary issue.

My sincere thanks to each and every one of you who named me, and I suppose this column, for the Silver Eagle award. To be so chosen means quite a bit to me and certainly speaks to the readership of this column, which many of you tell me is the first thing you turn to when your issue of *73* arrives in the mail. Then again, it is kind of startling to realize that this magazine has been published two more years than Johnny Carson has been on "The Tonight Show"!

Well, this month let's see what all of you Commodore users had to say. Now, I know that I am going to catch some flack for this, but I will look at both VIC-20 and C-64 programs together this month. From the letters I have received, it appears that many of you who are using one of these machines have used the other, also. Therefore, lumping seems appropriate.

I want to apologize ahead of time for not having some of the manufacturers' addresses this month. It seems that some of these folks do not advertise where I read, nor did the amateurs using the programs send in any specific information. So, some of what I pass along will be essentially all that I received.

Jerry Weihrauch KØHZI, in St. Paul, Minnesota, is using a C-64 computer with a RAK Electronics program. He states that it is very easy to use and that he was able to interface it to a DT-600 demodulator with an inverter chip and transistor. Sounds straightforward, and Jerry is happy with the setup.

By far, though, the great bulk of you seem to be using a select few RTTY programs. In no particular order, let's see what some of you have to offer up.

Kantronics, a company whose name I should have in a one-key macro on my word processor, puts out a program called Hamtext for the Commodore computers. One of you felt that "the Hamtext package is absolutely first rate. [Don't] bother with Hamsoft at all, for it pales by comparison. Hamtext features ten message buffers that can be any size, a type-ahead transmit buffer that defaults to 256 bytes but can be set to any size, automatic insertion of the time of day, automatic return to receive, and diddle mode.

"The sense of the RTTY signal can be inverted on both transmit and receive, independently. Auto CR and auto LF can be enabled or disabled. The software will also transmit text files directly from disk or tape. The buffer area is partitioned among the message buffer, the transmit buffer, and whatever is left over is given to the holding buffer which stores all transmitted and received text on a FIFO basis.

"On the C-64 approximately 30K of buffer is available, and approximately 3K on an unexpanded VIC-20. As an added bonus, Hamtext on the C-64 generates, with the internal C-64 sound chip, RTTY tones which are very close to the 2125- and 2295-Hz standard frequencies. Hamtext on the VIC-20 also generates tones, but because of the limited frequency resolution of the VIC sound chip, the tones are *not* suitable."

Another of you, also using this sofware, relates that in using the VIC, "the worst feature of the VIC for RTTY is that it cannot save to disk or tape while copying. This means that at least 16K of added memory is highly desirable to allow adequate receive buffer."

All is not golden, however, as one of you wrote, "the Hamtext plug-in module I trash-canned after the linear amplifier erased the ROMs. It had no shielding whatever." Oh, well.

Microlog's AIR-1 is another RTTY interface many of you have had experience with. One of you says that "the AIR-1 is a fine piece of equipment. It has a lot of desirable features; it is easy to operate and does not require a tape or disk drive to load. All in all it performs well. I do have one major complaint, and therein lies my problem.

"The AIR-1 is noisy. At least it is when used with my rig. When I turn on the C-64 without the AIR-1 installed there is a very slight increase in background noise. The noise is barely perceptible and does not cause the S needle to move. However, when I have the AIR-1 cartridge in place and turn on the computer, the S needle jumps between 1 and 2 units. It is really noisy! I have tried any number of things including .001-uF caps on all connectors and passing the shielded cable through a toroid coil. Nothing has had a significant impact on the self-generated noise.

"The end result of the noise is that I cannot work the weaker stations. That is not serious, just frustrating."

Of course, those long lists of ice-cream flavors are there because we all have different tastes, and the same goes for RTTY terminal programs. Another of you liked the AIR-1, and added that although it did not come equipped for transmitting 850-Hz shift, Microlog was very helpful in making the modification.

And then there's the AEA CP-1. You see, there again the opinions fly. Another helpful company is credited with adapting this device to transmit the 850-Hz signal (required by some services) that it does not normally transmit. On the noise front, the affected station noted that "there was none of the self-generated noise. It was quiet. What a pleasure to use."

In general, it would appear that all of these units provide a good interface for the ham wanting to put his VIC-20 or C-64 on RTTY. Each has features and options that make it slightly different. If you look around, you can find folks boosting or burying each of them. Good luck, and I will keep you posted on whatever else I hear here.

My thanks to all the others who sent in information on their systems: David Reasoner N4KTY, in Huntsville, Alabama, Billy Nielsen WB4APC, in Radcliff, Kentucky, Cdr. William Radican N7CAD/KA2WR, and Robert Smits VE7EMD, in British Columbia. Always appreciated, folks.

Okay, get your walking gloves on as your fingers stroll along *73* Boulevard, the finest shopping district this side of Radio Row. If you don't get that reference, look up someone in QCWA and ask for an interpretation. Once again, it is time for our annual search for the RTTY goodies on sale in the pages of the October issue of *73*.

We are going to ignore transceivers and the like (although I know that you need those for RTTY, too) and just look for RTTY-specific manufacturers and dealers. We hit paydirt on page 8, with an ad from ege, inc., featuring many of the RTTY packages mentioned above. They have the cryptic "CALL" for some items instead of a price, so maybe you can haggle. Try their toll-free number, 1-800-336-4799, and take a shot.

Page 25 features an ad from Microlog showing their AIR-1 mentioned above. I should note that Microlog moved some time back, so some letters or the like may have been lost in the shuffle. Anyway, tell them that "RTTY Loop" sent you when you call or write them if you are interested in the AIR-1 or any other of their products. Their address is 18713 Mooney Drive, Gaithersburg MD 20879.

Buried in the Barry Electronics Corp. ad on page 43 is mention of all of those RTTY interfaces again. Still no prices, though. Hmm, this could be interesting if you're in the market. Drop them a note at 512 Broadway, New York NY 10012, and see what turns up.

Another one of our manufacturers, AEA, features their new CP-100 interface on page 55. Featuring all kinds of shifts, baud rates, and features, it looks like quite a little package. Anybody using one yet? AEA can be reached at PO Box C-2160, Lynnwood WA 98036. No, I don't know how they can do all that manufacturing in a post-office box, either.

A surplus dealer, H&R Corporation, features a cabinet for a Model 28 KSR Teletype® in the ad on page 59. Cheap, yet. I have no idea who would want one, perhaps one whose presently-owned one is all scarred up, but they might have other goodies. I guess a note to them at 401 E. Erie Avenue, Philadelphia PA 19134, might pry loose a "free catalog."

The Martin Company, operating out of another post-office box, advertises a box meant for TRS-80 Model III/4 RTTY on page 60. To date, no one has written that they are using this thing, but if you're interested, they are at PO Box 982, Marysville WA 98270.

Hey, AEA has another ad on page 87 (this one a whole page) to tell you about their ATU-1000 Advanced Terminal Unit. Enough features to knock your socks off—I guess, at a price to match! If you need this level of equipment, at least the ad looks good, and I am sure that AEA would be delighted to inundate you with information. Send a note to the same post-office box mentioned above.

Let's not forget MFJ, whose three-page ad appears from pages 91 through 93. There's plenty of interest to the RTTYer in this ad, including their MFJ-1224 RTTY interface. They have a toll-free number to call, 1-800-647-1800; give it a try.

Finally, Kantronics is showing their new Universal Terminal Unit in their ad on page 95. Another of the high-class new demodulators now available, this one may be just what you're looking for. I should think that a letter to 1202 E. 23rd Street, Lawrence KS 66046, should produce some results.

Well, more and more, I am impressed by the number of manufacturers catering to the growing RTTY market. Be sure, folks, when you contact these advertisers, that you tell them that you saw mention of their products in *73*'s "RTTY Loop." That is important to us—and to them, so that they can tell where that valuable advertising dollar is reaching the most readers.

I have received several pictures of RTTY shacks worldwide. Would you be interested in a "Shack of the Month" or some such? No contest, no awards, nothing like that, just a chance to see another ham's setup on a semi-regular basis. Let me know. If there is some interest, we will put it in.

I have been busy between the mail at the above address and CompuServe (75036,2501). If you are waiting for a response and too much time in your view has gone by, don't be shy. Drop me another note and tell me so. I do get behind now and then.

Next month we will look at a computer that has had its share of ups and downs. At one time there were a half-dozen magazines devoted to this computer. As I write this, I learn of the demise of the next-to-last one, which will merge with a sister publication soon. I do not think this reflects on the computer but on the publishing industry. Oh, which computer? If you haven't guessed yet, I'm not going to spill it. Just be sure not to miss next month's column.

LETTERS

QUALITY, NOT QUANTITY

I am not a ham, but I am working on it. My wish is to make my first "sked" with my father, W4HBK, on Christmas Eve.

In reference to Mr. Monte Stark KU7Y's letter in the June, 1985, issue of *73*, I have to agree with him on keeping the Morse-code portion of the amateur-radio license test. With Morse code as a way of separating the truly interested people from the "slobs" on the street, it can only mean a more quality person will be operating the *ham* bands, instead of some ex-CBer who could care less whose QSO he is interfering with.

Now I realize that there are "slob" types in the amateur field also, but how would you feel if the ham bands sounded like profane channel 19? How would you feel having one of those loudmouthed, no brained, toilet-tongued individuals polluting the airways while you are trying to instruct your wife or your children on proper procedures and radio etiquette?

Being the holder of a Restricted Radiotelephone Operator's Permit and being able to operate on the HF, VHF, and 26.626-MHz frequencies of the Civil Air Patrol has taught me to be a more proficient radio operator, and I appreciate the "clean airways" of the CAP. So those of you out there in amateur-radio country should sit back and reevaluate the goodness in keeping Morse code and the laziness of those who do not wish to learn it. Just because it works for other countries to have a no-code license does not necessarily mean it will work here in the States. As for *73*, well you guys keep up the good work. I truly enjoy my personal copy each month.

From a future Novice to all you old-timers, God Bless.

John E. Everest RR-387
Dugway UT

WAKE UP

We are in sorry shape, I fear. A casual chat with our Section Manager revealed that many amateurs in Nebraska are against the ARRL enhanced Novice privileges proposal, some adamantly so. If this is true throughout the US, I think we have big problems in that I believe this is just the attitude that will be the death of our hobby. Look at the numbers on page 9 of the August, 1985, *QST*. The numbers are *still* not in our favor.

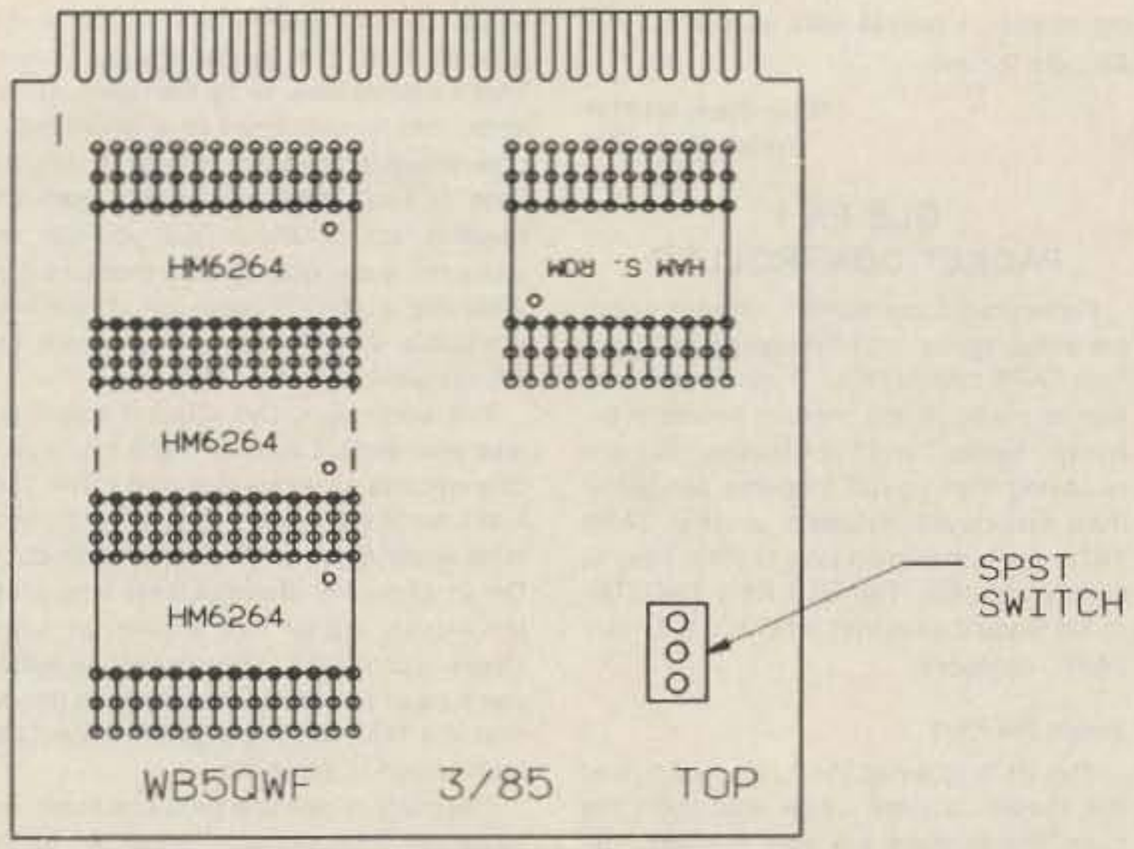
One of the favorite arguments seems to be that the bands are crowded enough already. Oh, really? Has anyone tried operating the HF bands mid-morning on a weekday? People who work nights should be made a target of our efforts if there is a general feeling that the bands are too crowded. The bands certainly are not overpopulated most weekdays.

Some repeater operators are concerned about losing 220 MHz to Novices because they may have to find new territory for their control links. Yes, there are lots of repeaters. . .probably more than we need in many areas, although not in Nebraska. But if they could take away band privileges by state, they could easily revoke 220 here since the control links wouldn't even occupy a space of several kHz, let alone five MHz. We are not going to keep the band if we just use it for control links. We must get more people on the band one way or another. A space can be reserved for the control links by band plan, as is done now. Novices can respect band plans, too: They must on the HF bands and do.

As one who acquired Novice privileges when phone operation was permitted on 2 meters, I see no problem in once again permitting Novices to operate phone. This, as has been stated in League literature on the subject, is even less of a problem now since the Novice license is renewable. During my term as a Novice, the phone privileges were taken away. I have often wondered whether this is a contributing factor to the seemingly low number of hams who are my own age (32) or who were licensed about that time (1966).

It's time to wake up, folks. There will still be plenty of room for those of us who like to tinker and prefer CW and SSB ragchews. But we have a dual problem: Lack of population on the ham frequencies will lead to their loss and ultimately to the loss of the hobby; the lack of population will become worse if would-be newcomers are not interested in joining our ranks. This is the only real stab at a solution yet proposed and it appears to be one which has been given much forethought. Hams spoke out against no-code. Here is a compromise. Let's put away petty differences and get behind it for the continuance of our hobby.

Michael S. Lennen KD0EV
Omaha NE



Switchable Hamsoft for your VIC-20. Note that the middle HM6264 is located on the reverse side of the board.

FLICK YOUR VIC

You might be interested in knowing that the VIC-20 memory expansion ("VIC RAMification: Part I," January, 1985) described in *73* can live in the same board and share expansion-port contacts with a ROM.

I bought my VIC to use as a RTTY machine and vowed not to get hooked on the computer capabilities, but I didn't like having to pull my Hamsoft ROM pack out of the expansion port to return to normal computer operation. I soon learned that I could turn off Hamsoft by applying +5 V to pin 18 of the 2732 EPROM, and I installed a switch to turn it off and on.

I laid out a board with two HM6264s and the Hamsoft memory on top and one HM6264 on the bottom, so they could share connections. I made a list of Hamsoft connections by tracing out the original board. A single-pole, single-throw switch was mounted on the board to select either the memory or the amateur program. To turn the memory on, +5 V is applied both to pin 18 of the 2732 and to pin 26 on each of the HM6264s. When Hamsoft is on, 2732 pin 18 floats rather than being grounded.

Andy Pickens WB5QWF
San Antonio TX

PROVE IT, PACKET

I've been reading about and listening to discussions on packet radio. Some seem to want to believe that it'll replace RTTY/AMTOR/CW/ASCII on all bands.

At a hamfest, one proponent of packet advised all those attending to "Get rid of your CW/RTTY/AMTOR gear now; by the end of the year packet will be the only mode used on those subbands, and you won't be able to even give away that other stuff." How he was able to say that with a straight face was rather amazing.

Personally, I don't believe packet will ever replace CW/RTTY/AMTOR, though it might have some uses; unless prices come down, it will remain as satellite communications has, strictly a rich ham's toy.

After all, why pay $500 and up for an interface capable of only one thing, when for half of that you can get an interface usable on four modes? It makes absolutely no sense.

At the same hamfest, another packet proponent declared, "Packet interfaces will be below $200 by the end of the year!", but he carefully failed to specify *which* year this miracle will happen.

As to packet being "error-free," I seriously doubt that it is, or will be, even on 2 meters and above. Remember—AMTOR was claimed to be absolutely error-free and I think that was proven wrong later on.

Another thing that's overlooked is the bandwidth used by packet. At 25 wpm, CW is about 100 cycles in width. So at 300 baud, packet is about 1200 cycles in width. And, at the speed packet keys a transmitter, wear on the relays is severe.

If, and it's a huge if, packet can be made affordable to the average ham, it may survive, but as long as it remains as it is now, a rich ham's toy, then it won't have much chance of survival. How many readers remember "narrowband voice modulation (NBVM)," which was supposed to do away with SSB around 1978? Unless something happens, packet will go the same way.

Getting back to satellites for a moment: It's always amused me to read that it only takes about 200 Watts erp to access OSCAR 10. If that's so, how come whenever you see photos of a station's antennas they're always running 25- or 30-foot dishes or stacked 12-over-12 arrays?

Gary Payne KE6CZ
Fresno CA

DISK DOPE

I read your article concerning diskettes ("Give Your Disks a Physical," October, 1985) and wholeheartedly agree with your observations. The best diskettes that I have seen through the microscope are Maxell. They have the smoothest surfaces and the best lubricant. 3M appears to be a middle-of-the-road product as far as surface quality is concerned. Verbatim is nothing more than 3M quality. Dysan appears to be the same thing as 3M but with a better polish. I confirmed that the Dysan raw material is in fact procured from 3M. Some of the bargain diskettes tend to vary greatly from box to box and, in fact, from disk to disk. The old adage, "You get what you pay for," is certainly true with diskettes. Very good article.

Bob Hill W4NIM
Cedar Rapids IA

REVIEW

HY-GAIN 205B-S ANTENNA

If there's one thing you soon realize after making your first contacts on VHF, it's the need for some kind of gain antenna. It can be a collinear, a 5/8-wave, an extended J, or a zepp, but whatever the choice, the message is clear: Unity-gain antennas are fine for local or repeater work, but they won't cut it for weak-signal or long-haul FM simplex.

One of the classic solutions to this problem is the yagi or beam antenna. With this type of antenna, a resonant dipole is used on a common boom with several parasitic elements which take the dipole's signal and direct it toward the station you wish to transmit to. The parasitic elements essentially take the signal from the dipole and combine it into a "beam" of radio-frequency energy so that rather than radiating and losing energy in two broad lobes, that extra rf is collected and used efficiently in one direction.

Enter the Telex Hy-Gain 205B-S five-element, 2-meter beam. It is an antenna which should prove valuable in FM-simplex as well as repeater work. It also provides a noticeable increase in system efficiency when you move from your vertically-polarized, unity-gain VHF antenna. Suddenly, signals which were hash are readable, and distant repeaters which were barely there are a solid S3.

To be certain, the 205B-S isn't the world's highest gain VHF antenna. Although it boasts a respectable gain (9 dB), there are specialized 11- or 15-element antennas with reflector arrays which have far more gain. Still, for the average FM operator this antenna should be more than enough.

When you first open the 205B-S box, the first thing you notice is its size. The boom is 75 inches long, which is quite a bit for an end-mounted antenna. You also notice the quality of the materials used. Although the boom and antenna elements are aluminum, the rest of the antenna parts are stainless steel, which should ensure long life. It will also make this antenna virtually maintenance free.

Assembly of this antenna is quick, thanks to the quality of the instructions. Although the written instructions are quite cryptic, Telex Hy-Gain uses very detailed exploded views of each section of the antenna, and just by using those views you'll have no trouble putting the whole thing together. It took less than an hour at N1BLH to have it assembled and ready for checkout.

