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Amateur Radio

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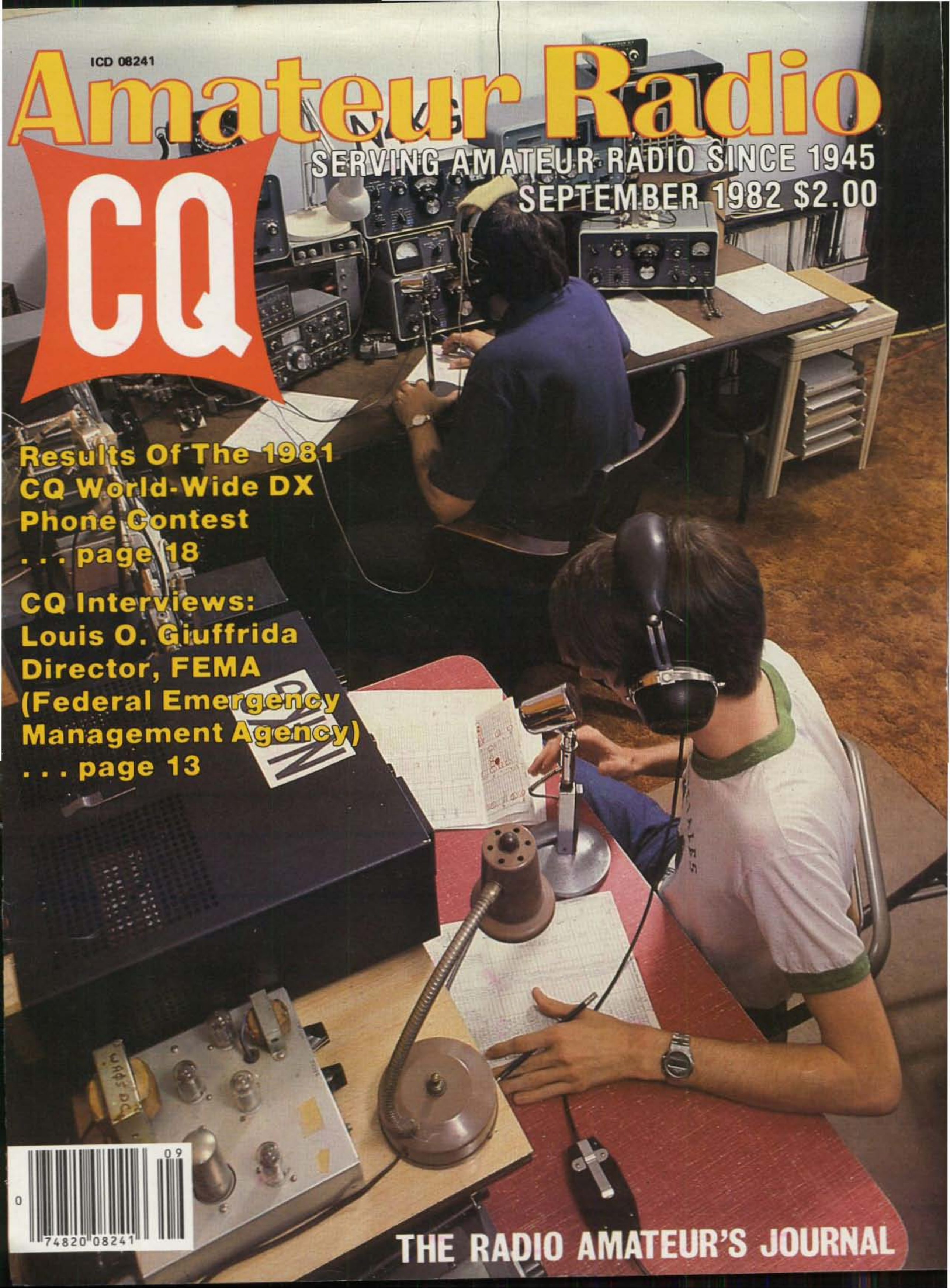
SEPTEMBER 1982 $2.00

CQ



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THE RADIO AMATEUR'S JOURNAL

TS-830S

"Top-notch"...VBT, notch, IF shift, wide dynamic range

The TS-830S has every conceivable operating feature built-in for 160-10 meters (including the three new bands). It combines a high dynamic range with variable bandwidth tuning (VBT), IF shift, and an IF notch filter, as well as very sharp filters in the 455-kHz second IF.

TS-830S FEATURES:

- LSB, USB, and CW on 160-10 meters, including the new 10, 18, and 24-MHz bands. Receives WWV on 10 MHz.
- Wide receiver dynamic range. Junction FETs in the balanced mixer, MOSFET RF amplifier at low level, and dual resonator for each band.
- Variable bandwidth tuning (VBT). Varies IF filter passband width.
- Notch filter high-Q active circuit in 455-kHz second IF.
- IF shift (passband tuning).
- Noise-blanker threshold level control.
- Built-in digital display, (fluorescent tube), with analog dial.
- 6146B final with RF negative feedback. Runs 220 W PEP (SSB)/180 W DC (CW) input on all bands.
- Built-in RF speech processor.
- Narrow/wide filter selection on CW.
- SSB monitor circuit.
- RIT and XIT (transmitter incremental tuning).

Optional accessories:

- SP-230 external speaker.
- VFO-230 external digital VFO with five memories, digital display.
- VFO-240 external analog VFO.
- AT-230 antenna tuner.
- YG-455C (500 Hz) or YG-455CN (250 Hz) CW filter for 455 kHz IF.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter for 8.83 MHz IF.
- KB-1 deluxe heavyweight knob.

NEW

TS-130SE

"Small talk"...IF shift, Processor, N/W switch, affordable.

A compact, all solid-state HF SSB/CW transceiver for mobile or fixed base station, covering 3.5 to 29.7 MHz.

TS-130SE FEATURES:

- 80-10 meters including the new 10, 18, and 24 MHz bands. Receives WWV on 10 MHz.
- TS-130SE runs 200 W PEP/160 W DC input on 80-15 meters, 160 W PEP/140 W DC on 12 and 10 meters. TS-130V version at 25 W PEP/20 W DC, all bands, also available.
- Digital display, built-in.
- IF shift circuit.
- Speech Processor, built in.
- Narrow/wide filter selection on CW and SSB with optional filters.
- Automatic SSB mode selection (LSB on 40 meters and below, USB on 30 meters and up). SSB reverse switch provided.
- RF attenuator, built-in.
- Effective noise blanker.
- Final amplifier protection circuit assures maximum reliability. Output power is reduced if abnormal operating conditions occur. For very severe operations, optional cooling fan, FA-4, is available.
- Dimensions: 3-3/4 H x 9-1/2 W x 11-9/16 D (inches). Weight: 12.3 lbs.
- Other features: VOX, CW semi break-in with sidetone, one fixed channel, and 25 kHz marker.

Optional DFC-230 Digital Frequency Controller
Frequency control in 20-Hz steps with UP/DOWN microphone (supplied with DFC-230). Four memories and digital display. (Also operates with TS-120S, TS530S, and TS-830S.)

Optional accessories:

- PS-30 matching power supply (TS-130SE).
- KPS-21 power supply (TS-130SE).
- PS-20 power supply (TS-130V).
- SP-120 external speaker.
- VFO-120 remote VFO.
- FA-4 fan unit (TS-130SE).
- YK-88C (500 Hz) and YK-88CN (270 Hz) CW filters.
- YK-88SN (1.8 kHz) narrow SSB filter.
- AT-130 antenna tuner.
- MB-100 mobile mounting bracket.

KENWOOD

TRIO-KENWOOD COMMUNICATIONS
1111 West Walnut, Compton, California 90220

R-600

"Now hear this"...digital display, easy tuning

The R-600 is an affordably priced, high performance general coverage communications receiver covering 150 kHz to 30 MHz in 30 bands. Use of PLL synthesized circuitry provides maximum ease of operation.

R-600 FEATURES:

- 150 kHz to 30 MHz continuous coverage, AM, SSB, or CW.
- 30 bands, each 1 MHz wide, for easier tuning.
- Five digit frequency display, with 1 kHz resolution.
- 6 kHz IF filter for AM (wide), and 2.7 kHz filter for SSB, CW and AM (narrow).
- Up-conversion PLL circuit, for improved sensitivity, selectivity, and stability.
- Communications type noise blanker eliminates "pulse-type" noise.
- RF Attenuator allows 20 dB attenuation of strong signals.
- Tone control. • Front mounted speaker.
- "S" meter, with 1 to 5 SINPO "S" scale, plus standard scale.
- Coaxial and wire antenna terminals.
- 100, 120, 220, and 240 VAC, 50/60 Hz. Selector switch on rear panel.
- Optional 13.8 VDC operation, using DCK-1 cable kit.
- Other features include carrying handle, headphone jack, and record jack.

Optional accessories for R-600 and R-1000:

- DCK-1 DC Cable kit. • SP-100 External Speaker.
- HS-6, HS-5, HS-4 Headphones.
- HC-10 Digital World Clock.

R-1000

High performance, easy tuning, digital display

The R-1000 high performance communications receiver covers 200 kHz to 30 MHz in 30 bands. An up-conversion PLL synthesized circuit provides improved sensitivity, selectivity, and stability.

R-1000 FEATURES:

- Covers 200 kHz to 30 MHz.
- 30 bands, each 1 MHz wide.
- Five-digit frequency display with 1-kHz resolution and analog dial with precise gear dial mechanism.
- Built-in 12-hour quartz digital clock/timer.
- RF step attenuator.
- Three IF filters for optimum AM, SSB, CW.
- Effective noise blanker. • Tone control.
- Built-in 4-inch speaker. • Dimmer switch.
- Wire and coax antenna terminals.
- Voltage selector for 100, 120, 220, and 240 VAC. Operates on 13.8 VDC with optional DCK-1 kit.

TS-530S

"Cents-ational"...IF shift, digital display, narrow-wide filter switch

The TS-530S SSB/CW transceiver covers 160-10 meters using the latest, most advanced circuit technology, yet at an affordable price.

TS-530S FEATURES:

- 160-10 meters, LSB, USB, CW, all amateur frequencies, including new 10, 18, and 24 MHz bands. Receives WWV on 10 MHz.
- Built-in digital display (six digits, fluorescent tubes), with analog dial.
- IF shift tunes out interfering signals.
- Narrow/wide filter selector switch for CW and/or SSB.
- Built-in speech processor, for increased talk power.
- Wide receiver dynamic range, with greater immunity to overload.
- Two 6146B's in final, allows 220W PEP/180 W DC input on all bands.
- Advanced single-conversion PLL, for better stability, improved spurious characteristics.
- Adjustable noise-blanker, with front panel threshold control.
- RIT/XIT front panel control allows independent fine-tuning of receive or transmit frequencies.

Optional accessories:

- SP-230 external speaker with selectable audio filters.
- VFO-240 remote analog VFO.
- VFO-230 remote digital VFO.
- AT-230 antenna tuner/SWR/power meter.
- MC-50 desk microphone
- KB-1 deluxe VFO knob.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter.
- YK-88SN (1.8 kHz) narrow SSB filter.

TS-660

The TS-660 "QUAD BANDER" covers 6, 10, 12, 15 meters.

- FM, SSB (USB), CW, and AM
- Dual digital VFO's
- Digital display
- IF shift built-in
- 5 memories with memory scan
- UP/DOWN microphone
- All-mode squelch
- Noise blanker
- CW semi break-in/sidetone
- 10 W on SSB, CW, FM; 4 W on AM.

Optional accessories:

- PS-20 power supply
- VOX-4 speech processor/VOX
- SP-120 External speaker
- MB-100 Mobile mount
- YK-88C, YK-88CN CW filters
- YK-88A AM filter.

KENWOOD

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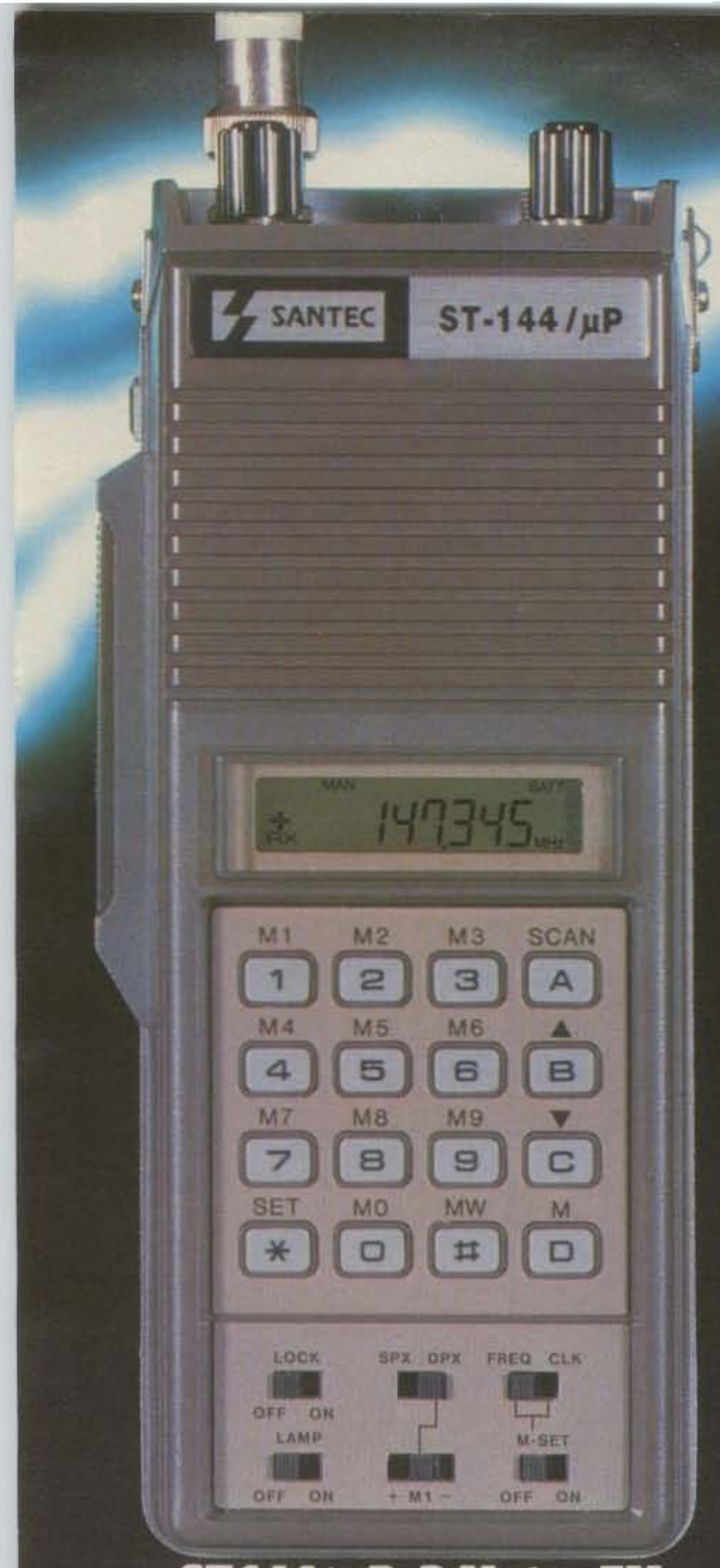
1111 West Walnut, Compton, California 90220



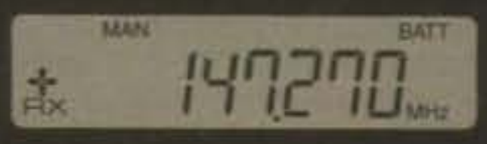
ST-144/μP, 2 Meter FM

It's Time!

■ It's time you got your share of the excitement of full-feature synthesized handheld operations. ■ SANTEC{nology zaps to the lead of the state-of-the-art in 2 meter handhelds with the new ST-144/μP. ■ Only SANTEC hands you all the up-to-the-minute features of this "clockwise" precision jewel.

■ The 24 hour format digital clock on the LCD display is uniquely SANTEC, and it typifies the thoughtful operator-oriented design incorporated throughout the ST-144/μP. ■ Not only does it give you accurate time checks whenever you want, but also it can display the time instead of the frequency, while this handful of radio continues to operate on your "favorite" frequency.

24 Hr Clock provides time of day even while the radio is turned off, or it can be selected by the front panel switch while in QSO.



Full Frequency Display showing offset selected, battery condition and current scan mode. At turnon, the contents of M-1 are loaded into the operating register, and the display looks like this.

The Memory Mode is indicated by the small "M" above " + ", the "5" indicates that the data were stored in Memory 5 before recall. The " + " indicates that the + offset was stored with the frequency.

Memory Scan with "Priority Scan/Auto-Resume" has stopped on Memory 9 to listen for a few seconds.

Transmit is indicated on a minus 600 kHz offset from 146.820 MHz which was stored in M-6. Activity on Memory 6 was found by using the "Search" mode of Scan.

■ The 10 frequencies that you put into the memories are stored with your repeater offsets, and you can have them scanned, searched or instantly recalled at the touch of a button. ■ Memory 1 even gets priority treatment in the memory scan mode. ■ That's timely complexity made amazingly simple: and the high power option of 3.5W (nominal) is simply the greatest reach you've ever held in your hand.

■ "Battery saver" function by the computer to hoard battery power when the frequency is quiet ■ Programmed limits for both ends of bandscan ■ Simplified frequency entry only by keyboard ■ Full capacity, low impedance audio output to drive an external speaker ■ Wide band span for MARS, CAP, AF MARS: 142.00-149.995 MHz ■ Quick-change 500mAh battery ■ Separate level controls for MIC, TT, PL and DEV ■ & so much more that we don't have space to mention ■ SANTEC hands it all over, while others can't even give you the time of day.

All stated specifications are subject to change without notice or obligation.

Accessories for SANTEC Handheld Radios
clockwise from upper left:
- Leather Case (ST-LC)
- Base Charger & Power Supply (ST-5BC)
- Remote Speaker (MS-505)
- Mobile Charger (ST-MC)
- Speaker Microphone (SM-1)

Sale of the ST-144/μP is subject to FCC certification: approval and availability expected January, 1982.

SANTEC

2000 Avenue G, Suite 800, Plano, Texas 75074
Phone (214) 423-0024 • INTL TLX 203920 ENCOM UR

Encomm, Inc.
2000 Avenue G
Suite 800
Plano TX 75074

Please send me more information about:
☐ The ST-144/μP
☐ Authorized SANTEC Dealers

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ADDRESS _____

CITY _____ STATE _____ ZIP _____ CQ

YOU MAY SEND A DUPLICATE OF THIS FORM.

The Radio Amateur's Journal

ON THE COVER: Tim Pearson, KU4J (front), Tom Russell, N4KG (rear), and Joe Veras, N4QB, who took the photo, operated with the call N4KG in the 1981 CQ World Wide DX Phone Contest, achieving a score of 2,182,275 points in the Multi-Operator, Single Transmitter category.

SEPTEMBER 1982 **VOL. 38, NO. 9**

FEATURES

DEPARTMENTS

MASTHEAD

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Zero Bias

AN EDITORIAL

The big news in amateur radio took place on July 1, 1982. On that date the FCC Commissioners voted seven to zero *for* a "No Code" amateur license. They then directed the PRB (Private Radio Bureau) to develop an NPRM (Notice of Proposed Rule Making) for a no-code license to encompass the amateur bands above 30 MHz. The basic requirements for this new license should fall somewhere between the current Technician license and one patterned after the Canadian Packet License (the latter is favored by the OST (Office of Science and Technology). The Canadian License is extremely difficult and very highly technical. Prior to any action on this new license, WARC-79 must be ratified, and both S929 and HR5008 must be approved, so it would appear that the earliest we could expect any action would be the beginning of 1983.

If we consider the code-free Technician class license for a minute, we immediately see a conflict with those who already hold that class of license. The present-day holders are credited with the minimum 5 w.p.m. code test, and therefore enjoy c.w. privileges on some Novice bands. According to the *Callbook,* there are about 76,000 Technician class licensees. Would dropping the code requirements from the Technician class disenfranchise those presently holding that class of license, since presumably they would have to give up their c.w. privileges? Is that legal? I don't know the answer to that one, but I'm sure that if the 76,000 were suddenly demoted in a sense, with a consequent loss of earned privileges, there would be a class action or two in the works.

Another consideration in this type of move is the possibility of (I sort of doubt it, though) a sudden influx of 6 meter operation with all accordant interference problems. I don't think that the FCC is ready to deal with a major increase in interference complaints. How about a couple of hundred thousand new 2 meter f.m. operators plus an additional few thousand repeaters? I don't think that this is the aim of the FCC either. After consideration of these and probably many other potential problems, the Canadian approach might look good only as a safeguard against these problems by being so exclusionary. This of course would introduce a sixth class of amateur license.

With funding running out for the existing five classes of amateur licenses, it is unlikely that Congress will rush in to shore up the FCC in a quest for a sixth class. I do admire the FCC for seeing the need and acting in a responsible manner to solve a real problem—namely, more people, especially younger people, entering amateur radio. If the original concept prevails, it will not mean hundreds of thousands or millions of sub-humans pouncing on the amateur bands as has been predicted. There are enough inherent problems with HR5008 and what will happen to current licensing procedures after the money runs out (reportedly in October), so a code-free license of any type at this point is strictly academic. A highly technical exam might assuage some bureaucratic types, but in its own way it is just as exclusionary as a 13 or 20 w.p.m. code test. While this may be an ideal, it is not based on reality. For those who think that it is, take one facetious moment to consider the converse. Consider, if you will, a 40 w.p.m. code test, theory-free, for those who have "technical barriers" and still want to be amateurs. While the move toward a code-free license by the FCC is in the right direction, it is heading away from the goals it seeks to achieve.

Perhaps some thought should be given to, or a reassessment taken of, some existing proposals at say 220 MHz or 900 MHz. Data or digital transmission at these frequencies is quite possible, the potential interference problems are minimized both in terms of r.f. and overpopulation, and these areas could really use a boost in both usage and the benefits that new technology will bring.

Spillover

The technological push for hardware for cellular radio-telephone equipment will no doubt spill over into amateur radio. For years, one of the bulwarks thrown up against the controversial 900 MHz code-free Communicator class license was a lack of adequate components for reliable equipment. Motorola has recently announced a series of r.f. devices with up to 30 watts output and operational through 960 MHz. These will be off-the-shelf devices at affordable prices. The series includes a predriver (MRF890), a driver (MRF892), and an output transistor (MRF894).

Travels With CQ

In mid June Dick and I went to Washington, D.C. to attend the AFCEA Convention. AFCEA is the **A**rmed **F**orces **C**ommunications and **E**lectronics **A**ssociation. Let me tell you that this is one heck of a communications show. The gear that we go bananas over at Dayton and the like seems as child's play compared to what is on display here. Not only is it almost impossible in some cases to tell what the gear is or does, it's even more difficult to figure out how to turn it on. Overall, this shows is very impressive and in some ways very similar to a hamfest.

Since we didn't have a *CQ* exhibit at this event, Dick and I spent our time looking at the booths and displays just like a ham visiting a hamfest. The people who came to this event gathered literature and "freebies" much in the same way we do at shows, and surprisingly enough, there were indeed a good number of hams there on both sides of the booths. Several of the exhibitors are also in the amateur radio business and were exhibiting as we were at the Atlanta Hamfest the previous weekend.

One of the main reasons for our attendance was the Amateur Radio Luncheon, an annual AFCEA function which now attracts about 200 amateurs from industry and government. The luncheon is hosted by our own Ted Cohen, N4XX. The food is good, the speeches short (mine is the shortest), and it is an excellent chance to exchange views with some very prominent people.

The only drawback to a very full day is the ride home, and this one was a trip to remember. After a hurried dinner with the folks from Cushcraft (Bob Cushman and his wife), Mary Ellen Stoner and Richard Robinson of the Electronic Equipment Bank, and Bill Henry and Ken Sartain of HAL Communications, Dick and I sped to National Airport to just make the last shuttle to New York at 9:00 p.m. The 9:00 shuttle left at about 9:40 and flew nonstop to Baltimore, about 10 minutes away. We stayed there until after 2:00 a.m. and finally flew to JFK, then boarded taxis to LaGuardia where our cars were. So, door to door it took 6 hours to get home that night.

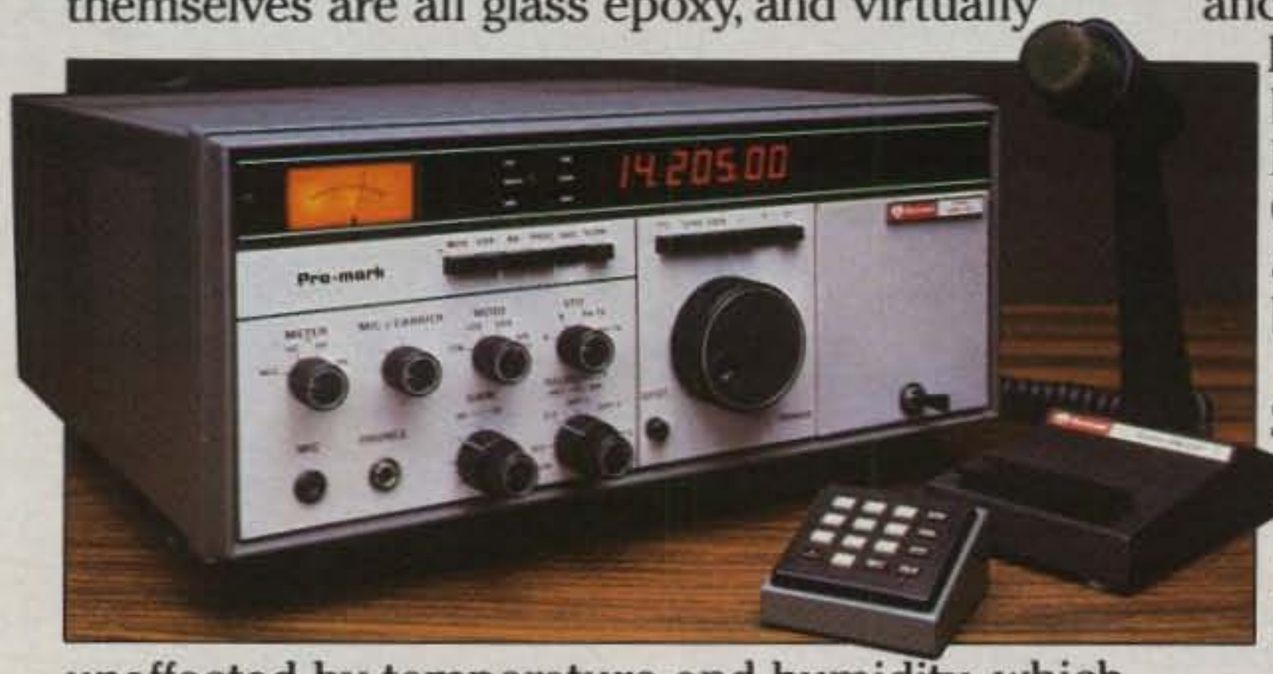
The weekend before, Dick and I were at the Atlanta Hamfest. Jack caught up to us from the San Diego show, and the three of us manned the *CQ* booth. The Atlanta show is probably at a turning point, whereby bigger facilities are in order within the next year or so. The weather held for the most part, although it rained for a short while on Saturday afternoon. Billy Williams, N4UF, our *CQ* DX Awards Manager, showed up, as did World of Video columnist Dave Ingram, K4TWJ, with his charming wife. Once again, as with other shows, the economic mood of the attending amateurs seemed optimistic, and people were intent on having a good time.

Surprise, surprise! Wayne flew in for a day to give two talks (no *73* booth at the

(continued on page 116)

The real beauty of the Collins KWM-380 is behind the panel, not on it.

At Collins, we know serious amateurs won't settle for less than professional performance. So we build every KWM-380 to commercial rather than amateur standards. For example, our PC boards are connected by ribbon cables with gold-plated pinfield connectors. The boards themselves are all glass epoxy, and virtually



unaffected by temperature and humidity which cause intermittents in the more commonly used phenolic boards.

Once built, every KWM-380 undergoes 24-hour burn-in, then is aligned and tested to meet or exceed every spec on the data sheet. Which makes us very confident about warranting your KWM-380 for one full year.

The result is a radio with superior performance and lasting quality, not front-panel glitter.

Frequency stability is just one example of its beauty: typically, drift is as low as 10-12 Hz per hour for normal ham shack environments. Other companies haven't matched our performance because they don't match our quality behind the panel.

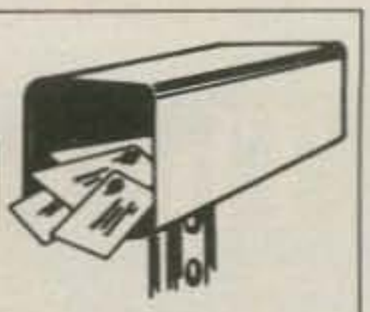
Add some real beauty to your station. See the KWM-380 at your nearest authorized dealer. Collins Telecommunications Products Division, Defense Electronics Operations, Rockwell International, Cedar Rapids, IA 52498. Phone (319) 395-5963. Telex: 464-435.

Rockwell International

...where science gets down to business

CIRCLE 50 ON READER SERVICE CARD

Our Readers Say



USA-CA Number One

Editor, *CQ:*

Today I received my USA-CA #372 award plaque. Throughout the years I have received various awards presented in the form of a plaque, trophy, etc. However, never before have I been as thrilled about an award as I was to receive this beautiful thing. You must know it will receive the honor spot on my wall forever.

Thank you for your sponsorship of this most exciting part of the amateur radio hobby. I am now chasing them for the second time and already looking forward to the third try. It's fun and the people are the greatest.

Mr. Ed Hopper does an excellent job in administering the USA-CA award program and in writing the Awards column in *CQ*. I know you are pleased to have him representing you in that capacity. Additionally, may I take this opportunity to say how much I enjoy receiving and reading *CQ* magazine. It was the first of the several ham radio magazines I at one time subscribed to, and it is now the only one interesting enough for me to continue.

Ace Burdett, N9CHU
Wheaton, IL

Another Modification To The Azden Memory Circuits

Editor, *CQ:*

I read with interest the article by Arthur Greenberg, W2LH, "A Simple Modification to Improve the Battery Life in the Azden PCS-2000 Memory Circuits," which appeared in the July issue. His modification to the PCS-2000 is a good one, but it is only one of several different approaches that may be used to solve the "expensive watch battery burnout problem" in the otherwise excellent Azden unit. There are other techniques that do not involve physical modification to the outer case of the transceiver, and/or the use of outboard components.

One such approach is to use three small, 1/3-AA size Nicads wired in series, mounted in a single penlight cell holder, which are connected to the watch-battery mounting terminals and a simple charging circuit.

Still another approach, and the one I use with my 10-meter Azden, is to use a 3.6-volt lithium battery, which is simply paralleled across the watch-battery terminals and tucked away in the control head of the Azden. I found that Poly-Paks, P.O. Box 942, S. Lynnfield, MA 01940, sells an inexpensive, high-energy 3.6-volt lithium battery that is designed to eliminate the need for recharging circuits in CMOS memory systems. The cell's high output (3.6 v. at 30 ma over an extended time period), coupled with the relatively low power requirements of the memory circuit, should enable a useful battery life of several times the approximate six-month life of the standard RS76 silver oxide cells. I obtained the lithium battery, Poly-Paks No. 7265, for $6.49, plus shipping, which is about two thirds of the cost of a set of RS76 cells.

Installation involved simply soldering pigtail leads to the ends of the lithium battery (which looks like a standard AA cell), wrapping it in several layers of plastic insulating tape, tucking it into a corner of the control head, and soldering the two wires to the watch battery terminals (observing correct polarity). While only time will tell just how long the lithium battery will hold up, if it only lasts as long as the watch batteries, it will represent money well spent.

You may want to let readers know of this simple, non-defacing modification, which should work equally well with either the PCS-2000 (2-meter) or PCS-2800 (10-meter) Azdens. (The newer PCS-3000 has a built-in rechargeable battery, so it does not suffer from the battery burnout problem.)

Karl T. Thurber, Jr., W8FX
Millbrook, AL

McKinney Interview Hits Home

Editor, *CQ:*

For the record, I want to say that the interview you published with Jim McKinney in *CQ (June 1982 issue)* is superb. Of course, we don't agree with Jim on no-code licensing, but I guess we can allow Jim one aberration! He's doing a great job as chief of the FCC's Private Radio Bureau, and Ted Cohen did a great job reporting on his work.

Perry F. Williams, W1UED
Washington Area Coordinator, ARRL

Thanks for the Award

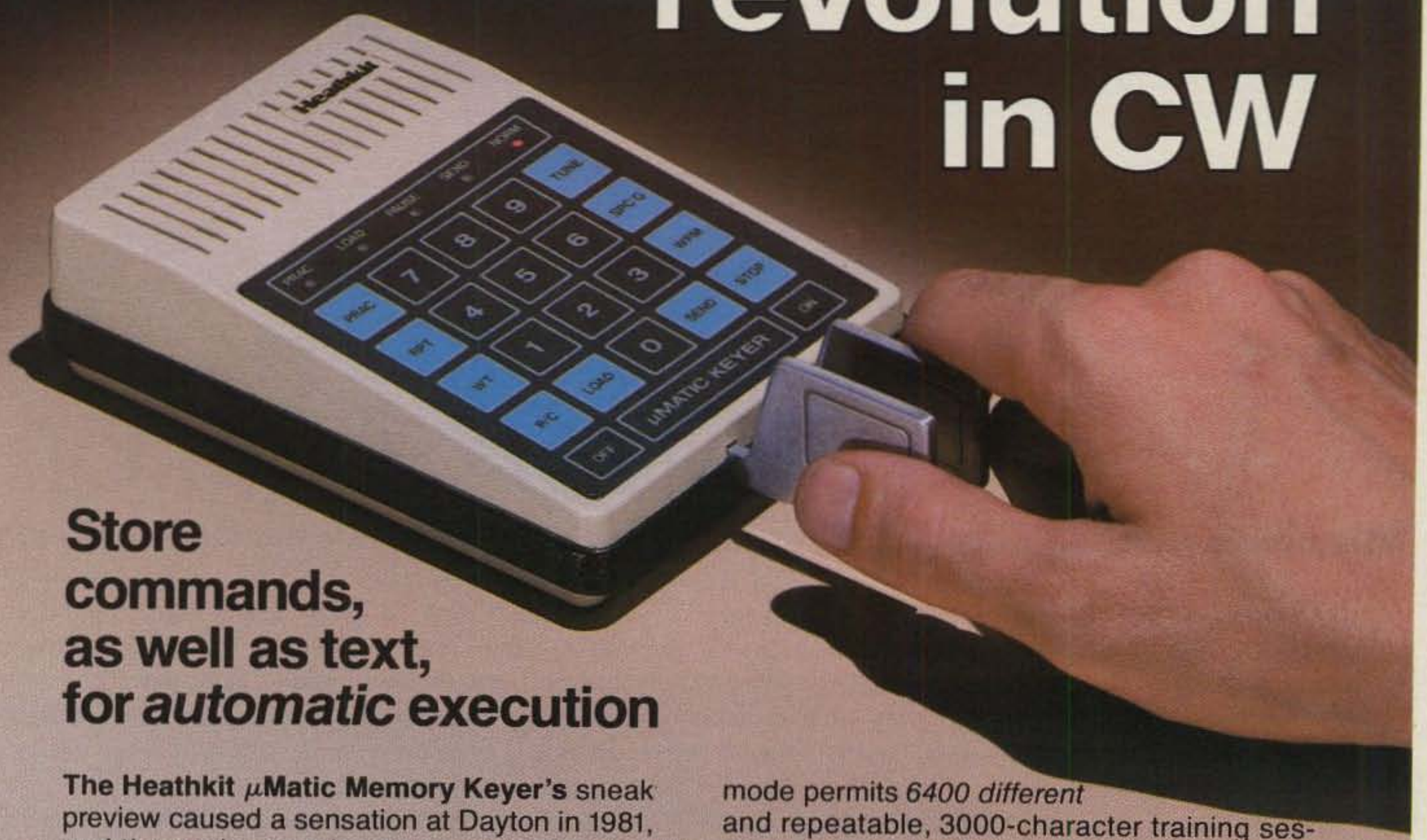
Editor, *CQ:*

I thank you for the CQ special WPX Award, second time (1978 first time). Hi! All awards are displayed so visitors can see them. I've been taking *CQ* magazine since 1953. I also have WPX SSB #1550 and am on the ARRL Honor Roll. I'm going after the WPX Award of Excellence and 5 Band WAZ.

The Fraser Valley DX Club (VE7DXC) also meets at my place (80 members). Keep up the good work, and I hope you can expand on *CQ*.

Henry Thel, VE7WJ
Langley, BC, Canada

The Memory Keyer that started a revolution in CW



Store commands, as well as text, for *automatic* execution

The Heathkit μMatic Memory Keyer's sneak preview caused a sensation at Dayton in 1981, and the excitement is still running high. *Ask about it on the air.* Those who own one will tell you it revolutionized their operating practices, eased their hand fatigue, multiplied QSOs – and increased the number of incoming QSLs. In contest, you can prove it's the best every time.

Inside, a custom microprocessor stores up to 240 characters of text or commands. *Variable-length buffers* eliminate wasted memory space. *Command strings* let you sequence speed, weight and repetition alterations or text in any order you desire. Choose the speed (1-99), any of 11 weight settings, plus spacing and message repeat count, then sit back and collect contacts...

Capacitive-touch iambic paddles unplug and store inside the keyer when not in use. Left handed? A two-key function will reverse the paddles! Or a socket will connect to your favorite keyer. To boost copy, a 4-level random 'practice' mode permits *6400 different* and repeatable, 3000-character training sessions at any speed you like.

Other features include a built-in sidetone oscillator and speaker with volume/tone controls, phone jack and earphone, message editing, entry error alarm, self-diagnostics, battery back-up and a unique auto-shutoff should you forget. Complete details on the revolutionary μMatic Memory Keyer are in the new Heathkit Catalog and at your nearby Heathkit Electronic Center.*

Send for a free catalog! Write:
Heath Company, Dept. 012-934
Benton Harbor, MI 49022
In Canada, contact Heath Company,
1480 Dundas Street E., Mississauga, ONT L4X 2R7.

Visit your Heathkit Store

Where Heathkit products are displayed, sold and serviced. See your telephone white pages for locations.

*Units of Veritechnology Electronics Corporation in the U.S.

Heathkit®

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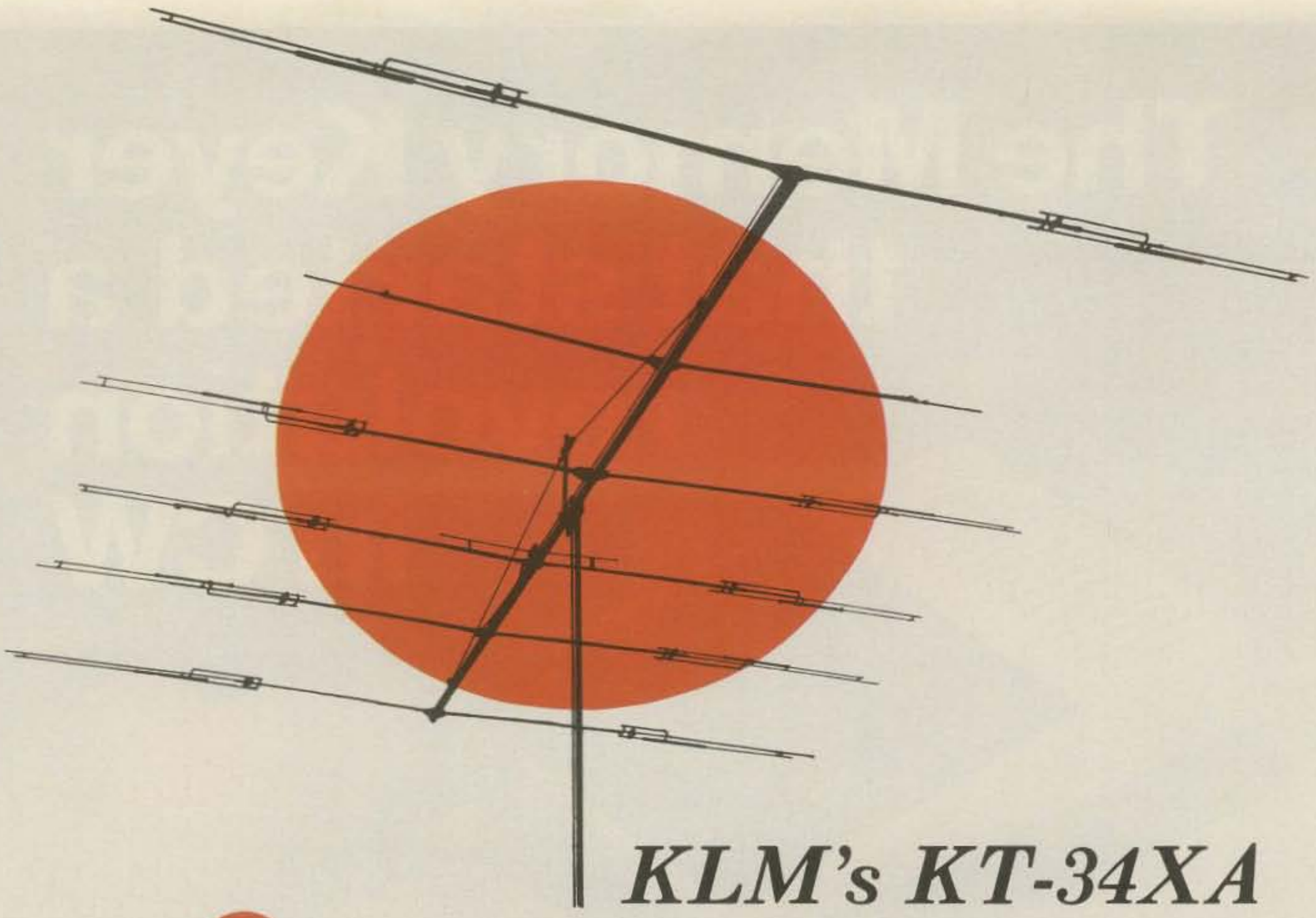
CIRCLE 133 ON READER SERVICE CARD

AM-422R1



KLM's KT-34XA

Outperforms ALL commercially available tribanders and many monobanders, too!

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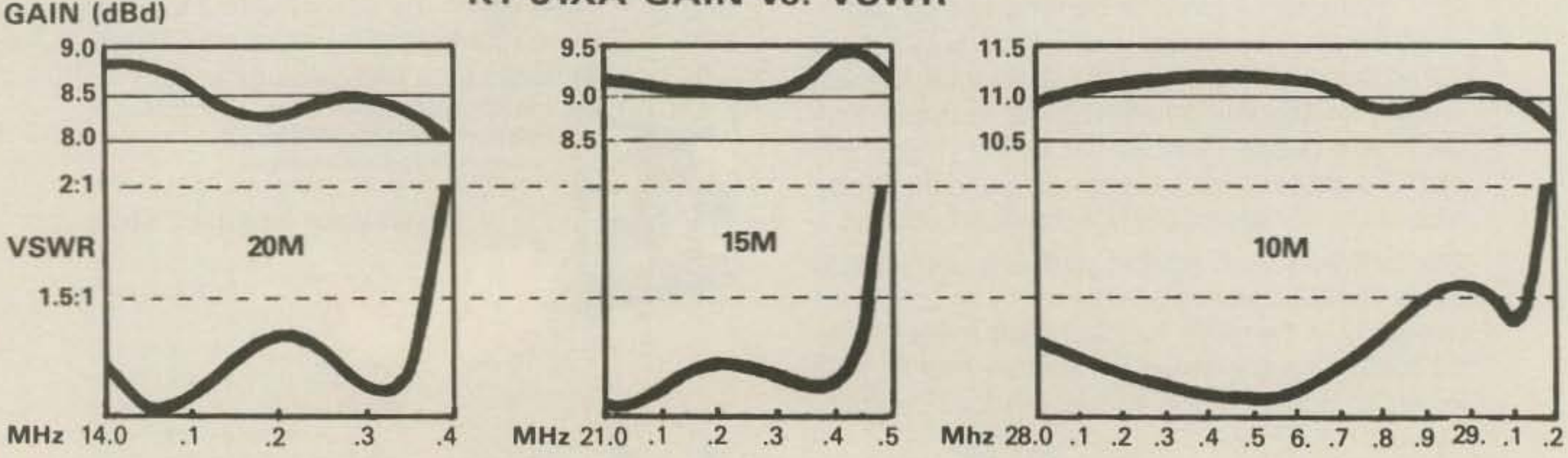

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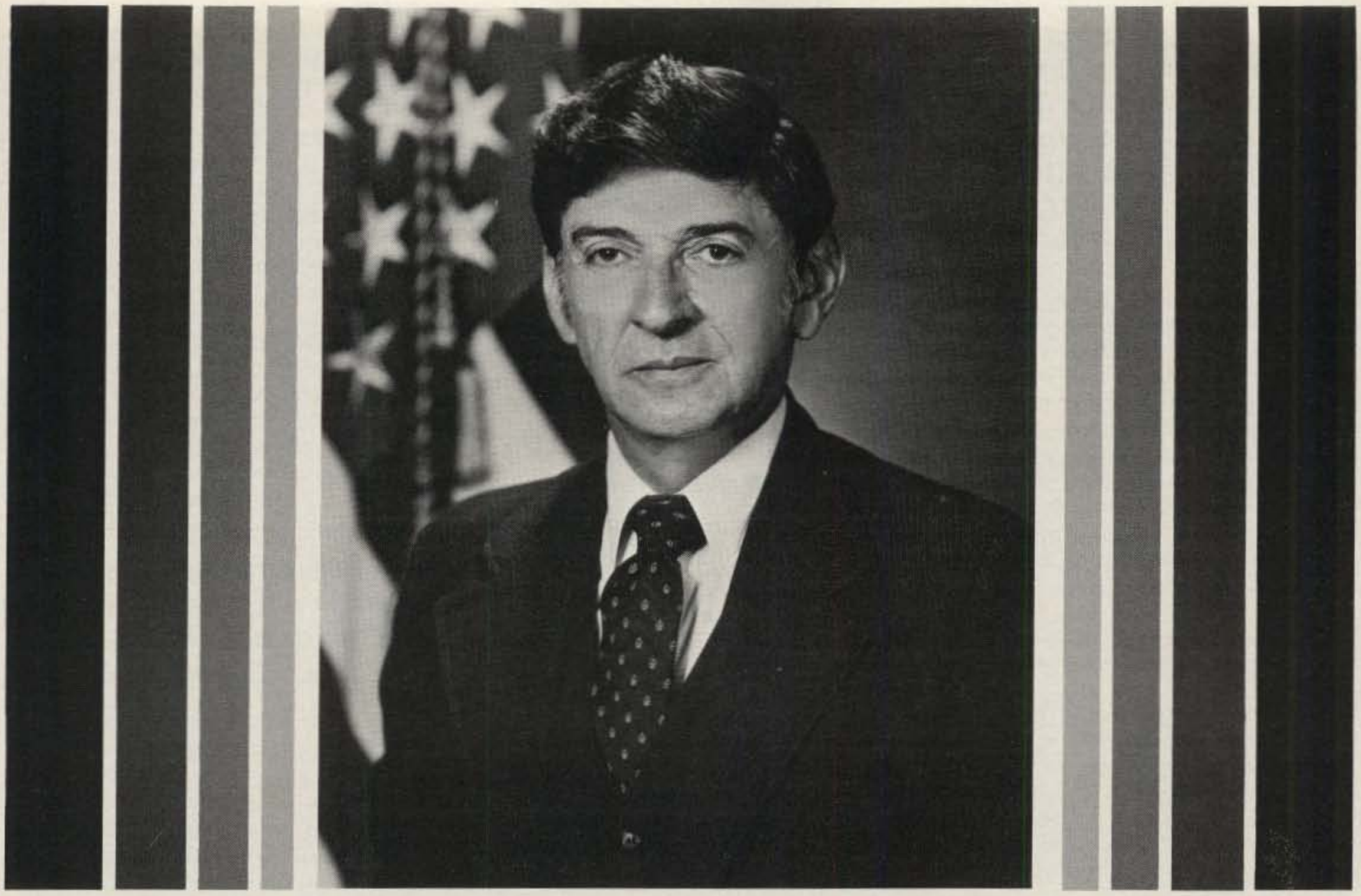

CQ INTERVIEWS: THE HONORABLE LOUIS O. GIUFFRIDA

Director, Federal Emergency Management Agency (FEMA)

BY DR. THEODORE J. COHEN*, N4XX

The Honorable Louis O. Giuffrida is the Director, Federal Emergency Management Agency (FEMA). He has had extensive civilian and military experience in the field of emergency management and is a recognized expert in the management of emergency training and response programs.

At the request of the governor of California in 1971, Mr. Giuffrida organized the California Specialized Training Institute. He served as its director and as an advisor to the governor on emergency management topics until his appointment to the FEMA post. Under Mr. Giuffrida, the Institute earned a prestigious international reputation for effective and innovative training in emergency management, including response to earthquakes, floods, civil disorders, terrorism, and hazardous materials incidents. Its 26,000 students include a wide spectrum of federal, state, and local officials with vital management and operational roles in natural and man-made disasters.

Prior to his work at the Institute, Mr. Giuffrida was a career military officer. Commissioned in the Marine Corps in 1943, he served in the Pacific Theater as a company commander. He was later commissioned in the Army and saw action again in Korea.

Attaining the rank of colonel in 1968, Mr. Giuffrida served in a variety of top-level staff, leadership, intelligence, management, academic, and command positions, and he was directly responsible for units having thousands of people and multi-million dollar budgets. Before his nomination to the FEMA post, he was promoted to the rank of brigadier general in the California National Guard.

Born in Middletown, Connecticut, Mr. Giuffrida earned a bachelor's degree from the University of Connecticut and a master's degree from Boston University. In addition, he has extensive military training, including that received at the U.S.A. Security Agency School, USA Command and General Staff College, Armed Forces Staff College, USA Advanced Industrial Security School, and the U.S. Army War College.

Mr. Giuffrida is a presidentially appointed member of the Board of Governors of the American National Red Cross, a fellow of the Academy of Criminal Justice Sciences, and a member of the Criminal Justice Administrators Association and the American Society for Industrial Security.

Currently residing in the greater Washington, D.C. area, Mr. Giuffrida and his wife, the former Genevieve Chapowicki, have three sons and two daughters.

CQ takes great pleasure in presenting this exclusive interview with the Honorable Louis O. Giuffrida, Director, Federal Emergency Management Agency.

*8603 Conover Place, Alexandria, VA 22308

FEMA is the central point of contact within the Federal Government for a wide range of emergency management activities in both peace and war.

CQ: Mr. Giuffrida, what, briefly, is FEMA?
Giuffrida: The Federal Emergency Management Agency (FEMA) is the central point of contact within the Federal Government for a wide range of emergency management activities in both peace and war. The Agency is dedicated to working closely with all the members of the emergency management community to achieve a realistic state of preparedness and an increased capability to respond to emergencies of all types.

CQ: Then so-called "civil defense" is only one part of your Agency's responsibilities.
Giuffrida: That's right, Ted. There will always be emergencies. Planning for them, responding to them, recovering from them, and taking steps to prevent their happening again is a responsibility shared by federal, state, and local governments and the private sector.

CQ: Could you be more specific as to the types of activities in which your Agency is involved?
Giuffrida: Of course. Among FEMA's activities are: coordinating civil emergency preparedness for nuclear attack, nuclear power plant accidents, and nuclear weapons accidents; ensuring continuity of government and coordinating mobilization of resources during national security emergencies; determining which materials are strategic and critical and setting goals for the national defense stockpile; supporting state and local governments in a wide range of disaster planning, preparedness, mitigation, response, and recovery efforts; coordinating Federal aid for Presidentially declared disasters and emergencies; providing training and education to enhance the professional development of federal, state, and local emergency managers; reducing the nation's losses from fire; developing practical application of research to lessen damaging effects of emergencies and disasters; administering national flood insurance, crime insurance, and riot reinsurance programs; and developing community awareness programs for weather emergencies and home safety.

CQ: Your ability to respond to man-made and natural disasters is critically dependent on timely communications. What means of communications do you employ, as the Director of FEMA, to coordinate the Agency's activities during emergencies?
Giuffrida: We have several different communications capabilities that would be used, depending upon the type of disaster. Many of these capabilities depend on use of leased, commercial, land-line services, but we also have a nationwide radio capability. As you might expect, most of our communications would be by telephone or dedicated message systems if the land lines have not been disrupted. We would like to utilize amateur radio when such service is available.

We would like to utilize amateur radio when such service is available.

CQ: What are the various means of communications FEMA is prepared to use in the field during an emergency?
Giuffrida: Ted, I should first explain that FEMA is structured into ten regions throughout the United States. Emergency Response teams are available in each of these ten regions to respond quickly to disasters within their particular region; they could also be dispatched to another region that might be experiencing more than one emergency. These teams would respond with items such as v.h.f. repeaters or base stations, v.h.f. mobile, and v.h.f. hand-held portable units. This equipment would be used to set up a network within the immediate disaster area. They may also use a portable h.f. transceiver to communicate with, or relay communications through, the regional h.f. station at region headquarters or at a remotely located Federal Regional Center (FRC). Additionally, under the provisions of the Disaster Relief Act, the FEMA Federal Coordinating Officer (FCO) can call on the communications resources of any Federal department and agency to augment his or her disaster response.

I definitely agree with the need for a good h.f capability.

CQ: Mr. Giuffrida, with the growth in the use of communication satellites, we, as a nation, have become increasingly dependent on this means of communication for both civilian and military application. Yet, in the event of nuclear war, high-frequency, or "shortwave," radio may be the only means of communication available for long-haul communications. Do you agree? And if so, what can you say about FEMA's h.f. capabilities?
Giuffrida: I definitely agree with the need for a good h.f. capability. In fact, we probably have the most extensive h.f. network of any government agency. The net control station is located at Olney, MD, and we have federally owned and operated stations in each of the ten regions. In addition, the network further branches out to each of the state Emergency Operation Centers (EOC). In the states, the equipment is federally provided, but it is operated by the state personnel. This system is called the FEMA National Radio System, but it is more commonly known by its old name: Civil Defense National Radio System (CDNARS). Each of the stations at the FRCs has radio-wire integration, or phone patch, capability; therefore, a disaster official or a person at the emergency site could get support or pass information via radio to the FRC or be linked via telephone, as required.

We probably have the most extensive h.f. network of any government agency.

CQ: What can you say about FEMA's relationship with the military during time of emergencies?
Giuffrida: We work very closely with the military and especially with the Army, which is the DOD Executive Agent for Military Support of Disaster and Civil Emergencies. In fact, during a wartime emergency, some of our sites would have their personnel staffing augmented with military reservists, and some of our maintenance—such as antenna maintenance—would be provided under interservice agreements.

FEMA regions are equipped for, and are members of, their respective Army area MARS networks.

CQ: Given your relationship with the military, does FEMA maintain liason with the Military Affiliate Radio System (MARS) as part of its work?
Giuffrida: FEMA regions are equipped for, and are members of, their respective Army area MARS networks. Regional day-to-day staffing may not permit answering daily roll calls, but the capability does exist for emergency coordination, as required.

CQ: What part does MARS play in the scheme of things?
Giuffrida: MARS has not been utilized to a great extent with FEMA in response to disaster support. It has been more active in forwarding health and welfare messages for individuals.

CQ: The Radio Amateur Civil Emergency

Service (RACES) is a part of the Amateur service which serves civil defense under a separate subpart of the Amateur regulations. What part does RACES play in FEMA?

Giuffrida: The Manual for RACES was published by one of our predecessors, the Office of Civil Defense, and it is still a valid publication. RACES plans are submitted through the State Civil Defense organizations for approval, and a limited amount of FEMA funds are available for RACES equipment. FEMA strongly supports the request for additional RACES frequencies, especially in the 2-meter v.h.f. band. In an emergency, RACES traffic would pass from the local level to the State EOC and, if necessary, would be introduced into the FEMA National Radio (CDNARS) system for forwarding to other states or here, to the National Office.

Licensed radio amateurs have always been ready and eager to respond in time of an emergency as has been demonstrated many times during and after hurricanes, tornadoes, and earthquakes.

CQ: Given that there are almost 400,000 radio amateurs in the United States and that many of these operators have mobile stations, how will FEMA tap amateur radio's capabilities during an emergency?

Giuffrida: Ted, licensed radio amateurs have always been ready and eager to respond in time of an emergency as has been demonstrated many times during and after hurricanes, tornadoes, and earthquakes. I believe that amateurs will provide a grass-roots network that may be utilized for reconstitution of official networks after a major wartime emergency, should one ever occur. As you know, many amateurs are also active volunteers in MARS and RACES so there will be many paths for emergency messages to take. In addition, several members of my staff are radio amateurs, and we have radio amateurs working in most of the regional offices. Since FEMA is also responsible for coordination of radio support in major disasters and emergencies, our regional offices coordinate amateur disaster response as well.

I believe that amateurs will provide a grass-roots network that may be utilized for reconstitution of official networks after a major wartime emergency, should one ever occur.

Several members of my staff are radio amateurs, and we have radio amateurs working in most of the regional offices.

CQ: With what amateur organization does FEMA maintain liaison?

Giuffrida: We maintain close liaison with the ARRL and frequently meet with Perry Williams and John Lindholm when they are in the Washington area. Also, some of the radio amateurs on my staff are very active in local amateur radio clubs. Our regional offices, in order to assist in this radio coordination role in disasters, hold copies of the ARRL Section Emergency Coordinators listing and the v.h.f. repeater directories.

CQ: I asked the previous question because the ARRL has an Amateur Radio Emergency Service (ARES) consisting of approximately 60,000 amateurs who are trained in message handling during emergencies. Does FEMA have a plan in place to tap ARES?

Giuffrida: No, Ted, there is no formal FEMA plan to do this. However, as you can see from some of my previous answers, amateurs will be called upon during an emergency, if needed. The plan that provides for this is the National Plan for Communications Support in Major Disasters and Emergencies, which was developed to support FEMA's disaster response requirements. This Plan identifies how amateurs, including those in the ARRL's ARES, will be utilized.

CQ: Mr. Giuffrida, the National Industry Advisory Committee (NIAC), Amateur Radio Service Subcommittee, is an FCC-established group, which, among other things, has been discussing emergency communications to be provided by amateurs. Does FEMA work with or monitor NIAC?

Giuffrida: Many of the items discussed and supported by the NIAC, Amateur Radio Service Subcommittee, such as the recent discussion on rebroadcast of amateur transmissions on Emergency Broadcast System (EBS) stations, are of great interest to FEMA. Usually we try to have someone monitor the proceedings of NIAC, Amateur Radio Service Subcommittee, and we do actively participate on other NIAC subcommittees.

CQ: The Federal Communications Commission recently created a State Emergency Capability Using Radio Effectively (SECURE). This system, intended initially to supplement other emergency communication systems, will be used by the states to communicate between emer-

gency command centers and disaster sites. How does FEMA tie into SECURE?
Giuffrida: SECURE is a radio service for providing statewide communications. They would interface with FEMA by refiling messages to CDNARS at their state EOC station. In addition, after SECURE plans are approved, the states will be eligible for funds controlled by FEMA to purchase radio equipment for use in the SECURE networks.

CQ: Are you concerned that unlike the other FCC-licensed disaster-communication services, SECURE operations may be conducted by operators who do not hold either a commercial or an amateur radio license? Put another way, are you satisfied that the states will be able to effectively train their SECURE operators?
Giuffrida: No, I'm not really concerned. First, Ted, I want to remind you that operators in the SECURE system will not be operating on CDNARS or RACES frequencies; they will be operating on FCC-authorized SECURE frequencies. I am sure that the FCC will do an adequate job in monitoring and controlling the use of those frequencies. Second, many of the people who will be operators on SECURE frequencies already operate in other radio services, such as police, fire, etc. Finally, I think that the states will easily be able to train their operators because the type of equipment that will be approved for their use will be simple to operate.

FEMA personnel can participate in any type of simulated disaster drills.

CQ: Will FEMA participate in simulated disaster drills with SECURE? With MARS? With RACES? With ARES?
Giuffrida: Yes, they will. FEMA personnel can participate in any type of simulated disaster drills.

CQ: Given your Agency's responsibilities, your budget must be significant. True?
Giuffrida: In this case, significant is a relative term. Certainly any agency would say they could use more money. The Agency's direct program budget for FY '82 is $283,614,000. This figure does not include funds for disaster relief assistance, crime and riot reinsurance, or the National Flood Insurance Program. Including these would bring FEMA's FY '82 budget to $913,548,000. I believe our budget request for FY '83 will enable us to effectively carry out our duties.

CQ: But do you feel you have the support required to do your job effectively?
Giuffrida: I feel strongly that we have the support of the Reagan Administration in carrying out our duties. If our budget is approved as proposed, we believe we can effectively meet any challenges facing our country. But keep in mind that our budget may be altered in the appropriations approval process.

CQ: Mr. Giuffrida, what is the most difficult task your agency faces today?
Giuffrida: It is to find and retain, in adequate numbers, the skilled people we need to properly carry out all of FEMA's missions during this period of a diminishing budget.

CQ: Are there any other comments you would like to make?
Giuffrida: Only this, Ted. FEMA has become a key player in the nation's effort to prepare for any emergency, irrespective of magnitude. While we still have much work to do, I am gratified by the hard work that hundreds of FEMA members across the nation have willingly devoted to our effort.

CQ: Thank you, Mr. Giuffrida, for a most interesting and enlightening interview.
Giuffrida: The pleasure was mine.

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I was cleaning up around the Emporium and was taken by the HF/VHF display. Next to it were some fifteen year old issues of QST, with "modern" gear on the covers. Are times changing quickly, or am I just getting older. 2 meter radios that fit in your pocket. HF rigs the size of 1970 vintage 2 meter rigs. Wow! I can only conclude that we ain't seen nothin' yet.

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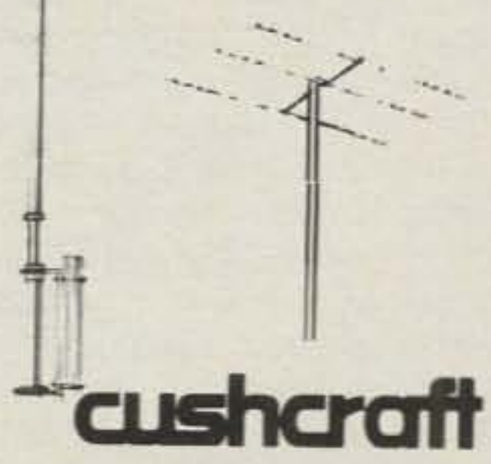

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Second in the World in the MS category was this happy group at I3MAU. The Italians really know how to celebrate!

Here they are, the whole P41C crew who just set the new all-time high score ever in a contest. In the back left to right are Chet, PJ9EE; Dave, K3JLT; Hans, PJ2GM; XYL of PJ2GM; Ed, N3ED; Bill, KB2XZ; and Stu, N7ZZ. In the front are Bill, W3XU; Tom, AD3V; Walt, WA3LRO; Jeff, N8II; and Wally, W8LRL. Missing from the photo are Frank, KA3E; Brooke, N2BA; and Neil, AE6E.

The number three Single Op, All Band entrant was Bill, N1GL, who operated HI8PGG (shown in background). What a fantastic score for North America at 9 M!

1981 CQ WORLD-WIDE DX CONTEST PHONE RESULTS

BY LARRY BROCKMAN*, N6AR, AND BOB COX, K3EST**

The dust has settled, and all the shouting is over. Yet 1981 may well be remembered as the year of the unbeatable record, as 5 of the 8 most coveted all-time phone records fell by the wayside. For the first time ever, a single operator station has bested the 10 million mark. Dick Norton, N6AA, still smarting over losing his previous World record last year to Fernando, EA8AK, has scored a phenomenal 11,085,529 points to demolish the old record and set what has to be a standard in DX contesting—a standard like the 4-minute mile. But alas, two others posted phenomenal scores as well, with Fernando, EA8AK, breaking his own one-year-old record to finish second at 9.9 M, and Bill, N1GL, coming in a close third with 9.0 M from HI8PGG. In the end, it was Dick's 20 and 10 meter QSO's that proved to be the difference, overcoming a substantial multiplier edge that Fernando held on the low bands. All in all, new World, North American, South American, and African records have been set in the Single Operator, All Band category, all of which may last for some time to come.

**7164 Rock Ridge Terrace, Canoga Park, CA 91307*
***6548 Spring Valley Drive, Alexandria, VA 22312*

The second major record broken was the all-time Single Band World record, one that was very hotly contested this year, too. Paul, N4PN, operating his VP2KAA call, managed to squeak by the 2 million mark on 14 MHz, the first time that number has ever been achieved on any band or mode, and that proved to be just enough to nose out Jim, N6RJ, who amassed 1.94 M from nearby ZF2FL. Paul's extra 8 countries and higher point ratio overcame Jim's fine 250 QSO edge, proving that one can work too many W's!

And then, of course, the largest score ever achieved in a contest (42 M) has been posted by the crew at P41C. Those guys were just absolutely determined after narrowly losing out last year from PJ2CC at a run for the record set by VP2KC in 1979.

In the U.S.A. arena, John Dorr, K1AR, has captured N7DD's old U.S.A. phone record with a fine 3.5 million points. John now holds both the phone and c.w. U.S.A. records! Congratulations are in order. In the Single Band category, Larry Pace, N7DD, abandoned his chance to stave off K1AR's assault at his record. Instead, Larry set an all-time record for the U.S.A. in the Single Band category with an unbelievable 920 K on 15 meters. Larry holds the U.S.A. record now for both 10 and 15 meters. WOW!

Other Multi-Operator Highlights

Things were a bit quiet this year in the Multi-Single category, with no records of any kind being set! The guys at VP2MFW took World high in the MS category with 8.3 M in a very tight race with the crew at I3MAU, who were just 42 K behind. U.S.A. high MS was K3LR with 3.87 M, just a tad above KX4S. In a Jim Lawson led comeback, W2PV edged out recent perennial Multi-Multi winner N2AA with a fine 10.6 M point score. We are pleased to report that Jim's trophy made it to him before he passed on in mid-May. W2PV's loss will be felt by all of us in contesting.

Other Single-Operator Highlights

This year's Single Operator, Single Band winners included ZZ5EG on 10 meters with a great 1.8 M score, and a new South American mark for that band. On 15 meters, VP2KAC, operated by Val, N4RJ, took World high and set a new North American record. Rounding out the trio of North American single-band records set this year, all three of which were from the VP2KC location of 1979, was Bob, K4UEE, at VP2KAE with a new 40 meter North American Record effort of 432 K. Not enough, though, for World high, as Mike, ZL1BIL, narrowly edged

him out with 443 K to snag a new all-time World high and Oceania high mark for 40 meters. On 80 meters, YV3AZC ran away with his second World high in a row, almost double the nearest score. The 160 meter band was tough, but UP2BAW accumulated a fantastic 20,000 points amidst all the static crashes. Congratulations on a terrific job!

Meanwhile stateside, Bill, W0ZV, took top 10 meter honors; Bob, K2HFX, took the top spot on 20 meters; and Roy, W7IVX, led a field of 3 U.S.A. contenders separated by less than 1,000 points on 80 meters. Chuck, K0RF, continued his fine work on 40 meters with a fabulous 150 K, a new all-time U.S.A. 40 meter mark. WB3GCG captured 160 meter honors with 1280 hard-to-get points.

Other Records

In other fine record-setting performances, 4X0U set a new Asian Single Operator, All Band mark at 3.5 M, while Randy, KH6XX, did the same for Oceania at 5.7 M. That's new records for all continents except Europe in the All Band category. Single Band records include Africa 21 MHz, EL2AV; Asia 1.8 MHz, 4X4NJ; Asia 7 MHz, 4Z4DX (what a signal here on the West Coast long path, too); Europe 7 MHz, I6NOA; Europe 21 MHz, YU3TU; Europe 28 MHz, 9H1EL; Oceania 14 MHz, KG6DX; Oceania 21 MHz, KP4KK/DU2; and South America 21 MHz, YV3BJL. Congratulations to all.

Some Off-Hand Comments

Each year when we compile the QRM section of the results, we are amazed at the variety of opinions that we get. Some guys comment on how wretched conditions were or activity was; other comment that things have never been better. There are the usual visits by Murphy, but judging from some of the pictures and scores that we get, sometimes things go just right, too. Anyway, your comments generally reflect the fact that you are having a good time, and that's what it's really all about. Please, let's not forget that point as you scan the incredible record-breaking results. It's still very easy to make a lot of good DX contacts and have a good time.

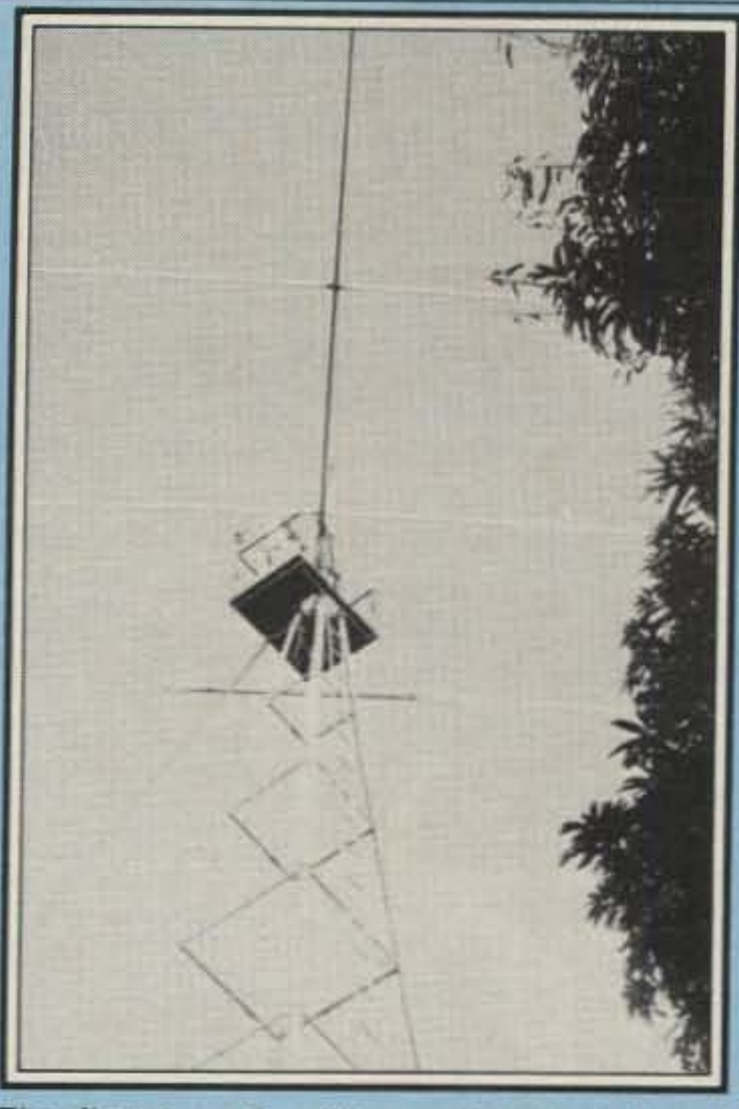
For those of you who think you don't have a chance to win anything, just scan over the results a little closer. There's hardly a call area or a country where some type of certificate wasn't available in one or more categories for those who put in an effort. For example, in W2 and W6 lands, there were no 80 meter entrants at all, nor were there any really competitive entries on either 14 MHz or 7 MHz from W4 land. So next year, why not give it a try yourself. Bet the contest bug will really bite you if you do!

Rules Comments

Each year we get a little static from the sea lawyers over some aspect of the rules. This year three rule areas in particular were in contention. We sent out warning postcards to some guys who didn't fill in the "sent" and "received" serial numbers (report and zone) in their logs for their contacts. One indignant fellow claimed that the rules didn't require logging the exchange! We thought about that and read the rules closely. Even though there are columns on our log forms for all sent and received exchanges, the logging data rule is not very clear. Come on guys, those columns on the log pages are there for a reason. Nevertheless, if we have to change the rule to make it more specific, we will. For the record, though, the committee feels that you are required to log or otherwise call out the complete exchange sent and received.

The second rules issue is club competition rules. As we've said at some of the conventions, we'd like to avoid having to enact explicit rules to cover every conceivable contingency. Yet, we are continually being hit with questions about mileage rules to meet club eligibility, meeting requirements, what constitutes a DXpedition, etc. One airline pilot has vociferously objected to our ruling that his Georgia state score can't be counted for the Frankford Radio Club's effort. Yet he hardly can be considered as part of the suburban Philadelphia scene under any stretch of the imagination. W4 land does not qualify as a DXpedition to us either.

The thing that makes it difficult for us here is that we don't feel that explicit rules are fair due to the wide differences in what constitutes local clubs across the country, and for that matter, over different parts of the world. Also, we don't feel we have any right to tell participating clubs how many meetings they must hold. So, like it or not, we plan to continue to rule on a case-by-case basis. By the way, the situation in New England with the YCCC is beginning to catch our eyes. We're not too sure that a New York City to Boston and beyond geographical area ought to be allowed as a "local club." There do have to be limits to the "local area."



The first-ever 2 million point single band effort was achieved by N4PN at VP2KAA with this 5-element Yagi. Paul, N4PN, is shown making some adjustments.

The annual battle for the most impressive QTH goes to K0UK, who sports this fantastic location.

The third area concerns the Multi-Single category. One station sent us a letter accusing another entrant of going through his Multi-Multi log and "converting" it into Multi-Single by deleting some contacts. Sorry, but we really take a dim view of that. Let's be fair about it. The category you begin in is the one you must claim. It may be hard for us to prove, but we'll do our best to catch anyone who tries that kind of nonsense.

Good News

The good news this year was all those African multipliers we heard. It looks like our appeal to the rank and file to drum up third world participation in the contest has worked. But heavens, don't relax. Keep up the good work for the benefit of us all in the 1982 test.

Other good news relates to some special log checks we ran this year. A substantial number of QSO's in the top four W Single Operator All-Band logs were cross-checked on a random basis. We're delighted (and amazed) to report that only one QSO could not be completely confirmed in all four logs, and that one QSO was a case in which the U.S.A. station's call was in the DX station's log, but was crossed out for some reason. Our congratulations to K1AR, W1ZM, K2TR, and K2BU on phenomenal logging accuracy, a real shot in the arm to us after some sad experiences in recent years.

C.W. Contest Results

The C.W. Contest conditions were the best we've ever heard. Stay tuned in next month's issue for all the exciting results.

73, Larry, N6AR, and Bob, K3EST

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15-3CD 3el monobander	$96.00
15-4CD 4el monobander	$108.00
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A32-19 19el 2m "Boomer"	$84.00
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ARX450B 450 mhx "Rng. Rngr."	$35.00
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TH5MK2S 5 el tribander	$312.00
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TH2MK3S 2 el tribander	$135.00
TH3JRS 3 el jr tribander	$157.00
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402BAS 2 el 40 meter	$195.00
205BAS 5 el 20 meter	$295.00
204BAS 4 el 20 meter	$226.00
203BAS 3 el 20 meter	$132.00
155BAS 5 el 15 meter	$176.00
153BAS 3 el 15 meter	$74.00
105BAS 5 el 10 meter	$115.00
103BAS 3 el 10 meter	$55.00
DB1015AS 3 el duobander	$150.00
64BS 4 element 6 meter	$52.00
66BS 6 element 6 meter	$99.00
18 HTS hy tower vertical	$339.00
18AVT/WBS 5 band vertical	$89.00
14AVQ 4 band vertical	$54.00
214 14 element 2 meter	$32.00
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5BDQ 5 band dipole	$98.00
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6el 20m "Big Sticker" mono	$610.00
6el 15m "Big Sticker" mono	$389.00
6el 10m "Big Sticker" mono	$225.00
144-148-13LB 2m "Long-Boomer"	$75.00
144-150-16C 2m circular	$95.00
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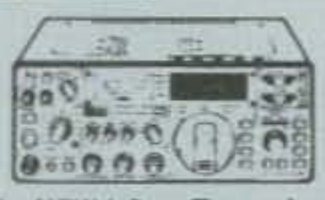

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15m845 5el 15m beam	140lb.	14.0
20m436 4el 20m beam	108lb.	12.0
This is a custom antenna.		
20m536 5el 20m beam	113lb.	13.5
20m546 5el 20m beam	n/a	n/a
This is a custom antenna.		
20m646 6el 20m beam	176lb.	17.0
40m329 3el 40m beam	110lb.	12.6
40m346 3el 40m beam	177lb.	13.8
T85EM 5el tribander beam	49lb.	7.0
T86EM 6el tribander beam	85lb.	10.0

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25G 10 ft. section	$40.50
45G 10 ft. section	$91.90
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Our BX series towers include the base stubs. Beware those who charge extra for them. Also, freight collect from Dallas may save over freight pre-paid because of varying distances and routing. Drop ship or factory pick-up prices may be higher due to factory pricing policies. West Coast/Rocky Mountain prices may be 10% higher depending upon shipping point. Call for firm quote before ordering.