About the most troublesome part of the assembly process is the beta match. You see, rather than using a gamma match to bring the antenna into resonance with 50-Ohm coaxial cable, Telex Hy-Gain uses a beta match and coaxial matching transformer. Actually a folded dipole, the driven element presents a basic impedance of 200 Ohms, which must be transformed to 50 Ohms. The coaxial balun handles this. If you can find 200-Ohm transmission line, you can feed this antenna directly, but you'll still need some kind of matching device to keep your rig happy.

To assemble this matching system (after you've assembled the dipole), you must first place the U-shaped beta rod on the dipole's elements. Then tighten it to the boom with a small clip and self-tapping sheet-metal screw. When this is

done, you then take the balun and attach it to the beta rod. You then attach your coax directly.

I know this sounds simple, and it is fairly straightforward, but like many straight roads in life, this one has some curves. First, there is no provision for an SO-239 female connector. You must attach the shield and center conductor to the same studs as the transformer assembly. I found the best way to handle this was by attaching solder lugs to the shield and center conductor, as Hy-Gain has done with its balun. When this setup is finished, you are advised to weatherproof the entire assembly. Using a lacquer such as Krylon will make short work of this.

This weatherproofing is mandatory. If you ignore it you'll soon find the performance of this antenna going downhill because your coax will fill up with water. I used cable putty to handle this just to have the ability to quickly disassemble things if I had to.

And, although this method of matching an antenna is quite functional, it would be far easier using the gamma match which is favored by other manufacturers. Beta matching is especially limiting if you must take the antenna apart later on.

The rest of the assembly involves little more than sliding the antenna elements through eyebolts that are inserted in the boom and tightening them down. You must measure the elements to determine their proper position so the lengths are correct. But this is little trouble.

As I noted earlier, the boom seemed huge when compared to the four-element beam I have run at N1BLH. Where the former beam was spaced for optimum gain on a short boom (about 40 inches) with little thought given to optimizing the front-to-back ratio, the 205B-S uses spacing which both optimizes gain and front-to-back ratio. Spacing was about .2 wavelengths. My tests showed the antenna had about 18 to 20 dB of front-to-back ratio, so that most of the energy was concentrated in the direction in which the antenna was pointed.

Further testing showed that this is a broadbanded antenna. As I checked vswr readings, I found that the curve I had drawn nearly matched the one in Hy-Gain's literature. The best-case vswr was 1:1 at 146 MHz and the worst-case was 1.5:1 as I neared the band edges. The match was good for my normal FM operating frequencies at the upper end of the 2-meter band. However, since it was so broadbanded, I was easily able to move to the other end of the band for some weak-signal SSB and CW work.

And, when I checked the antenna's gain with another station about five miles away, I received a signal report of S9 + 40. I realize that the other station didn't have a laboratory-grade receiving meter, but the performance of the antenna was certainly impressive since I was only running 300 mW. It was even more impressive because the antenna was mounted on a temporary mast about 5 feet off the ground near some construction equipment.

Overall, I was favorably impressed with the antenna, with the exception of the matching system. I found it performed as advertised and it handled all the chores I called upon it to do.

A word to the wise for those contemplating this antenna: Be aware that although the antenna is lightweight, it still presents quite a load to the mast. Use a good 2-inch piece of steel pipe. In fact, the U-bolts supplied are meant for that size mast. The antenna can be mounted for either vertical or horizontal polarization.

So, for the operator looking for the step into the world of gain antennas, look at the 205B-S. It should work as well for you as it did for me.

Marc Stern N1BLH
Framingham MA

GLB PK-1 PACKET CONTROLLER

Packet-radio controllers offered today are of two types—"TAPR-compatible" and "not TAPR-compatible." A similar distinction is made in the modem industry between "Hayes" and "not Hayes." No one is saying that Hayes modems are better than non-Hayes modems, or that TAPR TNCs are better than non-TAPRs: They're simply different. The GLB PK-1 TNC (Terminal Node Controller) falls into the "not-TAPR" category.

Inside the PK-1

The PK-1 is small (5"×10½"×2"), and the reason is clear once you open the case. Inside there are only thirteen integrated circuits and about twice that many resistors, capacitors, and transistors. Compare that to the over 25 ICs and dozens of discrete components in the Heath HD-4040 (a TAPR clone).

The PK-1 uses a Z-80 microprocessor and the popular Exar 2206/2211 chip set as a modem. The board comes with 8K of ROM (read-only memory) and 4K RAM (random-access memory), and there are sockets provided for another 10K of RAM. With factory modification the PK-1 can handle byte-wide RAM, increasing the total memory to 64K (8K ROM and 56K RAM). I'll explain why this extra memory might be handy in a moment.

There are three external connections to the PK-1: two 10-pin edge-card connectors and a miniature phone jack for power (11 to 14 V dc at 200 mA). Power may also be applied to one of the edge-card connectors, P2, which takes care of the lines going to and from the transceiver. P1 (the other 10-pinner) handles the terminal interface. The front panel houses an on/off switch and a momentary-contact push-button for resetting the controller.

Interfacer

Connecting the PK-1 to your radio and computer is straightforward. You can buy ready-made cables from GLB or you can make your own at home. Either way, a word of caution is in order: P1 and P2 are identical plugs, and they are not keyed. Check them *twice* before you power up!

The interface from the PK-1 to your terminal is via a "modified" RS-232 protocol. I say modified because only one voltage rail is used; +12 V dc is a mark and 0 V dc is a space. Many popular interfaces use this method to simplify circuitry and cut the parts count, and it seems to work just fine. Four RS-232 lines are supported: TXD and RXD (data in and out), RTS (request to send), and CTS (clear to send). A spare line, pin 9, is connected to +5 V dc inside the GLB and can be used to power an optional RTTY interface board that allows you to attach your PK-1 to a standard Murray teleprinter.

Five signals go to and from your transceiver: receiver audio, transmitter audio, receiver squelch, push-to-talk, and ground. Audio levels to the PK-1 can be anywhere between 5 millivolts and 3 volts, and GLB recommends that you tap audio directly from the discriminator output. That's a good idea, since the result will be audio that has not been de-emphasized or otherwised processed. However, for the faint of heart (like me), audio from the speaker jack is OK. In fact, you can improve the audio quality from there a bit by installing a .001-uF capacitor in line with the audio wire. Transmit audio from the PK-1 is about 1 volt.

You won't need the squelch signal unless your packet activity takes place on a channel shared with voice users. The TNC looks for the presence of a tone to determine whether or not the frequency is busy. On an all-packet channel there's no problem—every signal has a tone. In some cases, such as a voice/packet repeater, you'll need to hook up the squelch line so that the TNC will know when voice communication is going on.

The push-to-talk line switches to ground when the transmitter is keyed. All of the rigs I've worked with use this convention, as does most of the gear around these days.

Operation

There's no denying it. The PK-1 takes some getting used to. The reason that the chip count is so low is that GLB has implemented in software what most designs do in hardware. This means that the processor is kept extremely busy—so busy, in fact, that a separation must be made between sending and receiving packets. You must enter and edit your text off-line, then input it into the PK-1. And the PK-1 won't display incoming packets until you tell it to. You might think that this would be awkward (and I must admit that I did at first), but it isn't. After using the system for a short time, you become familiar with the commands and techniques and it is as easy as anything else you've had to learn.

Connecting to another station is done as a series of steps. First, your station call must be entered using the SC command (if you specify your callsign when you order your PK-1, it will be permanently stored in the ROM). Next, set the destination-station call using the SD command. You can specify a digipeated route using SV. Finally, entering AC (automatic connect) will send a connect request to the station specified by SD, using the route described by SV. Once conversion is established, the PK-1 enters a "chat" mode. And this is when the extra memory I mentioned before comes in handy.

Here's the reason that you need an off-line editor to type your text: The PK-1 cannot handle incoming text at the same time you are typing. Faced with the choice between the character coming from the keyboard and the packet coming over the air, the processor will save the character at the expense of the packet. After all, the packet will be repeated until it is correctly received. GLB mentions that you could simply stop typing when you hear an incoming packet. That may work in some places, but here in New England the local channel is busy all day and all night—and my packets don't sound any different than anyone else's. Besides, who wants to listen to *BRRRAAAPPP-GGRRAKK* all of the time?

The solution, then, is to assemble your text off-line and let the PK-1 store incoming packets until you are ready to see them. GLB even has a program to do it, called CPK, which they can supply for a variety of computers. I've also seen several programs posted on the local PBBSs (packet bulletin boards). Incoming packets are stored in a buffer until you call for them. Buffer means memory, and you get 4K of it with the PK-1. The system uses 2–3K for packet storage, and this seemed to be plenty for casual conversations. If you plan any long missives or are one of those people who measures social status by the K, by all means fill up the available space in the PK-1 with RAM.

Digipeating

This is a thing that the PK-1 does *extremely* well. Like any TNC, it can digipeat packets, but the PK-1's design makes it very well suited to remote operation. This means that you can put this board up on a mountain or a tower and just leave it there. All that's required is to pull the PK-1's data-in line high. In this mode, no terminal is connected to the TNC—programming is done by connecting via packet radio. You can turn the digipeater on and off, change parameters, display the system's status, or whatever else you might want to do just as if the machine were sitting in front of you.

A "watchdog" circuit is available from GLB for use in remote digipeaters. The circuit monitors a square-wave output by the processor. If this signal is not present for 20 seconds, the watchdog will reset the PK-1, which automatically comes up in the unattended-repeater mode. This is an exceptionally good thing to have. The module doesn't cost very much and is guaranteed to save you a lot of grief!

Final Thoughts

Overall I was impressed with the GLB PK-1. At first I was intimidated by the sheer number of commands (81), but you really only use a handful of them. The rest are interesting to play with, and you can learn a great deal about data transmission just by fiddling with the various parameters and looking at the results. Using an editor to prepare text also raised my eyebrows until I tried it. I can't say that I love doing it, but I can say that I don't notice it any longer.

The documentation is more than adequate. Separate sections deal with computer interfacing and on-line operation, providing a quick "cookbook" description of how to get the PK-1 on the air. Once things are hooked up and running, you can turn to the extensive command descriptions to learn more than you ever wanted to know about how the PK-1 works. Everything is explained in easy-to-understand terms and nothing is assumed. A *very* nice touch is a command reference chart printed on the back cover of the manual, which lists commands by function. I copied this chart with a photocopier set for reduction and pasted the now-tiny aid next to the CRT of my Xerox computer.

So there it is. If you're looking for a superb remote digipeater, try the PK-1. If it's an inexpensive way to get on packet that you want, try the PK-1 (it sells for $200 assembled). The engineers at GLB took a look at amateur packet radio and at the available TNCs on the market and came up with a design that is unlike any other. It took real guts to market a product that wasn't merely a copy of an already-popular unit, and their gamble has paid off with the PK-1.

If you want more information, contact *GLB Electronics, Inc., 151 Commerce Parkway, Buffalo NY 14224.*

Perry Donham KW1O
73 Staff

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73 Magazine*, Peterborough NH 03458.

Photo A. The SSB Electronics LT23S 1296-MHz transverter.

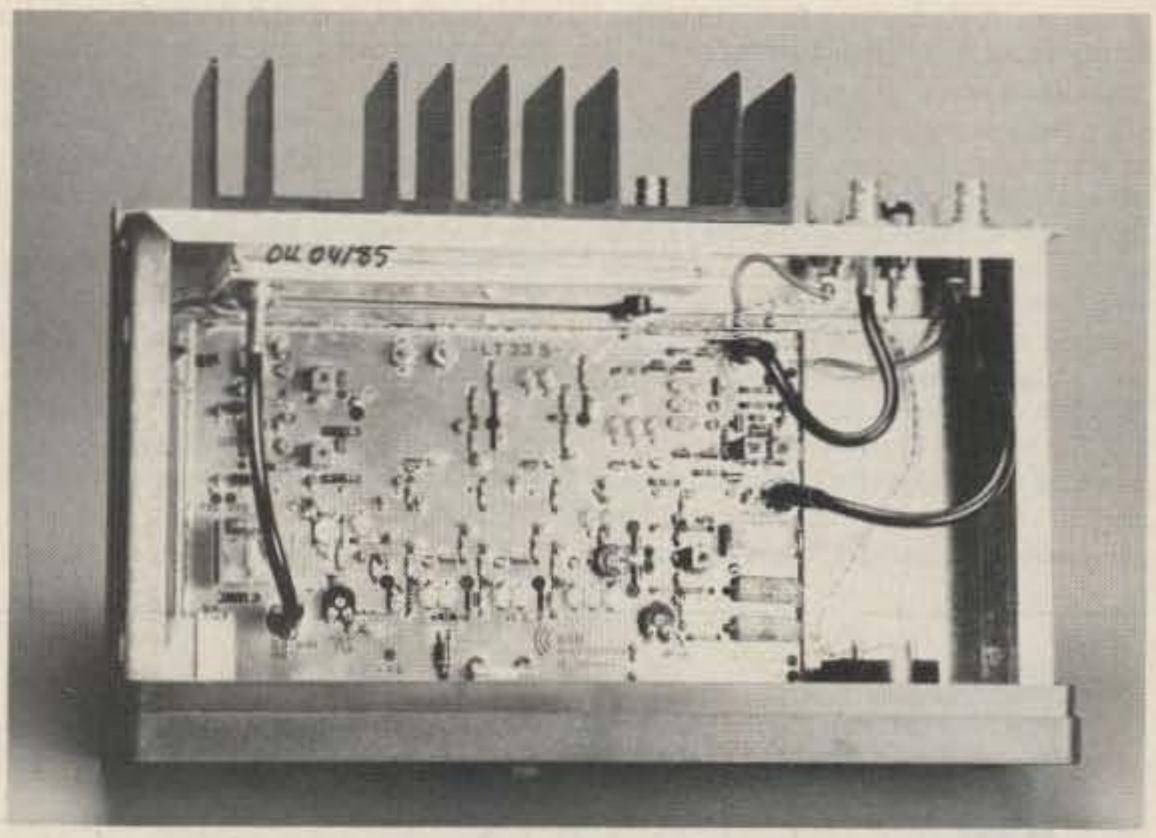


Photo B. Inside the LT23S (top view).

LT23S 1296 TRANSVERTER

The 1296-MHz amateur band, or 23 centimeters as it is frequently called, has long been a dark mystery to most amateurs. The logistics of getting something to oscillate at that frequency in a stable manner, as well as amplifying the resultant signal and modulating it, have served to discourage all but the most technically competent amateurs from ever operating on the band. Add the problems of designing a high-gain, low-noise front end, and the difficulties of getting all of this stuff to work with piles of interconnecting chassis and cables without a degree in electrical engineering, and you have the situation that existed not too many years ago on 23 cm.

With the advent of transverters using low-noise front ends and the reductions in chassis size made possible by solid-state circuits, 1296 began to be seriously considered by many UHF operators. There were still the problems with power, but even receivers with 5-dB noise figures could pull a weak, drifting CW signal out of the ether using a homemade disk constructed from chicken wire or door screening on an old TV antenna. Coffee-can feedhorns were the order of the day, and for the adventurous it was the loop yagi. A big step from the old days, but still not as convenient as a 144-MHz multimode transceiver.

Two developments have finally brought 23 cm down to earth for the casual operator: the Gallium Field Effect Transistor (GaAsFET) and new lines of high-gain (10–15-dB) power transistors for grounded-base operation at up to 3 GHz. It was inevitable that some manufacturer would marry the two in a high-performance 1296 transverter. What was surprising is that the manufacturer was from Germany—*not* Japan! Enter SSB Electronics of Iserlohn, West Germany, and the LT23S transverter.

At first glance, the LT23S is an attractive, functional piece of equipment. It measures 11¾" wide (30 cm) by 8¾" deep (22 cm) by 3¼" high (8 cm). The case is a hard aluminum shell with a plastic ring surrounding the front panel. A heat sink protrudes about 1¾" (4.5 cm) from the back panel.

The front panel contains the following controls: From the left, a switch selects either of two crystal i-f frequencies. The supplied crystal will downconvert the 1296–1298-MHz band to 144–146 MHz. Many serious contesters obtain a second crystal to shift the desired band segment up so that the conversion at two meters is now 146–148 MHz. This eliminates any possible feedthrough from strong nearby stations on 144 MHz during a contest. (In Europe, the two-meter allocation ends at 146 MHz, so shifting the conversion frequency up makes sense.) The formula for this crystal is detailed in the owner's manual.

Next is a transmit switch. This does exactly that and disables the receiver while setting the idling bias for the driver and final transistors. This function is paralleled by a rear-panel RCA-type phono jack. One merely grounds this jack and the unit goes into the transmit mode. The next switch is for power and controls the feed from the rear-panel dc connectors. Finally, there is a power meter that indicates output in Watts. On the rear panel, connections are made for input/output to a 144-MHz transceiver, 1296 receiver input from the antenna, and 1296 rf output (claimed 10 Watts across 50 Ohms). Three binding posts are supplied: dc input (13.8–14.5 volts dc), ground, and a second red post that supplies dc voltage in receive and cuts off while in transmit. This is to provide for a mast-mounted preamp if one is used.

All in all, the LT23S breaks new ground on 23 cm by offering the user a simple-to-use transverter. One merely adds an antenna relay, antenna, power, and multimode 144-MHz transceiver. The front end provides sufficient gain to work most signals encountered on the band, while the 10 Watts will carry a distance. That is, assuming the user has connected low-loss transmission line and a good gain antenna to the LT23S! Remember that conventional RG-8/U has about 10 dB of loss per 100 feet at this frequency, so something more along the lines of Belden 9913, ½" or even ⅞" hardline is in order. But having it all in one case instead of on 3 or 4 separate chassis with a myriad number of connecting cables can't be beat.

Now, on to the meat and potatoes of this review: How well does it work? The first LT23S sample made its way back from the VHF Shop in Pennsylvania as I was in the midst of frantically assembling a 432-MHz station for the Slide Mountain DXpedition (see the November, 1985, issue of *73*), and consequently it sat on the shelf for about 3 weeks until I was able to start making qualitative tests. One problem which surfaced immediately is that the on-board crystal oscillator drifted severely, to the tune of about 100–200 Hz per minute! This was unacceptable, and on-air tests with Tom Waldron KQ3R, the proprietor of the VHF Shop, convinced him that it was indeed galloping up the band.

Another unit was exchanged for the test unit and it, too, suffered from the same malady, and almost at the same rate! Subsequent conversations with the factory in Germany, Rick Connor WB2NPE, Ivars Lauzums KC2PX, and other LT23S users resulted in many solutions to the problem. Tom KQ3R suggested using a higher-grade crystal and said he will equip all models imported into the USA with crystals from International Crystal in Oklahoma. Rick WB2NPE suggested rounding the crystal case and shorting the unused crystal socket pins in the second oscillator together. Both mods worked, but the ultimate correction came via Ivars KC2PX through an unnamed amateur in Oklahoma, who removed the coupling capacitor from the unused oscillator to the first multiplier stage. *That* permanently fixed the problem, and I recommend to all LT23S owners the following modification:

The covers and inside board must be removed by loosening all screws around the case and panel on the front. This gives access to the underside of the mixer/i-f/switching board. Locate the 2.7-pF capacitor from the unused second oscillator and desolder it out of the circuit. Replace the cover and all will be well. Note that the supplied crystal is in channel 2, or "F2" as labeled on the front panel. The unit exhibits excellent stability (not measured) after this modification. Should you desire to use this oscillator again, merely replace the capacitor, or better yet, switch the crystal in the "F2" socket.

Photo B shows the main chassis layout. First-class workmanship is evident here. One unique feature of the LT23S is that unlike other transverters, you need not use an attenuator to cut down the drive from your multimode radio (assuming the maximum drive you are supplying is about 10 Watts). Two fixed-value resistors form a 50-Ohm, 10-Watt swamping network to "burn up" the excess power. For those using multimodes with adjustable output, I recommend turning the drive at 144 MHz all the way down to the minimum of 1 or 2 Watts. The swamping network will take care of the excess. A clearly marked potentiometer, "P IN," controls the drive level, and for your particular radio you should set this pot fully counterclockwise before applying drive. Carefully increase the sensitivity until the front-panel meter just about pins.

This brings us to a note regarding accuracy of that same meter: Using a Bird Model 43 wattmeter, 25-Watt 1.1–1.8-GHz slug, and Bird dry dummy load, the power measured when ten Watts was indicated on the LT23S was actually 8.5 Watts. This measurement was made using a 14-volt power supply, and when 10 Watts is actually measured on the Bird 43, the LT23S meter is pinned to the right. The sampling circuit in the LT23S uses an HP 2800 hot-carrier diode with a 50-Ohm terminated coupler. It's likely that the response of other 2800 diodes could vary all over the place, so it's not worth worrying about the accuracy of the meter. It is helpful as a relative output indicator, and if you are really a nitpicker, it could be recalibrated against a laboratory-standard wattmeter.