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3/16" EHS steel guywire	$.12/ft.
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TH7DX	7 el Tribander
HG 52SS	Self Supporting Tower
Ham IV	Rotor
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HG-TBT	Thrust Bearing
HG-COA	(3) Coax arms
Ham IV	Rotor

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U.S.A. QRM

QRM was tremendous on 28.5–28.8 . . . *N4CT.* Try saying WB0YCJ portable four one thousand times in a weekend . . . *WB0YCJ/4.* Biggest thrill was having UK1PGO answer my CQ . . . *AA4M.* Learned new propagation paths—the contest is a great teacher . . . *K4PI.* Working TYA11 and beating N2AA, W3BGN, and W3LPL on 6W8DY—Wow! . . . *WA4SVO.* A good warm-up for C.W.—it makes one mean . . . *W4NL.* Sure wish DX stations would listen up on 40 . . . *KB4CD.* Wish DX stations would identify more frequently . . . *W4KMS.* Mom screaming "go to bed," Dad screaming "do your homework," me screaming "*CQ* contest"—what a mess . . . *N5DDO.* Amplifier broke, rotor broke, and operator failed all on the first day . . . *K5NW.* Stopped to eat dinner (you had better print it) . . . *W6BH (Opr. WA6IQM).* I've had this call for 2 years and half the U.S. still thinks I'm on Midway . . . *KM6K.* Picked up country number 250 QRP . . . *WA2JOC/8.*

Biggest thrill was AH8A answering on second try—very hard to work on 2 watts . . . *WD8IDD.* My friends told me that working 20 M QRP would be crazy. They were right . . . *KB2NU.* Amazed at the number of stations with the call sign QRZ . . . *KC2P.* Our 20 M op got so excited that he asked YI1BGD to repeat his call six times . . . *K1UO.* Worked HZ1HZ, 4S7AAG, and 3X1Z all on 2–3 calls—the antenna must be working . . . *KA1EIV.* Ten meter op went into shock after A6XTH called . . . *KE2C.* Well, we tried and had fun . . . *N2BNC.* When K8MR worked YI1BGD, he started calling CQ in foreign tongues . . . *K3LR.* Someday I'd like to get into a contest and not have a transmitter go or an antenna break . . . *KB3HE.* I need to master the split control on the IC-730 . . . *W6GO.* Going into this contest without an amplifier is like being fed to the crocodiles . . . *N6WR.* Biggest thrill was when the line noise disappeared for a few hours . . . *WA7KLK.* Had a great time. Will be back next year . . . *KJ9D.*

Hard to have sympathy for DX stations I duped when some of them didn't give their own calls for 20 QSOs or more . . . *N7DF.* Missed EU multipliers by sleeping through the alarm clock both mornings . . . *KG5W/7.* Ten meter QSOs to Europe from the Pacific Northwest were rare this year . . . *KC7EI.* Smoke clouds from the gear meant plenty of rebuilding during the test . . . *K7LZJ.* In this contest you didn't need giant antennas to work lots of new countries . . . *KI7F.* I set a goal of 100 countries in less than 24 hours on one band—made it, too! . . . *W7IL.* Got my new tower up one day before the test—whew! . . . *W3HKK/8.*

Very helpful using *CQ*'s propagation forecasts to plan this one . . . *K8PUJ.* Biggest thrill? Just plain fun! . . . *K8CV.* Fun breaking pileups with my modest station (100 watts and trapped vertical)! . . . *WB8UGI.* Being a YL in the test was extra fun! . . . *N8CNT.* Enjoyed s.w.l.'ing the test as much as working stations . . . *K8PSR.* Two rotors died. Wait 'til next year! . . . *AI9J.* Wish DX stations would ID more . . . *Sheboygan County DXA.* Pinched nerves in left arm due to resting arm on desk all weekend. Fingers still numb, weeks later. My doctor says it's a case of Contest Elbow! . . . *N9AFV.*

Team competition within your DX club sure boosts the enthusiasm . . . *K9RN.* True love—my wife did the dupe sheet . . . *WA9MAG.* Fun until the cops showed up with a t.v.i. complaint . . . *N9ACP.* Best part of the phone test is looking forward to the c.w.! . . . *K9QVB.* Always enjoy running with the Big Guns . . . *W9MYG.* Great contest—no t.v.i. reports! . . . *WD0FSJ.* Still pruning my monster quad at start of test—exhausted . . . *AG0M.* Always enjoy the Big One—*CQ* WW . . . *WB0CMN.*

DX QRM

Very good activity . . . *HA4XX.* Worst propagation since 1970 on 80 . . . *HA8KQX.* Particularly happy to work XZ9A and 3X1Z . . . *HA4XH.* Homemade 4-element 40 meter Vee beam broke in wind 2 hours into the contest . . . *I6NOA.* I have been a ham since 1953 and say that the *CQ* WW contest is the best contest in the world . . . *IT9ZGY.* I hope to go multi-operator here next year . . . *SV0BP/SV9.* Smattering of long-path opening to JA/YB at about 1800Z on 10 meters was pleasant surprise . . . *9H1EL.* Called CQ zone 40 and OX3JF answered . . . *VE5AE.* Great contest, fantastic conditions, will be back next year . . . *VO2WL (fantastic—ed.).* Static on ungrounded antenna took out receiver front end . . . *ZS6BPL.* We had many problems with the electricity—7 rigs failed . . . *HK4RCA.* You never print our comments anyway . . . *VE1DXA.* My 10 meter log looks like the German callbook . . . *VE3PCA.*

Need bigger antenna, more operators, and better propagation . . . *VE5DX.* Our first contest. Quite an experience . . . *8P6MH.* Very enjoyable. Who says missionaries only run phone patches? . . . *WB5SNA/HR1.* Biggest thrill was working 160 M from Mexico . . . *XE2BC.* We operated only 46 hours because I fell asleep at the mike . . . *VP5IW.* Azores Island stations are always with you . . . *CT2CE.* This time I actually managed to hold a channel for awhile and get a stream of W's to call me . . . *G3ZAL.* 40 M is really tough going from Europe . . . *G3UKS.* The ZK2 called me through a JA pileup . . . *DK8NG.* Looking forward to the next one . . . *EI5DP.* Could not talk for 3 days afterward . . . *GD5DZP.* The mother-in-law visited during the contest! . . . *PA3ADJ.* I always look forward to this contest because of all the termites that come out of the woodwork . . . *KH6NO.*

First time on DX side proved most enjoyable . . . *WA1UZH/KH6.* Enjoyed it even though t.v.i. severely limits my operating hours . . . *VK1JN.* The "Yanks" were kind to me . . . *VK2NHV.* S9 noise on all bands the first day . . . *VK3SM.* Next year the whole weekend is booked for the contest . . . *VK5OU.* Bloody woodpecker—curtains . . . *VK6FS.* Very difficult to get a pile-up; no one is looking for zone 28 . . . *YB2CR.* Difficult to sort out countries from all the strange prefixes . . . *ZL3ABC.* My thanks to the most well-mannered operators—the JA8's . . . *S83W.* Could not be on the air longer because of my UN duties . . . *OH1TD/4U.* Only worked a half day; got sick from virus, but still enjoyed the contest . . . *9Q5FL.* I will be back next year . . . *ZL1BPK.* Will be on from CT2 next year for all the contests . . . *KP4KK/DU2.* Well pleased with a solid run of 1539 QSOs in 8 hours last day on 28 MHz . . . *GU3HFN (sorry, but you counted 100 per page instead of 80!—ed.).*

We put up a new 6 element log Yagi on 20 and it was very successful . . . *HG5A.* Last year the QSOs; this year the multipliers; next year both and a good score . . . *F3TV.* Plenty of snow and heavy winds . . . *HB0BHA.* Great fun . . . *YU4FRS.* We understood the multi-single 10-minute rule clearly 3 days *after* the contest . . . *EA7TH.* Never had such a cold shack . . . *GD5DLW.* Finished our 3 element 40 M monobander on Friday; it was a great help . . . *SP9PDF.* One hour after the contest we blew up the linear . . . *SV0BV/SV5.* Tried sloping dipoles for the first time after inverted Vees (for 80) . . . *UA9CBO.* I lost electricity during the second night . . . *UA6AAM.* Made DXCC this weekend with 101 countries . . . *UB5PBA.* With only 2 watts worked 6 continents in 90 minutes . . . *OE1SBA.* Could not get up early in the morning . . . *VE3MFA.*

Good conditions on the long path on 40 M to W6 . . . *4Z4DX.* Buying a beam and hiring a babysitter will improve the score next year . . . *VE6BEO.* Great fun—next year I won't have a throat virus . . . *ZS6YO.* Tried hard, but 40 and 80 M antennas didn't work . . . *ZS3HL.* 10 M opened to the east coast at 2354 the last day; they were glad to see me . . . *HL9DX.* Conditions were either feast or famine throughout the weekend . . . *VK4LX.* Sure wish the 10 M band had opened to Europe just once . . .*VE7BTV.* Lots of fun but hard on the constitution . . . *VE2EVO.* What a weekend to discover I had t.v.i. . . . *VE2DUN.* I even got 10 hours sleep . . . *VE3GCO.* Didn't Alaska participate? . . . *VE3IPR.* Fell asleep Sunday morning and woke up 5 minutes after the contest ended . . . *VE3EEW.* I found that I spent four times the actual operating time preparing the log . . . *TE1C (TI2CF).* Fantastic host, country, and contest. Wait till next year . . . *HI8PGG (N1GL).* Unfortunately, I could not finish the contest because of physical collapse . . . *4M2AMM.*

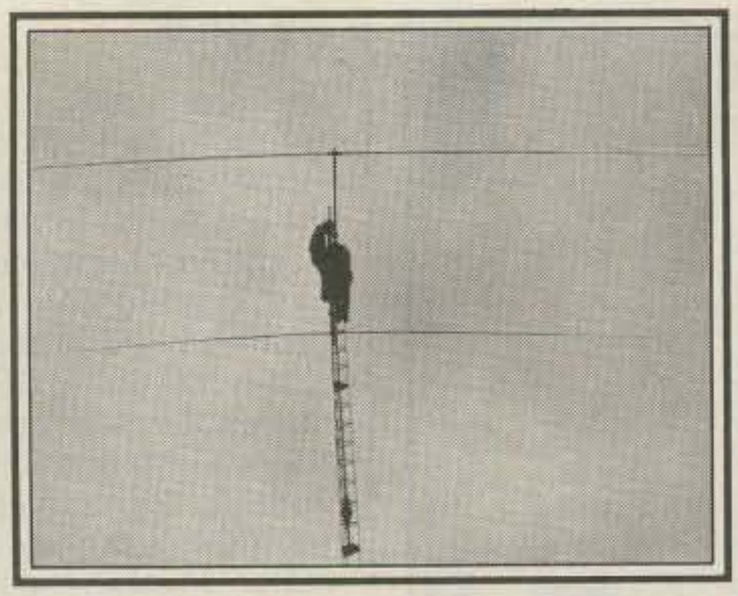
STATION OPERATORS

Multi-Operator Single-Transmitter

AG1C & W1YN. **AA4FF** & N4FMW, N4UA, NI4R, NJ4Q, W4VP, W4WWQ, WA4RTS, WB4ZPF, WD4ELJ. **AA6T** & KA6LAF, N6BSU. **AD8P** & K8NZ, N8ABL, WA8SAC, WB8WMB. **AI8Z** & WB8SEN, N8AN. **AK8M** & N8CAY. **CE2AA**: CE2BMV, CE2BNT, CE2BXN, CE2CC, CE2CZM, CE2DAM, CE2DCR, CE2HF, CE2MH, CE2MM. **DF8SI**: DF6CZ, DK8MO, DL1MAR, DL8MBS. **DJ8VZ**: DK6EI, DK8KL. **DL8PE**: DF3OE, DF6AU, DL4AAE. **DL8JK**: DF2ZN, DF2ZO, DF6ZH, DK2XX, DK6FT, DK8ZL, DL9FAX. **DL8WW**: DB9FB, DF1ZE, DF5ZF, DF7ZP, DJ6DU, DJ8SU, DK8WD, DL3ZA, DL5FAV. **EA1DX**: EA1QF, EA2AFZ, EA2AJH, EA2IA, EA2JG, EA2OP. **EA3APV** & Guest Op. **EA7TH** & EA7CEC, EA7CFW, EA7UH, EA7WC, Jose Angel. **EA8ND** & EA8MQ, EA8SB.

F2LY & F6BDN, F6DBH, F6DFQ, F6DYK, F6EDM, F6FIO, F6HBK. **F3TV** & F6ARC, F6BEE, F9IE. **G8JC** &

Bill, CN8CO, sent us this shot of his Morocco QTH. Bill has also signed EP2FB, JY9FB, and HS1FB. Fine business!



That loud YV on 40 phone this year was Enrique, YV3BQS, who used this fine 2-element Yagi to provide the punch.

Is this what it means to snag a YL in the pile-up? Stan, W1XK, of PJ8UQ shows us how it's really done!

G3DEF, G3RMF, G3TQD, G3WFZ, G4FWR, G4KTW, G8ASO, G8NSL, G8NWR, G8TIC, G8TMG, G8XGG, G8XRC, G8XRF. **GD5DLW**: DL7RT, DL7SP. **GM4KWS**: GM3YOR, GM3ZSP, GM4EJI, GM4HJO, GM4IPS, GM4MTV, GM8NCM, GM8ZTV. **GU3HFN**: GU3MBS, GU4CHY, GU4EON, GU4KPE, GU5BKX, GU5EEJ, GU6EFB, GU8TGP, GU4IUW. **HA7KPL**: HA7PL, HA7SH, HA7SQ, HA7PZ, HA7UG. **HB0BHA**: DF9GQ, DJ2EH, DJ4PX, DK6NN, DL9NAP. **HG5A**: HA5FM, HA5FN, HA5GF, HA5HO, HA5LN, HA5LZ, HA5MK, HA5NQ, HA5PP, HA5OM, HA7RY, L. Budai. **HK3A**: HK3AFD, HK3AXT, HK3TF, K3ZO. **HK4RCA**: HK4BKB, HK4DUM, HK4FZ, HK4UT, HK5BCQ. **HP1XRK** & HP1XAT, HP1XAW, HP1XRJ, HP1XRO, K4JPD, WB6HPS.

WB5SNA/HR1 & WB8VMN. **I1KN** & I1DFS, I1EVJ, I1JJZ, I1LBH, IW1PDP, I1SBU, W3US. **I4YSS** & I4KDJ, I4ZNU. **JA1YHA**: JH4JJS, JJ1AEB. **JG1ZUY**: JG1ILF, JG1IMM, JI1ACI, JI1QQI. **JA4YAD**: JA1QGC, JR6JOE, JE2QIZ, JH0DRT, JR5QAZ, JE3HMX, JH4VLL, JH7UFV, JH8JLI, JA9VEF. **JA4YFH**: JF3GPS, JH4DIT, JH4FMI, JH4MVB, JH4UID, JR4TKR. **JA6YDH**: JA4JYL, JH6NFR, JH6NLY, JH6RAD, JH6SWF, JR6GHN, JR6KDI, JE6DSG, JR6KYA, JE6ASN, JE6LFQ, JE6SAY, JG1TAW. **JA9YBA**: JA9LJI, JA9LNJ, JA9LWB, JA9OTX, JH0CAZ. **K1FWF** & Net. **K1RQ**: AI1S, KA1RE, KB1W, W1GG, Jay. **K1SA** & N1AFC, KB1U, KH6IRW, K1IXZ. **KB1O** & others. **K1UO** & K1RQG, KA1GM, N1AC. **KA1EIV** & KA1DTA, N1BSO, WA1EJM, WA1OEZ. **KA1GG** & K1KJT, N1AVA, N1ZE, W1KM.

K2BK & KQ2O. **K2HR** & Net. **K2ITG** & WB7KCN. **K2QF** & KA2HZN. **K2TD** & Net. **K2VV** & N2JJ. **KB2MG** & KA2DLK, KA2EVY, KA2MNJ, KI2S, WA2PVV. **KD2T** & WA2VFK. **KE2C** & KF2X, N2AU, W2PA. **K2PLF/3** & KB3MF. **K3FN** & Net. **K3LR** & AF3P, KA3DRR, N3CGI, N3CGK, W3HV, WA3WIK, WB3EUB, WB3EVB, K8CX, K8MR, KB8EI, WD8ALG. **K3TUP** & K3USC, KA3BFX, N3BJ, W3KHQ, WA3UCS. **KB3AG** & WB2YOF, KF3R. **KB3HE** & N2BLT, KB3NQ, N3CIZ. **KB3KE** & KA1CQM, K3BVQ, KA3BQS, KA3DRD, N3ARS, WA3TPF. **KB4YT** & KS4G. **KC4BG** & AJ4R, KC4SM, N4AUS, WA4MOJ, WB4CWB, WB4PEI, WB4TVQ, WB4TZR, KC5AD. **KD4RH** & N6AV, WB6RXW. **KX4S** & N4HB, N4ND, W4MYA, WB4BVY, WD4IMC. **KD4ZI** & N4CRH. **K5TA** & AA5B, K5HUI, KN5D, W5JW. **K9MK/5** & K9LA.

K6ANP & KK6X, KM6N, N6DCJ, KA6JHM, KD6GC, KD6LC, WB6NBR, KS6W, VP2ML. **K6HIH** & K6AUC. **K6MYG**: N6AMG, N6IG. **KB6ST** & K6CSL, N6CVC, N6QW. **KD6XM** & KD6BW, KS6A, N6DRA, NC6V, NE6K, WB6ZJZ, WD6BQV. **KD6XY** & KA6ING. **KV6H** & K6SG. **K7MX** & K5KT, KH6HDA, K7LXC, WA7CSK. **K7SS** & KA7KCK, KA7MSH, KE7V. **K7WQD** & K7OEW, WA7RKJ. **K7ZSD** & KC7EY. **KB7G** & KB7B, KL7QT, N7AYF, N7BJA, WA7TRI. **KB7PJ** & W7CTE. **K8BA** & WB8NBA. **K8JLB** & AC8W, K8DP, KA8HJG, KJ8A. **K8MN** & WA6EZV, N8ASV, N8AOL, W8LKX, WB8LUA, WB8NOJ, WB8ZJY, WD8JAW, WD8NMT, WD8NMV, WD8NNB. **K8RLQ** & K8CDE, WD8SDL, WB8RRR. **K8US** & WD8IJR. **KA8HXX** & KA8HUZ. **KA8IYM** & KA8IYN. **KB8IZ** & AI8S, KB8QS, KC8KO. **KQ8M** & KB8SX, N8CWX, N8DCJ.

K9BIL & WB9NOV, N9CPW. **KA9Y** & KA9DWB. **KJ9D** & KA9IQQ, KC9EB, KC9FP, W9OBF, W9MDY. **K0AA**: AB0W, AB0X, AE0K, K0CS, KB0X, KC0B, WA0TKJ, WB0UXI. **K0UK** & AE1V, HH2TD, K9MWM, K0CL, K0KE, K0YBX, W0KEA, WB0ITG, WD0ASM. **K0JSY** & K0AT, K0LUZ, KD0Q, W0IZ, W0WP. **K0FU/9** & K9HWU, N9BYL, WD9DSS, N0BUK. **KH6N** & KH6DD, KH6GMP, N4ADJ. **KL7Y** & AL7H, KL7EC, NL7K, NC7P, WL7E. **KL7CQ** & AL7CU, KL7AP, KL7CO. **LA4O**: LA3HL, LA4DW, LA9HW, LA0BS. **LU1MA**: LU3MCO, LU3MDO, LU4MEE, LU5MCM, LU5MDD, LU7MAJ, LU7MAY, LU7MEC, LU8MAJ, LU8MCO, LU9MAU, LU9MEE. **LU1EQ** & LU2DHY, LU8ECD. **LX1JE** & DK8AW, DL8AAE, LX1MN. **N1AU** & WB1BUS, AE9B, Net. **N1BMV** & WA1ZVI. **N1TZ** & K1DKX, K1FIR, K1KNQ, K1TU, K1SF, KA1ERF, KB1H. **N2BNC** & KA2EYS, KA2LGL, KA2MKK, KC2DE. **N2RM** & N2MM. **N3ARK** & KB3MM.

N4BS & KA4ADF, KA4BOE, KC4ZR, N4ERR, WA4GHO, WA4LSD, WA4UIV, WA4YNV, WA4YOF, WB4FOT, WB4LSG, WB4PRU. **N4KG** & KU4J, N4QB. **N4RV** & AB3L, WB3JRU, N4RA. **N4ZC** & AA4VK, K4NYV, N4CQ, N5TR. **N6MG** & KD6PY, K6RTC. **N6QC** & Net. **NC6T** & AA6DP, NF6H, W6CCP, W6TSE, N7NR. **N7CWY** & WB7RPJ. **N7RO** & AI7P, KA7AUH, W7EKM, WA7ZWG, WB7CLU. **N8BKB** & KC8HS, N8ATZ, WB8VGE, WD8MIJ, WD8ROR. **N8BKO** & KA8KGN, N8CJX. **N8DHO** & KA8LJX. **N8JW** & K8CC, K8NA, W8LU, W8TWA, W8UA. **OE4SZW** & OE3GSA, OE7UU. **OH1AF** & OH1HS, OH1XM. **OH5BM** & OH4EF, OH4MI, OH4MF, OH5UQ, OH7TN. **OH5SM** & OH5IS, OH5KS, OH5NQ, OH5NW, OH5NZ, OH5UL, OX5XT. **OH7AB**: OH7PF, OH7UE, OH7VR, OH7XM. **OK1KOK**: OK1MKK, OK1VIU, OK1-15088. **OK2KYC**: OK2BSK, OK2BUC, OK2SMO. **ON4BB** & ON5JE, ON5KH, ON6HE. **OY5J** & OY9R.

PA0RCA & PA0WFB, PA2SWL and son, PA3AJW, PA3ASD, PA3ASF, PA3BHY, PA3BLS, PE1PFA, PE1GDZ, PE1GRD. **PJ8UQ** & K1GW, PJ8YL, W1HCS, W1XK, WB8BTH. **PP5JD** & PY2SOB. **R5I**: Club. **SK5DB**: SM5DGA, SM5DSE, SM5ERK, SM5GOJ, SM5IRV, SM5KDM. **SK6AW**: SM6CVE, SM6CVT, SM6DER, SM6EHY, SM6FJB, SM6FMB, SM6HCX. **SK6JX**: SM6FHZ, SM6FQE, SM6FYU, SM6MFK, Reino. **SK0LM**: SM0CXU, SM0DRD, SM0FSK, SM0LZT. **SM5AOE** & SM6BJI. **SM5AZU** & SM4BGM, SM0ATN, SM0MC. **SP7PDF**: SP6BGB, SP7CND, SP8JPX, SP9BMQ, SP9DFH, SP9FIH, SP9MCU, SP9MQE, SP9DFH, SP9FIH, SP9MCU, SP9MQE, SP2-7631, SP9-2712. **SP7PGK**: Club. **SP9ZHR**: SP9EMI, SP9LWI. **SP0KAD**: SP9LJD, SP8BPJ, SP8HRA/9. **SV0BV/SV5** & K1LOM, WA2IZN.

UK1NAP: Club. **UK1TBB**: UA1TBD, UA1-144-7. **UK2AAX**: Club. **UK2BAG**: UP2BV, UP2BZ, UP2BAA, UP2GAE, UP2DT. **UK2BBB**: UP2BBB, UP2BIJ, UP2MB, UP2PX, UP2-038-892, UP2-038-938, UP2-038-1052, UP2-038-1053. **UK2BBX**: Club. **UK2BCC**: UP2BDW, UP2BJK, UP2-038-271, UP2-038-728. **UK2BCM**: UP2BFN, UP2BJV. **UK2GAB**: UQ2GA, UQ2GDF, UQ2GID. **UK2GKO**: UQ2GAG, UQ2GBU, UQ2-037-158. **UK2PAO**: UP2BHN, UP2BIC, UP2-038-624, UP2-038-1617. **UK2PAP**: UP2OX, UP2PAQ, UP2-038-1637, UP2-038-1638. **UK2PAT**: UP2BCO, UP2BCW, UP2-038-439, UP2-038-1514. **UK2PBR**: UP2BEY, UP2BJY, UP2-038-1541. **UK2PCR**: UP2BBT, UP2BCR, UP2BCT, UP2BDF, UP2BFI, UP2BFL, UP2BIO, UP2PCI, UP2PAV. **UK2PRC**: UP2BBM, UP2BIL. **UK2RAC**: Club. **UK2RAQ**: Club.

UK2RDX: UR2RCN, UR2REE, UR2RRJ, UR2RNA, UR2-083-159, UR2-083-160, UR2-083-162. **UK2TAF**: UR2RMC, UR2-083-1531, UR2-083-1532. **UK3ABC**: Club. **UK3ABO**: UA3AMC, UA3APF, UA3-170-193, UA3-170-339. **UK3DBV**: UA3DFO, UA3-142-1762, UA3-142-1770. **UK3TBF**: Club. **UK3TBY**: Club. **UK3WAF**: Club. **UK3XAA**: Club. **UK4FAV**: UA4FAR, UA4FBL, UA4FCJ, UA4FCM, UA4FDY, UA4-148-273. **UK5EAE**: Club. **UK5HAB**: UB5HFG, UB5-071-73. **UK5LAS**: Club. **UK5MAF**: RB5MUV, UB5MDC, UB5MNM, UB5MNX, UB5MOA, UBJMOX, UY5LK. **UK5MAZ**: UB5EC, UB5MBZ, UB5MGY, UB5MCD, UB5MOK, UB5MQF. **UK5MBF**: Club. **UK5MCO**: RB5MAU, UB5MRO. **UK5MCP**: EZ5MBZ, EZ5MDL, UB5MOJ, UB5MPD. **UK5MDI**: UB5MBM, UB5MJS, UB5-059-111, UB5-059-5. **UK5MEG**: RB5MGV, UB5MAQ, UB5MHY, UB5MRB.

UK5QBE: UB5QKG, UB5-064-1362, UB5-064-1576. **UK5UDX**: UB5RCA, UB5UAL, UB5XCM. **UK5WBF**: UB5-068-499, UB5-068-580, UB5-068-640. **UK5WBG**: Club. **UK6HCZ**: UA6HJU, UA6HKP, UW6FC. **UK6LAZ**: UA6LHK, UA6LIG, UA6LO, UB5ITW, UA6-150-1070. **UK6LEZ**: Club. **UK7GAA**: UL7GCS, UL7-018-99, UL7-018-136. **UK7LAH**: UL7LDS, UL7LEZ, UL7-018-99, UL7-018-136. **UK7LAH**: UL7LDS, UL7LEZ, UL7-026-133. **UK7NAQ**: UL7NAC, UL7NAJ, UL7NCF. **UK7PAL**: UL7PAE, UL7PBI, UL7PBY, UL7PCZ, UL7-023-158. **UK8MAA**: EZ8MBW, UM8MAN, UM8MCE, UM8MCY. **UK8MAF**: UM8MAS, UM8MBW, UM8MCW. **UK9AAN**: UA9AEN, UA9AIS, UA9AJD, UA9ALP, UA9QBS, UA9QCC, UA9-154-1099, UA9-165-943, UA9-165-1288. **UK9OAX**: UA900, UA9-145-631, UA9-145-217. **UK9SBH**: UA9SBM, UA9SBU, UA9SDB, UA9SEU. **UK9UAC**: UA9UUN, UA9-130-203. **UK9UBL**: UA9UAR, UA9UFJ, UA9UJM, UA9UMD. **UK9XAN**: UA9-090-426, UA9-090-445, UA9-090-484. **UK0KAB**: UA0IZ, UA4-133-21/UA0. **UK0LAS**: Club. **UK0QAA**: UA0GAS, UA0QBB, UA0QCA, UA0-098-74. **UK0SAV**: Club.

VE1DXA: VE1AI, VE1AIH, VE1AVX, VE1BSE, VE1FH, VE1MX, VE3IQ/1. **VE2CUA**: VE2AFQ, VE2DFH, VE2DUB, VE2EWG, VE2EWQ, VE2FUT, VE2GCE, VE2GMT. **VE3BVD** & VE3FRA, VE3HRS, VE3JTQ, VE3KZ. **VE3PCA**: VE2ZP, VE3CRG, VE3CXL, VE3FQX, VE3KKB, VE3MHI. **VK3WA/VE3** & WA2BFW. **VE5AE** & VE5AAB, VE5ACM, VE5ADA, VE5AFA, VE5MC. **VE5CHS**: VE5AEF, VE5AEL, VE5HN, Busse, Dyck, Steele. **VE5DX** & VE5AAD, VE5RG, VE5XK. **VE5NN**: VE5AEI, VE5AEQ, VE5GF, VE5OI. **VE6AMV** & VE6ADX. **VE6OU** & VE2QV, VE6KW, VE6WQ. **VO2CC** & VO2BF. **VO2WL**: VO2AA, VO2AE, VO2AG, VO2AH, VO2CZ. **VP2EM**: VE1BHA, VE4AHT. **VP2MFW**: K0OO, KP4BZ, NP4CC. **VP2VFL**: KS6H, KT6V, N6CW. **VP5IH** & VP5EE. **VP9IB** & N5UR. **VY1CC** & VY1AU, VY1BQ, VY1CJ, VY1DD, VY1DV.

W1BK & KA1CLV, N1BHI, N1CW, WA1UAR. **WA1ZAM** & Net. **W2UI** & N3KR. **W2VJN** & WA2ZKY. **WB2FZO** & K1EB, K1TA, KQ2M, WB2DHY. **WB2TCQ** & WB2RNT. **W3GNQ** & AE9I. **W3GU** & K3CY, W3KV. **W3HRD** & WB3FSB. **W3NX** & N8NA. **WA3JVG** & KA3BMU, KA3EDP, KN3ZAN, WB3KNS. **WA3SFJ** & K3UAV, KA3DRO, KD3B, WA3LSW, WB3ISS. **WB3DJF** & AA3B, KA3GIK, WB3FIZ. **W4QAW** & K3EST, K3RV, W3ZZ. **WA4QQV** & KB4PI, N4AOC, N4ETA, WA4QMQ, WD4MDY. **WA5SOG** & WA5VWH. **W6BIP** & WA6DJI, WA6PYN. **W6ERS** & Net. **W6OKK** & WB6DSV. **W6RDF**: K6XT, N6ND, N6ZI, WA6DBC. **W6UE**: N6DLU, N6LN, WB6YTU, ZL2BAK. **W6VLD**: KR6U, N6KN, WA6DPQ. **W6YX**: N3ER, WA6ITV. **W7EJ** & W7ZR. **W7NI** & AI7B, N7AKQ. **WA7KLK** & K4KSV, K7JVR, N7CW, WA7KPH, WB7FDQ.

W8NGO & K8ZE, K8ZZU, N8BKF, N8BLX, N8DEG, WA8TCI, WB8EQG, WB8RYJ, WD8BKM. **W8VPV**: KA8FVW, KA8NMC. KC8W, N8AKF, WB8CXL, WB8VNO, WD8CVH. **W8WE**: K8RT, KA8DWI, KC8AV, KC8HN, KC8NH, N8BAZ, N8CJR, N8CJS. **WD8KMX** & KA8CXL, N8ADV. **WD8PNF**: KA8DRA, N8BCB, WA8SNF, WA8VTS, WD8ITF, WD8KNB, WD8MDG, WD8RPJ. **W9DUB** & N6IN, K9BN, K9JF, KB9I, N9AW, W9RN, WB9AUK. **W9YH**: AC9L, K9GS, K9VV, KA9CJG, N9AHY, N9CFC, W9PK. **WB0OYA** & WB0UFL. **XE2BC**: N6DOK, K6KLY, K6WJ.

Y23DL & Y23CL. **Y23EK** & Y23YK, Y24TK, Y24UK. **Y31ZA**: Y24LA, Y31OA, Y31PA. **Y41ZF** & Y21CF. **Y43ZK**: Y54TA, Y54UA, Y54VA. **YO6KBM**: YO6DB, YO6-5863/MS. **YU4FRS**: Dubo, Edib, Ivo, Emin, Rajko, Nedim, Tiho, Edin, Ferid. **ZS6BPL** & ZS6BIM, ZS6BNZ. **4A2Q**: XE2ABA, XE2AQ, XE2GDD, XE2PQ, XE2QE, XE2XX. **4Z4EC**: 4X4KT, 4X4TR, 4X6GI, 4X4-14017, 4X4-1589, 4X4-1627. **8P6MH** & 8P6AH, 8P6CB, 8P6FV, 8P6JC, 8P6KW, 8P6KX, 8P6KY, K2QIE, WB2WSV. **8P6QL**: W6KG, W6QL. **8P6T**: 8P6JA, 8P6OR, K5MHZ.

STATION OPERATORS
Multi-Operator Multi-Transmitter

AI6V & KB6F, N6TV, N6AUV, W6BBN, WB6SHD, AA4KB. **LA1WA/LX/P**: DA1DF, DA2HS, DA1PN, DJ0WQ, DA1AF, DA2CK, DA2AB, DA2HH, DA1MR, DA1IO, DL9QN, DA1JF, DA1FI, DA1GG, DA2KR, LX1PD, LX1HU. **EA7RCC**: EA7AFV, EA7AKE, EA7ANJ, EA7AMO, EA7AML. **HB9H**: HB9LG, HB9ZE, HB9AGC, HB9AIB, HB9BAL, HB9BLQ, HB9CAT, HB9CIP, HB9BAH, HE9GYG, HE9AYE. **HZ1AB**: W7KJJ, K0JJ, WA8MOA, N6OL, G3ZSS, KA4RVA, W7SE, VK3BYR, W5JIZ, W5UJF, AJ7U, WA6BRE, VK3BSX. **JA2YEF**: JH2TNW, JR2PVI, JR2TPD, JR2TWA, JR2UWZ, JE2FRT, JE2KIH, JE2LLR, JE2RDI, JE2RWP, JE2UGT, JE2WBH, JE2WJB, JF2ACB, JF2ERH, JF2GYO, JF2FZF, JF2NFC, JF2NTV, JF2SFF, JF2VRV, JF2WMP, JF3EIT, JH4XKV, JA9XDR, JH9CTW.

JA2YKA & JG1GIF, JJ1BTA, JE2NQC, JE2RQT, JE2SRB, JH2QXG, JR2GMC, JH4VBQ, JH6RPZ, JA9NFO, JA9SSY. **JA3YBF**: JR3VSW, JE3MCC, JE3PAS, JE3PED, JF3KKO, JF3KZB, JF3NAL, JF3PGA, JG3GKK, JG3GQB, JG3IUG, JI3IUG, JI3BPB, JI3KWZ, JH4IFF, JR4AGT, JA5XUU, JH5BIT, JH5JKH, JA9QPF, JA9TAF, JA9TOZ, JH4CES. **JA3YKC**: JR4BSM, JF3PMM, JH4PAM, JH4WER, JR3FRR, JR6JNF, JH3PKS, JE3MAS, JR3RIU, JH3PRR, JG3LLB, JA5MOU, JE3MXQ, JG3IQJ, JE3BLA, JR3KEG, JF3RAL, JF3SFP, JA5TDH, JA5GZB, JA3ODC.

JA4ZQA: Club. **JA4YQO**: JR2EVU, JA4FIQ, JH4AQA, JH4LGI, JH4MBE, JH4NJC, JH4WAJ, JR4CBJ, JR4IWE, JR4MOQ, JR4PIV, JR6JZT. **JA6YCU**: JH6NHE, JE6HWI, JH6OFG, JF6DQL, JH4VIH, JE6CCM, JR6INB, JR6PPU, JF6DVD, JE6IGP, JH6XYR, JR6IQI, JR6EFU, JH5FYP. **JH7YJF**: Club. **JA7YRR**: JA7CEC, JA7CFB, JA7CLN, JA7CLX, JA7CXV, JA7FDY, JA7JUP, JA7LBY, JA7MQM, JA7MQQ, JA7OZW, JA7RQE, JA7WSC, JA7MEX, JA7BPM, JA7LVA. **K1CC** & K1NCD, K1ZZ, WA1ZDW, K1TO, K1GX, KD1Z, AK4L. **K1IK** & KA1BBY, W1IOU. **K1KI** & N2ME. **K1OX** & KF1V, N1BIP, W1HNZ, W1HD, W1UR, KC1F, W1FV, K1RX, KA1VQ, K1HI, W1FJ. **K1XM** & K1PR, KA1GHR, AJ1I. **KA8A/4** & K3LLJ, KB3OK, W4FCA, WD8CNM, WA4WQL, WA4CPD, WA4IKU, ND4M, KB8ME, WA6HAO, WA4THC, WB2CMV.

K3ND & W3FV, K3GM, K3RL, N3AMK. **K3WW** & K3WJV, N3EC, KB3GJ, WA3VLB, N2ATX, W2NM, WA2SFB, KB3TN. **K3ZJ/4** & K7SV, KB3RM, K4YEP, N4TW, N4NW, K4PQL. **K4VX/0** & KB9YN, N9HH, KA0DQI, KB0RC, N0DX, N0SS, N0XX, WB0GFV, WB0JUN. **K6HNZ/CT3** & W6TPH, K6SSJ. **K6MEP**: N6VR, N6MA, NR4F, N6AFI, K6VMO, WA6IJZ, KD6GP, WD5JEA, KD6CN, KD6LB, WA6DHS, AX6A, WB6EDA, WA6FPX, KA6DVA. **K6RR** & K3VA, KV6O, WB6KOU, WA6JAH, K6SSS, AA6RX, WA6OTU. **K6RU** & AA6AD, AA6G, N6BZA, K6SEM, K6XO, KB6ZL. **K6ZM** & K2PV, AK6T, NB6L, WA6JCZ. **K9GL** & K9HMB, K9PW, K9RS, K9ND, K9PPY, K9MTE, WB8MEL, AI9F, W9OFV, WB9TIY, WA9EYY, WB9CAS, WA0AVL. **KG6RE**: N6BT, N6TU, KC4BH, JA2VUP, JA5GZB.

KL7RA & KL7UN, KL7HT, KL7LI, KL7IUM, KL7IEH, AL7AF, AL7CG, AL7CQ, NL7V, NL7M. **LA9K** & LA5JS, LA8TF, LA3KV, LA0CV, LA4ZV, LA8DW. **N2AA** & K2BQ, K2EK, K2GL, K2GM, K2NG, K2SS, K2TT, K2TW, K2XR, KC2X, KR2J, KR2Q, KR2W, W2RQ, WB2ZKJ. **N2SS** & K2UA, WA2HGM, AC2U, W3RS, K3KNH. **N3RL** & N3GB. **N4KE** & K4UTE, WB4EYX. **N5AU** & N5JJ, K5FUV, K5TSQ, K5TM, K5ZD, K5HM, K5AQ, K5MM, N5CR, N5TP, N5AJW, N5HD, KM5R, W5FO, W5VX, AF5K, K7JA, WN4KKN, WD5EHB. **N6RO** & WA6DIL, N6NE, N6QW, KN6K, K9LBQ. **N6RZ** & K6TMB, W6JZU, WA6OCV. **N7GM** & WB6ION, N6KB, KA6LGX.

OH1AA: OH1TV, OH1HB, OH1IG, OH1NH, OH1SY, OH1FS, OH1NM, OH3ZE, OH5NG. **OK1KSO**: OK1AEZ, OK1JCW, OK1JJB, OK1JKT, OK1JWA, OK1WT. **ON6AH** & ON5AV, ON5IQ, ON6VL, ON7ZV, ON4GO. **OZ5DD**: OZ1CWM, OZ6QV, OZ1FKP, OZ8GW, OZ1CTC, OZ6KH, OZ1FMB. **P4IC**: N3ED, WA3LRO, N7ZZ, N8II, KA3E, WA8LRL, K3JLT, AD3V, N2BA, W3XU, KB2XZ, AE6E, PJ2FR, PJ9EE, N4RV. **VP9AD** & W3MA, N3RD, G5CMX, DK5EZ, VE3HGZ, VP9IJ.

W2PV & K1DG, K1GQ, K1JX, W1OD, W2IB, N2NT, WB2PUH, WA2SPL, K2TR, AG2X, K2XA, AA2Z, W3AZP. **W3LPL** & N2FB, K3PI, AI3M, K3NA, KF3P, K3RA, WD4AXM, KT4W. **W3YFV** & K3PPI. **W6OWQ** & WB6DSV, WD6ERA, N6AHA, KB7SC, KD6ZY. **WB6KBZ** & K6GSS. **W9AMM** & WD9CQH. **YT0R**: YU1EW, YU1PKC, YU1UU, YU7BB, YU7ODS, YU7OQI, YU7OQZ, YU7QBC. **YZ7R**: YU7PEG, YU7MAT, YU7QCV, YU7QQO, YU7PXH, YU7NQG, YU7NXO, YU7PEE. **ZK2ZZ**: WB6EXW, WA6AHF, KB6JK. **ZY3ZZ**: PY3ZZ, PY3HMC, PY3ASN.

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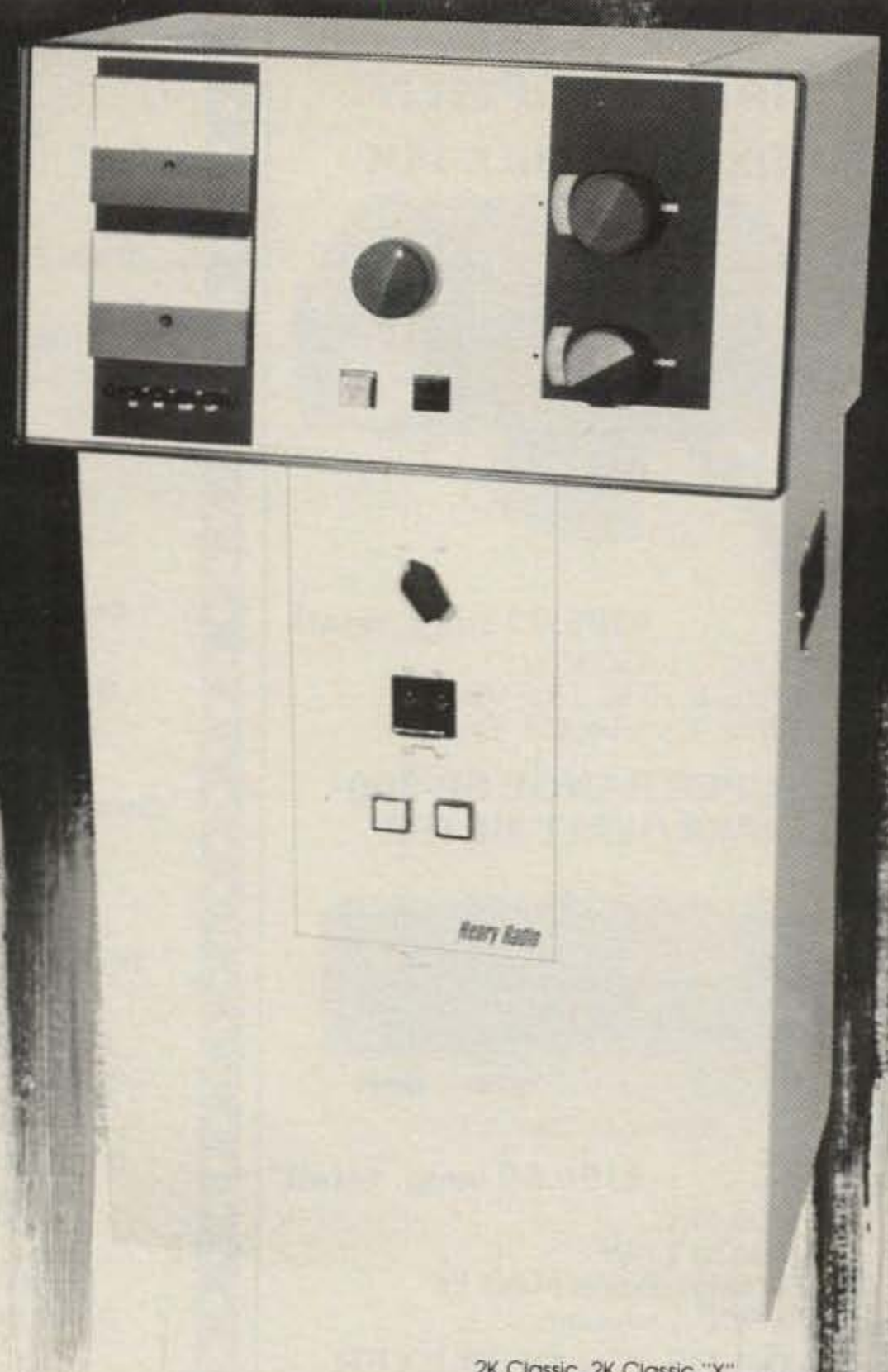

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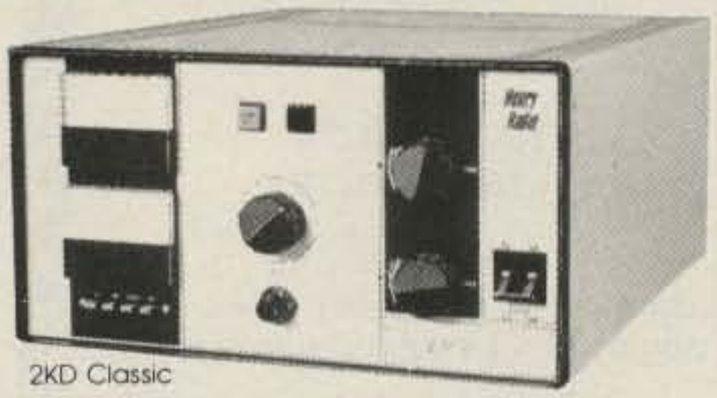

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SINGLE OPERATOR, ALL BAND

World
9Y4VT (Opr. Richard J. Norton, N6AA)
Donor: Bill Leonard, W2SKE

World—QRPp
Sergio S. Nesti, I5NSR
Donor: Adrian Weiss, K8EEG/Ø

U.S.A.
John Dorr, K1AR
Donor: Potomac Valley Radio Club

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Garry V. Hammond, VE3GCO
Donor: Jack Baldwin, VE7RG

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Donor: Jim Neiger, N6TJ

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Donor: Thomas J. Peruzzi, Jr., W4BVV

Africa
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Donor: Gordon S. Marshall, W6RR

Asia
David Goldstein, 4XØU (4X4UH)
Donor: Japan CQ Magazine

Japan
Toshikazu Kusano, JA1ELY
Donor: Palm Garden Contest Club

Oceania
Randall F. Sobol, KH6XX
Donor: Northern California DX Club

South America
Sergio Pontoni, 4M2AMM (YV2AMM)
Donor: David Novoa, KP4AM

SINGLE OPERATOR, SINGLE BAND

World—14 MHz
Paul H. Newberry, Jr., VP2KAA (N4PN)
Donor: K2HLB Memorial
(No. Jersey DX Assoc.)

World—21 MHz
Hugh S. Valentine, VP2KAC (N4RJ)
Donor: Lee Wical, KH6BZF

World—3.8 MHz
David B. Perrier, C6ADV
Donor: Fred Capossela, K6SSS

U.S.A.—21 MHz
Larry Pace, N7DD
Donor: Southern California DX Club

U.S.A.—28 MHz
William R. Tippett II, WØZV
Donor: Donald Thomas, N6DT

U.S.A.—3.8 MHz
Raymond N. Hoppins, W7IVX
Donor: Arnold Tamchin, W2HCW

Canada—21 MHz
Yuri Bianarovich, VE3BMV
Donor: Gene Krehbiel, VE7KB

Carib./C.A.—21 MHz
Carlos Fonseca, TE1C
Donor: KP4ES Memorial
(Pedro Piza, Jr., NP4A)

Europe—28 MHz (Zone 14)
Jose Miguel Sintes Pujol, EA6ET
Donor: A.G. Anderson, GM3BCL

Japan—21 MHz
Ichizo Kitade, JA2APA
Donor: DX Family Foundation

South America—28 MHz
Atilano De Oms, ZZ5EG
Donor: Rafael Ponce De Leon, CX3BR

MULTI-OPERATOR, SINGLE TRANSMITTER

World
VP2MFW (Oprs. KP4BZ, NP4CC, KØOO)
Donor: Don Wallace, W6AM

U.S.A.
K3LR (Oprs. K3LR, K8MR, K8CX, AF3P, WB3EUB, WB3EVB, WD8ALG, KB8EI, KA3DRR, W3HV, N3CGI, N3CGK, WA3WIK)
Donor: Theodore Pauck, Jr., K8NA

Canada
VE3PCA (Oprs. VE3KKB, VE2ZP, VE3CXL, VE3FQX, VE3MHI, VE3CRG)
Donor: Calgary Amateur Radio Assoc.

MULTI-OPERATOR, MULTI-TRANSMITTER

World
P41C (Oprs. N3ED, WA3LRO, N7ZZ, N8II, KA3E, W8LRL, K3JLT, AD3V, N2BA, W3XU, KB2XZ, AE6E)
Donor: Radio Club Venezolano

U.S.A.
W2PV (Oprs. W2PV, K1DG, K1GQ, K1JX, W1OD, W2IB, N2NT, WB2PUH, WA2SPL, K2TR, AG2X, K2XA, AA2Z W3AZD)
Donor: Dale Hoppe, K6UA

Europe
YTØR (Oprs. YU1EW, YU1PKC, YU1UU, YU7BB, YU7ODS, YU7OQI, YU7OQZ, YU7QBC)
Donor: Bob Cox, K3EST

CONTEST EXPEDITIONS

World—Single Operator
HI8PGG (Opr. Bill J. Ovca, Jr., N1GL)
Donor: Stuart Meyer, W2GHK

World—Multi-Operator
KG6RE (Oprs. N6BT, N6TU, KC4BH, JA2VUP, JA5GZB)
Donor: The YASME Foundation

TOP SCORES

WORLD

Single Op All Band

9Y4VT	11,085,529
EA8AK	9,974,811
HI8PGG	9,009,721
N6KT/HKØ	6,823,008
4M2AMM	5,770,310
KH6XX	5,713,434
DK3GI	4,461,908
DK8NG	4,127,424
DJ4PT	3,986,400
VP2MBA	3,628,944

Single Op Single Band 28 MHz

ZZ5EG	1,760,130
KB7IJ/KH2	1,442,480
9H1EL	1,355,760
I8UDB/IC8	1,355,648
YO1K	1,143,625
EA6ET	1,107,358

21 MHz

VP2KAC	1,783,500
JE1C	1,449,805
KP4KK/DU2	1,413,042
EL2AV	1,404,936
YU3TU	1,312,793
YV3BJL	1,231,630

14 MHz

VP2KAA	2,011,185
ZF2FL	1,940,539
OE6MBG	1,018,818
KG6DX	923,510
VO2CW	898,720
YV1DQU	882,735

7 MHz

ZL1BIL	443,646
VP2KAE	432,942
ZL1AZV	332,508
I6NOA	292,152
YV3BQS	287,850
CT2CE	257,580

3.8 MHz

YV3AZC	160,740
C6ADV	85,666
YU4VBR	79,524
YU3APR	79,390
DF9QO	70,551
HA5KDB	58,422

1.8 MHz

UP2BAW	20,091
YU3EF	7,611
VE3MFA	5,180
OK1KPU	4,740
4X4NJ	3,942
SP9DH	3,904

Multi-Op Single Transmitter

VP2MFW	8,321,040
I3MAU	8,279,232
HP1XRK	7,932,712
Y23EK	7,247,100
GU3HFN	7,234,392
R5I	6,742,879

Multi-Op Multi-Transmitter

P41C	41,957,244
KG6RE	18,781,080
YTØR	13,462,620
VP9AD	13,338,000
K6HNZ/CT3	13,149,240
OH1AA	10,840,617

USA

Single Op All Band

K1AR	3,554,880
W1ZM	3,206,348
K2TR	3,153,664
K2BU	2,646,098
W3BGN	2,493,900
K8LX	2,185,528
N2LT	2,056,912
N3AD	2,008,800
N7DF	1,920,192
W9RE	1,867,278

Single Op Single Band 28 MHz

WØZV	663,170
K5RC	623,729
W1WEF	535,382
W5XZ	498,170
W6RR/7	479,360
WB4DWD	457,530

21 MHz

N7DD	923,945
K7RI	630,136
W9ZRX	549,696
KM6B	527,150
K9DX	514,098
WBØCMM	422,280

14 MHz

K2HFX	484,449
WØUA	305,610
K1NG	284,170
W6YA	283,936
W7IL	282,408
K2RD	269,439

7 MHz

KØRF	150,810
K7UR	97,478
K6QEH	93,930
K9KA	58,860
K2IGW	57,810
KBØU	53,636

3.8 MHz

W7IVX	24,603
WA4SVO	23,779
N7RK	23,595
AB1A	20,976
W4NL	20,448
K9WZB	6,840

1.8 MHz

WB3GCG	1,280
N4IN	1,173
K5UR	1,008
W4PZV	738
AA1K/3	645
KB8AC	598

Multi-Op Single Transmitter

K3LR	3,867,840
KX4S	3,837,896
WB2FZO	3,755,350
N4ZC	3,749,108
W4QAW	3,722,928
KØUK	3,522,168

Multi-Op Multi-Transmitter

W2PV	10,618,352
N2AA	10,399,208
N5AU	10,003,840
K1OX	8,016,197
KN6M	7,300,170
W3LPL	7,260,708

BAND-BY-BAND BREAKDOWN—TOP ALL BAND SCORES

Number groups indicate: QSO's/Zones/Countries on each band.

WORLD TOP SINGLE OPERATOR—ALL BAND

Station	160	80	40	20	15	10
9Y4VT	50/6/10	257/14/32	363/22/63	1800/34/110	1130/33/88	3107/31/104
EA8AK	44/9/22	220/19/63	371/30/80	1034/30/88	1542/33/99	2295/31/104
HI8PGG	35/5/9	226/12/39	550/21/70	1170/31/89	1869/31/86	3337/31/99
N6KT/HKØ	9/4/4	310/11/25	470/16/34	1306/27/76	1957/31/78	2756/28/90
4M2AMM		210/13/28	582/22/66	1003/30/72	1112/28/88	1495/22/73
KH6XX	37/6/6	232/18/26	286/20/38	499/27/62	1436/30/65	2422/30/65
DK3GI		51/4/26	112/14/41	680/38/109	1027/37/102	1280/33/102
DK8NG	22/4/14	141/10/47	133/16/58	405/27/84	383/26/78	1972/33/111
DJ4PT	16/2/10	191/10/43	437/18/65	396/28/72	810/32/67	1695/34/72
VP2MBA	4/2/4	111/6/13	247/17/52	796/28/80	1240/24/77	1271/23/70

USA TOP SINGLE OPERATOR—ALL BAND

Station	160	80	40	20	15	10
K1AR	5/2/3	55/13/33	80/20/50	487/35/111	590/34/107	977/36/116
W1ZM	11/5/6	86/18/45	102/22/55	329/33/92	640/31/103	860/30/108
K2TR	5/2/2	59/14/33	100/19/51	321/30/89	671/35/99	991/29/105
K2BU		59/10/38	88/18/44	478/29/87	464/27/84	865/31/101
W3BGN	14/6/8	55/13/35	85/18/43	366/33/96	464/29/90	711/30/107
K8LX	7/4/4	64/15/40	114/21/62	249/32/83	359/30/92	713/30/101
N2LT	5/3/3	26/8/18	79/20/42	323/29/89	370/31/92	737/29/100
N3AD		42/12/28	38/12/26	363/29/89	378/29/87	760/30/108
N7DF	12/4/3	79/15/24	95/18/27	194/33/82	739/33/77	512/30/92
W9RE	8/5/6	36/9/21	82/23/49	240/32/90	364/32/89	615/28/99

WORLD TOP MULTI-OPERATOR SINGLE TRANSMITTER

VP2MFW		213/12/28	326/20/67	1640/28/102	1541/28/91	2927/32/96
I3MAU		225/16/61	379/26/80	1175/38/125	1548/36/105	1479/36/103
HP1XRK	9/7/6	32/12/25	610/21/59	1593/34/102	1746/34/100	2329/34/108
Y23EK		184/7/41	253/18/52	985/32/104	2168/32/98	1867/31/95
GU3HFN	34/3/15	286/11/53	246/13/64	827/29/95	1301/34/103	2630/30/86
R5I	26/6/22	275/18/58	534/31/85	936/39/127	1764/36/109	1386/31/109

USA TOP MULTI-OPERATOR SINGLE TRANSMITTER

K3LR	13/6/11	50/15/44	103/26/69	843/36/128	336/33/110	792/32/122
KX4S	6/4/5	35/14/32	85/23/70	474/36/112	729/35/109	919/32/121
WB2FZO	7/3/4	81/19/56	58/18/53	662/35/116	617/34/103	808/32/117
N4ZC	10/7/9	35/15/33	90/26/65	497/35/120	505/34/107	1019/34/128
W4QAW	11/6/9	54/17/42	120/27/72	266/34/109	565/35/124	1005/34/132
KØUK	13/8/12	60/20/39	403/28/57	278/36/102	669/35/90	768/33/108

WORLD TOP MULTI-OPERATOR MULTI-TRANSMITTER

P4IC	261/9/21	861/22/69	1752/30/98	4837/38/156	5790/39/143	4813/35/138
KG6RE	2/2/2	217/12/23	934/27/48	2207/38/116	4147/36/96	4552/35/95
YTØR	136/7/31	411/11/55	901/27/87	2556/39/144	2144/35/127	2178/35/110
VP9AD	82/4/6	459/15/37	413/19/64	2868/36/127	2732/35/106	3096/34/102
K6HNZ/CT3		185/11/39	378/13/48	1675/32/106	3038/36/106	3193/31/98
OH1AA	79/4/23	415/12/57	719/28/179	1835/40/144	2082/39/126	1460/37/122

USA TOP MULTI-OPERATOR MULTI-TRANSMITTER

W2PV	48/7/10	348/19/61	357/28/84	1112/37/149	1735/37/157	1524/34/146
N2AA	39/7/10	263/20/60	342/28/88	1064/36/141	1496/36/135	1730/32/146
N5AU	115/8/12	109/22/48	425/31/87	1079/37/147	1393/38/133	1751/35/147
K1OX	41/5/8	138/18/52	229/24/72	905/36/145	1286/34/128	1478/36/138
KN6M	16/4/4	243/18/36	803/28/64	475/35/109	974/37/104	1941/34/117
W3LPL	80/6/9	156/18/56	231/28/87	783/35/138	1297/37/144	969/35/139

WORLD TOP 10 QRPp

(5w input)

1. I5NSR 670,133
2. OA8V 545,400
3. WB2ULI 505,997
4. K3ZR 434,720
5. DF4RD 407,313
6. ON6NL 344,268
7. OK3CGP 299,446
8. N2US 171,264
9. G3FTQ 163,344
10. AJ7S 148,144

Number groups after call letters denote following: Band (A=all), Final Score, Number of QSOs, Zones, and Countries. Certificate winners are listed in Bold Face.

SINGLE OPERATOR NORTH AMERICA

UNITED STATES

K1AR	**A**	**3,554,880**	**2194**	**140**	**420**
W1ZM	"	**3,206,348**	**2028**	**139**	**409**
					(Opr. K1ZM)
AK1A	"	**1,490,138**	**1124**	**129**	**352**
KA1R	"	1,390,830	1329	100	270
WA1TFF	"	1,199,312	1154	98	270
W1ZT	"	734,252	764	99	248
K1TGX	"	505,005	753	71	186
K1BV	"	498,879	708	67	176
N1API	"	489,000	546	92	234
K1WJL	"	457,666	552	76	217
WA1YEC	"	441,441	546	78	195
AI1E	"	406,503	478	73	206
K1VDF	"	365,192	526	73	166
KA1RC	"	363,816	547	71	177
KA1UE	"	336,750	482	69	181
KE1F	"	303,432	410	60	189
W1HNZ	"	246,510	513	38	128
W1FM	"	243,522	352	75	174
K1EFI	"	218,572	361	63	149
N1DX	"	212,760	353	56	160
K1LXJ	"	169,338	348	43	126
KA1IM	"	153,959	308	46	123
K1TN	"	143,920	206	70	187
KA1O	"	108,800	253	49	111
AD1Z	"	93,380	228	43	102
K1JYM	"	66,080	179	41	99
KA1UI	"	53,720	137	45	91
KN1DPS	"	52,470	180	36	74
WØMHK/M1	"	41,154	132	30	84
KE1E	"	36,120	126	33	72
WB1FXI	"	34,216	125	33	71
K1KA	"	22,500	83	37	63
WA1YTW	"	21,930	97	26	59
K1BZ	"	20,775	98	20	55
KA1CZF	"	15,372	95	15	46
KF1B	"	10,752	65	20	44
KD1U	"	8,322	55	21	36
W1HUE	"	2,262	32	18	21
KA1ACC	"	2,146	23	16	21
W1WEF	**28**	**535,382**	**1219**	**31**	**115**
KA1CVM	"	187,782	556	26	93
WA1LOU	"	135,228	399	27	91
W1GNR	"	120,714	357	27	91
KA1FCH	"	111,825	365	22	83
K8CH/1	"	107,663	246	42	109
K1WVL	"	44,044	198	20	57
W1PLJ	"	3,534	40	8	33
KA1TR	"	507	13	4	9
W1NG	**21**	**439,110**	**919**	**37**	**133**
W1PH	"	165,984	443	32	101
K1THP	"	26,228	114	24	59
KA1EKR	"	9,724	67	16	36
KA1PU	"	3,380	47	12	23
K1ZZJ	"	3,040	33	11	21
K1NG	**14**	**284,170**	**636**	**37**	**120**
W1WY	"	5,670	40	14	40
WB1AEZ	**7**	**18,023**	**105**	**19**	**48**
WA1AER	"	2,006	20	17	17
AB1A	**3.8**	**20,976**	**126**	**18**	**51**
W1BB	**1.8**	**63**	**7**	**3**	**4**
K2TR	**A**	**3,153,664**	**2147**	**129**	**379**
					(Opr. K3UA)
K2BU	"	**2,646,098**	**1954**	**115**	**354**
N2LT	"	**2,056,912**	**1540**	**120**	**344**
K2DM	"	1,797,816	1452	114	319
W2YV	"	1,468,448	1171	114	322
W2TA	"	1,212,636	1018	114	303
K2NJ	"	1,115,224	908	108	310
KF2O	"	652,653	625	104	277
W2GD	"	651,037	615	109	254
N2VW	"	577,809	636	87	238
KB2CR	"	560,032	582	93	259
W2BHK	"	531,840	734	93	199
KF2U	"	486,920	657	64	195
K2FL	"	464,092	530	85	229
N2MR	"	441,098	475	102	241
W2REH	"	434,696	556	84	184
AB2E	"	393,108	576	67	179
N2ATD	"	293,066	365	77	200
W2BTU	"	291,116	450	71	188
K2SNK	"	281,880	405	62	181
K2PA	"	272,406	411	78	171
K2ZSY	"	260,775	407	53	172
W2KI	"	215,878	320	70	177
N2BIN	"	183,008	369	44	128
WA2WYR	"	176,436	255	75	186
N2BZK	"	164,889	321	51	146
K2SHL	"	154,036	284	54	140
W2HG	"	136,080	237	64	146
W2NC	"	127,908	228	58	146
WA2DPU	"	127,218	256	58	124
WA2CYQ	"	126,243	269	47	122
KB2SE	"	116,219	270	52	111
K2OY	"	115,857	239	67	122
KB2WN	"	113,103	232	53	124
WA2LJM	"	107,085	229	47	118
KE2M	"	105,860	240	49	109
AG2S	"	99,792	240	49	113
KA2HAR	"	93,578	293	45	97
N2AIF	"	84,854	199	45	109
WB2THN	"	72,615	254	28	78
WB2PXA	"	66,411	174	43	98
W2GKZ	"	62,282	163	44	105
KA2EAY	"	49,500	179	34	76
W2PHT	"	49,042	152	33	80
WB2CJL	"	48,720	148	39	77
KK2E	"	42,000	169	31	74
WA2EOQ	"	38,340	102	48	87
W2TZ	"	37,884	116	43	80
W2FTY	"	36,418	98	48	91
KK2A	"	19,110	117	17	48
WA2IMH	"	18,105	86	27	58
W2DSE	"	16,750	170	48	96
K2HPV	"	12,900	75	14	46
N2BCF	"	5,736	46	18	31
KB2SG	**28**	**217,074**	**543**	**28**	**110**
K2SPO	"	104,748	276	28	101
KJ2N	"	80,190	281	23	76
WB2NFB	"	70,560	252	23	75
WB2TKD	"	65,044	218	24	77
K2MFY	"	58,776	254	18	61
KA2EHO	"	38,456	158	21	67
W2KZE	"	36,450	154	21	60
W2AYJ	"	35,880	139	22	70
WA2GUM	"	28,835	142	18	55
W2HPF	**21**	**243,528**	**636**	**33**	**106**
KC2P	"	50,160	194	26	29
K2HFX	**14**	**484,449**	**977**	**37**	**140**
K2RD	"	269,439	573	38	125
WA2RLQ	"	50,048	139	35	93
W2GSN	"	14,694	90	17	45
W2IQD	"	9,675	76	15	30
K2IGW	**7**	**57,810**	**223**	**24**	**70**
WA2IFS	"	27,307	125	22	61
WA2PHA	"	5,842	48	16	30
N2KA	"	1,155	22	8	13
KA2CDJ	"	468	27	5	7
W3BGN	**A**	**2,493,900**	**1695**	**131**	**379**
N3AD	"	**2,008,800**	**1581**	**112**	**338**
K3OO	"	**1,778,700**	**1361**	**116**	**345**
K3ZUF	"	1,485,016	1188	111	325
W3GG	"	1,348,035	1133	108	295
W3UJ	"	884,282	828	103	278
W3MR	"	841,818	860	92	254
N3AUE	"	773,388	812	95	246
N3HW	"	769,626	941	78	208
K3NZ	"	731,000	754	101	240
N3RG	"	673,560	690	102	258
WB3CIW	"	530,726	584	98	236
W3ICM	"	527,553	553	99	252
K3ZZ	"	489,223	543	93	236
W3IQS	"	474,275	561	81	224
KC3H	"	459,096	624	73	191
K3TC	"	439,110	551	75	242
WA3NHO	"	429,828	602	60	178
K3OX	"	426,590	529	76	214
W3ARK	"	401,349	565	61	190
W3GK	"	381,952	522	67	189
W3GL	"	369,117	480	74	205
K3MWV	"	366,124	441	93	221
K3HP	"	351,392	447	86	192
W3JPT	"	343,910	523	61	117
WB3KIL	"	327,771	497	68	169
W3QHF	"	308,112	413	70	192
W3DHM	"	267,840	331	79	209
K3II	"	220,324	348	61	162
N3RW	"	208,488	343	63	156
W3EVW	"	200,925	328	71	154
W3KT	"	198,202	311	60	166
AF3E	"	190,190	280	78	188
K3IE	"	188,587	343	59	144
W3GN	"	180,994	316	55	154
AI3Q	"	179,010	273	79	176
N3CHL	"	173,844	331	54	144
WA3YHE	"	171,840	322	56	136
W3GRS	"	158,010	251	67	163
WA3IMY	"	158,004	287	58	140
AD3Z	"	140,580	236	57	156
W3HVM	"	133,407	267	52	131
K3KP	"	124,733	287	53	120
KB3BW	"	120,704	245	53	131
AI3E	"	97,088	213	47	117
K3WX	"	95,142	257	52	105
K3NL	"	86,019	198	46	113
K3JGJ	"	71,808	200	41	88
KA3DSW	"	62,853	180	39	84
W3ETB	"	51,729	156	41	88
KA3FLG	"	48,581	163	27	74
KB3OQ	"	41,838	127	32	82
WB3CZK	"	35,380	117	41	75
WB3JRU	"	28,476	91	35	78
K3VY	"	26,532	101	33	63
K3VW	"	22,854	101	18	60
WA3YJA	"	17,342	95	21	37
W3FQE	"	15,265	75	26	45
W3FQE	"	3,230	35	12	22
WA3JXW	"	1,104	78	7	16
W3AP	"	986	16	11	12
WA3CKY	**28**	**73,728**	**260**	**22**	**74**
KA3CRC	"	**73,670**	**244**	**22**	**84**
N3BBE	"	71,583	228	24	83
W3CDG	"	25,149	106	23	60
N3AGE	"	21,462	92	22	51
KA3DOO	"	9,000	73	15	30
N3CIX	"	570	12	8	11
WB3EKV	**21**	**125,750**	**361**	**33**	**92**
WB3DNA	"	**124,865**	**354**	**32**	**94**
K4JLD/3	"	101,088	316	31	86
W3DPH	"	15,420	93	18	42
W6GMZ/3	"	14,198	85	20	42
WA3DMH	"	6,118	56	9	28
W3KFQ	**14**	**56,880**	**170**	**36**	**84**
W3SOH	"	2,244	25	12	22
WA3VOQ	**7**	**20,085**	**115**	**17**	**48**
K3TW	"	14,348	115	14	44
WB3GCG	**1.8**	**1,280**	**50**	**7**	**13**
AA1K/3	"	645	28	7	8
KG4W	**A**	**971,364**	**987**	**113**	**253**
K4KZZ	"	**962,160**	**938**	**104**	**276**
AI2C/4	"	**717,641**	**717**	**94**	**260**
K4GFH	"	646,722	704	100	242
KD4UH	"	646,212	692	105	238
NQ4I	"	646,050	635	108	257
N4AJZ	"	643,670	678	101	236
N4MO	"	622,336	642	98	254
KC4UQ	"	563,760	568	103	257
W4RW	"	498,464	590	85	211
W4NT	"	494,262	532	103	236
			(Opr. AA4GA)		
KB4CD	"	466,057	537	92	221
W4YE	"	433,260	589	66	195
N4NX	"	431,288	491	91	228
N4CD	"	410,564	506	89	212
K4IQH	"	401,202	509	79	200
WB4GNT	"	391,776	433	94	242
N4PB	"	345,054	468	72	190
W4CEB	"	325,047	438	85	206
W4BV	"	306,290	407	82	199
KB4YG	"	259,598	321	82	211
KA4NCZ	"	257,760	399	67	173
WD4IXE	"	239,148	330	71	181
WD4IKI	"	231,812	359	72	166
K4PHE	"	154,475	297	57	128
W4NTI	"	147,472	260	66	142
K4BAI	"	130,203	300	45	108
K4IR	"	128,640	231	70	131
WA4MIT	"	127,246	306	38	111
WD4PVI	"	106,930	213	59	126
KD4PP	"	103,827	249	50	109
K4YXJ	"	88,068	193	49	115
K4DLI	"	63,832	152	54	104
N4TL	"	51,737	179	43	90
K4WHN	"	49,005	139	44	91
W4KMS	"	48,789	126	45	94
KC4LQ	"	47,736	120	55	98
W4IQ	"	47,560	150	33	83
W4PC	"	45,765	126	41	94
W4WJJ	"	45,240	163	41	79
WA4DRU	"	41,580	119	41	94
KB4IY	"	39,510	157	27	63
W4YN	"	37,430	139	30	65
KA4ETL	"	31,668	112	40	76
N4FGF	"	28,405	112	34	61
KD4UO	"	22,176	91	35	61
W4EZ	"	20,055	76	35	70
W4OGG	"	16,000	78	28	52
KA4KJI	"	15,170	87	27	47
N4CYG	"	13,650	68	25	50
K4FPF	"	12,198	76	17	40
KB4CF	"	10,500	66	20	40
K4OD	"	9,983	63	26	41
W4GTS	"	9,360	60	21	39
AK4T	"	4,488	32	24	27
WB4DWD	**28**	**457,530**	**1059**	**34**	**117**
N4ZZ	"	**398,724**	**1042**	**31**	**118**
N4CT	"	350,471	818	33	118
W8ZF/4	"	338,700	808	31	119
N4CC	"	338,560	729	33	127
WBØYCJ/4	"	209,608	580	31	102
AA4M	"	160,480	416	30	106
N4MM	"	156,745	383	29	116
KC4GR	"	115,290	336	28	94
WA4HNL	"	86,076	280	27	81
WB4VQO	"	77,589	251	28	83
K4DOB	"	22,680	91	24	66
K4ISV	**21**	**319,242**	**784**	**36**	**118**
K4PI	"	299,341	747	35	114
KW4T	"	154,432	440	34	93
KV4P	"	126,784	416	31	81
NA4M	"	126,080	374	33	95
WD4AMM	"	108,486	320	32	91

MFJ Super Keyboards

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

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

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

MODE 1: CW

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

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

Delete errors by backspacing.

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

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

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

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

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

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

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

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

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

Weight control makes your signal distinctive to penetrate QRM.

MODE 2 & 3 (RTTY): BAUDOT & ASCII

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

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

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

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

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

MODE 4: MEMORY KEYER

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

MODE 5: MORSE CODE PRACTICE

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

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

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

MORE FEATURES

Automatic incrementing serial number from 0 to 999 can be inserted into buffer or message memory for contests.

Repeat function allows repetition of any message memory with 1 to 99 seconds delay. Lets you call CQ and repeat until answered.

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

Clock option (496 only) send time in CW, Baudot, ASCII. 24 hour format.

Set CW sending speed before or while sending.

Tune switch with LED keys transmitter for tuning. Tune key provides continuous dots to save finals. Built-in sidetone and speaker.

PTT (push-to-talk) output keys transmitter for Baudot and ASCII modes.

Reliable solid state keying for CW: grid block, cathode, solid state transmitters (-300V, 10 ma Max, +300V, 100 ma Max). TTL and open collector outputs for RTTY and ASCII.

Fully shielded. RF proof. All aluminum cabinet. Black bottom, eggshell white top. 12"Dx7"Wx1¼"H (front) x3½"H (back). Red LED indicates on.

9-12 VDC or 110 VAC with optional adapter.

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

Every single unit is tested for performance and inspected for quality. Solid American construction.

OPTIONS

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W4ZTW	"	98,340	330	32	78	KJ6Z	"	62,618	230	58	73	W8IMZ	"	150,150	282	68	142	WA9ETR	"	17,340	106	25	43
W4JD	"	36,034	156	24	62	AC6V	"	58,050	159	46	89	K8TMK	"	119,493	229	57	130	W9LT	"	8,832	96	6	26
N4TZ	"	15,498	90	18	45	N6EZN	"	52,650	244	38	52	KC8JH	"	112,723	249	54	115	WA9MRU	"	6,042	60	11	27
AC4X	14	11,946	62	23	43	WB6DNN	"	50,794	166	40	69	N8BRQ	"	101,840	244	48	104	**W9ZRX**	**21**	**549,696**	**1170**	**39**	**129**
W4UYC	7.0	4,752	46	17	27	W6OGC	"	46,250	137	50	75	W8UPH	"	99,330	234	46	108					(Opr. N9NC)	
WA4SVO	**3.8**	**23,779**	**141**	**21**	**58**	N6OM	"	38,307	140	44	69	W8CBR	"	80,631	187	50	103	**K9DX**	"	**514,098**	**1063**	**38**	**131**
W4NL	"	20,448	123	19	52	W6AQ	"	35,984	112	45	68	WD8BSX	"	74,196	173	53	109	K9BGL	"	181,016	484	36	100
N4IN	**1.8**	**1,173**	**26**	**8**	**15**	K6PU	"	35,520	111	44	76	K8CMO	"	67,340	176	45	95	W9NGA	"	177,826	456	36	101
W4PZV	"	738	34	7	11	AF6S	"	32,248	89	55	84	N8AHK	"	58,828	147	58	96	K9QVB	"	130,944	369	32	96
KA4S	"	558	15	8	10	N6TR	"	27,456	120	44	60	W8SQ	"	55,096	151	46	96	KE9U	"	120,048	324	33	90
K8CFU/4	"	345	26	7	8	NC6Q	"	16,926	70	35	56	KB8WB	"	45,696	138	50	86	N9ER	"	90,828	278	29	87
K5DX	**A**	**837,668**	**799**	**105**	**257**	K6ASI	"	15,744	68	25	57	KB8RT	"	45,105	110	52	103	KI9U	"	36,378	139	25	69
N5JB	"	**661,440**	**748**	**96**	**224**	AA6EE	"	14,824	88	32	37	N8CLR	"	42,848	152	34	69	W9MYG	"	29,475	106	22	53
N5DDO	"	**569,160**	**775**	**87**	**183**	W6OVO	"	9,272	58	29	32	W8DXT	"	37,632	139	37	75	WB9CXY	"	6,811	51	16	33
K5LP	"	547,305	618	97	224	KA6JHU	"	9,000	67	32	28	AD8O	"	36,442	100	51	86	**WA9ZPR**	**14**	**233,532**	**517**	**35**	**121**
KS5A	"	520,995	926	77	158	KD6AZ	"	4,730	39	18	25	N8AKF	"	35,640	125	36	74	WD9IIC	"	148,190	360	35	110
N5BA	"	486,990	570	96	219	W6SX	"	3,192	32	21	21	K8KUH	"	35,616	124	33	73	KA9GRL	"	83,205	229	34	95
K5JW	"	446,213	686	74	165	W6KBO	"	1,250	21	12	13	N8TN	"	35,096	120	34	73	W9JUV	"	78,324	230	32	90
KA5W	"	379,764	516	86	188	**KM6K**	**28**	**254,520**	**691**	**31**	**95**	N8BTT	"	27,552	126	26	58	K9SD	"	71,250	265	32	82
W5DV	"	331,932	438	92	186	W6EUF	"	214,104	577	33	99	W8GV	"	23,520	114	23	61	W9NUD	"	66,788	204	29	89
K5QY	"	235,585	327	89	176	K6VI	"	160,544	580	29	87	WD8ECA	"	22,570	107	21	53	K9YNF	"	31,242	139	25	57
KC5CP	"	230,640	355	75	173	KD6DY	"	137,494	470	26	72	WB8ZJW	"	19,215	70	40	65	W9RKP	"	2,100	25	12	23
W5OSJ	"	223,560	362	82	161	WB6MBF	"	120,288	440	27	69	KC8JE	"	15,660	66	36	54	**K9KA**	**7**	**58,860**	**198**	**29**	**80**
N5UA	"	214,120	368	68	144	W6TMD	"	75,456	275	26	70	WD8OHC	"	14,616	70	29	55	W9CH	"	50,295	180	29	76
W5LMG	"	149,730	272	69	141	W8AKS/6	"	31,021	202	21	46	WB8UGI	"	14,535	69	29	66	WD9IIX	"	29,744	129	23	65
W5BE	"	130,248	233	65	136	AI6Z	"	30,494	138	22	57	WA8WMC	"	11,304	57	28	44	W9NB	"	23,085	111	25	56
WD5FJV	"	125,121	253	61	118	KA6DSW	"	18,868	127	20	33	K8HF	"	8,662	58	26	35	AG9S	"	22,356	108	24	57
K5GOE	"	119,184	237	63	128	K6UFT	"	16,775	99	18	43	WD8MDG	"	6,854	52	14	32	WB9IWN	"	264	9	5	7
N5KT	"	79,430	217	43	87	W6OUL	"	10,065	58	15	46	N8MK	"	6,498	43	24	33	**K9WZB**	**3.8**	**6,840**	**70**	**13**	**32**
AB5P	"	70,700	181	44	96	WA6TLA	"	6,020	47	16	27	WB8VPQ	"	2,656	30	9	23	WD9AHJ	"	6,292	75	14	30
W5UR	"	54,621	164	39	80	**KM6B**	**21**	**527,150**	**1422**	**36**	**94**	K8EIO	"	2,600	27	16	24	K9AJ	"	4,488	44	15	29
W5IYR	"	51,788	155	39	82	W6XJ	"	337,688	880	37	99	WD8CZA	"	1,696	19	15	17						
W5JC	"	45,816	125	54	84				(Opr. WB6OKK)			**N8CNT**	**28**	**219,726**	**721**	**29**	**88**	**N0GA**	**A**	**635,256**	**667**	**104**	**242**
KB5UW	"	39,663	135	41	76	N6UC	"	167,440	502	31	84	W8BCL	"	119,310	341	29	94	**WD0EWD**	"	**490,320**	**786**	**66**	**150**
W5YH	"	31,008	114	33	69	W6BSY	"	148,155	444	33	86	WA8DXB	"	80,738	198	32	114	**K0RWL**	"	**441,870**	**487**	**100**	**230**
W5GVP	"	29,295	108	41	64	N6TO	"	124,960	407	30	80	W8NWO	"	80,615	246	26	89	AC0N	"	405,216	586	79	173
W5JWM	"	26,631	103	39	60	WA6VNR	"	67,296	254	30	66	WD8IDE	"	62,699	258	22	69	KB0V	"	301,530	397	86	199
K5DEC	"	15,834	96	37	41	K6SMH	"	26,796	120	29	55	KA8IPL	"	45,838	189	22	64	WD0GML	"	273,182	399	76	171
W5EIJ	"	14,608	76	34	49	**W6YA**	**14**	**283,936**	**667**	**36**	**116**	KA8EEA	"	32,204	145	22	61	WA0ECN	"	258,990	351	88	179
W5ELN	"	5,304	42	22	30				(Opr. N6NI)			N8CXX	"	17,812	101	18	43	KB0PR	"	200,074	336	80	137
W5AE	"	4,048	34	20	26	W6HXW	"	52,965	179	28	79	W8KUK	"	11,368	69	17	41	W0FF	"	167,085	264	75	160
KC5HO	"	736	16	12	11	W6OK	"	44,700	159	29	71	WB8YEW	"	4,370	42	11	27	K0VBU	"	128,575	256	62	123
K5RC	**28**	**623,729**	**1385**	**37**	**132**	WB6JMS	"	41,405	170	29	62	K8PSR	"	3,706	40	11	23	WB0ISW	"	127,866	247	64	138
			(Opr. K5GN)			W6OPO	"	12,648	69	24	44	N8AXA	"	1,400	23	11	14	WD0FSJ	"	115,634	245	67	112
W5XZ	"	498,170	1191	32	123	W6QDE	"	5,208	23	15	13	**K8SS**	**21**	**218,933**	**543**	**34**	**109**	K9BLY/0	"	101,569	204	57	112
K5KLA	"	404,400	929	35	117	K6BIA	"	1,305	19	11	18	KB8LH	"	150,156	416	32	97	W0PPF	"	94,200	223	47	110
K5JJ	"	322,200	744	33	117	**K6QEH**	**7**	**93,930**	**322**	**31**	**70**	N8AJF	"	126,360	341	33	97	W0OSK	"	93,297	247	49	88
K8TD/5	"	277,836	772	32	105				(Opr. N6AW)			W3IWG/8	"	116,501	353	30	89	WA0DCB	"	93,264	204	56	118
W5VGX	"	266,110	729	32	98	WA6KKM	"	37,500	179	24	51	AC8C	"	73,600	268	26	74	KA0D	"	89,011	198	51	116
K5IID	"	235,884	631	30	102	AA6AA	"	21,216	77	33	71	K8EF	"	73,188	248	28	79	WB0RMT	"	82,584	205	47	101
W5ASP	"	73,034	240	27	79	N6QR	"	21,140	116	22	48	WB8KKI	"	34,830	151	23	58	W0RU	"	80,070	198	54	103
K5RF	"	69,576	239	26	78	**K6SE**	**1.8**	**480**	**38**	**8**	**8**	KC8MQ	"	23,652	117	22	51	N9BD/0	"	65,026	192	38	84
KA5KSS	"	47,120	182	24	71							K8RWL	"	8,800	55	20	35	W6FN/0	"	60,741	141	61	92
N5CEM	"	20,274	122	20	42	**N7DF**	**A**	**1,920,192**	**1631**	**133**	**305**	**WB8TRW**	**14**	**61,950**	**188**	**29**	**89**	WB8ZRL/0	"	47,656	124	53	95
AK5E	"	14,381	73	23	50	**KC7EH**	"	**717,457**	**1054**	**83**	**158**	**W8UVZ**	**7**	**50,796**	**209**	**29**	**73**	KM0P	"	46,112	136	44	87
K5GA	**21**	**334,734**	**858**	**37**	**104**	K7ZA	"	520,591	680	92	179	AD8C	"	38,634	146	26	68	K0IFL	"	44,640	134	42	78
			(Opr. KN5H)			KG5W/7	"	513,060	750	94	161	WD8CRY	"	28,652	144	19	57	WB0IEL	"	44,635	142	37	76
WB5UDX	"	203,885	601	32	89	KI7M	"	429,722	685	81	158	K8VFV	"	21,791	113	23	54	KF0Z	"	44,403	137	44	79
K5NW	"	117,351	356	35	82	W7AEP	"	421,610	552	93	173	**KB8AC**	**1.8**	**598**	**44**	**6**	**7**	N0BZE	"	40,893	131	47	82
W5LKP	"	108,160	301	33	95	W7JYW	"	301,698	494	76	146	WA8LXJ	"	570	28	7	8	WB0NPH	"	39,208	127	42	74
W9ZTD/5	"	97,991	338	32	77	WB7EEI	"	285,532	457	78	143							WD0FLO	"	35,880	125	44	76
W5VNZ	"	62,812	289	23	59	KJ7R	"	174,636	305	74	124	**W9RE**	**A**	**1,867,278**	**1345**	**129**	**354**	W0RT	"	35,192	126	39	67
WD5JBA	"	57,873	224	28	73	W7FGT	"	165,264	420	61	115	**AI9J**	"	**1,266,165**	**1104**	**122**	**293**	K0BJ	"	35,143	111	42	71
K5RR	**7**	**14,520**	**100**	**17**	**38**	WB7RYC	"	151,150	425	66	84	**KB9US**	"	**853,335**	**819**	**115**	**272**	KM0R	"	33,110	117	36	74
WB5DDI	"	912	18	10	14	W7GUR	"	100,717	237	50	101	KE9A	"	825,300	841	106	244	KN0O	"	18,531	84	25	62
KJ5W	"	341	12	5	6	W7ZI	"	91,360	200	54	106	W9OP	"	717,174	752	95	247	W0YHE	"	15,088	68	30	52
AE5B	**3.8**	**4,440**	**57**	**11**	**26**	W7BUN	"	76,982	224	46	76	K9SH	"	617,730	651	100	249	WD0EIF	"	14,160	67	30	50
K5UR	**1.8**	**1,008**	**46**	**8**	**13**	KB7EO	"	42,672	180	38	46	K9LWT	"	591,216	690	102	225	W0IUB	"	8,580	53	23	42
W6BH	**A**	**1,788,436**	**1519**	**128**	**294**	W7IIT	"	30,749	111	42	55	K9QXY	"	539,231	597	97	232	AG0M	"	8,107	49	28	39
			(Opr. WA6IQM)			K7WA	"	27,675	131	28	47	K9MDO	"	533,133	586	98	235	KA0P	"	1,647	29	16	11
N6CW	"	**1,699,338**	**1700**	**114**	**252**	W7JKA	"	14,774	72	35	48	WA9TGL	"	410,380	503	85	204	K0VUA	"	1,242	26	13	14
			(Opr. K1LL)			AE7W	"	5,459	43	23	30	W9GIL	"	388,626	513	74	192	**W0ZV**	**28**	**663,170**	**1370**	**34**	**132**
N6AR	"	**1,227,276**	**1015**	**134**	**304**	AK7F	"	2,240	26	16	16	KB9XG	"	354,475	440	82	193	K0TLM	"	180,840	469	31	106
W6PU	"	1,135,888	1157	108	236	**W6RR/7**	**28**	**479,360**	**1302**	**33**	**95**	N9AFV	"	322,580	444	78	176	WA0MHJ	"	127,125	354	30	95
W6MSF	"	1,055,054	1085	110	231	N7ABJ	"	332,631	980	32	85	N9BEM	"	321,776	475	84	188	WB0YJT	"	58,420	225	26	66
			(Opr. WA6HCI)			N2AIR/7	"	236,160	931	27	63	KB9AW	"	311,904	406	90	198	WB0YUC	"	49,450	202	23	63
KD6NH	"	875,824	1166	99	205	K7IDX	"	137,093	536	28	75	K9YAX	"	307,200	435	71	185	WA0WBU	"	39,140	182	19	57
N6MB	"	720,522	867	97	200	KM7E	"	124,544	748	23	41	K9BG	"	279,616	385	88	184	KB0TM	"	26,136	139	17	49
K6NA	"	634,410	679	114	228	KC7EI	"	35,620	196	24	41	W9EQP	"	255,783	395	75	178	WB0VHH	"	20,736	108	24	57
W6FQF	"	628,422	736	99	204	W7AYY	"	12,240	85	16	35	W9OA	"	239,292	402	64	143	N0CC	"	20,020	80	25	66
N6JV	"	575,845	766	92	173	W7KEU	"	8,208	59	21	36	K9CJK	"	194,220	300	79	155	KK0Q	"	6,138	76	15	18
KB6ZA	"	571,448	838	82	162	**N7DD**	**21**	**923,945**	**1998**	**36**	**121**	VE3CDP/						**WB0CMM**	**21**	**422,280**	**1077**	**34**	**104**
N6AN	"	407,456	612	82	156	K7RI	"	630,136	1466	35	111	W9	"	176,300	318	69	136	KB0UE	"	8,640	62	19	35
W6ISQ	"	395,764	436	106	220	K7LZJ	"	139,062	501	27	71	K9BQL	"	170,563	317	62	129	**W0UA**	**14**	**305,610**	**683**	**36**	**131**
K6BR	"	384,384	516	90	174	W7LXR	"	80,088	294	31	63	W9DIM	"	163,215	297	57	138	K0GU	"	187,089	469	36	115
W6UA	"	345,024	440	94	194	KI7F	"	10,128	79	18	30	K9IW	"	159,264	263	63	161	WD0AWL	"	260	7	6	7
NE6B	"	284,032	458	75	149	K7JCI	"	9,246	74	18	28	KB9YW	"	128,205	238	62	123	**K0RF**	**7**	**150,810**	**474**	**32**	**78**
WA6HAE	"	269,352	532	51	123	KE7Z	"	513	40	9	10	W9RF	"	125,417	265	50	117	KB0U	"	53,636	208	25	67
AF6F	"	268,479	464	74	133	**W7IL**	**14**	**282,408**	**606**	**38**	**126**	KC9EW	"	87,360	203	55	105	K0VUW	"	39,480	200	29	65
W6KXT	"	264,624	459	73	149	WB7WQE	"	128,960	377	32	98	W9GXR	"	75,970	194	45	97	WA0ETC	"	18,525	98	23	52
N6AFZ	"	206,220	378	78	132	W7HXG	"	67,488	207	31	83	KA9ADP	"	71,536	183	44	92	K0GT	"	12,736	77	22	42
WA6UFY	"	203,967	438	64	109	W7KKR	"	14,336	80	21	43	K9KVA	"	71,400	183	45	95	**K0CS**	**3.8**	**5,250**	**58**	**14**	**28**
WB6FDQ	"	202,895	387	67	120	KA7HHJ	"	336	27	7	7	AA9L	"	60,416	175	42	86	W0JU	"	2,635	37	11	20
WA6LFF	"	196,248	335	81	140	**K7UR**	**7**	**97,478**	**362**	**29**	**65**	KD9M	"	54,940	162	45	89						
W6YQ	"	164,433	329	66	111	**W7IVX**	**3.8**	**24,603**	**159**	**20**	**39**	N9AEC	"	49,920	135	40	88						
WD6EWG	"	155,040	360	76	94	**N7RK**	"	**23,595**	**151**	**20**	**45**	KB9OC	"	45,936	135	43	89						
N6CCL	"	148,672	287	66	118	N7AM	"	8,480	79	16	24	WB9EBO	"	45,594	159	34	68						
N6GG	"	139,442	230	81	145	N7EA	"	7,680	72	17	31	W9QWM	"	32,208	122	42	80						
K6YRA	"	139,097	234	75	142							WA9OVU	"	30,495	98	42	65						
N6HK	"	136,224	280	54	122	**K8LX**	**A**	**2,185,528**	**1506**	**132**	**382**	N9BAF	"	29,866	109	44	65						
K6SSX	"	127,072	272	62	114				(Opr. WA8ZDT)			N9BDM	"	29,610	100	38	67						
N6NF	"	111,104	311	52	76	**WA8TBQ**	"	**1,754,000**	**1265**	**138**	**362**	W9PNE	"	19,092	95	32	54						
W6THR	"	111,033	247	56	113	**W3HKK/8**	"	**1,018,014**	**948**	**104**	**279**	W9CRN	"	9,085	46	34	45						
W6WB	"	110,715	222	66	117	WB8VPA	"	638,044	630	106	268	K9IZT	"	8,220	54	25	35						
NB6G	"	105,792	260	52	100	N8ATR	"	554,524	648	91	223	WD9JKZ	"	8,050	46	29	41						
N6BZA	"	105,400	234	65	105	N8BJQ	"	440,440	531	95	213	K9GDF	"	748	13	10	12						
KG6O	"	103,455	234	59	106	W8KKF	"	349,776	491	72	180	**K9RN**	**28**	**389,620**	**835**	**34**	**127**						
N6SV	"	99,981	169	62	145	KF8K	"	285,384	412	74	179	**WA9EKA**	"	**282,802**	**677**	**30**	**119**						
AD6D	"	98,324	199	70	118	WD8MDV	"	279,314	364	85	196	WA9MAG	"	154,449	421	26	105						
W6ABT	"	85,828	184	57	115	N8ARA	"	257,621	410	78	169	KA9DOO	"	141,886	410	28	94						
W6BYH	"	81,184	170	60	112	K8PUJ	"	251,980	333	92	201	W9YYG	"	126,148	375	29	93						
W6MYP	"	80,645	227	45	82	K2AOE/8	"	211,140	356	60	147	N9ACP	"	121,699	324	30	101						
WD6FLB	"	79,937	203	58	85	KD8V	"	191,475	330	67	158	WB9GGD	"	98,119	324	29	78						
N6UW	"	72,836	204	50	81	KA8JRI	"	172,854	335	59	135	W9DDP	"	69,825	232	29	76						
K6MA	"	72,668	181	54	94	KB8FJ	"	171,808	298	59	149	N9CKB	"	56,212	214	26	68						
WB6MQF	"	69,966	192	62	76	WD8JBB	"	167,808	327	53	131	WA9BZW	"	55,776	209	24	72						
N6JM	"	69,402	194	49	80	K8CV	"	162,430	304	59	126	WA9JWL	"	47,790	181	21	69						
W6VG	"	68,150	174	51	94	K8IQQ	"	157,884	323	53	124	W9DWO	"	45,409	178	25	66						
N6ESV	"	68,110	245	40	58	WD8MRF	"	156,560	266	63	143	N9CHN	"	39,150	159	25	62						
W5FL/6	"	66,825	153	59	106	KB8NZ	"	155,980	262	77	143	KA9EVV	"	27,714	160	18	44						