SSB recommends using a 14.5-volt supply for the transverter. How much of a difference does this make? With a 13.8-volt supply, maximum output was 7.5 Watts. At 14 volts, it was 8.2. And at 14.5 volts, it was indeed 10 Watts. That's how much! If you are using an external amplifier, the difference between 7.5 and 10 Watts might not cause much consternation, but if you plan on running the unit barefoot, crank the output on your supply up. Most commercially-made power supplies can easily be adjusted for higher output with an internal pot or zener between the regulator and ground.

The receiver front end was tested for noise figure using a Hewlett-Packard model 340A noise-figure meter. On this equipment, the noise figure turned out to be 2.0 dB. SSB claims 1.8 dB, so the measurements are close enough for government work, as they say, The HP-340A is about fifteen years ols and the discrepancy could exist there. It was not possible to measure the 1-dB compression point as only about −20 dBm of signal could be generated on the available test equipment. This is a very strong signal for 1296 and could be likened to working a station with about 1-kW erp about a half mile away, or closer. No detectable compression occurred at this point. Similar tests on other SSB 1296 preamps indicate the actual 1-dB compression point to be about 0 dB or slightly better, so I'll assume that is the case here.

Receiver conversion gain is specified at 24 dB. The measured value is 18 dB, which is adequate, but it would be nice to have the additional 6 dB or so, especially when using an older multimode or two-meter converter with a mediocre front end. In receive, the unit consumes 180 milliamps of current. When in standby, the value is 350 milliamps, and key down with 10 Watts it's 2.5 Amperes. So a small power supply of 3–4 Amps will do the job. Another note of caution: The final transistors, Phillips BLU99s, are *not* swr protected. Be careful not to abuse them by transmitting into suspect loads or unknown loads. They are not cheap to replace and not easy to come by. Under normal operation, an swr of 2:1 can be tolerated without difficulty.

Well! Enough of that. Let's shut off the signal generator, unhook the spectrum analyzer, and engage in some on-the-air tests. The LT23S performed admirably in the recent *CQ* WW VHF WPX contest,

where the NV6O/2 group netted 18 QSOs. In the ARRL September VHF QSO Party, 18 stations were also worked from this QTH. Reports were of exceptional linearity of the audio waveform, and listening to other LT23S users confirmed this. Speaking of which, it appears to be the hot setup around here in northern New Jersey, as nearly half of the stations I worked claimed to be using one! It doesn't take long for good news to spread, apparently. At KT2B, I use the LT23S to drive a single 3CX100, yielding about 70–80 Watts of output. This feeds 60 feet of $^{7}/_{8}$" Spiroline and then drives 4×23 F9FT 23-cm yagis. The previous setup, using a Microwave Modules 1296/144 and SSB PA2510 amplifier, worked well, but the receiver in the LT23S gets the edge, as the noise figure in the MMT 1296/144 is about 2.5 dB or so. One confusing aspect was learning to wire the antenna relay backwards—that is, energized in "Receive" and out in the "Transmit" position. I had to remember to leave the power switch on, otherwise the amplifier went into standby with an idling current of 45 mA. A modified Dow-Key relay did the trick. The modification consisted of replacing the UHF connectors with type N, since I lost 1.5 dB on transmit using the UHF type!

The exciter in both cases is a Kenwood TR-9000, which has a fairly good front end but can scan memories and change frequencies at a very rapid rate. When I heard activity on part of the band, I programmed it into memory and scanned until I heard a station I needed during the activity hours. The LT23S does not have rf-detected switching and must be hard-keyed through the RCA jack on the back. A foot switch takes care of the problem, or you can use a keying jack on your multimode if it's there. I installed an internal reed relay in the TR-9000 and that did the trick. This was the way to go on 1296 during the contests! I had a ball with the LT23S and have one very minor complaint. The earth (negative) connection on the rear panel suffers from a condition where it comes loose and floats. You'll try making a secure fit with the power supply leads and go crazy. Apparently the binding post comes loose inside, and substitution of a typcial American-made post cures that problem.

All in all, a nice piece of work from *SSB Electronics*. The LT23S sells in the $650 price class and the sole US importer is the *VHF Shop, 16 S. Mountain Boulevard, Mountaintop PA 18707.*

Peter Putman KT2B
Morris Plains NJ

NEW PRODUCTS

MIDIAN ELECTRONICS DTCS-1 AND BTD-1

Midian Electronics has introduced two products for mobile radio service, the DTCS-1 DTCSS encoder/decoder and the BTD-1 Burst Tone Decoder.

The DTCS-1 programmable DTCSS encoder/decoder is compatible with Digital Private Line™, Digital Channel Guard™, Digital Quiet Channel™, and Digital Call Guard™. The DTCS-1 employs the 84 standard digital codes plus additional nonstandard codes and uses a 134-Hz turnoff tone.

The BTD-1 Burst Tone Decoder features operation over a wide input range. After a burst is decoded, a 2400-Hz tone alerts the user. Momentary and latched outputs are provided which will drive a horn, a call light, or some other indicating device.

For more information about either of these Midian products, contact *Midian Electronics, Inc., 2302 East 22nd Street, Tucson AZ 85713.*

ANTENNA SPECIALISTS BROADBAND VHF AMP

Antenna Specialists' new model ASA-3102-25 VHF power amplifier provides 50–115 Watts of output from 5–35 Watts of input between 150 and 174 MHz without tuning. The amp incorporates a low-loss T/R relay and is fully protected from dc-polarity reversal and high vswr. The unit has been type-accepted under FCC Parts 81 and 90.

For complete specifications, contact *Antenna Specialists Company, PO Box 12370, Cleveland OH 44112-0370.*

BIRD CONNECTOR ADAPTER KIT

Bird Electronic Corporation now offers a kit of precision 50-Ohm adapters which allows interconnection between any combination of four popular rf connectors. Included in the kit are one male and one female UHF, BNC, and TNC connector, as well as two male and female N connectors. Five couplers are included so that five complete adapters can be assembled at one time.

For complete information about this kit, contact *Bird Electronic Corporation, 30303 Aurora Road, Cleveland OH 44139.*

GRIPMATE ENTERPRISES OFFERS EXTRA HANDS

A new product from Gripmate Enterprises solves the "not enough hands" problem for hobbyists. The Gripmate consists of a base, which is clamped to the work table, and four adjustable arms, each of which carries an alligator clip. Two extra arms provide a 2.5× magnifying glass and a magnet for special jobs.

More information is available from *Gripmate Enterprises, Inc., PO Box 6179, Arlington VA 22206-0168.*

AEA PAKRATT™ PK-64

Advanced Electronic Applications, Inc., has announced the model PK-64 packet, RTTY, AMTOR, and Morse communications system for the Commodore 64 and C-128.

The PK-64 features an on-screen tuning indicator, split-screen operation with status indicators, disk, cassette, and printer capabilities, ten message/command buffers, text editing with block moves, a 20K QSO buffer, and a keyboard-selectable HF or VHF modem with pre- and post-detection filtering for improved signal-to-noise performance. Text received in one mode may be retransmitted in any other mode.

Features specific to packet radio include a connect alarm, connection with up to ten stations simultaneously, a date and/or time stamp for incoming messages or connections, a user-generated message for automatic response to connections, and a hardware HDLC for full-duplex operation.

For more information, contact *Advanced Electronic Applications, Inc., PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.*

The Bird Rf Interseries Adapter Kit.

AMATEUR TESTCALM FROM TWIN OAKS

Amateur Testcalm is an anxiety-reducing audio cassette offered by Twin Oaks Associates. Developed by Dr. Thomas Linde KZ0T and Dr. Michael Whiddon, Amateur Testcalm is intended to increase a student's attention, concentration, and data recall. The student hears simultaneous verbal and non-verbal messages designed to reduce apprehension and stress during amateur licensing exams.

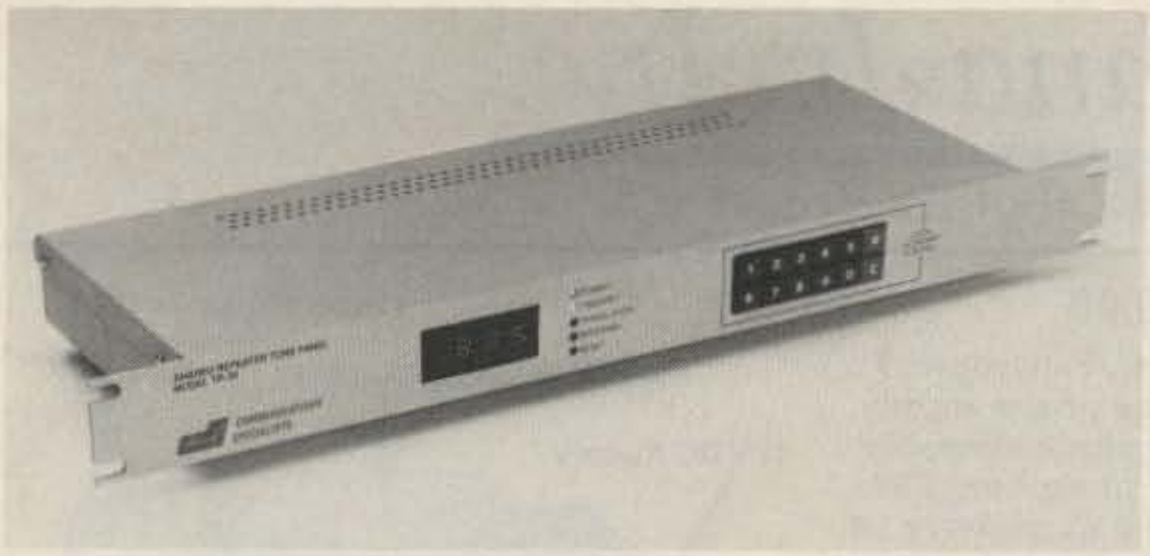
For more details, contact *Twin Oaks Associates, Rt. 5, Box 37, Knoxville IA 50138.*

TI ELECTRONICS REFERENCE BOOK

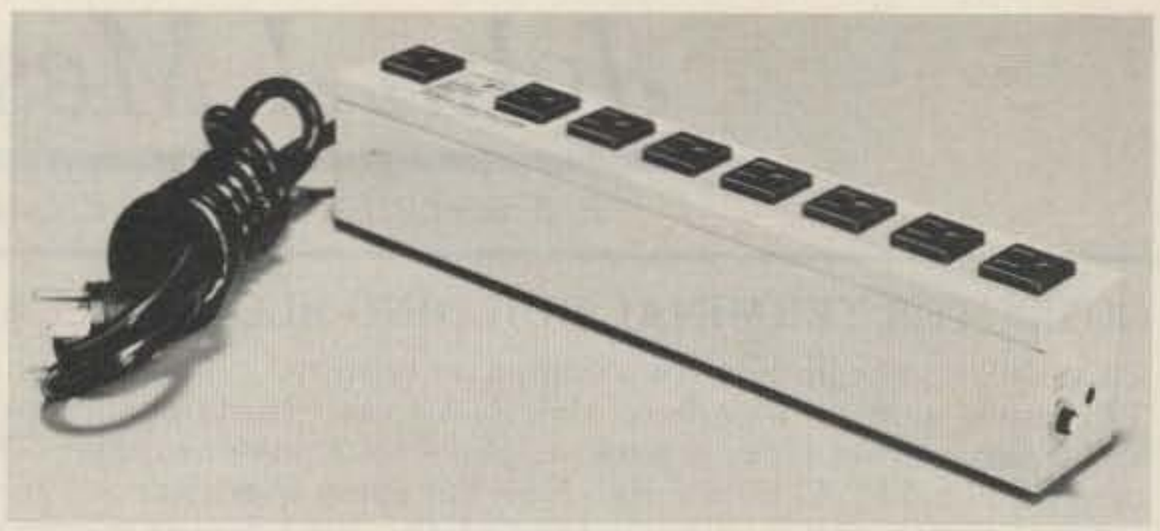
Basic Electronics Technology is a new

Antenna Specialists VHF broadband power amplifier.

AEA's model PK-64.



Communications Specialists' TP-38 Shared Repeater Tone Panel.



The Smart Outlet Box from Heath.

one-volume reference guide to semiconductor circuits and systems from Texas Instruments. The book explains how semiconductor circuits work in amplifiers, oscillators, power supplies, radios, TVs, and computers. Each chapter ends in a summary followed by a short quiz.

For more information, contact *Texas Instruments, Inc., PO Box 225474, MS 8218, Dallas TX 75265.*

CSI SHARED REPEATER TONE PANEL

Communications Specialists has announced the TP-38 Shared Repeater Tone Panel. Microprocessor controlled, the TP-38 provides all 38 EIA standard CTCSS tones to allow up to 38 subscribers. Built-in time and hit counters record the activity of all CTCSS tones on the repeater's channel.

The TP-38 has a low current drain, is suitable for battery- or solar-powered repeater sites, and is static- and lightning-protected. An LED display shows all received CTCSS tones received, whether they are active in the panel or not. An optional unit, the TP-DTMF, allows all control functions to be performed remotely with a 12- or 16-button touchtone™ pad.

For complete details, contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; (800)-854-0547.*

S-COM MRC-100 REPEATER CONTROLLER

S-Com's MRC-100 is a 6809-based repeater controller with 8K of NOVRAM and 16K of EPROM. Features include a polite CW identifier, CW messages with variable speed and pitch, an autopatch and reverse autopatch with mixed-mode dialing, a 200-number telephone dialing memory, DTMF and 5/6-tone paging, a CW clock and calendar, and programmable passwords for remote control.

The MRC-100 requires 8–15 volts at less than 300 mA. A diode-isolated automatic external-battery changeover input is also provided for emergency use.

For more details, contact *S-Com, PO Box 8921, Fort Collins CO 80525.*

HEATHKIT SMART OUTLET

Heathkit's Smart Outlet Box waits until a device plugged into one of seven sockets is turned on, then supplies power to it and the remaining six outlets. An eighth outlet is constantly on for units such as clocks which require continuous power. The Smart Outlet uses UL-approved surge protectors and power taps, and is available in either kit or assembled form.

To receive more information about the Smart Outlet Box and a free Heath catalog, write *Heath Company, Dept. 150-589, Benton Harbor MI 49022.* In Canada, write *Heath Company, Dept. 3100, 1020 Islington Avenue, Toronto, Ontario M8Z3.*

GLB PK1L PORTABLE PACKET CONTROLLER

GLB Electronics has introduced the PK1L, a packet-radio controller designed specifically for portable and solar-powered digipeaters.

The PK1L is entirely self-contained in a 4.6" × 5.9" × 1" shielded enclosure. The circuit includes an on-board CMOS Z-80A CPU, 8K of programmable memory, a pre-programmed 32K ROM, an RS-232 interface, and a packet modem. The system draws 25 mA and can be powered by solar cells or a 9-Volt transistor-radio battery. A lithium battery is employed for memory retention.

For further information, contact *GLB Electronics, Inc., 151 Commerce Parkway, Buffalo NY 14224.*

KENWOOD TH-SERIES ACCESSORIES

Two new accessories are available from Kenwood for the TH-series of pocket transceivers.

The PB-21H is an extra-life nickel-cadmium battery pack rated at 500 mAh (the standard PB-21 is rated at 180 mAh). It weighs 6½ ounces and is ½ inch longer than the PB-21

The BC-6 is an ac-operated two-pack quick-charger which doubles as a dc power source for a TH-series radio. The BC-6 can fully charge either a PB-21 or a PB-21H in one hour. Also included is an adapter cable which allows the HT to be operated while the batteries are charging.

For complete details about these and other Kenwood accessories, contact *Kenwood-Trio Communications, PO Box 7065, Compton CA 90224.*

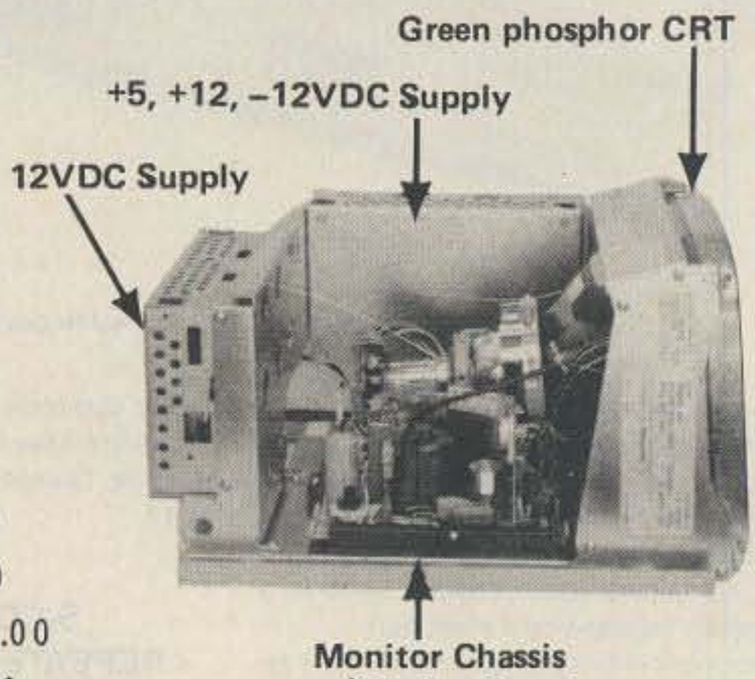
John J. Meshna Jr., Inc.

P. O. Box 62 19 Allerton St. E. Lynn, Ma. 01904 Tel: (617) 595-2275

COMPUTER TERMINAL BUILDING BLOCK $50.00

This is a great beginning for a computer terminal. It is a brand new, Panasonic, 9" TTL input monitor complete with its own self-contained, switching power supply, and a removeable (four screws) triple output power supply. The whole assembly runs on 115/230 V, 50/60 Hz. Now for some specifics: 9" green phosphor, TTL input monitor, attached regulated 12 VDC, 1.5 A power supply used exclusively to run the monitor and an attached triple output switching power supply with outputs of 5 VDC @ 3.5 A, +12 VDC @ 500 ma, and —12 VDC @ 500 ma. The assembly has mounting feet and should be a snap to make a case for. Comes with hook up data. New, factory boxed. We are offering this to you 4 ways:

* COMPLETE SET-UP AS SHOWN, including monitor, low voltage supply and triple output supply. SPL-116-38, 14 Lbs., $50.00, 5/$225.00
* TRIPLE OUTPUT SUPPLY ONLY, SPL-117-38, 3 Lbs. $15.00
* 9" MONITOR ONLY, (you supply low voltage input) SPL-114-38, 10 Lbs. $ 25.00
* 9" MONITOR W/LOW VOLTAGE SUPPLY ONLY, SPL-115-38, 12 Lbs. $40.00



We are now selling guaranteed working, starlight scopes which allow sight in almost total darkness. They are so named because they incorporate a light amplification tube which uses the available star or moon light to allow you to see - without being seen. The scope has a spectral response of 4,500 to 8,000 angstroms, resolution of 50 lines/mm, viewing area of 25mm, standard 50mm F1.4 lens, optional telephoto 135mm F2.8 lens. cross hair reticle and optional carrying case. A great tool for security and naturalist applications. Runs on 9VDC transistor radio battery. Due to the nature of this device and people only having a one time use for it, we cannot accept returns for refund, credit or exchange on this item. To our knowledge, this is the least expensive starlight scope on the market. Includes 90 day warranty.