ALASKA

KL7AF	**A**	**229,680**	**569**	**73**	**107**
AL7O	14	30,567	170	23	46

ANGUILLA

VP2EC	**A**	**3,385,448**	**4226**	**99**	**242**
			(Opr. KC5EA)		

BAHAMA ISLAND

C6ADV	**3.8**	**85,666**	**610**	**16**	**42**

BERMUDA

VP9BO	**1.8**	**3,190**	**159**	**4**	**6**

CANADA

VO1AW	A	5,253	39	14	37
VO2CW	**14**	**898,720**	**2216**	**35**	**129**
			(Opr. K6LPL)		
VE1CEG	**A**	**567,030**	**946**	**73**	**173**
VE1TG	**21**	**170,040**	**565**	**29**	**91**
VE1CAN	"	49,248	248	21	60
VE2AYU	**A**	**762,560**	**941**	**89**	**231**
VE2DUN	"	135,000	586	36	72
VE2FUY	"	22,018	90	35	66
VE2DVI	**28**	**110,052**	**363**	**24**	**84**
VE2EVO	"	52,207	241	23	60
VE2WA	**14**	**51,300**	**203**	**29**	**71**
VE3GCO	**A**	**2,108,592**	**1865**	**112**	**320**
VE3UOT	"	**934,908**	**1096**	**96**	**242**
			(Opr. VE1BCZ)		
VE3ABR	"	272,731	396	82	181
VE3GP	"	201,749	365	71	158
VE3MV	"	163,542	333	59	135
VE3CKR	"	95,760	564	26	58
VE3GCE	"	87,824	186	62	114
VE3EZU	"	63,048	186	43	99
VE3NBW	"	54,400	160	47	89
VE3NBY	"	37,030	128	40	75
VE3LNW	**28**	**571,608**	**1338**	**33**	**120**
VE3MKJ	"	14,628	118	14	39
VE3BMV	**21**	**1,130,206**	**2376**	**38**	**141**
VE3EEW	**14**	**314,145**	**1066**	**34**	**101**
VE3DYB	"	17,520	89	19	54
VE3LAJ	"	13,286	70	20	53
VE3IPR	**3.8**	**30,544**	**344**	**15**	**31**
VE3CPU	"	11,934	220	11	66
VE3MFA	**1.8**	**5,180**	**207**	**6**	**8**
VE3BBN	"	3,553	169	5	6
VE4AIV	**A**	**128,954**	**487**	**38**	**84**
VE4RP	**28**	**112,409**	**386**	**39**	**82**
VE4AKX	"	12,852	106	17	34
VE5RA	**28**	**319,451**	**1268**	**30**	**83**
VE6AYE	**28**	**113,661**	**705**	**24**	**49**
VE6BEO	"	12,300	129	19	22
VE7WJ	**A**	**3,303,990**	**3482**	**131**	**274**
			(Opr. WA6VEF)		
VE7BSM	"	533,200	800	89	159
VE7IQ	"	31,977	137	45	54
VE7BTV	**28**	**422,484**	**1742**	**31**	**71**
VE7AWT	"	271,710	1210	29	61
VE7EOA	"	69,714	540	24	30
VE7IN	**21**	**731,372**	**2058**	**37**	**97**
VE7AVU	"	128,380	756	23	47
VE7AZC	14	8,479	53	24	37

COSTA RICA

TI2LO	A	12,282	65	29	40
TE1C	**21**	**1,449,805**	**3670**	**37**	**124**

DOMINICAN REPUBLIC

HI8PGG	**A**	**9,009,721**	**7190**	**131**	**392**
			(Opr. N1GL)		
HI8GB	**28**	**437,580**	**1955**	**26**	**72**
HI8LC	**21**	**253,000**	**1100**	**30**	**85**

FRENCH ST. MARTIN

FG7AR/ FS7	**A**	**584,915**	**2027**	**42**	**89**
			(Opr. W1XK)		

GRAND CAYMAN

ZF2FL	**14**	**1,940,539**	**4525**	**37**	**142**
			(Opr. N6RJ)		

GUATEMALA

TG9EW	**28**	**421,880**	**1556**	**27**	**79**

JAMAICA

6Y5HN	**A**	**800,676**	**1565**	**80**	**196**

MEXICO

XE1CRC	**28**	**40,815**	**428**	**18**	**27**
XD0LCH	**14**	**490,038**	**1593**	**38**	**96**

MONTSERRAT

VP2MBA	**A**	**3,628,944**	**3669**	**100**	**296**
			(Opr. W7FP)		

PUERTO RICO

NP4DA	**21**	**102,410**	**610**	**25**	**52**
NP4AU	14	26,019	190	15	44

SAN ANDRES ISLAND

N5KT/ HK8	**A**	**6,823,008**	**6811**	**117**	**307**

ST. KITTS

VP2KAC	**21**	**1,783,500**	**3941**	**37**	**137**
VP2KAA	**14**	**2,011,185**	**4186**	**37**	**150**
VP2KAE	**7**	**432,942**	**1600**	**27**	**91**

ST. LUCIA

J6LIR	**A**	**898,846**	**2157**	**58**	**123**

AFRICA

BENIN

TYA11	**A**	**1,548,139**	**1624**	**90**	**233**

CANARY ISLANDS

EA8AK	**A**	**9,974,811**	**5506**	**152**	**457**
EA8TY	**28**	**57,424**	**261**	**18**	**56**

CAPE VERDE

D4CBC	**A**	**2,326,454**	**2301**	**96**	**242**

CUETA AND MELILLA

EA9GD	28	8,715	83	7	28

DJIBOUTI

J28DM	**A**	**302,750**	**582**	**50**	**125**

LIBERIA

EL2AV	**21**	**1,404,936**	**3087**	**35**	**117**

MADEIRA ISLANDS

CT3AF	28	2,912	38	8	20
CT3BM	**21**	**349,830**	**1020**	**29**	**86**
CT3BD	**7**	**142,978**	**499**	**20**	**77**

MOROCCO

CN8CO	**A**	**1,776,054**	**2022**	**74**	**220**

NAMIBIA

ZS3HL	**A**	**1,768,704**	**2116**	**80**	**202**

SENEGAL

6W8JU	**A**	**101,336**	**339**	**29**	**77**

SOUTH AFRICA

S83W	**A**	**800,792**	**1092**	**83**	**165**
ZS6YO	"	354,093	751	56	103
ZS4SP	"	90,440	237	43	90
ZS6AOO	**14**	**552,704**	**1371**	**34**	**102**

SWAZILAND

3D6BA	**A**	**117,478**	**268**	**55**	**96**

ZAIRE

9Q5FL	28	15,624	217	10	14

ZIMBABWE

ZE3JO	A	49,496	184	29	63

ASIA

BAHRAIN

A9XDD	**A**	**254,156**	**444**	**53**	**150**

ISRAEL

4X8U	**A**	**3,497,208**	**2774**	**116**	**313**
			(Opr. 4X4UH)		
4X6FY	"	42,768	182	21	60
4Z4AB	**28**	**887,404**	**1910**	**38**	**126**
4X6DK	"	31,293	189	15	46
4Z4EU	**21**	**602,184**	**1556**	**32**	**100**
4X6DX	**14**	**677,100**	**1588**	**35**	**113**
4X6BYB	"	571,119	1571	35	92
			(Opr. 4Z4LF)		
4Z4DX	**7**	**241,368**	**721**	**26**	**87**
4Z4KX	3.8	2,730	50	4	17
4X4NJ	**1.8**	**3,942**	**55**	**6**	**21**

JAPAN

JA1ELY	**A**	**2,090,880**	**1672**	**139**	**293**
JR1AIB	"	**1,191,456**	**1064**	**127**	**267**
JH1CNT	"	**1,723,752**	**1670**	**123**	**233**
JF1SEK	"	525,525	776	82	149
JA6CNL	"	501,270	611	101	193
JA4ESR	"	217,125	402	78	115
JE3DYW	"	175,062	338	67	112
JA1ALX	"	147,900	353	47	98
JA6QZ	"	146,720	325	50	110
JF1IMQ	"	142,044	433	41	73
JF3CCN	"	132,759	307	52	97
JA6CN	"	114,954	250	52	109
JA7JND	"	109,356	241	45	111
JA6WWW	"	107,663	251	60	91
JR1POW	"	96,142	310	43	63
JA7KCD/1	"	92,345	277	47	68
JA2OJ	"	78,338	210	47	84
JR3XEX	"	77,851	215	47	80
JA6QDU	"	65,392	197	47	75
JA7BAL	"	55,328	150	50	83
JA7KM	"	54,970	172	41	74
JA7CUK	"	53,805	251	27	58
JA6AKV	"	52,569	185	38	61
JA6PL	"	36,972	166	20	59
JA1IZ	"	36,260	130	35	63
JL1DBI	"	28,350	141	25	45
JH4QJT	"	27,720	104	34	65
JA1AOD	"	27,413	123	33	46
JH6TYD	"	26,477	113	34	49
JA3COA	"	9,027	56	22	29
JJ1SOE	"	5,700	64	14	16
JA1BNW	"	1,896	29	9	15
JI3DLX	"	1,701	23	11	16
JF2PKI	"	819	15	10	11
JA4UIT	"	816	15	11	13
JH1AJT	**28**	**735,165**	**1648**	**35**	**118**
JH1AGU	"	**405,765**	**1092**	**31**	**96**
JH1RNZ	"	**312,144**	**983**	**31**	**81**
JG1NBD	"	299,085	810	32	95
JL1NRR	"	224,808	686	34	82
JA7UMT	"	206,430	684	29	76
JJ1NUB	"	193,860	610	30	78
JA2YKR	"	188,570	605	30	79
JH1ARC	"	152,286	521	30	72
JA3EQC	"	150,500	524	31	69
JA8UFD	"	99,388	408	26	58
JH4UTP	"	81,360	356	25	55
JA1MYW	"	78,715	302	25	66
JG3KAB	"	69,300	333	24	53
JA4CTL	"	60,040	267	24	55
JH1LZC	"	59,013	246	26	57
JH2JUK	"	58,764	318	29	54
JA1FO	"	58,420	232	31	61
JR7TJP	"	58,108	278	22	51
JA1CQT	"	55,554	217	29	65
JA1DFQ	"	52,800	229	21	59
JR7CDL	"	45,084	207	24	54
JA1JGP	"	40,725	192	24	51
JA9YE	"	34,444	153	25	54
JA4AQR	"	29,098	173	19	39
JI1IXW	"	25,389	139	24	39
JE1PJR	"	25,368	155	20	36
JA1QZC	"	22,794	142	22	36
JH0QAD	"	20,970	159	18	27
JH8RZJ	"	17,014	134	19	28
JR1OYL	"	13,468	122	15	22
JF1EEK	"	10,030	63	18	41
JA8XMV	"	6,579	56	17	26
JA1AAT	"	4,725	38	15	30
JL1VKX	"	4,544	55	13	19
JA1ERW	"	1,549	41	5	8
JR3HUW	"	1,525	21	10	15
JA5SIX	"	1,121	21	9	10
JH8LLN	"	860	19	9	11
JA2APA	**21**	**594,789**	**1343**	**39**	**112**
JE3TBM	"	**476,721**	**1098**	**39**	**108**
JK1HAM	"	**302,016**	**853**	**36**	**85**
JK1PLZ	"	297,838	746	37	100
JM1FHL	"	266,600	742	35	89
JA1DCO	"	222,860	703	35	75
JR1DZA	"	220,750	643	35	90
JR3RIY	"	131,760	421	31	77
JH2VNY	"	106,636	337	32	74
JI1QLB	"	101,970	345	32	71
JA1SJV	"	66,187	152	33	88
JF3EGT	"	45,448	212	27	49
JJ1LBJ	"	45,192	192	28	56
JI1LLD	"	37,125	170	26	49
JM1BCF	"	36,725	202	24	41
JA1EYP	"	27,600	147	25	44
JH7JDB	"	20,176	130	22	30
JR3CVJ	"	15,438	89	21	41
JA3FZI	"	15,087	110	19	28
JA3GQK	"	14,016	105	18	30
JL1TVV	"	10,188	96	13	23
JL1EJO	"	6,762	56	17	29
JA7RXU	"	5,934	50	16	29
JF3NRT	"	3,822	53	8	18
JF3GEP	"	3,720	48	15	16
JA5DFY	"	2,106	27	13	13
JA1YGY	"	940	18	11	9
JA1RDP	"	920	18	8	12
JH1OEL	"	24	3	3	3
JA8JHA	**14**	**373,996**	**967**	**35**	**98**
JA1JXU	"	189,074	505	39	95
JH1QOJ	"	143,766	406	33	93
JH8NYK	"	111,936	387	36	96
JA1GSK	"	75,012	243	33	81
JA3ADK	"	41,076	185	25	59
JI1AJK	"	3,959	42	15	22
JH1LSS	"	2,077	25	11	20
JA0AGA	"	1,620	20	12	15
JA5LEX	"	1,344	22	9	15
JH1FJK	"	1,326	19	13	13
JR4PIU	"	600	16	13	7
JA0GZ	"	406	13	8	6
JA2BAY	**7**	**147,114**	**533**	**32**	**67**
JA1FKY	"	4,732	65	13	15
JA6IEF	**3.8**	**13,515**	**98**	**22**	**33**

KOREA

HL9KW	**A**	**453,123**	**858**	**73**	**134**
HL9FR	**28**	**228,351**	**851**	**29**	**74**
HL9DX	"	112,575	466	25	70
HM1SX	**21**	**118,496**	**793**	**29**	**63**
HL1SF	"	1,808	101	7	9
HM1PW	**14**	**159,123**	**759**	**27**	**66**

MACAO

CR9D	**A**	**337,584**	**1405**	**64**	**92**
			(Opr. OH5VD)		

MONGOLIA

JT1BG	A	19,456	154	31	45

SAUDI ARABIA

HZ1HZ	**A**	**1,421,552**	**1514**	**87**	**241**

SRI LANKA

4S7AAG	**21**	**918,925**	**2897**	**38**	**137**
			(Opr. OH2BCP)		

SYRIA

OH1TD/ 4U	21	12,314	102	17	30

ASIATIC U.S.S.R.

ARMENIA

UG6GAT	A	441	21	3	4
UG6GAF	**28**	**381,203**	**870**	**34**	**99**
UG6LQ	**14**	**303,372**	**1397**	**26**	**77**

ASIATIC RUSSIA

UV9PP	**A**	**604,692**	**826**	**90**	**207**
UA9AED	"	440,832	697	63	183
UA9OIE	"	9,364	70	22	34
UV9AX	**28**	**100,200**	**416**	**23**	**77**
UA9OGF	"	45,333	621	19	54
RA9UAD	"	27,258	413	16	50
UA9LAC	"	21,181	129	17	42
UA9WCQ	**21**	**182,790**	**755**	**24**	**66**
UA9AKO	"	133,675	434	32	86
UA9CBO	**3.8**	**35,280**	**242**	**12**	**44**
UA9SHU	"	6,032	79	7	22
UA9CBM	"	4,064	47	7	25
UA0WAY	**A**	**2,047,480**	**2469**	**105**	**235**
UA0QWB	"	1,047,200	1369	109	243
UA0CCW	"	39,750	110	46	79
UA0SAU	**28**	**240,279**	**1120**	**26**	**75**
UA0LCM	"	91,674	362	28	71
UA0QDI	"	80,520	496	26	62
RA0CCM	"	80,458	292	25	73
UA0LCZ	**21**	**136,224**	**1013**	**31**	**65**
UA0SGL	"	135,320	931	26	59
UA0MI	"	37,800	264	22	48
UA0PJ	14	4,719	143	13	20
UA0FCL	7	4,125	140	7	8

AZERBAIJAN

UD6DER	**A**	**84,224**	**172**	**67**	**121**
UD6DML	**28**	**17,500**	**186**	**11**	**24**

GEORGIA

UF6FFF	**14**	**302,841**	**815**	**32**	**101**

KAZAKH

UL7QF	**28**	**257,748**	**747**	**34**	**107**
UL7EAF	"	188,136	909	28	80

KIRGHIZ

UM8MAZ	**A**	**63,204**	**246**	**28**	**54**
UM8MDX	**14**	**92,293**	**390**	**26**	**63**
UM8MWW	**7**	**18,124**	**190**	**14**	**32**

TADZHIK

UJ8XCW	**21**	**147,561**	**662**	**32**	**69**

TURKOMAN

UH8BO	**A**	**95,152**	**201**	**48**	**104**

EUROPE

ALAND ISLANDS

OH8BH	**A**	**2,728,468**	**2414**	**132**	**376**
OH8NJ	**14**	**23,331**	**147**	**22**	**55**
OH8NA	**1.8**	**594**	**34**	**3**	**15**

AUSTRIA

OE5CWL	**A**	**1,504,096**	**1621**	**91**	**261**
OE9SLH	"	60,885	236	48	117
OE1OPW/3	**28**	**109,798**	**410**	**28**	**75**
OE1WWL	"	12,690	113	16	29
OE1WO	**21**	**42,336**	**211**	**24**	**60**
OE6MBG	**14**	**1,018,818**	**2549**	**39**	**132**
OE7SHI	"	36,340	324	22	57

AZORES ISLANDS

CT2CQ	**28**	**587,076**	**1879**	**27**	**89**
CT2DR	**14**	**173,625**	**913**	**30**	**95**
CT2CE	**7**	**257,580**	**951**	**23**	**83**

BALEARIC ISLANDS

EA6GP	**A**	**262,993**	**895**	**41**	**140**
EA6FS	"	4,576	41	17	35
EA6ET	**28**	**1,107,358**	**2747**	**37**	**124**

BELGIUM

ON6IT	**A**	**546,804**	**873**	**81**	**168**
ON8KD	"	8,268	88	19	33
ON5AZ	**28**	**136,590**	**557**	**23**	**64**
ON4XG	"	80,052	371	23	61
ON5GQ	**21**	**419,728**	**1120**	**35**	**113**
ON5WL	**3.8**	**21,526**	**450**	**6**	**41**

BULGARIA

LZ1CW	**28**	**117,824**	**569**	**30**	**82**
LZ1RN	**14**	**23,660**	**217**	**20**	**50**
LZ1HL	"	9,024	101	12	35

CRETE

SV8BP/ SV9	**14**	**83,444**	**567**	**21**	**70**

CZECHOSLOVAKIA

OK2BLG	**A**	**1,297,440**	**1366**	**120**	**360**
OK2PBM	"	**589,024**	**1864**	**83**	**233**
OK2ABU	"	**546,780**	**1073**	**65**	**195**
OK3PQ	"	308,880	641	65	169
OK1AVD	"	191,412	441	65	166
OK3YCA	"	185,525	391	69	36
OK1KZ	"	180,970	451	64	158
OK1EP	"	127,040	318	49	111
OK1DVK	"	69,007	286	49	102
OK3CRH	"	61,300	230	41	114
OK2BSA	"	44,928	416	42	66
OK1AOJ	"	42,504	177	43	89
OK1AXB	"	40,820	269	26	100
OK3YK	"	38,781	272	22	71
OK1AJY	"	36,860	269	23	72
OK2YN	"	35,964	167	33	48
OK2BJU	"	35,322	170	28	59
OK3KJF	"	34,600	201	31	69
OK1AOU	"	27,100	214	32	68
OK2BKR	"	19,882	129	35	44
OK2KVI	"	18,860	168	23	59
OK1AZI	"	12,151	53	33	52
OK2PBG	"	10,521	78	21	42
OK2BHX	"	7,866	61	20	26
OK1XG	"	7,250	101	15	43
OK3CEG	"	5,500	67	15	15
OK1DMJ	"	1,624	32	18	10
OK1ALW	**28**	**508,416**	**1498**	**35**	**93**
OK1AVU	"	**431,822**	**1183**	**35**	**107**
OK3CFA	"	340,296	1023	35	97
OK1ATT	"	259,065	749	35	100
OK1ZL	"	178,825	594	32	83
OK1VAM	"	70,161	312	24	67
OK3CFP	"	28,282	150	24	55
OK2BJR	"	27,300	151	24	51
OK2BLD	"	13,356	137	22	14
OK1JIM	"	4,290	55	13	17
OK1DKS	"	555	19	6	9
OK1TN	**21**	**637,392**	**1696**	**35**	**112**
OK1ARI	"	476,439	1408	35	106
OK7ZZ	"	147,763	631	28	73
OK2BQL	"	104,656	392	34	90
OK1AJN	"	85,500	370	31	83
OK3KEX	"	49,864	285	25	67
OK1ASQ	"	38,509	198	25	72
OK3CAQ	"	13,740	97	17	43
OK1AMF	"	756	14	10	11
OK7AA	**14**	**351,196**	**1248**	**36**	**109**
OK1ATE	"	57,680	274	29	83
OK3CKF	"	41,574	335	18	64
OK3TCK	"	21,684	161	21	57
OK1ALQ	"	20,640	150	18	62
OK3CGI	"	19,656	168	20	58
OK3TBG	"	10,452	129	14	38
OK1PFM	"	527	19	6	11
OK2SPS	"	240	14	4	11
OK1DDW	"	238	14	5	9
OK2QX	**7**	**11,712**	**169**	**12**	**49**
OK1MSN	**3.8**	**32,832**	**448**	**13**	**54**
OK1AYE	"	16,218	305	6	45
OK3YCL	"	13,524	302	6	40
OK3KFV	"	12,280	307	5	35
OK1ANB	"	2,592	97	4	23
OK1DGZ	"	1,256	57	3	23
OK2BBQ	"	352	22	3	13
OK1KPU	**1.8**	**4,740**	**152**	**5**	**25**
OL1BBR	"	2,054	85	4	22

DENMARK

OZ5EV	**A**	**1,422,720**	**1549**	**93**	**267**
OZ7TF	"	**1,300,284**	**1628**	**80**	**262**
OZ1CAH	"	527,310	886	71	199
OZ4MD	"	474,516	760	73	221
OZ7BG	"	134,277	376	49	94
OZ6OG	"	118,845	334	53	118
OZ4RT	"	111,444	220	64	158
OZ1FRR	"	106,535	292	51	98
OZ5BS	"	93,890	240	56	149
OZ2BM	"	64,050	154	58	152
OZ7XU	"	52,089	161	52	127
OZ1IBN	"	45,312	244	34	84
OZ8RB	"	22,968	120	33	66
OZ7KJ	"	14,112	94	23	40
OZ7MJ	"	10,336	130	13	55
OZ8T	"	8,901	59	18	25
OZ1DAF	"	7,832	85	17	27
OZ1BTE	**28**	**353,220**	**1225**	**27**	**89**
OZ3FC	"	49,648	47	16	29
OZ1FTE	"	3,570	33	17	25
OZ8AE	"	920	19	9	11
OZ9HN	21	7,104	98	11	26
OZ7JZ	**14**	**219,928**	**712**	**35**	**113**
OZ8ME	"	9,792	148	11	40
OZ1AXG	"	48	4	2	2
OZ3ZK	**3.8**	**3,339**	**97**	**5**	**30**
OZ6EI	**1.8**	**1,431**	**56**	**4**	**23**

ENGLAND

G3XTT	**A**	**2,016,288**	**1876**	**100**	**319**
G4JVG	"	768,911	1113	75	208
G3MWZ	"	60,288	244	33	93
G3AJB	"	39,039	223	29	114
G4FAM	**28**	**693,728**	**1564**	**38**	**125**
G2VJ	"	474,444	1278	32	106
G3XBY	"	329,984	1017	31	97
G3SNN	"	233,544	798	29	82
G3TXF	"	9,744	74	17	39
G4KIU	"	9,743	132	12	19
G3ZHL	**21**	**62,396**	**405**	**19**	**52**
G3RRS	**14**	**552,081**	**1373**	**37**	**126**
			(Opr. G4CEB)		
G3UKS	**7**	**174,130**	**832**	**25**	**86**
G5EBU	"	682	28	5	17
G5EBA	3.8	2,856	85	4	30

FAEROS ISLANDS

OY1A	**A**	**24,320**	**247**	**19**	**61**

FINLAND

OH2PM	**A**	**865,928**	**1177**	**96**	**233**
OH2BPE	"	187,658	465	62	140
OH2BDN	"	87,954	353	37	100
OH7NW	"	74,295	259	46	149
OH2JQ	"	74,256	224	52	152
OH9SLH	"	60,885	236	48	117
OH1RZ	"	53,320	160	46	126
OH5MQ	"	40,194	242	32	84
OH2VZ	"	31,863	123	43	86
OH6HI	"	26,544	170	28	56
OH5PA	"	24,038	88	41	78
OH3AT	"	22,866	161	28	73
			(Opr. OH3MP)		
OH1PY	"	16,281	69	24	57
OH1BV	"	8,228	68	24	44
OH2DN	"	7,308	55	25	33
OH1FM	"	2,795	27	16	27
OH1ED	"	928	17	13	16
OH3XZ	**28**	**546,360**	**1270**	**37**	**137**
OH4PW	"	29,532	180	23	69
OH1OR	"	7,852	90	18	34
OH2BAH	"	2,240	24	13	19
OH2GFS	"	893	26	6	13
OH3YW	**21**	**558,975**	**1361**	**37**	**108**
OH6AC	"	277,636	864	35	89
OH6AM	"	227,160	763	32	88
OH1KA	"	164,528	760	30	83
OH3OQ	"	4,350	53	13	17
OH7SC	"	3,627	45	14	25
OH2IO	**14**	**97,129**	**505**	**29**	**74**
OH2BCD	"	82,954	378	32	86
OH6AS	"	82,173	583	22	69
			(Opr. OH6DO)		
OH6NG	1.8	240	17	3	12

FRANCE

F9GL	**A**	**1,661,352**	**1844**	**98**	**243**
F6DZU	"	776,539	1354	77	152
F6BVB	"	337,617	699	52	152
F6CGP	**28**	**430,388**	**1117**	**31**	**102**
F6FNA	"	16,960	117	20	44
F6CGE	"	15,075	151	15	30

GERMANY (FDR)

DK3GI	**A**	**4,461,908**	**3150**	**126**	**380**
DK8NG	"	**4,127,424**	**3062**	**116**	**382**
DJ4PT	"	**3,986,400**	**3045**	**124**	**329**
DJ3HJ	"	3,338,888	2952	109	327
DK8AX	"	1,619,904	1604	105	324
DJ2RB	"	1,037,908	1381	86	227
DK2WH	"	903,408	1146	93	261
DF2RS	"	743,600	1063	78	247
DL6RAI	"	673,260	1163	86	208
DL2UH	"	491,582	829	74	185
DF4ZL	"	438,834	697	87	240
DH2FAW	"	263,340	782	31	102
DK8FS	"	258,856	834	81	181
DK1FW	"	251,986	387	78	209
DJ4PI	"	214,200	428	79	221
DK8KC	"	173,658	421	53	153
DK1YK	"	167,937	297	78	153
DJ2UU	"	165,000	339	149	149
DJ2YE	"	142,632	279	65	187
DK5XN	"	139,107	207	94	173
DF6VE	"	96,978	309	46	83
DL1MD	"	70,856	217	47	89
DK5PE	"	60,062	227	38	80
DKØRD	"	33,456	235	23	59
			(Opr. DK7QB)		
DJ8OT	"	29,070	130	36	66
DJ4JI	"	26,859	104	39	68
DL8CM	"	24,168	124	29	47
DL1AM	"	10,362	84	21	45
DF9IX	"	4,264	50	16	25
DF8AN	"	2,604	61	12	30
DJ8RI	**28**	**658,688**	**1850**	**30**	**94**
DF8XC	"	569,808	1382	37	107
DJ1ZU	"	558,699	1539	30	99
DKØWB	"	395,280	1194	36	86
			(Opr. DK5OC)		
DF2KD	"	90,912	290	26	70
DF9PF	"	38,736	199	24	48
DA1QL	"	37,675	281	20	35
DJ6TK	"	23,112	124	21	51
DJ4YH	"	10,564	99	16	22
DL8SAS	"	7,290	71	16	29
DL8PC	**21**	**739,508**	**1676**	**36**	**118**
DF9YY	"	283,491	994	31	86
DJ9ZB	"	106,140	405	30	92
DL1EAL	"	37,040	205	24	56
DL8PG	**14**	**786,784**	**1840**	**39**	**145**
			(Opr. DK3BJ)		
DJØBA	"	182,468	634	31	90
DL8HQ	"	13,862	180	12	46
DK7DV	"	11,400	156	13	44
DF3TJ	**7**	**123,552**	**629**	**27**	**81**
DL8OL	"	6,576	104	9	39
DF9QO	**3.8**	**70,551**	**708**	**16**	**65**

GERMANY (GDR)

Y57WJ	**A**	**524,035**	**798**	**85**	**252**
Y41ZI	"	**452,610**	**803**	**71**	**211**
Y38YK	"	**395,450**	**761**	**71**	**204**
Y45RN	"	349,520	653	74	183
Y37UF	"	255,944	763	54	160
Y22YN	"	243,512	537	60	184
Y67XL	"	149,358	413	60	159
Y38YE	"	144,724	354	57	137
Y43XL	"	128,310	441	53	142

Y22WF	"	125,136	296	62	136
Y41ZH	"	121,095	331	54	141
Y47XF	"	120,351	257	64	167
Y47VN	"	102,784	368	45	101
Y31ZE	"	97,900	269	53	125
Y44XF	"	93,186	416	37	130
Y31SC	"	90,285	331	48	147
Y33TA	"	71,685	205	49	128
Y46XF	"	71,485	198	42	103
Y32ZF	"	59,486	256	31	67
Y23DG	"	57,900	222	39	61
Y48YA	"	48,384	287	31	81
Y36UE	"	47,545	245	44	145
Y31SK	"	33,280	166	35	93
Y32UE	"	30,015	140	31	56
Y45SA	"	24,480	100	37	59
Y35XA	"	23,832	144	29	43
Y22HF	"	16,815	143	25	70
Y34YF	"	16,218	103	35	67
Y31XF	"	7,936	128	20	42
Y51WH	"	7,605	79	14	31
Y35ZB	"	3,996	39	18	36
Y23EE	"	3,808	40	12	22
Y21HB	"	2,806	43	12	11
Y44WA	"	2,806	50	16	30
Y35YA	"	741	13	7	12
Y54ZI	**28**	**159,644**	**631**	**30**	**77**
Y22TO	**"**	**69,006**	**394**	**20**	**42**
Y51VF	"	61,572	304	24	60
Y37ZE	"	31,488	160	23	59
Y32UG	"	24,174	136	23	56
Y51XO	"	19,649	153	17	32
Y56YF	"	16,897	112	19	42
Y53WL	"	15,120	206	11	19
Y34XF	"	5,852	91	10	12
Y22YE/A	"	4,018	38	14	27
Y22KG	"	3,024	55	10	14
Y21CF/A	"	864	13	11	13
Y32UC	**21**	**211,560**	**734**	**31**	**98**
Y78XL	"	148,571	684	26	75
Y24SG	"	46,366	198	29	68
Y55UG	**14**	**57,760**	**458**	**22**	**73**
Y43VF	"	29,600	250	18	62
Y22PF	"	14,195	80	24	61
Y24DF	"	8,760	112	14	46
Y23VB	"	3,225	37	15	28
Y52XF	"	3,007	106	4	27
Y26HO	"	2,738	34	14	23

GREECE

SV0AU	**28**	**183,162**	**1034**	**24**	**74**

HUNGARY

HA5NG	**A**	**562,596**	**878**	**88**	**258**
HA4XX	"	207,727	547	65	182
HA5KMB	"	45,129	211	32	115
HA8UB	"	22,425	141	26	49
HG5BA	28	6,604	101	12	14
HA7TM	**21**	**31,525**	**240**	**17**	**48**
HA3NU	"	15,870	135	17	52
HA4XH	**14**	**341,055**	**1014**	**39**	**126**
HA0KLE	"	317,714	1074	35	99
HA5KLF/P	"	93,951	461	28	89
HA9RT	"	76,680	447	30	78
HA5KDB	**3.8**	**58,422**	**673**	**16**	**62**
			(Opr. HA5NP)		
HA8KQX	"	46,324	571	15	59

IRELAND

EI1DH	**28**	**271,161**	**1117**	**25**	**74**
EI7CC	"	106,578	500	21	72
EI8DE	"	38,080	193	17	65
EI5DP	**21**	**28,980**	**296**	**19**	**50**

ISLE OF MAN

GD5DZP	**A**	**2,197,148**	**2751**	**83**	**233**

ITALY

I5SDG	**A**	**3,132,224**	**2677**	**113**	**323**
I4AVG	"	2,407,132	2513	100	264
I5VXG	"	1,670,834	1865	90	256
I0GPP	"	1,406,261	1988	74	189
I2UBI	"	951,210	1165	93	258
I2MQP	"	695,742	884	94	229
I4CSP	"	76,540	269	41	131
I8UGL	"	69,293	287	40	93
I8UDB/IC8	**28**	**1,355,648**	**2883**	**38**	**140**
I3GRX	"	142,290	557	27	66
I2RVW	"	82,485	452	23	42
I4ZSQ	**21**	**1,122,732**	**2635**	**35**	**122**
I1YBM	"	623,496	1877	35	131
I2VRN	**14**	**645,127**	**1880**	**39**	**122**
I5FCK	**"**	**630,539**	**1688**	**38**	**131**
I6NOA	**7**	**292,152**	**1042**	**35**	**113**
I4EAT	**3.8**	**41,952**	**461**	**15**	**61**
			(Opr. I4IYC)		

ITU GENEVA

4U1ITU	**A**	**892,755**	**1790**	**68**	**187**
			(Opr. KC9C)		

JAN MAYEN

JX7FD	**A**	**70,296**	**275**	**42**	**132**
JX5VAA	"	68,112	346	41	131

LUXEMBOURG

WD4JTK/LX	**28**	**100,200**	**422**	**28**	**73**

MALTA

9H1EL	**28**	**1,355,760**	**3662**	**36**	**132**

NETHERLANDS

PA2TMS	**A**	**2,272,424**	**2351**	**94**	**298**
PA0GAM	**"**	**947,940**	**1190**	**88**	**217**
PA0XPQ	"	744,120	1104	77	235
PA0INE	"	204,618	557	57	144
PA0KHS	"	173,889	533	39	100
PA3ADJ	"	120,560	254	64	154
PA3ADG	"	60,900	225	44	141
PA3AIR	"	48,906	205	38	61
PA0LIR	"	47,946	297	30	92
PA0COR	"	28,850	145	20	75
PA3AXN	"	17,250	123	27	48
PA0KDM	"	16,500	112	26	40
PA2ATX	"	5,796	60	24	45
PA3AIK	**28**	**74,336**	**323**	**25**	**67**
PI1PT	"	9,699	75	19	42
PA0GFW	"	4,477	47	12	25
PA0IJM	**3.8**	**29,214**	**501**	**7**	**47**

NORWAY

LA1NG	**A**	**707,166**	**1060**	**75**	**231**
LA9FY	**"**	**367,633**	**783**	**55**	**148**
LA2Y	"	218,932	648	60	136
LA4YW	"	167,860	477	63	165
LA8AE	"	108,965	312	57	98
LA2TO	"	48,545	140	43	90
LA1RN	"	25,056	176	26	70
LA6UL	"	22,002	110	36	78
LA7QI	"	12,467	62	33	58
LA7SI	"	3,196	53	11	23
LA1KQ	"	962	26	4	9
LA2AD	"	833	16	8	9
LA3WAA	**28**	**188,719**	**754**	**29**	**83**
LA1SP	"	5,000	70	10	15
LA5EBA	"	450	10	6	9
LA9DI	21	7,991	55	18	43
LA8DY	**14**	**64,862**	**791**	**21**	**61**
LA2ZN	"	35,358	262	22	61
LA4TG	"	30,885	235	19	52

POLAND

SP3HLM	**A**	**208,822**	**348**	**79**	**184**
SP1GHW	**"**	**139,812**	**496**	**50**	**133**
SP9GNP	"	132,678	318	63	171
SP7AWA	"	116,280	362	53	137
SP3CB	"	112,665	264	59	144
SP3IOE	"	97,900	322	47	131
SP8EMO	"	93,795	321	53	132
SP6KZW	"	71,862	289	35	83
SP5GTC	"	59,343	257	41	110
SP7FQI	"	52,029	298	32	109
SP8BJH	"	50,286	234	32	65
SP6CYV	"	41,600	163	33	71
SP3LPX	"	25,488	160	27	91
SP5KTR	"	24,166	132	29	57
			(Opr. SP6SA)		
SP3HFX	"	19,928	200	21	73
SP7MTH	"	17,578	164	22	72
SP8PFI	"	12,159	194	16	47
			(Opr. SP8COG)		
SP9AOA	"	6,996	46	26	40
SP9IZV	"	4,297	89	22	47
SP6CZ	"	3,157	27	16	25
SP3CMA	"	1,200	19	11	19
SP9ZD	"	1,040	18	13	13
SP3BYZ	"	805	27	7	16
SP5ENA/7	**28**	**118,272**	**367**	**33**	**95**
SP5ICN	"	57,375	180	32	93
SP9EVP	"	37,170	188	29	76
SP6BFK	"	28,478	209	19	39
SP5ECZ	"	26,134	146	24	49
SP6LB	"	9,471	88	15	26
SP5JUU	"	4,590	59	12	18
SP6HRK	"	1,020	21	8	12
SP6DNS	**21**	**103,212**	**370**	**30**	**92**
SP9PEZ	"	59,489	303	29	72
SP7DZA	"	21,597	146	20	49
SP6CCE	"	11,900	72	22	46
SP2UUU	"	5,412	59	16	28
SP6HTQ	**14**	**88,928**	**485**	**28**	**84**
SP7KTF	**"**	**84,260**	**417**	**28**	**82**
			(Opr. SP7LIH)		
SP5GIQ	"	69,690	456	28	73
SP2AYC	"	59,094	395	25	73
SP3IEZ	"	42,420	332	22	62
SP3JWG	"	34,692	413	21	63
SP6JIR	"	33,450	323	18	57
SP6UK	"	32,558	264	19	54
SP9BRP	"	24,016	171	20	59
SP3IXC	"	19,363	152	19	48
SP9AVZ	"	18,126	238	12	45
SP4LXC	"	15,433	217	15	46
SP3CFM	"	9,504	74	15	39
SP6JZL	"	8,932	57	22	36
SP1LJO	"	7,840	119	10	39
SP6BAX	"	5,040	107	9	31
SP9EMI	"	4,876	57	14	32
SP9EML	"	2,627	28	16	21
SP3JHY	"	1,525	23	11	14
SP2JS	"	660	18	5	10
SP2ZFJ	"	420	10	7	8
SP3DOI	**7**	**70,245**	**447**	**20**	**43**
SP9FSH	"	918	32	6	21
SP9HZF	**3.8**	**10,994**	**231**	**7**	**39**
SP5KGT	"	2,340	74	6	24
SP2JKL	"	1,725	72	4	21
SP5ANX	"	425	27	4	13
SP9DH	**1.8**	**3,904**	**124**	**6**	**26**
SP5INQ	**"**	**3,708**	**95**	**7**	**29**

PORTUGAL

CT1AHU	**A**	**184,496**	**552**	**50**	**158**
CT1ACW	**28**	**279,336**	**1060**	**26**	**77**
CT1AWD	"	21,513	161	20	51
CT4NH	**21**	**472,160**	**1453**	**32**	**98**
CT1BKW	**14**	**82,275**	**645**	**21**	**54**
CS1UA	"	72,446	368	22	52
CT1AOZ	**7**	**20,460**	**154**	**16**	**50**
CT1BGM	"	15,288	158	10	39

ROMANIA

YO6KEA	**A**	**317,490**	**1087**	**32**	**82**
			(Opr. YO6AWR)		
YO2BEH	"	161,557	509	52	156
YO2ARV	"	94,185	327	43	118
YO7ARY	"	15,735	310	40	125
YO7ARZ	"	55,485	203	38	97
YO7APA	"	33,813	164	35	82
YO2CEQ	"	33,562	223	28	69
YO3RF	"	32,964	104	45	78
YO600	"	27,434	196	24	62
YO9CBZ	"	16,100	216	14	56
YO8BDA	"	14,850	177	17	58
YO6AHP	"	6,144	78	16	32
YO2QY	"	5,723	45	21	38
YO3QK	"	1,296	8	10	17
YO1K	**28**	**1,143,625**	**2583**	**38**	**135**
YO2VA	"	22,560	176	19	42
YO4BXX	"	5,643	92	8	25
YO8AII	"	1,518	26	9	24
YO3JU	"	6	1	1	1
YO9HH	**21**	**12,915**	**123**	**20**	**43**
YO9HT	**14**	**77,367**	**431**	**27**	**84**
YO8FR	"	73,830	454	29	86
YO5BKZ	"	49,664	403	25	74
YO2FP	"	7,056	122	13	35
YO6AVB	"	3,564	47	13	23
YO6BTY	3.8	684	40	4	14
YO7BXE	"	405	24	5	12

SARDINIA

IS0DTK	**A**	**265,608**	**831**	**51**	**187**
IS0WON	**21**	**348,012**	**1251**	**33**	**93**

SCOTLAND

GM3RAO	**A**	**516,479**	**972**	**55**	**174**
GM3BCL	"	436,817	907	48	143
GM4CHX	**28**	**33,701**	**203**	**20**	**47**

SHETLAND ISLANDS

GM4GPN	**A**	**495,264**	**1060**	**72**	**192**

SICILY

IT9ZMJ	A	18,648	114	27	57
IT9ZGY	**28**	**716,128**	**2148**	**34**	**105**

SPAIN

EA3JE	**A**	**2,133,189**	**2290**	**109**	**360**
EF7TV	"	1,628,998	2310	78	244
ED2QU	"	1,259,766	1483	98	271
EA1AGN	"	439,008	871	64	140
EA3NA	"	251,636	445	77	224
EA3AIN	"	160,125	535	48	127
EA7BVI	"	45,762	227	29	58
EA2CR	"	27,864	163	28	80
EA5ANR	"	20,405	162	22	55
EA5TX	"	5,185	56	23	38
EA5BVR	**28**	**51,350**	**359**	**24**	**55**
EA3AB	"	39,675	305	22	53
EA3CBA	"	14,238	130	16	47
EA2ZE	"	8,575	120	13	36
EA5CDE	"	2,408	38	10	18
EA7LM	**21**	**103,064**	**471**	**26**	**78**
EA7BGE	"	29,754	194	23	64
EA1PJ	**14**	**443,688**	**1603**	**33**	**100**
EA1UZ	"	54,208	322	16	61
EA3PE	"	4,662	82	9	28
EA7BDL	**7**	**94,484**	**455**	**22**	**70**

SWEDEN

SM5GMG	**A**	**2,610,972**	**2115**	**115**	**353**
SM3BIZ	**"**	**903,870**	**1117**	**91**	**272**
SM6BGG	"	365,400	790	55	125
SM5ARG	"	99,792	306	44	124
SM0JOG	"	87,584	294	56	128
SM5CMP	"	66,066	247	40	81
SM3DXC	"	63,543	164	35	124
SM5AHK	"	57,348	184	52	125
SM5AAY	"	28,260	136	34	56
SM0CHA	"	13,416	189	10	14
SM6JY	"	8,015	92	19	40
SM5ALJ	"	1,470	35	12	18
SM6LGW	**28**	**304,920**	**1063**	**33**	**77**
SM5EQW	**"**	**118,800**	**435**	**26**	**84**
SM6KQK	"	106,248	403	29	85
SM0DRB	"	91,485	405	29	78
SM2JUR	"	67,400	353	26	74
SM6JNA	"	53,946	280	26	55
SM0BDS	"	51,875	260	22	61
SM5AQJ	"	32,238	155	24	57
SM6LPF	"	32,024	197	19	45
SM2JAA	"	30,476	190	22	54
SM6LIF	"	20,740	111	24	61
SM6LRR	"	18,821	156	16	45
SM3DXQ	"	15,680	108	19	45
SM5FYM	"	13,260	78	20	47
SM0FM	"	8,177	85	14	23
SM4BTF	"	7,992	88	13	24
SM0FO/0	**21**	**244,647**	**796**	**33**	**90**
SL2ZZU	"	90,013	534	28	49
			(Opr. SM2KUZ)		
SM7TV	"	18,042	159	19	43
SM6HCJ	"	11,596	106	15	37
SM7HSP	"	8,874	79	20	31
SM2CEW	**14**	**338,136**	**1100**	**36**	**110**
SM4CQY	"	54,384	240	30	73
SM0AJU	**7**	**131,000**	**680**	**28**	**86**
SM0ARR/5	"	374	28	4	13
SM6EOC	**3.8**	**19,152**	**323**	**8**	**49**
SM6BXC	"	5,203	118	7	36

SWITZERLAND

HB9AAA	**A**	**646,881**	**1120**	**62**	**151**
HB9ASJ	**28**	**52,975**	**305**	**20**	**45**
HB9IK	"	21,280	95	26	69
HB9DX	**21**	**27,216**	**99**	**30**	**96**

WALES

GW4BLE	**28**	**947,223**	**2220**	**36**	**117**

YUGOSLAVIA

YU2CZA	**A**	**709,200**	**997**	**92**	**268**
YU2OM	"	185,673	449	56	121
YU7OCZ	"	137,700	473	53	127
YU1NZW	"	125,085	355	47	108
YU2RNY	"	112,648	263	49	119
YU7NZR	"	37,476	133	41	67
YU7SF	"	29,820	140	36	69
YU4VEF	"	23,129	146	27	74
YZ6G	**28**	**971,380**	**2411**	**36**	**134**
YU4GD	**"**	**934,040**	**2256**	**35**	**117**
YU2QU	"	231,715	729	33	88
4N7NS	"	50,996	348	20	41
YU5XAF	"	15,688	151	15	38
YU7ORQ	"	777	13	10	11
YU3TU	**21**	**1,312,793**	**2644**	**40**	**141**
			(Opr. YU3ZV)		
YU7OCV	"	935,040	2212	39	121
YU4EGZ	"	259,644	925	31	101
YU2FB	"	46,410	217	28	77
YU7DVW	"	5,968	68	13	24
YU1KQ	**14**	**435,670**	**1237**	**33**	**106**
YU7ECD	"	305,450	981	35	114
YU1OVZ	"	26,400	136	25	71
YU3TOJ	"	11,628	154	13	38
YU3AIJ	**7**	**13,356**	**155**	**13**	**50**
YU4JOP	"	4,173	91	9	30
YU4VBR	**3.8**	**79,524**	**562**	**21**	**73**
YU3APR	**"**	**79,390**	**934**	**15**	**70**
			(Opr. YU3DM)		
YZ4Z	"	23,184	344	12	51
YU3EF	**1.8**	**7,611**	**170**	**9**	**43**

EUROPEAN U.S.S.R.

BYELO-RUSSIA

UC2AFA	**21**	**109,667**	**580**	**30**	**81**
UC2ACF	**3.8**	**40,188**	**339**	**8**	**51**
UC2ACA	**1.8**	**1,342**	**59**	**5**	**17**

ESTONIA

UR2RER	**A**	**54,516**	**136**	**57**	**120**
UR2RHF	"	36,920	110	49	93
UR2OI	"	1,664	26	12	20
UR2RAM	**28**	**116,736**	**471**	**29**	**85**
UR2RKB	"	102,740	450	26	84
UR2TBG	"	64,390	324	25	69
UR2RGJ	"	11,590	97	15	46
UR2RFL	"	384	10	7	9
UR2FQ	**14**	**553,711**	**1566**	**38**	**125**
UR2QD	**7**	**115,080**	**882**	**24**	**81**
UR2FU	"	19,710	208	17	53

EUROPEAN RUSSIA

UA3QDW	**A**	**518,112**	**1143**	**69**	**183**
UV3DN	"	408,618	892	75	207
UA3TN	"	263,480	523	70	210
UW6LC	"	136,413	417	58	149
UA4NAA	"	98,088	322	48	153
UA1TBP	"	6,665	69	28	49
UA4WAF	**28**	**142,952**	**615**	**28**	**79**
UA4HCN	"	115,329	1039	26	74
RA3DKE	"	108,885	500	29	90
UA3DRB	"	75,195	257	30	105
UA3TFY	"	25,506	219	19	59
UA4WBX	"	9,744	155	15	41
UA4ADA	"	2,871	56	12	21
UA3TEP	"	2,110	99	3	7
UW6MA	"	1,027	27	5	8
UA1DZ	**21**	**581,385**	**1676**	**37**	**110**
UA6APP	"	290,284	1175	33	91
UW3HY	"	132,209	532	29	72
UA3SBW	"	91,530	438	30	83
UA6LHB	"	80,504	365	29	87
UA1MU	**14**	**45,816**	**280**	**23**	**69**
UA1AET	"	36,635	296	26	59
UA4UBC	**3.8**	**19,720**	**243**	**11**	**47**
UA6AAM	"	16,218	236	9	44

FRANZ JOZEF LAND

UK1PGO	**A**	**175,228**	**610**	**45**	**97**
UA1PAM	28	288	8	3	4

KALININGRAD

UA2EC	**A**	**435,754**	**785**	**87**	**232**

KARELIA-FINNISH

UA1NBR	28	1,008	58	5	9

LATVIA

UQ2GDQ	**A**	**2,833,152**	**2676**	**118**	**358**
RQ2GGI	"	29,925	186	22	53
UQ2MF	"	22,680	108	34	71
UQ2GCN	**28**	**63,300**	**341**	**25**	**75**
UQ2GCP	"	37,018	198	23	60
RQ2GAI	"	25,110	190	19	43

LITHUANIA

UP2BAO	**A**	**827,266**	**1243**	**85**	**256**
UP2BAS	"	514,404	1222	69	228
UP2BAR	"	454,261	738	83	234
UP2NA	"	312,300	608	62	163
UP2BFB	"	229,596	727	60	168
UP2BBF	"	213,962	764	53	164
UP2PEW	"	211,926	546	63	189
UP2OO	"	139,518	440	51	156
UP2OQ	"	90,646	348	28	94
UP2PW	"	27,380	255	23	57
UP2BBD	"	9,594	118	9	30
UP2BDX	"	3,975	49	17	36
UP2DM	**28**	**244,760**	**797**	**32**	**84**
UP2BEX	"	104,104	425	28	76
UP2BIS	"	24,076	202	15	37
RP2BFG	"	8,440	97	14	26
RP2BDI	"	7,134	107	12	17
UP2BDO	"	4,284	57	13	21
UP2AV	**21**	**30,378**	**208**	**22**	**61**
UP2PCB	**14**	**68,377**	**440**	**28**	**73**
UP2PAE	"	35,364	287	20	64
UP2PCK	"	9,605	103	12	40
UP2NK	**7**	**206,584**	**1025**	**31**	**93**
UP2PAY	**3.8**	**15,949**	**415**	**7**	**34**
UP2BAW	**1.8**	**20,091**	**525**	**7**	**30**

MOLDAVIA

UO5OAK	14	9,487	91	15	38
UO5GR	**3.8**	**6,804**	**125**	**9**	**33**

UKRAINE

UY5OO	**A**	**2,539,569**	**2451**	**114**	**297**
UT5HP	"	590,450	913	85	265
UB5MDI	"	390,730	876	57	148
UB5MFY	"	319,381	772	68	209
UB5CE	"	275,644	556	76	198
UB5UKO	"	245,495	423	82	212
UY5TE	"	148,680	538	49	161
UB5MFR	"	49,532	295	27	89
UB5GBN	"	41,107	245	27	74
UB5VAZ	**28**	**462,594**	**1569**	**32**	**97**
RB5IZH	"	390,728	1178	34	102
UB5PBA	"	151,800	494	31	101
RB5CCO	"	113,314	501	26	80
UB5MBP	"	111,825	500	26	79
UB5KAN	"	110,238	423	30	84
UB5UGD	"	96,208	359	27	85
UB5DAG	"	82,110	320	30	89
RB5UDG	"	67,320	331	26	73
RB5MHY	"	63,525	335	25	80
RB5QFL	"	31,482	299	20	33
UB5MLP	"	8,820	71	16	47
UB5UKW	"	8,601	91	13	34
UB5FDF	**21**	**612,304**	**1703**	**39**	**115**
UB5UAL	"	474,932	1410	37	111
UY5XE	"	91,214	392	33	85
UB5WCW	"	52,266	304	25	68
UB5ICS	"	34,650	227	25	65
UB5QBG	"	27,864	200	23	63
UB5UCJ	**14**	**263,082**	**767**	**37**	**126**
UB5LAN	"	227,182	835	36	102
UB5JIQ	"	16,027	227	14	17
UB5IFN	**7**	**78,320**	**559**	**22**	**67**
UB5MBN	"	5,187	110	8	31
UB5EKG	**3.8**	**12,804**	**241**	**7**	**37**

OCEANIA

AUSTRALIA

VK4VU	**A**	**2,697,562**	**3028**	**101**	**200**
VK1RJ	"	216,224	644	46	70
VK2NHV	"	118,712	530	29	47
VK3SM	"	62,810	201	40	70
VK6NSD	"	19,565	104	23	42
VK6FS	"	19,170	71	34	56
VK5OU	"	17,574	71	37	50
VK1JN	"	9,396	63	16	38
VK4LX	**28**	**526,770**	**1335**	**34**	**101**
VK6AJW	**21**	**281,356**	**801**	**35**	**89**

FRENCH OCEANIA

FO8DF	**A**	**504,712**	**1660**	**45**	**59**

GUAM

WD4REE/KH2	**A**	**467,480**	**1247**	**43**	**87**
KB7IJ/KH2	**28**	**1,442,480**	**3339**	**37**	**109**
KG6DX	**14**	**923,510**	**1909**	**39**	**128**

HAWAII

KH6XX	**A**	**5,713,434**	**4912**	**131**	**262**
AH6J	"	364,452	1022	56	65
WA1UZH/KH6	"	173,731	871	33	34
KH6IJ	"	2,052	36	9	10
KH6DX	**28**	**134,820**	**552**	**26**	**58**
KH6KV	"	64,218	512	18	24
KH6MD	**21**	**475,760**	**1689**	**32**	**63**
KH6NO	**14**	**421,322**	**1209**	**34**	**87**

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MBA-RC Code Reader/Converter	CALL
CABLE BY SAXTON	
RG 213 Mil Spec	26¢/ft.
RG 8/m 95% shield-foam	24¢/ft.
Mini-8	11¢/ft.
RG 58	9¢/ft.
RG 59	9¢/ft.
8-wire Rotor 2 #18, 6 #22	16¢/ft.
CLOCKS BY BMI	
173B 24-hour clock	29.95
173 DM dual desk clock	59.95
DAIWA/MCM	
CN520/CN540 watt meters	59.95/69.95
CNW418/CNW518 Antenna Tuners	169.95/279.95
CNA 2002 Auto 2.5W Tuner	399.95

ORDER INFORMATION

Orders or Quotes Only **1-800-336-4799**
Information and Virginia Orders **(703) 643-1063**
Store Hours: **M-W-F: 12 noon-8 pm**
Thursday: 10 am-4 pm
Saturday: 9 am-3 pm

Mailing Address: 2410 Drexel St.
Woodbridge, VA 22192

Store Location: (New Location) 13646 Jefferson Davis
Woodbridge, VA 22191

— DEALER INQUIRIES INVITED —

— CALL FOR QUOTES —
Partial product listing — send stamp for a flyer or call for quotes. Terms: prices do not include shipping. VISA and Master Charge accepted. 2% discount for prepaid orders (cashier's check or money order). COD fee $2.00 per order. Prices subject to change without notice or obligation. No personal checks accepted. Returns subject to 10% restocking fee.

CIRCLE 81 ON READER SERVICE CARD

INDONESIA

YB8AEG	**A**	**720,252**	**1025**	**91**	**156**
YB2CR	**28**	**298,469**	**1036**	**30**	**67**
YBØGF	21	34,544	177	25	43

MARSHALL ISLANDS

KX6PI	**14**	**720,652**	**1838**	**35**	**99**

NEW ZEALAND

ZL3AAX	**A**	**266,604**	**584**	**62**	**94**
ZL3ABC	"	56,373	281	25	44
ZL4BO	**28**	**387,002**	**1333**	**30**	**68**
ZL1BPK	"	172,124	786	23	51
ZL1BIL	**7**	**443,646**	**1245**	**33**	**90**
ZL1AZV	"	**332,508**	**959**	**33**	**88**

PHILIPPINES

DU1CPL	**28**	**315,920**	**1341**	**27**	**53**
KP4KK/DU2	**21**	**1,413,042**	**3675**	**38**	**104**
DU1EFZ	"	197,088	700	33	63

SOUTH AMERICA

ARGENTINA

LU1BR	**A**	**3,134,040**	**3386**	**98**	**214**
LU2DSL	"	1,725,440	2332	75	181
LU8FEU	**28**	**1,021,750**	**2711**	**32**	**93**
LU5FGG	"	775,067	2296	31	82
LU1VK	"	220,023	856	23	64
LU7DGM	"	92,204	370	27	62
LU1ABT	"	11,050	130	15	19

BOLIVIA

W5KNA/CP6	**A**	**213,330**	**382**	**66**	**129**
CP5MP	28	4,959	87	7	12

BRAZIL

PP2ZDD	**A**	**1,424,110**	**1825**	**75**	**190**
PY1NEZ	"	611,200	1033	61	139
ZY5CIG	"	571,200	1126	56	119
PY3CB	"	549,360	1027	60	120
PY2BZD	"	514,418	829	66	145
PS7KM	"	133,764	294	43	114
PT7WP	"	25,330	106	31	54
PP5JB	"	15,745	80	22	42
PY4KB	"	14,924	65	31	51
ZY3HMC	"	7,564	42	23	38
PY2RHL	"	2,065	30	15	20
ZZ5EG	**28**	**1,760,130**	**3760**	**37**	**125**
PY1ZFO	"	231,610	743	26	80
PY2DJC	"	151,932	750	21	45
PY7ZZ	"	111,983	340	30	83
PY1DFF	"	69,630	364	18	48
PY2FT	"	14,994	102	20	31
PT7RNP	**21**	**312,761**	**957**	**28**	**79**
PT7VOB	"	140,400	661	21	51
PY1VT	"	66,531	337	20	47
PY2ESK	"	56,580	272	23	46
PY3BC	"	40,870	208	22	45
PY1ACY	"	7,656	64	20	24
PY2AJK	**7**	**52,632**	**259**	**20**	**52**
ZY5XFR	**3.8**	**3,438**	**48**	**14**	**20**
PY2TTV	"	1,127	26	10	13

CHILE

CE5CN	**A**	**383,669**	**617**	**47**	**96**
CE4DPV	**21**	**458,780**	**1400**	**29**	**84**
CE7BDJ	**14**	**37,791**	**324**	**14**	**25**

EASTER ISLAND

CEØAE	**28**	**505,605**	**1537**	**30**	**81**

ECUADOR

HC1HC	**7**	**183,120**	**767**	**23**	**61**

PERU

OA4AWD	**A**	**2,989,840**	**2688**	**111**	**269**
OA8CW	**3.8**	**10,206**	**135**	**11**	**16**

TRINIDAD

9Y4VT	**A**	**11,085,529**	**6680**	**140**	**419**

(Opr. N6AA)

URUGUAY

KA6ISE/CX	**A**	**210,552**	**768**	**22**	**71**
CX3BBH	**21**	**1,107,312**	**2704**	**35**	**103**
CX5BT	**14**	**156,938**	**416**	**34**	**97**

VENEZUELA

4M2AMM	**A**	**5,770,310**	**4402**	**115**	**327**
YV3OS	28	42,130	260	21	34
YV3BJL	**21**	**1,231,630**	**3100**	**35**	**102**
YV1DQU	**14**	**882,735**	**2028**	**35**	**115**
YV4CB	"	**840,924**	**2040**	**32**	**110**
YV2IF	"	573,870	1360	32	109
YV3BQS	**7**	**287,850**	**1020**	**25**	**70**
YV3AZC	**3.8**	**160,740**	**730**	**20**	**56**

QRP

I5NSR	**A**	**670,133**	**959**	**83**	**230**
OA8V	"	**545,400**	**838**	**76**	**149**
WB2ULI	"	**505,997**	**560**	**93**	**218**
K3ZR	"	**434,720**	**541**	**80**	**206**
DF4RD	"	**407,313**	**684**	**67**	**204**
ON6NL	"	**344,268**	**707**	**57**	**162**
OK3CGP	"	**299,446**	**634**	**77**	**216**
N2US	"	171,264	329	51	141
G3FTQ	"	**163,344**	**582**	**37**	**129**
AJ7S	"	**148,144**	**296**	**69**	**119**
UP2NV	"	**146,076**	**314**	**69**	**153**
JI1CBF	"	**142,800**	**308**	**71**	**99**
K7HBN	"	140,454	313	65	97
WA4FHQ	"	**130,720**	**252**	**54**	**136**
N2GC	"	121,752	254	50	128
WA2JOC/8	"	**90,117**	**201**	**52**	**119**
W6YVK	"	**89,473**	**250**	**53**	**78**
WA3FNK	"	74,382	189	44	94
DK6AO	"	69,058	231	43	103
JA1KFX	"	48,789	154	48	89
KL7IBT	"	**47,346**	**252**	**29**	**42**
JA6VZB	"	42,300	233	25	50
JH4MVQ	"	20,400	125	23	37
WB2BGA	"	19,380	104	27	49
SP2FAP	"	**17,716**	**90**	**26**	**60**
UL7LBM	"	**16,994**	**123**	**17**	**41**
OE1SBA	"	9,928	68	26	42
Y24TG	"	9,585	119	13	58
YO7BKT	"	8,892	110	17	40
JA1HGY	"	4,230	57	13	17
Y26TG	"	195	9	6	9
I5JHW	**28**	**102,580**	**346**	**29**	**86**
JA1EF	"	**100,386**	**363**	**28**	**71**
W6CN	"	**63,075**	**256**	**24**	**63**
SP6EIY	"	**41,535**	**252**	**24**	**41**
KBØHA	"	**38,315**	**176**	**24**	**55**
UP2BIM	"	**33,180**	**195**	**21**	**58**
KB7VD	"	**33,110**	**211**	**17**	**38**
I4BFY	"	29,484	177	23	40
WD8IDD	"	**26,640**	**137**	**16**	**58**
G3WFL	"	**26,314**	**203**	**17**	**42**
FØFXX	"	**19,446**	**187**	**18**	**24**
UP2BBX	"	14,728	146	17	39
UB5WAR	"	**9,240**	**91**	**12**	**28**
PA3ADH	"	**5,175**	**103**	**8**	**15**
UB5MNO	"	4,320	98	7	23
K8BX	"	2,912	38	6	20
UP2BHI	"	1,675	42	10	15
OZ8XW	"	1,612	21	11	15
WBØURA	"	459	10	7	10
KH6CP/W3	"	165	8	5	6
SP1OT	**21**	**31,950**	**215**	**20**	**55**
JK1QLH	"	**16,950**	**117**	**22**	**28**
KB2NU	**14**	**88,935**	**257**	**32**	**89**
I1RBJ	"	**23,700**	**209**	**17**	**58**
JA2JSF	"	**9,284**	**80**	**17**	**27**
PAØNRD	"	**4,656**	**80**	**9**	**39**
UI8ZAA	"	**4,644**	**49**	**9**	**27**
OK1AIJ	**3.8**	**6,755**	**196**	**5**	**30**
SP5FKW	"	**6,096**	**117**	**5**	**43**
OK1MNV	"	2,046	66	4	27
OK3IAG	**1.8**	**450**	**27**	**4**	**14**

MULTI-OPERATOR SINGLE TRANSMITTER

NORTH AMERICA

UNITED STATES

N1TZ	**2,987,088**	**1716**	**153**	**476**
K1UO	**2,353,783**	**1633**	**131**	**368**
K1RQ	1,947,816	1447	118	350
AG1C	1,937,306	1368	127	370
K1SA	1,195,524	1086	97	249
KA1GG	1,031,125	1006	92	273
W1IHN	842,270	708	109	309
W1BK	671,606	724	94	244
K1FWF	564,408	574	99	252
N1BMV	394,980	507	78	212
N1AU	303,831	399	81	198
KA1EIV	248,676	422	62	150
WA1ZAM	214,931	292	82	187
KB1O	13,462	89	11	42
WB2FZO	**3,755,350**	**2233**	**141**	**451**
N2RM	**2,957,565**	**1985**	**125**	**398**
KE2C	2,256,478	1631	129	370
K2VV	1,884,700	1691	105	296
WB2TCQ	1,058,400	942	107	293
K2BK	939,720	821	109	301
W1GD/2	933,232	879	97	279
K2ITG	849,816	766	115	292
KB2MG	830,148	912	90	241
W2VJN	780,450	759	99	264
K2QF	532,180	649	81	214
W2UI	524,805	620	79	216
K2TD	465,450	532	86	235
K2HR	432,846	549	87	191
N2BNC	256,100	371	70	190
N2BNC	256,100	371	70	190
KD2T	177,928	349	60	124
K3LR	**3,867,840**	**2137**	**148**	**484**
KB3AG	**2,368,740**	**1919**	**126**	**318**
K2PLF/3	1,275,855	1083	115	304
K3TUP	1,018,164	1001	105	267
WA3EKL	973,226	811	122	341
W3GU	881,842	951	88	250
W3NX	804,321	813	96	261
WB3DJF	649,296	705	90	244
W3GNQ	613,868	657	97	235
W3HRD	577,133	709	77	212
WA3JVG	476,452	564	89	222
N3ARK	427,182	517	82	212
KB3HE	383,136	448	88	224
K3FN	364,504	414	95	227
KB3KE	229,390	401	56	147
WA3SFJ	208,008	325	63	180
KX4S	**3,837,896**	**2248**	**144**	**449**
N4ZC	**3,749,108**	**2156**	**151**	**462**
W4QAW	3,722,928	2021	153	488
N4RV	2,305,457	1511	134	419
N4KG	2,182,275	1467	136	413
WA4QQV	1,028,034	1000	99	270
N4BS	973,504	839	117	307
AA4FF	794,466	855	94	248
KD4RH	526,473	574	98	235
KC4BG	482,474	687	92	225
KB4YT	284,550	480	60	150
KC4TJ	129,350	240	68	131
WD4RCO	111,315	214	65	140
KD4ZI	71,133	202	37	94
K5TA	**2,605,024**	**1863**	**139**	**389**
WA5SOG	383,688	501	91	201
K9MK/5	135,388	277	60	121
W6RDF	**3,154,782**	**2163**	**142**	**367**
K6MYC	**2,737,026**	**2038**	**134**	**343**
NC6T	2,415,420	2045	129	297
K6XV	1,893,970	1477	131	311
N6MG	1,506,776	1261	129	308
W6GO	1,485,375	1274	126	299
KV6H	1,297,803	1527	102	219
K6ANP	971,740	889	110	275
AA6T	833,310	1067	98	184
K6HIH	825,392	894	109	207
W6YX	611,556	871	92	154
W6OKK	605,206	771	93	185
W6BIP	512,354	659	92	186
WB6GFJ	457,773	502	101	230
KB6ST	441,336	647	101	158
W6VLD	423,549	604	79	170
KD6XM	412,528	635	77	159
W6UE	385,910	550	84	175
AJ6V	313,052	467	85	159
N6WR	243,800	426	75	137
W6ERS	96,839	214	73	106
KD6XY	81,366	210	53	89
K6OP	49,795	165	49	66
N6QC	35,728	109	39	73
K6FO	28,392	108	45	59
W6ZYC	8,514	46	29	37
W7EJ	**1,617,412**	**1349**	**129**	**299**
K7SS	**1,580,672**	**1397**	**131**	**293**
WA7KLK	1,556,352	1534	122	262
N7RO	1,542,325	1270	133	292
K7WQD	1,116,794	1211	118	213
K7MX	911,880	955	110	230
KB7G	627,080	786	100	205
W7NI	618,930	773	98	201
K7ZSD	591,136	862	86	146
N7CWY	238,368	482	66	125
KB7PJ	215,096	528	55	106
N8JW	**2,903,923**	**1754**	**143**	**440**
AD8P	**2,806,768**	**1731**	**143**	**435**
KB8IZ	1,728,724	1213	135	373
KQ8M	1,108,548	1108	94	277
W8NGO	1,051,859	858	114	323
K8MN	833,136	788	111	297
K8JLB	766,719	706	107	282
K8BA	381,424	553	82	195
N8BKB	377,536	475	82	190
K8US	316,111	409	91	192
WD8KMX	116,762	276	56	102
K8RLQ	109,343	239	54	115
W8VPV	106,560	178	51	134
W8WE	102,340	225	55	117
WD8PNF	96,161	213	50	119
N8BKO	67,760	209	33	79
N8DHO	47,424	178	38	76
KA8HXX	43,173	134	49	68
KA8IYM	28,820	104	38	72
W9DUB	**2,867,188**	**1706**	**152**	**452**
KJ9D	1,221,120	1056	122	302
KØFU/9	628,250	661	109	250
K9BIL	569,296	693	82	217
W9YH	424,099	525	100	223
KA9Y	104,000	230	58	107
KØUK	**3,522,168**	**2191**	**160**	**408**
KØAA	1,857,792	1482	144	348
KØJSY	1,853,484	1297	133	381
WBØOYA	451,836	524	90	218
AKØM	259,512	357	76	188
AIØZ	103,360	207	53	117
KAØGMX	33,182	113	37	68

ALASKA

KL7Y	**3,905,308**	**3812**	**116**	**275**
KL7CQ	704,930	1618	52	105

ANGUILLA

VP2EM	**2,340,877**	**3424**	**82**	**219**

BARBADOS

8P6MH	**5,014,140**	**4809**	**112**	**321**
8P6QL	2,045,612	2241	96	262
8P6T	2,023,500	3318	107	121

BERMUDA

VP9IB	**2,358,972**	**3172**	**93**	**229**

BRITISH VIRGIN ISLANDS

VP2VFL	**6,155,919**	**6176**	**111**	**330**

CANADA

VE1DXA	**6,057,990**	**4593**	**139**	**415**
VE3PCA	**5,057,492**	**3616**	**137**	**411**
VE6OU	4,920,807	4120	135	354
VE3BVD	3,761,032	3006	131	410
VE5DX	3,095,015	3719	122	263
VK3WA/VE3	1,538,166	1769	104	267
VY1CC	1,469,859	2541	82	159
VO2WL	1,173,510	2154	67	167
VE5AE	1,023,519	1373	105	224
VE6AMV	388,935	752	85	130
VO2CC	372,176	1618	43	69
VE2CUA	253,943	516	52	129
VE5NN	226,670	468	71	119
VE5CHS	34,522	183	29	53

HONDURAS

WB5SNA/HR1	**2,100,312**	**3142**	**90**	**189**

MEXICO

XE2BC	**2,495,484**	**3607**	**101**	**208**
4A2Q	1,538,190	2616	97	173

MONTSERRAT

VP2MFW	**8,321,040**	**6647**	**120**	**384**

PANAMA

HP1XRK	**7,932,712**	**6319**	**142**	**400**

ST. MAARTEN

PJ8UQ	**6,023,544**	**6087**	**104**	**315**

TURKS & CAICOS IS.

VP5IW	**2,200,608**	**3253**	**75**	**213**

AFRICA

CANARY ISLANDS

EA8ND	**659,950**	**1131**	**50**	**147**

SOUTH AFRICA

ZS6BPL	**4,039,672**	**3374**	**123**	**280**

ASIA

ISRAEL

4Z4EC	**892,332**	**1194**	**64**	**188**

JAPAN

JA9YBA	**2,683,180**	**2121**	**125**	**312**
JG1ZUY	1,644,550	1811	99	211
JA1YAD	1,346,624	1218	119	278
JA4YFH	1,298,880	1375	99	221
JAØYAK	346,788	557	79	149
JA6YDH	302,834	566	65	129
JA1YHA	151,525	365	58	87

ASIATIC U.S.S.R.

ASIATIC RUSSIA

UK9AAN	**5,626,544**	**3222**	**157**	**459**
UKØAA	**3,121,052**	**3797**	**111**	**245**
UK9SBH	1,027,140	1470	91	164
UK9UAC	671,738	929	101	197
UK9OAX	268,345	544	59	146
UKØSAV	53,640	310	20	52
UKØKAB	19,872	277	20	28
UK9XAN	7,353	43	26	32
UKØLAS	2,354	114	4	18

KAZAKH

UK7LAH	**2,642,754**	**3080**	**100**	**237**
UK7PAL	2,139,340	2158	142	271
UK7GAA	1,670,165	1899	113	288
UK7NAQ	1,066,500	1381	92	224

KIRGHIZ

UK8MAA	**1,207,458**	**1438**	**102**	**231**
UK8MAF	521,976	763	98	175

EUROPE

AUSTRIA

OE4SZW	**2,392,000**	**2374**	**111**	**349**

BELGIUM

ON4BB	**1,719,312**	**2308**	**79**	**215**

CZECHOSLOVAKIA

OK3FON	**235,704**	**468**	**68**	**176**
OK1KTW	120,600	496	40	80
OK1ORA/P	48,600	283	26	94
OK1KPX	40,110	206	32	73
OK2KYC	31,242	172	31	51
OK1KIR	24,465	136	34	71
OK2KJT	19,623	175	19	74
OK1KMP	13,689	129	19	62
OK1KJA	10,521	60	26	37
OK1KOK	4,851	67	12	21

DODECANESE

SVØBV/SV5	**2,842,258**	**4294**	**98**	**239**

ENGLAND

G8JC	**2,063,874**	**2276**	**100**	**266**

FAROE ISLANDS

OY5J	**326,196**	**793**	**60**	**161**

FINLAND

OH5SM	**4,097,004**	**2817**	**140**	**439**
OH7AB	1,790,646	2008	113	316
OH5BM	1,108,800	1180	114	336
OH1AF	10,830	67	20	42

FRANCE

F3TV	**5,780,424**	**3862**	**137**	**445**
F2LY	2,034,366	2046	122	287

GERMANY (GDR)

Y23EK	**7,247,100**	**5457**	**120**	**390**
Y23DL	2,164,824	2074	110	318
Y31ZA	1,125,641	1585	93	248
Y54ZA	632,640	942	82	238
Y43ZK	312,708	851	66	187
Y41ZF	21,060	116	27	51

LUXEMBOURG

LX1JE	**1,875,287**	**5703**	**89**	**240**

NORWAY

LA4O	**1,036,984**	**1389**	**79**	**259**

POLAND

SP9PDF	**2,824,080**	**2344**	**117**	**375**
SP9KRT	1,816,792	2137	97	285
SP6PAZ	803,352	1038	108	250
SP7KMX	252,080	747	56	174
SP6KGN/6	37,622	252	36	87

ROMANIA

YO6KBM	34,226	230	29	80

SCOTLAND

GM4KWS	**433,632**	**1733**	**30**	**107**

SPAIN

EA7TH	**4,740,884**	**4524**	**102**	**310**
EA3APV	1,008,200	1503	87	268

SWEDEN

SM5AOE	**2,892,202**	**2457**	**121**	**358**
SK6AW	1,630,431	1950	100	283
SK7NK	1,443,510	1454	107	280
SK7OA	283,182	728	52	166
SK5DB	321,012	635	67	155
SM5AZU	155,288	435	44	144
SKØLM	124,488	323	56	112
SK6JX	43,430	207	32	69

YUGOSLAVIA

YU4FRS	**4,168,959**	**3365**	**112**	**341**
YU2OG	384,192	1255	35	109
YU4ECJ	16,660	103	24	44

GERMANY (FRG)

DLØWW	**3,380,784**	**2732**	**119**	**337**
DLØJK	2,832,822	2471	116	351
DJØVZ	1,995,760	1981	100	304
DLØPE	485,680	860	70	138
DFØSI	180,630	426	62	161

GUERNSEY

GU3HFN	**7,234,392**	**5324**	**120**	**416**

HUNGARY

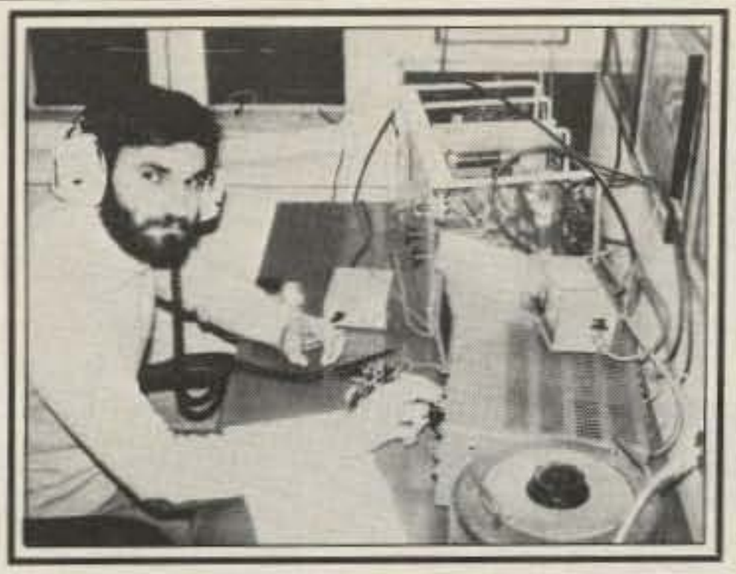
HG5A	**6,403,254**	**4572**	**135**	**426**
HG6V	5,046,406	4031	127	394
HG1W	3,447,234	2980	117	385
HA5KKC/7	3,188,351	3264	108	293
HA7KPL	1,232,912	1916	75	252
HA3KNA	881,954	1219	88	258
HA5KHE	151,400	474	59	141
HA8KAX	114,884	400	43	111

ISLE OF MAN

GD5DLW	**1,988,010**	**3166**	**97**	**301**

ITALY

I3MAU	**8,279,232**	**4806**	**168**	**474**
I1KN	5,766,519	3765	128	433
I4YSS	992,344	1477	86	240



Vojo, YU7OCV (ex-YU1OCV), sent us this shot of his station.

One of the top Single Band 10 M entries for this year was Dom, I8UDB/IC8, shown here in the heat of battle.

Here's a welcome addition to the contest at just 15 years—4X6DX.

Attention DX Stations

Starting with the January 1983 issue, the subscription rates for *CQ* will increase **to** the following amounts (payable in U.S. funds):

	U.S.A. (Domestic)	Canada/Mexico	Foreign
1 Year	$16.00	$18.00	$20.00
2 Years	$29.00	$33.00	$37.00
3 Years	$42.00	$48.00	$54.00

This is just an early notice to allow you time to make your subscription plans accordingly.

LIECHTENSTEIN

HB0BHA	**4,661,180**	**4290**	**117**	**343**

NETHERLANDS

PA0RCA	**164,352**	**515**	**56**	**136**

EUROPEAN U.S.S.R.

BYELO-RUSSIA

UK2AAX	**416,206**	**1246**	**51**	**166**
UK2TAF	4,366	104	9	28

ESTONIA

UK2RDX	**3,591,537**	**2727**	**146**	**433**
UK2RAC	468,430	880	78	200
UK2RAQ	59,472	371	42	102

EUROPEAN RUSSIA

UK6LAZ	**5,007,970**	**3825**	**142**	**441**
UK6LEZ	**3,610,800**	**2909**	**128**	**382**
UK4FAV	3,133,490	2916	122	348
UK3XAA	2,433,858	2109	130	371
UK3WAF	570,050	1129	80	245
UK3ABO	390,494	936	86	183
UK1TBB	295,382	649	59	167
UK3ABC	222,306	587	56	145
UK6HCZ	115,560	395	44	91
UK3DBV	36,864	186	28	68
UK3TBF	21,384	131	27	54
UK3TBY	465	26	23	28

KARELIA-FINNISH

UK1NAP	**23,875**	**126**	**10**	**28**

LATVIA

UK2GKO	**1,334,116**	**1701**	**136**	**270**
UK2GAB	945,554	1240	101	233

LITHUANIA

UK2PCR	**4,750,800**	**3227**	**140**	**452**
UK2BBB	**3,575,178**	**2872**	**125**	**397**
UK2PAP	2,432,480	2273	121	358
UK2PRC	1,563,726	1841	117	357
UK2BAG	1,111,877	1430	103	300
UK2PAO	884,224	1222	88	264
UK2PAT	755,185	1047	91	274
UK2PBR	688,989	1027	83	218
UK2BCM	188,188	551	48	134
UK2BBX	142,614	516	42	129
UK2BCC	44,512	256	25	82

UKRAINE

R5I	**6,742,879**	**4886**	**161**	**510**
UK5MAF	**5,066,982**	**3400**	**145**	**473**
UK5MAZ	2,635,397	2319	129	394
UK5MCO	886,470	1214	102	288
UK5MCP	530,271	852	76	203
UK5QBE	443,610	895	52	153
UK5WBG	248,589	508	62	181
UK5MDI	150,117	487	51	152
UK5MBF	126,112	346	54	170
UK5WBF	83,984	564	32	61
UK5HAB	57,000	246	33	92
UK5UDX	44,642	162	39	62
UK5EAE	31,410	215	21	69
UK5LAS	6,825	193	12	17

OCEANIA

HAWAII

KH6N	**3,516,480**	**3677**	**118**	**202**

SOUTH AMERICA

ARGENTINA

LU1MA	**5,004,850**	**4244**	**116**	**282**
LU1EQ	176,358	1049	24	54

BRAZIL

PP5JD	**2,324,131**	**2866**	**81**	**182**

CHILE

CE2AA	**1,986,864**	**2392**	**97**	**187**

COLOMBIA

HK3A	**6,420,100**	**4965**	**111**	**325**
HK4RCA	1,590,994	1932	86	192

MULTI-OPERATOR MULTI-TRANSMITTER NORTH AMERICA

UNITES STATES

W2PV	**10,618,352**	**5124**	**162**	**607**
N2AA	**10,399,208**	**4937**	**159**	**580**
N5AU	**10,003,860**	**4872**	**171**	**574**
K1OX	**8,016,197**	**4077**	**153**	**543**
KN6M	**7,300,070**	**4446**	**156**	**434**
W3LPL	**7,260,708**	**3455**	**159**	**573**
K9GL	**6,651,088**	**3392**	**162**	**539**
K3WW	6,123,408	3309	151	513
K1CC	5,794,722	3172	154	499
N2SS	5,447,362	2949	154	507
N6RO	5,325,320	3332	157	415
K4VX/8	**5,315,058**	**2946**	**164**	**430**
AI6V	4,848,260	2842	158	422
K6RU	4,270,050	2762	151	425
K1KI	3,951,377	2266	143	468
K3ND	3,833,421	2296	143	473
K3ZJ/4	**3,410,904**	**1930**	**147**	**485**
K6MEP	3,179,754	2384	147	335
K6RR	3,040,886	2284	149	358
K2BA/4	2,942,380	1757	144	446
N3RL	2,101,581	1416	133	394
N7GM	**1,519,220**	**1491**	**118**	**270**
WB7TAZ	1,498,720	1801	91	199
N6RZ	1,479,444	1354	121	267
K6ZM	1,454,222	1233	125	293
W60WQ	1,391,069	1243	119	282
K1XM	1,103,088	999	102	290
N4KE	887,678	654	144	370
WB6KBZ	667,980	910	88	182
K1IK	541,748	583	91	243
W9AMM	398,431	461	100	219
W3YFV	336,815	453	77	188
W6FPS	96,839	214	73	106
KD4ZI	71,133	213	37	94

ALASKA

KL7RA	**5,789,300**	**5784**	**121**	**281**
KL7IRT	4,856,005	4907	119	266

BERMUDA

VP9AD	**13,338,000**	**9650**	**143**	**442**

AFRICA

MADEIRA ISLANDS

K6HNZ/CT3	**13,149,240**	**8469**	**123**	**397**

ASIA

JAPAN

JA2YKA	**5,116,621**	**3467**	**145**	**366**
JA2YEF	**5,061,654**	**3956**	**139**	**307**
JA7YRR	4,110,648	3058	134	338
JA3YBF	4,076,336	2869	139	367
JA3YKC	3,645,972	2612	142	344
JH7YJF	3,030,100	2848	120	266
JA4ZQA	1,366,394	1436	107	227
JA6YCU	1,217,115	1303	116	217
JA4YQO	250,647	460	74	127

SAUDI ARABIA

HZ1AB	**5,565,170**	**4316**	**123**	**358**

EUROPE

BELGIUM

ON6AH	**2,236,125**	**2484**	**94**	**281**

CZECHOSLOVAKIA

OK1KSO	**3,565,354**	**2762**	**122**	**360**

DENMARK

OZ5DD	**1,309,280**	**1813**	**84**	**250**

FINLAND

OH1AA	**10,840,617**	**6585**	**160**	**551**

LUXEMBOURG

DA1WA/LX/P	**2,538,970**	**3194**	**108**	**329**

NORWAY

LA9K	**362,439**	**507**	**63**	**168**

SPAIN

EA7RCC	**237,840**	**562**	**66**	**174**

SWITZERLAND

HB9H	**5,937,585**	**4908**	**139**	**426**

YUGOSLAVIA

YT8R	**13,462,620**	**8226**	**154**	**554**
YZ7R	**5,144,280**	**5160**	**115**	**374**

OCEANIA

AUSTRALIA

VK2DZZ	125,100	556	34	41

NIUE

ZK2ZZ	**3,003,000**	**3779**	**99**	**174**

SAIPAN

KG6RE	**18,781,080**	**12,059**	**150**	**380**

SOUTH AMERICA

BRAZIL

ZY3ZZ	**987,940**	**1750**	**56**	**132**

NETHERLANDS ANTILLES

P41C	**41,957,244**	**17,718**	**173**	**625**

CHECK LOGS

We are grateful to the following stations for submitting check logs:

CO2GB, CT2EE, DL4NAC, EA7HG, F6CCI, HB9QA, HC1AK, JH7PWS, KA1DSQ, K4ZT, K5VYT, K6FM, LA2LV, LA3JT, LA4HH, LA4RQ, LA9LO, LA9OI, LA9ZV, LZ2CC, N4DCC, N5DY, OH1EB, OH1PN, OH1XX, OH2BBM, OH2BQG, OH2MM, OH3YI, OH8TU, OK1AD, OK1AKD, OK1AVG, OK1DIB, OK1JDJ, OK1KPA, OK2BNK, OK2BSG, OK2BUY, OK2SWD, ON5FV, OZ1EXZ, OZ2DM, OZ5JR, OZ6VQ, OZ7BW, OZ7TH, PA3AAV, PA3AMA, PA3ASE, PA0DUO, PA0LEG, PA0LRK, PA0RRS, PA0TV, PA0UV, PT7AEE, PY1DFJ, PY1HE, PY2TM, PY3JC, RA3DDU, RA3DPD, RA3DQP, RB5ADF, RB5GCJ, RJ8JCF, SM2BUW, SM2LKW/0, SM5ARL, SM5BDV, SM5FTH, SM5IRV, SM5LI, SM5UF, SM7DMV, SM7GGK, SM7IDF, SM7KVZ, SM7LVE, SM0HOW/0, SM0LEA, SM0MLZ, SP2CYK, SP2PHS, SP3CDR, SP3CZY, SP3IBX, SP3XR, SP4AWE, SP4EDV, SP4JSO, SP5ALV, SP5CFD, SP5DFG, SP5DRH, SP5EAQ, SP5EKY, SP5GMM, SP5GPA, SP5ILO/5, SP5LM, SP5XD, SP6DYD, SP6ECA, SP6KCS, SP6PDT, SP7AW, SP7EJS, SP7KTE, SP8FNA, SP9DST, SP9JPA, SP9UO, UA1AWO, UA1CIQ, UA1NBF, UA1ZCZ, UA2FBZ, UA3AEW, UA3AHA, UA3ALE, UA3AMV, UA3DAT, UA3DDC, UA3DNV, UA3DUA, UA3DUF, UA3DNU, UA3EAH, UA3EAL, UA3EAT, UA3PBY, UA3PDA, UA3QJK, UA3TAG, UA3TAM, UA3TDK, UA3TEP, UA3VAS, UA4ACA, UA4CDC, UA4CO, UA4HJA, UA4PWW, UA4WBJ, UA6AJO, UA6AKT, UA6HFO, UA6LIA, UA6LXZ, UA6PCJ, UA6RB, UA9AGC, UA9OS, UA9UGU, UA9UKL, UA9UOF, UA0LFK, UA0SFN, UA0SKL, UB5CDF, UB5ICD, UB5IHR, UB5IMD, UB5IPJ, UB5LAW, UB5MDP, UB5ML, UB5UCH, UB5UEV, UB5VCK, UB5WBF, UB5XBY, UC2AHG, UC2LBE, UC2SLF, UF6FER, UK2BAS, UK2GJT, UK3APV, UK3DAH, UK3DAU, UK3DAW, UK3DBE, UK3HCB, UK3TAG, UK3XAM, UK4ABW, UK4NAA, UK4NBM, UK4WAK, UK5DAS, UK5FAD, UK4ICX, UK5QCD, UK5UBE, UK5VAV, UK6HBA, UK6LTG, UK7LAF, UK7NAV, UK9CET, UK9FEN, UK9HAC, UK9SAD, UK9SAY, UK0AAB, UK0QBG, UK0SAW, UL7GBP, UL7PBI, UM8QAN, UP2BEL, UP2BHT, UP2BV, UP2NO, UQ2MU, UQ2OP, UR2JL, UV3TE, UW3FW, UW3RR, UW3ZU, UW4NH, UW4NN, UW9DZ, VE3AWF, VE3CEA, VE7DZR, VE7NI, VS6CT, W1PWK, W1TJQ, WB5ZKR, W8MB, YO2II, YO3LX, YO5NU, YO6LV, YO6VZ, YU10VZ, YU7AJD, YU7PFT, Y21XC, Y22FK, Y22GC, Y22LO, Y22WK, Y23IL/A, Y23LD, Y23MF/A, Y23TF, Y23ZF, Y24GF/A, Y24LA, Y24HF, Y25TO, Y26BN, Y26GN, Y26IL, Y26KN, Y26LN, Y27DL, Y27FN, Y27MN/A, Y27684/E, Y28AL, Y32WC, Y33VB, Y33VL, Y36ZM, Y38TI, Y38WA, Y38WI, Y39WG, Y41ZM, Y43ZB, Y44XI, Y46WF, Y47YM, Y49RO, Y51VE, Y51YF, Y54ZL, Y56MD, Y56YN, Y57TH, Y59YM, Y62XG, Y640L, Y66ZN, Y67ZG, Y750L, Y75YL/P, Y78WN, ZL3GQ, ZP5CG, ZS3AG, ZY3ASN, 4U36UN.

Disqualified: UF6DZ (unverifiable contacts and excess duplicates).

CQ Reviews:

The Hal-Tronix 5312 12/24 Hour 6-Digit Clock Kit

BY BOB SWEARENGIN*, W5HJV

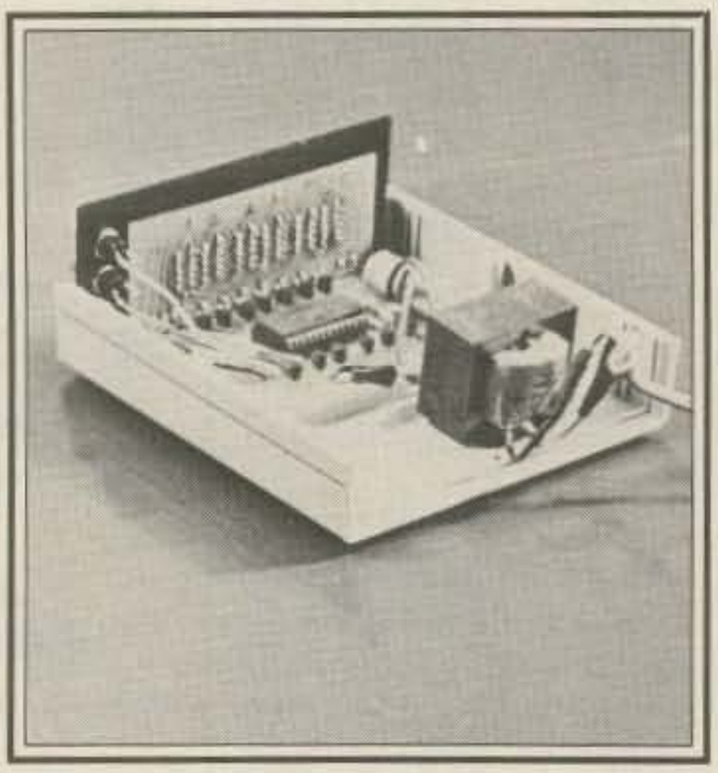
Of course I know what time it is! All I have to do is glance at the ancient electric clock on the shack shelf—the one transferred from the bedroom when the solid-state clock radios went on sale. It growls a little, but keeps perfect time.

Hmmm . . . it's 3 p.m. But 12-hour time is for non-radio people and doesn't look sophisticated in the log. Let's see. Add 3 hours to 12 noon and it's 1500 hours. Better, but still not good enough. The amateurs with 100-foot towers, expensive gear, and walls of awards go by Universal Time. For some reason Greenwich is where it's at. More figuring: to convert Mountain Standard I add 7 hours. But wait a minute; we're on daylight-savings time. Do I add 6 hours or 8 hours? Well, the rule is, "Spring ahead, Fall back." Or is it "Spring back, Fall ahead"? You can't "fall ahead," but . . . good grief, what time is it?

That's been the story at W5HJV for some 25 years. There never seemed to be enough extra bucks for a decent station clock. The dollars went into watts and decibels.

Things changed when I noticed an ad for the Hal-Tronix 5314 clock kit. Why not invest the price of a jug of good sour mash—only $12.95—and get in sync with the National Bureau of Standards for a change? I skipped the optional clock case at $4.50 (when purchased with clock kit) because this was to be a low-budget project. Figured I'd just use a coffee can or mount the clock on some scrap Plexiglass with standoff insulators.

The kit arrived as advertised. In spite of the low price, I was pleasantly surprised at the quality. The circuit boards were sturdy and well-plated—no peeling up when I goofed on a solder joint and had to apply more heat than usual. The kit furnished everything but the a.c. line cord. I clipped that from the old station clock, optimistically figuring I wouldn't need it anymore.



Inside the Hal-Tronix 5314 clock. The transformer attaches with "sticky-back" foam. The boards are held in place by the transformer leads and press-fitting the readouts to the front-panel cutout.

Most of the circuitry is in the CMOS clock chip, an MM5314, and this makes the kit easy to build. Construction involves the bridge rectifier for the d.c. voltage and installing the 13 transistors which drive the six 5/16-inch FND readouts. Be especially careful with the close connections on the readout board.

The manual contains detailed diagrams and construction hints and I experienced no problems. The kit went together in a leisurely two evenings. Because the solder pads are small and some are quite close together, I used a low-wattage pencil iron. Since I wish I had a 100-foot tower, expensive equipment, and a wall full of awards, I ignored the jumper for 12-hour operation.

The clock chip is sensitive to static electricity and should be handled carefully. Leave it in the foil until you are ready to install it, and touch the station ground before you do so. If you're new to kit building, note that pin #1 is marked on the underside of the chip. Don't put it in backwards! Before plugging in the completed clock, check the boards for solder bridges with a magnifying glass under a bright light. Use bifocals, if necessary.

My clock worked on the first try. The best part of any construction project is gloating over the finished product, so I bought the sour mash anyway and spent an hour sipping and watching the seconds tick away on the display. It was easily visible from across the room in normal light. Not too stimulating, maybe, but still more interesting than most of the stuff on network television.

I was so pleased that the next day I exceeded the budget and purchased a Radio Shack deluxe plastic enclosure (catalog #270-218) for $7.95. Counting sour mash and postage, this brought the total project cost to more than $30. Why didn't I buy the inexpensive case from Hal-Tronix in the first place? The Radio Shack cabinet, however, measures a bit over 2″ × 5″ × 5″ and is ideal for the clock. The gray and black finish matches the rest of my equipment. The clock was easy to install in the case. I just cut a rectangle in the front panel sized for a press-fit with the readouts. Of course, a case isn't mandatory. At 1¾″ high, 3¾″ wide, and

The Hal-Tronix 5314 clock in a Radio Shack 270-218 cabinet. Switches at right are for setting the time. Top button is hold, middle button is slow speed, and bottom button is fast.

*University of Wyoming, Journalism & Telecommunications Dept., Box 3904, University Station, Laramie, Wyoming 82071

3" deep, the clock would tuck nicely into a station console or control panel.

Things were fine for a couple of days. Then I noticed that my new accessory had gained several minutes. How could this be? The chip references the 60-cycle a.c. for a time-base and should be accurate to 2 or 3 minutes a year. The instructions had the answer: either stray r.f. or spikes on the a.c. line can cause the clock to gain or lose time. I ruled out r.f. immediately, because the rig here is grounded to the claw-foot tub in the upstairs bathroom. This totally eliminates surplus r.f., although problems arise if you forget to unplug the station before taking a bath. But that's another story.

Following the hints for curing a.c. spikes, I soldered 4.7K ohm resistors from pins 13, 14, and 15 of the clock chip to the B+ line. I did this on the bottom of the board, using a piece of electrical tape to keep the resistors from shorting to underside connections. These "pulling" resistors clipped the spikes and completely eliminated the problem. If you're the super-cautious type, you might want to go ahead and do this when you build the kit. And if you don't have a claw-foot bathtub, .01 capacitors from the same three pins to ground will bypass stray r.f. from transmitted signals and fluorescent lights.

The clock has been rock-stable for several months now, and I can truly say I know what time it is. Let's see. My watch says it's only 1000 hours in Laramie, but according to the clock it's cocktail time in Greenwich, England. Where did I hide that bottle of sour mash?

KB9FO is the former Publisher of A5 magazine and a long-time proponent of amateur television. In this article he proposes some new technology and new directions for our thinking.

Slow Scan With A Difference

BY HENRY B. RUH*, KB9FO

Slow scan as we know it has been used for ten years or more on the amateur bands, but the method used to transmit the pictures hasn't changed. The analog world is quickly changing to digital, and our transmission methods will change also. Even if you have a digital scan converter such as a Robot 400 or Wraase 422, you still use analog methods of transmission. The question I raise is: Why convert analog to digital to analog to digital to analog when the digital form is so much easier to send? Well, part of the answer is FCC regulations, and part of the answer is here.

First, the FCC has only allowed slow scan TV transmissions as an analog signal, using a voltage-to-frequency converter to produce an audio tone which is directly related to the luminance of the signal of the video source—*i.e.*, an f.m. audio representation of the video waveform. If you transmit a section of black, you actually send around 1500 Hz audio; white is 2700 Hz audio, with various levels in between. Old hat you say? Keep this in mind as we change to digital later.

In the analog world, the TV signal is a continuously variable voltage level. This produces a continuously variable audio signal which directly mirrors the TV picture undulations. With the advent of digital scan converters, the TV signal has been digitized. What has happened is that the signal which had virtually infinite possibilities of discrete levels between TV black and TV white, has changed. The process uses a series of voltage comparators. As the incoming signal is compared with a series of discrete voltage steps in the converter, a digital signal is generated which now represents various discrete and exact levels.

Most systems use 16 levels between TV black and TV white. There are commercial and experimental systems which use as few as 2 levels, and some which use 128 levels. The difference in the number of gray levels is a matter of taste and use whereby more levels will result in a more faithful representation of the original analog signal. For amateur use 16 levels is good enough, being a compromise between picture quality and cost. The drawback is that you do have errors and a visible contouring in the picture. But let's deal with the digitized signal a little more.

Once the SSTV signal is in the digital form, you can do a lot with the data. A simple memory will store the picture. By varying the load and read times, you effect scan conversion, changing fast scan TV signals into slow scan "frames." With a big enough memory, commercial uses include converting one fast scan TV picture to another set of fast scan standards. This is used to translate TV pictures recorded in European or French systems, which use 50 fields and 625 or over 800 lines, to U.S. standards, which are 60 fields and 15,750 lines (actually 59.94 fields and 15,734 lines). This is how we can watch *Benny Hill* and other British programs.

Our systems, however, change this wonderful digital information back to analog for transmission. We are still tied to the wasteful f.m. audio signal which has discrete and exacting conversion of the audio to video and vice versa, even though the signal will now only have 16 specific audio tones to represent the 16 discrete steps generated by our digital scan converter (plus 1200 Hz for sync). We have eliminated all the in-between "tones," since there is no way at this time (after digitizing the signal) to generate a gray level between, say, numbers 6 and 7, since the original information has been lost in the digitizing process. We can make guesses and use fancy averaging systems to recreate more gray levels, but they are not representations of the original signal, since when you receive the 16-level picture, you do not know what the actual level that generated each level was, or how the signal was changing (rate of change or slope) at the time the sample was taken. This is called a **quantization error** and is found in all digital systems. The greater the number of levels, the smaller the quantization error. However, there is always an error, since we are converting an infinite number of possibilities into a discrete number of actuals.

Our analog signal actually occupied (at any one moment it was only at one specific point, but over time it will cover all points) a frequency of from 1200 Hz to 2700 Hz in our transmitter audio bandwidth, and you just add your carrier frequency to find where you are in the radio spectrum. Our digitized signal will now occupy one of 17 discrete frequencies, so there is a lot of room in between steps to insert other material.

In commercial TV we use these in-between spaces in the luminance information to insert the color signal in a clever scheme set up by the National Television Systems Committee way back in the early 1950s, which is why we call our fast scan system NTSC (also known as "Never The Same Color" by engineers who prefer the other systems which are called PAL and SECAM). But the real question is, do we really need to send all that information? The related question is, can we send more or can we send it faster?

Let's look at the digital signal as generated in the scan converter. If we decide to use 16 gray levels, we will have to set up voltage comparators which will provide 16 data bits. Each comparator will represent one step between TV black and TV white. As the incoming signal is cut into tiny packages by a clock circuit, separating the continuous signal into samples, each sample is tested by the 16 comparators. One of the comparators will decide that the sample is equal to or nearly equal to its level and produce an **ON** state. The 16 discrete comparators are added in a special circuit which reduces the 16 parallel bits into a 4-level binary number. This is because we can count to 16 (or 0 to 15) in binary using only four powers of 2 (i.e., 1111 equals 16 and 0000 equals 1).

In-between numbers are made with different binary numbers (i.e., 15 would be 1110). We could now simply transmit the binary **WORD** which represents our digitized sample, but we don't. The scan converter will take the binary word and store it, or use it to generate a new frequency in an audio generator. Here the binary word is converted back to an ana-

*7391 W. Hwy 46, Ellettsville, IN 47429

log audio signal. Each binary word will generate a discrete audio tone, representing the 16 gray levels and sync. In the scan converter, sync is actually artificially generated, since there is no need to save the original sync information because it is always the same signal no matter what the video looks like. Keep this in mind when you build your TV decoder systems to watch pay TV. No matter what they do, the sync signal can always be regenerated, and thus the video restored. It is impossible to scramble a TV signal beyond recognition, since we know what the TV signal looks like, and all we have to do is tinker with the scrambled signal until we recreate what we know should be. But that's another story for another time.

Something new: If you go back and look at what happens inside the scan converter, you will find that we had the video signal reduced to 4 binary bits, or a 4-bit word. We could simply use these 4 bits to generate 4 audio tones. The only problem is a minor one: selecting 4 tones that do not produce any intermod products which would be one of the original tones (i.e., if you mix tone 1 and tone 2, they could not be allowed to produce tones 3 or 4). By detecting the 4 tones (a musical chord), you could send the 4 bits in a parallel data system. You probably would use 8 tones, since you would want to represent both 0 and 1 so as not to have a false tone appear from interference sources. But even with 8 tones, there is a savings over the 17 tones used in the analog system. Some folks would also find clever ways to use less tones by using "signature" or parity bits to eliminate false words.

But let's go back even further into the scan converter to the comparator. The basis on which the comparator works is that a specific voltage as set by a resistor divider network establishes 16 discrete voltages. As the incoming signal is sampled, each sample is compared to the reference 16 levels, and when the two are the same or nearly so, that one discrete comparator turns on. Each sample is put to 16 tests. The results then have to be changed to four "tests," which then are generated and transformed again into the audio analog signal. Wouldn't it be marvelous if there was only one comparator and only one data bit to send? *Well there is!*

The reference used for the multilevel scan converter is a discrete voltage for each level. But what we really need is a new reference to compare each sample. Then we would have only one data bit to send. The easiest way is simply to compare the first sample with the second sample, the second sample with the third, etc. Thus, each sample serves as the reference for the next sample, until we reach the end of the line of video. If we look at the TV signal, what we really need to transmit is the direction of the video from moment to moment (towards black or towards white) and how much. If we sample the video signal often enough, the changes from sample to sample can never be very large. The fastest and biggest changes are simultaneous.

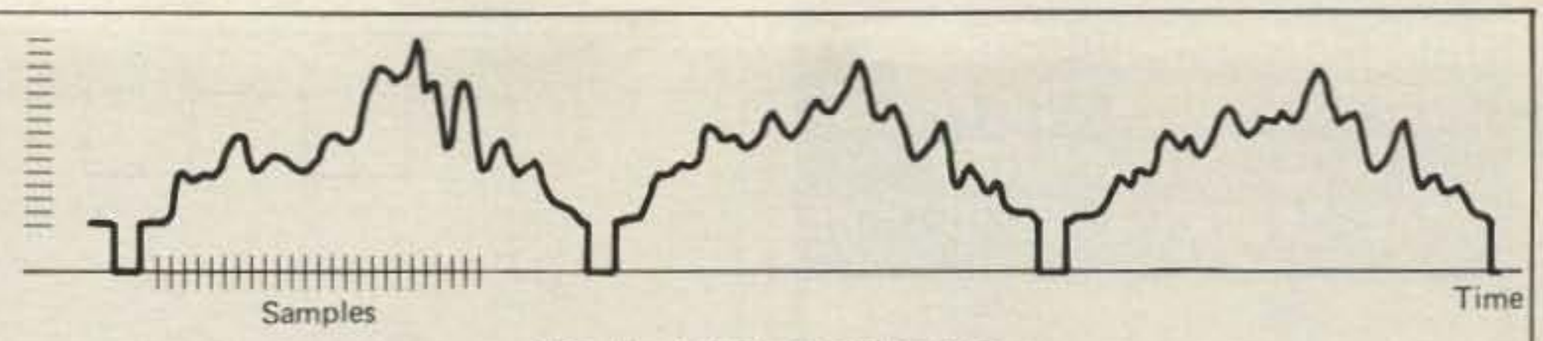


Fig. 1– A typical video line.

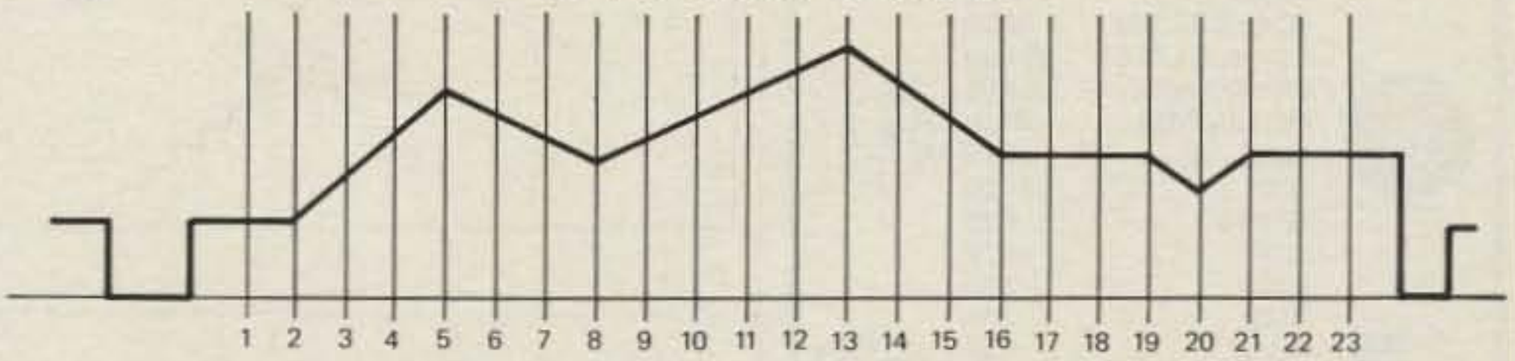


Fig. 2– For purposes of explanation, fig. 2 is a simplification of fig. 1.

If we have a picture which is black on the left side and white on the right side, we will send a series of samples that say there is no change, followed by a very large, quick change, followed by another series of no changes for the remainder of the white. A visual vertical grid of alternating black and white lines would be the worst case, since we would have to transmit a lot of changes, and all of these changes would be very large. But in real life, outside of test patterns, most of the TV pictures have a series of small changes between gray levels, or moderate changes from object to object. If our sample rate is fast, we can still represent these moderate changes, and with a little electronic trickery, we can even catch the big changes without too much delay. Since we are transmitting the differences between samples, or picture elements (we call these **pixels**, which stands for picture elements), let's call this **Delta Modulation**, delta being the greek letter we most often use to show a change when writing formulas and other scientific notation.

Let's look at a typical video line and how this would translate into delta modulation. Remember that all we can send is 0 and 1. Now in real life, we would have a very complex waveform as shown in fig. 1, and we would take a lot of samples per line, say 256 or 512. For discussion's sake, let's use a more easily understood waveform and less samples as in fig. 2. The principles are the same.

We see that the value of sample 1 is our start. Since it is close to black, we would send a 0. Sample 2 is a little more toward white, so we would send a 1. Sample 3 is a little more white than sample 2, so we would again send a 1. Sample 4 is a little more white than sample 3, so we would send another 1. Sample 5 is a little more white than sample 4, so we would send another 1. Sample 6 is a little less white than sample 5, so we would send a 0. And likewise for the entire line. Our transmission would be a series of 1's and 0's which would look like this:

01111000111110000100110

When there is no change, such as at sample 17 (18 compared to sample 16), we really don't have a way of saying *no change*. To compensate for this we simply send an alternating series of 010101. Since the largest change in a series of alternating 1's and 0's is only one level, if we use enough sensitivity (i.e., each change is only a very small amount), then the effect is very small. If the changes were very large, say from full white to full black at each 0/1 alternation, we would have a terrible picture.

If we say we are going to have 64 discrete levels in our final picture, then there could not be more than 1/64th change in brightness between samples. Therefore, a little fudging by alternating 1/0 to cover an area of equal brightness is not going to be easily noticed. However, there is a small drawback. The more levels you are going to have, the more samples it will take to get from full black to full white. Since we are only stepping one gray level at a time, it would take 64 samples to go from black to white. If we had only 64 samples per line, we would have a tough time drawing a checkerboard! We would end up with a single wavy line which would never get very far from the middle of the gray scale, depending on how many samples we had; if there are 8 samples per checker square, we would have a triangular wave with 8 gray levels (of our 64) from edge to edge, and back again, something like fig. 3.

While the desired picture is that shown for the input, our average output would look like the middle line. The actual signal would consist of 8 tiny steps up and 8 down as shown in the bottom line. However, because the pixels are small and we would view the picture from a distance, we would not perceive this aspect of the system, as our eye would simply blend the points together. Also, in a simple interlace scanning system the alternate lines on the display would be slightly offset and would provide an intermediate

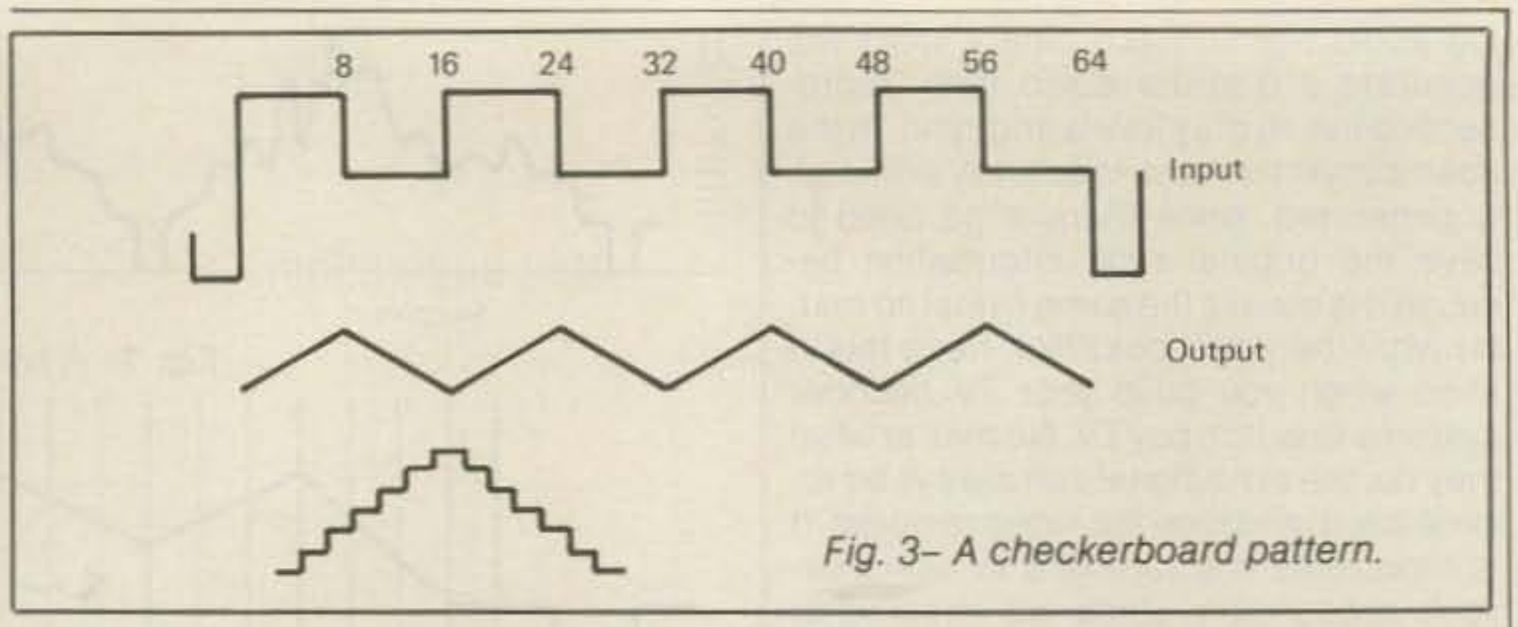


Fig. 3– A checkerboard pattern.

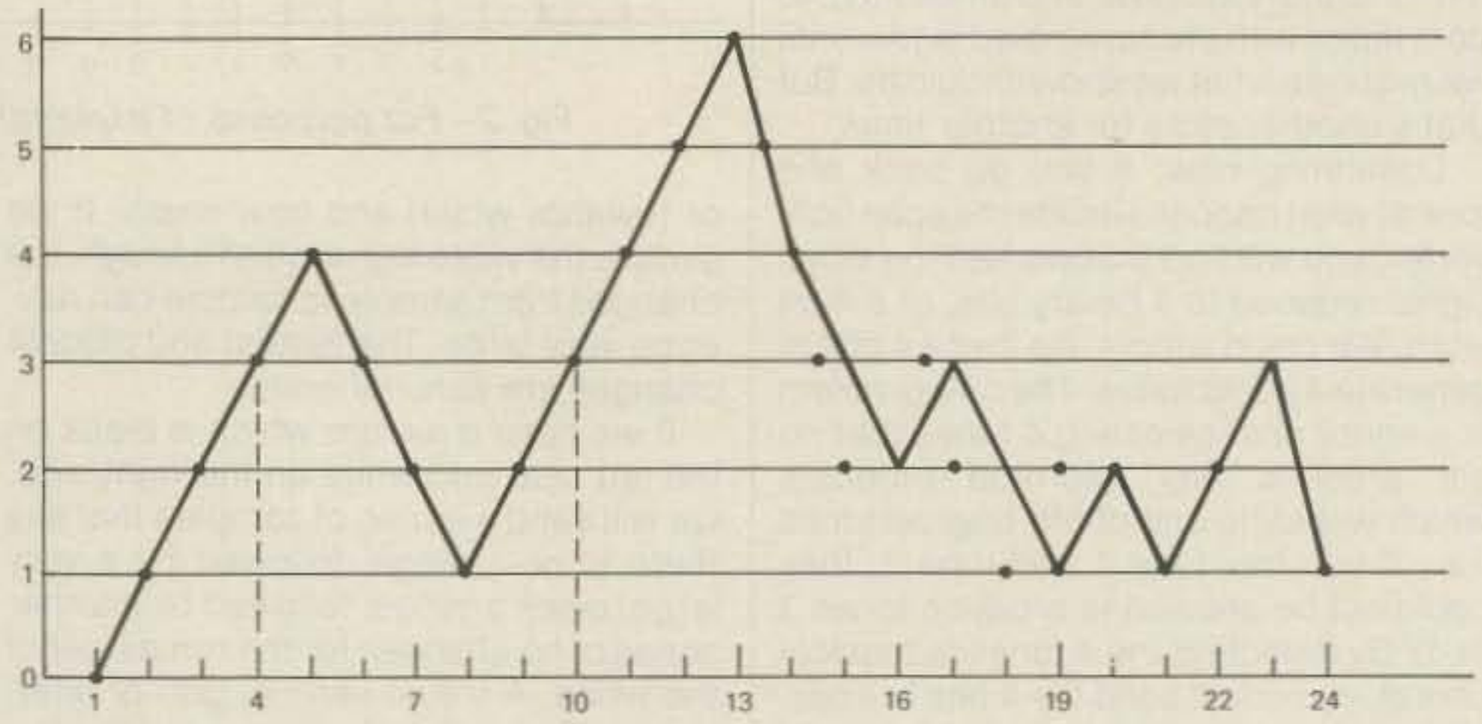


Fig. 4– A simple data train showing various samples with respect to gray levels. Details are explained in the text.

level as the two adjacent lines are visually merged, giving a smooth appearance. While this might be acceptable for a low-contrast picture, it is obvious that it adds a severe distortion to our checkerboard.

We could take more samples, say divide each of the 64 samples into 64 smaller samples (64 × 64), but this would create a very high data rate. We could also reduce the number of steps, say from 64 to 16, or 8, or 2. Each would provide a better and better reproduction of the desired picture. Since the checkerboard only has two gray levels, we could use a two-level video switch and we would have perfect replication of the gray levels. But when we change to another scene, with more information at more gray levels, we would have to change back to smaller steps. Now how can we do that?

If we examine the data train from our first example, you will notice that we have no difficulty following a gradual change. Samples 1, 2, 3, 4, 5, 6, through 15 would faithfully reproduce the waveform when reconverted from zeros and ones to the waveform. But what happens at sample 20? Depending on whether the flat area ahead of the 20th sample ends in a zero or a one, we either have a continued sawtooth, or a bump or bigger valley. What we need is a way of determining if the data series is actually following the data, or trying to catch up with the line. Let's look at a simple problem using the same line and give values to the various gray levels. We'll use 7 levels for simplicity.

Sample one is level 0.
Sample two is level 1.
Sample three is level 2.
Sample four is level 3.
Sample five is level 4.
Sample six is level 3, etc.

It changes our 0s and 1s as shown in fig. 4.

If we compare our generated waveform with the original waveform, we find that for the most part it follows rather well. When we get to the smaller details, the reconstructed waveform begins to depart from the original because of the quantization errors. From this we can see that the sample rate must be larger than the waveform to be reproduced. In commercial scan conversion and frame store units, a sample rate of three times the color subcarrier is used, as this is the minimum *Nyquist sample rate* required to reproduce the cyclical waveform. Because of the large number of samples and high frequency rates used in fast scan TV, a sample rate of four times the subcarrier frequency also works well. A sample rate that is much higher than the frequency of the detail is unnecessary, as you are only generating unnecessary bits and using a lot more hardware.

From all of this we can rationalize that the sample rate will be about three times the highest frequency we intend to reproduce. Thus, if we want to reproduce 64 bits per line, we need a sample rate that is 64 × 3, or 192 bits or samples per line.

However, we can cheat a bit with a little simple math.

For large changes we need either a very fast sample rate or large changes in reproduced level (larger steps). If we use large steps we end up with a severe contour artifact, since there are not enough intermediate levels of gray to produce a pleasing picture. Here is where our trick math system comes into play.

If you look back at the binary numbers that represented the delta or change in video level, you will notice that there is a basic pattern. As the change increases, the number of 1's increases, or the number of serial 0's increases. We can add a code recognition circuit which will count the number of series 1's or 0's. If there are three 1's or three 0's in a row, the counting circuit can say, "There is a large change here." We can now use our earlier binary system to do a little work.

If the change is large, there is going to be a series of the same numbers. If the number series is constantly trying to keep up, saying more more more in the same direction, we can accomplish the same change by using a new counting system—binary. Let's call this **Delta Delta,** since it represents a change in the rate of change—DD for short. When the incoming data says 111 or 000, the "rate" finder will say double the rate. Now we are taking twice the amount of gray-level change for each successive 1. Four 1's would give us a 6 level change. If we had another series of three 1's, we would double the gray-scale change again, or 4 levels for each 1. The same is true for going in the other direction with a series of 0's. Now we can accommodate large changes in gray level at a faster rate of change without increasing our data rate.

Our sample rate has not changed, so our amount of data to be transmitted has stayed the same. What *has* changed is the amount of change the data represents. If the series of numbers is alternating, then we know we are at or near the right level, since we know that alternating 1's and 0's are moving our representation only up and down by one gray level. We can now look again at a series of three incoming data bits and say that whenever the data bits alternate 010 or 101, we can ignore the changes and generate a flat area in the waveform. It would take a 001 or 110 to move up or down one level. The numbers are not alternating, and they are not a series of three of the same number.

With a little math trickery, we can now represent the waveform a little better with no increase in data. A 000 or 111 means a great change (double the rate of change), 001 or 110 means move up or down one, and 010 or 101 means stay the same. We can now use these three "words" to control the reproduction with more precision than our original 1 equals up and 0 equals down.

The last consideration is where do we start. The first data sample for a video line has no relationship to the last data sample from the previous line—not if we use the same scanning system we are used to. The usual scanning form is to start at the left side of the picture, go to the right, return to the left, and start over again. But in a digital world we have no need for this. It is much more likely that the adjacent lines in a picture are related vertically, rather than horizontally from end to end, since they are adjacent picture elements, not elements at opposite ends of the scan line. So why not reverse the scan line? Line one is scanned right as we normally do; line two is scanned left in the opposite direction. We can now use our same comparator to look at the last bit (the far right) of line one and the first bit (at the far right) of line two. We now maintain our same comparison for an entire frame; each pixel is compared to the previous pixel.

At the start of a frame we have no real idea of where to start. The first pixel of the first line is not related to the previous frame unless we are sending still pictures. However, the purpose of reducing the amount of data required to send one picture is to be able to send the pictures faster, which affords motion! Now in any analog video display, such as your CRT,

there is a bit of time required to move the scanning electron beam back to the top of the picture. We eliminate the horizontal "flyback" or blanking time by using a simple reverse scan system. Now the time to go from left to right is the same as it is to go from right to left. If we try this at the vertical rate, we have a bad visual flicker because of the decay of the display produced at the top of the picture between the time we started and the time we got back. If we reverse scan vertically, we double the amount of time between scans over the same spot at the top of the screen.

We can put this time to good use. After we send a *"go to the top and start over again"* sync pulse (vertical sync), we can send a little data. In fast scan TV we already do this. After the vertical sync pulses, but before the start of the active picture, we insert all sorts of information. This information is in the form of various test signals such as **VIR** (**V**ertical **I**nterval **R**eference), **VITS** (**V**ertical **I**nterval **T**est **S**ignals), and lately, closed captioning, which prints out the text at the bottom of the screen for hearing-impaired viewers.

We can also insert some intelligence into the same time period. We will send a *"look ahead"* or *"peek"* at the first bit of digital video. What we need is a simple binary word which tells us where to start. If we continue the same 16 gray levels used in analog slow scan, we need only a 4-bit binary word to tell us from what level to start counting. If we need more gray levels, we simply use a bigger *"peek"* word. If we make an arbitrary start, we might be right or dead wrong. If we always start from video black, and the real picture is video white, we will be completely wrong, and vice versa. It will take as many data bits as gray level error to catch up to the first pixel, and by then we will be partway across the screen and always behind until the video and data cross or meet somewhere towards the middle. If we always start at the middle gray level, we will be starting closer, but only once in a while will it be right. So let's use the *"peek"* system to get started at the right point.

So there you have it: a way to send SSTV with a faster frame rate, less spectrum, since we are only sending one data bit per pixel, and our replica will be close to the original. To summarize, let's pick a few numbers and start experimenting. Let's continue to use 16 gray levels. This will keep our data sample rate within reason. We need only 5 bits to go from full black to full white. We will use a series "detector" to keep track of the data trend, looking for 111, 000, 100, 001, 110, 011, 010, and 101. We will use reverse scanning on alternate lines so there is a better chance of having a small error or no error on the first bit of each line. Let's use 64 or 128 pixels per line to further keep with current SSTV standards before we settle on "optimized" rates, and let's use RTTY shift keying (FSK or AFSK) so we can use existing hardware to detect the two signal states (0 and 1) and stay within current bandwidths.

Since this new system is not listed in the FCC annals, we will have to get some STA's to use it on the air. However, we can work on it "closed circuit" or with intermediate conversion to ASCII or such on the air. With higher data rates such as that used for Packet radio, it should be possible to have motion at rates of 2 or 4 frames per second within voice bandwidth, and perhaps as high as 8 frames per second using the medium scan bandwidth as used by Don Miller, W9NTP, and others working in this same arena.

I hope this gets your thought processes working! 73

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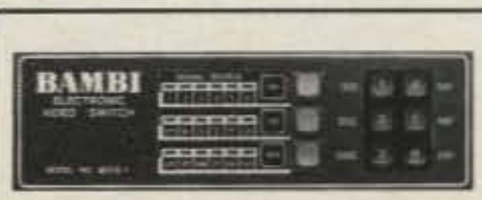

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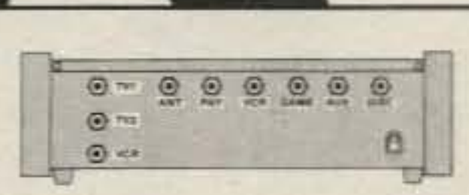

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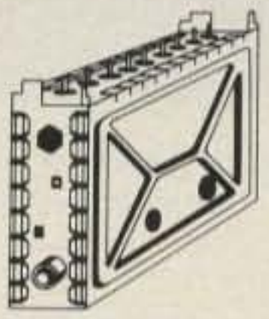

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W3BYM recycles one of amateur radio's golden oldies into his new linear amplifier. A venerable DX-100 plus parts and patience yielded this impressive addition to his shack.

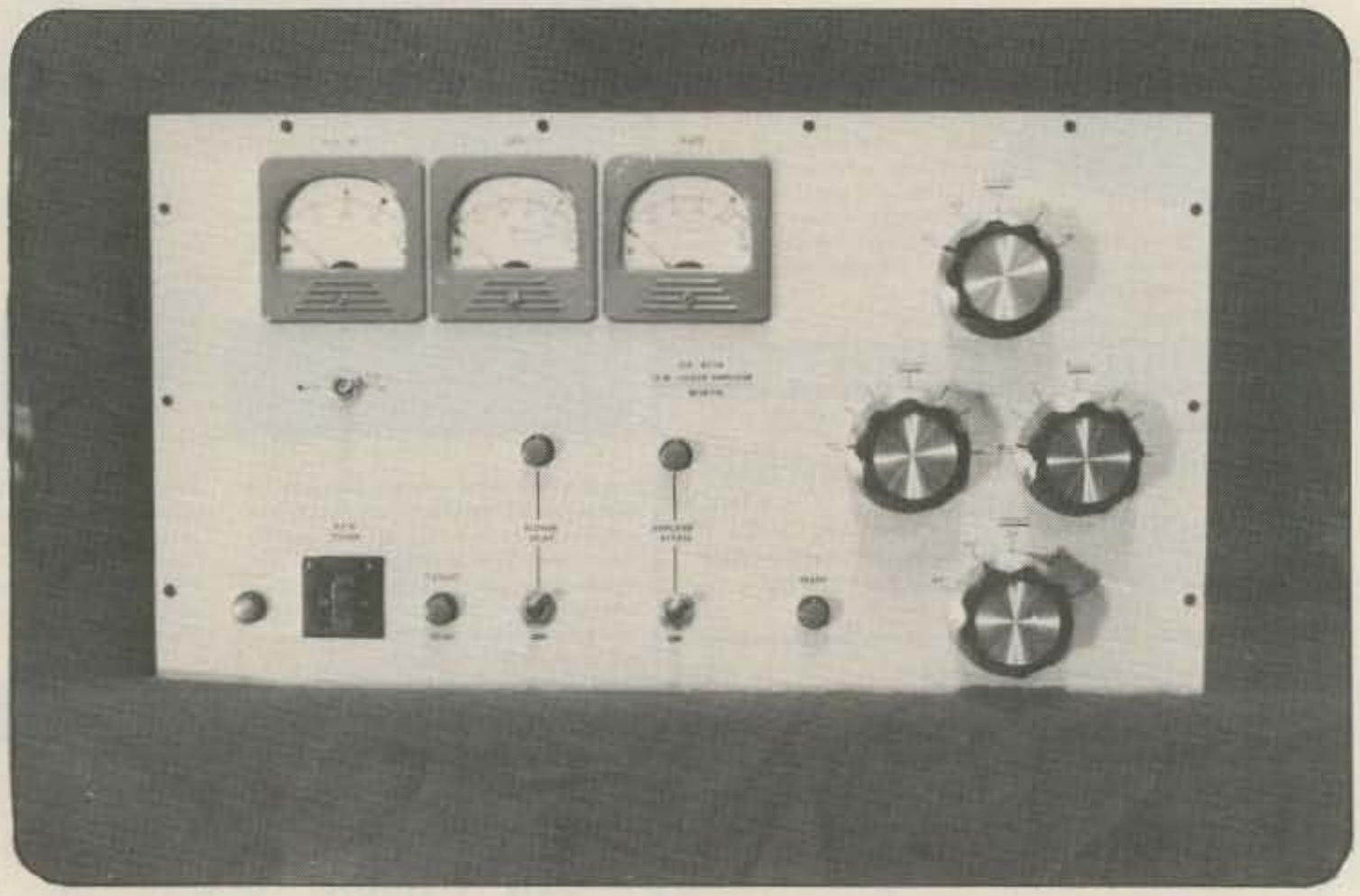
How To Build The DX-811A All-Band Linear Amplifier

BY F.T. MARCELLINO*, W3BYM

This project began in the summer of 1981 at a hamfest held at the Howard County Fairgrounds in Maryland. I purchased a real treasure that day for the grand sum of $15—a DX-100. The seller, sensing a fish on the hook, quickly loaned me his wheel cart for hauling my 100-pound purchase. For those of you too young to remember, the DX-100 was a real workhorse a.m., c.w. transmitter introduced about 1956 by Heathkit, and featuring 15 tubes, including a pair of 6146's in the final and a welded No. 16 gauge copper-plated steel chassis. The painted steel cabinet used double-lapped joint construction, giving excellent rigidity and r.f. screening.

I had no intention of restoring the old rig, but the idea of designing another linear amplifier using that enormous chassis, panel, and cabinet was an appealing challenge. Besides these three parts, the old rig contributed many high-quality components to the new project. These included brass panel bushings, shaft couplings, one E.F. Johnson plate tuning capacitor, ceramic tube sockets, and several pre-bent partitions.

Work began immediately by completely stripping the chassis and sorting the useful components. As the hours passed, I often thought of how I would have given my eyeteeth to own this rig in the mid-50s. But my thoughts soon turned to visions of replacing my trusty SB-220 with another homebrew linear, this being my third. You may ask, why would anyone want to replace the SB-220, especially when it's paid for and is such a good performer? The answer is simple to understand if you are a practical-minded, serious homebrewer. My old linear has fulfilled my station requirements admirably, while I've spent non-operating hours collecting information and components to eventually produce a linear of my own. In my case, this time spanned three years and the completion of the third linear. On the economic side, think of the replacement cost of just one 3-500Z—a mere $125.



Front-panel view of the DX-811A amplifier. The unit shown out of its cabinet is quite professional in appearance and bears no resemblance to its noble ancestry.

The new project presented many mind-boggling problems, with the most perplexing being what to do with all those chassis and front-panel holes. The excess chassis holes were simple to deal with. I just discarded the top plate and replaced it with a solid aluminum sheet. The front panel, as you can see in the photos, is original. Many of the holes were retained, some new ones were drilled, and some were filled. Filling of the unused holes was treated like repairing a dent in a car's fender. I first applied pieces of metallized tape to the back of each hole; this provided electrical contact to the chassis front and a base for the Liquid Solder™. A flat washer was placed in each hole along with a small amount of solder. Allowing the solder to dry as indicated by the instructions and then sanding and using additional applications as needed produced a very smooth surface.

The major goal in the design and construction of this project was to produce a quality 1 kw d.c. input linear amplifier having good reliability using affordable tubes and components. Early in the design phase I established these minimum requirements: (1) 1 kw d.c. input using 811A tubes, (2) filament inrush protection, (3) rectifier transient protection, (4) filament warm-up delay, (5) amplifier bypass capability, (6) simultaneous metering of the plate current, grid current, and HV, (7) blower delay and speed option, (8) lamp indicators for all vital functions, and (9) tuned input circuits. Some of these features are incorporated into commercial linears, but many are not because of added cost and size in the final product. These reasons become low priority to the homebrewer who has access to hamfests and other swap sources for his components, along with the imagination to design whatever he desires.

In this project the power transformer (Berkshire 6181) is rated at 600 v.a., and

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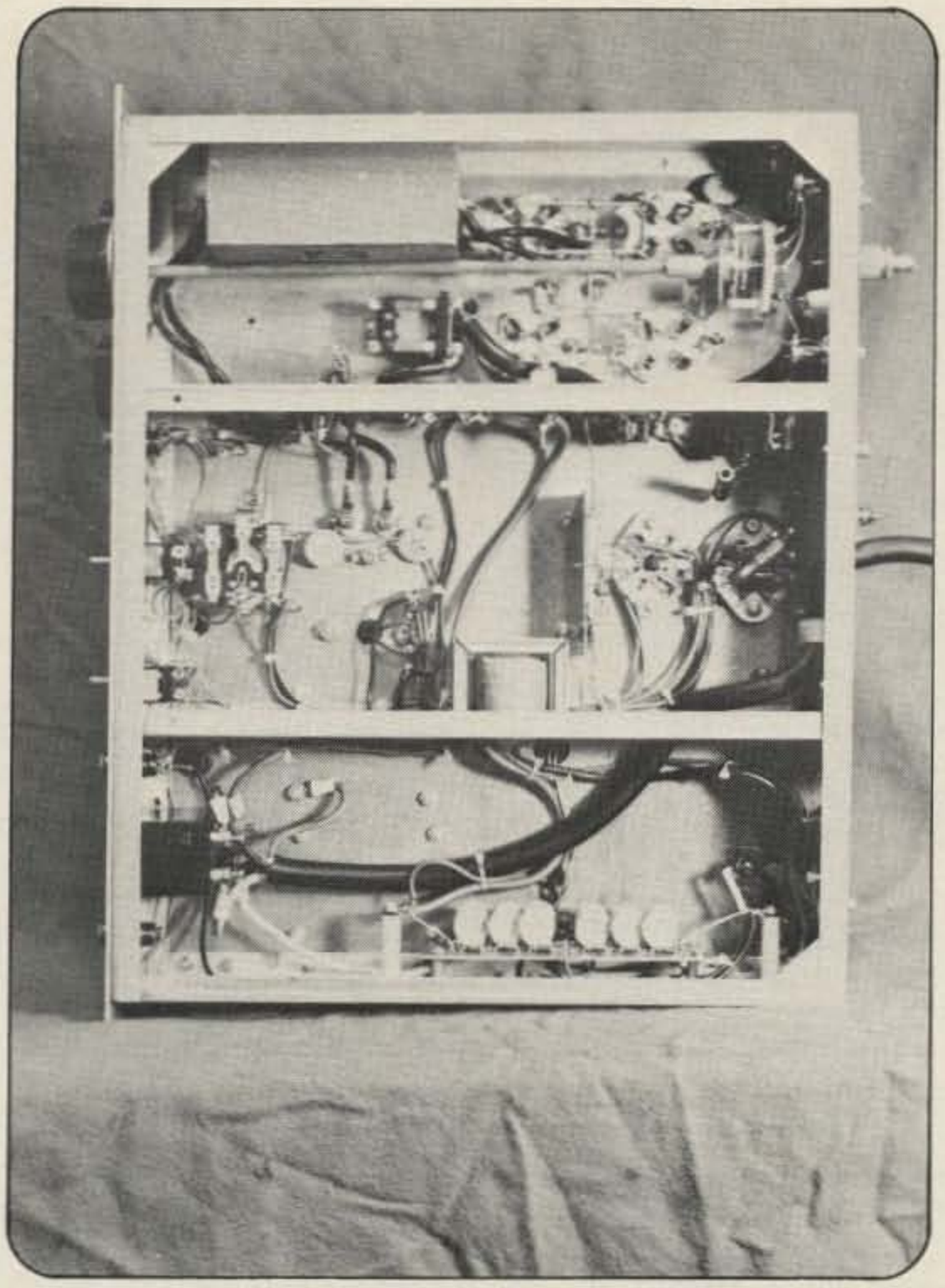
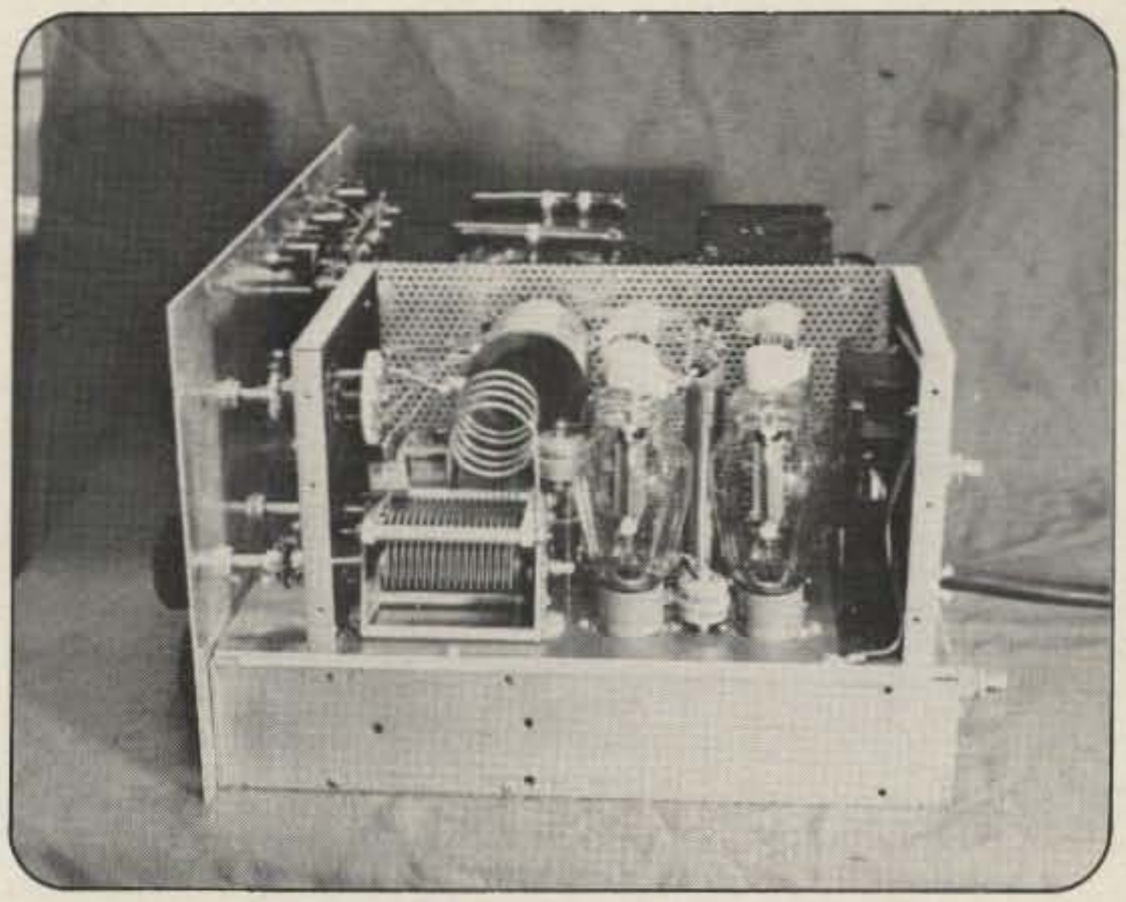




Side view showing r.f. output section.

Bottom view showing the three major compartments. Top, r.f. input circuitry; middle, low-voltage power supply and control circuits; bottom, rectifier stack and primary switching.

when rectified and filtered, it produces a compatible voltage of 1540 v.d.c. for the 811A's. I would also stress the use of a filament transformer having 25% additional current capacity. Also, buy a healthy quantity of .01 uF disc ceramic bypass capacitors rated at 1 kv. For this project I used 30 of the 1 kv type and another dozen of the 50 v.d.c. variety. If you want to keep power lines clean of r.f., bypass capacitors and r.f chokes are mandatory. Complete your circuit diagrams and chassis layout designs, and then prepare a shopping list. Carry the list with you to a hamfest or on friendly visits to other ham shacks. You never know when one ham's junk will be your treasure.

In my project the power supply shown in fig. 1 is comprised of three transformers with their primaries connected for 220 v.a.c. operation. All circuitry is protected with the front-panel dual circuit breaker which doubles as the main power switch. Relay K1 and its contacts in parallel with a 75 ohm 10 watt resistor form the necessary inrush current protection. All secondary voltages reach full power in about 4 seconds after simultaneous closure of CB1 and CB2. The rectifier stack is conventional with equalization resistors and transient bypass capacitors. I recommend using the Radio Shack No. 276-170 circuit board for mounting all the rectifier components.

The filters are likewise conventional with a pair of center-tapped 25K ohm 50 watt resistors used for voltage equalization and bleeders. Notice that I mounted these resistors on top of the capacitors. They normally run very warm, producing heat that will escape through the cabinet top and not affect other parts. One additional tap was added to the bleeder string about 5K ohms above B– for HV metering. The B– is raised above chassis ground by the 10 ohm 10 watt resistor and bypassed with a .01 uF capacitor. This point now becomes the amplifier's high-voltage return via the plate current meter.

The r.f. amplifier section is shown in the circuit diagram of fig. 2. This circuit uses many conventional features and one that surprisingly isn't found on many 811A amplifiers. The grids are hardwired to chassis ground, thus improving plate-to-cathode isolation with true grounded grid operation. Most of the circuits I reviewed use bypass capacitors from grids to ground which lift the grids off d.c. ground for biasing purposes. This is an acceptable method for r.f. grounding the grids and provides a means of supplying external cutoff bias to the tubes.

I selected the Zener diode method of bias because it is easy to install in the center tap circuit of the filament transformer and provides the necessary operating bias, which is again not used on many 811A amplifiers. *Caution:* If no bias is used, the resting plate current will be 150 ma for the four tubes. When the amplifier is keyed up and tuned for full power, the tubes will reach full plate dissipation capability very rapidly, as evidenced by glowing red plates even with maximum blower cooling. Maximum output power will be attainable, but the tube plates will literally deform and eventually fail with repeated use.

My bias circuit, which isn't new, uses a 10 watt Zener diode having a value of 4.7 v.d.c. and a 50K ohm 10 watt resistor for biasing the four tubes. This circuit is located in fig. 3. The voltage drop across the Zener plus the drop across the resistor provide cutoff bias, frequently called standby bias. This level is reduced to operating Zener bias only when K2 is closed by the VOX signal.

As shown in the rear panel photo, the biasing components are attached to a universal PC board which is supported by the grid meter terminals. The Zener diode is not mounted on this board, but rather is placed directly underneath on the main chassis using insulating washers.

In the event that abnormally high plate current is allowed to flow, the Zener will be protected by the series fuse. This could occur if the amplifier is overdriven before the final tank circuit is in resonance. With the fuse blown, the biasing circuit would be open-circulated, allowing plate current to flow through the tubes

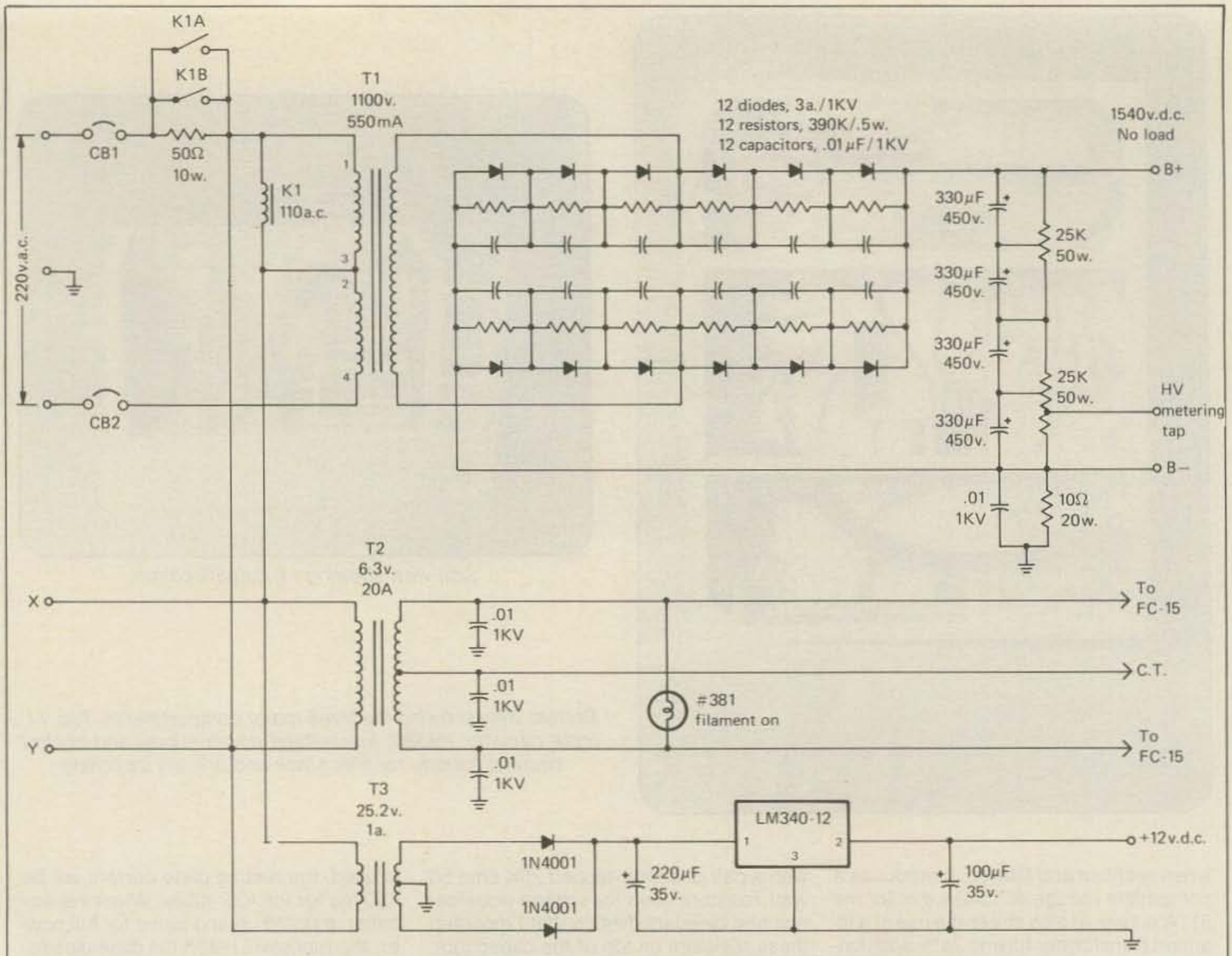
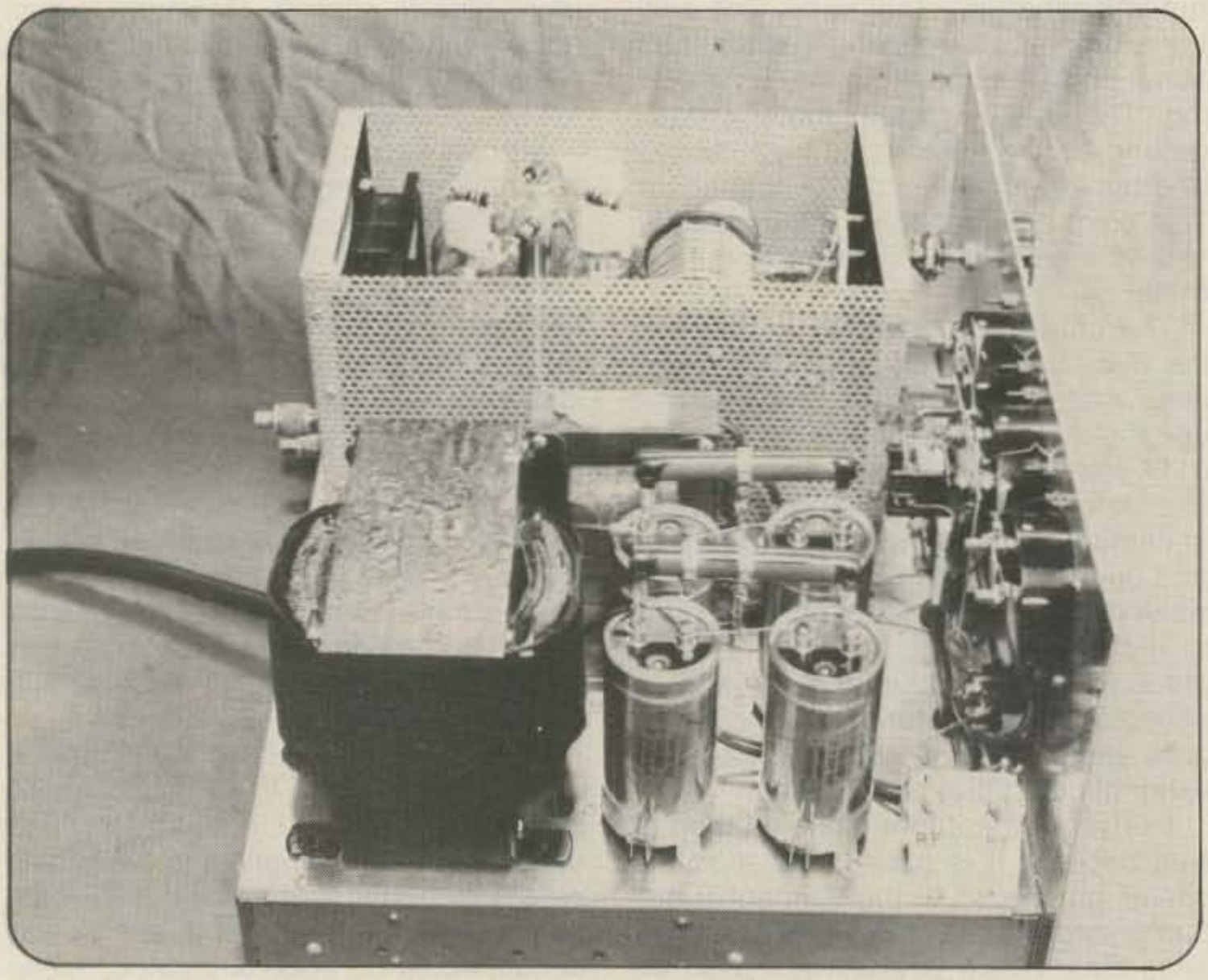


Fig. 1– Power supply circuits for the DX-811A amplifier. Details are described in the text.



Side view showing high-voltage section, r.f. and HV calibration controls.

in their idle state. This condition would not be indicated by the plate current meter because it likewise would be open-circuited by the blown fuse.

To prevent the occurrence of what has just been explained, I installed a protective resistor in parallel with the Zener and fuse having a value of 10K ohms and 10 watts. This resistor is ineffective with a working Zener/fuse circuit, but will supply the necessary protective bias in the unlikely event of a blown fuse.

Filament current is fed through a commercial, shielded r.f. choke which is rated at 15 amps. Although the four tubes draw a total of 16 amps from the 20 amp transformer, the extra one amp is easily dissipated by the choke.

The dimensions for L6 and L7 were taken directly from the *Radio Handbook* by Bill Orr (21st edition, Editors Engineers, Div. of Howard W. Sams & Co., pp. 22.6–22.8). The only problem I encountered was with 10 meters and my 350 pF tuning capacitor. To resonate the coil I had to short one turn of L6 using a piece of braid. The reason for this was the additional capacity of the four tubes adding to the large tuning capacitance.

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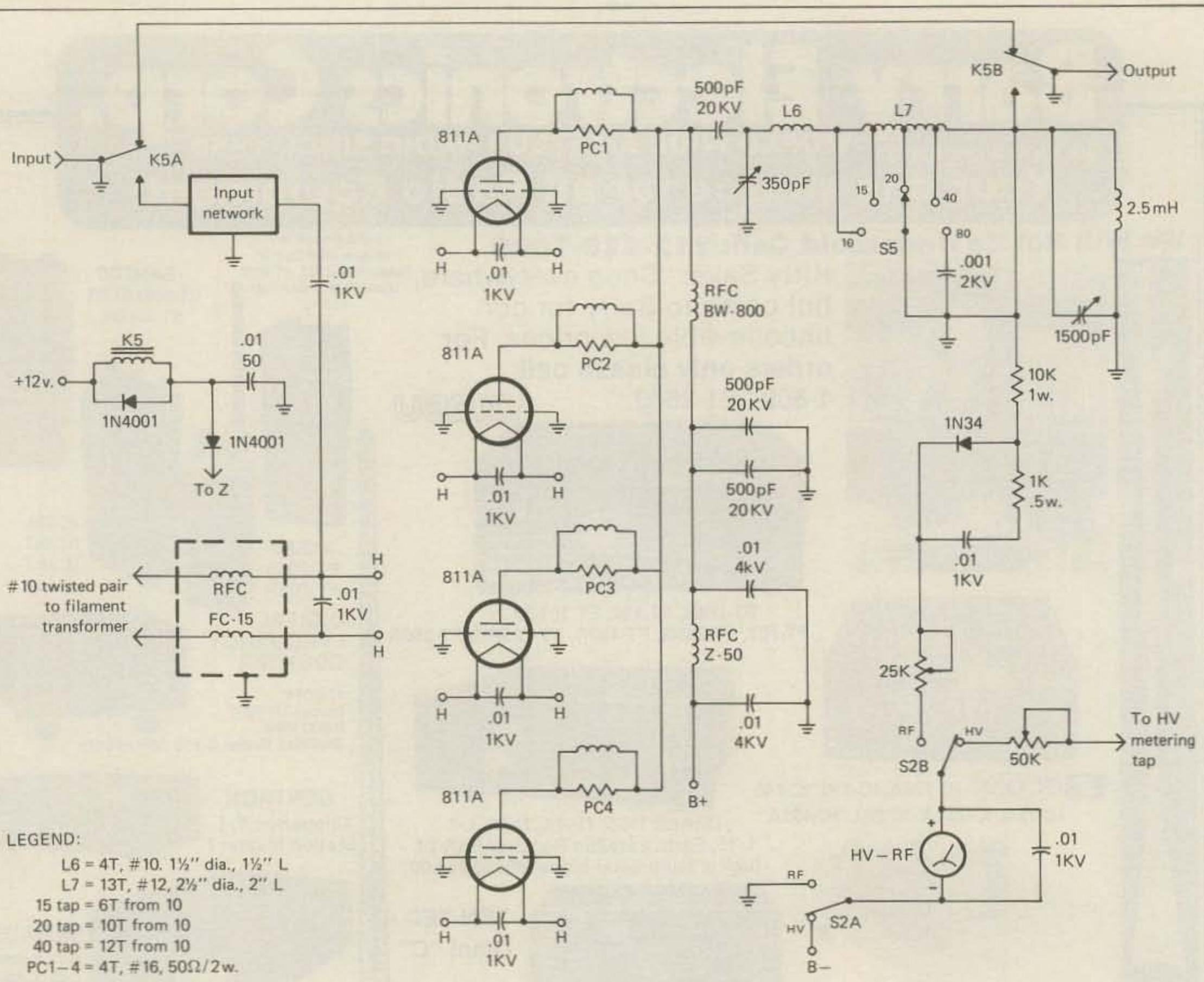

LEGEND:

L6 = 4T, #10. 1½" dia., 1½" L
L7 = 13T, #12, 2½" dia., 2" L
15 tap = 6T from 10
20 tap = 10T from 10
40 tap = 12T from 10
PC1–4 = 4T, #16, 50Ω/2w.

Fig. 2– The power amplifier circuit.