STARLIGHT SCOPE	**SPL-130A-39**	**$1,200.00**
Optional Telephoto Lens, 135mm F2.8	**SPL-131A-39**	**$85.00**
Optional Fitted Carrying Case	**SPL-132A-39**	**$65.00**

ATTENTION:
SECURITY PERSONNEL
NATURALISTS
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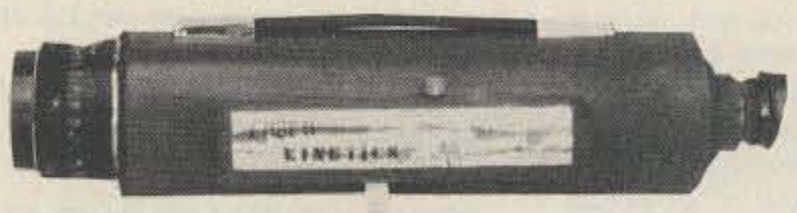
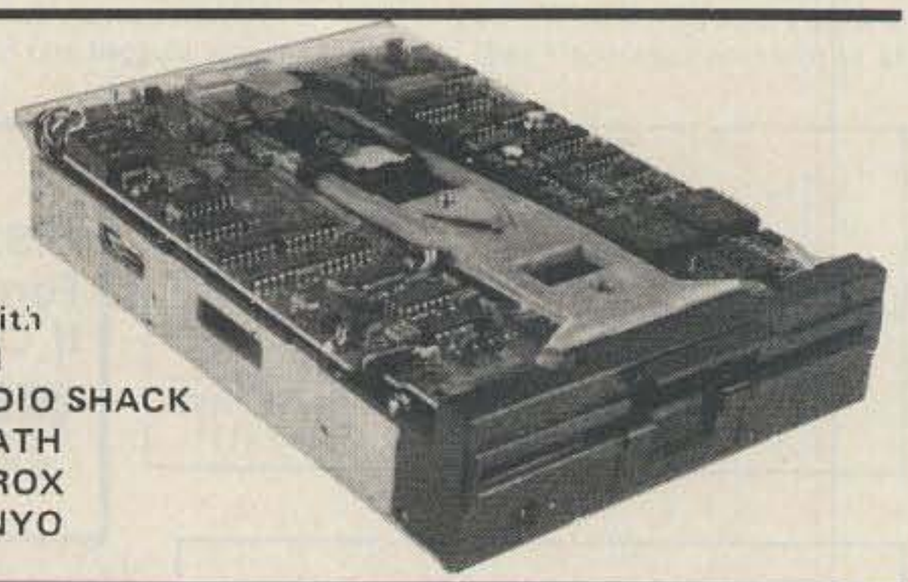
NEW SEE-IN-THE-DARK EQUIPMENT!



1/2 Height 1 MEGabyte Disc Drives

Here we go with another blockbuster buy on disc drives which should make the competion's head spin! We are offering brand new, Mitsubishi no. 4853, 1/2 height, 1 megabyte, mini floppy disc drives. These drives are beautiful. They are fully Shugart 34 pin compatible. All are double side, double density, 80 tracks per side units. Each runs on +5 vdc, .5 A and +12 vdc, .7 A. Just the drives to use with your IBM, Sanyo or other computer. Each order will come with schematics and pin out data.
SPL-85C-35 $175.00 each $175.00 each, 2/$325.00, 5/$725.00

New, 75 watt power supply. +5vdc 5.5amps, +12vdc 4amps, -12vdc .3amps 115/230 input. Made by GI, fully enclosed, with schematic.
Shpg. wt. 4 lb. PS-10 $50.00



Use with
* **IBM**
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* **HEATH**
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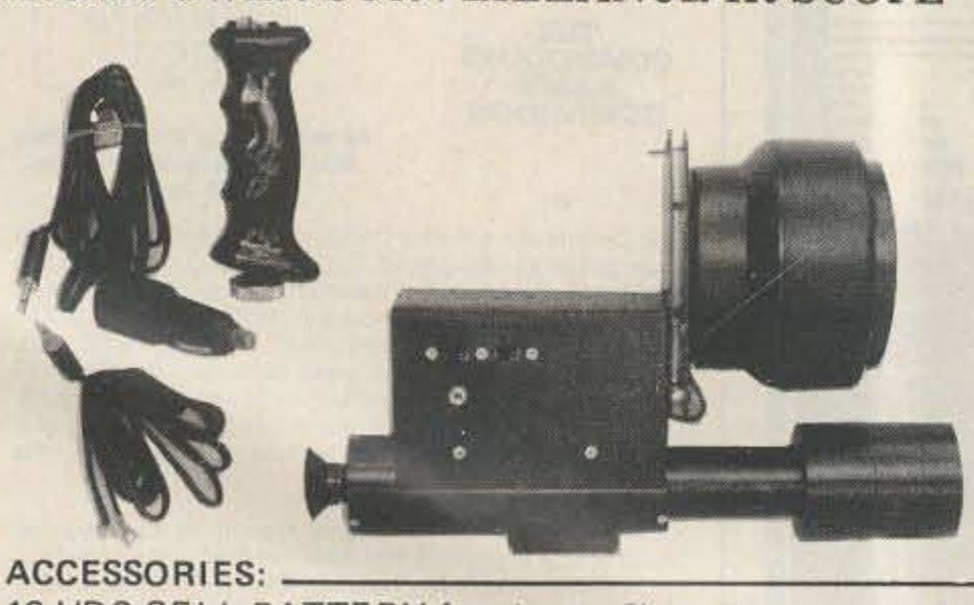
HIGH POWER SURVEILLANCE IR SCOPE



This Infra-Red scope was designed specifically for long range surveillance use. The built-in, totally invisible, 50 watt halogen lamp IR source is coupled with a premium grade type 6032 image converter tube, 265 mm f4.2 lens, and 16 power military spec., color corrected eyepiece make this an ideal unit for viewing of clandestine activities or animals. The scope is capable of detection at more than 300 feet, recognition at 300 feet and positive facial identification at 150 feet. It runs on 12 VDC which makes it ideal for mobile use. It comes with a removeable hand grip which allows for tripod mounting, 2 power cords for cigarette lighter or battery terminals, instructions and a 90 day warranty. Listed below are accessories which make this a very versatile instrument. The scope and accessories are new and guaranteed functional. Net wt. 5-1/4 Lbs.
IR Scope part no. ELD Shpg. Wt. 7 Lbs. $735.00 ea.

ACCESSORIES:

12 VDC GELL BATTERY for above. Shpg. Wt. 6 Lbs. $35.00

BIOCULAR EYEPIECE which can be used in place of the standard eyepiece. This allows the scene being produced by the IR viewer to be seen by the operator up to 4 ft. away. 2 Lbs. $89.95

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Phone (617) 595-2275 to place your order by phone. MC, VISA, or American Express charge cards accepted.

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20 MHz DUAL TRACE OSCILLOSCOPE

Unsurpassed quality at an unbeatable price, the Ramsey oscilloscope compares to others costing hundreds more. Features include a component testing circuit for resistor, capacitor, digital circuit and diode testing. • TV video sync filter • wide bandwidth & high sensitivity • internal graticule • front panel trace rotator • Z axis • high sensitivity x-y mode • regulated power supply • built-in calibrator • rock solid triggering

~~$399.95~~ * high quality hook on probes included **$369.95**

• USA—Add $10.00 per unit for postage, overseas orders add 15% of total order for Insured Surface Mail

NEW

45 MHz DUAL SWEEP OSCILLOSCOPE

The Ramsey 625 is a dual time base, delayed sweep unit that includes a built-in signal delay line to permit clear viewing during very short rise times of high frequency waveforms. Other features include; variable trigger holdoff • 20 calibrated sweep time ranges from 0.5 s/div to 0.2 µS/div. • fully adjustable sweep time • X5 sweep magnification • five trigger sources: CH1, CH2, LINE EXTernal and INTernal (V mode) • front panel x-y operation, Z axis input • sum difference of CH1, and CH2 waveforms displayed as single trace • sweep gate and sweep output • auto focus • single sweep

~~$799.95~~ * high quality hook on probes included **$669.95**

• USA—Add $10.00 per unit for postage, overseas orders add 15% of total order for Insured Surface Mail.

RAMSEY D-1100 VOM MULTITESTER

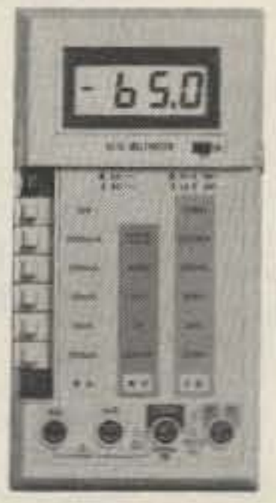
Compact and reliable, designed to service a wide variety of equipment. Features include • mirror back scale • double-jeweled precision moving coil • double overload protection • an ideal low cost unit for the beginner or as a spare back-up unit.

~~$19.95~~ test leads and battery included **$12.95**

NEW RAMSEY 1200 VOM MULTITESTER

Check transistors, diodes and LEDs with this professional quality meter. Other features include; decibel scale • 20K volt metering system • 3½" mirrored scale • polarity switch • 20 measuring ranges • safety probes • high impact plastic case

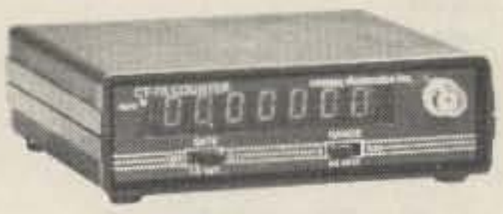
~~$24.95~~ test leads and battery included **$19.95**



RAMSEY D-3100 DIGITAL MULTIMETER

Reliable, accurate digital measurements at an amazingly low cost • in-line color coded push buttons, speeds range selection • abs plastic tilt stand • recessed input jacks • overload protection on all ranges • 3½ digit LCD display with auto zero, auto polarity & low BAT. indicator

$49.95 test leads and battery included



CT-70 7 DIGIT 525 MHz COUNTER

Lab quality at a breakthrough price. Features • 3 frequency ranges each with pre amp • dual selectable gate times • gate activity indicator • 50mV @ 150 MHz typical sensitivity • wide frequency range • 1 ppm accuracy

$119.95 wired includes AC adapter

CT-70 kit $99.95
BP-4 nicad pack 8.95

CT-90 9 DIGIT 600 MHz COUNTER

The most versatile for less than $300. Features 3 selectable gate times • 9 digits • gate indicator • display hold • 25mV @ 150 MHz typical sensitivity • 10 MHz timebase for WWV calibration • 1 ppm accuracy

$149.95 wired includes AC adapter

CT-90 kit $129.95
OV-1 0.1 PPM oven timebase 59.95
BP-4 nicad pack 8.95

CT-125 9 DIGIT 1.2 GHz COUNTER

A 9 digit counter that will outperform units costing hundreds more. • gate indicator • 24mV @ 150 MHz typical sensitivity • 9 digit display • 1 ppm accuracy • display hold • dual inputs with preamps

$169.95 wired includes AC adapter

BP-4 nicad pack 8.95

CT-50 8 DIGIT 600 MHz COUNTER

A versatile lab bench counter with optional receive frequency adapter, which turns the CT-50 into a digital readout for most any receiver • 25 mV @ 150 MHz typical sensitivity • 8 digit display • 1 ppm accuracy

$169.95 wired

CT-50 kit $139.95
RA-1 receiver adapter kit 14.95

DM-700 DIGITAL MULTIMETER

Professional quality at a hobbyist price. Features include 26 different ranges and 5 functions • 3½ digit, ½ inch LED display • automatic decimal placement • automatic polarity

$119.95 wired includes AC adapter

DM-700 kit $99.95
MP-1 probe set 4.95

PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiplies UP in frequency • great for PL tone measurements • multiplies by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner

$49.95 wired

PS-2 kit $39.95

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for shifting RF • ideal receiver/TV preamp

$44.95 wired includes AC adapter

PR-2 kit $34.95

PS-1B 600 MHz PRESCALER

Extends the range of your present counter to 600 MHz • 2 stage preamp • divide by 10 circuitry • sensitivity: 25mV @ 150 MHz • BNC connectors • drives any counter

$59.95 wired includes AC adapter

PS-1B kit $49.95

ACCESSORIES FOR RAMSEY COUNTERS

Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt bail, for CT-70, 90, 125	3.95

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AMATEUR TV

A few years ago, when the home-video craze began, I told all of my friends that we were on the verge of an amateur-television (ATV) boom. "Soon," I predicted, "we'll see ATV all over the place. It'll become so popular, we'll see a frequency squeeze so tight that it will make 2 meters look like the wide open spaces."

I was wrong.

What happened? Video equipment is cheaper today than ever before. In the late 1960s, a black-and-white videotape recorder cost about $2000. Today, I've seen *color* VCRs advertised for as little as $250. A color camera in the 1960s would have cost you a cool $50,000 or so. Today, you can get one for less than $500. All in all, you can get an ATV station up and running for under $700—antenna and everything. And that's with new equipment. If you're willing to scrounge around for used gear, you can probably get on the air for under $300, maybe even less.

So why hasn't ATV taken off? Perhaps it's for the same reason AT&T's Picturephone service never made it. Maybe hams just don't want to see each other's ugly mugs. Or maybe ATV is just suffering from the same malaise as ham radio in general.

But I think the reason is more fundamental. I believe the sort of people who are likely to be attracted to ATV are turned off by the code requirement. Think about it for a minute: learning Morse code to operate a VCR, camera, and TV transmitter. Sort of like being required to know how to tap dance before being allowed to drive a car. Totally irrelevant skills.

So ATV, like much of ham radio, languishes. In the meantime, I can enjoy the relatively vacant band space to show videos of my vacation to Europe, my trip to a vintage car show, the installation of my TVRO dish, and other activities to a few selected friends.

Still, it would be nice if I could find a few more people to bore.

ELEMENT 1
MULTIPLE CHOICE

1) The aspect ratio of a standard television picture is:
   1) three units high and four units wide
   2) four units high and three units wide
   3) one unit high and three units wide
   4) three units high and five units wide
2) Lighting intensity is often measured in:
   1) decibels
   2) lumen minutes
   3) brightness degrees
   4) foot-candles
3) The little red light found on top of most studio TV cameras is officially known as:
   1) a little red light
   2) an idiot light
   3) a cue light
   4) a tally light
4) The unit professionals use to transfer film images to video is called a:
   1) movie projector
   2) film-to-video adapter
   3) film chain
   4) kinescope
5) Which of the following *is not* a video pickup tube:
   1) vidicon
   2) plumbicon
   3) image orthicon
   4) image iconocon

ELEMENT 2
TRUE-FALSE

	True	False
1) A "Gen Lock" locks the synchronizing generators from two different video sources.	____	____
2) A "High Key" means a high-impedance signal.	____	____
3) "Head Room" is the space between a televised subject's head and ceiling.	____	____
4) The image iconoscope is still widely used in high-quality TV cameras.	____	____
5) The image orthicon is a highly sensitive video pickup tube.	____	____
6) Lens focal lengths are usually measured in inches.	____	____
7) A floodlight emits undiffused, directional light.	____	____
8) A "halo" is a dark flare around a very bright or reflecting object.	____	____
9) One "pans" a camera up and down.	____	____
10) "Slant track" scanning is the same as "helical scanning."	____	____

ELEMENT 3
SCRAMBLED WORDS

Unscramble these words relating to ATV:

maarec	omognilb
caleminun	klupcp
apet	doeiv
noastrct	siiletevno
cyns	tsnesrhgib

ELEMENT 4
FILL IN THE BLANK

1) An undesirable double image is a _____.
2) A mirror-like device that singles out red or blue light is a _____ filter.
3) A gradual transition from one picture to another where the pictures briefly overlap is called a _____.
4) A fluorescent light is also called a _____ light.
5) Fading a picture is also called "going to _____."
6) Commercial TV transmissions have a _____-line resolution.
7) TV audio is _____-modulated.
8) Commercial TV has an audio subcarrier that is _____ MHz above the picture carrier.
9) TV video is _____-modulated.
10) Perfect ATV reception is often referred to as _____-_____ copy.

THE ANSWERS

Element 1:
1—1, 2—4, 3—4, 4—3, 5—4.

Element 2:

1—True	Prevents picture rolling.
2—False	High-intensity lighting.
3—False	Top of the TV screen and subject.
4—False	The iconoscope hasn't been used for years.
5—True	Very sensitive.
6—False	Usually in millimeters.
7—False	Diffused, non-directional light.
8—True	Most evident when using a cheap camera.
9—False	One "tilts" a camera up and down and "pans" it from left to right or right to left.
10—True	Commonly used on VCRs.

Element 3:
camera, contrast, video, luminance, sync, television, tape, blooming, brightness, pickup

Element 4:
1—ghost
2—dichroic
3—dissolve
4—cold
5—black
6—525
7—frequency
8—4.5
9—amplitude
10—closed-circuit

SCORING

Element 1:
Five points for each correct answer.
Element 2:
Two and one-half points for each correct answer.
Element 3:
Two and one-half points for each correct answer.
Element 4:
Two and one-half points for each correct answer.

How did you do?
1–20 points—You're out of focus
21–40 points—You're a longshot
41–60 points—Only slight signal distortion
61–80 points—Armchair copy
81–100 points—An instant replay, please

BE MY GUEST

Guest Editorial by Ted Harris N6IIU

REACH OUT AND SERVE SOMEONE

We hams pride ourselves on being trained communicators, but how many of us are really using that training for the maximum benefit of our communities? It's not enough for a few hams with handie-talkies to just suddenly show up at a public-service event or a disaster. If we really want to serve, we have to get actively involved in showing civic leaders what communications capabilities we can offer, for routine local festivities as well as emergencies.

Better yet, we should show them how they can most effectively use all the communications resources available to them. Radio amateurs—and especially the local emergency coordinators—should be telecommunications managers. We should be familiar with all of the radio assets available to a community, not just the hams, ham equipment, and ham frequencies. Sure, this means more work for us, but it means we serve our cities better and feel prouder of our contribution.

Coordinate All Resources

Many of us are working actively with our communities in disaster planning, but there are plenty of other times throughout the year when we can acquire valuable experience and simultaneously demonstrate our expertise and willingness to help. Whether you're planning for a parade or a natural disaster, don't depend on others to figure out what your ham group can do. Find out all you can about the event and how your city handles it, then suggest specific ways in which you can help.

For instance, would it be helpful to have packet radio to send the correct order of participants to a parade announcer? Hams on bikes or motorcycles for easy access through crowds? ATV in a plane during a forest fire? Remember, some of these may need to be done off the ham bands, on government or business frequencies. A combination of city, ARES, and REACT resources might provide the perfect solution. Advance planning will give you time to get the necessary clearances and equipment.

When you're outlining your capabilities to non-hams, don't just list the equipment you have available, describe its capabilities. Instead of saying, "We have twenty operators who have synthesized radios equipped with DTMF encoders," explain that, "We have twenty trained people who can take their hand-held radios anywhere you need them. They can use the radios to relay information among your people at those remote sites or back to your headquarters. They can transfer messages between your agency and others. They can also direct-dial local emergency services from the field or, in some instances, call any telephone number you want."

Keep Up on the Latest Technology

It's vital that amateurs who want to serve their communities keep up with current technology. In these days of inexpensive portable equipment, it's inexcusable to show up at a disaster with a crystal-controlled two-channel radio that only runs on ac! Encourage your community's emergency agencies to have state-of-the-art equipment also. Ask them to provide funds for the purchase of amateur-radio equipment. It's surprising how much money is available in city and county budgets or through state or federal grants for such purposes if you just look for it.

At the very least, ask them to buy antennas that you and other local hams can install in locations that will be vital during a disaster. In the San Francisco Peninsula area where I live, for instance, hundreds of antennas (including coax runs to convenient radio setup sites) have been installed in schools, hospitals, Red Cross offices, forest service headquarters, fire and police departments, as well as in city and county emergency operations centers.

Along the same lines, look for ways to support your local agencies with sophisticated communications they can't afford. For instance, ask your local amateur-television afficionados to provide fast-scan TV between a disaster site and police, fire, forest service, etc., headquarters. The same goes for packet radio. Few communities can afford their own packet systems, but by taking advantage of local hams, they can have this valuable medium available to them.

Utilizing new technology to the fullest

THE MOST AFFORDABLE REPEATER

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(AND GIVES THEM TO YOU AS STANDARD EQUIPMENT!)

Band	Kit	Wired
10M,6M, 2M,220	$680	$880
440	$780	$980

FEATURES:

- SENSITIVITY SECOND TO NONE; 0.15 uV (VHF), 0.2 uV (UHF) TYP.
- SELECTIVITY THAT CAN'T BE BEAT! BOTH 8 POLE XTAL FILTER & CERAMIC FILTER FOR > 100 dB AT ± 12KHZ. HELICAL RESONATOR FRONT ENDS TO FIGHT DESENSE & INTERMOD.
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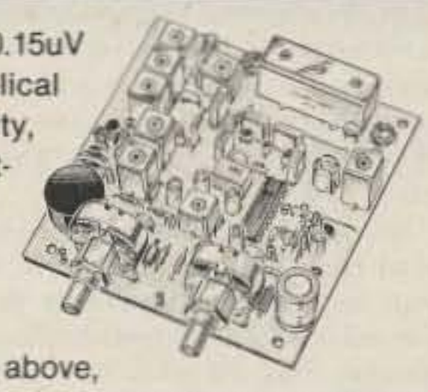

- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.;8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity, > 100 dB at ± 12 kHz, best available today. Flutter-proof squelch. AFC tracks drifting xmtrs. Xtal oven avail. Kit only $138.
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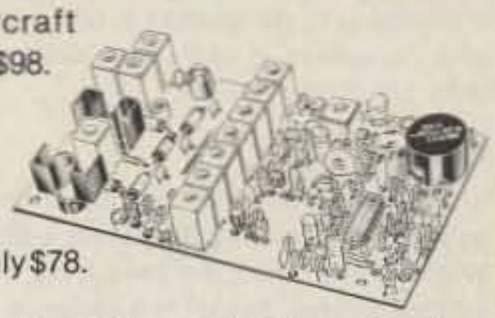
- **R76 FM RCVR** for 10M, 6M, 2M, or 220. As above, but w/o AFC or hel. res. Kits only $118. Also avail w/4 pole filter, only $98/kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft or ham bands or Space Shuttle. Only $98.



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- **T451 UHF FM EXCITER** 2 to 3 Watts. Kit only $78. Xtal oven avail.
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50-52	28-30
50-54	144-148
144-146	28-30
145-147	28-30
144-144.4	27-27.4
146-148	28-30
144-148	50-54
220-222	28-30
220-224	144-148
222-226	144-148
220-224	50-54
222-224	28-30
432-434	28-30
435-437	28-30
432-436	144-148
432-436	50-54
439.25	61.25

VHF MODELS

Kit with Case	$49
Less Case	$39
Wired	$69

UHF MODELS

Kit with Case	$59
Less Case	$49
Wired	$75

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For VHF, Model XV2 Kit $79 Wired $149 (Specify band)

Exciter Input Range	Antenna Output
28-30	144-146
28-29	145-146
28-30	50-52
27-27.4	144-144.4
28-30	220-222*
50-54	220-224
144-146	50-52
50-54	144-148
144-146	28-30

For UHF, Model XV4 Kit $99 Wired $169

28-30	432-434
28-30	435-437
50-54	432-436
61.25	439.25
144-148	432-436*

*Add $20 for 2M input

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FEATURES:

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- High Gain: 18 to 28 dB, Depending on Freq.
- Wide Dynamic Range for Overload Resistance
- Latest Dual-gate GaAs FET, Very Stable

MODEL	TUNES RANGE	PRICE
LNG-28	26-30 MHz	$49
LNG-50	46-56 MHz	$49
LNG-144	137-150 MHz	$49
LNG-160	150-172 MHz	$49
LNG-220	210-230 MHz	$49
LNG-432	400-470 MHz	$49
LNG-800	800-960 MHz	$49

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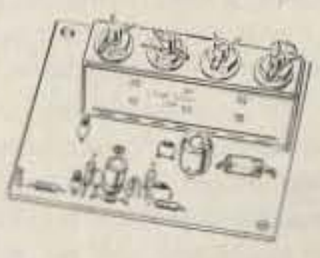
Low-noise preamps with helical resonators reduce intermod and cross-band interference in critical applications. 12 dB gain.



Model	Tuning Range	Price
HRA-144	143-150 MHz	$49
HRA-220	213-233 MHz	$49
HRA-432	420-450 MHz	$59
HRA-( )	150-174 MHz	$54
HRA-( )	450-470 MHz	$64

ACCESSORIES

- **MO-202 FSK DATA MODULATOR.** Run up to 1200 baud digital or packet radio signals through any FM transmitter. Automatically keys transmitter and provides handshakes. 1200/2200 Hz tones. Kit only $45.
- **DE-202 FSK DATA DEMODULATOR.** Use with any FM receiver to detect packet radio or other digital data in "202" modem format. Provides audio conditioning and handshakes. Kit only $38.
- **COR-2 KIT** With audio mixer, local speaker amplifier, tail & time-out timers. Only $38.
- **COR-3 KIT** as above, but with "courtesy beep". Only $58.
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- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 × 8 × 2 inches. Designed especially for repeaters. $20.
- **DTMF DECODER/CONTROLLER KITS.** Control 2 separate on/off functions with touchtones®, e.g., repeater and autopatch. Use with main or aux. receiver or with Autopatch. Only $90
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also means you'll be able to bring into the public-service fold many hams who would otherwise feel they have nothing to contribute. Hams who can't send 25-wpm code can perform a tremendous service by sending traffic via packet radio. Hams who are housebound or don't have portable equipment can act as relay stations between two or more amateur-radio emergency nets.

Your job as an emergency coordinator is to facilitate communications, offering your served agencies a wide variety of communications methods to manage the disaster more efficiently. Find what niche each group of hams can fill, and put them in charge of it. Be creative in utilizing the amazing variety of skills that radio amateurs can offer.

Train Everyone

Just as important as coordinating equipment is training the people using it. Whole books could be (and have been) written on this, but let me review a few points: For instance, we probably all need a reminder from time to time about keeping net communications brief and to the point. When providing communications, restrict the traffic to that actually needed to support the agency. Resources, logistics for amateurs, and the like can be handled on other channels.

Too often we hear hams talking to hams about non-disaster-related topics, tying up the frequency and making a bad impression on the agencies who are depending on us and the news-gathering people and citizens with scanners who may be listening in. It's surprising how many more people can participate on a single channel once we get down to the essentials. Try listening to your local fire channel for a while—you'll quickly understand how they can manage 30-50 radios at once during an emergency!

Incidentally, teach your hams not to be afraid to let go of the microphone once in a while. Complicated questions and answers between agency personnel can best be handled by letting the people involved talk directly to each other. It's perfectly feasible to do this while maintaining the legally required control over our equipment. Despite our training in passing traffic, there's no reason to add another person to the information flow if it's not necessary. Communications improve, agencies have more participation in the disaster-management activities, and they reach a new appreciation for us that results in more requests for our services.

Also, make it clear to your hams that they must take an active role in offering their help during disasters, even once they're at their assigned location. I've seen amateurs assigned to a shelter sit all day doing nothing, simply because they didn't let the people in charge know what services they could provide. High turnover both among the amateur operators and the agency people (such as shelter personnel) mandates constant reminders of the hams' presence and capabilities.

You can also provide a great service to your community by being willing to train non-hams in the use of radios for community events and emergencies. We hams have lots of experience in using radios. Don't be stingy with it!

If there's a major local event coming up, ask the organizers to let you give a training session a couple of weeks in advance. At the workshop, you can demonstrate how radios work and mention things that might go wrong (like the signs of battery failure). Show people how to speak properly into the microphone and give them hints on how best to identify themselves and to call others. Remind them to use plain language, to be succinct, and to avoid needless chatter.

Any time you're working with neophyte radio operators, think of ways you can "foolproof" the operation of the radios. For example, at the 1984 Olympics at Stanford University, we covered the switches of the handie-talkies with duct tape so they wouldn't get knocked into the wrong positions. We also put a sticker on each radio listing the frequencies used by each group (medical, security, etc.).

Besides teaching non-hams about radios, don't forget the opposite side of the coin: learning about *their* jobs and needs. For instance, I recommend that hams (especially emergency coordinators) take Red Cross shelter-management classes. Not so you can run a shelter, since your strength during a disaster will be keeping the radios going and the information moving. But if you're ever assigned to a shelter during a disaster, you'll better understand the needs of the people running it, so you'll be able to communicate those needs more effectively. In a nutshell, you'll be more helpful—and that, after all, is the bottom line of amateur radio.

A Real-Life Example

Here on the San Francisco Peninsula, we had a great opportunity to put this proactive philosophy to work during the 1984 Olympics. For ten days, Stanford University hosted soccer preliminaries for the XXIIIrd Olympiad, and among the many hardworking volunteers were eleven hams working for the Technology Group.

Our overriding attitude in approaching this assignment was, "We're here to help." Weeks before the games began, we were assisting Technology Manager Chris Veal with his planning. I attended as many coordination meetings (both before and during the Games) as I could, looking for ways we could help.

In at least one case, our early involvement headed off a communications disaster. Not long before the games began, we discovered a problem with the commercial hand-helds due to be shipped up from Los Angeles. In southern California, the frequencies assigned to the Los Angeles Olympics Organizing Committee (LAOOC) for security and administration were going to be clear during the games, but here in the Bay Area they are used heavily by local news-gathering agencies!

The manufacturer who was supplying the radios to the LAOOC didn't have time to recrystal them for different frequencies. So we swung into action up here, got permission to use some government frequencies, found some radios that would operate in that band, and ordered 75 of them. At the end of the Olympics, they were sold off, making the total cost nearly the same as renting would have been.

Had we just sat back and shown up the first day of the Games with our communications van and waited for a terrorist attack, the Olympics communications might have been in shambles, and we would have missed a tremendous opportunity to help.

During the course of the Games we sought out and were called upon to help with many other tasks, which we gladly handled. Most were related to telecommunications, but if we had a spare person we were happy to help even with ones that weren't. We didn't want to adopt a "we only do electrons" attitude. Our flexibility paid off in the respect we got from Olympic organizers—and more importantly, in the pride we felt at our participation.

Act As Community Advisors

If you've still got time and energy left after planning and supervising communications for your town's big events, there's yet another way your expertise can help.

A lot of cities—especially smaller towns—can't afford telecommunications consultants, so they rely for advice on manufacturers' salespeople. You, on the other hand, can be an unbiased consultant. Just make sure you stay levelheaded: This is not the place to grind axes about antenna ordinances or cable-television interference. Once they trust your opinion, you'll be able to address those problems calmly and rationally—and with more friends in high places on your side.

Overall, local hams are going to be better informed than most people on what communications equipment is on the market, what technologies are being tried, and which ones are working. Your expertise can help your town make better-informed decisions on the purchase of emergency communications equipment, or on cable-television franchising.

Your electronics knowledge can also help prevent RFI problems during local events. Many committees have summertime air shows; local hams can work with the FAA and FCC to make sure ground-based radio activities don't interfere with the airplanes. In fact, whenever multiband frequencies are in use, you should check to make sure they don't interfere with each other, or with broadcasting equipment.

Get Involved

If there's one message I could leave you with, it's this: Get involved. Take an active role in planning communications for your community. Don't sit at home waiting for someone to figure out what you do and what needs doing. When you're on the scene of a disaster, show initiative. Don't just show up with a "cordless phone" and a warm body.

Make yourself valuable to your community by becoming a telecommunications expert. Keep up on the latest technology so you can choose the best equipment for every communciations need.

If you're an amateur-radio emergency coordinator, know your people and what special talents they have. Who should be assigned to work with the schools? Who with industry? Who with the fire or police departments? Who with the press?

What do we hams get for all this hard work? Self satisfaction. Knowing that we've learned more and contributed more. You're a unique individual, with many more talents than just pushing a microphone button. You have special talent, skill, and aptitude that will make you valuable to your community.

Extend yourself beyond the attitude of, "Okay, I'm here with my radio; tell me what to say." Reach out, find out what people need, and serve those needs. Everyone has a contribution to make; it's up to each of us to find out what that contribution is and make it.

Ted Harris N6IIU is Disaster Services Director for the Palo Alto (California) Area Chapter of the American Red Cross, and Amateur Radio Emergency Service (ARES) Emergency Coordinator for Stanford, California.

SATELLITES

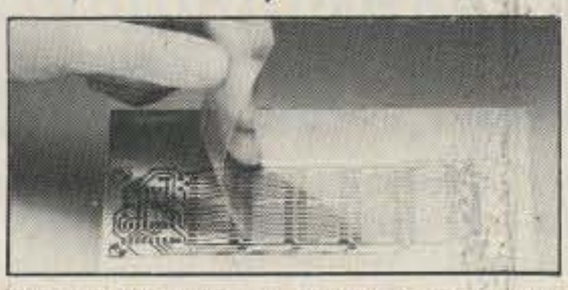
USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of December are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
DECEMBER 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
2187	1	2100	140	7				
2189	2	2000	131	1				
2194	5	0600					231	1
2196	6	0600					226	3
2198	7	0500					218	9
2200	8	0400			230	0	209	15
2202	9	0400			225	3	202	16
2204	10	0300	230	0	217	9	192	19
2206	11	0200	223	6	207	14	181	20
2208	12	0200	217	8	201	15	174	19
2210	13	0100	208	13	191	18	163	18
2212	14	0000	198	17	180	19	153	15
2214	14	2300	187	19	168	19	143	11
2216	15	2300	181	18	162	16	139	6
2218	16	2200	169	18	152	13	130	1
2220	17	2200	163	16	147	10		
2222	18	2100	153	13	138	5		
2224	19	2000	144	9	130	0		
2226	20	1900	135	4				
2228	21	1900	131	0				
2233	24	0500					229	0
2235	25	0400					221	7
2237	26	0400					216	9
2239	27	0300			228	0	206	14
2241	28	0300			223	3	200	15
2243	29	0200	228	0	215	9	190	18
2245	30	0100	221	5	205	13	179	19
2247	31	0000	212	11	195	17	168	18

MAKE CIRCUIT BOARDS THE NEW, EASY WAY



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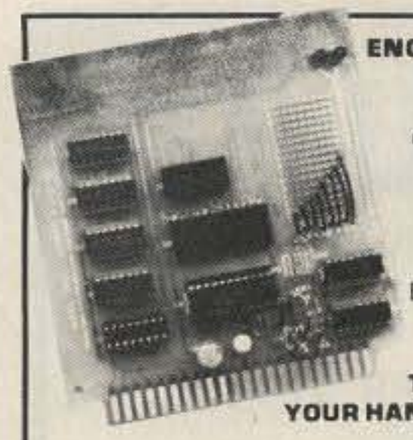

ENGINEERING CONSULTING INTRODUCES

'REMOTE A PAD©' MODEL RAP-1

2 FOUR DIGIT DTMF DECODERS, PLUS 16 DIGIT KEYPAD CONTROL

TUNE THE WORLD FROM YOUR HANDHELD VHF/UHF RADIO

- Audio tones from any source, are converted to solid state switches which control any 16 digit keypad of a radio or other device.
- Some examples you can control include the Pro-Search™ Rotator (rotate beam remotely), ICOM IC-701 or ICOM IC-211 when using the RM-2 controller, ICOM 7950 & 751, Azden PCS 4000, handhelds such as Yaesu FT-208, FT-708, ICOM IC-02AT, and many more...
- Anything you can do manually with your 16 digit keypad, the RAP-1 will do remotely using audio touch tones from any source.
- Two (four digit) programmable access codes are used to operate relays or other on/off functions.
- LED decoder status indicators and momentary plus steady state decoder outputs are provided.
- 22 gold pin card edge connector, 16 pin dip socket and ribbon cable are supplied.
- All CMOS low power drain (30ma). S.S.I. 201 Decoder.
- Hook eight wires (4 rows and 4 columns) in parallel with the existing keypad of the radio you wish to control remotely. Connect audio from any source, 12 volts D.C. and **you are in control.**
- The dual 4 digit decoders will turn your links on and off using your programmable access code.
- Detailed interface diagrams and instructions included with purchase. Interface cable for Pro-Search™ $9.95 (plugs in acc. socket)

Model RAP-1
$149.95
'Remote A Pad©'
Remote control interface board and DTMF decoder.

ICOM IC-02AT USER'S "AUDIO BLASTER©" MODULE

- Module installs inside the radio in 10 minutes
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- Low power drain (4ma stand-by)
- Complete step by step instructions included
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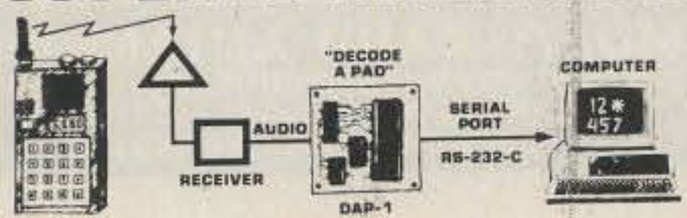
ENGINEERING CONSULTING INTRODUCES

TOUCHTONE™ DTMF to RS-232-C 300 BAUD INTERFACE



- **Use your computer to decode DTMF touchtones.**
- Receive all 16 digits as fast as they can be transmitted
- Easily program your computer in BASIC to decode multi-digit "strings", display digits, sound alarms, observe secret codes, control relays, remote base.
- Simple to use: just provide +12 VDC and audio, hook two wires to the RS-232-C serial input on your computer, enter a simple BASIC program and begin to decode.
- Sample BASIC program and instructions included.
- L.E.D. Indicator

Model DAP-1
Wired and Tested
"Decode-A-Pad"
$89.95

Includes shipping USA. Cal. addresses add 6%.
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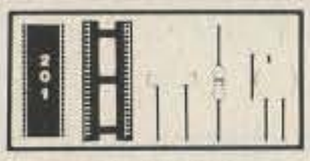
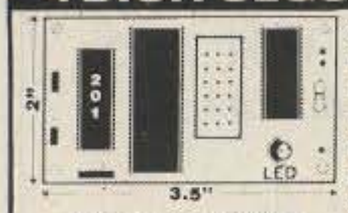
TOUCHTONE™ DECODER KIT



- MODEL TTK -
$22.95

- SSI 201 DTMF Receiver
- Receive all 16 DTMF digits
- No additional filtering
- Output BCD or hex format
- Low power (29ma @ 12V)
- Kit includes 3.58Mhz crystal, 22 pin IC socket, resistor, capacitors, data sheet and schematics

4 DIGIT SEQUENCE DECODER



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$59.95

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- User programable
- LED status indicator
- Open collector output
- Control relays; mute audio
- Control link on/off
- Custom IC insures high reliability & small size!
- Fits inside most rigs; runs on 12 VDC (35ma)
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3 " " - 160, 80, 40M	60 ft. "	$ 43 "
2 " " - 80, 40M	40 ft. "	$ 35 "
3 " NO-TRAP DIPOLE - 160, 80, 40M	113 ft. long	$ 71 "
2 " " " " - 80, 40M	85 ft. "	$ 55 "
9-BAND SPACE-SAVER DIPOLE - 160 thru 10M *	46 ft. long	$ 85 ppd

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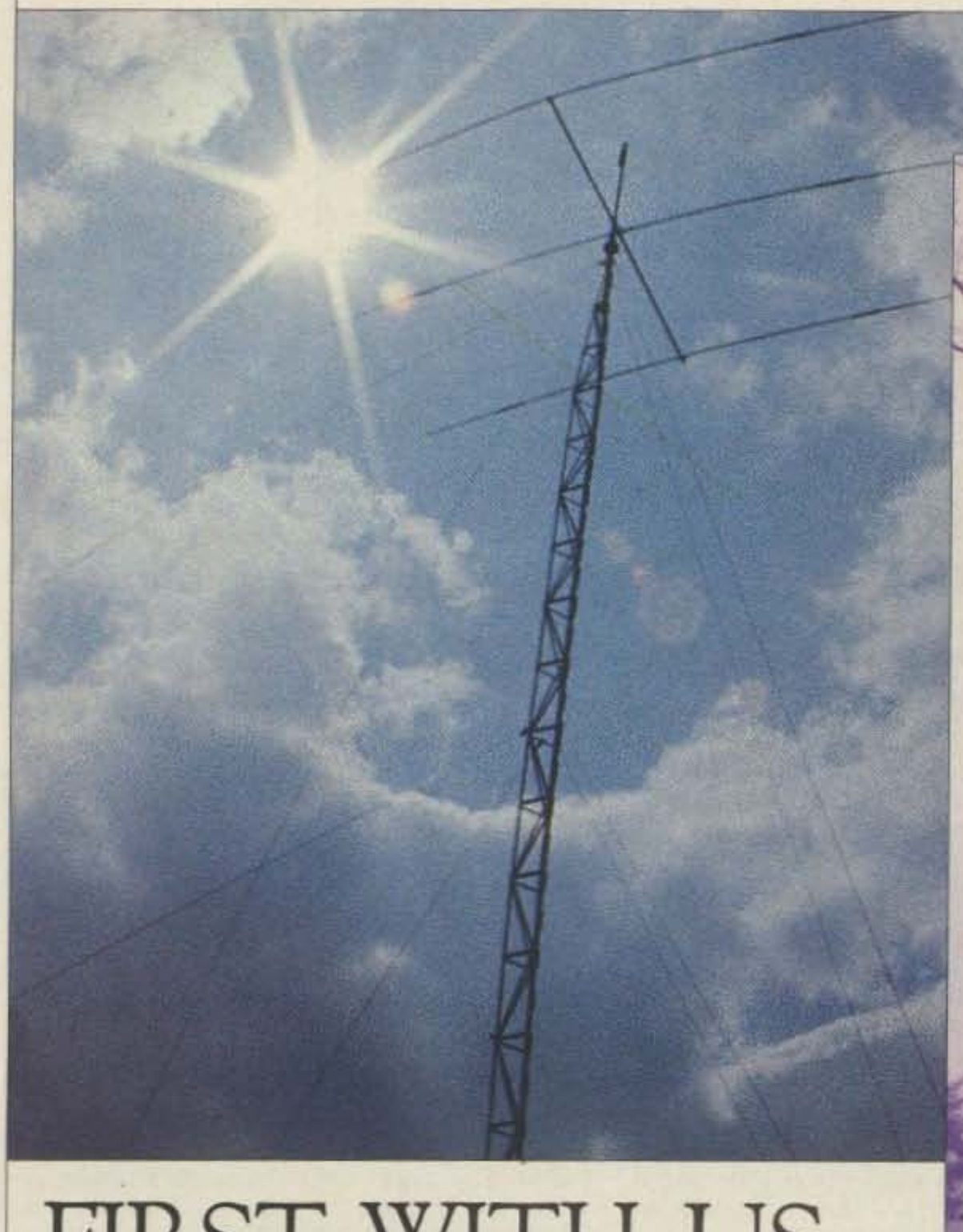