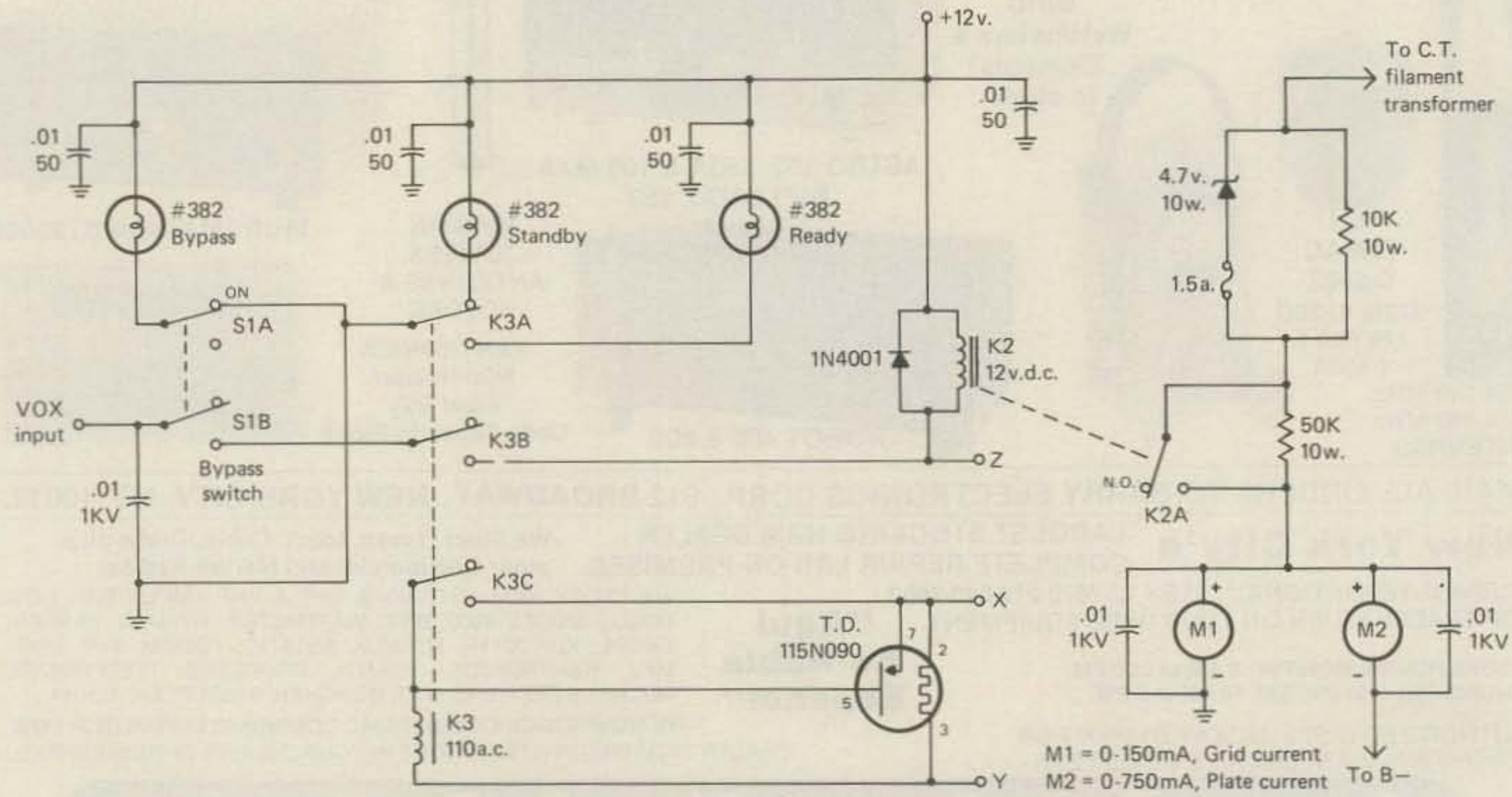

Fig. 3– Bias and control circuitry for the home-brew linear.

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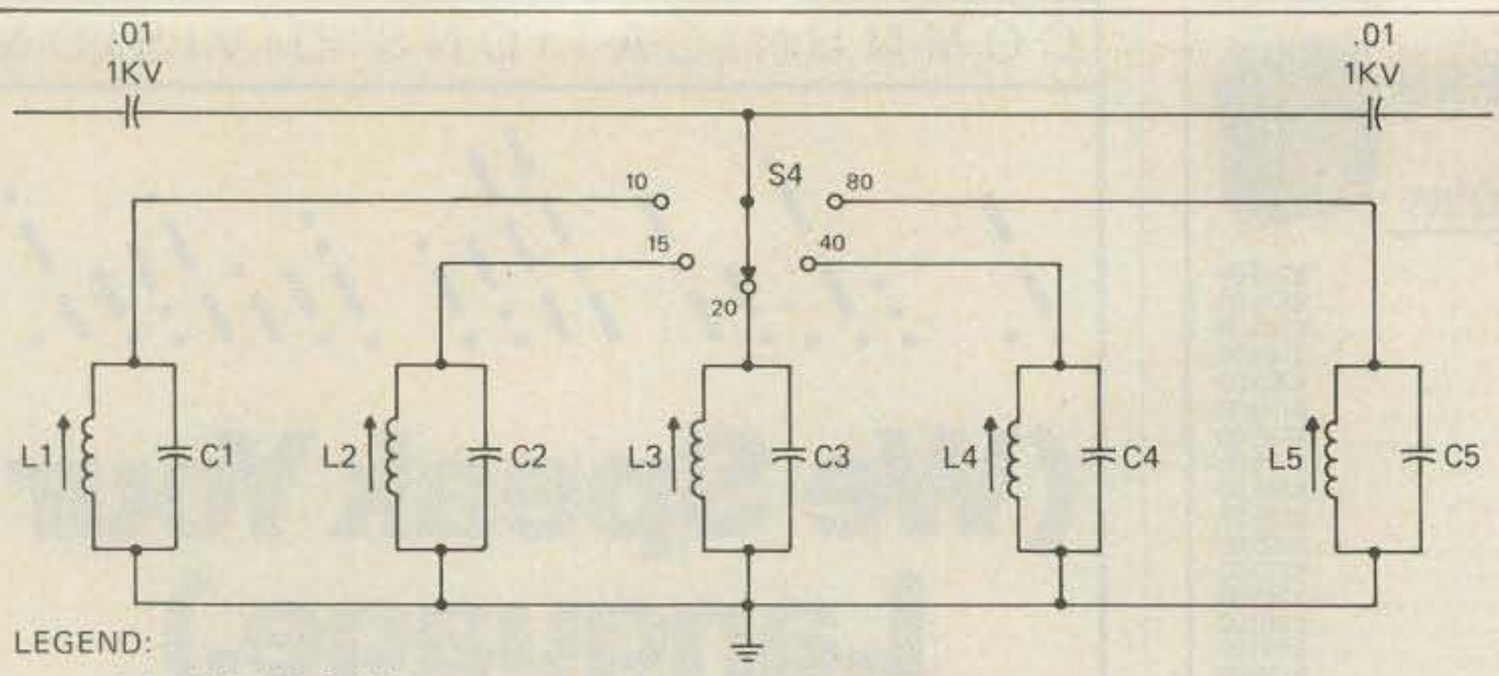


LEGEND:

L1 = 4T, #16, 3/8" form
L2 = L3 = 6T, #16, 3/8" form
L4 = 12T, #16, 3/8" form
L5 = 12T, #16, 1/2" form

C1 = C2 = 200pF, 500v. mica
C3 = 390pF, 500v. mica
C4 = 680pF, 500v. mica
C5 = 1000pF, 500v. mica

Fig. 4– Tuned input circuitry. Slug-tuned phenolic coil forms are used for L1 through L5.

Placement of the taps on L7 was the last operation performed on the linear. There are several factors which should be considered when this is done. I highly recommend the use of a calibrated dip meter to aid in correct placement of the taps. Although I have stated the number of turns for each band, these values will only hold for this linear. Chances are your layout and/or capacitances will be different, presenting new situations. But let's ignore these differences for now, because the procedure will be the same. Place all tubes in their sockets with completed plate circuits connected. Then connect a 50 ohm dummy load using one of the following methods: connect to the output r.f. connector and close K5A/B by nonelectrical means, or connect to the top of the 1500 pF loading capacitor. Place the input and output band selectors to the same band—say 40 meters. Set the loading and tuning capacitors near the center of their ranges. Using the dip meter, find the exact tap point. You will have to rotate both capacitors to resonate the inductors. If your antenna is close to a 50 ohm system, these same settings will also provide maximum r.f. transfer. The other band taps are located in a similar fashion.

The input circuits should be peaked at this time. The values for L1–L5 and C1–C5 can be found in fig. 4. I used phenolic instead of ceramic forms for all the inductors. The ceramic forms resonated okay, but produced a much smaller notch. All coils are slug tuned and have closely wound inductors using enamel-coated wire.

The two welded main chassis partitions provided many mounting holes that were used to hold various components, tie strips, and relays. One additional hole had to be drilled for the HV ceramic feedthrough. This hole was difficult to install, but by using progressive drill sizes and working from both sides of the partition, it soon became the required 3/8 inch diameter. The HV feed line is brought to one side of the feedthrough, and the other side picks up with RFC Z-50 to the second feedthrough. Notice the use of bypass capacitors on the tube sockets and HV line. In addition, notice the use of solid No. 12 bus wire connecting the filament pins in a symmetrical arrangement.

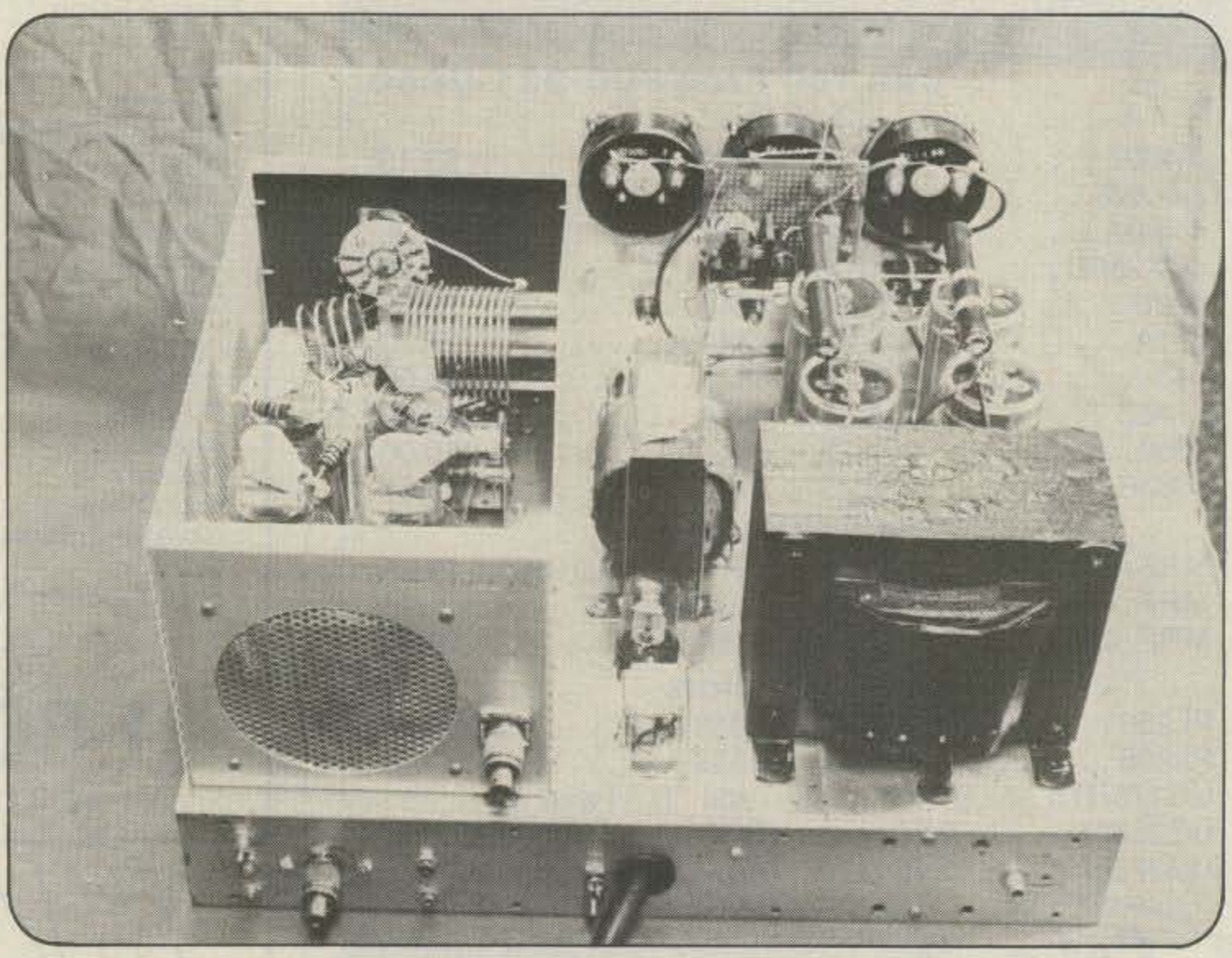
All components used in the r.f. output meter circuit, except for the calibration pot, are mounted in the output compartment. The rectified signal is conducted down through a feedthrough located near the rear of the loading capacitor on the chassis top.

The amplifier control circuit is shown along with the previously explained bias circuit in fig. 3. Vital functions are initiated by the transceiver's VOX signal. If amplifier bypass is required, S1A/B when switched ON will indicate the event by lighting a lamp and opening the VOX line. After initial turn-on via CB1 and CB2, the amplifier cannot be placed on line until the time delay relay has closed. This forces a needed warm-up time for the 811A filaments. When time delay contacts 5 and 7 close after the nominal 1 minute waiting period, K3 will close. This event is automatic and will be indicated by the transfer of the standby to ready lamp. The amplifier is now ready to be tuned once the transceiver closes the VOX line to ground.

The blower control circuit that I used has some interesting features. I wanted to eliminate or reduce the annoying blower noise, especially when the linear was sitting at idle with zero plate current. Additionally, I wanted full blower operation to commence automatically with the VOX signal. I did try complete blower elimination during standby, but with such close tube proximity the tube filaments produced undesirable heat concentrations.

After some experimentation I finalized the circuit that is shown in fig. 5. The blower delay circuit is actuated when S3A/B is in the ON position. With this condition set, the blower will turn at about one-half speed because of the series 250 ohm 10 watt resistor. Yes, the resistor will get warm, so be careful where you mount it. When the amplifier is initially turned on, the standby delay ON lamp will indicate this event.

When the amplifier's ready lamp comes ON and the VOX signal grounds Z, the 555 timer is triggered, closing K4, providing full power to the blower, and turning off the blower delay lamp. The 555 is wired in a negative trigger monostable circuit. Its output will stay in the second state as long as Z is momentarily grounded within the delay period. In other words, the blower will be running at a low, quiet speed until the VOX line is keyed.



Rear view, r.f. cage top not installed, showing thermal and surge relays (center, rear of chassis) and screened blower input. The input tuned circuits are nested around the r.f. input connector. VOX input is on right side of chassis.

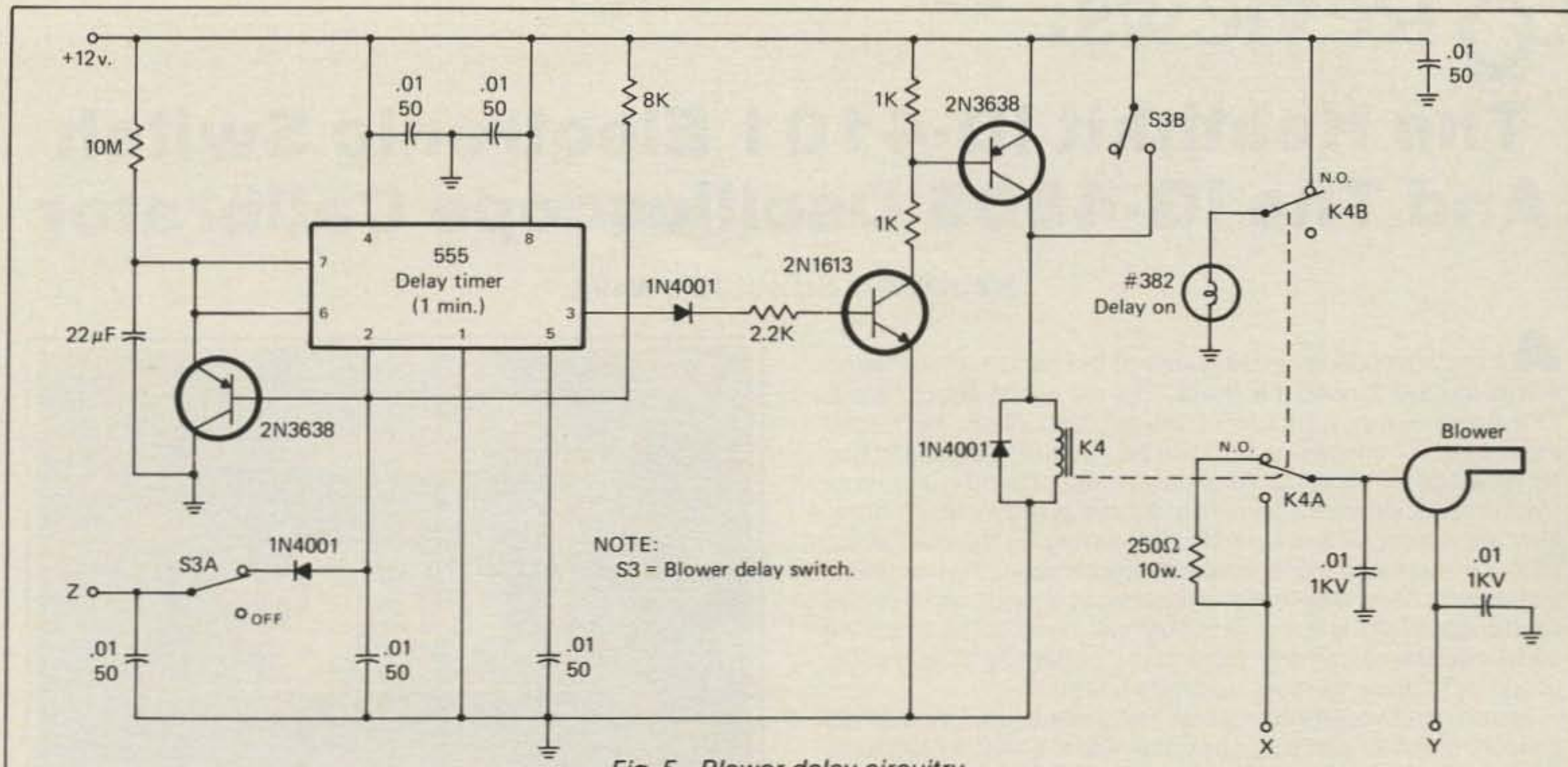


Fig. 5– Blower delay circuitry.

Then full blower operation will start and continue for the duration of the transmission, producing maximum cooling when it is most needed. After the last Z grounding or final dot/dash, the 555 will start its last timing cycle. When completed, its output will revert back to the original state, returning the blower to low speed.

I've set the delay time for 1 minute, and this has been adequate to cool the tubes to a safe level before the blower reduces speed. Full blower speed all the time is achieved through S3B's OFF position, which connects K4 directly to the +12 v.d.c. line. With c.w. mode used 100% of the time, I've never needed to use this position. The 555 delay time can be changed by substituting a different capacitor for the 22 uF unit that is connected to pin No. 7. False triggering is prevented when S3 is OFF by the 8K ohm resistor connected to pin No. 2, keeping that pin high.

The output of this linear compares very favorably with my SB-220 when either is driven by my HW-101. Using the same wattmeter and dummy load, each amplifier will produce 600 watts output at 1 kw d.c. input. The driving power for each ranges between 60 and 80 watts, depending on the band used.

Typical values required to produce 600 watts output from the DX-811A are grid current of 120 ma, plate current of 750 ma, and a loaded plate voltage of about 1450 v.d.c. The plate voltage drops about 100 v.d.c. from zero to full load. As with all linears, an r.f. wattmeter is essential for tuning-up and attaining maximum power transfer into the load.

With the completion of this linear, on-the-air reports have been truly gratifying. I feel that all design goals have been exceeded, and I now have another reliable, long-lasting piece of ham gear. I'm so confident of this that I've sold my trusty SB-220. Speaking from experience, this being my third linear as I mentioned earlier, once again proven is the old saying that if you persevere and learn from your mistakes, the end product will ultimately be a success.

For those of you contemplating a similar project, I hope my presentation of the DX-811A will be helpful. Admittedly, tackling a project of this complexity did occupy a large portion of my time for about six months, and were it not for a very understanding XYL, it may never have been completed.

If I can be of further help to anyone interested in building a similar linear, or if there are areas that need clarification, please let me hear from you.

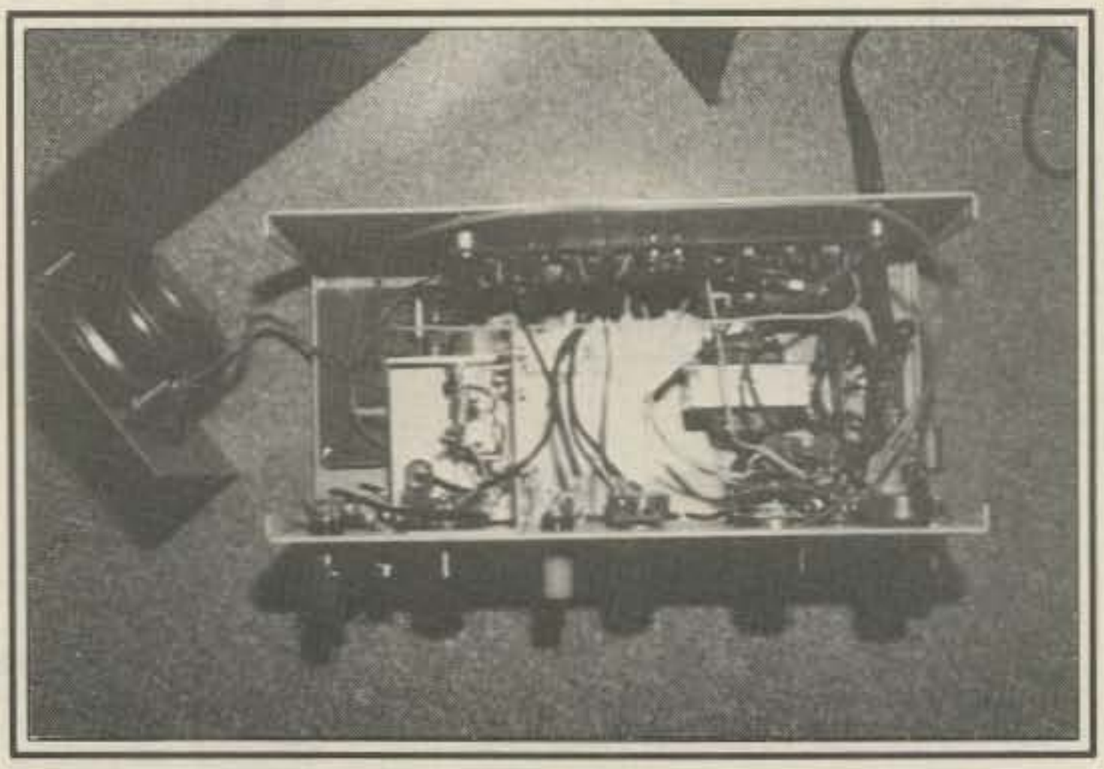
CQ Reviews:

The Heathkit ID-4101 Electronic Switch And The IG-4505 Oscilloscope Calibrator

BY JOHN J. SCHULTZ*, W4FA

An oscilloscope is certainly one of the handiest test instruments to have around the shack. The old cliche about "a picture being worth a thousand words" can easily be turned around into "a scope presentation being worth a thousand meter readings." Following the general trend of good quality hobbyist test equipment becoming available at reasonable prices, new oscilloscopes are now also appearing on the market, so probably more and more amateurs will be acquiring this useful instrument. Assuming that one purchases a moderately priced oscilloscope, an interest probably will develop in acquiring some accessory items to expand the capability of an oscilloscope or to allow its more accurate usage.

Heath has two interesting test instruments designed as accessory items for oscilloscopes: the Model ID-4101 Electronic Switch ($57.95) and the Model IG-4505 Oscilloscope Calibrator ($57.95). After one has used an oscilloscope for a while, either one or both of these items might be of interest. Besides their specific applications with oscilloscopes, both instruments can have a number of general-purpose applications around a ham shack.



This is photo shows the placement of the audio amplifier PC board added to the ID-4101 and the mounting of the loudspeaker in the top cover of the enclosure.

The ID-4101 Electronic Switch

The ID-4101 Electronic Switch is a solid state version of an oscilloscope accessory that has been around for many years. The basic functional diagram of the unit is shown in fig. 1. There are two independent amplifier chains, the output of each going to an electronic switching circuit. The electronic switch is driven by a square-wave generator, so the output of each amplifier is selected for the same period of time. If the output of the switch is viewed on an oscilloscope, the output of each amplifier in the switch does not appear in the same location on the oscilloscope screen. Rather, due to an offset voltage provided by the ID-4101, one display appears on top of the other. Therefore, one can simultaneously view the two outputs for comparison purposes. The square-wave generator which drives the electronic switching circuitry has four selectable output frequencies (100,500, 1000, and 5000 Hz), so one can select the frequency that provides the best display.

The uses for the switch are multifold whenever one wants to compare two circuit conditions. For instance, one can simultaneously view the input and output of some audio circuit, such as a compressor or clipper, and see how the input changes the output conditions. This can be done with r.f. circuits also up to 5 MHz if the oscilloscope has the necessary frequency response. So, one can check the linearity of low-level r.f. stages, the balance in mixer stages, comparative performance of different filter circuits, etc.

On the other end of the scale, one can also perform a variety of comparative measurements on d.c. circuits, since the two amplifiers in the switch are d.c. coupled. One can simultaneously check two d.c. voltages in a circuit or even the relationship of some a.c. voltage to a d.c. control voltage. Note that in the case of comparing two d.c. voltages, an oscilloscope is *not* necessary. One can also connect the output of the switch to an ordinary v.o.m.

Each amplifier in the switch is actually a 7 transistor unit with a d.c. to 5 MHz bandwidth and provides up to 20 dB of gain. There is a fixed input attenuator with 1, 10, and 100 volt ranges,

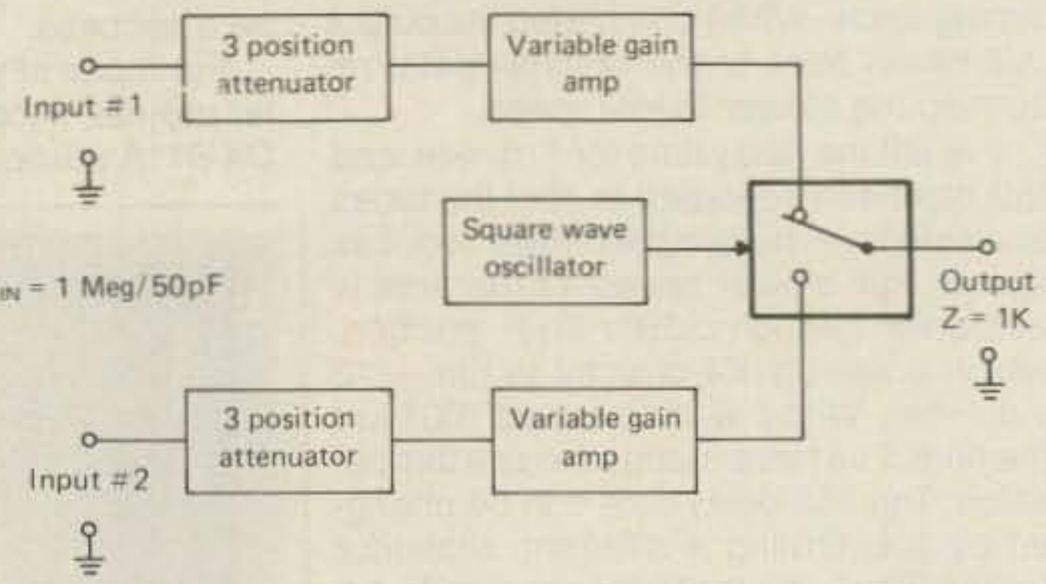


Fig. 1– Basic functional block diagram of the Heath ID-4101 Electronic Switch.

and also a variable gain control for each amplifier. Although not shown in fig. 1, the output switching arrangement in the unit is such that one can obtain not only the switched output, but also the independent outputs of either amplifier or the square-wave generator. This allows quite a bit more versatility.

For instance, each amplifier has an FET input (1 megohm) and an emitter follower output (1K ohm). Therefore, either amplifier can be used as a preamplifier in experimental circuits. The high-impedance inputs are over-voltage protected, but to maintain their broad frequency response, they contain no r.f. bypassing. When used as an experimental audio preamplifier, it may be necessary to place an r.f. choke in the inputs to prevent overloading from r.f. fields. The high-impedance input combined with the d.c. response also allows the amplifier to be used with an inexpensive v.o.m. to avoid circuit loading when making a d.c. voltage measurement. The output of the square-wave generator has a good rise time, so it can be used, for instance, to make square-wave response measurements of an audio amplifier in conjunction with an oscilloscope.

Construction of the ID-4101 kit is quite straightforward. Almost all of the components, except for the controls, switches, etc., mount on one PC board. The kit can easily be assembled in a few evenings. Perhaps the only point to note is to be sure that the unit is warmed up for 15 minutes or so if accurate measure-

*c/o CQ Magazine

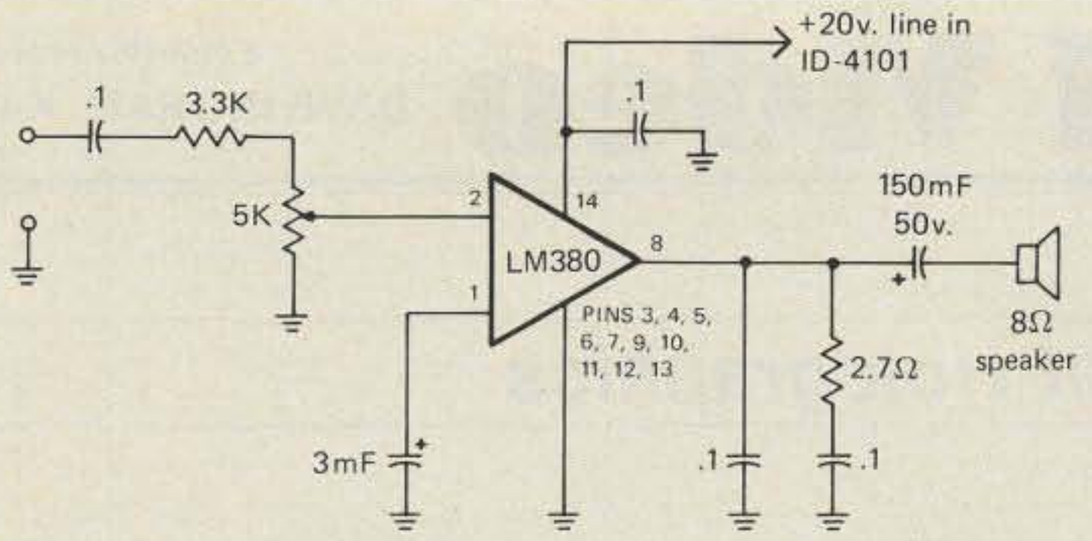


Fig. 2– Simple but good quality 2 watt audio amplifier which was added to the ID-4101.

ments and initial adjustments are to be made. The balance adjustments in the amplifiers are subject to temperature drift.

Two small additions were made to the ID-4101 which, it is felt, made the unit even more useful. One was the addition of BNC panel connectors by the inputs of each amplifier and by the output-terminal binding posts. These provide the possibility of a better shielded interconnection to other units. The other addition was a good quality a.f. power amplifier/loudspeaker. Since so many audio experiments were being done using the switch, it was found very handy to have the added amplifier capability. The circuit for the 2 watt LM380 amplifier is shown in fig. 2. Except for the volume control, the components are mounted in any convenient manner around the IC. The volume control was mounted on the front panel where the pilot lamp is normally placed. The latter was moved slightly to the left in a new mounting hole. The input connectors for the amplifier were mounted just above the ID-4101 output connectors on the front panel. As can be seen in the photograph, the PC board for the amplifier was mounted on the bottom left side of the enclosure. The loudspeaker, a good quality 3-inch unit, was mounted in the left side of the top enclosure.

The IG-4505 Oscilloscope Calibrator

The IG-4505 Oscilloscope Calibrator should appeal to those who have a moderately price oscilloscope but who want to make accurate voltage and/or time measurements. The calibration outputs of the IG-4505 are:

1. A square wave of 0.5 second to 1 microsecond period in a 1-2-5 switch-selectable sequence with .01% accuracy.

2. A square wave of from 1 millivolt to 100 volt amplitude in six switch-selectable steps with 2% accuracy.

3. A d.c. voltage of from 1 millivolt to 100 volts in six switch-selectable steps with 2% accuracy.

The internal circuitry of the unit consists basically of a square-wave source and a d.c. source. The output of either can be connected to a precision output voltage divider. The square source starts out with a 4 MHz crystal oscillator and then goes through various TTL dividers. By selecting the output of various dividers and by changing the input frequency to the divider chain, 18 different timed outputs are obtained. These are

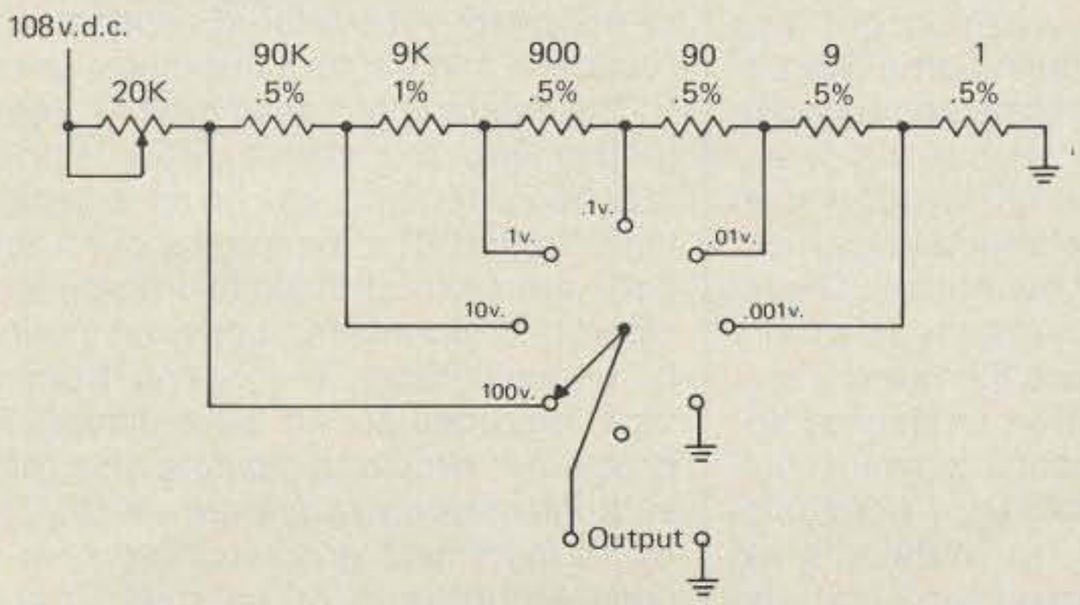


Fig. 3– Precision divider network, such as in the Heath IG-4505, can provide d.c. calibration voltages ranging from 100 volts to 1 millivolt.

square waves having a period of from 0.5 second to 1 microsecond (2 Hz to 1 MHz) in 18 steps. The square-wave output goes to two output transistor switching transistors. One is a direct output for a fast rise time (less than 4 nanoseconds) output. The other switching transistor actually keys a 108 volt d.c. source at the square-wave frequency, and this output goes through a precision resistor divider network to obtain a 1 millivolt to 100 volt output in six steps. The d.c. output is simply the steady 108 volt d.c. source applied to the precision output divider network.

Construction is relatively simple using one PC board. There is only one simple calibration step that must be done to adjust the output voltage divider network.

The uses for the IG-4505 are pretty much self-explanatory in checking the time base calibration on an oscilloscope and in checking the vertical amplitude calibration on an oscilloscope. The d.c. output can also be used to calibrate simple meters, although it is not accurate enough to check a digital d.c. meter. However, there are other useful applications of the IG-4505. The very wide frequency range square-wave output makes it useful for audio and r.f. checks, signal injection, receiver calibration, etc. The fast rise time also allows it to be used as the square-wave source in time domain reflectometry antenna checks.

If one purchased only the ID-4101 Electronic Switch, instead of the audio amplifier addition described earlier, it might be better to consider adding a d.c. calibrator circuit such as found in the IG-4505. This simple addition would greatly enhance the usefulness of any moderately priced oscilloscope used with the switch which has a d.c. frequency response but no voltage-calibrated input attenuator. The attenuator network is shown in fig. 3. The 108 volt d.c. source need not be exact in value, but it must be regulated. A simple power supply with a zener regulator will suffice. A one-time calibration is made by selecting the 1 volt output for measurement (preferably using a good digital meter) and adjusting the 20K potentiometer for a 1.0 volt reading.

The World of Video

a monthly feature by
DAVE INGRAM, K4TWJ

A LOOK AT THE WORLD AROUND US

Another Look at Holographics

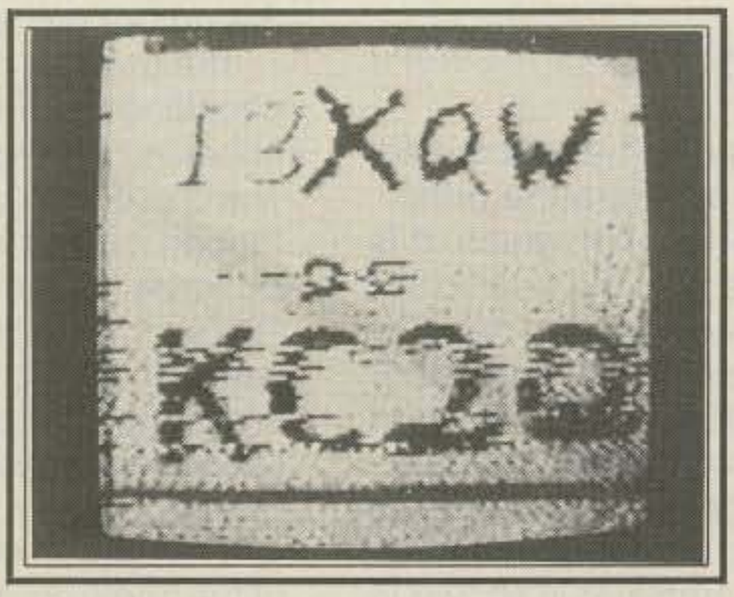
The first part of our May column carried a basic discussion of Holographic Video, a concept which we feel holds significant capabilities in tomorrow's visual communications. The initial system outlined in that column employed a "window" type hologram achieved through a modified form of LCD readout, a programmable matrix, and a diffused laser beam. Could such items be replaced by presently available components? Let's take a closer look at the system and ponder that possibility.

The photographic plate containing holographic-interference pattern information might be exposed from a conventional Slow Scan or Fast Scan TV display. The slide could then be independently viewed with the aid of a diffused laser beam. While this setup is far from optimum, it reflects a presently possible arrangement similar in style to early color SSTV techniques. Since "full blown" holograms require use of a split-beam laser firing into a cloud chamber for image reconstruction, electronic scanning and video modulation concepts may thus be applied in this area. Studying previous track records while visualizing future techniques as expansions of existing concepts, for example, we might see a "third return to the wheel" for instigating such real-life holograms (first wheel; mechanically scanned television, second wheel; CBS color system of the early 50's).

Scanning of the desired holographic area with the (split) laser beam can be accomplished by placing a group of small mirrors on a rotating wheel similar to vintage TV systems. Likewise, small dulations in the mirrors or variations in their reflectivity may be accomplished via modulation parameters. The end result would provide a scanned and modulated laser beam which, through proper lens/mirror alignment, re-establishes the hologram. We continue trying to find time for pursuing holographic video, but numerous other projects plus writing another book (this one on microwaves) keeps us "hopping." Meanwhile, we hope you enjoy sharing our thoughts.

Video Scene at Dayton '82

As old-time Slow Scanners are quite aware and newcomers quickly realize, the annual Dayton Convention is a prime gathering point of amateur video activity. The new developments and ideas presented and discussed at these April meetings set the pace of each year's ensuing technical innovations, etc. Many of the items revealed at Dayton do not appear in amateur magazines until many months (or years) later, thus a brief review is warranted for this month's column. We'll expand on these topics during coming months.



Not all SSTV signals are closed-circuit copy, but they all reflect exciting moments for their operators. This exchange recently took place between I3XQW and KC2Q via 20 meters.

Over 170 amateurs packed the Friday night informal gathering, and technical presentations ran late into the evening hours. The highlights of discussion included VE3EGO's color modification for the Robot 400, WB9LVI's new high-resolution digital scan converter, KB9MC's animated motion adaptation to the Robot 400, W0LMD's super microprocessor-controlled digital scan converter, plus discussions on a number of interesting video subjects. More than one of the program speakers expressed concern over the lack of resolution/definition in digitally scan-converted pictures as compared to old P-7 displays. This tends to indicate a "readjustment" of interest in digital scan converters and small computers (particularly those with small memories). Digital scan converters with expanded memory for greater definition are the rising trend, while computer control is favored for "housekeeping" functions such as memory designation/selection, horizontal scan rate switching, etc. WB9LVI's experimental unit, for example, featured 6-65k bit memories (2 for red, 2 for green, and 2 for blue), while W0LMD's unit contained 16 such memories! A rather powerful microprocessor is obviously necessary for control of such vast operations. In fact, W0LMD's unit was so complex that he used a "cheat sheet" to keep up with its many functions.

Other interesting suggestions included consideration of changing the Slow Scan aspect ratio from 1:1 (square picture) to 4:3 (similar to conventional television), and future format modifications of SSTV signals to include a 3 or 4 pixel-length back porch on the horizontal retrace period. The Saturday gathering was a more formal presentation/discussion of the previous night's activities. Eight-second color SSTV didn't make a grand finale debut at Dayton this year. The real time systems are still being pioneered, and a fixed set of parameters haven't yet been established. One of the more promising systems under investigation at this time involves the use of an approximate 1200 Hz phase-shifted subcarrier modulated orthagonally with color-difference information (technique similar to that used in conventional television). A discussion of this setup was presented by W9NTP in June *QST*.

Video activity was, indeed, paramount at Dayton '82. There were more SSTV and FSTV-related booths than ever before, and satellite TV dishes dotted the area in large numbers. What else can we say except start making your plans now to attend Dayton '83. It should truly prove an unbelievable cattle drive-err-experience (over 27,000 people reportedly attended Dayton '82).

More SSTV Basics

Continuing our monthly saga of SSTV basics, let's now move into a discussion of popularly encountered aspects of r.f. feedback and camera utilization ideas.

The dilemma of transmitted r.f. energy getting into a station's SSTV monitor, tape recorder, etc., can be an exasperating situation. The symptoms of r.f. feedback are characterized by improper displays only during transmission periods, or unusual tones emanating from the tape recorder during such times. This problem is similar to old-time "hot mike" entanglements which were usually traced to inefficient grounds, improper bypass techniques, or antenna arrangements which allowed r.f. energy to exist in the shack. Likewise, there's no single cut and dry solution for solving all r.f.

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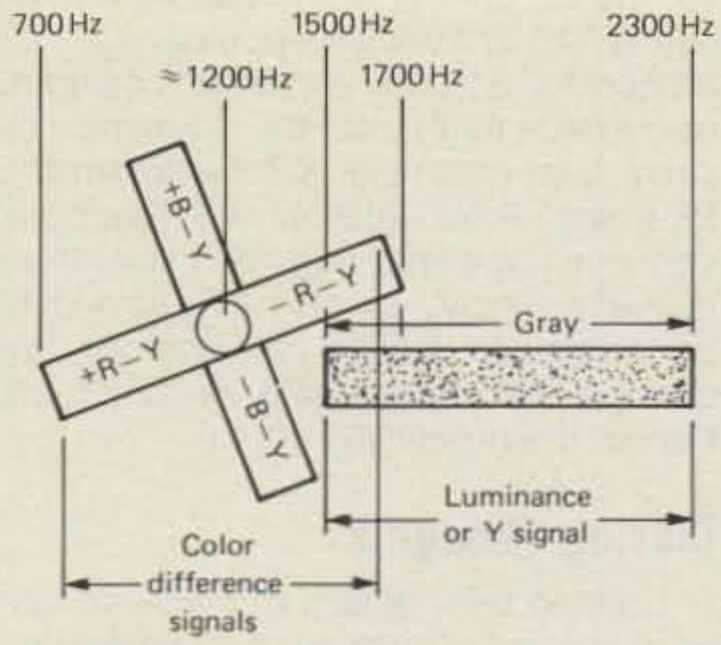


Fig. 1– Frequency multiplexing concept under consideration for 8-second color SSTV. Color difference information is contained in 1192.5 Hz subcarrier, while black-and-white information is contained in regular SSTV signal. A slightly wider than normal s.s.b. bandpass may be required for passing these signals.

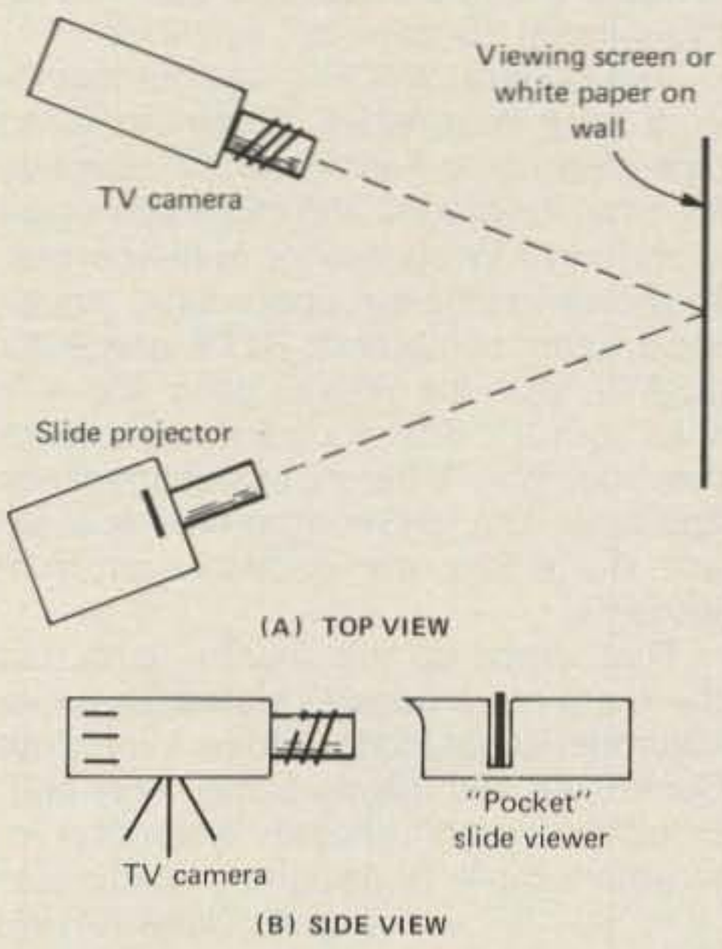


Fig. 2– Two beginning SSTV/FSTV setups for "low light" picture transmissions. A manual or automatic changer may be used at (A), while the camera merely looks into the viewer at (B). For best results, select a location that will permit camera movement (pan) to also view the operating setup.

feedback problems; each case is unique and must be handled accordingly. Hopefully, the following guidelines will help alleviate those problems in miniscule time. First, all equipment in the shack should be connected to a large ground buss which in turn is connected to a solid earth ground by heavy cable. We suggest placing a large copper strap on the operating desk's rear section and then grounding each piece of equipment to that strap via short lengths of cable braid (alligator clips are convenient for this use). Likewise, heavy braid can be used for the outdoor ground connections (which should include several rods, radials, and the cold water pipe).

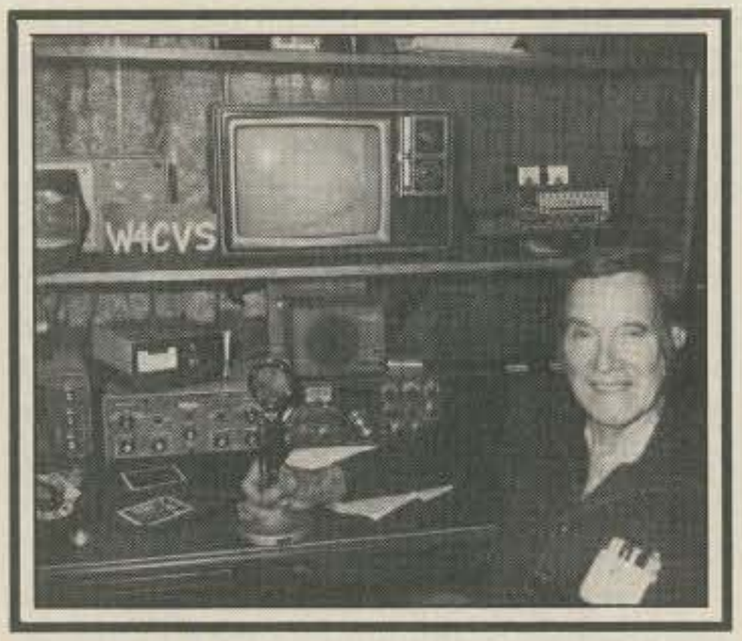
Many times, r.f. energy enters equipment via a.c. power lines. This situation can be reduced by installing .01 mFd disc capacitors precisely where those lines enter the equipment. Bypass both wires to the chassis proper, and remember to keep leads short. Also ensure that the three conductor cords and cables are utilized. The technique of winding excess a.c. cord on a large toroid, such as shown in March *QST*, is also quite effective in reducing recorder or monitor interference.

Another cause of in-station r.f. energy is antenna systems with radiating-type feedlines or a high s.w.r. This is again the old "hot mike" syndrome which may appear on some bands but not others or with only one particular station antenna. The solution may be as simple as repairing the skywire (Have all connections been cleaned and tightened lately? How old and frayed is its transmission line, and how secure are its grounds?) or eliminating an excess length of cable. The most aggravating cases are usually those with stations located directly below triband beams: r.f. energy emanates from the driven element downward and directly into equipment. Relocating either the station gear or antenna is occasionally required to eliminate that problem.

One of the most common problems when initially setting up an SSTV camera involves achieving proper illumination of the subject or subject area. Some low-light cameras may function relatively well with existing in-shack lights, but a more professional approach is desirable for best results. A single 100 watt floodlight and mating dimmer mounted atop the camera proper may be convenient, but it tends to produce overexposed or "hot spots" in televised scenes. Twin swivel-type floodlights, each with individual dimmers, mounted on a camera light bar produce quite acceptable results. Once the camera's controls and lens aperture are adjusted, variations in picture illuminations can usually be handled by the light dimmers.

Another interesting technique is "bouncing" floodlight illumination off a white ceiling. The results usually produce more lifelike views while creating a certain amount of highly desirable backlighting. If you really desire to go first class, small quartz lights are available from most photographic supply houses. Although these lights are rather fragile (don't move them when hot, and don't touch the bulb proper), they produce pure while light rather than yellow/orange tints (incandescent) or green tints (neons). Finally, remember to use enough light to permit small apertures (high number "*f*-stop settings") for greatest depth of field. Keep in focus, and your views should be grand.

This high-resolution SSTV picture (photographed in real time color but reproduced here in black and white) is the product of W4CVS's many unique SSTV programs.



Bill Wells, W4CVS, is quite active in real time color SSTV with a 3-memory modified Robot 400, color camera, and (Fast Scan) video recorder. H.f. gear includes a TS-830S and a 4-1000 amplifier.

Computer Controlled Scan Converter

The computerized digital scan-conversion system revealed by Dr. Robert Suding, W0LMD, at Dayton '82 was quite an impressive unit. The setup featured over one-million-bit storage in its 16 full-size SSTV memories, all of which were independently programmable and usable by its associated microprocessor. Any format (Slow, Medium, or Fast Scan) thus may be directly achieved, and any function from keyboard to superimpose or zoom can be instigated by the system. As shown at Dayton, 12 memories were used for high-resolution black-and-white SSTV operations, and 16 memories were used for color SSTV (6 memories for red, 6 memories for green, and 4 memories for blue).

Another interesting way of looking at the system was by considering its capability of storing eight 128 by 128 by 64 gray-level SSTV pictures, four medium-scan pictures, or two 256 by 256 by 64 high-resolution SSTV pictures. Talk about massive systems! Not for the weak hearted, the support system encompassed a hearty 147 IC's and an estimated cost approaching $1,000. Keyboard columns controlled functions for transmit, receive, etc. (example, K for keyboard, G for graph, R for receive, etc.). We could continue page after page on this system, but we'll simply summarize by saying it's a chameleon which can change and change and change with the times and trends. It's practically unreal.

Closing Thoughts

Looking over details of the Australian scan converter mentioned in last month's column while surveying the vast graveyard of discarded TV games set the mind whirring. These units seem rather adaptable for use as a receiving SSTV scan converter. Although the memory proper is lacking, sweep circuits, video generators, and TV oscillators are included on these relatively inexpensive boards. This concept might prove an interesting and rewarding winter project for you innovative-minded "Scanners." Opinion?

Tom O'Hara, W6ORG, has put together a very informative 20-minute video tape describing Fast Scan TV activities for amateur groups and clubs interested in starting ATV operations in their areas. It shows on-the-air operations, equipment, using computers, RTTY, and SSTV on ATV, plus the W6VIO gang and ATV links from JPL. This is a great way to learn the ropes of ATV before investing money and time. The VHS-format tape is available (for a $20 reproduction cost) from W6ORG.

That wraps up this month, gang, but there are more goodies slated for future columns: Robot mods, info on Microcraft Commsoft, and maybe some "way out" thoughts on light repeater systems or interactive cable TV designs of the future.

73, Dave, K4TWJ

A quite unusual creature, this aqua-colored frog with red eyes (in the original color photo) was received via 20 meters color SSTV and photographed on the monitor screen at W4CVS.

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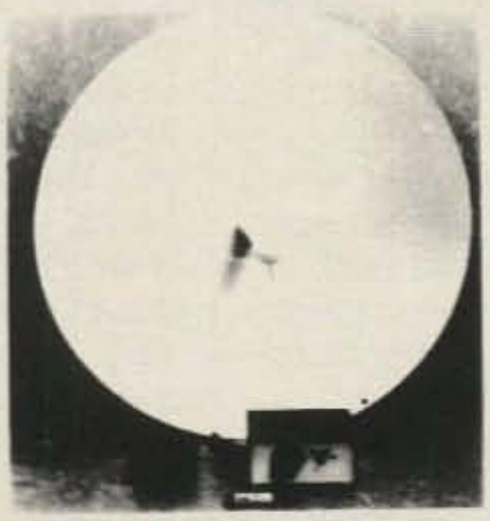

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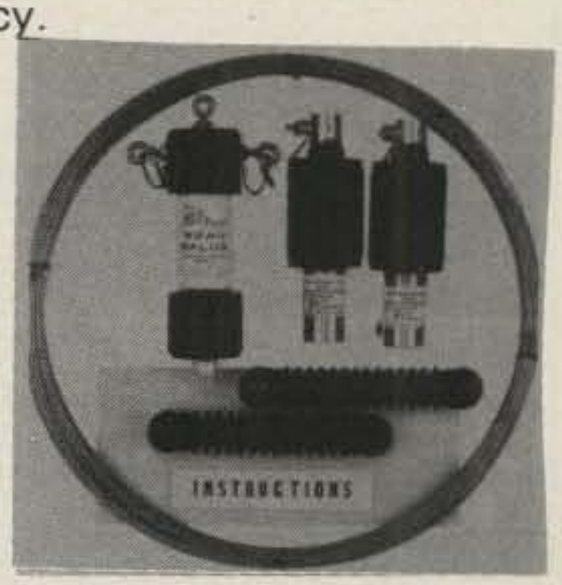

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CIRCLE 34 ON READER SERVICE CARD

Antennas

a monthly feature by
KARL T. THURBER, JR., W8FX

DESIGN, CONSTRUCTION, FACT, AND EVEN SOME FICTION

The Transmatch Revisited: Part III–Conclusion

In last month's column, W8FX continued his discussion of the transmatch. This time he concludes his series on transmatches with some useful selection and adjustment tips. Read on!

Last time we continued our discussion with coverage of some advanced designs such as the ultimate and SPC transmatches. We also highlighted possible problems with harmonics, and we went into some receiving and installation considerations.

In this month's *CQ* we will wrap up our transmatch feature with some important points on transmatch selection, along with some tune-up and adjustment procedures and considerations. Let's examine selection considerations first.

Transmatch Selection

Before even thinking of *which* transmatch to build or buy, you should consider whether or not a transmatch is, in fact, needed. Many amateurs are overly enamoured with the capabilities of the transmatch, when, in fact, an antenna tuner is not required in their particular situations. For example, if your operation is confined to a small segment of a single band, and a simple coax-fed dipole is used, it is questionable whether a transmatch would be a necessary or wise investment. On the other hand, the apartment amateur trying to get acceptable multiband operation from a random wire fed against a counterpoise would get good use from a transmatch; using one might, in fact, be the only way to get the transmitter to tune and load properly.

Obviously, there is no such thing as an "ideal" transmatch. However, if such a unit did exist, it probably would be one that would match virtually all kinds of antennas (coax-, parallel-line-, and single-wire-fed); allow for continuous, simultaneous monitoring of forward and reflected power; be capable of either straight-through operation, or operation through the matching circuit; have front-panel selection of several types of antennas and dummy load; and possibly operate at least partly automatically (the latter mode being the latest wrinkle in state-of-the-art matching circuits).

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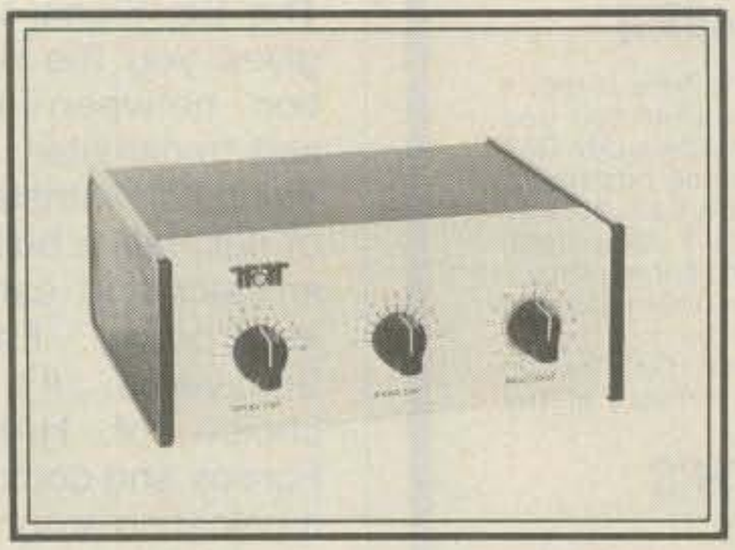


Classic Ten-Tec transmatch covers 1.8–30 MHz and handles 200 watts; an auxiliary s.w.r. bridge is required. Unit is popular with QRPers. (Photo courtesy Ten-Tec)

There are many specific features one might consider when evaluating transmatches. It's reasonable to expect that the transmatch one acquires should:

1. Be of overall high-quality construction and be adequately shielded.

2. Easily handle the transmitter's output power, and have some "growing room" for increased station power.

3. Cover all amateur bands on which operation is contemplated, plus frequencies "in between" if CAP/MARS work or general coverage reception are required.

4. Cover a sufficiently wide impedance matching range to allow transmitter s.w.r. to be reduced to 1:1.

5. Be capable of handling a variety of transmission lines: coax, single wire, and balanced.

6. Have a means of measuring feedline s.w.r., preferably to include simultaneous, continuous monitoring of transmitter output power and reflected power.

7. Have an internal antenna switching capability.

8. Permit off-the-air transmitter tuning using a built-in dummy load, or have provisions to switch in an external load.

9. Allow for transmatch bypass switching for automatic bypassing of the matching circuitry when it is not needed.

10. Attenuate second and higher-order harmonics to a significant degree.

11. Incorporate easy tuning features such as rotary turns counter, logging scale, vernier tuning, automatic electronic tuning, or similar features.

When searching for a transmatch, it's not easy to get a "handle" on all of the considerations mentioned above. However, inspection of the unit's schematic and specifications will tell a great deal; more is revealed if you can open one up and examine the internals. Some physical features to look for include a high-quality ceramic bandswitch; wide-spaced, heavy-duty capacitors; and sufficient space around the tuning inductor. Also, when comparing specs (even if you're now running QRP), look ahead to the day when you may run higher power. While a compact, 200-watt or smaller unit may serve well at this point, if there is any prospect of moving up to a 500-watt or full-gallon power level in the future, it likely will pay to buy a unit that will accommodate that power level now.

Recent trends have led to bigger, heavier, and more sophisticated transmatches that are anything but cheap. What, you may ask, makes some commercial tuners so expensive? There are two main cost drivers: expensive components (such as rotary inductors and precision counter drives), and special convenience features (such as built-in dummy loads, antenna switching, dual power/s.w.r. meters, etc.). Rugged, high-power tuners are very costly due to the large coils and heavy-duty capacitors that must be used if the tuner isn't to "arc-over" when running the legal power limit. Rotary inductors are particularly costly, and they are used in many of the top-of-the-line tuners (as opposed to tapped coils) in order to get the coil inductance "just right."

Whereas the amateur of 25 years ago had perhaps one or two commercial tuners from which he could choose (such as the Johnson Viking Matchboxes and Millen Transmatches), today's amateur has a variety of high-capability models from which to select. Manufacturers such as Drake, Dentron, Murch, Yaesu, Kenwood, Palomar, Ten-Tec, MFJ, J.W. Miller, Daiwa, Heath, RF Power Components, and others offer a wide assortment. MFJ alone makes upwards of a dozen models that are designed for a variety of antenna matching chores at many different power levels; Heath and RF Power Components offer transmatches in kit form.

In the past few years, there have been several important transmatch innovations. One of these innovations is the Palomar PT-2500A antenna tuner, which has two interesting and unique features. The first is the tuner's balun, which is located at the *input* of the tuner, rather than at the output; this placement was made on the theory that a balun should be used only at

its design impedance. When the balun is placed, as it normally is, at the tuner output, to convert the unbalanced transmatch to balanced output for open wire lines, it usually encounters a wide variety of impedances with resultant heavy r.f. losses in the balun as a result of the mismatch. With the 50-ohm balun placed at the input of the tuner, the tuner input is always 50 ohms when it is properly tuned so that the balun sees its exact design impedance. The result is a reduction in losses and improved circuit balance.

The second innovation in the Palomar tuner is the 50-ohm noise bridge that allows the operator to set the transmatch controls without transmitting. All adjustments to the transmatch are made in the receive mode using the receiver portion of the station transceiver or a separate receiver. The advantages of noise-bridge tune-up, according to the manufacturer, include more rapid adjustment, less risk of damage to final amplifier tubes and transistors, and reduced interference caused by on-the-air tune-up. Of course, the noise bridge tuning feature can be backed up by and cross-checked with a conventional s.w.r. bridge. Although the Palomar unit, priced at around $300, is a bit expensive for the s.w.l., the advantages of "no-r.f." tune-up are obvious.

Until very recently, little has been done to *automate* the actual tuning process. However, two recent transmatch offerings, the Daiwa CNA series and the J.W. Miller Auto Track AT2500, have enabled the amateur to rely on electronic means for setting the transmatch controls. These units have taken away much of the drudgery in transmatch operation under most circumstances.

The imported Daiwa CNA-1001 (500 watts PEP) and CNA 2002 (2.5 kw PEP) automatic antenna tuners are comprised of an internal directional coupler and associated s.w.r. meter, the pi-network matching network, and the sensing circuitry that controls the motorized tuning capacitors in the matching network. The matching function becomes automatic whenever the "operate" button is pressed, although at least 5 watts of r.f. must be applied to the unit for automatic operation. The internal detection circuitry senses forward and reflected reverse power, and the resultant proportional d.c. voltage is applied to the motor control amplifier, which drives the tuning motor. The motor is connected to the two variable tuning capacitors through a 30:1 gear train. Performing the tuning function in less than 45 seconds, automatic operation ceases when the s.w.r. is brought below 1.5:1; two manual fine-tuning controls can then be used to "tweak" the s.w.r. to 1:1. The Daiwa models make use of the cross-needle meters, which allow forward power, reflected power, and s.w.r. to be read simultaneously without bothersome sensitivity adjustments.

Similar in function to the Daiwa units,

Heath's SA-2040 antenna tuner, one of two transmatch kits sold by the firm, is billed as a "two-evening kit" in the catalog. Capable of handling the full legal power limit, the low-cost unit sports a continuously variable inductor for precise matching. Interestingly, the capacitors are put together by the constructor. Note the erasable front panel where band settings can be penciled-in. (Photo courtesy Heath Company)

the domestically manufactured J.W. Miller Auto-Track AT2500 is designed to automatically match unbalanced loads to a 50-ohm transmitter within a 15-second time frame. While the Daiwa models are self-contained, the AT2500 consists of two separate assemblies—a main tuner unit which contains the r.f. components and PC boards as well as the motors, and a remote coupler. Based on the "T"-network design, this unit will work with as little as 1 watt of r.f. applied; visual and audible alarms can be set to warn the operator of excessive s.w.r. conditions. Both the Daiwa and J.W. Miller units represent the vanguard of a new wave of super-sophisticated transmatch designs; right now, they are probably appreciated most by contesters, but the popularity of such units is sure to increase among casual operators who appreciate the convenience offered by such accessories.

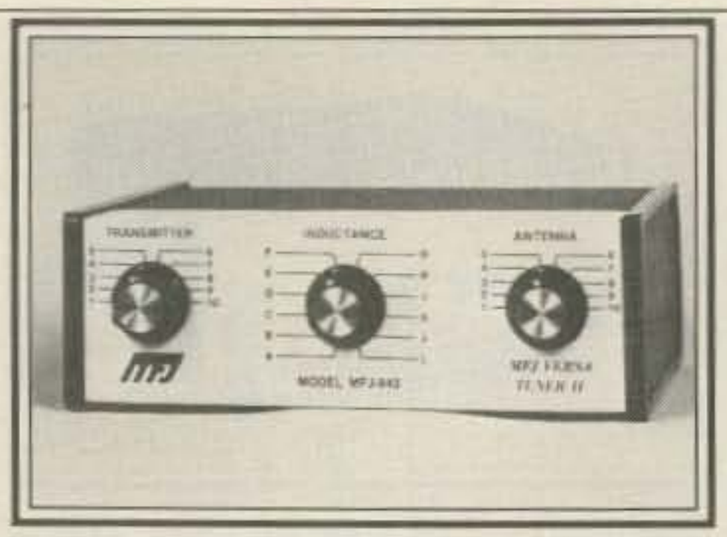
Since the transmatch makes an excellent construction project, it's surprising that there aren't many such *kits* sold today. However, there are a few on the market. One is the wide-range RF Power Components "Maxi Tuner." This is a heavy-duty, 3 kw PEP unit that features a rotary inductor, counter dial, balun, and vernier tuning drive. Based on the ultimate transmatch design, it will load up almost any kind of antenna system. The unit, available with or without an internal s.w.r. meter, is sold by RF Power Components, P.O. Box 11, Ladysmith, WI 54848.

Heath is also in the transmatch kit business with two models. One is the relatively simple and low-cost SA-2040 kit, a 2 kw PEP 80–10 meter wide-range model that sports a continuously variable inductor, a built-in 4:1 balun, and an "erasable" front panel for write-in band settings. This unit's big brother is the SA-2060, which covers 160–10 meters continuously and includes a built-in dual wattmeter/s.w.r. bridge, tuner bypass switching, and two coaxial outputs for front-panel antenna selection.

Although we have focused on manufactured transmatches and kits, we don't mean to imply that such units are the *only* way to go. But, in many cases, the cost of heavy-duty r.f. switches, capacitors, and inductors in today's marketplace may equal or exceed the price of a commercial transmatch, so the commercial models may be the cost-effective way to go. But if you have low-cost access to coils, switches, variable capacitors, and other components, you can likely whip up an effective unit with a minimum of difficulty.

It's entirely possible to build your own transmatch; construction and wiring are relatively easy, and there are no complex circuits to worry about. The ARRL *Radio Amateur's Handbook* and the *Antenna Book* include several popular and well-tested designs that should give you little trouble. And, the bibliography at the conclusion of this column suggests several other sources for construction details.

If you're looking to design your own transmatch, major considerations to work into your design would include a wide range of variable inductance and variable capacitance; using coils and capacitors that will stand up under the planned power levels without arcing or overheating; employing low-loss switches and insulators; and keeping r.f. leads as short as possible. Capacitors used should have a low *minimum* capacitance, which will help extend the impedance



The smaller MFJ "versa tuners" are popular with QRP operators and s.w.l.'s due to low cost and wide matching range. The unit shown here is designed to "match almost anything" over the 1.8–30 MHz range. A built-in 4:1 balun for handling balanced lines is provided. Up-scale models are similar but include an s.w.r. bridge/dual range wattmeter and 6-position antenna switch. (Photo courtesy MFJ Enterprises, Inc.)

matching range that can be accommodated on the higher bands, such as 10 and 15 meters.

Transmatch Adjustment Techniques

Proper adjustment of the transmatch is essential to good performance. The usual method of adjusting it involves the use of an s.w.r. bridge installed in the coaxial cable running to the transmitter. Just what tuning procedure to follow will depend on the design and controls on the transmatch. In any case, the tuner is adjusted for lowest possible reflected power readings.

Normally, it's possible to attain a perfect "1:1" s.w.r. indication if the antenna system is within matching range of the transmatch. Once adjusted, you can be reasonably certain that the transmission line reactance has been compensated for, that proper impedance transformation has taken place, and in the case of balanced-wire lines, that the right balanced-to-unbalanced condition has been achieved. After the adjustments have been completed, they can be left alone unless frequency is shifted to another portion of the band, or to a different band.

The objective, regardless of the method used, is to get the amplifier in your transmitter to "take a load"—to efficiently transfer power from the rig to the antenna. What you have accomplished by making these adjustments is to adjust the transmatch so that the transmitter (or transceiver) looks into the 50-ohm load it was intended to see.

There are a number of possible techniques for tuning and adjustment of the transmatch, but most procedures run along the following lines. First, a dummy load is connected to the transmitter output, and the transmitter is tuned up on the desired frequency. This step ensures that the transmitter is properly adjusted for

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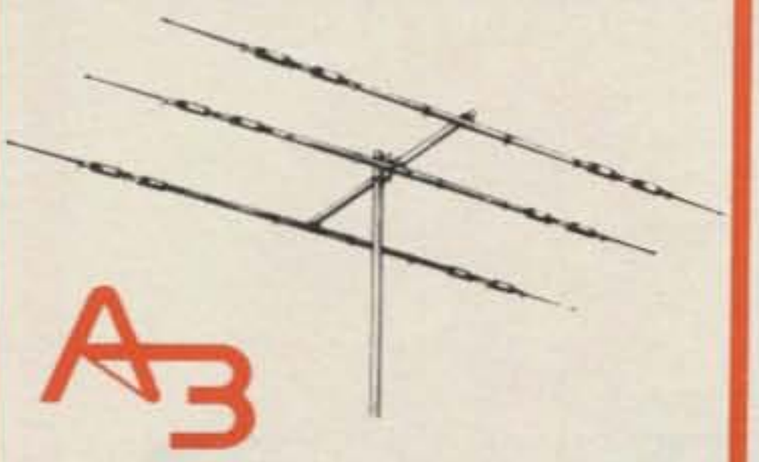

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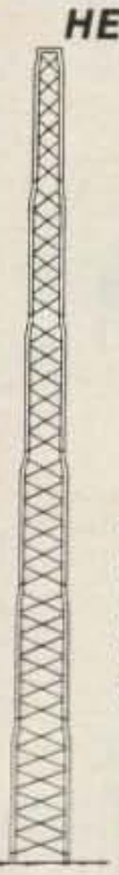

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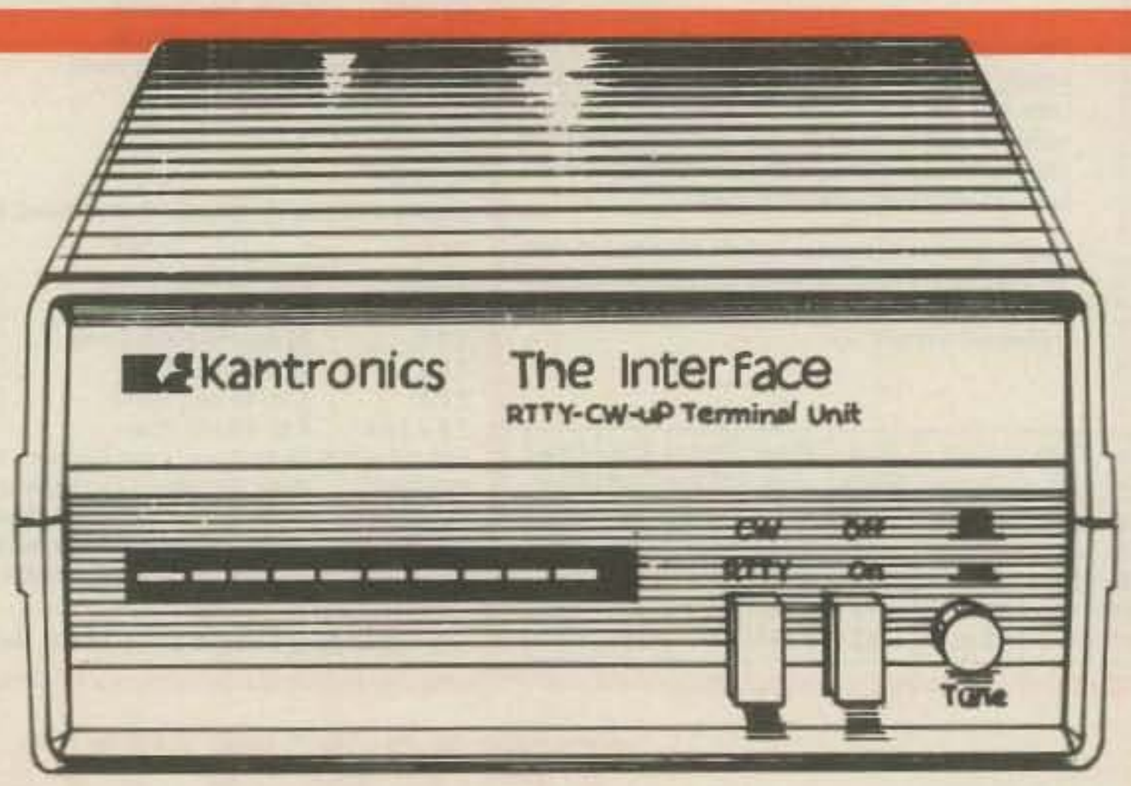

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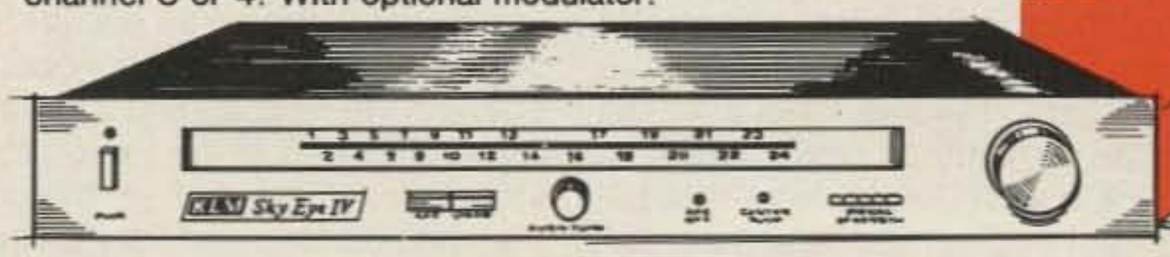

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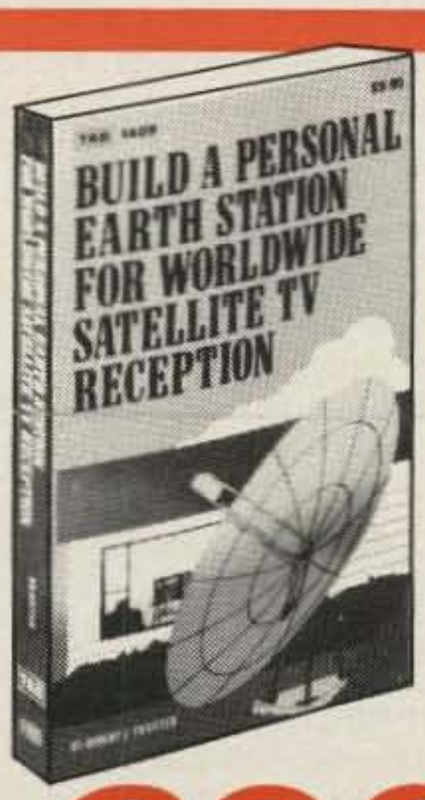

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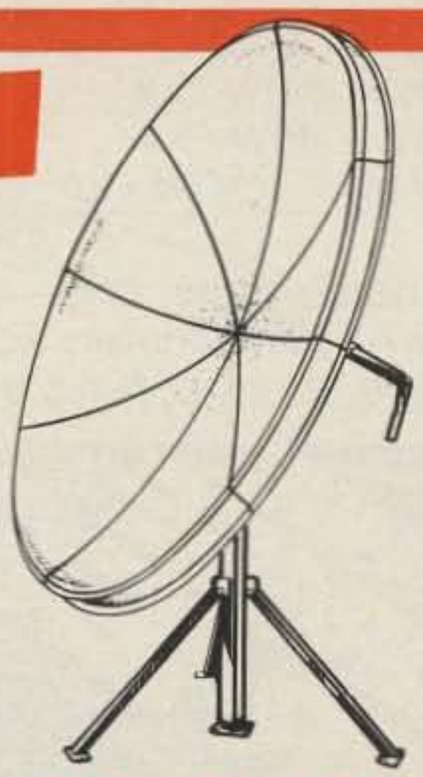

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matching to a 50-ohm r.f. load, the objective being to adjust the transmatch in such a way so that the antenna is matched to this pre-set load.

Second, an approximate setting of the transmatch controls is determined, but without applying power to the transmitter. This can be done by using the receiver (or receiver section of the transceiver), starting off with the transmatch's tuning capacitors set to mid-scale (plates one-half meshed). The variable or stepped inductor control is rotated until maximum signal or background noise is heard from the receiver; the variable capacitors on the transmatch may be adjusted to peak the background noise. This adjustment, although only a preliminary one, should be fairly close to the final one to be determined by actual s.w.r. reading.

Third, a minimum s.w.r. reading is obtained while a low level of power is delivered to the antenna through the transmatch. This is done by alternately adjusting the variable capacitors on the transmatch for minimum indicated s.w.r. The two capacitors interact, so it is usually necessary to adjust and re-adjust the two controls several times to obtain the lowest possible reading. If a 1:1 s.w.r. is not obtained, it may be necessary to adjust the inductor slightly, again working the tuning capacitors for minimum s.w.r.

Fourth, final adjustment of the transmatch controls is made with full transmitter power applied. Adjusting the s.w.r. meter to its "set" or full-scale position (if required), high power is applied to the transmatch and the unit's variable capacitors are readjusted to yield minimum s.w.r. When a good match is obtained, the s.w.r. should be at or very close to 1:1, although (depending on the transmatch's design and the specific antenna system) it may not *always* be possible to obtain a perfectly "flat" reading. Usually, an s.w.r. on the transmatch-transmitter link of under 2:1 is acceptable. Note that patience is required to find optimum settings; also, readjustment of the transmatch's variable capacitors and/or inductor may be required when a significant QSY is made.

An alternate (but somewhat less satisfactory) approach you can take if you don't own an s.w.r. bridge is to tune up the transmitter using a 50–75 ohm dummy load, making all subsequent adjustments to the antenna coupler and leaving the transmitter controls as they are except when changing bands. Still another method is to use an r.f power meter or ammeter in the output line to the transmatch; optimum tuner settings should coincide with lowest s.w.r. and maximum power transfer to the antenna. These two methods are not as precise as the s.w.r. bridge method, but they should give good results if you take care when making the adjustments.

Tune-up of a specialized transmatch such as the Palomar Engineers PT-2500A is rather unconventional, if one is accustomed to the usual s.w.r. bridge-based methods. In adjusting this unit, the specially-marked front-panel switch is turned from the "operate" to the "tune" position. Doing so turns on the noise bridge and results in the generation of a loud noise in the receiver. To tune up the transmatch, the "inductance" knob is turned to the setting that gives the lowest noise, while the "transmitter" and "antenna" knobs are subsequently adjusted for lowest noise. At the proper setting of these knobs, the noise level should drop or null out completely. The tuner now looks like a perfect 50-ohm resistive load, and the s.w.r. on the cable from the transceiver to the tuner is 1:1. Note that all of the adjustments are made in the receive mode; transmitting is not required to tune the transmatch, although final tuning conditions may, of course, be backed up with a standard s.w.r. bridge.

With automatic tuners of the kind sold by Daiwa and J.W. Miller, little adjustment is required, although the units must be "set up" when changing bands, and the antenna to be matched must be within somewhat restricted impedance criteria. And, although operation is largely automatic when changing frequency within a band, after the automatic tune-up cycle has been completed, it's usually necessary to manually fine-tune the variable capacitors for an exact 1:1 s.w.r. Both of these units are particularly useful in making rapid frequency excursions within a band, or from band to band, especially when narrow-bandwidth antennas are used. However, an s.s.b. signal may not provide a sufficiently "stable" signal to permit the units to retune properly, so the operator must switch to a continuous-carrier mode (such as c.w. or "tune") to obtain proper automatic operation. Of course, the specialized nature of these units requires that the specific tune-up instructions contained in the instruction manuals be followed very closely.

At this writing, ICOM recently brought out a completely "hands off" automatic tuner, the IC-AT500, that requires no manual adjustment. A special feature of this unit is a preset capability that allows "look-ahead" tuning to preset each band to a near-matched condition without application of r.f.; this allows the receive function of the transceiver to function effectively without the need to radiate a signal for adjustment purposes.

A few transmatch tune-up cautions are in order:

1. Take the time to log the correct transmatch control settings for each band (or band segment). Doing so will allow you to change bands rapidly and to arrive easily at the correct adjustments. Once you have a good match, final transmitter adjustments can be made and coupler controls left alone. (Many solid-state transceivers are "broadband" tuned; ensuring that the rig looks into a

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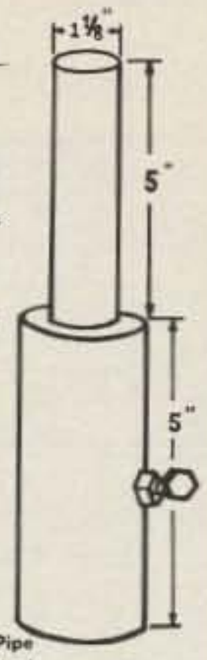

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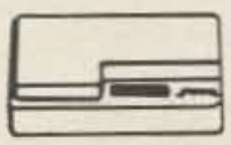

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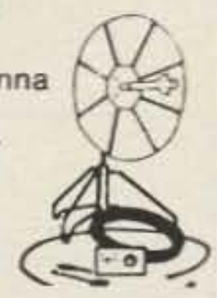

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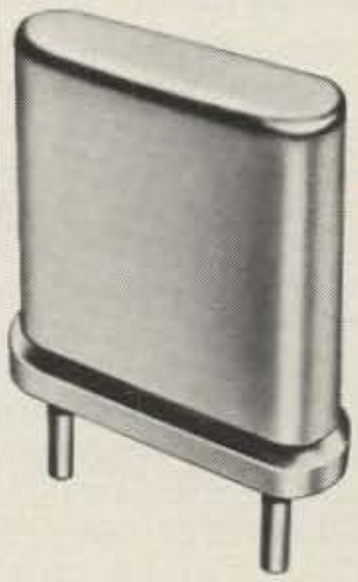

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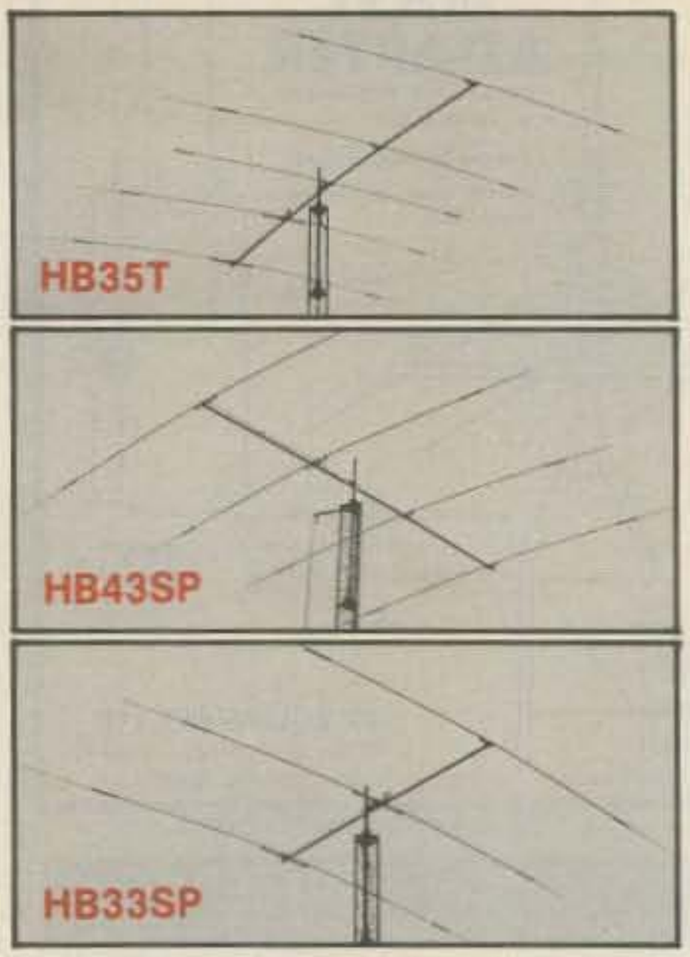

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50-ohm load practically guarantees proper transmitter tuning and power transfer).

2. Beware of harmonics in your signal. If you are unable to reduce s.w.r. to a 1:1 level, it may be because there is an excessive harmonic content in your signal that "distorts" the s.w.r. readings. If this occurs, carefully check transmitter loading procedure. A bandpass or lowpass filter may need to be installed at the output of the transmitter.

3. Watch for "bogus" tuning conditions. With many transmatches it's possible (especially in those with dual tuning capacitors and tapped inductors) to "load up the coupler," so to speak, and to obtain a 1:1 s.w.r. with little or no r.f. power actually reaching the antenna. Be especially wary of tuning adjustments that leave the tuning capacitors fully open or meshed, or that have the coil either fully "in" or "out" of the circuit. An r.f. power meter in the output line or a small field strength meter in the shack will serve as a cross-check on correct tuning by giving an actual (though relative) indication of power transfer to the antenna.

4. Use the lowest power possible to obtain a usable s.w.r. reading when initially tuning the antenna; generally, only a few watts of r.f. are required to obtain such readings. When high r.f. powers are presented to an improper load, which exists before the transmatch is adjusted, a strain is placed on the transmitter's output circuit. In addition, current and voltage loops can be created in the transmatch which can cause the capacitors to arc and switches to fail.

At the bottom line, don't expect the transmatch—regardless of superiority of design or care with which it is adjusted—to improve the antenna; its duty is to facilitate the transfer of power from the transmitter to the antenna, and little more. If your antenna suffers from poor system performance, don't expect a complete turnaround in transmission efficiency and reception quality when a transmatch is used. Overall antenna effectiveness depends primarily on the "business end": the antenna itself and the proper interface between the antenna and the transmission line.

Wrap-Up

In this series, we have looked at the transmatch as an important antenna and station accessory. We've defined and discussed essential transmitter matching considerations, highlighted basic and advanced transmatch designs, covered the harmonic problem and possible solutions, and presented some receiving, installation, selection, and adjustment considerations.

Next month, we will begin a series of columns that will bring into focus various station and antenna accessories that can help the antenna and transmitter to radiate a respectable signal. See you then.

73, Karl, W8FX

Daiwa CNW-418 antenna tuner incorporates the cross-needle meter display to indicate s.w.r./power, a feature unique to this manufacturer's equipment. The tuner is specifically designed to cover the new WARC bands (10, 18, and 24 MHz) in the 3.5–30 MHz range. The unit matches 10–250 ohm loads and handles 500 watts with an insertion loss under 0.5 dB. (Photo courtesy MCM Communications)

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Antenna of the Month: J.W. Miller Auto-Track AT2500 Automatic Antenna Tuner

The J.W. Miller Auto-Track AT2500 automatic antenna tuner. (Photo courtesy J.W. Miller Div., Bell Industries)

Of special interest to contesters and other rapid QSY'ers, the AT-2500 is the first transmatch of its kind manufactured in the U.S. for amateur use (the Daiwa units are imported from Japan). The Miller unit is designed to *automatically* match unbalanced loads from 10–200 ohms, to 50 ohms resistive, over the range 3.0 to 30 MHz—within a 15-second time frame.

The device is broken down into two separate assemblies: a main tuner assembly which houses the r.f. components and circuit boards as well as the motors, and a remote directional bridge coupler which is installed at the transmitter's r.f. output terminal. Five circuits, besides the bridge, work to achieve the automatic operating feature: the s.w.r. analog computer, power logarithmic amplifier, slope detection circuit, logic control circuit, and tune-load motor-drive circuit. A dual-mode (a.c. or d.c.) power supply provides power for these circuits. The AT2500's automatic functions will work with as little as 1-watt of r.f. carrier applied to the unit, and visual and audible alarms are built-in to warn the operator of excessive s.w.r. conditions. The transmatch, which uses a C-L-C "T"-network design, is capable of handling 2500 watts PEP and has smooth-acting interconnect circuitry for use with a linear amplifier.

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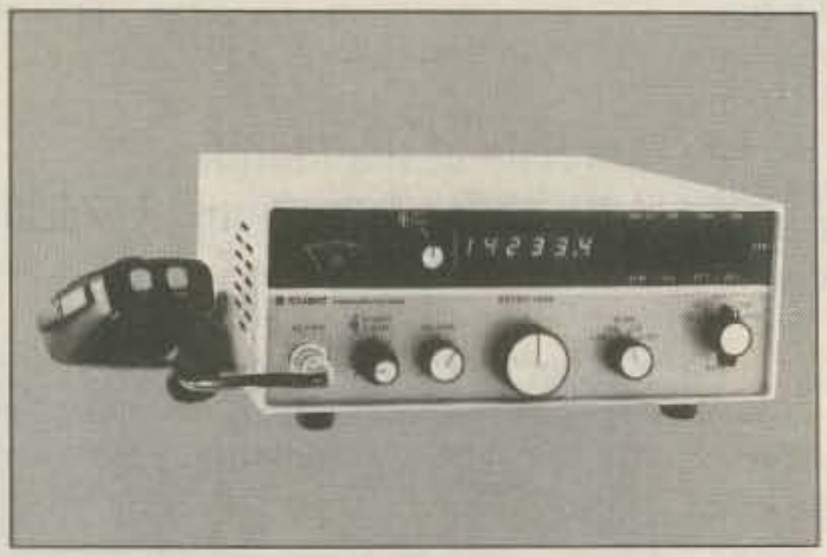

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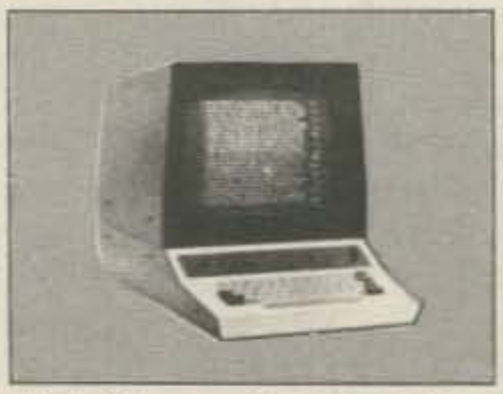

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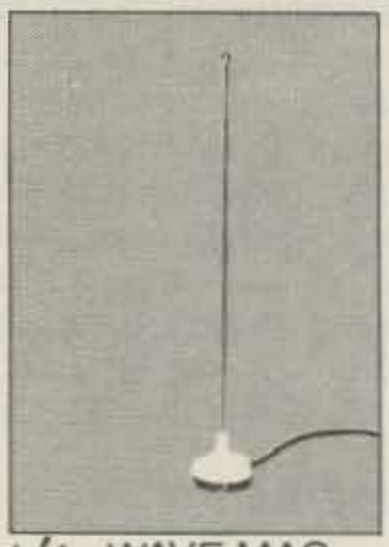

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Announcing

● **SCARA Special Events Station** - The Southern Counties ARA will have a Special Events Station (K2BR) on the air during the Miss America Pageant, Sept. 4–12, at the Atlantic City Convention Hall. Frequencies will be 10–80 meters on the General class phone band, 25 kHz up from the lower end of the band. Operation will also be on the c.w. General class portion of the c.w. band, 10–80 meters, 65 kHz up from the bottom. There are plans for Novice/Tech. operation on the c.w. portion of 40 and 15 meters, 50 kHz up from the bottom, and 2 meter simplex on 146.520. For QSL send an s.a.s.e. to SCARA, Box 121, Linwood, NJ 08221.

● **WB2SQX from Canisteo, NY** - The Canisteo Valley Radio Amateurs will operate WB2SQX from 1400Z to 2100Z on Sept. 11 in commemoration of the 50th anniversary of the "Canisteo Living Sign," the world's largest living sign. Suggested frequencies are 7245, 14.285, 21.375, 28.650 MHz, ± QRM. S.w.l.'s are also eligible. For a special QSL send a business-size s.a.s.e. to John S. Babbitt, WB2SQX, Square Woods Dr., Canisteo, NY 14823.

● **Palmyra DXpedition** - M.O.T.H.E.R.S. (Marengo Over-The-Hill Electric Radio Society), a group of north central Illinois amateurs, are planning a DXpedition to Palmyra. Expected ops are WB9NKH, K9UA, KF9E, KC9DC, and WA9TAH. Operation is planned from Palmyra on Sept. 11 and 12 (0700–2100 CDT on the 12th). Frequencies will be up 30 kHz from the bottom of the c.w. and General phone band edges. Call sign will be WA9TAH, with QSL's going to the Call Book address. A special QSL/award will be available for an s.a.s.e.

● The following hamfests, fleamarkets, etc., are slated for September:

Sept. 5, **Central Pennsylvania Repeater Assoc. Hamfest/Computerfest,** Harrisburg, PA. Contact Irvin Sanders, K3IUY, RD #3 Box FA53, Harrisburg, PA 17112, phone 717-469-2185.

Sept. 10–12, **Augusta, ME, Emergency Amateur Radio Unit Northeast Area Hamfest,** Windsor Fairgrounds, 10 miles east of Augusta, ME. Contact Windsor Hamfest Committee, c/o W.E. Jackson, W1WCI, RFD #1 Box 3970, Winthrop, ME 04364.

Sept. 11, **Grant County ARC Hamfest,** Marion, IN. Contact Beecher Waters, WB9YHF, RR #1 Box 357, Converse, IN 46919.

Sept. 11, **Sussex County ARC Hamfest, SCARC '82,** Augusta, NJ. Contact Sussex County ARC, P.O. Box 11, Newton, NJ 07860.

Sept. 11, **33rd Annual W3PIE Gabfest,** Uniontown, PA. Contact UARC Gabfest Committee, c/o John T. Cermak, WB3DOD, P.O. Box 433, Republic, PA 15475, phone 412-246-2870.

Sept. 11–12, **NJ Microcomputer Show & Fleamarket,** Newark, NJ. Contact Kengore Corp., 3001 Route 27, Franklin Park, NJ 08823, phone 201-297-2526.

Sept. 11–12, **4th Annual Georgia Hamfest & ARRL Georgia State Convention,** Warner Robins, GA. Contact Jim Piper, W4HON, 618 American Blvd., Warner Robins, GA 31093.

Sept. 12, **Suffolk County Radio Club Flea Market,** Port Jefferson Station, LI, NY. Contact Floyd, WA2SDI, 516-234-9376 after 6 pm.

Sept. 12, **Butler County ARA Hamfest,** Butler, PA. Contact Leighton Fennell, Crestmont Dr., RD 6, Butler, PA 16001, phone 412-586-9822.

Sept. 18–19, **Peoria Superfest '82,** Peoria, IL. Contact Superfest '82, 5808 N. Andover Court, Peoria, IL 61615 (s.a.s.e.).

Sept. 18, **Grand Rapids ARA Swap & Shop,** Grand Rapids, MI. Contact Grand Rapids ARA, Inc., P.O. Box 1248, Grand Rapids, MI 49501.

Sept. 18, **4th Annual Seaway Hamfest,** Louisville (Massena), NY. Contact Laird H. Chaffee, WV2HJK, Box 30, West Stockholm, NY 13696, phone 315-265-8710 days.

Sept. 19, **Central Alabama ARA Hamfest,** Montgomery, AL. Contact Hamfest Committee, 2141 Edinburgh Dr., Montgomery, AL 36116, phone 205-272-7980 evenings.

Sept. 19, **South Jersey Radio Assoc. Hamfest,** Pennsauken, NJ. Contact Fred Holler, W2EKB, 348 Bortons Mill Rd., Cherry Hill, NJ 08034.

Sept. 19, **L'Anse Creuse ARC Swap & Shop,** Mt. Clemens, MI. Contact Maurice Schietecatte, 15835 Touraine Ct., Mt. Clemens, MI 48044 (s.a.s.e.), phone 313-286-1843.

Sept. 19, **Skyview Radio Society Hamfest,** New Kensington, PA. Contact Skyview Radio Society, Turkey Ridge Rd., New Kensington, PA 15068.

Sept. 19, **Augusta Hamfest,** Augusta, GA. Contact John Schumacher, N4DOU, P.O. Box 3072, Augusta, GA 30904, phone 404-860-4460 between 6–9 pm EDT.

Sept. 19, **Candlewood ARA Fleamarket,** Newton, CT. Contact George, WB2THN, at 914-533-2758, or Ken, KA1GDS, 203-744-6953.

Sept. 25, **Elmira Hamfest,** Chemung County Fairgrounds. Contact Donald Estus, 42 Maplehurst Park, Horseheads, NY 14845, phone 1-607-739-4807.

Sept. 25–26, **Chicago FM Club Radio Expo,** Lake County Fairgrounds. Contact Harold G. Rowlett, c/o Radio Expo, P.O. Box 1532, Evanston, IL 60204, phone 312-588-3976.

Sept. 25–26, **Wichita ARS Hamfest,** Wichita Falls, TX. Contact WARS Hamfest, P.O. Box 4363, Wichita Falls, TX 76308.

Sept. 26, **Connecticut Valley FM Assoc. Hamfest/Fleamarket,** New London, NH. Contact KA1BWE.

Sept. 26, **Adrian ARC Hamfest,** Adrian, MI. Contact Adrian ARC, Inc., P.O. Box 26, Adrian, MI 49221.

QRP

a monthly feature by
ADRIAN WEISS, K8EEG

THE ART OF VERY LOW POWER OPERATING

QRP Field Day 1981

The 1981 ARRL Field Day provided for quite a few operators to test their knowledge and skill in an emergency operation situation. As usual, some hardy individuals locked horns with Murphy and won hands down. An unfortunate few were scratched by unforeseen variables. That's the neat thing about a QRP FD! Just about everyone plans a highly successful outing, and success looks certain on the drawing boards. The first big variable—conditions—automatically spells disaster if it goes negative. If conditions are good to excellent, something else usually gets in the way, like forgetting to replace the batteries in the keyer, or forgetting to resolder the splayed coax-to-connector joints. If it is going to fail, FD is the time when it does fail!

Last year (1981), the QRP ARC I and Michigan QRP Club joined with the Milliwatt Field Day Trophy program to offer an expanded set of awards, including a plaque for the highest scoring QRP multi-operator, multi-rig entry, and a trophy for the high-scoring under-one-watt entry. The first category enticed a goodly number of entrants, but alas, only one QRP operator had the courage to tackle the really difficult one-watt trophy; in his effort, K5WNH did a bang-up job, racking up 239 QSO's! Our hats are off to K5WNH, and anyone who has actually operated FD at the one-watt level can appreciate the amount of dogged determination that was necessary to come up with this kind of showing! On the other hand, the rest of us five-watt types can stand in amazement at N4BP's phenomenal success of 999 QSOs—one short of a thousand! That is simply incredible. Bet he doesn't do that well this year again, mainly because things can't be perfect every year! Ironically, the club award was won by a bunch of QRP nuts from the QRP ARC I, but it was all fair and square. So much for general comments, and on to the soapbox wherein the wisdom of the tried-and-true QRP FD operators is available for the taking.

"Go Tell It on the Mountain"

Seems like mountaintops were very popular as FD 1981 sites! **Gary Stay, KJ7G,** netted 195 QSOs from a valley at the top of the Wasach Mountains at 8500 ft. altitude in Utah. He used a 40 meter dipole at about 50 ft. and an 18AVT with several radials. He notes that "many contacts would not believe I was QRP, so I finally stopped telling them!" There may be some truth to getting the antenna high and in the clear!

That's Perry, W5SOD, at the controls of AF5B at the 10,800 ft. level in the Sierra Blanca. The cool temperatures were a bit of a hardship, as can be evidenced by the blanket wrapped around Perry.

Bob Spidell, W6SKQ, active in QRP since back in the old *Milliwatt* days, did a fine job from his mountain: "I went back to my old stomping grounds in the mountains near here at an approximate elevation of 7200 ft. Used a 515, homebrew 'ZL Special,' 120 ft. center-fed Zepp, and MFJ antenna tuner. This year the weather cooperated with lots of sunshine and mild temperatures during the daytime, but it sure got very cool at night."

G.E. Periera, K4KBL, used an Argo and dipole atop a mountain in Cobb County, GA, but was only able to put in about 7 hrs of operation. However, lest newcomers start combing local maps for peaks, mountaintops aren't all paradises for FD!

Phil Levine, NØBQL, an inveterate mountain-topper whose exploits will be chronicled in some future column, put in a lot of effort to get to "Top of the World" in Pike National Forest, but managed only 26 QSOs on 20 meters with a mini-transceiver I designed for the purpose. Phil was quite disgruntled, needless to say! Then, at times, success comes only with a dear price tag!

Dave Riehl, AF5B, and Perry Bell, W5SOD, have been going up for three years now with impressive results. "We have operated 1-B for 3 years in the mountains of central New Mexico at 10,000 ft. or higher with excellent results. In 1979 we produced 465 QSOs from Windy Point Overlook, just two miles from Sierra Blanca peak. In 1980 we operated from Monjeau, a 10,000 ft. mountain 4 miles from the '79 site, but we made only 279 QSOs, all c.w., probably due to being among trees and not on top of the peak. This year we struggled up to an elevation of 10,800 ft. We had to negotiate 3.5 miles of Forest Service road—rocky and rough.

"We arrived shortly after 1800Z, unloaded the gear, and put up the tent in sprinkling rain. When we got all ready to go, it began raining and continued for 6 hours till sundown. It was *cold!* The camp stove made the tent passably comfortable, but cold hands don't key very well, even on a keyboard. During the night the temperature must have dropped down into the 30's (F). A beautiful dawn was followed by 3–4 hours of sunshine, and then rain again all day until five minutes before the end of FD. We had beautiful weather for break-up and load-up, though.

Believe it or not, these guys worked an incredible 999 QSOs and still had time to goof around! That's Bob Patten, N4BP, on the left, and cohort N4UM on the right. The shot explains their group name, which, incidentally, is "The Bashful Perverts." "Perverts" we can understand, but "bashful"?

"Propagation was terrific from the high altitude, and that is the reason we go back each year. During a one-hour period on Saturday evening, we had a run of 90 QSOs on 15 meters s.s.b.! It was like a DX pileup; we would call QRZ and 5 or 6 stations would respond. It went on like that for an hour, working them as fast as we could go through the exchanges. It was 'fantastic' and a lot of fun! We would oc-

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casionally say that we were running 5 watts at 11,000 ft. and guys could hardly believe we were putting out such a fantastic signal with such low power. We proved to ourselves that 'mountain-topping' really works.

"But Murphy also got us, in a way. We went to sleep Saturday night with the rig hooked to the 20 ft. mast, loaded for 40 meters. We forgot to switch back to the beam on Sunday and operated all day with the 20 ft. mast. We kept wondering why we weren't producing those pileups of the previous day. We did not discover the reason until taking down the antenna. We were *sick* about it!"

Sounds great, doesn't it? Too bad the highest peak around here maxes out at around 103 ft.! SD is sort of flat. And boring. Oh well . . .

1981 Murphy Does It Again Award

Andy Reynolds, WD9IYT, deserves the recognition (or condolence?) reserved for the chief butt of Murphy this year. Andy read last year's FD report in *CQ*, got fired up, and decided to try FD for his first time ever, and then . . . "Murphy must have stored up especially for me. My 'confirmed' overnight privileges fell through when someone at the park office left an hour early, one of my two batteries (the main one at that) died, a last-minute coax run turned out to be faulty, reducing me to one of two antennas, a Mosley 40 meter loaded vertical. Had a great time, though! All of the above was also very educational so that I'll know better next year and start my planning more than a week in advance!"

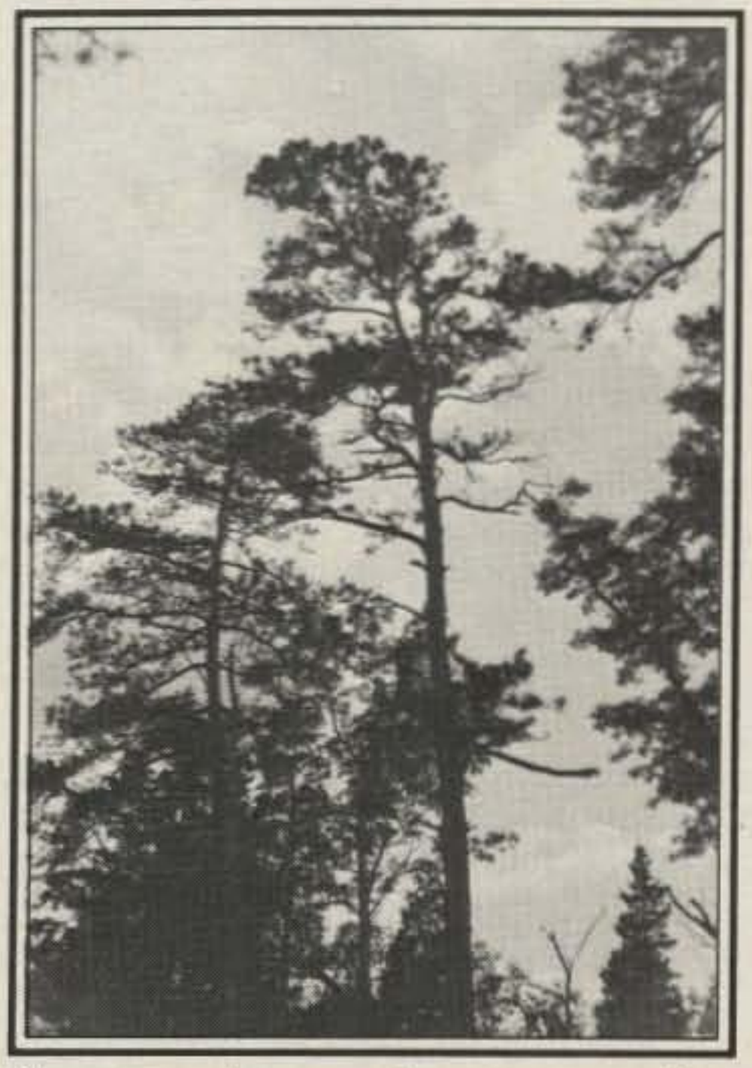
Better Than Last Year

Most FD reports end typically with some version of "wait 'till next year and I'll be ready." In some cases, determination and conditions permit the desired improvement.

Dan Tomcik, K4OU, from TenTec, spent last year (his first QRP FD) on his houseboat "The Love Barge" using an ingenious loaded dipole constructed with bamboo poles, fishing rods (what else would be laying around on a sea-going vessel?), and coils. Went back this year: "Well, I did it again. Spent the FD period on the Love Barge and had a ball. This year I managed to finish making the 40 meter coils and tips for the bamboo rod antenna *(see photo, last year's report, CQ, June 1981)* and it worked just fine. Worked through the night this year on 40 and added a considerable number of contacts to my score of 176 QSOs last year, again using the Argo 515."

Likewise, **Tom Magera, KA1CZF,** capitalized on his '80 FD experience: "Used an Argo and 67 ft. random wire antenna through a TenTec antenna tuner. Worked fairly well and managed a KH6 on 20 meters. Set up portable in a nearby park until dark on Sat. and then finished up at home

Steve, WØOGJ, in the tent at the Argo operating position. The reason for his smile can be seen in the next photo.



The easy-to-use trees supporting WØOGJ's antennas, which included a Delta loop at 55 ft.! Check this photo carefully for ideal tree characteristics: very tall with few if any branches until the top of the tree. Branches at lower levels make the task of tossing a weight over a branch at the top more difficult.

using the random wire thrown up in a tree and a 12v auto battery for power. QSO total not impressive, but greatly improved from last year's (137 QSOs vs 28 QSOs!). After 1½ years of QRP operating, I am still amazed at how well one can do with QRP even in pileups. I managed a c.w. QSO and c.w./s.s.b. QSOs with the KP2A/Desecheo expedition on 15 and 20 meters!"

Steve Russell, WØOGJ, found portable operation to have a distinct advantage over the home QTH: "I set out to better my last serious QRO FD effort of 1975, when I had 182 QSOs with the HW-7. This year found me in NJ, where I sought out some tall trees for supports for my 20 meter Delta loop and 80 meter inverted Vee fed with open wire. The apex of each antenna was at the 55 ft. level, making them far better than the antenna system at the home QTH. Used an Argo 509 and homebrew amp at 9w input. Most contacts were on 80, 40, and 20, with only a few on 15 and 10. At one point I was managing 30 QSOs/hour. Had I been able to operate continuously without sleep, I'm sure I could have exceeded 400 contacts."

Ken Gould, WAØSLU, and **Phil Ott, WAØNLK,** note: "Unfortunately, we were unable to operate the full contest period because of other committments on Sunday, but almost worked as many stations as last year anyhow. Forty meters was our best operational band this year, with fair results on 20 meters. Antennas were a ground-mounted vertical and center-fed Zepp double-extended on 15 meters at a height of 25 ft."

Hawaii is a dream location for everything but FD, judging from comments from **KH6CP:** "I operated at Puu Ualakaa State Wayside park when not participating in the 2A KH6WO operation 500 ft. away. Equipment consisted of an Argo 515 with dipoles at 15 ft. I quickly discovered that I could not operate on the same band as KH6WO—front-end overload. As a result, there were only a few hours when contacts outside KH6 could be made, including W2RQ, N4NC, and W8IZ."

Virg Willis, WB6KQI, and **Loren Murch, WA6OEY,** felt hampered by condx even though they outdid last year's effort. "Band conditions weren't nearly as favorable this year as last, but we had a good time. Used the same basic equipment with the Bird Tenuline Coaxial power attenuator to keep our output under the 5 watt limit. So, once again, we were out in the boonies with 100% battery power, the FT301S, and KLM KT34A tribander, plus dipoles for 80 and 40 meters. They were not too effective. We'll have to use something better next year for sure."

Don Bajorek, KA3ENK: "I had a ball even though I only operated about six hours total. The rig was the Argo 515 and end-fed Zepp fed with 300 ohm twinlead through a Dentron Jr. Monitor tuner. Operated from a small campground in Parkman, OH, with the XYL and kids having fun in the sun."

Ron Wilson, WB5NBQ: "I set up at Hords Creek Lake about 60 miles east of San Antonio, TX, with my tent under some nice Texas oak trees, using an Argo and 40 meter dipole. This was not one of my better performances. I guess I needed more antenna. Had a good time, all things considered."

Lee Carkenord, KAØFPJ: "I used a Kenwood TS180S powered with a 95 amp-hour battery. Antenna was a horizontal Vee beam, each leg 86 ft. long, with an apex angle of about 86 degrees. Fed it with 50 ft. of open line through a homebrew tuner up about 50 ft. The battery wasn't as good as I thought, and it was dead about 1.5 hours before the contest ended. That put an end to my operating. Next year, two batteries!"

WB6KQI at the controls of the FT301S.

Carl Moreschi, N4PY: "I operated from a beach cottage with an 80–15 meter trap dipole up 20 ft. using an HW-8 and car battery. The dipole is homemade with 3 traps on each side, overall length 70 ft. Trap capacitors were made by cutting RG58 to the proper length, with inductors wound on 1 inch PVC tubing. I found the going very rough with QRP. I could not get any answers to my CQs, so all my QSOs were made by answering others. My QSO rate was about 8–10 per hour, except the last hour when I worked 15. At this point, the station density on the band had dropped enough so I was more easily heard."

Ron Wilson, WB5NBQ, at the mike at his Hords Creek Lake QTH in TX. A simple and neat layout.

Clubs

The new category for multi-op, multi-transmitter groups brought out several clubs. **Red Reynolds, K5VOL/9,** headed up a group consisting of **K9BCM, K9PNG, KA9HAO,** and "Frank," and did fairly well with simple antennas. "Setup included a shortened, loaded dipole for 20/15/10 meters, which was designed for mast-mounting, but hung from a line and tree-branch. A trap dipole at about 20 ft. was used on 80/40 meters. A single Argo 515 served as the rig. When the sun was out, a solar panel, borrowed from Motorola by KA9HAO's wife who works there, ran the Argo for 124 QSOs. The panel was leaned against a step-ladder so we could take full advantage of our big thermonuclear generator 93,000,000 miles away."

Tim Fiebig, N2BCF, and **Norman Harbinson, K2NH,** were encouraged by their initial success during 1980 FD with an HW-8, and went back for more this year. "We had a terrific time this year running the two HW-8s and dipoles. Ran the rigs from a motorcycle and a car battery, neither of which showed any signs of weakening after the 24 hr. period. We made over 200 QSOs and are really proud of that!"

Operating position at K5WNH/0, winner of the 1 watt category, on Devil's Head Mountain. Terry operated alone in this beautiful setting with the HW-8 on the card table, appropriate publicity sign and T-shirt, and vertical in background. Must have been a great FD for him!

Joe Parsons, VE6PD, took his "ham family" out, including XYL, **Evelyn, VE6CHN,** and sons **Tim, VE6CGZ,** and **Rick, VE6CLO,** and turned in a good showing, working 34 states and 4 provinces with an FT-7 and trap dipole. "We found FD another exciting and challenging QRP activity. The band conditions, however, were not the best one would wish for, and we had typical FD weather with rain during the setup operation."

Randy Shirbroun, WA0VBW (DXCC QRPp Trophy #35), and three other unnamed operators used an Argo 515 and 80 meter dipole up 75 ft. for 302 QSOs. **Chris Hethorn, KM8X** (DXCC QRP Trophy #36), and 10 others from the MI QRP C used a 515 and introduced XYLs **Deb, KA8ME,** and **Lynn, WD8MFY,** to QRP FD. "They had a great time at their first FD as all of us did." Next year, KM8X plans an assault on the 1 watt trophy. Any other takers?

Ted Van Beek, AC2U, Steve Sacco, Jr., KC2X, and **Ralph Juliano, N3RJ,** used a KLM KT34A mounted on a borrowed trailer-mounted Tri-Ex crank-up to reach a 65 ft. height, plus 80 and 40 meter dipoles at 60 ft. to come up with a 627 QSO total.

N2RI, AI2Q, and **WB2OVH** used a pair of 509's and a double-extended Zepp fed with open line for 40 meters, a collinear array and two half-waves in-phase, both fed with open line through matching networks, for 20 meters. They win the award for the best club name—"Sticky and the QRP Mountain Boys." The QRP ARC I gang went into the field led by President **Tom Davis, K8IF,** with **K8BX** (call used), **WA2JOC, WD8DWQ,** and **WD8MFP** filling in the ranks. A pair of Argo's and 80 meter doublet, 40 meter dipole, and portable TA-33 Jr. led to 745 QSOs. Unimaginative group name—"QRP ARC I."

1981 QRP Field Day Results

5W, 2 Op/1 TX Class

(Entries: Station, Number of QSOs S.S.B./C.W., Total QSOs, Score)

	Call	S.S.B./C.W.	QSOs	Score
1.	N4BP	427/572	999	6144
2.	WB6KQI	519/--	519	3264
3.	W6SKQ	409/20	429	2724
4.	AF5B	216/181	397	2532
5.	W0OGJ	--/361	361	2316
6.	WA6POC	84/202	286	1866
7.	KA0FPJ	282/--	282	1842
8.	K4OU	--/263	263	1728
9.	WA4UQA	--/233	233	1548
10.	N5EM	--/208	208	1398
11.	K5BOT	--/208	208	1398
12.	WB9OAR	194/--	194	1164
13.	N4PY	--/156	156	1086
14.	WA0SLU	--/147	147	1032
15.	KA1CZF	34/103	137	972
16.	KC5EV	126/--	126	906
17.	K4KBL	89/18	107	792
18.	KJ7G	124/71	195	780
19.	KC8P	51/34	85	660
20.	K6TG	4/80	84	654
21.	KA0JGL	46/33	79	624
22.	WA3FNK	1/77	78	618
23.	WB6NYH	64/14	78	618
24.	N4EVC	--/121	121	484
25.	N5AE	17/35	52	462
26.	WB5NBQ	50/2	52	462
27.	KA3ENX	19/33	52	462
28.	N0BQF	--/26	26	306
29.	N9ANK	--/64	64	256
30.	KH6CP	2/10	12	238
31.	WD9IYT	--/5	5	180

1W, 2 Op/1 TX Class

1.	K5WNH	--/239	239	3018

Multi-Op/Multi-TX 5W Class

1.	K8BX	109/745	854	5274
2.	AC2U	--/627	627	3912
3.	N2RI	248/307	555	3480
4.	KM8X	30/377	407	2592
5.	WA0VBW	208/104	312	2022
6.	K9BCM	19/281	300	1950
7.	K2NH	--/224	224	1494
8.	VE6PD	--/155	155	1080
9.	K1NQG	9/53	62	398

One-Watt Lone Ranger

Terry Travis, K5WNH/0, was the sole 1-watt entry, and won convincingly with 239 QSOs. He notes: "This was my first year to enter solo operation and QRP. Actually, QRP isn't that much of a disadvantage, considering you can get to those 'good remote' sites using a battery for power. I operated from Devil's Head Mountain, CO, at an elevation of about 11,500 ft. I didn't start setting up until 1730 UTC (30 min. prior to FD opening), but found that a simple vertical and dipole only takes 30–40 minutes. After 22 years of hamming, I think this has been my most memorable FD experience, and I really look forward to next year, knowing what I learned this year!"

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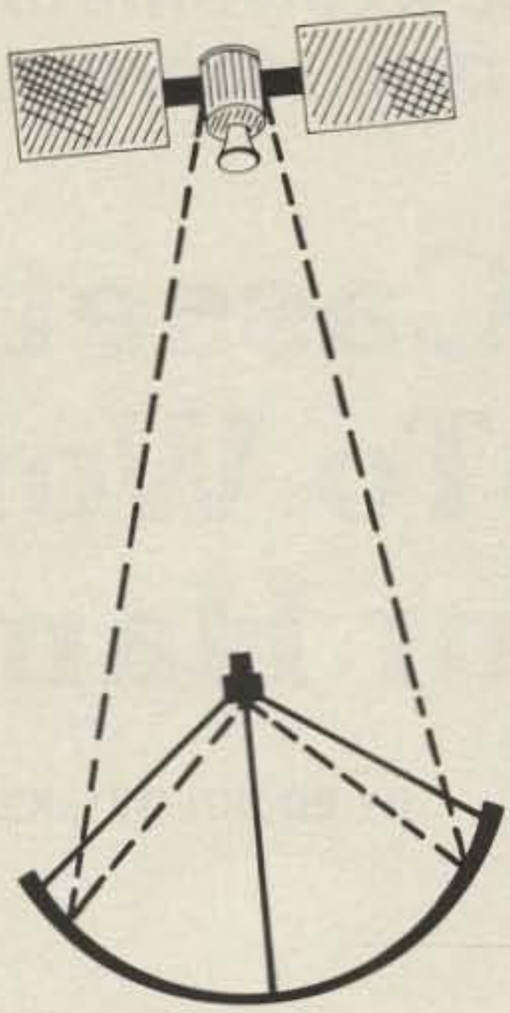

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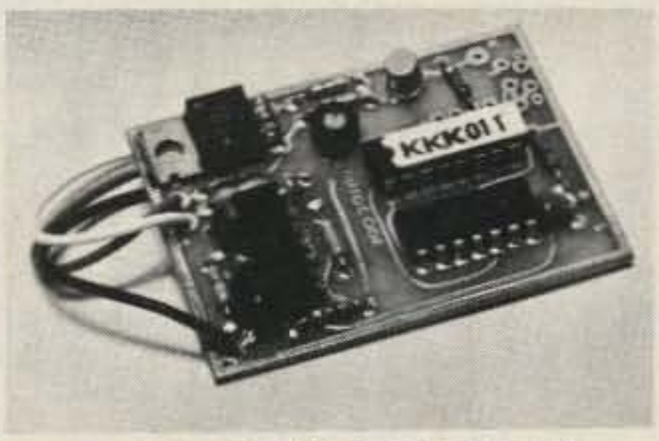

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CT2100 Terminal	$695.00
KB2100 Keyboard	159.00
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HY-GAIN	
TH7DX 7 EL Tribander	call
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V2 2 Mtr Vertical "Excellent"	call
HAM IV Rotator 15 sq. ft.	call
Tailtwister Rotator 20 sq. ft.	call
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720A Magnificent Xcvr!	$1140.00
740 Xcvr Wow!	990.00
730 Excellent Rig!	639.00
251A 2 Mtr All Mode	575.00
290A 2 Mtr All Mode	425.00
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2 AT 2 Mtr Hand Held	235.00
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KT34A 4 EL Tribander	$309.00
KT34XA 6 EL Tribander "Beautiful Ant."	465.00
KANTRONICS	
Interface	$169.00
Mini-Terminal Rcv/Code Conv. Xmt	249.00
Mini-Reader Pkg.	225.00
LARSEN NLA 150MM 2 Mtr Mag.	$39.00
MFJ	
496 Keyboard	$289.00
941C Tuner	81.00
VHF Converter for 2 Mtr HT's	36.00
MIRAGE	
B108	$155.00
B1016	239.00
B3016	205.00
ROHN Towers	call
SHURE	
444D Very Nice Mic!	$50.00
TEN-TEC	
546 Omni C	call
580 Delta	call
525 Argosy	call
TOKYO HY-POWER	
HL32V 25W Amp	$79.00
HL82V 80W Amp	149.00
HL160V 160W Amp	285.00

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CIRCLE 130 ON READER SERVICE CARD

Here's how to get some extra amateur mileage out of an inexpensive cassette tape recorder.

Put Your Cassette Recorder To Work In Your Ham Shack

BY ED SOLOV*, K2SE

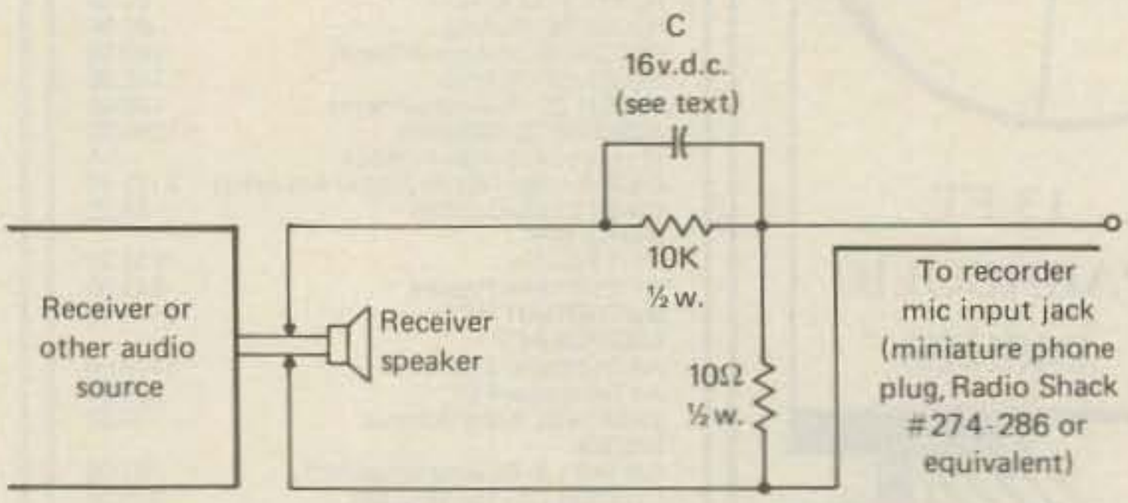

Fig. 1– Connecting a cassette recorder to an audio source.

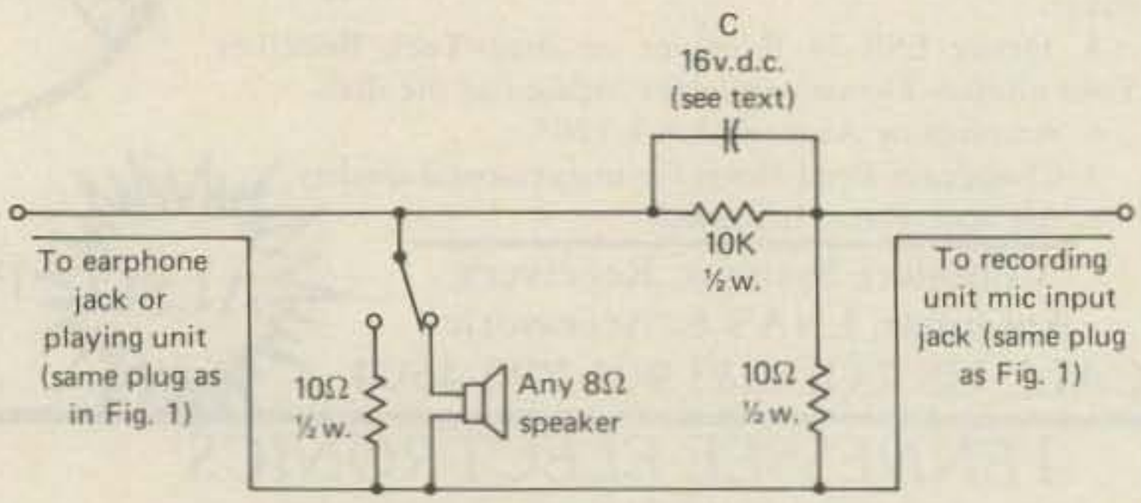

Fig. 2– Recorder to recorder patching connections.

A very handy gadget for the ham shack is an inexpensive cassette recorder. I use mine to record code practice sessions for Novice classes, to duplicate code practice tapes, to record my own QSO's, and to "compress time," as we'll see later. A few simple circuits will help you electrically interface your recorder to your receiver and to other recorders for duplicating tapes.

You might ask, "Why not use a recording mic next to the receiver speaker?" Well, that will work, of course, but then when the dog barks, the phone rings, or the XYL yells at you to take out the garbage, you'll have a permanent record of that on your tape. If you're duping tapes, you'll get sick of hearing the stuff after you've run eleven copies. Direct interfacing is easy and avoids all these problems.

Simple Patch Cords

My experience with a few different, low-cost cassette units—GE and Panasonic models—is that a few millivolts at the mic input jack provides a fine recording signal level. Too much signal, and the recorder overloads and distorts. On the other hand, audio amplitude across the typical 8-ohm speaker coil is a volt or two at normal listening level. Therefore, the first step is to cut down the signal level. In fact, that's the only step, and a circuit such as that shown in fig. 1 does nicely. Since the recorder has automatic recording-level control, there is no need to worry about the particular volume of the receiver; the recorder compensates for it.

Usually, the capacitor, C, is not needed. However, with one such hook-up, I found the recorded signal to be muffled, and I added the capacitor to beef up the higher frequencies. If you need it, try something in the range of 0.01 to 0.05 uF.

If you are connecting your cassette unit to another unit for tape duplicating, try the circuit shown in fig. 2. The 8-ohm speaker provides the proper load for the playing unit and allows you to monitor progress of the duplication. If you don't want to listen, switch in the 10-ohm resistor instead. I've found that results are best if at least one of the two recorders is running on batteries rather than a.c. Otherwise, there are unpleasant problems with 60 Hz hum.

Compressing Time

If you've ever monitored a public service frequency, you may have noticed that there are many minutes of total silence for every few seconds of conversation. A recorder is a handy way of eliminating the long silences. It's done using the remote-control jack and the little VOX-like device of fig. 3 to turn the re-

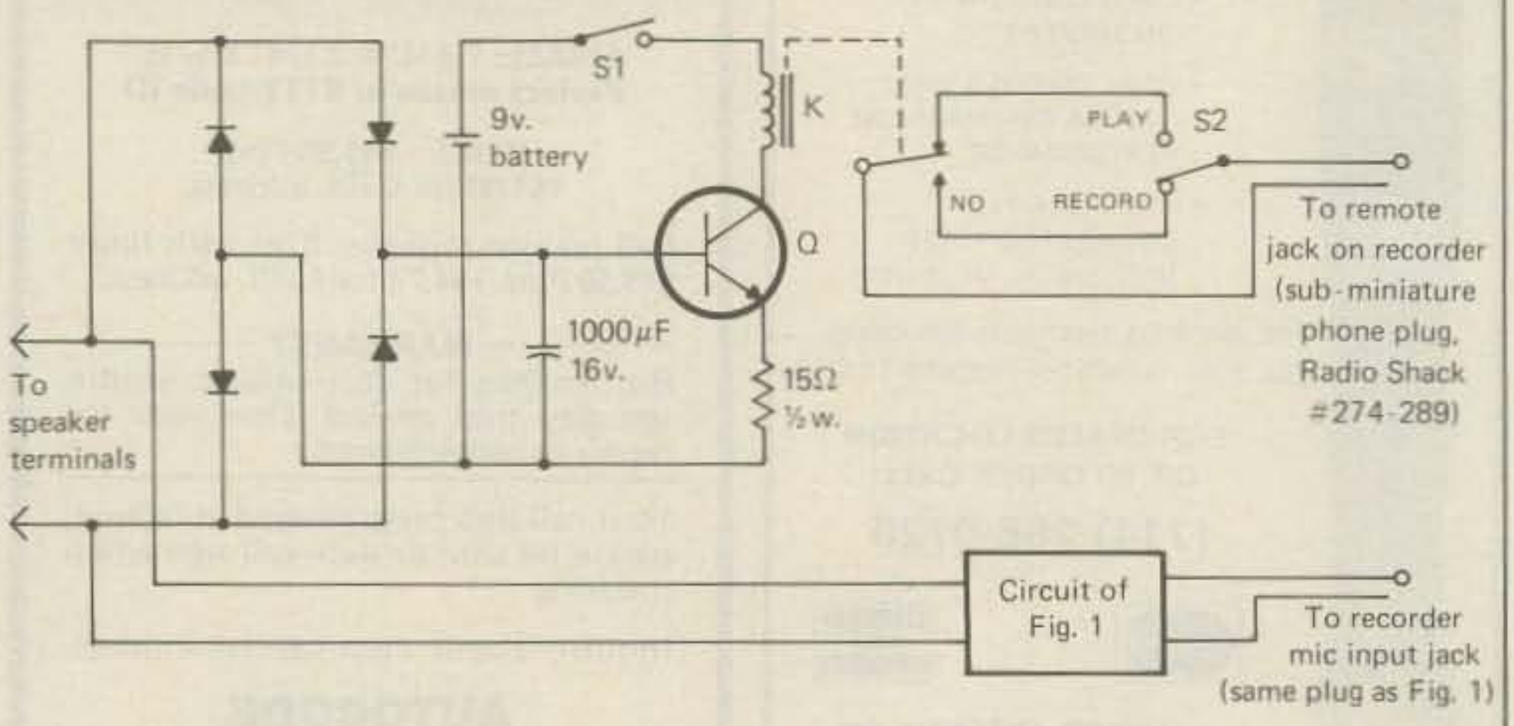

Fig. 3– How to control the cassette recorder by audio at the speaker terminals.

*247 Andover Drive, Wayne, NJ 07470

corder on when there is conversation and to turn it off when there isn't. If you record the conversation, you can come back after a few hours and listen, in a few minutes, to the total business transacted on the frequency during the hours you were off doing something else. It has the added advantage of allowing you to record hours of business on one side of a C-60 or C-90 cassette.

I used an HEP S0007 for Q, but many other NPN transistors, such as the ubiquitous 2N2222A (Radio Shack No. 276-1617, 15 for $1.98) would do as well. The relay, K, can be a 9 to 12 volt d.c. (coil) unit, such as the Radio Shack 275-004. Any handy diodes will do for the bridge.

The way the circuit works is that when there is audio at the speaker, the diodes rectify it and provide base current to Q. That turns on the relay. As long as S2 has been switched to the normally open relay contact (**Record**), the remote circuit of the recorder is completed and the recorder operates. The audio take-off (which is the circuit of fig. 1 again) feeds the speaker signal to the mic input jack, and if the recorder controls have been set in the **Record** position, all is recorded. When the talking stops, the relay shuts off and all stops.

When you come back to listen to what has been going on, put S2 in the normally closed (**Play**) position and leave S1 on. If a live signal comes on while you are playing back the recorded conversation, the circuit will shut the recorder off so that you can listen to the live conversation undistracted. When the live signal ends, playback of the recorded material resumes.

Conclusion

Your particular cassette machine and the uses to which you plan to put it might dictate modifications to some of these techniques, but with a little experimentation you can make your cassette recorder a very valuable addition to your shack.

Contest Calendar

a monthly feature by
FRANK ANZALONE, W1WY

NEWS/VIEWS OF ON-THE-AIR COMPETITION

During the last couple of months the rumor-mongers have had W1WY stepping down as Chairman of the *CQ* Contest program, and W8IMZ resigning under pressure as the WPX Contest Director.

Let's set the record straight. I have been involved with *CQ* contests since 1954 and have no intentions of retiring at the present time. And although Bernie Welch in fact wants to resign from his duties as WPX Contest Director, it is not because of any problems or complaints, but rather because of his workload in other areas.

We just cannot overlook the phenomenal growth of the WPX Contest under Bernie's leadership and have persuaded him to continue as a Co-Director and to pass on his vast experience to Steve Bolia, N8BJQ, in his new assignment as Co-Director of the *CQ* WPX Contest program. Steve has been assisting Bernie for the past several years.

So, the moral to the story is, "Don't believe everything you hear and only half of what you read," especially if you see it in an unreliable publication. And always keep in mind that it's not official unless the news comes out of Hicksville.

Rules for this year's World Wide Contest will be found elsewhere in this issue. There are a few minor modifications and additions, but basically everything is status quo. Following are a few items that you should review:

VIII. Awards: Certificates will now be awarded in each call area of Japan.

IX. Trophies: Six additional plaques have been added to last year's list. Some of these previously have been anounced in this column and are effective for the 1981 Contest now being reported. There is, however, one deletion.

The 3 year eligibility period remains in effect. In a survey of the donors the vote was overwhelmingly in favor of making no change. A minor adjustment has been made in the African and N6TJ Carib./C.A. awards at the request of the donors. These are now available to all participants.

XII. Disqualification: This clause has been rewritten and clearly states the penalty if a station or operator is disqualified.

A couple of corrections in the 1981 WPX Contest scores are also in order. In the S.S.B. Contest the 728 prefix multiplier of AI6V was not a new U.S. record as indicated. The record belongs to the AD8R multi-multi group with a total of 730 prefixes. In the C.W. section gremlins somehow deleted G3FXB's Single Operator, All Band score of 1,902,930 from the World Top Scores listing. Al Slater did indeed make the Top 10; he was 8th high.

A final reminder: Deadline for material for the December issue is September 15th, for the January issue, October 15th.

It's a long column this month, and I hope that I have not overlooked anything.

73 for this time, Frank, W1WY

14 Sherwood Road, Stamford, CT 06905

Calendar of Events

	Aug.	28-29	Ohio QSO Party
*	Sep.	4-5	Aruba Field Day
	Sep.	4-6	FOUR Land QSO Party
*	Sep.	5	Bulgarian C.W. Contest
	Sep.	8-10	YLRL "Howdy Days"
*	Sep.	11-12	European Phone Contest
	Sep.	11-12	Cray Valley SWL Contest
	Sep.	11-12	G-QRP Activity
	Sep.	11-12	ARRL VHF Contest
	Sep.	19	North American CW Sprint
	Sep.	18-19	CAN-AM Phone Contest
	Sep.	18-19	College Scrimmage
	Sep.	18-19	New Mexico QSO Party
	Sep.	18-20	Wash. State QSO Party
	Sep.	18-19	Scandinavian C.W. Contest
	Sep.	25-26	Scandinavian Phone Contest
	Sep.	25-26	CAN-AM C.W. Contest
	Sep.	25-26	Delta QSO Party
	Sep.	25-26	Maine QSO Party
	Sep.	26	North American SSB Sprint
	Sep.	25-27	Massachusetts QSO Party
	Oct.	2-3	California QSO Party
	Oct.	2-3	VK/ZL/Oceania Phone Contest
	Oct.	9-10	VK/ZL/Oceania C.W. Contest
	Oct.	10	RSGB 21/28 MHz Phone
	Oct.	16-17	Boy Scouts Jamboree
	Oct.	16-17	Pennsylvania QSO Party
	Oct.	16-17	ARCI QRP C.W. Contest
	Oct.	17	RSGB 21 MHz CW Contest
	Oct.	20-21	YLRL Anniv. CW Party
	Oct.	23-24	Maryland/D.C. QSO Party
	Oct.	**30-31**	**CQ WW DX Phone Contest**
	Nov.	3-4	YLRL Anniv. Phone Party
	Nov.	13-14	European RTTY Contest
	Nov.	**27-28**	**CQ WW DX C.W. Contest**

**Covered last month.*

Ohio QSO Party

0000Z Sat. to 2400Z Sun., Aug. 28–29

This year's party is again being sponsored by the Cuyahoga Falls ARC.

The same station may be worked on each band and mode for QSO and multiplier credit.

Exchange: RS(T) and QTH. County for Ohio, ARRL section or country for others.

Scoring: Two points for each contact with an Ohio station. Contacts with a Falls member are worth 10 points. Work the club station W8VPV for 25 points. (Club members should identify themselves.)

Ohio stations score 5 points for out-of-state contacts, plus the member and club bonuses.

Multiplier: For Ohio, ARRL sections and DX countries. All others use Ohio counties (maximum 88) for their multiplier.

Frequencies: 5 kHz up from low end of each General Class band, both on s.s.b. and c.w. The club station W8VPV will be found near these frequencies.

Awards: Plaques to the top-scoring Ohio and out-of-state station. Certificates to the winning stations in each ARRL section, Ohio county, and DX country.

Dupe sheets are required for stations making 200 or more contacts. A summary sheet showing the scoring, the usual signed declaration, etc., is also requested. Include a large s.a.s.e. for a copy of the results.

Mailing deadline for all entries is September 29th to: The Cuyahoga Falls ARC, P.O. Box 6, Cuyahoga Falls, OH 44222.

FOUR Land QSO Party

1800Z Sat., Sept. 4 to 0600 Sun., Sept. 5
1300Z Sun., Sept. 5 to 0100 Mon., Sept. 6

The Brightleaf ARC is again sponsoring this, the 12th annual QSO Party, to make the many counties in the eight 4th district states available to county hunters.

The same station may be worked on each band and mode, again if operating portable or mobile from each county change. Stations in the 4th area may work each other for QSO and multiplier credit.

Exchange: RS(T) and QTH. County and state for the 4th district; state, province, or country for all others.

Scoring: *4th call area*—One point per QSO. Multiply total QSO points by the number of states, provinces, and countries worked.

All others—Two points for each 4th area station worked, times the total 4th area states and counties worked. Contacts with the club station W4AMC count 5 QSO points.

Frequencies: C.W.—3575, 7055, 14070, 21070, 28090. Phone—3940, 7260, 14340, 21360, 28600. Novice—3710, 7110, 21110, 28110.

Awards: Certificates to the top scorers in each state, VE province, and DX country, 2nd and 3rd place where warranted. Also county awards to 4th call area states and Novices.

Mail logs within 30 days to: Contest Chairman, Bob Knapp, W4OMW, 105 Dupont Circle, Greenville, NC 27834. Include a large s.a.s.e. for results.

YLRL "Howdy Days"

1800Z Wed. to 1800Z Fri., Sept. 8–10

This activity is for YL's, and scores will be based on contacts between YL's only. All licensed women operators throughout the world are invited to join the party.

All bands and modes may be used. (Frequencies?) Crossband and Net contacts do not count. Only one contact with the same station is permitted, regardless of the band.

Score 2 points for each YLRL member worked, and 1 point if it's with a non-member. Therefore, members should identify themselves in the exchange. There is no multiplier; just add the QSO points.

The top scoring YLRL member will receive her choice of a YLRL pin, charm, or stationery. The highest scoring non-member receives a one-year membership in the YLRL.

Submit your original log, no carbon copies. Indicate if you are a member, score your log, and sign the summary sheet. You are expected to delete all duplicate contacts. For each duplicate contact that is removed by the Committee, a penalty of 3 additional and equal contacts will be exacted.

Logs must be received by October 11th and go to: Sandi Heyn, WA6WZN, 962 Cheyenne St., Costa Mesa, CA 92626.

Cray Valley SWL Contest

1800Z Sat. to 1800Z Sun., Sept. 11–12

Sponsored by the Cray Valley Radio Society of Great Britain, this event is probably the biggest s.w.l. competition in the world. The results are tabulated by an extensive computer system, and are known in a relatively short time.

You can use up to 18 hours of the contest period. Multi-operator groups may log during the entire period.

There are two sections, phone and c.w., each with two categories, single operator and multi-operator. Use all bands 1.8 through 28 MHz.

Scoring should be compiled as follows: One point for each station heard, multiplied by the number of different countries heard on each band. The call areas of the U.S., Canada, and Australia will each count as separate countries.

CQ, QRZ, or similar calls do not count, and the practice of logging a series of contacts made by one station is not permitted. If points are claimed for both sides of a QSO, the call sign of both stations must appear in the log.

Countries will be determined by the official RSGB country list, which is similar to the ARRL DXCC list.

Although not required, it is desirable that official log forms be used. A large s.a.s.e. (or IRC's) to G4DFI will get you a sample. If you make up your own, include the following information: date, time in GMT, band, station heard, station being worked. RS(T) at your location.

Certificates will be awarded at the discretion of the Society. Neatness of logging will also be taken into consideration.

Entries must be received no later than November 1st and go to: Owen Cross, G4DFI, 28 Garden Avenue, Bexleyheath, Kent DA7 4LF England.

G-QRP Club Activity

0001Z Sat. to 2400Z Sun., Sept. 11–12

This is the second of a series of three held by the G-QRP Group each year. The next one will be on Dec. 26–31. A full list of frequencies and times was given in the February Calendar.

This is not a contest, but an activity to promote QRP interest. Send all reports to: Chris. J. Page, G4BUE, Alamosa, The Paddocks, Upper Beeding, Steyning, West Sussex, BN4 3JW, England.

"College Scrimmage"

2200Z Sat. to 0400Z Sun., Sept. 18–19

This year the activity will be confined to s.s.b. only. The idea of this party is to put long-lost alumni in touch with each other and with their alma mater.

Entry classes are alumni and college stations, single transmitter only. Each station may be worked once per band.

Exchange: Name of school and the last number of the year you graduated or will be graduating (example, Harvard '77). Club stations use name of college in their exchange.

Scoring: Multiply total QSO's by the number of different colleges worked.

Frequencies: 5 kHz up from low end of each General class section of the phone bands.

Logs go to: Penn State ARC, 202 Engineering Unit E, University Park, PA 16802.

North American "Sprint"

C.W.: Sept. 19 S.S.B.: Sept. 26
Sunday: 0100 to 0459 UTC (Sat. night)

The National Contest Journal has added an s.s.b. section to this fall's contest. As the name "Sprint" implies, it's a real shorty—only 4 hours.

North Americans will be working other North Americans as well as stations in other countries. Single operator only.

Exchange: Call, QSO no., name, and QTH (state, VE province, or country).

Scoring: Multiply total QSO's by the sum of states, VE provinces, and other North American countries worked for your final score. (US and VE are not countries; KH6 is not a state.) There are 8 VE provinces: Maritime and VE2 through VE8.

Frequencies: Three bands only: 3530–3550, 7030–7050, 14030–14050 kHz on c.w., and 3870–3910, 7210–7240, 14260–14290 kHz on s.s.b.

Awards: A trophy to the highest scoring station on each mode. Certificates to the top station in each U.S.A. call district, Canada, and other countries. The top ten scores, the winning team, and each member of the winning team will also be rewarded.

Team competition is limited to a maximum of 10 operators as a single unit. Precontest registration is required for each team at least 24 hours before the start of the "Sprint." W6OAT is the coordinator.

There are other detailed rules, a special QSY rule, etc. I suggest you write to W6OAT or K7GM if you do not have a copy of the National Contest Journal.

Entries must be received no later than 30 days after the end of each "Sprint." The C.W. go to Rusty Epps, W6OAT, 948-H Kiely Blvd., Santa Clara, CA 95051, and the S.S.B. to Rick Niswander, K7GM, 1914 W. Cortez Cir., Chandler, AZ 85224.

Canadian-American Contest

Phone: Sept. 18–19 C.W.: Sept. 25–26
1800Z Sat. to 1800Z Sun.

Sponsored by the Ontario Contest Club and the Canadian DX Assn., this contest was organized to promote friendship among Canadian and American amateurs.

Use all bands, 1.8 through 28 MHz, in the U.S. General portion of each band.

Categories: Single operator, all band, single band, and QRP. Also multi-operator, single transmitter.

QRP is limited to a maximum of 10 watts input.

Single operator stations are limited to 20 hours with one or two rest periods. Multi-operator stations can operate the full 24 hours.

Exchange: RS(T) plus QSO no. starting with 001, and state or province abbreviation (use CN for Caribbean and PC for Pacific U.S. possessions).

Points: U.S. to U.S. and VE to VE QSO's, 2 points. U.S. to VE QSO's 3 points.

Multiplier: 50 U.S. states; 2 U.S. possessions (CN and PC); 10 VE provinces; 2 VE territories (NWT and YU); 1 VE island (Sable and St. Paul). Total of 65 per band (maximum of 390).

Final Score: Total QSO points times the sum of the multiplier from each band.

Awards: Certificates to the winners in each multiplier area on each mode in the single operator category and to the top five multi-stations in each country for combined phone/c.w. scores. In addition, there are nine plaques and trophies for the U.S. and Canadian champions: single operator, phone, c.w., combined, multi-operator combined, and club competition scores.

Do not use separate log sheets for each band. Indicate the multiplier the first time it is worked on each band. Entries with over 200 QSO's must include a check sheet.

It is suggested you send for the official

rules, sample log forms, and check and summary sheets from VE3BMV. Include a large s.a.s.e. (do not glue U.S. stamps to envelope).

Mailing deadline is 30 days from the end of the contest to: CAN-AM Chairman, VE3BMV, P.O. Box 65, Don Mills, Ont., Canada M3C 2R6.

New Mexico QSO Party

1800Z Sat. to 2100Z Sun., Sept. 18–19

The Albuquerque DX Assn. is again sponsoring this one. Efforts are being made to activate all 33 New Mexico counties.

The same station may be contacted on each band and each mode for QSO and multiplier credit, and New Mexico mobiles in each county change.

Exchange: RS(T) plus a consecutive QSO no., starting with 001, and QTH. County for NM stations; state, province, or DX country for others.

Scoring: Two points for phone contacts, 3 points for c.w. QSO's.

New Mexico stations multiply total QSO points by total number of states, VE provinces, and DX countries worked. All others multiply total QSO points by total number of New Mexico counties worked on each band and mode.

Frequencies: C.W.—35 kHz up from low end of each band. Novice—25 kHz up from low end of each Novice band. S.S.B.—3900, 7270, 14300, 21370, 28570.

Awards: Certificates to the highest scorer in each state, VE province, and DX country. Certificates will also be awarded to each station submitting a score of 100 or more points. Plaques to the top single operator score from NM and out of state, and highest scoring NM portable.

Mailing deadline for logs is October 15th to: Station K5QQ, 1005 Morina Court NE, Albuquerque, NM 87112. Include a large s.a.s.e. for results.

Wash. State QSO Party

0100Z to 0700Z Sat., Sept. 18
1300Z to 0700Z Sat./Sun., Sept. 18–19
1300Z to 0100Z Sun./Mon., Sept. 19–20

This is the 17th annual party sponsored by the Boeing Employees ARS (BEARS). The same station may be worked on each band and mode for QSO and multiplier credit. Wash. stations may work other in-state stations for QSO points.

Exchange: QSO no., RS(T), and QTH. County for Wash.; state, province, or country for others.

Scoring: Phone contacts are worth 2 points, c.w. contacts 3 points.

Wash. stations multiply total QSO points by number of states, VE provinces, and DX countries worked. Others use Wash. counties for their multiplier (maximum of 39). There is an additional multiplier of one (1) for each group of 8 contacts with the same Wash. county for non-Wash. stations.

Frequencies: C.W.—1805, 3560, 7060, 14060, 21060, 28160. Phone—1815, 3925, 7260, 14280, 21380, 28580. Novice—3725, 7125, 21150, 28160.

Awards: Certificates to the top scorers, both single and multi-operator, in each state, VE province, DX country, and Wash. county. Additional awards where warranted.

The World Five Bears Award is available to anyone working 5 club members before, during, or after the party. The Worked Three Cubs Award is available for working 3 Novice club members.

Include a check sheet with your entry if you made 200 or more contacts. Results will be mailed to all entrants, no s.a.s.e. required.

Mailing deadline is October 20th to: Boeing Employees ARS, Contest Committee, Att: Willes D. Propst, K7RS, 18415 38th Ave. S., Seattle, WA 98188.

Scandinavian Activity Contest

C.W.: Sept. 18–19 Phone: Sept. 25–26
Starts: 1500 GMT Saturday
Ends: 1800 GMT Sunday

It's the world working the Scandinavians in this the 24th SAC. The same station may be worked on each band for QSO and multiplier credit.

It is suggested that the following sections of the bands be used. C.W.—3505–3575, 7005–7040, 14010–14075, 21010–21120, 28010–28125. Phone—3600–3650, 3700–3790, 7050–7100, 14150–14300, 21200–21350, 28400–28700. Stations in Regions 2 and 3 use their frequencies above 3790 and 7100.

The prefixes used in Scandinavia are: LA/LB/LG/LJ (Norway); JW (Svalbard and Bear Is.); JX (Jan Mayen); OF/OG/OH/OI (Finland); OH0 (Aland Is.); OJ0 (Market Reef); OX (Greenland); OY (Faroe Is.); OZ (Denmark); SJ/SK/SL/SM (Sweden); TF (Iceland).

Classes: Single operator and multi-operator, both single and multi-transmitter. Multi-single must remain on the same band at least 10 minutes. Multi-multi only one signal per band. Club stations are considered as multi-operator.

Exchange: RS(T) plus a QSO number starting with 001. Multi-multi stations use separate serial numbers on each band.

Points: Europeans score 1 point for each SAC contact. Non-Europeans score 1 point for each SAC contact on 14, 21, and 28 MHz, 3 points on 3.5 and 7 MHz.

Multiplier: Each call area in the above list of Scandinavian countries worked on each band (call areas, not prefixes).

Final Score: The sum of QSO points from all bands times the sum of the multiplier from each band.

Awards: Certificates to the winning station in each class, both c.w. and phone, in each country and U.S.A. call area. Additional awards depending on the returns.

1981 C.W. All Asian Contest Results

U.S.A.		
*AE6U	1.9	126
K6SE	"	105
*W7DRA	3.5	806
*N6QW	"	256
*N6IG	7	29,848
N6TV	"	28,450
AI6V	"	23,506
N6VI	"	20,257
*WA7UEC	"	8,360
*KC2X	"	35
*W6SZN	14	20,328
K6XT	"	19,250
*K3TW	"	3,348
*KJ7I	"	703
*W5TVX	"	380
*K1MEM	"	208
*WA4MIY	"	144
WA4OML	"	70
*N6RZ	21	44,643
K6LL	"	24,163
*WA3DMH	"	558
*N4MM	"	340
*WB9UAI	"	312
*WA2LWT	"	144
*KA7GXO	"	121
*N0CKC	"	88
*W1OPJ	"	72
*KA8IPL	"	13
*N6PE	28	1,012
K6OMB	"	180
*N6RO	AB	337,549
*N6CT	"	176,042
*N5JB	"	40,208
*W8UVZ	"	36,080
*W3GM	"	32,648
*W7YF	"	8,245
*AI1S	"	8,107
AA6EE	"	5,820
W1END	"	5,376
*K0RWL	"	5,358
W3GRF	"	4,340
K8AC	"	3,788
*W2HL	"	3,240
W5OB	"	3,157
W1CNU	"	1,792
N6JM	"	1,530
KE5B	"	1,200
*W4KO	"	1,080
K2CL	"	672
*W9QWM	"	608
W7YS	"	468
KA2CGV	"	459
W3ARK	"	414
KD4PP	"	374
KA1CBD	"	265
WB2QEU	"	240
W7JKA	"	234
W5EIJ	"	35
KA3AKY	"	9
*N5CDO	M-Opr.	152,874
*W6BIP	"	142,635
N6AUV	"	16,245
*WA3SFJ	"	69
Canada		
*VE3BMV	21	975
*VO1AW	AB	6,903
VE7ZK	"	1,143
Dom. Rep.		
*HI8LC	AB	1,768
Panama		
*HP1XAT	21	4,180
*HP1AC	AB	5,616

Certificate winners

No-79-80

Plaques will be awarded to the top-scoring station in each continent.

The usual disqualification criteria will be observed. Include a summary sheet and a dupe sheet for logs with more than 200 QSO's.

Mailing deadline is October 30th, and this year logs go to EDR Contest Manager, Leif Ottosen, OZ1LO, Bankevejen 12, Kong, DK-4750 Lundby, Denmark.

Delta QSO Party

1800Z Sat. to 2400Z Sun., Sept. 25–26
(Rest period 0600Z to 1200Z Sun.)

This is the 13th annual QSO party sponsored by the Delta Div. of the ARRL.

Delta stations (Ark., La., Miss., Tenn.) may contact stations both inside and outside their boundaries. Others, only Delta stations.

The same station may be worked on each band and each mode, portable and mobiles in each county change.

Exchange: QSO no., RS(T), and QTH. County and state for Delta stations. ARRL section for others.

Scoring: *For Delta*—Total number of QSO's multiplied by ARRL sections worked (maximum of 74).

Outside Delta—Total QSO's multiplied by the Delta counties worked (maximum of 316). DX stations may be worked, but for QSO points only.

Frequencies: C.W.—80 kHz up from low end of each band. S.S.B.—3990, 7290, 14290, 21390, 28590. Novice—3725, 7125, 21125, 28125.

Certificate Awards:

A. Achievement: To all stations contacting 5 or more stations in each of the 4 Delta states.

B. Delta: To the 3 highest scoring stations in each of the 4 Delta states; 4th and 5th place awards if warranted.

C. Others: To the highest scoring station in each ARRL section and country; 2nd and 3rd place awards if warranted.

D. Plaques: To the top scorers in and outside the Delta division. Top portable and mobile Delta stations. Highest scoring Delta Club station.

(For more detailed information and sample log forms send an s.a.s.e. to W5XX.)

Mailing deadline for logs is October 21st to: Malcolm P. Keown, W5XX, 213 Moonmist, Vicksburg, MS 39180.

Maine QSO Party

2300Z Sat. to 2359Z Sun., Sept. 25–26

The Portland A.W.A. is running this one on this busy September weekend. The organizers of this party said they didn't mind being on a busy weekend, that they would profit from the activity created by other contests. You know, they might have a point there!

The same station can be worked on each band and each mode, and ME stations may work other ME stations for QSO and multiplier credit.

Exchange: QSO no., RS(T), and QTH. County for Maine; state, province, or country for others.

Scoring: Each contact is worth 3 points. ME stations multiply total by (ME counties + states, + VE provinces + DX countries) worked. All others use Maine counties for their multiplier (maximum of 16 possible).

Frequencies: C.W.—1805 and 60 kHz up from low edge on other bands. Phone—1815, 3930, 7280, 14280, 21380, 28580. Novice—3720, 7120, 21120, 28120.

Awards: Certificates to the top-scoring stations in each state, VE province, country, and ME county.

Applications for the Worked All Maine Counties Award may also be sent to the address below.

Mailing deadline is December 1st to: Portland A.W.A., P.O. Box 1605, Portland, ME 04104.

Massachusetts QSO Party

1600Z Sat. to 0200Z Mon., Sept. 25–27

This party is again being sponsored by the Greater New Bedford Contestors.

A station may be contacted once on each band and mode for QSO credit.

Exchange: RS(T) and QTH. County for Mass., state or VE province for others.

Scoring: Two points for each s.s.b. QSO; 4 points if it's on c.w.

Mass. stations multiply total QSO points by (Mass. counties + states + provinces) worked. Others QSO points × total Mass. counties worked.

Bonus: Add 100 points to total score for each of the 3 sponsors worked (KA1GG, N1AVA, K1KJT), counted once only for bonus points.

Mobile and portables may be contacted from each county change. DX stations count for QSO points only.

Frequencies: C.W.—1810, 3560, 7060, 7120, 14060, 21060, 21120, 28060, 28120. Phone—1820, 3960, 7260, 14290, 21380, 28590, 50110.

Awards: Certificates to 1st, 2nd, and 3rd place winners in each Mass. county and each state. Two special awards: one to the ARC in Mass. with the highest aggregate score (minimum 3 logs), and one to the Mass. station who beats the present record of 1483 QSO's made by K1GSK in the 1979 party. Certificates will be given to stations working all 3 sponsors.

Include a summary sheet showing the scoring and all essential information with your entry. Include 50¢ in postage (no envelope) for a copy of the results.

Mailing deadline is October 31st to: Ed Peters, K1KJT, 29 Greenbrier Drive, New Bedford, MA 02745.

dateline... Washington, D.C.

a regular feature by
THEODORE J. COHEN, N4XX

THE INS AND OUTS OF THE WASHINGTON SCENE

CQ Publishes Exclusive Interview with the Honorable Louis O. Giuffrida, Director, Federal Emergency Management Agency (FEMA)

Elsewhere in this issue, readers will find an in-depth, penetrating interview with the director of the agency responsible for responding to national emergencies. The exchange with the Honorable Louis O. Giuffrida explores a number of areas in which FEMA interacts with the amateur service and with various emergency radio services sponsored by the military, the states, and the ARRL. For a candid view of the role amateurs can play in providing communications during emergencies ranging from storms to nuclear war, don't miss this month's exclusive interview with Louis O. Giuffrida.

Sen. Harrison Schmidt Recommends Delay in Ratification of WARC-79 Treaty

Speaking before the Senate Foreign Relations Committee on 18 May 1982, Sen. Harrison Schmidt (NM) stated that his most immediate fear today was that the "United States will not be able to protect and promote (this) nation's telecommunications needs at the Plenipotentiary Conference and at subsequent ITU conferences." Schmidt was referring to the ITU's Plenipotentiary Conference which will be held this fall and will consider changes in the basic convention governing the structure and functions of the ITU.

It was Schmidt's opinion that "the basic objective of WARC-79, to provide uniformity and certainty in the Table of Allocations so that countries may effectively plan for their telecommunications needs, was not accomplished." Further, the Senator questioned the viability of the "one-nation, one-vote" policy of the ITU, given U.S. requirements for spectrum and orbit resources.

The Senator called on the Foreign Relations Committee to delay action on the WARC's "Final Acts" until after the conclusion of the Plenipotentiary Conference. Said Schmidt: "It is possible that, upon the conclusion of the Plenipotentiary Conference, we will be in a better position to determine what our prospects are for reaching acceptable agreements at future conferences."

In his speech, Sen. Schmidt cited numerous cases in which the U.S. delayed ratification of ITU decisions to protect our vital interests. And he recognized that by delaying ratification, we may reduce the protection to which we are entitled under the treaty. Regardless, Schmidt believed that "our long-range national interests will be served by 'biting the bullet' and delaying ratification."

The Senator noted that a delay such as that which he proposed does not prevent the U.S. from implementing the provisions of the Final Acts. In fact, he acknowledged that the U.S. is presently proceeding in a number of areas to bring U.S. operations into compliance with the provisions of the Final Acts.

The Senator closed his remarks with a stinging criticism of the Carter and Reagan Administrations: "This delay would also be beneficial as a strong signal of Senate disapproval of the dilatory approach of this Administration, which, like its predecessor, has failed to comprehend the extraordinary long-term importance of these ITU conferences."

FCC Cites San Diego Ham with Four Rule Violations

Earlier this year, the FCC San Diego field office received 15 complaints from California amateurs concerning alleged intentional interference in the 40-meter band from a station in the San Diego area. Engineers from that office subsequently monitored the station on 7255.5 kHz, noting that it identified using an unassigned "WB6" call. The station was broadcasting music and "party records."

Sophisticated mobile radio direction-finding equipment was then used to locate the source of the transmissions. An inspection of the pinpointed residence revealed that the station was operated by a General Class operator. The operator threatened bodily harm should FCC engineers return to this station.

As a result of the investigation, the operator was issued an Official Notice of Violation, charging violation of the following FCC Rules:

- Unauthorized one-way transmissions;
- Transmission of music;
- Use of call sign not assigned;
- Willful and malicious interference.

Former Amateur Indicted on Seven Counts

A federal grand jury has returned a seven-count indictment against Richard A. Burton for unlicensed operations and for broadcasting obscene, indecent, and profane language. Burton, formally licensed as WB6JAC, was arrested by U.S. Marshals on 30 April 1982, and was arraigned on 3 May; at that time, he was charged with operating an unlicensed radio station. Freed after posting a $10,000 personal recognizance bond, Burton was scheduled to appear in court early this summer. If convicted on all counts, he faces up to 10 years in jail and a fine of $10,000 on each count.

FCC Cracks Down on Unlicensed Operations

Continuing its intensive enforcement program begun earlier this year, the FCC, in the first three weeks of May alone, issued 18 notices of apparent liability ("fines") totaling more than $17,000. According to Joseph Casey, Chief, Investigations Branch, Enforcement Division, Field Operations Bureau, FCC, the following cases were among those handled:

- In St. Paul, MN, a Novice class licensee who had previously had his amateur license revoked for unlicensed h.f. broadcast operations was cited again for operating an unlicensed station. The station, operated by Michael Martin and identified as "Voice of the Voyager," was heard in the h.f. broadcast band, just outside the 40-meter amateur band. Martin was fined $2000; an accomplice, Scott Blixt (also a Novice), was fined $1000.
- In Grand Rapids, MI, the operator of Super Race Systems of New York was fined $1000 for unlicensed operations involving business use of the amateur 2-meter band. The operator used the 2-meter links to provide communications for activities such as white water rafting

8603 Conover Place, Alexandria, VA 22308

races, and he previously had been warned to cease operation.

● In Metairie, LA, Donald Walker was cited for unlicensed operations involving communications with his son, a licensed amateur. The communications took place outside the 40-meter amateur band. Said Walker: "Gee, I figured I'd never get caught because the FCC never monitors." Walker was fined $750. FCC action against his son is pending.

Sharp Nominated to Seat on the FCC

Following months of dispute over the nominee for a contested seat on the Commission, President Reagan earlier this year nominated the Commission's general counsel, Stephen A. Sharp. This nomination, according to *The Washington Post* and *The Wall Street Journal*, represents a victory for FCC Chairman Mark Fowler, who strongly supported Sharp for the position. Also supporting Sharp is the Rev. Jerry Falwell, head of the Moral Majority.

Earlier this year, Chairman Fowler came into conflict with the Senate over Sharp's nomination. Specifically, Mr. Fowler's support for Mr. Sharp was in conflict with Sen. Ted Steven's choice for the position, Marvin Weatherly, a member of the Alaska Public Utilities Commission (and, interestingly enough, KL7NU). Also supporting Weatherly was Sen. Bob Packwood (R-OR), the chairman of the Senate Commerce Committee. So strong was the opposition to Sharp that Sen. Steven, Majority Whip of the Senate, had little trouble convincing Sen. Packwood not to schedule confirmation hearings for him in the event he was nominated by the President.

As this is written, it is not clear whether confirmation hearings will be held for Mr. Sharp. While Sen. Steven has withdrawn Mr. Weatherly's name for the seat, several senators are known to be irritated by Mr. Fowler's lobbying for his candidate.

If confirmed by the Senate, Sharp would fill the vacancy created when Abbott Washburn's term expired on 30 June 1982.