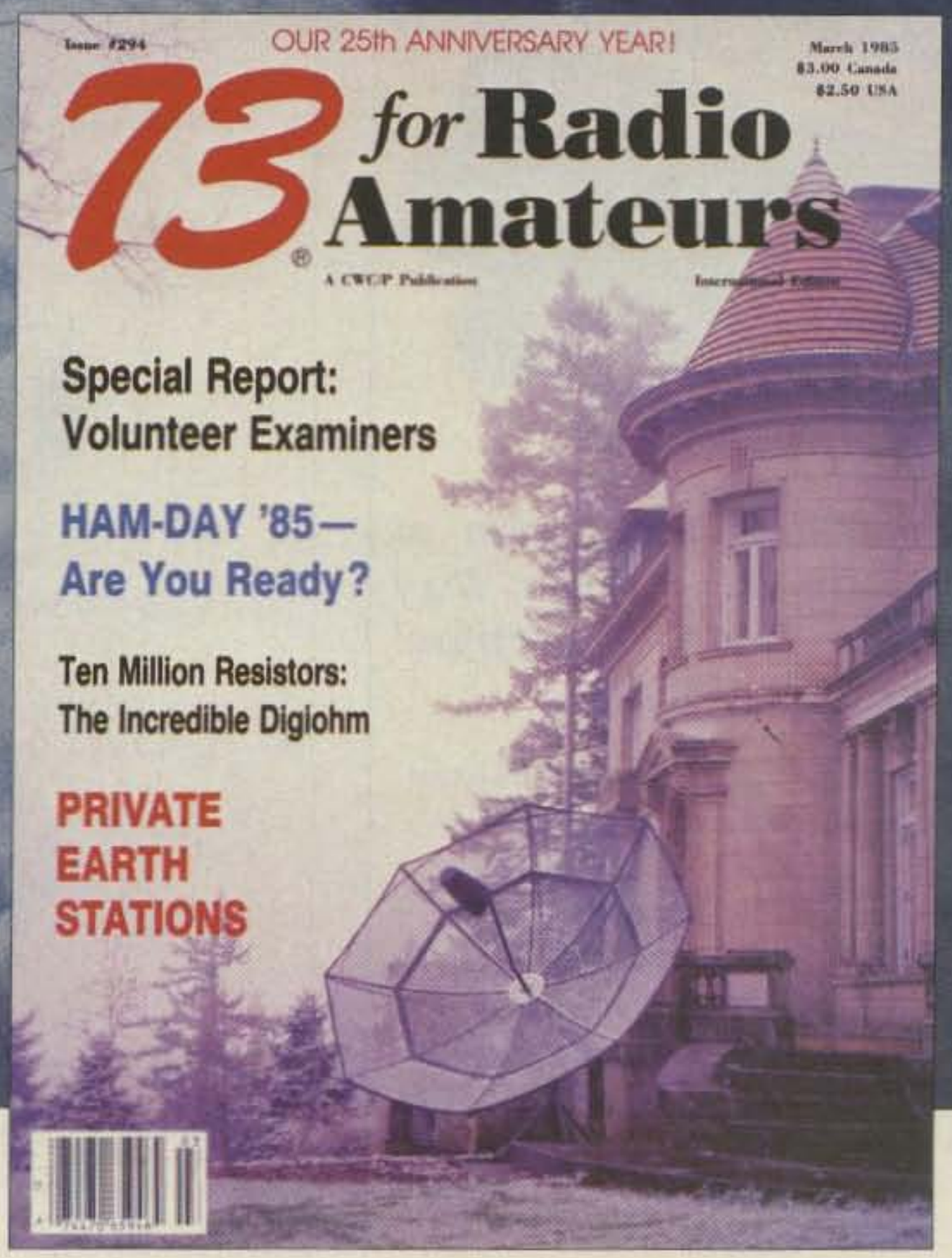

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MFJ'S BEST 300 WATT TUNER NOW GIVES YOU A CROSS-NEEDLE METER THAT READS SWR, FORWARD AND REFLECTED POWER — ALL AT A GLANCE.

MFJ-949C
$149.95

MFJ's best 300 watt tuner is now even better! **The MFJ-949C all-in-one Deluxe Versa Tuner II** gives you a tuner, cross-needle SWR/Wattmeter, dummy load, antenna switch and balun in a new compact cabinet. You get quality conveniences and a clutter-free snack at a super price.

A new cross-needle SWR/Wattmeter gives you SWR, forward and reflected power—all at a single glance. SWR is automatically computed with no controls to set. Has 30 and 300 watt scale on easy-to-read 2 color lighted meter (needs 12 V).

A handsome new black brushed aluminum cabinet matches all the new rigs. Its compact size (10 x 3 x 7 inches) takes only a little room.

You can run full transceiver power output—up to 300 watts RF output—and match coax, balanced lines or random wires from 1.8 thru 30 MHz. Use it to tune out SWR on dipoles, vees, long wires, verticals, whips, beams and quads.

A 300 watt 50 ohm dummy load gives you quick tune ups and a versatile six position antenna switch lets you select 2 coax lines (direct or thru tuner), random wire or balanced line and dummy load.

A large efficient airwound inductor—3 inches in diameter—gives you plenty of matching range and less losses for more watts out. 1000 volt tuning capacitors and heavy duty switches gives you safe arc-free operation. A 4:1 balun is built-in to match balanced lines.

Order your convenience package now and enjoy.

SUPER KEYBOARD

MFJ-496
$169.95

Price slashed 50% to $169.95! Get a full feature Super Keyboard that sends CW/RTTY/ASCII for the price of a good memory keyer.

You get the convenience of a dedicated keyboard—no program to load—no interface to connect—just turn it on and it's ready to use.

This 5 mode Super Keyboard lets you 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.

A 256 character keyboard buffer gives you perfect CW even if you "hunt and peck". A meter reads CW speed and buffer remaining. 4 message memories lets you store up to 256 characters. 4 preprogrammed messages lets you send CQ CQ DE, CQ TEST DE, DE, QRZ. Has speed weight, tone and volume pots that remembers their settings even after power is turned off. Send 60 WPM Baudot and 100 baud ASCII.

You can use it as a deluxe full feature memory keyer that has automatic and programmable memories, iambic operation, dot-dash memories. Has random and pseudo random code generator.

Automatic serial numbering, message repeating, tune switch, shielded for RFI. 12 VDC or 110 VAC with MFJ-1312, $9.95. 12 x 7 x 3½ inches.

CROSS-NEEDLF SWR/WATT METER

MFJ-815 $59.95

MFJ's cross-needle SWR/Wattmeter gives you SWR, forward and reflected power—all at a single glance! SWR is automatically computed—no controls to adjust. Easy-to-use push buttons select three power ranges that give you QRP to full legal limit power readings. Reads 20/200/2000 W forward, 5/50/500 W reflected and 1:1 to 1:5 SWR on easy-to-read two color scale. Lighted meter. Needs 12 V. ±10% full scale accuracy. 6½ x 3¼ x 4½ inches.

2 KW COAX SWITCHES

MFJ-1702
$19.95

$29.95 MFJ-1701

Instantly select any antenna or rig by turning a knob. Organizes coax cables and eliminates plugging and unplugging. Unused terminals are grounded to protect your equipment for stray RF, static and lightning. 2 KW PEP, 1 KW CW. For 50 to 75 ohm. Negligible loss, SWR, and crosstalk gives high performance. SO-239s. Convenient desk or wall mounting.

MFJ-1702, $19.95. 2 positions. Cast aluminum cavity construction gives excellent performance up to 500 MHz with better than 60 dB isolation at 450 MHz. Heavy duty, low loss switch has less than 20 milliohm contact resistance, less than 0.2 dB loss and SWR below 1:1.2. 2 x 2½ x 1 inches.

MFJ-1701, $29.95. 6 positions. White markable surface for recording ant. positions. 8½ x 1½ x 3 in.

ANTENNA CURRENT PROBE MFJ-206 $79.95

This new breakthru MFJ Antenna Current Probe lets you monitor RF antenna currents—no connections needed! Determine current distribution, RF radiation pattern and polarization of antennas, transmission lines, ground leads, building wiring, guy wires and enclosures.

- **Indicate transmission line radiation** due to high SWR, poor shielding or antenna unbalance.
- **Detect re-radiation** from rain gutters and guy wires that can distort antenna field patterns.
- **Detect RF radiation** from ground leads, power cords or building wiring that can cause RFI.
- **Determine if ground** system is effective.
- **Pinpoint RF leakage** in shielded enclosures.
- **Locate the best place** for your mobile antenna.
- **Use** as tuned field strenght meter.

Monitors RF current by sensing magnetic field. Uses an electrostatically shielded ferrite core, FET RF amplifier, op-amp meter circuit for excellent sensitivity, selectivity. 1.8-30 MHz. Has sensitivity, bandswitch, tune controls, telescoping antenna for field strenght meter. 4 x 2 x 2 inches.

DIGITAL SWR/WATTMETER

MFJ-818
$89.95

Fully automatic Digital SWR/Wattmeter reads SWR 1:1 to 1:9.9 directly and instantaneously—no SWR knob to set. Huge 0.6 inch bright orange digits make across-the-room reading easy. 12 segment LED bar graph wattmeter gives instantaneous PEP readings up to 200 watt RF output.

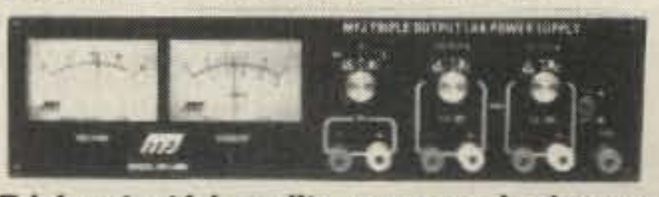
Good, bad, mismatch tri-color LEDs indicate SWR conditions. Small size (5½ x 4¼ x 1 in.) and easy-to-read digital display makes it ideal for mobile use. For 50 ohm systems. 1.8-30 MHz. 12 VDC or 110 VAC with MFJ-1312, $9.95.

MOBILE ANTENNA MATCHER

MFJ-910 $19.95

Lower your SWR and get more power into your mobile whip for solid signals and more QSOs. Your solid state rig puts out more power and generates less heat. For 10-80 meter whips. Easy plug-in installation. Complete instructions on how best to lower SWR. Fits anywhere, 2½ x 2½ inches.

TRIPLE OUTPUT LAB POWER SUPPLY MFJ-4002 $149.95



Triple output lab quality power supply gives you plenty of voltage and current for all your analog and digital circuits. You get **3 completely isolated outputs:** 2 variable 1.5-20 VDC at 0.5 amp and a fixed 5 VDC at 1 amp. Connect in series or parallel for higher voltage and current. It's short circuit protected, has excellent line (typically 0.01% /V) and load regulation (typically 0.1%). **2 lighted 3 inch precision meters** monitor voltage and current simultaneously. It's ruggedly built so you'll get many years of trouble free service. 12 x 3 x 6 inches. 110 VAC with safety ground.

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$99.95 MFJ-941D

NEW FEATURES

MFJ's fastest selling tuner packs in plenty of new features!
- **New Styling!** Brushed aluminum front. All metal cabinet.
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- **New airwound inductor!** Larger more efficient 12 position airwound inductor gives lower losses and more watts out. Run up to 300 watts RF power output. Matches everything from 1.8 to 30 MHz: dipoles, inverted vee, random wires, verticals, mobile whips, beams, balanced and coax lines. Built-in 4:1 balun for balanced lines. 1000V capacitor spacing. Black. 11x3x7 inches. Works with all solid state or tube rigs. Easy to use, anywhere.

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Maximize your antenna performance! **$59.95** MFJ-202B

Tells whether to shorten or lengthen antenna for minimum SWR. Measure resonant frequency, radiation resistance and reactance.

New Features: individually calibrated resistance scale, expanded capacitance range (±150 pf). Built-in range extender for measurements beyond scale readings. 1-100 MHz. Comprehensive manual. Use 9 V battery. 2x4x4 in.

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NEW! IMPROVED! with higher gain **"World Grabber" rivals or exceeds reception of outside long wires!** Unique **tuned** Active Antenna minimizes intermode, improves selectivity, reduces noise outside tuned band, even functions as preselector with external antenna. Covers 0.3-30 MHz. Telescoping antenna. Tune, Band, Gain, On-off bypass controls. 6x2x6 in. Uses 9V battery, 9-18 VDC or 110 VAC with adapter, MFJ-1312, $9.95.

MFJ-1020A $79.95

POLICE/FIRE/WEATHER 2 M HANDHELD CONVERTER

$39.95 MFJ -313

Turn your synthesized scanning 2 meter handheld into a hot Police/Fire/Weather band scanner! 144-148 MHz handhelds receive Police/Fire on 154-158 MHz with direct frequency readout. Hear NOAA maritime coastal plus more on 160-164 MHz. Converter mounts between handheld and rubber ducky. Feedthru allows simultaneous scanning of both 2 meters and Police/Fire bands. No missed calls. Crystal controlled. Bypass/Off switch allows transmitting (up to 5 watts). Use AAA battery. 2¼x1½x1½ in. BNC connectors.

MFJ/BENCHER KEYER COMBO

MFJ-422 **$109.95**

The best of all CW worlds- a deluxe MFJ Keyer in a compact configuration that fits right on the Bencher iambic paddle! MFJ Keyer - small in size, big in features. Curtis 8044-B IC, adjustable weight and tone front panel volume and speed controls (8-50 WPM). Built-in dot-dash memories. Speaker, sidetone, and push button selection of semi-automatic/tune or automatic modes. Solid state keying. Bencher paddle is fully adjustable; heavy steel base with non-skid feet. Uses 9 V battery or 110 VAC with optional adapter, MFJ-1305, $9.95.

VHF SWR/WATTMETER

MFJ-812 **$29.95**

Low cost VHF SWR/Wattmeter! Read SWR (14 to 170 MHz) and forward/reflected power at 2 meters. Has 30 and 300 watts scales. Also read relative field strength. 4x2x3 in.

1 KW DUMMY LOAD

MFJ-250 **$39.95**

Tune up fast, extend life of finals, reduce QRM! Rated 1KW CW or 2KW PEP for 10 minutes. Half rating for 20 minutes, continuous at 200 W CW, 400 W PEP. VSWR under 1.2 to 30 MHz, 1.5 to 300 MHz. Oil contains no PCB. 50 ohm non-inductive resistor. Safety vent. Carrying handle. 7½x6¾ in.

24/12 HOUR CLOCK/ID TIMER

MFJ-106 **$19.95** NEW

Switch to 24 hour UTC or 12 hour format! Battery backup maintains time during power outage. ID timer alerts every 9 minutes after reset. Red LED .6 inch digits. Synchronizable with WWV. Alarm with snooze function. Minute set, hour set switches. Time set switch prevents mis-setting. Power out, alarm on indicators. Gray and black cabinet. 5x2x3 inches. 110 VAC, 60 Hz.

DUAL TUNABLE SSB/CW/RTTY FILTER

MFJ-752B **$99.95**

Dual filters give unmatched performance! The primary filter lets you peak, notch, low pass or high pass with extra steep skirts. Auxiliary filter gives 70 db notch, 40 Hz peak. Both filters tune from 300 to 3000 Hz with variable bandwidth from 40 Hz to nearly flat. Constant output as bandwidth is varied; linear frequency control. Switchable noise limiter for impulse noise. Simulated stereo sound for CW lets ears and mind reject QRM. Inputs for 2 rigs. Plugs into phone jack. Two watts for speaker. Off bypasses filter. 9-18 VDC or 110 VAC with optional adapter, MFJ-1312, $9.95.

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MFJ 24 HOUR LCD CLOCKS

These MFJ 24 hour clocks make your DXing, contesting, logging and SKEDing easier, more precise.

Read both UTC and local time at a glance with the MFJ-108, $19.95, dual clock that displays 24 and 12 hour time simultaneously. Or choose the **MFJ-107, $9.95** single clock for 24 hour UTC time.

Both are mounted in a brushed aluminum frame, feature **huge easy-to-see 5/8 inch LCD numerals** and a sloped face that makes reading across-the-shack easy and pleasant.

MFJ-12/24 HOUR DUAL LCD CLOCK
MODEL MFJ-108

You can read hour, minute, second, month and day and operate them in an alternating time-date display mode. You can also **synchronize them to WWV** for split-second timing. Both are **quartz controlled** for excellent accuracy.

MFJ-108 **$19.95**

MFJ-107 **$9.95**

MFJ-24 HOUR LCD CLOCK
MODEL MFJ-107

They are **battery operated** so you don't have to reset them after a power failure, and battery operation makes them suitable for mobile and portable use. Long life battery included.

MFJ-108 is 4½x1x2 in. MFJ-107 is 2¼x1x2 in.

RTTY/ASCII/AMTOR/CW COMPUTER INTERFACE MFJ-1229 $179.95

Everything you need is included for sending and receiving RTTY/ASCII/CW on a Commodore 64 or VIC-20 and your ham rig. You get MFJ's most advanced computer interface, software on tape and all cables. Just plug in and operate.

The MFJ-1229 is a general purpose computer interface that will never be obsolete. An internal DIP switch, TTL and RS-232 ports lets you adapt the MFJ-1229 to nearly any home computer and even operate AMTOR with appropriate software.

A crosshair "scope" LED tuning array makes accurate tuning fast, easy and precise.

You can transmit both narrow (170 Hz) and wide (850 Hz) shift while the variable shift tuning lets you copy any shift (100-1000 Hz) and any speed (5-100 wpm, 0-300 baud ASCII).

Automatic threshold correction and sharp multi-pole active filters give good copy under severe QRM, weak signal and selective fading.

There's an FM (limiting) mode for easy trouble-free tuning that's best for general use and an AM (non-limiting) mode that gives superior performance under weak signals and heavy QRM.

A handy Normal/Reverse switch eliminates re-tuning while checking for inverted RTTY.

An extra sharp 800 Hz CW filter really separates the signals for excellent copy.

12½ x 12½ x 6 inches. Uses floating 18 VDC or 110 VAC with MFJ-1312, $9.95.

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AUSTRALIA

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VK4 RTTY GROUP

The South East Queensland Teletype Group recently held a seminar in the Communications Building of the South Brisbane TAFE College, the main aim being to introduce interested amateurs into the RTTY mode of operation. The seminar covered most subjects on RTTY from very basic topics to the writing of the most complicated computer programs for RTTY and was deemed a great success by all who attended.

The introduction to the seminar was given by the president of the SEQTG, Doug VK4ADC, who also lectured on the modulator/demodulator requirements and design and AMTOR with store and forward repeaters. Other subjects covered were: computer software for RTTY, Siemans 100 teleprinters (technical), packet radio, the Teletype™ Models 14 and 15 (practical), and modem tuning (practical).

The SEQTG is probably the most active RTTY group in Queensland (VK4), with a large reference library on both mechanical and electronic data on RTTY. They also have a 2-meter repeater located on Mt. Cotton (near Brisbane) for both data and voice, plus for RTTY DXers a weekly news service transmitted on 7.035 MHz each Monday night at 1000 UTC. For anybody wishing to know about RTTY activities within Australia, I could suggest nobody better than the SEQTG, PO Box 184, Fortitude Valley, Queensland 4006, Australia.

SOUTH AUSTRALIA—VK5

The state of South Australia, like Victoria, is a very young state, considering that we as amateurs talk to countries that have histories that go back thousands of years. We as Australians are proud of our history, however, and to us, celebrating 150 years of statehood is a big event.