Sabotage Silences Controversial F.M. Station

The Rev. Jerry Falwell's f.m. station, WRVL, long a source of controversy because of interference it causes to f.m. radio and Ch. 6 TV reception in the Lynchburg, VA, area, was put off the air on 31 May 1982, when someone cut the cables supporting the station's tower. However, leaders of the Concerned Viewers of Central Virginia, a group which opposes WRVL's operation because of the interference problem, denies knowledge of the act.

Falwell's 100,000-watt station, which has yet to be granted a permanent license, was ordered some months ago to reduce power to 5000 watts. Station officials complied, but had recently petitioned the Commission for permission to resume operations at full power.

This is the second incident involving the station. Late last year, someone fired several shots at WRVL's tower, but station officials did not report the incident because they feared it would encourage other acts of sabotage.

The latest incident of sabotage is under investigation by the Amherst County (VA) Sheriff's Department and the FBI.

Incidents of violence involving f.m. stations which interfere, among other things, with Ch. 6 reception are not new to the Commission. Two years ago, an f.m. station in Florida was the source of numerous r.f.i. complaints. When the problem was not resolved to everyone's satisfaction, a person or persons unknown set fire to both the station's studios and to the building which housed the transmitter.

International Electrotechnical Comm. Takes Action On TV Receiver Susceptibility to R.F.I.

During a meeting of Sub-Committee E: Interference Characteristics of Radio Receivers (a subcommittee of the International Special Committee on Radio Interference, or CISPR), a draft proposal was prepared which addressed radio-frequency interference immunity of television receivers. Specifically, the paper deals with the measurement techniques which should be used for determining the immunity of receivers to signals in the frequency range 3 to 30 MHz (the so-called "high frequency" band). Note that the paper does not address interference produced by harmonics of h.f. transmitters, but instead, focuses on what is more commonly known as "fundamental overload."

It is intended that the SC E paper be incorporated in CISPR's literature until such time that more extensive measurement techniques are developed.

AMRAD Completes First Phase of Spread-Spectrum Study

The Amateur Radio Research and Development Corporation (AMRAD) recently completed the first phase of its investigations into amateur use of spread-spectrum modulation techniques. These techniques employ a "spectrum spreading" function to produce transmission bandwidths significantly larger than the information bandwidth of the signal, thus allowing the signal to be "hidden" in the noise. Because of this property, SS signals cannot be received on receivers built for use with conventional modulation schemes.

Under the Special Temporary Authorization (STA) issued to AMRAD for the SS study, investigations were conducted in a number of areas. One major concern was the need for self-policing of SS transmissions by amateurs. As a result of its work, AMRAD has developed the concept for a new type of SS receiving system which does not require a knowledge of the spreading function used to produce a frequency-hopped signal.

The Corporation also discovered that there were numerous spreading codes, which while they were complex, did not have privacy properties. Thus, the number of spreading codes available to amateurs is larger than originally thought.

All that AMRAD learned about SS in their first set of experiments was not totally favorable. The biggest unresolved problem encountered with the SS modulation techniques used was the "near/far" effect. That is, in the vicinity of the SS transmitter, the SS signal is higher in signal strength than the ambient noise. However, the signal strength does fall below the noise some distance from the transmitter. Work continues on what can be done to mitigate this problem.

Future SS experiments planned by AMRAD may involve frequency-hopped transmissions in the 14 and 21 MHz bands. Hopping speeds of up to 80 hops per second could be used.

If your interests lie in areas such as spread spectrum and packet radio, AMRAD invites you to join them in advancing the state-of-the-art in communications as we know it today. Write to Mr. Paul Rinaldo, Amateur Radio Research and Development Corporation, 1524 Springvale Avenue, McLean, VA 22101.

General Electric Introduces New Consumer-Oriented Car-Phone Service

According to *Electric Engineering Times*, General Electric has proposed to introduce a new Personal Radio Communications Service (PCRS) for use by consumers. The service would operate on two 4.5 MHz bands in the 900 MHz band, with the two subbands separated by 45 MHz. This type of allocation would provide 150 channels, each 30 kHz in bandwidth.

Using PCRS, a person would communicate from his mobile unit to his base station (ranges of up to 5 miles should be possible). The base station, in turn, would be coupled into a commercial telephone line, giving the operator access to the public telephone network. If repeaters are used (yielding mobile-to-repeater ranges of up to 15 miles), the user would still communicate with his base station, using the latter to tie into the public telephone network.

General Electric estimated that a PCRS system would cost the owner $400 for the GE hardware, plus about $5 a month for service. Repeaters would be licensed to private individuals or groups, with user charges expected to be about $5 a month.

Amateurs could conceivably benefit in two ways from the introduction of PCRS:

- Relatively low-cost equipment for the 900 MHz band would rapidly become available;
- Amateur repeater operators could apply for licenses to operate PCRS repeaters, yielding opportunities for the small businessman.

If approved by the FCC, PCRS could represent a significant improvement over existing mobile telephone service and CB, since the PCRS user would be able to place direct-dial calls.

FCC Moves to Speed Consideration of Amateur Matters

In a move not well publicized, the Commission has begun to handle most matters pertaining to the Amateur service by means of internal memoranda which are circulated to the Commissioners. In fact, most items of a "non-controversial" nature are now handled this way. The memoranda are read and acted upon by the Commissioners, and if no dissenting votes are cast, the proposed action is implemented. If even one dissenting vote surfaces, however, the matter in question is placed on the FCC's agenda.

Some observers in Washington view the new procedure as a "plus," since it can serve to expedite the Commission's business. Others, however, are afraid that they will lose visibility of items before the Commission as well as their understanding of the Commission's day-to-day workings.

FCC Considers Steamlined Equipment Authorization Procedure

Under a proposed equipment authorization procedure, applicants would only be required to notify the FCC that their equipment meets the appropriate technical standards. Such authorization is used to reduce, if not eliminate, potential interference problems by requiring equipment to meet certain standards of operation before it can be sold in this country. Four types of equipment authorization procedures are currently used by the Commission:

- type approval
- type acceptance
- certification
- verification

It is the Commission's belief that simpler authorization procedures could be used without affecting the Agency's ability to control potential sources of interference.

As noted in *Electronic News*, "some of the likely candidates for (the new) notification procedure would be equipment that presents a low potential for causing interference, and 'technically mature' hardware which has been manufactured for a sufficiently long time that it no longer presents design problems." However, no specific classes of equipment were being proposed by the Commission for inclusion in their proposed program.

There are a number of benefits which could result from the introduction of the new authorization procedure. First, use of the new procedures would cut Commission costs. Second, the time required for a manufacturer to obtain authorization would be reduced, and so, manufacturing costs also could be cut.

Dr. Merle A. Tuve Dies

Dr. Merle A. Tuve, retired director of the Carnegie Institution's Department of Terrestrial Magnetism, died on 20 May 1982. Dr. Tuve, who earned his doctorate at Johns Hopkins in 1926, was credited as having played a major role in the development of the proximity fuze during World War II. Moreover, while at Johns Hopkins, Dr. Tuve and a Carnegie scientist (Briet) conducted a radio experiment which confirmed the existence of the ionosphere. Before retiring in 1964, Dr. Tuve announced the development of an image intensifier that significantly increased the power of telescopes used in astronomy.

His honors included a Presidential Medal of Merit and the rank of commander of the Order of the British Empire.

Your Editor thanks the Director of the FCC's San Francisco Regional Office and Mr. John Johnston, Chief, Personal Radio Branch, Private Radio Bureau, FCC, for their contributions to this month's column.

DX

This month by
JOHN A. ATTAWAY, K4IIF

NEWS OF COMMUNICATIONS AROUND THE WORLD

The Scottish poet Robert Burns said it very well:

"The best laid schemes o' mice and men
Gang aft a-gley;
An' lea'e us nought but grief and pain,
For promis'd joy."

In the June DX column we announced that Franz Langner, DJ9ZB, had been elected to the prestigious DX Hall of Fame, and that the award plaque was presented to him a a special DX meeting held in Germany in early May. That was our scheme, but as the poet says, things do go astray.

The presentation meeting was carefully planned by Jim Immelnkemper, DK2BI, Walter Geyrhalter, DL3RK, Rudi Knobloch, DJ3HJ, and myself, K4IIF. It was to be a surprise for DJ9ZB. He was to be present, but he was not to know the real purpose of the meeting until I stood up and unveiled the DX Hall of Fame plaque. I had pages of background material on DJ9ZB and my speech was prepared.

Let me say that surprise was complete! Unfortunately, the surpris*er* became the surprise-*ee* and the surprise-*ee* the surpris*er* when DJ9ZB announced his DXpedition to Mellish Reef also to take place in early May.

In a sense it was fitting. What better backdrop for the announcement of an election to the DX Hall of Fame than the honoree busily passing out contacts from a rare island country contest-style! High drama! It was a first.

Naturally, we were disappointed that we were not able to hand the plaque to Franz personally, but his absence was certainly excusable. Meanwhile, DK2BI is arranging a new presentation date and we hope to have a photo for you in a future column.

Walter's Plaque

One of the highlights of our trip to Germany was the opportunity to present the 5 Band WAZ Award plaque, for all 200 zones, to Walter Geyrhalter, DL3RK. Although Walter has been a good friend for 15 years, during which he has done an outstanding job as German checkpoint for the CQ DX Awards, this was our first opportunity for an eyeball.

In appearance, Walter is a tall, distinguished Bavarian. On the bands, he is one terrific DXer, having worked all 200 zones for a full 5 Band WAZ using only a ground-plane antenna. Earning the 5 Band WAZ plaque is an enormous achievement even with a superb antenna farm including stacked beams. To do it with a ground plane! Obviously, only the most highly skilled operators could ever achieve it.

Our thanks to Kurt Loos, DL1XT, his beautiful XYL, and two delightful daughters for their hospitality in hosting the meeting for the award presentation. Those in attendance included Bahri, DJ0UJ/TA2BR, Leo, DJ7CX, and Valentin, DJ4TV. Many thanks also to Valentin and his XYL for the wonderful dinner the second night in Munich.

P.O. Box 205, Winter Haven, FL 33880

Three of the biggest gun DXers of Germany meet with K4IIF in Trier, West Germany. Left to right are K4IIF, then Jim Immelnkemper, DK2BI, Hermann Samson, DJ2BW, and Karl Mueller, DL9OH. (Photo by the XYL of DJ2BW)

Walter Geyrhalter, DL3RK, receives the 5 Band WAZ plaque from John, K4IIF, Chairman of the CQ DX Awards Advisory Committee. The presentation was made in Munich, Germany, at the home of Kurt Loos, DL1XT. (Photo by Cordula Loos, youngest harmonic of DL1XT)

Contest Awards

While in Finland and Sweden we were pleased to award two plaques for the Contest Department. In Helsinki we presented the W4BVV Operators Plaque for 1980 to Antti Kiviluoma, OH6JW, for achieving the best score from Europe in the Single Operator, All Band Phone category. The presentation was made at a special award dinner held at the home of Miika Heikinheimo, OH2BAD. Attending were Ville, OH2MM; Jorma, OH2KI/OH3XZ; Anssi, OH2QV; Olli, OH2BBM/OH0XX and Jari, OH2BU/OH7RF. Our thanks to Miika and XYL Raili for hosting this event. Our thanks also to Ville, OH2MM, and family for another great dinner the second night in Helsinki.

In Sweden we awarded the Bob Cox, K3EST, trophy for 1980 to the SK2KW team for the best European effort in the multi-operator, multi-transmitter phone category. We were pleased that many of the Outback DX Club group were able to come to Stockholm from northern Sweden for the event, and we are grateful to Lars Mohlin, SM0GMG, for arranging the presentation dinner.

De Extra

Telephone Bills from European Hotels. Traveling DXers should be aware of the peculiar telephone billing practices of European hotels. The rate varies from country to country, but almost everywhere in Europe the hotels are permitted to add an exorbitant surcharge to the actual cost of the call.

These surcharges are less onerous in the Scandinavian hotels than in most other countries. In Norway, Sweden, and Finland the surcharge is about 40–50%, and for a flat fee of only 10 Krona ($2.00), the hotels will allow you to bill your call to your international telephone billing number, or to reverse the charge to your stateside number, where it will be billed at a normal rate.

Unfortunately, this is not so in Germany. Many travelers feel that German hotels are literally given a "license to steal" by their regulating authorities. It is not uncommon for a German hotel to add a surcharge of several hundred percent to the cost of a long-distance call dialed from one of their rooms. For example, on our recent trip we made two calls to the states from different hotels. At the first hotel, the cost of the room was 55 marks per night, about $24. However, a direct dial call to the U.S., less than 10 minutes in length, cost 231 marks, about $101, or over 4 times the charge for the room. At the second hotel a call was made simply

The WPX Program

Mixed

987	VE3KZE	989	JH8NYK
988	N4BPP		

S.S.B.

1502	VE2FOU	1505	SV8CS
1503	KJ9N	1506	JR7ICN
1504	WD5HEG		

C. W.

2151	KD5KP	2152	PY2FK

VPX

224	NL-4276	225	DE3WBD

Endorsements

Mixed: 450 N4BPP. 550 DL9TD. 600 K9BQL, DL9TD. 650 WB0LXM, DL9TD. 700 KP4V. 750 IS0MVE. 800 WA3GNW. 850 AF7M, I5AFC. 1050 SP9CTW. 1100 IT9HLO, SP9CTW. 1150 SP9CTW. 1200 WD8MGQ, SP9CTW. 1250 WA4QMQ, SP9AI, SP9CTW. 1300 SP9AI, SP9CTW. 1350 SP9CTW. 1400 SP9CTW. 1750 YU4HA. 1800 YU4HA. 1850 YU4HA. 1900 YU4HA.

S.S.B.: 350 SV8CS, JR7ICN. 400 SV8CS. 450 SV8CS. 500 EA5ANR. 850 K4CKS. 900 K4CKS, N2AC. 1000 WB9EBO. 1050 WA4OIB. 1200 WA4QMQ. 1450 W0YDB. 1500 I4ZSQ. 1550 I4ZSQ. 1750 K2POA.

C.W.: 350 JR7KND. 450 JA5SIX, WA2CNF, KA7AIG. 500 AG5C. 600 VE2FOU. 650 SP6FER. 750 KF2O. 800 KF2O. 1100 K4RDU. 1150 YU7SF. 1800 W2NC.

VPX: 1102 . . . UB5-0683. 1139 . . . NL-4276.

10 meters: WD5HEG, K9BG.
15 meters: K9BG.
20 meters: KJ7N, K9BG DL9TD.
40 meters: DF9FM.
80 meters: DF9FM.

Asia: JA5SIX, DL9TD, NL-4276.
Africa: WA4OIB, NL-4276.
Europe: NL-4276, EA5ANR, DL9TD.
No. America: KD5KP, NL-4276.
So. America: UB5-0683, NL-4276.
Oceania: NL-4276, KF2O.

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if air-mail desired) to CQ WPX Awards, P.O. Box 1351, Torrance, CA 90505-0351 U.S.A.

to give the phone number of the hotel so that it could be dialed from the U.S. at the U.S. rate. This call took 20 seconds. The charge was 55 marks ($24). Requests to the hotel operator to place a call and bill it to our international telephone credit card were flatly refused. The German hotel rule is that all calls must be billed at the hotel rate, not the true international rate.

The phone bill has arrived here, and we find that the cost of a direct dial call *from the U.S.* to a German hotel during this trip varied from $4.00 for a 3-minute call to $13.50 for a 10-minute call. The same 10-minute call placed from a German hotel would cost over $100. We have heard of unsuspecting travelers who dialed home, only to find when they checked out that the cost of their phone call was greater than the cost of a plane ticket back to the states. There are only two defenses: (1) have calls placed to you from the states at a prearranged time; or (2) leave the hotel and place your calls from a public phone booth. Never, never, never touch a telephone in a German hotel except in a serious emergency.

Perhaps this is out of place in a DX column, but if it saves one traveling DXer his hard-earned dollars, it will be worthwhile. Meanwhile, if someone from the German telecommunications authority wishes to offer an explanation, we will be happy to consider the comments for publication.

Where in the World Is_____?

Amateur radio prefixes have proliferated over the past decade. As a result, even the most ardent WPXer must struggle to keep track of all the new ones. An exotic-sounding prefix, heard for the first time, may be a rare island country halfway around the world, or he could be just across town.

As an aid to members of the Northern California DX Club (NCDXC), AC6V assembled Table I, which shows the locations of stations using the prefixes which are prompting the most questions on the club repeater. We present it to you with thanks to the NCDXC.

Successful QSLing

The following summary of the most important considerations in QSLing to DX stations appeared in the *W6GO/K6HHD QSL Manager List*. This information is always timely.

Basics: Use 24-hour UTC, write or print clearly, and *write out* the name of the month. *Always* send s.a.s.e. or s.a.e. and return postage. Send separate return envelopes for each card desired. If you fold anything, including the return envelope, place it in the envelope with the fold on the bottom. *Be patient!*

Explanations: If you keep your log in Universal Time Coordinates (UTC), the time on your card should agree with the time in the DX station's log and save the QSL manager countless hours. You must have a clock in your hamshack, preferably a 24-hour clock, which tells time in the international standard. This was formerly called GMT and is also referred to as Zulu time by members of the military and by MARS stations. *Keep your log in UTC,* and remember that the *date changes* at 0000. This is late afternoon or early evening in the U.S., 4 p.m. PST or 7 p.m. EST (5 and 8 p.m., respectively, when using Daylight Savings Time).

If you work a station on April 1, 1982, put 4/1/82 on the card, and send it overseas there will be a problem. In most every country but the U.S., dates are abbreviated with the day/month/year so that someone outside W/K-land will read that

Prefix	Location
A22	Botswana, old A2
A71	Qatar, old A7X
AH1–AH0	See KH1–KH0
CF–CK	Canada
CY–CZ	Canada
EA–EH	Spain
H31	Panama
H44	Solomon Is., old VR4
H5	Unofficial prefix for Bophuthatswana. Counts for South Africa.
HD	Ecuador
HG	Hungary
HT	Nicaragua
HW	France
J2	Djibouti, old FL8
J3	Grenada, old VP2G
J5	Guinea-Bissau, old CR3
J6	Saint Lucia, old VP2L
J7	Dominica, old VP2D
J8	Saint Vincent, old VP2S
KH1, AH1, NH1 & WH1	Baker, Canton & Howland Islands
KH2, AH2, NH2 & WH2	Guam
KH3, AH3, NH3 & WH3	Johnson Island
KH4, AH4, NH4 & WH4	Midway Island
KH5, AH5, NH5 & WH5	Palmyra & KH5K, Kingman
KH6, AH6, NH6 & WH6	Hawaii
KH7, AH7, NH7 & WH7	Kure Island
KH8, AH8, NH8 & WH8	American Samoa
KH9, AH9, NH9 & WH9	Wake Island
KH0, AH0, NH0 & WH0	Northern Marianas
KP2	U.S. Virgin Islands
KP4	Puerto Rico
NH1–NH0	See KH1–KH0
NP2	See KP2
NP4	See KP4
P41, P42	Netherlands Antilles, old PJ2, 3, 4 & 9
P47	St. Maartin, old PJ5, 6, 7 & 8
S4	Unofficial prefix for Ciskei. Counts for South Africa.
S8	Unofficial prefix for Transkei. Counts for South Africa.
SV5	Dodecanese Islands
SV9	Crete
SV0	Foreign hams in Greece, Crete or Dodecanese.
T2	Tuvalu, old VR8
T4	Assigned to Cuba, but used unofficially by Venda, which counts for South Africa.
T5	Somalia, old 60
T30	West Kiribati, old T3A, T3K, VR1. Includes Tarawa, Makin & Ocean Island.
T31	Central Kiribati, old T3P or VR1, British Phoenix Islands. Includes Canton & Phoenix Islands.
T32	Eastern Kiribati, old T3L or VR3, Christmas Island or Line Islands.
TK	France
V2A	Antigua, old VP2A
V3	Belize, old VP1
VK9N	Norfolk Island
VK9X	Christmas Island (Zone 29)
VK9Y	Cocos Island
WH1–WH0	See KH1–KH0
WP2	See KP2
WP4	See KP4
XJ–XO	Canada
XQ	Chile
Y11–Y99	East Germany, old DM
YT–YU	Yugoslavia
YZ	Yugoslavia
Z2	Zimbabwe, old ZE
ZV–ZZ	Brazil
1A	Unofficial prefix for S.M.O.M., which is a new country.
4K	Russian polar stations
4M	Venezuela
4N	Yugoslavia
4T	Peru
6D–6J	Mexico
6T–6U	Sudan
8J	Japan

Table I– Prefixes most often asked about. List courtesy AC6V, NCDXC.

The WAZ Program

10 Meter Phone

200	JL1BLW	203	N4WJ
201	JF3GKE	204	WA4VEK
202	OH3YI		

15 Meter Phone

130	I3ZKD	133	OH3YI
131	ZL1BIL	134	JA1MDK
132	KE2C		

20 Meter Phone

406	SP8GUV	409	OH3YI
407	W6PGK	410	KL7Y
408	WB3DNA		

40 Meter Phone

17	I4RYC	18	OH3YI

80 Meter Phone

19	I4RYC	20	OH3YI

10 Meter C.W.

36	N6AW

15 Meter C.W.

70	JH2QAY

20 Meter C.W.

168	KC9T	170	K4CXY
169	K4JLD	171	DL8CM

40 Meter C.W.

35	JH4JLZ

All Band WAZ

S.S.B.

2457	EA2SG	2466	N4WJ
2458	N8BKF	2467	G3WYN
2459	AC8R	2468	JH8BJG
2460	DL9ID	2469	DJ6DU
2461	I1WZT	2470	OE2VEL
2462	JH1BSR	2471	WB6TRP
2463	W1HEO	2472	DL8QS
2464	HB9BFS	2473	VE5ADA
2465	G4FDQ	2474	KE4RX

C.W. and Phone

5372	AG5C	5384	GM3OXX
5373	JA7COE	5385	WB6VGY
5374	DK5XF	5386	DJ8VC
5375	DL7YY	5387	DK5BQ
5376	KG9D	5388	DK9MB
5377	KG2A	5389	DF2NL
5378	N6NW	5390	DLØAF
5379	KE1K	5391	DLØIB
5380	WAØUIR	5392	WA4ZBK
5381	G3LQI	5393	DF8BD
5382	W3OGY	5394	DJ3CJ
5383	HZ1AB		

Applications and reprints of the latest rules may be obtained by sending a self addressed stamped envelope (37 cents) size 4½ × 9½ to the WAZ Manager, Leo Haijsman, W4KA, 1044 S.E. 43 Street, Cape Coral, Florida 33904. Applicants forwarding QSL cards either direct to the WAZ manager or to a check point should include sufficient postage for safe return of their QSL cards. The processing fee for all C.Q. awards is $4.00 for subscribers and $10 for non-subscribers. In order to qualify for the subscriber rate, please enclose your latest *CQ* mailing label with your application.

Mr. and Mrs. Leo Haijsman, W4KA. Leo is CQ's outstanding WAZ Award Manager. His tireless efforts keep this successful program going. Leo's own awards list includes Single Band WAZ (14 MHz), 5 Band WAZ, WPX, All Counties #43, DXCC (311 countries), 5 Band DXCC, and 5-Band WAS. He is president of the local QCWA chapter, past president of the Cape Coral Amateur Radio Club, and is active in Civil Defense. Since retiring from the FCC in 1969, he and his wife have traveled in about 30 countries on 4 continents.

S.a.s.e. is the abbreviation for self-addressed, stamped envelope and s.a.e. means self-addressed envelope. *Always* send at least one s.a.s.e. or s.a.e. If your request is for several cards, or for more than one station handled by the same manager, you may have a long wait unless you send a return envelope for each card you expect to receive.

Remember that postage expenses come out of the QSL manager's pocket. If you don't provide the means to answer your card, you may receive a reply via the bureau or you may not receive any reply at all. When you send a card to a DX station, or to his QSL manager, include International Reply Coupons (IRC's) for return postage with your s.a.e. S.a.s.e. is fine if the manager is in the U.S. Some people send "green stamps" (U.S. dollar bills) for return postage. Please use discretion in this regard. U.S. dollars are good in most countries, but there are a few places in the world where you may get the person in trouble by sending money to him. Also, he may never receive it, as mail theft is common in some areas.

If you fold your s.a.s.e. or s.a.e., put the fold in the bottom of the mailing envelope, otherwise it may be cut in half by a letter opener.

Be patient! The most common way for a DX station to send his log to the QSL Manager is through the mail. Sometimes it may take 6 months due to lack of mail service to some remote islands.

There is no avoiding the fact that QSL-ing is expensive. Just remember that it is also costly for the fellow at the other end because everybody wants his card. He

date as January 4, 1982 instead of April 1, 1982. Therefore, it makes sense to avoid the problem by writing out the name of the month.

Be sure that all of your entries on the card are readable. If your handwriting is poor, by all means print! If the DX station, or his manager, cannot decipher your writing, you may have your card returned to you without a reply, or your card may simply end up in the circular file. *Do not correct mistakes* on the card; fill out a new one. Correcting errors on a card which is later used to apply for an award may cause that card to be disqualified as "altered."

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RG11U 96% shield 75 ohm mil spec . . . . . 25¢/ft.
RG58AU Stranded Mil Spec 96% Shield . . . . . 12¢/ft.
RG58U mil spec 96% shield . . . . . 11¢/ft.
RG62AU 96% shield 93 ohm mil spec . . . . . 12¢/ft.
RG142/U Double silver shield . . . Teflon . . . . . 95¢/ft.
RG174/U-mil spec 96% shield . . . $8./per 100 ft or .10¢/ft.
RG213 noncontaminating 96% shield mil spec . . 36¢/ft.
RG217/U Double shield 50 ohm . . . . . 85¢/ft.
IBM-TWINAX #7362211 . . . . . $240.00/1000 ft.

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RG8U 80% shield . . . . . 16.95/100 ft. or 19¢/ft.
RG58U 80% shield . . . . . 07¢/ft.
RG58U 95% shield . . . . . 10¢/ft.
RG59/U 100% foil shield TV type . . . . $7/100 ft or .10¢/ft.
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PL-259 and/or SO-239 . . . . . 10/$5.89
Double Male Connector $1.79
PL-258 Double Female Connector . . . . . 98¢
1 ft. patch cord w/RCA type plugs each end . . . . 3/$1.00
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UG-255 (PL-259 to BNC) $3.50
Elbow (M359) $1.79
F59A (TV type) built on crimp ring . . . . . 10/$1.99
UG 21D/U Amphenol Type N Male for RG8 . . . . . $3.00
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must buy and send out thousands of cards every year. Just to send hundreds of cards per mailing to the QSL bureau can be prohibitive. Therefore, the more rare the station, the less likely you are to receive a reply by way of the bureau, and the more important it is that you share the expense by sending him an s.a.s.e. or s.a.e. with IRC's.

From the Mailbag

de Hugh, WA4WME: "Your DX Countries article in the May 1982 issue of *CQ* was very well done. I thought you might like to know that your FO8 for Clipperton was half correct. It is FO8 if the licensee is non-French, but FO0 if the licensee *is* French. For example, FO8AJ in 1954 was Bob Denniston, an American; FO8AN was Danny Weil, an Englishman; FO8AT was Doug Magill, an American; but FO0XA through FO0XH in 1978 were all French licensees, including F9JS and F6BBJ.

"Many DXers have asked 'Why FO8 before, and then in 1978 it was suddenly FO0?' The answer is that 1978 was the first time a Frenchman was licensed to operate from this French island."

de Art, W2HAE: "With reference to your countries list article in the May '82 issue, I have no fault with your definition of countries, but I do have some questions regarding the makeup of the list itself. For example, cards such as KS4, Swan; ZD5, Swasi; ZC4, Cyprus; KR6, Ryukus should be listed on the left index for reference even though you will say delete after that. 9Q5 is listed at the very end and in a different place, which implies two different countries, and the formerly VP2 islands in the Caribbean have in the same count the correct J prefixes."

de Tom, AA4A/8: "I enjoyed your recent *CQ* article 'The Countries List Revisited.' Like you, I have long relied on the National Geographic Atlas as my reference, and it seldom lets me down, even showing Barque Canada Reef of 1S1DX fame. However, for Abu Ail (Jabal at Tair) and Market Reef, it just doesn't make it. I have enclosed a copy of a portion of a plate from my Times Comprehensive World Atlas showing 'J. at Tair' near Kamaran Island. It *appears* in the Geographic Atlas, but without its name.

"And I have searched for *years* for Market Reef, finally finding it two weeks ago in the Detroit Public Library atlas collection in a Swedish Atlas."

de Leo, W4KA: "The Countries List is in error on the zones for S9, CR5—Sao Thome and 3C0, Annobon. Both are shown in zone 35, but both should be in zone 36."

Here and There

The International DX Foundation: The International DX Foundation was established by John Ackley, KP2A, in 1978 to promote international goodwill and understanding. The officers are KP2A, President; Gary Medford, N2CW, Vice President and Treasurer; Rudy Lehnert, KB2XS, Vice President—Operations; Bob Denniston, VP2VI, Vice President—DX Committee; Bob Schenck, N2OO, Vice President—Public Relations; and Stu Green, WA2MOE, General Counsel.

The International DX Foundation is an on-going membership organization with over 1,000 active members and sponsors many expeditions such as the 1982 Navassa effort, which produced 33,500 contacts, and the 1981 Desecheo operation, which resulted in 43,000 QSO's. In addition, donations of equipment are made to many rare countries such as 3X, 4S7, 8Q7, CR9, EL, J7, and 5R8.

The Foundation is a major contributor to the Heard Island Dxpedition planned for February 1983 by the Wireless Institute of Australia. It is not soliciting donations for the Heard effort, but is asking the DX community to show its support by responding to a membership drive. Suggested donations are $25 for a 1-year sustaining membership, or $500 for a life membership. Donations may be mailed to: International DX Foundation, Box 117, Manahawkin, NJ 08050. Please include call, name, and address. If more information is needed, send an s.a.s.e. to the above address.

CQ DX Awards Program

S.S.B.

1138	N5CSW	1144	DF7AU
1139	VK3JF	1145	G4JCZ
1140	K4JLD	1146	KA1RR
1141	K4SE	1147	HC2RG
1142	K4CXY	1148	WB1ALC
1143	KF2X	1149	N6ANR

C.W.

541	N8BQB	544	K4SE
542	G2FFO	545	K4CXY
543	K4JLD		

S.S.B. Endorsements

310	W6EUF/318	300	W8JXM/302
310	W3GRS/318	275	K4SE/296
310	I8AA/317	275	WD9IIX/288
310	W9KRU/316	275	K4CXY/287
310	F2MO/315	250	N8BKF/252
310	W3GG/315	250	WB0LXM/251
310	VE3GMT/315	200	K4JLD/248
310	K9MM/315	200	N9ANR/210
310	W4DPS/314	200	G4GED/204
300	VK4VC/309	150	DF7AU/150
300	OK1MP/307	28 MHz	WB0LXM
300	4Z4DX/306	28 MHz	AI9F
310	K1UO/305	28 MHz	W4LCL
310	VK3JF/305	28 MHz	KF2X
300	AI8S/302		

C.W. Endorsements

310	K9MM/313	275	K4SE/278
310	W4BQY/310	200	K4CXY/245
310	N6CW/310	200	G2FFO/224
300	OK1MP/300	200	KE9A/204
275	K9QVB/298	150	K4JLD/186

The number of active countries is now 318. The basic award fee for subscribers to CQ is $4. For non-subscribers, it is $10. In order to qualify for the reduced subscriber rate, please enclose your latest CQ mailing label with your application. Endorsement stickers are $1.00. Updates not involving the issuance of a sticker are made free when an s.a.s.e. is enclosed for confirmation of total. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business size, No. 10 envelope, self-addressed and stamped, to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. DX stations must include extra postage for air-mail reply.

5 Band WAZ

Standings as of June 1, 1982

All 200 zones worked:

1. ON4UN, John Devoldere (Belgium)
2. K4MQG, Gary Dixon (U.S.A.)
3. SM4CAN, Kent Svensson (Sweden)
4. AA6AA, Steve Orland (U.S.A.)
5. W8AH, Albert Hix (U.S.A.)
6. W6KUT, E. A. Andress (U.S.A.)
7. EA8AK, Fernando Fernande (Spain)
8. LA7JO, Stig Lindblom (Norway)
9. EA3SF, Fernando Blenert (Spain)
10. OH1XX, Hannu Nieminen (Finland)
11. EA8OZ, Julio Rosello (Spain)
12. W0SD, Edward Gray (U.S.A.)
13. K0ZZ, Gary Knutson (U.S.A.)
14. ON6OS, P. Michiels (Belgium)
15. OK3TCA, E. Melcer (Czech.)
16. K6SSS, Fred Capossela (U.S.A.)
17. ZL3GQ, Peter W. Watson (New Zealand)
18. OK3CGP, Stefan Melcer (Czech.)
19. SM0AJU, Leif Lundin (Sweden)
20. OZ3PZ, Preben Thomsen (Denmark)
21. I3MAU, Reno Mauri (Italy)
22. I2ZGC, Gianni Zillio (Italy)
23. 4Z4DX, Dov Gavish (Israel)
24. N4KE, Ron Blake (U.S.A.)
25. K5UR, Rick Roderick (U.S.A.)
26. K9AJ, Michael McGirr (U.S.A.)
27. SM3EVR, Tord E. Julander (Sweden)
28. LA5YJ, Bjorn Hugo Ark (Norway)
29. DL3RK, Walter Geyrhalter (W. Germany)
30. N4WJ, Frank McCormick (U.S.A.)
31. G3MCS, W.R. Hawthorne (England)
32. SM5AQD, Hakan "Hawk" Eriksson (Sweden)
33. W0MLY, George McKercher (U.S.A.)
34. I0RIZ, Gianni Rizzi (Italy)
35. ON5NT, Ghislain Penny (Belgium)
36. OH6JW, Antti Kiviuoma (Finland)
37. OK1AWZ, Milan Dlabac (Czech.)
38. IV3PRK, Pierluigi "Luis" Mansutti (Italy)
39. DJ6RX, Klaus Heintzenberg (W. Germany)
40. OH3YI, Ossi Lehvas (Finland)

The top 10 contenders for 5 Band WAZ:

1. CT1FL, 198	6. K1MEN, 197
2. DL6RX, 198	7. K7UR, 196
3. I4RYC, 198	8. TG9NX, 196
4. ZL1BIL, 198	9. N4RR, 192
5. EA8QL, 197	10. NE7IG, 192

159 Stations have attained the 150 zone level

30 Great DXpeditions: Do you need a DX adventure feature for hamfests, conventions, and banquets? Hugh, WA4WME, has assembled a show consisting of color slides of 30 great DXpeditions, featuring slides and narratives provided by the actual DXpeditioners themselves. For complete information, including equipment needs and travel arrangements, contact Hugh at 2308 Zinnia Court, Killeen, TX 76541, or call (817) 634-1053.

Heard Island Update: The arrangements are moving along nicely. A contract is being negotiated for the "Anaconda II," a larger ship than the one originally selected. She is one of the largest charter vessels presently based in Australia and has had previous Antarctic charters. Use of this ship will permit a larger operation, with three radio operators rather than

CQ DX Honor Roll

The CQ DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more ACTIVE countries for the mode indicated. The ARRL DXCC Countries List is used as the country standard. Honor Roll listing is automatic when submitting application or endorsement for 275 or more countries. To remain on the CQ DX Honor Roll, annual updates are required. Honor Roll updates may be made at any time, in any number. Updates indicating "no change" will be accepted to meet the annual requirement. All updates must be accompanied by an SASE for confirmation. The fee for endorsements involving the issuance of a sticker is $1.00. The basic award fee is now $4 for *CQ* subscribers and $10.00 for non-subscribers. Please attach your latest *CQ* mailing label to qualify for the $4.00 rate.

C.W.

W6PT	318	N6AV	313	W4OEL	305	N4MM	298	JH1VRQ	281
DL7AA	317	K9MM	313	W2GT	304	K1MEM	295	N5DX	280
ON4QX	316	K6JG	312	DL3RK	303	WA8DXA	294	W4BV	280
W3GRS	316	K4CEB	311	K3FN	301	JA1GTF	285	WB4RUA	279
W9DWQ	316	W4BQY	310	DJ7CX	300	W0SR	285	K4SE	278
K6EC	315	N6CW	310	OK1MP	300	W0IZ	285	W1WLW	276
N4PN	314	K4XO	306	N6FX	298	SM3EVR	284	I3OBO	276
W6ID	314	W1NG	305	K9QVB	298				

S.S.B.

K2FL	318	K4MQG	314	ZL1BIL	305	W9RY	294	I8KCI	280
W6EUF	318	N4WF	314	VK3JF	305	WA4DAN	294	XE1OX	280
K6WR	318	W4DPS	314	K1UO	305	WD8MGQ	293	KP4EQF	280
W3GRS	318	I8YRK	313	W1NG	304	W2FGY	293	N2AQH	280
W3NKM	318	EA4LH	313	G4CHP	304	JA5PUL	292	K1VHS	280
W9DWQ	317	OE2EGL	313	VE3FJE	304	WB1DQC	292	AC0A	280
I0AMU	317	DK2BL	313	WA4JTI	303	W7FP	291	WD8MOV	279
K8DYZ	317	W0SD	313	9H4G	303	I3OBO	291	WB4UBD	279
F9RM	317	K9RF	313	W8JXM	302	K0GT	291	WA2VEE	279
VE3MR	317	W0SFU	312	LA7JO	302	XE1NI	289	K8HV	278
I8AA	317	I5WT	312	AI8S	302	W4BQY	289	I0RIZ	278
W4UG	316	N4MM	312	K8PYD	302	YU2RTW	288	K3MWN	277
DL9OH	316	K5OVC	311	N5FG	302	K9UAA	288	KC8JH	277
XE1AE	316	VE7WJ	311	VE3MRS	302	WD9IIX	288	I8INW	277
I4ZSQ	316	K4XO	311	W6FET	301	K4CXY	287	WB3DNA	277
I8KDB	316	I3LLD	311	K9SM	301	VE3IPR	287	KB5RF	277
W9KRU	316	YV5AIP	310	K9BWQ	301	WB3HAZ	286	JH4PRU	277
VE3MJ	316	K6XP	310	I8LEL	301	WB6GFJ	286	WA6TOO	276
ZL3NS	316	W9SS	310	W2CC	300	AE5B	285	K1WJ	276
ZS6LW	315	OE3WWB	310	HP1JC	300	CT1UA	285	WA4TLI	276
W3AZD	315	W0YDB	310	DJ7CX	300	TG9EP	284	XE1CI	276
VE2WY	315	N6AW	310	K5DUT	300	K9HQM	284	KB8KW	276
K6JG	315	N2SS	310	JH1VRQ	300	KB5FU	284	KB8DB	276
DJ9ZB	315	N4KE	309	W7OM	298	SM4CTT	284	W0KU	276
I0ZV	315	N6AV	309	I8ACB	298	I2MQP	283	K9QVB	276
K6YRA	315	DL6KG	309	IV3YRN	298	W8IMZ	282	W8ILC/QRPp	276
VE3GMT	315	W2SUA	309	VE3GCO	297	KK0C	282	WA0TKJ	275
F2MO	315	VK4VC	309	W6DN	297	KA8T	282	VE4AT	275
K9MM	315	YV5DFI	308	W1LQQ	297	I5BDE	282	K8VFV	275
YV1KZ	315	W0SR	307	K4SE	296	AI8M	281	I0SSW	275
W3GG	315	OK1MP	307	K8CMO	296	N3RL	281	W6MFC	275
ZL1AGO	315	XE1J	306	K9IW	296	N9AMF	281	KB9KD	275
K6EC	314	4Z4DX	306	I6PLN	295	VE3IUE	280	KB3OQ	275
W4SSU	314	XE1KS	305	WA4LOF	295	WD0BNC	280	I5EFO	275
K9LKA	314	LU1BAR/W3	305	I0MBX	295	KB8O	280	NN4Q	275
OZ3SK	314	WA4WTG	305	AI5I	295				

two. An Australian and an American have already been chosen, and at mid-summer presstime a third operator is being sought, hopefully a medical doctor. The callsign, VK0HI, has been reserved for the operation.

Anyone wishing to contribute directly to the DXpedition may send his donation to the Heard Island Escrow Fund, c/o Wireless Institute of Australia, P.O. Box 10, West Perth 6005, Western Australia.

Silent Keys in the DX World: The DX world was saddened by the loss of two of its finest, Jim Lawson, W2PV, and Jesse Bieberman, W3KT, during the month of May. Jim passed away on May 25 after a long illness. He was an outstanding DXer and a prominent contest operator and had one of the most technically-advanced amateur stations in existence. Jesse died two days later on May 27 after a relatively short illness. He had been manager of the W3 QSL Bureau for 33 years and also operated the W3KT QSL Service. The latter service was used by me for about 15 years, always with excellent results. In fact, we were so pleased with Jesse's work that we continued to send our outbound cards via W3KT even after the League started its outgoing QSL Bureau.

QSL Information

BY1PK to Chinese Radio Sports Association, Box 6106, Beijing, People's Republic of China
BV2A & BV2B—U.S. DXers QSL to K2CM, Japanese DXers to JA2MOT, all others to Tim Chen, Box 30457, Taipeh, Taiwan 107
CE0ZAD to WB6WOD
CR9UT to Box 798, Macao
C53DZ to DJ6SI
CX5AO to CX7BY
DF8MP/LX to DL2KAO
DL7RT/EA6 to DL7RT
DX6NRA to DU7EM
EP2TY to JR3WRG
EJ3AK to EI3AK
F8WG to F2CL
F0GYM/FC to DL3RK, Box 1328, D-8950 Kaufbeuren, West Germany
FH8CL to VE2FOU
FH8CB to Box 50, Mayotte, Indian Ocean, via France
FR7CE to DF2OU, Box 1113, D-3120 Wittingen 1, West Germany
H5AIR & H5HAF to ZS6BSK
HC8SL to HC2SL
HH5CB to K9WJU
HK1RCB to Radio Club del Atlantico, Box 51378, Barranquilla, Colombia
HV2V0 to I0GPY
J5HTL to SM3CXS
J6LZA to K4LTA
J20/D to Box 1076 Djibouti or to F2GA
J20/Z to F6ATQ
JW0/P to SM5DQC
K4COG/DU2 to WA4LQQ
K4IIF/LX to W4KA
KN8M/SV9 to K8CW
LX2BQ to W. Bonbiet, Box 22, LX-6582 Rosport, Luxembourg
LX1RR to Ray Reiff, 35 rue Mathias Koener, Esch/Alzette, Luxembourg
N0ZO/DU2 to K0LST
NCDXF to Northern California DX Foundation, Box 2368, Stanford, CA 94305
P42C to PJ2PP
PY0RA to PY7YS
SV5SW to P.O. Box 349, Rhodes, Greece
T32AF to WH6AIP, Glenn Y. Arakaki, 98-1718 Piki St., Aiea, HI 96701
T32AB to N7YL
TA1A0 to Box 167, Bakirkoy, Istanbul, Turkey (No callsign on envelope.)
TI2EY to DF6EX
TI2PZ to Box 1816, San Jose, Costa Rica
TU2LE to F6ESH
UA1PAM to UK3SAB
UY4L to UA4LM
V9ADX to ZS6J
VK6ZX/LH to VK6ZX
VK9NYG to VK6NE
VK9ZH to VK6YL
VK9ZR to VK2BJL, D.H. Mead, Box 85, Round Corner, 2158 Australia
VK0DX to VK7LJ
VQ9CW to K1CW
VQ9WB to WD9GIG
VR6TC to W6HS
VS5DO to G4EFE
VS5GA to Box 1200, Brunei
VS6JW to G4LRG
VU2YOU to K4YT
XZ5KNU/9 to Box 4/25, Bangkok, Thailand
YK1A0 to Amateur Radio Club, Box 35, Damascus, Syria
YZ9LM to YU2HDE
ZD9BV to W4FRU
ZF2GC to W4UY
ZK1CQ to ZL1AMO
ZM7VU to F6DYG
3X1Z to W4FRU
4N0SM to YU7JDE, Box 20, YU-24400 Senta, Yugoslavia
4K1A to UA3AEL
4K1D to UA1AFM
4K1HK to UA3AEL
4U1UN to W2MZV
5B4IJ to OE8PSK
5B4JE to DF4FX
5H3AA to LA7FAA, Box 79, N-9372 Gibostad, Norway
5H3DM to Box 9112, Dar-es-Salaam, Tanzania
5H3M0 to Box 1133, Tanga, Tanzania
5N0BDJ to HB9RCJ
5N2RCN to Box 900, Minna, Nigeria
7Q7LW to Box 24, Mtakataka-ata, Malawi
8P6AX to G. Bell, Elsuento, Dover, St. Lawrence, Barbados
8Q7DL to DL9BAF
9K2EK to JA2LZB
9K2HE to DJ9ZB
9N1WW to JA8BMK
9V1VG to ON5SL
9X5SL to DL8DF
9Y0NP to W3HNK

73, John, K4IIF

Novice

a monthly feature by
BILL WELSH, W6DDB

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Shortwave Listening—Part V of VI

This is a six-part article about shortwave listening. The first four parts provide the introduction, plus coverage of the legality of eavesdropping, variety of transmissions, radio waves, selecting listening frequencies, publications, tapes, clubs, equipment and accessories suppliers, and receivers.

Loudspeakers

If your receiver is operated in an area where it can't be heard by other members of your household or the neighbors, it is acceptable to use a loudspeaker. If you use a speaker, be sure to use one which matches the output impedance of your receiver. Your receiver's instruction manual states whether the matching loudspeaker must be low impedance (4–16 ohms) or high impedance (500–600 ohms). The output impedance is usually marked on the terminal strip on the rear apron of the receiver.

If you have nothing else to go by, you can usually tell whether a speaker is high impedance or low impedance simply by looking in the back side of the speaker enclosure to see whether the input leads (from your receiver) connect directly to the leads attached to the speaker cone, or connect to a transformer. If no transformer is used, you probably have a low-impedance speaker. If a transformer is used, you have a high-impedance speaker; such transformers are usually mounted directly on the loudspeaker. The use of a loudspeaker which has an incorrect impedance causes power loss (reduced audio listening level), distortion, and reduced listening pleasure. Some receivers have both high and low impedance terminals, allowing you to use the speaker of your choice; in this case the "G" (ground) or "C" (common) terminal is used with either type of speaker.

Earphones

If you are going to operate your receiver in close proximity to others, it is extremely important that you use earphones. The squeaks and squawks emanating from your loudspeaker may well be of great interest to you, but they are just noise and annoyance to others. Your use of a pair of earphones makes your shortwave listening acceptable to the rest of your family. In addition, you effectively increase the strength of the received signal when you switch from a loudspeaker to earphones. This can make the difference between hearing a weak station or missing it. An ideal set of earphones for shortwave listening has:

(1) A communications-type frequency response of about 400 to 12,000 Hertz.

(2) Soft and flexible earmuffs to keep received signals in where they will be applied to your ears and to keep external (household) noises out.

(3) Dual earphones; leaving one ear uncovered permits increased distractions from external noises.

(4) Adjustable headband pressure. It is important to have enough pressure to hold both earphones firmly in place over your ears. However, an excessively tight fit causes discomfort which can become painful after an hour or more of continuous use. Adjust the headset so that it is tight enough to stay firmly in position but not tight enough to become uncomfortable. Once you have them adjusted perfectly, don't let others use or adjust your headset.

(5) A coiled (retractable) cord reduces the possibility of getting entangled with the headset cord, which usually causes the headset (and other objects) to be knocked down. The coiled cord extends out easily as one pulls on it and automatically retracts to its shorter coiled length as you reduce the pull. Coiled cords are available for any headset at an extra cost of a few dollars; they are provided with some headphone sets.

(6) Light weight is important in earphones which are to be worn for long periods of time. A heavy headset becomes uncomfortable after about an hour of use. Unfortunately, the better headsets do require some "guts" to function well and they are not the lightest ones. There are happy compromises, though, and not everyone agrees about how much weight is acceptable in headsets.

The preceding comments should help you in your selection of a good pair of earphones. Most receivers are designed to automatically disconnect (turn off) the loudspeaker when a headset connector is plugged into the receiver's headphone jack. It is best to have both a loudspeaker and a headset because there will be appropriate times to use each. You also must be careful to use earphones that match your receiver's output impedance to have maximum undistorted sound reproduction.

Twelve-year-old Shanon Olson, KA9MDZ, of Oglesby, Illinois, operates in the 40 meter Novice band using a Kenwood TS-520S Transceiver and a 40 meter inverted Vee antenna fed via a Mullen tuner. Shanon has worked several states since she received her license in November of 1981, and she particularly enjoys contacting other young amateurs. Her code speed is about 8 w.p.m. (words per minute), and she is preparing to upgrade to General. Shanon is also active in her school band, track, and Girl Scouts.

Antennas

The beginner is usually very confused about what type of antenna he or she should buy or build. The coverage of frequency and wavelength in this article is, of course, directly related to antennas and antenna lengths. A fundamental antenna is usually one-half wavelength long to be resonant. This is true because the r.f. energy has to travel back and forth over the entire length of the antenna wire to resonate (ring), rather than to just travel in one direction.

Consequently, the antenna is physically about half as long as the full wavelength of the frequency one wants to receive. There is a little "fudge factor" which causes the antenna to be about five percent shorter than the actual half wavelength, but it is easy to understand. Radio waves travel slower along wire

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than through air, so the antenna has to be physically shorter to be resonant. Copper wire is commonly used for antennas, and it slows down radio waves less than five percent. This slowdown is commonly referred to as the "velocity factor" of the wire, so copper wire is said to have a velocity factor of about 95 percent. There is also a higher voltage end effect which causes antennas to have to be cut physically shorter than their actual electrical length. Table I lists the physical halfwave lengths of antennas for the international shortwave broadcast bands.

Band (Meters)	Halfwave Length (Feet & Inches)
60	93′6″
49	78′
41	65′
31	48′6″
25	39′8″
19	30′9″
16	26′4″
13	21′8″
11	18′

Table I– International shortwave broadcast band antennas.

It should be understood that any antenna will provide some signal input. Today's highly sensitive receivers provide good results even when they are used with inadequate antennas. Nevertheless, a resonant antenna is required if you want to obtain optimum reception.

Temporary Antenna. It may take some time for you to build and erect a good antenna system. Take your time and get the job done right. Before you get your good antenna system completed, I advise you to enjoy some shortwave listening by just attaching a random-length piece of wire to your receiver's antenna input terminals and stringing it out. It is preferable to string such an antenna outside, but it will function to a lesser degree inside, unless you are in an r.f.-shielded enclosure such as a stucco house (chicken wire under the stucco) or a modern building which has steel girders. Do not bother to remove insulation from antenna wire because the radio frequency energy passes through it; just remove insulation at the end point that connects to the receiver's antenna input terminal.

Antenna Location. When you erect your antenna, locate it where it is as high as possible and clear of any nearby metal objects. Avoid running your antenna wire parallel and close to power and/or telephone lines. Most types of antennas have a slight gain characteristic when they are positioned broadside to the transmitted signal, simply because this position exposes the maximum antenna surface to the received radio wave. As a practical example, an antenna that runs east and west provides better reception north and south. However, the gain characteristic is quite small for random wire, dipole, and folded dipole antennas, and it should not be the primary consideration in choosing the antenna location.

Trap Antennas. There are several so-called "trap" antennas on the market and most of them provide satisfactory results. Unfortunately, some of these commercial trap antennas are supplied with poor-quality (high-loss) transmission line for connecting the antenna to the receiver, causing unnecessary and unacceptable signal loss in installations which require transmission lines longer than 50 feet. If you intend to use any antenna in an installation requiring a long transmission line, it is important to use a high-quality low-loss transmission line such as RG-213/U (low impedance) or open-wire ladderline (high impedance).

Trap antennas derive their nickname from the fact that they include one or more traps which effectively "cut" the associated antenna wire to different lengths for use on different bands. Simply stated, each trap is a parallel resonant circuit containing an inductor and capacitor pretuned to the desired cutoff frequency. From the transmission line out, the first antenna section is resonant at the highest frequency, which is the shortest wire length. This first wire segment is effectively cut off from the rest of the antenna by the tuned trap, and the wire past the trap (for lower frequencies) is not part of the short first segment, which is resonant at the desired frequency. The next lower frequency band makes use of the first (highest frequency) antenna segment, the coil section of the first (highest frequency) trap, and the following section of antenna wire.

If the antenna is to be resonant on more than two bands, a second trap is located at the far end of the second wire segment to cut this longer overall section off from the wire segment which follows the second trap. This arrangement is repeated for each band covered by the antenna, and the last wire segment is attached to an antenna insulator at the far end. The other side of the antenna end insulator is attached to a non-conductor such as a nylon line to hold the antenna in position when it is installed. When cutting an antenna wire segment which is to be attached to an antenna insulator, cut it about 6 inches longer than the actual resonant length to allow for the wire which is used to make the insulator connection; the straight-line remaining portion is the part that rings (resonates).

Random-Wire Antennas and Antenna Tuners. Since many shortwave listeners are interested in hearing stations throughout the frequency spectrum, they really need an antenna which is hundreds of different electrical lengths. A random-wire antenna, used with an antenna tuner, provides a resonant antenna at any frequency.

Simply stated, an antenna can be made electrically longer than its actual physical length by adding inductance in series between the antenna and the receiver's antenna input terminals. An air-variable tuning capacitor can also be substituted in place of the inductor to make the antenna electrically shorter than its physical length.

A tuner which can be used to insert variable capacitance and variable inductance in series with a random length of wire provides an actual resonant antenna system which will provide very good reception over the entire frequency range of your receiver. This ability to adjust the electrical length of an antenna permits one to erect a random-length antenna which fits one's site. An obvious added advantage to this combination is that no feedline (transmission line) is needed between the antenna and the receiver, and thus, there is no feedline loss of a weak antenna input signal. This tuner and wire combination is easy to use; you just set the variable capacitor at mid-range and adjust the coil for maximum signal reception at the frequency to which the receiver is tuned. Then, you adjust the capacitor tuning for peak signal reception.

Antenna Wire. When constructing any type of wire antenna, it is advisable to use a solid copper-clad steel antenna wire such as Copperweld. Stranded wire is twisted along its entire length to hold the strands in place. Twisted wire has an inductive effect, and an antenna made of such wire will be physically and electrically longer than is apparent, and it will actually resonate below the desired frequency. If soft-drawn copper wire is used, it will stretch-out quickly to incorrect longer lengths as it is buffeted by wind and stretched by the weight of any transmission line. Hard-drawn copper exhibits the same problem but to a lesser extent. Copperweld has a steel center which just about eliminates stretch problems, and it has a copper outer coating to provide excellent r.f. current-handling ability.

Directional Antennas. If you find that most of your listening becomes centered on one particular band or broadcasts from one region, it is worthwhile for you to erect a highly directional antenna (such as a Yagi-Uda or a quad beam) for optimum reception on that band. Such antennas are readily available from several manufacturers, and most are light enough to allow them to be rotated by heavy-duty TV-type rotators or light-duty amateur rotators. These directive antenna should be installed on rotators or you'll lose too much signal strength in all directions other than the one direction in which the antenna is pointed.

Antenna Books. Your local electronic outlet should have an assortment of technical books on antennas, and you may find the antenna facet of your hobby to be intriguing, educational, and rewarding. The publications list in this article includes sources of such books (Part III, July 1982 *CQ*).

Two-Terminal Antenna Connections. If your receiver just has two antenna terminals, they are usually marked "A1" and "A2." If you are connecting a longwire (unbalanced) antenna to your receiver, it should be attached to the "A1" terminal, with the best available external ground connected to the "A2" terminal. If you are connecting any balanced (two wire) antenna, the ground/shield lead should be attached to "A2" and the center/high lead should be attached to "A1."

Three-Terminal Antenna Connections. Many modern receivers have three antenna terminals and they are marked "A1," "A2," and "A3." The "A3" terminal is attached internally to the receiver chassis, and it should be wired to the best available external ground to ensure optimum receiver performance. If you are using a single-wire (unbalanced) antenna, it should be attached to the "A1" terminal, and the "A2" terminal should be wired to the "A3" terminal.

If you are using a balanced antenna (such as a dipole, folded dipole, quad, or Yagi-Uda), the grounding jumper must be removed from between terminals ("A2" and "A3"). The "high" side of the antenna input (center conductor of the coax, for example) is connected to "A1," and the "low" side (shield of the coax, for example) is attached to "A2." "A3" is connected to ground.

All connections must be made very carefully. Don't allow bare wires to short against each other or against any other metal object. It is wise to solder "spade" or "eye" lugs to each antenna lead, instead of just twisting them around antenna screw terminals and hoping that they will remain secured in place.

Ground

It is not always easy to locate a good radio frequency ground. Fortunately, this ground is not as critical to receiving equipment as it is to transmitting equipment. However, the receiver has many circuits which work against the reference ground potential of the metal receiver chassis. For best results, it is obvious that the receiver must be wired to a good external ground point. Radio frequency signals, intermediate frequency signals, other processing signals, and power-supply returns are commonly connected to the receiver chassis. If the chassis is not attached to a good external r.f. ground, the chassis is not at the desired zero-voltage reference potential, and receiver performance is degraded. It is worth your time and effort to install an excellent r.f. ground system.

House Power Ground. The electrical power system ground (conduit ground) may be satisfactory as a receiver ground. Do not ground your receiver to the telephone ground.

Water-Pipe Ground. If you are fortunate and have a copper water-pipe system (with its soldered connections), you should clean down a nearby connection point (to the bare metal) and attach your receiver ground lead to this pipe with a "C" clamp. The electrical connection to the pipe will be better if you can drain water out of the pipe and solder your ground lead directly to a clean (bare metal) area of the copper pipe. If you have other types of metal water pipes, they usually have sealant material between each section, and the sealant is also an unintentional but effective radio frequency insulator. A water system that does not use copper pipes is usually relatively poor as an r.f. ground, but it may have to be used if you have nothing else. You can improve your r.f. ground by attaching it as close as possible to the incoming water main, if you have to attach to water pipes that are not soldered.

Ground Rods. If you do not have an adequate r.f. ground readily available, drive a ground rod (steel rod with copper coating) into the ground close to the window where your ground lead will exit from the house. Electrolysis (battery action) from this rod can attack nearby plant life, so be very careful about where you locate it. These rods are available in various lengths at better electronic stores, and a 6- to 8-foot rod should suffice. If you are forced to drive your ground rod into nonconductive soil (such as sand), it may be necessary to first dig out the area and to make it electrically conductive by mixing in a generous amount of rock salt (or common table salt) into the dirt.

Ground Braid. For best results, use ground braid to interconnect your receiver's ground terminal to the external ground you have selected. Simply stated, a quarter wavelength of a piece of wire acts like an insulator. In effect, this would make a receiver act as if it were disconnected from ground at frequencies which happen to be exactly related to the quarter-wave length of a piece of wire being used as a ground. Ground braid acts like several different electrical lengths, and many will effectively tie the receiver to ground at all frequencies. This is just another installation consideration which must be observed to obtain optimum reception.

Multiple Ground. If you are not sure which available ground point is best, do not hesitate to connect to both (or all) of them. The electrical signals on the chassis of your receiver will automatically flow to the best ground point.

Part V Conclusion

This completes the fifth part of this six-part article about shortwave listening. Next month's concluding part covers signal reporting codes, QSL cards, logs, and amateur radio.

73, Bill, W6DDB

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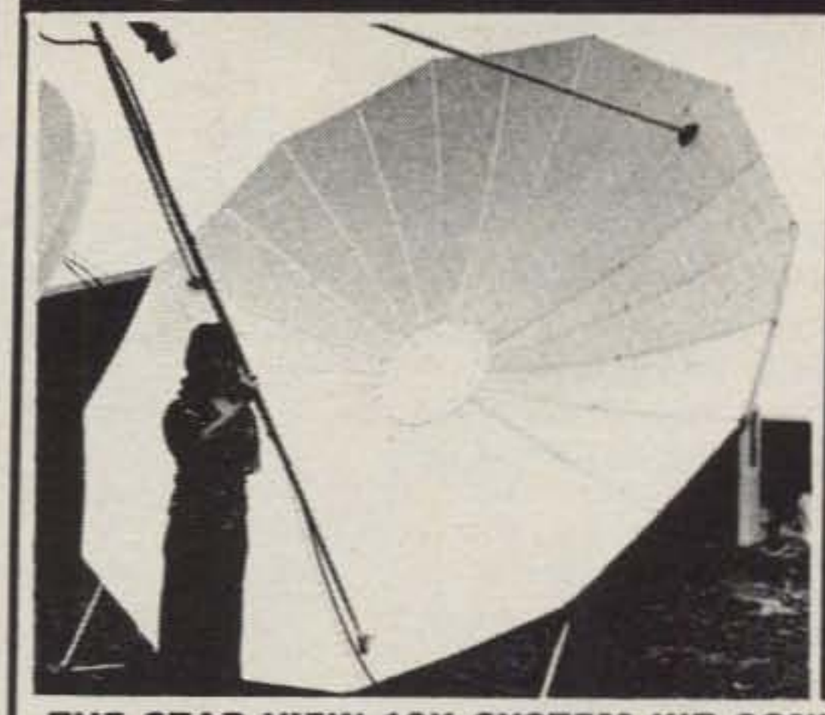

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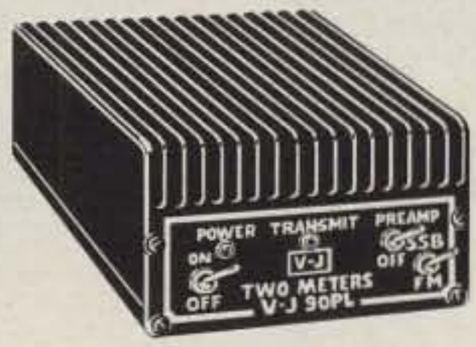

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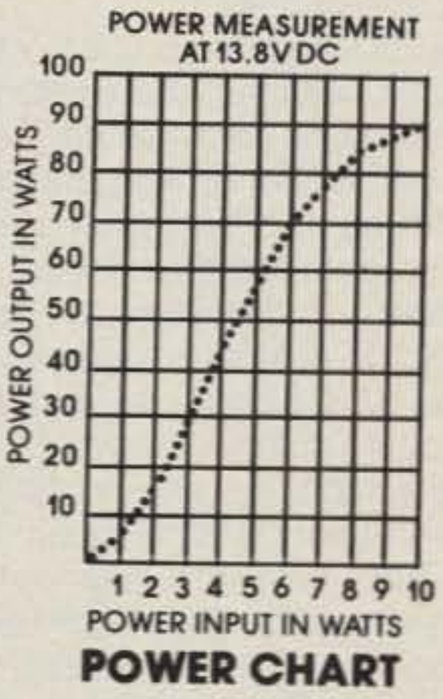

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CIRCLE 25 ON READER SERVICE CARD

Propagation

a monthly feature by
GEORGE JACOBS, W3ASK

THE SCIENCE OF PREDICTING RADIO CONDITIONS

Bulletin

Solar activity of historic proportions occurred during the week of June 7–13. The largest, most active sunspot group observed in more than 25 years caused the highest flare activity of any sunspot group seen during the present solar cycle. Flares of enormous intensity caused the blackout of skywave communications on all high-frequency bands for periods of time during the daylight hours. The blackouts lasted from several minutes to several hours, and they took place on each day of the week. The flare activity began to subside on June 14 as the group of sunspots passed into the side of the sun out of line with the earth. It is likely that this record solar event will reoccur over several 27-day rotational cycles of the sun.

Solar activity took a sharp drop during May, and the cycle is now declining again after remaining relatively constant for almost a year. The Royal Observatory of Belgium reports a monthly mean sunspot number of 81.4 for May 1982. This is the lowest level of solar activity observed since August 1978. It results in a smoothed sunspot number, upon which the solar cycle is based, of 139, centered on November 1981. A smoothed sunspot number of 116 is forecast for September 1982.

September Conditions

During September expect an increasing number of DX openings during the daylight hours on *10*, *15*, and *20* meters. Improved nighttime DX propagation conditions, with stronger signals and lower static levels, are also forecast for the *40*, *80*, and *160* bands. A seasonal decline in conditions is expected on *20* meters during the hours of darkness.

The *fall*, or *autumnal*, *equinox* will occur on September 22 as the sun crosses the plane of the equator on its apparent travel from northern to southern skies. On this day the hours of daylight and darkness are equal in length throughout the world. The affects of the equinox are felt on h.f. propagation conditions from about mid-September through early October. During this period, the characteristics of the ionosphere are similar over large areas of the world, and this is usually the best time for DX openings between the temperate regions of both the northern and southern hemispheres. A similar period occurs during the spring equinox, which is centered on March 21. Look for an improvement in conditions between the USA and South America, to the South Pacific area and Australasia, to southern Asia, and to southern Africa and Antarctica. Improved conditions should be noticeable on all h.f bands *10* through *160* meters. The best time for equinoctial-type openings should be the twilight periods around local sunrise and sunset, but they will occur at other times as well. Many of these inter-hemispheric openings may follow either the *long* or the *short* great circle path, so be sure to check both directions. The expected improvement in equinoctial propagation is reflected in the DX Propagation Charts appearing in this month's column.

11307 Clara St., Silver Spring, MD 20902

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for September 1982

Propagation Index	Expected Signal Quality (4)	(3)	(2)	(1)
Above Normal: 6, 13, 20	A	A	B	C
High Normal: 5, 12, 14, 17, 19, 21, 24-25	A	B	C	C-D
Low Normal: 4, 7, 10-11, 15-16, 18, 22-23, 30	A-B	B-C	C-D	D-E
Below Normal: 1, 3, 8-9, 26, 28-29	B-C	C-D	D-E	E
Disturbed: 2, 27	C-E	D-E	E	E

Where expected signal quality is: **A—Excellent opening, exceptionally strong, steady signals greater than S9 + 30 dB.**

B—Good opening, moderately strong signals varying between S9 and S9 + 30 dB, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.

2. With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be fair-to-poor (C-D) on Sept. 1st, poor-to-no opening (D-E) on the 2nd, fair-to-poor again (C-D) on the 3rd, good-to-fair (B-C) on the 4th, etc.

For updated information, subscribe to bi-weekly MAIL-A-PROP, David D. Meisel, Editor, 54 Westview Crescent, Geneseo, NY 14454.

V.H.F. Ionospheric Openings

Solar activity is still high enough to support some *F2*-layer DX openings on the 6 meter band from the USA to many areas of the world. Conditions should favor openings into the southern hemisphere, with the best times being the late afternoon hours. This month's DX Propagation Charts contain forecasts for 6 meter DX openings.

A seasonal improvement is expected for trans-equatorial (TE) openings on *6* meters, mainly between southern locations in the USA and South America. The best time to look for TE openings is between 8 and 11 p.m., local standard time. While *F2*-layer openings on *6* meters are generally steady and quite strong, TE openings are usually weak, and often accompanied by severe flutter fading.

Although sporadic-*E* ionization should fall off considerably during September, compared to summer levels, some *6* meter short skip openings should still be possible over distances ranging between approximately 1000 and 1300 miles. The best time to check for such openings is before noon and again during the early evening hours.

Although no major meteor showers are expected during September, some minor ones may permit meteor-scatter-type openings on the v.h.f. bands during the first two or three days of the month, and again for several days after September 20.

There is often a seasonal increase in auroral activity during the equinoctial periods, so expect some *6* and *2* meter auroral-type short skip openings during the month. The best possibilities for such openings should coincide with periods of expected storminess on the h.f. bands. Check the Last Minute Forecast at the beginning of this column for those days during September that are expected to be Below Normal or Disturbed.

CQ DX Contest Special—1982

This year's *CQ* Worldwide DX Contest will be held on the following dates:

October 30–31, Phone Section;

November 27–28, C.W. Section.

As during the past 31 years, next month's Propagation column will be devoted to a special, comprehensive forecast which will focus on both sections of the Contest.

73, George, W3ASK

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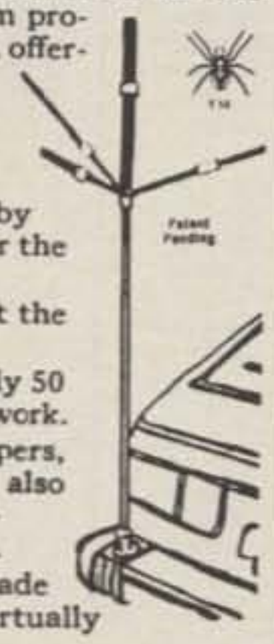

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CIRCLE 118 ON READER SERVICE CARD

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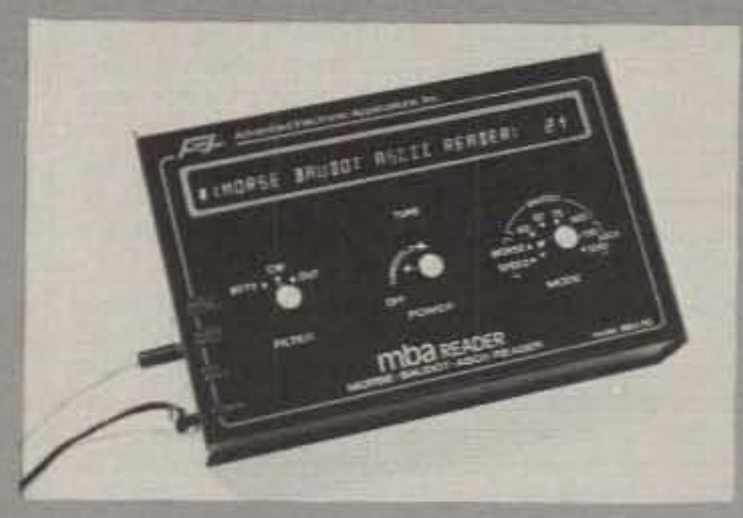

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RG-59 mil spec	11.5¢/ft
RG-11U	19¢/ft
450 ohm ladder line, 100ft roll	$10.75
8 conductor rotor cable	15¢/ft
14 Ga. Stranded Copper	(50ft. mult.) 8¢/ft
12 Ga. Solid Copperweld	(50ft. mult.) 8¢/ft
14 Ga. Solid Copperweld	(50ft. mult.) 6¢/ft
14 Ga. Stranded Copperweld	(70 ft. coil) $4.75
14 Ga. Stranded Copperweld	(140 ft. coil) $9.00
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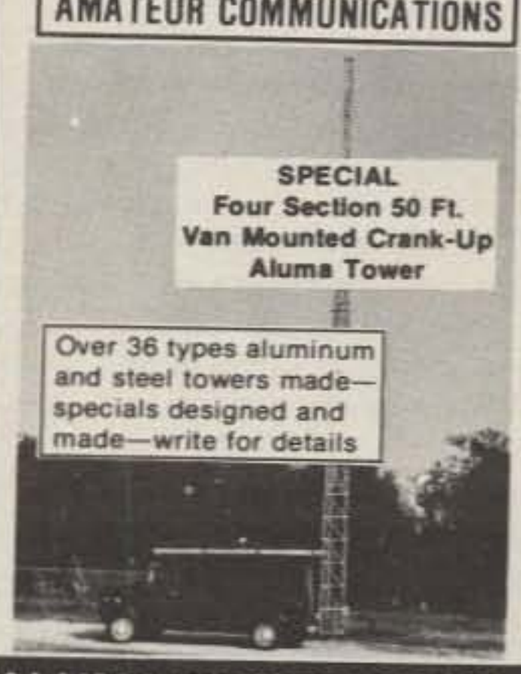

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CIRCLE 27 ON READER SERVICE CARD

HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart appropriate to your transmitter location, The Eastern USA Chart can be used in the 1, 2, 3, 4, 8 KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place as follows:
(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days
Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

4. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M. wetc. Appropriate *daylight* time is used, *not* GMT. T convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 GMT, etc.

5. The charts are based upon a transmitted power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, and a half-wavelength above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level; for each 10dB loss, it will lower by one level.

6. Propagation data contained in the Charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept of Commerce, Boulder, Colorado, 80302.

September 15 - October 15, 1982
Time Zone: EDT (24-Hour Time)
EASTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	08-10 (1) 10-11 (2) 11-13 (3) 13-15 (2) 15-16 (1) 09-11 (1)**	08-09 (1) 09-11 (2) 11-14 (4) 14-15 (3) 15-17 (2) 17-19 (1)	02-04 (1) 04-06 (2) 06-10 (3) 10-12 (2) 12-15 (3) 15-17 (4) 17-21 (3) 21-02 (2)	18-19 (1) 19-21 (2) 21-23 (3) 23-02 (4) 02-03 (3) 03-04 (2) 04-05 (1) 20-22 (1)* 22-01 (2)* 01-04 (1)*
Northern Europe & European USSR	09-10 (1) 10-13 (2) 13-14 (1)	08-09 (1) 09-10 (2) 10-13 (3) 13-14 (2) 14-16 (1)	03-06 (1) 06-08 (2) 08-11 (3) 11-13 (2) 13-17 (3) 17-19 (2) 19-21 (1)	18-20 (1) 20-04 (2) 04-06 (1) 21-04 (1)*
Eastern Mediter-ranean & Middle East	09-10 (1) 10-12 (2) 12-14 (1)	08-09 (1) 09-12 (2) 12-14 (3) 14-16 (2) 16-18 (1)	07-09 (2) 09-15 (1) 15-17 (2) 17-21 (3) 21-23 (2) 23-01 (3) 01-03 (2) 03-07 (1)	19-21 (1) 21-00 (2) 00-01 (1) 22-00 (1)*
Western Africa	09-12 (1) 12-14 (2) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1) 09-12 (1)**	07-09 (1) 09-13 (2) 13-15 (3) 15-17 (4) 17-19 (3) 19-20 (2) 20-22 (1)	05-08 (2) 08-15 (1) 15-17 (2) 17-21 (4) 21-00 (3) 00-03 (2) 03-05 (1)	20-23 (1) 23-02 (2) 02-04 (1) 00-03 (1)*
Eastern & Central Africa	10-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1) 09-11 (1)**	08-10 (1) 10-13 (2) 13-14 (3) 14-16 (4) 16-18 (3) 18-19 (2) 19-20 (1)	12-14 (1) 14-17 (2) 17-22 (3) 22-02 (2) 02-03 (1)	20-02 (1) 00-01 (1)*
Southern Africa	09-11 (1) 11-12 (2) 12-13 (3) 13-14 (2) 14-15 (1) 10-12 (1)**	08-11 (1) 11-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	06-08 (2) 08-15 (1) 15-16 (2) 16-19 (3) 19-00 (2) 00-03 (3) 03-04 (2) 04-06 (1)	19-22 (1) 22-00 (2) 00-02 (1) 23-01 (1)*
Central & South Asia	09-11 (1) 19-22 (1)	08-09 (1) 09-12 (2) 12-13 (1) 20-22 (1)	07-08 (1) 08-10 (2) 10-12 (1) 17-19 (1) 19-22 (2) 22-01 (1)	05-07 (1) 20-23 (1)
Southeast Asia	11-14 (1) 18-21 (1)	08-09 (1) 09-11 (2) 11-13 (1) 13-15 (2) 15-19 (1) 19-21 (2) 21-22 (1)	06-07 (1) 07-10 (2) 10-12 (1) 15-18 (1) 20-21 (1) 21-00 (2) 00-02 (1)	06-08 (1)
Far East	09-11 (1) 18-20 (1)	08-09 (1) 09-11 (2) 11-13 (1) 16-18 (1) 18-20 (2) 20-22 (1)	07-08 (1) 08-10 (3) 10-12 (2) 12-14 (1) 18-20 (1) 20-22 (2) 22-00 (1) 00-03 (2) 03-04 (1)	05-08 (1) 18-19 (1) 05-07 (1)*
South Pacific & New Zealand	09-14 (1) 14-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-22 (1) 16-18 (1)**	08-09 (1) 09-11 (2) 11-14 (1) 14-17 (2) 17-18 (3) 18-20 (4) 20-21 (3) 21-22 (2) 22-00 (1)	12-20 (1) 20-22 (2) 22-00 (3) 00-02 (4) 02-04 (3) 04-08 (2) 08-10 (3) 10-12 (2)	01-02 (1) 02-03 (2) 03-06 (3) 06-08 (2) 08-09 (1) 03-05 (1)* 05-07 (2)* 07-08 (1)*
Australasia	10-12 (1) 14-16 (2) 17-18 (3) 18-19 (2) 19-21 (1) 17-19 (1)**	08-09 (1) 09-10 (2) 10-12 (3) 12-14 (2) 14-17 (1) 17-18 (2) 18-20 (4) 20-21 (2) 21-23 (1)	07-09 (2) 09-11 (3) 11-13 (2) 13-16 (1) 16-18 (2) 18-21 (1) 04-05 (1)* 23-02 (3) 02-04 (2) 04-07 (1)	02-04 (1) 04-06 (2) 06-07 (3) 07-08 (2) 08-09 (1) 04-05 (1)* 05-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	08-09 (1) 09-10 (2) 10-17 (4) 17-18 (3) 18-19 (2) 19-20 (1) 09-12 (1)**	06-07 (1) 07-08 (2) 08-11 (4) 11-13 (3) 13-18 (4) 18-20 (3) 20-21 (2) 21-22 (1)	03-05 (2) 05-07 (3) 07-10 (4) 10-14 (2) 14-16 (3) 16-23 (4) 23-03 (3)	19-20 (1) 20-21 (2) 21-04 (4) 04-06 (3) 06-07 (2) 07-08 (1) 21-23 (1)* 23-04 (2)* 04-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile Argentina & Uruguay	08-09 (1) 09-12 (2) 12-14 (1) 14-15 (2) 15-16 (3) 16-18 (4) 18-19 (2) 19-20 (1) 09-16 (1)**	07-08 (1) 08-09 (2) 09-11 (3) 11-15 (2) 15-16 (3) 16-20 (4) 20-22 (3) 22-23 (2) 23-00 (1)	11-16 (1) 16-17 (2) 17-20 (3) 20-01 (4) 01-04 (3) 04-06 (2) 06-08 (3) 08-11 (2)	21-00 (1) 00-05 (2) 05-07 (1) 01-06 (1)*
McMurdo Sound, Antarctica	16-19 (1)	12-15 (1) 15-18 (2) 18-21 (3) 21-22 (2) 22-23 (1)	16-18 (1) 18-22 (2) 22-01 (3) 01-04 (2) 04-08 (1) 08-10 (2) 10-11 (1)	23-01 (1) 01-05 (2) 05-07 (1) 05-07 (1)*

Time Zones: CDT & MDT
(24-Hour Time)
CENTRAL USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	09-11 (1) 11-13 (2) 13-14 (1) 10-11 (1)**	08-10 (1) 10-12 (2) 12-14 (3) 14-16 (2) 16-17 (1)	06-07 (1) 07-10 (2) 10-13 (1) 13-14 (2) 14-16 (4) 16-18 (3) 18-23 (2) 23-03 (1)	18-20 (1) 20-23 (2) 23-01 (3) 01-02 (2) 02-03 (1) 21-23 (1)* 23-01 (2)* 01-02 (1)*
Northern & Central Europe & European USSR	09-13 (1)	08-09 (1) 09-11 (2) 11-12 (3) 12-13 (2) 13-15 (1)	06-07 (1) 07-10 (2) 10-12 (1) 12-13 (2) 13-17 (3) 17-19 (2) 19-21 (1) 23-04 (1)	20-23 (1) 23-01 (2) 01-02 (1) 22-01 (1)
Eastern Mediter-ranean & Middle East	10-13 (1)	08-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-16 (1)	06-07 (1) 07-09 (2) 09-14 (1) 14-16 (2) 16-20 (3) 20-22 (2) 22-00 (3) 00-01 (2) 01-02 (1)	20-23 (1) 21-23 (1)*
Western Africa	10-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1) 09-11 (1)**	07-10 (1) 10-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-20 (2) 20-21 (1)	05-08 (2) 08-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-02 (2) 02-05 (1)	20-23 (1) 23-01 (2) 01-02 (1) 23-01 (1)*
Eastern & Central Africa	11-13 (1) 13-16 (2) 16-17 (1) 09-11 (1)**	09-10 (1) 10-13 (2) 13-17 (3) 17-18 (2) 18-19 (1)	13-15 (1) 15-17 (2) 17-20 (3) 20-23 (2) 23-00 (1) 07-09 (1)	21-00 (1)
Southern Africa	09-11 (1) 11-12 (2) 12-13 (3) 13-14 (2) 13-15 (1) 10-13 (1)**	07-09 (1) 09-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	06-08 (2) 08-14 (1) 14-16 (2) 16-19 (3) 19-22 (2) 22-01 (3) 01-05 (1)	20-21 (1) 21-23 (2) 23-01 (1) 21-23 (1)*
Central & South Asia	09-11 (1) 19-21 (1)	09-11 (1) 18-19 (1) 19-21 (2) 21-22 (1)	07-08 (1) 08-10 (2) 10-12 (1) 17-19 (1) 19-22 (2) 22-01 (1)	06-08 (1) 19-21 (1)
Southeast Asia	10-12 (1) 12-13 (2) 13-15 (1) 17-18 (1) 18-19 (2) 19-20 (1)	09-11 (1) 11-13 (2) 13-15 (1) 18-19 (1) 19-20 (2) 20-22 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-11 (2) 11-13 (1) 16-20 (1) 20-23 (2) 23-02 (1)	05-09 (1)
Far East	15-17 (1) 17-19 (2) 19-20 (1)	10-16 (1) 16-18 (2) 18-21 (3) 21-22 (2) 22-23 (1)	07-08 (1) 08-10 (3) 10-12 (2) 12-16 (1) 16-19 (2) 19-21 (1) 21-23 (2) 23-00 (3) 00-01 (2) 01-03 (1)	03-05 (1) 05-08 (2) 08-09 (1) 06-08 (1)
South Pacific & New Zealand	11-13 (1) 13-14 (2) 14-15 (3) 15-18 (4) 18-19 (3) 19-20 (2) 20-22 (1) 11-14 (1)** 16-18 (1)**	08-09 (1) 09-15 (2) 15-17 (3) 17-20 (4) 20-21 (3) 21-22 (2) 22-00 (1)	04-08 (2) 08-11 (3) 11-13 (2) 13-18 (1) 18-20 (2) 20-22 (3) 22-02 (4) 02-04 (3)	00-01 (1) 01-06 (3) 06-08 (4) 08-09 (2) 09-10 (1) 02-04 (1)* 04-07 (2)* 07-08 (1)*
Australasia	09-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-22 (1) 16-18 (1)**	08-09 (1) 09-11 (2) 11-15 (1) 15-16 (2) 16-18 (3) 18-20 (4) 20-21 (3) 21-22 (2) 22-23 (1)	06-08 (2) 08-11 (3) 11-13 (2) 13-16 (1) 16-18 (2) 18-20 (2) 20-22 (2) 22-00 (3) 00-02 (4) 02-04 (3)	02-03 (1) 03-05 (2) 05-07 (3) 07-08 (2) 08-09 (1) 05-06 (1)* 06-07 (2)* 07-08 (1)*
Caribbean, Central America & Northern Countries of South America	08-09 (1) 09-10 (2) 10-12 (3) 12-16 (4) 16-17 (3) 17-18 (2) 18-19 (1) 09-12 (1)**	07-08 (1) 08-09 (2) 09-11 (4) 11-14 (3) 14-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	07-10 (4) 10-12 (3) 12-14 (2) 14-16 (3) 16-23 (4) 23-03 (3) 03-05 (2) 05-07 (3)	19-20 (1) 20-21 (2) 21-22 (3) 22-05 (4) 05-06 (3) 06-07 (2) 07-08 (1) 20-23 (1)* 23-05 (2)* 05-07 (1)*

Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Urguay	08-09 (1) 09-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1) 09-15 (1)**	06-07 (1) 07-08 (2) 08-11 (3) 11-15 (2) 15-16 (3) 16-19 (4) 19-21 (3) 21-22 (2) 22-23 (1)	10-16 (1) 16-17 (2) 17-18 (3) 18-00 (4) 00-03 (3) 03-05 (2) 05-07 (3) 07-10 (2)	21-00 (1) 00-04 (2) 04-06 (1) 01-05 (1)*
McMurdo Sound, Antarctica	15-19 (1)	11-15 (1) 15-17 (2) 17-21 (3) 21-22 (2) 22-23 (1)	16-17 (1) 17-20 (2) 20-03 (3) 03-05 (2) 05-07 (1) 07-09 (2) 09-10 (1)	23-01 (1) 01-05 (2) 05-07 (1) 04-06 (1)*

* Indicates best time for eighty meter openings. Openings on 160 Meters are also likely to occur during those times when 80 meter openings are shown with a propagation index of (2), or higher.