So, 1986 for VK5 is a time to celebrate statehood, with special events starting in 1985. The official launch of S.A. amateur-radio communications took place during the week 27th May-1st June, in support of the WIA (S.A.) Jubilee 150 celebrations. The launch was from the Renaissance Center in the Rundle Mall, the center of Adelaide.

A week's program of worldwide communications was used to demonstrate, with display material, as many modes of communication as possible, including HF, CW, RTTY, ATV, and satellite. Three operating locations were used: a mobile radio van, a radio rental shop's ground-level window, and the spacious restaurant on the 6th floor of the Renaissance Center. The restaurant has a commanding view of the suburbs and the hills overlooking Adelaide and, therefore, is an excellent point of contact from which to work.

The purpose of the activity was to promote S.A. in advance of S.A.'s Jubilee 150th year, to highlight its birthday year, to promote activities of worldwide interest, and to demonstrate the many facets of the hobby of amateur radio. A special-event Jubilee 150 callsign was activated, together with the propagation, worldwide, of a unique QSL card which has been sponsored by the S.A. Department of Tourism.

The coordinators, on behalf of the WIA (S.A.) and S.A. amateurs, invited VIPs from the government, the Jubilee 150 Committee, and the Adelaide City Council, to participate in the launch. A special effort on the launch was to link up with Texas, USA, S.A.'s sister state.

A sample of the QSL card and the award will be made available for publication at a later date, and it and a full program of activities will be detailed and published in the WIA's *Amateur Radio Magazine*.

Instructor Rod VK4KAP shows the workings of a model 100 Teleprinter during the SEQTG RTTY seminar. ("You hit it here," says Rod.)

VK7—TASMANIA

Tasmania, like most of the early settlements in Australia, started out basically as a prison colony. The prison settlement of Port Arthur on the southernmost point of Tasmania was the furthest that the English could send their prisoners, using the old adage, "out of sight, out of mind," apparently.

The *very few* who did survive the trip out plus the harshness of the penal system found a gem of an island in the southern ocean that even today, because of its rugged grandeur, has not been fully explored.

Tasmania, these days, is the main port of call for fuel and provisions for all those multinational fishing fleets that fish the southern ocean; it also is the main refurbishing port for our VKØ stations in Antarctica. It is one of the main apple and potato suppliers to the mainland. That is why we call it "The Apple Isle."

The Tasmanian Devil

Tasmania is perhaps best known by DX award hunters for its Tasmanian Devil's Award, which appears to be one of the most sought after pieces of wallpaper available from "down under."

The Tasmanian Devil itself is well depicted in those Walt Disney cartoons as a whirlwind of ferocious teeth, with a sour disposition. It is said that they can be tamed by feeding them with hand-held pieces of chocolate—if you are not frightened of losing your hand, of course!

There are approximately 500 licensed amateurs within Tasmania. Of these, only 150 would be active on HF, so the latest QSL card figures I have for 1984 of around 11,015 inwards, and 7,672 outwards is equal to 51 cards each, outwards, so except for a few keen DX operators, they are not very active. This makes the above award a little harder to get, but it is well worth the extra effort.

Broadcasts

There is a local Sunday WIA news broadcast on 7.130 MHz (or Saturday at 2330 UTC) for those stations wanting to check band conditions or get more Tassie Devil contacts. There also is a net running for the Sunday broadcast info on Saturday at 0930 UTC on 3.570 that is worth checking.

RTTY

RTTY activity from the north coast of Tasmania has increased lately, courtesy of VK7NW. The main operating time is 1000 UTC on 3.625 MHz. For those interested in RTTY, other UTC broadcast times from VK2 are :

3.545	0930	VK2HL	(Horst)
7.045	0030	VK2DPM	(Alan)
14.095	0030	VK2DAY	(Rod)
21.095	0130	VK2AJP	(Joe)

Repeaters

Tasmania, being very mountainous compared with the rest of Australia, has, over its small area, four repeaters on 2-meter FM and four on 70 cm, and it is not unusual for the VK7 operators to access the VK3 or VK5 2-meter repeaters across the 300 to 500 miles of ocean between us. Direct contact on 2-meter SSB is also quite common, without large beams or power. To highlight this, the following appeared in "QRM" (the Tasmanian Division of the WIA's newsletter). It is reprinted with the permission of editor John VK7JK.

FRUSTRATION SECTION

With great aspirations for some experimental DX operating, Alan VK7ZAR and Greg VK7KJ set out at the start of a weekend in early January (at the height of summer) and headed off in the direction of Ben Lomond, 5,000 feet up. They were carrying a load of equipment covering from 6 meters to 1296 MHz and had set up HF links prior to their departure. But on their arrival, what did they find? It was blowing a gale and temperatures were down to freezing. Conditions, as Greg says, "were VKØ"—visibility nil and, with those windspeeds, no antennas either! Mike VK7ZWW had the key to the ski lodge, but where was he?? David VK7ZOT was a 1296 contact, but later on Saturday morning they had to cancel everything. To cap this story, on Saturday evening, Andy VK7ZAY in Hobart, heard a ZL calling on 144.1 SSB!! After travelling 600 km for nothing, that really was the end.

Greg VK7KJ.

VK7RY's SOUND ADVICE

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VK7 Convention

In June, a special convention was held to help celebrate the WIA's 75th birthday. This convention was held in the Montrose Bay Yacht Club overlooking the beautiful Derwent River. It was special because never before had there been so many and so diverse events and exhibitors gathered in one place in Tasmania.

They had, for instance, a reenactment of the first spark transmission and talks by VK7AW on computer-aided design of loaded dipoles and vertical antennas. VK7ZPK gave a lecture on tracking amateur satellites by computer, while VK7ZAR talked about setting up a satellite station—the equipment required and how to work same.

There was a large amount of home-brew gear; the best crafted of this equipment was entered for the Max Loveless award (see below).

Department of Communications representatives were in attendance with all their technical expertise, plus state-of-the-art test equipment, to test (free of charge) any amateur's equipment as to its transmission or reception specifications. If either was found lacking, friendly advice was given as to the best way to solve the problem.

In all, a very successful convention, finished off with a gala dinner at the Hobart Masonic Club.

Winnie the War Winner

Max Loveless VK7ML, a former State Councillor of the Tasmanian Division of the WIA, died in April, 1971. Max, as well as being an active amateur, spent a lifetime in "real" wireless communications. He played with the newfangled gadgetry of the early 30s, worked for the ABC in Hobart prior to World War II, and spent time in the AIF on Timor during the early dark days of that conflict.

It was there that he built "Winnie the War Winner," the radio transmitter constructed on kerosene tins and built up of recovered domestic radio equipment, captured Japanese apparatus, and the remains of a low-power Australian wireless set. Until the successful contact with Darwin on this apparatus, using a Morse key made from bamboo(!), the 200-odd Australian Army personnel who had been left on Timor were thought to be either killed or POW. They had lived off the land for a

Continued on page 94

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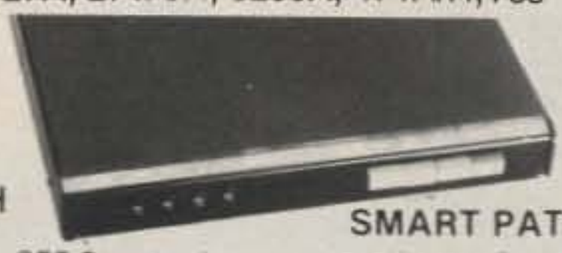

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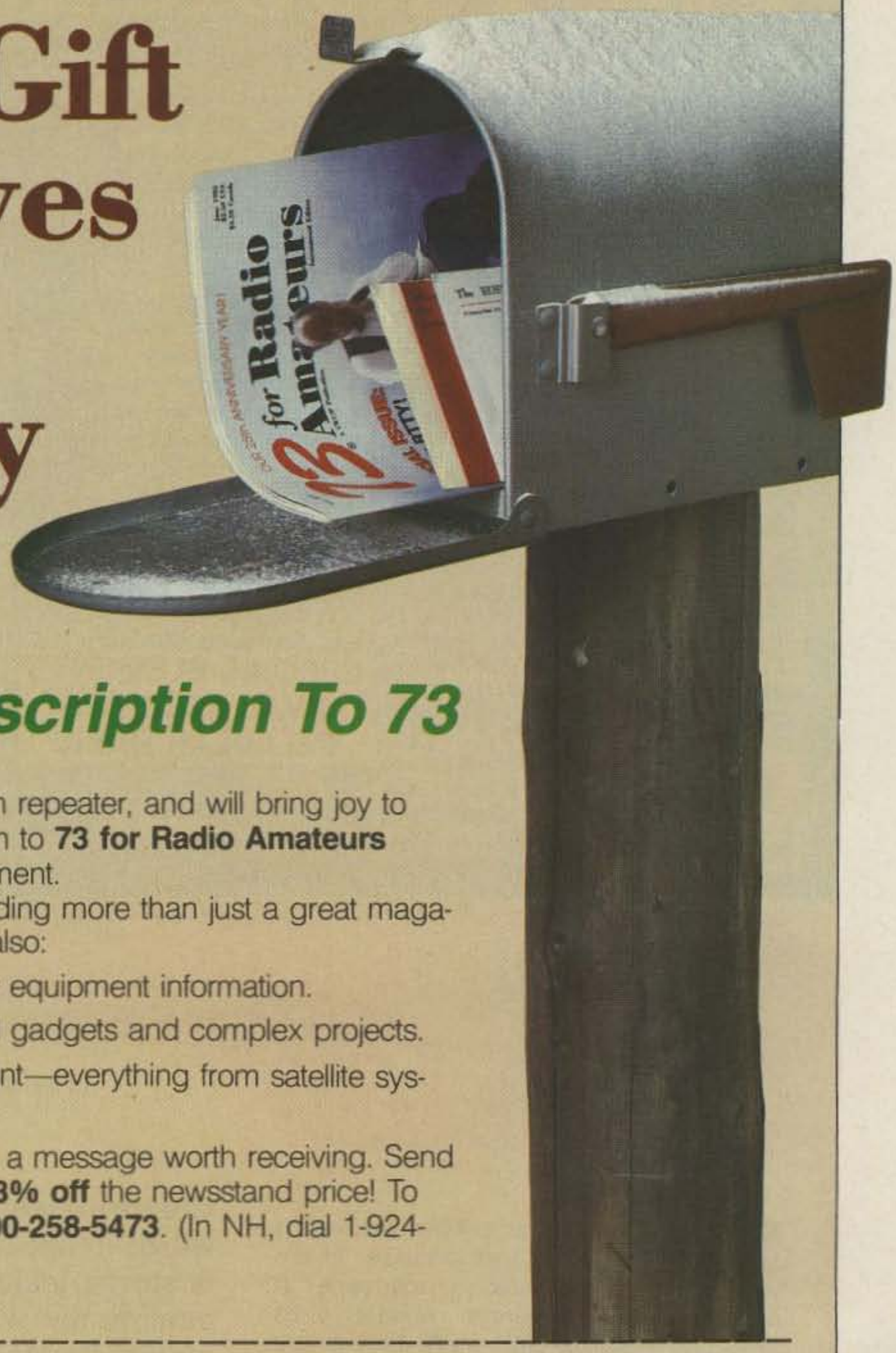

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A3	$215.00
A4	279.00
R3 Motor Tuned Vert.	279.00
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215WB 2M Wide Band	79.00
230WB Stacked 215's	219.00
32-19 Boomer 19ELE 2M	95.00
A147-4	32.95
A449-6	34.00
A449-11	44.00
Rango Ranger 2M,6M,220,450	39.95
AOP-1 Package	149.00

DAIWA

CN410M 3.5-150MHZ	$65.00
CN520 1.8-60MHZ	63.00
CN540 50-148MHZ	72.00
CN550 144-250 MHZ	81.00
CN620B 1.8-150MHZ	110.00
CN630 140-450MHZ	130.00
CN720B Same As CN6208 w/large Meter	CALL
CS401 4 Pos. Switch	62.00
CS201 2 Pos. Switch	23.00

KDK

HAL

Computer Interfaces & Dedicated Terminals

HEIL

Products in Stock ..... CALL

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All Amateur Antennas in Stock ..... CALL

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TH7DXS 7EL Tribander	$479.00
Explorer 14 3EL Tribander	329.00
18HTS 80-10M Vertical	439.00
18AVT/WBS 80-10M Vertical	109.00
14AVQ/WBS 40-10M Vertical	75.00
2 Mtr. Beams in Stock	CALL
V2S, V3S, V4S Verticals in Stock	CALL

ICOM

751 Top of the Line	$1179.00
745 Gen. Cov.	769.00
735 Fantastic New Xcvr	CALL
R71A World Class Receiver	Call
R-7000 Ultimate Scanner	CALL
1271A New 1.2GHZ Base Rig	CALL
471A/471H 430-450MHZ All Mode	699.95/949.95
271A/271H 2M Allmode	569.95/749.95
47A 440MHZ Mobile	399.95
37A 220MHZ Mobile	CALL

ICOM

27A/27H 2M 25W & 45W Mobiles	CALL
3AT/4AT 220/440 H.T.'s	ea. 229.95
2AT 2M H.T.	199.95
02AT 2 Mtr. H.T.	$289.95
04AT 440 MHZ H.T.	$289.95
3200 Dualband Mobile	CALL
Dual Band Antennas In Stock	CALL

Super Huge Inventory of Accessories & Radios

KANTRONICS

Packet Communicator in Stock	CALL
UTU Universal Terminal Unit	$179.95
UTU-Sx Do-It-All Terminal Unit	CALL
Interface II Deluxe interface	229.95
Large Inventory of Software & Pac-Term Programs in Stock	CALL

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2M-14C 2M Circular Ant	$ 85.00
2M-22C 2M Circular Ant	120.00
2M-16LBX 2M Ant.	105.00
435-18C w/CS-2	120.00
435-40CX Circular Ant	149.95
Many More Antennas in Stock	CALL

LARSEN

NLA 150/220/450 MAG. Mnt.	ea	$ 42.95
NLA 2/70 Dual Band MAG. Mnt. Ant.		59.95

MFJ

1229 Interface/free Software	$159.95
1224 Interface/free Software	85.00
1226 Interface/free Software	59.95
989 3KW Roller Inductor tuner	289.95
949C 300W W/Tuner w/D Load	135.00
941D 300 W/full feature tuner	89.95
204 Antenna Bridge	71.95
422 Keyer Bencher Combo	99.95
108 Dual Clock	$19.95

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B1016 10/160W-Preamp	$249.95
B3016 30/160W-Preamp	204.95
B23A 2/30W-Preamp	89.95
D1010N 10/100W 430-450 MHZ	289.95

NYE

MB-V-A The Ultimate Tuner	$499.95

RADIO AMATEUR CALLBOOK

1986 North American Callbook	$21.95
1986 International Callbook	$20.95

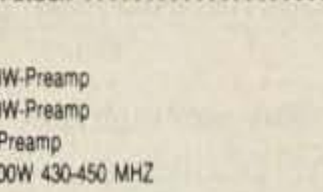
SANTEC

ST-20T **New** Superior Function H.T.	CALL

SHURE

444D Hi-Lo Z Desk Mic	$ 55.00

TEN-TEC



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Titan-Your Last Amplifier	CALL

TEN-TEC

Century 22 CW Xcvr	$349.95
525D Argosy	525.00
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229 2KW Tuner	$269.95
4229 2KW Tuner Kit	$199.95
Large Stock of Ten Tec Products	CALL

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HL160V 3 10-160W Amp	295.95
HL160V25 25-160W Amp	259.95
HL-20U 430-449 MHZ 3-20W Amp	105.95
HL 120U 430-449 MHZ 10-100W Amp	$329.95
HC-2000 2KW Tuner	295.95
HC 400L Tuner w/Dual Needle Mtr	175.95
HRA-2 2 Mtr. Gasfet Preamp mast mount	119.95
HRA-7 70 CM Gasfet Preamp mast mount	119.95

WELZ

SP-220 1.8-220 MHZ Peak Mtr	$49.95
SP-230 1.8-150 MHZ Watt Mtr	46.95
SP-420 140-525 MHZ Peak Mtr	63.95
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CT15A Dummy Load DC-500MHZ	$12.00
CT15N Same as above but w/N-Conn	21.00
DF72S Mobile Duplexer	29.95
DP-ED 770-E Dual Band Antenna	29.95
DP-SPM Mag. Mnt. for above Antenna	24.95
Large Stock of All SWR & Power Meters	CALL

YAESU

FRG 9600 60-905 MHz Scanner	CALL
FRG8800 HF Communications Rcvr	CALL
FT980 Deluxe Xcvr	1425.00
FT757GX Gen. Cov. Xcvr	CALL
FP757HD Heavy Duty Power Supply	175.00
FC757AT Auto Ant. Tuner	235.00
MMB-20 Mounting Backet for 757GX	24.00
FT726R Tri Band Xcvr	CALL
FT726R Modules in Stock	CALL
MD-1B8 Desk Mic.	69.00
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FT270R 45W 2M Mobile **Free FTS-8**	CALL
FT2700 RH Dual Band Mobile Free FTS-8	CALL

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Call for Discount

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Daiwa	Call for Price
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HyGain Ham 4	CALL
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COLLECTOR'S ITEMS

1986 Ham Station Calendar	$1.50
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I convinced my club to buy a repeater controller from ACC and I'm glad I did.

The group I belong to was looking to upgrade our system and I was the one asked to investigate. Of course, we've always been the best in our area but we needed more. We needed a system that was reliable, easy to interface, cost-effective, and something that would free-up the technical committee for more interesting projects than just keeping the equipment running.

Everyone in the club put a few bucks into the pot and it was ours!

We really use the features like the scheduler, remote programming (from an HT, over the phone, or via a computer terminal), informative voice messages and courtesy tones, telemetry, remote bases, and the most sophisticated autopatch ever designed for amateur use.

Of course, the controller is state-of-the-art, commercial quality, and built to last. Workmanship so solid even the military uses them.

What impressed me even more, though, is the support we get from the staff at ACC — both before and after the sale. And they protect our investment through simple plug-in software upgrades...new features and capabilities that keep our club on top.

I feel good about recommending the Advanced Computer Controls line of repeater controllers. After all, it's *my* club's money that was spent and *my* reputation that was on the line.

Call or write for detailed specifications on the RC-850 and RC-85 Repeater Controllers.

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QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

HAM HELP

I'd like to get in touch with anyone interested in starting a rag-chew net on 6-meter FM simplex in San Diego County and beyond.

B. Kirschner WB0YCQ
266 Carissa Drive
San Louis Ray CA 92056-1745

I need a schematic and any other information for a Hallicrafters S40A receiver. I will gladly pay copying and postal charges.

G. Samkofsky N4ZB
1420 Mount Vernon Drive
Holiday FL 33590

Kantronics out "SMARTS" the competition

Presenting three intelligent, versatile, compatible terminal units.

"SMART" means an internal microprocessor is used to improve performance and add versatility. The "Smart" Kantronics TU's can transmit and receive CW/RTTY/ASCII/AMTOR or Packet when combined with your computer and transceiver.

Any computer with a serial RS232 or TTL port can connect directly to a Kantronics TU. A simple terminal program, like one used with a telephone modem, is the only additional program required. Kantronics currently offers Pac-term and UTU Terminal Programs for **IBM, Kaypro, Commodore 64, VIC 20, and TRS-80 Models III, IV, and IVP.** Disk version $19.95. Cartridge $24.95.

UTU The Universal Terminal unit (UTU) is the original "Smart" amateur TU. CW, RTTY, ASCII, and AMTOR can all be worked with this single unit. Switched capacitance filters and LED display tuning make using the UTU easy for even the Novice. 12 Vdc 300mv power supply required. Suggested retail $199.95.

UTU-XT The UTU-XT is an enhanced version of the UTU. Programmable baud rates, tone frequencies, and tone shifts give special versatility. Automatic Gain Control and Threshold Correction circuits greatly enhance sensitivity and selectivity. A RTTY signal detect circuit mutes copy with no carrier, and the CW filter center frequency and bandwidth are programmable. Power supply is provided. Suggested retail $359.95.

Packet Communicator Kantronics joined the Packet Radio revolution with the Packet Communicator. The unit is an AX.25/ Vancouver compatible TNC with features not found in other units, including Direct TTL connection for easy hookup to the **VIC-20 and Commodore 64.** With our onboard modem you can select either Bell 202 or 103 tones for VHF/UHF or HF work. Power supply is provided. Suggested retail $219.00.

For more information contact your local Kantronics dealer or write:

Kantronics
1202 E. 23rd Street (913) 842-7745
Lawrence, Kansas 66046

73 INTERNATIONAL

from page 86

number of months and kept 15,000 Japanese troops occupied, who could otherwise have been moving into northwest Australia. "Winnie" is now preserved in the Australian War Museum in Canberra.

Pioneer Memorial Collection

Not many amateurs have the honor of an award (or, in this case, a collection) named after them, but the Max Loveless Pioneer Memorial Collection was created by the Tasmanian Branch of the Telecom Technicians' Union (ATEA) to honor a person who used his skills in amateur radio not only to help other amateurs but also his country in a time of need. The following is an excerpt from their impressive promotional literature:

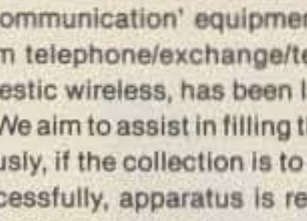
"The Tasmanian Branch of the Telecom Technicians' Union (ATEA) has decided to honour Max's name and the memory of all those people who have been engaged, by vocation or pastime, in the pioneer days of communications. The endeavours of these pioneers have brought us to the current state of the art which we now all enjoy."

"It is intended that a collection of valve-era equipment will be gradually assembled, restored to working order, and made available for public display. Hopefully, the whole collection will be able to be eventually placed in a permanent formal museum environment, maybe through the co-operative efforts of established authorities in the area. It is not intended that this collection should compete in any way with existing endeavors by other public or private initiatives, rather, we would see our efforts as being complementary to existing endeavours by both public and private collectors. We think the preservation of actual 'communication' equipment, as distinct from telephone/exchange/telegraphy and domestic wireless, has been largely neglected. We aim to assist in filling that gap."

Obviously, if the collection is to get under way successfully, apparatus is required. In particular, the following items are eagerly sought (some limited funds are available for the purchase of such equipment):

- Old ex-service gear; in particular, we would like to get hold of an R101 or an R109 set (these were actually in use on Timor and would be fundamental to the collection), no.22, no.19, HRO, AR8, AT5, AR88, B28, B40, and similar apparatus.
- Home-brew apparatus of all types which may have been discarded in intervening years.

Should you feel able to assist us in this most worthwhile venture, please contact me by telephone in Hobart, 002 286 351, or perhaps write to: Barry Riseley, Branch Secretary, ATEA, GPO Box 215c, Hobart, Tasmania, Australia.



LIBERIA

Brother Donard Steffes, C.S.C.
EL2AL/WB8HFY
Brothers of the Holy Cross
St. Patrick High School
PO Box 1005
Monrovia
Republic of Liberia

Moses EL2BS is on the air! He may be found up and down the 20-meter band calling CQ and cheerfully picking up anyone who would like a Liberian contact. Moses operates a Drake TR-4C into a Mosley TA-33 through one hundred and fifty feet of heliax.

So...what is there to get excited about? Well, a couple of things. Moses is a young Liberian. He is a student at the University of Liberia. He came to us asking, "What is ham radio?" Now, having finished our radio course with gusto and holding his own call, he has no radio and little likelihood of getting one.

We knew that this was going to happen when we started, four years ago, a program to expand amateur radio in Liberia. We decided then that the club station was the answer. Moses operates club station EL2RL, which is the property of the Liberia Radio Amateur Association. The Drake TR-4C was donated by David Shaw PJ8DFS of the Dutch Antilles. The TA-33 is my own station antenna which I switch to the club station through the long heliax—which is another donation.

Yes, we are excited. With this station in operation we see progress and, more important than that, with his experience of operating this station, Moses has developed into an excellent operator. He runs traffic into the States for some of the local missionaries, and with this new skill he has been able to take a job as a radio operator for an international company which has offices here in Monrovia.

We have two other club stations. One is operated by a missionary in Buchanan and the other by a missionary in Gbonga. I have no details on recent activities in these two places, but I do know that they are teaching classes in amateur radio. We have tested students in these mission communities and the results are discouraging. Their success rate, like ours here in Monrovia, is very low. We could write pages of reasons for this low success rate, bet let us say simply that these Liberian young people work under great handicaps. In spite of all this we see no other direction in which to go. We must offer this training in amateur radio to students, young and old, through our missionary people in the outlying areas, and set up stations for them to use—otherwise it will not be done.

When I came to Monrovia in 1980, this work of instructing and testing was already going on. The Liberia Radio Amateur Association at that time was under the leadership of Mr. Walcott Benjamin EL2BA, who was its president. Even now he is known as Mr. Amateur Radio of Liberia. Without his persistence and dedication it is doubtful that amateur radio would have survived in these parts. That is another whole story which needs to be written. Working with him was Mr. "Lee" Ruff EL2FE, who did all the technical work. Lee also wrote the examinations, and between the two of them they administered them. Lee is in engineering and management with Firestone. He keeps the plantation going.

Today we carry on. Ben EL2BA is still the power that keeps us going, though we now have the help of many other people, both native and expatriate. We hope to write into history many more success stories like that of Moses.

Give Moses a call on 20 meters between 1800 and 1900 Zulu on Monday or Wednesday. He will tell you about Liberia and its amateurs from the point of view of a native.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	40	40	40	80	80				20	15	15
AUSTRALIA	20		20		40	40	20	20			15[1]	15[1]
CANAL ZONE	15	20	20	40	40		20	20	15	15	15*	15*
ENGLAND	20	40	80	40	40		20	20	20	20	20	20
HAWAII	20		20		40	40	80	20			15[1]	15[1]
INDIA	[illegible]					20[1]	40[1]	20[1]				15[1]
JAPAN	20						20	20				20
MEXICO	15	20	20	40	40		20	20	15	15	15*	15*
PHILIPPINES							20					
PUERTO RICO	15	20	20	40	40		20	20	15	15	15*	15*
SOUTH AFRICA			40[1]	40[1]				15	15	15	20	20
U.S.S.R.	40	80	80	40			20	20	20			40
WEST COAST		80	80	40	40	40	20	20	20			

CENTRAL UNITED STATES TO:

ALASKA						80*	40*	20				
ARGENTINA	20		40	40	40						15	15
AUSTRALIA	15					40	20	20	20			15
CANAL ZONE	20	80	40	40	40	40	20	20	15	15	15	20
ENGLAND	40	40	40	80				20	15	20		40
HAWAII	15	20			40	40	40				15	15
INDIA	15[1]	20[1]	20[1]				40[1]	20[1]	20[1]			
JAPAN						80*	40*	20				
MEXICO	20	80	40	40	40	40	20	20	15	15	15	20
PHILIPPINES								20				
PUERTO RICO	20	80	40	40	40	40	20	20	15	15	15	20
SOUTH AFRICA	20	40*							15	15	20	20
U.S.S.R.	40		40	40				20	20			

WESTERN UNITED STATES TO:

ALASKA	15	20			40	40	40	40	40			20
ARGENTINA	15	20		40	40	40	40	40		15	15	15
AUSTRALIA	15	20	20				40	80*	40	15	15	15
CANAL ZONE	20	20		40	40	40			20	15	15	15
ENGLAND			80*	40					20	20		
HAWAII	15	15			20	20	20	20				15
INDIA		20										
JAPAN	15	20			40	40	40	40	40			20
MEXICO	20	20		40	40	40			20	15	15	15
PHILIPPINES	15	20					40	40		20		20
PUERTO RICO	20	20		40	40	40			20	15	15	15
SOUTH AFRICA	20	40[1]	40[1]							15	15	20
U.S.S.R.		40[1]	40[1]	40[1]	40[1]				20	20		
EAST COAST		80	80	40	40	40	20	20	20			

1 = May be open only once or twice during month.
*** = Try next higher band.**

G = Good, F = Fair, P = Poor.

DECEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
1 G	2 F	3 F	4 F	5 G	6 G	7 G
8 P	9 P	10 P	11 G	12 G	13 P	14 P
15 P	16 P	17 G	18 F	19 P	20 P	21 P
22 F	23 G	24 P	25 F	26 G	27 G	28 G
29 G	30 G	31 G				

ADVERTISERS

What To Look For In A Phone Patch

The best way to decide what patch is right for you is to first decide what a patch should do. A patch should:

- Give complete control to the mobile, allowing full break in operation.
- Not interfere with the normal operation of your base station. It should not require you to connect and disconnect cables (or flip switches!) every time you wish to use your radio as a normal base station.
- Not depend on volume or squelch settings of your radio. It should work the same regardless of what you do with these controls.
- You should be able to hear your base station speaker with the patch installed. Remember, you have a base station because there are mobiles. ONE OF THEM MIGHT NEED HELP.
- The patch should have standard features at no extra cost. These should include programmable toll restrict (dip switches), tone or rotary dialing, programmable patch and activity timers, and front panel indicators of channel and patch status.

ONLY SMART PATCH HAS ALL OF THE ABOVE.

Now Mobile Operators Can Enjoy An Affordable Personal Phone Patch. . .

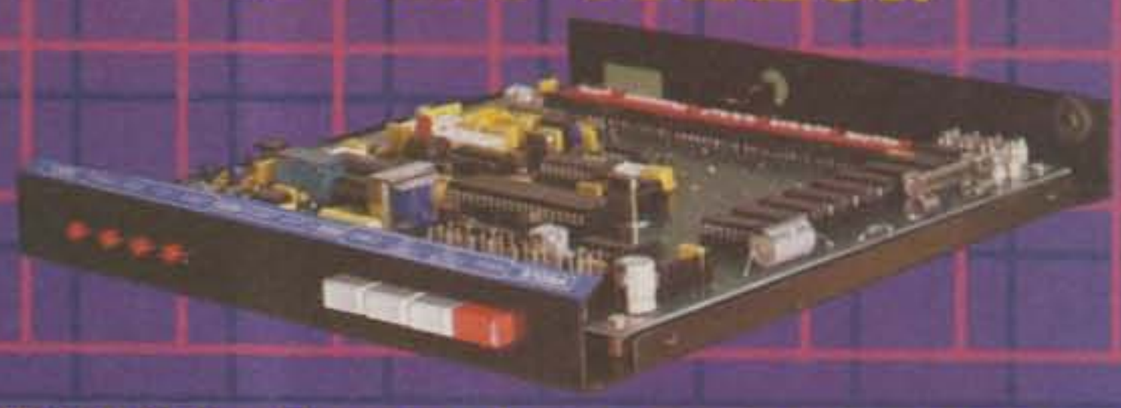
- Without an expensive repeater.
- Using any FM tranceiver as a base station.
- The secret is a SIMPLEX autopatch. The *SMART PATCH.*

SMART PATCH Is Easy To Install

To install *SMART PATCH*, connect the multicolored computer style ribbon cable to mic audio, receiver discriminator, PTT, and power. A modular phone cord is provided for connection to your phone system. Sound simple? . . . IT IS!

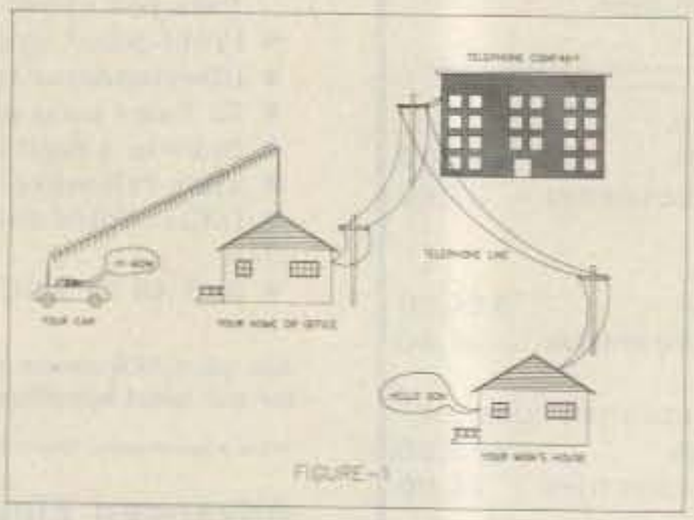
With SMART PATCH You are in CONTROL

With CES 510SA Simplex Autopatch, there's no waiting for VOX circuits to drop. Simply key your transmitter to take control.

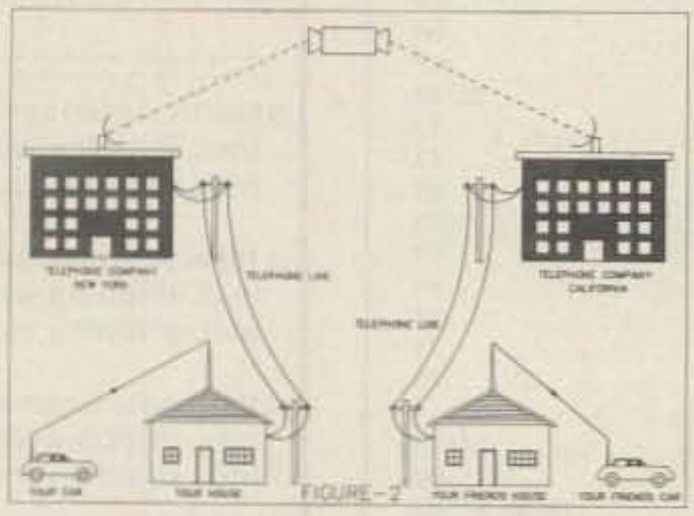


SMART PATCH is all you need to turn your base station into a personal autopatch. SMART PATCH uses the only operating system that gives the mobile complete control. Full break-in capability allows the mobile user to actually interrupt the telephone party. SMART PATCH does not interfere with the normal use of your base station. SMART PATCH works well with any FM transceiver and provides switch selectable tone or rotary dialing, toll restrict, programmable control codes, CW ID and much more.

To Take CONTROL with Smart Patch — Call 800-327-9956 Ext. 101 today.



FIGURE–1



FIGURE–2

How To Use *SMART PATCH*

Placing a call is simple. Send your access code from your mobile (example: *73). This brings up the Patch and you will hear dial tone transmitted from your base station. Since *SMART PATCH* is checking about once per second to see if you want to dial, all you have to do is key your transmitter, then dial the phone number. You will now hear the phone ring and someone answer. Since the enhanced control system of *SMART PATCH* is constantly checking to see if you wish to talk, you need to simply key your transmitter and then talk. That's right, you simply key your transmitter to interrupt the phone line. The base station automatically stops transmitting after you key your mic. *SMART PATCH* does not require any special tone equipment to control your base station. It samples very high frequency noise present at your receivers discriminator to determine if a mobile is present. No words or syllables are ever lost.

SMART PATCH Is All You Need To Automatically Patch Your Base Station To Your Phone Line.

Use *SMART PATCH* for:

- Mobile (or remote base) to phone line via Simplex base. (see fig 1.)
- Mobile to Mobile via interconnected base stations for extended range. (see fig. 2.)
- Telephone line to mobile (or remote base).
- *SMART PATCH* uses SIMPLEX BASE STATION EQUIPMENT. Use your ordinary base station. *SMART PATCH* does this without interfering with the normal use of your radio.

WARRANTY?
YES, 180 days of warranty protection. You simply can't go wrong.
An FCC type accepted coupler is available for *SMART PATCH.*

Communications Electronics Specialties, Inc.
P.O. Box 2930, Winter Park, Florida 32790
Telephone: (305) 645-0474 **Or call toll-free (800)327-9956**

More output for the money you put out.

Why buy a low-power thumbwheel HT when Yaesu's high-power handhelds are available for virtually the same price?

Ours give you 2.5 watts RF output right off the shelf. Or 3.7 watts with the optional FNB-4 battery pack.

Ours come with a hi/low power switch. A relative signal strength/PO meter with nightlight. And built-in VOX capability. (Optional headset required.)

Plus ours offer options like a DTMF keypad. And a plug-in subaudible tone board with both encode *and* decode capability.

And thanks to our unique robotic assembly of surface mount components, it's all enclosed in a lightweight and compact case, measuring just 2.6 x 1.4 x 6.1 inches.

Choose from three models: the FT-203R for 2 meters, the FT-703R for 440 MHz, and the FT-103R for 220 MHz.

As standard equipment you get a rechargeable battery, AC wall charger, rubber duck, earphone, belt clip and soft case.

Plus a wealth of optional accessories. Including a fast charger. VOX headset with boom mic. Mobile radio hanger. Speaker/microphone. DC car adapter. And much more.

So don't settle for low power in a thumbwheel HT.

Go with Yaesu. The best way to get more power for your dollar.

YAESU

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Yaesu Cincinnati Service Center
9070 Gold Park Drive, Hamilton, OH 45011
(513) 874-3100

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NEW!

"DX-cellence!"

TS-940S

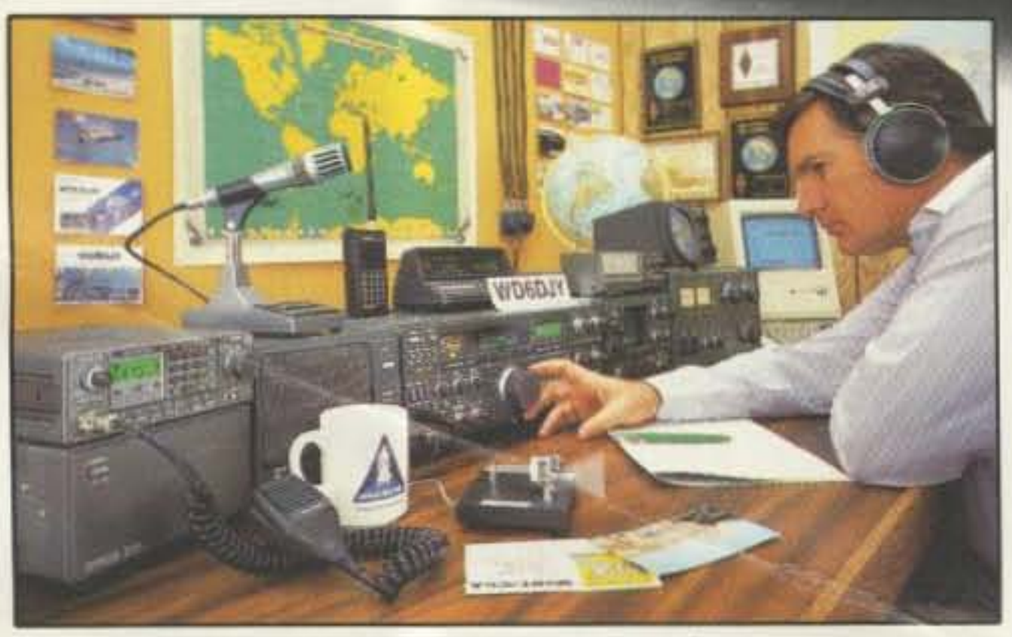
The new TS-940S is a serious radio for the serious operator. Superb interference reduction circuits and high dynamic range receiver combine with superior transmitter design to give you no-nonsense, no compromise performance that gets your signals through! The exclusive multi-function LCD sub display graphically illustrates VBT, SSB slope, and other features.

- **100% duty cycle transmitter.** Super efficient cooling system using special air ducting works with the internal heavy-duty power supply to allow continuous transmission at full power output for periods exceeding one hour.
- **Programmable scanning.**
- **Semi or full break-in (QSK) CW.**
- **Low distortion transmitter.** Kenwood's unique transmitter design delivers top "quality Kenwood" sound.
- **Keyboard entry frequency selection.** Operating frequencies may be directly entered into the TS-940S without using the VFO knob.
- **Graphic display of operating features.** Exclusive multi-function LCD sub-display panel shows CW VBT, SSB slope tuning, as well as frequency, time, and AT-940 antenna tuner status.
- **QRM-fighting features.** Remove "rotten QRM" with the SSB slope tuning, CW VBT, notch filter, AF tune, and CW pitch controls.
- **Built-in FM, plus SSB, CW, AM, FSK.**

Optional accessories:

• AT-940 full range (160-10 m) automatic antenna tuner • SP-940 external speaker with audio filtering • YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filters; YK-88A-1 (6 kHz) AM filter • VS-1 voice synthesizer • SO-1 temperature compensated crystal oscillator • MC-42S UP/DOWN hand mic. • MC-60A, MC-80, MC-85 deluxe base station mics. • PC-1A phone patch • TL- 922A linear amplifier • SM-220 station monitor • BS-8 pan display • SW-200A and SW-2000 SWR and power meters.

- **High stability, dual digital VFOs.** An optical encoder and the flywheel VFO knob give the TS-940S a positive tuning "feel."
- **40 memory channels.** Mode and frequency may be stored in 4 groups of 10 channels each.
- **General coverage receiver.** Tunes from 150 kHz to 30 MHz.
- **1 yr. limited warranty.** Another Kenwood First.



More TS-940S information is available from authorized Kenwood dealers.

KENWOOD

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Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.
Specifications and prices are subject to change without notice or obligation.