** Indicates best times to listen for F-2 layer openings on 6 meters.

Time Zone: PDT (24-Hour Time) WESTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	09-12 (1)	08-09 (1) 09-10 (2) 10-12 (3) 12-13 (2) 13-15 (1) 22-00 (1)	06-07 (1) 07-10 (2) 10-12 (1) 12-14 (2) 14-17 (3) 17-19 (2) 19-21 (1) 23-01 (1)	20-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
Central & Northern Europe & European USSR	09-11 (1)	08-09 (1) 09-11 (2) 11-13 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-17 (2) 17-18 (1) 21-23 (1)	20-21 (1) 21-22 (2) 22-23 (1)* 21-22 (1)*
Eastern Mediterranean & Middle East	09-11 (1)	08-09 (1) 09-10 (2) 10-11 (3) 11-12 (2) 12-13 (1) 20-22 (1)	06-07 (1) 07-09 (2) 09-14 (1) 14-16 (3) 16-20 (1) 20-23 (2) 23-01 (1)	20-23 (1)
Western & Central Africa	09-11 (1) 11-12 (2) 12-14 (3) 14-15 (2) 15-17 (1)	08-10 (1) 10-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	01-07 (1) 07-09 (2) 09-14 (1) 14-15 (2) 15-16 (3) 16-20 (4) 20-23 (3) 23-01 (2)	21-00 (1)
Eastern Africa	11-13 (1) 13-15 (2) 15-16 (1)	09-13 (1) 13-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	07-09 (1) 12-15 (1) 15-17 (2) 17-19 (3) 19-21 (2) 21-23 (1)	20-23 (1)
Southern Africa	09-10 (1) 10-12 (2) 12-14 (1)	07-09)1) 09-11 (2) 11-14 (3) 14-16 (2) 16-17 (1)	01-07 (1) 07-09 (2) 09-10 (1) 12-16 (2) 16-20 (3) 20-01 (2)	19-22 (1)
Central & South Asia	09-11 (1) 17-19 (1)	08-11 (1) 16-17 (1) 17-18 (2) 18-19 (3) 19-20 (2) 20-01 (1)	02-08 (2) 08-10 (3) 10-12 (2) 12-17 (1) 17-21 (2) 21-02 (1)	06-08 (1) 19-21 (1)
Southeast Asia	09-10 (1) 10-11 (2) 11-12 (2) 16-17 (1) 17-18 (2) 18-19 (1) 15-17 (1)**	07-10 (1) 10-13 (2) 13-16 (1) 16-18 (2) 18-19 (3) 19-20 (2) 20-21 (1)	03-07 (2) 07-09 (3) 09-12 (2) 12-13 (1) 21-22 (1) 22-01 (2) 01-03 (3)	01-03 (1) 03-06 (2) 06-08 (1)
Far East	15-16 (1) 16-17 (2) 17-18 (3) 18-19 (2) 19-20 (1) 14-16 (1)**	09-11 (1) 14-15 (1) 15-18 (2) 18-19 (3) 19-20 (4) 20-21 (2) 21-22 (1)	04-07 (2) 07-10 (4) 10-13 (3) 13-15 (2) 15-20 (1) 20-22 (2) 22-00 (3) 00-02 (4) 02-04 (3)	01-03 (1) 03-07 (2) 07-08 (3) 08-09 (1) 03-05 (1)* 05-07 (2)* 07-08 (1)*
South Pacific & New Zealand	10-12 (1) 12-13 (2) 13-14 (3) 14-18 (4) 18-19 (3) 19-20 (2) 20-22 (1) 10-13 (1)** 15-18 (1)**	07-09 (1) 09-10 (2) 10-12 (3) 12-14 (2) 14-16 (3) 16-21 (4) 21-23 (3) 23-01 (2) 01-02 (1)	14-17 (1) 17-19 (2) 19-21 (3) 21-02 (4) 02-04 (3) 04-08 (2) 08-09 (3) 09-11 (4) 11-12 (3) 12-14 (2)	21-22 (1) 22-23 (2) 23-00 (3) 00-05 (4) 05-07 (3) 07-08 (2) 08-09 (1) 23-02 (1)* 02-06 (2)* 06-07 (1)*
Australasia	09-12 (1) 12-14 (2) 14-15 (3) 15-18 (4) 18-19 (3) 19-21 (2) 21-22 (1) 15-17 (1)**	07-08 (1) 08-11 (2) 11-14 (1) 14-15 (2) 15-17 (3) 17-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	08-10 (4) 10-12 (3) 12-13 (2) 13-15 (1) 15-18 (2) 18-20 (1) 20-22 (2) 22-23 (3) 23-02 (4) 02-04 (3) 04-08 (2)	01-02 (1) 02-03 (2) 03-06 (3) 06-08 (2) 08-09 (1) 02-04 (1)* 04-06 (2)* 06-07 (1)*

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distances column of a particular Meter band (10 through 160 Meters) as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts the predicted times of openings are found under the appropriate Meter band column (10 through 40 Meters) for a particular geographical region of the continental USA as shown in the left hand column of the Charts. An * indicates the best time to listen for 80 meter openings.

2. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. On the Short-Skip Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. The index indicates the number of *days* during the month on which the opening is expected to take place, as follows:

(4) Opening should occurr on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

3. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M. etc. On the Short-Skip Chart appropriate *daylight time* is used at the *path midpoint*. For example, on a circuit between Maine and Florida, the time shown would be EDT; on a circuit between N.Y. and Texas, the time at the midpoint would be CDT, etc. Times shown in the Hawaii Chart are HST. To convert to daylight time in other USA time zones, *add* 3 hours in the PDT zone; 4 hours in the MDT zone; 5 hours in the CDT zone, and 6 hours in the EDT zone. *Add* 10 hours to covert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 15 or 3 P.M. in Los Angeles; 18 or 6 P.M. in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to *daylight* time in other areas of the USA *subtract* 7 hours in the PDT zone; 6 hours in the MDT zone, 5 hours in the CDT zone and 4 hours in the EDT zone. For example, at 20 GMT it is 16 or 4 P.M. in N.Y.C.

4. The Short-Skip Chart is based upon a transmitted power of 75 watts c.w. or 300 watts p.e.p. on sideband; the Alaska and Hawaii Charts are based upon a transmitter power of 250 watts c.w. or 1 kw p.e.p. on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 160 and 80 meters, a half-wave length above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level for each 10dB loss, it will lower by one level.

5. Propagation data contained in the Charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Department of Commerce, Boulder, Colorado, 80302.

Caribbean, Central America & Northern Countries of South America	08-09 (1) 09-10 (2) 10-12 (3) 12-15 (4) 15-17 (3) 17-18 (2) 18-19 (1) 09-12 (1)**	07-08 (1) 08-09 (3) 09-11 (4) 11-13 (3) 13-17 (4) 17-19 (3) 19-20 (2) 20-21 (1)	06-07 (3) 07-09 (4) 09-11 (3) 11-14 (2) 14-16 (3) 16-23 (4) 23-02 (3) 02-06 (2)	19-20 (1) 20-21 (2) 21-22 (3) 22-04 (4) 04-05 (3) 05-06 (2) 06-08 (1) 20-23 (1)* 23-04 (2)* 04-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	07-08 (1) 08-09 (2) 09-12 (3) 12-16 (4) 16-17 (3) 17-18 (2) 18-19 (1) 09-14 (1)**	06-07 (1) 07-08 (2) 08-10 (3) 10-15 (2) 15-16 (3) 16-19 (4) 19-20 (3) 20-21 (2) 21-23 (1)	09-15 (1) 15-17 (2) 17-18 (3) 18-23 (4) 23-03 (3) 03-05 (2) 05-07 (3) 07-09 (1)	21-23 (1) 23-03 (2) 03-05 (1) 00-03 (1)*
McMurdo Sound, Antarctica	14-16 (1) 16-18 (2) 18-19 (1)	10-14 (1) 14-16 (2) 16-20 (3) 20-21 (2) 21-23 (1)	08-10 (1) 15-17 (1) 17-19 (2) 19-22 (3) 22-00 (4) 00-03 (3) 03-08 (2)	22-00 (1) 00-05 (2) 05-06 (1) 03-05 (1)*

CQ Short-Skip Propagation Chart September & October, 1982 Local Daylight Time At Path Mid-Point (24-Hour Time System)

Band (Meters)	Distance Between Stations (Miles)			
	50-250	250-750	750-1300	1300-2300
10	*Nil*	10-19 (0-1)	08-10 (1) 10-12 (1-2) 12-14 (1-3) 14-15 (1-4) 15-17 (1-3) 17-19 (1-2) 19-22 (0-1)	08-09 (1-2) 09-10 (1-3) 10-12 (2-4)** 12-14 (3-4)** 14-15 (4) 15-17 (3) 17-19 (2) 19-20 (1-2) 20-22 (1)
15	*Nil*	08-10 (0-1) 10-14 (0-2) 14-15 (0-3) 15-17 (0-2) 17-21 (0-1)	08-10 (1-2) 10-14 (2-4) 14-15 (3-4) 15-17 (2-4) 17-20 (1-3) 20-22 (1-2) 22-08 (0-1)	08-09 (2) 09-10 (2-3) 10-17 (4) 17-20 (3) 20-22 (2-3) 22-23 (1-2) 23-01 (1) 01-08 (1-0)
20	12-14 (0-1) 14-17 (0-2) 17-22 (0-1)	08-10 (0-3) 10-12 (0-4) 12-14 (1-4) 14-17 (2-4) 17-18 (1-4) 18-22 (1-3) 22-03 (0-2) 03-08 (0-1)	06-08 (1-2) 08-10 (3-4) 10-18 (4) 18-22 (3-4) 22-01 (2-3) 01-03 (2) 03-06 (1)	06-08 (2) 08-10 (4) 10-14 (4-2) 14-16 (4-3) 16-22 (4) 22-00 (3-4) 00-01 (3) 01-03 (2) 03-06 (1-2)
40	08-10 (2-3) 10-12 (3-4) 12-18 (4) 18-20 (3-4) 20-23 (1-2) 23-06 (0-1) 06-08 (1-2)	08-10 (3-4) 10-12 (4-3) 12-16 (4-2) 16-18 (4-3) 18-20 (4) 20-23 (2-4) 23-01 (1-4) 01-06 (1-3) 06-08 (2-3)	08-10 (4-2) 10-12 (3-1) 12-16 (2-1) 16-18 (3-2) 18-20 (4-3) 20-01 (4) 01-04 (3-4) 04-06 (3) 06-08 (3-4)	08-10 (2-1) 10-16 (1-0) 16-18 (2-1) 18-20 (3-2) 20-04 (4) 04-06 (3-4) 06-08 (4-3)
80	07-09 (3-4) 09-11 (4) 11-19 (4-3) 19-00 (4) 00-05 (3-4) 05-07 (2-4)	07-09 (4-2) 09-11 (4-1) 11-17 (3-1) 17-19 (3-2) 19-21 (4-3) 21-07 (4)	07-09 (2-1) 09-17 (1-0) 17-19 (2-1) 19-21 (3-2) 21-22 (4-3) 22-06 (4) 06-07 (4-3)	07-09 (1-0) 09-17 (0) 17-19 (1) 19-21 (2) 21-22 (3-2) 22-04 (4-3) 04-06 (4-2) 06-07 (3-1)
160	17-19 (1-0) 19-21 (2-1) 21-06 (4) 06-08 (3-2) 08-10 (2-1) 10-12 (1-0)	18-20 (1-0) 20-21 (1) 21-03 (4-3) 03-06 (3-2) 06-08 (2-1) 08-10 (1-0)	20-21 (1-0) 21-23 (3-1) 23-03 (3) 03-06 (2-1) 06-08 (1)	21-23 (1-0) 23-03 (3-2) 03-06 (1) 06-08 (1-0)

HAWAII September & October, 1982 Openings Given In Hawaiian Standard Time —

TO:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	06-08 (1) 08-12 (2) 12-14 (3) 14-16 (2) 16-17 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-16 (2) 16-18 (3) 18-20 (2) 20-22 (1)	11-14 (1) 14-16 (2) 16-18 (3) 18-21 (4) 21-00 (3) 00-04 (2) 04-06 (3) 06-07 (2) 07-08 (1)	18-20 (1) 20-23 (2) 23-00 (3) 00-01 (2) 01-02 (1) 20-22 (1)* 22-00 (2)* 00-01 (1)*
Central USA	06-08 (1) 08-11 (2) 11-14 (4) 14-16 (2) 16-17 (1) 12-14 (1)**	05-06 (1) 06-08 (2) 08-10 (1) 10-12 (2) 12-14 (3) 14-16 (4) 16-18 (3) 18-20 (2) 20-22 (1)	09-14 (1) 14-16 (2) 16-18 (3) 18-22 (4) 22-00 (3) 00-04 (2) 04-06 (3) 06-09 (2)	18-20 (1) 20-22 (2) 22-01 (3) 01-03 (2) 03-04 (1) 21-22 (1)* 22-00 (2)* 00-02 (1)*
Western USA	07-09 (1) 09-11 (2) 11-14 (4) 14-16 (3) 16-18 (2) 18-19 (1) 12-14 (1)**	06-07 (1) 07-09 (2) 09-14 (3) 14-17 (4) 17-19 (3) 19-22 (2) 22-00 (1)	10-15 (2) 15-17 (3) 17-19 (4) 19-00 (3) 00-02 (2) 02-04 (1) 04-06 (2) 06-08 (4) 08-10 (3)	18-19 (1) 19-20 (2) 20-02 (4) 02-04 (3) 04-05 (2) 05-06 (1) 21-22 (1)* 22-23 (2)* 23-02 (3)* 02-03 (2)* 03-04 (1)*

ALASKA September & October, 1982 Openings Given in GMT —

TO:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	18-20 (1) 20-23 (2) 23-00 (1)	16-18 (1) 18-22 (2) 22-01 (3) 01-02 (2) 02-03 (1)	14-16 (1) 21-23 (1) 23-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	08-12 (1)
Central USA	19-21 (1) 21-00 (2) 00-02 (1)	17-19 (1) 19-22 (2) 22-00 (3) 00-02 (4) 02-03 (2) 03-04 (1)	15-17 (1) 21-23 (1) 23-00 (2) 00-04 (3) 04-05 (2) 05-07 (1)	08-11 (1) 11-13 (2) 13-14 (1) 11-13 (1)*
Western USA	20-22 (1) 22-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	18-21 (1) 21-23 (2) 23-02 (4) 02-03 (3) 03-05 (2) 05-06 (1)	16-18 (1) 18-20 (3) 20-00 (2) 00-02 (3) 02-04 (4) 04-05 (3) 05-06 (2) 06-10 (1)	08-11 (1) 11-14 (2) 14-16 (1) 11-14 (1)*

#See explanation in "How To Use Short-Skip Charts" in the box at the beginning of this column.

Note: The Alaska and Hawaii Propagation Charts are intended for distances *greater* than 1300 miles. For shorter distances, use the preceding Short-Skip Propagation Chart.

Announcing:

The 1982 CQ World-Wide DX Contest

Phone: October 30–31 & C.W.: November 27–28
Starts 0000 GMT Saturday Ends 2400 GMT Sunday

I. OBJECTIVE: For amateurs around the world to contact other amateurs in as many zones and countries as possible.

II. BANDS: All bands, 1.8 through 28 MHz.

III. TYPE OF COMPETITION:

1. Single Operator (Single band, and all band). Single operator stations are those at which one person performs all of the operating, logging, and spotting functions. The use of DX spotting nets or any other form of DX alerting assistance places the station in the Multi-Operator category.

2. Multi-Operator (all band operation only).

a. Single Transmitter, only one transmitter and one band permitted during the same time period (defined as 10 minutes). *Exception:* One—and only one—other band may be used during the same time period if—and only if—the station worked is a new multiplier. *Logs found in violation of the ten-minute rule will be automatically reclassified as multi-multi to reflect their actual status.*

b. Multi Transmitter (no limit to transmitters but only one signal per band permitted).

c. *All transmitters must be located within a 500 meter diameter or within the property limits of the station licensee's address, whichever is greater. The antennas must be physically connected by wires to the transmitter.*

3. QRPp (single operator only) Power must not exceed 5 watts output. Stations in this category will be competing only with other QRPp stations for awards.

IV. NUMBER EXCHANGE: Phone: RS report plus zone (i.e., 5705). C.W.: RST report plus zone (i.e., 57905).

A station in a zone or country different than that indicated by its call sign is required to sign portable.

V. MULTIPLIER: Two types of multiplier will be used.

1. A multiplier of one (1) for each different zone contacted on each band.

2. A multiplier of one (1) for each different country contacted on each band.

Stations are permitted to contact their own country and zone for multiplier credit. The *CQ* Zone Map, DXCC country list, WAE country list and WAC boundaries are standards.

VI. POINTS: 1. Contacts between stations on different continents are worth three (3) points.

2. Contacts between stations on the same continent but different countries, one (1) point. *Exception:* For North American stations *only*, contacts between stations within the North American boundaries count two (2) points.

3. Contacts between stations in the same country are permitted for zone or country multiplier credit but have zero (0) point value.

VII. SCORING: All stations: the final score is the result of the total QSO points multiplied by the sum of your zone and country multiplier.

Example: 1000 QSO points × 100 multiplier (30 Zones + 70 Countries) = 100,000 (final score).

VIII. AWARDS: First place certificates will be awarded in each category listed under Sec. III in every participating country and in each call area of the United States, Canada, Asiatic USSR, and Japan.

All scores will be published. To be eligible for an award, a Single Operator station must show a minimum of 12 hours of operation. Multi-operator stations must operate a minimum of 24 hours. A single-band log is eligible for a single-band award *only*. If a log contains more than one band it will be judged as an all-band entry, unless specified otherwise.

In countries or sections where the returns justify, 2nd and 3rd place awards will be made.

All certificates and plaques will be issued to the licensee of the station used.

IX. TROPHIES & PLAQUES (Donors)

PHONE

Single Operator, All Band

World - Bill Leonard, W2SKE
World - QRPp - Adrian Weiss, K8EEG/Ø
U.S.A. - Potomac Valley Radio Club
*Canada - Jack Baldwin, VE7RG
Carib./C.A. - Jim Neiger, N6TJ
Europe - Thomas J. Peruzzi, Jr., W4BVV
Africa - Gordon Marshall, W6RR
*Asia - Japan CQ Magazine
*Japan - Palm Garden Contest Club
Oceania - No. California DX Club
S. America - David Novoa, KP4AM

Single Operator, Single Band

World - K2HLB Memorial, No. Jersey DX Assoc.
*World - 21 MHz - Lee Wical, KH6BZF
World - 3.8 MHz - Fred Capossela, K6SSS
U.S.A. - 28 MHz - Donald Thomas, N6DT
U.S.A. - 3.8 MHz - Arnold Tamchin, W2HCW
U.S.A. - So. California DX Club
*Canada - Gene Krehbiel, VE7KB

Carib./C.A. - Pedro Piza, Jr., NP4A - KP4ES Memorial
*Europe - 28 MHz Zone 14 - A. G. Anderson, GM3BCL
*Japan - 21 MHz - DX Family Foundation
*So. America - Rafael Ponce de Leon, CX3BR

Multi-Operator, Single Transmitter
World - Don Wallace, W6AM
U.S.A. - Theodore Pauck, Jr., K8NA
*Canada - Calgary Amateur Radio Assoc.

Multi-Operator, Multi-Transmitter
World - Radio Club Venezolano
U.S.A. - Dale Hoppe, K6UA
Europe - Bob Cox, K3EST

Contest Expeditions
World - Single Opr. - Stuart Meyer, W2GHK
*World - Multi-Opr. - "The YASME Award."

Special - Single Operator, Phone/C.W.
World - All Band - John Knight, W6YY
World - Single Band - Yuri Blanarovich, VE3BMV

C.W.

Single Operator, All Band
World - Albert Kahn, K4FW - W2AB Memorial
World - QRPp - Gene Walsh, N2AA
U.S.A. - Frankford Radio Club
*Canada - Canadian DX Association
Carib./C.A. - Jim Neiger, N6TJ
Europe - Edward Bissell, W3AU
Africa - Gordon Marshall, W6RR
*Asia - Japan CQ Magazine
*Japan - Palm Garden Contest Club
Oceania - Maui Amateur Radio Club

Single Operator, Single Band
World - W2JT Memorial, No. Jersey DX Assoc.
World - 3.5 MHz - Fred Capossela, K6SSS
World - 1.8 MHz - Chip Margelli, K7JA - KP4ES Memorial
U.S.A. - No. Illinois DX Association
*Canada - Canadian Amateur Radio Federation
Carib./C.A. - DX Club of Puerto Rico
*Europe - 14 MHz - G2LB Memorial (From Friends)
*So. America - Rafael Ponce de Leon, CX3BR

Multi-Operator, Single Transmitter
World - Anthony Susen, W3AOH
U.S.A. - Douglas Zwiebel, KR2Q

Multi-Operator, Multi-Transmitter
World - Hazard Reeves, K2GL
U.S.A. - James Rafferty, N6RJ

Contest Expeditions
World - Single-Opr. - Yankee Clipper Contest Club
World - Multi-Opr. - Bill Schneider, K2TT

Clubs
World - Phone/C.W. - CQ Magazine
*Special - Phone/C.W. - Southeastern DX Club

**Trophy supplied by Donor.*

Trophy winners may win the same trophy only once within a three year period. (This does not apply to any of the Club or *CQ* Special Awards.)

A station winning a World Trophy will not be considered for a sub-area award. That Trophy will be awarded to the runner-up of that area.

The Canadian and Carib./C.A. awards are for residents *only*. *A resident is defined as one living in that country with an established Post Office address.

X. CLUB COMPETITION:

1. The club must be a local group and not a national organization.

2. Participation is limited to members operating within a local geographic area (except for DXpeditions especially organized for operation in the contest and manned by members).

3. To be listed, a minimum of 3 logs must be received from a club and an officer of the club must submit a list of participating members and their scores, both on phone and c.w.

XI. LOG INSTRUCTIONS:

1. All times must be in GMT.

2. Indicate zone and country multiplier only the FIRST TIME it is worked on each band.

3. Logs must be checked for duplicate contacts, correct QSO points and multipliers. Submitted logs must have duplicate contacts clearly shown. The *original* log may be requested by the Contest Committee if further cross-checking of the log is necessary.

4. Use a separate sheet for each band.

5. Each entry must be accompanied by a Summary sheet showing all scoring information, category of competition, contestant's name and address in BLOCK LETTERS and a signed declaration that all contest rules and regulations for amateur radio in the country of operation have been observed.

6. Sample log and summary sheets and zone maps are available from *CQ*. A *large* self-addressed envelope with sufficient postage or IRC's must accompany your request.

If official forms are not available, make up your own 80 contacts to the page on 8½" × 11" paper.

7. All entrants are required to submit cross-check sheets for each band on which 200 or more QSO's were made. All other entrants are encouraged to submit cross-check sheets.

8. For each duplicate contact that is removed from a log by the committee, a penalty of three additional contacts will be exacted.

9. QRPp stations must indicate same on their summary sheets and state the actual maximum power output used, with a signed declaration.

XII. DISQUALIFICATION: Violation of amateur radio regulations in the country of the contestant, or the rules of the contest; unsportsmanlike conduct; taking credit for excessive duplicate contacts; unverifiable QSO's; or unverifiable multipliers will be deemed sufficient cause for disqualification. (Incorrectly logged calls will be counted as unverifiable contacts.)

An entrant whose log is deemed by the Committee to contain a large number of discrepancies may be disqualified from eligibility for an award, both as a participant operator or station, for one year. If an operator is disqualified a second time within 5 years, he will be ineligible for any *CQ* contest awards for 3 years.

Actions and decisions of the *CQ* Contest Committee are official and final.

XIII. DEADLINE: All entries must be postmarked NO LATER than December 1, 1982 for the Phone section and January 15, 1983 for the C.W. section. An extension may be given if requested. Indicate phone or c.w. on envelope.

Phone logs go to: Bob Cox, K3EST, 6548 Spring Valley Dr., Alexandria, VA 22312.

C.W. logs go to: Larry Brockman, N6AR, 7164 Rock Ridge Terrace, Canoga Park, CA 91307.

Logs may also be sent to *CQ* Magazine, 76 North Broadway, Hicksville, NY 11801.

**Except the Jim Neiger, N6TJ, award.*

CQ Reviews:

THE ICOM IC-25A 2 METER TRANSCEIVER

BY AL GORDON*, WD6HAK

From the instant that one unties the unique string-secured box it is evident that the new hot little number from ICOM is an unusual rig. Dubbed the IC-25A (the European models are suffixed "E" instead of "A"), this rig measures 5½" × 2" × 7", yet emits a mustard-cutting 25 watts output. To boot, the transceiver sports a dual scanning system (one for memory and one for v.f.o. . . . dual v.f.o.'s, no less), and the entire package comes with a touchtone microphone as standard fare. But there are other unusual features of this rig.

Instead of random-access frequency selection, ICOM has elected to incorporate a rotary encoder pulse generator system which is push-button mode selectable. One switch setting is **VFO A** and the alternate setting is **VFO B.** Continuous tuning on the rotary switch produces resolution to the nearest 5 kHz, although VFO B tunes in 15 kHz steps. The entire 2 meter band plus MARS is accessible, the rig spanning 143.8 to 148.2 MHz. Furthermore, any interval within the band—or the entire band—can be traversed by a versatile scanning system: One can opt for memory scan through the 5 user-programmed channels plus the two v.f.o.'s, scan between upper and lower limits user-written into two memory channels, or else v.f.o. full-range scan covering the entire 143.8 to 148.2 MHz spread. Another scan option is automatic scan resume, a rarity in transceivers. Altogether, these niceties make for a compact package of bells and whistles, but what about the rig's basic features?

To squelch the most ardent skeptics among us who feel that none but ill audio can emanate from a small cabinet ("communications quality," I believe, is the current descriptive euphemism), the excellent response trumpeting from the compact IC-25A makes for a favorable first impression. ICOM uses common-collector buffers when matching to a high-impedance input, a corner that is cut in some rigs on the market. This kind of isolation appears at several locations in the analog portions of the transceiver. The spectral purity characteristics of the IC-25A almost defy any concern for their values (save satisfying FCC regulations, of course) because the power amplifier output enters a three-stage low-pass filter which suppresses harmonics by a calculated greater than 60 dB reading, and that is after considerable pre-filtering for the 2 meter band. Also, another amateur who lives not far away and who has an accurate frequency counter which bypasses the limiter stage of his rig measured no discernible amplitude modulation of the n.b.f.m. transmission on simplex, which, by the way, is direct f.m. and not phase modulation as is found in some rigs. The output of the PLL circuit, the oscillator for both transmit and receive, is 16.9 MHz below the receive frequency, keeping "spurs" to a minimum.

The ICOM IC-25A.

A side-by-side comparison shows the relative size differences between the IC-25A, an antique type 227 vacuum tube, and a standard coffee mug.

Circuit Description

A complete block diagram is shown in fig. 1. Relay T-R switching has been replaced by space-saving diodes to isolate the PA module from the receiver circuits. From the receiver, input signals are amplified by a MOSFET, cleaned up by a four-stage helical cavity filter, and then sent to one input port of the double balanced mixer comprised of Schottky diodes with their low forward cut-in voltage in order to keep sensitivity less than .6 uV for 20 dB quieting. To the other port is fed a PLL-produced 127.1 to 129.09 MHz signal to beat with the r.f. down to 16.9 MHz, the first i.f. frequency. After passing through a ceramic filter and being amplified, a second i.f. of 455 kHz is obtained

*1726 Spreckels Lane, Redondo Beach, CA 90278

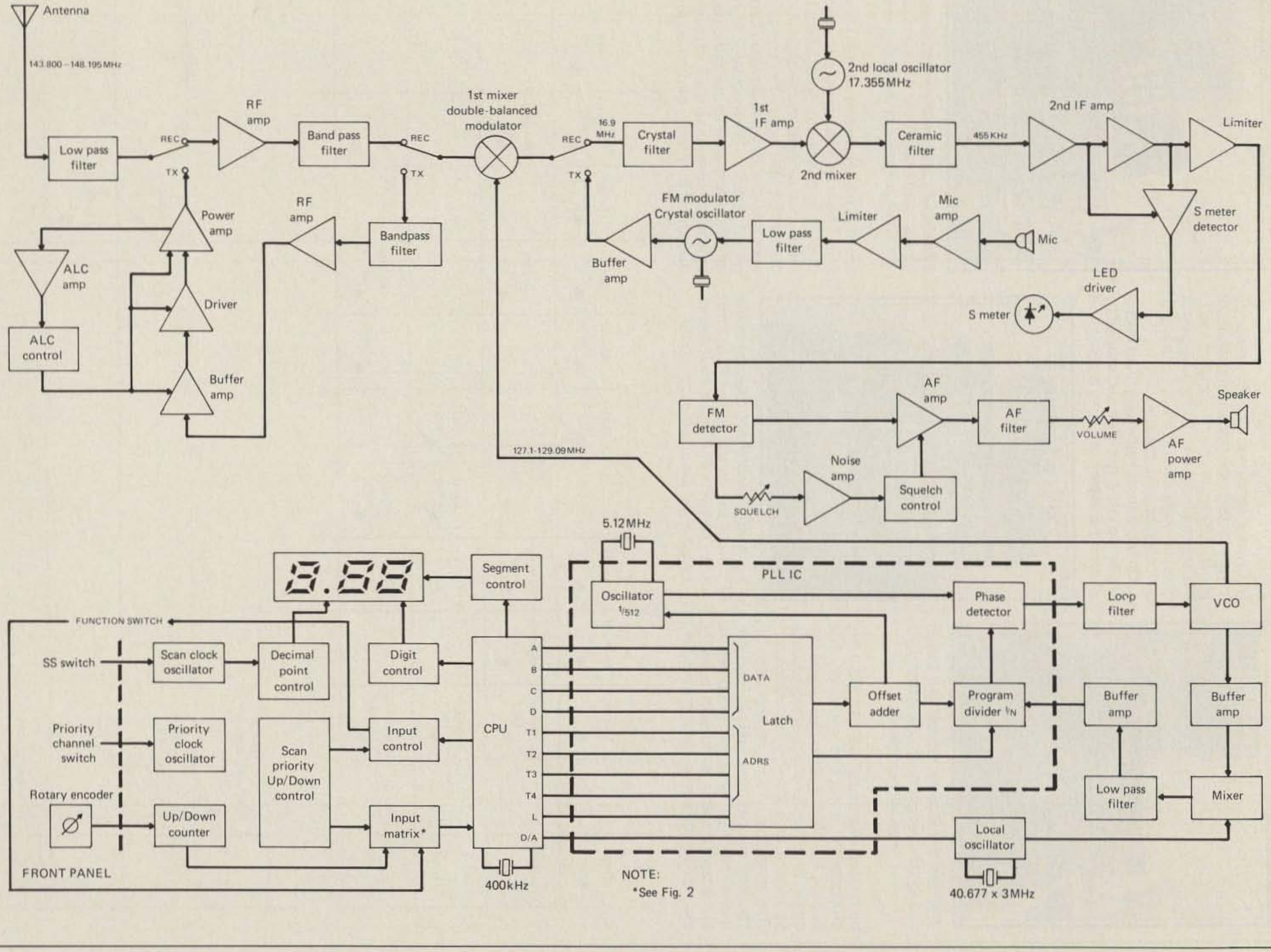
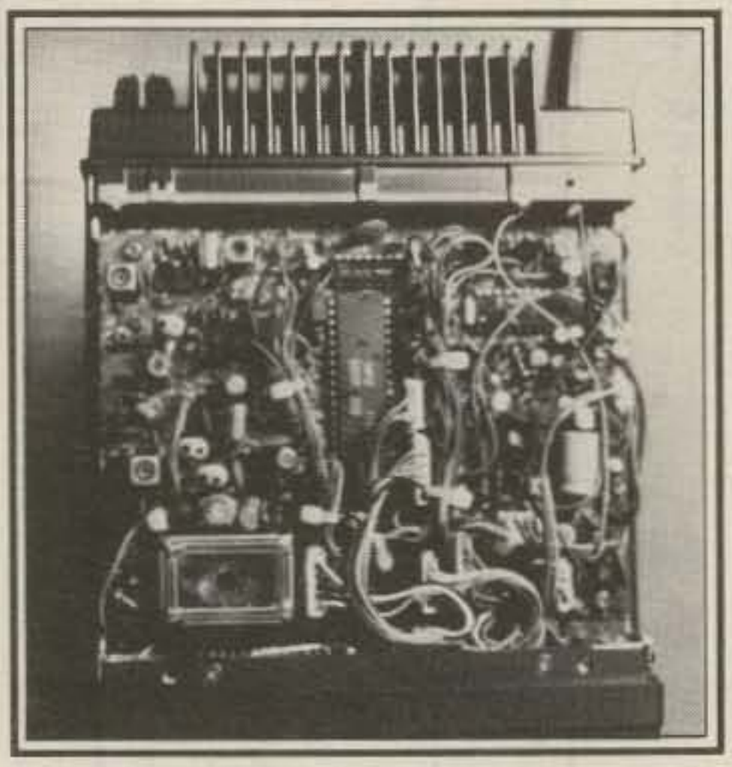


Fig. 1– The complete block diagram of the IC-25A illustrates the signal flow path indicated in the text.

The heat from the PA module is transferred to the diecast heat sink which radiates very efficiently.

adjusting the cutoff threshold accordingly. To avoid erroneous operation resulting from audio signals, noise components of about 25 kHz are selectively amplified in the squelch network. The final signal is given de-emphasis before a.f. power amplification of up to 2 watts.

On the transmit side, amplified microphone signals are limited and shaped by an amplifier which provides 6 dB/octave



A top down view of the IC-25A shows the CPU near the center of the PLL/Driver board. The VCO unit is inside the shield located in the lower left of the board.

The IC-25A comes with a touch-tone mike as standard equipment. Note the size of the miniature mike compared to the rig.

by beating the signal with 17.355 MHz produced by a second oscillator. The second i.f. amplifier/filter then feeds the output to the limiter and detection occurs by means of a ceramic discriminator. This demodulation scheme provides outstanding temperature stability and extreme linearity. The squelch loop begins at the discriminator output and re-enters the receive line at the first a.f. amplifier,

rolloff at the breakpoints of 300 Hz and 3 kHz. The output is low-pass filtered and passed to a varactor diode which reactance modulates a crystal-oscillator-produced 16.9 MHz signal. The crystal oscillator provides the suitable deviation and added stability. The modulated signal is amplified and sent to the same double-balanced mixer as is used in receiving, the double duty being performed to con-

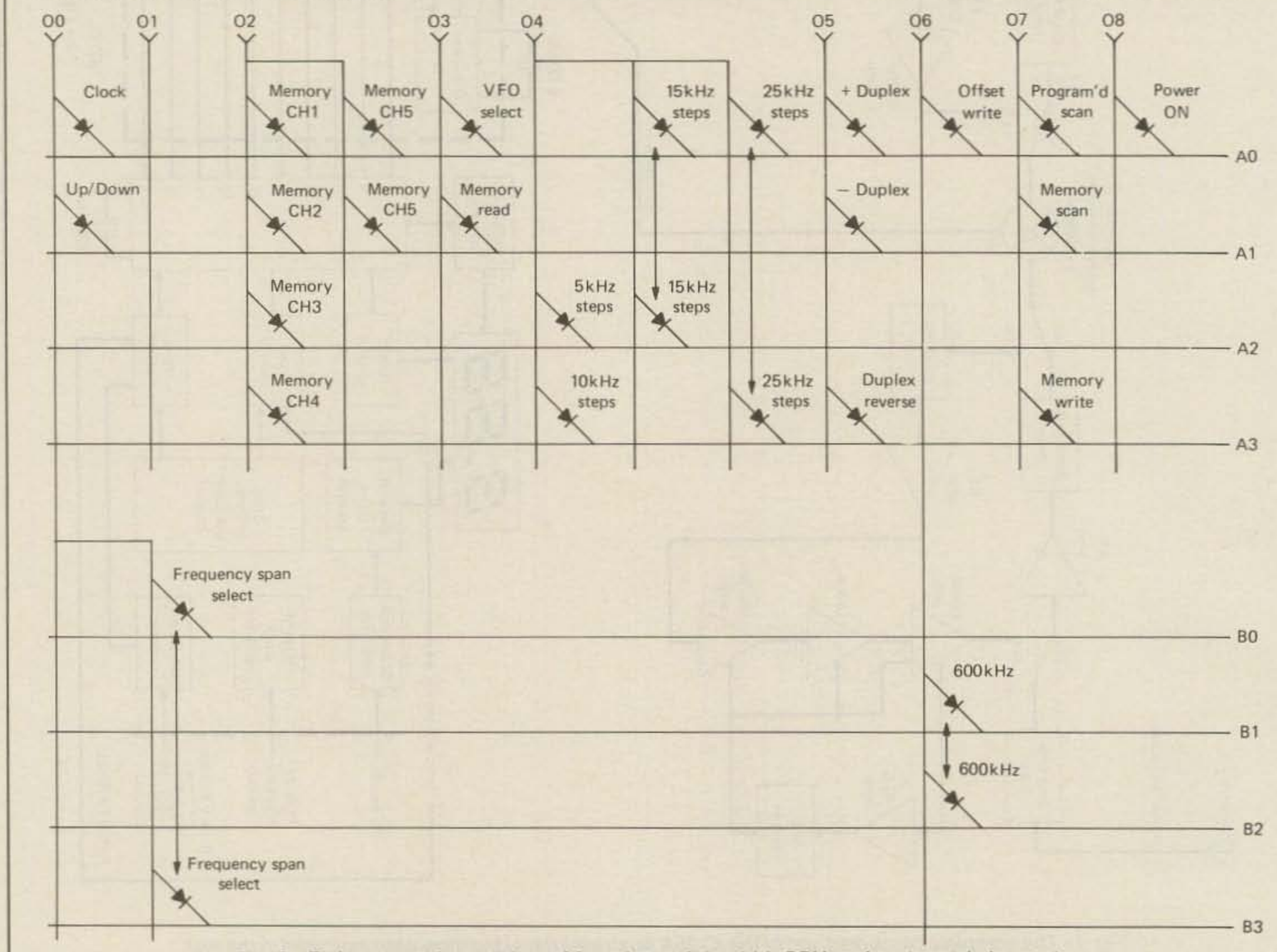


Fig. 2– To increase the number of functions of the 4-bit CPU an input matrix is used.

serve space. Here, 126 MHz signals from the PLL are mixed to give sum and difference resultants (the original signals are cancelled in the double-balanced mixer). The signals are prefiltered for the 2 meter band by a helical band-pass filter prior to final power amplification. The output signal is further filtered prior to output to the antenna. Feedback error amplifier a.l.c. stabilizes the final power under fluctuating antenna load conditions by providing gain control over the PA module.

The PLL unit local oscillator generates both a 40.677 MHz and a 122.03 MHz (third harmonic) output which are mixed with the VCO signals in an FET mixer. The output is filtered to pass only frequencies lower than 15 MHz and then amplified to proper drive level (3 volts p–p) for the programmable divider inside the PLL IC. The reference frequency generator is a crystal oscillator and a high-speed divider (÷12) which produces 10 kHz for the phase detector. This 10 kHz reference fixes the variation step of the PLL output frequency and the divide number (N) as determined by the CPU output via the display frequency, and determines the PLL output frequency. The digital phase detector senses the phase difference of the 10 kHz and the programmable divider frequency, proportionally sending positive or negative signals to the loop filter, which determines the loop response time. The filter output goes to the VCO unit as a control voltage, varying the VCO Clapp oscillator frequency around 127 MHz. The VCO output goes to the first mixer and to the internal PLL unit mixer via a buffer to complete the PLL unit loop.

In the driver unit, microcomputer input data is controlled by a custom LSI circuit. A mechanical rotary-encoder linked to the tuning-knob shaft produces two clock signals which are 90 degrees out of phase. The scan function is enabled and disabled by alternately starting and stopping the multivibrator scan oscillator via the front panel **SS** button. The CPU is a 4-bit with inputs A_0 to A_3 and B_0 to B_3. To increase the number of functions of the CPU, a scanning system across the matrix, which is mapped in fig. 2 (with 0_0 to 0_8 inputs, and A_0 to A_3 and B_0 to B_3 outputs to the CPU), is employed. The frequency display is derived from BCD outputs of the CPU, which include both 7-segment outputs and digit-control outputs.

Conclusion

All in all, the IC-25A is an excellent rig, and there appears to be no tradeoff for its reduced size; indeed, some aspects of the rig appear to be superior to many rigs of larger dimensions. In fact, the only fault I can find with the rig is that it is almost *too* small for my admittedly fat fingers. If the point of diminishing returns for operator convenience hasn't been passed because of this "little problem," then the ICOM IC-25A is an ideal rig for a subcompact car.

Awards

a monthly feature by
A. EDWARD HOPPER, W2GT

NEWS OF CERTIFICATE AND AWARD COLLECTING

The September Story of the Month as told by Bob is:

Robert G. Craig, K6XZ
All Counties #324, 4-25-81

"I was listening to the ICH Net on 14336 on August 19, 1978 when I decided to really go after all the U.S. Counties. Up to that time I had collected some 500 counties from various c.w. contacts on the different amateur bands over a period of 10 years, being strictly a c.w. buff.

"I got interested in ham radio one spring day in 1968 when my son, Jim, brought home a copy of *Popular Electronics* from his high school library. The magazine had an amateur radio column written by Herb Brier. At the time we lived in Huntington Station, N.Y., and I was teaching music and band instruments in the public schools of Uniondale.

"I found an Elmer in the person of Charlie, K2HTX, who proved to be quite helpful in getting me started. I attended his Novice classes, which were a service of the Larkfield Amateur Radio Club, and on August 1, 1968, I had my first QSO as WN2GMD.

"My Novice rig was a Knightkit T-60 transmitter (which I'd built), a new Hammarlund HQ-100 receiver, a hatful of 15 meter crystals, and a 2-element Mini-Beam antenna which my son and I installed on our rooftop.

"Prior to World War II, I had learned to play a few different band instruments and was active in musical groups. When I graduated from high school in June 1939, I enrolled at New York University to study music education.

"In 1942 I went into the Air Force, where I spent the next three years. I was stationed for 19 months at an Eighth Air Force B-17 bomber base in Deenethorpe, England, where I was a member of the control tower crew. I also found time to play saxophone in a band which Special Services sent to play for dances at our own and various other Air Force bases within a 50 mile area. My main instrument is drums, although my other hobby, in addition to amateur radio, is playing the electronic organ.

"My teaching career began in September 1948 at New London, Connecticut. I also taught school in New Jersey, spending a total of 28 years on the job in 3 states.

"In 1976 I decided to retire at age 55.

Bob Craig, K6XZ.

My wife, Marianne, and I moved here to Santa Rosa, California, for a change of scenery and climate. I was given the call WB6RWE, and later on in 1977, K6XZ.

"Many thanks to all the mobiles on the ICH Net who helped me get those needed counties. I'd also like to thank Mike, K7CLO, Arnie, K9DCJ, and Dave, W6CCM, who kept the land line buzzing when a mobile was nearing a 'last' county which I needed in a particular state. Special thanks to Bob, VE1RQ, who passed through North Carolina, giving me four counties I needed to finish that state. He then went into Georgia where he provided me with four more counties, including Emanuel County, my last one for, as they say, 'the whole ball of wax.' Last, but not least, I must express my appreciation to all the net controllers and their assistants for the fine help they provided in hunting those many counties."

P.O. Box 73, Rochelle Park, NJ 07662

Awards Issued

James Rounds, W1SSX, who got USA-CA-500 back in May 1963, has kept at it in his spare time and made USA-CA-1000 through All Counties endorsed Mixed.

David Taylor, KS5A (ex-WA5DXI, WB0CCW), waited until he had them All and requested USA-CA-500 through All Counties endorsed Mixed.

Aubrey Armstrong, K5MOF, who got his USA-CA-500 back in February 1965, had me send him USA-CA-1000 through USA-CA-3000 endorsed All S.S.B., All 20, All Mobiles, and All Counties endorsed Mixed.

Special Honor Roll
All Counties

#380 James E. Rounds, W1SXX 5-15-82.
#381 David S. Taylor, KS5A 5-22-82.
#382 Aubrey G. Armstrong, K5MOF 6-1-82.
#383 Franz B. Kurth, WB6ALC 6-5-82.

Franz Kurth, WB6ALC, who also waited until he had them All, then qualified for USA-CA-500 through USA-CA-2500 endorsed All S.S.B., All 20, All Mobiles, and USA-CA-3000 and All Counties endorsed Mixed.

Alex Marion, W2CUE, upgraded his endorsement from USA-CA-2000 through All Counties to be endorsed All S.S.B., All 14, All Mobiles.

James A. Rounds, K9WA (ex-K9DDA), not to be confused with W1SXX who is James E. Rounds, added to his nice collection USA-CA-2000 and 2500 endorsed All 2XC.W.

Stu Casper, W2PDM, who does a lot of mobiling, picked up USA-CA-500 through USA-CA-1500 endorsed All S.S.B., All 20, All Mobiles, and USA-CA-2000 endorsed Mixed.

Lew Milligan, WA4OIB, added USA-CA-1000 and 1500 endorsed All 2XS.S.B. to his collection.

Barry Siegfried, K2MF, acquired USA-CA-1000 endorsed Mixed.

USA-CA-500 certificates, endorsed Mixed, were claimed by:

Kenneth Kruger, WB8AAX.
Arie Guterbaum, 4X6AG.
Alfred Sengenberger, DK2UB.
Diane Elizabeth Haigh, N1YL.

USA-CA-500 Certificates, endorsed All C.W., went to:

Stanislav Antos, OK1FCA.

S.R. Scheltens, PA2SAM, who worked all 50 states to get it.

Gabriel G. Gonzalez, EA7PW, sent for USA-CA-500 endorsed All S.S.B.

USA-CA Honor Roll

3000		2500		2000		1500		1000		500	
W1SXX	408	W1SXX	466	W1SXX	519	WA4OIB	583	WA4OIB	715	WB8AAX	1720
KS5A	409	KS5A	467	KS5A	520	W1SXX	584	W1SXX	716	4X6AG	1721
K5MOF	410	K9WA	468	W2PDM	521	KS5A	585	KS5A	717	OK1FCA	1722
WB6ALC	411	K5MOF	469			W2PDM	586			KS5A	1723
		WB6ALC	470			K5MOF	587			DK2UB	1724
						WB6ALC	588			PA2SAM	1725
										N1YL	1726
						K9WA	522			W2PDM	1727
						K5MOF	523			EA7PW	1728
						WB6ALC	524			WB6ALC	1729
										K2MF	718
										W2PDM	719
										K5MOF	720
										WB6ALC	721

Awards

Worked All Oregon With W7ULC: Available to anyone who has worked W7ULC in all 36 Oregon counties. No time limit. Send a list (no cards) of contacts giving time, date, and signal report to: Jerry Skaife, W7ULC, Rt. 3 Box 3449, La Grange, Oregon 97850. (See story and photo of Jerry in November 1981 *CQ*.)

Worked All Oregon With W7ULC.

French Awards Program: *(General rules)* All REF certificates and awards will be issued to transmitting and/or s.w.l. stations (see Table I). In agreement with the I.A.R.U. Region 1 rules, each claim must be accompanied by a list of QSOs and by a statement from the applicant's national DX Award Manager that correctly filled-in QSLs are really in possession of the applicant. If this is not possible, the applicant must submit all the required QSLs. In the case of any dispute concerning a claim, the decision of the council of Reseau des Emetteurs Francais shall be final.

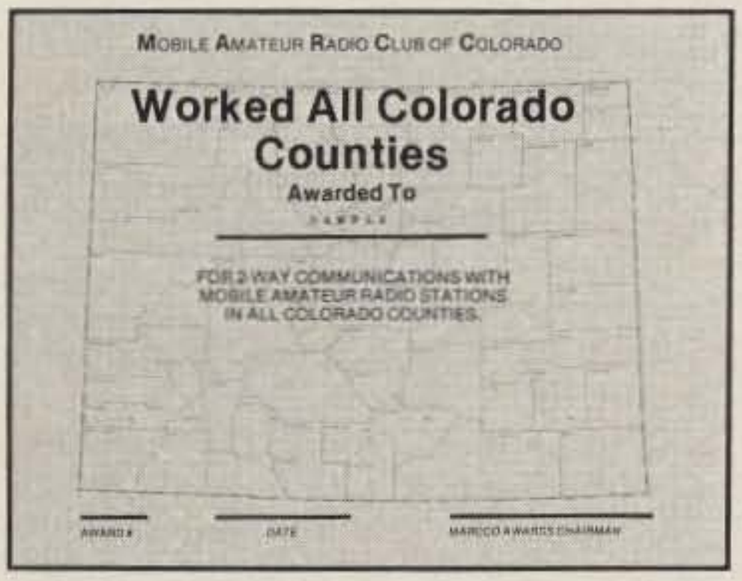
Unfortunately the complete rules would take up my whole column, so please send an s.a.s.e. (French stamps or a couple of IRCs) to: REF French Award President, F6AXP, Mr. Max Pomel, HLM Les Gargailles #134, 63370 Lempdes, France, or to the new DX Awards Manager, F9MD, Mr. Pouchoux Marcel, 39 Villa Belvedere, 9400 Villejuif, France. I have several of their awards and they are well worthwhile.

Awards	Award Manager	Fee, Surface Mail
DDFM	Mr. Max Anouzet, F6FWH	10 IRCs
5BDDFM	8, allee du Parc	65 IRCs
DPF	F 63110 Beaumont	10 IRCs
5BDPF		65 IRCs
DUF1	Mr. Edmond Dubois, F9IL	7 IRCs
DUF2	B. P. 7	9 IRCs
DUF3	Aubencheul Au Bac	12 IRCs
DUF4	F 59265 Aubigny Au Bac	15 IRCs
DUF Medal		20 IRCs
each endorsement		6 IRCs
5BDUF		65 IRCs
Initial DTC	Mr. Rene Roy, F8GA	10 IRCs
DTC1	8, rue des Mottes	10 IRCs
DTC2	Muides Sur Loire	10 IRCs
DTC3	F 41500 Mer	10 IRCs
REF ACHIEVEMENT		30 IRCs
F-CW-500		10 IRCs
each endorsement		6 IRCs
DTA	Mr. Alain Duchauchoy, F6BFH	10 IRCs
DDTOM	21, rue de la Republique F 76420 Bihorel	10 IRCs
DEE	Mr. Jean Robert, FE9434 2, rue Arsene-d'Arsonval F 64001 Pau	10 IRCs
YL REF	Mrs. Gilda Le Gall, F6FMO Ecole publique F 56490 Guilliers	10 IRCs for each award

Table I– REF awards managers and fees.

Coast to Coast Award.

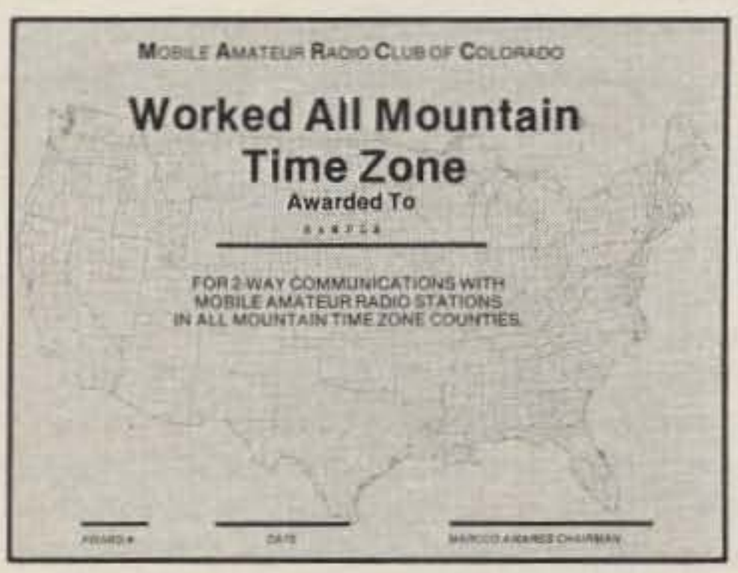
HAROAA Awards and Certificates: These are available to all licensed amateurs and amateur stations. Do not send QSL cards. A list showing full details of the contacts (log information) should be certified by you and one other amateur or a radio club officer. Photocopies of your QSL cards or original log will also be permitted. At your request, special endorsements will be added, such as: C.W., S.S.B., All YL, QRP, RTTY, SSTV, One Band, etc. No time limit, no contacts via repeaters, but QSOs via satellites are permitted. Apply to: HAROAA, P.O. Box 341, Hinckley, Ohio 44233.



Mobile Amateur Radio Club of Colorado Worked All Colorado Counties.

Border to Border Award.

Great Lakes Award.



Worked All Mountain Time Zone.

Mobile Amateur Radio Club of Colorado (MARCCO): They have an active club and four awards (complete rules in my column, page 82, *CQ*, January 1982). If you do not have a copy of the rules, send an s.a.s.e. or s.a.e. and IRCs to: Paul F. Hultquist, WBØSEQ, MARCCO Secretary, 2615 Van Gordon Drive, Lakewood, Colorado 80215.

HAROAA Great Lakes Award: Requires one contact with each state bordering the Great Lakes: New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Wisconsin, and Minnesota.

HAROAA DX Award: Obtained by working DX stations. Each DX station counts as one, even if several are from the same country or area. Special endorsements

for this award are 10, 25, 50, 75, 100, 200, and 500 DX contacts.

HAROAA Super Certificate Hunter Award: You earn this by having a minimum of 10 amateur radio operating awards. Simply list the awards that have been issued to you. Special endorsements are 10, 25, 50, 75, 100, 100 plus.

HAROAA Insomnia Award: This is earned by communicating with one other amateur for a minimum of one hour between the hours of 1:00 and 5:00 a.m.

HAROAA Super Operator: This is rendered for those providing a service on behalf of amateur radio, such as weather observer, public service, emergency, helping a new ham, providing communications for a community function, etc. Applicant should briefly describe the event or service, and the officials at HAROAA will determine whether it deserves this special recognition.

HAROAA Official Traffic Handler: This award is a self-issued achievement, allowing you to display the fact that you are indeed an official handler of radio traffic.

Each application for each award should be accompanied by three (U.S.) dollars. Payment may be made by cash, personal check, money order, 10 IRCs, or first-class-rate U.S. postage stamps. DX applicants may send a money order made out to U.S. funds, 10 IRCs, or any other of the above.


WØRR
TWO LETTER CALLS
The Heart of America Radio Club
recognizes and congratulates amateur radio operator
for his diligence and skill in establishing confirmed two way radio communication with at least one amateur radio station holding a two letter call in each of the fifty United States of America.
awarded this day. in Kansas City, Missouri

The Two Letter Calls Award.

The Two Letter Calls Award: This award is sponsored by the Heart of America Radio Club (HARC) in Kansas City, Missouri. Requirements: Contact a station in each of the 50 states with 2 or less letters in the suffix (examples: WØRR, KBØVL, and AKØA). Send full log data verified by two amateurs or any radio club secretary and $2.00 to: Adrianus Hoogenraad, WBØRAF, 7204 E. 28th Street, Kansas City, Missouri 64129.

Notes

If you were fortunate enough to work the special events station of the McDowell (County, W.Va.) ARC that was active June 15 through the 22nd in honor of West Virginia Day, a certificate is available to you via Andy Pitt, WB8WEZ, Secretary McDowell ARC, Box 484, Welch, W. Va. 24801.

The Wisconsin Valley Radio Association, Inc., Box 363, Wausau, Wisconsin 54401, will be on the air on September 12, 1982 using the club call W9SM. Operation will be from 7:00 a.m. to 7:00 p.m. CDT. Frequency of operation will depend on band conditions, but it will be 25 kHz up from the bottom of the General phone portion of whatever band is being used. Send an s.a.s.e. for a QSL. Send s.a.s.e. and $1.00 for a certificate. (Thanks to Gary, W9OAK, for this data.)

Another Special: On Labor Day weekend, September 4, 5, 6, 1982, the famous OK Corral in Tombstone, Cochise County, Arizona (where the Earp Brothers and Doc Holiday shot it out with the Clanton Brothers) will be the site of Special Event Station KC7MG. Operations will begin at 1500Z September 4 and continue through 2400Z September 6 on s.s.b. and c.w. S.s.b. will be on 28680, 21380, 14280, 7280, c.w. on 21130 and 7130. A certificate will be available for contact or for s.w.l.'s. Send a large 8½ × 11 s.a.s.e. (40¢ postage) to KC7MG, P.O. Box 1555, Benson, Arizona 85602.

Many thanks to Taroh Yagi, JH1WIX, and Naoki Akiyama, JH1VRQ, for all the nice publicity and photos on USA-CA and other *CQ* Awards in the Japanese magazines. (Both JH1WIX and JH1VRQ are County Hunters.)

73, Ed, W2GT

THE NEW MLX MINI

Tons of fun with a tiny side band transceiver

dealer inquiries invited

Suggested Retail
$229.50

Small enough for your hip, lunchbox, or camper, the new MLX Mini lets you create your own fun wherever you go. A monoband transceiver, the MLX performs like a big rig and has all the features you'll ever need, plus some options we know you'll want. Contact your nearest dealer for full specifications.

Specifications:

- 25W PEP, 20W CW, LED ± 100Hz accuracy
- Monoband transceiver covers any band 160 - 6 meters
- 12V DC power requirements
- 2.1Hz selectivity
- Sensitivity better than .35uV for 10dB signal to noise ratio
- Single conversion super heterodyne receiver design
- Easy to read digital display
- 5"W x 2½"H x 7"D, 4 lbs.

Options:

- NI-CAD 12V portapak available
- AC power supply with built in speaker
- Antenna tunner

DENTRON

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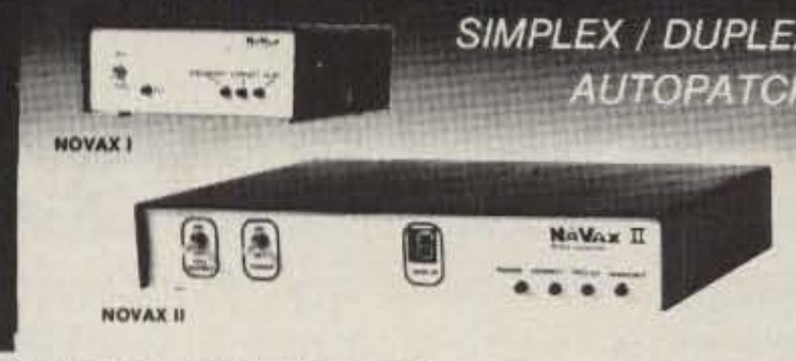

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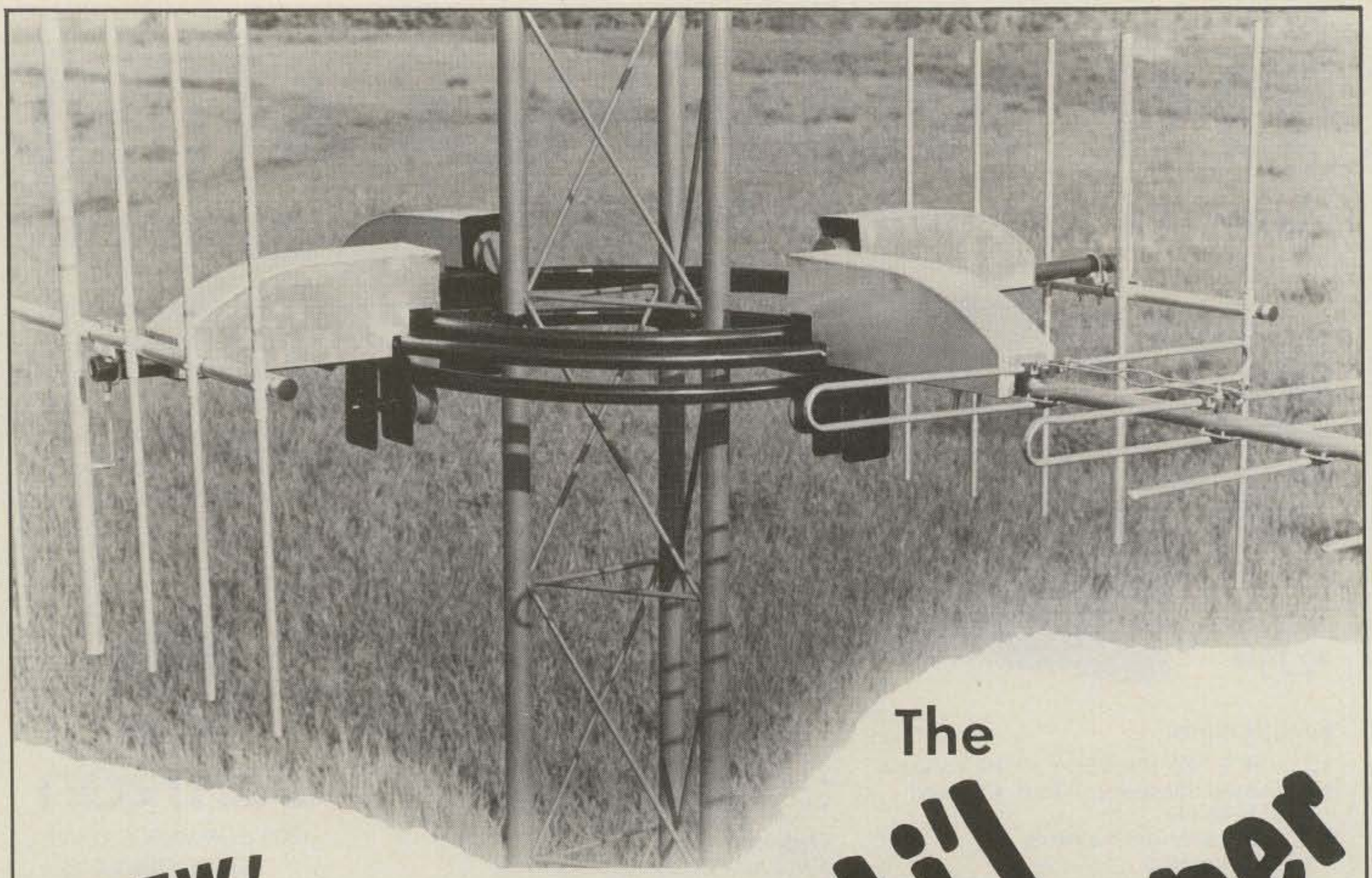

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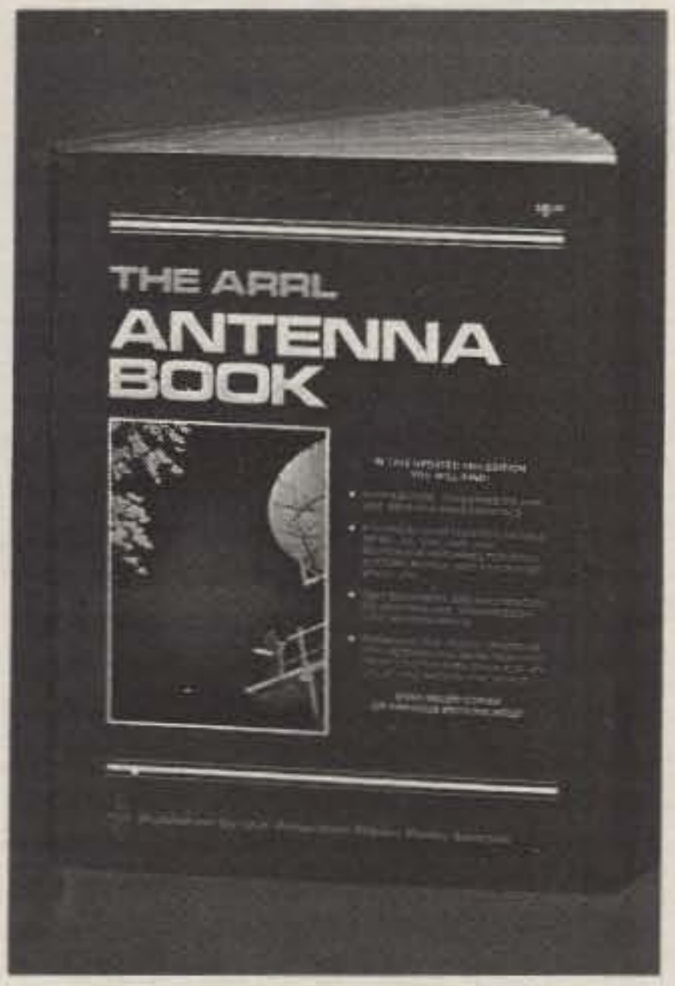

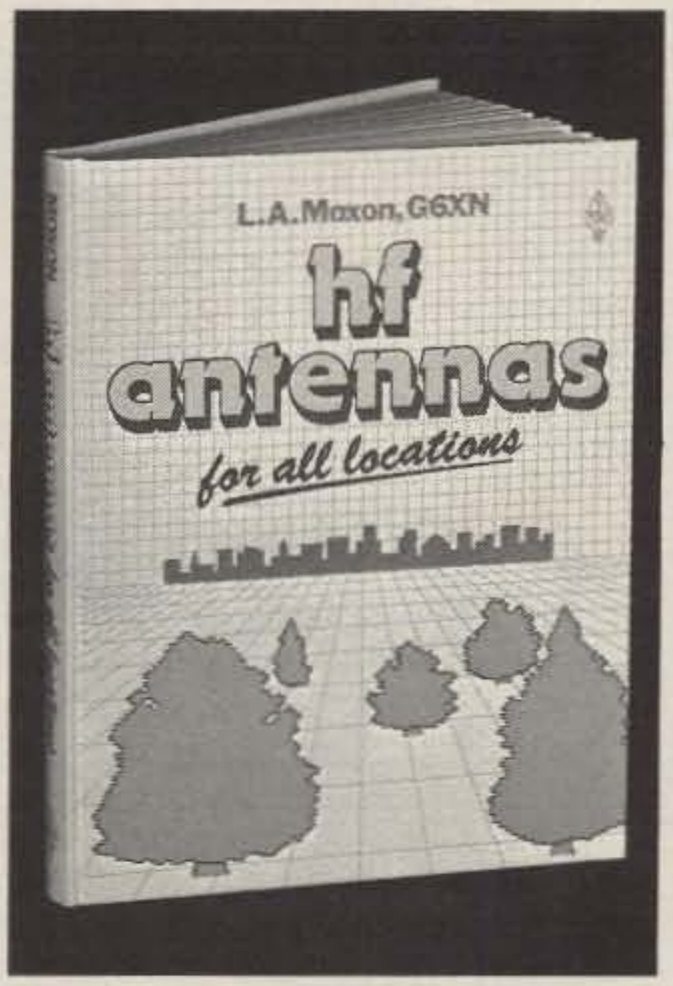

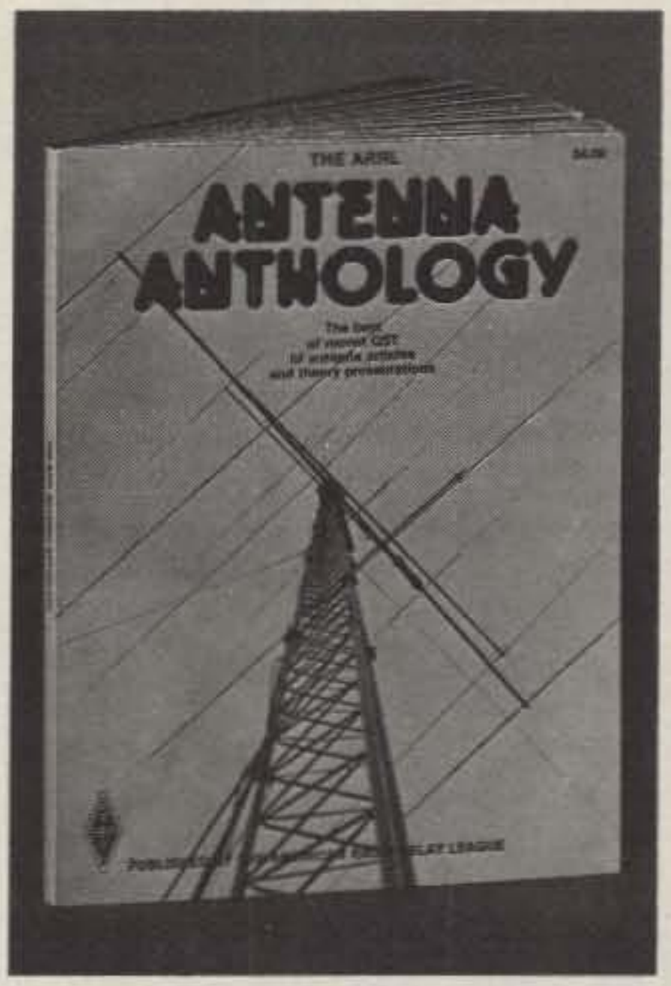

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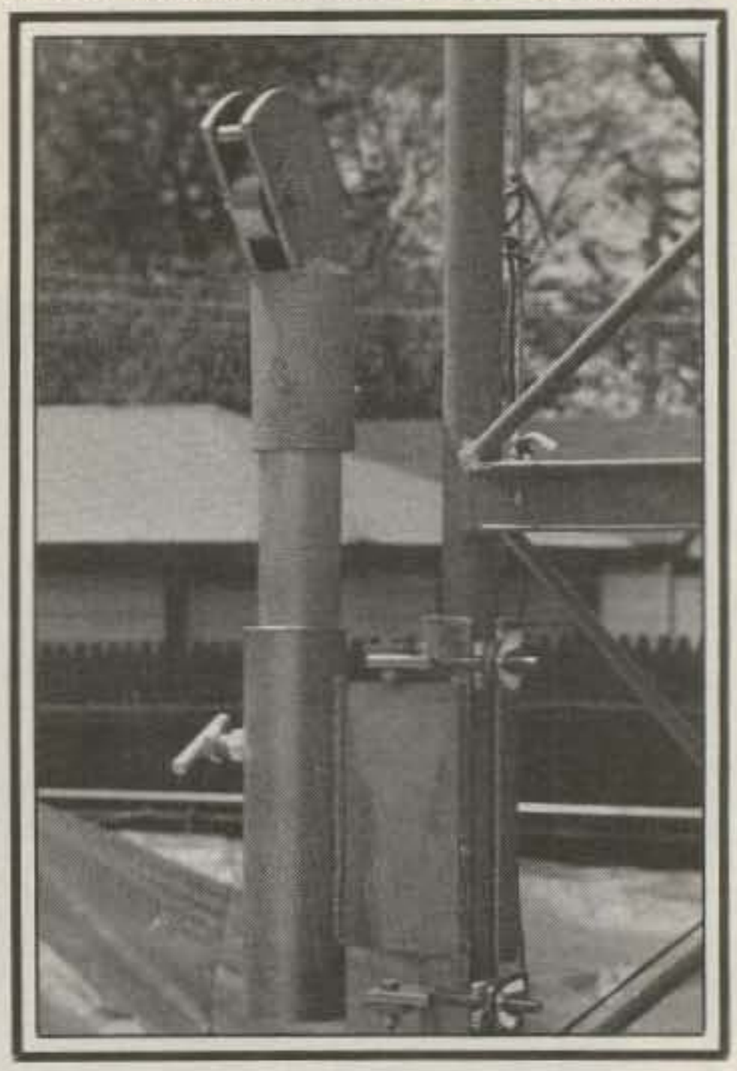

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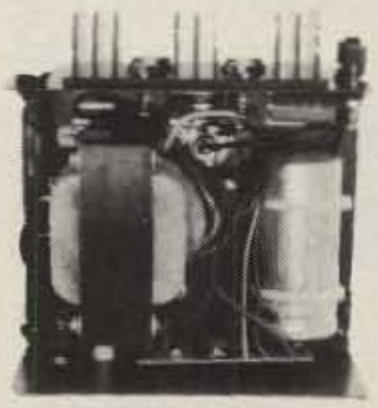

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(from page 4)

show) and reportedly took off for South America. He did congratulate me for finally getting out of the office and attending a show or two. Judging by his last editorial (July), I wonder if the $1,000-plus expenses covers one talk or two. Anyway, if it was $2,000-plus expenses (certainly no booth expense) or only $1,000, it's still a nice day's work. Yeah, maybe it is sour grapes after all.

Contest Dept. Heads Visit CQ

The day after AFCEA, *CQ*'s Contest Director, Frank Anzalone, W1WY, and WPX Contest Director, Bernie Welch, W8IMZ, came to the *CQ* offices for a visit and to discuss our Contests. Bernie drove in from Dayton, and at his suggestion we packed his car with WPX logs for the return trip. This will be Bernie's last year as WPX Contest Director. He will be turning over the reigns to Steve Bolia, N8BJQ, who has been his assistant for several years. Steve is responsible for automating the scoring of the Contest, which has grown tremendously in recent times to the point where automating it was the only way to handle the volume. Bernie will continue on in an advisory capacity for two to three years, so there will be a smooth transition and continued growth.

Silent Keys

In recent months, amateur radio has lost three stalwart supporters. Jim Lawson, W2PV, an avid Contester and prolific technical writer, passed away on May 25th. On May 23rd, just two days before, and through superhuman effort and cooperation, Jim was presented with two trophies for the 1981 CQ WW DX Contest. Knowing that Jim's condition was deteriorating, the Contest Committe, Frank Anzalone, W1WY, and Bernie Laight (our DX Contest trophy supplier) worked to quickly finalize Jim's score and engrave the trophies for presentation. W2PV was presented with the Dale Hoppe, K6UA, Trophy for High U.S.A. in the Phone portion, and the Hazard Reeves, K2GL, Trophy for World High C.W., both Multi-Operator, Multi-Transmitter.

Jesse Bieberman, W3KT, also recently passed away. He was world renowned for his W3KT QSL Service, which aided thousands upon thousands of amateurs. Most recently, we learned of the death of Kamchai "Kam" Chotikul, HS1WR, after a lengthy illness. "Kam" was founder and President of the Radio Amateur Society of Thailand and had just been promoted to Brigadier General in the Royal Thai Army.

73, Alan, K2EEK

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The FT-102's double conversion receiver features Yaesu's time-proven Variable Bandwidth System, which utilizes the cascaded IF filters to provide intermediate bandwidths such as 2.1 kHz, 1.5 kHz, or 800 Hz simply by twisting a dial. The Variable Bandwidth System is used in conjunction with the IF Shift control, which allows the operator to center the IF passband frequency response without varying the incoming signal pitch.

Wide/Narrow Filter Selection
Depending on the exact combination of optional filters you choose, a variety of wide/narrow operating modes may be selected. For example, you may set up 2.9 kHz in SSB/WIDE, 1.8 kHz in SSB/NARROW, then select 1.8 kHz for CW/WIDE, and 600 Hz or 300 Hz for CW/NARROW. Or use the Variable Bandwidth to set your SSB bandwidth, and use 600 Hz for CW/WIDE and 300 Hz for CW/NARROW! No other manufacturer gives you so much flexibility in selecting filter responses!

Variable Pulse Width Noise Blanker
Ignition noise, the "Woodpecker," and power line noise are modern-day enemies of effective Amateur operation. The FT-102 Noise Blanker offers improved blanking action on today's man-made noise sources (though no blanker can eliminate all forms of band noise) for more solid copy under adverse conditions.

Low Distortion Audio/IF Stage Design
Now that dynamic range, stability, and AGC problems have been largely eliminated thanks to improved technology, Yaesu's engineers have put particular attention on maximizing intelligence recovery in the receiver. While elementary filter cascading schemes often degrade performance, the FT-102's unique blend of crystal and ceramic IF filters plus audio tone control provides very low phase delay, reduced passband ripple, and hence increased recovery of information.

Heavy Duty Three-Tube Final Amplifier
The FT-102 final amplifier uses three 6146B tubes for more consistent power output and improved reliability. Using up to 10 dB of RF negative feedback, the FT-102 transmitter third-order distortion products are typically 40 dB down, giving you a studio quality output signal.

Dual Metering System
Adopted from the new FT-ONE transceiver, the Dual Metering System provides simultaneous display of ALC voltage on one meter along with metering of plate voltage, cathode current, relative power output, or clipping level on the other. This system greatly simplifies proper adjustment of the transmitter.

Microphone Amplifier Tone Control
Recognizing the differences in voice characteristics of Amateur operators, Yaesu's engineers have incorporated an ingenious microphone amplifier tone control circuit, which allows you to tailor the treble and bass response of the FT-102 transmitter for best fidelity on *your* speech pattern.

RF Speech Processor
The built-in RF Speech Processor uses true RF clipping, for improved talk power under difficult conditions. The clipping type speech processor provides cleaner, more effective "punch" for your signal than simpler circuits used in other transmitters.

VOX with Front Panel Controls
The FT-102 standard package includes VOX for hands-free operation. Both the VOX Gain and VOX Delay controls are located on the front panel, for maximum operator convenience.

IF Monitor Circuit
For easy adjustment of the RF Speech Processor or for recording both sides of a conversation, an IF monitor circuit is provided in the transmiter section. When the optional AM/FM unit is installed, the IF monitor may be used for proper setting of the FM deviation and AM mic gain.

WARC Bands Factory Installed
The FT-102 is factory equipped for operation on all present and proposed Amateur bands, so you won't have to worry about retrofitting capability on your transceiver. An extra AUX band position is available on the bandswitch for special applications.

Full Line Of Accessories
For maximum operating flexibility, see your Authorized Dealer for details of the complete line of FT-102 accessories. Coming soon are the FV-102DM Synthesized VFO, SP-102 Speaker/Audio Filter, a full line of optional filters and microphones, and the AM/FM Unit.

CIRCLE 48 ON READER SERVICE CARD

Price And Specifications Subject To Change Without Notice Or Obligation

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The radio.

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IC-720A

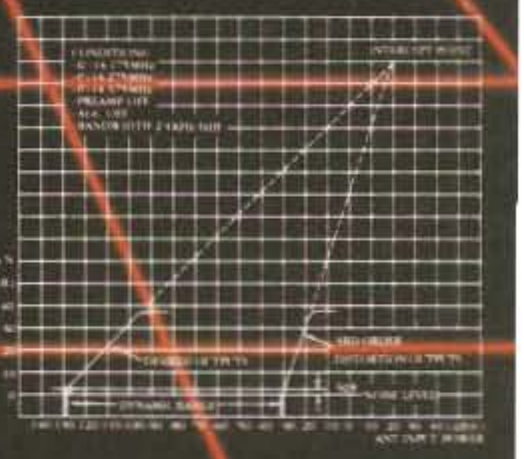
Listen to signals from around the world with a 100 KHz — 30 MHz receiver. Talk with a 160 — 10 meter transceiver — ready to go WARC 79 bands, dual VFO's — split operation. ICOM's DFM (Direct Feed Mixer), passband tuning, speech compressor, 100 watts, SSB, CW, AM, RTTY (FSK), computer compatible tuning, 12 volt operation, all features standard except CW & AM narrow filters. *ICOM system** accessories are available for a complete station.

IC-740

Versatility plus! ICOM's newest addition to HF offers features most asked for by ham operators. 160 — 10 meters, variable noise blanker and AGC with off position, IF shift and passband tuning, automatic SSB mode selection, notch filter, switchable CW filter, 8 memories, SWR meter, XIT, speech compressor, 100 watts and 12 volt operation. Options are FM, automatic keyer, internal AC power supply and 5 IF filters. *ICOM system** compatible.

IC-730

Go portable/mobile with ICOM's small HF. *ICOM system** compatible. 100dB dynamic range, +19.5dBm intercept point receiver utilizing ICOM's DFM, SSB, CW, AM, dual VFO's — split operation, one memory per band, CW/SSB filter options, 100 watts, 12 volt operation.



***ICOM system.** *The same accessories work with all three HF transceivers — IC-2KL autobandswitching broadbanded linear amplifier, AT-500 or AT-100 autobandswitching, autotuning antenna tuners, IC-PS15 power supply, BC-10A memory backup, IC-SP3 external speaker, IC-HP1 headphones, IC-AH1 autobandswitching mobile antenna, IC-MB5 mobile mount and IC-SM5 desk microphone (condenser type).*

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The World System

CIRCLE 135 ON READER SERVICE CARD

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All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions.