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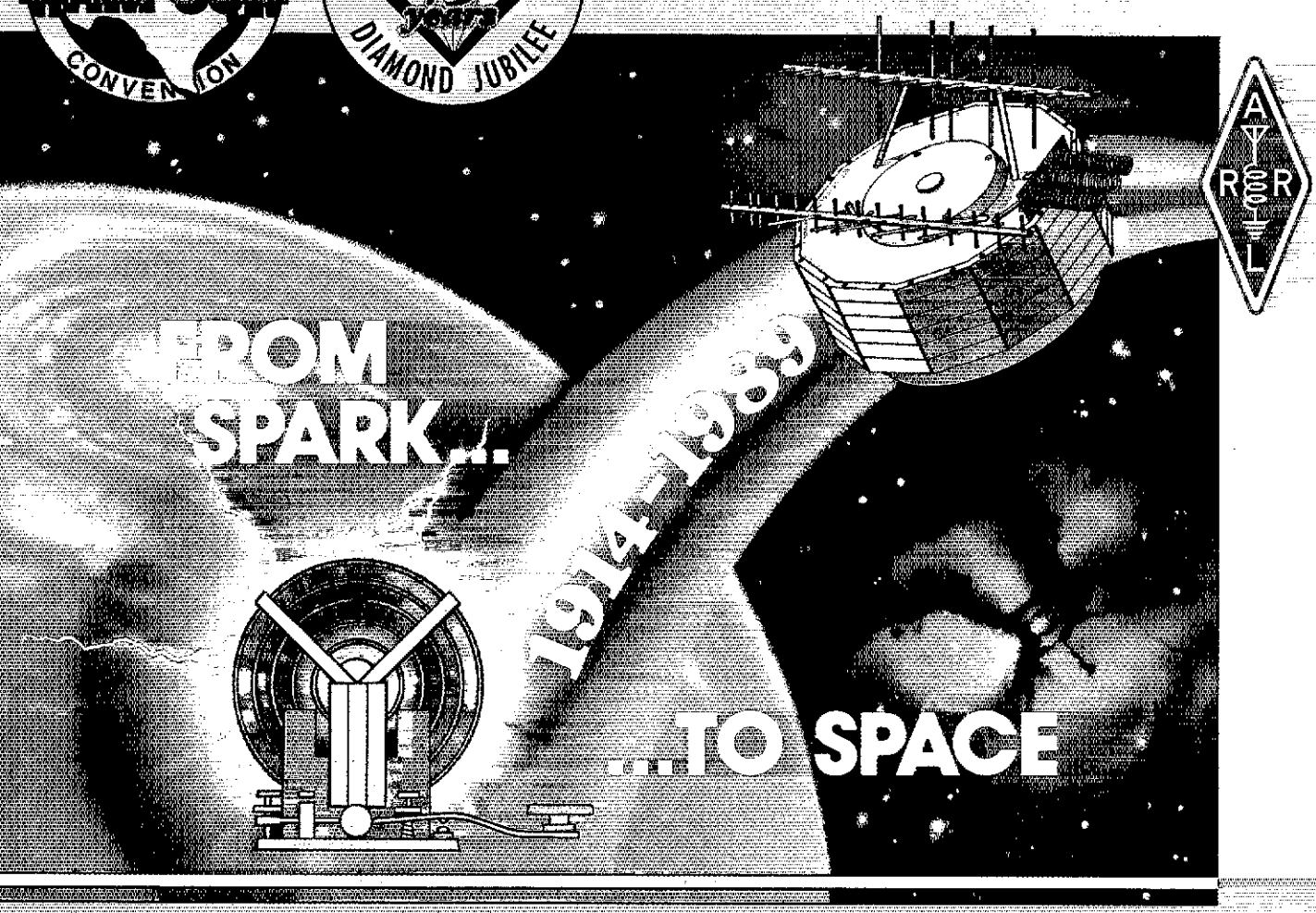

TEXAS HOSTS THE NATIONAL

—PAGE 52—

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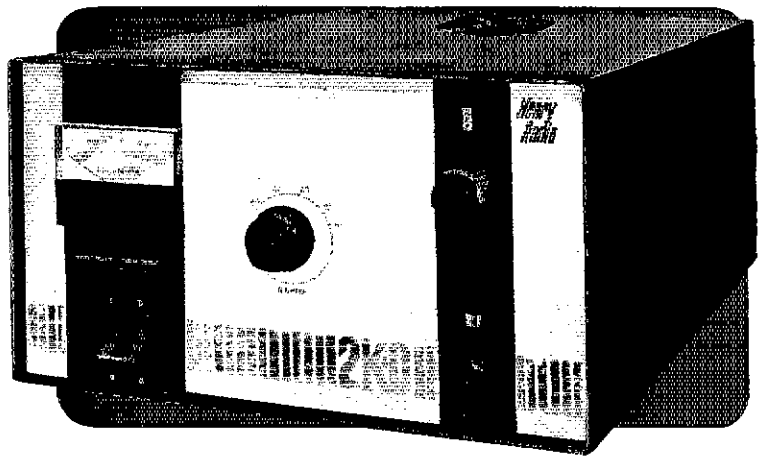
Introducing...two fine new desk model amplifiers

the 3KD Classic

the 2KD Standard



Now you have a choice of four high quality HF desk models providing the performance and reliability you have come to expect from a Henry Amplifier

2KD STANDARD. . .new to the Henry line

Smaller than the 2KD Classic and with a slightly lower power output, but still the same rugged construction, the same superior components, the same dependability. The 2KD Standard is a 1200 W PEP nominal output SSB, CW, 750 W RTTY, pulse RF linear covering the 3.5 to 30.0 MHz frequency range. It uses a Pi-L plate circuit with a rotary silver plated tank coil for maximum efficiency and attenuation of unwanted harmonics. Its tube complement consists of one Eimac 3-500Z glass envelope triode in a grounded grid circuit.

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1500 W PEP nominal output, SSB, CW, 1000 Watts ICAS, RTTY, FM, pulse. Gain: 15 times input, 20 times on some frequencies. Tube complement: one remarkable new Eimac 3CX-1200D7 ceramic triode. Operates on most frequencies between 3.5 and 30 MHz. (10 meters available on export models. Pi-L plate circuit with silver plated tank coil.)

3KD PREMIER

The same superb specs as the Classic, BUT with the addition of 160 meter operation and QSK break in keying. Both the Premier and the Classic desk models are no nonsense. . .no compromise amplifiers that will please the most discerning amateur for many years to come.

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A proven desk top workhorse providing full legal power in all inputs. Uses two Eimac 3-500Z glass envelope triodes plus a full complement of top quality components. And, as will all Henry amplifiers is backed by a 25 year history of the most reliable equipment available for the amateur market.

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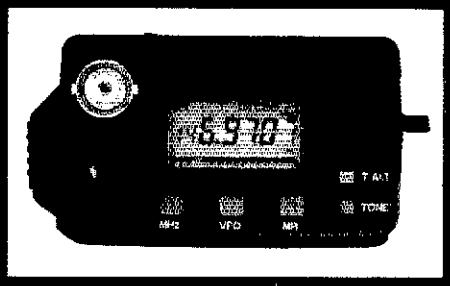
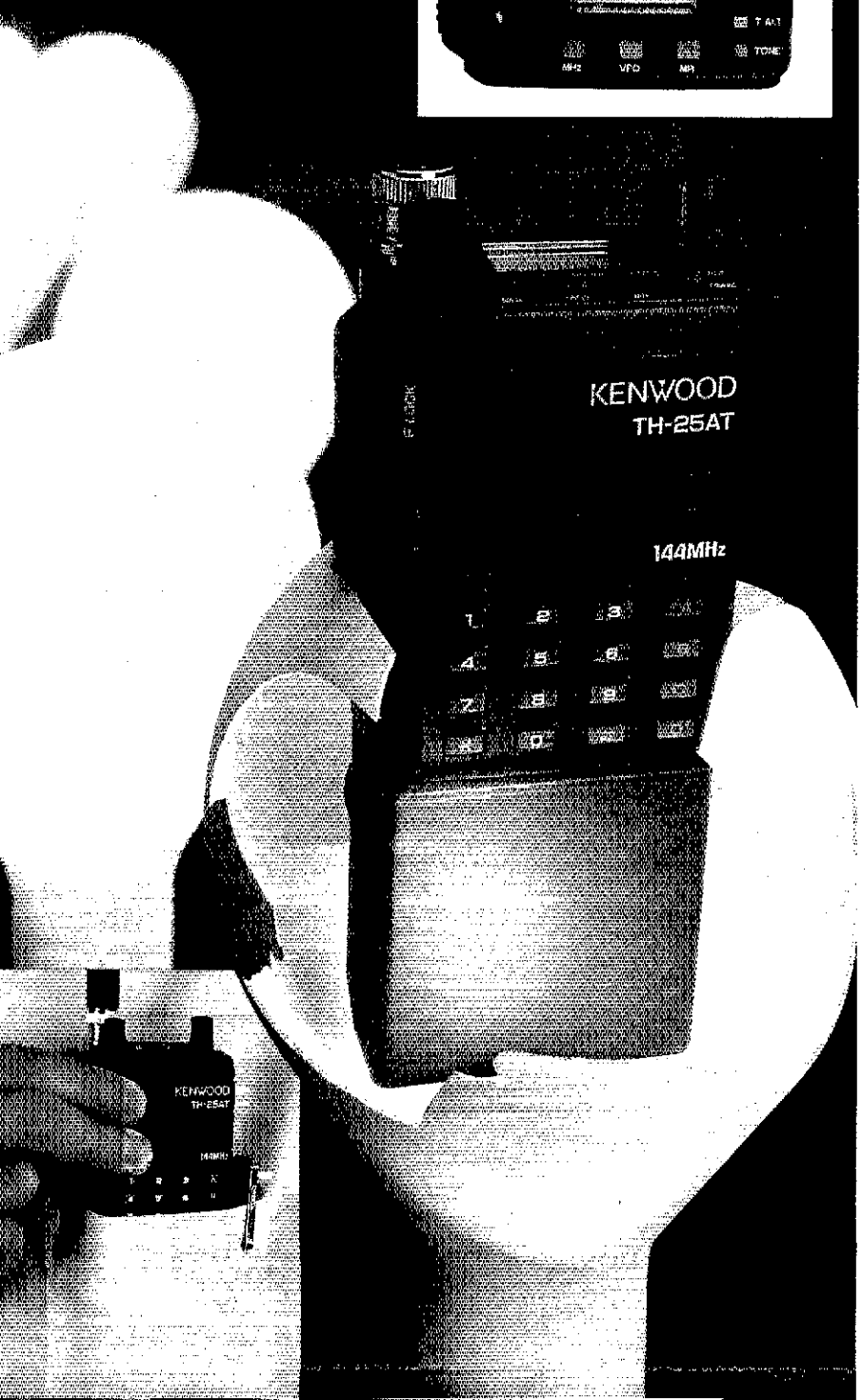


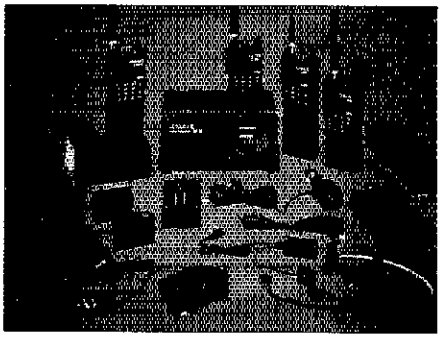


TH-25AT/45AT

New Pocket Portable Transceivers

The all-new TH-25 Series of pocket transceivers is here! Wide-band frequency coverage, LCD display, 5 watt option, plus...

- Frequency coverage: **TH-25AT:** 141-163 MHz (Rx); 144-148 MHz (Tx). (Modifiable for MARS/CAP. Permits required.)
  TH-45AT: 438-450 MHz.
- Automatic Power Control (APC) circuit for reliable RF output and final protection.
- 14 memories; two for **any** "odd split" (5 kHz steps).
- Automatic offset selection (TH-25AT).
- 5 Watts from 12 VDC or PB-8 battery pack.
- Large multi-function LCD display.
- Rotary dial selects memory, frequency, CTCSS and scan direction.
- T-ALERT for quiet monitoring. Tone Alert beeps when squelch is opened.
- Band scan and memory scan.
- Automatic "power off" circuit.
- Water resistant.
- CTCSS encoder /decoder optional (TSU-6).
- **Supplied accessories:** StubbyDuk, PB-6 battery pack for 2.5 watts output, wall charger, belt hook, wrist strap, water resistant dust caps.



Optional accessories:

• **PB-5** 7.2 V, 200 mAh NiCd pack for 2.5 W output • **PB-6** 7.2 V, 600 mAh NiCd pack • **PB-7** 7.2 V, 1100 mAh NiCd pack • **PB-8** 12 V, 600 mAh NiCd for 5 W output • **PB-9** 7.2 V, 600 mAh NiCd with built-in charger • **BC-10** Compact charger • **BC-11** Rapid charger • **BT-6** AAA battery case • **DC-1/PG-2V** DC adapter • **HMC-2** Headset with VOX and PTT • **SC-14, 15, 16** Soft cases • **SMC-30/31** Speaker mics • **TSU-6** CTCSS decode unit • **WR-1** Water resistant bag

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100 percent duty cycle rated for cool operation and superb long term performance on all modes!

FULLY AUTOMATIC ANTENNA TUNER
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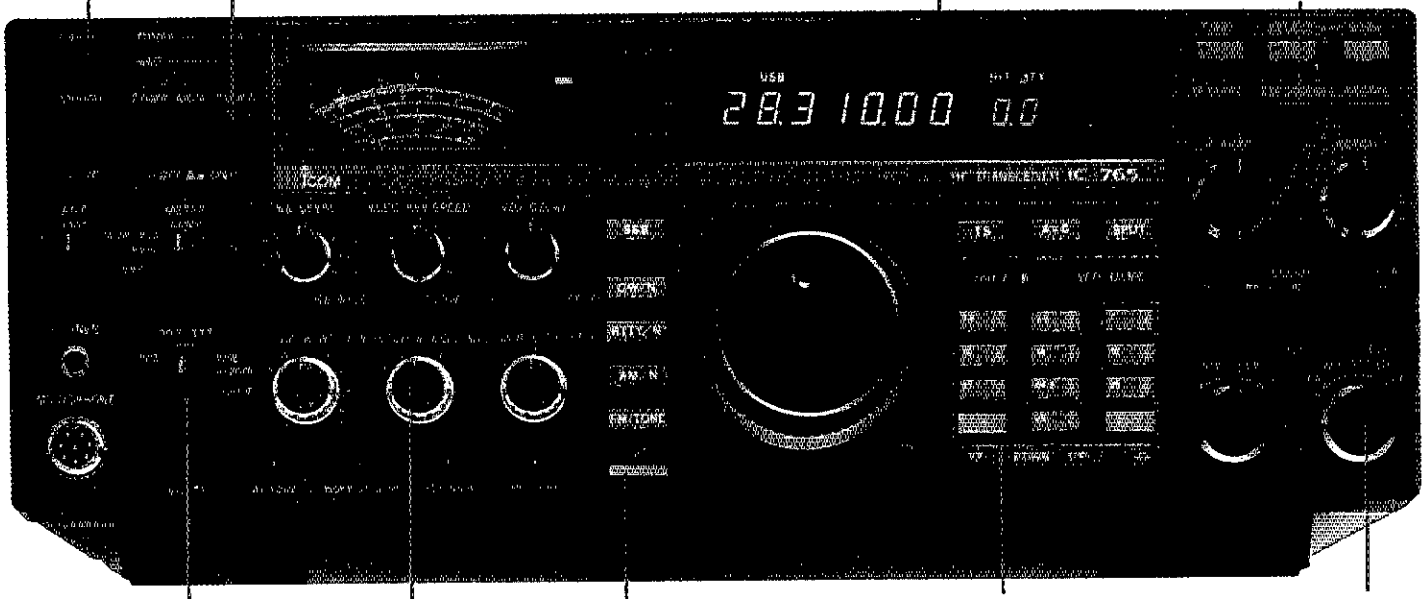
10Hz READOUT
Perfect on-the-dot frequency selection for nets, DX skeds and data communication modes. Large, easy-to-read display.

NARROW 500Hz CW FILTERS INCLUDED
ICOM's FL-32A and FL-52A deliver razor sharp selectivity. A serious DX'ers delight! 250Hz FL-53A and FL-101 optional.



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Three step attenuator cuts multi-station overloads. RF preamp pulls weak signals right out of the mud!

CW PITCH CONTROL
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DIRECT DIGITAL SYNTHESIZER
Assures ultra-fast PLL switching and lock-in for excellent PACKET, AMTOR and CW QSK operations.

BAND STACKING REGISTERS
Each band's VFO's retain their last selected frequency, mode and filter choice. Produces the equivalent of 20 VFO's; two per band. Great for multiband DX'ing!

99 FULLY TUNABLE MEMORIES
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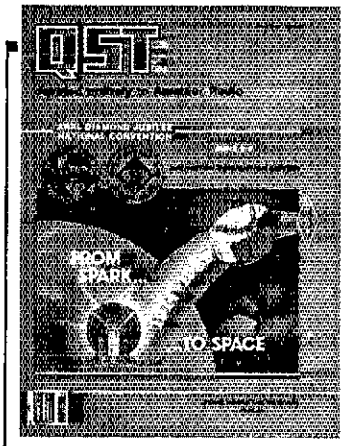


OUR COVER

The Dallas/Fort Worth ARRL Diamond Jubilee Convention has a program as big as the state of Texas! The details are on page 52.

CONTENTS

May 1989
Volume LXXIII Number 5

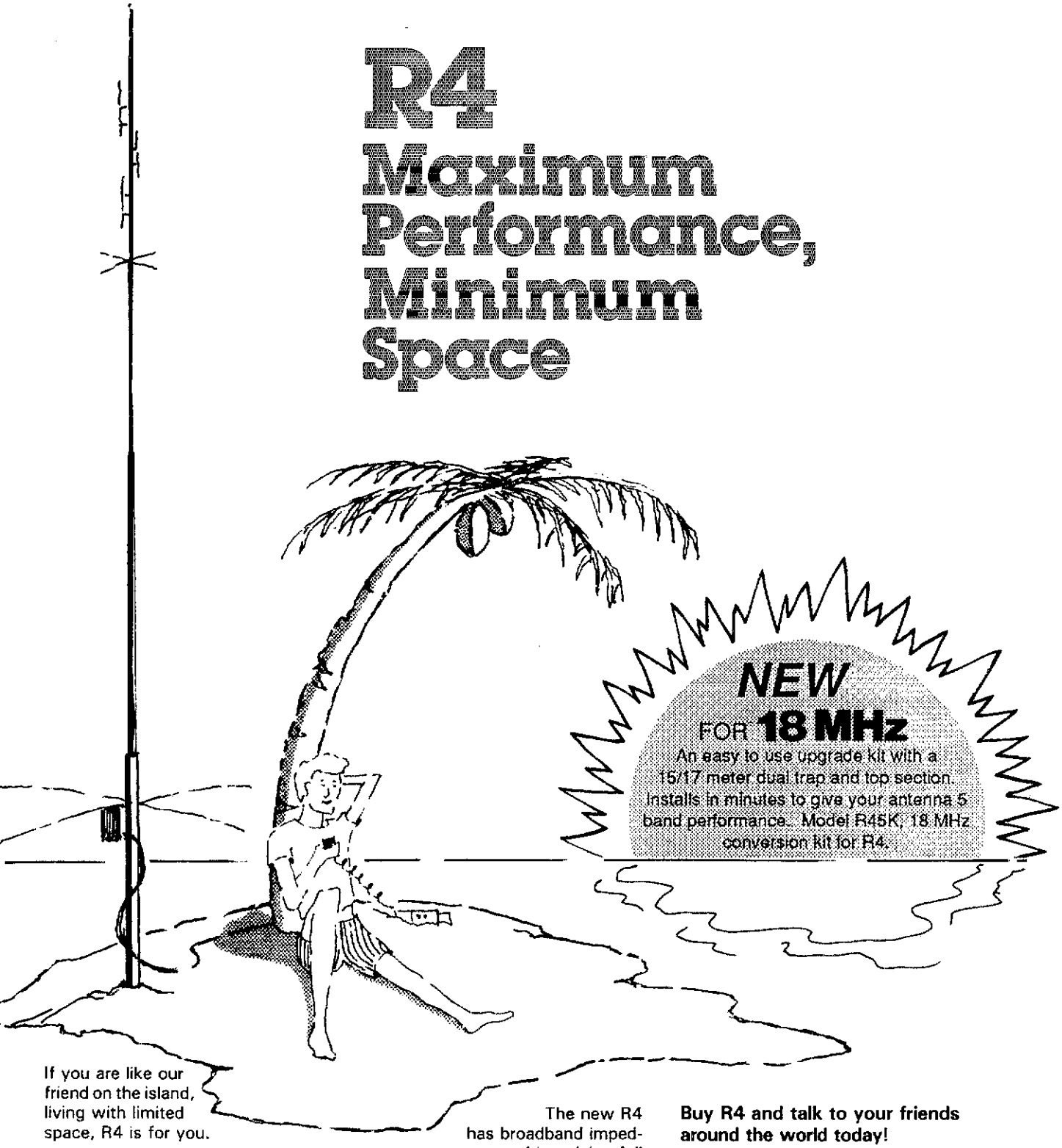
TECHNICAL

NEWS AND FEATURES

OPERATING

DEPARTMENTS

R4
Maximum Performance, Minimum Space



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An easy to use upgrade kit with a 15/17 meter dual trap and top section. Installs in minutes to give your antenna 5 band performance. Model R45K, 18 MHz conversion kit for R4.

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With R4 you get quick assembly, easy installation and top gun performance. Whatever your space, large or small, R4 will make ham radio more fun.

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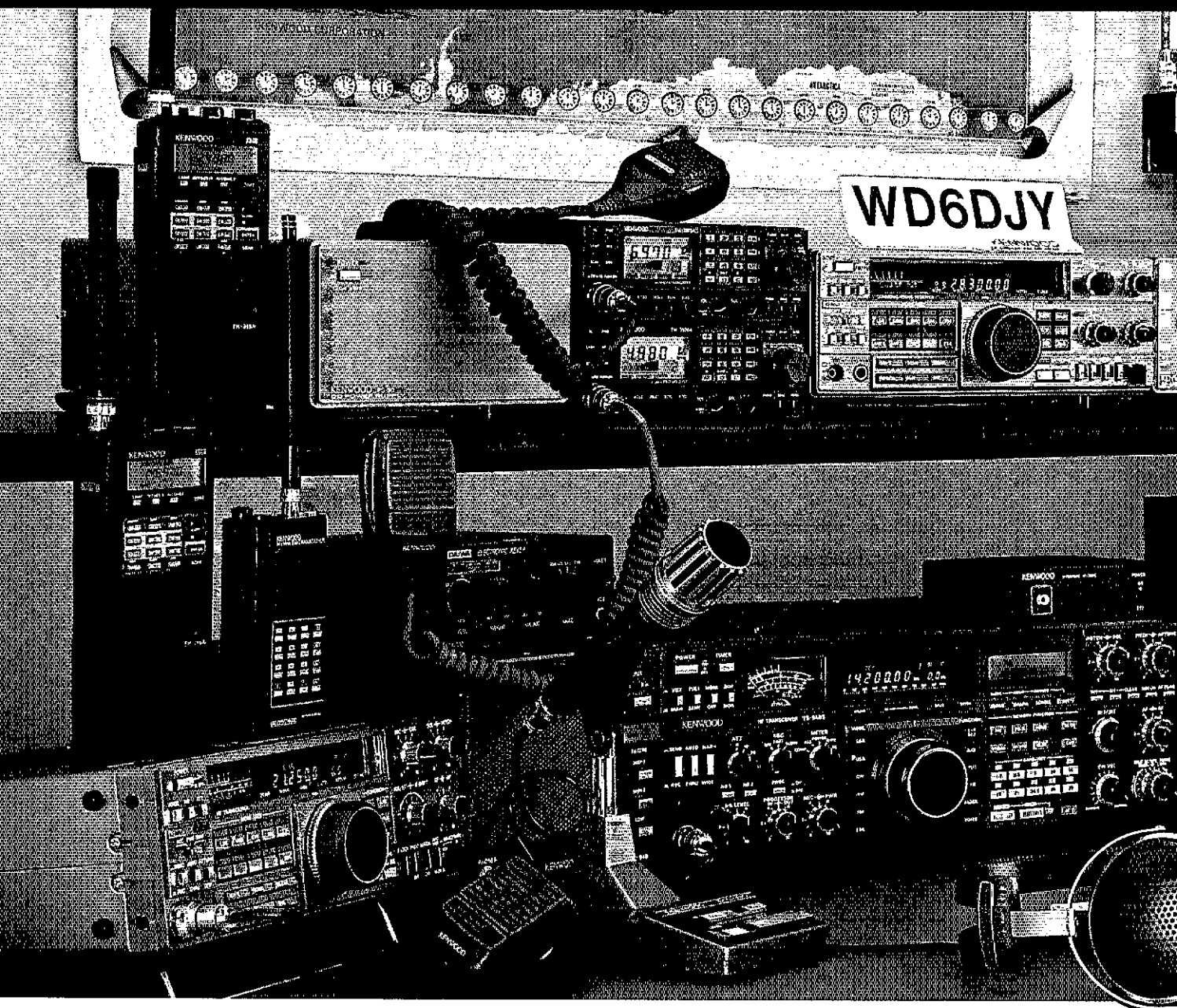

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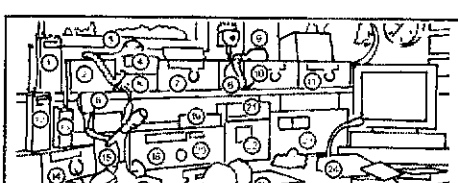

1) **TH-315A:** 220 MHz Hand-held Transceiver; 2) **PS-50:** DC Power Supply; (3) **MC-43S:** UP/DWN Microphone, included with (4) **TM-2530A:** Deluxe 25W,2m FM Transceiver; (5) **TM-3531A:** Deluxe 25W,220 MHz Transceiver (also comes with MC-43S mic.); (6) **MC-48B:** 16-key DTMF Microphone; (7) **R-5000:** High Performance Receiver; (8) **SP-430:** Matching External Speaker for TS-430S/TS-440S; (9) **MC-48B;** (10) **TS-711A:** 2m,25W,All Mode Base Transceiver; (11) **TS-811A:** 70cm,25W,All Mode Base Transceiver; (12) **TH-215A:** 2m, Full-featured HT; (13) **TH-21BT:** Pocket-sized, 2m FM Transceiver. (14) **TS-440S:** HF Transceiver (with AT-440 installed); (15) **SP-940:** Matching External Speaker for TS-940S; (16) **MC-48B;** (17) **MC-60A:** Base Station Microphone with UP/DWN controls; (18) **TS-940S:** Competition Class HF Transceiver with General Coverage Receiver (AT-940 installed); (19) **IF-232C:** Computer Interface Level Translator; (20) **IF-10B:** Computer Interface Module (installed inside TS-940S); (21) **SW-2000:** SWR/Power Meter; (22) **SM-220:** Station Monitor with pan display option BS-8 installed; (23) **TL-922A:** HF Linear Amplifier; (24) **MC-85:** Multi-function Desk Microphone with Graphic Equalization and three outputs. (25) **HS-5:** Deluxe Headphones.

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation

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Orange — Joe H. Brown, W6UBQ, 5444 La Sierra, Riverside, CA 92505 (714-687-8394)
San Diego — Arthur R. Smith, W6INI, 4515 Melisa Way, San Diego, CA 92117 (619-273-1120)
Santa Barbara — Thomas I. Geiger, W2KVA, 428 E Grant St, Santa Maria, CA 93454 (805-866-1359)

West Gulf Division
North Texas — W. W. "Dan" Dansby, W5URI, 5805 Walla Ave, Fort Worth 76133
Oklahoma — Joseph Lynch, N6CL, PO Box 73, Oklahoma City 73101 (405-528-6625)
South Texas — Arthur R. Ross, W5KR, 132 Sally La, Brownsville 78521 (512-831-4458)
West Texas — Amelia "Milly" Wise, W5OVH, 8516 Mt Scott, El Paso 79904 (915-751-4160)

"It Seems to Us . . ."

Spectrum Management, or Abdication?

The Federal Communications Commission has managed to find a way of denying radio amateurs the use of their allocated spectrum, without having to go to the trouble of withdrawing the allocation.

It's easy. Simply take a band already allocated to hams, either on an exclusive basis or shared with other services that are coexisting happily. Then, permit and even encourage the manufacture of nonlicensed consumer electronics devices that use the band. After all, hams don't have enough trouble with inadequately protected stereos and VCRs; why not suggest that manufacturers sell consumers wireless stereo speakers and wireless VCRs operating on *the very same frequencies* being used by their ham neighbors? That should keep those factories in the Far East humming, while creating some juicy neighborhood fracases to enrich the American lifestyle.

If you're the FCC, you would want a defense against accusations you weren't playing fair. So, you'd have the manufacturers print some technobabble in mouse-size type on the consumer device which means, but doesn't actually say, that if the thing doesn't work because there's a ham next door, that's just too bad and the consumer should have known better than to buy it in the first place. But you wouldn't want those poor manufacturers to have to actually *explain* this to their customers before they make a sale; that would distort the Marketplace Forces in whose honor golden calves have been erected all over town. An informed marketplace? That's wimpy textbook stuff. Offer the consumer instant gratification; that's what he wants.

And the real beauty of it is, if anyone tries to drag the FCC into explaining to a specific consumer that a specific ham isn't doing anything wrong just because his new gadget jumps off the table every so often, and that said consumer ought to take said gadget and force-feed it to its purveyor, you can point to your shriveled budget and plead poverty. "We wish we could help, but we just don't have the resources. Yeah, ain't it awful." And if in a few years Congress finally gets around to telling the FCC to clean up the mess it's made, well, you'll be long gone; that task will fall to the poor suckers who have made the FCC and public service their career, and not just a line on their resumes.

An exaggeration? We wish it were. While we're not suggesting they thought of it quite this way, it is *exactly* what results from a March 30 FCC action. Among other things, the new Part 15 rules adopted that day create a number of new bands for consumer devices that intentionally radiate signals, including the bands 902-928 MHz, 2,400-2,450 MHz, 5,725-5,875 MHz, and 24.0-24.25 GHz. Check your Part 97, and you'll find that these are all ham bands—*including a segment at 24 GHz where the only authorized radiocommunication service is Amateur.* But you'd never know this from reading the glowing FCC news release describing the as-yet-unreleased First Report and Order in General Docket 87-389; it doesn't even mention the affected bands! Instead, it talks about "major benefits to the manufacturers of Part 15 devices" (there were probably celebrations all over Tokyo, Seoul, and Taipei) and how the Commission's decision "should also serve the public by enabling new technologies and new equipment categories that satisfy consumer demands to be introduced *without the need for Commission rulemaking.*" (We've added the emphasis to show who *really* benefits from the new rules; once again, the regulators don't want to regulate.)

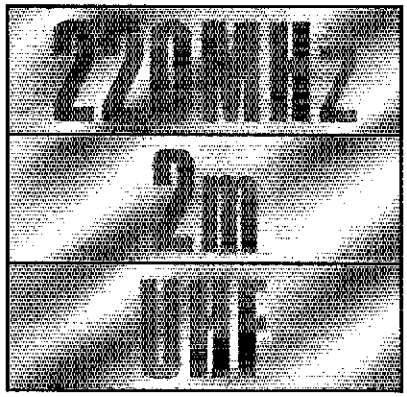
What *really* frosts us is that, in coming up with its fallacious calculation last August that the 220-222 MHz represented "less than two percent" of the available amateur allocations, the FCC counted 902-928 MHz as a big part of the other 98 percent! On that basis, we ought to be thirteen times as upset by this latest FCC miscue as we were by the reallocation decision.

The bands in question are what are known as "ISM" bands. ISM stands for "industrial, scientific, and medical" applications. In addition to radiocommunication, RF energy has a variety of such applications (microwave ovens, for example); by international agreement, some bands have been identified for this use where radiocommunications services have to tolerate the resulting interference. But the international Radio Regulations also say, "Administrations shall take all practicable and necessary steps to ensure that radiation from equipment used for industrial, scientific, and medical applications is minimal. . .". For hams, there's a fundamental difference between sharing a band with ISM and sharing it with intentionally radiating consumer devices. Your neighbor is never going to know if you're transmitting on the same frequency as his microwave oven, and the few minutes a day he might use it isn't going to seriously affect, for example, your use of future amateur satellites operating in the 2400-MHz band. But what's he going to think of your coming over the wireless stereo speaker or wireless VCR he's just spent good money for?

The League isn't taking this lying down. The ink was barely dry on the FCC news release when the Executive Committee met April 1 and voted to petition for reconsideration, and to seek whatever injunctive relief is necessary to protect amateur interests. Last year, we filed extensive technical documentation in support of our view that consumer devices cannot responsibly be permitted to operate in amateur bands; if the Commission took any notice of this work, it is not evident from the news release nor from the comments made by Commission staff at the March 30 press conference.

If there is a bright side to this, it is that we've been looking for additional evidence to take to Congress to show that the FCC decision-making process is out of control. We've just been handed a perfect example.—*David Sumner, K1ZZ*

Yaesu's mini HTs. The smallest, smartest, toughest radios. Anywhere.



Whether you're a Novice or Extra class operator, you're sure to appreciate the high power, durability and size of Yaesu's FT-23R Series mini-HTs.

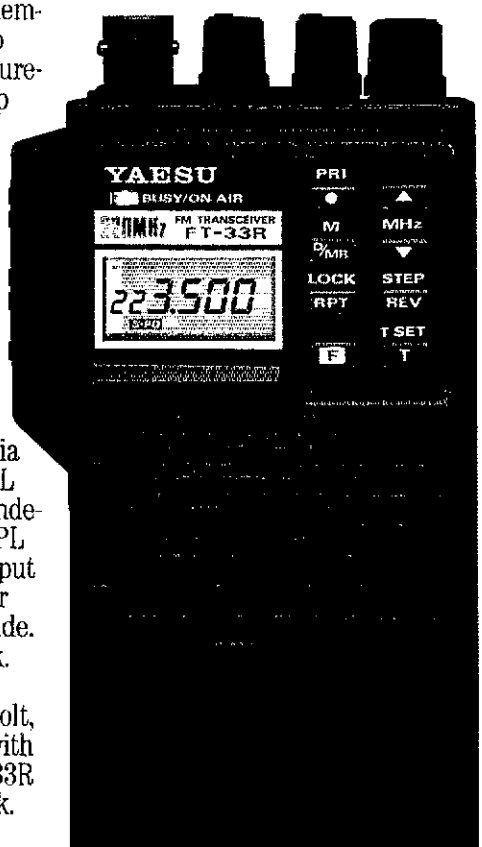
To begin with, you'll find a model that's right on your wavelength. The 2-meter FT-23R. The 220-MHz FT-33R. Or the 440-MHz FT-73R.

Whichever you choose, you benefit from incredibly small packaging. (Take a look at the actual size photo.) Aluminum-alloy cases that prove themselves reliable in a one-meter drop test onto solid concrete. And moisture-resistant seals that really help keep the rain out.

But perhaps best of all, each radio blends sophisticated, microprocessor-controlled performance with surprisingly simple operation. In fact, it takes only minutes to master all these features:

Ten memories that store frequency, offset and PL tone. Memory scan at 2 frequencies per second. Tx offset storage. Priority channel scan. Channel selection via tuning knob or up/down buttons. PL tone board (optional). PL display. Independent PL memory per channel. PL encode and decode. LCD power output and "S"-meter display. Battery-saver circuit. Push-button squelch override. Eight-key control pad. Keypad lock. High/low power switch.

The FT-23R comes with a 7.2-volt, 2.5-watt battery pack. The FT-73R with a 7.2-volt, 2-watt pack. And the FT-33R with a powerful 12-volt, 5-watt pack.



You can choose the miniature 7.2-volt, 2-watt pack shown in the photo below. And all battery packs are interchangeable, too.

And consider these options: Dry cell battery case for 6 AAA-size cells. Dry cell battery case for 6 AA-size cells. DC car adapter/charger. Programmable CTCSS (PL tone) encoder/decoder. DTMF keypad encoder. Mobile hanger bracket. External speaker/microphone. And more.

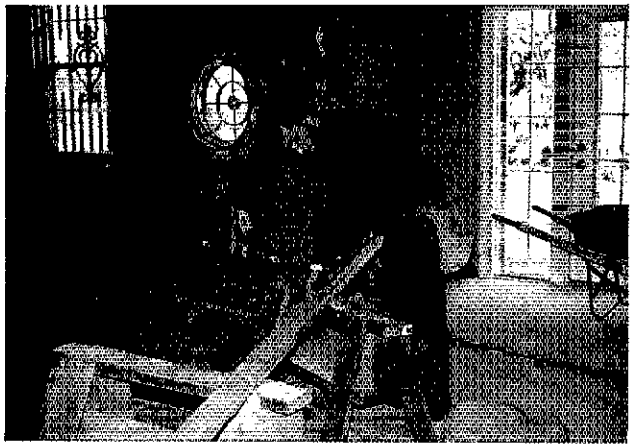
Check out the FT-23R Series at your Yaesu dealer today. Because although we can tell you about their incredible performance, toughness and small size, seeing is really believing.

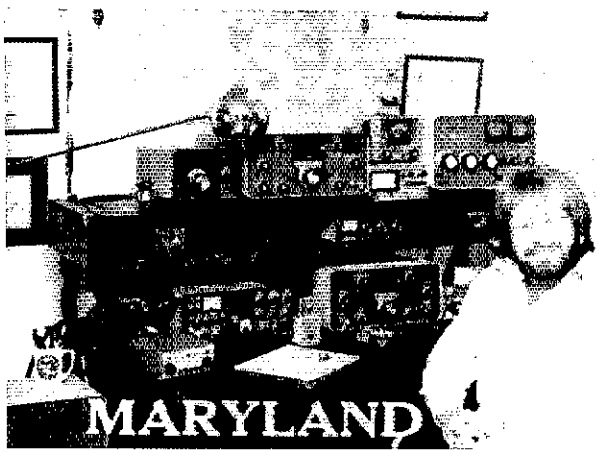
YAESU

Yaesu USA, 17210 Edwards Road, Cerritos, CA 90701. (213) 404-2700. Repair Service: (213) 404-4884. Parts: (213) 404-4847.

UP FRONT in QST

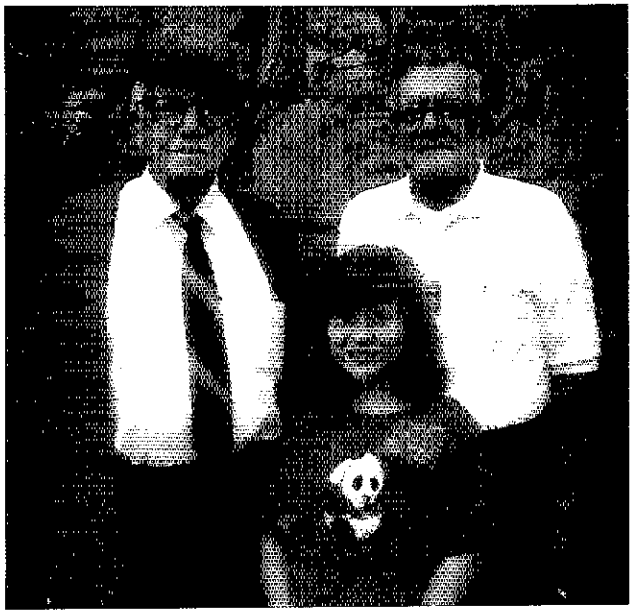
Renovation update: Work continues to progress rapidly on the W1AW building. (upper left) Part of the foundation was excavated to make way for a cooling duct for the transmitters. (left) An M & L Construction worker saws a board to frame up a new operating position. (above) Chief Operator Chuck Bender, W1WPR, keeps bulletins and code practice going from inside the temporary operating trailer. *(photos AA2Z and KC1MP)*





High honors: Steven Affens, K3SA, of Olney, Maryland, has been judged 1988 Cameraman of the Year for the fourth consecutive year by the White House News Photographers Association. Steve received two first-place and two second-place awards, as well as four honorable mentions, in individual categories. *(photo courtesy Patricia Affens)*

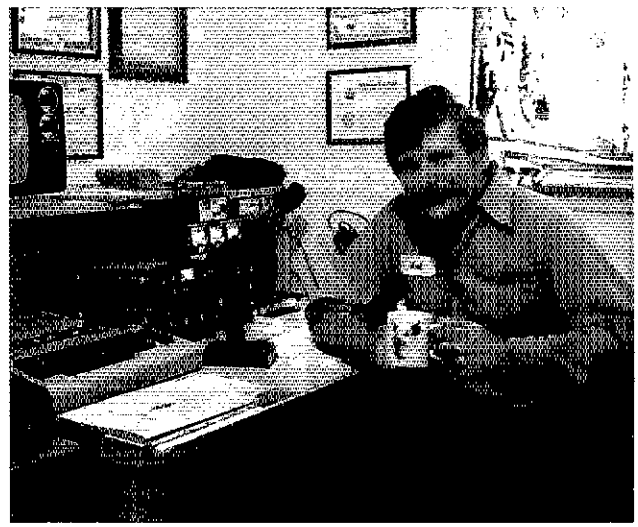
Three-Quarter Century Wireless: Ernest W. McNeil, W5MI, of Baton Rouge, Louisiana, recently received a QCWA 75 Years of Licensing award from QCWA Chapter 109 President E. B. "El" Charleton, W5MD. Ernest, or Mac as he is fondly known, was born in New Orleans in 1895 and first operated there with a spark transmitter in 1912. His first call, received in 1914, was 5AW. Ernest is still active at 94 and is a charter member of Baton Rouge QCWA Chapter 109. *(photo courtesy W5MD)*



Young Extra: The next time you hear a complaint about how hard it is to get an Extra Class license, consider the accomplishments of Sandra Saunders, N4QLZ, of Cleveland, Tennessee. She got her Novice license at age 7 and received her Extra Class last September, at the age of 10. Seen here with Sandra are Henry Johnson, KC4BZZ (l), of Dalton, Georgia, who received his Novice license in October 1987 at the age of 85, and ARRL Georgia SM Eddy Kosobucki, K4JNL, of Columbus, Georgia. *(photo courtesy K4JNL)*

A productive visit: James Grandinetti, KZ2P, of Lakewood, New Jersey, had a chance to operate several stations while on a visit to China. He is seen here with Yang Guang, operator at club station BY8AC; James also operated BY1PK and BY8AA. James not only enjoyed meeting with Chinese amateurs and operating there, he has also been named a Director of the Chengdu DX Club. *(photo courtesy KZ2P)*

Amateur Radio challenge: Norman Williams, WA5SVS, reports riders' progress in a qualifying trial of the Big Bend Chihuahuan Desert Challenge bicycle races held near Lajitas, Texas in February. The Big Bend ARC and the San Angelo ARC joined forces to provide communications in the rugged Big Bend area, helping to ensure the safety of 130 cross-country riders. In the background is the Mexican village of Nuevas Lajitas, which is just across the Rio Grande. *(photo KE5NO)*



Far-out QSO: Barton Rice, N4TGY, of North Wilkesboro, North Carolina, had a big thrill on March 8 when he worked U4MIR. Bart made the contact on 145.55-MHz FM simplex using a hand-held transceiver and a home-brew antenna. Contacting the Soviet space station is not the only feather in Bart's cap—he got his Novice license in April 1988 and his Extra Class last January. *(photo courtesy N4TGY)*

League Lines

The ARRL National Convention is June 2-4 in Dallas/Ft Worth, Texas! For further details, see page 52.
A reminder that the PRB-1 seminar entitled ***"Land Use Regulation of Federally Licensed Communications Facilities and the Doctrine of Federal Preemption"*** will be open to all ARRL National Convention attendees. For those wanting course materials, the cost is $50. The seminar will be run Saturday, June 3, from 8:30 AM-12:30 PM. The seminar is approved for Continuing Legal Education (CLE) credit for attorneys. For further details, see the League Lines column in March *QST*.

Open House: A reminder that the ***ARRL HQ building will be open Sunday, June 11,*** from 10 AM to 4 PM. There is also a local hamfest in Newington that same day. W1AW operation and access will be restricted due to construction.

It's May, and while most folks are enjoying the flowers and thinking about their summer vacations, hams are thinking about ***Field Day June 24-25!*** Complete Field Day rules appear in this issue on page 103. If you haven't done so already, send for your Field Day package containing publicity kit, dupe sheet, summary sheet and check list by sending a 9 × 12-inch SASE containing 4 units of first class postage or 4 IRCs to ARRL HQ, Special Requests, 225 Main St, Newington, CT 06111.

This year additional bonus points have been added for public relations. In addition to 100 points for media publicity, points have been added for operations in a public place and for conducting an information booth for the visiting public. See you on Field Day!

June is also the month for the ARRL ***June VHF QSO Party, June 10-11.*** Plaques will again be awarded to the top 10 single and multioperator stations and the top five QRP portable-single operator stations. For details, see page 104.

The 1989 **ARRL Net Directory** is hot off the presses! This Directory is not just a list of nets. It explains the National Traffic System, how to originate and receive messages, how to originate traffic via packet—in short, everything you ever wanted to know about traffic handling but were afraid to ask! Best of all, it's available for only $1 postpaid from HQ!

Another amateur in space! Tentative approval for the Space Shuttle Amateur Radio Experiment (SAREX) has been received from NASA. An Amateur Radio station is now scheduled to fly aboard the Space Shuttle in March, 1990. Astronaut Ron Parise, WA4SIR, will operate the station using voice, video and packet communications from the orbiting shuttle. The orbit of the shuttle will allow amateurs located between approximately 46 degrees North and 46 degrees South latitudes to communicate directly with the shuttle. Watch the pages of *QST* for further updates on SAREX.

Congratulations to ***Carole Perry, WB2MGP,*** on being invited by the ***NASA Education Department*** for a 3-day conference for educators. The conference includes seminars with astronauts and NASA officials and will culminate with the launch of the Space Shuttle *Atlantis* on April 28. The purpose of the mission is to launch the *Magellan* spacecraft which will map the planet Venus. Carole feels she was invited because of her class's 1985 SSTV contact with Tony England, WØORE, and her present class's participation in the 10-meter CQ All-Schools Net which has been in regular contact with Johnson Space Center hams. Carole was the 1987 ARRL Professional Instructor of the Year.

Want a unique QSO? From May 10 to September 4, South Dakota hams will be operating a special-events station from one, and possibly two, wagon trains that will be visiting every county to mark the state's centennial. The operation commences at Elk Point in the southeast corner of the state and comes to a close at the South Dakota State Fair in Huron August 29-September 4. Give them a call and help South Dakota hams celebrate the century!

Hams are certainly a mobile group! HQ handled over 25,000 address changes last year! To comply with new postal regulations, we've had to do away with our handy address change/postal index card. Please use the form, or a copy thereof, that appears on page 187 to notify us of your change of address.

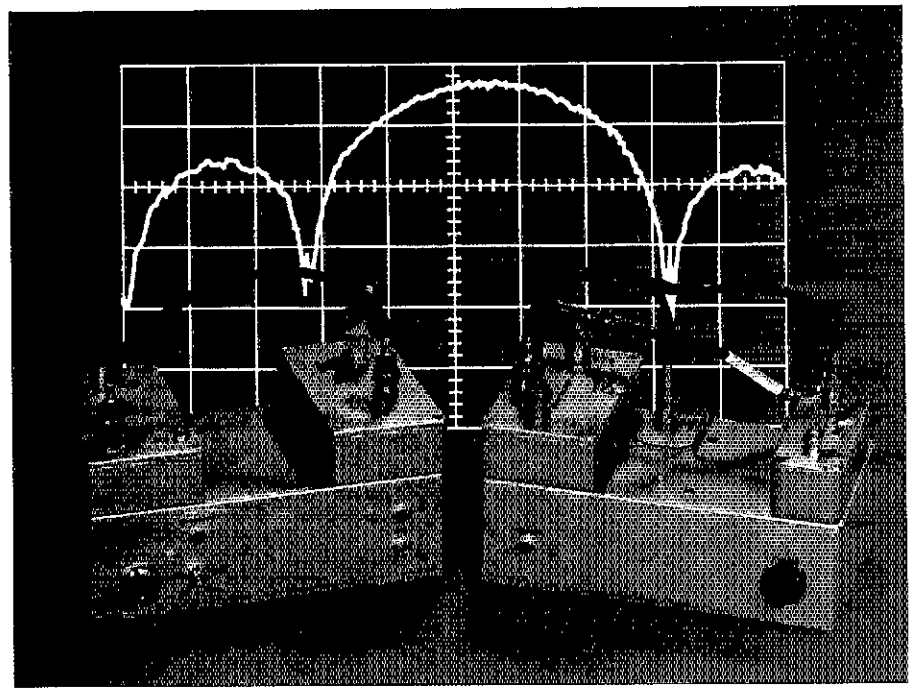
The ARRL financial statement which normally appears in this issue will appear in June *QST*.

HQ has received many questions asking what frequencies on six meter frequencies are recommended for radio control (R/C) of model airplanes. For the past five years, the recommended frequencies have been 50.800-50.980 MHz, in 10 channels using 20 kHz spacing.

A Practical Direct-Sequence Spread-Spectrum UHF Link

In this *QST* exclusive, amateur spread-spectrum communication moves off the drawing board and into practical reality. Read all about it—and warm up your soldering iron!

By André Kesteloot, N4ICK
ARRL Technical Advisor
6915 Chelsea Rd
McLean, VA 22101



Radio amateurs under FCC jurisdiction have been authorized to use spread-spectrum emission since June 1, 1986,[1] but practical information on how to get an amateur spread-spectrum system up and running has been scarce. This is so for good reason: Military applications of spread spectrum are routinely classified, while space and other civilian applications are usually proprietary. Because of this, the literature abounds with spread-spectrum articles replete with mathematical treatments and block diagrams, but very few articles that give *practical details* of spread-spectrum systems have been published.

This situation has, in effect, forced Amateur Radio experimenters to reinvent parts of the wheel! Notwithstanding the fact that spread spectrum has been around for about 50 years, this article is, to my knowledge, the first to give complete details of the concept, design and realization of a direct-sequence spread-spectrum UHF radio link. Although this article does not present construction information at the component level, experimenters with a good grounding in UHF construction techniques should have no trouble building a functional spread-spectrum system based on the information given here.

Introduction to Direct-Sequence Spread Spectrum

A direct-sequence (DS) spread-spectrum signal can be obtained by mixing a carrier with the output of a clock-driven pseudo-noise (PN) generator (see Fig 1). This is readily achieved in a doubly balanced mixer (DBM), and results in the suppression of the original carrier and the creation of a new signal that is spread over a wide bandwidth (typically several megahertz). This biphase modulation, described in more detail in the references cited at notes 2 and 3, creates sidebands, or "spectral lines," the envelope of which has a $(\sin x/x)^2$ shape as shown at Fig 2A.

A simplified understanding of this phenomenon can be arrived at by considering the PN sequence as a succession of identi-

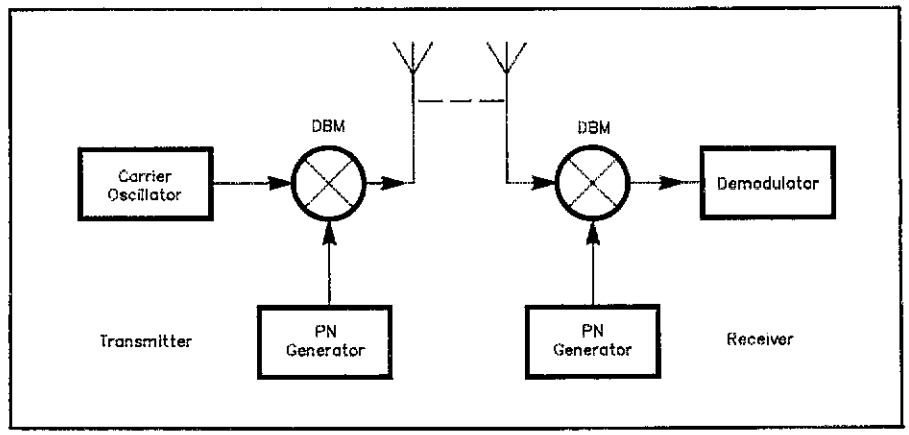
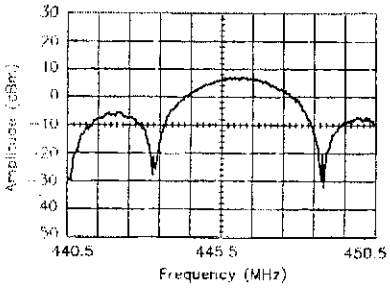
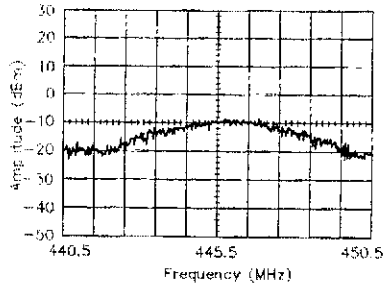


Fig 1—Simplified block diagram of a direct-sequence spread-spectrum communication system. In the transmitter, left, a spread-spectrum signal is generated by mixing carrier oscillator and pseudo-noise (PN) signals in a doubly balanced mixer (DBM). The energy of the resultant *biphase-modulated* suppressed-carrier signal is spread over a wide bandwidth. In the link receiver, right, the spread-spectrum signal is *despread* by mixing it with a PN signal identical to that used in the transmitter. In practice, the most difficult aspect of making this system work is that of synchronizing the PN-generator clocks at the transmitter and receiver sites.

[1]Notes appear on page 21.



(A)



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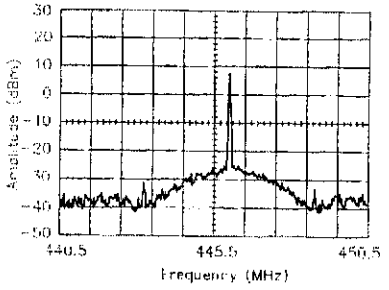


(C)

Fig 2—(A) Envelope of the unfiltered biphase-modulated spread-spectrum signal as viewed on a spectrum analyzer. In the practical system described, band-pass filtering is employed to confine the spread-spectrum signal to the amateur band. (B) At the receiver end of the link, the filtered spread-spectrum signal is apparent only as a 10-dB hump in the noise floor. (C) Despread signal at the output of the receiver DBM. The original carrier—and any modulation components that accompany it—has been recovered. The peak carrier is about 45 dB above the noise floor—more than 30 dB above the hump shown at B. (These spectrograms were made at a sweep rate of 0.1 s/div and an analyzer bandwidth of 30 kHz; the horizontal scale is 1 MHz/div.)

cal rectangular pulses of constant width, but variable repetition rate, the latter always being some submultiple of the (constant) clock frequency. Because the modulating signal is a rectangular pulse (rich in harmonics), a multitude of sidebands is created. As the shift register advances, the varying repetition rate changes the *number* and *position* of the spectral lines. Neither the shape of the envelope nor the position of the nulls—which are functions of the pulse width (see Fig 3)—changes.

The envelope is so shaped because a rectangular pulse in the time-domain has a (sin x/x) Fourier transform in the frequency domain. Hence, the sidebands, or spectral lines, created by such a pulse have a (sin x/x) envelope.[4] As we are dealing with a signal proportional to the output *power* (that is, a function of the square of the output voltage), the resulting signal appears as a $(\sin x/x)^2$ spectrum

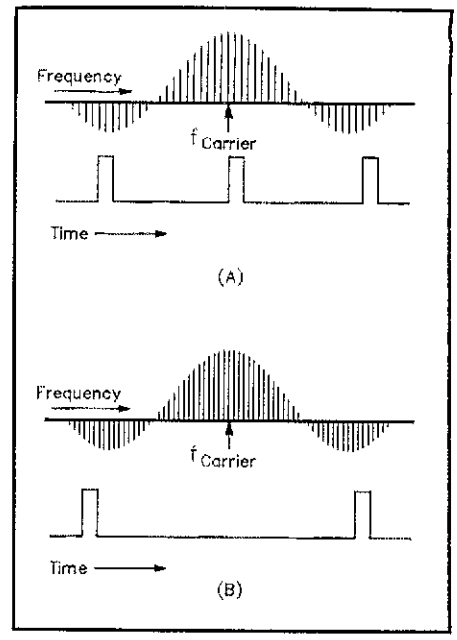
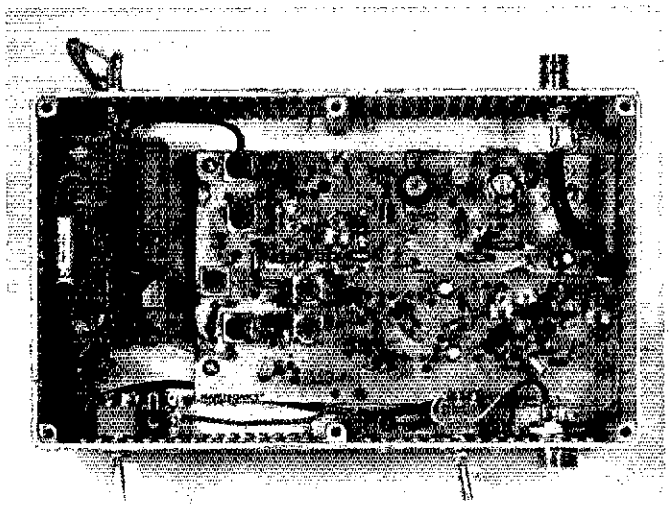


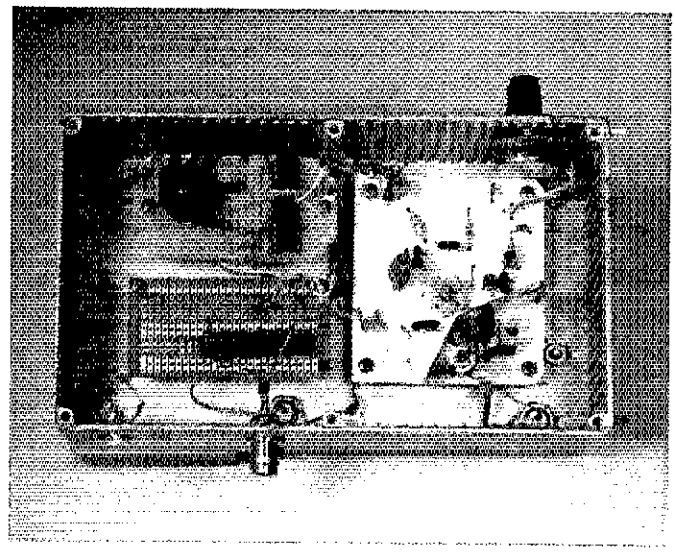
Fig 3—The PN signal (lower trace at A and B) consists of constant-width pulses that vary in repetition rate as the PN-generator shift register advances. Varying the PN-signal pulse rate changes the number and position of the spread signal's characteristic "spectral lines" (upper trace at A and B) without changing the shape of the signal envelope.

when observed with a spectrum analyzer (Fig 2A). Note that the spectrum-analyzer display shows only the *envelope* of all the sidebands—that is, an *imaginary* curve joining the peaks of all the spectral lines.[5]

At the receiver end of the spread-spectrum link, the output of the DBM



The spread-spectrum transmitter is based on a Hamtronics TA-451 446-MHz transmitter strip (Z1, right). The transmitter PN generator—the two piggybacked boards at left—uses 111.5-MHz energy from the TA-451 as the PN-sequence clock.



The heart of the spread-spectrum receiver is a synchronized oscillator (right) that recovers the transmitter PN-sequence clock from the received signal. The modules at left contain clock divider ICs (U8 and U9), a voltage regulator (U7) and the receiver PN generator (U10 and U11). R1, the OSC FREQ control, is at top right.

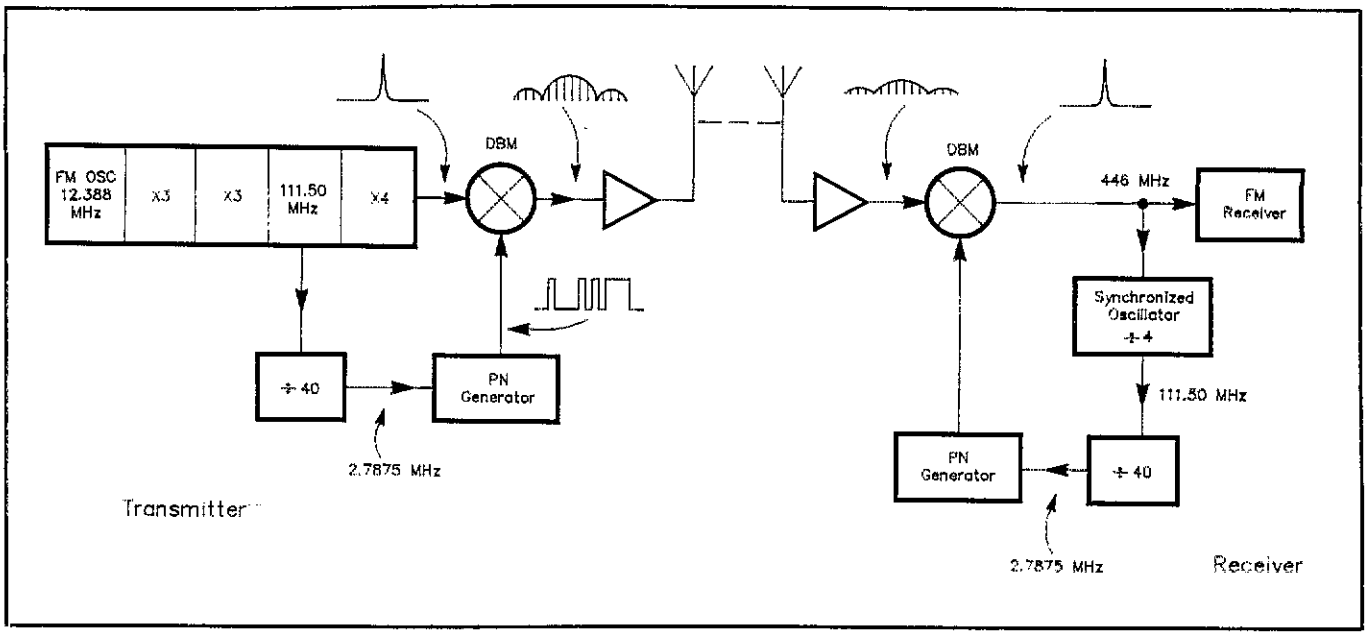
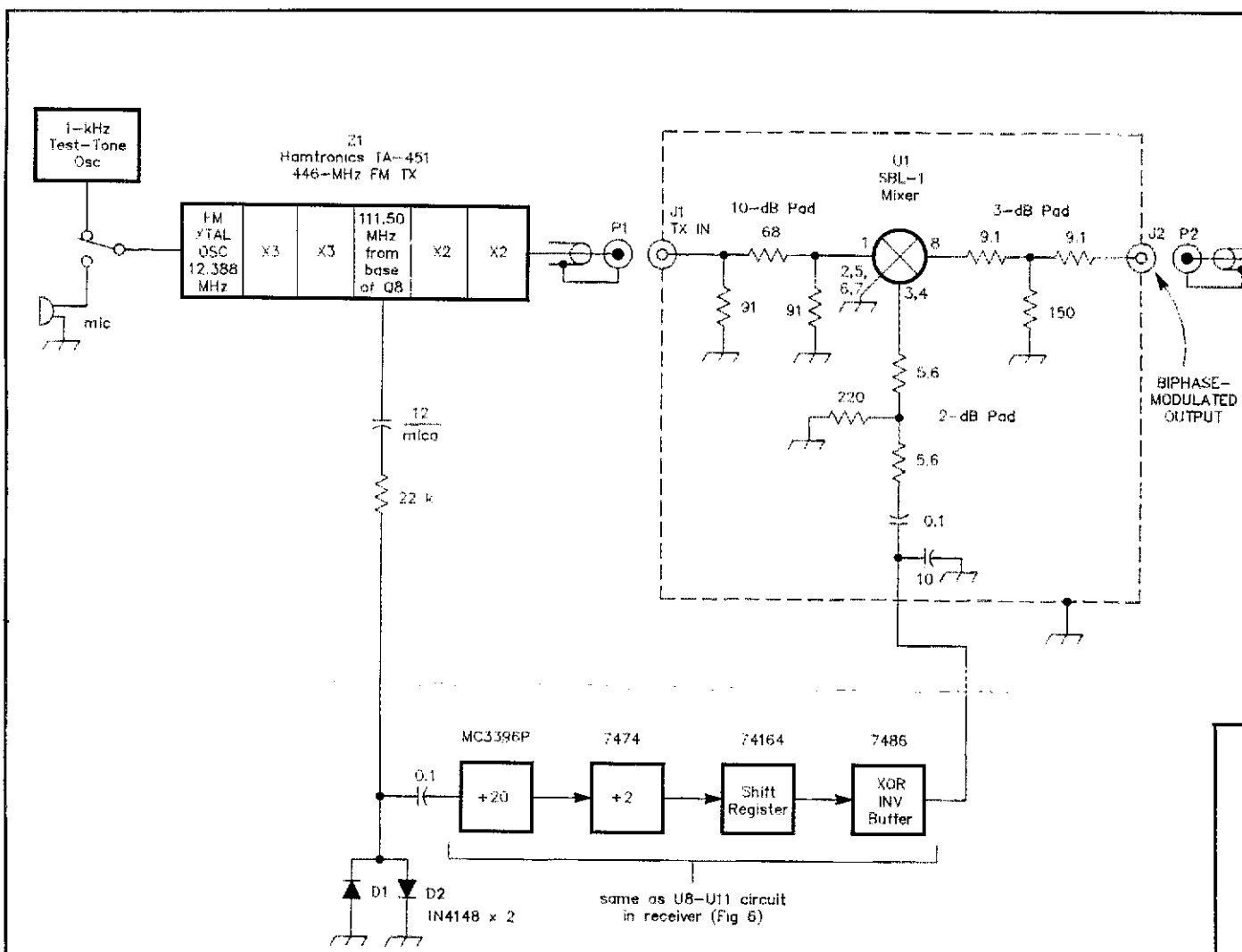


Fig 4—Block diagram of the practical spread-spectrum link. The success of this arrangement lies in the use of a synchronized oscillator (right) to recover the transmitter clock signal at the receiving site.



shows—in the absence of correlation—a *slight* rise in the noise floor, as shown in Fig 2B. If we now reintroduce PN identical in sequence, frequency and phase to that used at the transmitter, the received signal will be correlated or "despread," and the output of the DBM will be as shown at Fig 2C.

In Amateur Radio applications, the PN sequence is announced before spread-spectrum transmission begins[6] and can thus be easily duplicated at the receiver. A major problem—one common to all spread-spectrum systems—remains: that of synchronizing the receiver's PN sequence with that used at the transmitter. This can be done by recovering the transmitter clock frequency from the received signal. Because the received signal appears to be noise (Fig 2B), however, this can be a formidable challenge. Commenting on this problem, Robert Dixon writes that "...more time, effort and money has been spent developing and improving synchronizing techniques than any other area of spreadspectrum systems. There is no reason to suspect that this will not continue in the future."[7]

This article describes a simple solution to the synchronization problem. (Because of its simplicity, the solution does not offer all the antijamming properties of more sophisticated systems, but this should not be a concern to Amateur Radio operators.)

Overall Description of the Link

The UHF link described in this article was first demonstrated at the June 1988 AMRAD meeting. (Several members of AMRAD [the Amateur Radio Research and Development Corporation] have been involved in spread-spectrum experimentation since 1980.) Fig 4 shows the general arrangement used. The output of a 446-MHz transmitter is fed to one input port of a doubly balanced mixer. The other input port of the mixer is connected to a PN sequence generator that is clocked at a submultiple of the transmitter's carrier frequency.

At the receiver end of the link, a sliding correlator is used as follows: The output of a free-running "synchronized oscillator" [8] is divided to create a clock signal at a frequency close to that of the transmitter's clock. This locally generated clock is used to drive a PN generator identical to that used at the transmitter site. The resulting PN sequence is mixed with incoming RF in a doubly balanced mixer. The free-running frequency of the synchronized oscillator can be adjusted to run the receiver's PN sequence faster or slower than the transmitter's. The speed difference causes the receiver PN sequence to "slide by" the transmitter sequence (hence the name *sliding correlator).*

Because the transmitter and receiver sequences differ in speed, the PN sequence fed to the receiver's doubly balanced mixer will coincide with the transmitter sequence at some instant. Correlation, or *despreading,* then occurs, and the output of the DBM duplicates the original carrier as shown in Fig 2C. This carrier is fed to the input of the synchronized oscillator, which locks onto the incoming signal. The loop is now closed: The original clock has been recovered, and the system stays locked.

The Direct-Sequence Transmitter

As shown in Fig 5, I used a Hamtronics® model TA-451 transmitter strip (Z1), the output power of which is adjusted to 10 mW (+10 dBm), as an exciter. This transmitter is based on a

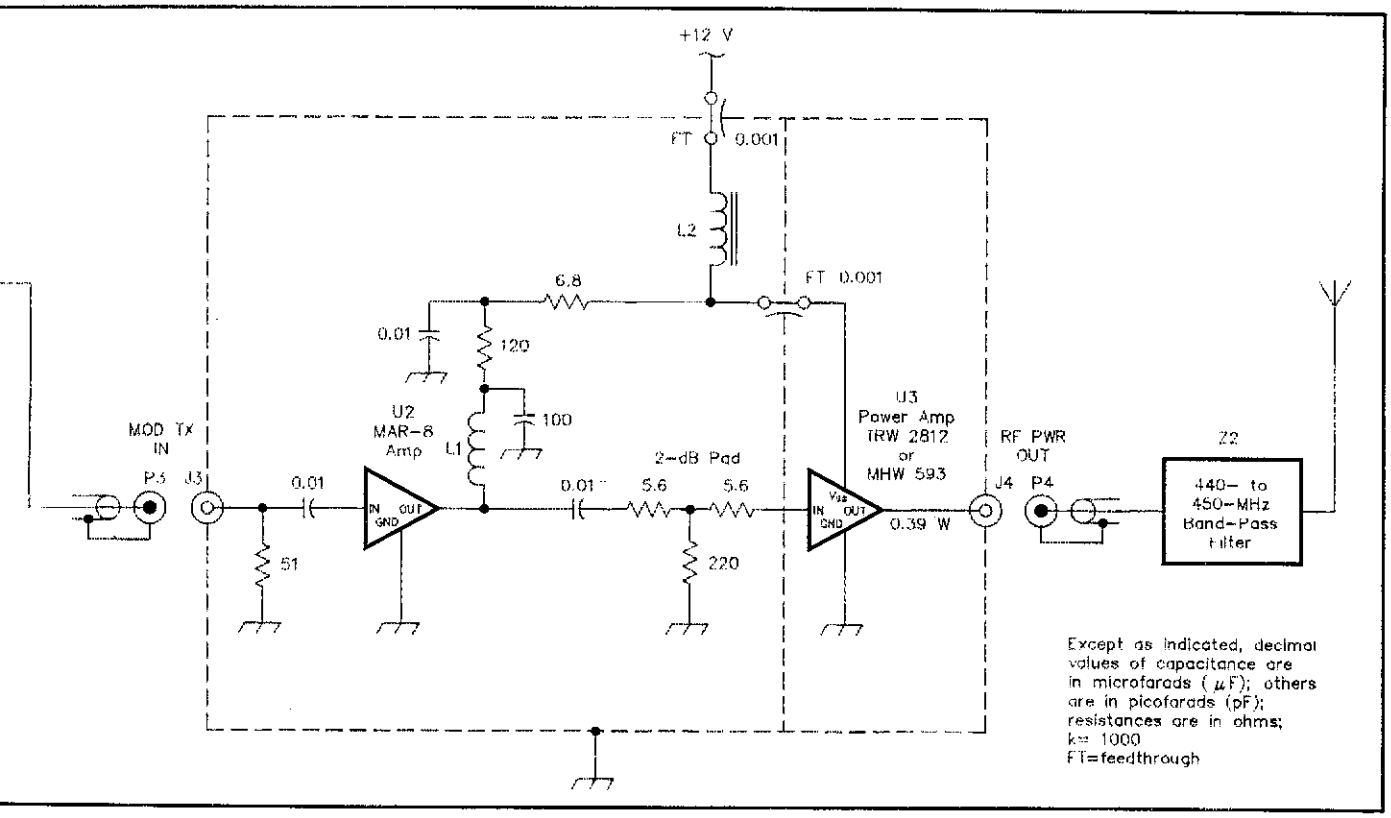


Fig 5—Schematic of the 440-MHz spread-spectrum transmitter. All capacitors under 0.001 μF are dipped mica; others are 50-V ceramic (0.1 μF units: monolithic ceramic) unless marked otherwise. Resistors are 5% tolerance, ¼- or ½-W carbon film or composition. Q8 (in the Z1 box) is a Hamtronics part designator. See Fig 6 for details on the PN generator. The 1-kHz tone generator, included to facilitate testing in the author's version of the link, is not described in this article.

D1, D2—1N4148 or equiv.

L1—10 close-wound turns of no. 30 KYNAR® -insulated (wire-wrap) tinned copper wire, 1 mm diam (use a no. 64 [0.036-in. diam] drill as a removable form).

L2—1 turn of no. 30 KYNAR-insulated wire through an Amidon FB-64-101 (Palomar FB-1-64, RADIOKIT FB64-101 also suitable) ferrite bead.

U1—Mini-Circuits SBL-1 mixer (Mini-Circuits, PO Box 350166, Brooklyn, NY 11235-0003, tel 718-934-4500).

U2—Mini-Circuits MAR-8 MMIC.

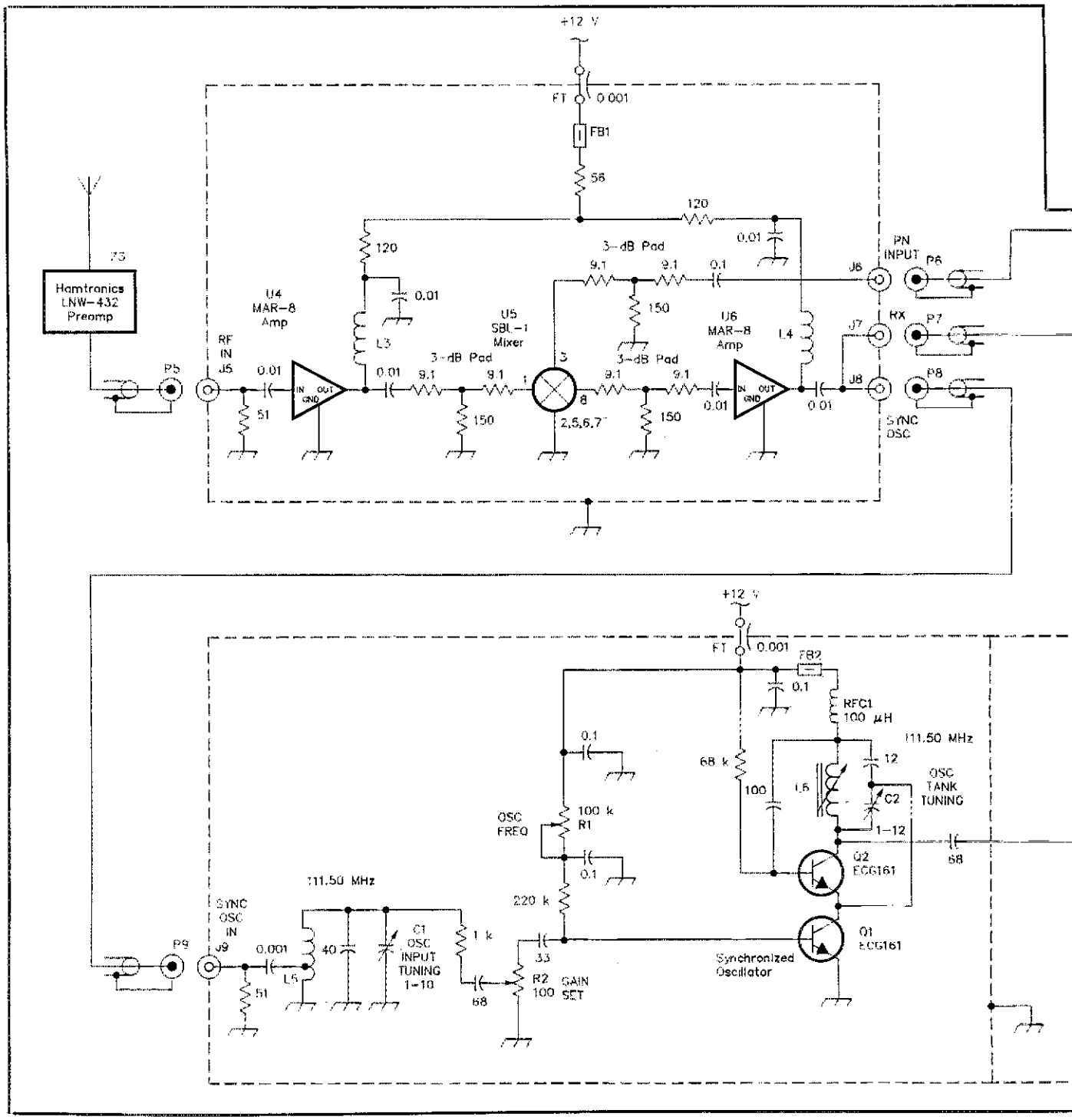
U3—TRW 2812 or Motorola MHW 593 amplifier module.

Z1—Hamtronics TA-451 446-MHz FM transmitter (Hamtronics, Inc, 65 Moul Rd, Hilton NY 14468-9535, tel 716-392-9430).

Z2—Hamtronics HRF-432 440- to 450-MHz, helical-resonator band-pass filter.

Fig 6—Mixer and PN-generator circuitry for the 440-MHz spread-spectrum link. Except for 0.1-μF units, all capacitors are 50-V ceramic unless marked otherwise; 0.1-μF capacitors are 50-V monolithic ceramic. Resistors are 5% tolerance, ¼- or ½-W carbon film or composition.

C1—1- to 10-pF, ceramic-dielectric piston trimmer.
C2—1- to 12-pF, air-dielectric trimmer.
FB1, FB2—Amidon FB-64-101 (Palomar FB-1-64, RADIOKIT FB64-101 also suitable) ferrite bead.
L3, L4—10 close-wound turns of no. 30 KYNAR-insulated (wire-wrap) tinned copper wire, 1 mm diam (use a no. 64 [0.036-in. diam] drill as a removable form).
L5—2½ turns of no. 16 tinned copper wire, ¼ in. diam. Tap ¾ turn from ground end. Use a ¼-in.-diam drill as a form. After winding the coil, remove the drill and spread the turns to make a coil ½ inch long.
L6—4 space-wound turns of no. 20 enam copper wire on a ¼-in. diam, slug-tuned plastic form. Nominal inductance, approx 0.2 μH.
R1—100-kΩ, linear-taper control.
RFC1—100-μH miniature molded choke.
U4, U6—Mini-Circuits MAR-8 MMIC.
U5—Mini-Circuits SBL-1 doubly balanced mixer.
U7—7805 regulator IC
U8—MC3396P divide-by-20 prescaler IC.
U9—7474 dual-D, positive-edge-triggered flip-flop IC.
U10—74164 8-bit, parallel-output shift register, asynchronous clear IC.
U11—7486 quad two-input exclusive-OR gate IC.
Z3—Hamtronics LNW-432 preamplifier adjusted for an input response flat from 430 to 460 MHz. See text.
Z4—446-MHz FM receiver, or transceiver in receive mode.



12.388-MHz crystal oscillator, the output of which is multiplied by 36 to produce output at 446 MHz. The link clock is based on transmitter energy sampled at one-fourth the output frequency (111.5 MHz, at the base of Q8 in the Hamtronics transmitter). This signal is fed to a divide-by-40 chain consisting of a MC3396P and a 7474. The divider chain produces a series of pulses at 2.7875 MHz. These pulses are used to clock a seven-stage shift register composed of a 74164 and a 7486. (This circuit, described in detail in the reference cited at note 9, is identical to that used in the link receiver [Fig 6].) This shift register, the PN generator, drives one input port of a doubly balanced mixer (U1). Attenuators are used on all ports of the DBM to reduce the effects of impedance mismatch and keep IMD products at a low level.

The output of the DBM, a biphase-modulated signal, is then amplified by an MMIC (U2), and a UHF amplifier module (U3) that produces about 0.39 W in the 440- to 450-MHz range. The output spectrum of the transmitter (ahead of the band-pass filter, Z2) is shown at Fig 2A.

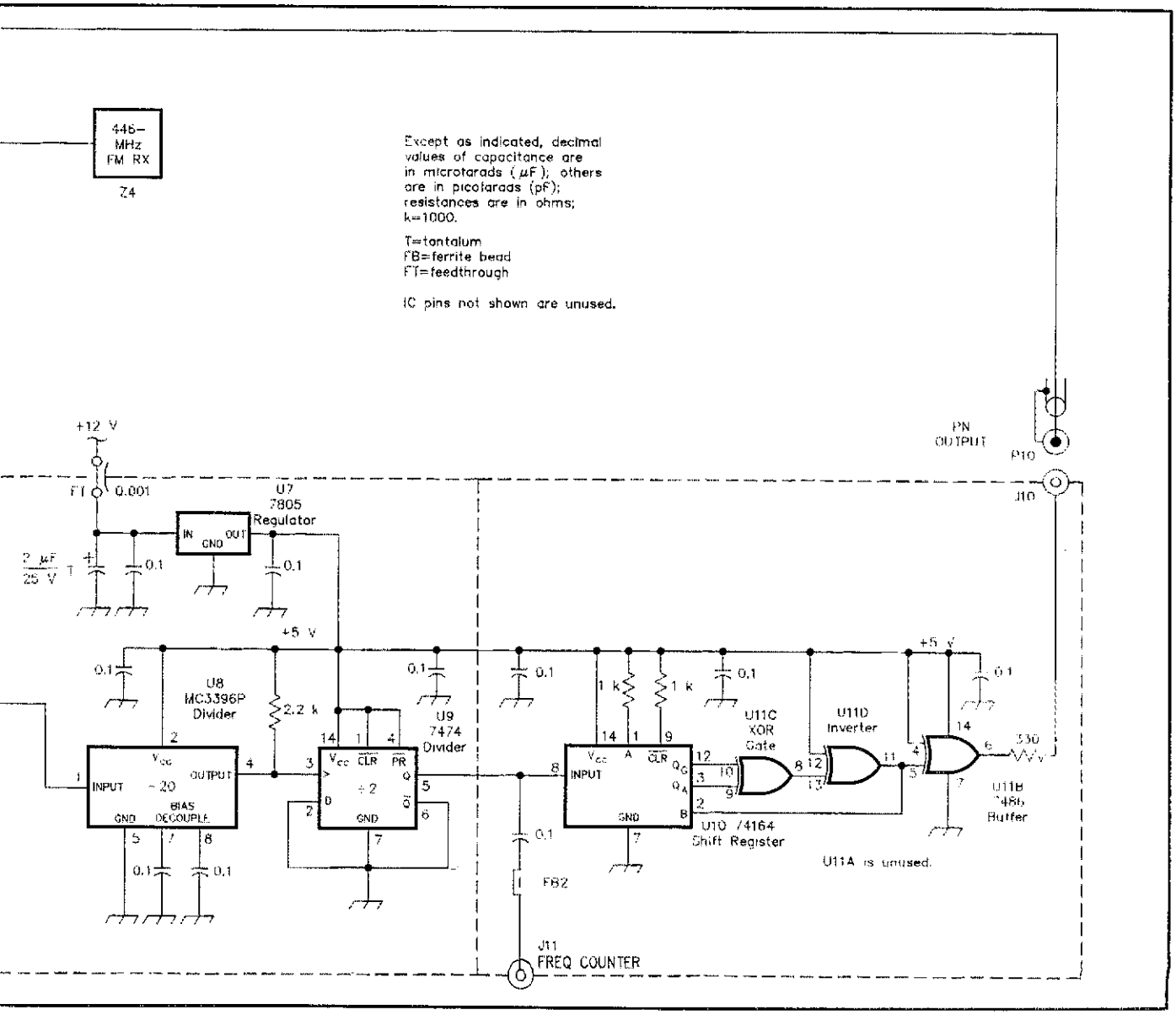
Because about 90% of the output power appears between the two first nulls (located at 443.2125 MHz [446.00 − 2.7875] and 448.7875 MHz [446.00 + 2.7875], respectively) the use of a band-pass filter (Z2) to attenuate the signal below 440 MHz and above 450 MHz does not appreciably affect reception of the radiated signal. (Reliable lock was obtained over a distance of more than a mile of fairly flat terrain using 0.39 W output and a quarter-wave groundplane antenna.)

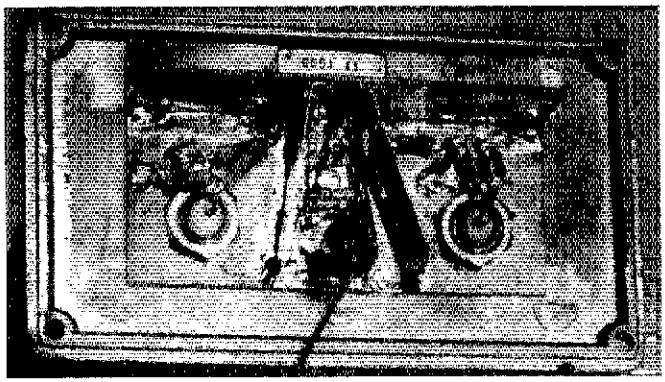
As Fig 5 shows, the link clock is slightly frequency modulated by the audio signal. This does not introduce jitter or cause false synchronization because a peak deviation of 5 kHz at 446 MHz translates to a shift of only 15 Hz at the clock frequency (2.7875 MHz)—a negligible variation. (As an alternative approach, the clock could be derived directly from the transmitter's crystal oscillator, ahead of the phase modulator. This would, of course, require a different divider chain at the receiver end of the link.)

The Direct-Sequence Receiver and Synchronizer

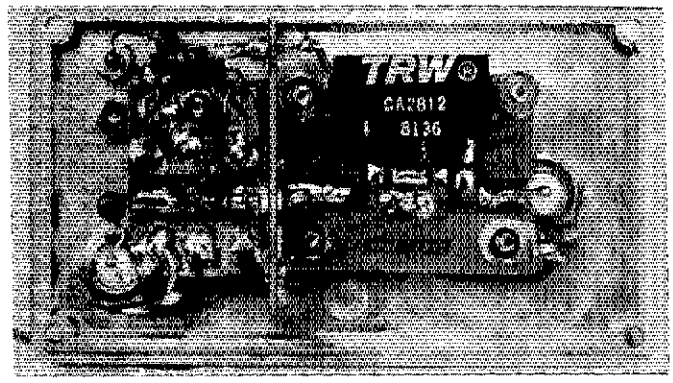
See Fig 6. Signals from the antenna are fed to a Hamtronics Model LNW-432 preamplifier (Z3) aligned for a flat response from 430 to 460 MHz, an arrangement that provides some limited RF selectivity. The output of Z3 is boosted another 20 dB by a Mini-Circuits MAR-8 MMIC (U4) and then applied to one port of an SBL-1 Mini-Circuits DBM (U5). The output of the DBM is further amplified by a second MAR-8 (U6), the output of which feeds Z4, a 446-MHz narrow-band-FM receiver (in my system, a Yaesu FT-708R transceiver), and the input of a synchronized oscillator.

The synchronized oscillator is a deceptively simple-looking circuit that is unfortunately as yet little-known in amateur circles. Q2 is a modified Colpitts oscillator that, in this application, free-runs at approximately 111.5 MHz, or one-fourth





Construction of the transmitter biphase modulator. J1, TX IN, is at left; the SBL-1 DBM, U1, at top center; and J2, BIPHASE-MODULATED OUTPUT, at right. U1 receives PN-generator injection via the wire in the foreground.



The transmitter MMIC (U2) and power (U3) amplifiers. J3, MOD TX IN, is to the lower left; J4, RF POWER OUT, to the right. U3, a TRW 2812 amplifier module, commands the right two-thirds of this view; U2, a Mini-Circuits MAR-8, is the tiny black pill above and to the right of J3.

of the expected input frequency. Because Q2 operates in class C, it draws supply current only during a small portion of each cycle of its output sine wave. The resulting pulsating emitter current develops a pulsating voltage across Q1. Because there is no voltage drop across Q1 when Q2 is cut off, Q1 operates as an amplifier only on the peaks of Q2's output sine wave. Thus, an RF synchronizing signal applied to Q1's base will be allowed to steer Q2's oscillation frequency only for the brief periods during which Q2 conducts. R1, OSC FREQ (labeled TUNING in the title photo), allows adjustment of Q1's base current and, hence, Q2's free-running frequency.

In practice, the synchronized oscillator provides the function of a phase-locked loop (PLL) while offering several advantages over a PLL. The synchronized oscillator, which uses only two transistors, is simpler to implement. Unlike a PLL, which depends on a multistage feedback loop (phase detector, loop filter and so on) to achieve and hold lock, the synchronized oscillator locks onto the input signal directly. Further to its advantage, the synchronized oscillator can operate with very noisy input signals.[10,11,12]

The output of Q2 is thus a sine wave at 111.50 MHz. It is divided by 20 in U8 (a MC3396P prescaler) and then again by 2 in U9 (a 7474 flip flop), the output of which—a 2.7875-MHz square wave—feeds a seven-stage shift register (U10, a 74164), the application of which is described in more detail in the work cited at note 9. This arrangement exactly duplicates that used at the transmitter end of the link.

The output of the PN generator is connected to the IF port of the DBM (U5). This constitutes a sliding correlator in the sense that the transmitter and receiver PN sequences—identical, but running at slightly different speeds—slide by each other within the DBM. At the instant the receiver PN sequence coincides with that of the transmitted signal, correlation takes place in the DBM, and the DBM delivers a despread signal (Fig 2C). This despread signal, recognized by the synchronized oscillator as a valid input, forces the oscillator into lock and keeps it there.

Construction of the Link Prototype

As shown in the photographs, the various elements of the circuit were built in individual die-cast aluminum boxes. This provides ample interstage shielding; it also allowed flexibility during development of the link. A second version could no doubt be made much simpler mechanically.

Adjustments

The Hamtronics transmitter (Z1 in Fig 5) requires only one adjustment specific to its use in this application: *Its output must be reduced to 10 mW.* If you do not own an RF-power meter capable of measuring this level accurately, you can easily construct one as follows. Build a dummy load by connecting a 1.5-V, 25-mA lamp (one of the two identical lamps available as Radio Shack® no. 272-1139) in series with a 1- to 8-pF variable capacitor. Connect this dummy load to the Hamtronics transmitter via a sensitive SWR indicator. Turn on the transmitter and adjust the capacitor to minimize the SWR

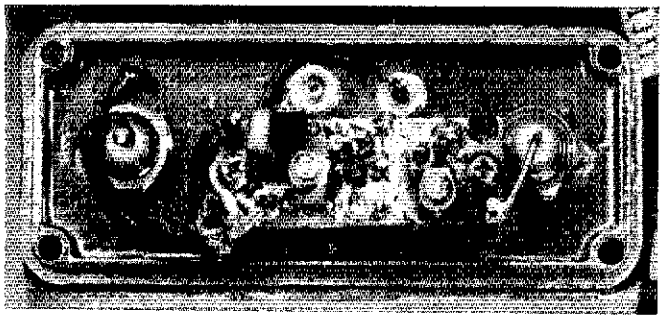
What's Spread Spectrum?

The useful energy in a conventional AM, FM or PM signal—including CW, RTTY, AMTOR, SSB and packet-radio transmissions—is concentrated narrowly around a center frequency. The bandwidth of such signals is directly related to the modulating frequency (and, where applicable, frequency deviation and modulation rate). The efficiency of these and other conventional modulation schemes is often equated with how tightly they concentrate signal energy for a given information rate.

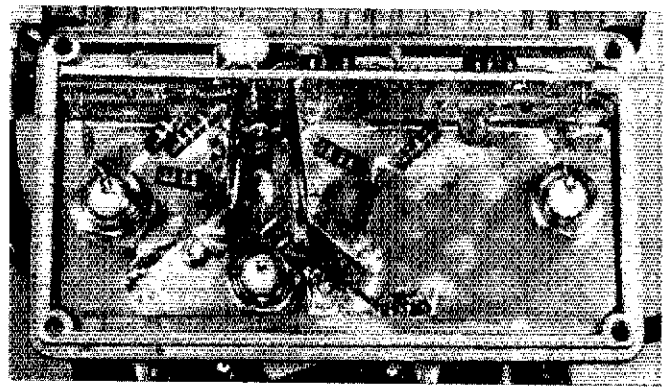
Spread-spectrum communication doesn't follow these rules. In spread-spectrum work, the signal energy is *intentionally spread* over a wide bandwidth. Because of this, spread-spectrum signals are largely immune to interference from, and less likely to cause interference to, nonspread signals. Spread spectrum offers the additional advantages of better noise rejection than nonspread systems, the possibility of hiding the communication channel in the ambient noise, and the possibility of conducting multiple communications at the same time on the same frequency (code-division multiplexing). Also, spread spectrum is highly resistant to jamming and can be used for precise ranging—characteristics that make it valuable in space communications.

Signal spreading can be done in several ways. In a *frequency hopping (FH)* system, the center frequency of a conventional signal is varied many times per second according to a predetermined table of frequencies. *Direct sequence (DS)* spreading is done by varying the phase of an RF carrier with a very fast, pseudorandom binary bit stream called pseudo-noise (PN). In *chirp* spread spectrum, the signal carrier is swept over a range of frequencies. (The USAF over-the-horizon-backscatter HF radar is a chirp spread-spectrum system.) In *time hopping* spread spectrum, a carrier is keyed on and off with a PN sequence. Many commercial and military spread-spectrum systems are *hybrids* of two or more of these spreading techniques, but current FCC rules limit amateur spread-spectrum work to FH *or* DS—FH-DS hybrids are not allowed.

To learn more about spread-spectrum communication, see chapter 21 of the 1989 *ARRL Handbook*, back issues of *QEX* and the amateur spread-spectrum rules in ARRL's *FCC Rule Book*. Watch for ARRL's upcoming spread-spectrum book. And stay tuned to *QST*: This month, André Kesteloot describes what we believe to be *the first practical amateur spread-spectrum communication system*—an *affordable* system that's simple to adjust and based on components readily available to experimenters. Amateur spread spectrum is here—and *you* can be a part of it.—*Ed.*



The receiver preamp, Z3, a Hamtronics LNW-432 module, fits neatly into its own die-cast box.



The three ICs in the receive-mixer module are contained on a single PC board. U4 is at left (above J5, RF IN); U5 is almost hidden from view by the disc-ceramic capacitor at top, and U5 is at the right (above J8, SYNC OSC). (In this model, a coaxial tee is used at J8 in lieu of mounting J7, RX, on the box.) The jack at center is J6, PN INPUT.

presented by the dummy load to the transmitter. Connect the second 272-1139 lamp across a 1.5-V cell in series with a 50-Ω adjustable resistor, and place this lamp so that you can simultaneously view it and the dummy-load lamp. Adjust the current through the dc-fed lamp so that the lamp dissipates 10 mW. Turn on the transmitter and adjust R37 (on the transmitter) so that the RF-fed lamp glows at the same brightness as the dc-fed lamp. This simple comparison method yields surprisingly accurate results. No other adjustments are required at the transmitter site.
method yields surprisingly accurate results. No other adjustments are required at the transmitter site.

At the receiver site, the only adjustments necessary concern the synchronized oscillator (Fig 6). Using a dip meter coupled to L5 as a resonance indicator, adjust C1, OSC INPUT TUNING, for resonance at 111.5 MHz. (Because R2 loads the tuned circuit, you may have to temporarily disconnect the 68-pF capacitor from the R2 wiper to obtain a discernible dip.) Connect a frequency counter to the output of the divide-by-40 chain via J11, FREQ COUNTER. Adjust R1, OSC FREQ, to the center of its range. Adjust the wiper of R2, GAIN SET, to the ground end of its range. Set C2, OSC TANK TUNING, to the center of its range, and adjust L6 for a reading of approximately 2.78 MHz on the frequency counter. Note that this reading can be varied by adjusting the OSC FREQ control.

Operation

After identifying your station on the link carrier frequency in accordance with §97.84(g)(5) of the FCC rules (identification by means of a narrow-band emission—AFSK or voice—is the easier option to implement) and stating the characteristics of your PN sequence, you may turn on the spread-spectrum transmitter.[13]

At the receiver end of the link, adjust the wiper of R2 (Fig 6) to about 30° from the ground end of its range. (Further advancing this control only "oversynchronizes" the oscillator and produces distortion at its output, and could lead to false triggering of the divide-by-20 stage.) Connect a frequency counter to J11 and adjust R1 for a counter indication of about 2.7875 MHz. Assuming that the received signal is sufficiently strong, you should observe that the counter suddenly displays exactly 2.7875 MHz as you adjust R1. When this happens, the receiver PN sequence has locked to the transmitter sequence.

The synchronized oscillator should be able to achieve lock at free-running frequencies from about 2.7860 to 2.7890 MHz. In my version, the receiver stays in lock for hours without needing readjustment of R1 once the synchronized-oscillator enclosure has stabilized (about 30 minutes after turn-on).

Summary

This article has described a direct-sequence spread-spectrum UHF link that uses readily available components and does not require sophisticated equipment for adjustments and tuning. As it stands, the system transmits and receives voice, or packets by means of AFSK. Work is currently proceeding to modify the system to allow direct data transmission.

Radio amateurs should expect spread-spectrum technology to become rapidly prominent in the field of amateur high-speed data transmission. I hope that this description of a practical spread-spectrum link will encourage others to undertake their own experiments on one of Amateur Radio's newest frontiers.

Acknowledgments

Vasil Uzunoglu, codeveloper of the synchronized oscillator, deserves much credit for clarifying my understanding of his circuit, and I thank Chuck Phillips, N4EZV, for his constant encouragement and support.

Notes

[1]Radio amateurs are now authorized by the FCC to transmit spread-spectrum emission using frequency hopping or direct-sequence spreading, but not a combination of both, at frequencies above 420 MHz. This article describes a direct-sequence 446-MHz link that uses a seven-stage shift register with feedback taps at stages 7 and 1. Because the FCC rules pertaining to amateur spread-spectrum operation contain logging, identification and technical-standards provisions that differ greatly from those regulating operation with "standard" emissions, radio amateurs contemplating spread-spectrum operation are urged to familiarize themselves with Part 97's spread-spectrum rules before putting their own spread-spectrum systems on the air.—*Ed.*

[2]R. Dixon, *Spread Spectrum Systems*, 2nd ed, (New York: Wiley, 1984), pp 114-125.

[3]A. Kesteloot, "Practical Spread Spectrum: Achieving Synchronization with the Slip-Pulse Generator," *QEX*, May 1988, pp 6-11.

[4]MIT School Staff, *Principles of Radar* (New York, McGraw-Hill, 1946), pp 4-12.

[5]A. Kesteloot, "Of Weltanschauung, Jitter and Amplitude Modulation," *AMRAD Newsletter 1987*, Vol XIV, No. 4, pp 4-7.

[6]FCC rules currently require that amateur spread-spectrum emissions be identified by means of narrow-band emissions, or by altering one or more parameters of a spread-spectrum emission in a fashion such that CW or SSB or narrow-band FM receivers can be used to identify the sending station (§97.84 (g) (5)). The current FCC rules do not require that the station ID include details concerning the spreading method and sequence in use, but interoperability of amateur spread-spectrum stations is facilitated when this information is given as part of the ID.—*Ed.*

[7]Dixon, p 214.

[8]V. Uzunoglu and M. White, "The Synchronized Oscillator: A Synchronization and Tracking Network," *IEEE Journal of Solid State Circuits*, Vol SC-30, No 6, Dec 1985, pp 1214-1224.

[9]A. Kesteloot, "Practical Spread Spectrum: A Simple Clock Synchronization Scheme," *QEX*, Oct 1986, pp 4-7.

[10]See note 8.

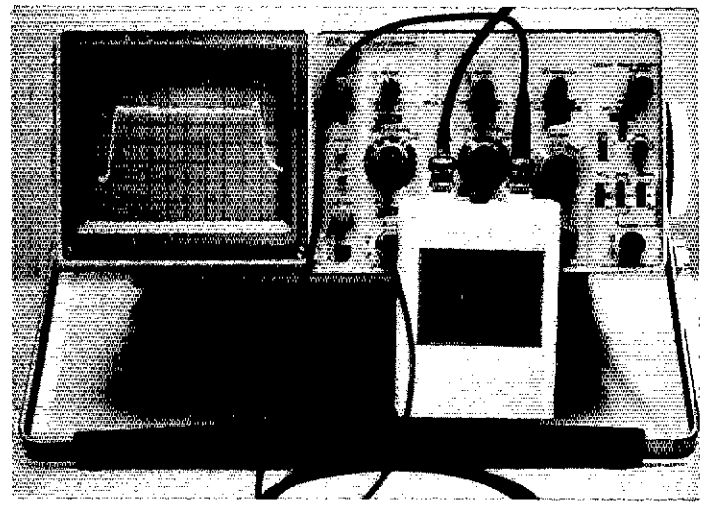
[11]A. Kesteloot, "Extracting Stable Clock Signals from AM Broadcast Carriers for Amateur Spread-Spectrum Applications," *QEX*, Oct 1987, pp 5-9.

[12]An ambiguity is introduced by the fact that the synchronized oscillator divides by 4. It is thus theoretically possible for the oscillator to lock onto any one of the four RF cycles that can produce the correct frequency relationship at the receiver end of the link. In practice, though, the receiver tends to lock onto the proper cycle very reliably. (This ambiguity will be resolved once it becomes possible to [1] build a synchronized oscillator capable of operating reliably at 446 MHz, or [2] find a reasonablypriced phase-locked loop capable of operating at 446 MHz.)

[13]I identify my spread-spectrum transmissions by speaking into a hand-held FM voice transceiver tuned to the link carrier frequency.

A Practical Time-Domain Reflectometer

With an oscilloscope and this handy device, you can check your transmission lines from the comfort of your shack!



By Tom King, KD5HM
6284 Stardust Drive
Watauga, TX 76148

A time-domain reflectometer? What in the world is that, you ask? A time-domain reflectometer (TDR) is a simple but powerful tool you can use to evaluate your transmission lines. This TDR is an easy and inexpensive construction project—you can build it for about $25!

Ever wonder what it would be like to crawl inside your transmission line and view it from the perspective of a radio wave? That's exactly what a time-domain reflectometer (TDR) allows you to do. When used with an oscilloscope, a TDR allows you to find impedance bumps (open and short circuits, kinks and so on) in transmission lines. Commercially produced TDRs cost from hundreds to thousands of dollars each, but you can add the TDR described here to your shack for much less.

To understand time-domain reflectometry, a review of some transmission-line theory is in order. If a load on a line has exactly the same characteristic impedance (Z_0) as the line, 100% of the power applied to the line is absorbed in the load.[1] If a mismatched load is connected to the line (or if the line impedance is not constant), some of the applied signal is reflected toward the source. A TDR tells you the nature of any mismatches *and* where they are on the line.

Transmission-line theory also tells us that mismatched impedances higher than the line Z_0 cause reflections to return to the source in phase with the applied signal—the reflections and applied signal thus *add*. As you would expect, impedances lower than the line Z_0 cause reflections to be out of phase with the applied signal, so the reflections *subtract* from the applied signal.

How the TDR Works

Simply measuring the magnitudes of the reflected and applied signals at the source end of a transmission line allows us to determine the nature of impedance disturbances along the line. Using the divisions on the oscilloscope screen (the graticule) to measure the time between the application of a signal and the arrival of the reflections at the source end, we can determine the locations of these disturbances with a simple proportional method. The locations of disturbances are found by

$$\ell = \frac{(983.5 \times VF \times t)}{2} \qquad \text{(Eq 1)}$$

where

ℓ = line length in feet
VF = velocity factor of the transmission line (from 0 to 1.0)
t = time delay in microseconds

The time-domain reflectometer circuit shown in Fig 1 consists of a CMOS 555 timer (Radio Shack® no. 276-1718) configured as an astable multivibrator, followed by an MPS3646 transistor acting as a 15-ns-rise-time buffer. The timer

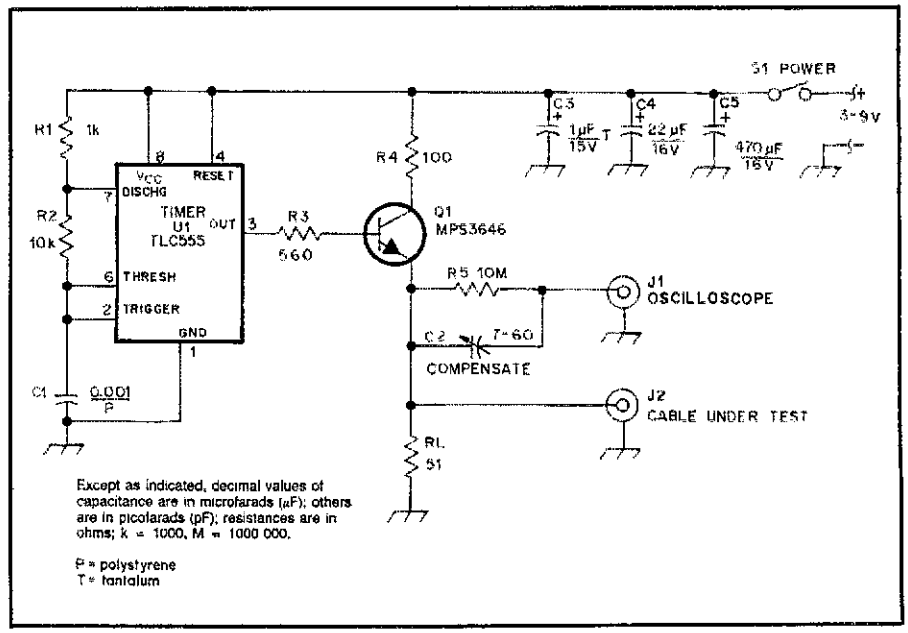


Fig 1—Schematic diagram of the time-domain reflectometer. All resistors are ¼ W, 5% tolerance. U1 is a CMOS 555 timer. Circuit current drain is 10 to 25 mA. When building the TDR, observe the construction cautions discussed in the text. C2 is available from Mouser Electronics, 11433 Woodside Ave, Santee, CA 92071, tel 619-449-2222, part no. ME242-8050.

[1]Notes appear on p 24.

provides a 71-kHz square wave. This is applied to the 50-Ω transmission line under test (connected at J2). The oscilloscope connects to the circuit at J1.

Construction

The PC-board etching pattern for the TDR is shown in Fig 2, and the parts-placement diagram in Fig 3. The TDR, including the batteries on which the TDR runs, is designed to be housed in a 4¼ × 3½ × 1½-inch enclosure. Right-angle-mounted components are used at S1, J1 and J2.[2]

There are two rather critical aspects to building the TDR. The first has to do with component substitution in the buffer circuit: *Don't do it!* Use *only* an MPS3646 for Q1. I chose the MPS3646 for its good performance in this circuit. If you substitute another transistor, the circuit may not perform properly. R5 and C2 form a compensation network—much like the networks in oscilloscope probes—that can be adjusted to eliminate the effects of the probe wire. The network is adjusted to compensate for the effects of the cable connected between the TDR and the cable under test.

A second caution: For the TDR to provide accurate measurements, the cable connected to J1 (between the TDR and the oscilloscope) must not introduce impedance mismatches in the circuit. *Do not* make this cable from ordinary coaxial cable. Oscilloscope-probe cable is the best thing to use for this connection. (It took me about a week and several phone calls to determine that scope-probe cable isn't "plain old coax:" Probe cable has special characteristics that prevent undesired ringing and other problems.) Mount a binding post at J1 and connect a scope probe to the binding post when testing cables with the TDR.

The TDR is designed to operate from supplies of between 3 and 9 V. Two C cells in series (3 V) supply operating voltage in my version. The circuit draws only 10 to 25 mA, so the cells should last a *long* time (close to the shelf life) in intermittent service. U1 can function with supply voltages as low as 2.25 to 2.5.

If you want to use the TDR in transmission-line systems with characteristic impedances other than 50 Ω, change the value of R_L to match the system impedance as closely as possible.

Calibrating and Using the TDR

The requirements for the oscilloscope used with the TDR are not very demanding. Just about any scope with a bandwidth of at least 10 MHz should work fine.[3] To calibrate the reflectometer, terminate CABLE UNDER TEST connector J2 with a 51-Ω resistor. Connect the oscilloscope's vertical input to J1. Turn on the TDR, and adjust the scope's timebase so that one square-wave cycle from the TDR fills as much of the scope display as possible *without uncalibrating the timebase.* You should see a waveform like that shown in Fig 4. Adjust C2 to obtain maximum amplitude and sharpest corners on the observed waveform. That's all there is to the calibration process!

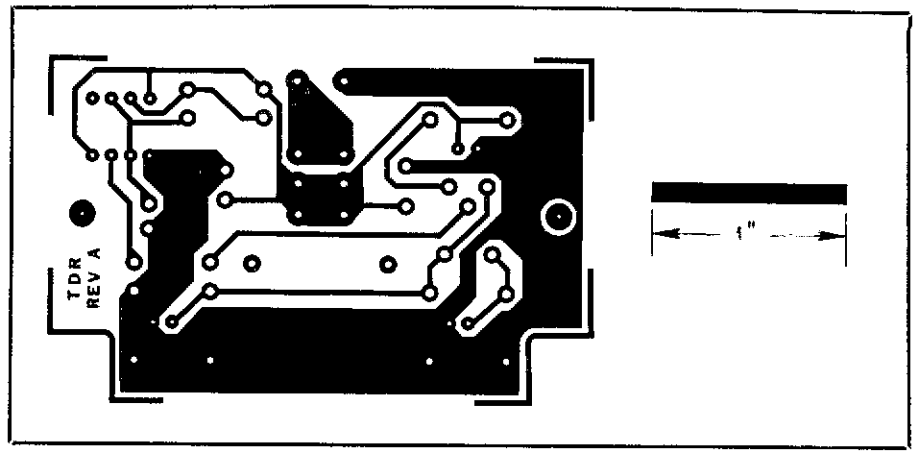


Fig 2—Full-size PC-board etching pattern for the TDR. Black areas represent unetched copper foil.

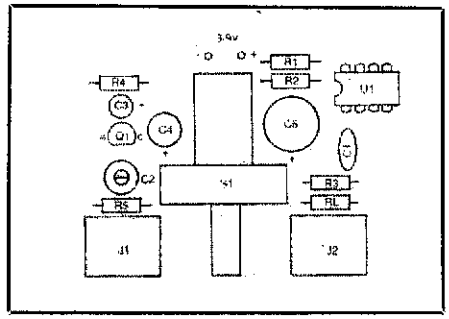


Fig 3—Parts-placement diagram for the TDR. Parts are mounted on the non-foil side of the board; the shaded area represents an X-ray view of the copper pattern. Be sure to observe the polarity markings of C3, C4 and C5.

To use the TDR, connect the cable under test to J2, and connect the scope's vertical input to J1. If the waveform you observe is different from the one you observed during calibration, there are impedance variations in the load you're testing. See Fig 5. For this example, I connected an unterminated test cable to the TDR. The beginning of the cable is shown at point B. (AB represents the TDR's output-pulse rise time.) Segment BC shows the portion of the transmission line that has a 50-Ω impedance. Between points C and D, there is a mismatch in the line. Because the scope trace is higher than the 50-Ω trace, the impedance of this part of the line is higher than 50 Ω—in this case, an open circuit.

To determine the length of this cable, read the length of time over which the 50-Ω trace is displayed. The scope is set for 0.02 μs per division, so the time delay for the 50-Ω section is (0.02 μs × 2.1 divisions =) 0.042 μs. The manufacturer's specified velocity factor (VF) of the cable is 0.8. Eq 1 tells us that the 50-Ω section of the cable is

$$l = (983.5 \times 0.8 \times 0.042\ \mu s) \div 2$$
$$= 16.52 \text{ feet}$$

The TDR provides close agreement with the actual cable length—in this case, the cable is really 16.50 feet long! (Variations in TDR-derived calculations and actual cable lengths can occur as a result of cable VFs that vary considerably from their published values. Many coaxial cables have VFs that vary as much as 10% from the specified values!)

A second example is shown in Fig 6. I connected the feed line to my 432-MHz vertical antenna to the TDR for this example. The 432-MHz antenna, mounted on my tower at 95 feet, is fed via a length of ¾-inch Hardline. The feed line has been in place for well over a year, so I wanted to check out the condition of the line. Fig 6 shows that the 50-Ω section of the line has a delay of (6.2 divisions × 0.05 μs) = 0.31 μs. Because the trace is straight and level at the 50-Ω level, the line is in good shape. The slight bump at the right-hand

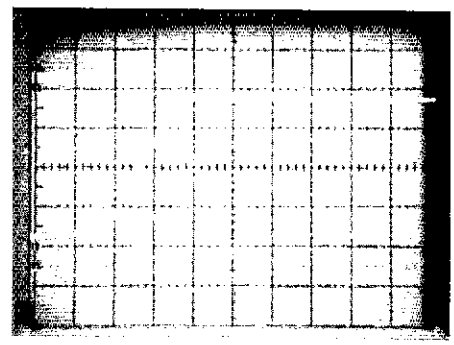


Fig 4—TDR calibration trace as shown on an oscilloscope. Adjust C2 (see Figs 1 and 3) for maximum deflection and sharpest waveform corners during calibration. See text.

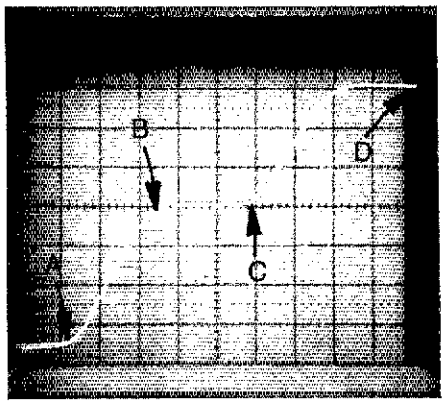


Fig 5—Open-circuited test cable. See text for interpretation of the waveform.

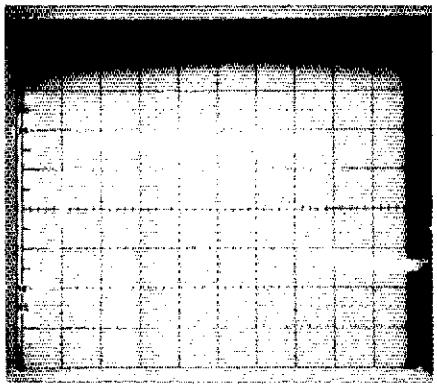


Fig 6—TDR display of the impedance characteristics of the 145-foot Hardline run to the 432-MHz antenna at KD5HM. See text for discussion.

end is where the antenna is connected to the feed line.

To determine the actual length of the line, I used the same procedure as before: Using the published VF for the Hardline (0.88) in Eq 1, I found the line length to be

$$\ell = \frac{(983.5 \times 0.88 \times 0.31\ \mu s)}{2}$$

$$= 134.1 \text{ feet}$$

Again, the TDR-derived measurement is in fairly close agreement with the actual cable length (142 feet).

Final Notes

The time-domain reflectometer described in this article is not frequency specific; its measurements are not made at the frequency at which a system is designed to be used. Because of this, the TDR cannot be used to verify the impedance of an antenna, nor can it be used to measure cable loss at a specific frequency. Just the same, in the two years since I designed and built the TDR, it has never failed to help me locate a transmission-line problem. I've found that the vast majority of transmission-line problems result from improper cable installation or connector weathering.

Building and using this TDR is fun. I'm sure you'll find the results to be worthwhile!

Notes

[1]This assumes a lossless transmission line. In real transmission lines there is some loss, so even if the load is perfectly matched to the line, the load will not dissipate 100% of the power applied to the line—some of the applied power will be lost *before* it reaches the load.

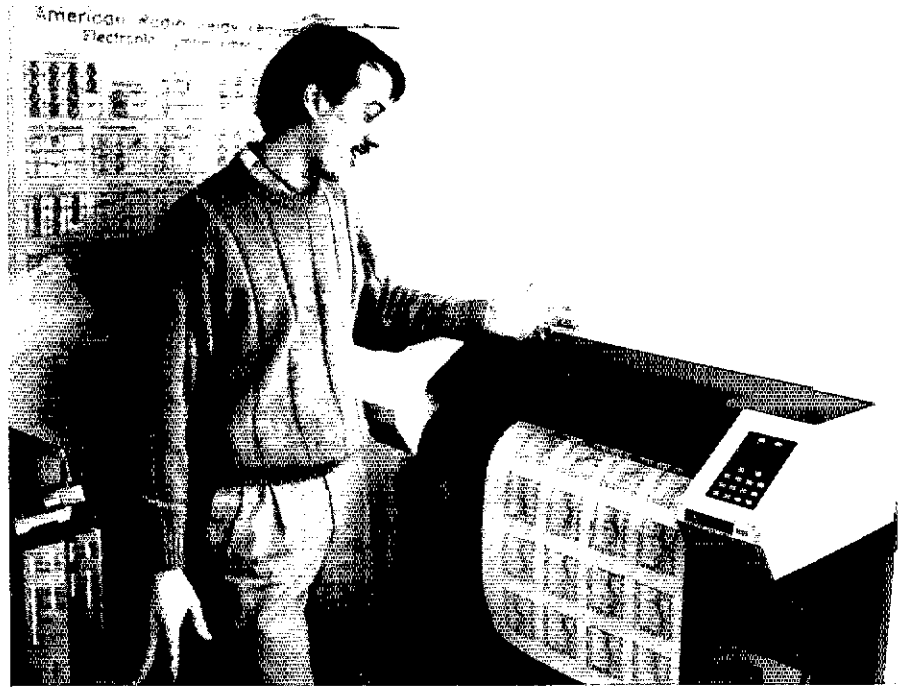
[2]Right-angle BNC connectors for use at J1 and J2 can be obtained from Newark Electronics 4801 N Ravenswood Ave, Chicago, IL 60640, tel 312-784-5100, part no. 89N1578. S1 can be obtained from All Electronics, PO Box 567, Van Nuys, CA 91408, tel 800-826-5432, part no. NISW-1 An SPST toggle switch can also be used at S1.

[3]Tests in the ARRL lab showed that a 50-MHz scope provides for much more accurate measurements, especially with short-length test cables.—*Ed.*

Reference

J. J. Carr, "Find Fault with Your Coax," *73 Magazine*, Oct 1984, pp 10-14.

Strays



Senior Technical Illustrator David Pingree explains the features of the plotter which, in conjunction with the Sun 386i computer-aided drafting system, produces the propagation charts for *QST*. (photo KC1MP)

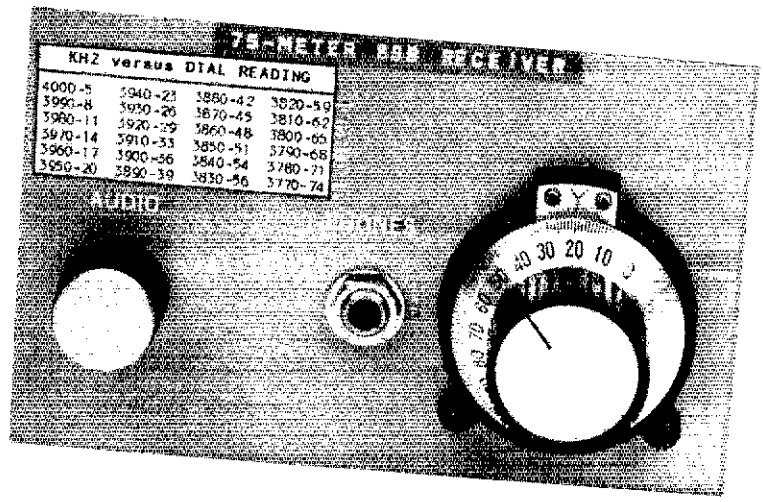
G3AYO RECEIVES ICELANDIC KNIGHTHOOD

☐ On February 14, 1989, Tony Welch, G3AYO, was created a Knight in the Icelandic Order of the Falcon and invested by the President with the Knight's Cross of the Order for long and distinguished service to Iceland. He has worked in the conception and development of an ATC radar system to promote safety and expedition for international air traffic traversing Icelandic airspace. Tony has been Consultant Radio Engineer to the Icelandic Civil Aviation Administration since 1970. During the course of his work, he has been able to assist the Icelandic Foreign Office, the Coast Guard, the PTT and the Engineering Institute of the University of Iceland.

Tony was chairman of CCIR Study Group which dealt with Amateur and Amateur Satellite Services. He has held a guest license in Iceland for many years and hopes to work old friends during his next visit.

Tony Welch, G3AYO, receives his Knight's Cross from Iceland's President Vigdis. *(photo courtesy Morgunbladid, Reykjavik)*

A Four-Stage 75-Meter SSB Superhet



Getting "the most for the least" is a typical ham radio objective for those who build circuits. This simple SSB superhet receiver is the product of such an effort.

By Doug DeMaw, W1FB
ARRL Contributing Editor
PO Box 250
Luther, MI 49656

"Must everything you design be for CW operation?" I have been asked this question many times. Perhaps my preference for CW work influenced my thinking when I sat down to design a new piece of gear. The circuit in this article is my "apology" for overlooking the voice operators who like to build homemade receivers. I want to stress that this four-stage receiver does not belong in the high-performance class. However, it is sensitive and stable, and it provides good audio quality.

Design Rationale

One objective when starting this project was to learn how few components could be used to develop a receiver with acceptable performance. A great deal of cutting and pruning took place over a one-month period of breadboard-circuit testing. I wanted to have *some* rejection of the unwanted sideband, but I also wanted to minimize the cost of a crystal filter. A low overall noise figure was also a criterion.

Another goal was to have a surplus of audio gain for even the weakest of SSB signals. Finally, the power consumption for the receiver should be modest enough to permit battery operation during emergency or field use. All of these objectives have been met.

Circuit Highlights

The tuning range of the circuit in Fig 1 is from 3.7 to 4.0 MHz. The FL1 and oscillator constants can be changed to provide coverage of the 80-meter CW band, should you prefer that to the SSB segment of the band. Filter information is presented in *The ARRL Electronics Data Book*.[1] A slight increase in inductance is needed for L5 in order to cover 3.5 to 3.7 MHz.

Although Q1 could be made to work as both a mixer and oscillator, I chose to isolate the oscillator from the mixer. Harmonic currents also inject the mixer when both circuits share a common transistor substrate. This causes all manner of spurious responses, and oscillator pulling may also be a problem. The injection waveform from the gate of Q3 is very clean.

FL1 is a band-pass filter with circuit values taken from the W7ZOI tables in the *Data Book*. Although the values specified in Fig 1 are for 3.8 to 4.0 MHz, the attenuation at 3.7 MHz is minor with the filter peaked at 3.85 MHz. There is some insertion loss through FL1 (about 2 dB). An earlier version of this receiver had a single, high-Q tuned circuit at the mixer input. Receiver sensitivity was better with that arrangement, but it was a nuisance to retune the input circuit when changing frequency. With the single tuned circuit a 0.35-μV signal was 3 dB above the noise floor of the receiver. A 3-dB rise occurs at 0.55 μV with FL1 in place. I should mention also that the single tuned circuit allowed signals from the image side of the mixer (20 meters) to pass through the receiver. The band-pass filter corrected the fault.

Should you want to cover both the 75- and 20-meter bands you can build a 20-meter version of FL1 and band switch the two filters. As with the 75-meter-only version, an IF of 9.0 MHz (Y1) is required. With this arrangement the 20-meter band will tune backwards from the 75-meter band, but upper- and lower-sideband reception will occur, as required, without changing the BFO frequency (Y2). This two-band scheme with a 5-MHz VFO is an old one!

In effect, the circuit in Fig 1 is a fixed-tuned direct-conversion receiver (Q2 and U1) with a tunable converter (Q1 and Q3) ahead of it. There are no IF amplifiers, and hence no AGC. Gain from an IF amplifier is not needed to ensure good performance. The overall receiver gain is approximately 75 dB. This is more than adequate for headphone reception.

Q2 serves as a crystal-controlled BFO and product detector. C14 is chosen to provide a BFO frequency that is roughly 1.3 kHz higher than the IF-filter crystal, Y1. (C12 and C13 lower the marked frequency of Y2.) A 50-pF trimmer can be used at W1/C14. You may want to eliminate C14 and order Y2 for a frequency that is 1.5 kHz higher than that of Y1. I found that I could shift a surplus 9.500-MHz HC-6/U crystal to 9.5013 MHz with C14 in place of W1, as shown. Changing C12 and C13 to 47 pF may help raise the Y2 frequency. I find that plated crystals in HC-6/U holders shift upward better than the small units in HC-18 holders. Crystals in FT-243 holders are not recommended for this application.

R3 is chosen to provide a relatively broad band-pass response for Y1. You may want to experiment with this value if you use crystals other than those listed in Fig 1. Filter ringing was a problem with a 100-kΩ value at R3. It appeared as a howl in the receiver output. C15 and C17 are used to prevent BFO energy from reaching U1. These capacitors also roll off the high-frequency audio response to minimize the effects of high-pitched audio energy.

[1]Notes appear on page 28.

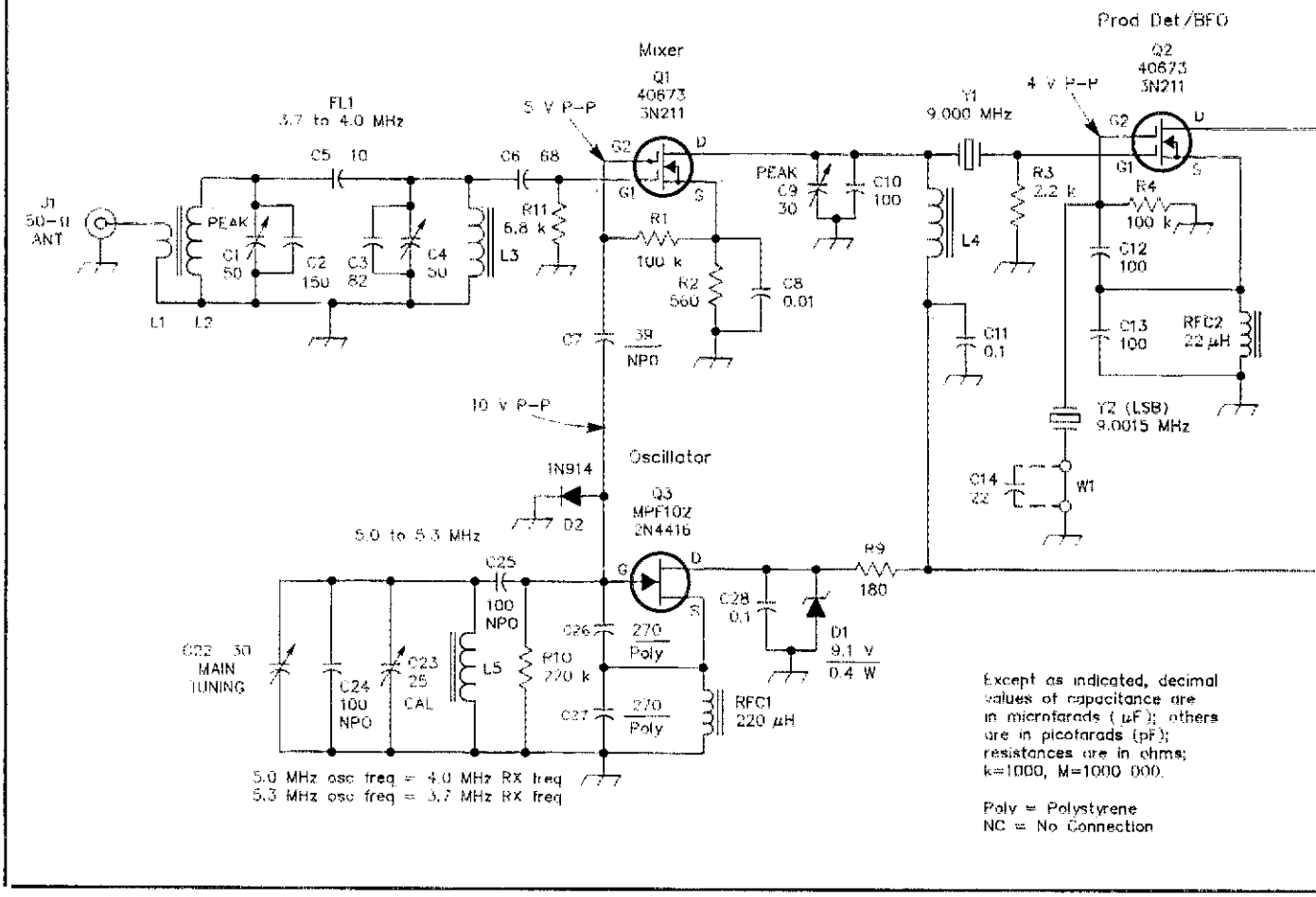


Fig 1—Schematic diagram of the simple SSB receiver. Fixed-value capacitors are disc ceramic unless otherwise noted. Polarized capacitors are tantalum or electrolytic. Fixed-value resistors are ¼-W carbon composition.

C1, C4, C9—Small plastic or ceramic trimmer, 50 or 60 pF. Small mica trimmers can be used also.
C2, C3, C10—Silver mica, polystyrene or NP0 disc.
C22—Miniature 30-pF air variable with shaft. Double-bearing type preferred. Should rotate smoothly.
C25—Ceramic trimmer capacitor. NP0 type preferred.
D1—9.1-V, 400-mW or 1-W Zener.
D2—Silicon high-speed switching diode, type 1N914.
L1—Four turns of no. 25 enam wire over L2 winding.
L2, L3—8.7-μH toroidal inductor; 44 turns of no. 28 enam wire on an Amidon Assoc T-50-6 toroid. Q_u = 170.
L4—2.6-μH toroidal inductor; 25 turns of no. 26 enam wire on an Amidon Assoc T-50-6 toroid.
L5—5.0-μH toroidal inductor; 33 turns of no. 22 enam wire on an Amidon Assoc T-68-6 toroid. Add two coatings of polystyrene Q Dope™ to winding for rigidity. Polyurethane varnish can be substituted.
Q1, Q2—Any dual-gate VHF MOSFET. RCA 40673 or 3N211 suitable.
R1—Audio-taper carbon-composition control.
RFC1, RFC2—Miniature ferrite-core RF choke (Mouser; see note 4).
Y1, Y2—9.0-MHz (Y1) and HC-6/U 9.0015-MHz (Y2) crystals (30 pF load capacitance). Available from JAN Crystals, 2341 Crystal Dr, PO Box 06017, Fort Myers, FL 33906, tel 800-237-3063. Catalog available.

The measured rejection of the unwanted (upper) sideband at 700 Hz (single tone) was 16 dB with a high-Q HC-6/U crystal at Y1. The closer the BFO frequency is to the IF, the worse the rejection. A two-crystal lattice filter can be substituted for Y1 if better rejection is desired. You may also want to consider a four-crystal ladder filter.[2]

Q3 operates as a Colpitts oscillator. C22 permits coverage from approximately 3.7 to 4.0 MHz. NP0 capacitors help to ensure acceptable long-term stability. NP0 units can be used at C26 and C27 to further improve the stability, although polystyrene capacitors are quite temperature stable.

Preventing Problems

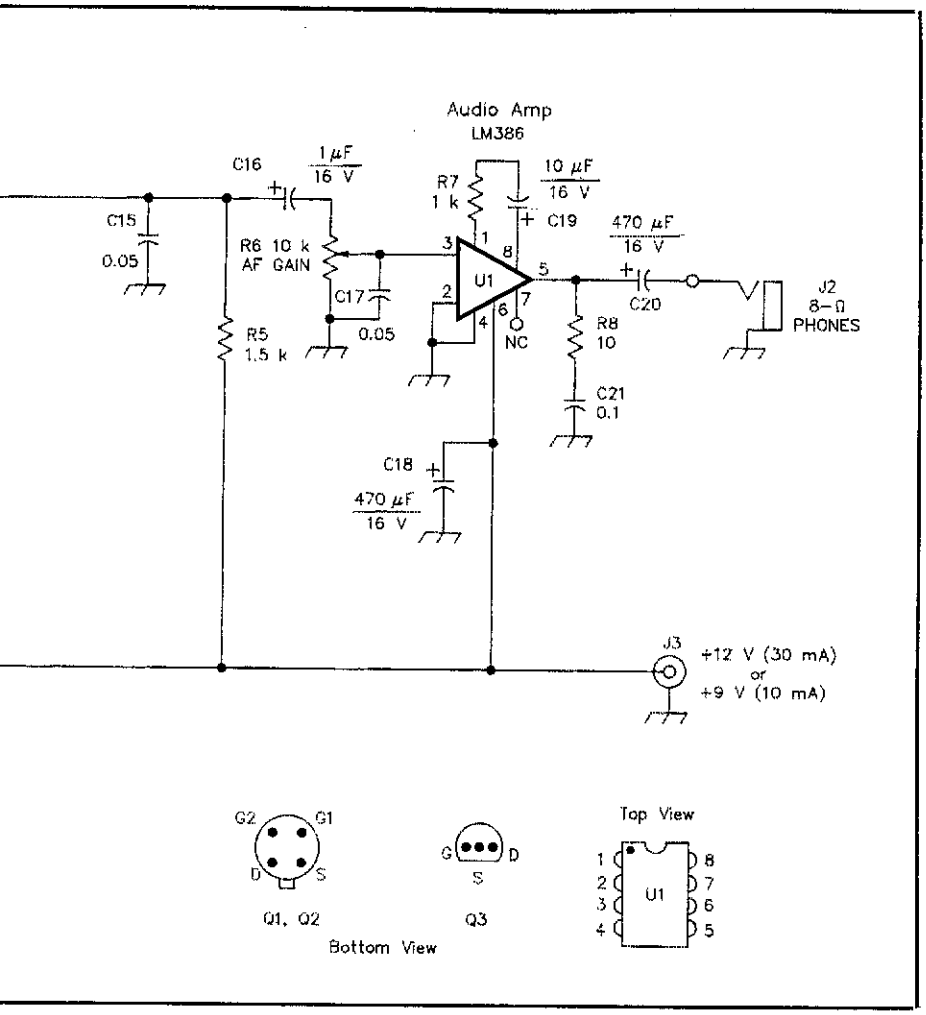
Owing to the high gain of U1, it is necessary to keep the leads going to the IC as short as practicable. C18 should be located as close to pin 6 as possible. R8 and C21 need to be close to pin 5 and C17 should be near pin 3. The gain of U1 can be increased by decreasing the value of R7, but instability lurks nearby when the chip gain is boosted!

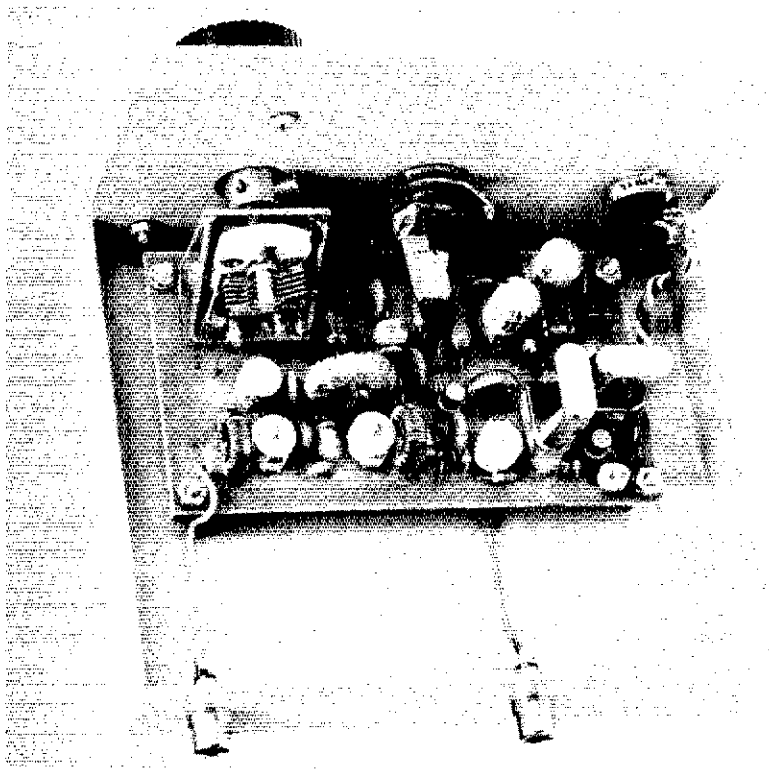
The value for RFC2 is critical. Too large an inductance value causes unwanted self-oscillation below 4 MHz. Use no more than 50 μH of inductance at RFC2.

Do not install Q1 and Q2 on the PC board until all of the other parts have been soldered in place. Dual-gate MOSFETs have fragile gate insulation, and static charges can perforate the insulation, thereby shorting the gates to the drain-source junction. Ground the tip of your solder pencil before soldering the FETs to the circuit board, and use minimum sustained heat.

Construction Comments

A PC-board etching pattern is provided in Fig 2. Boards for this project are avail-





Interior photo showing component layout. This circuit was designed with a minimum number of components, but optional modifications allow 20-meter coverage.

ARRL Lab Test Results

Tests of the model built by the author showed these results:

Minimum discernible signal (MDS): −99.0 dBm (decibels relative to a milliwatt) at 3800 kHz

Blocking dynamic range at 3800/3850 kHz: 76.0 dB

Two-tone, third-order dynamic range at 3800/3850 kHz: 59.0 dB

able from FAR Circuits.[3] A parts-placement guide is given in Fig 3. Single-sided PC board is used for this project.

Main-tuning capacitor C22 should be driven with a vernier mechanism to make tuning easy. An imported dial drive is suitable. The number scale can be used for frequency logging. Vernier drives are available by mail.[4] Surplus gear drives are available from dealers that sell WW II surplus.[5]

If C22 is not mounted securely to the receiver chassis or mainframe, cabinet flexing will cause mechanical frequency instability. Locate C22 as close to the Q3 circuit as possible.

Pads are available on the PC board for HC-6/U and HC-18/U crystals. The crystals can be soldered directly to the board, or you may install crystal sockets for Y1 and Y2. PC-board crystal sockets are available from International Crystal Manufacturing Co.[6]

Mount the receiver PC board by means of four metal spacers. This ensures that the ground foil of the board is well grounded to the mainframe. Proper grounding aids circuit stability.

Receiver Alignment

Use a frequency counter (or general-coverage receiver) coupled to RFC1 via a 50-pF capacitor to set 23 for the desired VFO range. The frequency range of the VFO is dependent on the crystal you select for Y1. In any event, it should have a 300-kHz range for coverage from 3.7 to 4.0 MHz. Adjust C22 for maximum capacitance and tweak C23 to obtain a 5.0-MHz reading on the counter.

Attach an antenna or signal generator to the input of FL1. Find a weak signal at approximately 3.85 MHz. Adjust C1 and C4 for maximum signal response. Repeat this step three or four times to overcome interaction between the resonators in FL1. Now, peak C9 for maximum signal level. There are no further adjustments, assuming that Y2 is on the proper frequency. You can check the Y2 frequency by sampling RF energy at the top end of RFC2 with a small-value capacitor.

Concluding Remarks

This receiver can serve as a foundation for further experimenting. For example,

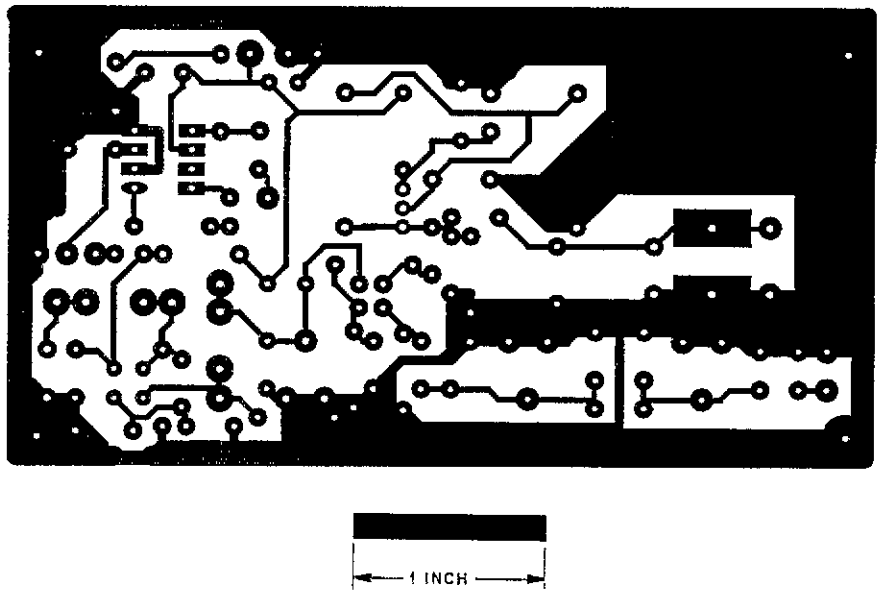


Fig 2—Circuit-board etching pattern for the receiver, shown full-size from the etched side of the board. Black areas represent unetched copper foil.

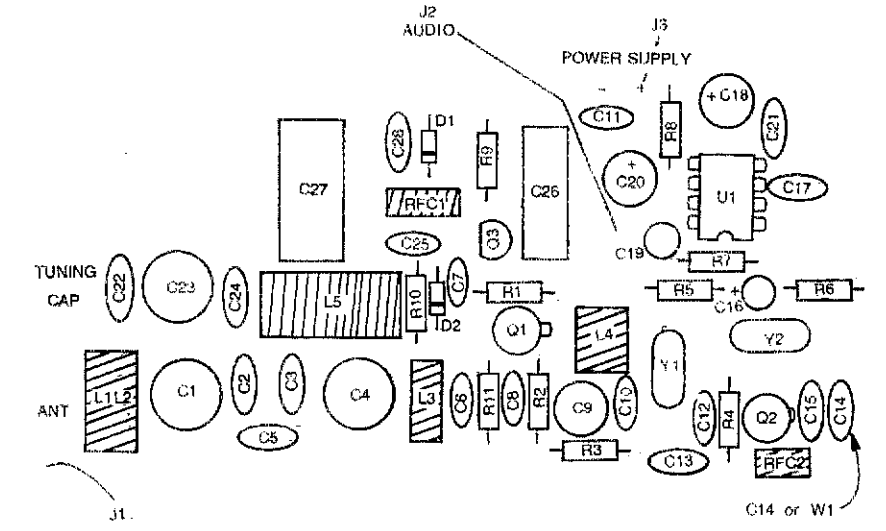


Fig 3—Parts-placement guide for the receiver. Parts are placed on the nonfoil side of the board; the shaded area represents an X-ray view of the copper pattern. Component outlines are not necessarily representative of the shapes of the actual parts used.

the IF filter can be improved, as discussed earlier. An RC active audio filter can also be added to improve the overall receiver selectivity.

Although this receiver will drive an 8-ohm speaker rather well for loud signals, it falls short of the mark on weaker signals. This can be corrected by inserting a one-stage audio amplifier between Q2 and U1. A 2N3904 or 2N2222 can provide the extra gain needed for speaker operation. If this is done, add a 100-Ω resistor and 22-μF bypass capacitor to the supply lead that feeds Q2. This will decouple the audio circuits and prevent motorboating.

An S meter can be added by sampling the audio signal at the drain of Q2. Amplify the sampled audio with a 741 op amp, then rectify it with a 1N914 diode and filter it. A microammeter can be driven with the rectified audio to produce meter readings.

A class-A broadband RF amplifier can be added between FL1 and Q1 to enhance the receiver sensitivity. Circuits for these optional changes are given in *Solid State Design for the Radio Amateur* (ARLB).[7]

It should be a simple matter to modify this receiver for operating on other amateur bands. Only the VFO and FL1 need to be changed.

Notes

[1]Available from ARRL HQ ($12 plus $2.50 postage and handling, or $3.50 for insured Parcel Post or UPS) or from your local dealer.
[2]W. Hayward, "Designing and Building Simple Crystal Filters," *QST*, July 1987, p 24.
[3]$6 (including shipping to US addresses) from FAR Circuits, 18N640 Field Ct, Dundee, IL 60118, tel 312-426-2431, evenings.
[4]Mouser Electronics, 2401 Hwy 287 N, Mansfield, TX 76063, tel 817-483-4422. Catalog available.
[5]Fair Radio Sales Co, 1016 E Eureka St, PO Box 1105, Lima, OH 45802, tel 419-223-2196. Catalog available.
[6]International Crystal Manufacturing Co, Inc, PO Box 26330, 701 W Sheridan, Oklahoma City, OK 73126-0330, tel 405-236-3741.
[7]Available from ARRL for $12 (plus $2.50 postage and handling, $3.50 for insured Parcel Post or UPS) or from your local dealer.

QEX: THE ARRL EXPERIMENTER'S EXCHANGE AND AMSAT SATELLITE JOURNAL

The April issue of *QEX* includes:

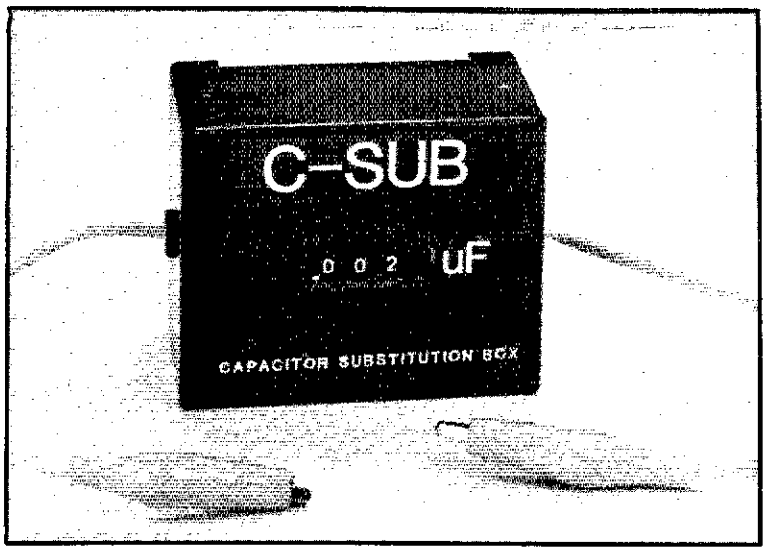
- "A Selective Calling Decoder for MF/HF Radio Systems," by Paul Newland, AD7I. If you've been looking for an effective selective-calling decoder for MF/HF SSB use, here's a unit that provides many features with simple hardware.
- "Correspondence" contains updates and corrections from Steve Powlishen, K1FO, concerning his November 1988 *QEX* article, "Characteristics of Some Common Power Tubes at 432 MHz."
- "Components," by Mark Forbes, KC9C. Response from reader survey: Where to buy components in small quantity.

QEX is edited by Paul Rinaldo, W4RI, and is published monthly. The special subscription rate for ARRL/AMSAT member is $10 for 12 issues; for nonmembers, $20. There are additional postage surcharges for mailing outside the US; write to HQ for details.

Strays

I would like to get in touch with...

☐ anyone who has pre-WW II cryptographic equipment or devices, for research and photographic purposes. Lou Kruh, WB2EZK, 17 Alfred Rd W, Merrick, NY 11566.



The C-SUB

Here's a cheap and easy-to-build capacitor-substitution box that's sure to come in handy!

By James C. Patrick
253 Lancaster Ave
Staunton, VA 24401

For those math calculations that don't work out right, for those instructions that tell you to "use an appropriate capacitor value" (and don't explain what "appropriate" means), the C-SUB is your answer. C-SUB comes in handy when you're trying to find the replacement for unmarked or destroyed capacitors. Use the C-SUB to quickly and easily find just the right capacitance value you need in that circuit you're dealing with.

Description

This simple capacitor-substitution box uses only three different capacitance values and three BCD (binary coded decimal) thumbwheel switches. Each BCD switch position (decimal numbers 0-9 on the dial) provides binary-coded connections on the switch's integral PC board. With 4 showing on the switch dial, only terminal 4 is connected to the switch's common terminal; dialing up 7 connects terminals 4, 2 and 1 (4 + 2 + 1 = 7) to the common terminal. Table 1 (the switch's truth table) shows which switch terminals are connected to the common terminal for each setting of an individual switch dial.

You'll recall that connecting two capacitors of the same value in *parallel* with each other *doubles* the capacitance values. Also, connecting two capacitors of the same value in *series* with each other *halves* the total value of capacitance. We can use these capacitor characteristics to our advantage. By properly connecting capacitance values of 0.002, 0.02 and 0.2 μF to three BCD switches, we can cover a capacitance range of from 0.001 to 0.999 μF using only three capacitance values. Of course, we'll need more than three capacitors to do this—a total of 27, to be exact.

Building the C-SUB

The pictorial diagram of the C-SUB is shown in Fig 1. An inside view of the prototype appears in Fig 2. There's no need for component-mounting strips—all of the capacitors can be attached directly on the BCD switches.

First, prepare the enclosure to accept the switches, but don't mount them until all of the capacitors have been attached. For my C-SUB, I used a small aluminum box (1-5/8 × 2-1/8 × 2-3/4 in. HWD) and cut a rectangular hole in the cover to hold the three switches. Also, drill two holes in the sides of the box to pass the test leads. Place rubber grommets in the holes to prevent the wires from chafing.

Connect the capacitors to the switches, starting with the units-position (.00X) switch (see Figs 1 and 2). Solder four 0.002-μF capacitors in parallel with each other, and attach one end of the assembly to terminal 8. Parallel two 0.002-μF capacitors and solder one end of the pair to terminal 4. Solder a single 0.002-μF capacitor to terminal 2. Then, solder two 0.002-μF capacitors *in series*, and attach one end of the pair to terminal 1. Next, connect together all the free ends of the capacitors.

Repeat the foregoing procedure for the tens- (.0X0) and hundreds-position (.X00) switches. Use 0.02-μF capacitors with the tens-position switch and 0.2-μF capacitors with the hundreds-position switch.

Now, fasten together the three switch assemblies and the end plates. Make sure the .X00 switch is at the left and the .00X switch on the right. You can make the decimal point (see the title photo) by using a toothpick dipped in white enamel paint.

Solder one test lead to the joint side of the three capacitor groups (see Fig 1) and connect the other test lead to all the common (C) terminals on the switches. Insert the completed assembly into the box, secure the switches in place (I used epoxy), attach alligator clips to the test leads, and the C-SUB is ready to go to work for you!

Table 1
Truth Table for the BCD Switches

Dial Setting	Terminal(s) Connected To Common			
	8	4	2	1
0				
1				X
2			X	
3			X	X
4		X		
5		X		X
6		X	X	
7		X	X	X
8	X			
9	X			X

Using the C-SUB

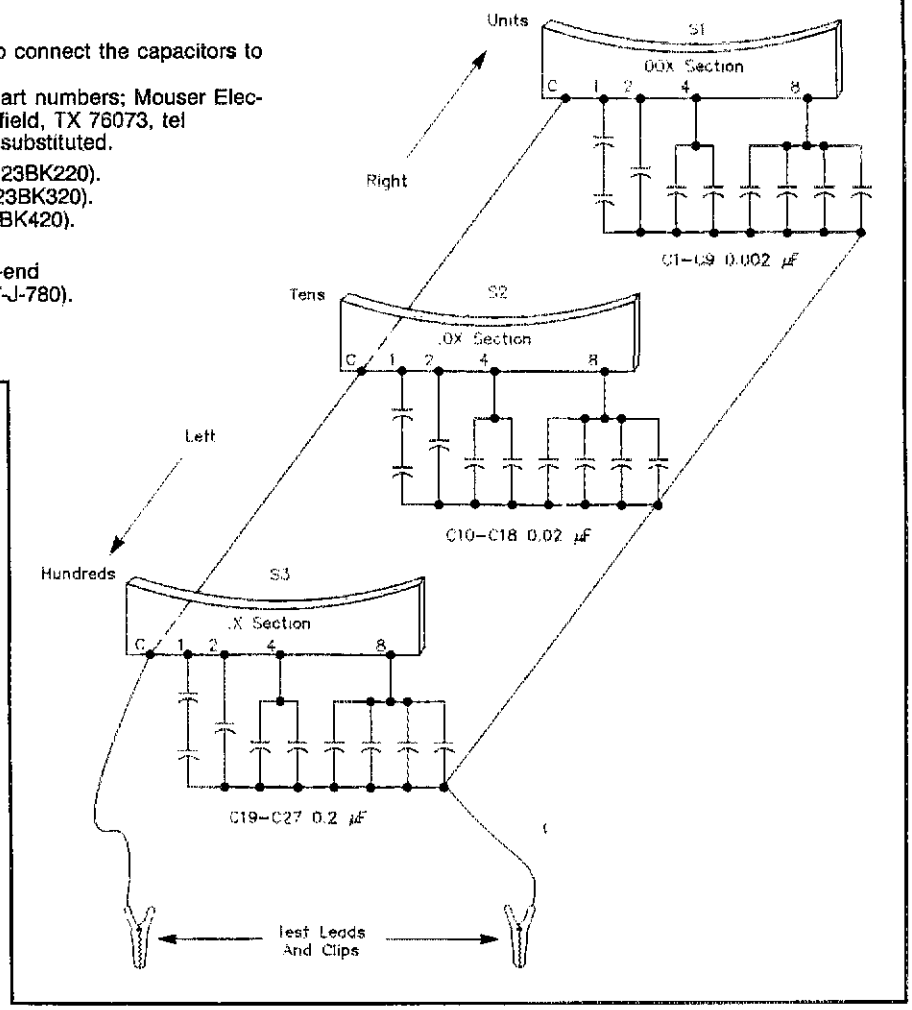
Most of the time, using the C-SUB simply means attaching the two clip leads of the C-SUB to the proper points in the circuit you're dealing with and setting the capacitance value by means of thumbwheel switches. When the circuit is performing the way it should (assuming nothing else is wrong), read the capacitance value from the thumbwheel-switch settings and install a capacitor of that value; nearest standard values will work in most cases. When you're troubleshooting a circuit and suspect a faulty capacitor is the problem, it's good practice to disconnect one lead of the suspect capacitor from the circuit before inserting the C-SUB in its place.

If you're experimenting with an RC timing circuit, you can use the C-SUB to easily change the timing-capacitance values.

Fig 1—Pictorial diagram showing how to connect the capacitors to the BCD switches.
Numbers in parentheses are Mouser® part numbers; Mouser Electronics, 2401 Highway 287 North, Mansfield, TX 76073, tel 817-483-4422. Equivalent parts may be substituted.

C1-C9—0.002 μF/100 V, 10%, Mylar® (23BK220).
C10-C18—0.02 μF/100 V, 10%, Mylar (23BK320).
C19-C27—0.2 μF/100 V, 10% Mylar (23BK420).
S1-S3—BCD switch (ME106-9801).

Misc: right-end plate (ME106-9802), left-end plate (ME106-9803), aluminum box (537-J-780).



In oscillator circuits, you can determine feedback/divider ratios for reliability and easy starting. C-SUB can help in selecting the best value of capacitance to use in coupling between circuit stages.

You should realize that the C-SUB does have some limitations—as does all test equipment. With the capacitors specified, the maximum potential applied to the C-SUB's clip leads should not exceed 100 V. So, don't try using this particular version of C-SUB in high-voltage environments! Also, the capacitor and test lead lengths will introduce added circuit inductance and, depending on the circuit and frequency of operation, unwanted feedback paths. Each BCD switch itself exhibits about 5 to 7 pF of stray capacitance. Lastly, if you use the most-significant decade (hundreds position), the least-significant decade (units) will probably not be accurate. Accuracy also depends on the tolerance of the capacitors used.

The C-SUB is an inexpensive, easy-to-build project. Have fun building your own! You'll find it to be a helpful companion at, and away from, the workbench.

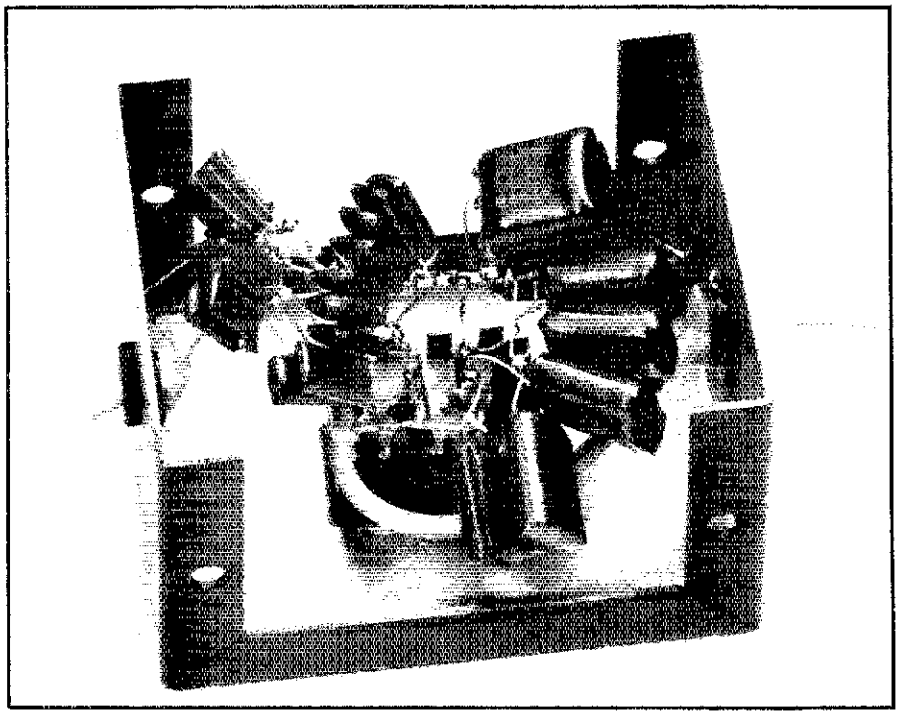


Fig 2—An inside view of the C-SUB.

James Patrick is an avid experimenter, SWL and LOWFER. He is a Component Specialist for Comsonics Inc, a manufacturer for the CATV industry. Crediting ARRL publications for most of his electronic education, Jim is progressing towards his ticket with help from Thomas Benson, WA4ESI, and Cowles Andrus, III, KB4CNI. Jim welcomes technical correspondence sent to his home address. 73

Strays

I would like to get in touch with...

☐ anyone who has specifications, schematics or an operating manual for an ALECTRA (EMI Division) CEC, Model 11B DBM/DBA meter. J. M. Scovill, W7GSZ, 9015 42nd Ave NE, Seattle, WA 98115.

Simple Low-Noise Microwave Preamplifiers

These preamplifiers cover the 2.3- to 10-GHz ham bands. They offer good performance, yet require no RF alignment!

By Al Ward, WB5LUA
Rte 9, Box 132
McKinney, TX 75069

One of the hurdles to overcome in building a microwave station is construction of a good low-noise preamplifier. Techniques using lumped constants (capacitors and inductors) that work well at lower frequencies are often difficult to realize above 2304 MHz. Once a design is worked out and the preamplifier built, the unit must then be tuned for minimum noise figure (NF) before any sort of reasonable performance can be expected. Preamplifier tune-up itself presents a hurdle because many hams don't have access to NF test equipment that is accurate in the microwave region.

This article describes the design and construction of low-noise amplifiers (LNAs) for 2.3, 3.4, 5.7 and 10 GHz. If the LNAs are duplicated exactly from the information presented, no RF adjustments are required. Just bias their active devices properly, and the units are ready to go—with NFs under 1 dB at frequencies up to 5.7 GHz and around 1.5 dB at 10.368 GHz!

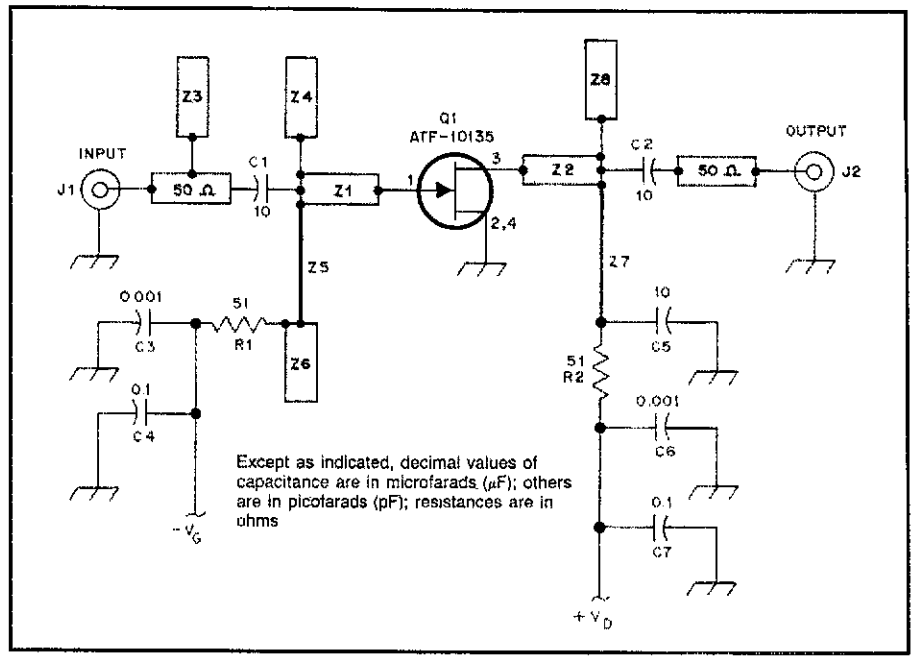


Fig 1—Schematic of the 2.3-GHz preamplifier. Z1 through Z8 are microstriplines etched on the PC board. Shaded rectangles marked "50 Ω" are 50-Ω transmission lines etched on the PC board. All resistors and capacitors are chip types. C1, C2 and C5 can be 0.05- or 0.1-in. square. C4 and C7 enhance "low-frequency" bypassing. J1 and J2 are SMA female connectors; see text.

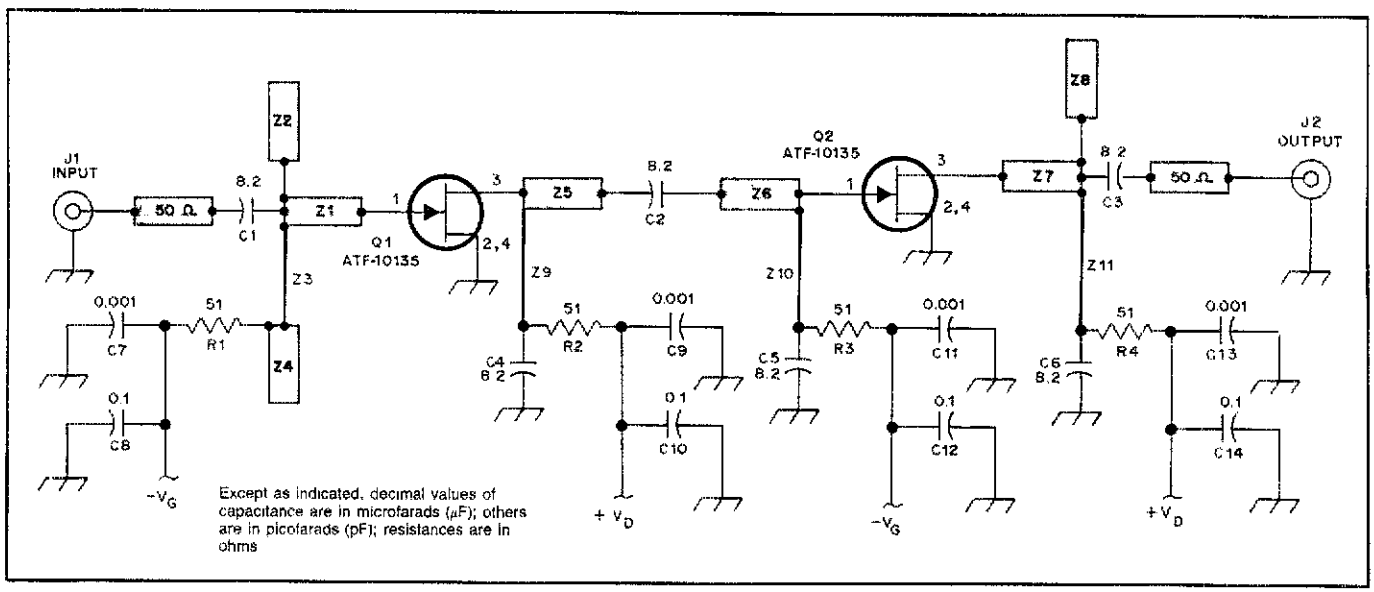


Fig 2—Schematic of the 3.4-GHz preamplifier. Z1 through Z11 are microstriplines etched on the PC board. Shaded rectangles marked "50 Ω" are 50-Ω transmission lines etched on the PC board. All resistors and capacitors are chip types. C1-C6 are 0.05-in. square. C8, C10, C12 and C14 enhance "low-frequency" bypassing. J1 and J2 are SMA female connectors; see text.

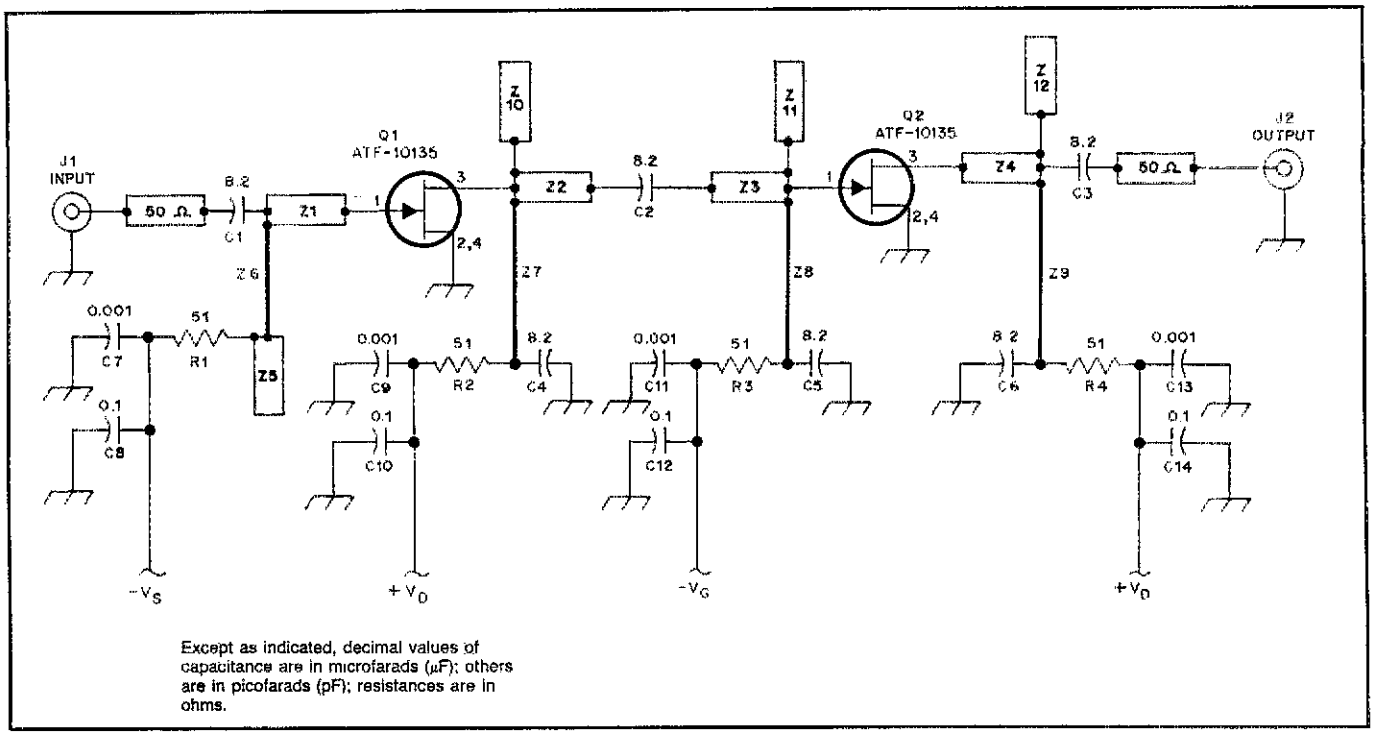


Fig 3—Schematic of the 5.7-GHz preamplifier. Z1 through Z12 are microstriplines etched on the PC board. Shaded rectangles marked "50 Ω" are 50-Ω transmission lines etched on the PC board. All resistors and capacitors are chip types. C1-C6 are 0.05-in. square. C8, C10, C12 and C14 enhance "low-frequency" bypassing. J1 and J2 are SMA female connectors; see text.

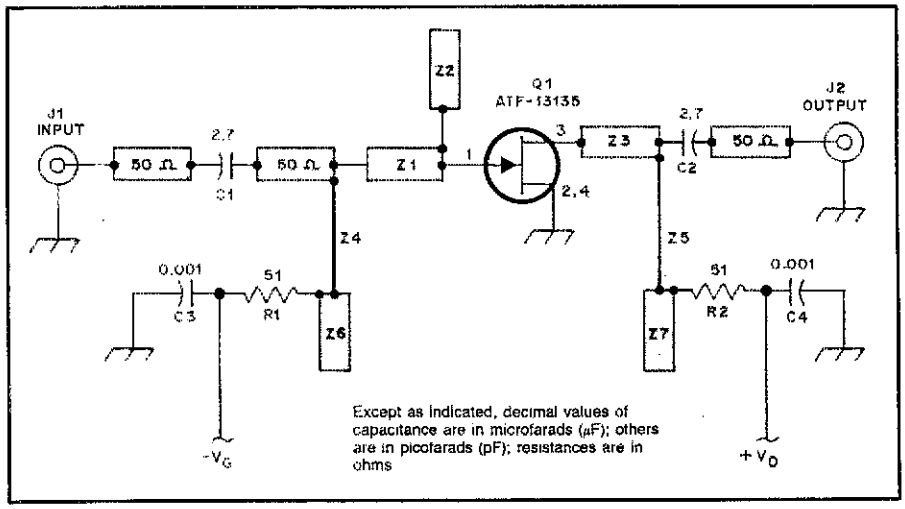


Fig 4—Schematic of the single-stage 10-GHz preamplifier. Z1 through Z7 are microstriplines etched on the PC board. Shaded rectangles marked "50 Ω" are 50-Ω transmission lines etched on the PC board. All resistors and capacitors are chip types. C1 and C2 are 0.05-in. square (ATC Type A capacitors are preferred). J1 and J2 are SMA female connectors; see text.

The 10-GHz amplifier is designed around the Avantek ATF-13135 GaAsFET, and the lower-frequency units are designed around the Avantek ATF-10135. Both devices have a nominal gate length of 0.3 micron. The ATF-10135 has a total gate periphery of 500 microns. The ATF-13135 has a gate periphery of 250 microns, making it more appropriate for higher-frequency operation. Best of all, these transistors are *not* high-priced exotics: The ATF-10135 sells for about $12.00, and the ATF-13135 is about $29.00 in small quantities.

Circuit Description

Schematics for the preamplifiers are shown in Figs 1 through 5. Fig 1 shows a single-stage 2.3-GHz design. Figs 2 and 3 show two-stage preamplifiers for 3.4 and 5.7 GHz. Figs 4 and 5 show single- and two-stage 10-GHz LNAs.

The same basic circuit configuration is used for each preamplifier. All impedance matching is accomplished with microstriplines. None of the amplifiers contain adjustable RF components. Fixed-value capacitors are used for input, output and interstage coupling. Fixed-value capacitors and resistors are also used in the gate- and drain-bias decoupling circuitry.

I did the initial design for these preamplifiers with the aid of a Smith Chart and optimized them through computer simulation. LNA design is made considerably easier by computer-aided-design software. I was fortunate to have access to Touchstone®, an RF design program made by EESOF.

One of the most important parameters that the computer can analyze is stability. Proper choice of components in the bias decoupling networks and the use of source inductance in the form of source-lead length helps to maintain stability. The results are improved input and output SWR while maintaining low noise figure and moderate gain. In the case of the 3.4, 5.7 and 10-GHz amplifiers, the effect of the "through-the-board" mounting of the source leads is taken into account in the design so that no plated-through holes are necessary to achieve good performance. An in-depth design analysis of these preamplifiers will be covered in a future *QEX* article.

Bias Networks

To minimize circuit losses, ground the GaAsFET source leads directly to the ground plane. To operate these devices with their source leads at dc ground, you must

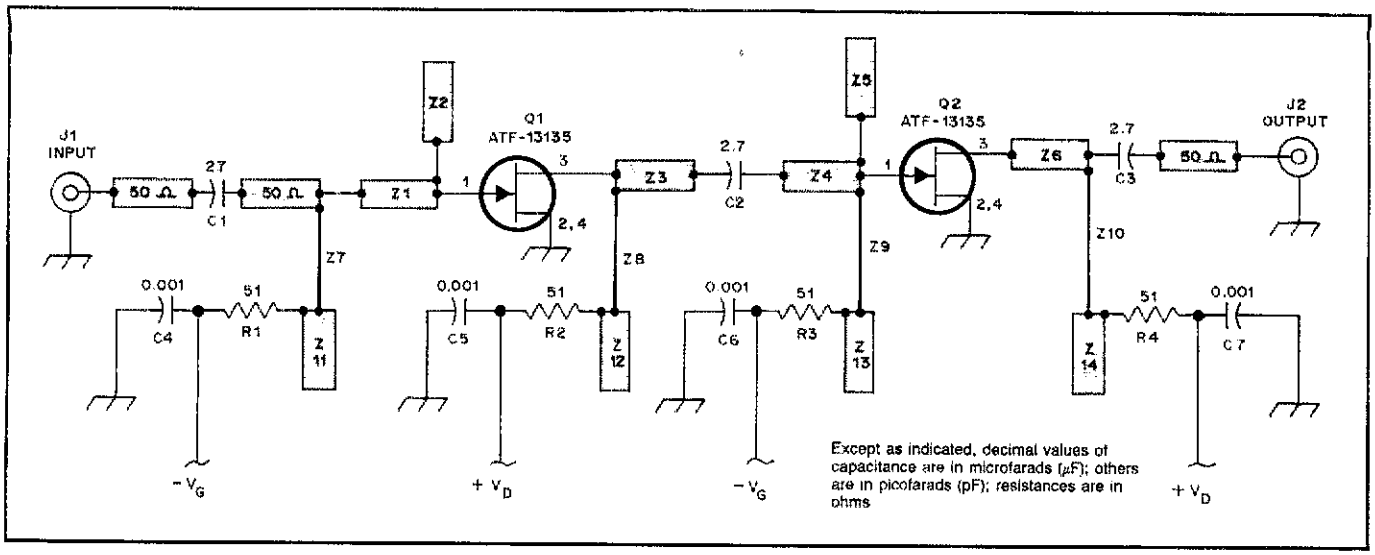


Fig 5—Schematic of the two-stage 10-GHz preamplifier. Z1 through Z14 are microstriplines etched on the PC board. Shaded rectangles marked "50 Ω" are 50-Ω transmission lines etched on the PC board. All resistors and capacitors are chip types. C1-C3 are 0.05-in. square (ATC Type A capacitors are preferred). J1 and J2 are SMA female connectors; see text.

bias each device's gate negatively relative to its source. This can be done in a number of ways, so I left bias circuitry off the PC boards.

Three basic bias circuits are shown in Fig 6. Two are passive. The third—and most desirable—is an active bias network that uses a PNP transistor to set the GaAsFET drain voltage and current.

The simplest bias network, shown in Fig 6A, uses a 3.3-V Zener diode to set the drain voltage. A 1.5-V AA cell is used for the bias supply. Bias, applied through R1, sets the gate voltage, which in turn determines the drain current. Generally, the AA cell is connected so that there is always a negative voltage applied to the gate. The preamplifier is then turned on by connecting V_D to a positive voltage source. Because there is a 51-ohm resistor in series with the drain, there is some interaction between drain voltage and drain current: Greater drain current produces a lower drain voltage. The gate voltage required to properly bias the device varies from unit to unit because of slight variations in pinch-off voltage. (Pinch-off voltage is the gate voltage required to turn the FET off.) A disadvantage of this simple bias circuit is that it lacks compensation for bias changes over temperature variations. Although not optimum, this technique has been used at WB5LUA and WA5VJB with good results. A high-grade, long-life alkaline AA-size cell should last several months before its voltage drops low enough to cause the FET to draw excessive drain current.

An adaptation of the simple passive bias configuration is shown in Fig 6B. Drain voltage is again provided by a 3.3-V Zener diode, but this circuit replaces the AA cell with a positive-to-negative voltage inverter. Several manufacturers make suitable inverter ICs. A less-expensive approach is to use a common 555 timer in the simple inverter circuit shown. With simple battery bias, the negative supply is continuously applied to the FET gate. With the inverter of Fig 6B, gate and drain supplies are simultaneously applied to the FET. This approach has been used by manufacturers of satellite TV receiving equipment for years. Although there can be problems if the drain voltage is applied before the negative gate voltage, the 51-ohm resistor

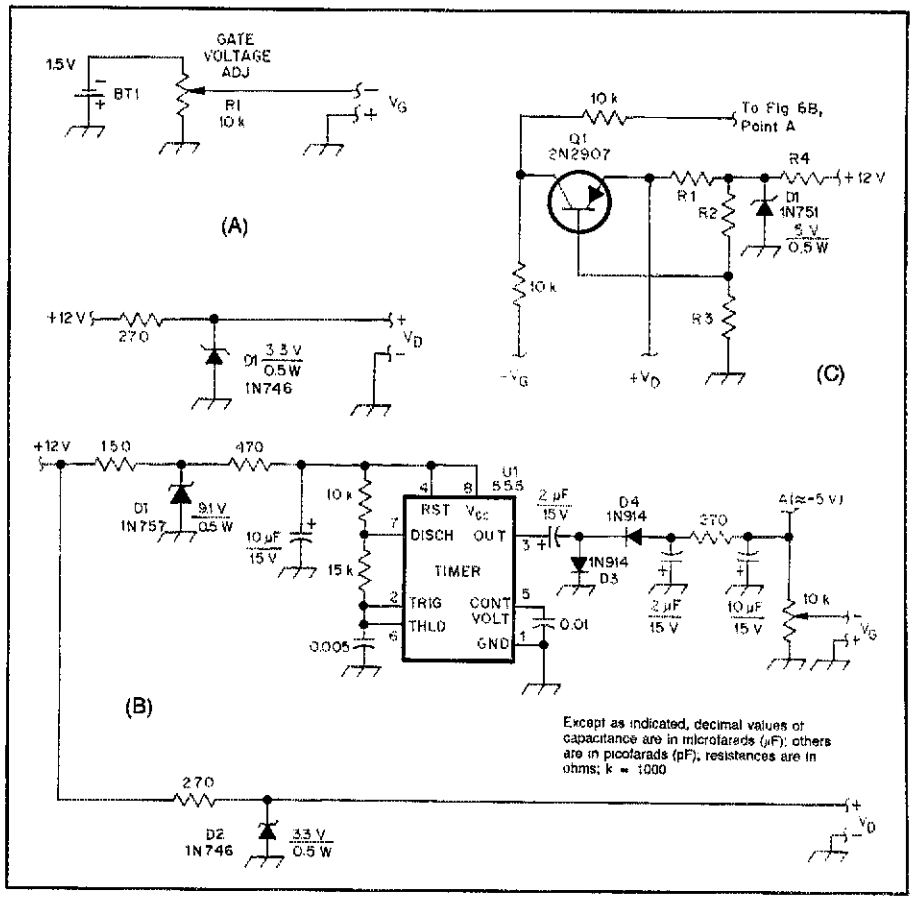


Fig 6—Bias circuits for the preamplifiers. See text for discussion. The passive circuit at A uses a 1.5-V cell for the gate supply and a Zener diode to stabilize the drain supply. The circuit at B, another passive arrangement, uses a 555 timer IC to generate negative gate bias, and a Zener diode to stabilize the drain supply. C shows an active bias circuit. The values of R1, R2 and R3 can be varied for different FET operating conditions; see text and Table 1. The value of R4 should be chosen so that 10-15 mA of Zener current flows when the FET (or FETs, for a two-stage design) is powered at rated bias.

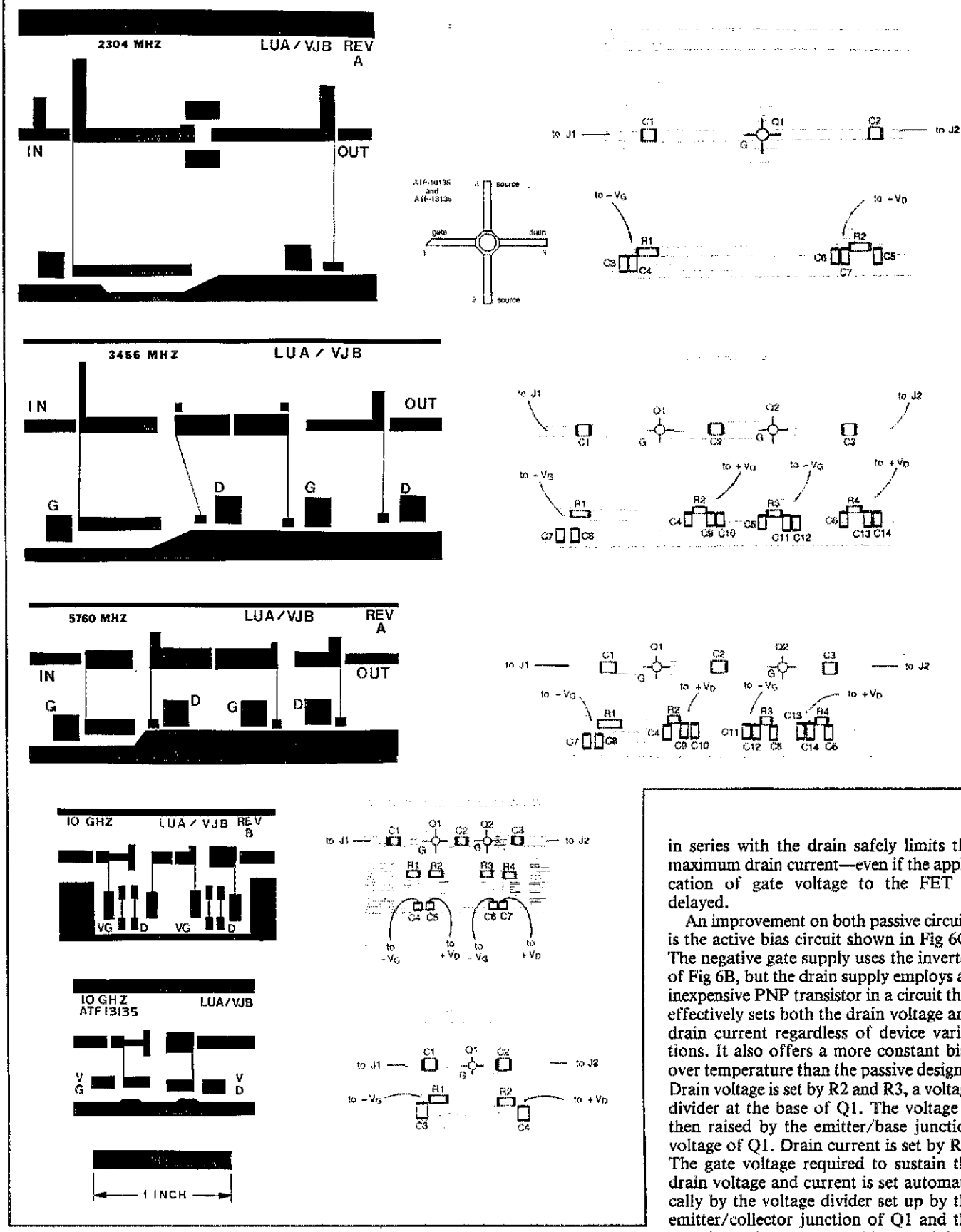


Fig 7—Circuit-etching patterns and parts-placement guides for the preamplifiers. The etching patterns are shown at full size. PC board material is double-sided, 0.031-in-thick Rogers Duroid 5880 or Taconic TLY-5 (dielectric constant, 2.2). Black areas represent unetched copper foil. The back side of the board is left unetched to act as a ground plane. The parts-placement guides are *not* shown at their actual size. All components mount on the etched side of the board.

in series with the drain safely limits the maximum drain current—even if the application of gate voltage to the FET is delayed.

An improvement on both passive circuits is the active bias circuit shown in Fig 6C. The negative gate supply uses the inverter of Fig 6B, but the drain supply employs an inexpensive PNP transistor in a circuit that effectively sets both the drain voltage and drain current regardless of device variations. It also offers a more constant bias over temperature than the passive designs. Drain voltage is set by R2 and R3, a voltage divider at the base of Q1. The voltage is then raised by the emitter/base junction voltage of Q1. Drain current is set by R1. The gate voltage required to sustain the drain voltage and current is set automatically by the voltage divider set up by the emitter/collector junction of Q1 and the negative voltage source. About −1 V is supplied to the FET gate.

Table 1 gives resistor values for various bias conditions. I suggest building a separate active bias network for each FET stage to properly set each device's bias

Table 1

Active Bias Circuit Values for Various Drain Currents

V_{DD} (V)	V_{DS} (V)	I_D (mA)	R1 (Ω)	R2 (kΩ)	R3 (kΩ)
3.5	2.5	20	75	2.2	2.8
3.25	2.5	15	117	2.2	2.3
4.0	3.0	20	50	2.2	4.3

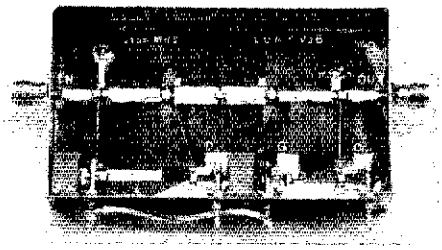


Fig 8—This prototype two-stage 3.4-GHz preamplifier was built by the author. The enclosure is made from sheet brass soldered to the PC board (see text). The trimmer potentiometers are for adjustment of the gate supply for each stage.

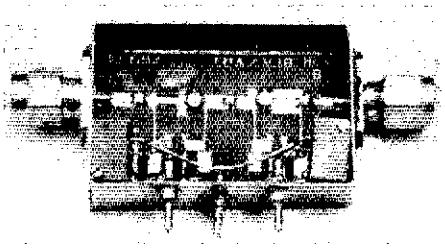


Fig 9—A completed two-stage 10-GHz preamplifier.

point. I have, however, used a single active bias supply to power a two-stage amplifier with good success. If the devices are fairly well dc matched (drain current v gate voltage), this technique will be okay. It will not, however, keep the device drain currents equal if they are not dc matched.

The active bias arrangement can also be used with a battery instead of the voltage inverter. Since the active bias network automatically adjusts gate voltage for a required bias condition, the circuit will adjust the gate voltage as it drops with battery age. The gate requires about −1 V, so the battery can age significantly before the FET bias condition is altered significantly. If this technique is used, it is best to start out with a 5- to 6-volt battery source. The active bias network will compensate for a battery voltage deteriorating to 1-1.5 V. Active bias networks are discussed in greater detail in Avantek application note AN-A002.[1]

Construction

Construction of all amplifiers is similar. Etching patterns and parts-placement guides are shown in Fig 7. All amplifiers are etched on 0.031-inch-thick Duroid 5880 or Taconic TLY-5 PC-board material with a dielectric constant of 2.2. The etched PC board can be installed in a housing such as a die-cast aluminum box. Another method, one that I prefer, is to solder thin (0.02-inch-thick) brass side walls to the PC board to form a shielded enclosure. The brass walls also connect the top and bottom ground planes, which is essential for low-loss "low-frequency" bypassing. Power connections for V_G and V_D can be made via 0.001-μF feedthrough capacitors soldered to the brass walls. See Figs 8 and 9.

SMA-type end-launch connectors are used for J1 and J2 to provide a low-loss transition from coaxial cable to the microstripline. Two- or four-hole gold-plated connectors are easily soldered to the PC board or brass side walls, depending on your assembly technique. End-launch connectors are preferred to the right-angle type because of the impedance discontinuity associated with the right-angle transition. Additional amplifier tuning may be required if right-angle connectors are used.

The type and size of the chip capacitors used in these amplifiers becomes increasingly important as frequency increases. For the blocking capacitors, I strongly recommend using good-quality RF-type ceramic chip capacitors, such as those made by ATC. The values specified are common and should not be hard to find. The physical size of the capacitors is especially critical at 10 GHz, where the 0.05-inch-square type *must* be used. Anything larger produces a sizable mismatch on the microstripline.

The value of the "low-frequency" bypass capacitors is less critical. Anything in the 820- to 1500-pF range will work fine. The value of the "high-frequency" bypass capacitors is somewhat more critical, though. Stay within 10% of the values indicated. Again, use good-quality capacitors for "high-frequency" bypassing.

To obtain a low noise figure, the preamp's FET source leads must be properly grounded. In the case of the 3456-MHz and higher-frequency preamplifiers, bend the FET source leads down right at the case and insert them through slots in the PC board. See Fig 10. The slots can be made with a sharp hobby knife or something similar. Be sure to clean up the area where the leads will pass through the slots by removing any extra dielectric material or copper. The source leads should be passed through the board, again bent at right angles and laid neatly along the bottom foil. Solder them to the bottom ground plane and try to force the solder to cover the length of the slot if possible.

Device installation is different with the 2304-MHz preamplifier because additional source-lead inductance is required. This inductance is added by making each FET

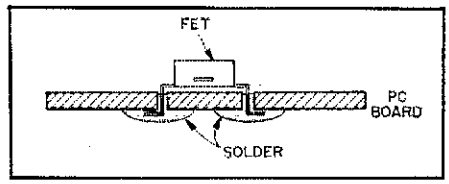


Fig 10—The FET source leads are bent, inserted through slots cut in the PC board, and soldered to the ground plane. See text.

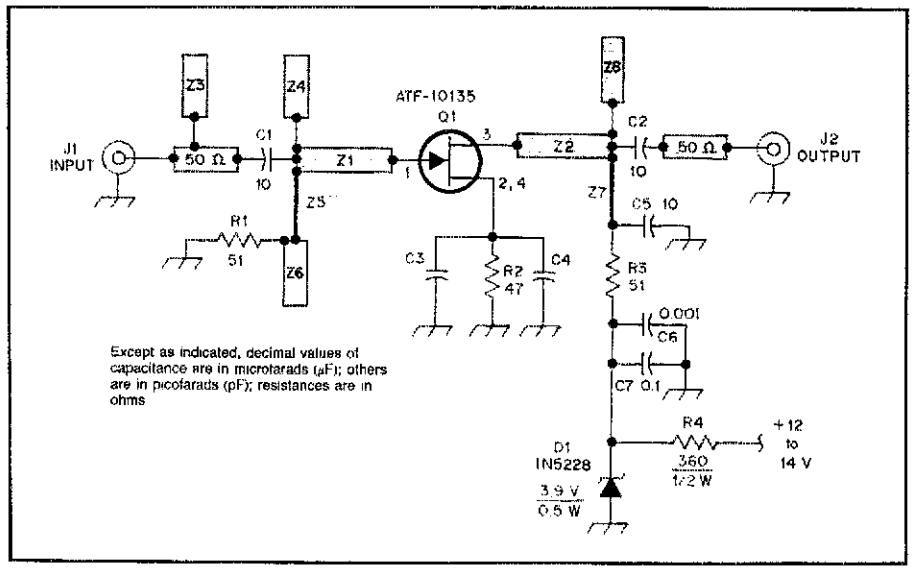


Fig 11—Schematic diagram of the self-biased version of the 2.3-GHz preamplifier. Z1 through Z8 are microstriplines etched on the PC board. Shaded rectangles marked "50 Ω" are 50-Ω transmission lines etched on the PC board. All capacitors are chip types.

C1, C2, C5—0.05- or 0.1-in. square chip capacitor.
C3, C4—470- or 1000-pF leadless, round, disc-ceramic capacitor (see text).
J1, J2—SMA female connectors (see text).
R1, R3—51-Ω chip resistor preferred; ¼-W carbon-film resistor with short leads should be okay.
R2—47-Ω ¼-W carbon-film resistor.

[1]Notes appear on page 75.

Table 2

Actual Preamplifier Performance Versus Computer Simulation and Projected Worst-Case Performance

Device	Freq (GHz)	Bias per device	Gain (dB) Typ	Gain (dB) Worst Case	Gain (dB) Simul	Noise Figure (dB) Typ	Noise Figure (dB) Worst Case	Noise Figure (dB) Simul
ATF-10135*	2.3	2 V @ 20 mA	13.5	12.0	13.9	0.5-0.6	0.8	0.60
ATF-10135**	2.3	2 V @ 20 mA	13.0	12.0	13.0	0.65	0.9	0.70
ATF-10135	3.4	2 V @ 20 mA	23.0	22.0	24.1	0.8-0.9	1.0	0.58
ATF-10135	5.7	2.5 V @ 15 mA	18.0	17.0	20.6	0.9-1.0	1.2	0.85
ATF-13135*	10.4	3 V @ 20 mA	8.5	7.5	10.6	1.25-1.5	1.7	1.25
ATF-13135	10.4	3 V @ 20 mA	18.0	15.0	21.9	1.5-1.7	2.0	1.35

*Single-stage amplifier
**Self-biased, single-stage amplifier

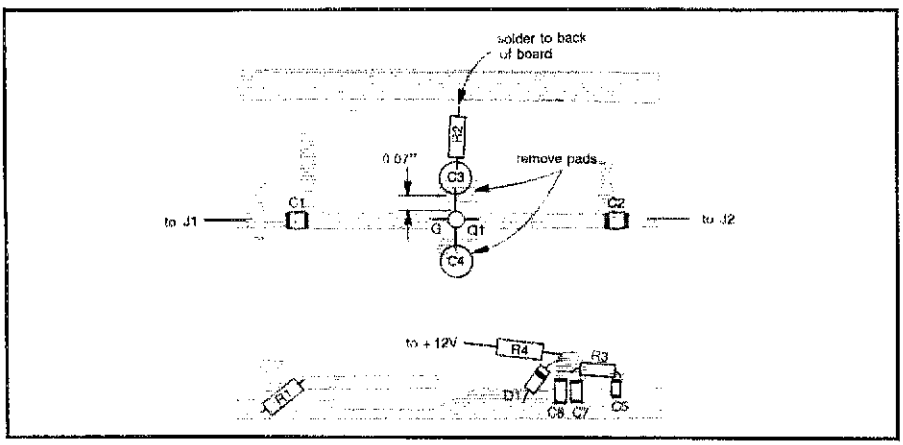


Fig 12—Parts-placement guide for the self-biased 2.3-GHz preamplifier. The etching pattern is the same as shown in Fig 7, except two pads are removed and Z3 must be lengthened. See text.

source lead 0.07 inch long, rather than grounding them with the minimum possible lead length. Ground pads have been established on the artwork, and these pads must be properly connected to the bottom ground plane. Cut slots near the edge of the two pads closest to Q1. Insert a 0.1-inch-wide copper strap through the slots and solder top and bottom. Each source lead is then 0.07 inch long when Q1 is centered on the PC board.

Components for these preamplifiers, including chip capacitors, leadless capacitors, chip resistors and SMA connectors are available from Microwave Components of Michigan.[2] Avantek GaAsFETs are available from distributors around the country (see note 1). Etched PC boards are available from Down East Microwave.[3]

Results

If the preamplifiers are built according to the information given in this article, RF adjustments should not be required. A slight adjustment can be made to the bias point if desired, but performance should be very close to that shown in Table 2 with the bias conditions shown. Based on test results obtained from preamplifiers built by a number of hams using available components, the average builder should be able to meet the worst-case gain and NF specifications shown in Table 2. If slightly different dielectric material or construction techniques have been used, the amplifier can be tuned by moving small capacitive tabs along the microstripline while monitoring NF and gain. A properly modified toothpick makes a handy low-loss tool for moving tabs around on the circuitry. Cut the end of a toothpick on a diagonal. Wet the end of the toothpick and use it to move small metal tabs around on the etch.

Applications

The 2304-MHz preamplifier provides acceptable receive performance in the 2401-MHz OSCAR band with no modification. The NF at 2401 MHz should be only 0.1 or 0.2 dB greater than that obtainable at 2304 MHz, and LNA gain at both frequencies should agree to within a dB. Using a pair of these preamplifiers at the feed of my 2401-MHz satellite system, I see about 5 dB of sun noise and 10 to 15 dB of signal-to-noise ratio from the Mode S transponder aboard AMSAT-OSCAR 13. My antenna is a 4-foot-diameter UHF TV dish with ¼-inch mesh.

A similar two-stage 2304-MHz preamplifier is in use at the feed of my 24-foot home-brew stressed parabolic reflector. The measured NF of this preamp is 0.65 dB. With this system, I have worked W3IWI/8, SK6WM, OE9XXI, and W4HHK on 2304-MHz moonbounce (earth-moon-earth, EME).

Variations

In the original design, source leads were grounded directly to obtain the lowest possible noise figure. This necessitates the use of a dual-polarity supply as discussed earlier. The typical approach at VHF is to self-bias the FET by using a resistor connected in series between the source and ground. A capacitor is used to bypass the resistor at RF. As the frequency of operation increases, it becomes increasingly difficult to obtain high-quality, low-impedance bypassing. Although the self-biasing technique is simpler to build and uses a single power supply, some RF performance is sacrificed.

I evaluated self-biased versions with the help of the computer, and several prototypes were built and tested. The artwork was modified to include 0.075-inch-square pads to mount the FET source leads. Chip capacitors were then bridged between these pads and a ground pad. The ground pad was then connected to the back ground plane by using 0.1-inch-wide ribbons through the board. This technique was tried on all preamplifiers except the 10-GHz models. With this configuration, the preamp NF at 2304 and 3456 MHz was 0.2 to 0.25 dB greater than that of the grounded source design. The gain of the 2304-MHz model decreased approximately 2 dB, while gain of the 3456-MHz model was reduced by slightly more than 3 dB. At 5760 MHz, performance deteriorated even further: NF increased by 0.8 dB, and gain decreased by 6 dB.

A computer simulation predicted similar results. In addition, the computer simulation indicated an oscillation in the 7- to 8-GHz range for all models. Apparently, the inductance associated with the addition of the chip capacitors, associated mounting pads, and ribbon ground returns is great enough to cause instability at higher frequencies.

In looking for a way to avoid this oscillation, I tried using leadless round disc capacitors to bypass the source leads. I soldered the FET leads directly to the capacitors and soldered the capacitors to the bottom side of the PC board. This technique was tried on the 2304-MHz preamplifier; see Fig 11.

The bypassed-source 2304-MHz preamplifier uses the same artwork shown in Fig 7 for the grounded-source version. You'll need to make one change to the artwork, though. The input stub (Z3 of Fig 11) must be made slightly longer (increase its length from 0.22 to 0.38 inch) to help tune out the effect of the source bypass capacitors. Z3 can be extended by soldering a piece of copper foil to the end of the etched line. To mount C3 and C4, the source bypass capacitors, drill holes the

(continued on page 75)

Microsat: The Next Generation of OSCAR Satellites—*Part 1*

Did you know that it is not only possible, but probable that OSCAR satellite enthusiasts will be tracking OSCAR 20 by the end of this year?

By Doug Loughmiller, KO5I, and Bob McGwier, N4HY

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East Windsor, NJ 08520

There are currently no fewer than seven different OSCAR satellites under development worldwide for launch during 1989. Among these satellites are four payloads that AMSAT-NA[1] plans to launch into low-earth orbit (LEO) on a single launch vehicle. These super-small satellites represent the first in a series of a new generation of OSCARs. Dubbed Microsats because of their small size (yet powerful capabilities), these spacecraft are 10-kg cubes, approximately 230 mm on a side. An exploded view of a Microsat is shown in Fig 1. Microsats are the most technologically advanced OSCARs to date. While these satellites will serve a number of purposes, the primary goal of the project is to implement a digital store-and-forward message handling packet-radio satellite system available worldwide. This article will provide you with various mission profiles, technical details of the individual satellites and information you will need to operate through the new Microsats.

Mission Background

This year, 1989, marks AMSAT's 20th anniversary. Since its inception in 1969, AMSAT has led the international amateur satellite community into the future with the development of small, low-cost and innovative amateur satellites. The evolution of these spacecraft has been dependent upon a number of factors:

- the advancing technology of small, efficient electronic components;
- the application of that technology within the realm of Amateur Radio;
- and the ability of our volunteer engineering staff to successfully envision future uses of leading-edge satellite technology, and to complement the Amateur Radio service as a whole, particularly in the areas of public service and educational activities.

The Microsat project is an example of how all these factors work together in defining the objectives of an OSCAR satellite mission.

Since the early days of TAPR,[2] while the TNC 1 was still on the drawing board, and before TAPR fomented the "packet revolution," some AMSAT and TAPR members were dreaming of building a satellite dedicated to packet radio.[3] Tom

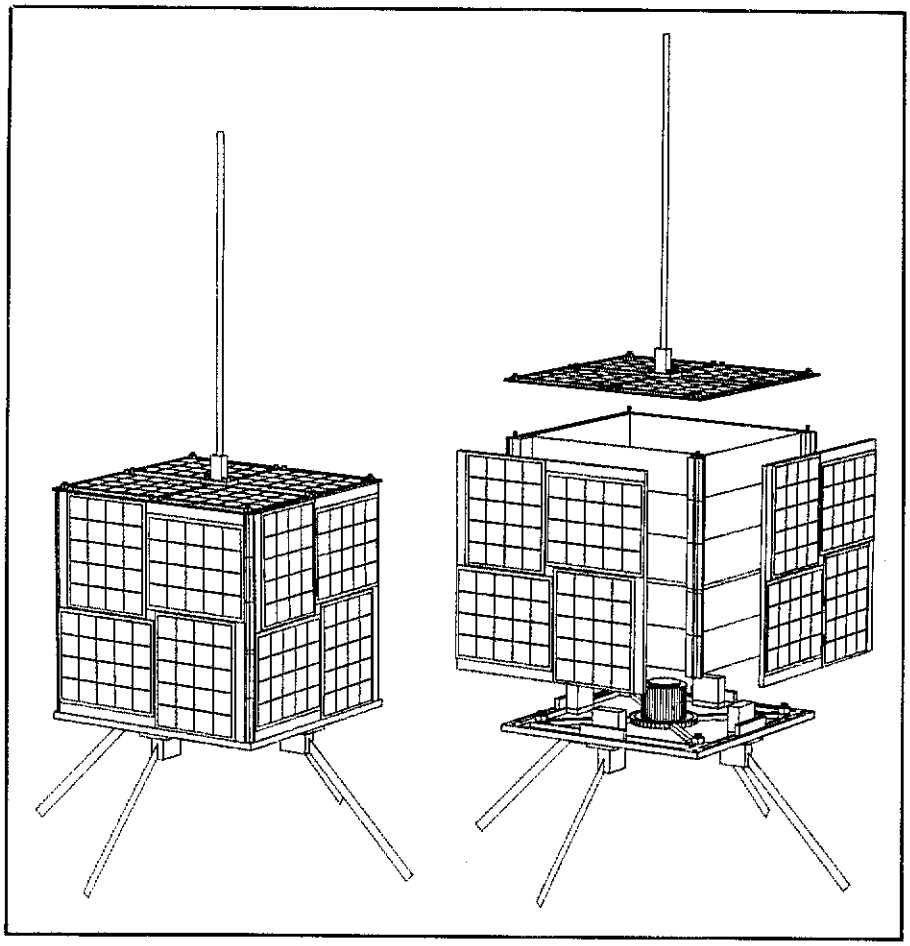


Fig 1—Two views of a Microsat. The drawing at A shows the satellite with the covers on; B is an exploded view. Note the exterior solar panels and the five "trays" or internal modules that contain the satellite's circuitry and make it structurally sound. *(drawings courtesy WD4FAB)*

[1]Notes appear on page 38.

Clark, W3IWI, and Den Connors, KD2S, former president of AMSAT and the first president of TAPR, respectively, started a project to build such a satellite. Volunteers in Technical Assistance (VITA), under the direction of Gary Garriott WA9FMQ, formed a working relationship with AMSAT to make this dream a reality. One of the earliest tasks VITA took on was to build a digital communications experiment (DCE) payload that was to fly as part of UOSAT-2, the follow-up mission for the University of Surrey's UOSAT-OSCAR 9 satellite. UOSAT-2 became UOSAT-OSCAR 11 after its successful launch on March 1, 1984. The DCE has been fully commissioned for some time now, and it boasts users from Antarctica, Australia, England, South Africa, the United States, and most recently, the Soviet Union. This experiment serves as proof of the efficacy of LEOs for packet-radio store-and-forward messaging service. The partnership between VITA and UOSAT has continued as two additional packet-radio satellites are now under construction at the University of Surrey. UOSATs D and E will be launched with the Microsats. This brings to six the total number of amateur satellites to ride into orbit on one launch vehicle.

Meanwhile, following the successful launch of UOSAT-OSCAR 11, JAMSAT (AMSAT-NA's sister organization in Japan) decided their first internal satellite project would contain both a packet-radio store-and-forward mode based on the concept being considered for our packet-radio satellite (PACSAT), as well as an analog linear transponder. This satellite, Fuji-OSCAR 12, was launched August 12, 1986, and is still operational.[4,5] Its digital mode, Mode JD, has four uplink channels in the 2-meter satellite subband and a single downlink channel in 70-cm satellite subband. The analog mode, Mode JA, operates with an uplink passband for SSB and CW transmissions in the 2-meter satellite subband, and a downlink passband in the 70-cm satellite subband. This configuration is much like the Mode J transponder JAMSAT built for inclusion on OSCAR-8 (which is no longer operational). FO-12's Mode JD uses Manchester-encoded FSK at 1200 bit/s on the uplink and BPSK at 1200 bit/s on the downlink.

From its earliest days, this satellite has been plagued by a negative power budget. (The satellite uses power faster than the solar cells can recharge the batteries.) A number of factors, including an overestimate of the efficiency of the solar arrays that power the spacecraft, an overestimate of the capacity of the batteries on board, as well as the slow deterioration of the solar panels because of continuous exposure to the harsh environment of space, have contributed to the power budget problem.

After 2½ years of service, what began as an annoying problem has become a serious one. Because of these difficulties, FO-12, produced with major funding from the Japanese Amateur Radio League (JARL), has had difficulty meeting its vast potential. Nevertheless, FO-12 has a large worldwide user base and has prompted the construction of equipment necessary to operate through it. This equipment is available in North America primarily from TAPR.[6] In Europe, a modem by G3RUH is available from AMSAT-UK.[7]

Microsat is Born

The design of FO-12's digital communication circuitry is sound. The satellite's user base is a group that AMSAT engineers decided to support rather than abandon. In November 1987, at the AMSAT-NA annual meeting and space symposium in Detroit, Michigan,[8] a late-night session took place involving Jan King, W3GEY, perennial leader of AMSAT-NA satellite projects, Tom Clark, W3IWI, Bob McGwier, N4HY, and Phil Karn, KA9Q. It was one of those magic moments that make this facet of our hobby so exciting. Jan King and Gordon Hardman, KE3D, had thought a bit about how to make a very small satellite. It was Jan's opinion that solar array efficiencies were now approaching the level where tiny satellites, with high-power transmitters, could be built with a positive power budget. At that time, he said he believed a good mechanical structure could be built out of trays, where individual modules would form the structure of the spacecraft. By 4 AM, the bleary-eyed group had picked a model for the computer, calculated power budgets, and chosen transmitter power levels based on these preliminary calculations. Indeed, the group had estimated the size, mass, and total power budget for each of the modules. Sleep had been pushed aside by a rush of excitement; we were on to something that would change the amateur satellite program for a long time to come.

Our early excitement paid off. A meeting was held in December 1987 at AMSAT headquarters. Participating in this meeting were representatives from TAPR, SANDPAC[9] and AMSAT-NA. Our early excitement was enhanced at this meeting by a nearly complete mechanical design, accomplished using wonderful new computer tools by the deft hand of AMSAT stalwart Dick Jansson, WD4FAB. A large collection of first-rate design drawings enabled those gathered to get a good visual picture of the satellite and allowed many critical construction decisions to be made.

The group considered carefully the question of whether we should try a new (better) modulation standard on these satellites. Thinking that we would be launching within a year, and knowing the effort that would go into such a design (getting together equipment for ground stations), the decision was made to use the currently existing digital mode adopted by the Japanese for FO-12. This guaranteed a built-in user base at the time the satellite was to be launched. Further, we decided to again place these satellites in Mode JD, with 2-meter channels up and 70-cm channels down.

Little did we know, we were on to something greater than originally imagined. During early 1988, Vern "Rip" Riportella, WA2LQQ, then president of AMSAT, was busy talking to several groups about getting involved in the Microsat project. Junior de Castro, PY2BJO, president of BRAMSAT (AMSAT Brazil), had wanted to loft a package on a satellite for many years. It was his dream to build and orbit the ultimate educational tool for young children to learn more about space science. Educational tools in the amateur satellite service are nothing new. UOSAT-OSCARs 9 and 11 are examples of such educational satellites. They have been good tools for educational purposes, but de Castro wanted to target children younger than those being addressed by existing satellites. PY2BJO also wanted to be able to support this spacecraft's operation with inexpensive ground station equipment. The Microsat project was perfect for his needs, and AMSAT-NA possessed the technical expertise to make his dream a reality. BRAMSAT's project is called DOVE.

Rip had also been trying to interest Arturo Caru, LU1AHC, in a project for some time. AMSAT-LU, under the leadership of Carlos Huertas, LU4ENQ, had begun discussing an inexpensive packet digital repeater for orbit. Upon hearing a description of the Microsat project from Rip, Arturo and Carlos came to the Dayton HamVention® in 1988 for technical talks with W3GEY, W3IWI and N4HY. They left Dayton with two dozen PSK modems from TAPR and a firm conviction to join us in producing a duplicate of our Mode JD satellite, now known as LUSAT. It will be functionally nearly identical to PACSAT. There are interns from AMSAT-LU working with us in Boulder, Colorado. Hams in Argentina are getting ready for operation of the spacecraft, and technical visits to the Boulder facility are common.

Weber State College in Ogden, Utah has, for some time, been interested in small spacecraft. They constructed NUSAT-I. It was launched from the space shuttle Challenger on April 29, 1985. NUSAT-I is the first satellite launched from a Get-Away-Special canister aboard a shuttle vehicle. AMSAT and Weber State had begun discussing ways in which they could help us with our long-term goal of launching a geosynchronous satellite, which we call Phase IV. Upon learning about the Microsat project, they knew this was a project for them. Weber State's Center for Aerospace Technology (CAST) took the

project to heart and is participating in the construction of a Microsat of its own.

What is a Microsat?

Before we describe each mission in detail, let us consider the features all four satellites on this launch have in common. The Microsat spacecraft bus structure is composed of five aluminum modules, or trays, framed into a stack. This stack is almost cubical, measuring 230 × 230 × 213 mm. WD4FAB, W3GEY and Jeff Zerr are primarily responsible for the mechanical design. This structure has been flight qualified for any of the world's currently available launchers. Fig 2 gives you an idea of just how small the new Microsats really are.

Smaller is Better

One of the things happening in electronics today is making the old axiom, "the nicest things come in small packages" truer than ever. W3IWI has taken particular advantage of this in two major subsystems in the Microsat design. The core of all the satellites' receivers is the Motorola MC3362 single-chip FM receiver operating at a 10.7 MHz IF. It follows a high-quality 15-kHz IF filter. Following the MC3362's FM discriminator are two sets of filters, each made of one section of TL274 op amp. These 2-pole Butterworth filters are optimized for 1200- and 4800-bit/s data transmission. Early in the design, we decided to allow for a speed increase (after the initial run at 1200 bit/s using currently existing equipment). The satellites (with the exception of DOVE) can operate receivers and transmitters at data rates of up to 4800 bit/s, and all are independently controllable. This part of the receiver was designed by W3IWI, with help from Eric Gustafson, N7CL. In the front end, we have a GaAsFET with large gates to withstand the rigors of space, and a dual-gate MOSFET mixer with a local oscillator (LO) of 100 MHz. The output of the mixer (40-50 MHz) drives five emitter followers to provide good channel isolation between the five FM IF stages. Jim Vogler, WA7CJO, and W3IWI designed this part of the receiver. The entire five-channel receiver draws only 180 mA.

Motorola makes another useful chip, the MC14469F addressable asynchronous receiver/transmitter (AART). Veterans of amateur satellite construction complain the most about one job—wiring harnesses. Determined to circumvent the wiring harness chore in this spacecraft, we are making use of many of the AART's features. It has increased the number of possible telemetry points, giving us more command over individual aspects of this spacecraft than we have ever had, yet it operates on only five wires! The on-board computer controls the modules and gathers telemetry by talking to the AART on each module. The telemetry values are selected by sending a command to the appropriate AART and telling it to place the correct signal on the analog signal wire. The CPU module samples the telemetry value through an A/D converter. Commands are sent in a similar fashion. This module, designed by W3IWI and Bob Stricklin, N5BRG, has greatly reduced the complexity of the wiring harnesses and allows the use of standard software modules to command the AARTs.

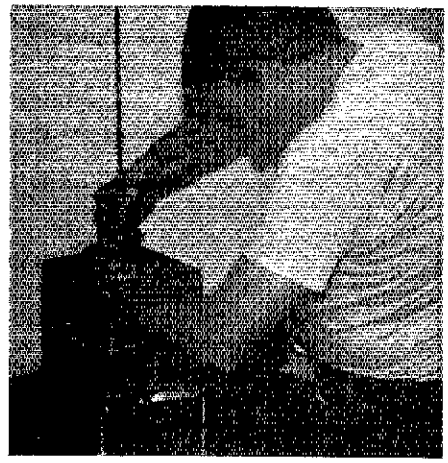


Fig 2—AMSAT's Vice President of Engineering, Jan King, W3GEY, removes protective plates from the Microsat mechanical model, exposing the small solar panels that power the satellite.

Power System

Probably the most important system in any spacecraft is the power system. At the heart of the system is the battery charge regulator (BCR) and the power regulators. The BCR takes the fluctuating input from the solar arrays, conditions it, and charges the batteries. Also in the power system are the regulators that produce 5 V and 7.5 V as needed to power the spacecraft. Work on the BCR circuitry is being done in the ARRL Lab by Jon Bloom, KE3Z, with help from Bruce Hale, KB1MW. The solar panels make use of high-efficiency silicon cells with back surface reflection to recapture some of the photons that made it through the silicon on the first pass. The solar panel electrical and mechanical design was done by W3GEY and WD4FAB. The panels are being produced under contract by Solarex.

Space-rated NiCd batteries are priced to fit budgets of major corporations, but not those of nonprofit organizations like AMSAT. Larry Kayser, VE3PAZ, and a group in Ottawa (working with him) have devised an ingenious testing procedure for space-qualifying commercial-grade batteries. His techniques have been proven in practice: A set of batteries chosen by these procedures has performed well in UO-11. The power subsystem will produce about 8 W (orbit average). This may not sound like much, but it is adequate for a powerful transmitter design.

Transmitters

The transmitters are all designed and built by Matjaz Vidmar, YT3MV. Matjaz is a well-known Amateur Radio talent in Europe. We found out what we had been missing when he became a Fulbright scholar this year. He is doing graduate work in electrical engineering at the University of Colorado. Fortunately, the Microsat project is underway nearby in Boulder, under the direction of W3GEY. Matjaz has designed some highly efficient transmitters for 2 meters (for the DOVE spacecraft) and 70 cm (for the other three spacecraft). The high-efficiency designs, acceptable for 70-cm PSK, are based on principles derived from the early work of Karl Meinzer, DJ4ZC, called high efficiency linear amplification by parametric synthesis (HELAPS). HELAPS has flown on several spacecraft built by AMSAT-NA and AMSAT-DL, including OSCAR 10 and OSCAR 13. Remarkably, the new 2-meter FM transmitter displays a whopping 85% efficiency. Understandably, the 70-cm transmitter displays a slightly reduced—yet commendable—efficiency in the 65% range.

YT3MV and WD4FAB did the mechanical layout of the transmitters. These transmitters produce 4 W at maximum power, with the ability to operate at reduced power levels on command. Again, this may not seem like much, but considering that the loudest signal from FO-12 is powered by a 1-W transmitter, you can see that the Microsat signals will be quite strong. The downlink will be usable with an omnidirectional antenna (with a good bit error rate at 1200 bit/s, and probably 4800 bit/s as well).

All of the satellites except DOVE will produce binary PSK at rates varying from 1200 to 4800. The satellites will start life at 1200 bit/s. In addition to these transmitters, YT3MV is building an L-band (1269-MHz) receiver and an S-band (2401-MHz) transmitter for the digital transponder. The 1269-MHz receiver is based on the receiver core designed by W3IWI, described earlier. In all, with the new L-band stages, this is a four-conversion superhet. A GaAsFET has been chosen for the front end. The exact uplink channel has not yet been selected. The S-band transmitter is again based upon the earlier 70-cm PSK transmitter. The mixer LO is replaced with a chain of multipliers (four in all) to give us the final mix to 2401 MHz. The final amplifier is an Avantek AV-8140; it produces 2 W at 32% efficiency. Using this downlink will be a real challenge for most receivers and modems, considering the total Doppler swing is in excess of 100 kHz during a 15-minute pass. As with the L-band receiver, the exact frequency has not yet been determined.

Computer Hardware and Software

Among team members who are computer builders and programmers, these satellites are considered to have a lot of hardware (for an orbiting computer). Departing from earlier AMSAT designs, the CPU is the primary payload. The model

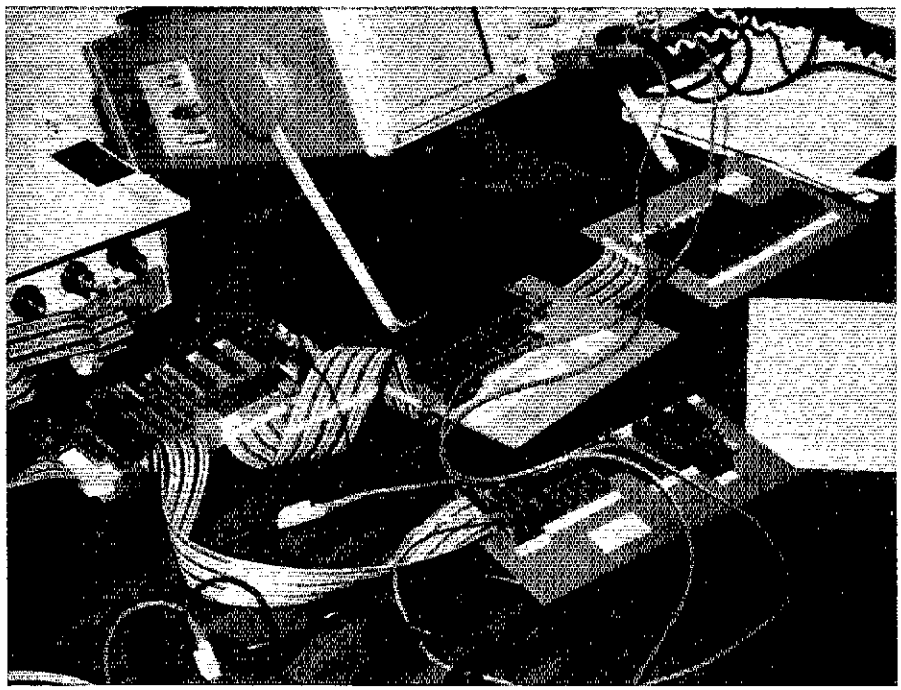


Fig 3—Prototype of PACSAT's CPU. *(N4HY photo)*

for the computer needed to be chosen with great care. Fortunately, shortly before the meeting in Detroit, SANDPAC had produced the PS186[10] computer for packet-radio networking. It is a fast, 80C186-based computer with lots of high-speed memory and HDLC serial controller chips, Zilog 8530s. N4HY was honored to receive one of these from SANDPAC in order to aid the development of packet-radio networking just two weeks before the November 1987 meeting. This greatly influenced our thinking about the way the CPU should look and operate.

The PS186 was delivered at the December 1987 meeting, where all agreed it was the type of CPU we wanted. Lyle Johnson, WA7GXD, one of the primary designers of the TNC 1, the DSP-1[11,12] and other TAPR projects took on the task of designing the CPU.[13] Lyle chose the NEC V-40 (an 80C188 look-alike). His design included lots of EDAC (error detecting and correcting) memory for storage of programs and critical data, and a whopping 8 MB of mass storage for a RAM disk. Also included are several sections of bank-switched, full-speed memory. This enables us to switch experiments in and out of the NEC V-40 bus so that maximum possible access to the experiments is afforded the satellite developers. WA7GXD and Chuck Green, NØADI, did the design and construction of the first prototype. Mike Brock, WB6HHV, is designing the fire-code reset devices so the command stations can hit the panic button if the software crashes. Jim de Arreas, WA4ONG, suggested the design for the mass memory and has also been instrumental in obtaining the hard-to-find memory chips for this project. Fig 3 shows a prototype of PACSAT's CPU. This is an incredibly dense set of circuit boards. There are well over 500 ICs to fit into one of the small modules. Fortunately, integrated circuit evolution has allowed us to do incredible jobs of packing lots of electronics into small places with surface-mount technology. For this reason, the flight units are being laid out professionally by Tex Engineering in California, and the parts will be placed on the CPU board by GMI, Inc in North Carolina.

Harold Price, NK6K, was one of the leaders of the software development for the TAPR TNC 1. He was also a primary member of the DCE development and software team. Harold has had a long interest in packet radio and computer networking—packet satellites in particular. Harold writes multitasking kernels primarily for smart serial I/O cards for Quadron, Inc. Quadron has donated the use of their multitasking kernel and the use of Harold's time to get the flight software developed. Harold will be writing the heart of the software system for the spacecraft.[14] The AX.25 software, which is a part of this kernel and other networking software such as TCP/IP, will be based on Phil Karn's (KA9Q) networking software. The device drivers, for talking to the serial data streams, are being designed by Skip Hansen, WB6YMH. The command and control software and telemetry collection software is being designed by N4HY. Harold will be writing the basic BBS software, and all the software team members will be adding the bells and whistles to what the user will actually see in this BBS. As any software writer will tell you, bugs never entirely disappear. The only piece of software that simply must work each and every time it is called upon is the bare-bones reset bootloader. Hugh Pett, VE3FLL, wrote the bootloader that saved the mission on UO-11. We decided such a track record should be put to work for us, and Hugh is writing the bootloader program that will be flown in ROM and will be executed upon reset.

This is a complex spacecraft system, and one that will take daily management by a dedicated team of volunteer command stations. Courtney Duncan, N5BF, has begun to put together plans for command stations and command operations. This will include gathering telemetry, PBBS sysop duties, and occasional uploading of new software. Courtney is being aided by Ralph Wallio, WØRPK. In addition, Weber State is putting together a command station that can be used for all spacecraft, when needed, and will be a professional operation with students, faculty, CAST members, and volunteers doing the operations duties.

Our Microsat discussion continues next month, when we cover operating frequencies, orbital data, and a detailed rundown of the Microsat missions.

Notes

[1]AMSAT-NA is The Radio Amateur Satellite Corporation, PO Box 27, Washington, DC 20044, tel 301-589-6062.

[2]TAPR is the Tucson Amateur Packet Radio Corporation, PO Box 12925, Tucson, AZ 85732.

[3]Several papers in the proceedings of the Second ARRL Amateur Radio Computer Networking Conference. These papers appear in the proceedings of *ARRL Computer Networking Conferences 1-4*, available from ARRL for $18 (plus $2.50 postage and handling, or $3.50 for insured Parcel Post or UPS) or from your local dealer.

[4]Talk given by Mori Ohara at the Third Space Symposium and AMSAT Annual Meeting, November 1985.

[5]T. Clark, "FO-12 Modems", *Proceedings of the AMSAT-NA Fourth Space Symposium and Annual Meeting*, November 1986.

[6]TAPR PSK modem kits are available from TAPR (see note 2) for $110 plus shipping/handling.

[7]AMSAT-UK, 94 Herongate Rd, Wanstead Park, London E12 5EQ, England.

[8]*Proceedings of the AMSAT-NA Fifth Space Symposium and Annual Meeting* are available from ARRL for $12 (plus $2.50 postage and handling, or $3.50 for insured Parcel Post or UPS) or from your local dealer.

[9]SANDPAC is the San Diego Packet Radio Association.

[10]M. Brock, et al, "A High Performance Packet Switch," *6th Computer Networking Conference*, August 1987. Copies of these proceedings are available from ARRL for $10 (plus $2.50 postage and handling, or $3.50 for insured Parcel Post or UPS) or from your local dealer.

[11]T. Clark and B. McGwier, "The DSP Project Update," *Proceedings of the Sixth AMSAT-NA Space Symposium and Annual Meeting*, November 1988. Copies of these proceedings are available from ARRL for $12 (plus $2.50 postage and handling, or $3.50 for insured Parcel Post or UPS) or from your local dealer.

[12]L. Johnson and C. Green, "Microsat Project—Flight CPU Hardware", *Proceedings of the Sixth AMSAT-NA Space Symposium and Annual Meeting*, November 1988.

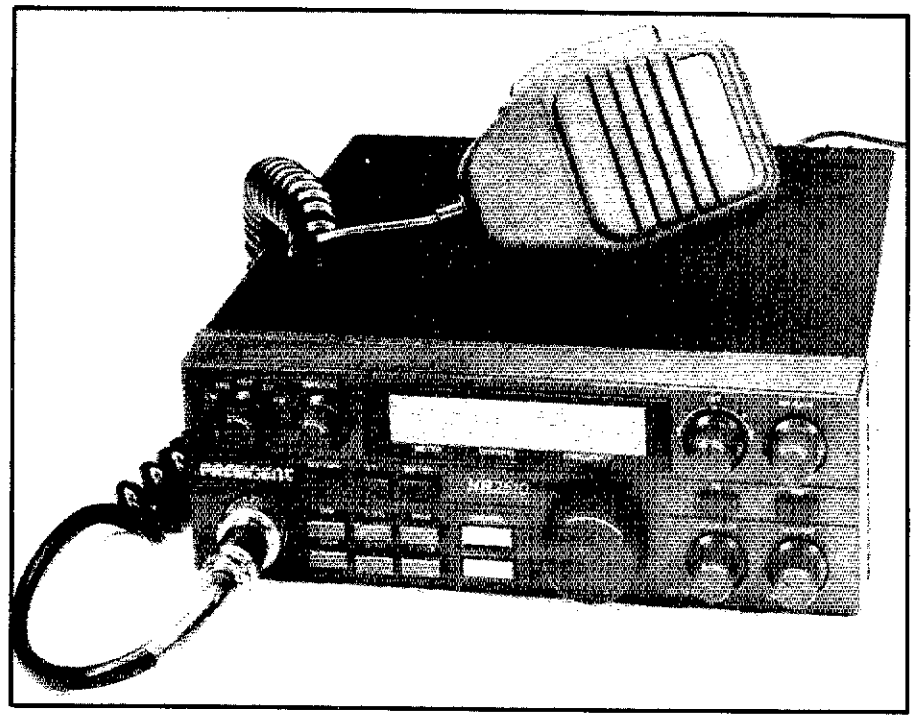
[13]L. Johnson, "The AMSAT/TAPR DSP 1 Project: Hardware Design," *Proceedings of the Sixth AMSAT-NA Space Symposium and Annual Meeting*, November 1988.

[14]H. Price and B. McGwier, "PACSAT Software," *Proceedings of the Sixth AMSAT-NA Space Symposium and Annual Meeting*, November 1988.

Conducted By James W. Healy, NJ2L
Assistant Technical Editor

Uniden President HR2510 10-Meter Transceiver

Reviewed by Kirk Kleinschmidt, NTØZ



Reasons to buy the Uniden® President™ HR2510 are many. It's a compact, full-function transceiver that features digitally synthesized frequency control, RIT, noise blanking and all-mode operation. The price is right (around $270), and it even looks good! With all of its positive attributes you might think it'll do anything, anywhere. It won't—but as a 10-meter mobile rig, it's a value that's difficult to top.

My '2510 experience began as soon as I got a glimpse of the box. The radio is pictured on all six panels! Superimposed on the high-quality color photographs are a lot of numbers and their associated descriptions of the rig's controls and functions. I've never seen a rig with such an attractive carton! It's not too difficult to see that the '2510 is an outgrowth of Uniden's experience in building and marketing CB radios—this radio even has the telltale public address mode. The HR2510 is one of several recently introduced 10-meter mobile rigs aimed at exploiting the fantastic band conditions associated with the rise of solar cycle 22, and the increase in 10-meter SSB activity since US Novices and Technicians gained voice privileges on the band a couple of years ago.

The '2510 comes with a mobile mounting bracket, a hand-held dynamic microphone with up/down tuning buttons, a power cord, accessory plugs and the operator's manual. The 22-page manual is well written, but not overly informative. The controls, connections and features of the rig are explained well enough with text and photos, but there's no schematic, and no technical information other than diagrams of the microphone and accessory connectors. (Heck, even my old CB rig came with a schematic!)

Controls

The rig's front panel contains a bunch of controls—some 20 in all—many of which perform multiple functions. Although the '2510 is relatively small, the front-panel controls are not crowded. You're not in danger of pushing two buttons at once, as you are with many VHF mobile rigs.

Here's a rundown of the 2510's front panel: mode switch (USB, LSB, AM, CW, and FM are available); SWR/CAL; MIC GAIN; TX switch; METER switch (S/RF, modulation and SWR indications can be selected); PA (public address) switch, NOISE BLANKER switch; display DIM switch (backlight brightness); SCAN switch; SPAN switch (selects VFO tuning rate); CHANNEL up/down, BAND switch (selects one of four portions of the 10-meter band); FREQUENCY LOCK switch; VFO; SQUELCH; on/off/AF gain; and the BEEP switch (discussed later). Also on the front panel are the mic connector and the multifunction meter/frequency display (LCD).

In contrast to the front panel, the rear panel is sparsely populated, with only an SO-239 antenna connector, power connector, heat sink and a multipin accessory connector.

The accessory plug is a 9-pin Molex type, which I found to be a real bother. Two of this connector's pins must be jumpered to enable the internal speaker. Connections to an external speaker, external public-address speaker and CW key are made here as well.

Operation

The HR2510 is easy to get on the air. It's about as close to "plug-and-play" as they come. Simply plug in the microphone and headphones (or jumper the rear-panel accessory jack to enable the internal speaker), attach the antenna and a suitable power supply, and you're ready to go. There's nothing to tune up (there's no mic gain adjustment other than a button that, when pressed, cuts the gain way down).

If you're itching to get the rig on the air, it's easy to figure out the front-panel controls, tune in a station or find a clear spot, and let 'er rip. The manual does, however, warn you to make sure the SWR at the antenna connector is below 2:1, or transmitter damage could result. How sensitive is the rig to high SWR? We can't say, but the rig came through unscathed after I accidentally keyed the transmitter without connecting an antenna.

Tuning the '2510 is accomplished by rotating the VFO knob, mounted near the middle of the rig's front panel. The VFO tuning steps are selected by repetitively pushing the SPAN button. Available steps are 10 kHz, 1 kHz and 100 Hz. The small VFO knob (it's only about an 1½-inch in diameter), and the fact that it goes "click-click-click" (because it is a detented control), makes the experience of tuning the rig seem rather "unradio-like." If you're used to a smooth-spinning tuning control, you'll have to get used to this one. It's a lot like tuning a 2-meter mobile rig or setting the rotary switch on a digital voltmeter. The "deedle-eedle-eedle" effect resulting from the rather large 100-Hz tuning increments present as you tune across the

Table 1

Uniden HR2510 10-Meter Transceiver, Serial no. 83000616

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: 28.0000 to 29.6999 MHz	As specified.
Modes of operation: USB, LSB, CW, FM, AM.	As specified.
Frequency display: backlit LCD.	6-digit LCD on orange background.
Frequency resolution: not specified.	100 Hz.
Power requirement: 13.8 V dc, 5 A max on transmit.	Minimum audio output (receive), 380 mA; full audio output, 630 mA; CW (transmit), 5 A.
Frequency accuracy: not specified.	Displayed transmit frequency, 28.0200 MHz; measured frequency, 28.0197 MHz.
Transmitter	*Transmitter Dynamic Testing*
Transmitter output power: CW, 25 W nominal; SSB, 25 W PEP; AM/FM, 10 W nominal.	CW, 25 W; SSB, 24 W PEP; AM/FM, 10 W.
Spurious signal and harmonic suppression: −50 dBc nominal, all modes	See Fig 1.
Carrier suppression: −55 dBc.	−66 dBc.
Unwanted sideband suppression: −45 dBc.	−64 dBc.
Third-order intermodulation distortion products: not specified	See Fig 2.
CW keying characteristics: not specified.	See Fig 3.
Receiver	*Receiver Dynamic Testing*
Receiver sensitivity (for 10 dB (S+N)/N): AM, 0.5 μV nominal; CW/USB/LSB, 0.25 μV.	Minimum discernible signal (noise floor); CW/SSB, −131.5 dBm; AM, −127.5 dBm.
FM sensitivity: 0.5 μV for 20 dB (S+N)/N	−115 dBm for 20-dB (S+N)/N; −111.5 dBm for 20-dB SINAD.
Receiver dynamic range: not specified.	Blocking dynamic range: 94 dB at 25-kHz spacing; 95 dB at 50-kHz spacing. Third-order IMD dynamic range: 69.5 dB Third-order input intercept: −27.25 dBm.
S-meter sensitivity (μV for S9 reading):	92 μV at 28.5 MHz.
Squelch sensitivity: not specified.	Min, 0.97 μV; max, 1500 μV.
RIT range: ±3 kHz.	As specified.
Receiver audio output: 4 W nominal.	2.88 W at 10% total harmonic distortion (THD) with an 8-Ω load.
Color: black.	
Size (H × W × D): 2.44 × 7.32 × 10.35 inches.	
Weight: 4.2 lbs.	

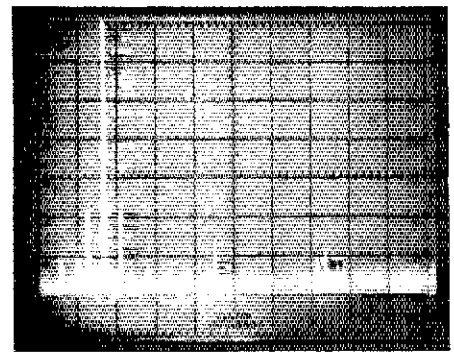


Fig 1—Worst-case spectral display of the Uniden HR2510. Horizontal divisions are each 10 MHz; vertical divisions are each 10 dB. Output power is approximately 20 W at 28.5 MHz. All harmonics and spurious emissions are at least 49 dB below peak fundamental output. The HR2510 complies with current FCC specifications for spectral purity.

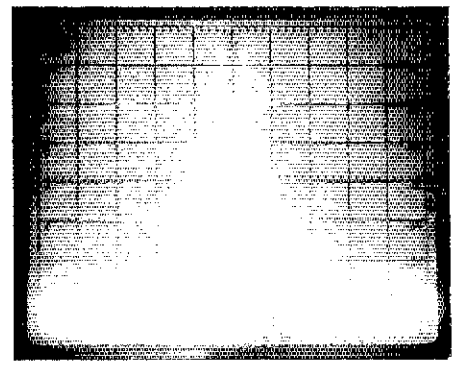


Fig 2—Spectral display of the Uniden HR2510 during two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 32 dB below PEP output, and fifth-order products are approximately 45 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 2 kHz. The transceiver was being operated at 20 W PEP output on 28.5 MHz.

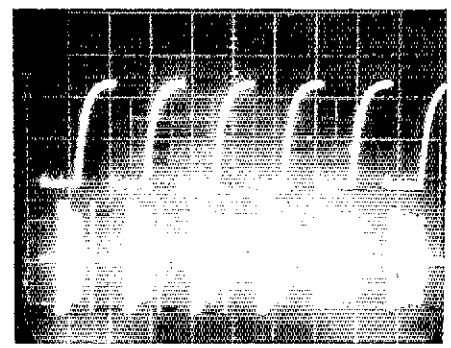


Fig 3—CW keying waveforms for the Uniden HR2510 in the semi-break-in mode. The lower trace is the RF envelope; the upper trace is the actual key closure. Each horizontal division is 50 ms. Note the unusual RF output waveform—particularly during the first three dots. The HR2510's CW keying causes audible key clicks on adjacent frequencies.

A Wrench in the Works

During the course of lab testing the Uniden HR2510, I found that the rig had a strange malady: While operating in the CW mode, the radio transmitted a short, but strong—and wide—burst of RF as the rig made the transition from transmit to receive. This noise burst occurred about 200 kHz *below* the carrier frequency in the Product Review rig. In normal CW operation, this produced a loud pop—almost as strong as the on-frequency CW carrier—in receivers tuned to the out-of-band noise-burst frequency.

I contacted Don Lane, N5NBU, of Uniden's Marketing Service Group, and discussed the problem with him. Being a ham (and all-around nice guy), Don was very helpful in resolving the problem. Uniden developed a modification to eliminate the unwanted out-of-band transmissions, and we subsequently modified and tested the Product Review unit. Sure enough, Uniden's modification solved the problem. Uniden has already incorporated a change into current production HR2510s to eliminate this problem.

Uniden has agreed to modify affected HR2510s (whether in warranty or not), mostly at their cost. The process goes like this: HR2510 owners should contact Uniden's Customer Service Department (Uniden Corp of America, Customer Service, 9900 Westpoint Dr, PO Box 501368, Indianapolis, IN 46250, tel 317-842-2483). Give them the serial number of the rig. If you have an affected unit, Uniden will give you instructions for returning the rig to them. You'll pay the shipping costs to get the rig to Uniden, and they will then modify your rig and pay the shipping costs to return it to you. Don Lane also emphasized that *any* modifications made to HR2510s by anyone other than Uniden will void Uniden's warranty.—*Rus Healy, NJ2L.*

band is particularly annoying when you're trying to tune in CW signals. The "channelized" feel of the HR2510 may reduce the quality of the rig's overall feel if used as the main station transceiver.

The UP/DOWN buttons on the front panel quickly move the operating frequency up or down the band in 10-kHz steps. The manual says that "the channel select buttons will select any 10-kHz channel in the current band segment...when tuning up and down the unit will tune to the nearest 10-kHz channel..." There are quite a few references to "channels" in the manual. (Fortunately, the 10-meter amateur band is not channelized—but the manual could mislead a noninitiate into believing that a there are a limited number of discrete channels available in Amateur Radio.)

For some reason, Uniden has divided the 10-meter band into four segments: a, 28-28.4999; b, 28.5-28.9999; c, 29-29.4999; d, 29.5-29.6999. At first glance, it appears that the HR2510 has memories; it doesn't. The channel indicator to the left of the frequency display shows which 10-kHz segment of the current portion of the band on which you are operating. The channel UP/DOWN controls simply step up or down to the nearest whole-10-kHz channel. For instance, if you've got the HR2510 tuned to 28.0313 MHz and you press the channel UP button on the mic or the front panel, the operating frequency will change to 28.0400 MHz. There are 50 channels each in band segments a, b and c, and 20 channels each in d.

If you're tuning around the band and you don't want to keep turning the clickety-click VFO knob, a touch of the SCAN button will let the '2510 do the work for you. Each time the SCAN button is pressed the rig tunes up the band looking for a signal strong enough to break the squelch, stops there until the transmission ceases, and waits another 1½ seconds. If you take no action, the scan function continues after this delay. To exit the scan mode, simply press the channel UP/DOWN buttons on the microphone or the front panel.

Operating in CW mode is fairly straightforward. If a key or keyer is connected to the rear-panel accessory plug, closing its contacts keys the transmitter (the rig uses a semi-break-in arrangement). The TR-switch hang time is approximately one second, and there is no provision for adjusting it. I had difficulty keying the HR2510 with some keyers; the on-state resistance of the outputs of some keyers is not low enough to key the rig. In some cases, keying the rig produced a sidetone, but no RF output.

One unusual—and potentially confusing—aspect of CW operation occurs when you tune the HR2510 across a CW signal. You hear the signal on both sides of zero beat, just as you would in a direct-conversion receiver. (Most modern CW receivers suppress the signal on one side of zero beat.) It is possible to tune an incoming CW signal on "the wrong sideband," in which case your carrier frequency can be as far as 1.5 kHz away from the incoming signal frequency. The HR2510 manual does not discuss this operational oddity. The correct sideband on which to tune CW signals is the lower sideband. (If you have any question, tune in CW signals in the LSB mode, then switch to CW when you want to transmit.)

As in the other modes, the RIT can be used to adjust the pitch of a received CW signal. With this rig, knowing your exact offset frequency can be a problem—the offset is not displayed. The RIT is always on, and, although there is an RIT tuning scale on the front panel, there's no center detent position that indicates the zero offset, or off position. *Here's* a place where a detent would be most welcome! The inability to turn RIT off, or at least to reliably set the RIT offset to zero, can make it difficult to answer a station on the correct frequency.

Note that although the HR2510 has FM capability, it has no provision for non-simplex operation. 10-meter FM repeaters are thus unusable with the '2510.

The HR2510 has several other interesting features, such as a generally effective noise blanker, a built-in SWR meter (useful), a modulation meter (of questionable usefulness without a variable mic gain control!), a built-in public-address system (of dubious value), and a beeper that adds a short tone to the end of every voice transmission (most people find such a beeper to be irritating).

Operating Impressions

As explained previously, getting the '2510 on the air is easy, whether the rig is in the car or your shack. I tested the rig under both conditions: At home, I hooked the rig up to a 12-V power supply and a triband beam antenna; for mobile operation I connected the rig to the car battery and a modified CB antenna. I used the rig primarily at home, however.

Once I got used to the tuning control and found the correct setting for the RIT control, everything was okay. The '2510's receiver audio sounds great—it's clean and crisp; in fact, it sounds better than the receiver audio from another transceiver I'm using that costs more than three times as much as the HR2510! The rig's AM-mode audio sounds so good that I built a single-transistor converter to listen to shortwave broadcasts using the HR2510 as a tunable IF!

On-the-air receiver comparisons were made between the '2510 and another late-model transceiver. As mentioned, the 2510's audio sounds good. Because the receiver lacks passband tuning, IF shift and other more sophisticated receiving aids (including narrow-bandwidth CW filters), the rig can't hold its own under heavy interference conditions. For casual home or mobile operating, however, the radio performs well.

One annoying receiver malady exhibited by the '2510 is AGC thumping. On loud signals, the slow AGC attack lets the received signal through relatively unattenuated at first, only to "hit it hard" shortly thereafter. The resulting pop and subsequent dramatic reduction in volume are quite noticeable.

All of the hams I worked while I was reviewing the '2510 gave the rig good marks on its transmitted audio. On-the-air tests with another late-model transceiver confirmed these reports. Of the dozens of stateside and DX stations worked, about a dozen were also using HR2510s! When asked if they liked the '2510, nearly every one responded enthusiastically. When I asked them about the tuning-knob detents, the lack of RIT offset display and the AGC thumping, they agreed (some begrudgingly) that the problems were there—but not bothersome enough to dampen their enthusiasm. All of the HR2510 owners I talked to said they would recommend the rig without hesitation. We found a rather serious problem with the rig's CW operation in the course of lab testing the '2510—see the sidebar.

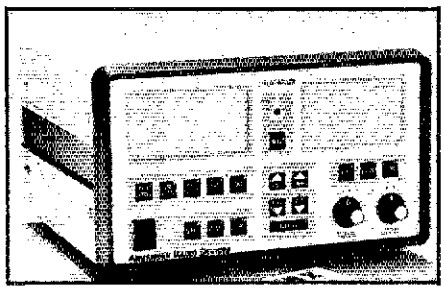
The HR2510 is great for mobile or portable operation. It would make a fantastic 10-meter vacation or DXpedition rig. It's also a lot of fun at home and, for the price, it's hard to beat. Now, if Uniden could only add 80 through 15 meters...

Price class: $269. Manufacturer: Uniden Corp of America, 4700 Amon Carter Blvd, Fort Worth, TX 76155. A service manual is available (for around $20) from Uniden Corp of America, Parts Department, 9900 Westpoint Dr, PO Box 50463, Indianapolis, IN 46250, tel 317-842-1036.

ADVANCED RADIO DEVICES 230A HF/MF LINEAR AMPLIFIER

Reviewed by Mark Wilson, AA2Z

Every now and then, a truly exciting, high-end piece of gear hits the Amateur Radio market. Often very expensive, such a product will be owned by relatively few hams, yet we all dream about having one. Over the years, for me such products have

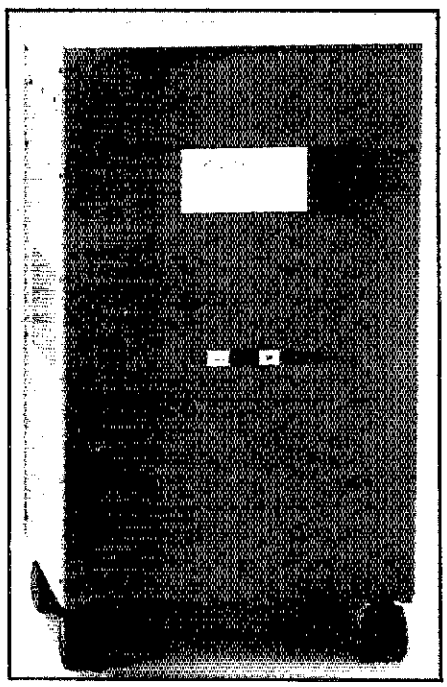


included the Telrex Big Bertha rotating pole and the Alpha 77 amplifier. The Advanced Radio Devices (ARD) 230A linear amplifier is another such product.

The 230A is a delightful mix of microprocessor wizardry and old fashioned RF engineering. It uses a pair of Eimac® 3CX800A7 high-mu triodes to deliver 1.5 kW output on the 160- through 15-meter amateur bands (excluding the new 17-meter band—more on this later). Modification for 10- and 12-meter operation can be done by licensed amateurs, as discussed later. Note that the duty cycle for 1.5 kW output is *continuous*—no time limit is specified! Other features include a vacuum relay for QSK, a pi-L output network for excellent harmonic suppression, and a forced-air cooling system.

The 230A is housed in two boxes: One contains the power supply/RF deck, and the other—much smaller—holds a microprocessor-based controller. All amplifier controls and metering required for setup and operation are housed in the microcontroller box, which is placed at the operating position. The RF deck/power supply, measuring 24 × 14 × 13 inches, can be placed anywhere up to 250 feet away from the microcontroller!

The 230A operates on 240 V ac, and



requires a service capable of providing at least 15 A. There is no provision for 120-V operation because of the high current requirements.

Microprocessor Control

Although some purists bemoan the intrusion of computer control into everything from autofocus cameras to automobile engine management systems, the fact is that microprocessor control makes possible performance—at consumer-level prices—that you wouldn't have dreamed of previously. In the 230A, the computer does not only control amplifier tuning: It also prevents damage to the amplifier by monitoring important operating parameters and taking the amp off line if critical values are exceeded.

The microcontroller front panel holds all of the controls, displays and metering necessary to operate the amplifier. On the rear panel are connections for your transceiver: KEY IN and OUT for QSK operation, PTT and ALC. There is also a multipin connector for the cable that runs to the RF deck and an RS-232-C port for remote control of the amplifier by an external computer.

In the past, several "no-tune" amplifiers have been available on the amateur market. These amplifiers usually use separate broadband pi networks that are switched in for each band. The 230A's no-tune feature is based on a different concept. In the 230A, dc motors drive the anode tuning and loading capacitors and the band switch. These motors are controlled by a Z80®-based computer with 32 kbytes of ROM, 4 kbytes of RAM and 2 kbytes of EEPROM.

The 230A has three modes of operation: automatic, semiautomatic and manual. The three modes require varying degrees of operator involvement in the amplifier tuning process.

Manual tuning is similar to that with conventional amplifiers. Press the MANUAL button and use the FREQ up and down buttons to select the desired operating frequency. Then use the TUNE and LOAD controls to tune the amplifier. TUNE and LOAD are momentary-contact switches that cause the tuning and loading capacitors to move clockwise or counterclockwise. It takes a little practice to tune "by wire" instead of turning knobs that are physically connected to their associated capacitors.

Manual tuning is also used to set up presets for the automatic and semiautomatic modes. To speed up the automatic tuning process, the positions of the tuning and loading capacitors are stored in memory for points every 100 kHz throughout the 230A's operating range. As supplied by the factory, these presets ensure proper amplifier tuning into a 50-ohm load. Most of my antennas are not perfectly matched, so I found it necessary to manually tweak the tuning on most bands. Once I entered the new preset information for my antennas in the 230A's memory, though, I did not have to manually tune the amplifier again.

Automatic and semiautomatic operation set the 230A apart from conventional amplifiers. An internal frequency counter samples the RF at the amplifier input. This frequency is shown by the FREQUENCY LCD at the upper right-hand corner of the front panel. The microprocessor reads the frequency of the drive signal, selects the correct input network and moves the anode tuning and loading capacitors and band switch to preset positions determined by data stored in memory. The whole process takes a few seconds for band changes, less for excursions within a band.

In the automatic mode, the microprocessor starts a fine-tuning process after the preset positions are reached. If you have stored the presets for your antennas as described earlier, minor adjustments to the positions of the tuning and loading capacitors occur as you move up and down a band. If you use the factory presets and your antennas are not matched to 50 ohms, the amplifier hunts for the right settings.

The semiautomatic mode is similar to automatic, except that the fine-tuning algorithm is not operational. The amplifier tunes to the 100-kHz preset closest to the operating frequency and stays put, rather than continuously hunting for the best match. As you move around a band in semiautomatic mode, the microcontroller still keeps track of your operating frequency and tunes for the closest preset. Note that you *must* tune the presets for your antennas in semiautomatic mode, or the amplifier probably *will not* be tuned correctly. After using the 230A for a while, I found the semiautomatic mode suited my needs, and I used it almost exclusively.

Metering and Safety Features

ARD has developed a comprehensive metering and safety-trip system into the 230A to help protect your investment. When you turn the unit on there's a five-minute delay while the 3CX800A7 heaters warm up. During the warm-up period, it's impossible to place the 230A in the transmit mode. Although this delay can be annoying, it's absolutely necessary to prolong the life of those expensive tubes. (Eimac specifies a minimum three-minute warm-up period for 3CX800A7s.)

The microprocessor checks the following parameters 30 times per second: anode current, grid current, heater voltage, reflected power and temperature. In addition, the microcontroller calculates anode dissipation eight times per second. As the values of any of these parameters approach the maximum safe values, a warning indicator on the microcontroller front panel flashes. For example, if grid current exceeds 100 mA, a flashing GRID CURRENT warning appears on the LCD. If the maximum safe value is exceeded (for

Table 2

ARD 230A Linear Amplifier, Serial No. 0126

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 1.75-2.0, 3.1-4.3, 5.8-8.0, 13.4-15.1, 18.5-21.6 MHz (24.8-25.0 and 28.0-30.0 MHz available for qualified users).	As specified.
Power output: 1.5 kW, continuous duty.	See Table 3.
Driving power required: 60-80 W.	See Table 3.
Intermodulation distortion: –35 dB.	Not measured.
Harmonics and spurious emissions: –45 dB.	See Fig 4.
Primary power requirements: 240 V ac at 15 A maximum.	As specified.
Color: Gray.	
Dimensions (height, width, depth): Microcontroller, 8 × 10 × 9 inches. RF deck/power supply, 24 × 14 × 13 inches.	
Weight: Microcontroller, 4 lbs; RF deck/power supply, 90 lbs.	

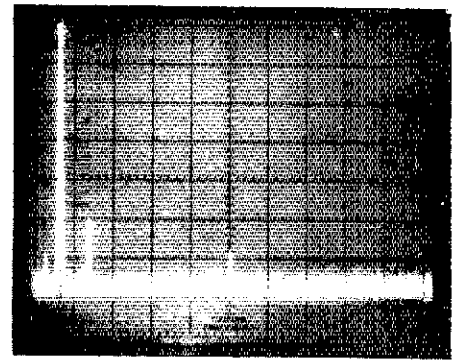


Fig 4—Worst-case spectral display of the Uniden HR2510. Horizontal divisions are each 10 MHz; vertical divisions are each 10 dB. Output power is approximately 20 W at 28.5 MHz. All harmonics and spurious emissions are at least 49 dB below peak fundamental output. The HR2510 complies with current FCC specifications for spectral purity.

Table 3

ARRL Laboratory Measurements ARD 230A Linear Amplifier

Band (MHz)	*Anode Current (A)*	*Anode Voltage*	*Power Output (W)*	*Drive Power (W)*
1.8	1.1	2200	1500	60
3.5	1.0	2200	1500	44
7	1.15	2200	1500	50
14	1.1	2200	1500	50
21	1.05	2200	1500	50
24	1.1	2200	1500	55
28	1.15	2200	1500	60

example, 120 mA grid current), the amplifier immediately switches to standby and you must press the front-panel RESET switch to resume operation.

There is so much protection built into the 230A that it is virtually impossible to damage the amplifier. You can transmit into the wrong antenna, hit the amplifier with 150 W drive or manually mistune it. There are no fireworks—the amplifier switches to standby and displays the reason. Correct the problem and try again.

Two LCD bar graphs in the upper left-hand corner of the front panel display important amplifier operating parameters. The top bar graph displays power output (except at amplifier power-up, when it displays the time remaining in the five-minute warm-up period). The bottom bar graph is a multimeter that can separately display anode voltage, anode current, grid current, SWR or reflected power.

RF Deck/Power Supply

The RF deck/power supply is a heavy-duty rectangular gray box on casters. As mentioned before, this box is made so you can place it in any well-ventilated space up to 250 feet away from your operating position. For me, this meant placing it in the far corner of my shack so that the blower noise didn't bother me. The RF deck/power supply has two front-panel indicators, POWER and ON. The rear panel features an SO-239 for RF OUTPUT, a BNC female for RF INPUT, and multipin connectors for ANTENNA SWITCHING (DB9), ACCESSORY (DB15) and CONTROL (DB25). It also holds the main power circuit breaker, three fuses, an ALC adjustment control and a ground lug.

CONTROL is for the interconnection between the RF deck/power supply and the microcontroller. ANTENNA SWITCHING provides outputs for controlling external antenna relays. There are six outputs on the ANTENNA SWITCHING connector, corresponding to the amplifier's specified frequency ranges (see Table 1). Note that the same antenna-switching-control signal is used for 10 and 12 meters. According to the manual, the ACCESSORY jack can be used for connection of accessories such as an automatic antenna tuner, but no detail is supplied.

The plain exterior of the RF deck/power supply gives little indication of what's under the hood. Inside, the 230A is a wonderfully crafted blend of mechanical and electrical engineering. The top third of the chassis is devoted to the RF deck, and the power supply is in the bottom.

Two 3CX800A7s are mounted on a chassis along the rear wall. A huge blower, mounted to the bottom of this chassis, hangs down into the power supply compartment. It draws air through slots in the sides of the cabinet and blows it into the chassis that supports the tubes. The only way for the pressurized air to exit is through slots cut directly below the tubes. Chimneys direct the airflow through the 3CX800A7 anode coolers, and warm air exits through slots in the cabinet top and sides.

A pi input network is used for each band to provide best linearity and drive characteristics. Input band switching is accomplished by relays; the microcontroller switches in the appropriate pi network for the frequency of operation. The input module also contains the ALC circuitry, an RF wattmeter and an RF sensing circuit for driving the frequency counter that tells the microcontroller the frequency of the RF input signal.

The band switch is a heavy-duty, three-section ceramic Radio Switch Co model 86. The output network, a pi-L circuit on all bands, features air variables for tuning and loading. Various transmitting-type capacitors are switched in parallel with these variable capacitors for operation on the low bands. Drive motors for the band switch and variable capacitors are mounted to the bottom of the RF deck and hang into the power-supply compartment.

The high-voltage power supply produces 2.25 kV dc at 1.2 A for the 3CX800A7 anodes. The supply features a Peter Dahl Hypersil® transformer and a full-wave bridge consisting of four high-voltage rectifiers. Filtering is accomplished by six 240-μF, 450-V electrolytic capacitors connected in series for a total filter rating of about 40 μF at 2.7 kV.

ARD included several protective features of note in the RF deck/power supply. There are three primary interlocks (one for each removable cabinet panel), and a high-voltage shorting bar. The primary circuitry incorporates inrush-current protection for the rectifiers. Following Eimac's recommendations, ARD has included a 25-ohm, 25-W resistor in series with the anode supply to limit current to a safe value in case of a high-voltage short circuit.

As mentioned earlier, the 230A (as supplied from the factory) will not operate on the 17, 12 and 10-meter amateur bands. Getting the 230A on 10 and 12 meters is easy: Send a copy of your amateur license to ARD, along with a check for $15, and they will send you a new PROM for the microcontroller. Installation takes about ten minutes. Operation on 17 meters is

somewhat more difficult to accomplish. The amplifier was produced well before 17-meter operation was authorized for US amateurs. According to ARD, a modification will be available to allow 17-meter operation, but the amplifier will have to be returned to the factory for installation of this modification. Future production units will incorporate 17-meter operation. Contact your dealer or ARD for more information.

Setup and Operation

Our 230A arrived from the dealer in three cartons—one each for the RF deck/power supply, microcontroller and high-voltage transformer. The transformer is shipped separately to minimize the potential for damage during handling.

Setup involves two steps: removal of packing material inside the RF deck, and transformer installation. The first operation involves taking off the top panel and carefully removing packing material that holds everything in place during shipment. While removing the packing material, it's a good idea to visually inspect components and connections and check that the tubes are properly seated. There were no shipping-related problems with the review amplifier.

Transformer installation is remarkably easy. The transformer is shipped on a plate that fits a cutout in the bottom of the RF deck/power supply. Position the RF deck/power supply upside-down (casters in the air). Remove four bolts, mate two connectors, lower the transformer into place (the mounting plate has convenient handholds) and replace the four bolts. The whole operation is over in five minutes. It takes a bit of effort to turn the RF deck/power supply right-side-up—with the transformer installed, the unit weighs a hefty 90 pounds.

Interconnecting the 230A with the rest of my station was easy. ARD supplies all necessary cables, including a 15-foot control cable to connect the microcontroller to the RF deck. Longer cables—up to 250 feet—are available.

Although I've used a number of different power amplifiers over the years, operating the 230A took some practice. On most bands, 60 W is all it takes to drive the amplifier to 1.5 kW output. With the 120-W transceiver I use, I often tripped the grid-protection circuit until I hooked up the ALC. After that, no problem.

After using the amplifier for a while in the automatic mode with factory presets, I decided to tune the presets for my antennas. Manual tuning took some practice, but the protective circuitry prevented any damage. Once everything is set up, the 230A is practically an extension of your transceiver.

The 230A has one characteristic that I find bothersome. On 10 meters, it sometimes fails to keep track of the new operating frequency as you move around the band. Also, if you switch bands with the amp in the operate mode, the frequency counter sometimes fails to read the new operating frequency and the microprocessor does not tune the amplifier for the new band. (This happens when the 230A is used with an exciter that contains SWR-dependent power-reduction circuitry, as follows: In its automatic and semiautomatic modes, the 230A changes bands by sensing that the exciter has changed bands. For this to happen, the exciter must transmit RF on the "new" band at a level sufficient to drive the 230A's frequency counter. Further, the exciter must be able to transmit "new"-band RF into the "old"-band input network until the 230A senses the new frequency and changes bands. Snag: The exciter "sees" the old-band input network as a high SWR and reduces its output power to a level insufficient to drive the 230A's sensing circuitry.) The solution is simple: Switch the amp from operate to standby, briefly transmit with your transceiver, and switch back to operate. In standby, the transceiver sees the antenna and delivers enough RF for the counter to get a reading. ARD has modified the input board to make the amplifier more responsive to frequency changes, and has incorporated this change in current production units. The modification cures the 10-meter problem, and helps with the band-change difficulty.

When we first received the 230A, it did not meet spectral purity requirements because of a spurious response in the 90-MHz range. After talking with Chuck White from ARD, we discovered a missing inductor on a trap on the output board. ARD sent a replacement board, which fixed the problem. Fig 4 shows that the spectral purity of the 230A is excellent.

The ARD 230A effortlessly delivers power at the maximum legal limit, runs cool even during extended contest operation, and is virtually impossible to hurt (at least with RF!). Once the amplifier is set up for your station, you have 1.5 kW on tap without having to think much about it. I'm not looking forward to surrendering the review unit to the Product Review editor!

Price class: $5500. Manufacturer: Advanced Radio Devices, 22560 Glenn Dr, Sterling, VA 22170, tel 703-450-5595.

SOLICITATION FOR PRODUCT REVIEW EQUIPMENT BIDS

[In order to present the most objective reviews, ARRL purchases equipment "off-the-shelf" from Amateur Radio dealers. ARRL receives no remuneration for items presented in the Product Review or New Products columns.—*Ed.*]

The following ARRL-purchased Product Review equipment is for sale to the highest bidder. Prices quoted are minimum acceptable bids and reflect a discount from the purchase price.

Sealed bids must be submitted by mail and be postmarked on or before May 26, 1989. Bids postmarked after the closing date will not be considered. Bids will be opened seven days after the closing postmark date. In the case of equal high bids, the high bid bearing the earliest postmark will be declared the successful bidder.

Please clearly identify the item you wish to bid on, using the manufacturer's name, model number, or other identification number if specified. Each item requires a separate bid and envelope. Shipping charges will be paid by the successful bidder, FOB Newington. The successful bidder will be advised by mail of the successful bid. No other notifications will be made, and no information will be given by telephone to anyone regarding final price or identity of the successful bidder.

Please send your bids to Kathy McGrath, Product Bids, ARRL, 225 Main St, Newington, CT 06111.

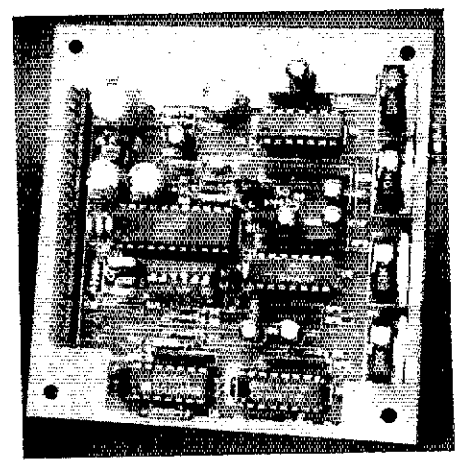
Alinco Electronics DJ-100T 2-meter FM hand-held transceiver, s/n 0000606 (see Product Review, Mar 1989 *QST*). Minimum bid $180.

ETO Alpha 86 1.8- through 28-MHz linear amplifier, s/n 88340043 (see Product Review, Apr 1989 *QST*). Minimum bid $1997.

New Products

REPEATER AUDIO INTERFACE

☐ Creative Control Products has introduced the UAI-20 Universal Audio Interface for repeaters. The UAI-20 is a link-audio mixer providing CTCSS decoding, DTMF mute and link-audio monitoring/mixing. Among the notable features of the UAI-20 is selectable muting of DTMF tones from the repeater's transmitted audio. Price: $89 plus shipping. For more information, contact Creative Control Products, 3185 Bunting Ave, Grand Junction, CO 81504, tel 303-434-9405.—*Rus Healy, NJ2L*



Hints and Kinks

Conducted By David Newkirk, AK7M
Assistant Technical Editor

INCOMPATIBILITY BETWEEN VACUUM-TUBE AND SOLID-STATE EQUIPMENT

☐ The growing popularity of modem-based digital communication (RTTY, packet radio, and so on) has led to the increased use of small, used oscilloscopes—often based on vacuum tubes instead of transistors—as tuning aids. Although tube-based scopes can be well suited to tuning-indicator applications, they should be thoroughly checked for compatibility before solid-state gear is connected to them.

The Heath® HO-10 monitor scope is an example of why such caution is necessary. This 3-inch-CRT oscilloscope was produced a number of years ago and is common at swap meets. Unmodified, the vacuum-tube-based HO-10 may damage solid-state equipment connected to it. Here's why—and how to modify the HO-10 for compatibility with solid-state gear.

The first fix involves the HO-10's MODE or FUNCTION switch. (This switch is marked MODE on the HO-10 schematic, but is labeled FUNCTION on the scope's front panel.) With age, this switch (see Fig 1A) may deteriorate to the point that it acts as a shorting switch (a switch containing moving contacts that connect to one circuit before breaking contact with another) instead of the *non-shorting* switch it was intended to be. When this happens, 170 V dc may appear at the HO-10's HORIZONTAL INPUT jack as the MODE switch is moved from SINE to AF TRAP. A voltage of this magnitude can instantly destroy low-voltage, solid-state circuitry. Cure: Replace the defective MODE switch with a switch that reliably breaks one circuit before making contact with another.

The second of the HO-10's problems is C16, the coupling capacitor between the HO-16's MODE switch and horizontal amplifier V3C. When the MODE switch is in the SINE position, C16 (2 μF at 200 WVDC) charges to about 170 V. If this happens, moving the MODE switch to AF TRAP (the position selected when the HO-10 is used as a RTTY tuning indicator)

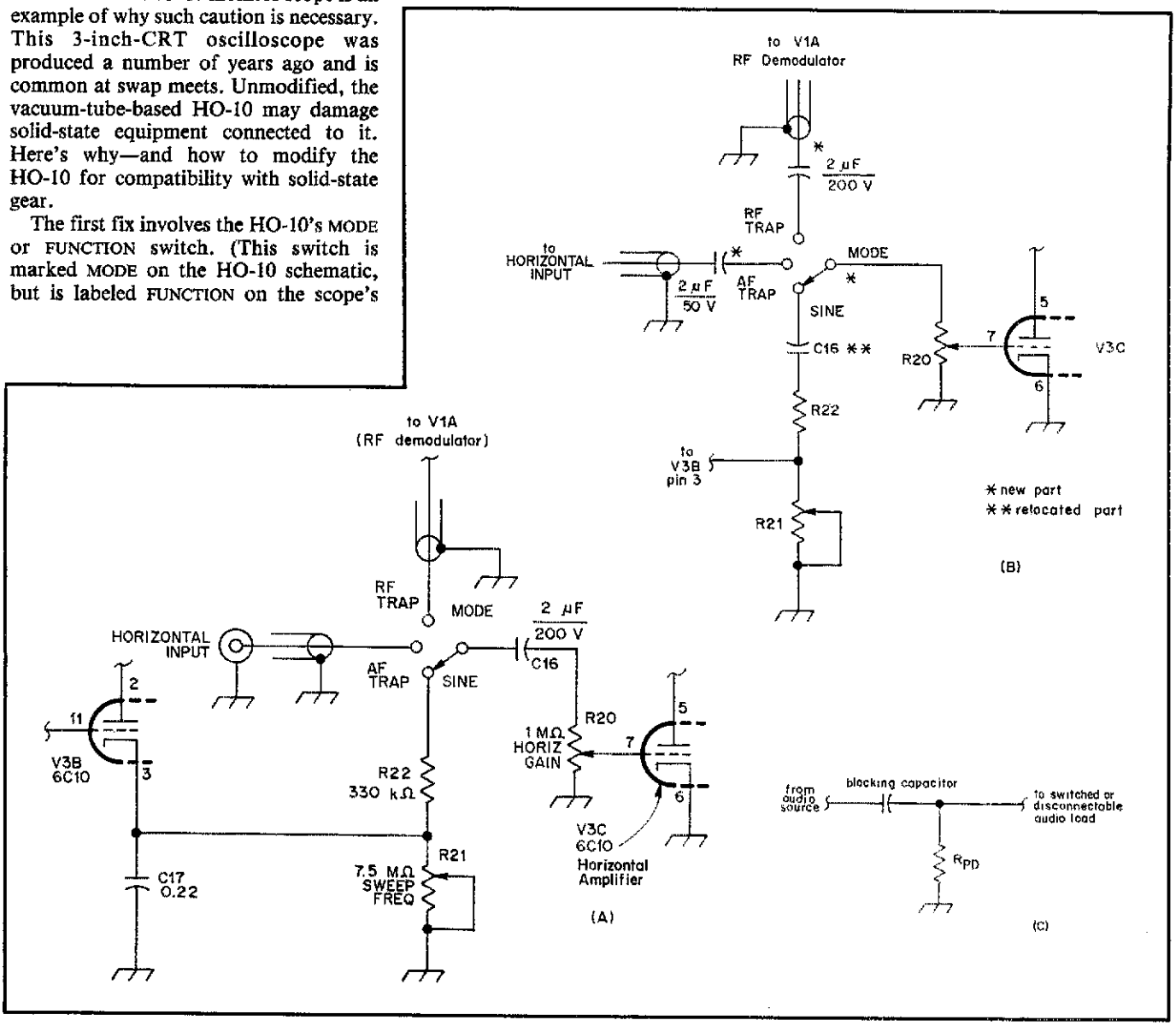


Fig 1—Deterioration of the Heath HO-10's MODE switch can cause momentary short circuits between the switch's AF TRAP and SINE terminals when the switch is cycled (A). When this occurs, V3B's cathode potential (as high as 170 V) appears at the HORIZONTAL INPUT jack, spelling almost certain doom for solid-state equipment connected to the jack. Dallas Williams suggests curing this with a new MODE switch. Even if the HO-10's MODE switch is in good shape, however, the high-voltage charge C16 acquires with the MODE switch in the SINE position is applied to the HORIZONTAL INPUT jack when the switch is moved from SINE to AF TRAP. Dallas's solution to this consists of moving C16 and adding two capacitors as shown at B. (The 2-μF capacitors are nonpolarized paper- or plastic-dielectric units.) C shows your editor's high-tech fix to thumps caused by sudden charging of blocking capacitors in audio circuits. To keep circuit loading negligible, make the resistance of pull-down resistor R_{PD} at least ten times the impedance at the point across which the resistor is connected.

connects the charged capacitor across the HO-10's HORIZONTAL INPUT jack. A voltage of 170 can be fatal to a solid-state device connected to the HORIZONTAL INPUT jack. Cure: Add two 2-μF, 200-WVDC capacitors and relocate C16 as shown in Fig 1B.

Modified in this way, the Heath HO-10 makes a fine tuning aid for digital communications. It's likely that other monitor scopes—and, for that matter, other vacuum-tube-based equipment—may have similar problems. Because of this, it's a good idea to check vacuum-tube gear for safe operation before connecting it to solid-state equipment.—*Dallas Williams, WA0MRG, PO Box 1, Sedgwick, CO 80749-0001*

AK7M: Although Dallas's equipment-compatibility hint may seem to be equipment-specific, it isn't. One of the first facts we learn about capacitors is that they can "block dc while allowing ac to pass." This quoted statement is a bit simplistic: A capacitor can block dc *only after it has charged to the dc voltage it's expected to block.* If the simplistic view were true, you could connect one lead of a 0.01-μF, 1-kV capacitor to, say, 500 V and grab the capacitor's free lead with no ill effect. In fact—and depending on how close your body is to ground potential—you may receive a short, *dangerous* jolt as the capacitor charges to 500 V *through you.* This happens because an uncharged capacitor "looks like" a short circuit until it charges.

Unplanned-for capacitor-charging effects may be no more than annoying. Have you ever put a pair of headphones on *before* plugging them into an unloaded solid-state audio amplifier and heard a deafening *thump* as you plugged the headphones in? Such thumps occur when an amplifier's dc-blocking output capacitor charges through the output transducer (your headphones or speaker). This situation can be more than an annoyance: I once blew the headphone-circuit blocking capacitor in a 1930s-vintage ham receiver merely by plugging in headphones. The capacitor had been on the verge of failure; the sudden charging-current pulse finished it off and caused a headphone pop that made my ears ring for several minutes. What would have happened if I'd plugged in a solid-state amplifier instead of headphones?

If component failure causes voltage to appear where it doesn't belong, the cure is simple: Replace the failed component. If suboptimal circuit design is the cause, the circuit can be modified for safer (or less annoying) operation. Audio thumps or clicks that occur when a load is connected or switched can often be cured simply by the addition of pull-down resistors at the "floating" side of culprit capacitors (Fig 1C).

INSULATION SUPPORTS AS RADIAL TIE-DOWNS

☐ Verticals are useful antennas for DX work on the low bands. For many hams, the tedious job of burying radials for a vertical-antenna ground system is a major drawback. Some studies have shown that radials laid *on* the ground, rather than buried in it, provide a more-efficient RF ground than buried radials. On-ground radials require special installation techniques, however: They must be securely fastened to the ground so that they do not trip people or foul lawn mowers.

For several years, I have successfully used insulation supports as on-ground-radial tie-downs. Insulation supports resemble very long, headless nails and are pointed at both ends. Designed to support thermal insulation between house floor joists, they are generally sold by building supply houses in 16- and 24-inch sizes at $12 to $15 per thousand.

Install the insulation supports on a given radial as follows: Lay the radial wire on the ground in its proper position. Prepare a dozen or so of the supports by bending them into a *U* shape. Drive these "staples" into the ground and over the radial every few feet along the radial. Space the staples closely enough along the length of each radial to secure the wire and keep flush with the ground.

The best time to install surface-mounted radials on a lawn is during colder months when grass is dormant: Turf will cover the radials as soon as warm weather arrives and the grass resumes growth. As a warm-weather alternative, mow the grass just before installing the radials.—*Drayton Cooper, N4LBJ, Bowling Green Presbyterian Church, PO Box 5, Bowling Green, SC 29703*

AN IMPROVED CIRCUIT FOR INTERCONNECTING THE SB-200 AMPLIFIER AND SOLID-STATE TRANSCEIVERS

☐ I encountered a problem similar to that discussed by James Hebert ("Using the SB-220 Amplifier with Solid-State Transceivers," *QST*, Jan 1988, p 45), when I sought to drive my Heath® SB-200 amplifier with a newly acquired Kenwood TS-940S transceiver. The hot contact of the SB-200's relay-control jack exhibits an open circuit voltage of −130 to ground; the short-circuit current of the SB-200's relay-control circuit is 50 mA. The open-circuit voltage could rise to as high as 170 under fault conditions in the SB-200. The Kenwood manual states that the TS-940's control relay is intended for low-current applications; I infer that "low current" also means "low voltage." As a result, I did not want to connect the SB-200's 130-V control line to my TS-940S. Instead, and in order to get on the air quickly, I used a relay between the TS-940S and SB-200. I wasn't satisfied for long: It seemed ridiculous—and rather noisy—to use the transceiver relay to drive another relay that finally switched *another* relay in the SB-200.

To solve this problem, I designed an interface circuit (Fig 2) that uses a high-voltage, P-channel MOS power transistor—an IRF9612—as a switch. The IRF9612 has a source-to-drain breakdown voltage of 200, can switch up to 1.5 A, exhibits a channel resistance of 4.5 Ω when turned on, comes in a TO-220 plastic package, and costs $3.50/unit in small quantities. The IRF9612 also includes an integral drain-to-source protection diode capable of clamping transients that can result from switching inductive loads.

The circuit is powered by a 9-V battery, which provides enough voltage to drive the MOSFET in this low-current switching application. The 1-kΩ resistor limits the peak current flowing in the transceiver relay to approximately 9 mA and sets the MOSFET turn-on time to approximately 0.3 μs (this assumes that the MOSFET's effective input capacitance is 300 pF). The 470-kΩ resistor sets the turn-off time constant to 140 μs and limits the closed-circuit current to 20 μA. The 15-V Zener diode protects the transceiver should the MOSFET develop a gate-to-drain short circuit. (In that unlikely event, the Zener diode will limit the voltage applied to the transceiver to −24. If you intend to substitute a diode with a different Zener voltage for this part, remember that the Zener diode's breakdown rating must comfortably exceed the battery voltage [9

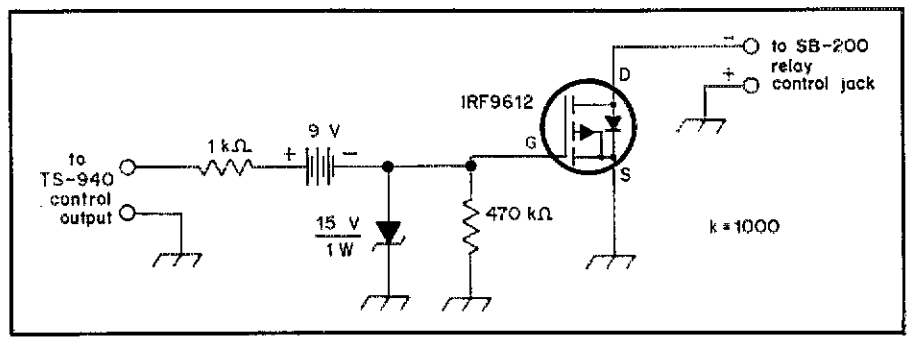


Fig 2—Richard Jaeger's solid-state transceiver-to-amplifier interface uses a power MOSFET instead of a relay for amplifier control. For amplifiers that use a *positive* relay-control voltage, reverse the polarity of the Zener diode and battery, and use an IRF612 N-channel MOSFET instead of the IRF9612.

in this application]).

I built the circuit on a piece of perfboard, mounted the board in a small metal box, and used shielded cable for connections between the interface box, amplifier and transceiver. Stray-RF problems have not occurred with this arrangement. Because the interface circuit is self-contained, the SB-200 and TS-940S need not be modified for operation with the interface.—*Richard C. Jaeger, K4IQJ, 711 Jennifer Dr, Auburn, AL 36830*

MORE ON MODIFYING GLOVES FOR INCREASED DEXTERITY AND BETTER FEEL

☐ When I read the suggestion about cutting the fingertips from work gloves (Ray Lustig, "Modified Work Gloves," *QST*, May 1988, p 40), it reminded me of something that may be of further value to your readers. As a police officer, I've learned a trick passed down from the old timers on the force: Cut a slit into the palm side of the glove's trigger finger to allow your trigger finger to slip out when you hold a pistol. Of course, this modification also allows the finger to be returned to the glove!

For doing antenna work in cold weather, a pair of gloves modified this way (perhaps the thumb and first finger of each glove, or at least these fingers on the glove for the dominant hand) would allow these fingers to be kept warm between instances of handling small parts.—*Harry Blesy, N9CQX, 7810 Central, River Forest, IL 60305*

SWITCHING AN 80/75-METER DIPOLE BETWEEN 80/75 AND 160 METERS

☐ A coax-fed 75/80-meter dipole can be used on the 160-meter band by connecting the dipole-feed-line inner conductor and shield together and feeding the coax and dipole as a random wire. Changing bands is inconvenient with this arrangement, however; moving from 75 or 80 meters to 160, for instance, involves disconnecting the antenna feed line, adding a shorting adapter to the feed-line connector, and connecting (or reconnecting) the shorted feed line to an antenna tuner.

Fig 3 shows my solution to this problem. When the BAND switch is thrown to 80/75, the coax line is connected to the transmitter, transceiver or antenna tuner as usual. When the BAND switch is thrown to 160, the inner conductor and shield of the coax feed line are connected together and to the center conductor of the TX OR TUNER connector. At the same time, the shell of the ANT jack is isolated from the TX OR TUNER connector shell.

Construct the switching adapter as shown in Fig 3. If you cannot locate a chassis-mount male connector for use as the TX OR TUNER connector, use a chassis-mount female connector in conjunction with a male-to-male adapter.

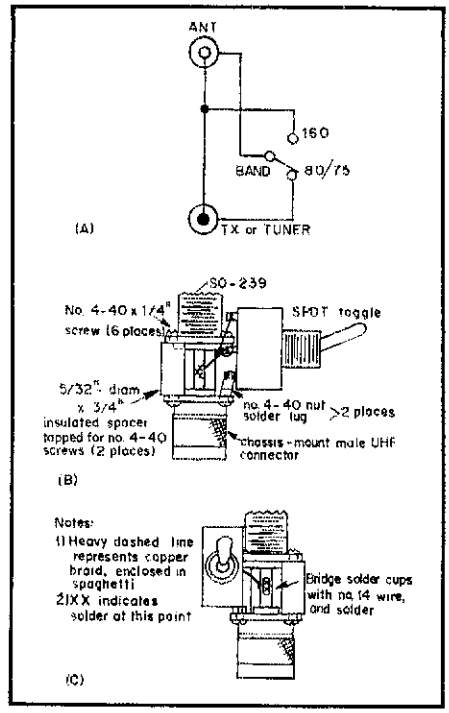


Fig 3—Robert Stein uses this arrangement to switch a coax-fed 75-meter dipole between dipole and random-wire modes. The BAND switch is a standard-sized toggle switch; don't use a miniature or subminiature switch in this application.

I have used this scheme at the 100-watt level without encountering arcing between the coax inner conductor and shield or between the BAND switch contacts. Nonetheless, be aware that RF voltage will be present *on the antenna feed-line shield* when a coax-fed 80/75-meter dipole is used as a 160-meter random wire—and don't touch the BAND switch when transmitting.—*Robert Stein, W6NBI, 1849 Middleton Ave, Los Altos, CA 94022*

BETTER SSB FOR THE COLLINS R-390A RECEIVER—REVISITED

☐ In my recent Hints and Kinks item, "Better SSB for the Collins R-390A Receiver" (*QST*, Jan 1989, p 38), every reference to the *R-390A* should read R-390. [The blunder was mine.—*AK7M*] The details of the modification and all circuit references described in that article apply only to the Collins *R-390* receiver, and *not* the R390A, because of the differences in their circuits.

Some receiver aficionados think that the R-390 and R-390A are identical except for their method of IF filtering. (The R-390 uses LC IF filtering; the R-390A uses mechanical filters and is generally considered to be more desirable because of this.) The R-390A is actually a pared-down R-390: It has one fewer RF amplifier and two fewer IF amplifiers than the '390. This seems to make the R-390 a little more sensitive than the '390A. The '390 and 390A also differ in their power supplies and tube complements. These differences make circuit modules and most parts non-interchangeable between the two receivers.

My modification concerns the R-390's AGC circuitry; the AGC circuits in the R-390 and R-390A are similar. Both receivers use 12AU7/5814 tubes for AGC-rectifier and AGC-time-constant functions; however, the part numbers and tube-pin references differ between the two receivers for the circuitry that serves these functions. Anyone wishing to improve the SSB performance of an R-390A by trying my modification should consult a schematic diagram of the '390A for circuit details. Please note that I have *not* attempted this modification on an R-390A; the basic idea should be applicable to this receiver, however.—*Ken Johnson, N5US, PO Box 10063, Austin, TX 78766*

A SIMPLE FIELD-STRENGTH METER

☐ Fig 4 illustrates a field-strength meter that can be used for antenna or matching-network tuning. It consists of a short dipole antenna, a detector and a digital multimeter (DMM). With A and A′ equal to about 2 feet, the field-strength meter provides adequate near-field sensitivity from 80 through 2 meters. (This is the range over which I've tried the circuit; the meter's actual useful range may be wider.)

I built my version of the detector on a small piece of copper-clad board and coated it with epoxy resin for permanent outdoor use. To minimize the pickup of feed-line radiation, I mount the meter antenna horizontally when sampling energy from my horizontal HF dipoles and vertically for use with my 2-meter groundplane antenna.—*Albert E. Weller, WD8KBW, 1325 Cambridge Blvd, Columbus, OH 43212*

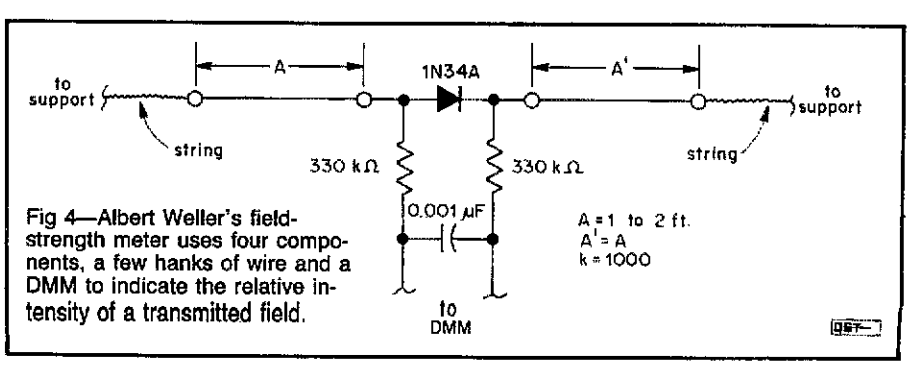


Fig 4—Albert Weller's field-strength meter uses four components, a few hanks of wire and a DMM to indicate the relative intensity of a transmitted field.

Technical Correspondence

Conducted By Paul K. Pagel, N1FB
Associate Technical Editor

ELEVATED VERTICAL ANTENNA SYSTEMS Q&A

☐ Several amateurs who read my article, "Elevated Vertical Antenna Systems,"[1] wrote to ask me some questions about it. I thought their questions and my answers to them would be of interest to others.

Q: Do I have to use a metal mast to hold up the monopole? Do I have to use metal masts for the supports at the end of the radials? Do I have to use ground rods at the base of all the supports?

A: No. The monopole and the radial(s) must be metallic, of course, but you can use anything you have available to support the structure. Wooden posts, plastic pipe, tree limbs, etc, are suitable. You don't have to run a ground wire from the coax shield to a ground rod. The entire antenna can "float" above ground, or you can tie the coax shield and the inner ends of the radial(s) to the metal support mast, if you use one.

Q: Can I let the radials droop so that their outer ends are lower than at the center where they join the coax feed line?

A: Yes. It's okay to let the radials slope downward from the base of the monopole toward their outer ends. This configuration will increase the feed-point impedance somewhat, which may provide a better match to 50-Ω coax. However, the gain of the antenna at low take-off angles also decreases when you allow the radials to droop. The more droop, the lower the gain. I have not modeled the case where the radials are *higher at the ends than at the feed point,* but I intuitively feel that this is not a good idea.

Q: What happens if I have a ground-mounted vertical and I vary the number of radials? What about varying the length of the radials on a ground-mounted vertical? How will it work compared to an elevated monopole with elevated radials?

A: I have run quite a few NEC[2] models on this topic, and the information presented in Table 1 summarizes the results. The gains listed are in dBi, at a take-off angle of 10 degrees. The radiator is ground-mounted, has a physical height of λ/4, and the operating frequency is 3.8 MHz. The radials are buried shallowly at a depth of only 3 mm, so the results for radials that are simply laid on the surface of the soil should be very similar. The ground constants (for average soil) are not exactly the same as those that I used in the *QST* article, but they are fairly close, so that a comparison between the data shown here and that in the article will be meaningful. Notice that when only four radials are used, *shorter radials are sometimes superior to longer ones!*

Table 1

Power Gain (dBi) at a 10° Take-Off Angle for an NEC-Modeled Ground-Mounted Vertical Antenna with Shallowly Buried Radials

Average soil (σ = 0.003 ϵ_r = 13)

Radial Length	Number of Radials						
λ	4	15	30	60	120	240	360
1/8	−4.51	−3.48	−3.29	−3.19	−3.14	−3.10	−3.09
1/4	−4.86	−3.20	−2.59	−2.27	−2.13	−2.07	−2.05
1/2	−4.82	−3.09	−2.32	−1.70	−1.34	−1.18	−1.14
3/4	−4.83	−3.06	−2.24	−1.54	−1.10	−0.93	−0.89
1	−4.81	−3.02	−2.15	−1.34	−0.70	−0.36	−0.28
Good Soil (σ = 0.05 ϵ_r = 42)							
1/8	1.45	1.85	1.98	2.07	2.12	2.13	2.14
1/4	1.46	1.88	2.06	2.21	2.32	2.37	2.38
1/2	1.48	1.90	2.09	2.27	2.42	2.53	2.56
3/4	1.49	1.91	2.10	2.29	2.46	2.57	2.61
1	1.49	1.91	2.10	2.31	2.49	2.64	2.70
Poor soil (σ = 0.00015 ϵ_r = 42)							
1/8	−6.60	−6.03	−5.89	−5.80	−5.74	−5.70	−5.69
1/4	−5.97	−4.51	−4.36	−4.28	−4.21	−4.15	−4.13
1/2	−7.68	−5.33	−3.97	−3.10	−2.76	−2.65	−2.62
3/4	−9.04	−5.46	−3.85	−3.00	−2.63	−2.48	−2.44
1	−10.23	−5.73	−3.65	−2.06	−1.28	−1.11	−1.10

Table 1 also reveals that, when given a fixed total length of wire, some radial configurations work much better than others. As an example, consider the situation where 30 wavelengths of wire are available, and the soil is "average." The wire may be arranged four different ways, producing gain as follows: 240 λ/8 radials, gain = −3.10 dBi; 120 λ/4 radials, gain = −2.13 dBi; 60 λ/2 radials, gain = −1.70 dBi; 30 λ radials, gain = −2.15 dBi. For this case, 60 λ/2 radials perform best.—*Al Christman, KB8I, Electrical Engineering Dept, Grove City College, Grove City, PA 16127*

BAUDS V BITS PER SECOND

☐ There seems to be some confusion among radio amateurs as to the meaning of the terms "bauds" and "bits per second" as used to describe data-transmission rates. The two terms are *not* interchangeable. Bauds are used to describe the *signaling* (or *symbol*) *rate.* This is a measure of how fast individual signal elements *could be* transmitted through a communications system. Specifically, the baud is defined as the reciprocal of the shortest element (in seconds) in the data encoding scheme. For example, in a system where the shortest element is 1 ms long, the signaling rate would be 1000 elements per second. Instead of using "elements per second," the term "baud" is used (incidentally, this is why it is not actually correct to refer to the "baud rate;" since baud already means elements per second, "baud rate" means "elements per second rate," something like "miles per hour speed"). Continuous transmission is not required, since signaling speed is based only on the shortest signaling element.

Signaling rate in bauds says nothing about actual *information transfer rate.* The maximum information transfer rate is defined as the number of equivalent binary digits transferred per second; this is measured in *bits per second.*

So far, everything seems fairly simple. The complications arise when more sophisticated data encoding schemes are used. When binary data encoding is employed, each signaling element represents one bit. In a quadriphase system, a phase transition of 90 degrees represents a level shift. There are four possible states in a QPSK system; since two binary bits are required to represent four possible levels, each state can represent two binary bits. If 1000 elements per second are transmitted in a quadriphase system where each element can represent two bits, the actual information rate is 2000 bit/s.

This scheme can be extended. It is possible to transmit three bits at a time using eight different phase angles (bit/s = 3 × bauds). In addition, each angle can have more than one amplitude. A standard 9600-bit/s modem uses 12 phase angles, four of which have two amplitude values. This

[1] A. Christman, "Elevated Vertical Antenna Systems," *QST*, Aug 1988, pp 35-42. See also Feedback, *QST*, Oct 1988, p 44.

[2] Numerical Electromagnetic Code; a mainframe computer program that is used to analyze antennas.

yields 16 distinct states; each state can then represent four binary bits. Using this technique, the information transfer rate is four times the signaling speed. This is what makes it possible to transfer data over a phone line at a rate that would produce an unacceptable bandwidth using binary encoding. This also makes it possible to transfer data at 2400 bit/s on 10 meters, where FCC regulations allow only 1200-*baud* signals.

When are transmission speed in bauds and information rate in bit/s equal? Three conditions must be met: binary coding must be used, all elements used to encode characters must be equal in width and synchronous transmission at a constant rate must be employed. In all other cases, the two terms are not equivalent. Each term is important at a different location in a communications link. Information transfer rate is most important to the communicator; how the information gets where it is going makes no difference. The link designer, however, need only worry about the signaling rate; the number of "bits per baud" is unimportant at this level.—*Bruce S. Hale, KB1MW, ARRL Lab Engineer*

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R. Freeman, *Telecommunication System Engineering* (New York: John Wiley and Sons, 1980), pp 327-328.

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W. Stallings, *Data and Computer Communications* (New York: Macmillan Publishing Co, 1985), pp 74-78.

ELIMINATING TV "BIRDIES"

☐ Those of us who operate in the 75- and 160-meter bands are not strangers to the raucous, grinding buzz caused by the family TV receiver, or from TV sets in the immediate neighborhood. This birdie appears every 15.75 kHz as we tune across the amateur band. Weak-signal copy is often impossible when one of these TV horizontal-oscillator harmonics (each of which is a multiple of the horizontal-oscillator frequency, 15.75 kHz) falls on a frequency we are using. Although we may copy louder amateur signals solidly through this racket, it is traumatic to endure it for more than a few minutes. What can be done to lessen or eliminate this form of QRM?

Recently, I had the occasion to suppress the interference caused by our Zenith console TV. Most of the TV trash was eliminated when I installed a "brute-force" ac-line filter at the TV set. I use the filter described in December 1986 *QST*.[3] It is important that you ground the filter case to the chassis of the TV set, or to an earth ground. The filter will not keep the horizontal oscillator harmonics from radiating via the ac line if the filter does not have a ground.

The TV-antenna feed line is also capable of radiating TV birdies. A TV high-pass filter may be of help in cleaning up horizontal-oscillator harmonics that are radiated in this manner.—*Doug DeMaw, W1FB, ARRL TA*

THE G5RV—WHICH COAX TO USE?

☐ The G5RV is a popular multiband antenna. Basically, it consists of two 51-foot collinear elements fed with 50-Ω coax through a 34-foot matching section made of twin lead. An antenna tuner is used between the coax and the transmitter. Some hams and G5RV antenna retailers pick RG-8X as the feed line because it provides low loss and—compared to RG-8 or RG-58—is physically lighter.

RG-8X has a foam dielectric that has a maximum RMS voltage rating of 300. The design of the G5RV makes it a voltage-fed antenna on 30, 15 and 10 meters. Even taking the matching stub into account, the feed-point impedance will be on the order of 500 to 1000 ohms, resulting in an SWR as high as 20:1! I've measured three G5RVs and found the SWR to be between 8:1 and 10:1.

With high SWR and power levels, the peak voltage rating of RG-8X coax can be exceeded.[4] Damage to the coax can occur slowly over a period of time, with symptoms such as increased receiver noise not being recognized as a coax problem. In other cases, damage can occur suddenly. I spoke with one ham who ran a kilowatt into a G5RV using RG-8X, and the resulting coax failure damaged his antenna tuner.

For low-power operation, I recommend using RG-58 to feed the G5RV. It has an RMS voltage rating of 1900, and its loss per 100 feet at 30 MHz is only 0.6 dB higher than RG-8X (2.3 dB v 1.7 dB). For high-power use, use RG-8 or RG-213, which both have voltage ratings of 5000. Do not use foam-dielectric RG-8 coax, which has a 600-V (RMS) rating.—*Richard Broomfield, K1TAV, 391 Gurleyville Rd, Storrs, CT 06268*

[3]D. DeMaw, "A Ham-Shack AC-Outlet Strip with Filtering," *QST*, Dec 1986, pp 25-27.

[4]J. Hall, "EMP Revisited," Technical Correspondence, *QST*, Oct 1987 p 38.

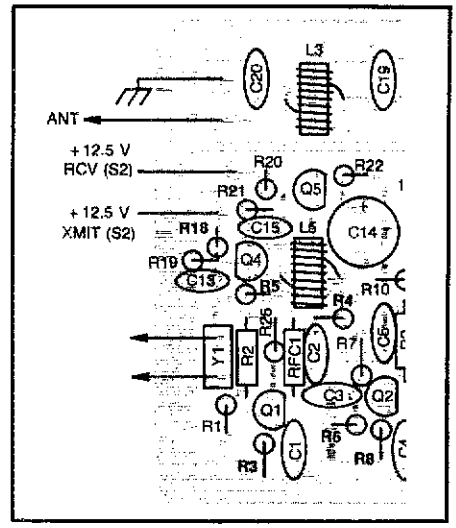
Feedback

☐ Please refer to "A Speaker Amplifier for Hand-Held Transceivers," *QST*, Jan 1989, pp 20-22. In Fig 1 on p 22, I've shown the polarity of C2 incorrectly; it should be reversed. Also, the correct Radio Shack® part number for C3 and C4 is 272-1070, and for C1, 272-1013. Mitchell Lee, KB6FPW, Linear Applications Engineer for National Semiconductor, recommends adding a 1-Ω resistor in series with C4 to assure stability of the amplifier. This addition is recommended because of process changes in the manufacture of the LM383.—*Leonard Van Prooyen, K8KWD*

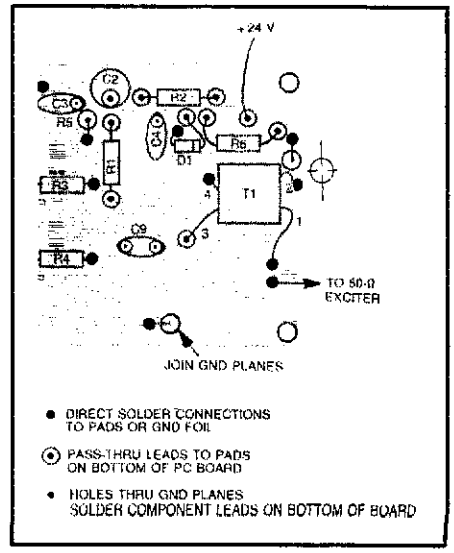
☐ Six resistor labels were inadvertently omitted from Fig 6 of "A Three-Channel CW Emergency Transceiver," Oct 1988 *QST*, p 30. A corrected portion of the parts-placement guide accompanies this item. In Fig 7, Nov 1988 *QST*, p 18, the capacitor labeled R26 should be C26. *(Tnx VE3THC).*

☐ In Fig 1 of "Power-FET Switches as RF Amplifiers," April 1989 *QST*, p 30, T1 should be grounded at point 3, and the RF input should be applied at 1. *(Tnx W3NQN).*

In addition, pass-through component leads should have been indicated at several places on Fig 3B, p 33. A corrected portion of the drawing accompanies this item. In Fig 2, p 31, FL1 uses four of the same capacitor labels (C2-C5) as are used in the amplifier schematic. Don't mix the labels; they are for two discrete items.



Corrected portion of Fig 6, Oct 1988 *QST*, p 30.



Corrected portion of Fig 3B, Apr 1989 *QST*, p 33.

Dallas/Fort Worth Diamond Jubilee National Convention: Y'All Come!

By John Fleet, WA5OHG
4348 Potomac
Dallas, TX 75205

The Ham-Com Amateur Radio Convention, in its 12th year, is pleased to host the Diamond Jubilee Convention of the American Radio Relay League. It will be the biggest Amateur Radio gathering ever in the State of Texas! Ham-Com represents 43 Metroplex Amateur Radio clubs who will provide a volunteer force of more than 200 for the convention. There will be activities for every interest: from serious ham radio to clowns for the kids. Plan to spend June 2-4, 1989 in Texas at the ARRL National!

Programs and Forums

The program is as big as Texas! There will be features on every aspect of Amateur Radio:

Friday night:

7 PM	CW for Instructors and Students
	Operating Procedures for New Hams
	Technician Cram Course

Saturday:

9 AM	ARRL Instructors' Class
	Contesting Forum
	MARS Joint Service Forum
	10/10 International Forum
	Packet-radio Forums (to 2 PM)
11 AM	AMSAT Forum
	DX Forum
	Traffic-handling Program
	Understanding Radio Waves
1 PM	ARRL Forum
	Antenna Forum
	Foreign Amateur Program
	Red Cross Forum
	YL Seminar
2 PM	ARRL Instructors' Workshop
3 PM	Basic Electronic Theory Program
	DX Program on Palmyra and Kingman
	UHF Forum
	160-Meter Forum
5 PM	Packet-radio Forums
Midnight	Wouff Hong Ceremony

Sunday:

9 AM	Contesting Forum
	Packet-radio Forum (to 1 PM)
	Power-line Conditioning
	SWL and Scanning Program
	10/10 International Program
11 AM	Alternative tower guy wiring
	AMSAT Forum
	Publishing Amateur Articles
	Surplus FM Gear Forum
2 PM	Skywarn School

Get Your Ticket! Upgrade!

There will be testing for all levels from Novice to Extra Class. The Friday session begins at 6 PM. On Saturday, there are sessions at 9 AM, 1 PM and 6 PM. The Sunday sessions begin at 9 AM. Tests are on a first-come, first-served basis. Bring your original license, a copy of your license which we may keep and photo ID. Testing fee is $4.75.

Giant Indoor Flea Market

The giant indoor, air-conditioned flea market boasts 444 6-ft tables with electricity available, if desired. Tables are $15.00 each for the first three. You will find everything you ever wanted from ham gear to computers, and much more.

Friday Hospitality Gathering

Ham-Com will host a Hospitality Gathering beginning at 6 PM on Friday in the lobby of the Sheraton CenterPark Hotel, adjacent to the Arlington Convention Center. There will be a cash bar, complimentary snacks and roast beef sandwiches. Live Texas Country Music will be provided by the "Hams," and yes, they are!

YL Hospitality

The YLs of the Texas YL Round-Up Net will host the YL Hospitality room during the convention. YL Hospitality will be open from 9-5 Saturday and 9-1 Sunday. At 1:30 PM on Saturday, this same group will present a program for the YLs, entitled *YLs in Amateur Radio*.

ARRL Banquet

On Saturday evening, Ham-Com will host the ARRL Banquet for 500 hungry folks. Seats are $16.00 each. We will feature a very special guest speaker and a very special Honorary Convention Chairman. AEA will be on hand to present their "Ham of the Year" award. Be sure to get your tickets early, as seating is limited.

Wouff Hong

Saturday night at midnight we will present the Royal Order of the Wouff Hong to some very deserving hams. If you have never attended this secret ceremony, plan to include it in your convention plans. Our local presenters are a hoot you don't want to miss.

Commercial Exhibits

You will find 100 commercial exhibit booths with every major manufacturer of Amateur Radio equipment represented. There will also be several regional dealers to sell you that new piece of gear you have been saving up for. In fact, you will find

Convention Special-Event Station

In celebration of the 75th Anniversary of the American Radio Relay League, the Metrocrest Amateur Radio Society (MARS) will operate W5AW as a special-event station from Arlington, Texas during the ARRL National Convention from 1700Z June 2 through 1800Z June 4, 1989. Suggested frequencies are as follows:

Band	*CW*	*Phone*
10	28.100-28.200	28.300-28.500
15	5-10 kHz above start of Gen plus Nov/Tech 21.100-21.200	5-10 kHz above start of Gen
20	5-10 kHz above start of Gen	5-10 kHz above start of Gen
40	5-10 kHz above start of Gen plus Nov/Tech 7.100-7.150	7.230 and up—Listen for DX at 7.050-7.100
80	5-10 kHz above start of Gen plus Nov/Tech 3.700-3.750	5-10 kHz above start of Gen

Send SASE for QSL to MARS, PO Box 117381, Carrollton, TX 75001-7381

that Ham-Com is a great place to save some money when buying new gear.

Commemorative Station W5AW

The Metrocrest Amateur Radio Society will operate the special Diamond Jubilee Commemorative Station at the convention. This station will operate for 49 continuous hours on all bands and modes. ICOM America, Inc is contributing the radio gear. The League is printing special QSL cards for the station to confirm all contacts. The station will be open for inspection during the entire convention. Be sure you contact this station, so you can receive one of the special QSL cards.

Delta Official Airline

In cooperation with the ARRL and Ham-Com, Delta is offering special rates which afford a 5% bonus off Delta's published round-trip fares within the United States and San Juan. Seven-day advance reservations and ticketing will be required.

To take advantage of this discount, call Delta at 1-800-241-6760 from 8 AM-8 PM Eastern Time, daily, for reservations. Refer to File Number E-0539.

Invited Foreign Amateurs

Ham-Com will present the Invited Foreign Amateur Program at 1 PM on Saturday. Each year Ham-Com invites and sponsors a foreign amateur who is known to make frequent contacts with area hams. This year's guest is Ing. Karel Karmasin, OK2FD. Karel is a member of the HF Committee of the Czechoslovakian Central Radio Club, founder of the Commodore computer Users Group in OK land, and should be a fascinating speaker. Be sure to meet this very interesting foreign ham while you are at the convention.

Transmitter Hunt

The amateurs of the North Texas Regional Communication System are sponsoring the Transmitter Hunt scheduled for Saturday afternoon. Anyone can sign up to hunt. The frequency will be 146.52 MHz and the competition is fierce. The North Texas boys are very good at hiding transmitters, so it should be loads of fun.

Saturday DX Breakfast

Come gather with the DX crowd at 7:30 AM on Saturday. There will be a special breakfast gathering at the Sheraton CenterPark Hotel. Tickets are $8.85 each for a full Texas breakfast.

Sunday QCWA Hospitality And Continental Breakfast

On Sunday at 7:30 AM, the combined Dallas and Fort Worth chapters of the QCWA will host a Hospitality Continental Breakfast at the Sheraton CenterPark Hotel. Tickets are $3.50 each, but you need not purchase breakfast to attend the hospitality. Just come and enjoy your fellow QCWAers.

Nonham Activities

You can come to the convention even if you don't want anything to do with radio and still have a great time.

The Saturday tours offer an excellent opportunity to sample the best shopping in Texas (Tour #1) or the best food and sightseeing (Tour #2). Buses leave the Convention Center at 10 AM Saturday and return at 4:30 PM, so you have the whole day away.

Ham-Com offers a professional kid-care room with clowns and cartoons free of charge for all kids over two years of age so you can have the day to yourselves. We'll even feed them lunch if you'll leave the money. For kids under two, just call the convention office at 214-423-7636 to make special arrangements.

The Arlington Convention Center is located right in the middle of the largest entertainment complex in Texas. The Six Flags Over Texas amusement park is just next door and the Wet N'Wild water park is just across the freeway. Ham-Com will operate shuttle buses to these attractions and discount tickets will be available for Six Flags.

Hotel

There are plenty of hotel rooms for you here in Texas! The special convention hotels for 1989 are as follows:

Sheraton CenterPark Hotel	$70 S/D
Radisson Suite Hotel	$74 S/D/T
Rodeway Inn Arlington	$47 S, $54 D
Quality Inn Arlington	$37 S/D

All reservations are made through the Housing Bureau at the Arlington Visitors and Convention Bureau. For reservations by mail, just fill out the preregistration form on this page. For reservations by phone, call Shirley or Brenda at the Arlington Visitors and Convention Bureau tel 817-265-7721.

See you at the Diamond Jubilee!

HAM-COM 1989
ARRL "DIAMOND JUBILEE" NATIONAL AMATEUR RADIO CONVENTION
JUNE 2-4, 1989
ARLINGTON CONVENTION CENTER
ARLINGTON, TEXAS

NAME _____ CALL _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Single Ham-Com Pre-Registration, $7.00 Each	$
Family Pre-Registration for 1 Ham & __Non-Hams (Max of 3) $10.00	$
Flea Market Tables - Max of Three, $15.00 Each	$
Additional Flea Market Tables over first 3, $25.00 Each	$
Flea Market Electrical Outlet, $25.00 Each	$
Tour #1, Shopping Tour to Dallas Galleria Mall $12.00	$
Tour #2, Tour to Old City Park & West End Market Place, $17.00	$
Saturday Morning DX Breakfast, $8.85 Each	$
Sunday Morning QCWA Continental Breakfast, $3.50 Each	$
ARRL Saturday Night Banquet & Program, $16.00 Each	$
I have enclosed my check or money order in the amount of	$

Hotel Room Reservations Request Form _____

Type of Room Requested: ___Single; ___Double; ___Quad/Suite. No. of Persons _____

Arrival Date & Time: _____ Departure Date & Time: _____

Hotel Preference: (Indicate first choice. Indicate 2nd and 3rd choice also.)

___Sheraton CenterPark Hotel, Convention HQ, $70.00 Single or Double
___Radisson Suite Hotel, $74.00 Single/Double/Triple/Quad. King/Double Suites.
___Rodeway Inn Arlington, $47.00 Single, $54.00 Double or Twin.
___Quality Inn Arlington, $37.00 Single/Double, $39.00 Triple/Quad, $59.00 Apt.

Guarantee: ___VISA; ___MC; ___AMEX; Card No. _____ Exp. _____

Signature: _____

PRE-REGISTRATION
DEADLINE: MAY 26, 1989

Mail Your Check Or Money Order To:
Ham-Com/ARRL National
P.O. Box 861829
Plano, Texas 75086

The Great 1989 HF Packet Design Quest

There be dragons: multipath, intersymbol distortion, group delay, QRM, QRN, bursty errors, contention and retries. Here's a chance for serious designers to make a valuable contribution.

By Paul L. Rinaldo, W4RI
Editor, *QST*

Medieval mariners *knew* that the earth was flat. As they sailed near the edge of the earth, it was commonly accepted that "beyond this place there be dragons." Hams now *know* that amateur packet radio works well on VHF/UHF, but not too well on HF. Sure, many of the HF ham bands are buzzing with packet activity. What's more, quite a volume of traffic is being handled by packet-bulletin-board-system (PBBS) stations. The problem is efficiency; ie, too many retries to get past the monsters. Because the AX.25 protocol includes an error-checking feature, packets with even itty-bitty errors are shunned by the receiving station. Then, the automatic repeat request (ARQ) feature of AX.25 takes over and keeps on retrying until a packet runs the ionospheric gauntlet completely unscratched.

We are no longer alone. What started out as terminal node controllers (TNCs), modems and AX.25 link-layer protocol developed by North American amateurs for our own use has spread to hams in all continents. Moreover, amateur packet technology is now used by some commercial enterprises, police, military, ocean research, weather reporting, the US Forest Service, the Federal Emergency Management Agency (FEMA) and others. The reasons? It is inexpensive, readily available and it works (at least on VHF/UHF). These nonamateur radio services have the need and the wherewithal to design their own solutions to the HF packet reliability problem, possibly by contracting the development to the US electronics industry.

WAN for the Realm

The major snag is cost. If Government or industry does it, the chances of getting something in the few-hundred-dollar class are mighty slim. If hams do it, the costs naturally have to fall within that price range or fail to meet amateur market realities. FEMA indicated their willingness to consider a modest grant to the ARRL to underwrite out-of-pocket costs of the designers.

Now, wait a minute! Shouldn't we just be worrying about amateur packet radio and let the other guys find their own solutions? Some Federal agencies, particularly FEMA, want to stay interoperable with whatever hams use for packet radio. They know that hams are usually first on the disaster scene. If the Government contracts for the development, per-unit cost of production models would probably be in the range of kilodollars rather than one-tenth that. There would be no assurance that the Government units would be able to intercommunicate with hams. Would hams likely purchase new gear at a much higher price than they're used to paying just on the off chance they might talk to the Government in emergencies? Hams may be frugal, but not silly.

There's another reason why it makes sense for amateurs to tackle this design job: It's part of our basis and purpose, specifically paragraph 97.1(b), "Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art." From an enlightened self-interest viewpoint, we need to solve this problem for our own reasons. Having accomplished that, we would have advanced the state of the art, reduced the risk inherent in the design process, created a market and produced a low-cost product that others can afford in quantity. No less important, we would have earned another feather in our cap, which would come in handy when someone coveteth our little oases of green space in the radio spectrum.

Protocols: Avoiding the Dragons

Why not just use AMTOR? Of course, it is a partial solution that's here today. There are even packet-to-AMTOR gateways. However, AMTOR has its problems. AMTOR is based on the older Baudot character set rather than the newer ASCII character set which is replete with upper and lower case, more symbols and computer control characters. At best, even when band conditions are perfect, AMTOR has a *maximum* efficiency of 50 percent, as only three characters are sent at a time, then the sending station must get an acknowledgment (ACK) before proceeding with new characters. While the symbol rate is 100 bauds, the throughput is between 0 and 50 bauds depending on band conditions. When the concept on which AMTOR is based was first conceived some years ago, designers didn't have the luxury of today's microprocessors and other digital

integrated circuits. Now, of course, it is *relatively* easy to implement a mutation of AMTOR that would dynamically adjust the transmission block length to circuit conditions. However, to do that with the older Baudot character set is an inelegant solution to the need to operate HF links as pieces of a growing worldwide packet network. In packet, the ASCII character set is widely used, and some countries are using 8-bit extended character sets to accommodate their non-Latin-alphabet written languages. And we have to keep reminding ourselves that packet can handle non-alphanumeric data transparently, something for which AMTOR is unsuited.

AMTOR has both ARQ (automatic repeat request) and FEC (forward error correction) modes. ARQ is used for point-to-point linking, and FEC is the mode to use for point-to-multipoint transmissions such as for bulletins and roundtables. It seems desirable to retain the point-to-point and point-to-multipoint capabilities of AMTOR and its robustness. However, AMTOR's limited character set and throughput are problems. Then there's AMTOR's pit bull persistence to hold onto a channel, which is a blessing to the two stations involved, but which doesn't let anyone else get a transmission block in edgewise. Whether or not AMTOR is used as a point of departure for a new HF packet protocol, it nevertheless sets a standard for comparison.

For an HF packet protocol to fit into the network snugly, it should be able to act as a bridge between distant VHF/UHF packet nets. It may be desirable for the sending HF packet station to take standard AX.25 packets and segment them into smaller transmission blocks for individual ACKing and glue the AX.25 packets back together at the receiving HF packet station. Transmission block lengths could be adjusted dynamically according to circuit conditions, at least in the point-to-point case.

Some special attention needs to be given to the point-to-multipoint case where at least some of the stations are having marginal reception. What happens if the protocol calls for sending some fancy FEC format or simply repeats the transmission block t times, yet the receiving station almost got the transmission but not quite—the frustrating close-but-no-cigar syndrome? AX.25 packets have to get there unscathed or "sorry, no ACK." This problem leads one to dream about a majority vote or anagram feature. Majority voting could be used where the packet was sent three times, but circuit conditions caused three different versions to be received. If 2 out of 3 transmissions of a particular character agree, then why not take a chance? If the particular character was received only twice, then why not display both somehow, perhaps anagramatically, and let the reader flip a coin? That might work fine for textual messages, but not so well for data where the integrity of each bit must be chaperoned. Then there's the soft decision. What if a whole packet is good except for one bit? Foiled—the frame check sequence (FCS) doesn't check—REJECT. But, what if the modem knew that bit no. 87 was a weak little bit? Wouldn't a smart packet disassembler like to know that so it could flip that bit, try the FCS and celebrate?

My Empire for a Modem

The de facto standard for HF packet modulation was based on the Bell 103 modem, which was available surplus and easy to home-brew. It uses frequency-shift keying (FSK), lopes along at 300 bit/s, and can fit into a CW filter bandwidth of 500 Hz. The two tones, being only 200 Hz apart, tend to fade together in the presence of frequency-selective multipath. That makes it likely that both tones will be gone some of the time. Thus there is little in-band diversity effect. The data rate, of course, is not breathtaking compared to some of the 2400-bit/s commercial HF modems. Right now, the 300-baud (not bit/s) speed limit is written into section 97.69 of the FCC rules. It may or may not be necessary to petition the Commission to change its rules in this regard depending on the type of modulation used. For example, a QPSK modulation system could transmit symbols at 300 bauds but have a data rate of 600 bit/s (said to be two bits per baud).

Also ricocheting off the ozone layer these days is some 600-Hz-shift FSK. The wider shift makes them less vulnerable to selective fading. Empirical observation shows that tones on the order of 400 Hz apart or greater tend to be more or less decorrelated; ie, they fade independently in the presence of multipath propagation. If the demodulator is designed to do so, it can keep demodulating during fades when one tone is down in the soup.

Thus far, we're using only *serial* (more technically, *serial-by-bit*) modems—the kind that takes a bit in and spits a modulation symbol out. Serial modems have been made to work on HF in speech bandwidths at speeds up to 9600 bit/s using training techniques; ie, send some known test bits, measure them, then do some adaptive equalization. But there's another camp that says that parallel (aka *multifrequency*) modems are best. Parallel modems use multiple tones throughout the speech passband and key each one at a much slower rate, maybe as slow as 75 bauds. Then all the keyed tones add up to some higher data rate. It's an old technique for HF data and one that's received a lot of attention lately.

Under Tucson Amateur Packet Radio (TAPR) and Radio Amateur Satellite Corporation (AMSAT), there is a move afoot by Bob McGwier, N4HY, Tom Clark, W3IWI, and others to dispense with hardware-type modems and do it all with software. Of course, they have to use some hardware in the form of special-purpose computers known as digital-signal-processing (DSP) boards. Two designs exist: One around the Texas Instruments TMS320 series, the other using the Motorola DSP56000 chip. Several designers in TAPR, AMSAT and Amateur Radio Research and Development Corporation (AMRAD) groups have a software developmental capability for these DSP engines. Most of the DSP investigations thus far have been directed toward parallel, rather than serial, HF modems. DSP appears to offer excellent possibilities, provided that the cost of the boards can be reduced somewhat in production.

Some Sleepless Knights

You don't have to have a PhD in HF packet technology to participate in this project. Participation is open to all radio amateurs who have the necessary technical abilities. A prior track record in completing design projects is desirable. Participation is not necessarily limited to individuals. In fact, there may be an advantage to a group of hams taking on the project. It is likely that most individuals would be more at home with either hardware or software aspects of the project rather than being all Renaissance types. Because it will be necessary for the software deliverables to work on the hardware deliverables and for understandable documentation to be generated, an interdisciplinary group appears to be an ideal approach.

Logistics

Some modest funding will be available to cover participants' direct out-of-pocket costs necessary for hardware and software prototype development. Funding will not cover indirect costs such as labor, overhead, fees or general and administrative (G&A).

Plans are to have at least one in-person meeting of the project participants to make sure that everyone involved fully understands the design goals and shared resources available. Also, the 8th (October 7, 1989, Colorado Springs) and 9th (Ontario locations and dates are under consideration) ARRL Amateur Radio Computer Networking Conferences will provide opportunities for public disclosure of design progress and achievements.

Prospective participants in this design project should immediately contact Lori Weinberg at ARRL HQ to be added to the mailing list and receive some preliminary information on the project. Subsequently, we will release additional data on how and when to submit proposals, the evaluation process to determine the winning proposals, and the timetable. In the meantime, if you plan to participate, it wouldn't be a bad idea to update your resume and give some thought to how you might slay or elude the dragons.

Committee Releases Report for Comment on Possible Code-Free Amateur License

ARRL study committee submits its recommendations to ARRL Board; member views sought before Board adopts League position.

A special committee appointed by ARRL President Larry E. Price, W4RA, has submitted a report recommending the creation of a class of Amateur Radio license not requiring a knowledge of Morse code. The mission of the committee was "to explore the implications of a no-code amateur license."

The report was presented to the ARRL Executive Committee, which met on April 1; the Executive Committee did not take a position on the substance of the report, but authorized its publication in full in this issue of *QST* and referred it to the full Board of Directors for consideration. ARRL members, other licensed radio amateurs, and others interested in Amateur Radio are invited to review the report and to make their views known to ARRL Division Directors before the next Board Meeting, July 21-22.

It proposes a new class of Amateur Radio license, with a written examination somewhat more comprehensive than the present Technician exam but with no requirement for a Morse code examination. Holders would be permitted to operate on all frequencies and with all privileges now available to Technicians above 30 MHz, except that 2-meter operation would be limited to frequencies between 144.9 and 145.1 MHz and to digital modes only. Examinations would be given only by accredited Volunteer Examiners, and distinctive call signs would be assigned. The committee carefully reviewed a wealth of input from interested individuals and clubs, as well as information it had requested from IARU member societies in other countries which already have a code-free class of amateur license. A large number of alternatives were considered by the committee in developing its recommendations.

Anyone reading the report and wishing to have his or her views considered is urged to write the Director of their Division sometime prior to the July Board Meeting.

Executive Vice President Sumner stressed that the committee's report does not represent League policy at this time. The Board of Directors is the policy-making body of the organization, and as such will determine whether the report, with or without modifications, will become League policy. He pointed out that the League is a representative democracy, with Directors elected to represent the members of their Divisions.

A list of Division Directors is given on page 8 of this issue. A verbatim copy of the Committee report follows.

Report of the Committee to Examine a Possible Codefree License in the Amateur Radio Service

This Committee was appointed by the President pursuant to direction of the Executive Committee at its meeting of December 10, 1988 (Minute 2.6.1), "to explore the implications of a no-code amateur license and make a report to the ARRL Second Board meeting of 1989." The extent of the Committee's investigation and exploration, and its recommendations, are contained in the body of this report, which is herewith respectfully submitted.

Conclusions

1. No licensee should lose any present privileges.

2. The present Technician (3A) pool is already being revised to correct shortcomings in its syllabus. The Committee feels this action is needed, and its completion is a foundation of our recommendations. The examination length for this element should be increased to 30 questions to accommodate the slightly expanded syllabus.

3. The present Technician class will be renamed "Technician Plus." Each holder of the present Technician class license on the date of implementation of this proposal by the FCC will become a "Technician Plus."

4. A new class of license, called the "Technician," will be created. To obtain this license, an applicant will be required to pass the present Novice (Element 2) and the revised Technician (Element 3A) written examinations. Both of these examinations must be administered through the Volunteer Examiner Program and credit will not be given for having passed Element 2 before Novice Examiners.

5. For a Technician to become a Technician plus, he or she need only pass the Novice Code (Element 1A) examination at five words per minute. This must also be done through the Volunteer Examiner Program.

6. The licensees of the new class should have distinctive callsigns. These would be 2×3s beginning with NA#AAA. Upon obtaining a Technician Plus license, the first letter would change to "K" (or the appropriate 1×3 if the licensee requests). In practice, these licenses would probably begin with NE#AAA to avoid duplications with suffixes already issued in the KA-KC series.

7. The new Technicians should have all privileges now allowed present Technicians above 30 MHz except in the two meter band. On two meters, the new Technicians

should have only digital privileges from 144.9 to 145.1 MHz.

Committee Composition

The Committee consisted of:

John M. Crovelli, W2GD, At Large
Y. E. (Ed) Juge, W5TOO, Industry Representative
Kenneth G. Kopp, KØPP, At Large
C. Mike Lamb, N7ML, Industry Representative
Rod Stafford, KB6ZV, ARRL Director, Pacific Division
George S. Wilson III, W4OYI, ARRL VP, Chairman

Consultants to the Committee who provided helpful participation at all stages were:

Thomas B. J. Atkins, VE3CDM, CRRL President
Larry E. Price, W4RA, ARRL President
Leland Smith, W5KL, QCWA President
David Sumner, K1ZZ, ARRL Executive Vice President

The Committee thoughtfully considered all material received directly from the amateur community at large or forwarded to it by various Directors and by recipients at ARRL headquarters. As Chairman, I must note that the time between appointment of the Committee and its March 11, 1989 meeting allowed each member to do his homework well. Each member demonstrated thorough familiarity with the file.

Rationale

National and international pressures on our spectrum, the continuing increase in the average age of amateurs, the expected decrease in the number of young people coming of "ham age," a desire to help improve the human technological resources of the United States, and fundamental fairness have led the Committee to recommend a code-free license class be established which requires unmistakable technical competence.

Domestic pressures on our spectrum are so clear that they need not be documented here; and it appeared to the Committee that serious international pressures, including the possibility of a WARC, exist as well. An increased number of amateurs may aid in our defense of those frequencies. The proposals made by this Committee should increase the number of persons joining the Amateur Service without introducing uncontained or unrestrained growth. Population studies indicate that there will be a dramatic decrease in the number of young people reaching "ham age" in the next few years. To hold our own in the number of licensees, we must recruit an ever-higher percentage of the total pool of young people as they reach an appropriate age. Indeed, to attain growth figures which would be of significant assistance in frequency defense, the Committee feels an aggressive recruiting campaign, far beyond anything previously attempted, must be considered. International experience with codeless license classes confirms this view.

The ARRL special study committee met in New Harmony, Indiana, March 10-11, 1989. Standing (l-r): Thomas B. J. Atkins, VE3CDM; Leland Smith, W5KL; George S. Wilson III, W4OYI; C. Mike Lamb, N7ML; Ed Juge, W5TOO; Rod Stafford, KB6ZV. Kneeling: Ken Kopp, KØPP; John M. Crovelli, W2GD; David Sumner, K1ZZ.

The Committee did not opt for a codeless license class with an idea that it would, by itself, guarantee the successful defense of our frequencies. We were well aware of this Nation's loss of its technological edge. This is seen in the transfer of technology overseas and in the decline of technological skills here at home. Anything we, as amateurs, can do to help reverse this trend is important to our Nation. We are aware that many of today's leaders in technology began their careers in ham radio, and are painfully aware that many rising technologists today do not see the code as relevant. The Committee feels that this proposal, in its own way, can help restore the technological viability of the United States.

In analyzing how to reach the goals of technological improvement and controlled growth the Committee kept before it these concerns most commonly raised by the amateur community:

1. Will existing amateurs lose any privileges? The answer is an unqualified, "No."

2. Will we create another CB debacle with uncontrolled growth and irresponsible behavior? Again, "No!" The anticipated growth will not be overwhelming, and it will be carefully controlled through the examination system. Frequency and mode selections are common, in all cases, with existing activity and will not place newcomers to the service in a ghetto in which they can develop unacceptable operating techniques. Further, the effort required should ensure respect for the license and for good operating practices.

3. Would existing amateurs be overcrowded? Again, "No." The privileges recommended by the Committee will be those portions of the spectrum where additional activity can be accommodated, yet newcomers can be assimilated with an anticipated growth rate on the order of that experienced in the middle 1970s.

While a new "doorway" is recommended for ham radio, the license structure we propose is not one of easy access. Rather, one must demonstrate technical knowledge and knowledge of the rules that equals and surpasses that now required by present Technicians.

What the Committee Report Recommends

- No licensees to lose any present privileges.
- New license to be called "Technician." Old "Technicians" to be renamed "Technician Plus."
- New Techs to have all present Technician privileges above 30 MHz, except that 2-meter operation restricted to the subband 144.9 to 145.1 MHz and to digital operation only.
- New Techs to have distinctive call signs, such as NA#AAA.
- Upgrading to Technican Plus to require only Element 1A exam at five WPM; call sign would change to counterpart in KA#AAA series, or to Group C call sign.
- New Techs to take Element 2 and 3A exams only. Element 3A exam to be expanded from 25 to 30 questions.
- All examination elements for Technician to be administered by Volunteer Examiners.

The Committee strongly believes that Morse Code does not work well as a filter to weed out undesirables. It is quite clear that code does act as a "filter"; but there are hundreds of cases indicating that technically qualified persons of good character did not become hams, not because they did not wish to spend the necessary study time, but because they saw no relevance in the code requirement. Illustrative is this excerpt from a letter to the Committee from William L. Call, KJ4W, as Assistant Professor in Engineering Technology at Murray State University in Kentucky. The school has a long and proud history as the location of a college radio club; but the club is now in a serious decline:

> "The Department has allowed me to give extra class credit to students who attend my free license course and get their novice ham license. College credit for getting a free ham license! You know what: very few students will take me up on it. The stopper, of course, is the Code. These kids are bright, polite, disciplined, and would make good hams, but won't do it because of the Code. Their extracurricular interests in electronics are in computers, audio, music, video, satellite TV, etc. Some of them would easily get involved in ham radio if it weren't for the Code."

Thus, code is believed to be an undiscriminating, and thus unfair, filter that rejects the good as well as the bad.

On the other hand, the dedication required to learn the code has not worked well to keep undesirables out of the Service. One would have to listen but a short time on some of our more popular HF phone bands to hear any number of persons we would all just as soon not be among us.

Having concluded that the code was not acting as a proper filter, the Committee sought to determine what sort of filter should be used. Considered were: mandatory study requirements (which was rejected as being unfair to brighter, or more experienced, applicants), a mentor program (rejected as being too difficult to standardize and fairly administer), and a written test. This last is the only one that seems fair and capable of consistent administration.

The Committee caused a questionnaire to be mailed to each IARU Society which is known or believed to have a codeless license in compliance with the ITU Regulations. Information was requested on the date the license was instituted, the licensing figures before and after its institution, and the extent to which licensees later converted to the more traditional licenses. In every case the license structure could be distinguished from one that might be instituted here. For instance, in Japan, often pointed to as some sort of a model, codeless licensees remain on the books; but there is strong evidence from which it must be concluded that there is little or no expectation that an individual so licensed will be more than a transitory member of the Amateur Community.

Some countries have shown little or even negative growth despite such a license being available. Great Britain is an example of a country in which there is believed to be little growth in real or percentage terms, while New Zealand reportedly has had a recent loss of hams. Except for the Japanese example, which is believed by the Committee to be an anomaly and an undesirable format for the United States, New Zealand has the highest ratio of hams to population—closely followed by us. Both statistical and anecdotal evidence indicates little tendency anywhere for codeless licensees to mainstream without genuine incentives being deliberately included in the structure. This Committee believes that the structure of the system in the United States should encourage such licensees to do so. Our proposal, especially the integration of new licensees into the overall licensing structure, has some kinship with the Australian, Belgian and West German programs, each of which has a very high percentage of their codeless licensees joining the more traditional ranks. Indeed, Australia reports 95% of those who initially take a codeless license eventually move to a full privilege license. These countries indicate the presence of active, on the air, code activities among their codeless licensees who are working on joining the mainstream. Such activity can and should be encouraged by sponsored on-the-air events.

In addition to being required by the ITU, there are many good reasons to retain Morse Code as a requirement for operation below 30 MHz. These include, but are not limited to, its unique function as a universal language crossing all cultural and language barriers, thereby fostering international friendship. This, alone, is adequate reason to retain Morse Code as a requirement on the HF bands. Few amateurs in the United States, however, will need to use this universal language beyond our own borders on VHF/UHF. Therefore, this reason for learning Morse Code is not valid above 30 MHz.

There are other good reasons to retain the Code as a requirement below 30 MHz. For instance, the recent Region III IARU conference in Seoul reaffirmed its insistence on a world-wide code requirement below 30 MHz. The policy of our Region II is even stronger. This Committee, even if it were within its scope, would not recommend either the elimination or any easing of present code requirements for operation below 30 MHz.

The committee had a long discussion about permitting newly licensed Technicians on six meters. Six meters, with its unique propagation and widespread ham population, is the ideal training ground for the new codeless licensees and presents the best opportunity for their assimilation into the general ham population. Its characteristics can pique their interest in moving to the HF bands; and the distances attained, even without exceptional propagation, can expose them to enough diversity of operators to properly educate them in the operating techniques needed when they mainstream to a full privilege license. The Committee feels that of all the available bands, six meter operation may do the newcomer and the Amateur Service the most good. The Committee is aware that this band has a reputation for causing TVI problems in some parts of the country. Amateurs have been able to cope with TVI in the past. There is no reason to believe the newcomers cannot do so as well, or that knowledge of the Code would help them to do so. As in all Amateur activities, the assistance of peers will help newcomers overcome the problem. This subject should be touched upon in the study materials and in the question pool.

The Committee debated long on two meter privileges for the newcomers. This band is full (even over-occupied) in many areas, and has been fully developed by existing amateurs. The prohibition of voice operation on this band to Technicians will give them a strong reason to learn the Code and join the mainstream and will present a minimal deterrent to entry. The Committee did feel that the newcomers should not be denied the opportunity of using digital communications in this band and the privilege of joining other amateurs while contributing to improvement of the digital system. For that reason, the Committee recommends that 144.9 to 145.1 MHz be permitted to Technicians using digital modes only. The distinctive call sign will help prevent abuse of this privilege.

Testing

In theory, the present General written test is no more difficult than the present Technician test. Indeed, they were one test until rather recently when the question pool was simply divided. The two tests cover different subjects, with the Technician being more strongly oriented to VHF/UHF techniques and theory, while the General is directed more toward HF. The present Technician question pool does need some modification to more accurately include subjects with which Technicians need to cope. This should (and will) be done regardless of the outcome of the codeless license proposal. The new Technicians should pass both the Novice (Element 2) and the newly modified Technician (Element 3A) written examinations to achieve the license.

The Committee believes that the codeless Technician test should be administered only through the VE program. The privileges to be granted the new licensees are sufficiently broad to mandate the most carefully controlled testing. Likewise, the five words per minute Code test required to mainstream to "Technician Plus" should also be administered through the VE Program.

Incentives to mainstream to the Technician Plus are adequate under the Committee proposal. The primary differences between the two grades of Tech-

nicians are that the Technician Plus is permitted HF CW, and existing ten meter phone privileges, and all-mode operation on two meters.

Other Considerations

The Committee also considered the following concepts:

1. The Committee does not believe that every ham needs to know Morse Code for possible emergency work. While there may be some validity to this argument on the HF bands, the rarity of the use of CW for such an occurrence on VHF/UHF does not justify excluding prospective hams from the Amateur Service.

2. The Committee does not believe that every ham must know the code because it gets through in adverse propagation conditions. Digital modes have the same advantage. That the code does so is certainly true, but this is no reason to require it. There will be no prohibition against anyone using the code, but if the amateur can't get through, so be it. It happens to each of us almost every day. There is no absolute NEED to communicate through marginal conditions.

3. The Committee does not feel it necessary that every new ham be required to know the code because it is most simple technically and least expensive mode. Relatively few hams who operate VHF/UHF even have rigs capable of receiving CW or transmitting MCW on those bands. The days of building a junk box CW rig for these frequencies are long gone—if, indeed, they were ever really here. For those who might wish to use code, they certainly may.

4. That CW enhances ability to listen, discriminate and react cannot be denied, of course; but other activities serve the same purpose, and it is not vital that every operator use the code as a means to enhance those admirable qualities. Again, use of the code is not forbidden to anyone, nor is it discouraged. It is just "not required" for the privileges we propose.

5. The Committee agrees that the code provides an end in itself and a sense of accomplishment. However, we need not all share the same sense of accomplishment nor the same goals for our Amateur careers.

6. The Committee is well aware that 432 MHz is overcrowded in a few areas, and also that it is not available in others. However, this band is not at full capacity in many areas and is the most practical band from which the Technicians may enjoy satellite communications. AMSAT has specifically requested that the new licensees be able to operate via the new satellites now in the planning stages. It is illogical to allow satellite communications while not allowing terrestrial communications on the same band.

7. Many of those who will become Technicians are likely to be technically trained persons of the highest order, will pass an examination at least as demanding as that now required of Technicians, and will have been adequately tested to permit full-power operation. We should not stifle their ability to contribute.

8. The Committee rejects limitation to commercially manufactured rigs for the same reasons that caused it to reject power limits.

9. New Technicians should not be limited to voice subbands tighter than those permitted present Technicians. This would so isolate the newcomers that a new and perhaps undesirable culture could arise unchecked. The newcomers should not be confined to a ghetto of their own kind, but given needed exposure to the existing Amateurs to expedite their assimilation.

10. The Committee recommends against a limited license term for the new Technicians. These new hams will have passed an examination more rigorous than present Novices and at least as rigorous as that passed by present Technicians. They will have demonstrated their "seriousness" by taking the test. There is no valid reason to limit their terms. They will be in a position to contribute to the radio art and the Amateur Service from their first contact.

11. The Committee considered a two-level codeless structure with an entry level test similar to the present Novice. Were the new Technicians to have more privileges than those recommended, the Committee felt that insufficient additional privileges would remain to encourage their upgrade to Technician Plus; and the Committee also felt that no additional privileges should be given the Technicians Plus for this would discourage their upgrade to General. Likewise, were the newcomers to be granted privileges less than we suggest the license would be unattractive. The balance of privileges among these classes of license is delicate. The effect of each privilege must be weighed for its attractiveness and its impact on the other classes of license. Therefore, the Committee believed that the privileges for each class are appropriate and will encourage both prospective hams to enter the Service and to work to obtain the further privileges. Further, an entry-level license would unnecessarily, and unwisely, complicate the structure.

12. The Committee considered restricting Technician Plus operation either in, or from, the portions of the bands recognized as utilized in "weak signal" operations. It would perhaps be desirable to forbid FM operation entirely from these portions of the spectrum. To so recommend would be to recommend removal of present privileges from existing licensees. That is beyond the scope of this study of a codeless license. While a total FM restriction might be a good thing with respect to these subbands, it must be done outside of these proceedings. This leaves the question of forbidding FM by new Technicians in, or forbidding them from, the weak signal spectrum. The Committee feared that to do so would aggravate, not ameliorate, the problem. That Technicians Plus could operate FM in those subbands would be seen as an additional "privilege" or "incentive" of that class, and they would be encouraged to use it. Thus, restriction of new Technicians could easily have the adverse effect of encouraging even more encroachments by Technicians Plus. At present, occasional encroachment can usually be handled by peer pressure. Repeated encroachment might even be considered as a violation of "good amateur practice."

Summary

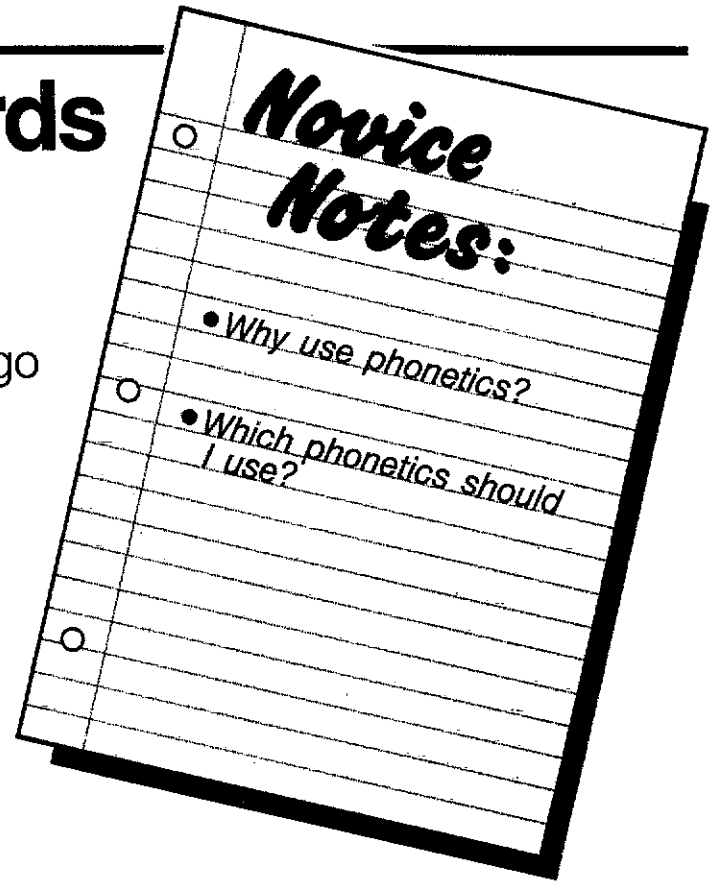
For several years, it has been the goal of the League to increase the number of hams. This position is well-advised. The Committee does not for one moment accept that the code is antiquated or obsolete. Neither does the Committee encourage the slightest easing of code requirements below 30 MHz. However, as a filter against undesirable operators, Morse Code has demonstrated its own lack of validity. Many undesirables have, at one time or another, demonstrated skill in the subject. On the other hand, there is much evidence that the code is filtering out far too many desirable and technically qualified operators. These individuals COULD learn the code, but they see no relevance in doing so and spurn participation in a hobby guarded by what they erroneously believe to be an antiquated requirement. No matter how hard we might try, we cannot demonstrate to them the folly of their thinking. They must learn this for themselves. Thus, to expose them to the benefits of Amateur Radio while at the same time exposing them to the opportunity to see the benefits of Morse Code, we permit them to enter and allow them to find the value of the Code as a means of practical communication. The proposed structure encourages them to fit into the mainstream of Amateur Radio. We can also take advantage of the skills and knowledge they will bring to the Service. We believe only a proper written examination will provide an appropriate filter. The privileges we suggest for the new Technicians both demonstrate a proper level of competence and expose them to more mature operators and their techniques while permitting these newcomers to join the mainstream with an appropriate level of effort. Likewise, we believe the privileges we recommend be reserved to traditional licensees present adequate incentive to the new Technicians to join the mainstream.

Further, the Committee believes the claims that vast hordes of newcomers will join ham radio as a result of the creation of the codeless license are purest folly. Rather, we propose a fairer system with a more realistic examination for those, especially young people, who might join our ranks—and one that will permit and invite qualified prospects into the Amateur Service. 73

Respectfully Submitted,

George S. Wilson, III, W4OYI
Chairman

Phonetics: Words to the Wise



Proper usage of phonetics can go a long way toward smoother operation. Here's the lowdown on the dos and don'ts of phonetics.

By Rick Booth, KM1G
c/o Offshore Publications
PO Box 817
Needham Heights, MA 02194

You can find applications for Amateur Radio in the darndest places. When I was an editor at a small newspaper, one of my jobs was reading the Associated Press wire and alerting reporters to items that might be useful on their regular beats. Each wire entry had a number/letter ID tag, and the usual practice was to call the tag across our small newsroom to the recipient.

It happened that my best friend among the reporters was a former Army radio operator. We often shared stories about our respective radio experiences, he in the service and I on the amateur bands. One day I had an AP item for him, and on impulse I ad-libbed a little experiment.

"Jeffrey," I said crisply, "traffic, your station."

Without blinking, he reached for a pencil. "Ready," he said.

I smiled, as newsroom eyes widened. "Roger," I said, "please copy Two Five Seven Three, Romeo November."

"Roger your traffic, Two Five Seven Three, Romeo November," Jeff said, and put his pencil down. He never looked at me, never so much as twitched. I turned back to my word processor screen, so my face wouldn't give our private joke away.

As sometimes happens, the gag became routine format between us. At first, it was a newsroom joke; people tried ridicule by imitation. But they failed—they didn't have a standard phonetic alphabet. When groping for a word starting with a particular letter, they either couldn't think of one or found one unsuitable because it wasn't distinct. Unable to duplicate what Jeffrey and I were successfully doing, they returned to the usual derision.

"Laugh if you will," I said, "but you say your tags three and four times. Jeff and I only say them once. And we're *never* misunderstood." They had to admit I was right. Sophomoric as it was, our little game illustrated the importance of common phonetics and at least some semblance of procedure. We succeeded because we had both.

Amateur Radio is not the military. It's not even MARS, the Military Affiliate Radio System, which passes messages to and from service personnel overseas (although the vast majority of MARS members are amateurs). But amateurs often find themselves the only communications link in disasters, and when the chips are down is not the time to bumble around. Good procedure is something we need to practice every day. You may not plan on being in ARES, the Amateur Radio Emergency Service, or NTS, the National Traffic System, but plenty of others before you weren't in it when circumstances called on them to provide emergency communications or

International Telecommunication Union Phonetics

A—Alfa (**AL** FAH)
B—Bravo (**BRAH** VOH)
C—Charlie (**CHAR** LEE or **SHAR** LEE)
D—Delta (**DELL** TAH)
E—Echo (**ECK** OH)
F—Foxtrot (**FOKS** TROT)
G—Golf (GOLF)
H—Hotel (HOH **TELL**)
I—India (**IN** DEE AH)
J—Juliett (**JEW** LEE ETT)
K—Kilo (**KEY** LOH)
L—Lima (**LEE** MAH)
M—Mike (MIKE)
N—November (NO **VEM** BER)
O—Oscar (**OSS** CAH)
P—Papa (PAH **PAH**)
Q—Quebec (KEH **BECK**)
R—Romeo (**ROW** ME OH)
S—Sierra (SEE **AIR** RAH)
T—Tango (**TANG** GO)
U—Uniform (**YOU** NEE FORM) or **OO** NEE FORM)
V—Victor (**VIK** TAH)
W—Whiskey (**WISS** KEY
X—X-RAY (**ECKS** RAY)
Y—Yankee (**YANG** KEY)
Z—Zulu (**ZOO** LOO)

Note: The **Boldfaced** syllables are emphasized. The pronunciations shown in this table were designed for speakers from all international languages. The pronunciations given for "Oscar" and "Victor" may seem awkward to English-speaking people in the US.

handle health-and-welfare traffic.

Besides, even when chewing the casual rag, who wants to say everything two and three times? Novice voice frequencies have not only opened up wonderful opportunities, they've also created the need for beginning operators to know standard voice *conventions* (a convention in this context is not the place where you find a big flea market and manufacturer displays, but a generally accepted custom, mode of behavior, or rule). In Amateur Radio *operating*, many such have proven useful through the years. You probably used them beginning with your first QSO (on-air contact), whether you realized it or not.

Think for a minute, those of you with a few filled logbook pages. You're making a contact, but copy is spotty. It could be QRM (interference from other signals) or QRN (static). The words come and go. Judging from what you've learned, and on CW how fast the other station is sending, you can make a fair guess at what's being sent: Call signs first, then signal report (readability and strength, along with tone on CW), then the other station's QTH (location), and finally a name. If you miss part, if the signal drops and then re-emerges from the mud, an experienced operator's mind almost automatically expects the next installment in that series.

There's no rule that says we should send things in that order; we simply *do*. And knowing that convention can help you copy, so long as you don't anticipate too stubbornly, and get lost when the other fellow sends in a different order (a good reason not to vary the order).

Phonetic Alphabet

The phonetic alphabet is a very useful convention. Over the years, several phonetic alphabets have come and gone. Many services use their own. Remember the TV show *Adam-12*? "Adam" meant the letter "A." Remember police officers Reed and Malloy calling in license plates for a check? "Lincoln, X-Ray, Ida..." Phonetics again. If you've seen the movie *PT 109* about John F. Kennedy's wartime exploits in the Pacific, perhaps you remember the Australian coastwatchers talking about "Peter Tare." In World War II, Peter was phonetic for P and Tare for T, ie, PT, the kind of boat Kennedy was on.

Today, most countries in the world are members of the International Telecommunication Union, a United Nations agency which regulates radio communications worldwide. The ITU has its own phonetic alphabet, which all amateurs should know and are encouraged to use:

Nobody says you *have* to use those phonetics. You'll hear an amazing variety of others on the bands. Lots of hams devise cute phonetics specifically for their call, to help people remember it. My friend Rick, AI1V, advises, "Always Include One Vegetable." Not only sound nutrition, it's a handy way to remember Rick's call.

Experienced single-sideband (SSB) operators also vary from the approved ITU phonetics on occasion, especially in pileups, when many stations are calling a rare DXCC country. "Germany" and "Kilowatt" are popular substitutes for Golf and Kilo, respectively, in circumstances like that. Being longer and stronger words, they may have a better chance of being heard. And, for example, in the push and shove of a pileup, just the "watt" might get through, and the DX station might call back, "Ending in kilowatt, go ahead." Some hams think other phonetics play better in the slightly strange sound of sideband. They may be right, too.

So why the ITU phonetics? Why are they recommended by the ARRL? Why doesn't everyone just make up his or her own instead? Language, for one thing. Though English is becoming the world's universal language, your cute phonetics, the ones that play so well in domestic QSOs and the local FM repeater, may not be as catchy to a foreign ear. But even spoken with a foreign accent, "Uniform," "Whiskey," "Victor" and so on are easily recognizable.

Standardization is another reason, and it translates into speed. If you've practiced your CW, you've probably noticed it's not that different from learning a foreign language. In the beginning, you translated "dit dah" into A. But that step will soon disappear, if it hasn't already. Dit dah will *be* the letter A. Same with phonetics. When someone spells their name as "Juliett Oscar Hotel November," you won't hear those words—your mind will instantly register J-O-H-N, with no middle step. Without standard phonetic words, you couldn't do that.

If you're going to go your own phonetic way, and you're going to have to go *some* phonetic way because you can hardly do without them, pick words that don't clash with the accepted ones. For instance, don't use "Motel" for M—it rhymes with Hotel, the accepted word for H. Think about the complications of creating your own alphabet, and chances are you'll stick with the ITU. Most everyone else has.

Nobody wants to be welded to rules for the sake of rules. But conventions are something else. We need them for smooth operation, to better our chances of being understood the *first* time. And there may well be a time in your ham career when you'll need to be understood without delay. Remember, somebody else just might be counting on you.

It's happened before.

The Phonetic Alphabet: A Short History

When voice operation started becoming popular in the thirties, the League recommended the use of the Western Union alphabet (Adams, Boston, Chicago, Denver and so on). During World War II, the Joint Army-Navy (JAN) alphabet (ie, Able, Baker, Charlie, Dog and so forth) came into vogue, and the Western Union alphabet was all but forgotten. After the war, there was widespread feeling among radio amateurs that they had had enough military stuff, so the League adopted its very own phonetic alphabet (Adam, Baker, Charlie, David, etc), a hybrid list adopting words from several other alphabets. Nevertheless, the JAN list continued to be heard most often on the amateur bands, purely as a matter of habit.

Not until the late fifties did the ICAO (International Civil Aviation Organization) list start being used officially by the military, its principal advantage being that it contained words that could be understood in any language. It was the ICAO list that was adopted by the ITU and the ITU phonetic list is identical to that originally promulgated by the ICAO.

Although the ICAO/ITU list is a generally accepted operating convention today (see text), amateurs originally resisted its introduction on their bands. At the same time, the post-war ARRL list never took hold. Most amateurs continued to use the JAN list or lists of their own devising (the latter being inconsistent with good operating practice; see text).

Through the influence of the governments of the many Spanish, French and English-speaking nations, the ICAO/ITU list eventually gained acceptance throughout the mainstream of Amateur Radio, and thus its widespread use in phone operation today. Recognizing that the ICAO/ITU list had become the *de facto* standard on the amateur bands, the ARRL Board of Directors first ordered it to appear in the ARRL literature alongside the ARRL phonetic alphabet, and later, at the May 1969 Board Meeting, adopted it as *the* ARRL standard.
—Robert Halprin, K1XA

Strays

I would like to get in touch with...

☐ any hams who attend or are graduates of the University of Southwestern Louisiana. Jeff Kilgore, KC1MK, 28 Carol Dr, Plainville, CT 06062.

How to Interest Significant Others in Amateur Radio Without Losing Them Forever

By Linda Mayer, N1EER
20 Driftwood Dr.
Tawksbury, MA 01876

"Go ahead, it's OK, want to say something on the air?" queried an enthusiastic Eliot, W1MJ (my "OM") while holding up to my face the microphone of his 2-meter rig. I shook my head a little too hard. "No thanks, I'm not interested," I replied breezily. We looked into each other's eyes, and I knew it would never end until I had my license in hand.

I put up a good fight, dragged my feet for six years, but on a cool rainy day in May of 1986, I walked out of a building at MIT in Cambridge, Massachusetts with my General-class license. Proud as could be, I announced my newly acquired status to an even prouder W1MJ. We had survived to become a two-ham family! But how did we get from there to here?

Listen my friends and you shall hear,
Of how I got from there to here.
While shedding a few tears,
And taking 6 years,
I got my license like all of my peers.

It started ever so slowly. "Want to go to a really neat thing called a hamfest?" A whatfest? I went to several and discovered that everyone wears their call signs on anything and everything: hats, badges, shirts, car license plates, and hand-held transceivers. This was a whole new world to me. They talked their own jargon and had their own jokes. They *were* fun, though!

I no longer wanted to appear foolish at these hamfests. In self-defense, I learned the lingo. At the next flea market, a ham friend happened to ask me what frequency the others were conversing on. "64," I replied. "5.64 or 6.64?" he asked. "5.64," I said. "Direct?" "Of course!"

Later, "Tim said you told him what frequency we were on," spouted Eliot with that all-too-familiar gleam in his eye. "I sure did." "I didn't know you knew it." "Of course I do. I'm not stupid you know." "I know, and that's why you should get your license."

Now that I knew the language, and even partially understood it, I began to feel naked without some letters and a number with which people could address me. I especially liked the way people used call signs as a special form of a nickname. K1BA is "KEY-BA." W1MJ is "Mumbo Jumbo" or just plain "Mumbo" to those who know him well.

Eliot took every opportunity to expose me to the enjoyable aspects of Amateur Radio: the exciting QSOs with hams around the world, hamfests, making friends on 2 meters.

But what really pushed me along that final road to my destiny was meeting other female hams. "Well, if they can do it, so can I." "Exactly," Eliot would respond, "you're at least as smart as they are, if not

My conclusions on how to interest significant others without losing them forever:

- Talk about how much fun ham radio is.
- Try to involve your significant other in as many ham activities as possible.
- Acknowledge their fears. This step is crucial. Of course, learning the code and theory is easy for many, but for others it's not so simple. If you keep telling them how easy it is, then they may become more afraid of failing and appearing stupid.
- Do point out others who have recently obtained their licenses and try to involve your SO in a conversation with them.
- Talk a lot about the joys you experience from ham radio; enthusiasm is contagious.
- Don't nag!
- Offer them your help in learning, or get a close friend to offer help or have them learn on their own. It may be more threatening to learn from your spouse or friend.
- Involve them in a community service using and relying on ham radio. Example: The Walk For Hunger or The Boston Marathon. This provides an exciting demonstration of how Amateur Radio is used as a public service.
- Leave a copy of *Tune In The World With Ham Radio* on your coffee table.
- Teach them an easy letter in code. E, T or A, for examples. Then they only have 25 more to go.
- Leave a copy of this *QST* on your coffee table and make sure it's open to this article.

Eliot, W1MJ, and Linda, N1EER, Mayer and their three-year-old daughter, Jennie. *(photo courtesy N1EER)*

smarter." Clever boy, that Eliot. I took the bait.

The code was next. I was afraid of not being able to master the code. How could I ever face W1MJ and all the others if I failed? I would be humiliated, made an outcast! Despite my fear, I bought the ARRL's *Tune In The World* package and, along with help from Eliot, set to work.

I passed my Novice test easily. "Call me KA1GQJ," I would now say to my friends. W1MJ and I had "his and hers" call badges made up. I had my own call! It truly was an unanticipated thrill.

However, it didn't take me long to realize that being an inactive Novice wasn't going to cut it with the OM. "You know," whispered a most subtle W1MJ into my ear, "wouldn't it be grand if we could talk on our favorite 2-meter repeater together? Maybe you could become a Technician."

"A Technician?" I groaned. (OK, OK, I confess, I wasn't satisfied to stop at Novice either and it bugged me that I couldn't talk on 2 meters.)

So, I studied for the Tech test, walked out of the exam session, picked up the microphone of our 2-meter rig, tuned into 64 and proudly said, "W1MJ, W1MJ, this is KA1GQJ/Temporary KT, are you there?" I was proud. Eliot was thrilled! At last, I felt like a real ham.

Six weeks later my new call arrived: N1EER. On a roll, I decided to get my General quickly. A month later, after intense study, I took the 13-WPM code test. When the examiners corrected my test and told me I had passed, they said "come take the Advanced theory test." Foolish examiner. He assumed I wanted to further upgrade. I looked at MJ and smiled proudly. "No thanks, I like it just fine here."

We are now truly a ham radio family. Our three-year-old daughter knows five letters in Morse code. She welcomes her father home some nights by exclaiming, "Yeay, W1MJ is home!" She loves to talk to Eliot on the radio. "See you on the radio, Jennie," W1MJ will say as we all leave the house together and he climbs into the W1MJ mobile and we climb into the N1EER mobile. "On 64 Papa?"

I can honestly say that I am proud to be a ham. I'm only sorry it took me so long to discover the joys and satisfaction of Amateur Radio.

"What does that lightning bolt on your license plate mean?" people often ask. "That means I'm a ham radio operator," I reply with pride, "and the number and letters are my call sign. Let me tell you about ham radio..."

New Books

RADIOWAVE PROPAGATION

By Lucien Boithias. Published by McGraw-Hill Inc, 11 W 19th St, New York, NY 10011. First edition, 1988. Hardcover, 9½ × 6¼, 324 pages, $49.95.

Reviewed by Bob Rose, K6GKU, ARRL Technical Advisor

This book's title, *Radiowave Propagation*, is somewhat misleading. The first-time reader who wants to know how ham radio propagation works may be surprised to find that this textbook was primarily written for engineers and experimenters who design communication systems for frequencies above 100 MHz.

Lucien Boithias is chief telecommunications engineer at the Centre National d'Eutudes des Telecommunications (CNET) in France. He is recognized as an authority in tropospheric propagation, and is a primary contributing consultant to the International Radio Consultative Committee (CCIR). In the preface, the author contends that modern telecommunications no longer rely on the spectrum from 2 to 32 MHz, except for unimportant short links in developing countries and for some military uses. Based on this, Boithias contends that propagation theory for telecommunications using ionospheric refraction can be drastically reduced, and added to a volume with information on line-of-sight (LOS) and transionospheric propagation that supports satellite or high-data-rate point-to-point communications systems. This book is a testament to this contention.

The first six chapters deal with LOS propagation. Chapter 1 provides a traditional description of free-space propagation. In chapter 2, Boithias describes the types of LOS propagation. Chapter 3 introduces the effects of the Earth and its curvature. Chapter 4 presents tropospheric propagation, and chapter 5 describes atmospheric conditions that effect tropospheric propagation. Chapter 6 describes the problems in LOS communications. For the most part, pragmatic formulation and charts are provided for an audience that is assumed to have the background to use this information.

Non-LOS propagation is discussed in chapters 7 through 9. The chapters on diffraction and scattering (chapters 7 and 8, respectively) are quite good for someone who has no background in these phenomena. On the other hand, the discussion of ionospheric propagation regarding HF signals (chapter 9) is particularly weak when compared to other references. This same section deals with transionospheric propagation, which is important to satellite communications.

Radiowave Propagation is full of practical nomographs and charts that the serious VHF/UHF/microwave enthusiast will find invaluable. This book is written in the conservative, traditional style of CCIR documents, and is not light reading. Although this book is part of the McGraw-Hill series for electronics engineering, I, as both a teacher and a practicing engineer, would not use it as a teaching textbook, but as a working handbook. This is as the author intended. This book is a useful document in the electromagnetic domain; it was written form and reflects the author's years of experience in tropospheric propagation science. *Radiowave Propagation* was not written for the Amateur Radio community, and is not recommended for the newcomer who wants to know how "skywave ham radio" works.

Strays

ARMENIA EQUIPMENT THANKS

☐ The International Amateur Radio Network has advised that MFJ, AEA, Mosley, Kenwood, Cushcraft and Catholic Relief Services were responsible for the generous donation of equipment shipped to Armenia by IARN following the earthquake last December. The ARRL wishes to acknowledge these contributions.

Chuck Sheffer, KJ4TY, accompanied the equipment to Armenia and has asked us to convey his thanks to those amateurs and listeners who provided moral support and other assistance.

I would like to get in touch with...

☐ anyone with a manual or info on Motorola 6- and 2-meter VHF transceiver MOD-L4100B, trans type TA104, and a manual for a Hallicrafters SR-108 receiver. Tony Furnari, KA1RKR, PO Box 539, Goshen, CT 06756.

☐ anyone with a manual for a Realistic DX-300 receiver. Craig Hinton, NMØL, 2668 N Riviera Drive, White Bear Lake, MN 55110

How To Write A Proposal With Punch

Planning to propose? Get off those bended knees and read below. We'll help you learn a few fundamentals!

By Mary Schetgen, N7IAL
Secretary
The ARRL Foundation

Into every club, a little cash should flow. That's the idea behind many inquiries we receive at the Foundation. Representatives of community organizations, schools and clubs often call to ask how they might secure funding for a special Amateur Radio project. When appropriate, we naturally encourage application to the Victor C. Clark Youth Incentive Program with its matching-fund mini-grants of up to $500. We also underwrite major grants, such as the current SAREX project. However, many worthy projects fall outside of the guidelines for our current Foundation programs. Since Amateur Radio education, preservation and innovation is what your Foundation is about, we can't sit by and let good projects die on the vine.

Before we get to the proposal structure itself, let's discuss the purpose of a proposal and when and to whom to make one. When we say proposal, we're actually discussing a grant request. The true proposal part refers to our intention to propose or suggest funding for a specific project with specific outcome or results. When do we use a proposal? Whenever we want to present the most professional and comprehesive plan outline to a prospective sponsor. Finally, to whom do we submit a proposal? To any individual or organization with sufficient commitment and means to fund our project. Where do we look to discover potential sponsors? At the library! Current reference books listing the financial status of local businesses/wealthy individuals who maintain granting programs or foundations are available for your use. Write to all grant programs of interest and request information on how to apply. This information will give you a feel for the types of grants normally made by said sponsor.

Don't get discouraged if it looks as if your project can't be pigeonholed into any preexisting grant category. Organizations which grant for local educational and scientific projects may give preferential consideration to your project based solely on the goodwill community-service publicity generated by a tie-in effort with your group. However, the logical first choice for finding sponsors would be to investigate the grants programs of any major or medium-sized business directly related to radio or electronic applications. Trade publications are the best source for learning about industry grants programs of either a local or national nature. The not-for-profit status of many research organizations often goes hand in hand with an active grants program. Be vigorous and leave no stone unturned in your group's search for funding. When you think you're ready to apply, here's how to write a proposal that will stand out:

1) Write a paragragh of *introduction* for your group or organization. Include all important contact names, addresses and phone numbers.
2) State the *reasons* or *needs* for seeking funds.
3) Outline the *objectives* of your project.
4) Outline what *methods* you will use to meet your objectives.
5) State how you will *measure* or *evaluate* your project.
6) State how you will maintain your project when the grant is depleted—in other words, your plans for *future funding*.
7) Include a *budget breakdown* showing how funds will be used and if any matching or co-funding is to be used. If your project is underway when applying for funds, include a progress report and photos, if available.
8) Close your proposal with a *summary paragraph* or statement and thank the reader for their consideration of your proposal.

Use a good typewriter or printer, good stationery and call on the editing skills of your group's best writers to produce a letter-perfect, professional-looking document. Notebook paper and pencil is out. Let's go first class and offer a professional first impression.

To learn more about writing proposals, the following references can provide more in-depth information:

Stewart, *Proposal Preparation*. New York: John Wiley & Sons, Inc, 1984.

Ammon-Waxler and Carmel, *How To Create A Winning Proposal*. Santa Cruz: Mercury Communications Corporation, 1978.

Manning and Rugh Associates, *Proposal Management Using the Modular Technique*. Los Altos: Peninsula Publishing, 1973.

ENCOURAGING RESPONSE TO SIMPLE WILL KIT INTRO

Just a few days after the March *QST* reached mailboxes across the US, we began to receive postcards and letters requesting our Simple Will Kit informational materials. We've heard from good folks in Texas, Pennsylvania, Kentucky, California, Louisiana—and many other states—all seeking to learn how they might include a gift to the Foundation in their wills. Thanks to all who have so far sent in requests. We're gratified to learn of your interest. To send for our information, write: Simple Will Kit, The ARRL Foundation, 225 Main Street, Newington, CT 06111.

WE'RE ALL FRIENDS ON THIS PAGE

Take a look on the next page at Contributor's Corner. You'll see quite a few names listed as contributors to our General Fund. Others prefer to designate their contributions to a specific scholarship fund or perhaps a grants program. We appreciate your support of any Foundation program and are happy to list your name in addition to that of a Silent Key for whom you may have made a memorial contribution.

Recently, we were asked if contributions

could be made in honor of a friend, relative or clubmate who might be celebrating a special occasion, in need of an encouraging word or just to salute that special someone. We think it's a fine idea, so...if you wish to make a contribution to honor a friend, we'll list the names of you or your group, the names of the friend(s) you wish to fete and the reason for the tribute. See the examples below.

Ex: The Jesse Bieberman Meritorious Membership Fund

Mary E. Schetgen, N7IAL
in honor of Rosalie White, WA1STO, Friendly and Helpful Co-Worker

-OR-

Ex: The Victor C. Clark Youth Incentive Program Fund

Steven R. Ewald, WA4CMS
in honor of Phillip R. Ewald, W4EWR, Happy Birthday, Dad!

Contributor's Corner

We wish to thank the following for their generous contributions to:

The Victor C. Clark Youth Incentive Program Fund

George R. Leone, K6SG

The Jesse Bieberman Meritorious Membership Fund

George R. Leone, K6SG
Arnold Cohen, KF7MK
Stephen P. Rector, KA8QHC

The Bill Bennett, W7PHO Scholarship Fund

John L. Dack, W7KH

The Edmond A. Metzger Scholarship Fund

Wheaton Community Radio Amateurs (IL)

The Goldwater Scholarship Fund

Stephen P. Rector, KA8QHC

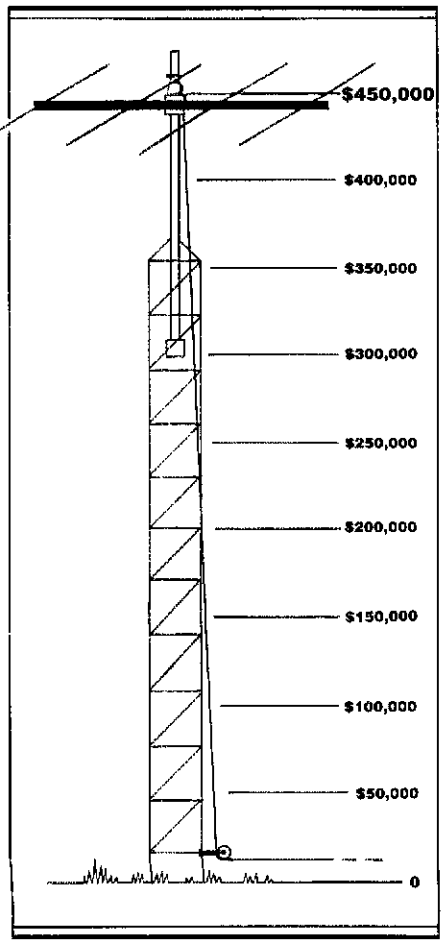
The General Fund

Harold V. Randall, NØERH
Ernest T. Howell, Jr, W1DQI
Pete Ladjimi, Jr, KA6LWX
Edward Litfin, KC2AN
James S. Evans, N7KBJ
C. Durfee Marshall, KC4CAC
Donald L. Pipkin, N6DTB
Victor Fabrega
Edwin S. Guilford, WA2YWF
William M. Hampton, Jr, WA1OIR
Robert Acosta, KB7DZE
John D. Pieniadz, NL7AJ
Frederick L. Rayman, Jr, WDØEIT
James W. Sullivan, K4TSC
Ralph H. Plumb, K4WGW
Nelson W. Lawhorn, KM4DS
Dorothy F. Sohn
in memory of Samuel D. Sohn, WA1LMW
St Charles Amateur Radio Club, Inc (MO)
Hugh van Valkenburgh
Rikio Nishioka, KH6ALF
Robert C. Colbert
Adolph Darr, W9MCR
C. Spencer Powell
Lanny Phillips, W5BOS
Clifford W. Hess, N2CRP
Hubert F. Worthy, WB4LLQ
Walter G. Kenney, W2IZC
Richard D. Lindgren, WD9BFV
Richard Shafer, N2CFD
Michael J. Levine, N9HEL
John E. Schlueter, W8WYH
Peter Lefferson, K4POB
Camille S. Marie, W3EPR
Barry F. Maguire, WB4IZR
Tad Shibuya, W7YWS
John W. Swancara, WA6LOD
Donald F. Fleischhauer, W9DIP
Marion J. Chelkowski, W5DBN
Joseph J. Mercuri, WA2ZTB

Received and acknowledged during the month of **February.**

THE ARRL FOUNDATION, INC.

"for the advancement of amateur radio"



How to Contribute

W1AW is *your* station. You've been updating your home station periodically, keeping up with the constantly evolving technology of the Amateur Radio Service. After 50 years of nonstop code-practice and bulletin service to the entire amateur community, W1AW now needs to upgrade as well. This is not, however, simply a case of replacing one box for a newer one as you might do in your own shack. This is a massive renovation, inside and out. After years of wear-and-tear, W1AW is in dire need of numerous repairs structurally and technically, just to remain functional. Please help us make W1AW a modern station at the cutting edge, one that any ham (and all ARRL members) will be proud of. Here's how to contribute to the Fund Drive:

- **By Mail:** Address all contributions to W1AW Fund Drive, 225 Main St, Newington CT 06111. Please make your check or money order payable to W1AW Renovation Fund.
- **By Phone:** For your convenience, credit-card contributions can be made by calling Jennifer at ARRL HQ, tel 203-666-1541, between 8 AM and 4 PM Eastern Time, weekdays.

All contributions are tax deductible to the extent allowed by law, as ARRL is a 501(c)(3) tax-exempt organization. Please be as generous as you can to help W1AW maintain its leadership on the frontlines of Amateur Radio technology. Thank you.

Field Day Friendship

The spoken word isn't necessary to confirm the bond between these two hams.

By Tom Kravec, W8TK
1282 McCoy Rd
Columbus, OH 43220

I have long ago forgotten the teacher's name and face, but not his words: "True friendship is an unspoken bond. I have a friend of many years with whom I may spend an evening watching television or reading a book, neither of us feeling obligated to utter a word. We know each other so well, we have become so comfortable in our friendship, that words are not necessary to confirm it."

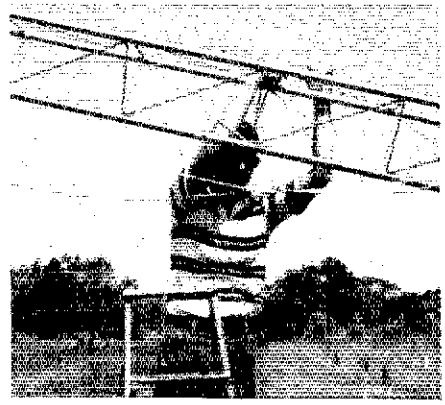
Half the class of eighth-grade boys had wandered to thoughts of lunch or football, and the other half wondered what the man was talking about. We boisterous teenagers weren't confident enough about anything to treat it quietly. Rapidly developing and fading friendships needed constant verbal support. We communicated everything loudly. Nevertheless, the teacher's thoughts got quietly filed in a dusty corner of my brain's RAM.

In that same year my Novice ticket arrived, I got on the air and discovered Field Day, an activity which has become a hobby within a hobby—a real obsession for me. I earned my Novice license on my own, without any friends to share my interests. I got on the air a lot that first year and learned to handle fast CW easily, as only youngsters can. I learned how to operate proficiently, simply because I spent so many hours operating. I found a local radio club and was swallowed up by my first Field Day!

Surrounded by others who enjoyed radio as much as I did, I operated around the clock with equipment I had only seen in magazine ads. A DX-100 is a boat anchor to me now, but then it was a dream come true. After that 24 hours of heaven, my parents drove me home. I remember waking up the next morning on the living room couch with a mouthful of peanut butter sandwich that I was too tired to chew.

At college, I managed to organize a club rooftop FD effort that lasted only a couple hours until the generator died in the parking lot five floors below. The other operators not only didn't understand my love for FD, they honestly thought I was crazy, like Captain Queeg!

Off the air for a few years of graduate school and postdoctoral training, my mind still wandered to the low end of 40 on those warm late-June weekends. A college friend introduced me to Bud, W9DY, in Chicago, whose real name is Elmer (not just by coincidence). I joined his neighborhood club Field Day, and he taught me how it should be run. Murphy doesn't stand a chance against a group that is properly prepared. If you don't believe that, then you have never operated FD with W9DY. Finishing my schooling, beginning a career, taking a wife and buying a house left little time for hamming, but I still made the trip back to Chicago for FD each summer for a few years.



Author Tom Kravec, W8TK, rigs a tower in preparation for his 1B entry.

One day a blond kid appeared at my door with a baseball glove under his arm, but ham radio on his mind. He had recently gotten his Novice license and didn't know of any other hams in the area until he spotted my beam in the yard. He wanted to talk about antennas, Morse and the ham radio experience. I easily recognized myself in this kid!

Doug spent hours at the key as I had, operating in some contests, learning the ropes and growing up. His first FD was at my farm, the highest point in the county, with a group from the Mad River Radio Club—contesting's hard core. Doug acquitted himself well at the key and loved every minute of it. He was a victim of Field Day mesmerism, as I was.

Doug Klein, WD8AUB, at the Field Day operating position.

In the next couple of years, Doug and I operated FD from my farm as class 1B, just the two of us. He had developed into quite a talented contester and practiced his skills frequently. Busy with my work, I operated much less than he did. While I didn't notice, I'm sure he saw that he was getting better as I was getting slower. I know he would never say anything about it, but he carefully checks the hourly rates from the computer log. As I get older, I'm glad to let him have a couple hours more at the key, especially on Sunday afternoon.

Doug moved to another part of the state. He got married on FD weekend a half dozen years ago. My wife said that would be the end of his Field Day activities. I knew FD would win out over a wedding anniversary, and I was right.

We don't have much contact with each other anymore except to exchange a quick hello during Sweepstakes or *NCJ* Sprint, but there's always that phone call about mid-June announcing his arrival time and maybe a brief discussion about antenna strategy.

The last Friday in June arrives—along with Doug. We have a few beers, pore over last year's logs and take a dip in the pool. Each of us politely inquires about the other's family and career. He shares my joy at the birth of my kids. I share his grief at the deaths of his parents. The conversation is mostly radio, specifically Field Day. We won it last year, and we're going do it again this year.

Saturday dawns, and we're off to the farm. There's no time to talk because we drive two cars full of gear. Our work is cut out for us getting the antennas up and the rig working. Somehow each of us knows what to do and goes about his task quietly. With an hour to spare, the station is on the air and we seek out a burger in town. Operating strategy is the topic of conversation now. Doug likes the fast hours at the start, and I am willing to let him take them. Once on the air, we are sentenced to 24 hours of communication with only the outside world. Experience and preparation keep Murphy at bay. We post another personal best for us.

Teardown is automatic. We're tired, and we just want to go home and get some sleep. Everything is packed up and in the cars within an hour. We shake hands and vow, "Wait until next year!"

Our friendship is an unspoken bond. For a decade we have seen each other for just one day each year, speaking little, yet enjoying our quiet friendship throughout the year. Field Day has made us neighbors once more. QST

Happenings

Conducted By Phillip Sager, WB4FDT
Regulatory Information Department, ARRL

Canada's Proposed Deregulation Addressed

The Canadian Department of Communications (DOC) has published a notice in the *Canada Gazette* (February 18) outlining proposals for deregulation of the Amateur Service in Canada.

The proposals would (1) eliminate restrictions on the type of emissions Canadian amateurs may use within the amateur bands and instead, simply specify maximum permissible bandwidth in each band without specifying subbands by mode; (2) permit foreign amateurs visiting Canada to operate with the same frequencies and emissions as Canadian amateurs (at present, "lowest common denominator" restrictions apply); (3) eliminate endorsements to the Amateur Radio Operator's Certificate, the legal authority for which apparently is questionable, and incorporate the privileges now granted by endorsement within the basic Amateur Certificate (one popular endorsement, available to a licensee after six months, permits 10-meter phone operation); and (4) accomplish some other, relatively minor, updating and revision.

The Canadian Radio Relay League (CRRL) recognizes the problems likely to be created by deregulation of subbands in Canada, and at its August 1987 meeting, the CRRL Board of Directors went on record to request that DOC recommend the use of IARU band plans should deregulation occur. To place ARRL concerns on the record, President Larry Price, W4RA, sent a letter to CRRL President Tom Atkins, VE3CDM, with the request that our comments be incorporated in the CRRL filing (deadline for which was March 18).

President Price stated that DOC's proposals for privileges to be granted to foreign amateurs visiting Canada are quite generous, easy to understand, and adoption of these proposals would resolve some ambiguities associated with reciprocal licensing. The proposals for HF mode subband deregulation, however, appear to be based on an incorrect premise and raise serious concerns among US amateurs. The DOC states "Such an elimination of emission restrictions permits the Canadian amateur to enjoy equal privileges on a par with other radio users in the international radio environment and particularly with those privileges currently extended to US radio amateurs." At least with regard to US HF privileges, this statement is fundamentally incorrect.

Canadian amateurs already enjoy considerably greater freedom to use the most popular HF mode, SSB emission, than do their US counterparts. If the purpose of DOC's proposal is indeed to bring about equity between US and Canadian amateurs, then the proposal is unnecessary and should be abandoned or significantly modified.

The real question is how Canadian amateurs will respond to deregulation. We have faith in our Canadian brethren to act responsibly, if given the proper guidance. However, we believe that it is a responsibility of the DOC, in proposing to upset the existing equilibrium, to emphasize to its licensees the extreme importance of Canadian amateurs observing the voluntary band plans that have been developed through the representative international mechanisms of the IARU. We were disappointed to find no such reference in the notice, nor in the proposed regulatory text.

FCC PROPOSES NEW BEACON SUBBANDS ON 2 METERS, 70 CM

In response to an ARRL petition filed last September, the FCC has proposed, in Docket 89-65, to relocate beacon operation in the 2-meter and 70-cm bands. The ARRL petition had requested the changes since present beacon frequencies are very close to frequencies used for moonbounce and other weak-signal activities. The ARRL said that it had filed the petition after consulting with weak-signal operators and beacon users.

The Commission said that it agreed that the beacon subbands in the 2- and 70-cm bands should be relocated. The Commission followed the ARRL proposal to move beacon operation from 144.05-144.06 MHz to 144.275-144.300 MHz, and from 432.07-432.08 MHz to 432.3-432.4 MHz.

The ARRL had also requested the Commission to change the beacon subbands on 220 MHz. The Commission declined to propose changes in the 220 MHz beacon subbands at this time, citing its decision to reallocate the bottom two MHz of the 220 band to the Land Mobile Service. Comments on this proposal are due on or before June 12, 1989.

FCC DENIES REQUEST FOR SSB ON 30 METERS

The FCC Commissioners have upheld the Private Radio Bureau's decision denying Anthony Sivo's (W2FJ) request to amend the amateur rules to authorize single sideband in the 30-meter band. The Commissioners agreed with the Bureau's conclusion that the need for SSB transmissions in the 30-meter band had not been established and there were already ample HF frequencies available for SSB emissions.

FCC DENIES TECHNICIAN F1B PETITION

The FCC has denied a petition (RM-6559) which would have allowed Technician class operators to use F1B emissions (teleprinting, packet) in the Novice/Tech segments of the 80-, 40- and 15-meter bands. The petitioner, Nicholas Sayer, N6QQQ, said that the additional privilege for Technician operators would be an incentive for Novice operators to upgrade.

The Commission said that the Technician class is currently the fastest-growing amateur class, and there was no need to offer addtional incentives for Novice class operators to upgrade to the Technician class. Additionally the Commision stated, "the opening of these small segments to such a large number of stations for teleprinting, moreover, could have a serious negative impact upon their usefulness in providing an opportunity for Novice and Technician class operators to improve their telegraphy skills sufficiently to qualify for a General class operator license. Such a result would be undesirable because the General class shows the slowest rate of growth."

The Commission noted that Technicians could upgrade to the General Class and by doing so, could obtain access to the HF bands for F1B emissions. Thus, the Commission felt that to adopt the proposal "would actually have a negative impact of removing some of the incentive to upgrade from Technician class to General class." The Commission denied the petition on March 2.

ARRL FILES REPLY COMMENTS ON 6-METER SUBBAND EXPANSION

The ARRL has filed Reply Comments on the FCC proposal to expand the 6-meter repeater subband, Docket 88-527. This NPRM would expand repeater operation

FCC-ISSUED CALL SIGNS UPDATE

The following is a list of the FCC's most recently issued call signs as of December 1.

District	*Group "A" Extra*	*Group "B" Advanced*	*Group "C" Tech/Gen*	*Group "D" Novice*
Ø	WRØT	KFØBD	NØKGH	KBØEAQ
1	NV1M	KC1NT	N1GIL	KA1TID
2	WN2R	KE2LT	N2JBS	KB2HHC
3	NT3W	KD3LQ	N3GXE	KA3UFQ
4	AB4NG	KM4OV	N4VDB	KC4JCA
5	AA5KQ	KG5SE	N5NZS	KB5ION
6	AA6MW	KJ6RK	N6UMN	KC6BZK
7	WX7Y	KF7RV	N7MJU	KB7GZA
8	WO8Z	KE8WT	N8KLI	KB8GOV
9	WF9Z	KE9OY	N9IFH	KB9CDV
Guam	KH2K	AH2CE	KH2DR	WH2ALY
Hawaii	**	AH6JQ	NH6SQ	WH6CBV
Alaska	**	AL7KW	NL7QT	WL7BTX
Virgin Islands	NP2E	KP2BO	NP2CV	WP2AGP
Puerto Rico	**	KP4PV	WP4UC	WP4IHF

**indicates all 2 x 1 calls have been issued in these areas.

to encompass 51-54 MHz. The League agreed with the Commission that "it is apparently desirable to expand the repeater subband, at least in certain areas of the country." Our comments discussed the comments filed by the Six Meter International Radio Klub (SMIRK) which were concerned about the possible impact of the expansion of the repeater subband on the Pacific DX Window (51.0-51.1 MHz). This portion of the 6-meterband is used for weak-signal, long-distance communications primarily with Australia and New Zealand and other areas in ITU Region 3. SMIRK is concerned about interference to the window which could result from repeater operation on the same or nearby frequencies.

The League said that it "is cognizant of the need to protect these operations, and absolutely will insure, through vigorous efforts to properly develop and administer a revised band plan for this band, that weak-signal operation is protected as long as operation in the Pacific DX Window is necessary."

The League's comments concluded by again emphasizing that expansion of the repeater subband on 6 meters to include 51-52 MHz was desirable "and can be accommodated on a planned, coordinated basis within the Amateur Service" without relying on FCC regulatory restrictions.

GEORGE S. TURNER, K4AP, SK

George S. Turner, K4AP, former Chief of the FCC Engineering and Monitoring Bureau, died February 7 at his home in Boca Raton, Florida. He was 89 years of age.

Turner joined the FCC in the 1930s and remained there until his retirement in 1964.

WILLIAM W. EITEL, W6UF, SK

The Silicon Valley lost a pioneer with the passing of William Eitel, W6UF, on February 26. He was a past President of the ARRL Foundation and Vice Director of the ARRL Pacific Division in 1976-77.

In 1934, Eitel joined with another enthusiastic radio amateur, Jack A. McCullough, W6CHE, to form Eitel-McCullough, Inc. Their dream was to build more powerful vacuum tubes that would operate at higher frequencies than anything then available.

The tubes, originally designed for Amateur Radio usage, were quickly adopted for military and commercial transmitters as well, and led to important advances in radio communications.

Eimac, as the new company became known, went on to become one of America's leading producers of electron tubes and related devices.

Eimac continued producing technical data and equipment for radio amateurs worldwide, including Project OSCAR. In 1965 Eimac merged into Varian Associates, which remains in existence to this day.

Bill had a fully equipped laboratory at his Nevada retirement home where he continued work on ideas of interest to him. The amateur community shall miss W6UF.

SIDDALL NAMED ACTING ASSISTANT CHIEF, LAW, MASS MEDIA BUREAU

David R. Siddall, K3ZJ, former President of the Potomac Valley Radio Club and Capitol Hill ARS, W3USS, has been named acting Assistant Chief, Law, Mass Media Bureau, FCC. He is responsible for legal review of Mass Media Bureau items.

Siddall has been Senior Attorney in the Policy and Rules Division, Mass Media Bureau. Prior to joining the FCC Siddall worked as a Legislative Attorney with the Congressional Research Service of the Library of Congress.

AMATEUR AUTOPATCH UPDATE

US West (Mountain Bell) has approved residential phone rates for Amateur Radio autopatches regardless of whether they are in a commercial or business location.

The basis for Mountain Bell's decision was that radio amateurs are prohibited by law from using the service for business purposes whether the line terminated in a commercial location or not.

For further information, contact the Regulatory Information Department at HQ.

NEW ASSISTANT CONTEST MANAGER AT HQ

Newly arrived from the snow and cold of the Midwest, Phil Rice, WB9JKI, has joined the ARRL Contest Branch as Assistant Manager.

Phil's duties at HQ will include assisting the Contest Manager in administering League contests, scoring logs, *QST* results preparation, Special Events and Contest Corral.

Phil's interests fall into the area of contesting. He has held call signs in the UK, Belgium, Switzerland and Belize. He is a past member of the Society of Midwest Contesters and looks forward to contesting from his new home in New England. Welcome aboard, Phil!

FIRST 17-METER WAS AWARD ISSUED

The first 17-meter Worked All States award was issued to Christopher M. Merchant, KA1LMR, on March 1. Chris was the first to submit his cards to the Awards Branch at HQ, according to Awards Manager Eileen Sapko. Congratulations Chris!

SPREAD SPECTRUM SYSTEMS IN 902-928 MHz

A number of inquiries have been received from members concerning the local-area network (LAN) use of spread spectrum in the 902-928 MHz band as offered by Telesystems, Don Mills, Ontario, Canada; PA Consulting Group, Hightstown, New Jersey; and possibly other suppliers.

Spread-spectrum systems, for LANs or other purposes, are permitted at a 1-watt power level in the 902-928 MHz band as authorized under section 15.126 of the FCC's rules. Such operation is also permitted under this section in the 2400-2483.5 MHz and 5725-5850 MHz bands. Of concern to amateurs is the potential interference from such operations to amateurs operating in the 902-928, 2390-2450 and 5650-5925 MHz bands.

The rules place a number of limitations on spread-spectrum operation in these bands. The main point to bear in mind is 15.126(c), which requires that the spread-spectrum systems not cause harmful interference to any other operations which are authorized the use of these bands under other Parts of the Rules. Also, they must accept any interference from these sources. As far as the FCC is concerned, the

Amateur Service, and the Amateur-Satellite Service where applicable, both have priority over the spread-spectrum systems despite our secondary status relative to a number of other services in these bands.

On the practical side, it is unlikely that these spread-spectrum devices will cause harmful interference to amateurs except when the amateur is physically close to the spread-spectrum transmitter. Interference from spread-spectrum devices, watt for watt, will be at least an order of magnitude less than from narrowband transmitters in the same frequency bands. Because the modulation rate of these transmitters is much higher than the audible range (66 kbit/s in the case of the PA Consulting system), any interference should not result in an audible output of an amateur radio (voice) receiver. Desensing could occur, but only in the near zone.

Spread-spectrum system designers are cautioned by FCC to keep the potential high EIRP emanations from government radars in mind when developing their designs for these bands, and are also cautioned that the 1-watt power limit on 902-928 MHz operation may be reduced in the future.

FCC TERMINATES RECEIVER ADVISORY LABELING PROPOSAL

In May 1988, the FCC proposed amending Part 15 to require labeling radio receivers to advise users that it may be unlawful to intercept radio communications protected by the Electronic Communications Privacy Act (ECPA) of 1986.

The FCC said that although the ECPA prohibits interception of certain classes of communications, the frequencies on which these communications are transmitted can be used for unprotected communications as well. The FCC decided that, given the complexities of the ECPA, it was impractical for a label to provide sufficient information to properly advise users of the legal requirements.

The FCC also said that it agreed with some of the commenters that, in some instances, a warning label might encourage prohibited activity by calling attention to it.

Lastly, some manufacturers are voluntarily informing users of ECPA provisions or by redesigning equipment to omit certain frequencies. The FCC concluded that an advisory label on radio receivers was unnecessary and terminated the proceeding, Docket 88-281.

FCC DENIES SENIOR CITIZEN UPGRADE PETITION

The FCC's Private Radio Bureau has denied a petition by Shannon Cisco, WB4AZT, to change the amateur operator license requirements for senior citizens. Cisco had requested that amateurs over 65, licensed for 20 years, be automatically upgraded from Technician to General, General to Advanced, or Advanced to Extra Class respectively, without any examination. Cisco appealed the Order to the FCC Commissioners, who upheld the Private Radio Bureau's decision.

MIAMI FCC FIELD OFFICE MOVES

Effective immediately, the Miami field office of the FCC is now at: Rochester Building, Room 310, 8390 NW 53rd St, Miami, FL 33166. Recorded phone information, tel 305-592-0399, Public phone tel 305-526-7420.

Are You a Lawyer? Amateur Radio Wants You!

Your legal expertise is needed in the Amateur Radio community to help build and maintain the legal foundations for our hobby. The League's Volunteer Counsel (VC) Program is designed to help stem the tide of overly restrictive regulations on Amateur Radio. You can help if you have an interest in this exciting area of communications law, are a reputable member of the bar of at least one state and are a League member, please contact us. As a Volunteer Counsel, you will be kept well informed about areas of law affecting Amateur Radio. For further information, write to the ARRL Volunteer Counsel Program, 225 Main St, Newington CT 06111.

If you live in one of the following ARRL Sections, your legal experience is especially needed: Arkansas, Hawaii, Idaho, Kansas, Maine, Mississippi, Montana, New Hampshire, North Carolina, North Dakota, Nevada, Oregon, South Carolina, South Dakota, Southern New Jersey, Texas, West Virginia and Wisconsin.

NEW ADDRESS FOR HAWAII QSL BUREAU

Effective immediately, the new address for the Hawaii QSL Bureau is:

Hawaii QSL Bureau
PO Box 788
Wahiawa, HI 96786

SECTION MANAGER ELECTION NOTICE

To all ARRL members in the Colorado, Georgia, Los Angeles, Sacramento Valley, San Francisco, South Texas, Eastern Washington, Western Washington, and West Virginia Sections: You are hereby solicited for nomination petitions pursuant to an election for Section Manager. Incumbents are listed on page 8 of this issue.

A petition, to be valid, must contain the signatures of five or more Full ARRL members residing in the Section concerned. Photocopied signatures are not acceptable. No petition is valid without at least five signatures *on that petition*. It is advisable to have a few more than five signatures on each petition.

Petition form (FSD-129) are available on request from ARRL Headquarters but are not required. The following is suggested:

(Place and Date)

Field Services Manager, ARRL
225 Main Street, Newington, CT 06111

We, the undersigned Full members of the ...ARRL Section of the...Division, hereby nominate...as candidate for Section Manager for this Section for the next two-year term of office.
(Signature... Call...City...ZIP).

Any candidate for the office of Section Manager must be a resident of the Section, a licensed amateur of Technician class or higher, and a Full Member of the League for a continuous term of at least two years immediately preceding receipt of a petition for nomination.

Petitions must be received at Headquarters on or before 4:00 PM Eastern Standard Time June 9, 1989. Whenever more than one member is nominated in a single Section, ballots will be mailed from Headquarters on or before July 1, 1989. Returns will be counted August 21, 1989. SMs elected as a result of the above procedure will take office October 1, 1989.

If only one valid petition is received for a Section, that nominee shall be declared elected without opposition for a two year term beginning October 1, 1989.

If no petitions are received for a Section by the specified closing date, such Section will be resolicited in October 1989 *QST*. An SM elected through the resolicitation will serve a term of 18 months.

Vacancies in any SM office between elections are filled by the Field Services Manager.

You are urged to take the initiative and file a nomination petition immediately.

Richard K. Palm, K1CE
Field Services Manager

REPEAT NOMINATING SOLICITATION

Since no petitions were received for the Wyoming Section Manager election by the deadline of December 9, 1988, nominating petitions are herewith resolicited. See the above notice for details on how to nominate.

SECTION MANAGER ELECTION RESULTS

Balloting results: In the North Texas Section, W. W. "Dan" Dansby, W5URI, received 605 votes and George E. Lyons, K5MXQ, received 460 votes. Mr. Dansby was declared elected.

In the Iowa Section, Wade Walstrom, WØEJ, received 328 votes and Rollin J. Sievers, WBØAVW, received 207 votes. Mr. Walstrom was declared elected.

In the Montana Section, A. F. Peters, KF7R, received 175 votes, and Ken Kopp, KØPP, received 166 votes. Mr. Peters was declared elected.

In the Mississippi Section, Vessen "Butch" Magee, KF5DE, received 233 votes, and James N. Davis, KK5Z, received 151 votes. Mr. Magee was declared elected.

The above Section Managers will begin a two-year term of office beginning April 1, 1989.

League Advisory Committee Members

This list contains the names and addresses of the members of the ARRL's five advisory committees. Correspondence for any of the committees may be addressed to the committee c/o Administration Liaison, Lisa Clark, ARRL, 225 Main St, Newington, CT 06111

DX ADVISORY COMMITTEE

Atlantic Division—Tony Gargano, N2SS
32 Bryant Rd, Turnersville, NJ 08012

Central Division—Steve Lamb, W9NUF
143 Willow Ave, Deerfield, IL 60015

Dakota Division—Robert Parlin, WØSFU
1507 Kaltern Ln, Minneapolis, MN 55416

Delta Division—Richard Roderick, K5UR
Chairman, PO Box 1463, Little Rock, AR 72203

Great Lakes Division—Theodore Pauck, Jr, K8NA, 2820 Lenox Rd, Troy, MI 48098

Hudson Division—David Beckwith, W2QM
151 Whitney Ave, Pompton Lakes, NJ 07442

Midwest Division—James Spencer, WØSR
3712 Tanager Dr NE, Cedar Rapids, IA 52402

New England Division—Joe Reisert, W1JR
17 Mansfield Dr, Chelmsford, MA 01824

Northwestern Division—Jim Fenstermaker, K9JF, 10312 NE 161st Ave, Vancouver, WA 98602

Pacific Division—James Maxwell, W6CF
PO Box 473, Redwood Estates, CA 95044

Roanoke Division—Gay E. Milius, W4UG
1416 Rutland Dr, Virginia Beach, VA 23454

Rocky Mountain Division—Ron Stockton, NØRR
Bonanza Star Route, Nederland, CO 80466

Southeastern Division—Robert R. Beatty III, W4VQ, 11 Heritage Cove Court, Casselberry, FL 32707

Southwestern Division—Bill F. Mauzey, Jr, W6RT, 1631 Comstock Ave, Los Angeles, CA 90024

West Gulf Division—George Huling, K5GH
721 White Court, Garland, TX 75040

CRRL—Barry Garratt, VE3CDX, RR #2, Caledonia, ON Canada N0A 1A0

Board Liaison—John Kanode, N4MM
Rte 1 - Box 73A, Boyce, VA 22620

CONTEST ADVISORY COMMITTEE

Atlantic Division—John Carioti, K2ZJ
6893 Peck Rd, Syracuse, NY 13209

Central Division—Gerald Brunning, K9BG
15 Tilipi Court, Schaumburg, IL 60192

Dakota Division—Ron Dohmen, NØAT
125 Magnolia Ln, Plymouth, MN 55441

Delta Division—Bill Rayburn, K4CXY
289 Taraview, Collierville, TN 38107

Great Lakes Division—Randy H. Farmer, W8FN
8155 S Palmer Rd, New Carlisle, OH 45344

Hudson Division—Bill Inkrote, K2NJ
RD 10 - Box 294, Quakertown Rd, Flemington, NJ 08822

Midwest Division—Richard Barnette, KBØU
PO Box 4798, Overland Park, KS 66204

New England Division—Rich Assarabowski, K1CC, 306 Vernon Ave, Vernon, CT 06066

Northwestern Division—Dale Jones, K5MM/7
Rte 2 - Box 468, Bald Peak Rd, Hillsboro, OR 97123

Pacific Division—John Hultquist, K6GSS
188 Noe Street, Kihei, HI 96753

Roanoke Division—David Siddall, K3ZJ
9763 Oleander Ave, Vienna, VA 22180

Rocky Mountain Division—Walt Stinson, WØCP
4150 East Quincy Ave, Englewood, CA 80110-5051

Southeastern Division—Robin A. Gist, NE4L, Chairman, PO Box 975, Auburn, AL 36831-0975

Southwestern Division—Marty Woll, N6VI
17780 Ridgeway Rd, Granada Hills, CA 91344

West Gulf Division—James Eppright, K5RX
123 Tower Trail, Dallas, TX 75229

CRRL—Garry Hammond, VE3XN
5 McLaren Ave, Listowel, ON Canada N4W 3K1

Board Liaison—Rush Drake, W7RM
Rte 2 - Box 372AC, La Center, WA 98629

VHF REPEATER ADVISORY COMMITTEE

Atlantic Division—Willem Van Aller, K3CZ
7623 Old Washington Rd, Woodbine, MD 21797

Central Division—No appointee at this time

Dakota Division—Eric Foss, KDØZ
4615 Oakview Ln North, Plymouth, MN 55442

Delta Division—Jean Giesler, W4TYU
4544 Lyons View Pike, Knoxville, TN 37919

Great Lakes Division—Steven Corso, KV8G
PO Box 9072, Livonia, MI 48151

Hudson Division—Phil Bradway, KB2HQ
1119 Hedgewood Ln, Schenectady, NY 12309

Midwest Division—A. H. Groff, KØVM
1446 Council St, Cedar Rapids, IA 52402

New England Division—Mitch Stern, WB2JSJ
14 Kimberly Dr, Essex Junction, VT 05452

Northwestern Division—Clay Freinwald, K7CR
8515 Idelwood Dr, Tacoma, WA 98498

Pacific Division—William Walters, WA2IBM
542 Papac Way, San Jose, CA 95117

Roanoke Division—Sherman R. Starnes, W4TZU
Rte 1, Box 99, Franklinton, NC 27525

Rocky Mountain Division—Robert Q. Fugate, W8GY, 8820 Delamar Ave NE, Albuquerque, NM 87111

Southeastern Division—David L. Shiplett, WL7ACY
107 Mossy Lake Rd, Perry, GA 31069

Southwestern Division—Karl Pagel, N6BVU
PO Box 6490, Orange, CA 92613-6490

West Gulf Division—Joe Jarrett, K5FOG
Chairman, 13411 Overland Pass, Austin, TX 78736

CRRL—Dr David Toth, VE3GYQ
499 Bobbybrook Rd, London, ON Canada N5X 1G8

Board Liaison—William R. Shrader, W7QMU
2042 Jasmine Ave, Medford, OR 97501

VHF/UHF ADVISORY COMMITTEE

Atlantic Division—Robert Bennett, W3WCQ
1006 Green Acre Rd, Towson, MD 21204

Central Division—Joseph Schroeder, W9JUV
Box 406, Glenview, IL 60025

Dakota Division—Terry Van Benschoten, WØVB
2326 - 11th Ave, NW, Rochester, MN 55901

Delta Division—R. A. "Bob" Taylor, WB5LBT
10715 Waverland, Baton Rouge, LA 70815

Great Lakes Division—David Smith, W8YZ
530 Hollywood Dr, Monroe, MI 48161

Hudson Division—Douglas A. Sharp, WB2KMY
PO Box 9408, 1197 Hillside Ave A-16, Schenectady, NY 12309

Midwest Division—Larry Lambert, NØLL
405 Shelton Dr, Smith Center, KS 66967

New England Division—Thomas Kirby, W1EJ
Chairman, PO Box 455, Pelham, NH 03076

Northwestern Division—Rick Beatty, NU7Z
23115 84th Ave W, Edmonds, WA 98020

Pacific Division—H. Paul Shuch, N6TX
14908 Sandy Ln, San Jose, CA 95124

Roanoke Division—Ted Mathewson, W4FJ, 1525 Sunset Ln, Richmond, VA 23221

Rocky Mountain Division—Lauren Libby, KXØO
6166 Del Paz Dr, Colorado Springs, CO 80918

Southeastern Division—Ronald E. Monk, W4ODW, 103 Keller Court, Niceville, FL 32578

Southwestern Division—S. Keith Thompson, K6PVS, 15130 Fir St, Hesperia, CA 92345

West Gulf Division—Derwin King, W5LUU
7335 Wild Eagle Rd, San Antonio, TX 78255

CRRL—Dana A. Shtun, VE3DSS
500 Willard Ave, Toronto, ON Canada M6S 3R6

Board Liaison—Jay Holladay, W6EJJ
5128 Jessen Dr, La Canada, CA 91011

PUBLIC SERVICE ADVISORY COMMITTEE

Atlantic Division—Bob Josuwelt, WA3PZO
9 Derwen Dr, Havertown, PA 19083

Central Division—Rich Regent, K9GDF
5003 S 26th St, Milwaukee, WI 53221

Dakota Division—Ray Munger, KAØARP
2172 Pequaywan Lake Rd, Duluth, MN 55803

Delta Division—Dale Temple, W5RXU
1620 Tarrytown Rd, Little Rock, AR 72207

Great Lakes Division—James Wades, WB8SWI
1952 Traver #202, Ann Arbor, MI 48105

Hudson Division—No appointee at this time

Midwest Division—Larry Staples, WØAIB
425 W 49 Terrace, Kansas City, MO 64112

New England Division—No appointee at this time

Northwestern Division—John White, K7RUN
PO Box 13274, Portland, OR 97213

Pacific Division—David B. Tyler, N6DRT
PO Box 6017, Albany, CA 94706

Roanoke Division—Charles Moeller, N4FVU
116 Willow Winds Dr, Columbia, SC 29210

Rocky Mountain Division—Joe Knight, W5PDY
10408 Snow Heights Blvd NE, Albuquerque, NM 87112

Southeastern Division—Joel I. Kandel, KI4T
5463 SW 92nd Ave, Miami, FL 33165

Southwestern Division—Jerry Boyd, KG6LF
345 B Ave, Coronado, CA 92118

West Gulf Division—Tom Anderson, WW5L
901 Forest Glen Dr, Bedford, TX 76021

CRRL—Jack Strangleman, VE3GV
512 Pinetree Dr, London, ON Canada N6H 3N1

Board Liaison—Paul Vydaren, WB2VUK
259 N Washington St, North Tarrytown, NY 10591-2314

How's DX?

Conducted By Ellen White, W1YL/4
19620 SW 234 St, Homestead, FL 33031

Chagos Archipelago

That snazzy operator VQ9QM (alias W4QM/W4DQS) updates what's new at Diego Garcia, British Indian Ocean Territory. Dale is QRV with a TH7DX atop a 100-ft tower. In addition, there are dipoles for 40, 30, 17 and 12 meters and a quarter-wave sloper for 80. 160 is a current impossibility with the local AM broadcast-station tower a stone's throw away. Diego Garcia is about 7 degrees south and 72 degrees east, resulting in a tropical climate with lots of rain. The rain is really needed to keep the salt washed off the power lines. Diego Garcia is part of the Chagos Archipelago, British Indian Ocean Territory, leased to the US. The British retain civil law authority and amateur licenses are issued by the local British representative, a painless operation (show your license, pick an unused call, license valid for a year). At the moment the crew (see photo) uses a Ten-Tec Corsair and TS-820. The equipment situation is fluid as hams furnish their own. Active as always, Dale has sent out over 10,000 cards. All requests, via W4QM, are honored. The island's ham complement includes VQ9QM, VQ9JS, VQ9AA, VQ9JD, VQ9SG, VQ9TS, and awaiting VQ9 calls K5SA, K4GXY, WA3QLY.

Chagos operators (see text); standing (L-R) K5SA, K4GXY, VQ9QM, VQ9JS; seated WA3QLY. (*VQ9AA photo*)

FULL CALL SIGNS

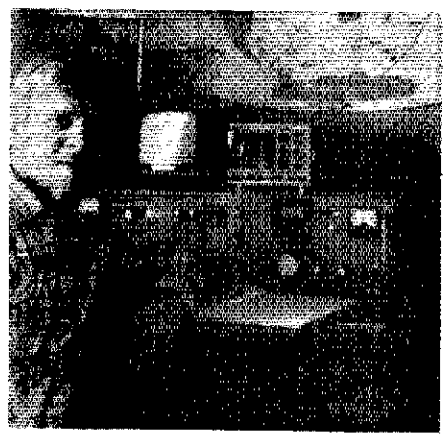
N6RJ has been concerned over the "last two letters" method of operating (check p 67, October 1988 *QST*). Jim took the plunge at ZF2JR (CQWW) and actually did the following: CQ CONTEST, LISTENING FOR FULL CALL SIGNS. ZED FOX 2 JULIET RADIO. Well, it really worked and Jim got wonderful cooperation from the people calling. He was able to set a new personal high of 340 QSOs in his best hour and had several 300-plus hours to boot. N6RJ encourages other DXpedition/contest operators to try this method, saying everyone benefits.

K9KQ EARNS WAB DIAMOND TROPHY

WAB award requirements are tough (see p 57, November 1988 *QST*), particularly for those of us on this side of the pond, says G4GEE. Jim, K9KQ, had to work 1100 of the 4000 WAB "grid" areas. (Only about 20 percent of the areas are likely to have resident hams, so Jim had to persuade people to go out mobile to activate some of the less-common ones.) On top of this, he had to work 70 of their 78 counties, work at least 125 offshore islands, contact members in at least 10 different DXCC countries and work 600 WAB members. In addition, K9KQ had to work 400 of their so-called districts. Whew! Jim has since gone on to be accepted into the WAB Honor Roll for working over 1200 areas.

DX REALITIES SOUTH OF THE BORDER

XE1MD/6D5MD forwarded the following material to your editor in hopes that it might help both sides of a pileup. "A lot of our hams and would-be DXers come from what the US calls CB. Concepts such as split frequency or a second VFO are unknown to them. Information about working a list or in a pileup is nil. Confirmed DXers aren't prone to let out some of their 'secrets' for fear of being surpassed by their pupils. There are no genuine DX books in Spanish or Portuguese. Now, with the onset of monoband DXCC awards, things got worse. To avoid the endless calling/pileups, can DXpedition operators stand by for Caribbean and Latin American stations only, after W5s and WØs? Extend your kindness to work transceive. No harm will result—we are not as yet so numerous—and this will permit relatively new operators using a 15-year-old QRP transceiver to make the contact. Attend to your order: Indicate clearly when you change mode/frequency. Periodically repeat your QSL information. You won't waste time, you'll get more contacts in an hour and more hams will be happy than frustrated. DX is a game and a new one is a great reward."



RVØYF

OKINO TORI SHIMA

DXers remain particularly close to what is happening in the world—albeit with a DXCC viewpoint! There are more important perspectives, however. *Science Digest* recently carried a small item from *Nature Magazine* indicating that salvaging the Japanese rocks will cost an estimated $240 million!

"Two rocks poking a few feet out of the blue-green sea are all that remain of Japan's southernmost territorial border. The rocks are the highest points on the vanishing coral island of Okino tori shima, and if they disappear Japan stands to lose 400,000 square kilometers of its exclusive 200-mile 'economic zone,' and the fishing and mineral rights that go with it. Understandably, the Japanese are trying to keep the rocks above water, and helicopters already have lowered iron tripods to serve as the backbone of a concrete seawall around the coral pinnacles. The engineers plan to be especially careful pouring the concrete because if the rocks are covered, Okino tori shima will no longer qualify as a natural island under international law."

ASSISTANCE

☐ The interesting Canadian DX Association periodical *Long Skip* (nice format, lots of info and DX photos) recently noted that the city of Kanata, Ontario has honored the late VE3SR/VE2NV by renaming the Riddell Area "Jack Ravenscroft Park." Membership in CANAD-X brings this interesting publication ($25 US). Write to the club at Box 717, Station "Q," Toronto, Ontario, Canada M4T 2N7.

☐ The outgrowth of the famous Geoff Watts *DX News Sheet* (published by Geoff 1962-1982) is now produced weekly by RSGB, "aimed at experienced DXers operating CW/SSB/RTTY on 10-160 meters," including the WARC bands; 6 meters covered occasionally. The weekly 4-pager includes hot news by prefix, IOTA updates, DX calendar, band reports, QSL roundup, etc, in an easy-to-use, understandable format. Check with RSGB, Lambda House, Cranborne Rd, Potters Bar, Hertfordshire, EN6 3JW, England.

☐ Speaking of Geoff Watts, note that he produces a 15-page Radio Amateur Prefix-Country-Zone list (which includes information on Antarctic stations, USSR club stations, etc). His *USSR Oblast Guide* contains outline maps of all oblasts, oblast list, oblast award info, CQM contest rules, etc; same price as above. The DXNS CQ/ITU Zones

Guide is a useful companion to the prefix list. The DXNS DXCC Guide is a useful shack addition with present/past prefixes back to 1945, reference material, a full list of deleted countries, etc. The list also gives the Islands on the Air (IOTA) reference numbers. Each of the four noted publications goes airmail for $3.00 each (6 IRCs). No foreign checks, please. Write Geoff Watts, 62 Belmore Road, Norwich NR7 0PU, England.

(L-R) Two of the most active Guadeloupe hams are FG5BT and FG5BG. (*FS5UQ photo*)

☐ The 1989 edition of *K1BV's Directory of DX Awards* is a knockout, with the latest revision 60 pages longer and containing 375 more awards. $15.50 postpaid first class/priority mail for W/VE; DX surface $14.00; DX air to Western Europe and South and Central America $18.00; $21.00 airmail to the rest of the world. Contact Ted Melinosky, K1BV, 525 Foster St, South Windsor, CT 06074-2936; tel 203-644-2358. For general info, an SASE would be appreciated. (This would make a super gift for some DX friend.)

☐ OE2DYL is now into the eighth edition of his popular *DX Nets Around the World*, with info on more than 100 active DX nets ($3 US or 9 IRCs airmail). SAE from Dieter Konrad, OE2DYL, Bessarabierstr 39, A-5020, Salzburg, Austria.

☐ W6EL has released Version 3 Miniprop for IBM and compatibles. It uses a unique version of searching through the several ionospheric modes to find the combination of E and F hops yielding the strongest received signal at each half hour UTC (on each of 7 frequencies chosen by the user), making it significantly more accurate. More from W6EL, 11058 Queensland St, Los Angeles, CA 90034-3029.

CIRCUIT

☐ **YJ:** Mid-May will see VK8AV operating YJ1BKS mornings and YJ1TRS afternoons. Look for Alan portable here and there for an extended period. Meanwhile, back in Alice Springs, VK8XX and XYL VK8MM will help keep VK8AV's QTH radio-active.

☐ **JXØA:** This drifting-icepak station will shortly close down. Operated be LA2FFA/JW2FFA the operation gets confirmed via Mathia Bjerrang, LA5NM, Box 210, N-9401 Harstad, Norway.

☐ **Clubs:** Alamo DX Amigos (San Antonio, TX)—K5DB Pres, W5LUU VP, NI5S Treas, N5HB Sec'y.

☐ **4XØT:** Kibbutz Tzora (4Z4YJ) is celebrating anniversary #40 throughout the year. If you work the station on 3 bands, a special certificate will be awarded to you. QSL to 4XØT, Kibbutz Tzora Club Station, POB 99705, Israel.

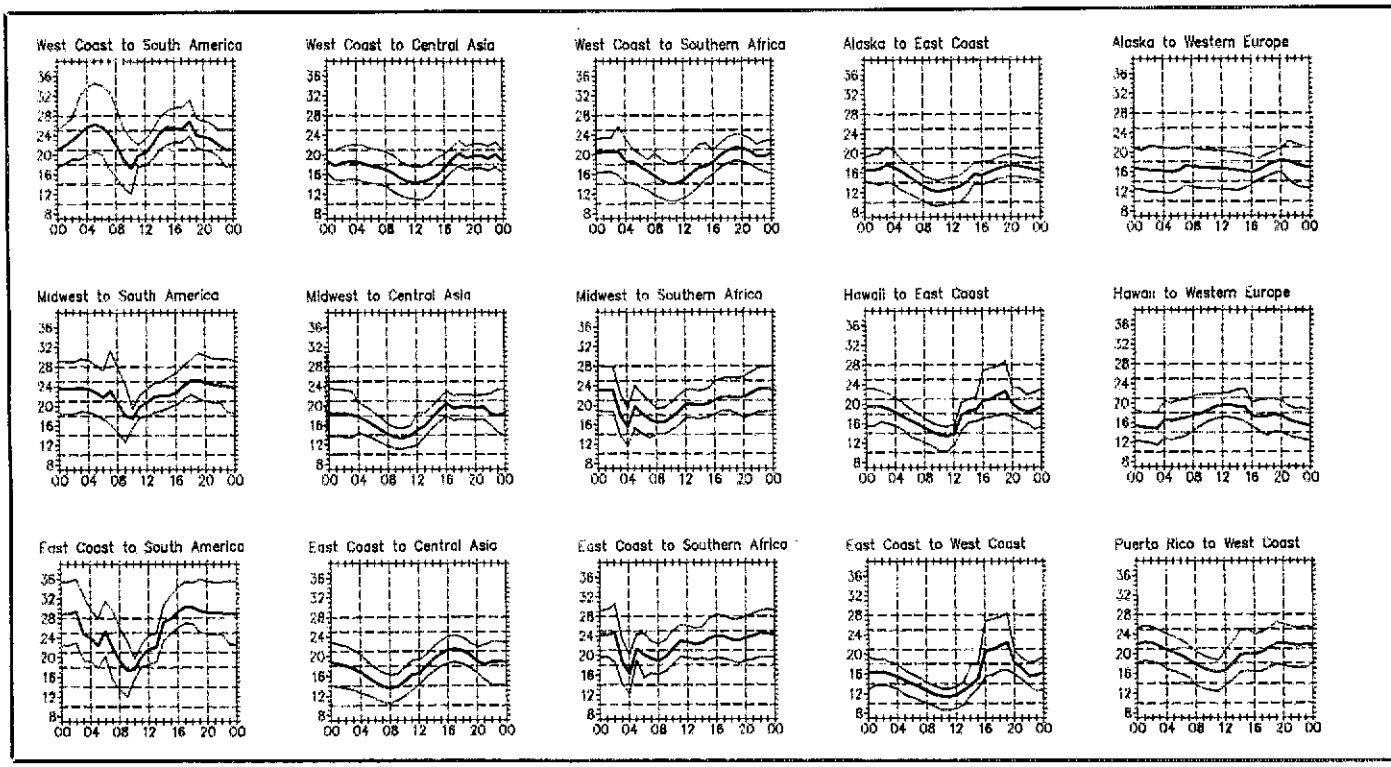
☐ **AH2CA:** K1KOB reiterates he is not the manager for this station. Ralph says to QSL this Guam station direct: Box 8423, N25MOV3, Guam 96912.

☐ **AP2NK:** Green stamps by mail is illegal many places, including Pakistan. Please send only 3 IRCs for return QSLing. (*Thanks K3TLP*)

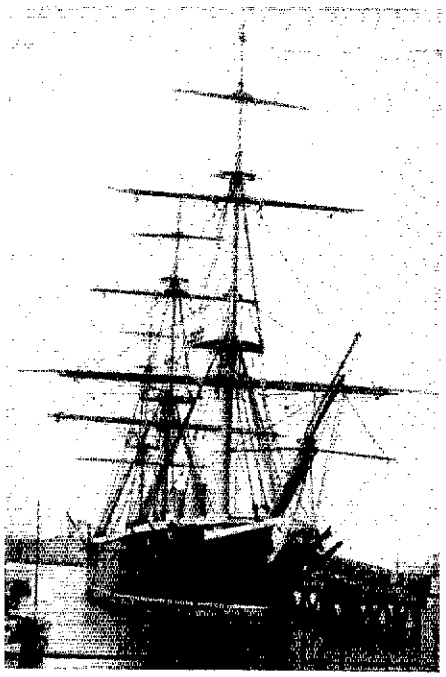
☐ **ZP5XDW:** Doug has retired to Caacupe, Paraguay (PO Box 73) and hopes for ZP6CW, but may wind up with ZP6XDW or ZP6XCW.

☐ **XF4T:** Look for this Revilla Gigedo operation early May for about 10 days. XE2TCQ will handle SSB, 1850 3795 7050 7185 14250 21300 28500 (all this split, 5 up); XE2BDG will be at the key on 25 kHz up from the bottom band edges (split, 5 up); XE2MRV/XE2JFG RTTY, normal DX frequencies. XF4T with SASE to XE2TCQ, PO Box 66-D, Tijuana B.C. 22150, Mexico.

☐ **YASME:** In mid-February the Colvins concluded their 5B4KG-ZC4ZR-9H1JN-W6QL/5NØ 4-month Africa-Asia swing. You're sure to get their seasonal recap at the April DX Convention in Visalia and the DX session in Dayton, and learn of their upcoming visit to all 15 Russian Republics!



When are the bands open? These charts predict this month's average propagation predictions for high-frequency circuits between the US and various overseas points. One chart showing East Coast to West Coast is also included. On 10 percent of the days of the month, the highest frequency propagated will be at least as high as the uppermost curve (highest possible frequency, or HPF). On 50 percent of the days of the month, it will be at least as high as the middle curve (maximum usable frequency, or MUF). On 90 percent of the days of the month, it will be at least as high as the lowest curve (optimum traffic frequency, or FOT). The horizontal axis shows Coordinated



The Fareham and District Amateur Radio Club will be operating GB4HMS on board the 3-masted, square-rigged sailing ship *HMS Warrior 1860* this spring/summer. (*Thanks GØERS*)

☐ **3W8CW/DX:** At the end of January, the International DX Association shipped 150 lbs of these "rare" cards to Vienna for use by HA5PP/MY/WA, cards representing their Oct 23-Nov 28, 1988 operation.

☐ **FS7:** Look for 6- and 2-meter operation by K4MQG, WA4VCC, WW4T and AA4SC for the June VHF Test, with possible PJ7 operation if plans jell. Plans have them utilizing the intercom frequency of 28.885, and an operational beacon on 50.085. A complete OSCAR 13 station will be on the air, with emphasis on Mode B. "Spare" time may see the group on 10, 15 and 20.

QSL Corner

Administered By Joanna Hushin, KA1IFO

Here is some information for those of you who would like to QSL a QSL manager or direct to the station location. It is passed along as we receive it and, therefore, may not be accurate. The call sign in parentheses is the QSL manager.

A35CE	(HB9CUY)	ZYØFX	(W9VA)
KC6MS	(JA2NQG)	3D2HO	(GØGLJ)
OD5MM	(HB9CYH)	5W1HM	(JH4IFF)
PJ2J	(K1CPJ)	6O1GG	(I2MQP)
VP5U	(NM2Y)	8P9NX	(WØSA)
V31C	(NA5S)	8Q7CQ	(DK9FN)
V31CV	(NA5S)	8Q7CW	(DK9FN)
YL2ZG	(UQ2MU)		

QSL MANAGER VOLUNTEERS

NM3B	WB2PQG
KC6AWX	N4SQZ
WBØYEA	

SPECIAL NOTES

The FCC has been issuing KG6 call signs to amateurs in the 6th call district in California for quite some time, and the majority of KG6 call signs are now held by amateurs in the state of California and *not* by amateurs in Guam or in Saipan. The following are known Guam and Saipan call signs at this time:

1. Guam calls:
   AH2(x) or AH2(xx)
   KH2(x) or KH2(xx)
   WH2(xxx)
   KG6xxx (any KG6 call followed by 3 letters)
   KG6DX
   KG6RN
2. Saipan calls:

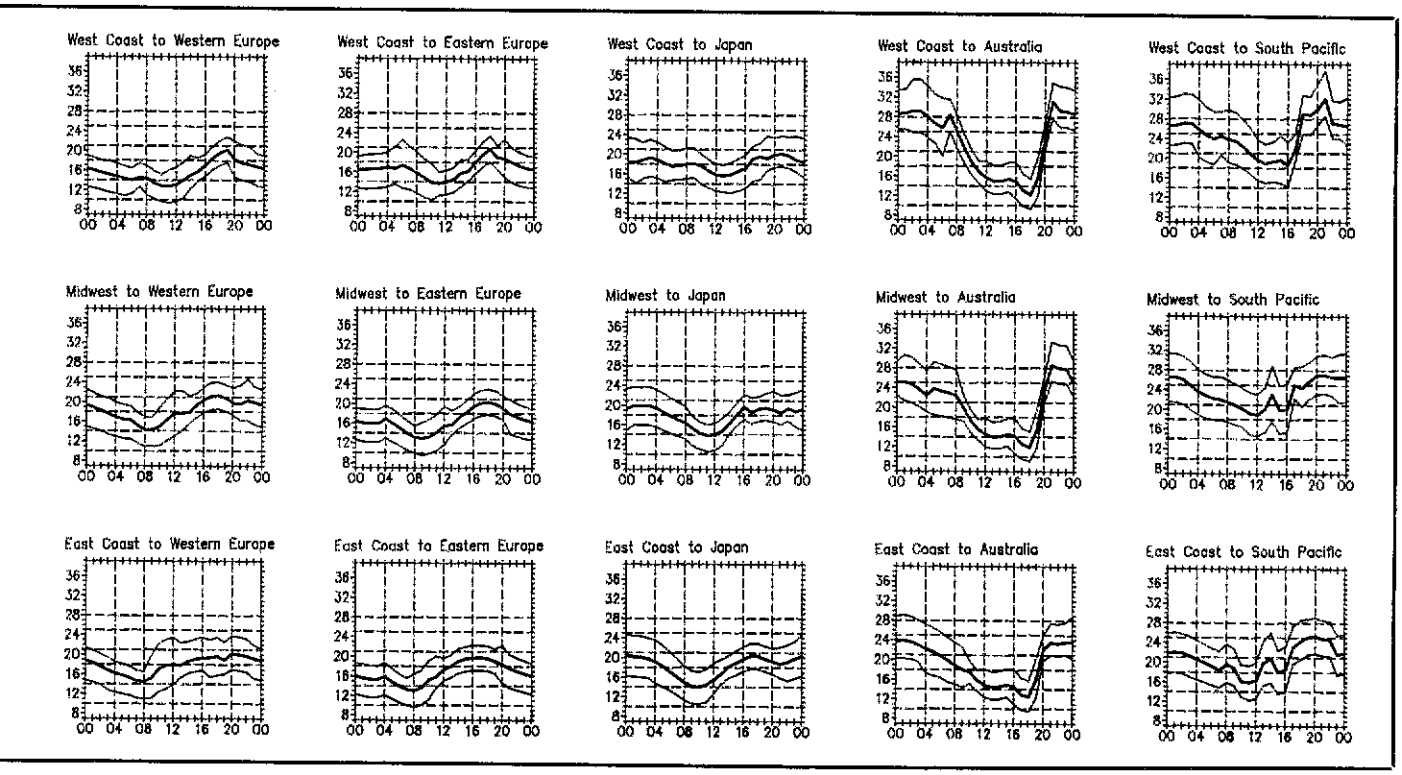
KG6II	KG6ARL
KG6RE	KG6SL
KG6RI	

1. These cards go to KH2 bureau in Guam.
2. These cards go to KHØ bureau in Saipan

Cards for any other KG6 call sign not listed above should be sent to W6 bureau in California.

TNX to KH2D, Guam QSL Bureau Manager

☐ QSL Corner, December 1988 *QST*, page 74, contains information and addresses for the ARRL Incoming Bureau. QSL Corner, March 1989 *QST*, page 68, contains information on the operations of the ARRL Outgoing Service. For additional information on bureau operations (Incoming and Outgoing), send a self-addressed, stamped envelope to ARRL QSL Bureau, 225 Main St, Newington, CT 06111.



Universal Time (UTC); the vertical axis, frequency in MHz. See April 1983 *QST*, pp 63-64, for a more-detailed explanation. The 3rd edition of *The ARRL Operating Manual* contains similar charts for a range of sunspot numbers and times of the year. Data provided by the Institute for Telecommunication Sciences, Boulder, Colorado. These predictions, for May 16 to June 15, 1989, assume a sunspot number of 179, which corresponds to a 2800-MHz solar flux of 223.

DX Century Club Awards

Administered By Don Search, W3AZD

The ARRL DXCC is awarded to amateurs who submit written confirmation for contacts with 100 or more countries on the official DXCC Countries List. You may endorse your award in 25-country increments through 250, 10-country increments through 300, and 5-country increments above 300. The Satellite and 160 Meter DXCC awards are endorsable in 10-country increments through 200, and 5-country increments above 200. The totals shown below are exact credits given to DXCC members from January 13 to February 7, 1989. An SASE will bring you the rules and applications forms for participation in the DXCC program. Send $1.00 to request the ARRL DXCC Countries List.

New Members

Mixed

DJ6MT/109	JO1RDV/140	OK1IVU/102	7J1AAL/100	N2DCH/100	W4IB/107	K6UO/165	W7EFL/106	KA9YMV/109
DL7AEJ/117	JA2NQG/165	PA3DMH/185	KA1LLH/124	W2WOE/160	W4KHL/265	KI6HT/102	W7THY/105	W9DDP/305
DL7EJ/139	JH3KEA/256	PS7KM/270	KA1OFC/101	WE2E/119	WB4HNM/112	NK6A/157	W8SWC/106	W9EDA/209
G3XON/104	JH3VNC/277	SV2TX/110	KA1PCN/104	KA3RGF/121	KG5NW/105	W6MSG/101	KD8KA/104	W9PWI/109
HB9DC/122	LA1VFA/256	UY5OO/308	N1DGC/110	W3ULI/160	N5DKS/124	W6NIZ/105	KD8RZ/104	NØJR/256
IK1FRI/110	OH1UN/130	VE4XQ/263	W1ZGP/104	AB4IU/102	N5MJB/105	WA6BKR/101	NS8O/107	WØQEV/160
IØPJQ/115	OH2BPA/151	XE1EEF/107	KC2SO/105	N4MWR/100	AA6EQ/101	WA6JCD/145	WA8MZQ/155	WBØSYV/101
JA1ORM/110	OK1DWC/105	YU3XA/109	KF2C/103	NK4U/104	AA6JH/112	N7EF/312	KA9SMD/100	

Phone

CP5CW/105	HL9HP/104	JT1BQ/105	SM5EMR/151	W1NXW/114	K4WJB/217	KD6SE/109	K8CHN/128	NX9T/146
DF6QF/105	IK2DUW/103	LA1MFA/218	SV9ANJ/124	KC2SO/104	NK4U/104	W6NIZ/105	K8SQL/100	W9DDP/299
EA7CWA/228	I4ZXO/121	LA1VFA/256	TI2QP/104	KC2YW/100	AG5Z/133	WA6JCD/121	KA8YYZ/103	NØJR/228
EA7GEK/115	JO1RDV/133	LU8MCO/110	4X1KP/102	KA3RGF/115	W5SLO/VE3/106	KA7GXO/100	AA9F/100	WAØEWU/100
FE6IUS/110	JE3LKC/104	OZ1ADL/113	7J1AAL/100	W3ULI/160	W5TOO/107	N7EF/307	KB9ANR/102	WAØWAU/105
GM4WEX/105	JH3VNC/256	PS7KM/270	7J1ACH/130	K4OHA/108	K6UO/138			

CW

D44BC/102	JA3KLT/115	JA9TSI/109	W1OD/101	KA3HIE/152	WA4JVE/104	AA6DV/101	W9DDP/250	KØIIR/103
I2KAJ/199	JH3KEA/153	PA3DMH/161	KA2LAS/100	AA4OV/168	K5SL/104	N7EF/293	W9EDA/207	KKØV/107
JA2NQG/165	JH3VNC/187	VS6UW/104	W2WOE/154	KI4LP/110	WN5W/106	WA8YWK/100	WA9PWP/101	NØJR/207

RTTY

DF2UA/109	DF3NA/101

160 Meters

D44BC/101	G3TJW/121	RA9AB/102	WB4OSN/102	WØLYI/126				

10 Meters

I7IJU/122	ZS6P/114	N1ETT/100	KI4LP/108	N5EIN/133	K7NW/128	K9MDO/177	KØTLM/239	WBØZKG/126
VE4UD/100	4X4VF/107	AA4UJ/189	N4ONI/177	K7GEX/108	WA8LLY/115			

5BDXCC

KBØNL	N2US	FM5DN	WA4BEC	KF5DX	CX2CB	UB5ILA	W5UYD	JAØUUA
K6CID	OH3JF	JH3VNC	JA5BSQ	KI4LP	KV2I	UL7NW	WD4KXB	XE1VIC

New Honor Roll Members

Mixed

313	311	310		
W6MJG/331	JA3ART/328	DJ3TF/313	K4NYV/314	

Phone

311		310		
TI2CC/323	K7ZBV/315	I7KXG/313	WD5DBV/315	
K2SHE/327		VE3HO/318	W8MAW/323	

Endorsements

Mixed

DJ1XP/340	JA7GLB/324	ZS2U/278	K2PEQ/250	K4JAG/289	WB4BBH/276	N6IBP/221	W7KSK/260	N9CAR/157
DJ8CR/337	JA9NLE/307	4X1KP/221	KB2XJ/282	K4LW/296	WB4CSK/305	N6NXV/150	W7OC/280	NJ9X/239
DL1LD/336	LAØEW/126	4X4IL/260	N2AMS/278	K4QE/228	WB4FLB/290	N6VI/300	W7XA/329	NK9X/175
G3KLL/306	OE1ZL/301	K1MZB/150	W2AAN/293	KA4LRM/244	WB4MAI/311	NS6D/220	WS7W/164	NX9T/147
G4QK/177	OH2DW/207	K1VSG/129	W2GKZ/346	KC4MK/277	WJ4S/199	W6CTL/315	K8UNP/280	W9AA/253
HB9BMZ/219	OK1RD/302	K1WVX/252	W2SR/306	KI4KJ/137	WN4G/229	W6MFC/312	KC8MK/260	W9MCJ/300
HB9CRV/201	RT5UN/330	K1ZZI/250	WA2IKL/201	KI4LP/255	WS4G/225	W6PCS/237	KD8FO/294	W9TNZ/201
HK3BFU/204	SM7NJJ/260	KA1MX/201	WA2UDT/225	KJ4MD/265	WT4Z/221	W6PLJ/155	KD8YM/131	WA9ZWL/228
I2SM/347	SP6BZ/332	KA1RRL/175	K3SEW/301	N4BQD/290	AG5Z/134	W6PMT/305	N8AGU/152	WB9BZE/175
IK2BLA/273	SV1JA/260	KC1DQ/150	KC3LM/128	N4RU/266	K5HKX/177	W6TZD/362	N8EL/313	ABØP/280
IK8BQE/295	TG9NX/317	KC1GN/253	KD3AO/131	N4TL/292	NZ5O/181	WA6TJM/249	N8EOA/158	KØQQ/320
IK8DOI/292	VE3HD/356	KZ1L/200	KD3FV/150	NK4L/304	W5OG/300	WA6WZO/322	W8SYR/310	KCØD/265
IØSNY/259	VE3HO/319	N1CIX/261	KX3Q/261	NX4N/273	W5ZF/326	K7JBQ/130	WA8NDL/292	KMØQ/200
IKØAZG/300	VE3JGC/273	NC1E/162	N3AKD/292	W4JAT/273	WN5MBS/250	K7LJ/282	WA8PYL/328	KQ8J/287
JA1SJV/307	VE3JGC/W4/251	NG1I/122	N3CZJ/181	W4KA/322	WZ5U/305	K7SZN/225	WA8YTM/290	N8ICI/151
JA2BHG/335	VE3MRX/152	W1ENE/203	W3SOH/321	W4QQN/343	WZ5V/287	KC7MM/131	WB8HIW/215	WØBWJ/251
JA2JRG/301	VE7CXN/143	W1FDR/177	AA4H/313	WA4CTC/264	KB6DSX/150	KE7CR/175	WD8PKF/313	WØEFK/318
JA3IYS/296	XE1ALH/208	W1YCO/125	AA4WX/127	WA4TLI/323	KE6KT/162	N7BES/281	AI9Y/175	WAØIDK/318
JA4LXY/324	XE1VIC/305	WA1UDH/290	AA4XR/251	WA4YLD/258	KG6JW/201	NT7E/157	K9EC/249	WAØQVC/253
JA8BEE/330	XE1XRC/201	WB1BVQ/278	K4GXQ/216	WA4ZNU/208	KJ6NZ/179	W7HS/250	N9BUS/297	WDØHNQ/289
JA7ARD/323	ZL1BWK/232	AF2K/251	K4IQJ/230					

Phone

CT1AMK/250	I2SM/347	JA9NLE/295	K1WVX/252	W2GKZ/341	KC4MK/225	K5UKN/327	W6UVW/183	WB8IXV/205
CT1BGC/201	IK2BLA/273	JY9LC/175	KA1FSO/175	W2RGU/330	KI4LP/238	NJ5X/299	WA6TJM/237	WD8PKF/311
CT1QF/214	IN3DEI/315	OE1PPC/200	KA1ORB/155	WA2LWM/232	KJ4MD/260	NZ5O/172	WA6WZO/322	K9BSL/150
CX4ABY/154	IK5EEG/216	PY4OD/316	KE1F/280	WB2CVL/313	N4IQN/212	W5BWA/198	WB6PSY/307	K9KJS/231
DL5OAH/200	IK7DBB/251	SM7NJJ/210	W1FAB/290	K3SEW/281	N4RU/210	WB5IUU/126	WW6F/270	N9BUS/288
DL7FP/325	I8IHG/312	TG9NX/317	W1MMV/359	KC3NO/265	N4TL/283	WN5MBS/250	N7BES/279	W9TNZ/183
EA3CCN/233	IK8BQE/293	VK4ZM/234	W1WRN/255	KD3AI/125	NI4Y/280	WQ5Y/255	WS7W/150	KØHSC/277
EA5AD/306	IK8DOI/292	XE1ALH/206	WB1BVQ/277	KX3Q/254	NK4L/287	WZ5U/305	K8UNP/257	KØQQ/316
EI6EW/225	IØSNY/256	XE1ILI/179	AG2K/248	N3AKD/271	W4FPS/335	WZ5V/287	KC8MK/256	KQ8J/284
G3KLL/305	IKØAZG/299	XE1VIC/304	KB2XJ/273	N3BQS/151	W4KHL/265	KE6KT/178	KC8NU/254	NR8Q/267
G4MBT/175	JA1SJV/261	XE1XRC/201	KB2XP/270	N3CZJ/180	W4QQN/331	N6ARS/240	N8BSB/273	WØBWJ/251
GØAEB/149	JI1HWV/280	YV5EF/202	KC2KU/300	W3YHR/288	WA4MXD/180	N6NXV/150	N8FUM/157	WØGLG/208
I1HAG/320	JA2JRG/285	ZL1BWK/232	KQ2O/279	AA4DO/270	WA4TLI/320	W6BDD/174	N8HTT/264	WAØGUD/280
I1ZFT/318	JA6BEE/325	ZS6TB/158	N2AWM/238	AA4JO/227	WB4MAI/293	W6MFC/310	W8ILH/282	WDØHNQ/287
IK1AOD/290	JA7ARD/321	4X4IL/253	NK2B/208	K4LHH/166	WB4ZIM/280	W6PLJ/142	WA8PYL/321	WK9I/144
I2JSB/304	JA7GLB/324	5B4ES/205	NX2H/150	KB4WY/250	WJ4S/173	W6PMT/305	WA8YTM/283	

CW

DJ1XP/307	HK1BYM/244	LA6YN/234	VK6HD/176	W2SR/286	N4IHT/152	WD4AHZ/150	N6IBP/167	W9TNZ/138
DK5PR/300	IK2CIH/177	PA3CNI/176	ZL1AMO/202	K3SEW/190	N4TL/127	WS4G/212	W6CTL/229	KØQQ/239
DL6VW/262	JA1SJV/200	PY4OD/283	ZS2U/200	N3AKD/232	NK4L/280	AB5X/125	W6MFC/126	KCØD/250
EA8IR/200	JH1OCC/145	SM7NJJ/204	KA1FVY/125	W3FG/165	WA4YLD/149	NR5Q/155	KY7M/260	WØLYI/201
G4QK/134	JA2JRG/283	TG9NX/314	KE1F/200	AA4CM/302	WB4BBH/223	W5OG/294	NN7A/201	WØULU/200
HB9BMZ/161	JA4LXY/298	VE1VX/150	N1CIX/201	AA4XR/136	WB4MAI/285	W5XJ/191	WA8YTM/270	WA0GUD/226
HB9CRV/174	JA7JT/249	VE3HO/275	KA2DIV/279	KC4MK/200	WB4OSN/306	WD5DBV/281	WD8PKF/267	

RTTY

I5FLN/280	W1AX/149	K2PEQ/161	W2FXA/200	WA4WIP/204				

160 Meters

VK6HD/142	K1ZM/210	K2FL/110	K3UA/156	N4JJ/201	W4OWJ/185	K9UWA/170		

10 Meters

HB9RG/231	K2ARO/303	K4MF/177	KB5DZY/126	K6EMN/250	W6CTL/111	WA6BYA/125	WB6PSY/290	

DXCC Notes

The DXCC Honor Roll Listing will appear in the July 1989 issue of *QST*.

Simple Low-Noise Microwave Preamplifiers

(continued from page 36)

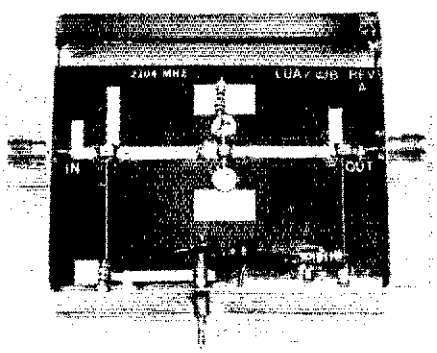


Fig 13—The prototype self-biased 2.3-GHz preamplifier. The large rectangular pads near C3 and C4 are not needed and were dropped from the final artwork.

diameter of the capacitors through the PC board as shown. See Fig 12. Be sure to place the holes so that the FET source leads are 0.070 inch long when Q1 is centered between Z1 and Z2. Solder a brass or copper sheet across the holes on the ground-plane side, and solder one side of C3 and C4 to the sheet. Then solder the Q1 source leads to the tops of C3 and C4. Fig 13 is a photograph of the finished unit.

According to the computer simulation, this technique yields unconditional stability in the 7- to 8-GHz range. The overall stability of a preamp built in this way is comparable to the grounded-source design. The *measured* performance of this configuration is good too. Compared to the grounded-source model, the gain of the bypassed-source LNA is within 1 dB, and the NF is within 0.1 dB, of that obtained with the grounded-source configuration—and no stability problems are evident. This technique is suggested for the 2304-MHz model only.

Although the preamplifier circuits are designed for minimum noise figure, the ATF-10135 and the ATF-13135 devices are capable of producing moderate power at microwave frequencies. When biased at 4 V and 70 mA, the ATF-10135 is capable of producing +20 dBm (100 mW)—operating at its 1-dB gain-compression point—at 4 GHz. Slightly less power can be expected at 5.7 GHz. At 12 GHz, the ATF-13135 is capable of producing +17.5 dBm at its 1-dB gain-compression point when biased at 4 V and 40 mA.

Summary

This article has described a series of low-noise amplifiers that require minimal adjustment for optimum performance. Any one of them can be constructed easily in an evening. They offer low noise figure, acceptable gain, good input and output SWR, and good stability.

I would like to thank Kent Britain, WA5VJB, for his valuable help in laying out the artwork for all of these preamplifiers and their subsequent revisions. His help, plus that of many other people, was invaluable in testing out the prototypes. Several dozen of these preamplifiers are already in use nationwide with good results. Copies of the 10.368-GHz preamplifiers, for instance, were used by WA5VJB and WA7CJO to make the first-ever 10-GHz EME QSO! I also thank George Vendelin, to whom I owe a great deal for his guidance and advice.

Notes

[1]Avantek AN-A002, as well as other Avantek application notes, are available from your local Avantek distributor. If you do not know the location of your local distributor, contact Avantek, 3175 Bowers Ave, Santa Clara, CA 95054-3292, tel 408-727-0700.

[2]Microwave Components of Michigan, PO Box 1697, Taylor, MI 48180, tel 313-753-4581.

[3]Down East Microwave, Box 2310, RR 1, Troy, ME 04987, tel 207-948-3741. *QST* and ARRL in no way warrant this offer.

Al Ward, WB5LUA, earned a BSEE from the University of Illinois in 1973. He worked for Texas Instruments from 1973 until 1987 as a microwave design and systems engineer. In 1987, he joined Avantek as a microwave semiconductor field applications engineer. First licensed as WN9QZE in 1965, Al is well known for his technical and operating achievements on VHF and above. He holds WAS and WAC on 50, 144 and 432 MHz, and WAS on 220 MHz. He has worked 30 states and WAC on 1296 MHz. Al holds a number of VHF/UHF/microwave distance records and has operated EME on all bands from 144 to 2304 MHz. He is presently active on SSB and CW on all bands from 50 MHz through 10 GHz, and can even be found chasing DX on 160 meters.

Correspondence

Conducted By John Hennessee, KJ4KB
Regulatory Information Department Assistant

THE NO-CODE DEBATE CONTINUES: PRO...

☐ Having been licensed more than 20 years, I never thought I would be saying this. However, I think the time has come to again consider the idea of a no-code license. In the past, I felt "I had to learn CW—so should everyone else." I still feel this way; however, what has changed my mind somewhat is the development of packet. I personally know two people who, while having no interest in talking on the radio, were very interested in my packet setup. Neither could understand the need to learn CW.

I am beginning to feel we have no other choice if we are to keep our VHF/UHF bands.—*David J. Hardingham, KE7JM, Cheyenne, Wyoming*

☐ As I read each letter carefully, I became aware that some confusion on the subject exists.

No-code does not mean totally eliminating the current code requirements. Nor does it mean a rash of new, pathetically uninformed licensees suddenly appearing on a favorite HF band to compete with each of us for limited frequencies. International treaties do not provide for no-code operations below 30 MHz.

What it does mean is an opportunity to increase the number of amateurs in the USA. And those new amateurs could be placed on frequencies we risk losing through lack of use. What it does mean is an opportunity to attract technically oriented new amateurs. What it provides, through the process of incentive licensing, is an opportunity to increase the pool of fully competent amateurs who know and practice the honorable art of communicating via Morse code. If the no-code license is popular, it will quickly attract a large number of new amateurs. These new amateurs would have the incentives to easily upgrade and acquire limited HF and two-meter privileges by passing a 5-WPM code test. I believe the net result would be more amateur operators and actually an increase in the total amateur population capable of operating CW.

Regardless of what we say about the evils of no-code, what we are really fighting is increasing the total number of amateurs because we are unwilling to share limited frequencies with additional hams.—*Terrence R. Redding, WB5LMJ, Lawton, Oklahoma*

☐ The US Air Force trained me as an expert in electronic warfare and I've spent six years with the Federal Aviation Administration. I feel confident that I might qualify as one of the people who Terrence Redding, WB5LMJ, mentioned in his letter as being the type who ought to be attracted to Amateur Radio. Of those who took the con position, not one of them gave a viable technical reason to retain the code.

If CW can't stand on it own merits, does it deserve to [continue as a licensing requirement]?—*Pat A. Hines, Morrisville, North Carolina*

☐ Well, now that the great debate is on again, I think that it is imperative for all of us to stop counting the trees and look at the forest! I remember well being 12 or 13 years of age and taking my Novice test. I only had 15 minutes of code before the old boy passed me and then a simple written test followed. I didn't know a thing about radio. I didn't really learn about radio until I put together my Heath transceiver and made a dipole. We had to learn from each other and from our Elmers. The point here is that we hams learn by doing, not testing.

We have to change. Our public service will disappear as cellular telephones become consumer items. Our traffic handling is going to the FAX and to the computer. We all love this hobby, but love ain't enough! We have to make it a growth industry and we need more bodies. Let's all talk about how we would shape the hobby if we had a blank piece of paper and [then go about changing things.]—*Bill Levy, WA2RUD, Mt. Kisco, New York*

☐ CW will live as long as there are bands with overcrowded spectrum resources, uncertain propagation and frequent interference. While these conditions are usually true of the HF bands, they are not always the case at VHF and above and the ITU Radio Regulations reflect this fact by not requiring Morse code proficiency for amateur stations "making use of frequencies above 30 MHz." I know many people who would make fine additions to the ham fraternity, except that they cannot or will not learn Morse code. It is time to bring them into Amateur Radio and bring US amateur licensing in line [with that of other countries] by dropping code test requirements above 30 MHz.

Then, as now, the strongest influences on an individual ham's on-the-air behavior are peer pressure and the examples heard on the air, thus the lack of CW proficiency has and will have little effect on other modes of operation. Proponents of "CW forever" will no longer be able to count on new hams being forced to learn the code and instead, they will have to try to attract other hams to this mode of operation (called CW), just as packeteers, EMEers and others do now for other modes.—*Avery Davis, WB4RTP, Marietta, Georgia*

☐ Why must every station be a top-notch CW operator? To those who want to use CW, fine, but why must you continually try to force your likes on others? No other faction of our group insists that everyone must learn and use a particular mode. The time has come to look beyond the emotion and personal opinion on the no-code issue.

I would like to see the League contact other IARU member societies in countries which have a no-code license and find out what effect no-code has had on Amateur Radio in those countries and then report to US hams the results of that investigation. We would then know whether no-code has benefited Amateur Radio where it has been tried. If it has worked in other countries, it could work here; if it hasn't, it probably wouldn't work here either. The decision should be based on fact rather than feelings.—*Bob Irvin, KB6CYQ, Ft. Mugu, California*

[The ARRL has done just that—contacted other IARU member societies who have had experience with a no-code license. The information has been provided to the ARRL No-Code Study Committee.—Ed.]

AND CON

☐ It's my opinion that individuals refusing the simple task of learning the code are no asset to ham radio. It is evident that they want a license, but only if they get it their way. It is as simple as that.—*Raymond P. Gascon, W7SJS, Salem, Oregon*

☐ I am not in favor of any no-code license in any form. I stand for quality, not quantity. We as a nation should be setting standards, not deleting them. Our licensing structure need not be relaxed any more and the code should always be a requisite to becoming licensed.—*Orlin D. "O.J." Jenkins, KØOJ, Greeley, Colorado*

☐ In all but an insignificantly small percentage of society, a CW proficiency of 5 WPM is not impossible or even difficult. It remains a skill that the prospective ham must master to get a license. It is an aspect of the personality of he who puts forth the effort to learn 5 WPM, not because he has to, but because he is willing to take the initiative...

Another thing no-code pundits do not seem to be aware of is the sad lack in the general population of interest in science. Here is an area we hams can jump on with both feet. What is sorely needed is for clubs and individuals to put together programs that can be taken into our high schools and junior high schools and even grade schools to promote and excite our children into the fascinating world of science and its practical application—Amateur Radio. How many of us got our start in our respective fields because of an interest in our hobby? We need lots of young people in our ranks: Let's go get 'em.—*John Gebuhr, WBØCMC, Omaha, Nebraska*

Conducted By Luck Hurder, KY1T
Deputy Manager, Field Services Department, ARRL

Hazardous Materials Awareness

Prepared by the staff of the Initiatives Division, US Department Of Transportation

There has been an increasing public sensitivity about the apparent increase in the number and severity of incidents involving hazardous materials. The Bhophal, India disaster raised the issues to a concerned world that the potential for disaster was present at every chemical factory. A subsequent (and smaller) incident at a similar facility in Institute, West Virginia brought home the fears of a similar catastrophe to this country.

There is also increasing public sensitivity to the impact of hazardous materials incidents on transportation systems. Whenever a gasoline tanker overturns or a rail tank car derails, the public hears concerned emergency responders discussing the great dangers to the public, the length of time required to open the road and the expense to repair or replace the road. Remember, a single hazardous materials incident has the potential for loss of lives and millions of dollars in property damage!

It is impossible to imagine a community which does not have hazardous materials transported on its streets, under its roadways in pipelines and in use in its homes and business establishments. It is important therefore, that Amateur Radio operators, as well as other concerned citizens, recognize the widespread presence of these materials, understand the possible consequences of a spill or release and be prepared to take appropriate actions in case of an incident involving hazardous materials.

What Are Hazardous Materials?

They are substances which, because of their physical and chemical properties (eg, their ability to burn, explode or cause sickness), present a high risk to people, property and the environment if they are released from their container.They may pose unreasonable risk to health, safety and property when transported in commerce. Some of the more commonly known examples of hazardous materials are flammable liquids, such as gasoline, which give off vapors which can burn at ordinary temperatures, and corrosives such as sulfuric acid, which can damage skin tissue or metals.

While one may not normally think about the amount of hazardous material in transport, one's sensitivity improves when stranded on a freeway because of a tanker accident or when suddenly asked to communicate the details of a hazardous material accident to the authorities. There is an amazing amount of hazardous materials being transported. The Congressional Office of Technology Assessment has estimated that more than 1.5 billion tons are transported per year!

Labels

Warning labels are an indication of hazardous materials and must be displayed on most packages containing hazardous materials. Labels are diamond shaped, 4 inches on a side, color coded and show a graphic symbol depicting the hazard class. In some cases, more than one label must be displayed, in which case the labels must be placed next to each other. In addition to labels for each of the DOT hazard classes, there are other labels with specific warning messages such as "Magnetized Materials," and "DANGER—do not load in passenger aircraft."

Placards

Placards are similar to the hazard warning labels discussed above, except that they are displayed on transport vehicles, such as truck-trailers and rail cars. They are also diamond-shaped (although 10 inches on a side), color-coded and bear a graphic symbol indicating the class of hazard.

The Trained Observer

If you should witness or come upon a transportation incident, your first concern should be for your *own* safety. If a highway accident has occurred, hazardous materials may or may not be present; people may or may not be injured and the authorities will certainly need to be notified. This is nothing new. Amateurs have always reported accidents to police, but you now know that hazardous materials are transported almost everywhere. What's different is the concern that you should show for your own safety and the safety of others based on your knowledge that hazardous materials may be present.

As a trained observer, you should always be cautious and prepared to take actions to protect yourself. If you see a placarded vehicle, a rail car in an accident or packages with colored warning labels, you should take action to protect yourself and others by moving away from the incident. A trained observer will also notice if a package, bottle or cylinder is in a place in which it does not belong and report this to authorities as well.

Other recommended actions include notifying local or state authorities immediately, trying to keep people away from the scene, not walking into or touching any spilled material and avoiding inhalation of fumes, smoke or vapors. In addition, it is recommended that you try to note markings and the color of placards, but don't overestimate your ability to handle the situation by yourself. A small event can become a much larger one. A delay in getting help may result in greater consequences.

Getting Their Attention

When reporting an incident in which you suspect a hazardous material may be involved, it is important to describe the situation using words which will trigger an appropriate and informed response by the emergency services. Your accurate reporting, at the least, will provide emergency responders with the warning they would not otherwise have had until their own arrival. In this case, forewarned should mean forearmed.

Amateur Radio Operators Can Assist at Hazardous Materials Incidents

Transportation incidents can—and do—occur away from towns, quickly tying up the emergency services' radio channels. Consequently, there is a need for a reliable communications bridge between the incident site and outside assistance.

As an Amateur Radio operator, you may also be able to provide communications links for emergency responders as part of the hazardous materials response system in the community. The value of Amateur Radio operators in emergency situations is well documented; the ARES and RACES programs are examples of this.

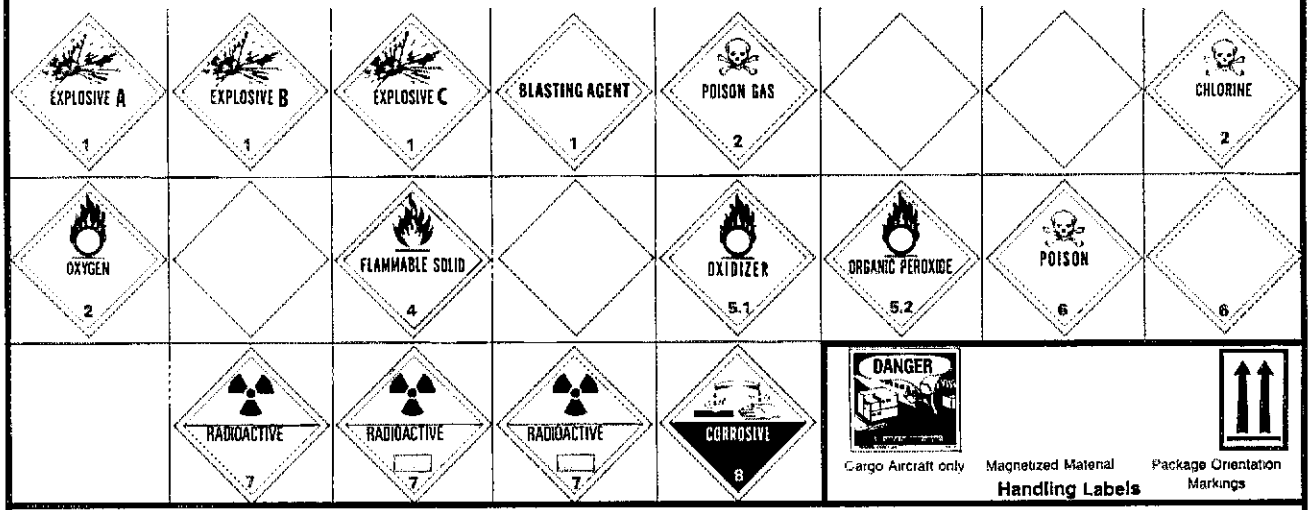
Amateur Radio groups often have landline autopatch service. This feature could connect emergency responder personnel to one of the most valuable resources; the Chemical Transportation Emergency Center (CHEMTREC). CHEMTREC (1-800-424-9300) is operated by the Chemical Manufacturers Association and has access to numerous technical resources. They can provide information about the nature of the product and can also act as a telephone communications bridge between the caller and the shipper.

Conclusion

In this article, we have established that hazardous materials are widely transported, transportation accidents involving hazardous materials can result in serious consequences, and Amateur Radio operators can provide assistance to emergency response personnel. We suggest that

Amateur Radio groups cooperate with local emergency planners and responders in the tradition of public service which is always associated with the Amateur Radio Service.

For additional information and literature about hazardous materials transportation, call or write David L. Sargent, Office of Hazardous Materials Transportation, 400 Seventh St SW, DHM-50, Washington, DC 20590, tel 202-366-4900.



General Guidelines on Use of Labels

- Labels illustrated above are normally for *domestic shipments*. However, some air carriers *may* require the use of International Civil Aviation Organization (ICAO) labels.
- Domestic Warning Labels *may* display UN Class Number, Division Number (and Compatibility Group for Explosives only.) Sec. 172.407(g).
- Any person who offers a hazardous material for transportation MUST label the package, if required. [Sec. 172.400(a)].
- The Hazardous Materials Tables, Sec. 172.101 and 172.102, identify the proper label(s) for the hazardous materials listed.
- Label(s), when required, must be printed on or affixed to the surface of the package near the proper shipping name. [Sec. 172.406(a)].
- When two or more different labels are required, display them next to each other. [Sec. 172.406(c)].
- Labels may be affixed to packages (even when not required by regulations) provided each label represents a hazard of the material in the package. [Sec 172-401].

UN Class Numbers

Class 1—Explosives

Class 2—Gases (compressed, liquified or dissolved under pressure)

Class 3—Flammable liquids

Class 4—Flammable solids or substances

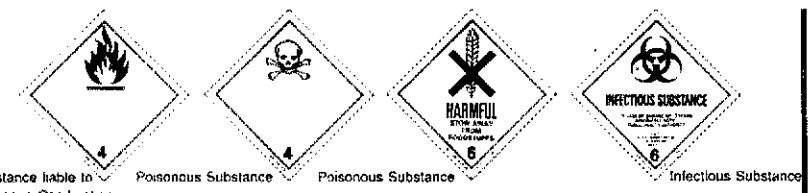
Class 5—Oxidizing substances
Division 5.1-Oxidizing substances or agents.
Division 5.2-Organic peroxides.

Class 6—Poisonous and infectious substances

Class 7—Radioactive substances

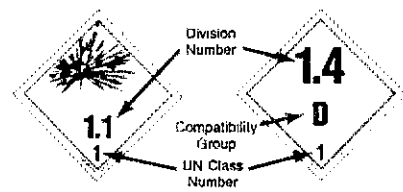
Class 8—Corrosives

Class 9—Miscellaneous dangerous substances



EXAMPLES OF INTERNATIONAL LABELS

- These are examples of International Labels not presently used for domestic shipments.
- Text, when used Internationally *may* be in the language of the country of origin.



EXAMPLES OF EXPLOSIVE LABELS

- The NUMERICAL DESIGNATION represents the CLASS or DIVISION.
- ALPHABETICAL DESIGNATION represents the COMPATIBILITY GROUP (for Explosives Only)
- DIVISION NUMBERS and COMPATIBILITY GROUP combinations can result in over 30 different "Explosives" labels (see IMDG Code/ICAO).

- Code of Federal Regulations, Title 49, Transportation, Parts 100-199. [All Modes]
- International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by air. [Air]
- International Maritime Organization (IMO) Dangerous Goods Code. [Water]
- "Transportation of Dangerous Goods Regulations" of Transport Canada. [All Modes]

U.S. Department of Transportation

Research and Special Programs Administration

Washington, D.C. 20590

CHART 8
REV. FEBRUARY 1986

Field Organization Reports February 1989

ARRL Section Emergency Coordinator Reports

Thirty SEC reports were received, denoting a total ARES membership of 18,130. Sections reporting were: EPA, EWA, GA, IA, IN, KY, LAX, MI, MN, MO, MS, NE, NFL, NH, NNJ, OH, OK, OR, PAC, RI, SD, SDG, SJV, UT, VA, WNY, WPA, WTX, WV, WWA.

Transcontinental Corps

Area	Successful Functions	% Successful	TCC Function Traffic	Total Traffic
Cycle Two				
TCC Eastern	101	90.00	765	1542
TCC Central				
TCC Pacific	103	91.36	488	960
Summary				
Cycle Three				
TCC Eastern	56	100.00	40	80
Cycle Four				
TCC Eastern	106	95.00	518	1059
TCC Central	62	89.90	385	854
TCC Pacific	101	90.18	588	1153
Summary				

TCC Roster

Eastern Area, Cycle 2: KW1U, Director. K1EIC WA1FCD KA1MDM KT1Q W1QYY KW1U WA2FJJ W2FR NN2H WB2MNA W2MTA KA2UBD N2XJ N3AZW N3EMD NC3V NJ3V WA3YLO AA4AT WD4FTK W4FRR N4GHI WB4PNY N4SS KA8CPS W8PMJ NJ8S KA8WNO WB8YDZ VE3ORN.

Eastern Area, Cycle 3: KN1K, Director. WA1FCD KY1T WA2SPL W3JKX W3OKN AA4AT K8TPF KA8WNO.

Eastern Area, Cycle 4: KN1K, Director. KB1AF W1CE KN1K KA1MDM W1NJM W1QYY KY1T KW1U W1WCG W2GKZ NQ2H W2LWB W2RQ WA2SPL N2XJ N3FM WB3GZU W3PQ KQ3T NC3V WD4FTK N4GHI N4SS W4UQ K4WJR K4ZK W8BO W8PMJ N8XX VE3FAS VE3GSQ.

Central Area, Cycle 4: K5GM, Director. W4ZJY K5GM WB5J K5MXQ WZ5N WR5O N5TC K5TL W5TNT KB5W W9CBE WB9UYU AI0O KS0U.

Pacific Area, Cycle 2: ND5T, Director. W5JOV KB5UL K6UYK WF6O VE6CHK W7AMM VE7EIL KF7R W7TGU W7IGC N0HFZ N0IA WA0OYI WA0YNP.

Pacific Area, Cycle 4: K0DJ, Director. N2IC ND5T W5QVK K6LL W6EOT W6INH W6VZT K7GXZ W7EP W7GHT W7LG W7VSE KA7CPT KN7B NN7H NR7E K0EZ K0TER KC0D KJ0G.

National Traffic System

Net	Sess	Tfc	Avg	Rate	% Rep	% Rep to Area
Cycle Two						
Area Nets						
EAN	28	1310	46.80	1.066	95.8	
CAN	28	544	19.42	.489	100.0	
PAN*	56	485	8.66	.640	100.0	
Region Nets						
1RN	56	645	11.67	.552	91.0	100.0
2RN	54	504	9.30	.580	90.7	100.0
3RN	28	206	7.35	.466	95.7	96.4
4RN	56	608	10.86	.480	77.0	100.0
RN5	56	701	12.52	.539	89.0	100.0
RN6	54	187	3.46	.335		100.0
RN7	56	410	7.30	.506	89.8	100.0
8RN	56	455	8.12	.359	98.2	96.4
9RN	56	289	5.16	.338	96.8	100.0
TEN	56	280	5.00	.230		100.0
TWN	55	223	4.05		88.4	100.0
ECN						82.1
Cycle Three						
Area Net						
EAN	28	274	9.79	.608	90.3	
Region Net						
1RN						96.4
2RN	28	206	7.40	.330	95.7	92.8
3RN	23	54	2.34	.231	100.0	82.1
4RN						88.8
8RN						96.4
ECN						82.1
Cycle Four						
Area Nets						
EAN	28	1485	66.20	1.719	94.9	
CAN	28	789	28.18	1.300	100.0	
PAN	28	772	27.57	1.067	97.6	
Region Nets						
1RN	56	455	8.12	.524	97.5	96.4
2RN	38	183	4.81	.530	66.4	92.8
3RN	56	257	4.58	.351	97.6	97.6
4RN	56	857	15.30	.483	98.2	100.0
RN5	56	617	11.02	.800	83.9	100.0
RN6	55	382	6.94	.647	94.6	96.4
RN7	56	366	6.53	.685	86.0	98.2
8RN	55	420	7.67	.501	93.0	100.0
9RN	28	452	16.14	.570	96.0	100.0
TEN	56	493	8.81	.735	85.3	100.0
TWN	52	273	5.25	.495	94.9	98.2
ECN	52	93	1.79	.350	55.0	100.0
ARN	28	120	4.28	.116		89.2

*PAN operates both cycles one and two.
TCC functions not counted as net sessions

ARRL Section Traffic Managers reporting: AL, AR, AZ, CT, EMA, ENY, EPA, GA, IL, IN, KS, ME, MI, MN, MO, NC, NE, NFL, NH, NNJ, NTX, OH, OK, OR, ORG, SB, SC, SD, SDG, SFL, STX, UT, VA, VT, WI, WNY, WPA, WTX, WMA, WV, WWA.

Public Service Honor Roll

This listing is available to amateurs whose public-service performance during the month indicated qualifies for 60 or more total points in the following nine categories (as reported to their SM). Please note maximum points for each category: (1) Checking into CW nets, 1 point each, max 30; (2) Checking into phone/RTTY nets, 1 point each, max 30; (3) NCS CW nets, 3 points each, max 12; (4) NCS phone/RTTY nets, 3 points each, max 12; (5) Performing assigned NTS liaison, 3 points each, max 12; (6) Delivering a formal message to a third party, 1 point each, no max; (7) Handling an emergency message, 5 points each, no max; (8) Serving as Emergency Coordinator or net manager for the entire month, 5 points max; (9) Participating in a public-service event, 5 points, no max. This listing is available to Novices and Technicians who achieve a total of 40 or more points. Stations that qualify for the Public Service Honor Roll 12 consecutive months, or 18 months out of a 24-month period, upon sending notification of qualifying months to ARRL Public Service Branch, will be awarded a special PSHR certificate from HQ.

210 W8AKF
207 N4GHI
177 N4EXQ
170 WA9W
163 W2QNL
155 WD8V
149 KA7AID
144 KA3DLY
141 WB2OWO
136 ND2S
135 KA8BBY
133 WA9VND
131 KA1BBU
130 K4MTX WA2SPL
128 W9YCV
127 N0DPF
126 W2MTA
125 WA0HTN N1CPX
122 K0BXF
120 N6DOJ W1PEX
119 WX4H
118 WA4QXT
117 WD8KQC WB2VUK WB4KSG
116 K4NLK
115 KF5BL KA1NXT
114 WB4DVZ
113 W7VSE
112 WB0FFV
111 K4ZK
110 NO3M
109 N2EIA

KT1Q WF6O
108 WB2EAG W4ANK W7LRB KW1U
107 WB2ZJF WB7WOW KA0PDM
106 NR9K
105 WA4JDH WA1TBY WB2VUK
104 W9CBE KD7ME WA4EIC WA4PFK W4JLS K9CNP
103 K2VX WA2ERT N0FOO
102 AG9G W4PIM K5UPN WB4WII
101 KD8HB WB8SYA WA2JBO N5MEA N6NLW KA0KPY NM1K WG7H NG1A
100 KI6ZH KA2QOO KJ4VT WA9VLC W3FA
99 KA1GWE
98 W4CKS W7GHT WT7A K5MXQ
97 WB1GXZ
96 WD5GKH N2XJ N4MEJ
94 WB2UVB
93 W7TVA N1DHT WA4YYQ
92 N3DRM K0ERM KB9LT

91 W1KX KA7EEE
90 W0OYH KB4WT KI4YV
89 W3YVQ
88 N6NLW KV5X N3EGF
87 ND0N KV7F
86 W0KK W9DM WB4WQL K2ZVI
85 WA2FJJ W5CTZ WB5J W2RRX K3JL
84 W4ZJY KA8WNO N4KSO KT9I
83 W1RWG WD0GUF AA4AT
82 AC5Z W5YQZ
81 WA0TFC
80 KA7SYG N4ORZ KA4HHE WA4TXT
79 N8FPN K1ABO
78 NN2H KA2INE N5KCL K3RXK
77 WA6WJZ KQ3T WA3UNX KA2ZKM WD4KBW W4RWB N1DUB
76 K2YAI W7LBK N7BGW WA4RUE KA4FZI
75 KA0UEQ KI4W N4SMB W9HBI

KJ4NK
73 NY8W NS9Q WB2QIX WE2G
72 KC2HJ WB1BTJ
71 N8HSC NZ5J NO0A
70 N3AZW
69 AI0O KB2BNW KF7FF WX7A KA1MDM
68 KF8J WB0ZNY NJ3V W4TZC KA0ARP KJ9J KC3Y
67 N8CEI WB8YPG KB2EPU W3JKX K1EIC WB5CPY
66 K8CQF KA2ZNZ KK4FV
65 KA8CPS WA8DHB KA2CQX/T WB5YDD WA4RNP KI4BR K3GHH
64 WB8KWC NW8M N2IYA/T N2IKR/T WB2OEV WB2FTX WC2R WB0WNJ WB6QBZ KM4LS KA1GEP WB4TZR K4IWW NC3V
63 KD8KU K3UWO WB8BGY W2FR KD0YL KA1JXH N4TJT/T WD4COL
62 N2ABA/T

N2DXP
N0IYE
KA9QXI
NC9T
N1FLO
KC4GRU
WA3YLO
61 WB8R W3OKN KA9FVX AA4GL
KD0NH K9ZBM
60 N8GPU K8JDI W8OUD KA3MVM WS7U N1FNN KC5NG N4RHV/T
WB4PNY
W1TC
W9UMH
59 KA9CTW/T
58 N2EVG/T
54 KB4CYC/T
51 KC4ESG/T
50 KB2CDB/T
45 N4LST
44 KA9TVU/T
41 KB5IFH/T

The following station qualified for PSHR during the month of January but were not listed in last month's PSHR column: N1FNN, NZ2T, N3EGE, KJ3E, W3FA, K3GHH, NC3Y, WA3YLO, W3YVQ, W7LRB, K8CQF. Nov. 88: WB1BTJ 61.

Brass Pounders League

The BPL is open to all amateurs in the United States, Canada and US possessions who report to their SM a message total of 500 or a sum of originations and delivery points of 100 or more for any calendar month. All messages must be handled on amateur frequencies within 48 hours of receipt in the standard ARRL form.

The Brass Pounders League Medallion is available to individual operators who achieve BPL and are listed in the BPL column for the third time. This medallion is a one-time-only award, ie, it is not issued more than once. It is not necessary that the three months involved be consecutive. Any three months will qualify an operator. Stations that qualify for the BPL medallion, upon written notification of the qualifying months to the ARRL Public Service Branch, will be awarded the callsign-engraved BPL medallion.

Call	Orig	Rcvd	Sent	Dlvd	Total
W4DUG	2827	57	2846	8	5738
W3CUL	688	2407	1296	94	4485
W3VR	238	818	1254	81	2391
W1PEX	9	589	1057	36	1691
WB9YPY	0	903	86	526	1515
N0BQP	26	835	90	478	1429
N0FBW	—	—	—	—	1354
KC9CJ	5	754	17	468	1244
WA2SPL	25	692	488	24	1229
N1BBT	308	296	308	258	1170
WB0TAX	0	584	584	0	1168
WA4JDH	1	553	557	4	1115
WA1TBY	11	518	558	21	1108
WA9VND	7	523	498	34	1062
WB0WNJ	195	125	725	5	1050
N4GHI	53	494	388	101	1036
N3AZW	15	475	464	16	970
KB4N	0	476	457	0	933
KA9FEZ	—	—	—	—	786
WA9W	36	394	327	14	771
KB4PW	348	32	322	17	719
WA0HJZ	24	420	270	0	714
KT1Q	4	344	330	8	686
K4DOR	54	286	326	14	680
W2MTA	1	380	276	10	667
WD4IIO	280	53	295	29	657
KA8WNO	0	296	339	0	635
WX4H	3	320	315	5	643
AA4HT	1	323	273	6	603
W3ATQ	3	288	276	15	582
K1UGM	0	290	290	0	580
KA8CPS	—	—	—	—	575
KW1U	4	298	252	7	561
WB2IJH	6	262	282	10	560
KA1BBU	178	99	185	91	553
NJ3V	26	244	275	0	545
WF6O	7	263	257	13	540
WB2OWO	45	198	249	40	532
K0YFK	28	232	260	0	520
N1CPX	9	209	290	9	517
N2EIA	0	245	262	8	515
NM1K	10	221	259	21	511
WA1FHB	3	249	252	0	504
NR9K	69	145	264	25	503
W2QNL	1	257	181	62	501

BPL for 100 or more originations plus deliveries: W4HAW 254, AB4EA 220, WC2G 167, W0FIR 105, K1GGS 102

BPL for Jan: W3IWI 841

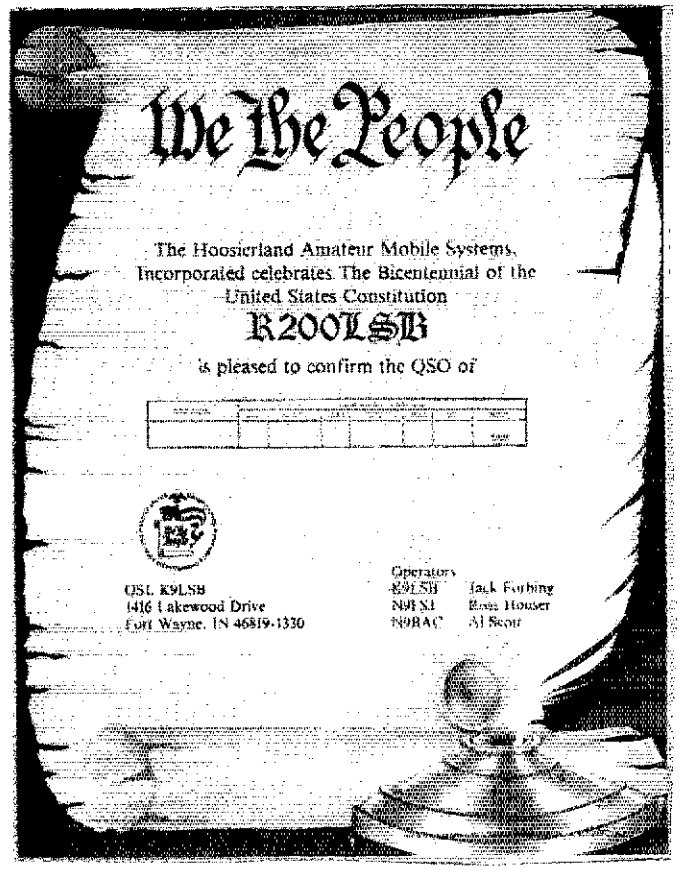
Independent Nets

Net Name	Sess	Tfc	Check-Ins
Amateur Radio Transmitting Society	24	330	391
Central Gulf Coast Hurricane Net	28	106	3405
Clearing House Net	28	288	309
Empire Slow Speed Net	28	92	446
Great Lakes Emergency Traffic Net	28	52	1153
Golden Bear Amateur Radio Net	28	216	1322
Hit and Bounce Net	28	405	656
IMRA	24	905	1827
Mission Trail Net	28	159	813
Northern California Net	84	361	1063
NYSPTEN	28	94	487
Southwest Traffic Net	28	244	1898
West Coast Slow Speed Net	28	90	466
20 Meter ISSB Net	38	1225	528
75 Meter Interstate SB Net	*28*	*992*	*1212*
7290 Traffic Net	44	462	3605

Club Spectrum

Conducted By Rick Palm, K1CE
Field Services Manager, ARRL

Club Hubbub



Jack Forbing, K9LSB, of Hoosierland Amateur Mobile Systems Inc, reports a most successful operation of K200LSB during Indiana's celebration of the Bicentennial of the US Constitution on December 3-9, 1988. With assistance from operators N9FSJ and N9BAC, K200LSB racked up a few hundred contacts, spreading the word about the celebration. (l-r) Here's the K9LSB/K200LSB shack, Jack at the controls, and the handsome certificate QSL awarded to contacts.

Scouting and Amateur Radio—made for each other! The PHD Amateur Radio Association, Missouri, put on a "Jamboree On The Air" exhibit at last fall's Boy Scout Jamboree at Smithville Lake, north of Kansas City. (l-r) Seated at the controls is KØBGW, standing KBØCSS, NØHGG and WØDCI—"All scouts, all amateurs, all PHD members, all ARRL members!" reports correspondent Chuck Miller, WAØKUH, the ARRL Midwest Division's Vice Director.
PHD is a very active club in the Kansas City area. This year the club is sponsoring the Midwest Division Convention on April 1-2, and next year they're sponsoring the ARRL National in Kansas City, June 8-10! *(photos courtesy AJØE)*

If you would like to see your club's activities depicted in this column, send your photos and brief stories to K1CE at HQ. Thanks!

The Garland, Texas ARC signed K200QHD in celebration of the Bicentennial of the US Constitution on December 24-30. With the assistance of 30 operators, K200QHD made 4000 contacts. "Pole sitter" K5GH is shown installing the 10-meter monobander for the K200QHD show. That's W5BJ running the 15-meter pile-up on Christmas Eve. *(Tnx KF5PE)*

On Line

Conducted By Stan Horzepa, WA1LOU
75 Kreger Dr, Wolcott, CT 06716-2702
CompuServe ID no. 70645,247

Putting Packet Radio on Taiwan

We were over Okinawa when an idea began to coalesce into a plan. Wayne Wilson, WB8TSO, and I were on our way back home from a trip to an electronics show in Taiwan. We talked about our next trip there (October 13-16, 1988) and were convinced that a DXpedition was possible. We decided to "go for it."

Wayne is a packet-radio nut, so we decided to include a Heath HK-232 multimode controller in the station if at all possible. And it was obvious that we would need the power that the SB-1000 linear amplifier could provide, if we were going to maintain some semblance of crowd control. By the time we were back in Benton Harbor, we started the work needed to pull it all together.

As you can imagine, a country coming out of decades of martial law does not take lightly the issue of bringing radio equipment into the country and, initially, we hadn't the foggiest idea who to contact to get permission. While driving through downtown Taipei, we had spotted a Yagi atop a building. Our eyes are set to trigger on objects like that and in Taipei, such objects are notably absent.

A business contact recalled that the antenna had something to do with Senator Barry Goldwater, so back in the States we wrote to Barry and he kindly supplied us with the name of Tim Chen, BV2A, who is head of the Taiwan radio association and the key to the permission puzzle. I would hate to think how difficult it would have been to get permission if we had not found Tim.

Reptile Radio Eschewed

Early on, we considered setting up a Field Day-type operation—renting a generator, hauling everything to the top of a mountain and operating from there. However, Snake Alley killed that idea. Snake Alley is a bazaar and not a place where you want to lose sight of your host. You are likely to find anything from fake Rolex watches to fine cuisine. They think nothing of arc welding galvanized steel right out in the open. It is not a place OSHA would approve.

In the middle of it all are sales stalls that give the area its name: vendors with cages of live snakes. When I learned that the snakes came from the mountains, all thoughts of mountain-topping vanished. This was destined to be a civilized DXpedition, thank you.

BV2A went to work and got our authorization to operate, to bring radio equipment into the country and special authorization to operate the first packet-radio station in Taiwan. Shane, BV2FA, made a special trip to the airport to greet us and help us through all the paperwork. We would have been lost without them!

Both are very likable gentlemen who went far out of their way to help. They smoothed the paperwork, spent days fixing a typhoon-damaged antenna system and stayed with us (as required by regulations) while we operated. They provided us with a building-top operating shack and, in short, did all that the most gracious of hosts could do.

With things going so well, we put the station together a day early, loaded up and, *voilà!*, were on the air. We quickly worked a few stations on 20 to see if the magic still worked. It did. We shut down for the night with plans to operate early the next morning.

Bob Brown, NM7M, provided a set of propagation predictions which said we ought to do very well on 20 and 15 meters. However, old Sol had been pretty perky before we left and we thought that 10 meters might be open, so we planned the operation around the times he furnished, but just moved up a band. That worked out super.

Taiwan and Eastern Daylight Time are 12 hours out of phase and the predictions were that we could work stateside from 7 until 9 or 10 AM Taiwan time. That fit with our workday fine, since we had appointments from 9:30 AM on. 5:30 AM is nothing most want to inflict on themselves, but that was the price of getting to the station in time for 7-AM operation. So, 5:30 it was for the whole week.

With excitement running high, we were at the station the first day by 6:40 AM. We tried 10 meters. Ah! An opening! A pile-up! We were in business! KL7—, nice signal. Would we drop down into the Novice/Technician band to work his daughter? Sure thing. In fact, that set the pattern for most of our 10-meter work. This was a good opportunity for Novices and Technicians to work BV, so we spent most of our US-oriented operating time at 28.400 MHz. Only when Hong Kong CB was clobbering us did we move up to the General portion of the band.

History is Made

Packet radio was especially exciting to the younger prospective BV hams. We had left an HK-232 on an earlier trip and they seemed to have comprehended the nature of the beast from reading. They did not have any opportunity to see the actual machinery in operation until Wayne arrived and put it into the system.

CQ DX FM WB8TSO/BV2 FIRST PACKET STN ON TAIWAN—CONN FER QSL INFO. Beacon. Beacon. Beacon again... Would we make history? Tension. Finally: ***CONNECTED TO DUIJMG

Wayne was connected to Manila and made history by putting Taiwan on with packet radio for the first time, and the tension quickly turned to excitement and celebration.

Packet-radio history is made from Taiwan as Wayne Wilson, WB8TSO, connects for the first time from that island nation, with Tim Chen, BV2A, looking on approvingly.

We worked the US each morning and, in the late afternoon, tried to give other stations a fair chance. We'd work JAs for an hour, then Europeans, VKs, ZLs, then the stations outside JA-VK-ZL. If we did not ask the nearby stations to standby, we couldn't hear some of the exotic stuff that we wanted to work; we hope our system gave everyone a fair opportunity.

Good news? We provided a Taiwan contact for 580 friends worldwide and picked up a fair bit of rare DX for ourselves, including Easter Island, Brunei and West Kiribati. Overall, we netted about one contact per minute even though we did allow ourselves the luxury of some short rag chews. And, despite high QRN, we did work a few QRP stations (it can be done with 5 W). Bad news? It was very tough to explain that mainland China and the Soviet Union were off limits, especially when BY is 59-plus and you don't have it confirmed.

Kudos are in order for the US, Australian and New Zealand hams. When we called QRZ, we'd get a pile-up, but when we called a specific station, that's who we would get almost all the time as the others stood by. Some of the other areas of the world were a little less disciplined and the contact rate would fall as we attempted to extract our intended station from a pile-up of eager competitors.

No doubt, we will be back on the air from Taiwan. Once permission is granted, it is easily renewed. And I would not be surprised to see packet radio become a popular mode there if permission is granted by the government.—*Denton Bramwell, K7OWJ*

The World Above 50 MHz

Conducted By Bill Tynan, W3XO
Send reports to HCR 5 PO Box 574-334,
Tierra Linda Ranch, Kerrville, TX 78028
or call 512-257-1296 to record late-breaking information.

"Conditions" on 70 cm?

Recently, I received a letter from W4YV Bedford, VA. Mickey asked that I help him settle a disagreement he has been having with a fellow local amateur. The reason I am highlighting my reply is because the discussion these two have been having typifies the state of knowledge possessed by many whose only association with the bands above 50 MHz is on FM. Before I get another pile of anti-FM letters, let me make it clear that I think that FM and repeaters have been one of the most beneficial developments in the history of Amateur Radio. They have provided us with a really reliable means of local communication and brought about occupancy of the bands above 50 MHz that we badly needed to defend these frequencies from raids by selfish commercial interests.

Nevertheless, those whose interest in VHF and UHF operation is confined to FM miss a lot of the fascination these bands afford—particularly the vagaries of propagation. FM is, by nature, a strong-signal mode. Below a certain signal level, FM performs very poorly; eg, the signal-to-noise ratio is unsatisfactorily low. As that signal level, the threshold, is reached, the signal-to-noise ratio improves rapidly, and at only a few dB above that point, "full quieting" is reached. Above that level, it is difficult to tell, without watching a signal-strength meter, what the level is or whether or not it is varying. On the other hand, the means of transmission we generally refer to as weak-signal modes, such as SSB and CW, can be copied at levels considerably lower than can FM, but their signal-to-noise ratio improves gradually, rather than abruptly, as the signal level increases. In other words, there is no one signal level that can be called a threshold. Because of the fact that communication is possible at lower signal levels, the reliable range achievable with weak-signal modes is greater than with FM, for a given combination of receiver sensitivity, transmitter power and antenna gain. Especially for mobile and hand-carried equipment, repeaters help FM to overcome this difference.

Because most FM operators, most of the time, employ communications circuits which provide full quieting, differences in signal levels frequently go unnoticed. W4YV's difference of opinion with a fellow user of a 440-MHz repeater involves whether conditions on the band can vary—producing differences in signal-to-noise ratio at various times. The answer, Mickey, is a flat yes! Conditions on this band, and higher as well as lower VHF/UHF bands, do vary for a number of reasons. Regular readers, and certainly those who use SSB and CW on this and the other bands above 50 MHz can confirm that conditions do, indeed, vary. This variation is one aspect of VHF/UHF operation that make it so much fun. For example, on 70 cm, the reliable range between similarly equipped SSB stations might be something on the order of 100 miles. At times, when tropospheric bending occurs, such stations may be able to communicate over a thousand miles or more. Accounts of such openings appear regularly in The World Above 50 MHz. Space doesn't permit an explanation of tropospheric bending, but those interested are referred to recent editions of *The ARRL Handbook* or the new *ARRL Operating Manual* for treatises on this and other types of VHF and UHF propagation.

Tropospheric bending does not always result in increased range. It can cause a decrease in range or lower signal level for nearby stations. This is particularly true when antennas are located at elevated points, such as on mountains and high TV towers. Generally, such installations are very beneficial. However, at times tropospheric bending may cause the waves from such high antennas to bend away from the earth. Under these circumstances, a repeater user who has just enough signal strength to obtain good communication most of the time may observe a difference in conditions during the time the tropospheric bending is in effect. This may last from only a few minutes to several days. On the other hand, users who are closer to the repeater or have better antenna installations, may never observe such varying conditions. I don't know if this is the situation with the gentleman who chided W4YV for suggesting that 70-cm conditions may vary, but it's one possible explanation for his lack of observation of such phenomenon.

Yes, Mickey—you are correct. But you have barely scratched the surface of the fascinating thrills that exist in the world above 50 MHz. In this column conductor's humble opinion, you can't fully appreciate what these bands have to offer until you try CW and SSB on 70 cm, as well as the other bands above 50 MHz.

ON THE BANDS

6 Meters—F2 openings continued during February and early March, although there was some shifting in terms of the parts of the country which were favored. The eastern section of the US and Canada began to experience somewhat fewer and weaker openings and those of us in the more southerly climates finally got a few breaks. For this conductor, whose new QTH is about 70 miles northwest of San Antonio, February 28th was the first big day of Cycle 22. An afternoon opening brought HC1BI and HC5K, both with S9 signals, at 2128 and 2134Z, respectively. Also heard at the same time was the HC2FG beacon. At 2139Z, KH6IAA was worked with 55 signals. But the real plum came three minutes later at 2142Z in the form of a contact with VP8PTG. Fred's signal was a solid S7. Following this exciting QSO was one with LU2WM, exchanging 57/58 reports. The following day, March 1, was also very productive here, yielding contacts with HC2FG at 22556Z, HC5K at 2311 and LU6WN at 2316. While that QSO was in process; my nearest 6-meter neighbor, W5OZI, 50 miles to the west, called to inform me that he had just worked a ZL on 51 MHz. A quick QSY to 51.110 MHz and a CQ on CW brought a response from ZL2CD. I guess that this is one of the reasons I moved to Texas! The next day brought only a few backscatter signals and the following day, the 3rd, several LU QSOs with quite weak signals. But Saturday, the 4th, was a different story, with strong signals from the LUs beginning about 1730Z and continuing for many hours—and a QSO with CX8BE, a country that has long eluded me. In addition, OA8ABT, KH6IAA and KH6HI were worked. VP8PTG was in again with a good signal. Among those he worked this time was W5OZI, who missed him the first time. My initial success with a temporary station consisting of a 100-W solid-state amplifier and a three-element beam at 25 feet, makes one wonder what a more elaborate set-up will produce.

According to a report put on the answering machine by WA6BYA, the West Coast has been getting its share of openings too. Bob says that he worked 9Y4VU February 22 for a new country. The following day, beginning at 1750Z, he worked TI2KD and HH7PV. Starting at 2005, the HC2FG beacon was in, along with HC5K, HC2FG and HC1BI. While the South Americans were still in, he turned his antenna to the south Pacific and worked ZLØAAH, known stateside as K9AKS/6. At 2200Z, Bob heard VP8PTG but couldn't complete a QSO. A few hours later, beginning at 0311Z March 1, WA6BYA worked FK1TS followed by KH6FOO. At 0312 it was FK1RF and FK8GA, for that station's first US contact on 6 meters. Several VKs followed. Bob says that the band was still open at 0600Z when he turned off the radio.

FIFTEENTH ANNUAL EASTERN VHF CONFERENCE

The 1989 Eastern VHF Conference, sponsored by the Northeast VHF Association, will be held May 19 through 21 at Rivier College, Nashua, NH. The conference chairman, Tom Kirby, W1EJ, and his able assistants have assembled a fine program featuring a Friday-evening

50 MHz DX Standings

DXCC countries worked (first column) and confirmed (second column) based on information received as of March 8, 1989. Space limitations dictate that continental US and lower-tier Canadian stations with fewer than 15 countries and others with fewer than 10 countries not be listed. Those residing in countries not generally authorizing 6-meter operation who have submitted a list of at least 10 countries worked via crossband are included in a separate list. Countries are those listed in the latest ARRL Countries List, but deleted countries worked prior to their deletion have been counted. Credit has not been granted for contacts with stations known not to have been authorized 6-meter operation at the time of the contact. Unless noted, totals are those worked by individual or club stations operating from a single location or multiple locations within a radius of 150 miles. The next update will be published in the November 1989 column. In order to be included in that update, reports must arrive at the address listed at the head of each World Above 50 MHz column by September 1. Reports need not be on the special forms, but use of these forms is helpful. They are available through an SASE to the column address. Whether or not reports use the forms, they must state each country, one station worked in that country, an indication as to whether the contact was two-way on 6 meters or cross-band, the date of the contact and whether or not the contact has been confirmed by receipt of a QSL.

6-Meter Two-Way Contacts

VE1YX*	90	88
W4CKD/8*#	83	81
W5FF*	81	80
W2CAP/1*	81	79
JA4MBM*	81	79
K8WKZ*	81	78
W4OO*	80	80
W2IDZ*#	80	79
K5FF*	80	79
K1TOL*	80	79
N3AHI/4*#	78	75
LU3EX*	78	75
W3XO/5*#	78	63
JA1RJU*	77	76
VE1BNN	77	74
WB8IGY*	76	73
W5VY*	76	72
WB4OSN*	75	73
KH6IAA	75	73
WB2CZB*	74	73
W3IWU*#	74	73
WA1OUB	74	71
KA1PE*	74	70
W3JO	72	72
W8CMS	72	68
W4WHK	72	64
ZD8TC*	71	71
WA5IYX*	71	61
JA3EGE*	70	70
K4CKS*	70	66
WA4OWC*	69	69
W5HUQ/4*#	68	64
W1JR*	67	66
W3WFM	67	64
JA1VOK*	66	66
WA2BPE*	66	65
K2QIE*	66	60
WD4IYS*	65	65
WB2MAI	65	65
JA2DDN*	65	65
K5CM*	65	63
WA7JTM*	65	61
K3QMX*	64	64
WA4UAS*	64	63
N4EJW#	64	60
K4KUZ*	63	63
K5ZMS*	62	61
K2YOF	61	59
WB2WSV*	61	54
NØLL*	60	58
WA8LXJ*	60	55
K5SW*	59	59
JA5HTP*	59	58
W6BJI*	59	57
W6XJ	59	—
WB7OHF*	58	58
W2RTW	58	55
LU9AEA	57	56
LU7DZ*	57	55
WA6BYA*	56	56
WA3DMF	56	55
W5DZF/4*	56	54
N5DDB*	56	52
K1ZFE*	55	55
LU3DCA	55	55
KA1BRD*	55	55
KØGJX*	55	52
W1QXX	54	54
JE1TGN*	54	54
WB4RUA	54	52
N6AJ*	54	51
K1GPJ*	54	48
WA7EPU/5*#	53	53
K8UNV*	53	52
W7KMA*	53	52
KS2T	53	52
K8EFS*	53	51
WA5HNK*	53	51
K5GE*	53	51
WB8YFE*	53	50
JA2ODM*	53	48
W5UWB*	53	42
WB8BKC*	52	52
JAØAGA*	52	52
WA1AYS	52	51
W3OTC	52	40
WØSF*	51	51
W1EJ*	51	50
N5KW*	51	48
W3BWU	50	49
WB2PMP/4*	50	49
WBØPKN*	50	49
N4TL	50	48
W8SMS*	50	48
PY2XB*	50	47
WB7TOV*	50	47
N6CT*	50	44
K3ICH/4	50	43
WA5LIG/6#	49	48
WBØV*	49	46
WA9AHZ*	48	48
JA1TTO	48	48
WB8YFE/9*	48	47
W2MPK*	48	44
K1SF	48	42
JA6YBR*	48	—
WD4FAB	47	47
JF3KQA	47	47
WA1UQC*	47	45
KA1DHO	47	44
WA6PEV*	47	44
KG6DX	47	42
WB8GEX*	46	44
W5NZS*	46	43
LU8BF	46	42
WA5UFH*	46	41
K1ICM*	45	45
JA9DUR*	45	45
KA1A	45	45
WB8GEW*	45	44
W4NVW/3	45	44
XE1GE	45	42
K2QWD*	45	41
WA8ONQ*	45	41
KØTLM*	45	41
CX8BE*	45	35
N9CEX*	44	44
K4QXX	44	43
K6QXY	44	43
W1AIM*	44	42
K1MNS*	44	42
JA2GHT	44	42
W1GXT	44	38
AE3T*	43	43
WB8KAY*	43	42
K2OVS	43	39
WB4NMA	43	—
VK8GB	42	42
ZL1MQ	42	42
KB4CRT	42	41
KAØAYN*	42	41
KG6JDX*	42	38
KH6FLD	42	35
N5BBO*	41	41
K1FWF*	41	40
W5KRH*	41	39
WB7SLY*	41	38
WB5CHW*	41	37
JG3AOD*	41	37
W5HN*	41	35
K7ICW	41	34
WAØCSL*	41	15
VP2VGR*	41	—
K4VPK*	40	39
N5WM*	40	39
K6KLY	40	39
N4VC	40	38
WB6BMB*	40	38
VP2MO	40	34
WB6KBZ*	40	29
K1FJM/4*	39	39
K4GOK	39	37
JA1NVG	38	38
K1LPS	38	37
WA7UJH*	38	37
WA5VJB	38	35
WB5JAR*	38	34
N7AKB*	38	34
G4UPS	38	34
VE3ASO*	38	31
KØUS*	38	23
N4MM	37	37
WA1CRE	37	36
JA7QVI	37	35
WA2QCE	37	34
WA6HXM	37	29
K7GGJ	37	28
WBØZKG*	37	20
VE3DSS*	36	36
WD2AKA	36	34
HC2FG	36	34
WA6THT	36	34
KØAYN*	36	33
W6ABN*	36	32
JH3WXB	36	32
K3HCE	36	31
WB8PAT*	35	35
WA9ETW*	35	34
KØUDZ*	35	32
KC2TX/5	35	32
K8TGC	35	31
N6AMG	35	26
W2VO*	35	26
WB4SLM	35	16
N7DB	34	34
W2CNS*	34	33
K1DAT	34	33
WØJR*	34	33
WA6CRA/4	34	31
KAØETE*	34	31
WA1ZUB	34	30
WD2AFH	34	28
K1SC/7	34	28
VP2MJ	34	26
K6JYO*	34	22
W2LT	34	20
K6JZK	33	33
WA7GCS	33	33
W2RLV	33	31
KA4AOK	33	30
N4VA#	33	27
N6RZ	33	24
AE9M*	33	23
W3ZZ	33	23
K6GSS	32	32
VK4ZJB	32	32
K5VVV*	32	31
AD1C	32	31
KS4J*	32	31
N6VI	32	31
N7ARC*	32	31
WS4F	32	30
K8QAX	32	29
K1ZKR	32	29
KD9JQ#	32	29
WB2QLP/4	32	26
W5NKG	32	25
K4LFF*	32	22
K6PHE	31	31
WA2EQK	31	30
VE4AS*	31	30
WB6NMT	31	26
VE1RC	31	26
W2BN	31	24
LU6DLB	31	16
VK2BA	30	30
N4CD	30	27
VE3EVW	30	22
JG3RGG*	30	22
KC3EP	30	22
G4GLT	30	21
VK2DDG	29	28
K4ROM	29	27
WAØNOK	29	27
K8RZB*	29	26
VE3FDP	29	25
WB2TMD	29	25
WA8OGS*	29	25
8P6KX	29	24
C6AEH*	29	—
K6BEM	28	28
KCØJ*	27	25
N5JM	28	25
N5DDS*	28	25
W9TC	28	25
WB5QBV	28	23
N7AQM*	28	22
WA5QCP	27	27
N9ANO*	27	27
VK2VC	27	27
W7FIV	27	26
WA5OLT*	27	25
KQØJ*	27	25
N6AMD	27	25
KA5CAW	27	23
K9SM*	27	21
YV4UY	27	20
N2ASC	26	26
WA9DYV*	26	26
VK2QF	26	26
VK2DDG	26	25
VE5LY	26	25
VK3OT	26	25
VK3XQ	26	24
K9XY*	26	22
WA9DYT	26	22
KØSE*	26	21
NP2AE	26	21
KA1CDZ	26	13
WA2YWP	26	13
N7EIJ	25	25
KAØCDN	25	25
WA8LLY/6	25	25
JF3TDC	25	22
WØRGU*	25	21
VE5JQ	25	20
W9NAW	25	20
N8AXA*	25	19
XE1FE*	25	17
9Y4LL	25	13
W8NE/4*	24	24
WA4TJW	24	24
KØSFH*	24	23
W7HAH	24	23
WBØRJR	24	22
KD4HP	24	21
W8QOI	24	21
JM1LCW	24	17
KJ3F	23	23
HK4EB	23	23
W7ABX	23	22
VK2KAY	23	21
W7JXU	23	20
KN5S	23	20
HC8VHF*	23	—
OA8V	23	—
W7KNT	22	22
WB6AAG	22	22
KA6ING	22	22
VK3AWY	22	22
VK5LP	22	21
WB2QLP	22	18
KA1YQ	22	17
K7NV	22	16
KB7N	22	16
PY2TTV*	22	15
KA5FLE*	22	14
KA1GIY	22	12
JE3YIA	22	12
HC1MD/HC6	22	—
WDØFOY	21	21
KD6PY	21	2
KB6OX	21	21
VK2BNN	21	20
KA4CRT	21	20
WØJRP*	21	20
WB4WXE	21	20
WB6CTQ	21	19
K6ZMW	21	18
VK3AUI	21	17
VK9XT	21	17
NI6E	21	16
K1HTV/3	21	15
9Y4JW	21	12
VK4ALM	20	20
WD8OXK	20	19
K9LCR	20	19
JG3JLC	20	19
VK7JG	20	18
KB1WW	20	18
VK7JG	20	18
K2JF	20	17
VE1BUF	20	15
W5OZI	20	14
G3COJ	20	12
KB6OK	20	—
VK4TL	19	19
ZB2BL	19	18
VE5XU	19	18
PY2DJC*	19	15
NA4I	19	12
W9OEH	19	—
VE6CX	18	18
WØLSD	18	18
VK4ZAL	18	18
NØAJU	18	16
WA4TNV/KL7	18	15
GW3MHW	18	15
WAØOFO	18	14
KC4KK	18	14
ZD8MB	18	7
VK3AMK	17	17
WB9OPD	17	16
KB7Q	17	16
VK3NM	17	16
N2AVR	17	15
VK4AYX	17	14
KA4CRT/5	17	14
W7IDZ	16	16
WØPVL*	16	16
KØCJ	16	15
VK4ZSH	16	15
VK2ZRU	16	15
KL7GLL/4	16	14
WØPKN	16	12
W8SMD	16	11
OA8CW	16	—
KØWM	15	15
VK3AQR	15	14
N5BOG	15	13
8P6CX	15	11
VK9YT	14	12
GW3LDH	14	10
V2ADX	14	4
KL7JAI	13	13
VK2EEC	13	12
VK3ZZX	13	12
VK6HK	13	8
EI2W	13	—
VP9WB	12	11
W1QXX/KP4	12	10
G4BPY	11	11
AL7FH	11	11
AL7C	11	11
J6LOV	11	9
JN1DQO	11	5
GJ3YHU	11	3
VK6OX	10	10
KL7WE	10	10
KL7JJH	10	10
KL7IKV	10	10
ZD7BW	10	10
FK8EB	10	10
VK4KHZ	10	8
SZ2DH	10	—
XE2BC	10	—

*6 meter two-ways claimed with all continents.
#Some contacts made from locations more than 150-miles apart.

6- to 10-Meter Crossband

DJ2RE	33	—
SM6PU	23	10
DK6JL	11	4
SV1DH	10	—

hospitality room, including an informal swapfest. A series of technical talks of interest to VHFers is scheduled for Saturday, followed by a buffet-style banquet. Sunday will be devoted to antenna-gain and noise-figure measurements.

General conference registration is $16 prior to May 5, but first-time attendees will receive a $2 discount and Novice licensees get a $6 discount. Registration at the door is $20 for all. Cost for the banquet is $18. Money should be sent to the Registration Chairman: David Knight, KA1DT, 15 Oakdale Ave, Nashua, NH 03062.

Accommodations are available in the college dormitory as well as at nearby hotels and motels. For further information, contact Lew Collins, W1GXT, 10 Marshall Terrace, Wayland, MA 01778 or call 508-358-2854 between 6 and 10 PM Eastern Time.

Conducted By
Vern "Rip" Riportella, WA2LQQ
PO Box 177, Warwick, NY 10990

Preparing For the Fiery End: Adieu UoSAT-1

It's always difficult losing an old friend. Losing UoSAT-1 (UoSAT OSCAR-9 or UO-9) will be especially painful for many. It is the first of its breed—patriarch of a proud, growing family of satellites fostered in the satellite rookeries of the University of Surrey, England. Perhaps more poignantly, its dramatic recovery from near-fatal adolescent misfortune, and its subsequent maturing to a productive life in space, makes its imminent loss more heartfelt than it otherwise might be.

Launched into a low earth orbit from Vandenberg AFB, California, on October 6, 1981, UO-9 has, at this writing (February 1989), completed nearly 41,000 earth orbits. In the 8½ years UO-9 has performed in space, it has traveled at least one billion miles, which is just about equal to six round trips to the sun! In the process, UO-9 has given up nearly 80 miles in altitude. Therein lies the key to its fate. Within a few months, UO-9 will plummet to earth and burn up, ending an historic near-decade of service to radio amateurs, students and scientists worldwide.

What makes the demise of UO-9 thoroughly unique in OSCAR annals is that it will be the first OSCAR ever whose electronics package outlived its orbit. (The orbits of all prior OSCARs—running back to OSCAR 1, which went radio silent on January 1, 1962—outlived the satellites' electronics, which, for one reason or another, failed after various lengths of service.) This is especially noteworthy because UO-9 was built largely with judiciously selected, commercially available parts. By contrast, most commercial, military and scientific spacecraft are fabricated from astonishingly expensive components. One recent military spacecraft cost, pound for pound, more than seven times as much as if it had been made of solid gold![1] The relatively low cost and high performance of UO-9 combine in an attribute which can be labeled "cost-effective." According to its builders, UO-9 required 30 months and about £250,000 (about $400,000) to construct and prepare for launch.

Containing a host of payloads including magnetometers, particle counters, radio beacons, a digital-voice-telemetry generator and a CCD camera, among other things, UO-9 has set new standards. One metric I find especially interesting is that UO-9's "on-station cost" is a remarkably low $10 per orbit![2] Ten bucks! Discounting launch costs, some satellites—especially older, low-orbiting photoreconnaissance types with perigees below 100 miles—might cost $30,000,000 and last only two months for an on-station cost of about $32,000 per orbit—a remarkable 35 dB more per orbit![3]

But alas, all this will come to an end sometime later this year when UO-9's loss-of-altitude rate begins to increase precipitously. Then, this benchmark of low-cost satellites will become the first OSCAR to come down with its radios on, "its guns still blasting," like a WW-II fighter pilot whose Spitfire has absorbed too much lead.

The "lead" in the case of UO-9 is atmospheric drag. The friction imposed by the thin atmosphere at UO-9's altitude is slight but perceptible. Just above the ionosphere (at about 270 miles), UO-9 now flies in a borderland between Earth's environs and deep space. Whereas satellites placed higher—say, at altitudes of 600 miles or more—can be expected to remain in orbit for hundreds of years[4], satellites in orbits below about 400 miles have orbital lifetimes measured in terms of a few years, not decades or centuries as the higher-orbiting satellites do.

Satellite orbits and their decay may be qualitatively understood in terms of energy. The chemical energy of the launcher's rocket engine increases the satellite's kinetic energy (energy of motion) and its gravitational potential energy (energy of position). When in orbit, the kinetic energy tends to drive the satellite in a straight line off into space in accord with Newton's oft-quoted law about objects in motion tending to remain in straight-line motion unless affected by outside forces, and so on.

Gravity *is* an affecting force, obviously. In fact, earth's gravity tends to pull the satellite towards the center of mass of the earth, gently curving the satellite's otherwise straight path. If the velocities and forces involved are in proper balance, a compromise is struck: an *orbit*—a trajectory that closes on itself. If the forces are out of balance, two outcomes are possible, and which of these happens depends on the nature of the imbalance. If the satellite has excess velocity, its trajectory never closes on itself, and the spacecraft leaps from gravity's web off into space. It has achieved *escape velocity*. On the other hand, too little velocity means that the trajectory has a radius less than that of the earth, causing an intersection of sorts. Crash!

Orbital decay occurs when the satellite's kinetic energy is slowly converted to atmospheric heating through molecular turbulence as the satellite plows through filaments of gas at velocities of 17,000 mi/h. As the satellite slows, its trajectory bends more to gravity's will and the satellite travels in tighter and tighter arcs. A smaller, lower-altitude orbit results.[5]

The relationship between altitude and orbital lifetime is nonlinear. That's because the atmosphere compresses under its own weight, confining most of its mass to low altitudes. Some gas remains at higher altitudes—even as high as 500 miles—but it's tenuous indeed. Because of this, satellites plowing through the upper ionosphere at high velocity can be visualized as pressing through a viscous fluid. The turbulence imposed on the gas by the satellite's rapid motion through it is converted to higher average gas molecular kinetic energy—in other words, the temperature of the gas is raised slightly. Since kinetic energy is being transferred from the satellite to the gas molecules, the satellite decreases velocity slightly and descends a bit.

At the lower altitude, the satellite encounters denser atmosphere. That means energy is lost to friction at a higher rate, which further accelerates the altitude loss. The process compounds itself quickly, until, in the last few days of a satellite's orbital life, air friction increases geometrically rather than linearly, and the satellite suddenly plummets.[6]

The big question is, "How long will it take for UO-9 to fall from the sky?" If the story were told entirely in terms of friction in a stable atmosphere, predicting burnout with a precision of a few hours would, in principle, be possible even though UO-9's altitude-v-time curve is of higher order[7]. But there's a joker in the deck!

Just as Old Sol makes forecasting ionospheric propagation a complex, often-risky guessing game, predicting satellite deorbit time and place is fraught with uncertainties. The main uncertainty is the temperature of the atmosphere and the gas density at the satellite's orbital altitude. And, the grand engine that drives all life on earth (the sun) pulsates with bursts of energy that periodically warm, then cool, earth's atmosphere in response to magnificent, if poorly understood, solar cycles.

What *is* known is that at times of increased solar activity, the sun's energy output at all wavelengths increases dramatically. Absorption of some of this energy causes the earth's atmosphere to

(continued on page 90)

Conducted By Bob Atkins, KA1GT
103 Division Ave, Millington, NJ 07946

Using TVRO Dishes for EME on the Microwave Bands

TVRO (TV receive only—satellite TV) dishes have decreased in cost since they first became available to the consumer. These dishes are designed for reception at 4 GHz, so their performance should be excellent on the microwave bands up to 3456 MHz. Above their design frequency, performance of some TVRO dishes falls off quite rapidly, depending on the magnitude and periodicity of dish profile errors. For example, a dish with a peak deviation of $\lambda/10$ (surface variations from a true parabola by $\lambda/10$) and a periodicity of $\lambda/6$ (average distance between high spots is $\lambda/6$) exhibits about 0.5 dB gain deterioration from these imperfections.

If the same dish is used at twice the frequency, these inaccuracies become $\lambda/5$ and $\lambda/3$, respectively. Under these conditions, the gain deterioration becomes about 6 dB, and becomes worse very rapidly with increasing frequency. In addition, the mesh size used on dish surfaces (solid dishes are undesirable for weight and wind-resistance considerations) ideally should be less $\lambda/10$ to keep gain deterioration under 1 dB.

Within these limitations, however, TVRO dishes can be used as high-gain multiband microwave antennas. One person who is using such an antenna in this way—with very good success—is Dave Hallidy, KD5RO, now located in grid square FN13, near Rochester, New York. Dave uses the 3-meter (10-foot) TVRO dish shown in Fig 1 on the 902, 1296, 2304 and 3456-MHz bands. In a recent letter, Dave writes:

> Since last summer, Al Ward (WB5LUA) and I had been talking about the different bands/modes on which we could work each other and maybe set some new records, with him near Dallas and me relocated near Rochester, NY. One of those possible QSOs was, of course, 902-MHz EME. Earlier in the year Al had been successful getting on the moon on that band and worked K5JL for what was the distance record—about 185 miles. I had purchased a 10-ft TVRO dish in the spring and had used it to work F1HDI on 1296 MHz. I decided that I could make this dish usable on all bands from 902 MHz on up and so I proceeded to start collecting pieces to build a real EME station. My goal was to be on at least one band in time for the EME competition in the fall. Al suggested that since the antenna was not being used currently on any band, why not start on 902 MHz? It seemed like a good idea to me, so I got busy. I modified the TVRO polar mount to allow true az-el positioning and then mounted the dish on a single section of Rohn 25G tower. The dish is rotated in azimuth with a small prop pitch motor and it is elevated with a TVRO linear actuator arm. The modifications to the dish mount removed the fixed declination adjustment, and now when the actuator is extended it lifts the dish from the horizon to a vertical position very easily. I mounted pots on both the azimuth and elevation systems and coupled them to a digital voltmeter in the shack to give digital read-out to an accuracy of one degree in azimuth and one tenth of a degree in elevation.
>
> For 902 MHz I built a dual-dipole EIA-type feed, very similar to one described by WØPW at the 1986 Microwave Update for use on 2.3 GHz. My preamp is a WB5LUA design using an Avantek ATF-10135 GaAsFET, with a noise figure of 0.43 dB and 14.5 dB gain. It is located about one foot from the feed. The transmitter runs about 250 W output from a borrowed Hi-Spec amplifier (2 × 7289 air-cooled). The transmit feed line is about 50 ft of 7/8" Andrew LDF Heliax® and the receive feed line the same amount of 1/2" LDF. I use a home-brew transverter to drive the amplifier and to convert the received signal to 144 MHz. On completion of the assembly of the hardware, Al and I decided we would try a QSO during the second weekend of the EME Competition, November 26th and 27th. On the afternoon of the 26th I made the first tests of the receiver and dish and found that I was seeing about 10 dB of sun noise. We agreed to run starting at 0615Z on the 27th and we decided to allow an hour in case signals were weak. At 0500 I still didn't know if I was radiating any signal so I pointed the dish at the moon and let fly with a string of dashes. Back to receive and there they were—ECHOES!!! Not very strong, only a couple of dB out of the noise, but pretty solid copy—I would have given myself an "M" report. Every time I hit the key I heard myself, so I felt confident Al and I would be successful.
>
> At the appointed time we began our sked, but signals were barely detectable and after a half hour, Al called me on the phone to tell me why. It seems that he had his feed vertically polarized, while mine was horizontal. This was intentional, to account for polarization rotation, but apparently it was not helping. Al said he would rotate his feed and start again at 0700. What a difference! When he called me at 0700 he was a solid "O" copy and gave me the same report. We completed the QSO easily, finishing by 0730. Al's station was set up as follows: His home-brew 24-ft dish was fed with the same type dual-dipole feed as I used. His feed lines were similar, though somewhat longer. His transmitter power was derived from a surplus Varian TWT with about 170 W output. His receive preamp was similar to mine, as was his transverter (we designed and built the major part of all this stuff when we lived 6 miles apart!).
>
> The distance for this QSO is 1239 miles, which we believe to be the current EME DX record. Al and I both hope that our efforts will encourage other EME-oriented amateurs to make attempts to get on 902-MHz EME. Currently the only other stations capable of 902-MHz EME are K5JL and WA5ETV, both located near Oklahoma City. I have temporarily QSYed from 902- to 1296-MHz EME. Using the same dish and similar power I have been relatively successful, working eight stations the first weekend I was on and hearing at least eight more. As soon as I have a power amplifier of my own for 902-MHz I will be back on EME and hopefully by that time others will be there to join the fun.

Fig 1—Dave Hallidy, KD5RO, and his 3-meter dish. Dave uses this antenna on the 9, 13, 23 and 33-cm bands. Dave operates from his home in western New York, near Rochester, in grid square FN13.

Dave and others have demonstrated the utility of TVRO dishes as multiband microwave antennas capable of real success on EME, and they are equally effective for terrestrial work. Typical good, long Yagi antennas have gains of 20 to 23 dB, so a 10-foot dish should outperform an array of 4 Yagis on 902 and 1296 MHz, 8 Yagis on

(continued on page 108)

IARU News

Conducted By Richard L. Baldwin, W1RU
HC 60, Box 60, Waldoboro, ME 04572

International Telecommunications Conferences

There are at least two kinds of international telecommunications conferences that affect amateurs, either directly or indirectly. These are conferences of the ITU—the International Telecommunication Union—and they are named Plenipotentiary Conferences and World Administrative Radio Conferences.

World Administrative Radio Conferences (WARCs), which you have read about in this column a number of (many, many!) times, are those conferences which decide how the radio-frequency spectrum is going to be used—which services get which frequencies, what the appropriate technical standards shall be, how to solve interference problems, how call signs shall be formed and so forth. Even WARCs are broken down into two types—general and specialized.

A general WARC tackles *all* of the international Radio Regulations relating to *all* of the radio services. A general WARC is a massive undertaking; at a general WARC some 2000 delegates from the ITU's 166 member administrations will gather in Geneva for a period of two or three months. Of course, in addition to the time spent *at* the conference, every administration has to spend a considerable amount of time preparing for the conference. For most administrations, this means about two years of preparatory work. A specialized WARC deals with only a particular service, or a related group of services, such as Mobile or Space. A specialized WARC has a limited agenda, and is not supposed to stray outside that agenda and take any action that could significantly affect a radio service not included on the agenda.

When a specialized WARC runs up against problems (such as inadequate frequency allocations) which it can't solve within the framework of the published agenda, then it may recommend that the ITU hold a WARC with greater authority in the future. That's what happened a couple of times in the recently—a Mobile WARC and a Broadcasting WARC decided that some of their problems could only be solved in a WARC with reallocation authority, and so they recommended that the ITU hold some such WARC no later than 1992.

That leads us to a Plenipotentiary Conference of the ITU. A Plenipot is where the supreme power of the ITU rests. It has the power to revise the ITU Convention, and thus establish the broad policies under which the ITU conducts its affairs. It determines who are going to be the officers of the Union. It establishes budgetary guidelines. It establishes policies relating to the staff of ITU. It outlines the scope of the conferences that are to be held for the next five or more years. Only administrations may participate in the Plenipot—international organizations which participate as observers in WARCs (such as IARU) play no role in Plenipot.

In May and June of this year an ITU Plenipotentiary Conference will take place in Nice, France. Some of the matters that it will decide affect us directly, while some others will affect us indirectly.

Directly affecting us will be their decisions on the schedule of future WARCs to be held by the ITU, in particular the scheduling of some form of an allocations WARC to answer the concerns expressed by the recent Mobile and HF Broadcasting Conferences. You see, both of those services believe they need more spectrum space, and where will it come from? If one service gets more spectrum, another has to lose spectrum. And so we are directly affected by the scheduling of another allocations WARC, currently predicted for about 1992. The minute we know that schedule, and the agenda, then the IARU, working through its member-societies, has got to make sure that every administration is fully briefed on the Amateur Radio Service, its needs, its goals and its values. IARU has already made a great deal of progress in preparing for WARC 92, but much will remain to be done once we know the exact date and agenda and can schedule our efforts accordingly.

Probably of less direct concern will be the scheduling of additional specialized WARCs. They will be of lesser concern to us if their agendas do not contain any items affecting the Amateur Radio Service. They will be of *some* interest to us because each WARC, regardless of its scope, is an opportunity for us to expose delegates to the IARU, to Amateur Radio internationally, and thus, subliminally, to build up support for Amateur Radio.

Our final concern about the upcoming Plenipot is one that is difficult to categorize as direct or indirect, but it is a concern that didn't exist just two months ago. Although most of us had expected him to stand for another term of office, ITU Secretary-General Richard E. Butler recently announced he was not a candidate. For those of us who have been deeply involved with the ITU, this is disquieting news. Mr Butler, an Australian by birth, has been a strong supporter of the Amateur Service. He has encouraged the existence and growth of 4U1ITU at the ITU Headquarters, he has participated in many IARU official functions, he has been a strong supporter of the Amateur Radio Administration Course and has always been ready and willing to give us advice, counsel and assistance. We can only hope that, if indeed he does not stand for re-election, the Plenipot will choose a new Secretary-General who is equally supportive of IARU and Amateur Radio.

The decisions taken by the ITU's Plenipotentiary Conference in Nice in May and June will affect every radio service, not the least of which are the Amateur Service and the Amateur-Satellite Service. QST

Mini Directory

As a convenience to our readers, here is a list of items of particular interest and when they most recently appeared in *QST*.

Conducted By Joan Gibson, KG1F
RR 1, Box 1465, Waterbury, VT 05676

Maria's Sound of Music, XE1MMJ Style

Maria Martin's aunt must have gazed into a crystal ball and seen a young YL with an extraordinary musical talent. "She enrolled me in piano lessons with a teacher at the University of Southern Mississippi when I was only a junior in high school," recalls Maria, XE1MMJ. "Although my mother had given me piano lessons since age nine, my former teachers allowed me to develop many bad habits which took the poor university teacher two years to undo. Nevertheless, because of my lessons there, I was awarded a four-year piano scholarship when I enrolled as a full-time college student."

Maria loved singing and decided to also study voice. "The piano majors were always put under the poorest voice teachers, leaving the best teachers for the voice majors. Much to my amazement, my voice teacher recognized a vocal talent of which I was completely unaware. In a week's time, I was placed under the best voice teacher in the whole university who, along with the head of the music department, pushed me into singing the contralto solos in all of the oratorios, cantatas and choir trips available." Much to her piano teacher's consternation, Maria switched her major from piano to voice after one year. She earned a BA in music with honors from the university. During her college years she was privileged to sing the contralto solos in Handel's Messiah with professional singers. Her outstanding talents were recognized by faculty members who selected her to be listed in *Who's Who Among Students in American Colleges and Universities* as well as to be named to the honorary music society.

Shortly after graduation, Maria married Mack Jones. Both became students at New Orleans Baptist Theological Seminary where Mack received his theological degree and Maria studied religious education and became the music director for several churches. In 1956, the Joneses moved to Oregon where "we began a love affair with a beautiful state which continues even to this day." In 1963 they moved to San Jose, Costa Rica where they spent a year in school learning Spanish. "We spent four hours in the morning in classes where the teachers never spoke one word of English, even to explain the grammar lessons. Then we spent four hours in the afternoon with a tape recorder spilling out long, long sentences in Spanish which were designed to loosen our tongues."

Knowing the language was what the Joneses needed to begin their careers in Spanish-speaking countries. From 1964 to 1968, Maria taught music at the Baptist Theological Seminary in Asuncion, Paraguay. "Basically, I was the music faculty!" The Joneses returned to the States where Maria earned a Master of Church Music degree from the New Orleans Baptist Theological Seminary.

Maria proudly displays a collection of QSL cards in her shack.

It was not until 1970, when they were invited to teach at the Baptist Theological Seminary in Montevideo, Uruguay, that the Amateur Radio bug bit. "One of our colleagues, an Amateur Radio operator, contacted some of our family members via Amateur Radio for us one afternoon, and that is when it all started. I remarked that I would love being an Amateur Radio operator, and our friend suggested that Mack and I study at the Radio Club of Uruguay and become licensed. I told him I would never be able to learn the code, but what I didn't realize was that the electronics, in which I had no background, would almost be my downfall. Nevertheless Mack and I enrolled in an evening class which met three nights a week for two hours a night. We began with 19 students, and three of us finished the course nine months later. Much to my own amazement, I was the star code student. My headache was trying to assimilate electronics taught by a brilliant young man. After teaching in Spanish all day, and then having formulas thrown at me in Spanish at night, I left many classes with a terrible headache. However, my incentive to finish was because both Mack's and my parents were elderly, and we wanted to keep in touch with them via radio. Telephone calls on our shoestring salary were financially prohibitive for us from 9000 miles away. For three years, due to the courtesy of stateside amateurs, I was able to talk with my mother nearly every week."

Uruguayan radio law permits third-party privileges, and Maria ran traffic into the States for people three nights a week. "Sometimes people were actually lined up at our house waiting. I had never met some of these people, but they had heard of me. This part of Amateur Radio was a public service which I greatly enjoyed at the time."

When Maria first operated from Uruguay she was overwhelmed by the number of stations she would hear after putting out a CQ. "I did not understand the importance of being a DX station, and that I needed to help people make their DX contacts. Being a natural-born rag chewer, I must have frustrated many a DX hound when I chatted endlessly with one or two stations. It was an honest mistake!"

"We owe the Uruguayan amateurs a big thank you for helping us assemble and erect a conventional quad antenna which had been a gift to a colleague who decided not to use it. It was assembled one afternoon and put in place by moonlight. In these unusual circumstances, someone forgot to tighten some essential bolts. In a wind storm one evening, two elements flew off and landed on our neighbor's roof (the houses were joined together), narrowly missing a glass skylight. Trying to wedge our feet between the red tile as we climbed on our slanted roof to make sure the elements were all right would have been a comical sight, had anyone seen us."

Life's little ironies were experienced by Maria when she returned to the states and requested US operating privileges. It was a shock for her to learn that even though Uruguayans were provided a reciprocal license when they came to the US, she, as a North American, would have to study and take the tests in English. In Uruguay, Maria had taken an essay-type test in Spanish which included drawing a schematic. "It honestly was harder for me than my Master's degree. I had learned everything in Spanish and didn't even know what some of the parts of the radio were in English. So, I was off the air from 1974 to 1978, because I knew no one to help me learn the electronics in English." Thanks to W5NRU, now a Silent Key, Maria was tutored in electronics, while she relearned code on her own.

When the Martins returned to Mexico, Maria barely had time to catch her breath. An earthquake struck Mexico City and XE1MMJ, like so many other amateurs, was there to help. *(To be continued next month.)*

Coming Conventions

ATLANTIC DIVISION/NEW YORK STATE CONVENTION

May 19-21, 1989, Rochester, New York

The Atlantic Division/New York State Convention will be sponsored by the Rochester Amateur Radio Assn. It will be held from noon on Friday to 1:30 PM on Sunday. Admission in advance will be $6, at the door $7. Features will include flea markets, commercial exhibitors, VE exams. Talk-in will be on 146.28/88. For more information contact Rochester Hamfest, 300 White Spruce Blvd, Rochester, NY 14623, tel (D) 716-424-7184, (N) 716-225-5260.

TENNESSEE STATE CONVENTION

May 20, 1989, Knoxville

The Tennessee State Convention will be sponsored by the Radio Amateur Club of Knox County. It will be held at the Shriners Temple. Take I-75-40 to downtown Knoxville, south on Henley St (US 441) across TN River; second left onto Mimosa to Kerbela. Doors will be open from 9 AM-4 PM. Features will include ARRL Forum, Joe Fairclough of the New York Public Schools, VE exams, refreshments. Admission will be $5 at door, no advance. Talk-in will be on 147.90/30. For further information contact L. B. Cebik, W4RNL, 2414 Fair Dr, Knoxville, TN 37918, tel (D) 615-974-7215, (N) 615-687-0139.

LOUISIANA STATE CONVENTION

May 20-21, 1989, Baton Rouge

The Louisiana State Convention will be sponsored by the Baton Rouge ARC. It will be held at the Ramada Hotel. Doors will be open on Saturday from 9 AM-4 PM and Sunday 9 AM-2 PM. Features will include forums, VE exams, flea market, radio dealers, QCWA breakfast. Admission will be $1 at the door, no advance. Talk-in will be on 146.19/79 (146.28/88 backup). For further information contact Rick Pourciau, NV5A, 879 Castlekirk Dr, Baton Rouge, LA 70808.

May 6-7
Alabama State, Birmingham

May 19-21
Atlantic Division/New York State, Rochester, NY

May 20
Tennessee State, Knoxville

May 20-21
Louisiana State, Baton Rouge

June 16-17
Georgia State, Albany

ARRL NATIONAL CONVENTIONS
June 2-4, 1989—Dallas/Fort Worth, Texas
June 8-10, 1990—Kansas City, Missouri

Attention Hamfest and Convention Sponsors

ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You are encouraged to register your event with HQ as far in advance as your planning permits. Note that the hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register: Registering dates with ARRL HQ does not constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your Division Director. For conventions, approval must be made by your Director and, additionally, by the Executive Committee. Application forms can be obtained by writing to or calling the ARRL Convention Program Manager, tel 203-666-1541 ext. 283.

Note: Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance.

Hamfest Calendar

Administered By Bernice Dunn, KA1KXQ
Convention Program Manager

Attention: The deadline for receipt of items for this column is the 5th of the second month preceding publication date. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes. For those who send in items for Hamfest Calendar and Coming Conventions: Postal regulations prohibit mention in *QST* of prizes of any kind and games of chance such as bingo.

Alberta (Namao)—May 26-28. *Sponsor*: Northern Alberta RC. *Time*: Friday 6 PM, Saturday 10 AM, Sunday 8 AM. *Place*: Namao School. *Features*: flea market, plenty of demonstrations, commercial displays, RV parking Friday from 6-9:30 PM, banquet $13 each, 2 for $25 on Saturday 7:30 PM, Sunday pancake breakfast $3.50. *Talk-in*: 147.66/06. *Admission*: advance $4, door $5, students 18 and under free. *Contact*: SASE to Northern Alberta RC, 9628-69A St, Edmonton, AB Canada T6W 1W3.

Arkansas (Springdale)—May 20. *Sponsor*: Northwest Arkansas ARC. *Time*: 8 AM-3 PM. *Place*: Rodeo Community Ctr. *Features*: programs, VE exams (walk-in basis). *Tables*: $5. *Contact*: Randall Spear, WA5QGH, tel 501-846-3210.

†**California (Fresno)—May 5-7.** *Sponsor*: Fresno ARC. *Time*: Friday 5 PM-9 PM, Saturday 8 AM-8 PM, Sunday 10 AM. *Place*: Airport Holiday Inn, 5090 E Clinton Way. *Features*: forums, refreshments, tech talks, VE exams. *Talk-in*: 146.34/94. *Admission*: advance $23, door $25. *Contact*: Ed Plummer, KB6LBS, 12460 E Heather, Clovis, CA 93612.

California (Sacramento)—May 21. *Sponsor*: North Hills RC. *Time*: 8 AM-3 PM. *Place*: Folsom Community Clubhouse, Folsom, California, take 50 East from Sacramento and follow signs. *Features*: HAMSWAP, refreshments, club auction, tailgating, free parking. *Talk-in*: 144.59/145.19, 223.18/224.78. *Admission*: free. *Tables*: $6 each (no advance sales). *Contact*: North Hills RC, PO Box 41635, Sacramento, CA 95841, tel Bob, WA6ULL 916-983-2776.

Colorado (Colorado Springs)—May 20. *Sponsor*: Pikes Peak RAA. *Time*: 8:30 AM. *Place*: Rustic Hills Mall at Palmer Park and Academy Blvd. *Talk-in*: 146.37/97. *Admission*: free. *Tables*: advance $8, door $10. *Contact*: Al, N0CMW, tel 719-473-1660 or write Pikes Peak RAA Swapfest 88, PO Box 16521, Colorado Springs, CO 80935.

†**Georgia (Hartwell)—May 20-21.** *Sponsors*: Anderson, South Carolina, Hartwell and Toccoa, Georgia Radio Clubs. *Place*: on the shore of Lake Hartwell about 3 miles east of Hartwell, just north of US Hwy 29. *Features*: tailgating. *Talk-in*: 146.19/79, 147.93/33, 146.295/895. *Admission*: free. *Contact*: George C. Haddock, KB4HCB, Rte 1, Box 52, Martin, GA 30557, or Carl Davis, KY4T, College Ave, Hartwell, GA 30603.

†**Idaho (Coeur d'Alene)—June 10.** *Sponsor*: Kootenai ARS. *Time*: 7:30 AM-3 PM. *Place*: Avionics, north on 95 through Hayden Lake to Coeur d'Alene Airport. *Features*: VE exams, refreshments. *Talk-in*: 146.38/98, 146.52. *Admission*: free. *Contact*: Marjorie Hogeweide, WB7WUB, N 11655 Sundler Lane, Rathdrum, ID 83858.

Illinois (Chicago)—May 21. *Sponsor*: Chicago ARC. *Time*: 9 AM-3 PM. *Place*: North Park Village, 5801 N Pulaski. *Admission*: $2. *Contact*: George Sopocko, WA9JEZ, 312-545-3622.

†**Illinois (Godfrey)—May 20.** *Sponsor*: Lewis & Clark Radio Club Inc. *Time*: vendors 7 AM, public 8 AM-3 PM. *Place*: Lewis & Clark Community College Campus. *Features*: free parking, refreshments, commercial vendors, exhibits, flea market. *Talk-in*: 144.63/145.23. *Admission*: free. *Contact*: Lewis & Clark Radio Club Inc, PO Box 553, Godfrey, IL 62035 or Harold Elmore, KC9GL, 5203 Dixon Dr, Godfrey, IL 62035.

†**Illinois (Knoxville)—May 21.** *Sponsor*: Knox County RC. *Time*: gates open at 7 AM, commercial building at 8 AM-3 PM. *Place*: Knox Co Fairgrounds, exit 51 on I-74. *Features*: refreshments, VE exams. *Talk-in*: 147.00/146.40. *Contact*: Keith L. Watson, WB9KHL, 119 S Cherry St #3, Galesburg, IL 61401-4527, tel 309-342-3885 evenings.

†**Illinois (Princeton)—June 4.** *Sponsor*: Starved Rock Radio Club. *Time*: 8 AM-2 PM. *Place*: Bureau Co Fairgrounds Bldg. *Features*: refreshments, flea market. *Talk-in*: 147.72/12, 146.355/955. *Admission*: advance $3.50, door $4. *Contact*: Ken Stasiak, WB9ZFO, PO Box 134, Lostant, IL 61334, tel 815-368-3284.

†**Illinois (Willow Springs)—June 11.** *Sponsor*: Six Meter Club of Chicago Inc. *Time*: 6 AM-3 PM. *Place*: 91st and Wolf Rd. *Features*: dealers, ARRL, AMSAT, flea market, refreshments. *Talk-in*: 146.37/97. *Admission*: advance $3, door $4. *Contact*: Joe Gutwein, WA9RIJ, 7109 Blackburn Ave, Downers Grove, IL 60515, tel 312-963-4922.

†**Indiana (Evansville)—June 4.** *Sponsor*: Tri-State ARS. *Time*: 6 AM-3 PM. *Place*: I-64 to Hwy 41S, 5 miles to 4-H Ctr. *Features*: refreshments. *Talk-in*: 147.75/15, 146.19/79, 144.65/5.25 Indianapolis, 144.55/145.15 Evansville. *Admission*: advance $4, door $5. *Tables*: $5. *Contact*: Martin Hensley, KA9PCT, 1506 S Parker Dr, Evansville, IN 47714, tel (D) 812-424-8284, (N) 812-479-5741.

Indiana (Muncie)—June 4. *Sponsor*: Muncie Area ARC. *Time*: setup after 5 PM Saturday, 8 AM-3 PM Sunday. *Place*: Delaware Co Fairgrounds.

†ARRL Hamfest

Features: refreshments, VE exams from 9 AM-11 AM, free parking, overnight camping with full hookups $5 per space. *Talk-in*: 146.13/73, 222.32/223.92. *Admission*: advance $3, door $4. *Tables*: $5 with power. *Contact*: Ted Snodgrass, RR #2 Box 4, Daleville, IN 47334, tel 317-378-5569.

Kansas (Augusta)—May 6. *Sponsor*: Flint Hills ARC. *Time*: 8 AM-3 PM. *Place*: Augusta City Park located 20 minutes east of Wichita. *Talk-in*: 147.75/15. *Admission*: $2. *Tables*: $3. *Contact*: SASE to Zack Wilkerson, KØDVY, Rte 1, Box 90, El Dorado, KS 67042.

†**Kansas (Pittsburg)—June 10.** *Sponsor*: Pittsburg Repeater Organization, Inc. *Time*: 8 AM-3 PM. *Place*: Lincoln Ctr, 709 West 9th. *Features*: refreshments. *Talk-in*: 146.34/94. *Admission*: $5. *Contact*: Kenneth L Johnston, 2402 Wall Ave, Joplin, MO 64804, tel 417-623-1895.

Maine (Bangor)—June 10. *Sponsor*: Pine State ARC. *Time*: dawn to 5 PM. *Place*: Hammond St, campground near I-95. *Features*: overnight camping with power available June 9 to June 11 ($8.50 per night charged by campground management), refreshments, ample parking, VE exams at nearby school. *Talk-in*: 146.34/94. *Admission*: $2, children 12 or under free. *Tables*: bring your own. *Contact*: Ed Richardson, NQ1L, tel 207-825-4417 or Howie Soule, K1CZ, tel 207-848-3397, for exam info Bill Sullivan, K1AG, 207-947-0336.

Maryland (West Friendship)—May 28. *Sponsor*: Maryland FM Assn, Inc. *Time*: 8 AM-3 PM. *Place*: Howard Co Fairgrounds, Rte #144. *Features*: refreshments, VE exams, commercial displays, ample parking, tailgating $3. *Talk-in*: 146.16/76, 222.16/223.76 and 449.1/444.1. *Admission*: $4. *Tables*: advance $7, door $10. *Contact*: Mike Cresap, 1294 Dorothy Rd, Crownsville, MD 21032, tel 301-923-3829, exam reservations, Steve Silberman, K3RMX, tel 301-578-8527.

Massachusetts (Dalton)—May 21. *Sponsor*: Northern Berkshire ARC. *Place*: Dalton American Region, Rte 9. *Features*: refreshments, tailgate space free to sellers. *Talk-in*: 146.31/.91. *Admission*: $1. *Contact*: Dick, WB1HIH, tel 413-458-8267 or 413-458-8452.

Michigan (Cadillac)—May 20. *Sponsor*: Wexaukee ARA. *Time*: 8:30 AM-2:30 PM. *Place*: Cadillac Middle School, 500 Chestnut St. *Features*: refreshments. *Talk-in*: 146.37/97. *Admission*: $3. *Tables*: $6. *Contact*: John Craddock, KX8Z, tel 616-797-5491, or write to Wexaukee ARA, PO Box 163, Cadillac, MI 49601.

†**Michigan (Chelsea)—June 4.** *Sponsor*: Chelsea ARC. *Time*: 8 AM-1 PM. *Place*: I-94 to exit 159, go north, turn right at first light, turn left one block. *Features*: refreshments, parking, campgrounds available, special handicap parking. *Talk-in*: 146.52. *Admission*: advance $2.50, door $3. *Tables*: 8 ft $8. *Contact*: Robert Schantz, 416 Wilkinson St, Chelsea, MI 48118, tel 313-475-1795.

Michigan (Midland)—June 10. *Sponsor*: Central Michigan ARA. *Time*: setup 7 AM, public 8 AM-1 PM. *Place*: Midland Community Center, George St, at Jefferson. *Features*: new and used amateur electronics and equipment, refreshments, VE exams. *Talk-in*: 147.60/00. *Admission*: $3. *Tables*: $8 and $4. *Contact*: Central Michigan ARA Hamfest, PO Box 67, Midland, MI 48640, tel 517-631-9228 (evenings and weekends).

Minnesota (Duluth)—May 20. *Sponsor*: Arrowhead RAC. *Time*: 10 AM-3 PM. *Place*: First United Methodist Church (the Copper Domed Church), located at 230 E Skyline Parkway. *Features*: VE exams will be held at the Government Services Building, 320 W 2nd St. *Talk-in*: 146.34/94. *Admission*: $4. *Tables*: 4 ft $5. *Contact*: for exam registration, John Crow, KAØSYN, 1365 Roland Rd, Cloquet, MN 55720, tel 218-879-5356, for general information, Duane Flynn, KBØLC, 4907 Peabody St, Duluth, MN 55801, tel 218-525-4580.

Nebraska (Omaha)—May 13. *Sponsor*: Aksarben ARC. *Time*: 9:30 AM (registration time for buyers 8 AM, sellers 8 AM-9:15 AM equipment check in). *Place*: Holy Name Social Hall, 5739 N 60th St (60th & Hartman). *Features*: refreshments. *Talk-in*: 146.34/94 WØEQU/R. *Contact*: Ken Noel, AJØA, 6730 S 73rd Circle, Ralston, NE 68127, tel 402-592-2338, or Mitch Gagne, NØAZF, 4026 Nebraska Ave, Omaha, NE 68111, tel 402-451-3859.

Nebraska (South Sioux City)—May 5-6. *Sponsor*: 3900 Club and Sooland ARA. *Place*: Marina Inn. *Features*: seminars such as beginning packet, advanced packet, QRP, Satellite, ARRL Forum, FCC, QCWA luncheon, MARS, flea market, get acquainted dinner Friday night, Luck Hurder, KY1T, will represent ARRL HQ. *Admission*: $6. *Tables*: $5, make early reservations with Al Smith, WØPEX, 3529 Douglas St, Sioux City, IA 51104. *Contact*: Dick Pitner, WØFZO, 2931 Pierce St, Sioux City, IA 51104.

New Jersey (Paramus)—May 7. *Sponsor*: Bergen ARA. *Time*: 8 AM-3 PM. *Place*: Bergen Community College, 400 Paramus Rd. *Features*: refreshments, free parking, VE exams (walk-ins only, 8 AM-11 AM). *Talk-in*: 146.19/79. *Admission*: buyers free, sellers $5. *Contact*: Jim Joyce, K2ZO, 286 Ridgewood Blvd, N Westwood, NJ 07675, tel 201-664-6725, for testing information contact Pete Adely, K2MHP, 13-30 Edward St, Fairlawn, NJ 07410, tel 201-796-6622.

†**New Jersey (Stirling)—May 7.** *Sponsor*: Tri-County RA. *Time*: 8 AM-2 PM. *Place*: Passaic Township Community Center off Valley Rd. *Features*: refreshments, limited reserved tailgating. *Talk-in*: 147.855/255, 444.975/449.975, 146.52. *Admission*: no advance, door $3 under 12 free. *Tables*: $8, with power $10. *Contact*: Dick Franklin, PO Box 182, Westfield, NJ 07090, tel 201-232-5955.

New York (Brewster)—May 6. *Sponsor*: Putnam Emergency Amateur Radio League. *Time*: setup 8 AM, public 9 AM-4PM (rain or shine). *Place*: John F Kennedy Elementary School, Foggintown Rd, off Farm-to-Market Rd, off Rte 312. *Features*: ham gear, refreshments, VE exams, free parking, flea market. *Talk-in*: 144.535/145.135. *Admission*: $3. *Tables*: indoor $8 (includes 1 admission), additional tables $5 each, tailgate $5. *Contact*: Terri Cullum, N2GWF, 40 Mile Hill Rd, Highland, NY 12528 or Jim Morgan, KA2FIQ, 39 Overlook Rd, Ossining, NY 10562.

New York (Lancaster)—June 4. *Sponsor*: Lancaster ARC. *Time*: 8 AM-5 PM. *Place*: Depew Grove, 271 Columbia at French Rd, Columbia is off Rte 78 (Transit Rd), 1.5 miles south of Rte 33 (Genesee St), or at 5939 Transit Rd (Rte 78), thruway directions are I-90 NYS Thruway to Depew exit 49, turn right, Rte 78 south 2.1 miles to Columbia (5 minutes from the Thruway exit). *Features*: commercial vendors, refreshments. *Talk-in*: 146.55, 223.04/224.64. *Admission*: advance $3 (till May 1, 1989), door $4. *Tables*: $4 (try to reserve in advance) or bring your own. *Contact*: Nick, WA2CJJ, 5645 Genesee St, Lancaster, NY 14086, tel 716-681-6410.

New York (Rome)—June 4. *Sponsor*: Rome Radio Club. *Time*: 9 AM flea market until 5 PM dinner. *Place*: Stanwix Heights Fire Dept, corner of Bartlett Rd and Rte 233. *Features*: forums, radio controlled aircraft demo, RACES, ARES, simple computer programs. *Talk-in*: 146.28/88. *Admission*: no advance, door $3. *Contact*: Frank Scatigna, N2GNH, 2805 Leibel Pl, Utica, NY 13501, tel (D) 315-733-2363 ext 254, (N) 315-735-7665.

New York (South Fallsburg)—June 2-5. *Sponsor*: Jewish Amateur Radio Operators. *Time*: 10:30 AM. *Place*: Raleigh Hotel in the Catskill Mountains of NY. *Features*: participation meetings, entertainment, dinner and dance. *Contact*: Sonny Gutin, WB2DXB, 42 Arrowwood Ct, Deptford, NJ 08096, tel 609-853-7889.

†**New York (Queens)—June 4.** *Sponsor*: Hall of Science ARC. *Time*: setup after 7:30 AM, public 9 AM. *Place*: New York Hall of Science parking lot, Flushing Meadow Park 47-01-111 St. *Features*: Amateur Radio Exhibit Station WB2JSM, tuneup clinic, free parking, refreshments. *Talk-in*: 144.300 simplex link, 223.600 RPT, 445.225 RPT. *Admission*: buyers $3, sellers $5 per space. *Contact*: tel at night only, Steve Greenbaum, WB2KDG, 718-898-5599 or Arnie Schiffman, WB2YXB, 718-343-0172.

†**North Carolina (Winston-Salem)—June 10.** *Sponsor*: Forsyth ARC. *Time*: 9 AM-3 PM. *Place*: Dixie Classic Fair Grounds I-40 to Cherry St, north to Winston-Salem Coliseum and Dixie Classic Fairgrounds, Gate 5. *Features*: refreshments, VE exams (preregistration only, send completed 610, copy of license and check for $4.75 made out to TEARC/VEC to Bob Gates, KJ4IC, Box 60 Cedar Grove Pk, Kernersville, NC 27284). *Talk-in*: 146.04/64, 147.555. *Admission*: advance $4, door $5. *Contact*: Mike Mahan, KB4WJA, 2061 Academy St, Winston-Salem, NC 27103.

Ohio (Athens)—May 14. *Sponsor*: Athens County ARA. *Time*: 8 AM-3 PM. *Place*: City Recreation Ctr, take East St, exit on either US Rte 33 or US Rte 50 and look for the signs. *Features*: flea market, VE exams (you should mail a completed FCC Form 610 and a check for $4.75 payable to ARRL/VEC to John Cornwell, NC8V, 101 Coventry Ln, Athens, OH 45701, walk-ins accepted). *Talk-in*: 145.15/55. *Admission*: $4. *Tables*: free paved outdoor flea market space adjacent to building for tailgaters and those bringing their own tables can be claimed the day of the event, indoor space is only available by advance registration. *Contact*: for table information, Rod Holley, KA8NDC, 15267 S Canaan Rd, Athens, OH 45701, tel 614-593-8177, for general information, Carl J. Denbow, KA8JXG, 63 Morris Ave, Athens, OH 45701.

†**Ohio (Medina)—May 14.** *Sponsor*: Medina M2M Club Inc. *Time*: 8 AM-2 PM. *Place*: Medina Community Center, State Rte 42, west of Medina. *Features*: special nonham activities. *Talk-in*: 147.63/03. *Admission*: advance $3, door $4. *Contact*: Clarence Miller, WA8JLA, 620 Oak St, Medina, OH 44236, tel 216-725-4492.

Oklahoma (Tulsa)—May 19-21. *Sponsor*: Broken Arrow and Tulsa ARCs. *Place*: Expo Square Pavillion at 17 St and S Louisville Ave. *Features*: banquet, transmitter hunt, flea market, new equipment dealers, VE exams (1 PM on May 20 and 9:30 AM May 21, walk-ins welcome on the 21st). *Talk-in*: 146.31/91, 146.28/88. *Admission*: advance $5, door $7. *Tables*: advance $3, door $5. *Contact*: for exam preregistration, Georgia McReynolds, KA5VIL, 5332 S Irvington Ave, Tulsa, OK 74135, for general information write PO Box 4283, Tulsa, OK 74149-0283, tel 918-272-3081 day or night.

Ontario (Kitchener)—June 10. *Sponsor*: Central Ontario Amateur Radio Flea market. *Place*: Bingeman Park. *Contact*: Ray Jennings, VE3CZE, 61 Ottawa Crescent, Guelph, Ontario N1E 2A8, tel 519-822-8342.

Pennsylvania (Ephrata)—May 20. *Sponsor*: Ephrata Area Repeater Soc, Inc. *Time*: 8 AM. *Place*: Ephrata High School. *Features*: refreshments, ATV and packet seminars, VE exams. *Talk-in*: 144.85/145.45, 449.85/444.85, 146.52. *Admission*: $4. *Contact*: Tom Youngberg, K3RZF, tel 215-267-2514.

†**Pennsylvania (Pittsburgh)—June 4.** *Sponsor*: Breeze Shooters. *Time*: 8 AM-4 PM. *Place*: White Swan Amusement Park, Rte 60 (Parkway West) near Greater Pittsburgh International Airport. *Features*: free parking, free tailgating, amusement park on site. *Talk-in*: directions on 147.63/03, mobile check-in on 146.52 and 28.495. *Admission*: free. *Tables*: inside vendors by advance reservation, limited space, registration $2 each, 3 for $5, 7 for $10, 15 for $20. *Contact*: John Colbert, K3SDL, 1851 Highland Ave, Irwin, PA 15642, tel 412-863-5167.

†**Pennsylvania (Tamaqua)—May 21.** *Sponsor*: Tamaqua Transmitting Society & Anthracite Repeater Assn. *Time*: vendors and tailgaters 7 AM, public 9 AM. *Place*: from Rte 309, at the center of Tamaqua, follow the large hamfest signs pointing toward the New England Valley Fire Company, 1 mile west of Tamaqua. *Features*: ARRL booth, homing pigeon flights, contests, auction, forums, VE exams (walk-ins accepted), refreshments. *Talk-in*: 146.52, 146.07/146.67, 145.105/705. *Admission*: $3, tailgaters $1. *Tables*: $3 with power. *Contact*: A. R. Breiner Jr, K3NYX, 127 Market St, Tamaqua, PA 18252, tel (B) 717-668-0300, (H) 717-668-5198.

†**Pennsylvania (Wrightstown)—May 21.** *Sponsor*: Warminster ARC. *Time*: 6 AM for vendors, public 8 AM. *Place*: Middletown Grange Fairgrounds located on Penns Park Rd. *Features*: new equipment dealers, flea market. *Talk-in*: 147.69/09, 223.76/222.16, 52.04/53.04, 146.52. *Admission*: $4, nonhams and children free. *Tables*: 8 ft $5/space, some power available, unlimited outdoor space at $5/space. *Contact*: Bill Cusick, W3GJC, Apt 804 Garner House, Hatboro, PA 19040, tel 215-441-8048.

Quebec (Sorel)—May 28. *Sponsor*: Sorel-Tracy ARC. *Time*: vendors 7 AM, public 9 AM. *Place*: Tracy Curling Club. *Admission*: $5. *Tables*: indoor $10, outdoor $7 (limited quantity reserve before May 15). *Contact*: Sorel-Tracy ARC, PO Box 533, Sorel, Quebec J3P 5N6.

Rhode Island (Forestdale)—May 20. *Sponsor*: RI

Amateur FM Repeater Service, Inc. *Time*: flea market 9 AM, auction 12-5 PM. *Place*: VFW Post 6342, Main St, (N Smithfield), take the Forestdale exit off Rte 146 in N Smithfield, take a left at the end of ramp, go 6/10-mile to the Post on your right before the Village Haven Restaurant. *Features*: refreshments. *Talk-in*: 222.16/223.76, 146.52. *Admission*: free. *Contact*: Rick Fairweather, K1KYI, Box 591, Harrisville, RI 02830, tel 401-568-0566 from 7-9 PM.

Texas (Abilene)—May 20. *Sponsor*: Key City ARC. *Time*: setup 6 AM-8 AM, public 8 AM-5 PM. *Place*: Abilene Civic Ctr, 3210 Pine St. *Features*: refreshments, VE exams (walk-ins welcome), RACES/ARES lectures, ATV, packet, free RV/auto parking across from Ctr, large arts/crafts show. *Talk-in*: 146.16/76, 146.52, 444.5/449.5 (alternate 147.12/72 West Tex Conn). *Admission*: advance $5, door $6. *Tables*: $2 each, electricity available. *Contact*: Bill Jones, N5DOX, tel 915-698-4606, or AE5I Auto-Forward BBS or WB5EKW-3 Gateway 8 AM-10 PM daily on 7096/145.01.

†**Virginia (Roanoke)—May 28.** *Sponsor*: Roanoke Valley ARC. *Time*: 8 AM-5 PM. *Place*: Roanoke Civic Ctr, intersection I-581, Rtes 460, 220, 11. *Features*: dealers (radio and computer), flea market, SKYWARN forum, ARRL forum, refreshments, women's programs. *Talk-in*: 146.385/985, 146.52. *Admission*: no advance, door $5. *Contact*: Charles H. Nichols, KB4WSB, tel (D) 703-345-1404, (N) 703-342-8562.

†**Washington (Yakima)—May 20-21.** *Sponsor*: Yakima ARC. *Time*: Saturday 9 AM-4 PM, Sunday 7 AM-2 PM. *Place*: Modern Living Building at Central Washington State Fairgrounds. *Features*: VE exams, exhibitors, refreshments. *Talk-in*: 146.06/66, 146.24/84. *Admission*: $5, earlybird special prior to May 1. *Contact*: Dick Umberger, N7HHU, tel (D) 509-453-8632, (N) 509-453-3580, or mail to Yakima ARC, W7AQ, PO Box 9211, Yakima, WA 98909.

West Virginia (Buckhannon)—May 28. *Sponsor*: Buckhannon ARC and the West Virginia Wesleyan College ARC. *Time*: 2 PM-10 PM. *Talk-in*: 7.250, 14.250, 18.150, 28.350. *Contact*: Richard Clemens, 103 Barbour St, Buckhannon, WV 26201, tel 304-472-1651 or 304-472-3029.

†**West Virginia (Wheeling)—May 21.** *Sponsor*: Triple States RAC. *Time*: 8 AM-3 PM. *Place*: Wheeling Park. *Features*: free flea market, overnight parking dealers/RVs, refreshments, wheelchair accessible. *Talk-in*: 146.31/91. *Admission*: advance $3, door $4. *Contact*: Triple States RAC, Box 240, RD 1, Adena, OH 43901, tel 614-546-3930.

Wisconsin (Manitowoc)—May 13. *Sponsor*: Mancorad RC. *Time*: 8 AM-5 PM. *Place*: Manitowoc County Expo Ctr, intersection of Hwys 42-151 and I-43 on Co Hwy R. *Features*: flea market, VE exams (all classes), refreshments, camping available via Manitowoc Co Expo Ctr tel 414-683-4378. *Talk-in*: 147.63/03. *Admission*: advance $2, door $3. *Tables*: 8 ft $3, with electric outlet $5. *Contact*: SASE to Mancorad RC, PO Box 204, Manitowoc, WI 54221-0204.

Amateur Satellite Communications

(continued from page 84)

heat slightly and expand. Thus, when the sun is active, the gas density at a given altitude increases. These fluctuations in solar activity occur in short- *and* long-term cycles. Because the fundamental mechanisms that determine the cyclic nature of solar activity are only dimly perceived, predictability is absent, especially in the short term. In sum, it is virtually impossible to predict with high confidence sudden energetic solar outbursts.[8]

Day-to-day predictions are mostly guesswork. Thus, predicting the date and time of deorbit is difficult at best. Making the prediction more difficult is the "knee" in the altitude-v-time curve. Analogous to a nuclear chain reaction, the knee is where altitude begins to decrease rapidly, subjecting the satellite to the higher and higher levels of friction that lead to a sudden end. Because of the knee in the curve, small errors in estimating solar activity can cause large errors in impact prediction. The result? For most observers (governments, students, scientists and radio amateurs), prediction reduces almost to a lottery.

But what a fun time might be had if a technical challenge were made of it! In fact, satellite aficionados have twice in the past held what we've termed "Chicken Little Contests" to challenge the best guesstimates on when certain satellites would deorbit.[9]

Unlike prior Chicken Little contests, however, this one—let's call it CL-III—holds special attraction. Since UO-9's radio beacon is still active, tracking the satellite and gauging its approach to doom will be much easier. Its 2-meter beacon (145.825 MHz) is easily heard on even basic equipment. The time of UO-9's demise should be determinable to within a few minutes—after the fact—by the silence of the 2-meter beacon, assuming that the beacon is under close radio surveillance when the satellite comes down. The basic tools you'll need to do this are a 2-meter all-mode radio and antenna. The techniques for locating the satellite and determining its orbital period (and decay) are described in *The Satellite Experimenter's Handbook*.

If you're interested in participating in CL-III, send an SASE to me for some orbital predictions for your QTH and a copy of the CL-III contest rules. After UO-9's demise is confirmed, the top ten predictors will receive suitable recognition in these pages, and a minor award. Happy vapor trails![10]

For more information on getting started on OSCAR and information on AMSAT membership and membership benefits, call AMSAT at 301-589-6062 or write: AMSAT, PO Box 27, Washington, DC 20044. Please include a business-size SASE.

Notes

[1]A military intelligence satellite thought to have cost the government at least $500 million (perhaps twice that) was recently launched by the space shuttle. Its launch weight was thought to be in the 10,000-pound range, making its per-pound cost about $50,000. Gold, at $450 per ounce, costs "only" $7,200 per pound, or about 1/7 that of the satellite.

[2]$400,000 cost divided by 40,000 orbits of operation equals $10 per orbit.

[3]Obviously, the photoreconnaissance satellite is more capable and complex, but its high operational cost per orbit helps place UO-9's cost in perspective. The ratio of $32,000 to $10 is 3200. 10 log 3200 = 35.

[4]M. Davidoff, *The Satellite Experimenter's Handbook*, (Newington: ARRL, 1984), p 8-6, Fig 8-6.

[5]A circular orbit may be thought of as a spiral wherein the degree of inward spiraling is some finite, positive value. In this sense, UO-9 (over the course of, say, 41,000 orbits) has spiraled in—on average—nearly 10 feet per orbit. It started off at 554 km, and is now at 430 km. Net change is −124 km, or −77 miles. Averaged over 41,000 orbits, that's a descent of 9.92 feet per orbit.

[6]The shape of the curve contained in the figure cited at note 4 reflects this nonlinear relation.

[7]Nonlinear in the same manner, and for the same fundamental reasons, the curve in the figure cited at note 4 is of higher order.

[8]Conversely, some long-term trends are coming to be better understood. The famous 11-year solar cycle—the length of which has actually varied from 7.3 to 17.1 years, yielding an average of 10.7—is now seen as more likely a 22-year cycle wherein solar magnetic poles reverse. Moreover, long-term cycles leading to dramatic, global climate changes are beginning to be discerned in the historic records dating to the late 17th century (see J. Lynch, "The Maunder Minimum," *QST*, Jul 1976, pp 24-26). We may see unprecedented high levels of solar activity in late 1989 if current trends are accurate indicators of future levels.

[9]The name *Chicken Little* derives from the children's story about the wily fox who convinces the dumb chickens to leave the safety of their roost on the ruse that the sky was falling. When UO-9 deorbits, the sky will, in a sense, be falling! Chicken Little I was held in June 1982 to predict the demise of the little Russian satellite ISKRA-2, which had been deployed from the Salyut-7 space station. Chicken Little II, held in September 1988, attempted to predict the demise of the huge Russian radar satellite, COSMOS 1900.

[10]Detailed technical information about UoSAT OSCAR 9, UoSAT OSCAR 11 and the upcoming Surrey OSCARs to be launched later this summer, may be obtained by writing to: UoSAT Spacecraft Engineering Research Unit, University of Surrey, Guildford, Surrey GU2 5XH, England.

Silent Keys

Administered by Nancy A. Slipski

It is with deep regret that we record the passing of these amateurs:

W1DAY, Alexander Burr, Jr, Kennebunk, ME
WB1DSN, Russell W. Foss, Hiram, ME
W1ETE, Gray Jensvold, Morrisville, VT
K1MED, Franklin M. Seiferth, Methuen, MA
W1QBC, Robert E. Dutcher, Fort Myers, FL
W1VCX, Edward J. Brennan, Maynard, MA
K1ZZN, Raymond J. Levesque, Somerset, MA
W2GTB, Warren A. Ford, Schenectady, NY
W2HCN, J. Walton Gangloff, Baldwin, NY
W2LRW, Marcel C. Reeds, Schenectady, NY
WA2MDN, Anthony Miller, Farmingdale, NY
WB2RDV, Joseph R. Wickland, Vincentown, NJ
WA2URP, William N. Meppen, Nassau, NY
W2YJR, John F. Lavigne, Wynantskill, NY
K2YRU, Lawrence P. Bengle, Rochester, NY
W3AFM, Paul D. Rockwell, Chevy Chase, MD
WB3BOD, Paul B. G. Twomey, Southbury, CT
K3GL, John L. Alline, Ft Myers, FL
K3HEI, Harold E. Reed, Pennsburg, PA
W3JHO, George C. Miller, Jr, Avalon, NJ
W3JLX, Norman F. MaCarthy, Ellicott City, MD
W3NHX, Louis D. Elliott, Feasterville, PA
W3OAW, Frank Palik, Kensington, MD
WA3UHA, Alvah R. Caldwell, Lewistown, PA
KV3V, Ray E. Markel, Gratz, PA
K3ZGO, Steven E. Carr, Gouldsboro, PA
K4AUL, David H. Bloch, Richmond, VA
K4BD, Justin Peterson, Hendersonville, NC
KB4BFQ, L. Edward Myers, Lake Placid, FL
WA4CCK, Warren L. Gibson, Nathalie, VA
W4DUK, George Vandenburg Ruos, Deerfield Beach, FL
K4HOE, Willard J. Zahalka, Frankfort, KY
W4JSM, Thomas A. Smith, Williamston, SC
N4KFT, Walden A. Brummel, Englewood, FL
WA4KGA, Charles Jones, Greenfield, OH
WA4KRA, Ashton Tyler, Englewood, FL
W4LKO, Herbert H. Stauss, Pinellas Park, FL
WB4ODR, Harvey L. Thomas, Gainesville, FL
K4QPI, Willa J. Bodycote, Sarasota, FL
K14QR, Herbert H. Price, Snow Hill, NC
WB4TCP, Alvin E. Pittman, New Bern, NC
*W5BW, Thomas W. Braidwood, Biloxi, MS
W5DDJ, Garth L. Johnson, Houston, TX
N5DD, J. P. Ashcraft, Dallas, TX
KB5FCA, John R. Harner, Albuquerque, NM
WD5FNL, Ruben Balko, Rockdale, TX
W5HFV, Raymond L. Nichols, Sand Springs, OK
KE5JQ, Emile C. Gibbons, Sr, Picayune, MS
W5LUN, Edgar F. Meyer, Dallas, TX
K5LVA, Jesse L. Bell, McAlester, OK
WA5MQU, Dodderidge C. Abernathy, Jr, Commerce, TX
W5UVM, Reynold O. Klemetti, Alameda, NM
WA5WDW, Eilene G. Spiegel, Irving, TX
W5YLL, William B. Thomas, Dallas, TX
WB6BFD, Waldo C. Nelson, Tujunga, CA
WD6BMT, Bill Williams, Arivaca, AZ
W6DGI, Elmer J. Sugars, Turlock, CA
WA6DXO, Everett W. Linscott, Modesto, CA
W6EAN, Herschel B. Calvert, Pasadena, CA
N6FOF, Raymond W. Traynor, Citrus Heights, CA
WA6FYX, Elmer W. Thayer, Canyondam, CA
KH6GJN, Charles N. Stem, Honolulu, HI
WA6HFW, Raymond L. Randolph, Bloomington, CA
W6HZJ, Russ Krebs, Fallbrook, CA
K6KWN, Charles F. Pfeiffer, Lake Almanor, CA
W6OGL, Hugh K. Graham, Bakersfield, CA
KB6OW, Edward H. Knowlton, Rolling Hills Estates, CA
KD6PP, Donald P. Krusen, Santee, CA
W6RTJ, Arthur A. McKiel, La Porte, IN
W6SOU, O. W. Richardson, Castro Valley, CA
W6TOC, Edgar S. Hussey, Calimesa, CA
KB6UCL, Gerald H. Waters, Santa Rosa, CA
NM6U, Thomas M. Kenney, Westwood, MA
N6UW, W. A. Winnegar, San Mateo, CA
WA6VKW, Bart Bernocco, Newbury Park, CA
W6WND, Edwin L. Winslow, Lancaster, CA
AJ6Y, Jean B. Ardman, Santa Maria, CA
K6YTO, James C. Crocker, Bodfish, CA
W6ZDB, Dennis Kiely, Covelo, CA
WA7CBN, Francis A. Bacon, Richland, WA
WB7CKX, Lavern J. Massee, Tucson, AZ
W7EGG, Archie F. Miller, Glendale, AZ
N7GCS, Thelma L. Huntley, Yuma, AZ
W7GSN, Mearl W. Buchanan, Okanogan, WA
W7INM, Emmett E. Eden, Joseph, OR
K7JS, Jean W. Seymour, Tucson, AZ
KA7PGD, Orton L. Steele, Sparks, NV
W8AMS, Albert H. Buch, Tawas City, MI
KA8AWY, Tony Castelletti, Euclid, OH
N8BZK, Joseph W. Curran, Vermilion, OH
W8CDW, Charles A. Kunkle, Waterford, MI
W8CPY, Leo J. Vachow, Mackinaw City, MI
W8END, Gordon F. Theisen, Taylor, MI
WB8FDI, Kasimer L. Wierzbicki, Redford Twnp, MI
KA8GOW, Frank O. Kruger, Benton Harbor, MI
W8PO, Eldon L. Heck, Shelby, OH
WA8QNC, Earl T. Gay, Novi, MI
WB8TSM, Willard W. Carson, Bath, NC
K8ZEU, Charles Duckett, Cincinnati, OH
W9SKR, George J. Vesely, Ingleside, IL
WBØBGG, Iver P. Wynnemer, Waseca, MN
KØCCK, Richard S. Kelvin, Olivette, MO
NØDTQ, R. E. Norris, Edina, MN
WØEXP, Charles E. McNeel, North Platte, NE
WØFWC, Arthur J. Holmberg, Roseville, MN
NØGTD, Francis B. Camilli, Denver, CO
WAØIXS, William A. Rokusek, Scotland, SD
WØKCW, Harry C. Hottle, Adrian, MO
WØLWG, George T. Vaughan, St Louis, MO
WØNN, Rue O'Neill, St Louis, MO
WØSCN, Paul F. Bauer, Colorado Springs, CO
G4CSB, Brian Silverman, London, England

*Life Member, ARRL

Notes: All Silent Key reports sent to HQ must include the name, address and call sign of the *reporter* as well as the name, address and call of the Silent Key in order to be listed in the column. Please allow several months for the listing to appear in *QST*.

In order to avoid unfortunate errors in the Silent Keys column, reports of Silent Keys are confirmed through acknowledgment only to the family of the deceased. Thus, those who report a Silent Key will not necessarily receive an acknowledgment from HQ. Canadian reports should be sent to the CRRL HQ address on page 9.

Many hams have remembered a Silent Key with a memorial contribution to the ARRL Foundation. Should you wish to make a contribution in a friend or relative's memory, you might designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund or for the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation, Inc, 225 Main St, Newington, CT 06111.

50 Years Ago

May, 1939

☐ This is the 25th anniversary of the League's founding, and *QST* commemorates with its first full-page photographic cover, a once-handsome ultra-audion receiver of early this century, complete with loose-coupler. Editor Warner recaps some of the highlights of our birth.

☐ Urgent aviation requirements have cut 2 Mc. from one v.h.f. band, leaving it only 112-114 Mc., but 56-60 and 224-230 Mc. are confirmed as amateur in the F.C.C.'s decision concerning the 30-300 Mc. study it has been conducting since 1936.

☐ "A Three-Element Rotary Beam for $16.61" pretty much sums up W7GBY's new antenna. Plumber's hardened copper tubing is used for the elements, and the entire structure is rotated from inside the shack by direct drive to a bevel gear on the supporting pole.

☐ W2AOE finds that the 954 acorn tube, while built primarily for v.h.f., works well in his pre-selector not only to reduce images, but improve signal-to-noise ratio even on 14 and 28 Mc.

☐ League directors are traveling to San Francisco for their annual meeting this year. Among several proposals for constitution and by-law amendments is one to pay directors $1000 per year! One reason for the journey is to visit W6USA at the S.F. World's Fair. (W2USA will be in operation later at the New York World's Fair.)

☐ *Velocity* modulation? Yep, Stanford University researchers have developed the "Klystron," whose innards change the speed of electrons in the stream, "bunching" them in clusters in conformity with applied modulation.

☐ No neutralization adjustments are needed in W6GNR's r.f. amplifier, even when changing bands. He wound the oscillator coil inside the amplifier tank, thus achieving inductive neutralization.

☐ As one goes higher in frequency, the input resistance of a tube drops rapidly. Technical Editor Grammer provides us some dope on what various types of tubes do to the gain and selectivity of tuned circuits at high frequencies.

☐ You can give your average modulation a boost and at the same time reduce the possibility of over-modulation by adding W6OGC's compressor circuit to your speech amplifier.

25 Years Ago

May, 1964

☐ This is the 50th anniversary of the League's founding, and *QST* commemorates with a cover drawing by artist Harry Hick, beautifully showing a typical ham layout of around 1914. Harry has contributed art (schematics *et al.*) to nearly every issue in the magazine's history.

☐ Former Presidents Herbert Hoover and Dwight Eisenhower are among many distinguished persons offering congratulations to the League on its accomplishments. The historical section highlights the 1927 international radio conference, where lack of support, and even suspicion of amateur activities by foreign governments, caused substantial cuts in our major bands. The newly formed International Amateur Radio Union, however, offers hope for better results at future conferences.

☐ Moderately priced v.h.f. transistors capable of handling appreciable amounts of power are becoming available, a development K2HXE uses to advantage in his all-transistor 50-Mc. station.

☐ The next Oscar satellite, due up later in the year, will be a translator rather than a simple beacon. W7SMC and W6HEK provide some advance dope on the capabilities of Oscar III and hints on how most effectively to communicate through it.

☐ Now that the ARRL Emergency Corps (primarily for local disaster communication) and the National Traffic System (for longer-haul coverage) have been combined into the Amateur Radio Public Service Corps, W1NJM informs us how the total system is organized and what it does, along with authority and traffic-flow charts.—*W1RW*

Las Vegas Sweepstakes Adventure

Two teenagers put Nevada on the map—1938 style.

By Ken Langenbeck, W4NW
9523 Narragansett Pl
Vienna, VA 22180

It was November 1938. The first weekend of the two-part Sweepstakes contest was over. I was discussing my results from the first SS weekend with my good friend Thompson McNeal, W6LDJ (now Silent Key), when he mentioned that neither of us had worked Nevada. It seemed a shame because Nevada was so near to our QTH in Southern California. After we had kicked that thought around for awhile, we realized that we had worked or heard very few Nevada hams in our four or five years of operation. So W6LDJ said, "Look, I have my car here. We could drive to Las Vegas in one day with no trouble, set up a station and operate the second SS weekend." It sounded like a great idea, even though neither of us had much money. We thought that it wouldn't cost much to drive over for a weekend. From that point on, we started planning on what equipment to take. We decided to take W6LDJ's TRF receiver, 100TH final and high-power supply, and my crystal-controlled exciter and small power supply. We had to round up the necessary antenna, guy wire, insulators and so on. We figured that it would all fit in the rumble seat of his Model A Ford.

On a Friday morning in mid-November, we took off for Las Vegas in W6LDJ's *SS Special* with a full load. We arrived late in the afternoon and started looking for a place to operate. In 1938, Las Vegas was not much of a town. After driving through the town (a trip of about three minutes and one stop sign), we located what seemed to be the only auto camp in town. We noted that it was adjacent to a large open field. We went in and talked to the owner and came to terms with him. We asked him if he objected to our putting up a large aerial in the open field behind the rear cabin. He said that he didn't care, but he gave us a funny look and asked what we were going to do. We could see that he was beginning to wonder about these two teenagers who had some strange ideas. We explained, in a vague way, that we were going to do some radio listening, and he accepted it. After a quick home-cooked dinner (I can't remember who opened the can of beans), we unpacked the rumble seat and set up the equipment. By pushing together two small tables, we created a rather efficient operating position.

Bright and early the next morning, we decided that the equipment was organized, but we had no antenna system yet. We drove around town until we found the Las Vegas Lumber Co. W6LDJ asked the manager if we could borrow two poles until Monday. Apparently they had never had that type of request before, but the manager asked us what poles we wanted. We looked around until we found a pair of 40-foot wooden poles that looked straight and solid and told the manager that these were the ones. Much to my amazement the man said, "Oh, that will be fine, boys." We loaded the poles on the *SS Special* so that they overhung the front and back by about 15 feet and drove slowly for the few blocks to the auto camp. We spent the next several hours erecting and guying the poles, stringing a 200-foot flat top and running the open-wire feeders to our new Zepp. We located the operating position next to the open door so as to have a nice feeder run. We hooked the antenna to a small antenna tuner and tried it out on 40-, 20- and 10-meter CW (15 wasn't opened for our use until the 50s). Low and behold, it loaded the final beautifully on all the bands.

It was now about an hour before the SS started, so we decided to try a little DXing while we waited. A few calls on 10 CW brought a 1938 version of a pileup, which consisted of several stations in Europe and Africa calling us at the same time, but on different frequencies. There was very little co-channel operation because most stations were crystal-controlled and the DX would often remain well inside the band while the Ws would operate near the edge. We had great fun providing a Nevada contact.

As the SS hour approached, we suddenly realized that we hadn't decided which call sign to use. W6LDJ decided that we should flip a coin, which we did, and he lost. He was a little bent out of shape, but he buckled under without any problem and we started the contest with CQ SS DE W6LVB/6 NEV. There was considerable response. We operated through the evening on 20 and 40, but later that night, calls were somewhat sparse. On Sunday, we added a number of contacts when 10 opened to the East Coast. We were a big hit on the air. Fortunately, for QRM sake, there were considerably fewer stations in the SS in 1938, since our receivers weren't as selective or stable as today's equipment.

While we were working away Sunday afternoon, I heard some noise in our antenna field and went out to investigate. We were apprehensive of being thrown out of the auto camp. I found the owner standing there looking at his hand. For some reason, he had run his hand down the Zepp feeders for about 30 feet. All of a sudden, his hand got very hot. I explained to him that it had to do with the receiver we were using. By this time I was positive we would be thrown out, but as it turned out the auto camp owner had a receiver problem. He said that he had bought a new broadcast radio on Friday. When it was first installed, it worked great, but the last two days he had been experiencing severe thumping sounds coming from the radio, as if it was going to jump off the table. The repairman wouldn't come out until Monday. He asked if I knew what was wrong. I sympathized with him, but explained that I knew very little about radio because I was so young. I did volunteer to go listen to his problem, and sure enough, there were decided thumping sounds just as he had said. I'm sure his problem was solved by Monday.

Heroes for the '38 SS—Thompson McNeal, W6LDJ, Kenny Langenbeck, W6LVB (now W4NW), and the *SS Special*, in which they took their portable set-up to Nevada. They made it possible for at least 290 contestants to work that elusive state. Many operators completed WAS, thanks to these gentlemen.

Early Monday morning, we loaded the antenna poles on the *SS Special* and returned them to the lumber yard. We thanked the manager for the use of his poles, and told him they had worked out very well and were obviously from very fine lumber. We returned to the auto camp and started loading things into the rumble seat when W6LDJ said, "You know, we have something very unique going on here, and we might want to send a picture of this setup in to *QST*." We stopped the loading operation, jumped in the Model A and started looking for a photographer. We found one at the only photo shop in Las Vegas. The owner agreed to come over and take some shots of our equipment. We explained that we had very little money left, so he agreed to take the pictures and mail the prints to us for $1.00. Since that would leave us enough money for gas on the return trip, we agreed to his offer. He then closed his shop, and we all went over for the picture taking. The result is shown here in a reprint from *QST* for April 1939.

We loaded the remaining equipment into the rumble seat and took off for home. Our big concern was that we had cut our classes on Friday and Monday. As it worked out, neither of us had any problem at school (we both used the old-time excuse of being ill).

We started receiving QSLs shortly after returning home. The plea for a Nevada confirmation for WAS was written all over most cards. We answered the cards and then decided to get dressed up and went into the backyard where a neighbor took a picture of the "Heroes of the '38 SS." We ended up with fond memories of our adventure in Las Vegas.

Results, 1988 ARRL November Sweepstakes

By Billy Lunt, KR1R
Contest Manager

Sweepstakes is one of the most fun and popular ARRL sponsored contests. It gives the US and Canadian hams a chance to work each other. SS is held on two different weekends, one for CW and the other for phone. The 1988 SS was held on Nov 7-9 (CW) and Nov 21-23 (phone).

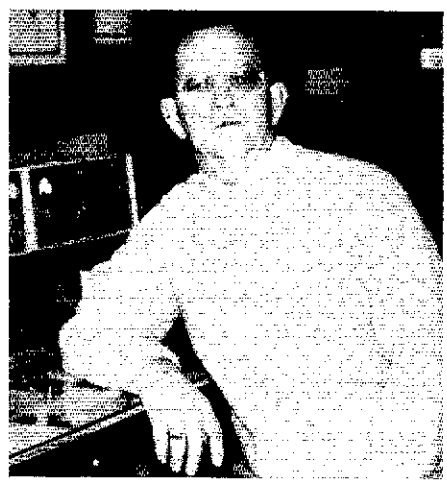
One of the fun things about SS that makes it so popular is saying hello to old friends in the midst of running stations. It is always a great pleasure to work familiar calls in a contest, and Sweepstakes contesters keep coming back year after year. Working old friends makes long contest hours seem to go by so quickly that we keep yearning for more. Leigh, N8LM, claims "This is the 50th anniversary of my first try at SS!" K9BB has been around even longer and is still having fun. Bob discloses, "It is lots of fun even after 53 years of operation. I am getting a little slower now that I am 69+ years young!" N6SJ still loves CW and expresses, "So nice to hear the hard-core CW regulars. I forget about these guys all year and then when I work each one in SS, it is like bumping into an old friend!" Gary, W1ECH, says, "It's always great to hear familiar calls year after year." With comments like these, it is easy to understand why SS is so popular.

Besides the friendly side of SS, there is the challenging side. John, K1NG, summed it up with, "What a high energy blast of excitement! Nonstop action resulted in a clean sweep after only seven hours." Working that last section for a clean sweep is a great feeling, but doing it for the very first time is even better. Marc, WA2S, divulged, "My first clean sweep! What a thrill! I have never had so much fun in a contest! The XYL and harmonics got in the act by keeping the pressure on to make more contacts. I am already making plans for improving next year's score."

Phone remains as the most popular mode again this year. HQ received 979 phone entries and 824 CW entries. Among the single ops, the low-power entry class (less than 150-W output) is the most popular choice. On CW, there were 463 A-class entries as opposed to 229 B-class entries and 86 Q-class entries. During the phone weekend, there were 568 A-class entries, 255 B-class entries and 53 Q-class entries. Multiop entries numbered 46 on CW and 103 on phone.

When all the brass pounding subsided and everything settled into place, KØRF (WØUA, op) was the clear single-operator high-power winner, scoring 176k points in the CW Sweepstakes. Tim, K3LR, was only 4k behind in second place with 172k points. W7NI (N6TR,op) was third with 170k points. In the low-power class (less than 150 watts), the battle was fierce with only a few points separating the top spots. KØEU edged out K4VX (WOØG, op) by only 1K for first-place low power. KV4FZ (N6OP) finished in third. In the second running of the new QRP class, Bill, KVØI, took top honors scoring 100k points. Les, KØSCM, was second with 99k points and Randy, AA2U, was third with 92k points. The crew at N4RJ slipped by K5CM for first-place multioperator. N4RJ scored 167k points and K5CM scored 163k points. NF7P was third with 161k points.

Taking advantage of the new Virgin Islands Section, KP2A (N2IC, op) easily moved into first place scoring 398k points in the phone Sweepstakes. West Coaster W7WA claimed second place with 332k points, and N6IG was third with 320k points. New Mexico's AA5B won first place in the low-power class with 254k points. Tom, K7RI, was 30k off the mark,



Ray, W5EW, handed out Louisiana multipliers.

Single Operator High Power Top Ten

CW		Phone	
Call	Score	Call	Score
KØRF (WØUA,op)	176,250	KP2A (N2IC,op)	398,088
K3LR	172,216	W7WA	332,424
W7NI (N6TR,op)	170,240	N6IG	320,720
N5AU (WN4KKN/5,op)	170,088	KØDD	319,808
N2IC	169,936	KI3V/7	315,096
WM5G (KRØY,op)	169,800	K6LL	301,720
N6IG	169,328	WM5G (KRØY,op)	296,856
WZ4F	168,112	WBØO	296,704
K6NA	166,744	W6GO (K3EST,op)	296,552
K5ZD	166,650	KØRF (WØUA,op)	295,944

Single Operator QRP Top Ten

CW		Phone	
Call	Score	Call	Score
KVØI	100,500	WØLSD	120,384
KØSCM	99,718	W5VGX	79,804
AA2U	92,850	KG5U	76,500
KE7X	90,150	WAØVBW	72,200
NM2L	89,688	W5PAA (WC5D,op)	66,120
K4VFY/5 (N4EVS,op)	89,644	KBØZQ	61,350
KØFRP	85,118	KB9S	61,056
W6IO	80,512	K1KNQ	59,472
W4MYA	78,292	KH6CP/1	58,380
KH6CP/1	70,004	KD2TT	55,380

Single Operator Low Power Top Ten

CW		Phone	
Call	Score	Call	Score
KØEU	145,950	AA5B	254,904
K4VX (WOØG,op)	144,900	K7RI	225,416
KV4FZ (N6OP,op)	144,892	KE5CV	214,776
W2GD	144,450	KØEU	211,432
K1CC	138,624	K7LXC	209,456
W2TZ	138,150	WBØIKN	201,400
K2ZJ	134,700	WO7Y	198,150
AA5B	134,250	WØCP	197,144
WØCP	133,304	AA4RX	185,744
K4XU/9	133,200	KØFRP	184,528

Multioperator Top Ten

CW		Phone	
Call	Score	Call	Score
N4RJ	167,352	W7EJ	318,440
K5CM	163,248	W7XR	282,872
NF7P	161,250	NK7U	254,904
WF5E	142,950	K1NG	243,504
N6VR	136,800	NIØE	241,376
N4EEB	132,608	K5RX	235,448
WDØT	130,950	K5CM	234,688
KØWA	130,832	KF6OG	232,712
WØAIH	128,896	K7MM	228,760
NY6C	125,400	W6UE	227,088

Affiliated Club Competition

Score	Scores	Entries	CW Winner	Phone Winner
Medium Category				
North Texas Contest Club	4,365,026	35	N5AU (WN4KKN,op)	WM5G (KRØY,op)
*Society of Midwest Contesters	3,987,030	50	AG9A	K4VX/Ø (WOØG,op)
Minnesota Wireless Assn	3,463,098	40	KØDD (KØKX,op)	KØOD
Murphy's Marauders	3,328,964	36	W1WEF	W1WEF
Potomac Valley Radio Club	3,114,624	41	W3LPL	N2FB/3
Yankee Clipper Contest Club	2,793,226	48	KD2RD	N6BV/1
*Mad River Radio Club	2,693,480	26	K3LR	N8CXX
*Texas DX Society	2,004,508	19	WB5BIR	NR5M
*Northern California Contest Club	1,944,044	18	N6BT (N6TV,op)	N6IG
Southern California Contest Club	1,525,864	13	K6NA	W6UQF
*Frankford Radio Club	1,260,578	15	W2GD	W3MA
Overlook Mountain ARC	1,219,670	11	WB2Q	WA2STM
Motor City Radio Club	1,196,882	50	W8UMP	KA8GOM
*Kansas City DX Club	835,316	9	KBØG	KBØG
*Western Washington DX Club	784,626	12	K7NW	KM7E
Grand Mesa Contesters	678,798	11	KJØG	KØGAS
South Jersey Radio Association	646,484	20	W2LYL	W2PAU
*Dixie DXers	610,416	5	K4BAI	K4BAI
*Willamette Valley DX Club	602,688	6	K5MM/7	K5MM/7
*Colorado Contest Conspiracy	598,758	3	KØEU	KØEU
*Salt City DX Assn	532,036	5	K2ZJ	WA2UUK
*Long Island Mobile ARC	461,150	9	N2AU	KS2G
*Eastern Iowa DX Assn	414,264	5	WØWP	WBØZKG
*Warminster ARC	395,524	15	KY3T	KA3SIO
Central Michigan ARC	387,310	14	W8TJQ	W8VPC
*Arkansas DX Assn	344,216	3	W9OBF	K5FUV
*Central Virginia Contest Club	336,244	3	K4BAM	W4MYA
*Hoosier Contest Club	305,002	7	W9RE (WA8YVR,op)	WB9CIF
*Farout ARC	296,976	4	WB8SVN	WB8X
*Penn Wireless Assn	217,328	3	K3TX	K3TX
Western New York DX Assn	202,062	6	W2RR (WB2YQH,op)	W2RR (WB2YQH ,op)
*Redwood Empire DX Assn	198,136	6	WA8LLY	WA8LLY
*Rowan ARS	197,302	7	W8UT	KJ4TI
Local Category				
River City Contesters	1,365,466	10	N6IG	W6GO (K3EST,op)
Rubber Circle Contest Club	1,111,962	6	KR7G	W7WA
New Mexico Big River Contesters	706,404	5	AA5B	AA5B
Calumet Amateur Radio Enthusiasts	485,838	6	KE9I	AJ9C
*Central Arizona DX Assn	457,220	4	KY7M	KC7V
*Rochester (NY) DX Assn	454,854	8	W2TZ	W2HPF
*Reading Radio Club	421,138	6	KS3F	K83F
Radio Club of Tacoma	356,210	7	W7LKG	W7LKG
Zygo ARC	294,004	6	W1ECH	W1ECH
*Western ARA	289,980	3	K7JA	K7JA
Ramapo Mountain ARC	273,816	5	NW2D	NW2D
*TRIAC	266,424	4		K3ZA
*Murgas ARC	253,932	7	WA3YON	WA3YON
*Fox River Radio League	245,568	3	WA9TPQ	WA9TPQ
*Northrop Radio Club	237,760	10	K6HRT	W6CN
Falmouth ARA	223,556	4	KA1IOR	K1BT
Utah Contest Club	220,890	3	W7MR	W7HS
West Park Radiops	199,714	9	W8IDM	WD8AJF
*Valley Radio Club of Eugene	178,382	6	K7DBV	AI7W
Ventura County ARC	174,054	3		WA6DJS
*Rip Van Winkle ARS	157,942	6	KW2D	KW2D (KC2KK,op)
*Schenectady ARA	153,588	4	WB2SPN	WB2EAR
*Gloucester Co ARC	145,938	3	K2HPV	N2ETJ
*SHY-WY Radio Club	143,656	3	N3AHA/7	N3AHA/7
*Tyler ARC	131,932	3		KD5GD
Burlington Co RC	130,078	7	WB2R	WA3RHW
Clark Co ARA	126,300	8		N9HAV
*Grant Co ARC	111,798	3		NX9T
Western Illinois ARC	108,008	3	N9JF	N9JF
*Crystal Radio Club	106,130	6	K2CIB	N2BJ
*Albany ARA	100,402	4	N2DU	N2DU
*Utica ARC	89,350	3	K2XU	K2IQ
Fresno ARC	89,232	5	KA6LAC	KA6LAC
*Columbia ARC	85,164	4	WF2G	WD4BHM
*Bolingbrook ARS	84,858	4	NA9I	N9DIX
*Rockford ARA	84,840	3		K9GH
Highland ARA	72,100	6		N8FSP
*Montcalm Area ARC	58,576	3	WA8QCW	KE8JW
*Hazel Park ARC	58,478	4		N8FPN
Naked Chicken Contest Club	54,940	3	KA1MIS	NUØX/1
*Radio Amateur Transmitting Society	26,110	3	W4AY (WA4ZZU,op)	W4AY (WA4ZZU,op)
Brooklyn Technical HS ARC	11,246	3		N2RQ

*Indicates that a list of eligible club members, as per the Club Competition Rules, was not received at HQ.

coming in second with a score of 225k. Mike, KE5CV, finished third with 214k points. Ken, WØLSD, ran away with top honors in the QRP class with 120k points. There were only 3k points separating second-and third-place QRP. W5VGX was second with 79k points, and KG5U was third with 76k points. In the multioperator class, W7EJ and crew scored 318k for first place and W7XR finished in second place with 282k points. NK7U was third with 254k points.

Affiliated Club Competition was prevalent as ever, boasting 75 clubs meeting the minimum requirement of having three log entries. There were no entries in the unlimited-club category this year. This was not a sign of low participation by any means. Generally, club scores were on an increase over last year's scores. The medium-club category had 33 different club entries for 1988. The North Texas Contest Club moved up one slot from last year to win the medium-club gavel this year. The Society of Midwest Contesters was close behind for second place. In the local-club category, the River City Contesters edged out last year's champs, the Rubber Circle Contest Club, for the local-club gavel. If your club has an asterisk before the name, your club did not send HQ a list of qualified members and entry class. HQ listed all clubs that turned in at least three entries this year. In the future, the clubs must meet the Club Competition Rules and Criteria which appear in January *QST*.

If participation and conditions keep improving as in the last few years, 1989 should be a record-breaking year! So spend the summer getting your equipment and antennas ready for next November. See ya then!

Bill, WBØO, gave many of us that ND multiplier.

SOAPBOX

CW

VE8 spells relief! (W1WEF). I blew up the amplifier Sunday morning. My score suffered as a result (K1XA). The secret to a good score is get everyone else out of the house, take the phones off the hook and then only Murphy can interrupt you. The secret to a better-than-good score on CW is a narrow filter. Absolutely the most fun I have had in contesting yet! (KA1IOR). Not many points, but a great success since I picked up three of the last states I needed for We the People Worked All States (W1IMQ). Missed VT for the second year in a row. Is it time for a SSexpedition? I missed VE8 this time and heard many others saying they didn't find one either (N1CC). FB contest! Excellent conditions! Although I was only able to spend eight hours in the contest for physical reasons, the eight sections I missed were never even heard! Where were all the W6s? (W2DW). New and improved conditions make it a whole new ball game! (KD2RD). This was first SS after 18 years of ham radio. I found it difficult to build up speed with my long call sign combined with the exchange (WB2AMU). Low power is a real challenge! (W2GD). I had a great time! It was the first time that I tried seriously in a contest. I made some mistakes. I have to get a better dupe-checking process for the next contest (NS2K). This was my first SS, and I had a great time! I am already looking forward to the 1989 Sweepstakes (WF2W). Every year the contest gets better. I made new highs in QSOs, sections and score. First WAS in a contest! Also was my first full 24-hour participation. Now if I only had 10-and 15-meter beams, a kW, computer, etc, etc... (N2EY). This was my first SS, and I really enjoyed it! See you next year with a much higher score (KA3SIO). I had to work Sunday, so I could only put in a part-time effort. I can't believe it. I missed VT, PR and AB, but I worked my usual toughies—SJV and VE8

CW Division Leaders

Division	High Power	Low Power	QRP	Multioperator
Atlantic	K3LR	W2TZ	NM2L	WB2PSI
Central	AG9A	K4XU/9	N9NE	WØAIH
Dakota	KØDD (KØKX,op)	WØUC	WØYHE	WDØT
Delta	AA4DO	K5GO	K4VFY/5 (N4EVS,op)	WC5N
Great Lakes	KW8N	K8BL	W8IDM	W8EDU
Hudson	KZ2S	W2GD	AA2U	K2GQ
Midwest	KBØG	K4VX (WOØG,op)	KVØI	KØWA
New England	W1WEF	K1CC	KH6CP/1	W1OP
Northwestern	W7NI (N6TR,op)	W7YAQ	KE7X	KE7C
Pacific	N6IG	N6SJ	W6IO	NF7P
Rocky Mountain	KØRF (WØUA,op)	KØEU	KFRP	W7MR
Roanoke	K4PQL	N4AA	W4MYA	K4IX
Southeastern	WZ4F	KV4FZ (N6OP,op)	K4MF	N4RJ
Southwestern	K6NA	NE6I	KD7E	N6VR
West Gulf	N5AU (WN4KKN/5,op)	N4DW	AC5K	K5CM
Canada	VE7CC	VE7ARQ	VE3OOL	VE3ART

Phone Division Leaders

Division	High Power	Low Power	QRP	Multioperator
Atlantic	N2FB/3	KZ2I	N8NA	K2ZJ
Central	KS9O	AJ9C	KB9S	WØAIH
Dakota	KØDD	ACØW	KBØZQ	WØMXW
Delta	W5WMU	K5FUV	K5KLA	N4TG
Great Lakes	AI8D	AA4RX	N8EIH	N8EKE
Hudson	K8HVT/2	KS2G	KD2TT	KZ2S
Midwest	K4VX/Ø (WOØG,op)	KVØI	WAØVBW	ABØS
New England	N6BV/1	K1VSJ	K1KNQ	K1NG
Northwestern	W7WA	K7RI	N7ICC	W7EJ
Pacific	N6IG	ND7M	KB6LEI	W6BIP
Rocky Mountain	KØRF (WØUA,op)	AA5B	WØLSD	NIØE
Roanoke	KX3Q	N4AA	AA4YZ	AA4NC
Southeastern	KP2A (N2IC,op)	KC4ZV	K4VFY (N4EVS,op)	W4AQL
Southwestern	K6LL	N6HC	W6CN	KF6OG
West Gulf	WM5G (KRØY,op)	KE5CV	W5VGX	K5RX
Canada	VE7SV	VE4GV	VE7EKS	VE5FN

(WB2EKK). Not only did I pick up the two states that I needed for WAS with QRP, I worked all 50 states during the SS (WA8MCQ). It took 35 years of continuous entry in the Sweepstakes to get this close to a clean sweep, and I still cannot find a VE8! I even worked one from my mobile last year but can't work one in the contest. Is it really a valid multiplier? (W3HDH). Not much activity in the Novice subbands (N3GLK). When I heard W1OP's check of 19, I almost told him I needed the last two digits of the year! (KA7LKV). Sweep! (N4AA). It was real nice to work W2KWW with a check of 32; then along came W7NQ with a check of 29! (WA3SSB). I couldn't believe that I could work 74 of the 76 sections with a trap dipole only 14 ft off the ground! (K9BB/4). Oh well, missed VE8! (KØEJ). I enjoyed the contest, but CW activity seems to be declining, much to my dismay! (K4LTA). Sweep! (AA4UJ). Clean sweep! (W4YE). VT, VT...my linear for VT! (KX4V). Being the first-ever entry from the VI Section was a novel experience (KV4FZ). Where was all the activity? The bands were great! (KRØY). Worked all but VE8! (N5AW). Enjoyed it! Go North Texas Contest Club! I blew the power supply in my TS-930. I hope to be back on the air by the SSB weekend. See you again next year (W5FO). This can really be fun! Now, if I could just get VCRs outlawed, then just maybe...(KC5M). Snagged VE8AW for my sweep with 12 minutes to spare (K7JA). The local prohibition of outside antennas limits me to an indoor trap dipole. This resulted in a decreased QSO rate. SS is still my favorite contest (K6MP). I heard that the VE8 was on for the last 15 minutes of the contest (N6VR). I had a 40% better score than last year. I never heard VT, PR or VE8. This is my absolute favorite contest. CU in '89 (W6MVW). Where were the crowds on Sunday? (W6JTI). Where was everybody? (N6IG). Band conditions were pretty good but it seemed that participation was down. This was my first time using a C-64 for real-time logging and it worked real good. At 72 years of age, I need all the help I can get! (K6SG). This was my first QRP effort—ears hurt, headache, feel ill, had fun! The conditions were absolutely FB. Not any QRP station I worked was less than 569 (KD7E). This was not a full effort. My brother was in town from the Army (NC7K). This was my first November Sweepstakes. I know my score might not seem very good, but I think I worked every Novice and Technician in the contest (N7KPR/T). Maybe my call is too long. It can't possibly be the operator! Can it? (WA7RKJ). I can't take it anymore! This is my last year SS...until next year (N4SL). It sure was great to hear the higher bands come to life again. I bet we will see some new contest records in the next few years (KB8FJ). Everyone in PR must have been on the beach looking at YLs instead of looking for me! I missed PR for a clean Sweep (K9UIY). Thanks for the great contest. I wish I had more time to operate (KG9N). Where was PR? (W9EBY). Good to see all my friends again. CU next year (W9JOO). Can I have an extra multiplier for YL interference? (N9CIQ). Next year, I am going to try high power. The year after that maybe QRP! It is really tough to get through the QRM without at least some punch. But I did work 49 states in less than one day, so all was not lost. CU next year (NI9C). All my QSOs were made on 15 meters using low power and an indoor dipole. My good-ears award goes to WØEJ, who was the only station that could hear me on backscatter (NØBSH/9). Those long Sundays get pretty tough for us old guys (WØUA). I had to catch a plane at 2300Z Sunday. I missed the last few hours (KØFRP). I was enjoying the contest until evening, when I switched to my 40-meter dipole only to find that the wind had tangled it around one of the guy wires on the tower. I switched to 80 meters, and that caused so much TVI that I thought my family was going to shoot me. I retired for the night. Still had fun and I am looking forward to next year (NOØZ). This was my first SS in 21 years! The format was different, but the fun was the same! (WAØOUI). We all had a great time! Thanks to Tim and Chip at Turtle River State Park for accommodating us on our ND SSexpedition. The B1B bomber flying over from a local air base was a real bonus (NV9C).

Phone

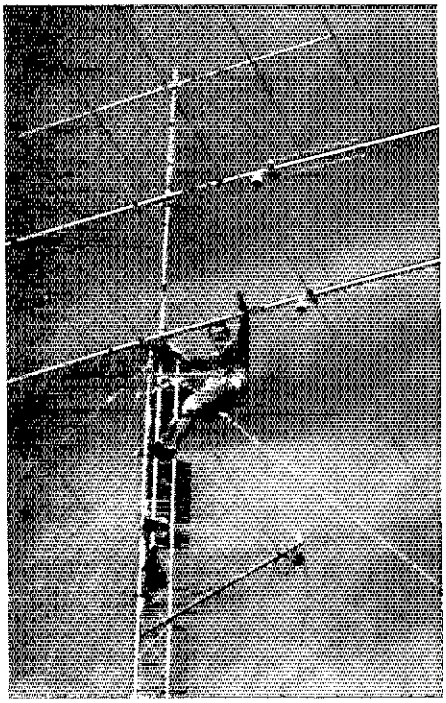
There was terrible rain static Sunday and strange conditions (W1WEF). Eighty-meter wire was just not enough for all bands. I couldn't get through to K6GSS/KH6 on 10 for the final section (W1ECH). This is a completely different contest from the East Coast! (N6BV/1). Thank goodness for 10 meters. The last time I had a clean sweep was when 10 was wide open a few years ago (KQ1V). I enjoyed working W6BIP (60 years as a ham) just after his 73rd birthday. Isn't that a wonderful ham career! (AD1Z). We got our second straight clean sweep, although it wasn't easy. The rotator control box quit on Sunday morning, and the printer needed a new ribbon during a string of contacts. The control box was fixed and spare ribbons were on hand. The PTT foot switch broke apart, but we still managed to work our 76th section (VE8) with a few hours to spare. The pressure is on for the hat-trick clean sweep (WB1GEX). I was very disappointed at the inability to run stations. I had to search and pounce. Next year, hopefully, it will be better. Twenty died at 8 PM local time, and I couldn't find a clear spot on 75 (KT2D/1). Thanks for initiating the QRP group. I had a ball in the few hours available to me! Worked everyone I heard except a KL7. Next year I'll have a computer for dupes. I spent too much time checking to see if I'd worked someone! I had dozens of unsolicited FB signal reports before I announced the Q power. It was very satisfying. If only others knew what QRP can do! (KT1H). I made a big gamble by starting out on 10 meters. Normally 10 is a bad place to start in the northeast at 2100Z. Four hours later, after 400 QSOs, I knew I made the right choice (WB2JSJ). Almost everyone asked for a repeat on our check and said, "You don't sound old." We aren't, but our club is—1916. People should believe their ears, not their minds (K2AA). I had all but given up finding VE8. Then, 20 minutes before the end of the contest, I heard VE8DX call WB5BIR and give him #1. BIR was kind enough to let me use his frequency, and I received #2 from VE8DX for my sweep. BIR, I owe you one! (K8HVT/2). This was my first venture into the SS contest. I enjoyed the experience, and I am already planning antenna improvements to do better next year (KE2JJ). We were not sure what our check was, but after finding some old SS logs, we decided on 1922. We later found our club charter dated 1919. No one believed our 22 check. I'm not sure what to expect next year using 19! (W2SZ). Last year I bounced one baby on my knee while I operated SS. This year I bounced two. I'd better give up contests before next year's SS (WA2YEI). Multiop + logging software = more Qs (KD2RD). This was the best contest ever for me. I finally broke the 1k contact barrier! Computers are great for logging and dupe checking. However, they forget if the power goes out, like it did twice during the contest. Next contest I'll save more often to avoid having to reinput contacts lost in RAM (KC7KU). I'm glad this wasn't Field Day. We had an inch of rain on Saturday alone. My mini quad was soaked and did not work on 20 meters. It worked fine on 15. The next day we had another inch of rain. Now it works on 20 meters, but not 15... you figure it out! (WB2AZE). I operated less than half as many hours as last year plus had a new Explorer 14 antenna. I got the same score as last year. How did I ever get along without a beam? As always, it was nice to run into old friends (N2ETJ). When WB5BIR asked, ARE YOU HAVING FUN? I answered, I SURE AM! (KB2EMZ). Great contest! Hope to be back next year with a tower and a bigger antenna, as well as more hours to operate (KV3U). I enjoyed my first SS. See you next year (KA3SIO). Fastest sweep I can remember (K3WW). Although I gave my precedence as B, I never did turn on the amplifier, hoping to avoid a TVI problem. It didn't work. I still got into the neighbor's hi-fi and only got to work eight hours (KY3T). Okay, who hid Puerto Rico?

Randy, K5ZD, battled it out with fellow WPA contester K3LR on CW. Both made the Top Ten.

(WB2EKK). I could only work 16 hours this year. A storm came up Sunday afternoon with gusts up to 60 mi/h. I had to crank the tower down and terminate operations. I almost doubled last year's effort. It was a great contest (KA3ROX). Three years of trying, and finally, a sweep! Getting the AK and PAC sections in the first hour sure took some of the pressure off. The guys at VY1 QST are to be congratulated. First time I've ever heard a YU/NWT station calling CQ during the Sweeps (AA4LR). There were great band conditions. The Novice activity on 10 meters and contesting tips from the *NCJ* helped to make this my most enjoyable SS ever! (AA4RX). Doesn't anyone keep a dupe sheet anymore? I had 130+ dupes. I ran most of the time so most of the dupes were the cause of the other station. A station sent me a #1 (which I copied plainly) and he was a dupe! It was a good contest! I'll be back next year! (K4XS). It was an excellent contest. Thanks for a good time (WA4GNR). I was back in SC for the phone SS. I operated in the QRP category and worked all of the hard ones (KH6, KL7, VE8) and only had to call a few times. On the other hand, I missed most of VE-land plus AL and MS. Those darn sunspots (KJ4KB). A great contest. There were lots of stations and good band conditions. My score was about double my last year's score, and I had less time to work the contest (WA4VQD). I was surprised at the large number of 4-digit calls worked in the Novice/Tech portion of 10 meters! (W4JM). This was my first real contest. I had a lot of fun during CW and phone. Looking forward to next November. I couldn't believe I worked all 76 sections (N4QYK). I finally was able to work the last two states I needed for WAS! I didn't expect to have a real big score since I was limited on time. Maybe next year (N4SMB). The electricity went out at 1830Z Saturday due to a thunderstorm. I had to start the contest using a generator and 100-W output until the electricity came back on at 2137Z! (KRØY). Thanks for a good contest (WB5J). Great contest! I wish it could happen every weekend (N5JWL). Wow! 1323 QSOs on 10 meters! Thank you, Novices (N6IG). Clean sweep! (WB6JJE). In about 30 years of SS contests, this was the first time I ran

A view of Randy's (KØEU) shack and antennas that he used to win 1st place Low Power Phone.

a kW. My QSO-per-hour rate was about double. It was nice to catch VY1CM on 10 meters late in the contest for my last section (W6JVA). At age 72, I still enjoy contesting and SS is my favorite. I can't remember when I first entered SS. Why not a little recognition for the old-timers? The check tells the story except for club stations. I can't say enough about my DVK-100 digital voice keyer. It kept me from losing my voice (K6SG). This was my best SS effort. Nevada was well represented this year. I had my sweep with 7 hours left. It was just pure fun after that. Thanks to N8II for WV, my last section (NC7K). Why do I always get the difficult sections and miss the easy ones? I guess I will have to stay up later next year (NS7O). Where was Maine? I missed it two years in a row (KE8KG). Between football, beer, pool and food, we managed to get a clean sweep. It was the first time in several years (WA6EZV/8). I do not contest often, but had a ball for the eight hours I could spare (N8FXH). This was my first clean sweep ever! (N9AEJ). A



clean sweep with a trap dipole is tough! (KY9W). I went to bed at 0930 and set the alarm for 1130. I didn't wake up until 1530. I lost my last four hours! (KØFRP). This was my first entry in SS. The 24 hours seems like a long time when single op! (AF9T). I went to bed Sunday morning with 75 mults. I didn't get the sweep until the last 25 minutes of the contest. Great fun (KMØL). Only the top US ops knew what a real horse race this was—the great '88 shoot out! (KØDD). Finally, a clean sweep! (VE6NN).

Scores

CW scores are listed first, followed by phone. Within each call area, scores are listed by ARRL sections. Within each section, single operator scores listed first in decending numerical order, followed by multioperator scores. Each line score lists call sign, final score, number of QSOs, number of sect worked, hours operated and output power used (A = 150 watts or less, B = more than 150 watts, Q = 5 watts or less). Example in Connecticut, W1V worked 983 stations in 76 sections for a final score of 149,416 points. He operated for 24 hours and used more than 150 watts.

CW

1

Connecticut

W1WEF	149,416	983	76	24	B
K1CC	138,624	912	76	24	A
K1XA	124,950	833	75	23	B
K1TO	121,800	812	75	15	B
K1WB	101,952	708	72	24	A
K1YRP	101,672	716	71	23	A
K1IN	97,920	670	73	17	B
W1ECH	92,400	816	75	22	A
KG1D	70,416	488	72	12	B
KH8CP/1	70,004	473	74	24	Q
K1RM	65,088	452	72	7	B
N8RA	53,568	372	72	14	B
N1JW	51,830	355	73	14	A
KA1MWX	37,788	282	67	18	A
W1BIH	30,222	207	73	4	B
WA1FCN	26,760	223	60	5	A
K1NYK	21,728	194	56	5	A
W1TKG	17,920	160	56	11	A
N4XR	15,840	120	66	24	B
K1BV	15,794	149	53	3	B
NC1E	12,512	136	46	4	B
K1KI	10,500	150	35	2	B
KA1JAN	9,680	105	46	4	A
WA3VIL	9,212	98	47	8	A
KA1SAG	3,700	50	37	24	A
KA1CV	3,472	56	31	18	Q
KA1RPQ/N	1,188	27	22	12	A
KA1MIS/T	160	10	8	3	A
NJ2L (+K1TO)	72,668	491	74	11	B

Eastern Massachusetts

W2SC	118,400	800	74	23	A
KA1IOR	91,800	612	75	24	B
W1FM	82,218	579	71	18	A
WA1OLV	72,988	514	71	20	A
K1BT	67,488	456	74	17	A
W1KEE	66,896	452	74	23	A
K1NTR	65,262	447	73	14	A
KT2E	64,610	455	71	15	A
KB1VL	40,460	289	70	15	A
N1DC	37,240	266	70	16	A
W1MJ	35,488	257	69	10	Q
KQ1F	35,088	258	68	11	A
N1IR (WA3ZTW,op)	34,170	255	67	8	B
AD1Z	30,552	228	67	13	A
N1RC	28,908	219	66	8	A
K1OM	28,200	235	60	12	A
W1AX	24,800	200	62	3	B
K1SEC	17,952	176	51	5	A
K1XM	17,202	141	61	3	A
W1TUM	7,224	84	43	7	A
W1SR	6,888	76	44	4	A
W1IMQ	6,210	69	45	17	A
N1EDM	6,084	78	39	4	A
K2PNK	4,480	84	35	4	A
W1PLJ	3,712	58	32	5	B
W1BK	1,120	28	20	6	A

Maine

KX1E	75,210	545	69	21	A
K1BZ (N1ATN,op)	42,380	326	65	12	A
K1MZB	32,696	288	61	5	B
N1AFC	21,720	181	60	17	Q
KA1ZX	13,320	111	60	24	A

New Hampshire

N1ELN	108,770	745	73	24	A
K1AR	87,468	591	74	10	B
KC1F	59,200	400	74	9	A
KK1E	50,112	348	72	12	A
KB1T	29,036	238	61	10	B
K1TR	25,978	191	68	4	A
AC1J	1,496	34	22	2	A
K1OSM (+K1IM)	45,640	326	70	14	A

Rhode Island

KM1X	118,992	804	74	24	B
K1IU	82,656	574	72	13	B
K6IM/1	54,020	370	73	20	B
K1VSJ	46,718	329	71	12	A
KD2SX/1	41,942	313	67	7	B
K2MN	16,940	154	55	7	A
KA1DNB	11,236	106	53	8	A
W1RFQ	8,450	65	55	8	A
W1OP (K1DS,KA1RSH,N1AKO,W1GS,ops)	74,382	539	69	19	B

Vermont

WA1GUV	19,116	177	54	6	Q

Western Massachusetts

KZ1M	110,084	754	73	24	B
KB1W	100,500	670	75	14	A
K1FIR	3,720	60	31	3	B

2

Eastern New York

WB2Q	149,700	998	75	24	B
K8HVT/2	126,600	844	75	24	B
N1CC	118,104	798	74	23	B
N2AZS	114,450	763	75	23	A
WA2STM	107,850	719	75	20	A
W2JU	100,950	673	75	20	B
N2HIF	70,650	471	75	13	A
N2DU	47,286	333	71	17	A
KW2D	46,576	328	71	17	A
NW2J	41,676	302	69	10	A
AA2Y	39,438	313	63	17	A
W2DW	32,640	240	68	8	A
WE2G	26,352	183	72	12	A
W2NRD	22,644	153	74	15	A
WA2CJY	9,512	118	41	4	A
WB2SPN	8,528	104	41		
KD2IX	7,728	92	42	1	
WD2K	3,980	60	33	1	
K2CIB	2,352	42	28		
KB2EMB	1,520	40	19	1	

NYC—Long Island

KC2AG	133,780	880	76	2	
KD2RD	125,400	836	75	2	
N2AU	105,750	705	75	2	
N2MG	99,308	671	74	2	
KC2FD	92,304	641	72	2	
WB2AMU	48,960	340	72	2	
W2KTF	27,264	213	64		
W2DX	26,390	203	65		
K2HVN	9,800	70	70		
K2YGM	9,522	69	69		
WD2R	3,172	61	26		

Northern New Jersey

KZ2S	154,800	1032	75	2	
W2GD	144,450	963	75	2	
W2RQ	110,400	736	75	2	
AA2U	92,850	619	75	2	
NW2D	91,980	605	76	2	
NS2K	79,620	560	71	2	
WA2S	73,416	483	76	2	
W2HCA	48,300	322	75	1	
KT2D	42,432	312	68	1	
W2KWW	29,670	215	69	1	
N2HDY	23,936	187	64	2	

N4E 23,010- 177- 65- 7- A
I2J 21,720- 181- 60- 5- A
2TI 19,910- 181- 55- 6- A
A2UDT 19,152- 152- 83- 7- B
A8QOA/2 17,024- 152- 56- 12- A
VX 9,352- 87- 48- 2- A
2JEK 4,070- 55- 37- 5- Q
GE (K2FD,op) 3,456- 72- 24- 6- A
IEH 1,536- 32- 24- 10- A
GQ (W2QR,WA2NXW,WB2JBZ,WF2O,
3FKX,ops) 15,370- 145- 53- 14- A

outhern New Jersey

2MM 105,000- 700- 75- 22- A
I2E 104,784- 708- 74- 23- B
2LYL 96,064- 632- 76- 20- A
A2VYA 93,024- 612- 76- 24- A
2BOP 88,622- 607- 73- 20- B
5KI 66,900- 446- 75- 21- A
2PAU 53,874- 369- 73- 12- B
OSV 46,480- 332- 70- 17- B
2GZL 44,530- 305- 73- 10- O
B2DIN 42,884- 302- 71- 14- B
HPV 38,780- 277- 70- 13- Q
32R 35,496- 261- 66- 18- A
2TA 32,818- 259- 61- 12- A
EZ 24,544- 208- 59- 15- A
BELJ 17,820- 162- 55- 9- A
2GUW 14,688- 136- 54- 6- A
KED (WB2YOF,op) 13,208- 127- 52- 7- A
BCF 12,240- 120- 51- 5- A
TD 8,514- 99- 43- 3- A
2EA 3,600- 60- 30- 3- A
NU (+WA2IUO) 112,568- 771- 73- 24- B

estern New York

RTZ 138,150- 921- 75- 24- A
ZJ 134,700- 898- 75- 24- A
I2O 93,586- 641- 73- 23- B
I2L 89,668- 808- 74- 24- Q
V2J 83,028- 561- 74- 22- B
MQY 74,592- 504- 74- 21- A
F2W 66,528- 462- 72- 22- A
RR (WB2YQH,op) 84,080- 445- 72- 18- B
A2EYA 55,200- 400- 69- 20- A
UNR 52,080- 372- 70- 10- B
PHPF 47,886- 347- 69- 8- B
GU 40,896- 284- 72- 13- A
I2J 38,448- 267- 72- 17- B
FR 36,680- 262- 70- 8- A
2YP 21,700- 175- 62- 14- A
V2I 18,724- 151- 82- 16- Q
EMTA 10,600- 100- 53- 12- A
XU 10,074- 73- 69- 5- A
OMV 7,680- 96- 40- 6- A
2B 7,200- 60- 60- 6- A
A2ABD 4,810- 65- 37- 1- B
PHG 4,366- 58- 37- 2- B
2PSI (K2s MP,OS,KD2OM,KE2CP,
2AV,WA2s AUY,DHS,IKC,ZKD,ZQN,
B2s KAO,QCJ,ops) 117,344- 772- 76- 24- B
B (+K2ZR) 78,144- 528- 74- 24- B

laware

NA 129,808- 854- 76- 24- B
WUW 111,568- 734- 76- 22- B
5G 52,560- 360- 73- 16- B
HBP 33,184- 244- 68- 8- A

stern Pennsylvania

3B 117,600- 784- 75- 24- B
3F 104,880- 690- 76- 21- B
NW 95,460- 646- 74- 20- A
MQH 91,732- 646- 71- 24- A
3M 88,920- 588- 76- 23- A
3JLD 81,992- 554- 74- 22- A
EY 79,776- 554- 72- 24- A
TX 76,160- 544- 70- 24- B
3M 50,304- 393- 64- 16- A
3T 49,348- 338- 73- 18- B
3SIO 47,740- 341- 70- 9- B
3YON 46,860- 330- 71- 19- A
3RTY 43,746- 317- 69- 21- A
3UK 28,080- 230- 61- 12- B
3Z 25,350- 195- 65- 14- A
3N 24,360- 203- 60- 11- A
3I 18,544- 152- 61- 9- A
3OYH 14,308- 146- 49- 12- A
/W 13,328- 119- 56- 24- Q
CEI 11,760- 120- 49- 8- A
3KXM 10,406- 121- 43- 12- A
3G 10,028- 109- 46- 7- A
3Z 9,900- 99- 50- 9- Q
3GC 9,212- 98- 47- 15- A
CZB 4,366- 59- 37- 5- A
/W (+NET) 46,324- 313- 74- 11- B
3ESR (+K3USV) 41,580- 330- 63- 13- A
3D (+WB3IGS) 11,040- 120- 46- 9- A

ryland—DC

LPL 163,096- 1073- 76- 24- B
3Q 141,450- 943- 75- 24- B
1G 138,000- 920- 75- 24- B
TM 103,514- 709- 73- 24- A
2FKK 88,644- 614- 73- 13- B
GN 88,488- 569- 76- 19- B
HVQ 49,680- 360- 69- 13- B
GA 42,000- 300- 70- 8- B
8MCQ 39,900- 266- 75- 17- Q

WB3BRF 34,920- 291- 60- 9- A
K3DJ 21,384- 198- 54- 5- A
W3CPB 4,680- 60- 39- 8- A
WA3GYW 1,968- 41- 24- 4- Q
W3FOF 1,364- 31- 22- 5- B
WB3JRU (+KC3AJ) 17,556- 154- 57- 4- A

Western Pennsylvania

K3LR 172,216- 1133- 76- 24- B
K3ZO 166,650- 1111- 75- 24- B
K3TUP (K3UA,op) 162,600- 1084- 75- 24- B
KA3MMM 65,262- 447- 73- 24- A
W3HDH 39,450- 263- 75- 8- A
N3EQF 26,850- 205- 65- 10- B
NJ3K 21,700- 175- 62- 14- A
N3GLK 2 1- 1- 1- B

4

Alabama

WZ4F 188,112- 1106- 76- 24- B
KC4ZV 110,960- 730- 76- 23- A
NB9P 39,192- 276- 71- 12- A

Georgia

K4BAI 140,904- 927- 76- 24- B
N8LM 76,608- 532- 72- 21- A
W4GOG 69,696- 484- 72- 17- A
AA4VD 68,550- 457- 75- 18- A
WB4UIH 64,084- 433- 74- 19- A
K3PI 62,488- 428- 73- 24- Q
AB4FX 56,304- 391- 72- 24- A
KB4GID 55,500- 370- 75- 23- Q
KA7LKV 41,072- 302- 68- 16- Q
N4CXF 40,602- 303- 67- 17- A
ND1J 26,780- 206- 65- 23- Q
KI4Y 17,820- 135- 66- 8- A
N4RJ (+KM9P) 167,352- 1101- 76- 24- B

Kentucky

WM4T (KU8E,op) 147,556- 997- 74- 24- B
N4XM 108,336- 732- 74- 24- B
K4FU 102,600- 684- 75- 23- A
KC4WQ 30,958- 623- 73- 21- A
N1WR 83,768- 566- 74- 24- A
N4OGW 82,350- 549- 75- 20- A
WB4FOT 76,650- 525- 73- 20- A
N4TY 41,138- 307- 67- 6- B

North Carolina

K4POL 146,100- 974- 75- 24- B
AA4NC 139,050- 927- 75- 23- B
K8AC 126,150- 841- 75- 24- B
N4AA 113,088- 744- 76- 23- A
WA4FFW 97,800- 652- 75- 23- A
K4JEX 93,600- 624- 75- 19- A
W8UT 52,360- 385- 68- 15- A
NK4Q 38,924- 263- 74- 21- Q
KY2P/4 36,852- 249- 74- 9- A
WB6M 33,660- 306- 55- 12- A
N4MPO 9,180- 85- 54- 10- A
NJ4R 5,390- 77- 35- 8- A
N4QVM 612- 18- 17- 17- A

Northern Florida

N4WW (KØLUZ,op) 160,200- 1068- 76- 24- B
WC4E 130,568- 859- 76- 24- A
K4XS 129,908- 871- 74- 24- A
W4RVU 59,888- 352- 72- 16- A
NX4N 50,646- 367- 69- 6- B
WA4SSB 44,020- 310- 71- 12- A
K9BB/4 43,512- 294- 74- 15- A
K4VRT 34,048- 265- 64- 12- A
WD4IIO 32,912- 242- 68- 9- A
WB8PAF 29,140- 235- 62- 17- O
W2SHM 21,960- 180- 61- 6- B
N4EEB (+KB4T,K8SR) 130,950- 873- 75- 24- B

Puerto Rico

WP4FMH 29,168- 239- 61- 13- A
NP4XM 9,360- 104- 45- 15- A

South Carolina

KØEJ 121,500- 810- 75- 22- B
K4PYM 20,952- 194- 54- 8- A
W6OKX/4 6,330- 85- 49- 4- A
WF2G 6,478- 79- 41- 7- A

Southern Florida

N4BP 152,608- 1004- 76- 24- B
WD4AHZ 85,200- 568- 75- 24- A
K4MF 69,856- 472- 74- 19- Q
K1TN/4 67,340- 455- 74- 16- A
WB9OEP 26,524- 208- 64- 10- A
KK4DK 24,552- 198- 62- 17- A
W1UCI/4 17,700- 150- 59- 15- A
W4YN 3,400- 50- 34- 3- A
KO4D 1,650- 33- 25- 2- B

Tennessee

AA4DO 138,778- 913- 76- 24- B
K4LTA 136,800- 912- 75- 24- B
N4IR 106,704- 702- 76- 24- A
N4ZZ 97,720- 698- 70- 12- B
K4OAQ 74,314- 509- 73- 15- A
K3CO 70,448- 476- 74- 16- B
N4TG 36,856- 271- 68- 7- A
W4AY (WA4ZZU,op) 7,410- 95- 39- 9- B

Virginia

K1ZZI 124,172- 839- 74- 24- B
AA4UJ 105,856- 703- 76- 24- B

AA4FF 104,700- 698- 75- 23- A
W4YE 102,600- 675- 76- 18- A
K4BAM 84,064- 568- 74- 23- A
NK5I 82,200- 548- 75- 21- A
W4MYA 78,292- 529- 74- 20- Q
WD4JHY 73,296- 509- 72- 18- A
N3OS 55,440- 396- 70- 16- A
W4FOA 47,888- 328- 73- 18- Q
W4XD 39,032- 287- 68- 14- Q
K4FPF 36,778- 259- 71- 11- A
N4ZH 33,930- 261- 65- 7- A
KX4V 32,700- 218- 75- 12- Q
W4HM 23,270- 179- 66- 7- A
K4OD 19,608- 172- 57- 6- B
WD4MUR 11,250- 75- 75- 13- A
N3JT 10,082- 71- 71- 3- B
N4SMB 6,162- 79- 39- 11- A
N3AVA 4,850- 75- 31- 2- B
N3RC 3,348- 54- 31- 2- A
WB4BLJ 330- 15- 11- 4- A
K4IX (+KC4ACB,KK4FV,N4QYK,W4HIR,
WA4GDB,WB4ENE,W8RJL,KØJH) 75,450- 503- 75- 24- A
W4RV (+K1FR) 36,300- 275- 66- 14- A

Virgin Islands

KV4FZ (N6QP,op) 144,892- 979- 74- 24- A

5

Arkansas

K5GO 127,832- 841- 76- 24- A
KM5G 100,010- 685- 73- 24- A
W9OBF 83,232- 578- 72- 23- A
WA5VBE 15,792- 141- 56- 8- A
W5KL 10,486- 107- 49- 3- B
WC5N (+N5NHU,W5EW) 105,228- 711- 74- 24- B

Louisiana

WC5D 96,976- 638- 76- 24- A
NT5G 77,256- 522- 74- 18- A
NO5W 32,240- 248- 65- 17- Q
AA5HV 1,364- 31- 22- 6- A

Mississippi

W5XX 107,850- 718- 75- 23- A
K4VFY/5 (N4EVS,op) 89,644- 614- 73- 24- Q
WA5OYU 66,748- 451- 74- 24- A
WQ5L 26,792- 197- 68- 6- A
AC5R 13,208- 127- 52- 6- A

New Mexico

AA5B 134,250- 895- 75- 24- A
KI5L 78,110- 535- 73- 12- A
W5YZ 76,500- 510- 75- 18- A
K1SX 53,600- 400- 67- 7- A
WD5CAW 33,550- 275- 61- 12- B
W5TTE 24,278- 199- 61- 10- Q
KD5VV (+K5QQ,AI9X) 97,680- 660- 74- 13- B

North Texas

N5AU (WN4KKN/5,op) 170,088- 1119- 76- 24- B
WM5G (KRØY,op) 169,800- 1132- 75- 24- B
N5RZ 157,200- 1048- 75- 24- B
K5RX (AA5DX,op) 146,250- 975- 75- 24- B
KC5DX (WQ5W,op) 139,536- 918- 76- 24- B
KW5P 131,400- 876- 75- 24- B
N5AW 107,250- 715- 75- 23- A
W5ONL 107,100- 714- 75- 21- B
KO9Y/5 88,848- 617- 72- 22- A
W5FO 85,988- 581- 74- 14- B
W5IJDA 84,064- 568- 74- 20- B
N5RM 76,796- 526- 73- 12- B
K5MR 76,220- 515- 74- 13- B
NN5T 52,128- 362- 72- 18- A
K5WXZ 46,920- 340- 69- 16- A
KA5W 42,768- 297- 72- 11- A
KT5V 37,728- 262- 72- 10- A
W5TB 31,680- 220- 72- 23- Q
N3BAO 22,984- 169- 68- 18- A
NT5V 20,416- 176- 58- 12- A
KL7FDQ/5 11,448- 106- 54- 7- A

Oklahoma

KM5H 101,972- 689- 74- 24- A
WM4Z 95,046- 651- 73- 20- A
K5CM (+N5s CG,KW) 163,248- 1074- 76- 24- B

South Texas

WB5BIR 133,912- 881- 76- 24- B
AD5Q 131,850- 879- 75- 24- B
W5ASP 121,904- 902- 76- 21- B
K5LZO 118,408- 779- 76- 15- B
KG5U 115,350- 769- 75- 18- B
K5WA 106,096- 698- 76- 24- B
W5WON 100,962- 711- 71- 24- B
KN5A 96,712- 628- 77- 16- B
W5XD 92,016- 639- 72- 24- B
NT5D 84,064- 568- 74- 24- A
AC5K 68,080- 460- 74- 21- Q
K5DX 61,776- 429- 72- 12- B
W5LXG 53,600- 400- 67- 11- A
W5NR 39,760- 280- 71- 14- B
N5KAE 37,524- 318- 59- 11- A
WA9YLB/5 32,640- 240- 68- 19- Q
K2UA/5 29,264- 248- 59- 6- B
WX5I 17,360- 140- 62- 14- A
KC5M 10,780- 110- 49- 8- A

NV5L 2,800- 50- 28- 2- A
W5EHM (KB1CM,AA5BT,KG5KI,ops) 119,732- 909- 74- 24- B
KC5CP (+N5EY) 89,376- 588- 76- 23- B

West Texas

N4DW 111,300- 742- 75- 23- A
W5VGX 33,410- 257- 65- 8- Q
KT5H 31,222- 233- 67- 13- A
WA5MFI 24,056- 194- 62- 10- A
WF5E (K5CFA,NQ5C,NV5R,ops) 142,950- 953- 75- 24- B

6

East Bay

K6PJY 105,228- 711- 74- 23- A
N6EK 99,752- 674- 74- 24- A
KS6H 98,100- 654- 75- 23- B
K6ATV 62,196- 426- 73- 16- A
K6CSL 26,880- 210- 64- 19- A
N7AZU 25,376- 208- 61- 13- A
N6SKF 24,948- 198- 63- 8- A
N6RO 8,064- 96- 42- 2- B

Los Angeles

W6AQ (WA6OTU,op) 160,968- 1059- 76- 24- B
NE6I 131,936- 868- 76- 24- A
N6PN 121,952- 824- 74- 24- A
N6HC 98,404- 674- 73- 21- A
KE6B 77,526- 531- 73- 20- A
N6GL 50,400- 350- 72- 21- A
WA6FSF 48,848- 344- 71- 13- A
WB6JJE 39,712- 272- 73- 15- Q
W6FA 31,264- 237- 66- 10- A
N6RVC 12,800- 128- 50- 13- A

Orange

K7JA 109,288- 719- 76- 17- A
K6HRT 41,208- 303- 68- 17- A
W6HAL 40,170- 309- 65- 17- A
WB6YNI 38,778- 281- 69- 13- A
K6WS 29,920- 220- 68- 10- A
W6SX 26,016- 212- 59- 3- B
WB6OWD 4,810- 65- 37- 13- A
KB6YAR 112- 8- 7- 4- A

Pacific

AH6AZ 102,300- 682- 75- 21- B
KG6DX 60,208- 424- 71- 20- B
AH6JF 26,978- 221- 59- 22- B
WH6I 7,396- 85- 43- 4- A
AH6IO 7,332- 94- 39- 14- A

Santa Barbara

W2KVA/6 91,104- 624- 73- 20- B
WA6FGV 82,080- 570- 72- 19- A
W7CB 77,404- 523- 74- 13- B
W6TKF 65,888- 464- 71- 14- B
K6MP 60,336- 419- 72- 13- B
VE3AWE/W6 54,576- 379- 72- 12- B
N6NMH 23,436- 166- 63- 10- B
N6MW 16,912- 151- 56- 5- A
N6VR (+NM5M,AC6T,NS6X) 136,800- 912- 75- 24- B

Santa Clara Valley

N6BT (N6TV,op) 148,504- 977- 76- 24- B
N6SJ 116,920- 790- 74- 24- A
N6NF 112,480- 760- 74- 19- A
NS6V 102,268- 691- 74- 16- B
N6ZB 101,850- 679- 75- 22- B
AD6E 93,900- 626- 75- 23- A
W6IO 80,512- 544- 74- 20- Q
W6ISQ 54,168- 366- 74- 10- B
WA6CUX 29,172- 221- 66- 9- A
N6PT 21,912- 166- 66- 12- A
W6PRI 18,900- 150- 63- 24- Q
W6PLJ 17,280- 144- 60- 17- A
W6IGU 6,240- 80- 39- 7- A
WB6QKG 6,020- 70- 43- 5- A
NY6C (+KI6KT,WA9ZBV) 125,400- 836- 75- 24- B

San Diego

K6NA 168,744- 1097- 76- 24- B
N6ND (NI6W,op) 153,450- 1023- 75- 24- B
W8UQF 116,250- 775- 75- 24- A
W6MVW 65,564- 449- 73- 23- A
W6JXA 35,778- 267- 67- 9- A
W6QX 34,560- 240- 72- 20- Q
KI6ZH 29,040- 220- 66- 24- Q
AA6EE 27,008- 211- 64- 8- A
W6JVA 5,396- 71- 38- 3- A

San Francisco

W6JTI 113,664- 768- 74- 24- A
K6LRN 37,380- 267- 70- 9- B
WA6LLY 12,084- 116- 52- 6- Q
KE6WL 10,600- 100- 53- 10- B
W6BIP (+KK1A) 96,824- 637- 76- 19- B

San Joaquin Valley

WA6IQZ 48,528- 337- 72- 20- A
KA6LAC 7,998- 93- 43- 6- A
WB6ITM 3,600- 50- 36- 2- Q

Sacramento Valley

N6IG 169,328- 1114- 76- 24- B
KV6H 113,848- 749- 76- 23- B
N6JV 113,100- 754- 75- 24- B
N4KS/6 107,712- 748- 72- 24- B
K6SG 86,284- 583- 74- 23- B
W6NKR 78,440- 530- 74- 17- B
K6BPB 56,856- 412- 69- 20- A
NB6G 14,700- 147- 50- 3- B
W6EGX 9,800- 70- 70- 24- A

7

Alaska

AL7CQ 125,248- 824- 76- 24- B
NL7DQ 54,264- 398- 68- 14- A
NL7DU 44,744- 329- 68- 19- A
KL7UR 31,872- 249- 64- 16- A

Arizona

KY7M 164,700- 1098- 75- 24- B
K8LL 164,400- 1096- 75- 24- B
K7GM 164,008- 1079- 76- 24- B
N7CPL 68,328- 468- 73- 20- A
KD7E 61,466- 421- 73- 24- Q
N7IR 27,264- 213- 64- 19- Q
NN7A 10,400- 100- 52- 6- A
W7ZMD 6,000- 75- 40- 24- A
W2HTX 2,700- 50- 27- 2- A

Idaho

WO7Y 113,700- 758- 75- 24- A
W7ZRC 91,072- 563- 72- 16- A
KN7K 65,536- 512- 64- 14- B
KK7A 61,320- 420- 73- 23- Q
KA7NOC 4,884- 74- 33- 4- A
WS7U 2,600- 50- 26- 7- Q

Montana

KØPP/7 125,504- 848- 74- 20- B
KS7V 97,528- 668- 73- 21- A
KS7T 92,016- 639- 72- 21- B
KE7X 90,150- 601- 75- 24- Q
W7LR 600- 20- 15- 1- A

Nevada

NC7K 70,596- 477- 74- 13- A
AE7K 68,728- 484- 71- 24- A
NF7P (+NET) 161,250- 1075- 75- 24- B

Oregon

W7NI (N6TR,op) 170,240- 1120- 76- 24- B
K5MM/7 162,450- 1083- 75- 24- B
W7YAQ 127,528- 839- 76- 24- A
K7FD 39,680- 310- 64- 21- B
N7ENU 35,088- 258- 68- 12- A
K7DBV 22,806- 181- 63- 8- Q
W7IMP 13,664- 122- 56- 11- B
K7GDN 13,520- 130- 52- 12- A
AI7W 13,250- 125- 53- 10- A
N7DG 6,760- 65- 52- 9- B
W7WHY 5,772- 74- 39- 6- B

Utah

W7CFL 101,808- 707- 72- 17- B
N7IUN 29,808- 216- 69- 11- A
WB7TJI 29,990- 223- 65- 14- A
KK7C 23,280- 194- 60- 10- Q
N7KPR/T 312- 13- 12- 7- A
W7MR (+KE7RU,KF7IM,WE7s B,D,WJ7M,WK7V) 121,656- 822- 74- 24- B

Washington

KR7G 142,820- 965- 74- 24- B
WA7RKJ 130,608- 907- 72- 24- B
K7LXC 111,000- 760- 74- 24- A
K7NW 91,980- 630- 73- 19- A
N4SL 90,132- 609- 74- 22- A
W7LKG 78,144- 528- 74- 24- B
N7ETC 75,180- 537- 70- 20- A
N6CY 74,736- 519- 72- 20- A
K7WA 62,652- 454- 69- 12- A
N7LOX 57,960- 420- 69- 20- A
N6MZ 51,696- 359- 72- 16- A
WA7EGA 51,520- 368- 70- 24- Q
NØAX 50,976- 354- 72- 20- Q
N7KZN 41,538- 301- 69- 14- A
W7HWR 37,128- 273- 68- 13- A
W7BYK 36,850- 275- 67- 12- A
KF7MD 33,902- 253- 67- 24- A
K7XX 33,390- 265- 63- 8- B
N7EPD 33,108- 267- 62- 7- A
N7DM 29,832- 226- 66- 12- Q
N7HUS 26,664- 202- 66- 11- A
N6CHU/7 22,428- 178- 63- 11- A
N7GGJ 16,956- 157- 54- 15- Q
W7KJ 9,000- 100- 45- 5- Q
W7IEU 5,880- 70- 42- 5- A
KD7GB 2,800- 50- 28- 5- A
K7BFL 2,484- 46- 27- 3- Q
W7HX 1,872- 36- 26- 2- A
KE7C (+N5HSG,WB/OJV) 111,740- 755- 74- 24- A
K200LED (K7ND,KA7CSE,N7NW,NU7Z, W7EVS,WA7UVJ,WM7N,ops) 75,970- 535- 71- 24- A
KE7LE (+N7KLX) 24,676- 199- 62- 12- A

Wyoming

K7MM 128,464- 888- 74- 24- A
W0ETT/7 86,256- 598- 72- 21- A
KZ7V 29,700- 225- 66- 21- A
N3AHA/7 20,900- 190- 55- 7- A
NC7O 6,536- 76- 43- 4- A
WG7Z (+KB7AWM) 72,816- 548- 71- 22- A

8

Michigan

K8CC 156,436- 1057- 74- 24- B
K8DD 103,008- 696- 74- 23- B
W8UMP 94,572- 639- 74- 24- A
W8TJQ 87,172- 589- 74- 24- A
KJ8A 84,096- 584- 72- 21- A
K8SB 77,672- 532- 73- 22- A
K8RDJ 64,368- 447- 72- 20- A
W8VPC 60,006- 411- 73- 18- B

Jim, N6IG, operated both modes.

Dee, N8JLT, talking her turn at the controls of multiop station WB8SMC/KH6.

John, K6GSS/KH6, smiles from his operating position in Hawaii.

K8SAK 57,936- 408- 71- 18- A
WA8VEB 54,244- 382- 71- 19- A
W8QM 52,302- 379- 69- 23- B
K8CV 48,528- 337- 72- 19- A
KW8G 44,238- 303- 73- 17- A
WB8AAX 42,600- 300- 71- 19- Q
WA8YPY 42,504- 308- 69- 20- A
W8EGI 34,544- 254- 68- 13- A
K8SIA 26,352- 216- 61- 7- A
KE8RA 24,400- 200- 61- 12- A
KA8GOM 21,594- 183- 59- 14- A
N8HSN 20,648- 178- 58- 24- A
W8VWY 19,520- 160- 61- 8- Q
N8LA 16,302- 143- 57- 13- Q
K8MVZ 12,208- 109- 56- 8- A
W8WVU 9,000- 100- 45- 3- A
WK8V 8,740- 115- 38- 6- Q
KA8IZE 8,352- 87- 48- 19- A
WA8FRD 6,060- 80- 38- 11- A
KD8FR 3,120- 52- 30- 6- Q
W8ROS 2,296- 41- 28- 4- A
NX8K 1,452- 33- 22- 17- A
WA8QCW 884- 26- 17- 3- A
WJ8J 768- 24- 16- 14- A
WB8IFD 192- 12- 8- 10- A
KA8YVW 50- 5- 5- 3- A
NE8O (+KA8JBK) 94,544- 622- 76- 24- A

Ohio

KW8N 156,712- 1031- 76- 24- B
W8FN 132,016- 892- 74- 24- B
K8BL 130,720- 860- 76- 24- A
K8MR 121,600- 800- 76- 18- B
WB8PHI 93,520- 668- 70- 22- B
W8UPH 79,716- 548- 73- 23- B
WA8TMK 68,620- 470- 73- 23- A
W8PN 62,640- 435- 72- 19- A
W8IDM 53,136- 369- 72- 19- Q
N8AM 40,576- 317- 64- 14- A
NS8O 36,432- 253- 72- 17- A
W8EAR 36,224- 283- 64- 15- A
W8KIC 33,370- 235- 71- 6- A
W8XT 32,776- 241- 68- 17- A
KC8JH 18,900- 150- 63- 24- A
W8KRR 11,552- 76- 76- 11- A
AF8C 11,136- 116- 48- 7- A
WA8RCN 7,800- 100- 39- 4- A
WD8AJF 7,740- 90- 43- 7- A
WBEDU (AF8A,N8ARD,WB8WTS,ops) 114,150- 761- 75- 24- B
WB8SMC (KA8YLY,N8s JLT,IWC,NC8Q, NR8C,W8ILC,WB8QVC,ops) 72,816- 492- 74- 24- A
WA8M (+KF4AV,NU8U) 27,032- 218- 62- 11- A

West Virginia

KB8FJ 80,000- 625- 72- 15- B
W4NW 71,852- 506- 71- 12- A
W8JWX 30,552- 228- 67- 9- Q
NJ8J 21,360- 178- 60- 9- A
KE8SF 20,920- 182- 55- 8- A
KA8MWW 24- 4- 3- 4- A

9

Illinois

AC9A 150,936- 993- 76- 24- B
K9KM 150,450- 1003- 75- 24- B
K4XU/9 133,200- 888- 75- 23- A
AC9C 127,200- 848- 75- 24- A
KS9O 120,324- 813- 74- 24- B
N9AEJ 119,550- 797- 75- 24- B
K9UIY 118,200- 788- 75- 24- A
K9LJN 115,440- 780- 74- 24- B
WB9JKI 103,896- 702- 74- 24- A
K9HDE 87,912- 594- 74- 22- B
WA9TPO 87,080- 622- 70- 24- A
WB9SVN 84,972- 582- 73- 24- A
NA9J 80,550- 537- 75- 18- B
KC9T 66,598- 468- 71- 12- A
N9JF 66,008- 446- 74- 18- A
K9JU 64,094- 439- 73- 24- Q
WB9VLV 61,100- 470- 65- 23- A
W9LNQ 56,832- 384- 74- 14- A
N2CKZ 53,392- 378- 71- 19- A
KA9LTR 51,100- 350- 73- 17- A
W9LO 46,576- 328- 71- 17- Q
K9CC 44,640- 310- 72- 12- Q
WD9AFL 43,808- 296- 74- 24- A
AG9E 42,704- 314- 68- 19- A
K9PPW 36,846- 267- 69- 10- A
NA9I 35,968- 281- 64- 14- A
K9UON 35,154- 279- 63- 11- A
WB9HBI 27,720- 220- 63- 9- A
W9ZEN 24,278- 199- 61- 11- A
KG9N 22,400- 200- 56- 3- A
W9REC 17,956- 134- 67- 6- A
W9EBY 10,658- 73- 73- 24- A
WA9AXL 10,512- 73- 72- 8- A
WA9AGM 2,900- 50- 29- 3- A
ND9X 2,852- 46- 31- 7- Q
NM9C 2,520- 45- 28- 24- A
KA9NZI 520- 20- 13- 4- Q
KB9BMW/T 18- 3- 3- 7- A
WA8AVL (+N9CXQ) 103,860- 710- 73- 24- B
KJ9G (AK9N,KI9G,WE9B,ops) 75,600- 525- 72- 21- B
KG9Z (+KA9TNZ,KB9AFG,N9AX) 61,466- 421- 73- 18- A
AF9M (+KA9GIZ,N9RF,WB9RGZ) 59,478- 431- 69- 22- A
W9OO (WB8RFB,KA9JXU,ops) 31,500- 250- 63- 14- A

Indiana

KE9I 123,728- 814- 76- 24- B
AJ9C 93,632- 616- 76- 22- B
W9RE (WA8YVR,op) 86,240- 616- 70- 12- B
W9JOO 71,832- 492- 73- 23- A
WB8UAG/9 61,864- 418- 74- 22- B
N9ACD 60,760- 434- 70- 16- A
N9CSR 58,240- 416- 70- 19- A
NN9H 50,518- 377- 67- 21- Q
KM8I 43,824- 332- 66- 13- A
WB9CIF 28,910- 245- 59- 9- A
KR9V 25,838- 213- 63- 14- A
KA9JWI 25,230- 215- 61- 16- A
KA9IRS 25,288- 218- 58- 15- B

Wisconsin

W2WOE/9 107,136- 744- 72- 23- B
W9NA 105,000- 700- 75- 15- B
K9CAN 99,572- 682- 73- 24- B
WA1UJU 95,460- 645- 74- 24- A
W9HE 94,024- 644- 73- 24- A
N9CIQ 93,388- 631- 74- 21- A
W9GHY 86,112- 598- 72- 24- B
AE9H 68,620- 470- 73- 22- A
N9NE 66,600- 450- 74- 20- Q
K19W 65,888- 464- 71- 16- A
WB9HRO 53,280- 452- 70- 21- Q
K9OSH 59,670- 459- 65- 18- B
KB9S 58,220- 410- 71- 24- Q
NI9C 47,232- 328- 72- 17- Q
NA9M 44,446- 313- 71- 22- Q
N9HDE 42,458- 299- 71- 15- A
K9RR 42,000- 300- 70- 15- B
N0BSH/9 32,118- 303- 53- 15- A
WB9HGS 29,040- 220- 66- 18- B
NG9L 27,324- 207- 66- 7- A
K1TMM 27,068- 202- 67- 10- A
K9GDF 24,000- 200- 60- 3- A
W9KHH 20,800- 160- 65- 24- A
N9EZ 19,470- 165- 59- 5- A
N9CKG 18,560- 160- 58- 5- A
K9KR 16,800- 140- 60- 9- B
KB9W 1,540- 35- 22- 1- A
N9GBB 80- 5- 5- 3- A
WBAH (K8FVF,K8TG,ops) 128,886- 848- 76- 24- B

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Colorado

K8RF (W8UA,op) 176,250- 1175- 75- 24- B
N2IC 169,936- 1118- 76- 24- B
K8EU 145,950- 973- 75- 24- A
KN5H 136,012- 919- 74- 24- B
W9CP 133,304- 877- 76- 24- A
KC8D 132,422- 907- 73- 24- B
KJ0G 111,106- 761- 73- 24- B
W1XE 110,704- 748- 74- 24- A
AC0S 109,646- 751- 73- 21- B
K0FRP 85,118- 583- 73- 19- Q
WA2MNO 83,376- 578- 72- 24- A
N0FFZ 49,392- 343- 72- 22- A
N0CNV 48,714- 353- 69- 17- Q
KR0U 48,576- 352- 69- 17- Q
N0ZA 37,324- 301- 62- 14- B
W0GOR 35,108- 262- 67- 19- B
NX0Q 23,880- 198- 60- 15- Q
NC0I 13,176- 122- 54- 4- B
AB0G 11,220- 110- 51- 9- A
NY0Q 10,922- 127- 43- 10- A
W0UAT 3,200- 50- 32- 4- A
KA0YXI 1,254- 33- 19- 4- A
N5OP (+K2NA) 81,750- 545- 75- 21- A

Iowa

W0WP 119,016- 783- 76- 24- A
NO0Z 31,878- 253- 63- 8- A
W0JTC 22,960- 205- 56- 12- A
WB0CHS 6,240- 78- 40- 5- B
WB0B 1,836- 34- 27- 4- Q
K0JGH (+KD0RT,N0CI) 90,288- 827- 72- 24- B

Kansas

KB0G 152,250- 1015- 75- 24- B
K0VBU 110,556- 747- 74- 24- A
NW0F 30,192- 222- 68- 13- Q
WB0YJT 28,476- 226- 63- 19- A
WA4TWB 25,970- 245- 53- 4- B
N0FMR 21,120- 165- 64- 10- A
NE4F/0 17,520- 146- 60- 8- A
W0YRN 10,900- 109- 50- 11- A
W0BT 10,192- 98- 52- 11- A
NO0Y 270- 15- 9- 24- A
K0WA (+AB0S,W0CEM) 130,832- 884- 74- 24- B

Minnesota

N0AT 143,116- 967- 74- 24- B
W0AA (N0CIB,op) 127,376- 838- 76- 22- B
W0HW 117,216- 792- 74- 24- B
K0UL 116,654- 799- 73- 22- B
W0UC 114,600- 764- 75- 24- A
WB0HCH 114,464- 784- 73- 24- B
WA0RBW 102,150- 681- 75- 19- B
KB0ZQ 93,440- 640- 73- 22- A
W0SA 87,696- 609- 72- 13- B
K0HB 85,410- 585- 73- 24- A
K0FZG 84,804- 573- 74- 24- A
KN0V 84,242- 577- 73- 17- A
K3WT 73,130- 615- 71- 15- A
N0NO 71,852- 606- 71- 12- A
K0AD 68,544- 504- 68- 16- B
K0TK 66,960- 465- 72- 9- B
KE0OL 43,594- 307- 71- 7- B
W0YHE 40,986- 297- 69- 19- Q
N0BG 39,980- 257- 70- 8- A
WJ0M 35,768- 263- 68- 21- A
W0HBE 35,508- 269- 66- 20- A
KG0B 30,418- 227- 67- 9- A
K0MPH 20,336- 164- 62- 5- A
K0VW 15,900- 150- 53- 5- A
WB0YUC 15,750- 125- 63- 9- A
KB0VP 12,168- 117- 52- 10- A
KF0T 10,658- 73- 73- 15- A
WB0GGM 9,504- 108- 44- 6- A
K0GJX 6,642- 81- 41- 9- Q
W0NGB 5,700- 75- 38- 6- A

Missouri

K4VX (WO0G,op) 144,900- 966- 75- 24- A
KM0I 132,750- 885- 75- 24- B
K0DEQ 78,588- 531- 74- 16- B
W0RNG 41,400- 300- 69- 9- A
N0TT 23,836- 202- 59- 4- B
KA0P 20,790- 165- 63- 6- A
WD0ARX 17,490- 159- 55- 17- A
WA0OUI 4,580- 80- 38- 3- A
NS0B 2,560- 40- 32- 1- A
W0RNM 1,254- 33- 19- 10- A

North Dakota

WB0O 139,050- 927- 75- 20- B
AK0T 13,158- 129- 51- 6- A
NJ0C/0 (+K9s BQL,LUW) 93,388- 631- 74- 24- B

Nebraska

KV0I 100,500- 670- 75- 24- Q
K0SCM 99,718- 683- 73- 24- Q
K0MZV 49,008- 353- 68- 15- A

South Dakota

K0DD (K0KX,op) 148,650- 991- 75- 24- B
WA0NSY 30,366- 241- 63- 13- A
WD0T (+KB0QA) 132,606- 896- 74- 24- B

VE

Maritime—NFLD

VO1AW 34,432- 269- 64- 11- B

Quebec

VE2AOP 70,800- 472- 75- 22- B
VE2FFE 17,820- 162- 55- 12- A
VE2BLX 5,340- 89- 30- 9- A

Ontario

VE3OOL 44,588- 314- 71- 18- Q
VE3ST 36,852- 249- 74- 11- A
VE3TEE 21,450- 165- 65- 18- A
VE3CUI 12,032- 128- 47- 4- A
VE3NYT 9,632- 86- 56- 11- A
VE3ART (VE3s DAO,FPI,GAS,QB,ops) 99,960- 735- 68- 15- B

Manitoba

VE4IM 100,776- 663- 76- 19- B
VE4GV 75,260- 530- 71- 16- A
VE4VV 13,616- 152- 46- 4- A

Saskatchewan

VE5VP 74,160- 515- 72- 23- A
VE5AGA 42,284- 341- 62- 15- A

Alberta

VE6UX 103,950- 693- 75- 17- B
VE6DZ 68,670- 485- 71- 24- A
VE6RI 22,156- 191- 58- 15- A

British Columbia

VE7CC 161,880- 1065- 76- 24- B
VE7ARQ 98,988- 678- 73- 22- A
VE7YU 36,294- 263- 69- 19- Q
VE7CKF 13,260- 130- 51- 18- Q
VE7EKS 4,830- 69- 35- 19- Q

Phone

1

Connecticut

W1WEF 237,728- 1564- 76- 24- B
K1NYK 167,552- 1088- 77- 24- B
K1RM 138,380- 935- 74- 15- B
N8RA 124,976- 856- 73- 16- B
K1TO 103,156- 697- 74- 8- B
KG1D 90,440- 595- 76- 10- B
KA1JNR 86,968- 597- 72- 21- B
N1JW 81,168- 534- 76- 14- B
K1IN 71,248- 488- 73- 16- B
WA1LJP 69,768- 459- 76- 24- A
W1ECH 66,000- 440- 75- 20- A
KA1MWX 64,084- 433- 74- 19- A
K1DII 62,926- 431- 73- 11- A
KH6CP/1 58,380- 417- 70- 24- Q
NC1E 44,676- 306- 73- 9- B
K1YRP 38,304- 304- 63- 9- A
NU0X/1 35,772- 271- 66- 24- A
KA1JTH 33,150- 255- 65- 14- B
AB1U 28,148- 227- 62- 6- A
W1BIH 27,600- 184- 75- 4- B
KB1WR 21,000- 175- 60- 12- B
KA1MIS/T 19,008- 198- 48- 13- A
WE6G/1 17,110- 145- 59- 5- B
W1TKG 15,812- 134- 59- 7- A
K1CC 13,728- 156- 44- 2- B
N1FNV/T 10,800- 135- 40- 15- A
NI1L 5,810- 83- 35- 6- Q
K1KI 2,300- 50- 23- 1- B
KA1SPM 1,088- 32- 17- 7- A
KA1CI (+K1s TO,XA) 141,000- 940- 75- 24- B
NJ2L (+K1s NCD,TO,XA,KA1CI) 119,776- 788- 76- 20- B
N1GAU/T (+N1GAT) 6,720- 80- 42- 7- A

Eastern Massachusetts

N6BV/1 258,704- 1702- 76- 24- B
W1FM 98,952- 651- 76- 19- A
N1AU 97,382- 667- 73- 15- B
KQ1V 78,760- 505- 78- 18- A
K1BT 55,056- 372- 74- 15- A
W1XS 44,696- 302- 74- 11- A
W1AX 39,450- 263- 75- 9- B
W1KRS 38,778- 261- 69- 18- B
AD1Z 35,328- 258- 69- 14- B
N1FIO 33,880- 255- 66- 16- A
W1TUM 31,498- 254- 62- 11- A
WA1EOT 27,960- 233- 60- 4- A
KB1VL 17,024- 152- 56- 11- A
KA1PES 10,578- 123- 43- 12- A
K1AGM 10,000- 100- 50- 6- A
N1DGO 9,212- 98- 47- 7- A
N1FYZ 8,400- 100- 42- 10- A
WB1EHL 6,586- 89- 37- 13- Q
W1BK 6,314- 77- 41- 4- A
W1SR 6,308- 83- 38- 3- A
W1PLJ 4,950- 75- 33- 13- B
KC1F 198- 11- 9- 1- B
N1DZJ 42- 7- 3- 1- A
WB1GEX (+KS1A) 164,920- 1085- 76- 24- B
N1IR (+WB2MZU,WA3ZWT) 140,700- 938- 75- 24- B

Maine

KA1ZX 29,792- 196- 76- 7- A
WB2ZWT/1 27,804- 206- 67- 13- A
N1AFC 27,300- 210- 65- 16- Q
N1CDF (+N1GAX) 38,226- 277- 69- 18- A
KT2D/1 (+WA2OFI) 28,006- 209- 67- 13- A

New Hampshire

AK1K 154,050- 1027- 75- 22- B
K1TR 89,376- 588- 76- 13- A
K8LT/1 45,648- 317- 72- 10- A
KT1H 24,790- 185- 67- 9- Q
NU1I 15,250- 125- 61- 11- A
WA1KSW 11,938- 127- 47- 7- A
KA1LMR 11,088- 99- 56- 7- Q
AC1J 10,000- 100- 50- 2- A
KC1F 1,330- 35- 19- 1- A

Rhode Island

K1VSJ 108,832- 718- 76- 24- A
KD2SX/1 57,456- 399- 72- 12- B
KA1DNB 35,360- 272- 65- 11- A
K6IM 35,052- 254- 69- 10- B
WA2FTC 33,000- 250- 66- 20- A
K1IU 23,860- 182- 65- 5- A
K2MN 17,056- 164- 52- 7- A
N1DTG 13,176- 122- 54- 8- A
W1RFQ 9,922- 69- 69- 8- A
K1NG (+KB1EM,KI1G) 243,504- 1602- 76- 24- B
WA1TAQ (+KA1KWE) 139,536- 918- 76- 20- B
W1OP (K1DS,K1PLX,KZ1K,N1s AKD,BBM,ERJ,ops) 91,050- 607- 75- 22- B

Vermont

WB1GQR (WB2JSJ,op) 246,392- 1621- 76- 24- B
W3LPR 19,468- 157- 62- 14- A
KA1RRX/N 9,976- 116- 43- 14- A
KA1OVA 9,600- 100- 48- 8- A

stern Massachusetts

1M	130,568-	859-	76-	24-	B
1RI	88,504-	598-	74-	19-	A
KNQ	59,472-	413-	72-	19-	Q
A1HFF	29,988-	238-	63-	9-	A
2R	13,776-	123-	56-	9-	A
1F	4,340-	70-	31-	1-	B

AA (WA2s TBA,VYA,ops)
119,850- 799- 75- 24- A
A1ZAM (+NET) 29,054- 199- 73- 8- A
A1KPH (+NC1B)
13,568- 128- 53- 3- A

stern New York

HVT/2	184,832-	1216-	76-	24-	B
A2STM	179,100-	1194-	75-	24-	B
CC	125,400-	825-	76-	17-	B
2NE	87,308-	598-	73-	23-	B
B2EAR	85,264-	584-	73-	16-	B
AZS	76,464-	531-	72-	17-	A
BJ	53,280-	360-	74-	9-	A
2IV	49,392-	343-	72-	24-	A
CIB	37,122-	269-	69-	6-	A
B2SPN	33,840-	282-	60-	12-	A
HIF	32,086-	263-	61-	14-	Q
2F	28,672-	224-	64-	12-	A
A3AFS	28,470-	195-	73-	6-	B
2JJ	25,956-	206-	63-	13-	A
B2KHE	20,640-	172-	60-	15-	A
NRD	20,128-	148-	68-	14-	A
B2MJQ	12,584-	121-	52-	5-	B
HIG	9,594-	123-	39-	6-	A
FS	9,212-	98-	47-	4-	A
2D (KC2KK,op)	8,976-	102-	44-	3-	A
OU	6,630-	85-	39-	4-	A
2EIK	4,810-	65-	37-	4-	A
2EHI	2,262-	39-	29-	2-	A
HTT	1,518-	33-	23-	2-	A
2J (+KA2TIP)	179,968-	1184-	76-	24-	B
2Q (+KU2Q,K5NA)	148,352-	976-	76-	19-	B
SZ (KA1PRT,N2s DCM,HPA,NY2U,					
B2s FOB,KMY,N3GI,ops)	125,704-	827-	76-	24-	B
2Q (+K5NA,WB2Q)	116,584-	767-	76-	19-	B
NA (+KU2Q,WB2Q)	112,176-	738-	76-	15-	B
2UMX (KG2H,WB2HIH,ops)	38,364-	278-	69-	12-	A

C—Long Island

2G	87,900-	586-	75-	18-	A
AU	86,432-	592-	73-	18-	B
GM	56,980-	385-	74-	11-	B
2TT	55,380-	390-	71-	19-	Q
2R	42,120-	324-	65-	11-	A
2YEI	10,212-	111-	46-	8-	B
IVN	6,962-	59-	59-	5-	A
2RCJ	5,000-	50-	50-	1-	A
RQ	1,920-	40-	24-	2-	A
IG	1,276-	29-	22-	6-	A
2CAO	1,160-	29-	20-	5-	A
2IJY	2-	1-	1-	1-	A
MG (+NQ2D)	176,850-	1179-	75-	24-	B
RD (+N2PL)	166,440-	1095-	78-	24-	B
CXN (+N2RQ)	9,324-	111-	42-	5-	A

thern New Jersey

KU	154,432-	1016-	76-	24-	B
2D	78,584-	517-	76-	18-	B
2UDT	62,250-	415-	75-	10-	B
RQ	47,250-	315-	75-	10-	B
ZQ	46,900-	335-	70-	20-	A
4E	36,000-	250-	72-	12-	A
CG	30,660-	210-	73-	14-	B
GD	23,408-	154-	76-	6-	A
NC	12,150-	81-	75-	24-	B
HCA	11,400-	100-	57-	7-	A
EH	11,374-	121-	47-	13-	A
2AZE	10,622-	113-	47-	7-	A
3QOA	10,406-	121-	43-	5-	A
2J	6,136-	113-	36-	2-	B
JEK	3,828-	58-	33-	5-	Q
PX	1,470-	35-	21-	1-	B
2U	1,088-	32-	17-	1-	Q
S (+KA2AEV)	205,200-	1368-	75-	24-	B
Q (KA2s EYH,HJH,KB2FKX,W2QR,					
A2NXW,WB2s GJE,SRY,ops)	120,450-	803-	75-	22-	A
MFF (KA2s PFM,RRR,KB2EDH,N2FXZ,					
G2W,WJ2J,ops)	75,628-	518-	73-	16-	B

thern New Jersey

PE	160,512-	1058-	76-	24-	B
PI	110,856-	728-	76-	23-	A
PS	89,528-	589-	76-	23-	A
PAU	67,650-	451-	75-	16-	B
CTJ	65,268-	441-	74-	13-	A
FGY	51,652-	349-	74-	22-	B
2UEY	41,890-	295-	71-	19-	A
2WJI	41,124-	298-	69-	10-	A
PV	39,902-	261-	71-	20-	A
OSV	37,264-	274-	68-	13-	B
ORA	32,604-	247-	66-	14-	A
KI	23,424-	183-	64-	9-	A
EA	22,360-	172-	65-	7-	A
GZL	19,680-	164-	60-	7-	Q
OO	15,162-	133-	57-	9-	B
KFO	12,548-	123-	51-	11-	B
3RHW	8,428-	98-	43-	9-	A
2Y	8,330-	85-	49-	5-	A
HW	7,740-	90-	43-	8-	A

N2VW 6,278- 73- 43- 9- B
N2HQL 4,864- 76- 32- 7- A
K2TD 2,632- 47- 26- 2- A
KD2AE 1,610- 35- 23- 3- A
KA2YKN 1,224- 34- 18- 5- A
K2KED (K2EWZ,WA2SDX,WB2R,
WB2YOF,ops) 55,522- 391- 71- 20- A

Western New York

W2HPF 161,424- 1062- 76- 18- B
W2RR (WB2YQH,op)
72,504- 477- 76- 16- B
WA2UUK 72,000- 480- 75- 21- A
WF2W 71,248- 488- 73- 21- A
WJ2O 58,108- 398- 73- 15- B
NM2J 50,400- 350- 72- 22- B
KB2NU 41,400- 300- 69- 6- B
K2QR 38,056- 268- 71- 14- A
KD2YP 34,992- 243- 72- 12- A
KB2SE 34,500- 250- 69- 8- A
WA2WPI 32,604- 247- 66- 15- A
WB2EKP 23,640- 197- 60- 11- A
WE2T 18,328- 158- 58- 15- A
NW2I 14,760- 123- 60- 15- Q
W2OMV 11,628- 114- 51- 8- A
W2TZ 8,800- 100- 44- 2- A
WK2N 7,800- 78- 50- 9- A
WB2ABD 3,976- 71- 28- 2- A
KB2EMZ 3,016- 58- 26- 4- A
N2IHQ/T 2,592- 54- 24- 6- A
K2ZJ (+K2ZL,N2MF)
198,968- 1309- 76- 24- B
K2CC (KA2KWB,KB2DUE,KE2EU,N2ITR,
NS2F,N4TW,N5KTP,ops)
76,812- 519- 74- 20- B
K2IQ (WA1LLC,K2OZV,KA2s CFM,MTB,
KK2B,WA2AZA,WB2PYU,ops)
72,076- 487- 74- 24- A

3

Delaware

K3WUW 119,472- 788- 76- 13- B
AC3T (KA3B,op) 108,376- 713- 76- 23- B
N8NA 50,540- 361- 70- 12- Q
KV3U 9,936- 108- 46- 5- A

Eastern Pennsylvania

W3MA 180,750- 1205- 75- 24- B
K3ZA 170,348- 1151- 74- 24- B
KS3F 152,912- 1006- 76- 22- B
KA3SIO 111,750- 745- 75- 14- B
WB3FED 97,384- 658- 74- 14- B
N3CHL 94,276- 637- 74- 20- B
K3TX 90,864- 631- 72- 24- B
K3MQH 85,768- 604- 71- 21- A
K3MRG 70,308- 558- 63- 15- A
WA3YON 69,900- 466- 75- 21- A
AA3B 68,408- 503- 68- 9- B
WA1MKE 50,370- 365- 69- 20- A
K3WW 46,816- 308- 76- 6- B
KD3GC 46,760- 334- 70- 20- A
WB3AAK 40,820- 314- 65- 19- A
NI3J 32,500- 250- 65- 15- A
KB3JK 28,832- 212- 68- 9- B
KY3T 23,436- 188- 62- 8- B
KA3DYX 20,008- 164- 61- 24- A
WB3FAA 19,504- 184- 53- 3- B
K3EBZ 14,800- 148- 50- 7- A
NS3P 13,886- 131- 53- 7- A
KA3QYH 11,088- 126- 44- 8- A
N3GOY/T 9,718- 113- 43- 10- A
NK3O 8,772- 86- 51- 5- B
W3GBG 7,600- 100- 38- 10- Q
N3FOB 6,630- 85- 39- 12- A
KA3AFY 4,288- 67- 32- 5- A
AG3G 3,782- 61- 31- 6- A
WA3LGG 3,200- 50- 32- 11- A
N2EY 3,172- 61- 28- 3- A
NE3F 2,900- 50- 29- 3- A
WA3VFM 918- 27- 17- 1- A
N3CZB 360- 15- 12- 2- A
N3ESB/T 160- 10- 8- 1- A
WA3BIF (+KA3QKJ,KA3TFM)
69,438- 489- 71- 20- B
NJ3N (+ops) 15,228- 141- 54- 9- A

Maryland—DC

N2FB/3 214,624- 1412- 76- 24- B
KE3Q 187,568- 1234- 76- 24- B
N3AQE 150,900- 1008- 75- 24- B
N3EHD 104,272- 686- 76- 22- A
NO3X 61,124- 413- 74- 16- B
N3GB 53,456- 399- 67- 7- B
KC3EK 30,798- 261- 58- 4- A
WB2EKK 23,520- 210- 56- 5- A
KA3SKQ 22,568- 182- 62- 21- Q
K3TM 13,886- 131- 53- 3- B
NS3T 10,080- 90- 56- 3- A
KD7JZ/3 9,504- 108- 44- 10- A
K3DI 6,630- 85- 39- 2- A
WB2BZR 5,984- 88- 34- 11- A
KA3LKQ 5,928- 78- 38- 8- A
KA3OUT/T 5,214- 79- 33- 7- A
K3SA 4,410- 63- 35- 1- A
W3FQE 3,672- 54- 34- 3- B
W3GN 2,288- 44- 26- 2- B
WA3EKL (+K3ZZ)
194,408- 1279- 76- 24- B

Western Pennsylvania

K3MD 132,608- 896- 74- 22- B
K5ZD/3 112,568- 771- 73- 10- B
KA3MMM 40,704- 318- 64- 24- A
WA3JPJ 37,752- 286- 66- 14- A
N3FAS 31,620- 310- 51- 18- B

KA3ROX 27,040- 208- 65- 17- A
K3RYA 14,812- 161- 46- 9- A
K3UA 10,260- 126- 41- 1- B
WA3WAW 5,040- 63- 40- 2- A
WA8KIW/M 1,972- 34- 29- 1- A
N3GLK 1,634- 43- 19- 8- A
WA3PCX 300- 15- 10- 2- A

4

Alabama

WZ4F 221,312- 1458- 76- 24- B
KC4ZV 135,280- 890- 76- 24- A
NB9P 48,020- 343- 70- 21- A
KA7WPD/4/T 7,752- 114- 34- 9- A

Georgia

AA4LR 74,328- 489- 76- 24- A
K4BAI 40,446- 321- 63- 5- B
KI4Y 18,048- 141- 64- 11- A
W9UIX/4 7,392- 84- 44- 13- A
KA7LKV 220- 11- 10- 1- A
W4AQL (KC4GLA,KJ4SC,N4s CXF,JOD,
RMM,NR4E,WA4ABY,WD4DWN,ops)
143,792- 946- 76- 24- B

Kentucky

AA4HX 185,744- 1222- 76- 24- A
N4TY 108,488- 764- 71- 13- B
KI4DC 45,816- 332- 69- 10- A
KA4MTX 8,064- 96- 42- 8- A
KE4KE 7,912- 86- 46- 8- Q
KB4BVP 5,816- 87- 34- 10- A
WA4RZD 2,808- 52- 27- 3- A
N4OHW (+KB4QNR)
48,960- 340- 72- 17- A

North Carolina

K4JEX 120,600- 804- 75- 15- B
N4AA 76,000- 500- 76- 15- A
K3LL 60,882- 417- 73- 20- A
KJ4TI 59,714- 409- 73- 20- A
WA4FFW 36,432- 276- 66- 5- B
KA4HKK 32,110- 247- 65- 22- A
W8UT 31,602- 229- 69- 9- A
WB4Y 27,600- 200- 69- 12- A
KB4EON 25,218- 197- 64- 16- A
NK4Q 21,840- 168- 65- 16- Q
KB4MIL 18,240- 160- 57- 15- A
N4UH 198- 11- 9- 1- A
AA4NC (+WB5M)
213,408- 1404- 76- 24- B

Northern Florida

K4XS 268,128- 1764- 76- 24- B
N4WW (N4XN,op)
231,800- 1525- 76- 24- B
W4WKQ 114,300- 762- 75- 20- B
WC4E 60,648- 399- 76- 8- A
K4VFY (N4EVS,op)
44,400- 300- 74- 15- Q
WA4GNR 25,328- 201- 63- 18- A
N4MUH 17,556- 154- 57- 17- A
N4PSD 10,412- 137- 38- 12- A
WA4VIY 9,416- 107- 44- 9- A
N4SGQ 3,328- 52- 32- 3- A
KB4T (+KJ4WN,N4s NKB,NKK,PLT,
WD4GDZ,N8DTN)
108,726- 731- 73- 24- B

South Carolina

K0EJ 176,776- 1163- 76- 17- B
AA4V 24,898- 211- 59- 7- B
WD4PLF 20,178- 171- 59- 9- B
WD4BHM 18,476- 149- 62- 6- A
KJ4KB 14,760- 123- 60- 14- Q
K4BAM 3,472- 56- 31- 3- A
WF2G (+KC4LB,N4s QWL,RYO)
53,424- 371- 72- 18- B
KC4EFI (+KA2CUF,KC4s EFJ,HER,HNQ)
6,786- 87- 39- 24- A

Southern Florida

KO4J 86,140- 590- 73- 21- B
WA4VQD 57,720- 390- 74- 12- A
N8ESK 26,130- 201- 65- 14- A
W1UCI 14,732- 127- 58- 10- A
K1TN/4 13,650- 91- 75- 5- A
WA2MZE 11,808- 123- 48- 5- A
WK4F 9,600- 70- 70- 8- B
N4BP 4,380- 73- 30- 1- B
W4JM 1,680- 35- 24- 2- B

Tennessee

N4ZZ 155,550- 1037- 75- 16- B
K3CQ 49,152- 384- 64- 15- B
AA4DO 46,136- 316- 73- 14- B
W4AY (WA4ZZU,op)
18,224- 136- 67- 9- A
WA4MCZ 16,520- 140- 59- 10- A
KS2X 13,888- 131- 53- 5- A
N4SFO 12,348- 126- 49- 5- A
N4TG (+KI4UZI) 206,264- 1357- 76- 24- B
W4PQP (+WBØVBG) 476- 17- 14- 2- A

Virginia

KX3Q 208,240- 1370- 76- 24- B
W4MYA 173,888- 1144- 76- 24- B
AA4UJ 125,400- 825- 76- 22- B
K1ZZI 100,168- 659- 76- 24- B
N4QYK 64,600- 425- 76- 22- A
AA4FF 62,472- 411- 76- 15- A
W4TMN 57,226- 403- 71- 16- B
W4YE 51,100- 350- 73- 11- A
WA3RGH 44,220- 335- 66- 7- A
W4LMJ 43,452- 306- 71- 12- B

AA4YZ 30,464- 224- 68- 16- Q
N3RC 27,776- 224- 62- 6- A
K4OD 27,608- 203- 68- 9- B
N3AVA 25,392- 184- 69- 6- B
WD4KQJ 25,326- 201- 63- 8- A
N4MM 16,632- 132- 63- 7- Q
N4SLR/T 13,818- 147- 47- 13- A
N4NPX/T 13,348- 142- 47- 16- A
N4SMB 8,504- 108- 44- 7- A
K4OCI 3,266- 71- 23- 3- A
KC4DY (+AB4U,N4VG)
156,104- 1027- 76- 24- B
WR4I (+NG3K) 80,104- 527- 76- 22- A
W4HFH (KA4s COQ,GFY,KB4WKK,N4s
ASX,CWP,HCP,QOS,QOT,SFG,ops)
19,548- 181- 54- 19- A

Virgin Islands

KP2A (N2IC,op) 398,088- 2619- 76- 24- B
NP2E 12,688- 122- 52- 13- Q
NP2B (+NP2C,KV4JC,KE8CA)
41,100- 274- 75- 20- A

5

Arkansas

K5FUV 152,000- 1000- 76- 24- A
W9OBF 108,984- 717- 76- 21- A
WD5COT 52,114- 367- 71- 14- A
N5KKD 34,056- 258- 66- 17- A
WA5VBE 32,026- 239- 67- 9- A
K5JH 14,310- 135- 53- 9- A
WA5VWH 7,650- 85- 45- 4- A

Louisiana

W5WMU 261,150- 1741- 75- 24- B
W5EW 122,056- 803- 76- 20- A
K5KLA 36,984- 268- 69- 10- Q
WB5SSD 16,644- 146- 57- 8- A
AA5HV 6,860- 74- 45- 5- A

Mississippi

K5MK 112,832- 741- 76- 20- A
NT4I 82,276- 614- 67- 24- A
WA5OYU 36,018- 261- 69- 15- A
WB5KYK 9,400- 100- 47- 11- Q

New Mexico

AA5B 254,904- 1677- 76- 24- A
N5EPA 162,640- 1070- 76- 24- A
KB3EI 121,500- 810- 75- 24- A
KE5BL 96,900- 646- 75- 14- B
WB5TXJ 38,480- 260- 74- 20- A
KN5S 26,400- 200- 66- 3- B
WA5VAL 16,128- 144- 56- 10- A
N5JXU 8,960- 112- 40- 13- Q

North Texas

WM5G (KRØY,op)
296,856- 1953- 76- 24- B
N5AU (WB5VZL,op)
266,304- 1752- 76- 24- B
N5RZ 243,504- 1602- 76- 24- B
KE5CV 214,776- 1413- 76- 24- A
KC5DX (WQ5W,op)
195,472- 1286- 76- 24- B
KC5NQ 153,450- 1023- 75- 18- B
NJ1V 149,700- 998- 75- 20- B
NT5V 123,576- 813- 76- 14- A
AA5FB 122,380- 805- 76- 21- A
W5PQ 107,920- 710- 76- 15- B
KD5GD 102,144- 672- 76- 22- A
KW5P (N5LAU,op)
100,168- 659- 76- 24- A
K5MR 66,000- 440- 75- 13- B
KA5W 60,040- 395- 76- 13- A
K5WXZ 58,460- 395- 74- 22- A
N5DTO 48,720- 348- 70- 16- A
W5LKP 46,512- 306- 76- 18- B
NN5T 45,440- 320- 71- 15- A
KD5XH 42,980- 307- 70- 19- B
N5IET 35,880- 260- 69- 11- A
AA5AA 26,788- 181- 74- 15- A
KL7FDQ/5 13,608- 126- 54- 13- A
AA5EG 3,000- 50- 30- 6- A
K5RX (+AA5DX)
235,448- 1549- 76- 24- B
WH6AYI/5/N (+W5ONL)
90,468- 407- 62- 15- A

Oklahoma

KM5H 141,600- 944- 75- 24- A
WM4Z 116,432- 766- 76- 18- A
W5PAA (WC5D,op)
66,120- 435- 76- 24- Q
AA5CO 45,114- 309- 73- 10- A
KB5BOB 33,012- 262- 63- 22- B
WD5COS 18,178- 149- 61- 11- A
K5CM (+N5s CG,KW)
234,688- 1544- 76- 24- B
N5KKB (+N5JKN)
128,168- 866- 74- 24- A

South Texas

NR5M (KE5IV,op)
275,120- 1810- 76- 24- B
WB5BIR 234,384- 1542- 76- 23- B
KC5CP 134,672- 886- 76- 22- B
WU5Z 126,550- 837- 75- 21- A
WN4KKN/5 87,552- 576- 76- 6- B
WA5IYX 76,808- 532- 72- 22- A
KG5U 76,500- 610- 75- 21- Q
N5KAE 66,096- 459- 72- 10- B
K5DX 63,384- 417- 76- 12- B
W5ASP 61,180- 437- 70- 7- A
WB5RUS/T 54,432- 432- 63- 14- A

W5LXG 46,640- 326- 70- 6- A
K5HKX 37,760- 295- 64- 6- B
WB5J 33,728- 248- 68- 12- A
K2UA/5 27,450- 225- 61- 6- B
W5NR 25,608- 194- 66- 9- B
KB5AJS 22,044- 167- 66- 8- A
N5JWL 19,800- 198- 50- 6- A
W5XD 17,690- 145- 61- 7- A
W5UFA 17,052- 147- 58- 9- A
KG5LM 14,784- 132- 56- 12- A
NV5L 7,452- 81- 46- 4- A
W5EHM (CE3LAR,KA5WSS,KF5XR,
KG5KI,N5LZX,WN4KKN,WR5J,ops)
175,408- 1154- 76- 24- B
K5RVK (+KC5M,N5AQT,N5EA,W5ASP,
W5/GW8ECO) 173,128- 1139- 76- 23- B
WB4LZG (+ops) 29,568- 224- 66- 16- A

West Texas

WF5E 190,772- 1289- 74- 23- B
W5VGX 79,804- 562- 71- 17- Q
N4DW 50,820- 363- 70- 9- A
KE5GO 44,622- 333- 67- 17- A
KC5PU 25,800- 200- 64- 16- A
KT5H 72- 6- 6- 1- A

6

East Bay

N6IG 320,720- 2110- 76- 24- B
W6BSY 169,936- 1118- 76- 22- B
KS6H 145,920- 960- 76- 16- B
N6EK 101,824- 688- 74- 24- A
WB6OHH 44,100- 294- 75- 19- B
W6RPY 480- 16- 15- 2- B

Los Angeles

N6HC 166,896- 1098- 76- 20- A
W6CN 41,756- 286- 73- 23- C
WB6NFO 41,026- 281- 73- 17- A
KB6STF 26,934- 201- 67- 24- A
KF6HI 26,004- 197- 66- 11- A
KD6JP 16,170- 147- 55- 14- A
W6UGU 12,672- 99- 64- 10- A
K6SPQ 11,628- 102- 57- 15- B
WB2ODH/6 11,250- 125- 45- 4- A
WB6BXP 10,388- 105- 49- 6- A
W6FA 3,604- 53- 34- 2- A
WA6HQS 1,470- 35- 21- 3- A
W8UE (KA6SAR,N6DLU,WA6OTU,ops)
227,088- 1494- 76- 24- B
W6KAT (+KC6AMD,WA6SNG,WB6JBL)
45,156- 318- 71- 24- A
WB6JJE (+WA6FSF)
38,304- 252- 76- 16- Q

Orange

K7JA 105,300- 702- 75- 14- A
KI6DU 93,288- 676- 69- 17- A
W6HAL 53,682- 389- 69- 23- B
K7YCI 44,436- 322- 69- 14- B
K6HRT 41,538- 301- 69- 14- A
KH6WZ/6 19,344- 156- 62- 13- A
K6BVE 14,950- 115- 65- 15- A
KB6YAR 13,300- 133- 50- 15- A
NM6R 11,368- 98- 58- 10- A
KG6F 10,082- 71- 71- 9- A
WA6GFR 5,760- 72- 40- 5- A
KF6OXG (+N6RPL,WA6OWM,WA6T)
232,712- 1531- 76- 24- B
K6RUB (+KB6s SRM,ZMR)
75,392- 496- 76- 18- A
WA6YNT (K6HRT,KA6ART,N6s OUG,QHR,
NR6V,WB6s IXV,OWD,ops)
67,248- 467- 72- 15- B
KI6WD (+N6QYO)
11,760- 147- 40- 6- A

Pacific

K6GSS/KH6 171,000- 1125- 76- 22- A
AH6IO 45,648- 317- 72- 16- A
WL7E/WH6 24,240- 202- 60- 8- A
WH6BMP 20,880- 174- 60- 16- A
WB8SMC/KH6 (N8JLT,W8XT,WB8s
OFR,QVC,ops) 33,500- 250- 67- 18- A

Santa Barbara

N6MB 147,440- 970- 76- 21- B
WA6FGV 120,450- 803- 75- 18- A
W6TKF 117,900- 786- 75- 15- B
WA6DJS 89,540- 605- 74- 20- B
K6VMN 73,264- 482- 76- 20- B
KD6LD 38,494- 257- 71- 22- B
W6HYK 34,484- 233- 74- 22- A
N8OQZ 25,254- 207- 61- 7- B
N6NMH 16,464- 147- 56- 9- Q
KA6L (+KD6QX,WA6VNO)
121,618- 833- 73- 16- B

Santa Clara Valley

N6NF 142,376- 962- 74- 14- A
NS6V 108,708- 721- 74- 10- B
W6PLJ 28,290- 205- 69- 18- A
W6LPW 23,936- 187- 64- 14- A
WA6HRK 19,440- 162- 60- 22- A
KJ6MW 19,032- 183- 52- 22- A
K3QM 17,360- 140- 62- 7- A
K6VGW 13,600- 136- 50- 5- A
W6IGU 10,290- 105- 49- 8- A
N6TV 1,426- 31- 23- 1- A
AA6BS (+N6s NAE,RCE,WA6CUX,
G8HQA) 50,718- 409- 62- 17- A

San Diego

N6ND 181,792- 1196- 76- 19- B
W6UQF 116,888- 769- 76- 22- A

W6JVA 106,552- 701- 76- 13- B
KI6ZH 93,176- 613- 76- 22- A
W6JXA 30,685- 229- 67- 7- A
AA6EE 2,496- 39- 32- 2- A
W6MVW 1,200- 30- 20- 2- A

San Francisco

WA6LLY 70,376- 463- 76- 12- A
WB2CHO 66,900- 446- 75- 12- A
K6LRN 28,980- 210- 69- 7- B
KF6WL 9,216- 96- 48- 5- B
W6BIP (+KK1A) 136,496- 898- 76- 21- B

San Joaquin Valley

KD6WW 131,784- 867- 76- 17- A
WW6O 95,400- 636- 75- 21- B
N6PKI 52,394- 391- 67- 17- A
KA6LAC 51,216- 398- 66- 20- A
WA6YAB 26,400- 200- 66- 10- A
KB6LEI 12,054- 123- 49- 4- Q
WB6TM 18- 3- 3- 1- A
WU6I (+KI6DS) 96,976- 636- 76- 22- A
KI6PR (+K6RAU,KA6FTA,KB6SBH, KH6JWJ,N6QVI,NR6N,WA6PIC) 88,950- 593- 75- 24- A

Sacramento Valley

W6UO (K2ESI,op) 298,552- 1951- 76- 24- B
KV6H 223,896- 1473- 76- 24- B
KF6A 156,864- 1032- 76- 24- B
K6SG 112,200- 748- 75- 21- B
N6JV 78,694- 539- 73- 17- A
N6JM 9,800- 100- 49- 5- A

7

Alaska

AL7CQ 274,500- 1830- 75- 20- B
KL7CQ 49,580- 370- 67- 13- B
AL7HS 35,112- 265- 66- 16- A
NL7DU 5,850- 65- 45- 12- A

Arizona

K6LL 301,720- 1985- 76- 24- B
WE7G 174,000- 1160- 75- 18- B
WA7LNW 155,952- 1026- 76- 16- A
KC7V 122,512- 806- 76- 17- B
WA7NWL 12,126- 174- 47- 11- Q
W7KAJ 2,460- 70- 39- 6- A
WB7CFL 4,060- 58- 35- 2- A

Idaho

WO7Y 198,150- 1321- 75- 24- A
W7QDM 41,038- 389- 71- 8- A
KE7RT 27,300- 195- 70- 19- A
W7KDB 7,040- 80- 44- 24- A

Montana

K7T 122,250- 815- 75- 24- B
KW7I 29,842- 209- 68- 18- A
KA7YYR 27,430- 211- 65- 16- A
N7ICC 21,816- 163- 66- 16- Q
W7LR 14,248- 137- 52- 3- A

Nevada

KI3W7 315,096- 2073- 76- 24- B
ND7M 175,864- 1157- 76- 20- A
NC7K 163,856- 1078- 76- 23- A
WB7VVH 18,848- 152- 62- 12- B
KF7MW 13,936- 134- 52- 9- A

Oregon

K5MM/7 202,768- 1334- 76- 16- B
K7KJM 160,988- 1059- 76- 21- A
N7LXB 103,600- 700- 74- 20- A
W7YAQ 100,928- 664- 76- 14- A
AI7W 70,928- 464- 76- 20- A
K7ED 65,232- 453- 72- 24- B
K7GDN 51,840- 360- 72- 19- B
W7XN 46,150- 355- 65- 4- A
N7HPA 45,724- 322- 71- 19- B
W7IMP 40,500- 270- 75- 22- B
K7GWK 39,450- 263- 75- 12- B
N7GRY/T 35,868- 294- 61- 10- A
W7GUR 29,680- 212- 70- 12- A
KA7OAI 25,172- 203- 62- 9- A
KC7DH 21,516- 163- 66- 21- A
N7IXI 16,200- 150- 54- 10- A
W7WHY 14,304- 149- 48- 10- B
N6TR/7 13,600- 136- 50- 2- A
W7PXL 6,438- 87- 37- 2- A
WA7IIM 672- 21- 16- 2- A
W7EJ (+AI7B W7ZR) 318,440- 2095- 76- 30- B
NK7U (+N7GPO,NI7T) 254,904- 1677- 76- 30- B

Utah

W7CFL 244,112- 1606- 76- 24- B
W7HS 55,626- 381- 73- 19- A
W7GXC 50,550- 337- 75- 11- A
KE7QA 43,608- 316- 69- 21- A
N7IUN 36,390- 303- 65- 10- A
KF7CD 23,530- 181- 65- 15- A
WA7TUX 1,280- 35- 18- 5- Q
W7MR (+KE7RU,KF7IM,WE7B,WL7D, WJ7M,WK7V) 196,384- 1292- 76- 24- B

Washington

W7WA 332,424- 2187- 76- 24- B
K7RI 225,416- 1483- 76- 24- A
K7LXC 209,456- 1378- 76- 24- A
KM7E 191,976- 1263- 76- 22- B
NG7P 145,440- 1010- 72- 24- A
W7LKG 116,736- 768- 76- 24- B
W7HX 87,756- 618- 71- 10- B
N7LOX 87,308- 598- 73- 20- A
N7KZN 69,204- 474- 75- 23- A
N7GGJ 50,094- 363- 69- 18- A
NS7O 40,044- 282- 71- 13- A
N7ETC 22,936- 188- 61- 6- A
N7KWC 20,768- 176- 59- 19- A
N6CHU/7 15,344- 137- 56- 8- A
N7DX 12,896- 124- 52- 3- A
W7OCV 10,300- 103- 50- 7- A
KD7LJ 9,898- 101- 49- 6- A
N7JZO 7,760- 97- 40- 10- A
KE7ZG 3,630- 55- 33- 9- A
N7AME 2,610- 45- 29- 3- A
K7WA 2,494- 43- 29- 2- A
W7XR (+K7HBN,K7SS) 282,872- 1861- 76- 24- B
NN7L (+NB7N) 223,440- 1470- 76- 24- B
WA7IUL (+WA7GWX) 55,578- 471- 59- 10- A

Wyoming

WD7L 194,850- 1299- 75- 21- B
N3AHA/7 116,216- 796- 73- 19- A
KB7M 34,176- 267- 64- 15- Q
N7GVV 34,160- 244- 70- 13- A
KD7RX 30,470- 277- 55- 10- A
N7LOD/T 6,540- 109- 30- 10- A
K7MM (+KB7BII,N7HYE) 228,760- 1505- 76- 24- B
WG7Z (+KB7AWM) 104,940- 795- 66- 22- A

8

Michigan

AI8D 188,480- 1240- 76- 24- B
N8OXX 155,496- 1023- 76- 19- B
WD8MGQ 148,808- 979- 76- 24- A
K8CC (W8WD,op) 144,900- 966- 75- 23- B
KE8OC 105,000- 700- 75- 21- B
KE8KG 63,028- 561- 74- 20- A
KA8GOM 81,992- 554- 74- 19- A
K8GSR 80,400- 529- 76- 24- B
K8SAK 59,250- 395- 75- 19- A
K8SB 58,400- 400- 73- 18- A
WD8O 58,350- 389- 75- 20- A
K8CV 57,670- 395- 73- 24- B
K8RDJ 52,560- 360- 73- 16- A
W8UMP 51,150- 341- 75- 21- A
W8VCF 46,056- 303- 76- 19- A
KE8RA 45,582- 321- 71- 13- A
W8VPC 44,446- 313- 71- 20- B
WB8THO 40,328- 284- 71- 19- A
WA8YPY 38,080- 272- 70- 20- A
WA8FRD 32,736- 248- 66- 15- A
NS8F 31,416- 238- 66- 13- A
WE8L 29,568- 224- 66- 12- A
KA8GIA 26,320- 240- 59- 8- A
KA8IZE 27,048- 196- 69- 18- A
W8TJQ 26,980- 190- 71- 12- A
K8KUH 26,400- 200- 66- 11- B
KE8JW 26,004- 197- 66- 13- A
N8FPN 24,050- 185- 65- 12- A
WD8KZX 23,932- 193- 62- 17- A
K8MVZ 23,562- 184- 64- 11- A
KB8CRR/1 23,100- 210- 55- 22- B
WB8AFO 22,936- 186- 61- 11- A
K8DD 22,800- 200- 57- 4- B
KB8OSF 22,302- 189- 59- 10- A
W8EGI 22,230- 171- 65- 10- A
WB8TOT 19,096- 164- 62- 9- B
N8HSN 17,400- 150- 58- 23- A
WD8R 17,280- 144- 60- 11- A
NX8K 17,226- 146- 59- 20- A
KB8DRY 17,000- 170- 50- 7- A
W8PPG 16,200- 150- 54- 13- A
K3UWG 15,400- 140- 55- 10- A
KA8WBQ 14,848- 128- 58- 24- A
WB8IFD 14,168- 154- 46- 11- A
WJ8J 13,260- 130- 51- 15- A
N8DDV 12,826- 121- 53- 11- A
WB8PDV 12,430- 113- 56- 7- A
KE8GC 11,024- 104- 53- 10- A
N8EUQ 10,716- 114- 47- 10- A
N8JVN/T 9,424- 124- 38- 8- A
W8VWY 9,328- 106- 44- 7- Q
KB8BJN 9,024- 94- 48- 7- A
KA8KGW/T 7,488- 96- 39- 15- A
KA8MEF 7,268- 79- 46- 5- A
WB8BUQ 6,970- 85- 41- 5- A
W8QIY 6,320- 79- 40- 4- A
N8ECL 6,216- 84- 37- 8- A
W8KZM 6,162- 79- 39- 3- B
WD8NQD 4,130- 59- 35- 8- B
WB8NXG 4,012- 59- 34- 3- A
WD8KZO 3,300- 50- 33- 3- A
W8FEM 3,000- 50- 30- 3- A
W8ROS 2,378- 41- 29- 4- A
KB8CHA 2,300- 50- 23- 10- A
KA8ZUQ/T 1,760- 40- 22- 2- A
WA8MJY 1,610- 35- 23- 2- A
KA8ZUP 1,156- 34- 17- 5- A
N8GMM 144- 12- 6- 2- A
KA8EGC/T 70- 7- 5- 1- A
KB8EXY 18- 3- 3- 1- A
NE8O (+KA8JBK) 115,672- 761- 76- 24- A
WA8QCW (+KA8CAU) 31,668- 233- 68- 7- A

Ohio

WB8JKR 147,896- 973- 76- 21- B
KE8PG 118,992- 804- 74- 19- B
W8UPH 78,280- 515- 76- 23- B
WF8E 74,304- 516- 72- 24- A
W8FN 66,882- 471- 71- 10- B
WD8AJF 51,830- 355- 73- 13- A
W8ILC 49,704- 327- 76- 10- A
N8ATR 47,880- 315- 76- 15- A
N8EIH 42,918- 311- 69- 16- Q
K8BL 42,778- 293- 73- 9- A
NC8V 42,192- 293- 72- 7- B
K8MR 41,464- 292- 71- 6- B
NQ8Y 36,938- 253- 73- 21- Q
N8FSP 36,312- 267- 68- 19- A
W8KIC 29,104- 214- 68- 5- A
WB8HIY 27,122- 191- 71- 22- B
W8IMF 24,570- 189- 65- 13- B
W8NHO 24,448- 191- 64- 19- B
NU8U 22,504- 194- 58- 17- A
KD8UC 22,440- 170- 66- 17- A
KC8JH 22,050- 175- 63- 24- A
W8IDM 21,350- 175- 61- 10- Q
N2FRW 19,964- 161- 62- 10- A
KA1S 19,008- 176- 54- 14- A
KC8F 17,920- 128- 70- 9- A
K8RSH 16,582- 147- 53- 7- A
KD8UN 8,832- 96- 46- 7- A
KB8DTY/T 7,280- 91- 40- 7- A
K8CKY 5,070- 65- 39- 5- A
N8JOC 4,864- 64- 38- 8- A
KA8YKI/N 4,416- 69- 32- 12- A
KA8ZEP 3,200- 50- 32- 4- A
N8KAG 2,850- 57- 25- 8- A
WD8KTM 462- 21- 11- 1- A
N8EKE (+N8IXX,WB3KKX) 168,416- 1108- 76- 22- B
AL7JP/8 (+KB8AHJ,N8HOB,WB8s MIP,PIY,ZYD) 118,200- 788- 75- 23- B
WB8X (+KA8YI.Y,KB8DEB,N8IWC, W8ILC) 106,412- 719- 74- 24- B
WD8EOL (+W2DIN,KA6WBG) 56,980- 385- 74- 24- A
WA6EZV/8 (+N8ASV,WD8s NMT,NMV) 45,752- 301- 76- 17- B
W8EDU (KA1PNF,KL7GQ,N8IRS, NV8L,WD8LQG,ops) 27,156- 219- 62- 13- A
N8INT/T (+N8INS) 3,456- 64- 27- 10- A

West Virginia

N8II 79,236- 558- 71- 9- B
NJ8J 35,340- 310- 57- 16- A
N8FXH 23,364- 198- 59- 8- A
W8VEN 14,756- 119- 62- 8- B
W3PYZ (+K3LDE,KQ3S,W3DQI,WA3QGA) 130,872- 861- 76- 24- B

9

Illinois

KS9Q 169,480- 1116- 76- 24- B
N9AEJ 96,520- 635- 76- 16- B
AG9E 75,184- 508- 74- 14- A
AG9A 65,512- 431- 75- 9- A
WA9TPQ 65,100- 434- 75- 13- A
W9KVF 63,688- 419- 76- 21- A
WA9DRE 57,760- 380- 76- 17- B
K9GH 51,120- 390- 71- 20- A
WB9JKI 49,950- 333- 75- 9- A
N2CKZ 46,650- 311- 75- 17- A
WD9AFL 42,458- 299- 71- 19- A
WB9GKA 40,460- 289- 70- 21- A
N9JF 39,480- 282- 70- 10- A
K9HDE 25,080- 209- 60- 5- B
N9DIX 20,050- 170- 58- 8- A
N9EVX 19,836- 171- 58- 20- A
W9LNQ 19,454- 137- 71- 9- A
KB9BIB/N 19,208- 196- 49- 10- A
WA9DIP 14,790- 145- 51- 11- A
KA9IMX 14,756- 119- 62- 7- A
N9ABF 14,040- 135- 52- 9- A
N9ALC 12,720- 106- 60- 8- A
W9REC 12,160- 95- 64- 11- A
KA9CJG 6,786- 87- 39- 4- A
K9UQN 4,224- 66- 32- 2- A
KA9OIK/T 2,400- 50- 24- 4- A
KB9BMW/T 884- 26- 17- 4- A
KA9TNZ (+KB9s AAW,AAX,KG9Z,NJ9Q) 187,264- 1232- 76- 24- B
WA8AVL (+N9CXQ) 164,768- 1084- 76- 24- B
W9YH (KE9NA,N9HXG,NM9H,ops) 123,120- 810- 76- 23- B
W9OO (K1BVS,KA9s JXU,ZMW,N9s GZF,HDL,WB8RFB,ops) 51,984- 361- 72- 22- A

Indiana

AJ9C 138,168- 909- 76- 23- A
N9QX 123,728- 814- 76- 23- B
KB0C 109,440- 720- 76- 20- B
W9JOO 81,928- 539- 76- 22- A
NX9T 47,328- 348- 68- 17- A
KR9V 42,240- 330- 64- 10- A
WB9CIF 36,778- 259- 71- 13- A
NN9H 34,164- 234- 73- 15- Q
N9HAV 26,532- 201- 66- 15- A
WB9NQQ 25,662- 193- 67- 11- A
KE9IT 25,452- 202- 63- 18- Q
NX9B 24,566- 173- 71- 11- A
N9GEU 18,480- 140- 66- 24- A
KB9LQ 17,040- 142- 60- 9- B
W4WQO 13,640- 124- 55- 21- A
KE9B 10,800- 100- 54- 6- A
N9HKW 10,000- 100- 50- 9- B
N9ACD 7,632- 106- 36- 4- A
N9HOV/1 6,888- 84- 41- 12- A
KE9I 6,006- 77- 39- 9- B
KB8AC 2,400- 50- 24- 24- A
N9FIM 1,150- 25- 23- 5- A
WB9WDW 972- 27- 18- 3- A
KE9FZ 576- 18- 16- 2- A
N9RJ (+AF9A,N9AZD,NE9O,WB9CEP) 195,016- 1283- 76- 24- B
N9BHQ (+ops) 45,990- 315- 73- 24- A

Wisconsin

K9OSH 162,914- 1006- 76- 20- B
WA1UJU 114,760- 755- 76- 24- A
K9KR 104,340- 705- 74- 20- B
WB9HRO 88,992- 618- 72- 9- B
KE9HJ 84,600- 564- 75- 22- A
W9NA 70,050- 467- 75- 14- A
KT9W 68,552- 451- 76- 14- A
NG9L 61,500- 410- 75- 12- A
KB9S 61,056- 424- 72- 16- Q
N9BSH/9 197,752- 411- 74- 7- B
N9HDE 55,522- 391- 71- 19- A
K1TMM 50,680- 362- 70- 9- B
K9RR 50,400- 350- 72- 15- B
W9WI 49,876- 337- 74- 16- A
N9HKD 40,068- 299- 67- 18- A
NA9M 28,098- 223- 63- 10- Q
KE9FT 26,400- 200- 66- 14- A
NI9C 24,966- 219- 57- 9- A
W9FPA 23,718- 201- 59- 11- A
WB9BWP 20,040- 167- 60- 12- A
KA9JAC 19,040- 170- 56- 15- A
K9CAN 16,200- 135- 60- 24- Q
W9VTL 10,080- 105- 48- 14- A
W9KHH 9,720- 81- 60- 24- A
WD9IAB 6,986- 73- 41- 24- A
KA9LOE 4,788- 63- 38- 24- B
N9FZK 4,628- 89- 26- 8- A
KA9JCP 1,610- 35- 23- 14- A
KA9KFU 40- 5- 4- 2- A
WBAIH (K9FVF,K9TG,N9BSH,ops) 197,752- 1301- 76- 24- B
WA9AKV (+KA9WXN) 29,312- 229- 64- 16- A
KA9YAF (+N9NE) 6,080- 80- 38- 3- A

0

Colorado

K9RF (W0UA,op) 295,944- 1947- 76- 24- B
K0EU 211,432- 1391- 76- 24- A
WB0IKN 201,400- 1325- 76- 24- A
W0CP 197,144- 1297- 76- 24- A
K0FRP 184,528- 1214- 76- 20- A
AC0S 181,800- 1212- 75- 20- B
W1XE 162,792- 1071- 76- 24- A
K0GAS 160,876- 1087- 74- 24- B
WBLSD 120,384- 792- 76- 24- Q
W0GOQ 109,938- 753- 73- 15- B
N0ZA 90,576- 612- 74- 21- B
WBGOR 73,556- 497- 74- 14- B
WA2MNO 65,240- 466- 70- 22- A
KD0DI 61,200- 408- 75- 20- A
KR0U 49,640- 340- 73- 19- Q
KE0PX 35,376- 268- 66- 20- A
N0AJM 33,672- 244- 69- 17- A
WD0T 29,440- 230- 64- 7- A
NQ0I 21,042- 167- 63- 4- B
WB0AJA 19,706- 167- 59- 15- A
WB0Z 19,140- 165- 58- 12- B
K2NA 12,880- 115- 56- 9- A
WD0GVH 12,700- 127- 50- 11- A
N0FS 10,058- 107- 47- 5- A
NY6Q 3,472- 56- 31- 4- A
KA1MPF/0 1,920- 40- 24- 4- A
KN5H 1,120- 28- 20- 3- A
N0JPY 952- 28- 17- 5- A
NI0E (+WB0IWL) 241,376- 1588- 76- 24- B
NY6R (+N0JAB) 22,040- 190- 58- 11- B

Iowa

WA0VBW 72,200- 475- 76- 23- Q
KC0GM 50,700- 338- 75- 19- A
WB0ZKG 39,000- 300- 65- 18- A
W0PPF 38,756- 269- 72- 19- B
KA5NWB/0 23,838- 202- 59- 24- B
KE0WO 23,790- 195- 61- 24- A
W0BVR 19,430- 145- 67- 14- A
K0EVC 11,536- 103- 56- 12- A
AD0H 11,000- 110- 50- 4- A
KD0RT (+K0JGH,N0ICI) 127,224- 837- 76- 23- B
W0YSE (+KA0WAA) 9,400- 100- 47- 13- A

Kansas

KB0G 163,616- 1208- 76- 24- B
WB0YJT 58,800- 392- 75- 21- A
K0VXU 46,920- 345- 68- 4- B
WB0SRX 45,402- 329- 69- 14- A
NW0F 29,614- 221- 67- 10- A
KA0SIX 3,780- 70- 27- 24- A
KB0DAC 3,016- 58- 26- 3- A
NO0Y/M 1,120- 28- 20- 3- Q
AB0S (+K0WA,W0CEM) 211,050- 1407- 75- 24- B
N0FBS (+N0s IXZ,JEI,WJ0H) 17,110- 145- 59- 14- A

Minnesota

KR0B (AF9T,op) 192,000- 1280- 75- 24- B
WB0HCH 153,150- 1021- 75- 24- B
AC0W 134,672- 886- 76- 24- A
W0UC 124,640- 820- 76- 23- A
K0FZG 115,144- 778- 74- 24- A
N0AT 111,456- 774- 72- 10- B
WA0RBW 84,656- 572- 74- 13- B
K0UL 69,204- 474- 73- 5- B
WB0YUK 65,846- 451- 73- 11- B
K3WT 65,136- 472- 69- 12- A
KB0ZQ 61,350- 409- 75- 15- B
W9RXJ 48,240- 335- 72- 19- B
W0YHE 40,392- 297- 68- 16- B
N0HJZ 21,476- 182- 59- 5- A
WA0WWW 17,400- 150- 58- 5- A
K0MPH 14,300- 130- 55- 4- A
KF0T 10,952- 74- 74- 11- A
K0AD 10,332- 126- 41- 2- B
KA0ZPP 2,878- 101- 29- 8- A
K0TK 6,776- 77- 44- 1- A
KB0CWV/T 6,264- 108- 29- 4- A
KA0ZIA 1,880- 47- 20- 4- A
W0NGB 780- 13- 10- 1- A
W0MXW (K0EN,DL5BAN,ops) 103,650- 691- 75- 17- A

Missouri

K4VX/0 (WC0G,op) 248,368- 1634- 76- 24- B
KM0L 167,352- 1101- 76- 24- A
NJ0X 51,876- 393- 66- 16- A
KE0WR 23,540- 214- 55- 12- A
K0HOF 9,604- 114- 43- 12- A
N0ZZ 9,400- 100- 47- 9- A
W0RNM 9,180- 90- 51- 12- A
KA0NAY 9,040- 113- 40- 2- A
KA0P 3,536- 52- 34- 3- A
N0HBH 3,234- 49- 33- 9- A
KB0DAX/T 800- 20- 20- 3- A
KA0USY 192- 8- 8- 5- A
W0QEV (KA0s HJY,VYF,WCH,WA0S, WB0OOO,ops) 120,028- 811- 74- 24- B

North Dakota

WB0O 296,704- 1952- 76- 23- B

Nebraska

KV0I 180,728- 1189- 76- 24- A
K0SCM 168,750- 1125- 75- 24- A
KB0QA 54,954- 387- 71- 9- A
K0PFV 42,174- 297- 71- 15- A
K0MZV 32,768- 256- 64- 11- A

South Dakota

K0OD 319,808- 2104- 76- 24- B
WB0MWJ 183,180- 1205- 76- 18- B
K0WIU 30,336- 237- 64- 9- A

VE

Maritime—NFLD

VE1BEM 119,524- 787- 76- 23- B
VO1AW 16,688- 149- 56- 8- A

Quebec

VE2MS 57,868- 391- 74- 20- A
VE2AQP 1,920- 48- 20- 2- A
VE2MAB (VE2s AMY,BRT,BT,DWT, ESP,GOP,HAK,HNL,JJL,MAJ,MPD, NAM,SHW,TD,YW,ops) 81,568- 416- 74- 24- A

Ontario

VE3IXU 35,644- 265- 67- 18- A
VE3CDS 33,880- 242- 70- 18- A
VE3TJL 33,180- 237- 70- 16- A
VE3OVI 29,964- 227- 66- 12- A
VE3FSV 28,416- 222- 64- 12- A
VE3NYT 16,330- 115- 71- 12- A
VE3FWF 13,552- 121- 56- 9- A
VE3SFK 10,528- 112- 47- 7- A
VE3FVW 10,488- 114- 46- 10- A
VE3OBU 5,858- 61- 48- 12- A
VE3ECH 4,896- 51- 48- 24- A
VE3LRB 2,800- 50- 28- 7- A
VE3XD (VE3s HHL,GAS,ops) 88,950- 593- 75- 8- A

Manitoba

VE4GV 155,700- 1038- 75- 21- A
VE4IM 69,160- 485- 76- 23- A
VE4SD 51,264- 356- 72- 18- A
VE4GN 50,224- 344- 73- 21- A
VE4VV 16,450- 175- 47- 4- A
VE4AR 12,852- 109- 59- 8- A

Saskatchewan

VE5AG 189,024- 1112- 76- 20- A
VE5FN (+ops) 183,768- 1209- 76- 20- A

Alberta

VE6DZ 47,996- 338- 71- 19- A
VE6NN 31,768- 209- 76- 19- A
VE6RI 12,444- 122- 51- 8- A

British Columbia

VE7SZ 307,936- 1968- 76- 19- A
VE7ARQ 63,114- 471- 67- 11- A
VE7FKS 8,256- 96- 43- 13- A
VE7TND 3,460- 56- 30- 8- A

Yukon

VY1QST (VY1s AD,AL,AU,BM,BQ,BR, CC,CW,DN,DU,ops) 120,900- 806- 75- 24- A

Checklogs

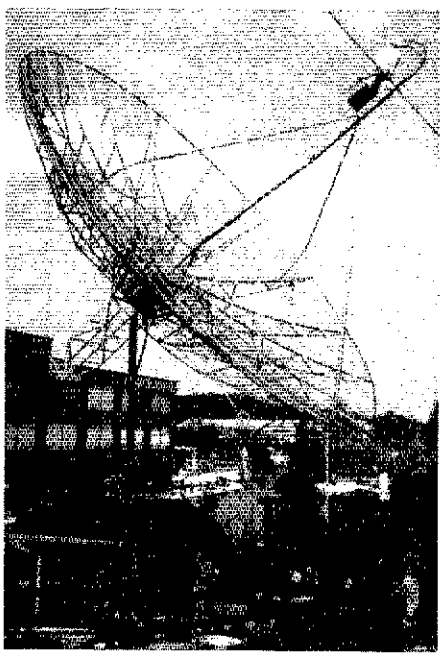
N1EUK, KK4RV, K5SL, K6MP, AE7K, W8VUV, NZ8M, VE3NRU

Results, Twelfth Annual ARRL International EME Competition

By Billy Lunt, KR1R
Contest Manager

As young lovers look out across the starlit night and their eyes focus on the full, golden moon set off brilliantly by the contrast of the sky, they think of romantic thoughts and lazy nights. But to the avid EMEers, this represents a time of good perigee and high activity as they bounce their signals off the rising moon in hopes of their signals being heard in far-off lands. This was the case for the 134 EMEers who participated in the 1988 ARRL International EME Competition during the weekend of Oct 22-23 and Nov 26-27.

There are so many determining factors to a good EME weekend: weather, perigee, geomagnetic field conditions, azimuth and elevation, fully visible moon, and propagation. The Contest Branch received varied reports from many different parts of the world. Hannes, OE5JFL, enjoyed the contest very much and claimed, "The weather was ideal with no wind and the equipment worked near optimum at all times." But, in contrast, Enrico, HB9SV, contended, "The propagation wasn't good at all during the second part of the contest. Sometimes, I couldn't even hear any echoes on 144 and 432 MHz." Dave, W5UN, stated, "I found the first weekend to have much better conditions than the second weekend. I had a lot of line noise here in the second part. I think it was caused by the windy weather we were experiencing. The noise kept me from operating Saturday moonrise. I had an S5 noise until the moon was at 45 degrees elevation."



The crew at HB9BM used this dish on 1296 MHz and scored 33,600 points.

Many EMEers commented on the abundance of newcomers across the bands. Newcomers are always welcomed with open arms in any Amateur Radio activity, especially in the specialized art of moonbouncing. One such newcomer was PAØJMV. Joop was very pleased to be able to participate in this year's EME contest and explained, "During the past years, I have spent most of the contest time listening and learning about EME phenomena. This year I gave it a try! Conditions were really good from my QTH." I am sure there are many more cases like Joop's. If you have been pondering the thought of moonbouncing, jump right in and give it a try.

OE5JFL led the way among the single-operator multiband entrants by operating on 144, 432 and 1296 MHz and gathering 1.2 million points for first place. HB9SV was close behind with 1 million points. KB8RQ was third with 899k points.

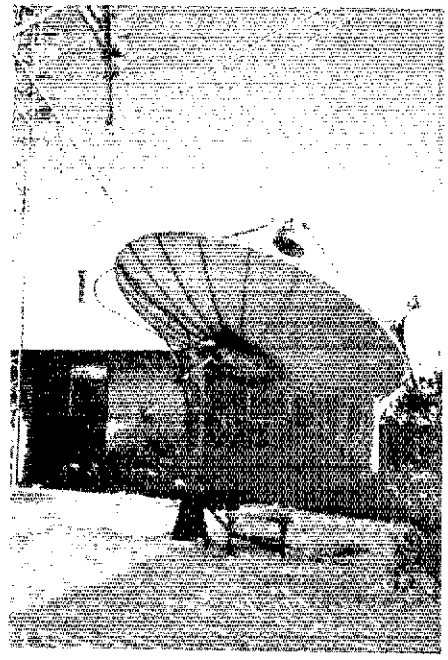
WA4NJP was the lone single-op 50-MHz entrant scoring 400 points.

Single-operator 144 MHz was the most popular entry category with 62 entries. W5UN ran away with first place completing 300 QSOs and 52 multipliers. DL8DAT was second with 865k points followed by SM5FRH with 697k points for third place.

Single-operator 432 MHz was the second most popular category. SM4IVE led the field of 28 EMEers for first place scoring 475k points. DL9KR and DJ6MB were only about 40k apart for second and third places respectively.

KD5RO completed one QSO on 902 MHz and was also the only single-op entry on 902 MHz.

WBØQMN outdistanced all others on single-op 1296 MHz for first place, scoring 22,400 points. WD5AGO was second with 4,800 points and DJ2US was third with 3,600 points.



Barry, VE4MA, operated 432, 1296 and 2304 MHz in snowy Manitoba.

OE9XXI was the only single-op entrant on 2304 MHz, completing 6 QSOs for a total of 3,600 points.

In the multioperator-multiband competition, we received two entries. In first place was OK1KIR with 110k points, followed by I2COR with 42k points.

Twelve multiop teams tried 144 MHz. HB9CRQ was the leader scoring 468k points. I2FAK came in second place with 326k points and HGØHO in third place with 263k points.

In the multiop, 432-MHz category, F1ELL and crew edged out KU4F for first place. F1ELL scored 293k points and KU4F scored 249k points. WBØTEM and friends were third place with 189k points.

The ops at HB9BM were the only ones to try multiop 1296 MHz. They completed 24 QSOs and 14 multipliers.

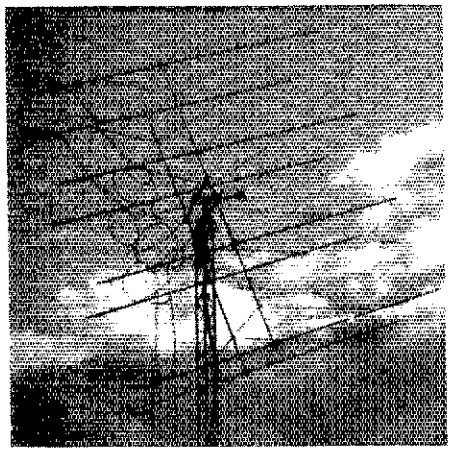
SK6WM and crew made 10 QSOs and 9 multipliers in the Non-Amateur Radio Equipment category on 2304 MHz.

Thanks to all for sending in lots of great photos and soapbox comments. HQ wishes we could print them all.

The Contest Branch is looking forward to seeing everyone again in 1989 along with many newcomers. Watch *QST* for the dates to be announced for the 1989 ARRL International EME Competition.

SOAPBOX

The only problem I had was that the power on 432 MHz dropped 2 dB at some times. I completed my 2-meter power amplifier just a few days before the second contest weekend. Conditions were good both weekends and a lot of very strong signals could be heard, especially on 70 cm (OE5JFL). There was good propagation on the 3 bands (144, 432 and 1296 MHz). On 1296 MHz the echoes were always clear. I only worked a few stations on 432 and 1296 MHz. I noticed a big increase in activity on 2 meters. I worked 35 new stations out of my 72 QSOs on 2 meters (HB9SV). During the first weekend, I had lots of fun working old and new stations. During the second weekend, Mother Nature's weather kept me tied down with very little fun (KB8RQ). The Oct weekend had high winds. I had to shut down with only a few hours of operation (W7HAH). This was my first real EME operation from my new QTH. It has taken one year to build a shack and rebuild the dish (G3LTF). This year I operated 2 bands. Next year, my goal is work 5-band EME (WA4NJP). I found the first weekend to have much better conditions than the second weekend. I had a lot of line noise here the second weekend. I think it was caused by the windy weather we were experiencing. Anyway, the noise kept me from operating the Saturday moonrise. I had S5 noise until the moon was at 45 degrees elevation. As usual, I was pleased to work several new stations. Notable remembrances were hearing KC3RE/TA3 calling CQ and having Martin answer my call. Also working several non-EME, Midwest stations on their moonset. It was fun hearing and working some of the European stations on my setting moon. Since expanding my antenna from 32 to 48, I seem to be hearing the small stations much more consistently. I sure wish more of the 2-meter gang to the east of me who do not work EME would give their moonset a try. It is pretty lonely during those final hours. KD5RO was one such eastern station who



Scott, WA3FFC, used these antennas to complete 62 QSOs and 24 multipliers on 432 MHz.

heard me shortly before his moonset. He gave me a call and made an EME QSO with his modest power and a single Yagi (W5UN). I am very pleased to see so many stations every year in the contest. This year the low end of 144 MHz sounded like hundreds of bumblebees. Just super! (OZ4MM). The conditions were disturbed by a big aurora that made signals come and go in an instant. Very bad lockup of Faraday on my western moon all four days. Still, the results were better than ever. It was probably due to the perigee weekend with low noise that made it easier for US small stations. Thanks for the fine contest (SM2CEW). I was very sorry to lose my new array, 16 × 15 el, in a storm the week after the first period of the contest. I am already working on my new antenna. It will be 16 × 17 el KLM. My new amplifier is soon ready to go. I hope to be back next year with a much more powerful station (SM5DGX). There were generally poor conditions. My new 4CX1500 amp was a big improvement the second weekend until the plate transformer let go. I hurriedly put a pair of 4CX250s back in service. I am already looking forward to next year (KI3W). No electricity the first day, wind and amp troubles the second day and poor conditions the second weekend made for troubled times! (WA7TDU). Conditions were FB the first weekend, but poor the second. Using a single Yagi with no elevation, I was pleased to work 4 stations during my 22-degree moonrise window. There were plenty of good signals to choose from, but it was impossible to get them all worked before the moon got too high! (WA7VHW). Thanks for the contest. Cooperative Faraday rotation was a rarity, but a new larger array provided some measure of compensation. I will be looking forward to the 1989 event (N4GJV). My best results ever but the first half was rain, rain, rain! (WA3FFC). Putting up eight instead of four antennas was really worth the effort. I worked 23 new stations (YU1IQ). This was my first EME contest. I hope to do better in the next one (ZS6AXT). This was my first EME contest from my own station. It was great to work WB5LUA on 902 MHz for what appears to be a distance record and a real good shakedown of my equipment (KD5RO). Great fun! We pooled equipment and ops to put the station on the air (W4IY). Our old 4CX250 amplifier is nicknamed Old Sparky and we discovered where the name comes from! Replacing shorted tubes and blown resisters kept us busy between contacts (KD3JS). We set up at the local high school. W5UN was copied very well with a 3-element Yagi! If you have a single Yagi, give EME a try (AF1T).

Scores

Each line score lists: call, score, stations heard, stations worked, multipliers, band (A = 50 MHz, B = 144 MHz, C = 220 MHz, D = 432 MHZ, 9 = 902 MHz E = 1296 MHz, F = 2304 MHz).

Single Operator, Multiband

OE5JFL	1,247,400	47	37	23	B
		105	94	34	D
		31	31	20	E
HB9SV	1,029,000	72	72	30	B
		48	48	22	D
		27	27	18	E
KB8RQ	899,600	166	166	47	B
		7	7	5	D
W7EN	323,700	43	35	22	B
		51	48	17	D
K4QIF	246,400	71	71	28	D
		6	6	4	E
W7HAH	244,000	40	40	27	B
		21	21	13	D
SM3AKW	185,500	14	14	11	B
		32	32	19	D
		6	6	4	E
		1	1	1	F
UA9FAD	169,600	40	40	25	B
		13	13	7	D
JA4BLC	129,000	16	16	12	B
		27	27	18	D
F2TU	126,000	20	20	13	D
		16	16	11	E
		6	6	6	F
W7ID	112,000	26	26	18	B
		14	14	10	D
VK5MC	77,500	5	5	5	B
		21	21	17	D
		5	5	3	E
G3LTF	55,100	22	22	14	D
		7	7	5	E
VE4MA	40,800	11	11	8	D
		10	10	6	E
		3	3	3	F

Single Operator, 50 MHz

WA4NJP	400	2	2	2	A

Single Operator, 144 MHz

W5UN	1,580,000	300	300	52	B
DL8DAT	865,000	173	173	50	B
SM5FRH	697,500	155	155	45	B
YU3WV	648,000	144	144	45	B
W4ZD	630,000	150	150	42	B
N5BLZ	559,000	130	130	43	B
EA2LU	534,300	137	137	39	B
SM7BAE	479,700	123	123	39	B
OZ4MM	433,200	114	114	38	B
YT2ME	366,300	99	99	37	B
SM4GVF	354,900	91	91	39	B
KD8SI	323,000	85	85	38	B
SM2CEW	308,100	79	79	39	B
AF9Y	283,500	81	81	35	B
LZ2US	280,500	85	85	33	B
W9HP	270,000	75	75	36	B
SM5DGX	262,400	82	82	32	B
PA0NIE	191,400	58	58	33	B
OK1MS	182,400	57	57	32	B
NP4X	174,000	58	58	30	B
UA1ZCL	168,000	60	60	28	B
DJ7UD	153,700	53	53	29	B
KI3W	153,000	51	51	30	B
F6DRO	150,800	52	52	29	B
KF0M	137,700	62	51	27	B
PA0JMV	111,800	70	43	26	B
PE1GBT	96,000	40	40	24	B
RA6AAB	94,300	41	41	23	B
K8HXW	80,500	35	35	23	B
Y23RD	69,300	33	33	21	B
UG6AD	68,000	34	34	20	B
EA3DXU	62,000	31	31	20	B
AA4FQ	52,200	29	29	18	B
WP4G	50,000	47	25	20	B
KA5AIH	47,600	37	28	17	B
SM5CPD	45,000	25	25	18	B
PA3CEG	40,800	24	24	17	B
RA6AX	40,000	25	25	16	B
I1KTC	36,800	23	23	16	B
K1GVM	31,500	21	21	15	B
WA7KYM	28,500	28	19	15	B
SK0UX (SM0LCB,op)					
	26,000	20	20	13	B
LA8YB	25,500	17	17	15	B
OH5IY	24,700	19	19	13	B
K5WE	23,400	18	18	13	B
DJ4UF	22,800	19	19	12	B
WSUWB	21,600	18	18	12	B
PA3EON	21,600	18	18	12	B
WA7TDU	20,800	16	16	13	B
HG2RG	16,800	14	14	12	B
DL2OM	11,700	13	13	9	B
SP5EFO	9,000	10	10	9	B
WA7VHW	9,000	10	10	9	B
W8WVM	8,000	10	10	8	B
WA4MVI	5,400	9	9	6	B
EA3BTZ	3,000	6	6	5	B
EA3AQJ	2,500	5	5	5	B
VE3EQQ	1,200	4	4	3	B
WB9MSV	400	8	2	2	B
JA9EYI	400	11	2	2	B
EA3EHQ	400	2	2	2	B
W2RS	100	3	1	1	B

Single Operator, 432 MHz

SM4IVE	475,800	122	122	39	D
DL9KR	407,000	110	110	37	D
DJ6MB	364,800	96	96	38	D
F1FHI	336,600	99	99	34	D
N4GJV	326,400	100	96	34	D
K1FO	208,800	72	72	29	D
DJ9BV	186,000	62	62	30	D
DF3RU	176,900	61	61	29	D
N6AMG	170,000	68	68	25	D
WA3FFC	148,800	72	62	24	D
YU1IQ	112,700	49	49	23	D
RA3YCR	62,700	33	33	19	D
DK5AI	62,000	31	31	20	D
SM6EUP	62,000	31	31	20	D
JA9BOH	40,000	25	25	16	D
W0RAP	39,000	26	26	15	D
JA2JRJ	37,500	25	25	15	D
WA4OFS	33,600	24	24	14	D
RB5LGX	32,500	51	25	13	D
XE1XA	26,400	22	22	12	D
K8WW	25,300	23	23	11	D
W1JR	24,000	20	20	12	D
UA6LGH	23,000	23	23	10	D
K5WXN	22,100	17	17	13	D
K2OS	16,000	16	16	10	D
OH2DG	10,400	13	13	8	D
LA8AE	9,600	12	12	8	D
I5TDJ	3,500	7	7	5	D

Single Operator, 902 MHz

KD5RO	100	1	1	1	9

Single Operator, 1296 MHz

WB0QMN	22,400	16	16	14	E
WD5AGO	4,800	8	8	6	E
DJ2US	3,600	6	6	6	E
KD7YZ	2,800	7	7	4	E
SM0PYP	1,600	5	5	3	E
ZS6AXT	800	4	4	2	E

Single Operator, 2304 MHz

OE9XXI	3,600	6	6	6	F

Multioperator, Multiband

OK1KIR (OK1s CZ,DAI,DAK,PG,ops)					
	110,000	28	28	15	D
		13	13	8	E
		2	2	2	F
I2COR (+I2s TFI,YID,IW2ATM)					
	42,500	18	18	13	D
		7	7	4	E

Multioperator, 144 MHz

HB9CRQ (+HB9DBM)					
	468,000	117	117	40	B
I2FAK (+IK2LZT)					
	326,800	88	88	38	B
HG0HO (+ops)					
	263,500	85	65	31	B
HG1W (HG1s YA,YU)					
	76,200	36	36	22	B
KL7X (+AL7FS,KL7WE)					
	77,000	35	35	22	B
OK1KRA	44,800	28	28	16	B
FF6KBF (F6s FLU,HSW,FC1s DDA,DRR,ops)					
	43,200	24	24	18	B
W4IY (K4HWG,KA4CKI,K0RI,ops)					
	33,600	21	21	16	B
EA3BB (EA3s AEN,AYX,ops)					
	22,400	16	16	14	B
EA4AO (+EA4ED)					
	14,000	14	14	10	B
I3MW (+I3s EJ,LDP,MEK,YXC)					
	4,900	7	7	7	B
K3CR (AF1T,KA3RRF,KD3JS,ops)					
	1,600	4	4	4	B

Multioperator, 432 MHz

F1ELL (+F1DDA,FD1s FLN,HTB)					
	293,700	89	89	33	D
KU4F (+WT4A)					
	240,000	80	80	30	D
WB0TEM (+WA2PHW,NS0N,WB0GGM)					
	189,000	70	70	27	D
JH0YSI (JA0s HVL,RWF,ops)					
	56,800	31	31	18	D
JA1YWX (JM1MCF,JP1GOH,JF2IWL, JI2GUT,JN3PYQ,JA6XKQ,JH7PKU, JH9GGH,ops)					
	19,200	16	16	12	D

Multioperator, 1296 MHz

HB9BM (HB9s CXR,MZQ,VI,ops)					
	33,600	24	24	14	E

Non-Amateur Equipment

SK6WM (SM6s EBM,FHZ,SM0PYP,ops)					
	9,000	13	10	9	F

Field Day Rules

1) **Eligibility:** Field Day is open competitively to all amateurs in the ARRL/CRRL Field Organization (plus Yukon and NWT). Foreign stations may be contacted for credit but are not eligible to compete.

2) **Object:** To work as many stations as possible on any or all amateur bands (except 10 MHz) and, in doing so, learn to operate in abnormal situations under less-than-optimum conditions. A premium is placed on skills and equipment developed to meet the challenge of emergency preparedness and to acquaint the public with the capabilities of Amateur Radio.

3) **Dates:** June 24-25, 1989.

4) **Field Day Period:** From 1800 UTC Saturday until 2100 UTC Sunday. Class A and Class B (see below) stations who do not begin setting up until 1800 UTC Saturday may operate the entire Field Day period of 27 hours. Others must begin their setup no earlier than 1800 UTC Friday and may operate no more than 24 consecutive hours; ie, once on-the-air Field Day operation has started, it must end 24 hours from that point.

5) **Entry Categories:** Field Day entries are classified according to the maximum number of simultaneous transmitted signals, followed by the designation of the nature of the individual or group participation. Below 30 MHz, once a transmitter is used for a contact on a band, it must remain on that band for at least 15 minutes. During this 15-minute period, the transmitter is considered to be transmitting a signal, whether it is or not, for purpose of determining transmitter class. Switching devices prohibited.

(Class A) Club/nonclub portable: Club groups (or nonclub groups with three or more licensed amateurs) set up specifically for Field Day. Such stations must be located in places that are not regular station locations, and must use no facilities installed for permanent station use, nor any structures installed permanently for Field Day use. Stations must be operated under one call sign (except when the Novice/Technician position is used) and under the control of a single licensee or trustee for each entry. All equipment (including antennas) must lie within a circle whose diameter does not exceed 300 meters (1000 feet). All contacts must be made with transmitter(s) and receiver(s) operating independent of commercial mains. Entrants who, for one reason or another, operate a transmitter or receiver from commercial mains for one or more contacts will be listed separately at the end of their class.

Any Class A group whose entry classification is two or more transmitters (non-Novice) may also use one Novice/Technician operating position (Novice bands only) without changing its basic entry classification. For Field Day purposes only, any Canadian "Amateur" licensee, who has been licensed for less than six months prior to Field Day, shall be considered a "Novice" to provide a means for Canadian Field Day Class A stations with two or more transmitters to participate with a "Novice/Technician" operating position. This "Canadian Novice station" is restricted to the US Novice sub-bands and power/mode restrictions. The Novice/Technician station (including antennas) should be set up and operated by Novice and Technician licensees and should use the call sign of one of the Novice/Technician operators.

Send for Your Field Day Package

Send to HQ a 9- × 12-inch self-addressed envelope with 4 units of First Class US postage or 4 IRCs for the official Field Day Entry Package. This package includes 1 publicity kit, 1 Field Day summary sheet, 1 large dupe sheet with instructions and a check list to ensure that your entry is complete. If you require more dupe sheets, indicate so in your request and affix 1 unit of additional First Class postage to your SASE for each two additional dupe sheets requested.

(Class A—Battery) Club/nonclub portable: Club groups (or nonclub groups with three or more licensed amateurs) set up specifically for Field Day and all contacts are made using an output power of 5 W or less and the power source is other than commercial mains or motor-driven generator (eg, batteries, solar cells, water-driven generators). Other provisions are the same as for class A.

(Class B) One- or two-person portable: Nonclub stations set up and operated by not more than two licensed amateurs will be placed in Class B. Other provisions are the same as for Class A. One- and two-person Class B entries will be listed separately in the results.

(Class B—Battery) One- or two-person portable: Nonclub stations set up and operated by not more than two licensed amateurs and all contacts are made using an output power of 5 W or less and the power source is other than commercial mains or motor-driven generator (eg, batteries, solar cells, water-driven generators). Other provisions are the same as for Class A. One- and two-person Class B—Battery entries will be listed separately in the results.

(Class C) Mobile: Stations in vehicles capable of operating while in motion and normally operated in this manner, including antenna. This includes maritime and aeronautical mobiles.

(Class D) Home stations: Stations operating from permanent or licensed station locations using commercial power. Class D stations may count contacts only with Class A, B, C and E Field Day groups for points.

(Class E) Home stations—emergency power: Same as Class D, but using emergency power for transmitters and receivers. Work stations in Class A, B, C, D and E.

W1AW Field Day Bulletin Schedule

In addition to the regular schedule detailed on page 90 of April *QST*, extra CW bulletins will be run at 1400 UTC (10 AM EDT), and extra phone bulletins at 1500 UTC (11 AM EDT) both Saturday and Sunday mornings.

6) **Exchange:** Stations in any ARRL/CRRL Section will exchange their Field Day operating class and ARRL/CRRL Section. For example, if your club group was planning to operate in the three-transmitter, Class A category from Missouri, you would send 3 A MISSOURI. Foreign stations send RS(T) and QTH.

7) **Miscellaneous Rules:**

A) Operators participating in Field Day may not, from any other station, contact for point credit the Field Day portable station of a group with which they participated.

B) A station used to contact one or more Field Day stations may not subsequently be used under any other call during the Field Day period. Family stations are exempted.

C) Each phone and each CW segment is considered as a separate band. All voice communication contacts are equivalent, and packet/RTTY/ASCII/AMTOR is counted as CW. A station may be worked once on each band. Crossband contacts are not allowed. The use of more than one transmitter at the same time in a single band is prohibited, except that a Novice/Technician position may operate on any Novice band segment at any time. No repeater contacts.

8) **Scoring:** Scores are based on the number of valid contact points times the multiplier corresponding to the highest power used at any time during the Field Day period, plus bonus points. Phone contacts count one point each, and CW contacts count two points each. Power multipliers: If *all* contacts are made using an output power of 5 W or less **and if a power source other than commercial mains or motor-driven generator is used (eg, batteries, solar cells, water-driven generators), multiply by 5.** If any or all contacts are made using an output power of 150 W or less, multiply by 2. Multiply by 1 if any or all contacts are made using an output power over 150 watts. Batteries may be charged while in use for Class C entries only. For other classes, batteries charged during the Field Day period must be charged from a power source independent of the commercial mains.

A) **Bonus points:** The following bonus points will be added to the score (after the multiplier is applied) to determine the final score. Only Class A and B stations are eligible for bonuses. Just check the box on the Field Day summary sheet to indicate that you qualify for the bonus, and attach the necessary proof.

1) *100% emergency power:* 100 points per transmitter for 100% emergency power. All equipment and facilities at the Field Day site must be operated from a source independent of the commercial mains. Example: A club operating 3A, using 100% emergency power, may claim 300 bonus points.

2) *Public relations*

A) *100 points for media publicity.* Publicity must be obtained or a bona fide attempt to obtain publicity must be made.

Evidence must be submitted in the form of a newspaper clipping, a memo from a BC/TV station stating that publicity was given or a copy of the material that was sent to the news media for publicity purposes.

B) 100 points for physically locating in a public place (eg shopping center, parks, etc) with significant access by the public. The intent here is for Amateur Radio to be on display to the public.

C) An additional 100 points can be earned by such display stations in public places actively conducting an information booth for the visiting public and dispensing information handouts, maintaining visitor's log, etc, as an information/recruiting tool for Amateur Radio. Evidence submitted for both (B) and (C) may consist of copies of handouts, visitor's log, brief report on activities conducted, photos, etc.

3) *Message origination*: 100 points for origination of a message by the club president or other Field Day leader, addressed to the SM or SEC, stating the club name (or nonclub group), number of operators, field location and number of ARES members participating. The message must be transmitted during the Field Day period, and a fully serviced copy of it must be in standard ARRL message form or no credit will be given.

4) *Message relay*: 10 points for each message received and relayed during the Field Day period, up to a maximum of 100 points. Copies of each message, properly serviced, must be included with the Field Day report.

5) *Satellite QSO*: 100 points can be earned by completing at least one QSO via satellite during the Field Day period. The repeater provision of Rule 7C is waived for satellite QSOs. A satellite station does not count as an additional transmitter. On the summary sheet, show satellite QSOs as a separate "band."

6) *Natural Power*: Field Day groups making a minimum of five QSOs without using power from commercial mains or petroleum derivatives can earn 100 points. Intuitively, this means an "alternate" energy source of power such as solar, wind, methane or grain alcohol. This includes batteries charged by natural means (not dry cells). The natural-power station counts as an additional transmitter. If you do not wish to change your entry class, take one of your other transmitters off the air while making the natural-power QSOs. A separate list of natural-power QSOs should be enclosed with your entry.

7) *W1AW message*: A bonus of 100 points will be earned by copying a special ARRL Field Day bulletin sent over W1AW on its regularly announced frequencies just before and during Field Day. This message can be received directly from W1AW or by any relay method. An accurate copy of the received message should be included in your Field Day report.

8) *Packet radio*: 100 points can be earned by completing at least one QSO on packet radio during the Field Day period. The repeater provision of Rule 7C is waived for packet-radio QSOs. A packet station does not count as an additional transmitter. On the summary sheet, show packet radio QSOs as a separate "band."

9) **Reporting**: Entries must be postmarked by July 25, 1989. No late entries can be accepted. A complete entry consists of an official ARRL summary sheet (or reasonable facsimile) and a list of stations worked on each band/mode during Field Day, plus bonus proof. The list of stations worked on each band or mode may take the form of official ARRL dupe sheets or an alphanumeric listing of call signs worked per band and mode. This list may be computer-generated. Incomplete or illegible entries will be classified as checklogs. A copy of Field Day logs should be kept by your Field Day group but should not be sent in unless specifically requested later by ARRL.

10) **Condition of Entry**: Each entrant agrees to be bound by the provisions, as well as the intent, of this announcement, the regulations of his or her licensing authority and the decisions of the ARRL Awards Committee.

11) **Disqualifications**: See January 1989 *QST*, page 104. QST

ARRL June VHF QSO Party Plaque Program

Listed below are the plaques that will be awarded in the 1989 ARRL June VHF QSO Party. Sponsors as of March 7 are shown adjacent to the corresponding category. If you are interested in sponsoring one or more of these awards that have not been sponsored, contact the Contest Branch at ARRL HQ.

The list of sponsored plaques may change because of *QST* lead time, so please call us for a list of what is available before sending payment. We salute all who have helped make the Plaque Program such a success!

Single Operator

Position	*Donor*
1st	John Kanode, N4MM
2nd	Bald Knob VHF Contest Group
3rd	Cushcraft
4th	Terry Netzley, W8NJR
5th	Delaware Valley VHF Society
6th	Down East Microwave
7th	Mt Greylock Expeditionary Force—W2SZ/1
8th	
9th	
10th	

Multioperator

Position	*Donor*
1st	Randy Stegemeyer, W7HR
2nd	Cushcraft
3rd	In Memory of Morris Tillotson, W4OKN—WB4FDT
4th	Frank Potts, NC1I
5th	Mt Airy VHF Radio Club
6th	
7th	Mark Wilson, AA2Z
8th	Down East Microwave
9th	
10th	W1XX (+WB1AVA,K1GX,K1JX, KB9NM) Contest Team

QRP Portable—Single Operator

Position	*Donor*
1st	K2OVS and K2RIW
2nd	Peter Putman, KT2B
3rd	Contest Committee—LIMARC
4th	West Coast VHFer
5th	Sunrise Radio Club—W2SV

QST

Rules, June VHF QSO Party

1) **Object**: To work as many amateur stations in as many different 2° × 1° grid squares as possible using authorized amateur frequencies above 50 MHz.

2) **Contest Period:** Begins 1800 UTC Saturday, June 10, and ends at 0300 UTC Monday, June 12.

3) **Categories:**

(A) **Single Operator**: One person performs all operating and logging functions.

(1) *Multiband.*

(2) *Single band:* Single-band entries on 50, 144, 220, 432, 902, 1296 and 2304-and-up categories will be recognized both in *QST* score listings and in awards offered. Contacts may be made on any and all bands without jeopardizing single-band entry status. Such additional contacts are encouraged and should be reported. Also see Rule 9, Awards.

(B) **Single Operator, QRP Portable**: Run 10-W output or less using a portable power source from a portable location. The intent of this rule is to encourage operation from remote locations, not to have home or fixed stations run low power.

(C) **Multioperator**: Multioperator stations must locate all equipment (including antennas) within a circle whose diameter does not exceed 300 meters (1000 feet).

4) **Exchange**: Grid locator (see Jan 1983 *QST*, page 49). Example: W1AW in Newington, CT would send FN31. Exchange of signal report is optional.

5) **Scoring**:

(A) *QSO points*: Count one point for each complete 50- or 144-MHz QSO. Count two points for each 220- or 432-MHz QSO. Count three points for each QSO on 902- or 1296-MHz. Count four points for each 2.3-GHz-or-higher QSO.

(B) *Multiplier*: The total number of different grid squares worked per band. Each 2° × 1° grid square counts as one multiplier on each band it is worked.

(C) *Final score*: Multiply the total number of QSO points from all bands operated by the total number of multipliers for final score (see scoring example).

6) **Use of FM**:

A) Retransmitting either or both stations, or use of repeater frequencies, is not permitted. This prohibits use of all repeater frequencies. Contest entrants may not transmit on repeaters or repeater frequencies on 2 meters for the purpose of soliciting contacts.

(B) Use of the national simplex frequency, 146.52 MHz, or immediate adjacent guard frequencies is prohibited. Contest entrants may not transmit on 146.52 MHz for the purpose of making or soliciting QSOs. The intent of this rule is to protect the national simplex frequency from contest monopolization. There are no restrictions on the use of 223.50 MHz.

(C) Only recognized simplex frequencies may be used, such as 144.90 to 145.00; 146.49, .55 and .58; and 147.42, .45, .48, .51, .54 and .57 MHz on the 2-meter band. Local-option simplex channels and frequencies adjacent to the above that do not violate the intent of (A) or (B) above or the spirit and intent of the band plans as recommended in the *ARRL Repeater Directory*, may be used for contest purposes.

Scoring Example

Band (MHz)	QSOs	QSO Points	Grid Squares
50	25 (×1)	25	10
144	40 (×1)	40	20
220	10 (×2)	20	5
432	15 (×2)	30	10
1296	6 (×3)	18	3
Totals	96	133	48

Final score = (QSO points) × (total no. grid squares): (6384 = 133 × 48).

7) **Miscellaneous:**

(A) *Stations may be worked for credit only once per band from any given grid square, regardless of mode.* This does not prohibit working a station from more than one grid square with the same call sign. Such a roving station, however, must submit a separate entry for each grid square from which operation takes place. In this situation, the entrant may opt to waive rule 7 (C) and use a single different grid square. Crossband QSOs do not count. Aeronautical mobile contacts do not count.

(B) Partial QSOs do not count. Both calls, the full exchange and acknowledgment must be sent and received.

(C) A transmitter used to contact one or more stations may not be used subsequently under any other call during the contest period (with the exception of family stations where more than one call is assigned to one location by FCC/Comm Canada); one operator may not give out contest QSOs using more than one call sign from any one location. The intent of this rule is to accommodate family members who must share a rig, not to manufacture artificial contacts.

(D) Only one signal per band (6, 2, 1¼ etc) at any given time is permitted, regardless of mode.

(E) While no minimum distance is specified for contacts, equipment should be capable of real communications (ie, able to communicate over at least 1 km).

(F) Multioperator stations may not include QSOs with their own operators except on frequencies higher than 2.3 GHz. Even then, a complete, different station must exist for each QSO made under these conditions.

(G) A station located *precisely* on a dividing line between grid squares must select only one as the location for exchange purposes. A different grid-square multiplier cannot be given out without moving the complete station (including antennas) at least 100 meters.

(H) Above 300 GHz, contacts are permitted for contest credit only between licensed amateurs using coherent radiation on transmission (eg, laser) and employing at least one stage of electron detection on receive.

(I) Marine Mobile (and Maritime) entries will be listed separately as "Marine Mobile" in the score listings and compete separately for awards.

8) **Reporting:**

(A) Entries must be received no later the 30 days after the end of the contest (July 12, 1989). No late entries can be accepted. Use ARRL VHF QSO Party forms (available from HQ for an SASE with 2 units of first-class postage) or reasonable facsimile.

(B) Logs must indicate time in UTC, bands, calls and complete exchanges sent and received. Multipliers should be numbered clearly in the log the first time they are worked. Entries with more than 200 QSOs total must include cross-check sheets (dupe sheets).

9) **Awards:**

(A) Plaques will be awarded in the following categories:

(1) Top ten single-operator scorers

(2) Top ten multioperator scorers

(3) Top five single-operator QRP portable scorers

(B) Certificates will be awarded in the following categories:

(1) Single operator

(A) Top single-operator score in each ARRL Section.

(B) Top single operator on each band (50, 144, 220, 432, 902, 1296 and 2304-and-up categories) in each ARRL Section where significant effort or competition is evidenced. (Note: Since the highest score per band will be the award winner for that band, an entrant may win a certificate with additional single-band achievement stickers.) For example, if WBØTEM has the highest single-operator all-band score in the Iowa Section and his 50- and 220-MHz score are higher than any other IA single-op's, he will earn a certificate for being the single-operator Section leader and endorsement stickers for 50 and 220 MHz.

(C) Top single-operator QRP portable in each ARRL Section where significant effort or competition is evidenced.

(2) Top multioperator score in each ARRL Section where significant effort or competition is evidenced. Multioperator entries are *not eligible* for single-band awards.

10) **Condition of Entry:** Each entrant agrees to be bound by the provisions, as well as the intent, of this announcement, the regulations of his or her licensing authority and the decisions of the ARRL Awards Committee.

11) **Disqualifications:** See January 1989 *QST*, page 104.

Strays

I would like to get in touch with...

☐ any hams who served aboard the *USS Richard L. Page* FFG-5. Steve Lare, N8KDV, 824 W 25th Street, Holland, MI 49423.

☐ anyone with a manual for the Heath Model QM-1 Q meter. Harry Knoll, WAØGOZ, 10081 103rd St N, Stillwater, MN 55082.

Contest Corral

Conducted By Billy Lunt, KR1R
Contest Manager

MAY

3

West Coast Qualifying Run, 10-35 WPM, at 0400Z May 4 (9 PM PDT May 3). W6OWP prime, W6ZRJ alternate. Frequency is approximately 3.590 MHz. Underline one minute of the highest speed you copied, certify that your copy was made without aid and send to ARRL HQ for grading. Please include your full name, call sign (if any) and complete mailing address. A large SASE will help expedite your award or endorsement.

5

ARRL Spring Sprints, 902 MHz, see Apr *QST*, p 88.

6-7

Ten-Ten International Net Spring CW QSO Party, see Apr *QST*, p 88.

MARAC County Hunters CW Contest, see Apr *QST*, p 88.

Danish SSTV Contest, see Apr *QST*, p 88.

Florida QSO Party, sponsored by the West Palm Beach ARC and the *Florida Skip* from 0000Z May 5 until 2400Z May 6. Phone and CW are separate contests. Work stations once per band and mode. No crossband, crossmode or repeater contacts. Work FL stations, FL stations work everyone. Entry Classes: Class A—FL stations operating portable or mobile and using less than 100 W; Class B—FL stations operating CW in their home county; Class C—FL stations operating phone in their home county; Single operator; Multioperator. Exchange RST and state/province/country (FL stations, RST and county). Non-FL stations: count 2 points per QSO and multiply by the total number of FL counties (67 max) worked. FL stations: Class A—count 1 point per QSO; Class B—count 2 points per QSO; Class C—count 3 points per QSO. Total QSO points and multiply by the total of states (max 49), provinces (max 12) and countries (max 27). Send separate logs for phone and CW before Jul 4 to Florida QSO Party Contest Committee, PO Box 8194, West Palm Beach, FL 33407.

9

W1AW Qualifying Run, 10-35 WPM at 0200Z May 10 (10 PM EDT May 9). Transmitted simultaneously on 1.818 3.580 7.080 14.070 147.555 MHz. See May 3 listing for more details.

11

ARRL Spring Sprints, 1296 MHz, see Apr *QST*, p 88.

13

Ten-Meter Dash, see Apr *QST*, p 88.

Crooked Stick & Rats Nest QSO Party, sponsored by the Issaquah ARC, 2000Z-2300Z May 13. Phone and CW. Frequencies: CW—28.100-28.200; phone—28.300-28.500. Work stations once per mode. Max 200 W PEP output. Exchange signal report and serial number of contact. QSO points: CW—4 pts; SSB—1 pt. Multipliers: times 2 if with an apprentice; times 2 if using an antenna constructed especially for this contest. No part of this antenna may be more than 20 feet above ground and no more than 100 feet of wire. Bonus points: 100 points for a newly licensed Novice making first-time-ever contact; 100 points if operator or apprentice is physically handicapped; 50 points for working all US call areas; 25 points for description of contest activity or a photograph of antenna, contest operation or contest group. Total QSO points times multipliers plus bonus points for final score. Awards. Send log by May 25 to Martha Stedman, N7IVX, 15423 SE 7th Place, Bellevue, WA 98008.

13-14

Nevada QSO Party, see Apr *QST*, p 88.

CQ-M Contest (Peace to the World), see Apr *QST*, p 89.

18

ARRL Spring Sprints, 2304 MHz, see Apr *QST*, p 89.

20-21

OMARC Midnight Special, see Apr *QST*, p 89.

Armed Forces Day—This year marks the 40th anniversary of communications tests between the Amateur Radio community and the Military Communications System. Special commemorative QSL cards will be issued to amateurs achieving a verified two-way radio contact with any of the participating military radio stations. Those who receive and accurately copy the Armed Forces Day CW and/or RTTY message from the Secretary of Defense will receive a special commemorative certificate.

Crossband Radio Contacts—The military-to-amateur crossband operations will be conducted from 1300Z May 20 until 0245Z May 21. Military stations will transmit on military frequencies and will announce the specific amateur band frequencies being monitored. Limit contacts to three minutes. The following stations will transmit on the designated frequencies (in kHz): AAE, Fort Sam Houston, TX: LSB—4028.5 7358.5; USB—13994.5 27992.5; RTTY/CW—14665; Packet—20992.5. AAH, Fort Lewis, WA: LSB—4033.5; USB—14488.5 27820; RTTY/CW—6988. AIR, Washington, DC: LSB—4025 7315; USB—14408; RTTY—13986.5; CW—6995.5 13997.5. NAM, Norfolk VA: USB/RTTY/CW—14400. NAV, Cheltenham, MD: USB—14389.5; RTTY—7372.5. NPG, Stockton, CA: LSB—4001.5 7301.5; USB—14375 21460; RTTY—13927.5; CW—4010 6970 7365 10259.5 13975.5 20998.5. NPL, San Diego, CA: USB—14385; RTTY—7382.5. NMH, Alexandria, VA: LSB—7346.5; USB—20937.5; RTTY—14440; CW—4015. NMN, Portsmouth, VA: USB/RTTY/CW—7393. NZJ, El Toro, CA: USB—14480; RTTY—7375. WAR, Fort Detrick, MD: LSB—4018.5; USB—14403.5 20994.5; RTTY/CW—13992.5; CW—6997.5.

Receiving Test—The CW and the RTTY broadcast will be special Armed Forces Day messages from the Secretary of Defense to any Amateur Radio operator or SWL who desires to participate. A 10-minute tuning call will precede each transmission. The CW broadcast will be transmitted at 25 WPM beginning at 0300Z May 21. The RTTY broadcast will begin at 0345Z May 21 and be transmitted at 60 WPM using 170-Hz shift. Both the CW and RTTY broadcast will be transmitted from the following stations at the listed frequencies (in kHz): AAE, Fort Sam Houston, TX—4018.5 6988 9990; AAH, Fort Lewis, WA—4021.5 7309.5 13994.5; AIR, Washington, DC—6995.5 13997.5; NAM, Norfolk, VA—4005 7393 14400; NAV,Cheltenham, MD—7372.5 14389.5; NPG, Stockton, CA—4010 7365 13975.5; WAR, Fort Detrick, MD—4028.5 6997.5 14403.5.

Submission of Test Entries—Transcriptions of the CW and/or RTTY Receiving Tests should be submitted as received. No attempt should be made to correct possible transmission errors. The time, frequency and call sign of the military station copied as well as the name, call sign and address of the individual submitting the entry must be indicated on the page containing the test message. Entries must be postmarked no later than May 27 and submitted to the respective military command as follows: AIR to Armed Forces Day Test, 2045CG/DOJM, Andrews AFB, Washington, DC 20331-6345; AAE, AAH or WAR to Armed Forces Day Test, Commander, USAISC, ATTN: AS-OPS-OA, Fort Huachuca, AZ 85613-5000; NAM, NAV or NPG to Armed Forces Day Test, Naval Communication Unit, Washington, DC 20397-5161.

World Telecommunications Day Contest, sponsored by the Liga de Amadores Brasileiros de Radio Emissao, beginning 0000Z May 20 until 2400Z May 21. Phone and CW. Bands: Only 160/80/40/20/15/10. Categories: Single-op/single-transmitter/all-band operation (No spotting nets in this category); multi-op/single-transmitter/all-band operation (After band change the station must remain there for at least 10 minutes). Exchange: RS(T) and serial number starting with 001 (Brazilian stations send RS(T) and two-letter designator of their state). Contacts between stations on different continents are worth 3 points on the 20/15/10-meter bands and 6 points on the 160/80/40-meter bands. Stations on same continent but different country count 2 points on the 20/15/10-meter bands and 4 points on the 160/80/40-meter bands. Contacts between stations in the same country are worth 1 point on 20/15/10-meter bands and 2 points on 160/80/40-meter bands. Same station may be worked once on each band. Multipliers: count 1 per band for each DXCC country (Brazil does not count for country) and each Brazilian state. Multiply total QSO points by the sum of all multipliers worked on each band for final score. Certificates and plaques. Logs required with a separate sheet for each band. Send logs by July 31 to LABRE, WTD Contest Committee, PO Box 07-0004, 70359, Brasilia (DF), Brazil.

26

W1AW Qualifying Run, 10-35 WPM at 2000Z May 26 (4 PM EDT May 26). See May 9 listing for more details.

27-28

ARRL Spring Sprints, 50 MHz, see Apr *QST*, p 89.

CQ WW WPX Contest, CW, see Mar *QST*, p 89.

28

ARCI QRP Hoot-Owl Sprint, CW, sponsored by QRP ARC International, from 2000Z-2400Z May 28. Work stations once per band. All-band or single-band entries. Send signal report, state/province/country and QRP number if member. Nonmembers send power output. Suggested frequencies: 1.810 3.560 3.710 7.040 7.110 14.060 21.060 21.110 28.060 28.110 50.060. No 12, 17 or 30-meter QSOs. Count 5 points for QSO with ARCI member. Others count 2 points for same continent and 4 points for different continent. Multiply QSO points by states/provinces/countries worked per band and by power multiplier (1-5 W output × 7; 0-1 W output × 10). More than 5 W output counts as a checklog. If 100% natural power, multiply final score by 2; if 100% battery, by 1.5. Awards. Postmark entry no later than 30 days after the contest and mail to QRP ARCI Contest Chairman, Red Reynolds, K5VOL, 835 Surryse Rd, Lake Zurich, IL 60047.

JUNE

6

West Coast Qualifying Run, 10-40 WPM at 0400Z Jun 7 (9 PM PDT Jun 6). See May 3 listing for more details.

10-11

World Wide South America CW Contest, sponsored by *Antenna-Eletronica Popular* magazine, from 1500Z Jun 10 until 1500Z Jun 11. CW only, 160 through 10 meters. No crossband QSOs. Single operator, single band or multiband; and multi-operator, single-transmitter classes; SWL. Exchange RST and serial number starting with 001. Work stations once per band. QSO with own country—0 points (multiplier credit only); QSO with same continent—2 points; QSO with different continent—4 points; QSO with South American station (only for DX stations)—8 points. Multiply total QSO points by total number of DXCC countries worked plus total number of different South American prefixes worked on each band for final score. Separate logs per band. Mail logs (with SASE/IRC for results) by Aug 31 to WWSA Contest Committee, PO Box 18003, 20772 Rio de Janeiro, RJ, Brazil.

Delaware QSO Party, sponsored by the Nanticoke ARC from 1600Z Jun 10 until 2200Z Jun 11. Work *stations once per band and mode.* Exchange serial number, signal report and QTH (county for DE stations; state/province/country for others). Suggested frequencies: CW—1.810 3.540 7.040 14.040 21.040 28.040; phone—1.860 3.860 7.260 14.260 21.360 28.360. Count 2 points per phone QSO and 4 points per CW QSO. Multiply by QTH per band and mode. Outside DE count 2 multiplier bonus for all three counties per band per mode worked (max 24). QRP stations (5 W or less) multiply total by 1.5. Mail logs by Aug 1 to E. Dallas Carter, K3WUW, Rte 1 Box 125-D, Laurel, DE 19956.

ANARTS World-Wide RTTY Contest

10-12

ARRL June VHF QSO Party, this issue, p 105.

14

W1AW Qualifying Run, 10-40 WPM at 0200Z Jun 15 (10 PM EDT Jun 14). See May 9 listing for more details.

18-19

All Asian DX Contest, phone.

SMIRK QSO Party, sponsored by the Six Meter International Radio Klub, from 0000Z Jun 18 to 2400Z Jun 19. Exchange call sign, SMIRK no., and grid square. No crossband, multiop, or partial contacts allowed. Scoring: 2 points per SMIRK contact made, 1 point per non-SMIRK contact. Total points multiplied by total number of different grid squares equals claimed score. Only new contest log forms acceptable. Provide a legal-sized SASE for copy of log. Certificates issued for high scorers in ARRL sections/foreign state/province/prefecture/UK shire county/region/country. Must be paid up SMIRK member to receive contest award. Others may exchange SMIRK no. for points. Failure to provide name, call, SMIRK no. on log are grounds for disqualification. Send log requests with SASE and logs (postmarked no later than Jul 6) to Lisa Lowell, KAØNNO, Box 547, Hugo, CO 80821.

24-25

Field Day, this issue, p 103.

28

W1AW Qualifying Run, 10-35 WPM at 1300Z Jun 28 (9 AM EDT Jun 28). See May 9 listing for more details.

Deadline: The deadline for receipt of items for this column is the 1st of the second month preceding the publication date. For example, your information would have to reach HQ by **Jun 1** to make the **Aug** issue. Please include name of contest, dates, times (Z) and complete rules. Send to Contest Corral, 225 Main St, Newington, CT 06111.

Special Events

Conducted By Billy Lunt, KR1R
Contest Manager

Garden Grove, California: The Clairemont Repeater Assn will operate W6FZZ **Apr 30** to honor Samuel F. B. Morse. Suggested frequencies: CW—14.030 21.030; SSB—14.300 21.300. For QSL, send SASE to CLARA, Box 7675, Huntington Beach, CA 92615.

Louisville, Kentucky: KB4DCG will operate **May 1-6** to celebrate the 115th running of the Kentucky Derby. Suggested frequencies: 7.237 21.377 28.487. For certificate, QSL and two units of first-class postage to KB4DCG, 641 Camp St, Louisville, KY 40203.

Bristol, Virginia: The Bristol ARC and the Bristol Regional Medical Center will operate WB4DKI **May 5-6** to celebrate National Hospital Week. Operation will be in the lower parts of 80, 40 and 20 meters and in the 10-meter Novice band. For certificate, send 9- × 12-in SASE to BARC, PO Box 1943, Bristol, VA 24203-1943.

Louisville, Kentucky: The Amateur Radio Transmitting Society will operate W4CN 0000Z-2400Z **May 6** in commemoration of the 115th Run for the Roses (Kentucky Derby). Suggested frequencies: phone—7.250 14.250 28.450; CW—30 kHz from bottom of bands and Novice subbands. For certificate, send large SASE to ARTS, PO Box 7391, Louisville, KY 40207.

Sacramento, California: The California State Railroad Museum will operate WB6RVR/6 1500Z-2400Z **May 6** to commemorate the 6th consecutive year of steam train operations at the site. Suggested frequencies: phone—7.270 14.270 21.370 28.370; CW—7.125 21.150 28.150. For QSL, send QSL and no. 10 SASE to California State Railroad Museum, Attn: Steam Trains, 111 I Street, Sacramento, CA 95814.

Fort Pierce, Florida: A special-event station will operate 1400Z-2100Z **May 6** to celebrate the annual Cracker Trail Cattle Drive. Suggested frequencies: CW—3.568 7.068 14.068 21.068 21.168 28.168; phone—3.868 7.268 14.268 21.268 28.468. For certificate, send QSL and large SASE to Fort Pierce ARC, PO Box 5, Fort Pierce, FL 34954.

Clinton, Maryland: The Southern Maryland ARC will operate a special-event station **May 6** from the National Capital Area Boy Scout's Expo. Operation will be on 28.410. Send QSL and SASE to South MD ARC, PO Box 273, Cheltenham, MD 20623.

Pittsburg, Pennsylvania: WA3BKD will operate 1300Z-2100Z **May 6** from the Allegheny Trail's Boy Scout Council Jamboral Campout. Operation will be on 28.400, lower end of the 40-meter General band and packet on 145.03. For certificate, send 9- × 12-in SASE and QSL to WA3BKD, RD 3 Box 368, McDonald, PA 15057.

York, Pennsylvania: The York ARC will operate W3EDU 1300Z-2300Z **May 6** and 1300Z-1700Z **May 7** to commemorate York as the home of the Continental Congress in 1777-1778. Suggested frequencies: phone—3.875 7.275 14.250 21.350 28.350; CW—10 kHz up from bottom of General bands. For certificate, send QSL to Millard J. Martin, NN3Z, 2070 Thelon Dr, York, PA 17404.

Hoquiam, Washington: The Grays Harbor ARC will operate W7ZA from 1600Z **May 6** until 2400Z **May 7** to commemorate the maiden voyage of the tall ship *Lady Washington.* Operation will be in the lower 50 kHz of the General bands and 28.310. For QSL, send SASE and QSL to Joe Ledesma, KA7AIR, 516 6th St, Hoquaim, WA 98550.

Bridgeton, New Jersey: The 4-H Club will operate K2UQK 1500Z-2100Z **May 8** to commemorate the 75th anniversary of the 4-H in the US. Operation will be on 14.330. For certificate, send QSL to Robert Westcott, W2MAS, 17 Button Mill Rd, Bridgeton, NJ 08302.

Promontory, Utah: The Ogden ARC will operate W7STB 0000Z-2400Z **May 10** from Promontory Summit to commemorate the 120th year of the driving of the Golden Spike. Suggested frequencies: phone—3.970 7.270 14.280 21.375 28.415. Send QSL and SASE to Ogden ARC, PO Box 3353, Ogden, UT 84409.

South Dakota: South Dakota hams will operate a special-event station from **May 10** through **Sep 4** from a horse-drawn covered-wagon train. Operation will be according to present operators' operating privileges. Send QSL and SASE to South Dakota Centennial Wagon Train, PO Box 91, Sioux Falls, SD 57101.

Owensboro, Kentucky: The Owensboro ARC will operate K4HY from 0300Z **May 12** until 0500Z **May 13** during the 11th annual Barbecue Festival. Suggested frequencies: 7.235 28.350. Send QSL and SASE to Ray Tate, N4EKG, 1615 E 23rd St, Owensboro, KY 42303.

Leesville, South Carolina: KB4KEN will operate 1500Z-1900Z **May 13** in conjunction with the annual South Carolina Poultry Festival. Operation will be on 14.260 and 28.360. For QSL with special-postal cancellation send QSL and 15-cent stamp to John Keck, KB4KEN, Rte 2 Box 340, Leesville, SC 29070.

Fairfield, Connecticut: The Greater Fairfield ARA will operate a special-event station 1300Z-2200Z **May 13** during the 54th annual Dogwood Festival. Suggested frequencies: 3.975 7.235 14.330 21.420 28.310. For certificate, send QSL and 9- × 12-in SASE to FARA, PO Box 486, Southport, CT 06490-0486.

Pierre, South Dakota: The Pierre ARC will operate WØHVY 1100Z-2300Z **May 13** and 1500Z-2300Z **May 14** from the state capitol rotunda to commemorate 100 years of statehood. Suggested frequencies: phone—7.267 14.287 21.287 28.400. For certificate, send QSL and 9- × 12-in SASE to Gary Wallace, KAØAHI, PO Box 1261, Pierre, SD 57501-1261.

Richfield, Wisconsin: The W/K ARC of Greater Milwaukee will operate AE9K from 1400Z **May 13** until 0600Z **May 14** to commemorate National Astronomy Day. Suggested frequencies: CW—30 kHz from bottom of bands; phone—1.850 3.850 7.250 14.250 21.350 28.450; packet—145.090. For QSL, send SASE to Nichols Observatory, 3885 Pioneer Rd, Richfield, WI 53076.

Irving, Texas: The Irving ARC will operate WA5CKF railroad mobile **May 13-14,** 1500Z-0400Z each day from Annetta Valley and Western RR. Suggested frequencies: SSB—3.915 7.270 14.210 21.350 28.360. For certificate, send QSL and 9- × 12-in SASE to WA5CKF, PO Box 153333, Irving, TX 75015.

Angels Camp, California: The Calaveras ARS will operate WA6YGA **May 19-21,** 1700-0100Z each day, to celebrate the annual Calaveras County Fair and the Jumping Frog Jubilee. Suggested frequencies: phone—lower 25 kHz of the 40- through 15-meter General bands and 28.405. For certificate, send QSL and SASE to CARS, PO Box 122, San Andreas, CA 95249.

Baltimore, Maryland: The Maryland Mobileers ARC will operate WA3PJQ 1400Z-2100Z **May 20** aboard the submarine *USS Torsk* to honor the Submarine Service. Suggested frequencies: phone—7.240 14.240 21.340 28.340; FM—146.805. For certificate, send legal-size SASE to MMARC, PO Box 784, Severna Park, MD 21146.

Millington, Tennessee: Military Club Station W4ODR will be operating from 1300Z to 2300Z **May 20** in recognition of Armed Forces Day. Suggested frequencies: phone—7.230 14.280 21.370; CW—21.145 28.145; 2-meter—146.52 simplex. For certificate, sent QSL to W4ODR, Box 54278, Naval Air Station Memphis, Millington, TN 38054.

Pasadena, Maryland: The Bay Area ARS will operate KM3I **May 20** to commemorate the 145th anniversary of the telegraph message WHAT HATH GOD WROUGHT? Suggested frequencies: CW—7.110 14.035 21.110 28.110. For certificate, QSL and SASE to Bay Area ARS, PO Box 805, Pasadena, MD 21122-0805.

Pentagon, Washington DC: The Pentagon ARC will operate K4AF **May 20** in celebration of Armed Forces Day. Suggested frequencies: phone—7.235 14.235; CW—7.035 14.035. For QSL, send QSL to PARC, PO Box 47063, Washington DC 20050.

St Charles, Missouri: The St Charles ARC will operate WBØHSI **May 20-21,** 1300Z-2100Z each day as part of the Lewis and Clark Rendezvous. Suggested frequencies: phone—7.250 14.325 21.350 28.410

146.670. For certificate, send large SASE to St Charles ARC, PO Box 1429, St Charles, MO 63302-1429.

Milford, Pennsylvania: The Morris County Office of Emergency Management will operate W2LOP/3 from 1500Z **May 20** until 1500Z **May 21** to honor the bicycle riders of the 4th annual Multiple Sclerosis 150 Mile Bike Tour. For QSL, send SASE to MCOEM, PO Box 77, Rockaway, NJ 07866.

Chicago, Illinois: The DuPage ARC will operate W9DUP **May 20-21,** 1600Z-2300Z each day at the Chicago Museum of Science and Industry. Suggested frequencies: phone—7.250 14.300 28.400. For certificate, send no. 10 SASE to DARC, PO Box 71, Clarendon Hills, IL 60514.

Washington, Pennsylvania: The Washington Amateur Communications will operate N3FHG **May 20,** 1500Z-2100Z, and **May 21,** 1700Z-2100Z in honor of the National Pike Festival. Suggested frequencies: 7.250 14.250 18.150 21.350 28.333 146.43. For QSL, send QSL and SASE to WACOM, Box 1386, Washington, PA 15301.

Alabama: The Birmingham ARC will operate WA4ZIO **May 21-27** from aboard the Alabama Reunion Train. Operation will be phone and CW on 80-10 meters.

Mt Washington, New Hampshire: The RF Hill ARC will operate W3A1/1 from 1300Z **May 20** until 0200Z **May 22** from the summit of Mt Washington. Suggested frequencies: phone—14.280 28.310; CW—7.125 21.125; RTTY—14.085. For QSL, send SASE to RF Hill ARC, PO Box 29, Colmar, PA 18915.

Petal, Mississippi: The Amateurs of Petal and Hattiesburg will operate **May 26-Jul 18** to celebrate the International Checkers Tournament. Operation will be in the lower part General bands and Novice 10-meter SSB. Send QSL and large SASE to KA5UBL, PO Box 2131, Hattiesburg, MS 39403-2131.

Alma, Michigan: The Gratiot Co ARA will operate NO8V **May 27-28** from Alma College in conjunction with the Alma Highland Festival and Games. Suggested frequencies: phone—lower 25 kHz 40, 20 and 15-meter General bands and 28.400; CW—14.035 21.035. For certificate, send QSL and SASE to NO8V, 917 Mill, Alma, MI 48801.

North Freedom, Wisconsin: The Morse Telegraph Club will operate AD9E **May 27-28,** 1400Z-2400Z each day, to commemorate the 145th anniversary of the WHAT HATH GOD WROUGHT message of Samuel F.B. Morse and Alfred Vail. Suggested frequencies: 7.044 7.144 10.117 21.044 28.044. For QSL, send QSL and SASE to R. L. King, KA9GNY, 411 Lynn Ave, Baraboo, WI 53913.

Cumberland River, Tennessee: The Nashville ARC will operate K4CPO **May 27-29,** during daylight hours, aboard the *General Jackson* stern-wheeler river boat as she cruises the Cumberland River during Memorial Day weekend. Operation will be in various sections of the phone bands. For QSL, send QSL and SASE to K4CPO's *Callbook* address.

Indianapolis, Indiana: WB9SBI will operate 0600Z-1700Z **May 28** from the Indianapolis Speedway during the race. Operation will be in the 80-10 meter General bands and 2 meters. For certificate, send 9- × 12-in SASE to WB9SBI's *Callbook* address.

Normandy, France: The Association Des Radio Amateurs will operate HX6JUN **May 28** through **Jun 12** from Utah Beach commemorating the 45th anniversary of landing Allied troops in 1944. Suggested frequencies: CW—3.550 7.015 14.015 21.015 28.050; SSB—3.750 7.080 14.215 21.215 28.550. For QSL, send two IRCs via F5AM's *Callbook* address or via the bureau.

Mauchline, Ayrshire, Scotland: The Scottish tourist board will operate GB2RB **May 27-28** from the Robert Burns House Museum. Suggested frequencies: phone—14.240 21.250 28.400; CW—10 kHz from band edges; RTTY—14.080 21.090. A special QSL will be sent out for each QSO.

Deadline: The deadline for receipt of items for this column is the 1st of the second month preceding the publication date. For example, your information would have to reach HQ by **Jun 1** to make the **Aug** issue. Please include the name of the sponsoring organization, the location, dates, times(Z), frequencies and call sign of the special-event station. Requests for donations will not be published.

QSLing Special-Event Stations: To get your QSL or certificate from any of the special-event stations listed here, follow these simple guidelines. (1) After working the station, carefully fill out a QSL card for the QSO. Show the date and time accurately using UTC. (2) Prepare a self-addressed, stamped envelope. If sending for a certificate, use a 9- × 12-in envelope if you want an unfolded certificate, or a no. 10 envelope if folds are okay. Include enough postage for return of your envelope. (3) Mail both your QSL and your SASE to the address listed, or to the address given on the air by the station you QSO. Be patient. Special-event stations will often print their cards and/or certificates after the operation is over so they will know how many to order. QST

New Frontier

(continued from page 85)

2304 MHz and 16 Yagis on 3456 MHz. Although not yet truly cheap in price (perhaps $500 to $1000 new for an 8- to 10-foot dish—much less through used or surplus channels), TVRO dishes represent a cost-effective alternative to multi-antenna arrays, particularly when their multiband capability is taken into account.

LASER DIODE COMMUNICATIONS

Heinz Steinboeck, OE6HS, has written to invite letters from any other amateurs experimenting with light communication. Heinz comments that he has recently been experimenting with infrared laser diodes and has also worked with infrared LEDs for some time, including using them in a pulse-modulated beacon at 950 nanometers. Heinz' address is Klosterwiesgasse 64, A-8010, Graz, Austria.

NEW EXTREMELY-HIGH-FREQUENCY TRANSISTORS

Researchers at AT&T Bell Laboratories have announced the development of a new type of bipolar transistor with a switching rate of 140 GHz. Commercial bipolar transistors currently available have a maximum switching rate of around 12 GHz. The new transistors are made from indium phosphide and gallium indium arsenide. QST

New Books

SHORTWAVE GOES TO SCHOOL: A TEACHER'S GUIDE TO USING SHORTWAVE RADIO IN THE CLASSROOM

By Miles Mustoe. Published by Tiare Publications, PO Box 493, Lake Geneva, WI 53147. First printing, 1989. Soft cover, 8½ × 11-inches, 60 pages, $25.

Reviewed by Rosalie White, WA1STO

Are you a teacher, or do you know a teacher, who occasionally uses Amateur Radio in the classroom to enhance student interest in school? If so, you'll want to get (or recommend) the book *Shortwave Goes to School*, by Miles Mustoe, KA7GQB. The book's subtitle, *A Teacher's Guide To Using Shortwave Radio In The Classroom*, perfectly describes the contents. Through shortwave listening, Mustoe says, "Kids learn about other countries and cultures. Geography, social studies, current events, history, foreign languages and a wider range of music appreciation are closely tied to shortwave's use in the classroom. Students also improve their listening skills, learn to work together and make better use of their time."

The book tells teachers what shortwave radio is, where to find equipment, what frequencies are most interesting and how to set up a shortwave "learning center" in the classroom. It contains "master forms," such as log sheets, to be used in the learning center. This book also describes 40 shortwave classroom activities, ten of which introduce Amateur Radio, on cards that students work with. I would have liked to see the author include more Amateur Radio activities to pique student interest in our hobby, but this book creates a starting point; I realize that setting up a shortwave listening station is much simpler than putting together an Amateur Radio station, especially for a nonham teacher.

Miles Mustoe, a professional geographer, teaches school in Washington state. He gives seminars on using shortwave radio in the classroom, for which he receives enthusiastic endorsements by teachers. QST

Exam Info

LEAGUE PRODUCES IMPROVED CODE EXAM TAPES

The ARRL/VEC has completely revised its CW tapes for exams. The code exams have been shortened and are now between five and six minutes long. We are using the Farnsworth method of generating the code on all tapes up to 18 WPM.

Element 1A, the 5-WPM code test, has the characters sent at 18 WPM with the spacing at 5 WPM. Element 1B, the 13-WPM code test, has the characters sent at 18 WPM with the spacing at 13 WPM. Element 1C, the 20-WPM code test, has the characters sent at 20 WPM with the spacing at 20 WPM.

All ARRL/VEC field-stocked teams should have received the new tapes. If not, please let us know. If needed, the ARRL/VEC office can supply special code exam tapes with other code characteristics.—*Maria A. Somma, VE Services Supervisor* QST

Section News

Administered by Steven Ewald, WA4CMS

The ARRL Field Organization Forum

ATLANTIC DIVISION

DELAWARE: SM, Harold K. Low, WA3WIY—ASM: Walt Dabell, KD3GS— Kudos to the newly forming Kent and Sussex County ARES groups on their participation in the Feb. snow emergency. The Kent group was active for about 9 hours and the Sussex group logged about 18 hours. It's spring at last, and there are a lot of activities in the "air." The Delaware QSO party, sponsored by the Nanticoke ARC will be June 10 and 11. Even if you only get on the air for an hour or two, you can help take Delaware off the endangered species list. Field Day planning can be heard on just about every repeater in the state. Looks like there is going to be some fierce competition in category 1A. Good luck to all who participate. The Del. Hamfest will be August 20. For more info contact KCARC at PO Box 1000 in Dover. The Del. Traffic Net meets Mon. thru Fri. on 3905 kHz at 630 PM local and the Del. Emergency Phone Net meets on 3905 kHz at 6 PM local on Sat. February net rpt: DTN stns 312 tfc 29 in 205 sessns, DEPN stns 45 tfc 13 in 4 sessns, SEN stns 57 tfc 1 in 4 sessns. Traffic: WA3WIY 30, K3YBW 28, WB3DUG 28, KA3GRQ 18, K3JL 17, W3FEG 17, KD3GS 3, KC3FW 2. TOTAL 143.

EASTERN PENNSYLVANIA: SM, Kay Craigle, KC3LM—ASM: WA3PZO, KA3A, KO3B, K3ZFD. SEC: KB3YS. ACC: KC3QB. OOC: W3IS. SGL: WA3IAO. STM, BM: KB3UD. PIO: W3ZXV. TC: W3FAF. This is a big hamfest month, with Warminster ARC and Tamaqua Transmitting Soc. both on the 21st and Ephrata on the 27th. The ARRL Atlantic Division Convention is May 19- 21 up in Rochester, NY. Thank you to all traffic handlers and Net Managers for quickly adapting to the new monthly traffic report routes, sending SAR/PSHR reports to KC3LM and net manager reports in duplicate to KC3LM/KB3UD. Your cooperation has eased the *QST* deadline crunch for Tom and me. All Field Organization appointees are reminded that current ARRL membership is necessary to maintain your appointment. Turning to ARES developments, welcome several Emergency Coordinators appointed earlier this year: KA3QKV in Delaware Co., KA3MNT in Philadelphia Co., and N3EUM in Montour Co. DelCo ARES/RACES held an organizing meeting that produced an impressive roster of volunteers with special skills and community contacts. Suggestions from ARES leadership meetings about how the ARRL Simulated Emergency Test might be changed to make it more helpful to today's ARES were relayed by the Section Manager for consideration by the Board's Volunteer Resources Committee. We can never have too much good publicity for ham radio, so we welcome WB3KNU as a PIA associated with Warminster ARC. If your club's PR chairman is an ARRL member, he or she can become a PIA by contacting PIO W3ZXV or the SM. My area's cable TV has a community bulletin board channel that will carry info about VE tests, license courses and club meetings. Yours might, too. Why not phone and find out? Add KA3OGL to the list of ARRL local HF/VHF Awards Managers. Knowing that hams love to eat, Ephrata ARS ran a sub sandwich (that's a hoagie, Philly folks) sale to benefit the club. A recent Penn Wireless newsletter cover featured the new "Amateur Radio Operator" Pennsylvania auto license plate. RF Hill's officers are KA3POV, K3ZXQ, W3ZC, and N3GGV. Lebanon Valley was scheduled for a program on awards hunting by Assistant TC W3FM. Harrisburg RAC continues to offer Novice tests before many of its meetings. Traffic (February): N3AZW 970, AA3B 74, N3DRM 380, W3JKX 203, KA3DLY 148, N3CD 101, W3KAG 82, K3TX 80, WB3EVL 76, N3EFW 71, WB8KPE 71, KD3AO 65, N3COY 60, W4UQ 52, KU3R 48, N3DKC 46, KA3SKT 44, W3AQN 31, KA3RGF 27, W3VA 26, W3DP 24, K3ARR 22, W3CL 20, W3KOD 20, W3BUR 18, K3WPI 15, KO3M 14, W3ADE 13, KA3MVM 13, N3FGC 12, W3TWV 12, W3FAF 10, WA3CKA 9, W3GJC 6, W3HK 3. Nets (QNI/QTC): SEPATN 75/14, MARCTN 142/59, MARC ARES 69/18, D8ARES 89/7, SCESN 69/8, D8ARES 71/2, EPAEPTN 563/300, D5ESN 78/17, EPA 448/221, PTTN 248/96. @P8BS: @K3RLI 369, @AG3F 150, @N3ET 3, @KB3UD 218, @WA3TSW 118, @WB3JOE 4.

MARYLAND-DC: SM, Philip E. Battey, W3FZW—There is a big nationwide movement afoot to consider the no-code license. Read and think about it and make your opinions known. Send your comments to ARRL. Thanks to FAR (Foundation for Amateur Radio) for their hefty contribution to the W1AW Restoration Fund, and thanks to all contributors to this worthy cause. Holly, N3BMB, our PIO in MDC, has written a nice article on the training of potential hams: watch for it in QST. Through the efforts of PIA WA3SCW, the Governor of MD has proclaimed the week of June 19-25 as Amateur Radio Week in this state. Great work, Bill. KK3F helped one of over 70 propective hams at classes of the Anne Arundel Club. The Atlantic Division Convention will be held in Rochester, NY, May 19-21. K3RXK, the manager of the MEPN, issues an attractive newsletter. So. Maryland ARC will operate a special event station May 6 from the National Capital Area Boy Scouts Expo at Upper Marlboro, MD (28.410 MHz). New members of SMARC are Stafford, KA3TZM, and Mike Higgins. N3AQG, N3ESR, W4KM, K4FPT, W3FZV, W4IIG, and WA3YLO have written articles for recent Auto Call magazine issues. MSN and MDD member NT3S was first licensed in 1922 at the ae of 15 as 2COF. He has returned. The new CD Director in MD is Dave McMillion. Give him your support. Al, KN3U, issues a neat, informative ARES bulletin for MDC. An EC is needed in the following counties: Caroline, Charles, Dorchester, Garrett, Harford, Somerset, St. Mary's, Talbot, Wicomico. Any help? N3EKZ is active on the nets and in ARES exercises. WA1QAA is active in Howard Co. emerg work. NF3X is trying to start local 2 mtr nets as NTS outlets. N3EIO of CBRA is into packet in a big way. Walt, AK3B, with help from KA3GPT and K3KTS showed and commented on slides of RCARA repeater. Nancy, KD3KJ, is the new EC of AA county and Tom, WA3TAI, is a new OES in PG county. See Auto Call Magz. for a schedule of upcoming ham exams. WITH THE NETS: NET/MGR QND/QTC/QNI: MSN/KC3Y 28/59/340, PON/WB3BFK 24/22/194, MDD/W3FA 56/286/510 (TOP BRASS W3FA/88, K3GHH/79, WA3YLO/73, K3JL/63, N3EGF/62), MEPN/K3RXK 31/200/893, HOCARES/WA1QAA 2/0/18, MAVEN/W3YVQ 1/0/1. TRAFFIC: W3IWI 504(BPL), NC3V 309, K3GHH 278, NB3P 198, N3EGF 185, K3RXK 173, W3FA 169, KC3Y 162, WA3YLO 142, KJ3E 79, W3YVQ 78, WB3BJM 73, K3NNI 70, KA3ENQ 57, KX3U 56, WA2WDT 52, K3USO 47, NF3X 47, W3FZV 46, K1BGT 46, N1FJW 37, W3LDD 28, WB3BFK 22, KK3F 12, W3ZNW 9, W3EAX 8, KA3DXX 7, WA3GYW 7, KD3JK 7, KC3DW 6, WA1QAA 4, N3EKZ 3, W3DQI 1. PSHR: W3FA 100, W3YVQ 89, N3EGF 88, K3RXK 78, KC3Y 68, K3GHH 65, NC3V 64, WA3YLO 62.

SOUTHERN NEW JERSEY: SM, Richard Baier, WA2HEB—SEC: K2QIJ. STM: WB2UVB. ACC: K2IXE. TC: N2BQT. PIO: KA2RAF. SGL: vacant. BM: WB2UVB. OOC: WA2HEB. ATCs: K2JF, KA2RJA and WB2MNF. VE testing by the DVRA on May 13 at the Hopewell Twsp. Branch of the Mercer County Library, W. Delaware Av., Pennington. Session starts at 12:30 PM. Walk-ins OK, but reservations are preferred. For further information contact Don Wright, AA2F at (609) 737-1723. Testing will also be given in Bellmawr on May 18. See Jan. 1989 QST column for full info on this session. From the Mercer County EC, WB2BOO comes word that as of February, 70 members have been recruited. AEC of RACES is KE2GG; AEC of Welfare is K2ASK; and AEC for hospitals is KB2EGI. For the very latest on the status of the "Scanner Bill," look for items addressed to NJLAW on your home packet BBS. Until next month, very 73. Traffic: WB2ZJF 353, WB2UVB 127, W2FFE 40, NG2R 31, K4FFM 24, WA4JRP 16, KB2CDB 15, KC2PB 12, N2AEP 7, WA2JAN 7, KA2CQX 6, WA2JSG 6, WA2HEB 5, WA2GYF 4, WB2SYJ 4, NT2I 4, KF2U 3, N2EPH 3, N2DWS 3, KA2PFM 2, KE2EH 1, N2HQL 1, KA2YKN 1, K2JJC 1. PSHR: WB2ZJF 107, WB2UVB 94, KA2CQX 65, KB2CBD 50.

WESTERN NEW YORK: SM, William W. Thompson, W2MTA—Blue Line Service Net and the Greater Adirondacks Repeater Association (GARA) provide FB public service atop Mount Morris. Thanks to KE2Q and N2IIK for their February trek topside to replace duplexers. 147.93/33 is vital link, especially in winter time conditions—WB2JAB & WA2SEF. Public Service Honor Roll: N2ABA N2EIA N2EVG WA2FJJ W2FR NN2H KC2HJ N2IKR N2IYA W2MTA WB2OEV WB2OWO WB2OIX KA2QOO ND2S NJ3V K2YAI KA2ZKM KA2ZNZ. February BPL to N2EIA WB2UH W2MTA WB2OWO NJ3V.

Net Name	Mode	QNI/QSP/QND	Net Name	Mode	QNI/QSP/QND
NYSEMO	SSB	105/008/04	NYSR	CW	012/006/04
NYS/M*	CW	297/222/28	NYS/E*	CW	291/203/28
WDN/M*	FM	422/215/28	WDN/E*	FM	515/238/28
NYP*	SSB	248/358/28	TIGARDS	FM	042/009/04
NYPON*	SSB	577/503/28	BLUELINE	FM	174/024/30
ESS	CW	446/092/28	VHF THIN	FM	051/000/04
NYSPTEN	SSB	487/094/28	BRVSN	FM	271/007/28
LCARES	FM	033/000/04	CNYTN*	FM	272/176/27
OCTEN/E*	FM	673/146/28	OCTEN/L*	FM	221/075/28
Q NET	FM	356/006/28	WDN/L*	FM	478/166/28
STAR*	FM	296/092/28	NYS/L*	CW	309/252/28
Pathfinder	FM	313/010/28	ORTN	SSB	020/000/04
JCRACN	FM	217/010/28	*NTS net		

SPNS Reports: WB2ACV 21/58/79, NA2B 8/204/212. CNYTN (Jan.) 262/087/31. OARCN 044/01/04. Club Officers: Tompkins County ARC KD2IM WK2K KB2BON KA2BRI. Appointments: (ORS) KA2ZNZ N2IKR. Recent articles by good friend K2VX perk up many readers. Here's a quote of K2VX well worth considering—" . . . eliminating the CW requirement will only attract a very small number of young people. The problem is that long distance communications is something which is available to most people today. When I got started, being a ham gave me access to the "far away places with the strange sounding names. It made me special. Today nothing is strange or far away except the past." Thanks, Dave; I agree, we need to put the "adventure" back into ham radio if we want to attract the unwary youngster, midster or oldster to our wonderful "hobby." "Adventure" has different meanings to the general populace, spanning many aspects of daily living. EVENTS SKED: Dayton Apr 29, Owego Fest May 6, Rochester State/Division Convention May 19-21, Rome June 4, Lancaster June 4, Cortland June 17, Batavia July 9. Traffic Handlers Picnic at Verona August 12, Syracuse October 14. Traffic (Feb.): W2MTA 667, WB2IJH 560, NJ3V 545, WB2OWO 532, N2EIA 515, WA2FJJ 449, KC2HJ 405, ND2S 340, K3YAI 339, KA2QOO 189, KA2ZKM 189, KA2ZNZ 168, WB2QIX 164, W2FR 155, N2ABA 141, NN2H 121, N2IYA 119, WB2OEV 82, W2UYE 80, KA2DBD 76, AF2K 42, KA2TWY 41, KC2JW 40, WB2NLU 36, N2IKR N2EVG 31, KG2D 30, N2DLN 12, WA2OEP 10, KE2EA 4, W2PHQ 4. It's Lilac time!

WESTERN PENNSYLVANIA: SM, Otto L. Schuler, K3SMB—SEC: WA3UFN. STM: N3EMD. BM: KC3ET. TC: N3EFN. OOC: KX3V. ACC: AK3J. SGL: KA3OEM. PIO & ASM: N3DOK.

Net	QNI	QTC	Sess	kHz	T/D	NM
WPACW	221	136	28	3585	7:00 P/D	WA3UNX
WPAPTN	523	212	28	3983	6:00 P/D	WA3HLN
KFN	174	76	24	3983	1:30 P/D	KA3OEM
PFN	186	237	28	3958	9:00 P/D	WA3THT
WPA2MTN	298	68	28	28/88	8:00 P/D	KA3BGC
NWPA2MTN	528	27	27	44.53/45.13	9:00 P/D	KC3NY

Warning: respect your power supplies, house voltage, even if it is only 110 volts can kill. Too many people say, "Oh, it's only 110. Don't worry, it's harmless." But do you know more people are killed by that low voltage than much higher voltages? I know because before I retired, one of my responsibilities was making sure that the place where we had to work was clear. Of course, the voltages there ran into very high levels up into the kilovolts. So please be safe. We'd like to see you at the next hamfest. What brought this on is the death of a man in the news. We had a meeting with the NDMS Officers at the 911th TAG Officers Club near the greater Pgh Airport. I explained the purpose of Amateur Radio, that we are communicators, not directors. We provide the communications that they request. I also explained what the letters RACES and ARES mean. It was a very productive meeting. We have about 49 hospitals in the ear that will be involved. By the way things are being planned, amateurs will be stationed at each hospital for communications. We have had good response to our problems, so this should work out quite well. Feb. traffic: KQ3T 305, W3OKN 283, NO3M 258, N3AES 248, N3FM 235, WB3DWL 180, WA3UNX 131, W3KUN 61, KA3OEM 60, W3NGO 62, W3RUL 51, K3SMB 45, KC3YE 43, N3EMD 40, KA3EGE 39, WA3DBW 38, KC3HR 38, WA2QXA 37, KD3AC 32, N3GCN 15, N3KB 12, NR3T 10, W3AHH 6, W3SN 5.

CENTRAL DIVISION

ILLINOIS: SM, Dave Carlson, AA9D—SEC: W9QBH. STM: K9CNP. OOC: W9TT. BM: K9EUI. SGL: K9IDQ. PIO: N9EWA. ACC: WB9SFT. TC: N9RF. DEC: WD9EBQ Illinois Section Nets

NET	FREQ	TIMES
ISN	3905	1800 DAILY
ILN	3890	1830 & 2200 DAILY
ITN	3705	1900 DAILY
CTN	149.69/09	2100 DAILY
ILARES	3905	1630 1ST & 3RD SUNDAYS

Illinois Independent Nets

IEN	3940	0900 SUNDAYS
ILPN	3855	1645 M-F; 0830 SUNDAY
NCPN	3915	0700 MONDAY-SATURDAY
NCPN	7270	1215 MONDAY-SATURDAY

The Joliet Amateur Radio Society has its own packet BBS, presently on 145.01. Connect to W9OFR for further information on JARS activities. Also from JARS, Will County ESDA is in need of additional people for shelter operations in time of emergency. Contact KA9OXP or KA9ZKP for more information. The Western Illinois Amateur Radio Club's Novice classes ended February 14th with 7 graduates. Special thanks to NG9R for teaching the class and to N9JF for his help in providing code practice each evening. WIARC will be starting technician/General theory classes soon. Contact NA9Q for details. The Knox County Amateur Radio Club Hamfest is scheduled for May 21st, 1989 at the Knox County Fairgrounds in Knoxville, IL. Contact WB9KHL for more information. New officers for the Radio Amateur Downstate Illinois Organization (RADIO) are Pres., WA9TJE; VP, KR9M; Sec/Treas., AI9H. Congratulations to N9FXQ on receiving the 1988 Ham of the Year award at the FRRL Winter Banquet. Congratulations are also in order for Don, KØZTI and Jean, N9GWU, who received the FRRL's Broken Paddle Award for their Amateur Radio public service efforts. Traffic: KA9FEZ 786, W9HLX 378, W9HOT 151, K9CNP 155, WA9VLC 135, W9HBI 112, K9QEW 91, WD9HQW 70, KA9QXI 66, WB9TVD 57, KA9CTW/T 48, KA9JNE 42, WA9SLT 42, WD9EBQ 40, NC9T 37, W9OBU 34, WD9CIR 28, KA9TVU/T 25, N3AIA 14, W9VEY/M 7, WA9RUM 6, WA9AXL 4.

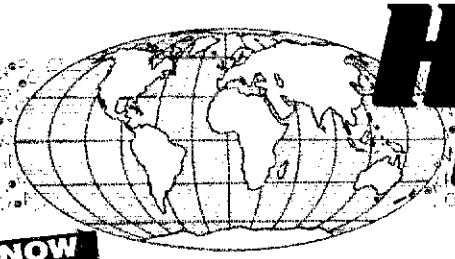
INDIANA: SM, Bruce Woodward, W9UMH—SEC: WD9AVQ. STM: WA9OHX. ACC: K9ZBM. TC: WA9JWL. SGL: WA9VQO. BM: W9OCL. PIO: KA9WXT. OOC: KJ9G. Net Managers: ITN KA9EIV. QIN KJ9J. ICN KD9ER. VHF W9PMT. IWN KA9ERC. FEBRUARY Net Reports:

Net	Freq	Time	Daily	UTC	QNI	QTC	QTR	Ses
ITN	3910	1330	2130	2300	2667	507	2025	56
QIN	3656	1430	0000	0300	465	235	1118	56
ICN	3705	2315			150	45	579	28
IWN	3910	1310			1213		300	28
IWN VHF Bloomington					731		196	28
IWN VHF Kokomo					737		181	28
IWN VHF FM Ligonier					664		201	28
Hoosier VHF Nets (12)					4891	49	3716	145

D9RN for FEBRUARY 289 QTC 56 ses. IN. 100% by N9DWU, K9ZLS, K9GBR, NX9I, WA9OHX, K9CGS, N9GRZ. CAND 544 QTC in 28 sess. D9RN 100% by N9DWU, K9ZLS, NR9K. WA9OKK Early Bird Wet Net Report for February 240 QTC in 3360 minutes and 28 ses. Silent Keys: Luther A. Hatton, W9ERB, Alexandria IN. Virgil Turner, W9EML, Columbus IN. Margaret Bavis, WA9YIF, Columbus, IN, was active on the Illinois Traffic Nets and a worker in Bartholomew County. She will be missed. Ed Hinsdale, W9BY, Inidanapolis. Ed was a member of the RCA Amateur Radio Club. Appointments: EC Kosciusko Co. Stephen Arnold, WB9AVS, Syracuse In. ORS Frank D Brandenburg, KA9ZOD, CARMEL IN. ATC Charles W. Lenhart, WB9HPR, Hanover, IN. ATC Louis Kruizinga, N7BBW, New Albany, IN. STM John Wallace, WA9OHX, Atlanta, IN. We are sorry to lose NX9I as the STM and N9ETL as an OO. I wish to commend Dave Thomas, N9FOZ for 388 hours of monitoring 146.10/70. I would appreciate others reporting their public-service activity. Congratulations to the Muncie Area Amateur Radio Club upon becoming a Special Service Club. It has been a pleasure not to have the 2300Z net due to problems. I am not sure that the net is necessary. I invite your comments. EC reports for February: W9BTZ, N9DTG, WA9DOL, W9CFI, NG9J, NG9J, KW9D, KD9ZN, WB9FLK, KA9ZOR, KA9OOH, KA9ZLG, WA9SGA, N9DUZ,

(continued on page 116)

WORLDWIDE DISTRIBUTION



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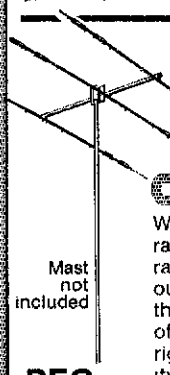

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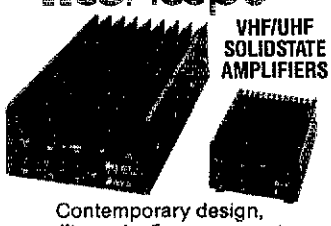

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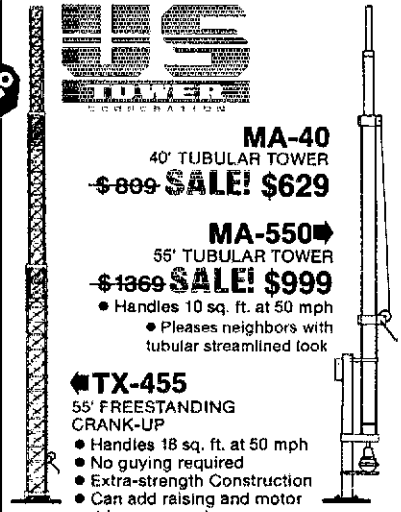

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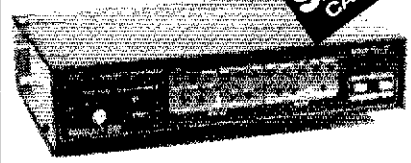

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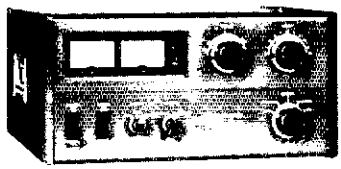

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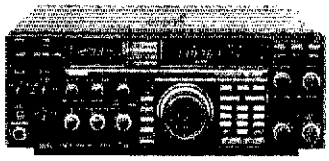

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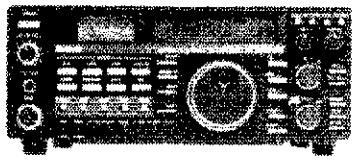

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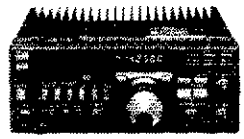

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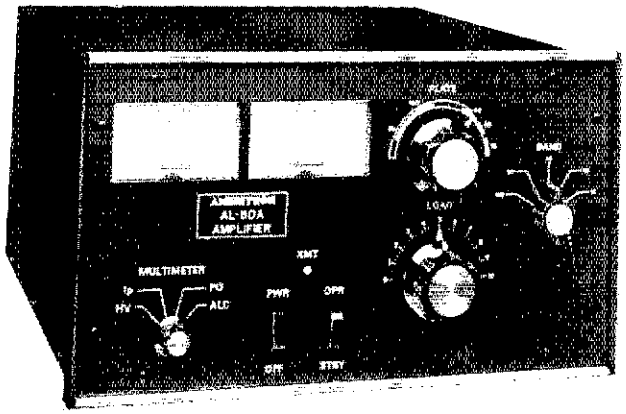
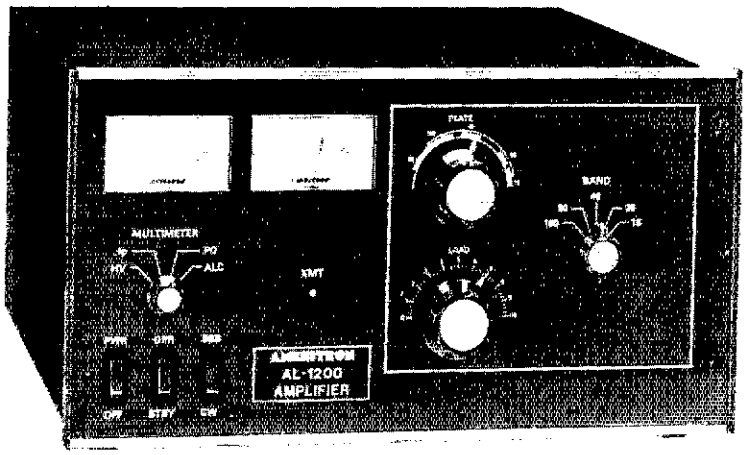


AL-80A LINEAR AMPLIFIER

The AL-80A will provide a signal output that is within 1/2 "S" unit of the signal output of the most expensive amplifier on the market—and at much lower cost.

The Ameritron AL-80A combines the economical 3-500Z with a heavy duty tank circuit to achieve nearly 70% efficiency from 160 to 15 meters. It has wide frequency coverage for MARS and other authorized services. Typical drive is 85 watts to give over 1000 watts PEP SSB and 850 watts CW RF output. A new Pi-L output circuit for 80 and 160 gives full band coverage and exceptionally smooth tuning.

Size: 15½"D. x 14"W. x 8"H. Wgt. 52 lbs.



AL-1200 LINEAR AMPLIFIER

3CX1200 TUBE

Full legal output with 100 watts drive.

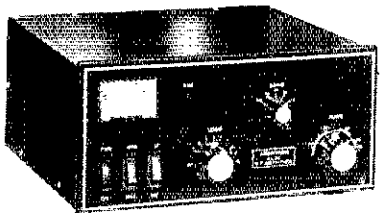
AL-1500 LINEAR AMPLIFIER

8877 TUBE

Full legal output with 65 watts drive.

The cooling system in both amplifiers keeps the tube safely below the manufacturers ratings even when operating at 1500 watts output with a steady carrier. The filament supply has inrush current limiting to insure maximum tube life.

Size: 18½"D. x 17"W. x 10"H. Wgt. 77 lbs.

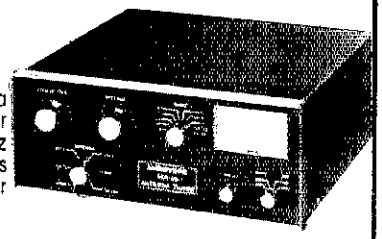


AL-84 LINEAR AMPLIFIER

The **Ameritron AL-84** is an economical amplifier using four 6MJ6 tubes to develop 400 watts output on CW and 600 watts PEP on SSB from 160 through 15 meters. Drive required is 70 w typical, 100 w max. The passive input network presents a low SWR input to the exciter. Power input is 900 watts. The AL-84 is an excellent back-up, portable or beginner's amplifier.

Size: 11½"W. x 6"H. x 12½"D. Wgt. 24 lbs.

ATR-15 TUNER



The **Ameritron ATR-15** is a 1500 watt "T" network tuner that covers 1.8 through 30 MHz in 10 dedicated bands. Handles full legal power on all amateur bands above 1.8 MHz.

Five outputs are selected from a heavy duty antenna switch allowing the rapid choice of three coaxial lines, one single terminal feed or a balanced output. An internal balun provides 1:1 or 4:1 ratios (user selectable) on the balanced output terminals.

A peak reading wattmeter and SWR bridge is standard in the ATR-15. It accurately reads envelope powers up to 2KW.

Size: 6"H. x 13¼"W. x 16"D. Wgt. 14 lbs.

Remote COAX Switches

RCS-4 FOR CONVENIENT INSTALLATION

No control cable required.
Selects one of four antennas.
VSWR: under 1.1 to 1 from 1.8 to 30 MHz.
Impedance: 50 ohms.
Power capability: 1500 watts average, 2500 watts PEP maximum.

RCS-8V FOR SPECIAL APPLICATIONS

Selects up to five antennas.
Loss at 150 MHz: less than .1 dB.
VSWR: under 1.2 to 1 DC to 250 MHz.
Impedance: 50 ohms.
Power capability: 5 kW below 30 MHz, 1 kW at 150 MHz.

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N9ENC, W9EPT, K9EFY, N9FMO, NO9G, WA9HEE, WD9HII, NX9I, W9KGE, WB9LRR, K9LMJ, W9NPA, WB9NCE, WA9OQT, WD9X, W9YDP. Packet BBS Reports: W9ZRX 2830, WA9UXP 1352, N5AAA 651, N9BAC 624, WB9SYK 249, and WA9IVB 523. Traffic: NR9K 503, KJ9J 296, WB9QPA 152, W9UMH 143, N9DWU 142, K9ZL8 108, W9ZGC 92, N9BS 73, WA9OHX 72, WA9QCF 65, KA9ERC 50, K9SBW 49, WB9TFD 48, W9OCL 46, N9EER 40, NX9I 35, K9GBR 32, WB9OZZ 31, W9PPO 31, N9FEI 30, WB9IHR 27, KA9QMI 22, KA9ZOD 22, KD9U 22, KB9HH 21, W9CNE 20, N9DTG 20, WD9HII 18, WA9OKK 18, N9DOP 16, W9PMT 15, W9DLN 15, W9BTZ 14, K9ZBM 14, K9EBK 13, WD9DWD 12, KB9GK 12, KA9RTD 12, WB9JUV 10, N9FMO 10, KA9QMI 9, N9ENC 8, K9EFY 8, WB9NCE 7, NZ9S 7, WA9JNC 7, KB9SU 7, WA9QVH 6, AB9A 5, K9OUP 5, KB9AVO 4, K9DIY 4, WD9CIV 3, W9RTH 3, W9BDP 2, W9KMY 1, WA6OIZ 1.

WISCONSIN: SM, Richard R. Regent, K9GDF—The Ozaukee RC will hold its annual ARRL sanctioned Swaptest May 6th starting 8:00 AM at the Circle B Recreation Center, Highway 60 and County I, north of Cedarburg. Walk-in exams beginning at 9:00 AM will be given by the Badger Examiners with exam info from WA9UJK. May 13th, Tri-County Hamfest sponsored by MANCORAD and Sheboygan 220 Clubs starting at 8:00 AM at the Manitowoc County Expo, Highways 42, 151, and I-43 on County Highway R. Amateur exams will be available. Milwaukee ARC members promoting Amateur Radio to prospective amateurs and have brand new club roster by name and calls; they will have exams on May 3rd starting 7:00 PM at Wauwatosa East High School, contact KE9JJ for details. May 11th Oldtimer's Spring Dinner Party at Kuglitch's 16000 West Cleveland Avenue, New Berlin, cocktails at 5:30 and dinner at 6:30 PM; reservations with KD9AJ. For an up-to-date list of Wisconsin repeaters, contact the Wisconsin Association of Repeaters, P.O. Box 23928, Milwaukee 53223. New officers Madison DX Club: Pres. N9ADN, V. Pres. WB9NOV, Sec/Treas. K9VAL. New officers Taylor County Area ARC: Pres. W9LEE, V. Pres. N9GEN, Sec. N9GHZ, Treas. WD9FWP. Ask our SEC, W9ZAG, about the new free Emergency Coordinator's Training and Certification Course. Tri- County ARC assisted at Valentine's Run at Countryside. Outagamie County ARES net meets Wednesdays at 9:00 PM on 16/76 repeater. The Watertown ARC emergency net meets Thursdays at 6:30 PM. Four Lakes ARC President NB9C says 70 percent of club members own a computer and the same number hold either an Extra or Advanced class license. FLARC also has a new member directory. Sorry to report Silent Key W9HSY. NB9H, Bill, moved to Fond du Lac with new job at Goodrich High School teaching graphic communications and power mechanics, besides recently graduating with two majors in Education. Bill will soon be back on 75 meters. W9NK became father of new girl named Arielle. W9VQD is reading about submarines, but still surfaces frequently to enjoy ham radio. Traffic: WB9YPY 1515, KC9CJ 1244, WA9W 771, KA9WDE 356, W9YCV 308, W9CBE 238, W9LKN 236, WA9WYS 230, K9GDF 225, N9BDL 111, KA9BHL 110, KA9KLZ 89, AD9X 88, W9UCI 87, AG9G 65, K9AKG 63, KA9FIII 57, N9BCX 54, K9JPS 40, K9FHI 36, NS9Q 33, KA9VIA 31, KA9TTM 26, KA9FVX 22, K9EP 22, W9ODV 21, N9BDL 111, W9VW 11, K9BED 6, W9PVD 6.

DAKOTA DIVISION

MINNESOTA: SM, George Frederickson, KCØT—Thanks, Lou, KØOGI, for the fun article on "How Airline Pilots Are Chosen." Whatever title you want to use is up to you, but I have been looking for that piece for many years and so Lou surprised me with it. I can't reprint it here as it is much too long, and to condense it would ruin it, so we'll have to figure out something else. Again, thanks, Lou, KØOGI. Traffic for the month of February came in at a respectable 2,968 with 20 stations reporting. And that doesn't include 64 training messages on MSSN. Speaking of MSSN, look at their ON! again. Holding in their number 2 spot as the most popular CW Net, Congratulations to all. However, MSN/1 and MSN/2 are looking for "Graduates." Judy Mortensen, WBØWNJ, resigned as Net Manger of MSPN/N on the 1st of March. Thanks, Judy, for a job well done, but we're sure glad you are active with your sked and other participation. I can't announce a new Manager yet, but hope that by the time you read this, it will be settled. Congratulations to Kenny Broshofske, KDØCI, Onamia, as our February Amateur of the Month. As you know, Kenny was my predecessor as STM for many years and currently is Net Manager for the Minnesota Amateur Weather Net (MAWN). Among other things, Kenny and his wife, Mary, KAØAJF, (Amateur of the Month May, 1986) publish a quarterly newsletter, "The Feedline," for East Central Minnesota, which is a first-class publication! I have received my copy of the spring issue of "Feedline" so I think I can make it now. Ray, KAØARP, MN EC, advises that anyone interested in continuing (or becoming) a Minnesota SKYWARN participant with the National Weather Service MUST be re-trained and re-certified this year, 1989. That means everybody, so watch for scheduled classes for SKYWARN in your area. Thanks, Gang, until next time, 73 es GL. Jim Swisher, KAØEPY, STM.

Net	Freq	Time	QNI/QTC/SESS	NET
MSN/1	3685	6:30P	361/113/28	NRØS
MSN/2	3685	10:00P	243/67/28	KDØNH
MSPN/N	3860	12:05P	323/161/28	WBØWNJ
MSPN/E	3860	5:30P	829/211/26	KCØT
MSSN	3710	6:00P	428/37/28*	KAØSBY
MAWN	3860	6:00P	287/211/28	KDØCI
PAW	3925	9:00A	3203/295/111	WDØBAC

*MSSN additionally 64 Training Messages. Traffic: WBØWNJ 1050, KAØEPY 349, WAØTFC 305, WØGRW 227, KAØPDM 130, KT9I 122, KAØSBY 117, NRØS 107, NØFOO 92, KCØT 78, KØOGI 62, KDØCI 56, KDØNH 55, KØQBE 50, KAØARP 48, W9DM 34, WDØGUF 33, NØJP 28, NØIYE 14, WØKYG 11. Total Traffic: 2,968.

NORTH DAKOTA: SM, Bill Kurtti, KCØM—Peace Garden Hamfest July 7, 8 & 9. Lots of hamfest fun for all ages—camping in the Turtle Mountains. Plan it as part of your vacation. Superlink is now in operation into Cooperstown and Grand Forks, tnx to KCØSD. Congratulations to the following upgrades, Tech KBØDSW, KBØDQI, KAØZUX, KBØCHV, KBØCLV & Myron Loberg. General, KBØDSG, NØJMG. Advanced NØJL WA7FCF, KAØUMV & KAØZAL. Extra KEØZM. Also to NØFBB on being chosen the outstanding woman of the year. Dickinson Group is finishing work on their Emergency Vehicle & Club station at the Law Enforcement Center. Devils Lake Hams have been busy again this winter providing communications for dog sled races, fishing tournaments, a

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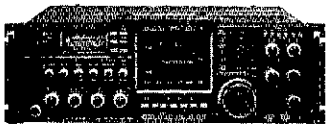

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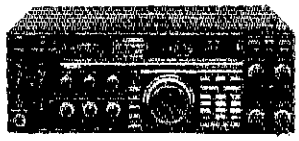

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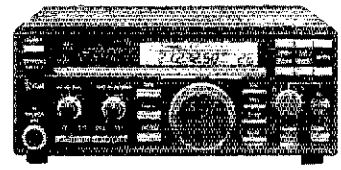

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hamfest and working the MIR space station with KDØEM, WAØKOB being added to the list. We are still looking for hams to set up stations in the historic sites around the state this summer, special QSL cards are available from me. Also, we need operators for the Centennial Celebration in Bismarck July 1 to 4. Contact me for more details. If you plan to attend the celebration, be sure to bring your hand-held along even if you can't help officially. Packet continues to grow in ND with the addition of NODES at White Butt WDØDAJ-1 NDDIK and, Rosegien WØTUP-5 NDROSE. Fargo hams are getting ready for the 1990 ARRL Dakota Division Convention. Seems like a long time away, but before we know it, it will be here. North Star Radio amateurs are hoping to get the 146.7 repeater near Grand Forks on the Superlink this spring. NØJR is our new DATA NET mgr.

NET	FREQ	TIME	SESS/QNI/QTC	MGR
Goose River	1990 kHz	9am su	4/125/2	WØCDO
Data	3885 kHz	6:30 da	28/625/35	NØJR
Wx Nets	3885 kHz	9am 12:30pm	41/571/27	WØGFE

SOUTH DAKOTA: SM, R.L. Cory, WØYMB—Asst SM: WAØFPR, NØABE. SEC: KAØKPY. STM: KDØYL. South Dakota was well represented at the Federal Emergency Management Agency meeting that was held in Rapid City on Feb 20-21. The purpose of the meeting was to improve emergency communications between the federal government, states and Amateur Radio. It was an excellent meeting with much progress toward these goals. The Deuel Band Radio Club will meet the third Friday of each month at 8 PM at the Deuel County Court House in Clear Lake. WØJOZ has installed a Packet Digi on a tower near Webster. Contact your club secretary and sign up to ride the Centennial Wagon Train this summer as it goes thru your area. It will run from May 10 thru Sept 4. Both HF and two meters on the radio-equipped wagon. Ham license plate bill SB231 killed in House Transportation committee, after passage in the Senate. Total traffic for Feb. was 1419.

DELTA DIVISION

ARKANSAS: SM, Bob Harmon, W5SEP—Marion County Radio Club met with Sheriff's Dept. and established agreement to assist in event of emergency situations. K2MJJ and N5BK report that they have established an Amateur Radio club at Mountain View High School with 16 students studying to get their radio license. Chuck Bishop, WB5GFA, gave a fine program at MARC February meeting. Chuck brought test monitor and checked and adjusted deviation on members' transceivers. Congratulations to Bob Matthews, K2MIJ, of Mountain View and Travis Burton, KB5ILY of Prescott for their applications for club affiliation with the ARRL. Bruce Vaughan, NR5Q's article in December QST was great and I understand he will have another in the April issue. Congratulations Bruce. Interesting program for the NWAARC radio club for April will be a supervised debate on the no-code issue with three members on each side of the issue given 5 minutes each and 3 minutes for rebuttal. Jonesboro Amateur Radio club announces new officers for 1989. They are President-Art Brown, WA5YWJ. VP-Pat Snodgrass, KB5FYN. Sec.- Evelyn Castleberry, N5DSY. Asst. Sec.- Betty Gibson, KA5ZUF. Treas-Jim Clarday, WF5AXX. Public Relations-David Moore, N5MOT. Officers for Russellville ARC are: Charles Shingleur, KF5JH. VP-John Evan, WB5BHS. Sec/Treas-KB8CJT.

LOUISIANA: SM, John "Wondy" Wondergem, K5KR—ASM: KB5CX. SEC: N5ADF. ACC: K5KR. SGL: KD5SL. TC: W5RWF. OOC: WB4ICV. Packet: NE5S. Recently elected officers of the Acadiana DX Assoc. are Pres: Howard, K5BLV. VP: Bodie, WD5GJB. Sec/Treas: John, N5JUJ. Regretfully, Al Oubre, K5DPG has resigned as ARRL Affiliated Club Coordinator for Louisiana. Al held this position for many years and along with his many other appointments contributed a great deal to Amateur Radio. His help and influence will be missed. ARRL Certificate of Merit in Recognition of outstanding service to the Amateur Radio community during 1988 were awarded to the Acadiana ARA, Lafayette for their outstanding hamfest; to the Central Louisiana ARC Alexandria for their monthly publication, "The Brass Key;" and to the Radio Amateur Service Club of Baton Rouge for Public Service Communications. ARRL Field Day is just a few months away. This year a plaque will be presented to the Shreveport Hamfest in August to the group that is judged to have both benefited and contributed most in participating in Field Day. The winner will be selected solely on the contents of the Field Day Report submitted to ARRL Headquarters. A duplicate copy of the report should be mailed to the ARRL Louisiana Section Manager (listed on page 8 QST) no later than 31 July 1989. All categories will be judged together in selecting a single winner. Mark your calendar for the 1989 Baton Rouge Hamfest May 20 & 21 in their new location at the Ramada Inn, 1480 Nicholson Drive. 73 & GL de K5KR.

MISSISSIPPI: SM, Jim Davis, KK5Z—ASM: W5TRD. SEC: KA4PKA. SGL: KA5WRX. PIO: WN5M. STM: KB5W. BM: W5EPW. TC: KF5DE. OOC: KK5K and ACC: NC5Y. Sincere congrats to KF5DE, new SM for Miss Section, taking office 1 Apr 89. Good luck, Butch! Vy nice letter received from Charles Terrell, NOAA/NWS/B'Ham, Al, Thanking all Miss hams, especially Monroe County ops, for help during severe wx condx on 20 Feb 89. We are appreciated. Miss SEC phone net (KF5DE) Sess 28, QNI 2093, QTC 81. DRN5 (WB5YDD) Sess 56, QNI 701. Miss rep 95% by KB5W, KT5Z, NS5M and W5HKW. CAND, Sess 28, QTC 544, rep 100% by NS5M. Tfc: WD5JXT: R-10, D-9, O-7, Checking into 5 daily and 10/10 "Light House Chapter." Congrats, 'Miss Bea. K5BW now SK, Billy Jepsen of Pritchard, MS. Billy was a real OT'er and will be missed very much.

TENNESSEE: SM, Harry Simpson, W4MI—Eastern Assistant SM and PIO: W4TYU. Central Assistant SM: WA4GLS. Western Assistant SM and ACC: K4CXY. STM: NG4J. SEC: K4UVH. OOC: K4LSP. SGL: N4PQY. TC: W4HHK. The TN Phone Net, managed by W4PFP, is on 3980 kHz with early sessions at 6:40 AM Eastern, Regular sessions at 7:45 AM Eastern Monday thru Friday, at 9 AM Eastern on Saturdays, Sundays and Holidays. Evening sessions, managed by WA4HKU, are Monday thru Saturday at 7:30 PM Eastern. CW Net Sessions are on 3635 kHz at 8 PM Eastern, Monday thru Friday. As this is being written, plans are going forward to make the Knoxville Hamfest and Computer Fair a rousing success! With W4RNL as Chairman and N4TZP as ARRL Coordinator, the membership of the Radio Amateur Club of Knox County stands firmly behind their efforts. Delta Division Director Joel Harrison has indicated that he will attend as well as several members of the ARRL state staff. The Hamfest will be held on Saturday, May 20, at Kerbela Shrine Temple, and I look forward to seeing you there! Hey, maybe we can get Knoxville's own Steve Ewald, WA4CMS, to come back for a visit. Steve is ARRL Assistant Public Service Manager, and works with all SMs in producing these monthly columns, produces the ARRL Net Directory, and handles a host of other duties. Steve was recently honored at a Board/staff dinner when he was presented the ARRL Employee Performance Award in recognition of his outstanding service to the ARRL Field Organization. The TN Evening Net has 24 sessions in February, and averaged 84 checkins per session! The TN Morning Net had 28 sessions and averaged just over 80 per session! TN was represented on DRN5 by K4WWQ, NG4J and WD4GYT during 74% of their 56 sessions. Traffic: WA4FMR 124, W4DDK 98, WD4GYT 67, K4WOP 66, WA4GZZ 65, WA4HKU 55, W4MI 50, KI4V 40, KA5KDB 36, W4PFP 24, K4CXY 20, W4TYU 15, WB4LAL 12, NG4J 9, W4TYV 9, W4PSN 4, W4EWR 4.

GREAT LAKES DIVISION

KENTUCKY: SM, John Thernes, WM4T—Asst SM: KC4WN. SEC: WB4NHO. STM: KA4MTX. PIO: WA4SWF. (February) Hope to see all of you at the NKARC Ham-O-Rama on June 11th. This month, we had many amateurs doing their best to assist government officials with the recent flooding in Elizabethtown, Frankfort and the Northern KY area. I salute all of you who took part. Headquarterss is looking at ways to improve the relationship between ARES and NTS. Let us know your comments now. The evening phone net (KTN) is in need of net control stations. Why not give it a try by contacting WD4RWU. If you know of a new Novice who wants to get started handling traffic, remind them of the KNTN on 3.727 MHz each evening.

Net	QNI	QTC	Sess	Mgr
MKPN	1463	301	38	WD4RWU
KTN	967	79	37	WD4RWU
KYN(both)	320	160	56	K4AVX/KZ8Q
TSTMN	371	30	28	KZ8Q
KNTN	215	92	36	WA4EBN

Traffic (Feb.): WD4RWU 342, K4VHF 204, KI4QH 96, KB4UJA 80, WA4EBN 47, N4PET 43, KA4MTX 33, K4AVX 28, K4MHL 25, WA4HLW 21, WB4AUN 16, N4PEK 9, W4TPB 9, WA4NOG 4. PSHR: KI4QH 96, KA4MTX 61.

MICHIGAN: SM: George E. Race, WB8BGY (@N8FTY)—ASM: WA1LRL (@WA1LRL). STM: WD8KOC (@NT8R), SGL: N8CNY. TC: W8YZ. OOC: WA2AJQ. ACC: N8JVA. PIO: N8KBA. BM: W1BW. Silent Keys, with deep regret, WD8CRY, W8LPW. I would like to express my sincere thanks to Jim Hundley, N8AYQ for the fine job he has done as SEC during the past 10 months. Jim's future is full of weddings, graduations, and new job training. During his term as SEC, he was in charge of the highest scoring SET in recent MI history. He also appointed 19 new EC's for MI Counties. Although Jim is stepping down as SEC he will continue to be DEC and RACES Officer for MI District 7. Thanks Jim from the whole MI Staff for a job well done. During February, Larry, WA2AJQ, completed the formation of a Local Interference Committee serving Detroit and the surrounding areas. Committee members are Larry, WA2AJQ, Oakland Co., Joe, WD8PSX, Wayne Co., and Al, NW8M, Macomb Co. Signatories to the governing memorandum outlining LIC operation include your SM and Irby Tallant Jr., FCC Field Supervisor from the Detroit FOB. Copies can be obtained from Larry or your SM. Dave, W8YZ, our TC, reports that MI now has 30 ATC's around the State. Dave has put together a real cadre of experts. Don't hesitate to call on them to help solve any technical problems. Dave, N8CNY, our SGL, reports that new legislation is being formed at the State level to allow Tech. class operators to operate scanners in motor vehicles on frequencies assigned to police and other official agencies. Congratulations to The L'Anse Creuse ARC who recently became a member of the W1AW Century Club. Your support of the League is greatly appreciated. Mark your calendars, the Five-County group will be hosting the MI ARRL Convention during their Swap'N Shop in Saginaw on August 26. Summer is just around the corner and schools will soon be closing for summer vacation. Why not set aside a couple of hours each weekend and invite in the neighborhood children for a ham radio show and tell. Invite a Scout or 4H group to visit your shack for a demonstration. You may be surprised to see how many of them show up for local ham classes in the fall. Each of us need to do our part to promote Amateur Radio to the next generation. Let's all do as much as we can to get others involved in our hobby. Please support the following MI area Nets:

NET	FREQ	TIME/DAY	QNI	QSP	SESS	MGR
UPN*	3921	5:00PM Dy	1180	72	32	WA8DHB
MACS*	3953	11:00AM M-Sa	308	87	28	K8OCP
MITN	3953	7:00PM Dy	589	370	28	WD8EIB
QMN*	3683	6:00PM Dy	828	146	83	WB8R
MNN*	3722	5:30PM Dy	258	85	56	KA8BBY
SEMTN	145.33	10:15PM Dy	288	158	28	N8HSC
QLETN	3932	9:00PM Dy	1153	62	28	NW8M
WSSBN	3935	7:00PM Dy	561	33	28	W8NDI
VHF Net Activity			583	7	28	NO8Q

*QMN Fast-6:30PM Dy; QMN Late-10PM Dy.; MNN Late-8:00PM Dy.; MACS-1PM Sun.; UPN-12PM Sun. Traffic for February: KA8CPS 575, N8FTY/BBS 386, WD8KQC 302, WA8OOH/BBS 282, KA8BBY 252, NJ8S 188, WB8BGY 156, WB8SYA 119, W8RNQ 109, NW8M 101, WB8YPG 98, N8IIC 88, N8JAT/BBS 88, K3UWO 84, WA8DHB 72, N8HSC 72, WB8R 60, NY8W 59, K8UPE 50, N8CNY 47, WB8YDZ 44, WD8MJB 42, K8EQO 41, W8YIO 38, K8HAP 37, WB8EOI 36, WD8EIB 35, K8ZJU 34, K8OCP 30, N8FPN 29, KA8BYK 28, N8IQS 26, WA8MVH 19, WI8J 19, KI8Q 18, K8CQF 16, W8IHX 13, NX8S 13, KN8JDN 12, KA8LAR 12, W8YZ 11, WD8AXB 10, WN8H 10, W8CSO 6, N8FTY 6, W8VIZ 5, W8BEZ 5, N8EXS 4, W8URM4, N8CUP 3, KF8M 3

OHIO: SM, John Haungs, WA8STX Phone: (513) 563-7373—ASM: David Kersten, N8AUH, (216)-221-6740. SEC: WD8MPV. STM: KF8J. ACC: KJ3O. BM: W8ZM. TC: KB8MU. OOC: WB8ZCE. SGL: N8CVK. PIO: K8QOE.

Net	QNI	QTC	Sess	Time	Freq	Mgr
BN(E)	281	111	28	1845	3.577	WD8C
BN(L)	199	116	28	2200	3.577	K8TVG
BNR	261	77	28	1800	3.605	W8EK
BSSN	305	60	28	1900	3.873	K8OZ
OSN	265	82	28	1810	3.708	WD8KBW
OSSBN	1959	1216	84	1030 1615 1630	3.9725	KA8CQF
OSSN	192	116	28	0645 M-F	3.677	KD8HB
OSSN	—	—	—	0800 S-SN	3.708	KD8HB
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Power Rating, Watts FM	1000	500	500
Radiation Angle, Deg.	7	7	7
Horizontal Radiation Pattern, Deg.	360	360	360
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Weight, lbs. (kg)	6 (2.7)	5 (2.3)	1 (.45)

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The Ohio ARRL Convention in Cincinnati was a good show with a slight attendance gain over 1988. Plans are already under way for the Great Lakes Division Convention in 1990. ARRL was well represented with ARRL VP George Wilson, W4OYI; ARRL Exec. VP David Sumner, K1ZZ; Great Lakes Division Director Leonard Nathanson, W8RC; Vice Director Allan Severson, AB8P; Gerald Hall, K1TD, QST Editorial Editor; David Kersten, N8AUH, Asst. Section Manager; Larry Solak, WD8MPV, SEC; Joanne Solak, KJ3O, ACC, and WA8STX 149, the Ohio SM. The ARRL forum was well attended with many questions about "No-Code" and the "220 MHz Band." If you have thoughts on the "No-Code" question, write to the ARRL study committee with your comments. You all have a role in the ARRL Field Organization. It's been a long-standing tradition that the work of Amateur Radio begins at the local level by Amateurs working in official capacities in the ARRL's field family. Whether it's serving the public in emergencies and emergency planning, message handling, parades and marathons, or serving fellow hams by representing Amateur Radio in Government; Public Relations; Information Dissemination, and the Technical arena, the vital volunteer is ready. Novice members of the League are eligible for Field appointments. Official Bulletin Stations, Official Relay Stations, State Government Liaison, Asst. Technical Coordinators, Public Information Asst., and Net Managers. So if you're a Novice, there are lots of new opportunities in today's ARRL Field Organization family. A lot of Amateurs ask "How do I sign up?" Your local Amateur Radio Clubs are active in public-service activities of all types. If you don't know who they are, you can get onthe air and ask or write to ARRL for information on clubs in your area to contact. Jim Miller, K8EIO, a new EC, from Stow, OH, was involved in a Goodrich Tire Co. industrial fire and an evacuation of between 1500-2000 people within a half mile of the plant. Four other county ECs and Amateurs were ready to assist in the emergency. Dayton Amateur Radio Assn. had a successful ARRL night at their February meeting. The Great Lakes Division Director and Vice Director were there to answer questions. The ARRL staff has been asked by the Board of Directors to study the desirability of adding a new, full-time position to the Headquarters staff, so that when an emergency develops, the League can move more quickly and efficiently. The North Coast Amateur Radio Club has an interesting activity called a "fox hunt." They are conducted each month to train amateurs in the skill of locating a hidden transmitter such as would be the case of interference that might plague an area repeater. Then the game becomes fun. I want to thank all the traffic handlers who are sending their traffic reports to WA8STX by the 5th of the month so they can get into ARRL for QST copy. Traffic: W8ZOL 449, KD8KU 385, W8PMJ 310, K8JDI 302, W8BO 291, W8QZK 288, WD8QXT 255, KD8HB 251, N8IIP 192, KA8GJV 185, WD8IKC 179, W8SKP 158, WD8KFN 157, W8LDU 152, KA8CGF 150, WA8STX, KE8J 137, N8XX 123, N8GEC 123, K8ALV 123, WB8RIB 123, K8IOW 120, WA8SSI 118, N8FWA 101, WA8HED 96, KE8CV 90, W8CXM 87, W8EK 88, W8JLW 85, WB8JGW 85, K8TVG 85, KC8YV 75, K8CMR 73, WD8DPZ 64, KA8HBN 62, NE8X 62, WA8EYQ 61, KC8TW/BBS 60, N8GPU 60, KA8BNQ 59, N8CW 56, KA8SON 54, NS8C 54, WD8KBW 49, WD8MPV 46, N9AUG 44, KB8DEB 44, K8DHD 40, WB8FSV 40, N8CEI 39, WB8KWC 35, KA1S 31, KA8ZOL 30, KD8WK 29, KJ3O 28, KA8YIT 28, WB8HHZ 27, W8PBX 26, KA8CKZ 27, K8CKY 25, NC8Q/BBS 23, W8BI/BBS 21, K8ES 21, N8GOB 20, K8WZX 20, KB8EMD 20, W8BDC 19, N2NS 19, NW8E 18, K8LQM 18, KB8FSR 17, KB8ABO 16, N8AJU 15, KA8RIX 15, N8HJB 15, W8FPA 14, K6ES 13, N8EFB 13, N8JDH 13, N8JYV 12, N8CJS 12, WD8PWG 10, KB8ESU 10, N8INP 10, WA8RLB 10, KD8XL 9, KE8DQ 9, NC8Q 9, W8GDQ 9, W8LDQ 8, KA8VYT 8, W8XT 8, N8HBF 8, KA8RQS 7, K8DXE 6, WA8NZE 6, N8JSN 6, WB8AJC 5, WD8JYE 5, KD8IC 5, KD8IC 5, KB8EEX 5, N8FPH 3, KA8OQF 3, KC8UR 3, N8JLT 2, WA8DYO 1. (Jan.): K8OZ 78, WB8FSV 26, KB8DEB 9, N8HRW 8, N8IWC 6, W1HVU 5, W8XT 1, N8JLT 1.

HUDSON DIVISION

EASTERN NEW YORK: SM, Paul S. Vydareny, WB2VUK—ASM: K2ZM. STM: WB2EAG. SEC: WA2ZYM. BM: WB2IXR. PIO: KB2TM. OOC: N2DVQ. ATC: WA2VGM. SGL: KB2HQ. ACC: KV2A. ASM & NWSLTR ED: WB2NHC ASM/PACKET: N2FTR. NET REPORTS FOR FEBRUARY(QNI/QSP): AESN 34/2 CDN 689/75 ESS 446/92 HVN 307/60 NYP 248/358 NYPON 577/503 NYS/E 291/203 NYS/L 309/252 NYS/M 297/222 SDN 253/110. CLUB NEWS: N1CC made a presentation on propagation at the Albany ARA meeting. They welcome new members KB2FUI KA2HRM KA2EVM WB2KMY. Congrats to W2ANB, 65 years in Amateur Radio. Catskill Mtn ARA were making plans for many public-service activities. CCNR had a program on CW training programs via computer. W2SZ club celebrated the opening of the shack at the March meeting. Mt. Beacon had a program on disaster and social support services. Pearl is working on plans for its May 6th hamfest. Saratoga RACES had a program on the use of GHz. amateur frequencies and is working on plans for the Sept. 9th hamfest. West. ARA learned all about tuners and transmatches from KN2X. WECA had a very successful hamfest on Mar. 5. They had a presentation by National Weather Service on Skywarn and had a number of volunteers for the program. Yonkers ARC is working on plans for field day. No, it is not too early! Now is the season for public service. Please get out and lend a hand! Now is the time to check out all equipment, antennas, etc and have it all ready for field day as well as any emergencies which might arise. FEB. PSHR: WB2EAG WB2VUK WA2JBO N5MEA K2ZVI WE2G WB1BTJ KB2EPU. NOV. PSHR: WB1BTJ FEB. Traffic: WB2EAG 462, N5MEA 249, WB1BTJ 210, WB2VUK 200, K2LYE 140, WA2JBO 121, WB2IIV 117, K2ZVI 101, WD2K 92, N2HIF 80, WA2GYY 64, KB2EPU 61. NQ2H 55, KA2O 28, K2HNW 21, W2CJO 19, WE2G 15, WF2M 14.

NEW YORK CITY-LONG ISLAND: SM, Walter M. Wenzel, KA2RGI—ASM: N2GQR. ASM VE: W2NL. ACC/PIO: KA2LCC. SEC: WA2UJI. STM: K2MT. OOC: NB2T. TC: W2QUV. BM: W2JUP. The following are traffic nets in and around the section that handle NLI:

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NCVHF	146.745/R	1930	M-F	N2IMP
SCVHF	145.370/R	2000	S-F	KA2JMA

(continued on page 124)

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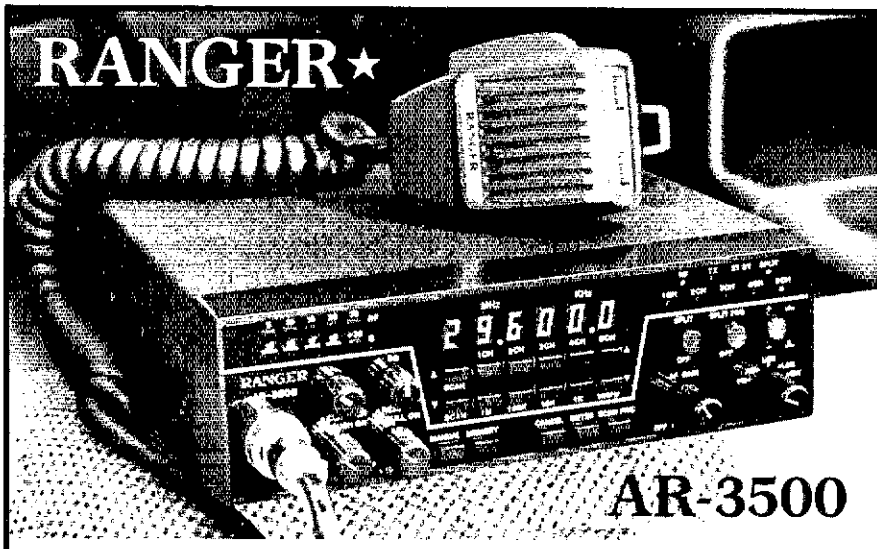

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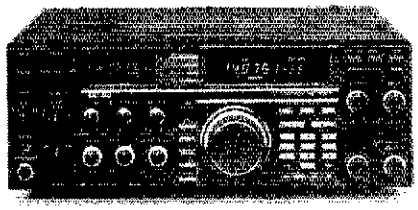

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FL-53A 250 Hz 2nd IF CW filter	115.00	109.95
FL-102 6 kHz AM filter	59.00	
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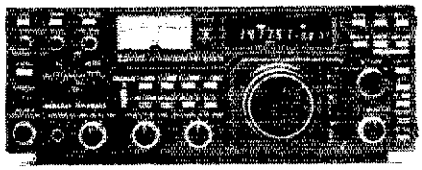

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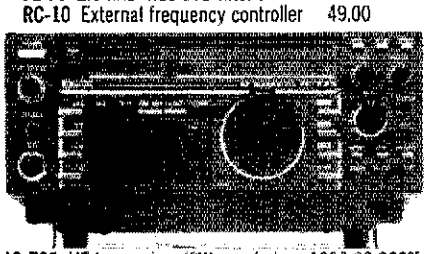
FL-53A 250 Hz CW filter (2nd IF)...	115.00	109.95
FL-33 AM filter.....	49.00	
FL-70 2.8 kHz wide SSB filter	59.00	
RC-10 External frequency controller	49.00	



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IC-38A 25W 220 FM, **TTP** mic	489.00	349.95
IC-48A 25W 440-450 FM, **TTP** mic....	509.00	449.95
HM-14 Extra TTP microphone	59.00	
UT-28 Digital code squelch.....	39.50	
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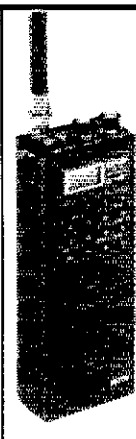

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BC-16U Wall charger for BP7/BP8.....	21.25
LC-11 Vinyl case for Dlx using BP-3	20.50
LC-14 Vinyl case for Dlx using BP-7/8	20.50
LC-02AT Leather case for Dlx models w/BP-7/8	54.50

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BP-4 Alkaline battery case.....	16.00
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CP-1 Cig. lighter plug/cord for BP3 or Dlx....	13.65
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LC-2AT Leather case for standard models.....	54.50
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HS-10 Boom microphone/headset.....	24.50
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PNS(Alt)	144.79	24hr	DLY	W2HPM-4	

*Independent Net, recognized by NTS, all times are local. VE LISTINGS: LIMARC-second Saturday of each month at 9:30 AM at Salten Hall, NY Institute of Technology,Old Westbury-contact Al Jones,W2ZDB 516-676-5790 SUFFOLK COUNTY VE TEAM—second Saturday of each month at 9:30 AM at the Suffolk County Community College,Selden—contact George Sintchek, WA2VNV 516-751-0894; GRUMMAN ARC—second Weds. of each month, until June, at 5 PM at the Bethpage High School, Bethpage—contact Howard Liebman W2QUV 516-354-6861; GREAT SOUTH BAY ARC—fourth Sunday each month at 12 Noon at the Babylon Town Hall Annex, North Babylon—contact Walter Wenzel, KA2RGI 516-957-5728; MAARC—last Thursday each month at 6:00 except July, Aug. and Dec., at the Robert Wagner JHS, Manhattan—contact Rubina Asti, KD2IZ 212-838-5995. If your group holds regularly scheduled license exam sessions and/or classes let me know at least three months in advance so they can be added to this listing. Please remember that the three month advance notice also includes meeting and club information that you would like to see printed here. Reminder: Field Day is just around the corner. I hope everyone is in their final stages of preparation for Field Day 1989. Please remember to send me copies of any Press Releases you send out on Field Day and your activities. I want to thank everyone for the opportunity last year to visit eleven of the thirteen Field Day sites within the section. This year due to the fact that my wife and I are expecting a new harmonic at the end of this month (May), I have canceled my plans to visit Field Day sites this year. Please remember that I will be at the Great South Bay ARC Field Day site in North Lindenhurst and that you can send extra credit messages to me directly there or through NTS during Field Day. To all Club Newsletter publishers: If you are using a Desktop Publishing Program that uses *.PCX files or you have a conversion program and can use *.PCX artwork let me know if you are interested in scanned ARRL Artwork for your use. This artwork is the clipart that was available to affiliated clubs a few years back-plus additional items. There is almost two megabytes of artwork available at the present time.

NORTHERN NEW JERSEY: SM, Robert R. Anderson, K2BJG—ASMs: NW2L (NE). N2CXX (SE). N2WM (NW). WB2NQV (SW). N2XJ ((Cen) and VE). SEC: WB2HBZ. STM: K2VX. OO/AAC: KA2BZS, ACC: K2BJG. SGL: W2KB. TC: K2BLA. BM: WA2UPK and PIO: NW2L. NNJ Ham Radio Info Line 201- 680-1585. Appointment endorsements for the next two-year term starting 05/89 are: NM for Packet Liaison W2QNL. ORSs: KB2JG, N2CJO, W2KWW, W2RQ and WB2RAG. OO applicant WA2NHZ of Howell has, effective 02/89, been certified as a member of the FCC Amateur Auxiliary (AA). ARES District Emergency Coordinator (DEC) leadership positions for Hunterdon and Warren counties remain open. Emergency Coordinators (ECs) or others who can meet qualification requirements and reside in either of these counties are requested to contact SEC WB2HBZ at 838-1835 concerning appointment. Congratulations to the following who were newly licensed or upgraded during February sessions conducted by Northeast NJ Testing Assn. (4/10), Raritan Bay ARC (14/18) and NNJ VE Board (14/22). Novice (6): J Delaney, B Hallingse, J Jankowski, G Mazmanian, E Rogacki and J Rosenberg. Technician (13): KA2OTD KB2GEO KB2GXJ KB2GYU KB2HDL KB2HDV KB2NBV D Pulver T Schulteis KB2ENY KB2GMX KB2HAK and E Rogacki. General (8): N2IOP N2IUT JS errell J Kardos (ex W2WMZ) N3GRQ KB2HBT N2IEE and KA2OEE. Advanced (3): J Digioia KB2HBS and KB2FCV. Extra (2): N2IRL and KE2KP. Total applicants (50). Total New or Up-Grade (32). 64%. The Hudson County Amateur Traffic Emergency Net (HCATEN) meets Thusdays at 1930 on 145.43-R. N2HNK Mgr. Traffic Nets and Statistics for Feburary 1989 follow.

Net	Mgr	Freq	Time	Sess	SES	QSP	QNI
NJM	WB2ZJF	3695	1000	Dy	28	260	148
NJPN	W2CC	3950	1800	Dy	32	384	173
NJ/E	W2QNL	3695	1900	Dy/P	28	258	123
NJN/L	WA2QPY	3695	2200	Dy/P	28	170	50
NJVN/E	WB2FTX	146.895	1930	Dy	28	636	96
NJVN/L	N2FGC	146.49	2230	DY/P	242	92	
NJSN	KA2INE	3735	1830	Dy	28	151	43
OBTTN	W2RRX	147.12	2000	Dy	28	283	119
NJTN	N2DXP	223.88	2100	Dy	28	195	60
NNJ/PL	W2QNL	145.01	24 hr	via	WA2SNA-1		

Packet NTS activity: Total 115, WA2SNA-1 auto forward (45) plus liaison (70) N2HNK (2) NZ2T (3), W2QNL (62), W2KB (1), WA2EXX (1), WB2FTX (2). SAR/PSHR: W2RRX 131/85, K2VX 155/103, W2QNL 501/163, KB4CYC 15/54, N2XJ 223/96, N2DXP 172/62, KA2INE 118/78, W2FTX 148/64, WC2R 58/64, WA2CLP 18/-, WA2MHA 5/-, KB2BNW 40/69, W2XD 17/-, KB2WI, N2DIY 10/-, KA2KJF 52/-, KE2JX 79/-, NW2L 17/- and W2CC 23/-. BPL: 8/88, 9/88 and 12/88 WB2QMP. 2/89 W2QNL.

MIDWEST DIVISION

IOWA: SM, Wade Walstrom, WØEJ—ASM: WBØAVW. SEC: KDØBG. STM: KCØXL. ACC: NUØP. OOC: WAØQMU. BM: KØIIR. TC: KØDAS. The results of the Iowa Section Manager election are now known and I am pleased to remain in this position. Thanks to all who voted and a special thanks to WBØAVW for demonstrating your concern and interest in the affairs of the Section. New Technician licensees from the January Cedar Rapids VE exams are KBØDLU, KBØDMZ, KBØDNA, KBØDKH, KBØDMY, KBØCTW and KBØDRI. New Advanced class licensees are KBØBMK, KAØZLK and WAØWGE. The March 5 VE exams at Benton County yielded 1 new Extra, 1 new Advanced, 3 new General, 1 new Technician and 2 new Novice class licensees. Congratulations to all of these people! The hamfest season got off to a good start with the Davenport HAMFEST the end of February. It was fun to see so many of you there. Remember the HAMBOREE XI in South Sioux City on May 5 and 6. Other upcoming events for this year include Des Moines Hamfest '89 on July 8, RAGBRAI, the Cedar Rapids Hamfest, and the West Liberty Hamfest. WAØV is the February DMRAA Ham of the Month. Congratulations, Annette! The Cedar Valley ARC has started a Spring Novice Class. If you have not already done so, please include your SM and ACC on your club newsletter mailing lists. Traffic: WØYLS 116, WØSS 114, WBØMCX 80, KØIPT 55, KØGP 52, KAØADF 51, WBØAVW 41, KØKQJ 16, WBØOKA 15, KAØVBA 12, KCØXL 8.

KANSAS: SM, Robert M. Summers, KØBXF—SEC: NØBLD. STM: WØOYH. ACC: KØBXF. TC: KAØHEP. BM: KØJDD. SGL: NØBLD. Net Mgr's: CW- WBØZNY. Voice: WØFRC. RTTY-open. Slow Speed CW-WØMYM. WX Net- WBØYWZ. PIO: WBØWSG. DECs: WØOAG, WØEB, WBØYJT, WØFRC, NKØV, WBØMDF & WAØCVR. Packet *Radio Coordinator NXØR.* KBØDGI has started a TEN MTR net Thursdays 7:30 PM on 28.400 for hams in the Wichita area. Others are welcome to QNI if the band is right. How about the rest of the areas out there, do you have a 10-meter net functioning? Let your SM know. In and out of the hospital was WØFDJ recently, feeling better we hope. Sorry to report the Sunflower QCWA HF net is no longer meeting due to lack of activity, WØMYM sending this along. Net activity for January is as follows: KSBN QNI 1810 QTC 117. KPN 445/15. KMWN 813/614. KWN 1230/851. CSTN 2128/63. QKS 285/72 and QKS-SS 36/5. More ECs need to report each month to your DEC and the DECs should compile a report for the SEC. The time of year for severe storms is upon us and we need to be geared up and ready to function. The need for alternate NCS on quite a few of our nets is still there. How about a few more volunteering to fill the gaps as needed. If you have questions about the duties etc, contact WØOYH. Traffic: KØBXF 343, WØFIR 220, NZØM 163, KSØU 120, WØFRC 107, KAØRCH 88, WØOYH 79, WBØZNY 73, WØFDJ 68, WØQMT 59, WØMYM 13, WØCHJ 11, WØRBO 5, WØNYG 4, NØBDG 4, WAØYXK 4.

MISSOURI: SM, Ben Smith, KØPCK—By the time this Section News has appeared in print, the 1989 ARRL Convention will have come and gone. The 89 Hamfest season will be in full swing. Try to attend as many hamfests as possible. There is a lot of time, work and expense for a lot of people in holding an event such as this. For a lot of clubs, their yearly hamfest is their number one source of income. You also get to meet a lot of great people and their fleas, in the flea market of course. Most club newsletters have a list of upcoming events, check them out and go and enjoy. Spring and summer is the time many clubs are assisting with different community projects. If your club is involved, contact the chairperson from your club to see if they need more help. Give them your support. More club officers: Eastern Ozarks ARC, Pres. KAØOLK, VP W2HBL, Sec. WØFWY, Treas. KDØIK and Directors: AIØH, WAØJRF and NØFLO. PHD: Pres. AJØE, VP KØTLM. Sec. NJØX. Treas. WAØKUH, Property, WAØZOG, Membership, KDØKA, Activity, WBØTIN, Editor, KAØKSH and A. Editor, WØOGT, Kansas City DX Club; Pres. NXØI, VP WKØG Sec. AJØE and Treas. KBØG and the Heart of America ARC; Pres. NTØP, VP KMØE, Sec. KAØREN and Treas. WB8TVV. Columbia Hamfest 89 will be Saturday, June 10 at the Midway Expo Center 2 miles west of Columbia on I-70. Contact NØFPI or KØPCK for information.

Silent Key Report: KOTVY, KOYNB, KBØZYS, and KØCCK, WØKCW

NET	SESS	QNI	QTC
MOSSB	28	864	141
MEOW	28	664	106
MON	56	198	105
HBN	20	399	24
HARC	4	88	16
RRABN	21	171	6
LOZBC JAN	23	357	4
LOZBC FEB	20	323	6
SWMSWN	4	94	5
ZAEN	4	30	3
SLARES	269	2	
JCRC	4	49	1
CMEN	4	59	1
LOZFM JAN	4	74	0
LOZFM FEB	4	65	0
QCWA Chp 35	4	41	0
MOPAC-1	4	20	0
CARL	4	19	0
P Rever	4	180	0
SEDARES	4	43	0

Traffic: NØFBW 1354, AIØO 220, WBØOIZ 196, WAØHTN 187, KØORB 181, WAØYJX 142, NDØN 140, KØPCK 37, WBØCJB 35, K9OCU 34, WØOUD 33, WB8TVV 31, KDØAJ 11, KEØAH 2.

NEBRASKA: SM, Vern Wirka, WBØGQM—Richard Newsome, WØHXL, and William Moniger, WAØGQH, both of Omaha, are now Official Observers and members of the Amateur Auxiliary in the Nebraska Section. We can always use more volunteers for the Field Organization. Contact your Section Manager for details of the various field organization appointments. The Blue Valley Club reports a new VHF and HF antennas have been installed at the Utica Fire Hall along with some new HF equipment. The Blue Valley ARES Net meets twice each week, check-ins are always welcome. The Blue Valley ARES Sunday Net is at 9:00 PM and the Wednesday net is at 8:30 PM, both local time, on repeater, WAØHOU 147.87/.27 MHz. A weekly Saturday morning coffee is held at "Chances R," 124 West 5th Street, in York at 10:00 AM, local time, everyone is welcome. Two Nebraska Section Volunteers Examiners report that the FCC recently contacted them to verify signatures which appeared on a 610 Form. Everything was in order. It should be noted that the 610 Form, which was being checked, was for a Novice license. The signatures on the 610 were accredited VEs but note that anyone who signs a 610 Form for a Novice license is subject to verification. VE exams have been scheduled on Lincoln on May 6 and on August 12, contact WAØYPY in Lincoln for details. At the time this report is being written, legislative Bill 58 which reduces the additional fee for Amateur Radio license plates in Nebraska, has been passed by the Unicameral and is awaiting the signature of the governor. At this time, there is no indication that the bill will not be signed. The reduction of additional fee from $10.00 to $5.00 dollars will become effective ninety days after the current session of the legislative adjourns. Traffic: KØDKM 186, WØKK 177, WØAP 122, KAØBCB 46, WDØEWH 17, NOØA 15, WBØGQM 5, WØWZR 4, WCØO 2, WØNIK 1.

NEW ENGLAND DIVISION

CONNECTICUT: SM, Caesar Rondina, N1DCS—ASM: KB1H. STM: K1EIC. SEC: N4GAA. OOC: NA1I. ACC: NK1J. BM:

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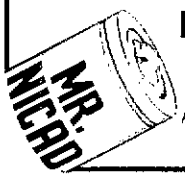

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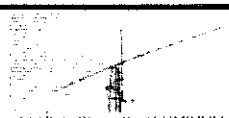

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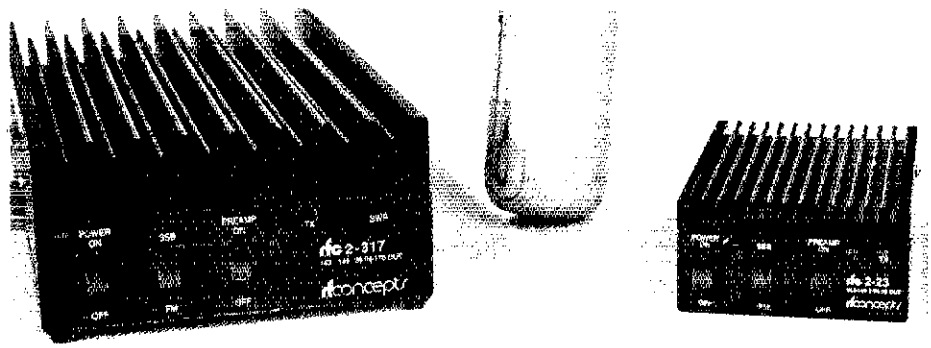

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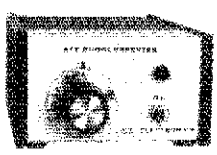

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N1EEE. PIO: WA1CMF. TC: KC1Q. SGL: K1AH. OK, gang. This is it. Field Day is almost here. Sharpen your skills, practice your CW and get to it. Milford, Connecticut, will celebrate its 350th anniv. with a special event station on Sat. June 10th and Sun. June 11th from 1200 Z Sat to 2200 Z Sun. Freq will be the lower third of general band on 80 thru 15 mtr. 10 meter will be in the mid portion of the Novice band. 2 M via 146.925/R. Special QSL available with QSL and SASE to PO Box 1639, Milford, CT 06460. CARA keeps 'em busy with building electronic kits. Nice club project. Congrats to N1API for accepting the position of Bulletin Mgr. Al also runs a PBBS on 145.05. Great place to get your bulletins, packeteers. A special thanks to FARA officers for the help they have given me in advising many other clubs. Thanks Carol, KA1FVY, and Jack, W1FDY. The Tri-State Amateur Repeater Council has a new address. It is PO Box 16220, Baybrook Station, West Haven, CT 06516. A note of congrats and thanks to Betsey, K1EIC, STM, and Luck, KY1T, CSTN, for their dedication and efforts in making the packet traffic flow thru our section. Almost all volunteer jobs are usually a thankless task, but from me and the rest of the Section, thanks for a job well done. In closing, let me state that summer is now upon us. From your Section leadership, we all wish you a safe and healthy summer. 73.

Net	Ses	Stations	Traffic	NM
CSN	20	86	30	WB1GXZ
CN	56	288	196	WB1GXZ
WESCONN	28	298	137	KA1GWE
CPN	28	394	138	KY1F
RTN	28	243	77	WA1FCA
NVTN	28	589	249	NM1K
TMRCN	4	85	11	NM1K

PBBS: Reports
Ct. Section Traffic Node KY1T BBS 160
N1API-4 61,
N1DCS-4 183.

Traffic: NM1K 511, N1DMV 423, W1EFW 215, KA1JAN 214, KY1T 197, WB1GXZ 175, KA1GWE 147, KA1ROL 109, K1EIC 103, N1GFM 96, KB1ZC 82, KY1F 82, N1GBP 65, KA1KP 57, N1FQO 43, W1KYD 43, N1FNN 38, W1BDN 36, W1WP 31, W1YOL 15, N1BOW 11, WA1NLD 10, W1QV 9, K1HEJ 9, WB2SGI 6, W1CUH 4.

EASTERN MASSACHUSETTS: SM/SEC, Barry Porter, KB1PA— STM: WA1TBY. PIO: K1HLZ. BM: N1BGG. OO/AA: AG1F. SGL: K3HI. TC: KA1IU. ACC: KA1SAO. EMass Ham Info Line/Westlink Report: 617-395-KISS EMass Hotline: 617-437-0111

Net	Mgr	Freq	Time(EDT)	Day	Sess	QTC	QNI
EMRI	N1AJJ	3658	1900/2200	DY	55	174	232
EMRIPN	WA1FCD	3880	1730	DY	28	156	136
EM2MN	N1DUB	63/23	2000	DY	28	333	482
NEEPN	K1BZD	3945	0830	SUN	4	31	6
HHTN	N1FLO	04/64	2230	DY	28	245	407
EMRISS	N1CVE	3715	1600/2030	DY	17	14	31
CITN	KB1AF	745/045	1930	DY	27	133	339

I want to thank those hams that volunteer their time so our hobby can be more enjoyable. I also want to point out that while Ham Radio is a service, it is also a hobby that attracts a diverse group of people with many interests. One of the ways we keep our hobby enjoyable is the "self-regulating" aspect of ham operation. There have been a few cases of malicious interference recently that are really disturbing. Al Hamilton, AG1F, and his FCC Amateur Auxillary team deserve a lot of praise for doing such a fine job, but they need your help! Ensure you operate your station in a manner that reflects positively on the hobby. Local clubs can lead the way and promote good operating practices by inviting hams and nonhams to operating events where they learn the proper ways to operate. This should help reduce the population of nasty hams on the bands. Due to increased work commitments, Wendy Kincaid, KB1AF, has had to resign as Section Bulletin Manager. She has done an unbelievable job with the program over the last few years and I would like to thank her for all the time she puts into ham radio. I would like to welcome Elaine Chase, KA1SAO, and Jack Callahan, N1BGG, to the Section Leadership Team. Elaine will be the Affiliated Club Coordinator and Jack will be the Section Bulletin Manager. Both offer a lot of enthusiasm and energy and welcome your input and support. For those of you that have packet and 220-MHz radios, the 224.80 repeater is dedicated to duplex packet. You just set up like you were going to have an FM contact on the repeaters freq and transmit your packets to the person you want to contact (provided they are also on freq). You don't have to "connect" to the repeater like you do to a digipeater. This repeater has good coverage and the sponsors want to encourage duplex packet radio. Another packet note: you have a DOS computer, a Mac, Atari ST or Amiga and are interested in furthering your packet-radio exploration, try running TCP/IP, which is a true networking program. (I've tried it and it makes regular packet seem old fashioned). If you have tried packet but found it boring or uninteresting, try TCP/IP. It is incredible! There is a 440 repeater that has a TCP switch hooked up on 448.375. Boston's new ham radio club (there hasn't been a ham club in Boston for about 10 years), will have had its first meeting by the time this is out. They will be meeting at the Red Cross Building on 99 Brookline Ave. (near Fenway Park and Kenmore Square). The meeting site is accessible by public transportation if you don't have a car. It is open to all who have an interest in radio. College students from out of town are especially welcome. This group will become responsible for the 145.23 repeater. When I know the clubs regular meeting nights, I will put it in here. Have you done anything to enhance ham radio's reputation this month?? Please express your opinion on Amateur Radio issues to you Section or Division staff. We appreciate your input. Traffic: N1BBT 1170, WA1TBY 1108, K1UGM 580, KW1U 561, KA1BBU 553, KB1AF 448, NG1A 253, WA1FCD 212, K1GGS 211, W1CE 202, N1BGG 196, KA1MDM 176, K1ABO 140, KA1AMR 128, W1TC 106, WA1FNM 105, N1CVE 81, N1DUB 81, N1FLO 80, N1AJJ 61, KA1GEP 59, K1BZD 55, KA1KCU 47, NS1N 29, WA1CRE 26, KA1EDY 18, KB1EB 16, N1BNG 9, KA1NOI 8.

MAINE: SM, Ted Bonesteel, WA2ERT—Effective emergency communications is our major goal. Contact your county EC. No EC in your county? Have you thought about the position yourself? Contact the SEC or SM. We need three District ECs for northeast, central/west, and southern counties. Contact the SEC or SM for details. I'll be attending the New England Cabinet Meeting in July. Your input, feelings, suggestions are needed. Also looking for club newsletters, reports of public service involvement, and other Maine activities. Keep the tidbits of info flowing this way. Exams: May 20, Sat, 9 AM, Bangor Hamfest, 20, Tue, 6:30 PM, Harrison (KA1REB). Net activity: (Mgr/Sess/Checkins/Tfc) Oxford County RACES/W1RWG/4/42/7; Cumberland Cty ARES/KA1ODT/4/46/4; Hancock Cty/WA2ERT/4/40/4; Kennebec Cty ARES/RACES/KA1LPW/4/77/0; Seagull/K1GUP/24/782/143; PineTree/W1KX/28/258/97; Aroostock Emergency /WA1YNZ/4/79/0; Central Maine Emergency/N1DZI/8/145/5; Maine Public Svc (no rpt). Station activity: KA1JOJ 310, W1KX 132, WA2ERT 86, KA1REB 59, N1BCF 56, W1JTH 51, W1RWG 43, W1BMX 38, ND1A 35, K1UNQ 18, N1BJW 13, W1OTQ 10, WA1YNZ 9, NI1Y 9, N1FPP 4, KA1ODT 4.

NEW HAMPSHIRE: SM, Bill Burden, WB1BRE--ASMs: W1NH- DX and contesting, KX1L- Youth, WB1HBB- State Organization president. Recently, a casual conversation on a local repeater resulted in what may be a big payoff for our continuing efforts to get in touch with more hams in the section. It turns out that Scott, KB1NW, has a current copy of the FCC database including all the information on the 610 form *and* the computing power to do some specialized and difficult sorts for us. As a result of initial efforts, he has provided WRONE (Women Radio Operators of New England) with a sort of all licensed women in the New England region. (WRONE is part of the NH Section this year). This requires some manual and some machine sorting by first name and gives them a valuable tool for recruiting. Next he provided me with a sort on all hams 18 years or under. This was a good news/bad news sort. Good news—we have 3300 hams in the NH Section. Bad news-only 50 are 18 or younger!! We have our work cut out for us! Scott is working on further special sorts as we try to learn more about our ham population. I would remind all the affiliated clubs that the ARRL has this data base and can, upon request, provide your club with mailing labels of hams sorted by ZIP code. Take advantage of this benefit—it could help your club grow. I will be working with Scott to use his unique resource to develop more information in this column and in the NHARA state newsletter which is sent to all clubs three times each year. Another reminder that the Hosstraders return to Deerfield on June 3rd for the biggest hamfest in the Northeast—with proceeds benefiting the Boston Shriner's Burn Center. SEE YOU THERE! Butch, WB1GXM, sent me a report on his experience with the new Packet BBS at the Concord Weather station. Weather info from the CVFMA Weather nets is relayed to WA1WOK-9 and Butch reports that his contact with the office during his vacation indicates the reports are being received with enthusiasm! They are looking for more reports from the west and from the mountain areas, so crank up your TNC and give them a little WX. The Twin State club newsletter, the Ragchewer, has a new column called DX Rumblings by Dave, KA1CRP. With the bands coming alive again, is there someone in your club that can give newcomers and new DXer's some hints and information? Another local ham featured in a newspaper article—Frank, KX1L, in Sandown in the Haverhill, Ma, Gazette with a half page and great picture. Good going, Frank! More input from the fast-growing club at the University of NH—Jay, KA1PQK, says that they have a digi up on 05—KA1PQK-1 and will have a BBS up soon. They also will be doing Field Day and they currently have 15 members in the club. Drop Jay a note on Packet—he would like to hear from other groups. Our next Division Director's cabinet meeting will be on Sunday, July 16. I plan to attend so think about questions, ideas, issues for the Director and drop me a note. Had a good visit with CNHARA this month. They were getting ready to support a CAP exercise in the North country and Field Day planning was on the agenda! And finally, Pres Dick W1FJH of SVARC led a presentation on Amateur Radio to Weblos scouts from New Ipswich and Greenville. After two and one-half years of excellent service as Net Manager of GSPN, WA1YZN has resigned and will be succeeded by W1FYR. Thank you, Bruce, for your dedication to NTS. Traffic: GSPN 145, GSFM 119, NHN 50, NHTTN 37. Stations: W1PEX 1891, KB4N 933, N1CPX 517, WA1FHB 504, K1TQY 384, W1FYR 269, KA1NXT 110, KK1E 69, WB1HBB 50, WA1YZN 48, N1FYD 32, W1ALE 31, WB1EAE N1ALM NE1J 30, KA1ROH 27, KA1HPO 15, KA1JOU 13, KI1M 11, KA1PFS 10, KA1SLT 8, W1TN 5, KA1LMR 4, KA1KFX 1. BPL: W1PEX, KB4N, N1CPX, WA1FHB. PSHR: N1CPX, W1PEX, KA1NXT.

RHODE ISLAND: SM, William M. Foss, KA1JXH—K1DT reminds all users of the New England Network to obtain the latest users guide. Available for one dollar from K1MOQ. RI freqs are 223.68, 224.68 and 441.15. Encouraged are DX QSOs, calling then QSYing, pausing for others, listening, iding, experimentation, technical forums. Discouraged are local QSOs, long-ragchewing, monopolies, kerchunking. The new ARES in RI under Mike, N1FKI, is looking for NCS for the state ARES net. EC and OES for the whole state. Requiring any info write to RI ARES P.O. Box 9303 Prov, RI 02940. There is a Trivia Net on Wed at 7:30 PM on 145.17 & 224.56. OSARG has a new controller for their 70 repeater. Traffic: W1EOF 237, KA1JXH 178, PSHR 63, WA1CRY 29. Start planning for FD.

VERMONT: SM, Jonathan P. Maguire, N1CQE—ASM (RFI): W1CTM. ASM (Education): WB2MIC. ASM (Packet): K1AUE. SGL: WB1AJG. STM: KT1Q. TC: W1AIM. PIO: WA1YOY. OOC: WB1BWV. Our new SGL has been very busy with the license plate bill. Bob, WB1AJG, reports that the bill, as of this writing, is progressing through the various committees of the house. Contact your local representative NOW and indicate your support. The No. VT winter hamfest was once again an overwhelming success. Although I was out of town on business, the reports that I heard were enthusiastic. WB2JSJ reports that the turnout for the exam session was a record breaker—39 applicants, including 5 Novices. The passrate was 58% which is right in line with the national average of 60%. KA1LDJ is looking for volunteers to report regularly to the Emergency Management Headquarters. Contact Richard for further information. WB1BWV, our OOC, has been actively involved in monitoring of the bands. He reports that a small group of amateurs are consistently breaking the rules. If you are interested in the Amateur Auxillary and an OO position, contact Jon or myself. It's not too early to start thinking about Dayton and Deerfield. The WA2SPL BBS in Alburgh has become the official gateway for NTS traffic in and out of the First region. Also, the BBS has been granted an

STA for unattended HF packet operation, and will assist the WA1VXW BBS with intra-region traffic handling. PSHR stations for February were WA2SPL, KT1Q and N1DHT. VT representation on 1RN/2 was 98%, 1RN/3 was 100%. The NTS has need of a few volunteers. Contact WA2SPL or KT1Q. I'd like your comments on the no-code proposal, and also your interests in serving the section. Traffic: WA2SPL 1229, KT1Q 686, N1DHT 203. Net reports: CN 24/498/38, CVFMN 4/99/7, VTN 28/121/146, TwinSFMEN 4/55/3, TriSFM 4/66/5, GMN 24/491/24, VPN 4/64/5.

WESTERN MASSACHUSETTS: SM, Bill Voedisch, W1UD—OO/RFI: N1CM. PIO/ACC: K1BE. SEC/SGL: WB1HIH. TC: KA1JJM. STM: W1KK. The number of active traffic handlers in the section is on the rise thanks to Dan, KA1RON. His direction and instruction has activated the Central Mass Two Meter Traffic Net. Explorer Scout Troop 73, under the sponsorship of the CMARA, has a number of new amateurs actively engaged in traffic handling. That's great. It certainly is encouraging to see young people interested in traffic. MARA has a fox hunt planned for April, and has been formulating plans for Field Day. A Novice class has been completed with seven new hams as a result of their fine effort. The members of the MtARA enjoyed an informative lecture on "Verticals and Dipoles: Why They Work" presented by Jim Ussalis, W1EQO. Our QSL bureau manager wrote a very informative article in "Intermod" explaining the operation of the QSL bureau. Now, when someone questions me about the bureau, I'm going to send him a copy of the article. George, K3SQQ, came up with a check list in NOBARC's "Squelch Tail" of equipment that should be taken on a search-and-rescue mission. The guys and gals out in the Berkshires do not get their share of people lost in those mountains. This sunspot cycle certainly is in full swing. Ten meters has been open to just about every part of the world. Spring and summer should have 20 meters open all night. Seems great to be able to work 20 into the wee hours of the morning. Traffic: KA1IFC 899, KA1EXJ 166, KA1QFV 95, WB1HIH 35, KB1TH 20, KA1LZC 31, K1JHC 23, W1SJV 54, KA1QFV 91, W1KK 72, W1UD 278, WA1OPN 5, W1ZPB 5, KB1TH 51, KA1RVN 65, KA1MEW 76, KB1XK 35, KC2IU 57, KA1OFC 36, KI2L 5, WB1CGK 17, KA1LZC 15, NU1S 9, NM1U 31.

NORTHWESTERN DIVISION

IDAHO: SM, Don Clower, KA7T—ASM: W7REX. OOC: WB7CYO. STM: W7GHT. ACC: N7BI. PIO: WG7E. Well, Feb. was a long and cold month and I think all of us are looking forward to spring. I hope you have had a chance to see the N.W. Division Newsletter that Rush & Bill have put out. It gives us all a chance to sound off and keep abreast of the local news. If you missed it, contact your local affiliated club for a copy. Traffic: W7GHT 319, KA7WZM 65, WS7U 48, KA7IHO 18. 73, Don.

NETS	SESS	QNI	QTC	MNGR
IDA. CD	20	646	11	K7UBC
NWN	28	729	38	N7LMA
IMN	28	203	150	KA7EEE
FARM	28	2278	140	WA7GSM

MONTANA: SM, Ken Kopp, KØPP.—SEC: KC7HP. RACES Rep W7RZY. EC: KF7KN to Rapid City for 6 state FEMA/ARRL/RACES meeting about packet linking. In a typical close Montana election, KF7R elected SM by 9 vote (2.6%) margin with 341 voting. One few years ago had only 3 vote margin. He'll take office April 1st. Valley ARC (Glasgow) elected N7CTF/P, KB7GRX/VP, N7FSH/S- T. Contact editor N7FFA to exchange newsletters. GHRC's (Bozeman) KE7X nominated for ARRL's Herb S. Brier Instructor of the Year Award. Welcome SEMARC (Miles City) as new ARRL affiliate. AARC (Anaconda) had centennial station at C-of-C. Traffic: KA7VYR 236.

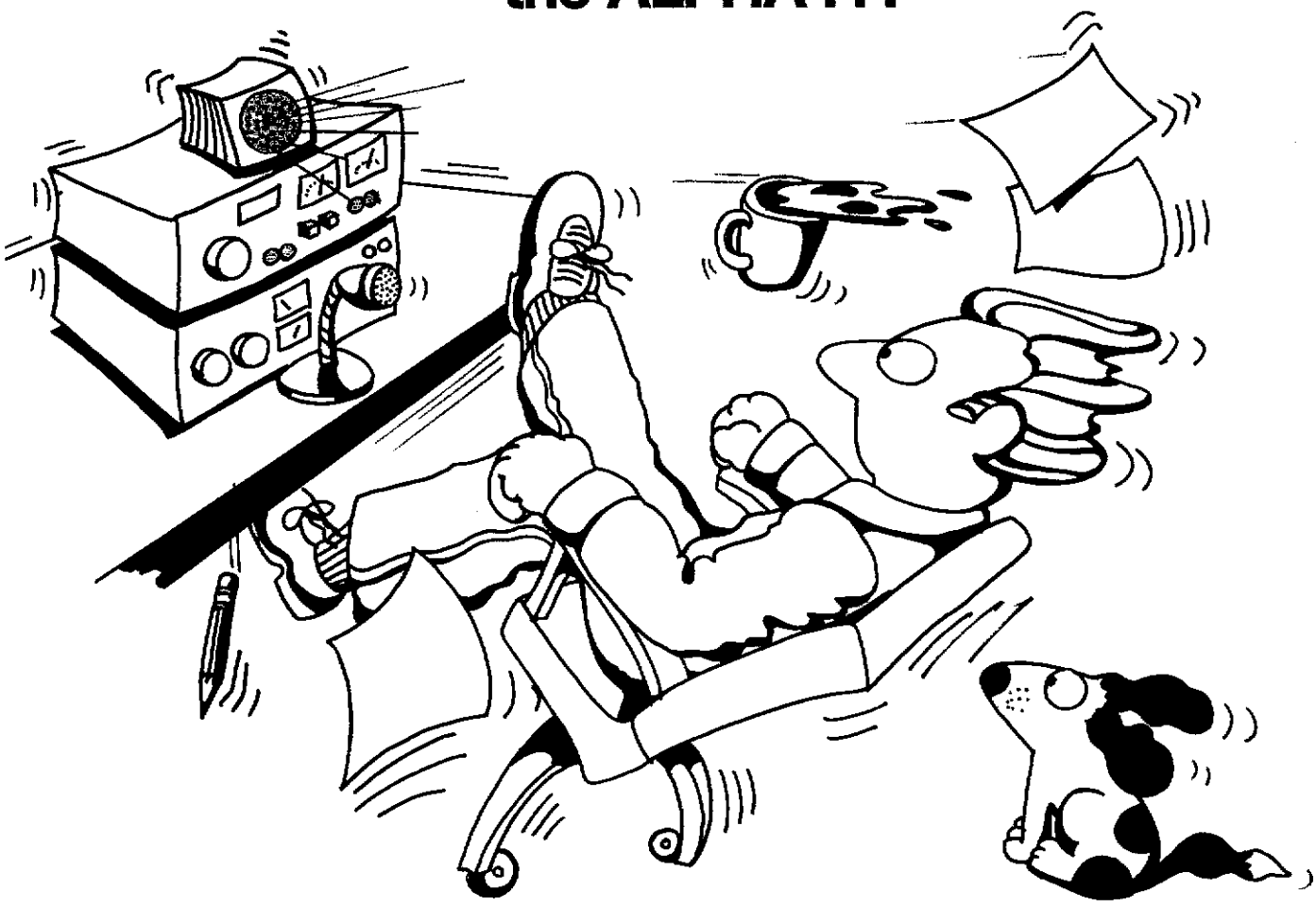
Net	Sess	QNI	QTC	Mgr
MSN	4	83	0	KØPP
IMN	28	203	150	KA7EEE
MTN	28	1736	107	KF7R

OREGON: SM, Randy Stimson KZ7T—ASM: KM7R. ASM: W7FBP. STM: W7VSE. SEC: KV7F. PIO: KC7YN. SGL: KA7KSK. OO: WN7W. STC: N7ENI. ACC: WF7Q. I have some good news and bad news. First the bad news. Dale LeBarron, W7FBP, has resigned as Section Emergency Coordinator. He did so because of recurring inner ear problems which affect his balance. It is not continuous and Dale never knows when it will occur. Now for the good news. Dale has agreed to help me with special projects and will do so as Assistant Section Manager. There is more good news, Bob Dorman, KV7F, has accepted the position of Section Emergency Coordinator. Bob has been the District EM for Dale so the transition will be very smooth and Bob is well qualified for the job. One big plus is that I now have two very capable ASMs-Bren, KM7R, who has done a fantastic job getting the Packet System established statewide and Dale. A big welcome to Jim Yohe, KF7KY, Washington County Emergency Coordinator and Al Henry, N7HZT, Polk County Emergency Coordinator. A final reminder about SEA-PAC ham convention. As of this writing, we have more exhibitors registered than ever before and the same for the flea-market tables. Registrations are far ahead of any previous year and I contribute this to the National Convention held here in 1988. Speaking of conventions, our first convention of the year held at Rickreal, near Salem, was bigger and better than ever before and because of the people who organize it, I'm sure it will continue to grow. Traffic (P) = Packet W7VSE 343, WG7H 250, N7BGW 236, KA7EEE 229, WT7A 174, WB7VMS 143P, WB7EMO 130, KA7AID 127, W7LRB 108, N7DTX 81, W7ODG 64, KV7F 43, KA7SYG 43, KD7YJ 29P, W7BDU 3. Late Jan. WG7H 171, W7LRB 114, WJ7E 78, W7LNE 67, N7APC 25.

EASTERN WASHINGTON: SM, Tom Plaisance, KC7PH—Appointees for this new section include Section Traffic Manager, Don Calbrick, W7GB, from Moses Lake. The Section Emergency Coordinator is Bernie Frazier, WA7CBX, from Walla Walla and the Official Observer Coordinator is George Fitzpatrick, W7LKR, from Pomeroy. The section needs more qualified volunteers to fill other section leadership positions. Please contact SM if interested. Leo Neiswander, W7ZEP, became a Silent Key on February 25. Leo was very active on the Mission Ridge Rpt and his accurate weather forecasts will be missed. Don't miss the Yakima Hamfest on May 20 & 21 at the Fairgrounds and the Apple City Hamfest in Wenatch-

(continued on page 132)

"... (click) ... just turned on the ALPHA ..."



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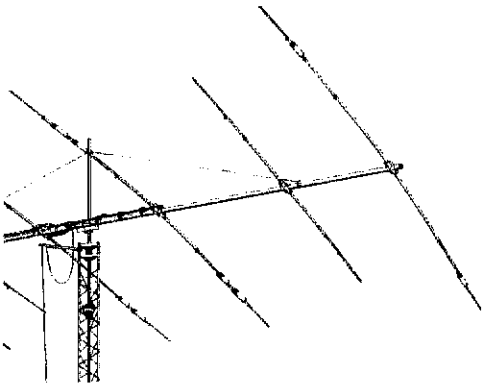

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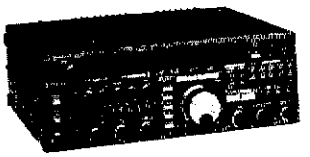

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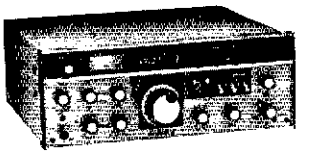

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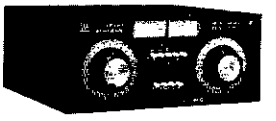

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ee, at Rocky Reach Dam June 3 & 4. Thanks are due to Brad Wells, KR7L, and Director Rush Drake, W7RM, for their efforts to secure section status for Eastern Washington.

WESTERN WASHINGTON: SM, Brad Wells, KR7L (@ W0LVJ). STM: KD7ME (@ W0LVJ). SEC: KA7INX (@ KE7OM). TC: W7BUN. OOC: N7DVR (@ W0LVJ). SGL KD7AC. BM: N7CAK (@ W0LVJ). PIO: N7FVK. ASM: W7UOF, ASM: K7CLL (@ K7IFG). The Olympia Amateur Radio Society, as a follow up to their Bicentennial station, N200HOE, sent a commemorative QSL card and letter to each of Washington's State Legislators. It was a gesture which will promote a continued public awareness of Amateur Radio. Sorry to report that KA6ITF has resigned as EC. Congratulations to NT7H on his appointment as Emergency Coordinator for Thurston County, W7KCJ, on his appointment as Certified Emergency Coordinator for Jefferson County, and WB7PTX on his appointment as Certified Emergency Coordinator for Island County. KA7AEF is now a Certified DEC, while NU7D, W7AY and W7YLD are Certified ECs in their respective counties. Bud Churchward, WB7FHC, and Larry Luchi, W7KZE, have been nominated for the ARRL Instructor of the Year Award. NV6Z moved the DX Packetcluster to 145.73 MHz. It is located southeast of Everett at Mill Creek. New officers for the West Seattle Radio Club (W7AW) are: K7NC-Pres; W7LSI-VP; W7GUW-Sect; N7EZU-Treas. New officers for Evergreen Amateur Radio Service are: KF7QX-Pres; KB7FO-VP; NK7V-Sect; KF6FT-Treas. Congratulations to N7DSR on her Official Emergency Station appointment. This is my final Section News column. I have resigned as Section Manager effective March 10. The demands of my recent promotion with Washington State Ferries and the priorities of my family dictated this very tough personal decision. I felt your interests would be best served by someone who has more time to devote to this important job. That person is Ed Holloway, KA7INX, who is your new Section Manager. Ed has been our Section Emergency Coordinator for the past 2-1/2 years, a key member of my Section Staff, and very active in various public service activities. He brings a great deal of expertise and enthusiasm to this position. He has appointed NM7N as our new Section Emergency Coordinator. I will continue to serve you as the Affiliated Club Coordinator, a position more consistent with my currently available time. It was a real honor for me to serve as your Section Manager. My thanks to all the individuals who kept me informed of Section activities and the many clubs who mailed me their monthly newsletters. A very special thanks to my Section staff for their continued support, dedication, and many hours of hard work. I would like to pass on a final observation for each of you to think about: there is a distressing trend to belittle modes or methods of operation than our own. There is no place for this type of bigotry within our hobby. Amateur Radio should expand our minds and personal horizons. We should revel in our diversity, not complain about it. ARES Public Service Hours: King 225; Pierce 108, San Juan 11; Thurston 90. Traffic: K7AJT 10, W7AZU 16, K7CLL 17, KA7CRN 17, N8EQZ 75, KR7F 238, KF7FF 109, N7GGJ 91, W7ICG 308, W7LG 10, KA7PMD 25, W1PRT 10, KA4SBE 74, K7SUX 149, KA7TTY 34, W7TVA 153, K7UQH 74, WB7WOW 191, KR7L, KD7ME. PSHR: KF7FF, KD7ME, W7TVA, WB7WOW.

PACIFIC DIVISION

EAST BAY: SM, Bob Vallio, W6RGG—ASMs: W6ZF, WB3FCV. SEC: W6LKE. STM: K6APW. OOC: NY6Z. TC: N6AMG. The latest issue of "THE RELAY," the Northern California Net (NCN) newsletter lists the following nets, and suggests that you try checking in to one or more: NCNV - 1930 on 145.41 and 145.91, NCN1 - 1900 on 3630, NCN2 - 2030 on 3630 (slow-speed session), RN6 - 1945 and 2130 on 3655, and PAN - 2030 on 3675 (all times are PST). MDARC's new EC is N6CUK. Their new members are Cynthia Baker/SWL, WD9BIV, N8UGD, KC8AWV, Beverly Curtis/SWL, Bobby Curtis/SWL, KB6AML, Erlyn Madsen/awaiting Novice license, K6PWF, N6IPE, N6IPB, N6IOZ, and NY6D, the last four all being members of the Stenger family! The club mourns the loss of former president, WD6BZQ. LARK welcomes new members WA6JFZ, N6SQC and KI6TZ. WB6YBA is now Communications Officer for the Livermore Valley. Their new 10 meter net meets each Wednesday night at 1930 on 28.485. EBARC's new Club Station Chairman is N6ASB, and new member KC6BID has upgraded to Tech. Feb tfc: WB6DOB 212, W6VOM 119, K6APW 81, WB6UZX 49, K7VA 17. Late Jan tfc: N6VV BBS 376, K7VA 13. Late Dec tfc: N6VV BBS 1202.

NEVADA: SM, Joe Lambert, W8IXD—ASM: Curly Silva, K7HRW. NW7O has been appointed Technical Coordinator for Nevada. Jim is well-known for his VHF and UHF activities, is past-president of FARS and is active in DX-ing. Welcome aboard, Jim. SIERA is supporting the Pony Express re-run in Nevada June 15-17. If you can help please contact K4CTZ. There is a proposal before the Nevada legislature to provide amateur plates with the words "radio amateur" embossed on them. You can support this by writing to Senator Lawrence Jacobsen, Capitol Complex, Carson City, 89710, or call his office at 885-3665. WADG reports that the 147.03 repeater is on the air with 10-meter FM and UHF link capability. SNARS reports that the .61 and .05 radios are back on the air after having been repaired. LVRA reports that temporary repairs have been made on both Mt Potosi sites, after severe wind and ice damage. Final repairs which include a new tower on High Potosi should be completed by the time you read this.

PACIFIC: SM, Wayne Jones, NH6GJ—Greetings to all from the land of Aloha! For those who don't know about them, there are several recurring "social" events that happen throughout the state. Every Tuesday at 9:00, a group gathers for breakfast at Denny's in Pearlridge Center. On Thursdays, a group meets at the Kaimuki Inn on Waialae Avenue at 0900 also. On Fridays, an informal meeting of the BIARC happens at the Pizza Hut near the airport at lunchtime. Finally, on the first Saturday of each month, the Mililani hams meet at McDonalds at 0800. If you haven't been to one of these meetings, give one a try when you are in the area. All are invited! The latest Kauai ARC Bulletin says that KH6PH made successful contact with the MIR space station on 146.55. This is the first contact with MIR by a ham from this section that I am aware of. Congratulations! So, until next time, Aloha from all of us to all of you! Traffic: KH6GMP 7, KL7IVQ 14, KH6S 23, KH6AFS 31.

SACRAMENTO VALLEY: SM, Bob Watson, W6IEW—The most important happening of the month from my standpoint

is the resignation of Deane Coats, NR6A, as the Section Emergency Coordinator. The demands of his job leave him too little time to do the SEC job in the way he feels it should be done. I cannot object to his reasoning, but he will really be missed. Thanks, Deane, for all that you have contributed to the Section. Another of our top emergency men, Dave Carlson, KE6NS, the District Emergency Coordinator for the Central Sierra Counties has resigned because of other pressing activities and he will also be sorely missed. We need to get these important posts filled before fire season starts and hope there are no serious floods in the meantime. Cass Tressl, KX6Z, the DEC for the Metro Sacramento District held an excellent meeting on preparing for emergencies. He is on the right track in getting input on problems (challenges?), needs, solutions, etc. from responsible people in his and adjacent areas. OO Coordinator John Canaris, WY6O, gave a presentation at the annual dinner of the Amador County ARC explaining how the OOs serve the cause of ham radio and help out their fellow hams by giving friendly warnings of infractions before serious problems develop. Section Net at 8 PM, first Sunday of every month on the Yuba/Sutter repeater 146.085, input up .600 MHz. CU there. Traffic: WA6ZUD 258, N6DOJ 212, WA6WJZ 195, K6SRF 81, N6LAM 28, W6CQF 25, WB6SRQ 12, W6RFF 16.

SAN FRANCISO: SM, Dick Wilson, K6LRN—Apologies to all who have sent mail to the address on page 8 in Feb. & Mar. QST. The correct address is Box 4212, San Rafael, CA 94913. If you will send the returned envelope with the incorrect adx, I will refund the postage (Tnx W6VV). NU6P is on from India with call sign VU2HPA-QSL via WA6BXV. Look for Pete on 14.175 at 0200 Z or 1500 Z. Lake County ARS has KB6AMP, Pres. & KB6ALT, Secty-Treas. The club meets the last Thurs. of each month at St. John's Episcopal, 1190 N. Forbes, Lakeport. Info from W6BIY Secty for past 12 years, deciding he will take a break. KB6LO spoke on solar cells at the March meeting of LCARS-Don has given MARC a lecture on FAX-that man gets around. Station Activities space is predicated on ARRL members—more members, more space. Renew through your club and your treasury benefits. Put your club number on form. Send reports to SM by 6th of the month.

SAN JOAQUIN VALLEY: SM, Charles McConnell, W6DPD—SEC: WC6U. STM: N6AWH. TC: WA6EXV. Asst. SMs W6TRP and K6YK. The Turlock ARC is celebrating its 60th anniversary in 1989. The Southern Sierra ARS is celebrating its 10th anniversary. Congratulations to WA6EXV, the SJV TC, for finishing first in the US in the 10 GHz contest for the 2nd consecutive year. WA6DXO and K6LLF are Silent keys. N6SAE is Advanced. KB6JFL is General. KB6MBN and KB6ZJN are Tech. KC6APL is now N6UGN. W6DPD has an IC 375A. W6TUI is on packet. K6XJ and W6XP operate a node for the DX packet cluster network that covers northern California. The Fresno Hamfest is May 5-7, 1989, at the Airport Holiday Inn, Fresno. Gatherings like this one need your support if they are to continue. Contact the Fresno Hamfest at P.O. Box 783, Fresno, CA 93712-0783 for registration information. Traffic: N6AWH 129, WA6YAB 22, W6DPD 11, K6PMG 11. (Jan.) N6AWH 107.

SANTA CLARA VALLEY: SM, Glenn Thomas, WB6W—SEC: WA6OCV. TC: WA6PWW. STM: N6JLJ. PIO: WB6OML. ASM: N6JCJ. ACC: W6MKM. BM:(vacant). OOC: KA6S. FEBRUARY - In our section, 145.695 MHz is the ARES alerting frequency. Its purpose is to provide a quiet channel that may be monitored by those who want to become aware of an emergency situation developing, but do not wish to listen to chatter on the repeaters. Lately, I have heard simplex chatter that is often only 5 kHz away on 145.7 kHz. Please folks, try and keep the ARES alerting frequency clear so that it can serve its purpose... There is a telephone number that has information on Amateur Radio license classes, (408) 971-1424. Well...it only has the info that I put on it, and I can only put on it what I know about. PLEASE, let me know about any classes your group or club is sponsoring so that I may include them on the recording. January classes include the West Valley ARA, City of Menlo Park, Santa Clara County ARA, the Naval Post Graduate School, and the ERI. My phone number is on page 8 of this issue of QST... I apologize for the short report this month. I'll have more next month. Traffic: Feb. NR7E 141 (0), N6JLJ 6 (3). Phone numbers: Amateur Radio Classes (408) 971-1424. License Exams (408) 984-8353 (ARRL VEC) or (408) 255-9000 (Sunnyvale VEC).

ROANOKE DIVISION

NORTH CAROLINA: SM, W. Reed Whitten, AB4W— ASM: AB4S. SEC: N4MYB. STM: K4NLK. BM: K4IWW. ACC: WC4T. TC: K4ITL. SGL: KE4ML. PIO: AB4FW. Weather related problems have kept ARES operators busy! Winter storms in Feb. and Mar. required that Skywarn Nets be activated to gather snow depth, current precipitation and road condition reports for the National Weather Service (NWS) and Emergency Management officials. Tornado watches and warnings were issued on Feb. 21 for central & eastern NC which again required Skywarn Net activation. Several funnel clouds were reported by Amateurs to the Raleigh and Wilmington NWS offices and warnings were issued based on these reports. [BT] A multi-state tornado awareness exercise was held by NWS during a lull in the winter weather. Amateur Skywarn nets were activated by EBS announcements made on Radio and TV stations throughout the state. The NWS offices in NC appreciate our assistance and have been a source of good publicity for Amateur Radio in NC. REMEMBER: size of hail, damaging winds (50 mph or more), funnel clouds (& weather rotating), extremely heavy rain & storm - induced power outages are the information to report on Skywarn Nets. [BT] A coastal storm caused severe damage to the beaches of Dare Co. on Mar. 8. ARES provided communications for NWS, Dare Co. EOC and the state EM Area A office. Over 20 Amateurs participated in this effort including the following ECs: N4JXG, WA4SLC, W4TLA, KA4BVX, KB4ZAZ & KB4BME; Asst. ECs WN4A & KA4RPZ; and DEC WA4MOK. [BT] The question of "no-code" licensing is again being raised. This is a MOST important issue and deserves careful consideration by ALL amateurs. Read all you can and discuss this question with others. When you have formed a well-thought-out opinion, share your thoughts with your ARRL officials. [BT] Roanoke Division League Planning Meeting is scheduled for May 20-21 in Ripley WV. The LPM is your opportunity to meet with elected and appointed ARRL officials and participate in discussions about the concerns of Amateur Radio and YOUR ARRL. [BT] Durham FM Association sponsored DurHamfest is scheduled for May 27. [BT] Silent Key, KA4OXF. [BT] February traffic: K4NLK 402, K4IWW 199, WD4HTE 185, N9CGD 123, KI4YV 73, WB4WII 63, WD4MRD 59, N4JRE 55, K4GI 46, WB4DAR 45, NT4K 43, KC4GRU 40, N4NOY 39, W4LWZ 38, WA9NEW 36, KA4KGZ 36, W4EHF 31, WA4MNR 31, N4LST 28, WD4LOO 28, AB4EO 27, WD4LSS 20, KM4BN 19, N4TNB 19, N4SVZ 15, K8SKX 14, AB4W 9, N6LHE 7, KC4BJB 6, N4JTG 4 & WB4BCX 3 [AR]

SOUTH CAROLINA: SM, Ned Moeller, N4FVU—We're achieving public visibility & recognition throughout our state. Our local newspapers published articles describing how resident radio amateurs in Goose Creek & Irmo, SC persuaded their city councils not to restrict the height of antenna towers. Anderson Radio Club's emergency preparedness was featured in a full-page article & picture by the Anderson Independent-Mail. During February, radio amateurs participated in a state-wide tornado-awareness exercise, snow emergencies, tornado damage reporting, a hunt for a dog and dead infant in Cherew, plus public events. Our PIO, AB4ID, has sent an overview of the goals of Amateur Radio and their activities in a letter to all newspapers, civic clubs, TV & radio stations in SC. The Columbia ARC newsletter is now available to all SC hams who have access to their local packet BBs. Increasing the readership of your newsletter, should increase your public visibility & membership. HAMFESTS: Greenville May 6-7, Lake Hartwell May 20-21. Traffic: W4ANK 140, N4MEJ 121, KA4LRM 44, W4DRF 26.

VIRGINIA: SM, Claude Feigley, W3ATQ—STM: KB4WT. SEC: N4EXQ. ACC: NT4S. OOC: W4HU. BM: AB4U. PIO: AA4VP. TC: WX4C. SGL: W4UMC.

VTN	1 PM	3907/7260	W4JLS
VSBN	6 PM	3947	KI4BR
VSN	6:30 PM	3680	N4KSO
VN(EARLY)	7 PM	3680	N4GHI
VN(LATE)	10 PM	3680	WB4KSG
VLN	10:15 PM	3947	KK4FV
SVEN	7:15 PM	146.82	N4TS
STARES	9 PM	146.97	KJ4VT
DEC/EC	9:45 (3rd Wed)	3910	KA4NWK

New appointees: WA5FAC as OES. N4EXQ reports that he and ECs KB4WOM and WB4ZTR have been busy responding to a request for amateur communications during the reenactment of the Battle of New Market on May 11, 12, 13, and 14. Discussions are being held with N3ECL who coordinated the amateur participation in the reenactment of the battle at Gettysburg last summer. If plans materialize as expected, there will be a need for VHF ops during this time period. KA4VHR sez the Virginia Tech annual Valentine Day Massacre was a huge success with approximately 900 messages generated over a 3-day period. N4GHI, VNE manager, has set the last Saturday in July which is the 29th as a tentative date for the VN picnic. You have heard it early, so plan to attend. It is good to hear Gil, W4SQQ and Andy from K4KDJ back in the CW nets. Condx for the VTN have been very erratic, so if you do not hear the net on 3907 go to 7260. To all AFFILIATED CLUBS, a reminder, that the League's "Challenge for the 80s" is still in effect. Your club receives a rebate on all new ARRL memberships and membership renewals passed through your club. If you need further details, contact the SM or ACC. Considerable interest is being generated in the ARRL Diamond Jubilee Award. There are 3 ways to quality for this very attractive certificate. Award applications are available from Headquarters or the SM. As usual, February has been a great month for traffic mainly as a result of the Valentine Day load. We had 53 stations reporting a total message count of 9483. WBØTAX, N4GHI, KB4PW, K4DOR and W3ATQ made BPL. Hope to see you at the Roanoke hamfest May 28 and at Manassas June 4th. Traffic: WBØTAX 1168, N4GHI 1036, KB4PW 719, K4DOR 680, W3ATQ 582, K4MTX 495, N4HOG 482, N4EXQ 479, W4JLS 366, WB4PNY 308, KI4BR 230, KK4FV 228, WB4QOJ 226, AA4GL 214, N4TJT 170, W4SQQ 157, KJ4VT 156, WB4EDB 141, KB4WT 138, WB4KIT 136, WB4KSG 131, N4KSO 118, KK8L 103, K4BGZ 89, N8ANQ 87, WD4MIS 77, WD4MIZ 76, KI4W 74, K4JM 73, WD4FTK 64, W4TZC 53, KB4OPR 48, W4HDW 46, KB4NGO 41, N4SMB 40, WB4RZW 34, KC4ESG 31, WB4UHC 27, N4RHV 25, KI4VU 24, K4MLC 16, W4HU 15, N6GVG 15, WA4TVS 15, WB4DQZ 12, K4GR 12, K4AXF 8, N4FNT 5, K4JST 5, K4VWK 5, WA1VRL 2, N3RC 1.

WEST VIRGINIA: SM, Karl Thompson, K8KT—SEC: K8QEW. STM: N8FXH. SGL: K8BS. TC: K8LG. Rept. Coordinator: WB8GDY. ACC: WD8EBH. Regret to report that R. L. Monroe, W8WHQ, has become a Silent Key. R. L. was an institution in ham radio and will be greatly missed. Fayetteville H. F. on Feb. 26 was well attended in spite of the snowy WX. Congrats to all who upgraded. The Roanoke Div. Planning Meeting will be held on May 20 & 21 at Ripley. Plan to attend this most important meeting and make your views known. KA8WNO made BPL AGAIN! Congrats Jack.

Net	Freq	Time	QNI	QTC	Sess	NM
WVFN	3865	6:00	1095	160	28	WD8DHC
WVN	3567	7:00	267	101	28	KZ8Q
WVMD	7235	11:45	866	793	96	WD8V
WVRN	3640	6:30	206	37	28	K8LG
WVNN	3730	7:30	103	40	28	KA8ZGY
HILLBILLY	14290	Noonsu	197	20	4	W8YP

Traffic: KA8WNO 635, WD8V 314, W8YP 268, K8TPF 157, KE8FI 122, W8FZP 98, K8QEW 78, WD8DHC 85, WD8LDY 47, K8KT 47, N8FXH 30, KA8OGF 23, WD8EBH 16, KD8WX 16, N8JPR 10.

ROCKY MOUNTAIN DIVISION

COLORADO: SM, Edie Sheffield, KAØMQA—SEC: WBØTUB. STM: KBØZ. ACC: WBØDUV. PIO: WBØFQB. TC: WØLJF. OOC: KAØCDN/WØIJR. SGL: WDØHNQ/HNP. BM: KAØVKM. Last year, when a federal judge ruled that an amateur in Boulder County be limited to one tower at 35 feet, it was stated that the impact would be broader than only Boulder County. Recently, many amateurs in El Paso County have attended hearings on the proposed tower ordinance of that County. Presentations were made to the Commission regarding two major provisions of the ordinance which were opposed by the Amateur Radio Community. The El Paso County Commissioners will hear this proposed ordinance in April. Two of the latest counties contemplating tower and antenna ordinances are Elbert & Logan Counties. The Boulder case is in the process

(continued on page 138)

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Priority control • Search/Scan • AC/DC
Bands: 29-54, 118-174, 406-512, 806-912 MHz.
The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4½" x 12½." If you do not need the 800 MHz. band, a similar model called the **BC 210XLT-T** is available for $178.95.

Bearcat® 145XL-T

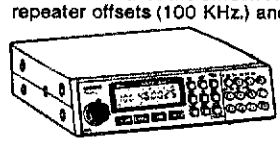
List price $189.95/**CE price $94.95/SPECIAL**
10-Band, 16 Channel • No-crystal scanner
Priority control • Weather search • AC/DC
Bands: 29-54, 136-174, 406-512 MHz.
The *Bearcat* 145XL is a 16 channel, programmable scanner covering ten frequency bands. The unit features a built-in delay function that adds a three second delay on all channels to prevent missed transmissions. A mobile version called the **BC560XLT-T** featuring priority, weather search, channel lockout and more is available for $94.95. CEI's package price includes mobile mounting bracket and mobile power cord.

President® HR2510-T

List price $499.95/**CE price $239.95/SPECIAL**
10 Meter Mobile Transceiver • Digital VFO
Full Band Coverage • All-Mode Operation
Backlit liquid crystal display • Auto Squelch
RIT • Preprogrammed 10 KHz. Channels
Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.
The *President* HR2510 Mobile 10 Meter Transceiver made by Uniden, has everything you need for amateur radio communications. Up to 25 Watt PEP USB/LSB and 25 Watt CW mode. Noise Blanker. PA mode. Digital VFO. Built-in S/RF/MOD/SWR meter. Channel switch on the microphone, and much more! The HR2510 lets you operate AM, FM, USB, LSB or CW. The digitally synthesized frequency control gives you maximum stability and you may choose either pre-programmed 10 KHz. channel steps, or use the built-in VFO for steps down to 100 Hz. There's also RIT (Receiver Incremental Tuning) to give you perfectly tuned signals. With receive scanning, you can scan 50 channels in any one of four band segments to find out where the action is. Order your HR2510 from CEI today.

NEW! President® HR2600-T

List price $599.95/**CE price $299.95/SPECIAL**
10 Meter Mobile Transceiver • New Features
Delivery for this new product is scheduled for June, 1989.
The new *President* HR2600 Mobile 10 Meter Transceiver is similar to the *Uniden* HR2510 but now has repeater offsets (100 KHz.) and CTCSS encode.



BC760XLT
800 MHz. mobile scanner SPECIAL!

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★★★ Extended Service Contract ★★★

If you purchase a scanner, CB, radar detector or cordless phone from any store in the U.S. or Canada within the last 30 days, you can get up to three years of extended service contract from Warrantech. This service extension plan begins *after* the manufacturer's warranty expires. Warrantech will perform all necessary labor and will not charge for return shipping. Extended service contracts are not refundable and apply only to the original purchaser. A two year extended contract on a mobile or base scanner is $29.99 and three years is $39.99. For handheld scanners, 2 years is $59.99 and 3 years is $79.99. For radar detectors, two years is $29.99. For CB radios, 2 years is $39.99. For cordless phones, 3 years is $34.99. Order your extended service contract today.

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BC70XLT-T *Bearcat* 20 channel scanner.....$159.95
BC175XLT-T *Bearcat* 16 channel scanner.....$156.95
R2060-T *Regency* 60 channel scanner.....$149.95
TS2-T *Regency* 75 channel scanner.....$269.95
UC102-T *Regency* VHF 2 ch. 1 Watt transceiver...$114.95
BPS5-T *Regency* 16 amp reg. power supply.....$179.95
BP205-T Ni-Cad batt. pack for BC200/BC100XLT ...$49.95
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Team ICOM's Recordbreaking DX'pedition to P4ØV

ICOM AMERICA actively participates in several noteworthy public events each year. Some of those activities are relatively low-key while others are popular topics of widespread discussion. A prime example of the latter was TEAM ICOM's world recordbreaking operation from P4ØV during the 1988 CW Worldwide DX Contest.

Twenty-five well-known and proficient radio amateurs equipped with today's best communications equipment operated from the small Caribbean island of Aruba during this phenomenal DX'pedition. After the contest, they emerged with an incredible tally of 20,000 contacts and 50 million points to establish a new all-time SSB world record. Team ICOM returned to Aruba approximately four weeks later for the CW contest section, and their final score was equally impressive. The combined tally of both SSB and CW contest portions generated more world-record points than any other score ever reported.

Successfully accomplishing a feat of such magnitude was the supreme challenge of operator and equipment. Each member of TEAM ICOM was well qualified in this respect, being previous contest winners, Clipperton DX'peditioners, etc. The Team included the following notables...Mark Allen, WJ7X; Pat Bacon, WA7NIN; Carl Cook, AI6V; Ron Debry, WA6DGX; Jim Duffy, WA6AUE; Wally Eckles, W8LRL; Dick Erhorn, W4ETO; Rusty Epps, W60AT; Danny Eskenazi, K7SS; Dale Green, VE7SJ; Dan Handa, W7WA; John Kiesel, KE7V; Wayne Mills, N7NG; Jim Pratt, N6IG; Dave Rietz, NB6G; Ron Rueter, NV6Z; Tom Schiller, N6BT; Bob Shohet, KQ2M; Bruce Swearingen, N6TU; Bob Wruble, AI7B; Bill Everett, K7RIE; Jim Hadlock, K7WA; Jerry Heron, K7XX; Ed Radlo AJ6V and Jim Sullivan, W7EJ. ICOM sends hearty congratulations and sincere thanks to all the above for a job well done!

The equipment used by TEAM ICOM consisted of ICOM IC-781, IC-761 and IC-751A HF transceivers, Alpha amplifiers and Cushcraft beams. Several ICOM IC-735's were also used for multiplier hunting, second receivers for tuning pileups and backup rigs. The stations were set up in three closely located cottages rented for the occasion. ICOM 2-meter handhelds were used for communications between the cottages, and for keeping track of contest multipliers. All equipment operated perfectly. There were no failures in anything...and every unit was operated "full bore" for the solid 48 hours of both contest segments. That is true reliability!

Like any extensively planned and diligently prepared DX'pedition, P4ØV also encountered its fair share of gremlins. Air freight erroneously delivered the towers and amplifiers to Curacao, a nearby island, and the Cushcraft beams were discovered hiding in Miami three days before the contest time. All equipment was secured on Aruba just in time for assembly and checkout. Team members jumped into action putting together stations and erecting antennas, with barely enough time to be operational at the "opening gun."

Reflecting back on the super DX'pedition reveals a number of points beneficial to many areas. Team leader Carl Cook, AI6V, described the venture as follows: "Band conditions were absolutely superb, all equipment worked flawlessly, and all areas of the world were worked with continuous pile-ups. At the contest close, we were only 3-80 meter countries shy of 5BDXCC...in only 48 hours! There was extremely good cooperation between all team members. It was the most spectacular operating event I have ever experienced." That's quite a compliment from a multi-time contest winner and avid DX'er of long standing!

Team member and ICOM America's Service Manager, Mark Allen, WJ7X, adds these additional points of interest: "We operated at the full legal limit on all bands at adjoining sites. Everything was pushed to the limit. We even placed fans blowing on wall circuit breaker boxes to prevent overloads. I was both surprised and pleased there were only miniscule intra-station interference problems. Our extensive use of external bandpass and band reject filters was logical for such a blowout effort; they enhanced the excellent strong-signal rejection abilities of ICOM transceivers. Fine details become quite critical under multi-station conditions. During pre-contest checkout, for example, we found several poorly installed PL-259 connectors caused significant intermod problems. Overall, it was fantastic. All ICOM equipment performed admirably amidst a wide variety of loading and operating conditions." What else can we say except going with the best always assures maximum success!

Team member Danny Eskenazi, K7SS, said, "Having a chance to work with the best of the best, to go after, and achieve the top prize in amateur contesting was a career high for me! The flawless equipment from ICOM was an added bonus."

After the contest, TEAM ICOM members took to the bands with their "personal Aruba calls." They continued passing out Aruba contacts until hoarse. We sincerely hope everybody's needs were answered. Now the big news: TEAM ICOM is QSL'ing their WHOLE LOG...all 37,000 plus QSO's...100 percent! If you contacted P4ØV/TEAM ICOM, your QSL is forthcoming as we wade through the enormous stack of logs! Viva La DX!

WINNING THE WORLD OVER!

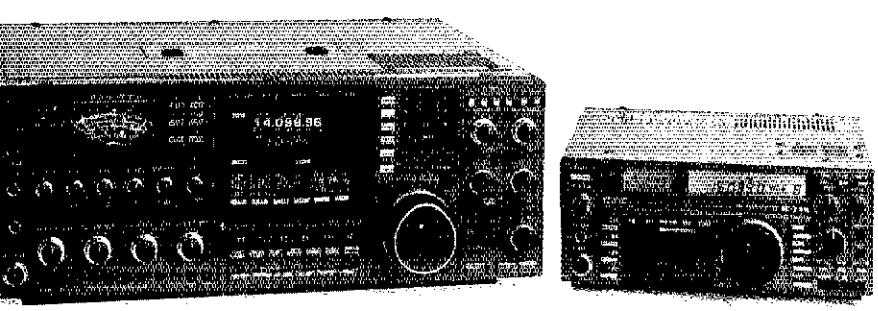
Over 50 million points and 0,000 SSB contacts in 48 ours. That's what TEAM COM's operation from Aruba/ 4ØV achieved during the 1988 Q DX Contest setting a new l-time world record. Their credible CW performance four eeks later was an overwhelming uccess... P4ØV's combined cores resulted in the highest SB/CW contest score ever ecorded!

Unbelievable? Not really. They sed ICOM HF transceivers, the nest quality and most reliable adios available today.

"The ICOM radios performed flawlessly. It was a thrill to operate with such a great group of contestors. My thanks goes to each and every one of them and to ICOM for helping make it possible." Carl Cook, A16V

"The IC-781 is a great radio, especially for split operation on 75 meters. It's easy to use. I liked the IC-761 so much I'm buying one." Dale Green, VE7SV

TEAM ICOM's record-setting operation was supported by the same IC-781 and IC-735 HF transceivers chosen by leading contesters and DX'ers around the world. Their demands for high intermod immunity, low noise reception and superior transmitted signal quality are standard design features incorporated in all ICOM HF transceivers,including the new IC-765 and IC-725. Naturally, all ICOM HF transceivers are confidently backed with a one-year full service warranty! ICOM: Winning the World Over!



1988 CQ WORLDWIDE SSB&CW DX CONTEST

P4ØV

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of being appealed in Federal Court. When your local amateur committees ask for your help in attending hearings and writing letters on the various antenna and tower ordinances being proposed, remember to give them your time and effort to maintain and defend your Amateur Radio interests. The PPRAA Swapfest will be held May 20th in the Rustic Hills Shopping Mall, Colo Springs. Contact: NØCMW. Hope to CU there. NETS: Col QNI 1145, QTC 82-152, QNF 1008, 28 Sess. CWN QNI 54, QTC 49, QNF 267, 25 Sess. CWXN QNI 1878, QTC 1461, QNF 2520, 28 Sess. HNN QNI 1746, QTC 125 620, QNF 1867, 28 Sess. NCTN QNI 117, QTC 48, QNF 187, 24 Sess. SCTN. QNI 207, QTC 38, QNF 292, 27 Sess. Traffic: NØBQP 1429, WAØHJZ 714, KØYFK 520, N1CWP 492, WØLVI 475, NØHFZ 472, WDØAUN 241, KAØWIE 175, WBØFFV 119, WØGVT 64, NØFCR 55, KBØZ 38.

NEW MEXICO: SM, Joe T. Knight, W5PDY—ASM: K5BIS. SEC: K8YEJ. DEC: WD5HCB. STM: ND5T. NMs: WA5UNO, KA5NNG, W5QNR. TC: W8GY. ACC: KA5BEM. Southwest Net meets daily, 3583 @ 0230 UTC, handled 99 msgs with 161 checkins. NM Roadrunner Net meets daily, 3939 @ 0100 UTC, handled 90 msgs with 1227 checkins. NM Breakfast Club meets daily, 3939 @ 6:30 AM, handled 143 msgs with 979 checkins. Yucca 2-mtr Net, 78/18 handled 29 msgs with 385 checkins. Caravan Club 2-mtr Net, 66/06 with 108 checkins. SCAT Net, 66/06 handled 6 msgs with 502 checkins. Info Net 12/72, with 76 checkins. So very sorry to report the passing of K5CEO. Kemey will be deeply missed by all. The BEAN FEED is almost upon us and all are looking for a grand time again this year. A possible no-code class of amateur license is again under discussion. Please share your thoughts with the ARRL committee, AGØX, our Division Director, or to me for forwarding. W4OCZ & W5FZ not doing well. Our thoughts are with them and their families. Traffic: KN5D 98, W5DAD 20, Sunday Noon ZIA CONNECTION Packet Net, 47 checkins.

UTAH: SM/STM, Jim Brown, NA7G—SEC: Rich Fisher, NS7K. Both the OARC and DARC are conducting AR licensing classes. Congrats to Fred Clavell III for passing his Novice exam—he's a 4th grader! DXers: Ten meters has really been hot lately. KA7LPI worked her first DX on ten—way to go! DARC reports they now have 69 mbrs and they are now affiliated with the ARRL. 73 de NA7G. Traffic: N7IUN 60, WA7MEL 56, N7JLC 34, NS7K 25, NA7G 20.

WYOMING: SM, Jim Raisler, N7GVV—ASM: Steve Cochrane, WA7H. SEC: Jim Anderson, W7TVK. STM: Dan Ransom, K7MM. Traffic: NN7H 173. K7SLM 15.

NET	FREQ	MST	QNI	QTC	SES	NM
Cowboy	3923	545 P M-F	707	10	20	KC7AR
Pony Ex.	3923	8:00 A Sun	212	3	4	W7MZW
State ARES	3923	9:00 A Sun	181	-	-	W7TVK
2M-ARES	varies	139	-	-	-	

Several 2-meter nets operate around the State, are u involved? W7TVK, WC7S, WA7D, and myself attended the Region VIII FEMA meeting to talk about amateur role in emergency communications. Frank, KD7AN, and W. Larson represented the State EMA. Of particular interest to us hams was the federal and state agencies. Sincere appreciation for the many hams and their dedication to assisting in emergency communications. 73 till next month. Remember to get involved.

SOUTHEASTERN DIVISION

ALABAMA: SM, James Spann, WO4W—ASM: W4XI. SEC: KB4GDN. STM: N4RT. PIO: KB4KCH. ACC: AA4BL. OOC: KF4VS. SGL: N4FRQ. BM: KA4ZXL. This is the year for the "Alabama Reunion" and amateurs are getting involved in an exciting project this month. The Alabama Reunion train will be rolling through the state— and WA4ZIO will be on board working "railroad mobile." We will be looking for volunteers to man the special events station that will be on HF bands and two meter FM from May 21 through May 27. The Birmingham ARC is one of the sponsors of this station. Alabama amateurs came through again March 5th, as severe thunderstorms and tornadoes ripped through the state, providing excellent information to NWS and helping with emergency communication in the hardest-hit areas. The new DEC for the Montgomery ARES district is N4RRL, who encourages south Alabama amateurs to check into their SKYWARN net each Monday night at 8:15 on 147.18 MHz. The Mobile ARC net meets each Wednesday night at 8 PM on 146.82 MHz. Congrats to Scotty, N4PYD, new President of the Huntsville ARC. The new Auburn Univ. RC President is Dale, N4QGO. In Tuscaloosa, the Univ. of Ala ARC is putting up a two-meter repeater on 145.21 MHz. They are looking for equipment donations. Contact WA4QHI if you can help. See you at the Birminghamfest May 6/7! BPL: WA4JDH. PSHR: WA4JDH, W4PIM, W4ZJY, W4CKS, WA4RNP. Traffic: WA4JDH 1115, W4PIM 220, W4CKS 144, W4ZJY 61, WA4RNP 56, W4DGH 14, WO4W 11, WB4TVY 4.

GEORGIA: SM, Eddy Kosobucki, K4JNL—ASM: KC4MJ. SEC: NC4E. STM: WB4WQL. Packet: W4QO. ACC: KM4IH. BM: WB4ZOJ. OOC: W4TG. PIO: WB4DEB. SGL: WB4UVW. TC: WD4PAH. Our sympathy to the families & friends of K4AVK, W4QQ & W4WY who became Silent keys recently. We'll miss them. As of Mar 1st, I have appointed Neil, KC4MJ as the section's ASM. He will be a lot of help to me & the GA Section. The Dalton Hamfest was a huge success due to the many efforts of the DALTON GANG. Wx was cold but the attendance was great. Our hats off to Jim, WB4LBM, for his efforts given to the Georgia Training Net. Sponsored by Ga SSB Association he brought out many things to old & new hams. TNX Jim. Major HF Nets in the Ga section are as follows: Ga Cracker Net on 3995 dy at 7 AM, Sun at 8 AM. Georgia Net dy on 3987.5 at 1 PM, Ga SSB net on 3975 nightly at 7:30 PM, Ga State Net dy at 7 & 10 PM on 3597, QCWA net has been moved to 3855 at 9 AM on Sat morn so that General-class QCWA members may check in. Nets & traffic are very important to the existence of the hobby, so won't u please chek in to one of the above. On March 5th, many of us were involved in WX nets etc. during the severe storms & tornadoes that came into the state. TNX once agan for a fantastic job. The NWS in Atlanta & throughout the state benefited by ur information. Please send on a postcard or letter ur new club officers right after the club election if u want them listed in this column. Also, if u hear of a Silent key, please try to get the obituary & send it to me or to the ARRL direct. Sometimes some are not sent in & nobody knows abt it. I want to thank the 39 clubs & groups who are sending me their monthly newsletters. It helps me know what goes on in ur area. The latest I received is "RAG CHEWER" from the West GA ARS in Carrollton. Once agn TNX to u FB Ga HAMS for ur cooperation.

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-1986 CQWPX SSB (K7SS, WH6)
-1986 ARRL DX PHONE & CW (K7SS, KH6)

ICOM's IC-735 is the world's most popular HF transceiver. With the highest performance, smallest size, and best customer satisfaction of any HF transceiver, the IC-735 is the winner's choice for fixed, portable, or mobile operations.

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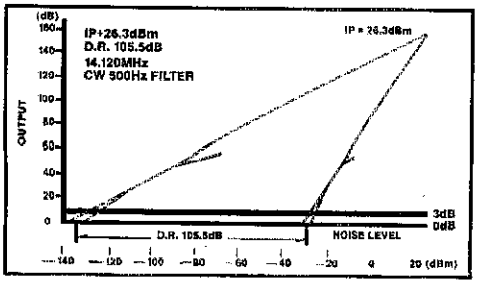

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*Final contest results pending.

PSHR honorees for Feb are: WB4DVZ, WA4YYQ, WB4WQL, KA4HHE, WA4TXT, W4RWB, KJ4NK, KM4LS & WD4COL. 73 Eddy. Traffic: WB4DVZ 226, KA4HHE 155, WB4WQL 133, WA4TXT 58, KJ4NK 40, WA4YYQ 29, W4RWB 23, K4BAI 15, K4JNL 15, W4AET 9, W4BIA.

NORTHERN FLORIDA: SM, Roy Mackey, N4ADI—ASM: Bill, KB4LB. ACC: Dick, WA4BIH. STM: Cotton, KB9LT. PIO: Petey, WA4PUO. SGL: John KC4N. SEC: Rudy, WA4PUP. BM: Dave, N4GMU. TC: Ed, W6RAO. OOC: John, AB6I. Packet Al, K4CY. There are two new calls in our list this column. Dick Carr from Jax has agreed to help with our Affiliated Clubs and SSCs and Cotton has come back to us as our STM to replace AA4HT who is moving into our Southern Florida Section later this year. We're sorry to have Rip leave us, and we welcome Cotton as our STM, again! We offer these two new volunteers our sincere help to keep the section moving ahead in all our area. HAMM RAM officers are Buzz, W4JUL, Pres, Hank, K4RLH VP, Jack WD4AKL Tres, and Lamar, WA4DFA Sec. Gulf Coast has John WA2UNO, Pres; Ed N4AYH, VP; Lorena N4LLQ Sec; and Walt KE8O Tres. NOFARS has Billy N4UF, Pres; Pete W4PTT VP, Bob WD4PFN Sec; and Bob KB4NTI Tres; RANGE has Bob N4JFO, Pres; Ron KA4ZUH, Sec; Harold KB4BDY, VP; and Tres is Bill WD4COW. SSRC has Gene, WB4NJA, Pres; Bryan K3AAF for VP; Carolyn AB4FB, Sec; and Jessee N4LSV for Treas. SUN COAST elected Ralph N4QIK, Pres; Hardy WB8VWS VP; Don WA4T Sec, and Don KA2KDP Treas. Some club newsletters do not have the officers listed on their letter head, so if it seems you've been left out, please send the info along somehow. All these officers are to be thanked for their willingness to serve their clubs, without you we wouldn't have as stong an organization as we do. Thanks to all! 73, Roy. Traffic: WD4IIO 657, WX4H 643, AA4HT 603, WA4QXT 337, WC2G 334, KB9LT 311, N4SS 302, WC4D 254, W4YWF 170, AA4FG 136, W4MGO 97, WA4EYU 93, K4CY 85, N2AOX 79, NF4O 66, W4KIX 57, N4JAQ 56, N4JHI 42, N4GMU 39, N4KNI 35, N4UF 33, AA4WE 31, N4DY 29, WB4TZR 28, N4QYS 27, KB4FIY 26, WA4STZ 23, KF4SP 21, W4AT 18, WA4SXW 16, KJ4HS 15, W4UEA 15, KI4NN 13. KA4KAH 10, K4UTY 8, WB4GHU 7, W8IM 2. (Jan.) W4UEA 35, WA4PUP 31.

SOUTHERN FLORIDA: SM, Richard D. Hill, WA4PFK—SEC: W4SS. STM: K4ZK. TC: KI4T. BM: WD4KBW. PIO: N4PBF. SGL: KC4N. OOC: W4TAH. ACC: K4EUK. Packet Mgr: K4CY. The Tampa ARC's QRM reports that a new Novice class should be starting on or about the Tuesday after the State Fair. Congrats to Neil Cornwell, N4PSV, who was named Ham of the Year by the Fort Meyer ARC. I had nice two-meter QSOs with WA4EIC and KA4FZI as I passed Ft. Myers on the way home from the Sarasota Hamfest. I believe almost every ham in Lee County was on frequency preparing for the Festival of Lights later that evening. The Sarasota Hamfest was a rousing success—very well attended and interesting ARRL Forum and a most successful Traffic Handlers Luncheon which all present agreed should be continued next year. The South Brevard ARC Spark indicates plans for an FCC field trip to be coordinated with the Vero Beach Club. I was able to attend the Stuart Outdoor Freefest for the first time and had a nice talk with K4ZK who was manning an ARRL table. KD4GR said he gave a presentation on traffic handling and packet at the monthly BARDS meeting. How time flies- W1NJM's SAR said his estimated departure date for CT is April 4. Friday night, March 2, N4MML came rushing into QFNS excited about returning from Orlando where she saw her four-day- old granddaughter! Eli Nannis, the new president, thanked their former president, W4STX, for a very fine job—from the Gator Chapter QCWA Newsletter. The Tamiami ARC Communicator states that the annual auction will be held at the March 28th meeting. They are also chartering a bus for the Orlando Hamfest. The Everglades ARC Beam reports the club booth at the Tropical Hamboree was a booming success. The club also had W4WYR as speaker at the meeting this month. She spoke on the ARRL and the benefits available to members. The Englewood ARS newsletter states that their first meeting of the year had over 43 members in attendance. It also reported that their first batch of club shirts went like hotcakes. The Manasota Repeater Association newsletter reports that this year's booth at the Manatee County Fair was a great success and presented a fine image of Amateur Radio to the public. WB5YDD reports that Florida was represented on RN5D 86 percent by K4CY—many thanks to Al, and looks like he needs some help from some of the daytime traffic handlers in the Florida sections. The Tampa ARC thanks all traffic handlers for their assistance with the Florida State Fair traffic. WD4KBW reports 67 bulletins sent and 105 received by W4DL 37, WA4EIC 33, WT4F 15, K4IEK 25, WD4KBW 20, AA4MI 16, WA4NBE 6 and WA9VND 20. WA4PFK is on packet @ KB4FO thanks to the able assistance of Joe, KB4FO. Remember the ARRL Information Net which meets on 3940 kHz each Saturday morning at eight AM. 73 de WA4PFK. Traffic: W4DUG 5738, W3CUL 4485, W3VR 2391, WA9VND 1062, W4NFK 435, K4SCL 409, WA4PFK 382, K4IA 360, N4HAP 324, K4ZK 272, W4HAW 254, AB4EA 220, KA4FZI 220, WA4EIC 206, AA4BN 196, K4EUK 189, WV5Z 186, N4MML 186, N4KFU 168, N4ET 162, WD4KBW 160, W4DL 147, KD4GR 132, N4ORZ 120, WA4RUE 108, KJ9L 107, WA4NBE 105, WX4J 103, WB4WYG 102, W1NJM 91, KA4YHS 89, K4FQU 74, N4HAS 72, KC4GHT 72, KA4NXF 59, KM4LP 59, KB4UIA 55, KA4SIH 42, KF4RL 41, W4DFP 40, KA4AJR 40, KB4MON 38, KJ4WJ 38, W4VQE 37. W4DWN 37, KY4U 35, KB4UHC 35, K4JI 34, KA4AKY 22, AA4CH 21, KC4HDJ 21, W3TLV 20, W1KAM 18, KI4ZW 17, KA8GYF 17, W4UIO 17, KA4GDU 16, K9ALX 15, N4QWN 14, KA8RUL 14, KB4ECH 13, WT4F 13, N2COI 12, N1EGN 12, K4ENA 10, K9EHP 8, N4RHJ 7, WD4AEP 6, W4MPV 5, WA4VWJ 5, WA4PIL 4, W4MFD 3, N4PSV 3, WD4CHO 2, N4OIA 1, W3IJR 1, WA4LLC 1, K3KT 1, W4NSY 1.

VIRGIN ISLANDS: SM, Ron Hall, KP2N—ASM: KV4JC. SEC: NP2B. STM: NP2E. NM: VP2VI. February was a very busy month here in the islands. VIARC officers fro 1989: W8DX-Pres; K5HK-V. Pres.; WP2ABG-Scty/Tres. 23 participated in VE exams on St. Thomas. Largest session ever. 11 upgraded to Tech. 4 passed Novice, 2 to Gen., 1 to Adv. 4 CSCs. WP2AGA & AGL appointed AEC. ARES check in on St. Thomas: Session-4, QTC 37. St. Croix: Sessions-4, QTC 77. ASM reports ARES liaison is set up with FAA, VITEMA, Red Cross & Hospitals. St. Thomas ARES will start training at VITEMA

(continued on page 144)

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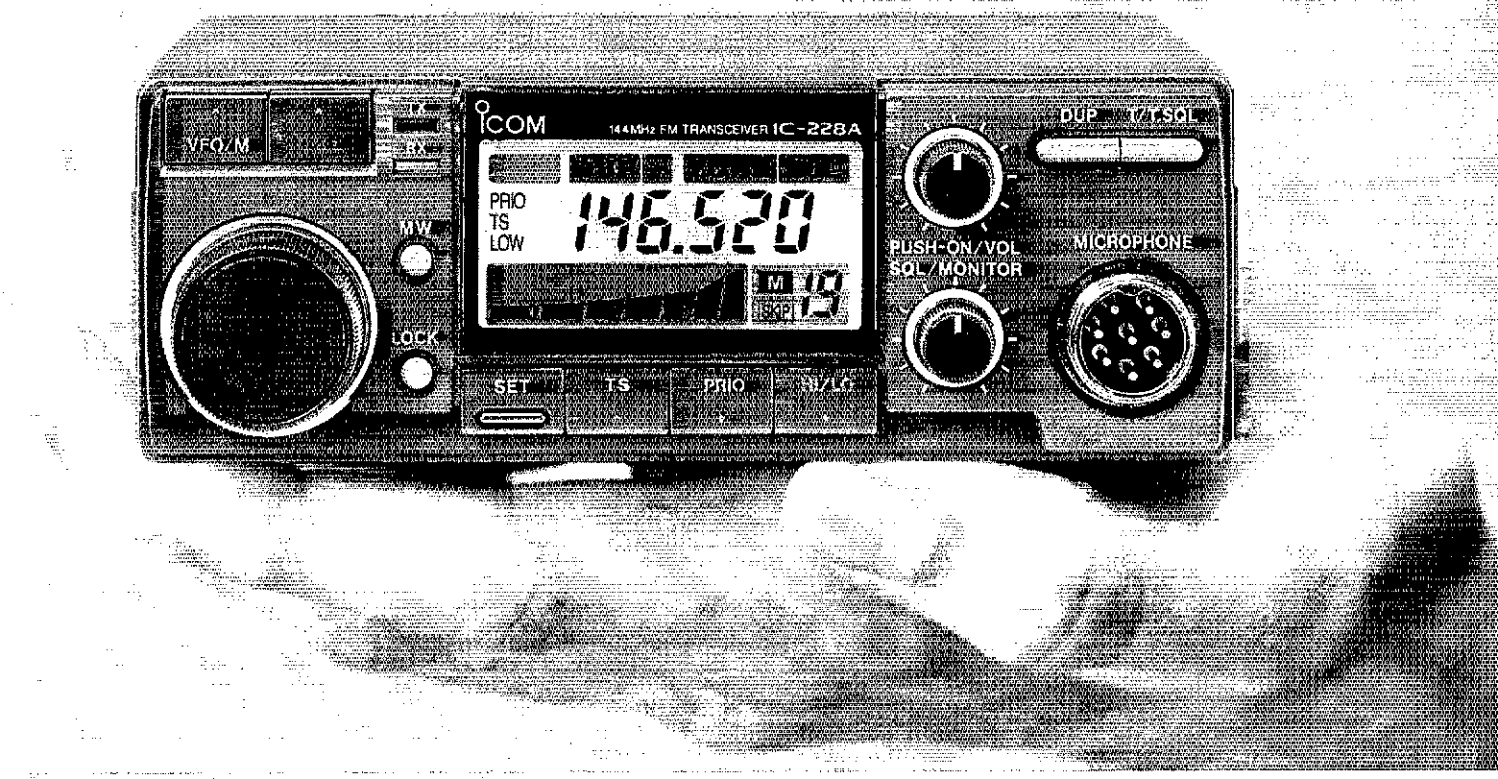

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One tough radio.

HQ under KV4EY, Comm. officer. KP2A and crew went to KP5 for ARRL DX Phone. SEC and STM planning for 2 meter antennas at shelters for hurricane usage. Now is the time for all locals to get equipment ready for up-coming hurricane season. The 147.250 repeater sporting a new phone patch. Traffic: NP2E 6. 73 de KP2N.

SOUTHWESTERN DIVISION

ARIZONA: SM, Jim Swafford, W7FF—STM: W7EP. NMs K7POF, K6LL, KI6ZH. Send all monthly traffic reports to STM, and all other station activity reports to the SM by the fifth of each month. The SEC, KX7P and SM called a State Emergency Services Mtg. in Phoenix which was attended by 18 amateurs interested in ARES and RACES in the Phoenix-Tucson area. A representative of the State Director of ES gave a talk on their interests and activities, followed by talks by K7WUG and W7FF on ARES and RACES organizations. John, NJ7E, gave an interesting talk with slides on his personal experiences during the Mexico City earthquake disaster a few years ago. A very interesting discussion from the group then took place the result of which may lead to some real progress in organizing an effective statewide emergency system in AZ. The AZ Packet Radio Association still holding their Wednesday net on 147.1 (+600) at 7:30 PM local, except on the 3rd Wed. Congrats to Stewart, KA7VUX, Holbrook on his recent EC appointment. Art, NN7A, reports on his successful DX-pedition to Belize, Central America, in Feb. operating as V31JZ there. He worked the ARRL CW test making 530 contacts in six hrs. Also worked some of the NADXA gang including W7YS, NN7F, K6FM, WX7E, N7GLT, NG7S, and KF7NN. He used low power and a 135-ft-long wire strung from his hotel window to nearby palm trees. Bob, W7EP, our STM reports he has received first traffic report from London Bridge ARA, WB7DSW. They handled tfc for the annual Snowbird Jamboree in Lake Havasu City. Good work. Bill, W7YS, has weekly sked with his former H.S. teacher, K2UHM, who got him started in ham radio in 1939. K7VCI Phoenix reports another very successful disaster drill in cooperation with the Am Red Cross on Feb. 18. The scenario was a simulated Boeing 747 airliner crash at Sky Harbor with 110 college students from Phx. College playing the victims. The following provided Red Cross officials and emergency vehicles with Amateur Radio communications: K7VCI, K7WZX, W7WGW, WW7B, W7FEZ, W7KCM, N7IZM and KA7ZNC. Congrats. A sad note: During the drill, Ken, W7KCM, suffered a massive coronary attack and subsequently because a Silent Key. We will miss Ken on the AZ tfc nets, and our condolences go to his family. The Mesa city council passed a restrictive antenna ordinance in Dec. It limits max. height to 30 feet. The Superstition ARC at its Feb mtg voted to commit resources to be used in the effort to convince the city council to reconsider. Bill, KA7SUF and Marge, K1YCZ are leading this effort. Scottsdale ARC has been alerted and may get involved also. More later. ARCA reports VE testing will be given again at Ft. Tuthill hamfest July 29-31. Hope everyone is enjoying working new 17 mtr. band. Let's have some reports. 73, Jim.

Southwest Net	SWN	161	99	28	TWN
Arizona Cactus Net	(HF)	532	51	28	TWN
Arizona Cactus ACN Net	(VHF)	215	44	28	ACN(HF)
Arizona Tfc& Emerg Net	ATEN	946	172	28	TWN

Traffic: W7EP 222, W1FJI 155, W7AMM 152, W7LVB 125, K7VVC 76, WE7G 61, WB7DSW 52, W7OIF 51, K7POF 37, WW7P 34, N7ETP 24, W7KXE 25, K7JKM 19.

LOS ANGELES: SM, Phineas J. Icenbice, Jr. W6BF—Your HAMCON 89 planning is in full swing. Mailings are in your post office now. There is still time to be active in your ARRL SOUTHWESTERN DIVISION HAMCOM 89. Write to me or Joe Cira, KB6AXK, 64 N. Berley Ave, Pasadena, CA 91107, with your sugesstions. With your help, this will be one of the greatest HAM CONVENTIONS to hit Los Angeles this century. Yes, Century Blvd. near LAX at the Hilton Hotel. HAMCON 89 will feature a SPECIAL TRW SWAPMEET in conjunction with HAMCON 89. The HILTON (LAX) HOTEL is located about four miles north of the TRW SWAPMEET. Parking and shuttle bus transportation between the Hotel and the TRW special SWAPMEET will be provided. Thanks to all of the fine support from the LA Council of Amateur Radio Clubs and the host of fine volunteers. Oh, yes Ken Andrew, WA6SMB, has agreed to demonstrate the latest most sophisticated Tektronix SPECTRUM ANALYZER. This analyzer looks at a MHz section of the spectrum and stores it digitally for analysis. Comb filters and dozens of microprocessors allow resolution to a few Hz. With all of the planned options, the price is still under $150K, we understand. On-the-air signals and special measurements will be demonstrated so plan to attend this outstanding demonstration with your pet project and see its spectral signature. Spectral emitter signals from malicious interference can be catalogued and stored to reject or null out the offenders. W6MEW, C. Arthur Bruner, has just joined our group as a BULLETIN MGR. Congratulations to you Arthur. Also joining the local ARRL family is Bill Shanney, KJ6GR. Bill is an engineer and a member of the TRW ARC. Bill lives in Torrance and will be available for easy or complex technical questions. He can be reached at (213) 542-9899. According to the West Coast RTTY DX Association, ZS6PT will be QRV in early April on Marion Island. The OSCILLATOR editor Nate Brightman, K6OSC, (213) 427-5123 may get a few calls from England. My phone rang several times asking about W6RO on the Queen Mary. I hope that they don't take the ship back to England with all the Ham gear aboard. Harry, WA6JTM, you had better beef-up the guard just in case. According to the W6SD Carrier Jaffe's percept is: "There are some things that are impossible to do, but it is impossible to know which they are." However Beach's law is: "No two identical parts are alike." Things are changing faster than you think! Maybe not the way that you would like to see them change, but they are changing. Many hams call every day and a few write. More need to write to their Congressional representatives and the Agencies that need support in writing. Short notes on QSL CARDS are very worth while especially to the FCC and always request an answer. If you don't USE IT YOU MAY LOSE IT! According to my mail and the telephone calls that I have received it appears that TASMA NEEDS HELP! Don Root, WB6UCK, Pres. TASMA, 107 S. Broadway, Rm 19, LA, CA 90012. Office (213) 943-4151. It appears that the 4W documentation and the license for Dr. Hans have been issued according to PA3CXC, his QSL Mgr. STM News: Band conditions have been very poor of late, many skeds had to QSP on 7 MC. The SCN group had a luncheon in Santa Ana and a very good turn out and many old friends showed N7CZF, Bryan, has been one of the most originating message stations the last two months. Handling Palmdale traffic with W6TH via two meters. Traffic: K6UYK 430, AJ6F 240, N7CZF 175, W6INH 133, W6TH 119, WA6SAN 46, W6NKE 22.

ORANGE: SM, Joe H. Brown, W6UBQ—Orange Section Bulletin, serving the counties of Orange, Riverside, San Bernardino, and Inyo. The Orange section is in need of volunteers. If you feel the need to serve and know you are qualified, join the fun and frolic. Let's work together. Contact one of the people listed below. Programs we have been working on are the FCC Auxiliary, packet for tactical application, ARC Affiliation, training, testing, resource management, and of course the ever widening requirements and responsibilities of public service. Through involvement in ARES, RACES, NTS, Clubs, training, recruiting and other organized activities, the many problems facing the Amateur Radio Service can be minimized. We need you! There are eleven Section Level appointees to help you make Amateur Radio a better and more enjoyable service (hobby). You are needed, go for it! ASM, Riv Co: Bob, W6LKN, 5127 Glen Haven Ave, Riverside, CA (714-686-3823) Info amateur activities. ASM SB Co. and SEC: Ken Walston, WA6ZEF, 1248 N Cypress, Ontario, CA. 91762 (714 983-1272). ACC, Sandy Heyne, WA6WZN, 962 Cheyenne, Costa Mesa, CA 92626 (714 549-8516) info club matters. OOC, Nicolas H. Klos, KA6GVY, 15421 Vassar Stret Westminister A 92683. (714 897-9424) info F AUX ASM Orange Co, Ralph Swanson W6JI 506 Hilda ir. Anaheim, CA 92806 (714 776-9272) info projects. ASM, Digital Comm, Michael A. Burton, N6KZB, 3078 Panirama Rd. #B, Riverside, CA 92506, (H 714 682-6212) (W 657-3183). Info Digital applications. TC, John Lind, KD7XG, 2194 Conejo Street, Corona ca. 91720-4001 (714-737-8949) TVI/RFI? call John STM, Fred Farrell, WF6O, 534 North Whittier Street Anaheim CA 92806 (714-778-4896). NTS info. BM, Fred Roberts, W6TKV, 5464 Peacock Lane, Riverside, CA 92505 (714-687-8145) Information Notes. SGL Larry Lammers N6HIQ 14931 Santa Catherine Fountain Valley CA 92708 (714-962-3453) SAC info. The Amateur Radio Service has done a fantastic job supporting public service activities, more importantly, it has proved it's value in emergencies to Public Safety and Public Service Officials. Training and organization is dependent on your support of ARES/RACES net activities. Your are needed! Contact the Section leaders and offer you support. The Amateur Radio Emergency Service (ARES) headed by the SEC is organized through each of the four counties by the DEC as listed. Inyo Co. DEC, Micheal R Franz, KA6HII, 1430 Rocking W Dr. Bishop, Ca 93514 (619-872-2441) Riv Co DEC, Deane Chambers, KG6YS. 5230 Tower Road Riverside, CA 92505. (714-687-8878)
Orange Co. DEC, H.B. Cororran N6HQI. 3113 South Rene Drive. Santa Ana Ca 92704 (714-557-6230). S.B. Co DEC Tony Petrone, WB6QHB. 125 Morgan Way Upland, CA. 91786 (H 714-981-1836) (W 714-981-5631) By working with Amateur Radio Clubs and the Radio Amateur Community, the Orange Section Leadership Hopes to develope a more aggressive, visible and effective Amateur presence in every community.

SAN DIEGO: SM, Arthur R Smith, W6INI PIO; N6PKY. TC: N6JZE. SEC: W6INI. STM: N6GW. 1989 officers for poway ARS: Pres N6QEB, VP WD6ENP, Sec KB7VE, Treas N6OHS. Poway ARS Ham-of-the-Year award went to K7VE, Coord for the club's Explorer Post is KA6PXO. N6PPW is historian for the North Shores ARC and is solicitating info about the club's early days. Call him at 222-3698. The San Diego Packet RA (SANDPAC) meets second Tue, 7 pm, in the cafeteria of MACOM Linkabit 3033 Science Park Rd. Everyone welcome. SANDPAC brunch 1st Sat monthly at Mr G's, cor Clairemont Mesa & Ruffin Rd, at 10 am. SANDPAC voice net each Tue (XCPT 2nd Tue) at 9 pm on palomar ARC rptr, 146.73(-). W6KSI received Ham of the Year award at So Bay ARS annual dinner. QCWA Net meets each Wed on 145.52 MHz at 8 pm. AFFIL CLUBS: don't forget that ARRL renewals will benefit your treasury and, by the way, have you sent your Annual Report for 1989? ARES windbreakers, T-shirt, caps, are available thru KA6RLX, 449-1282. WA1ZEN has joined the traffic handlers. Welcome Tim. NCTN: 27 sessions, 89 msgs, 390 ck-ins. Traffic: KI6ZH 366, WV6K 67, KI6ZM 46, N6GW 40, N6RVO 35, WA1ZEN 11.

SANTA BARBARA: SM, Thomas I. Geiger, W2KVA—ASM/N. Vntra: N6TNG. STM: N6WP. OOC: W8AKF. PIO N6FOU. SEC & DEC/N. Sbar: KI6XG Another round of "No-Code" activism is upon us. While this column avoids editorializing, and tries to stay clear of controversy (this isn't the place for it), we need to be informed and and alert if we're going to make decisions not based on knee-jerk emotional reaction. The issue of a codeless entry level license is of utmost concern to all amateurs, and the reasoning on both sides deserves an open minded hearing. People on both sides in this debate have made claims that have no basis IN EVIDENCE! People on both sides are allowing emotion to rule logic! Please take the time to determine for yourself the validity of the claims being made, and to project the net effect of implementing, or failing to implement, a codeless entry level license. Some of the questions that are unanswered (except by rhetoric), and which MUST be answered by solid investigation and statistical evidence are: IS THE CURRENT CW REQUIREMENT EXCLUDING A SUBSTANTIAL NUMBER OF YOUNG PEOPLE? (Saying so doesn't make it so, where is the evidence? Introduce a program on ham radio in you children's schools, the ASK if exchanging the Morse Code requirement for a somewhat more comprehensive theory requirement would provide any inducement to becoming a ham. Remember NOT to inject your own bias - DON'T LOAD THE QUESTION! Examine your own roots in Amateur Radio, and those things that got you "hooked" in the first place. Then ask yourself if those elements are as exciting in today's world. What DOES stir the imagination today? Why? Are those things relevant to Amateur Radio? Is Amateur Radio relevant to our modern technological world? Consider what the Amateur Radio service IS-why governments allow hams to occupy valuable spectrum-what the goals of the service are and/or should be-how we are, or are not, meeting these goals. Is amateur radio a "hobby"? Is it something more? If it isn't just a hobby, is there a need for entrance requirements that show some degree of commitment? What might serve that purpose besides a knowledge of CW? Finally, consider the potential impact (if any) of a major change in licensing policy. We are dealing with a complex issue, with many, many, ramifications. Let's not deal with it

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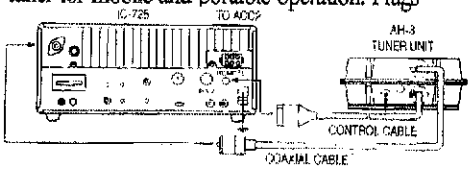

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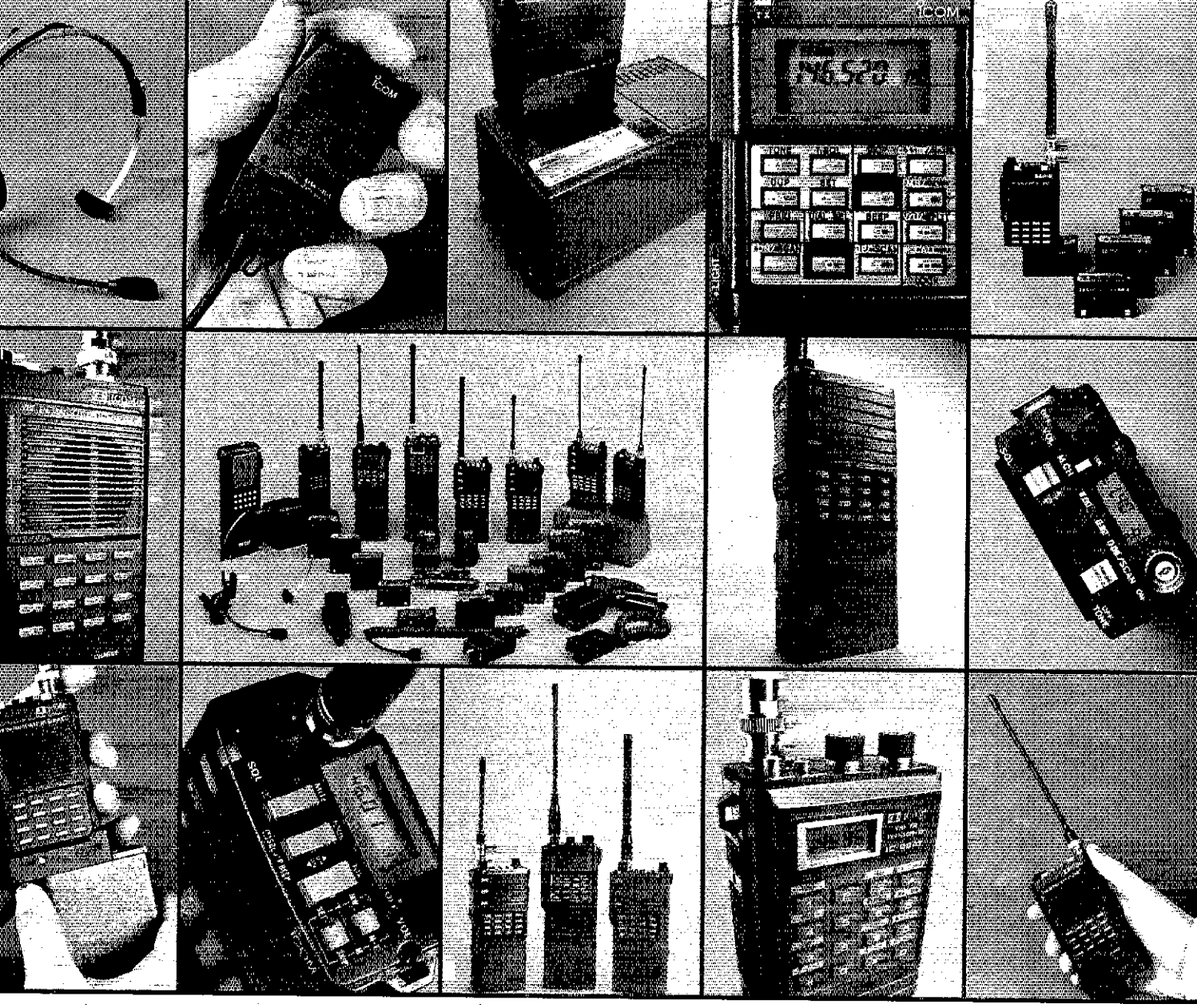
blindly - we'll all lose if we do! When you have reached your decision, pro or con, or if your research can provide additional information (such as relevant local statistics), please share your findings with our No Code Study Committee (W4OYI, K1ZZ, KB8ZV, W2GD, K9PP, N7ML, W5TOO, VE3CDM and W5KL), and with me. A hearty WELL DONE to our own Technical Coordinator John Norback, W6KFV, for his recent article on restoration of 3-500s in (January) QST, to ATC Jim Hendershot for his article "Flagpole J For 10 Meters"; to Doug Fouts, KI6QR for his article "Collinear Phased Antennas for the HF Bands" and to Richard Measures, AG6K, for his article "Calculating Power Dissipation in Parasitic- Suppressor Resistors". The latter three articles all appearing in the March issue of QST. AG6K also had a very interesting article in February "Hints and Kinks" on improving the SB-220 amplifier. (That's a pretty impressive showing for our little Santa Barbara Section!) February testing successes: SMRA VE Session, 11 Feb.- VEs: N6SR, K6JTJ, AA6ES, W6HW, K6VK, W6IJJ, KA6KTU, KB6RZG, AA6BD, W6MUL, W6TKF. Non-VE assistants, KA6YFD and KB6DDT. Next Session - April 8th. To EXTRA-WA6OHX; To ADVANCED-KB6CEF; To GENERAL-WD6EJO; To TECHNICIAN-KB6HKM, KB6ZSF, KC6BHM, KB6AMQ, Cathy Feeney (Santa Paula), Robert Haggard (Camarillo), Brian Hausknecht (Ventura). Estero ARC Session, 18 Feb.- VEs: W6JTA, AA6CT, N6MUJ, W6MSW, W6FL, W6JU. Next Session - May 6th. To GENERAL-KC6BLJ, KB6BHL; To TECHNICIAN-KB6YUO, KB6YUN, KC6BHL, KC6BRX, Thomas Kotten; To NOVICE-Marvin Bassi, Robert Rosenberg. CONGRATULATIONS to all the above on their successes, and thanks to the many Volunteer Examiners who made it all possible. Finally, most of you already know that Fred Milan, W6POE, has moved to Oregon. Bob Tauxe, W6JTA, is also moving to the Oakhusrt area. We wish them both much happiness in their new homes. 73 for now.

WEST GULF DIVISION

OKLAHOMA: SM, Joe Lynch, N6CL—SEC: W5ZTN. STM: N5FEM. ACC: WB5CDW. OOC: K5WG. TC: W5QMJ. SGL: W5NZS. KF5MO is recovering nicely from heart surgery. WB5TYW is recovering nicely from an operation for removal of a non- malignant brain tumor. Oklahoma Repeater Society Inc. had its winter meeting at the Edmond Library. N5MS was charged by them to research the possibility of petitioning the Corporation Commission for relief from the business telephone rates repeater autopatch operators are paying. N5FM has cancelled the monthly Central Oklahoma ARES meeting at the Salvation Army bldg. In place of the meeting is an on-the-air meeting for all ARES members in Central Oklahoma every Thursday at 8 PM local on 146.94. The Choctaw club held another excellent Swapmeet with bargains everywhere. W5MGZ, President of Wheat Straw RC, put on an excellent program on magnetic forces at their last monthly meeting. Also at the meeting WO5B and KG5JB were surprise recipients of Elmer Awards from AA5IY and AA5JQ. Your SM always enjoys visiting with the warm and friendly group at Wheat Straw. See you at the Green Country Hamfest, May 19-21. 73, Joe. Traffic: N5IKN 194, WA5OUV 135, W5RB 81, KF5RD 58, WB5OHK 55, KV5X 48, K5GBN 45, WA5ZOO 25, W5VLW 24, W5VOR 22.

SOUTH TEXAS: SM, Art Ross, W5KR— SEC: K5DG. STM: WD5GKH. BM: WA5WCY. ACC: WB5YDD. OOC: K5SBU. PIO: WA5UZB. TC: NZ5U. SGL: K5KJN. ASM: N5TC plus all of above. Congratulations to Volunteer Counsel and Texas State Legislator K5SNA for earning that 35 wpm certificate; now he is going for 40 wpm! BM WA5WCY helping Cub Scouts make code oscillators; he will be an Elmer to a bunch of them soon. PIA N5FIX, NW ARS, Houston, rprts 39 members in latest Novice class; KB5ESQ is newly-appointed NARS Educational Committee Chairman to promote Ham Radio within the local school system; KB5GEW, one of NARS newer members, elected treasurer - great to have younger ones show their stuff; congratulations to N5LJV on his upgrade to EXTRA. CAND NM K5UPN rprts 544 msgs in 28 February sessions; DRN5 represented 100%; STX stations helping were WB5EPA, WB5FQU, W5KLV, KD5KQ, WB5YDD, KE5ZV, NX5Y. PIA NZ5J, Seguin, rprts first Bastrop swap meet a rousing success; congratulations to N5MTJ on upgrade to Advanced. DRN5 NM WB5YDD rprts 701 msgs in 56 February sessions; STX represented 100% by KD5KQ, W5KLV, W5CTZ, WB5HZQ, WA5ZJY, NZ5U, KE5ZV, WB5EPA, WB5FQU, KA5THB, WB5YDD. Hill Country ARC, Kerrville, announced with pride the arrival of W3XO at "World Above 50 MHz" fame as a permanent resident. OBS W5KLV rprts 4 propagation tests and 2 bulletins given 31 readings on 7 nets in February. Austin Amateur Television Club has a sharp new club bulletin: Camera Amateurs; TX DPS had preview. Traffic: WB5J 307, WB5YDD 263, W5CTZ 228, WD5GKH 167, WB5FQU 111, AC5Z 41, NZ5J 39, W5BGE 31, W5KR 27, W5KLV 11. (Jan.) WA5UZB 5.

WEST TEXAS: SM, A. Milly Wise, W5OVH—The 75th ARRL National Convention Committee asked for and received permission to use the call sign of the Big Spring ARC during the conv. The Prairie Dog Chatter Bulletin of Childress reports that the spring storm season began early as lightning struck the Highway Dept. tower site, the location of the PDARC repeater along with the Childress general hospital base transmitter and the highway dept. transmitter. It blew phone jacks off the wall, burned up wiring and killed the PDARC repeater. The EPARC of El Paso, W5ES, has had the largest radio class in years. Fifty five people started, and in the third week, 35 were still attending classes. The teachers are Jack, KB5QV and Lou, K5CU. Howard Brokate, W5RO, a long-time DXer, QCWA member became a Silent Key in Feb. ASM: Glenn, KA5PTG advises that Amarillo is very proud of the N5LTZ 146.32/92 repeater being on a 200 foot tower and having a coverage along these boundaries, Dalhart, Pampa, Silverton, Tulia and Dimmit. The Cloud Chaser's Net and SKYWARN operations are now on that repeater. N5ERC put a new 443.65/448.65 repeater on the same tower. The San Angelo ARC communication van has been renovated by K5JEZ, KF5EI, K5CMW, WA6CMJ, WU5S, and they have named it "Van-O-White"—Amarailo's Panhandle ARC put up antennas on the new tower at the Red Cross building. 73. Sorry to have missed last month's QST.



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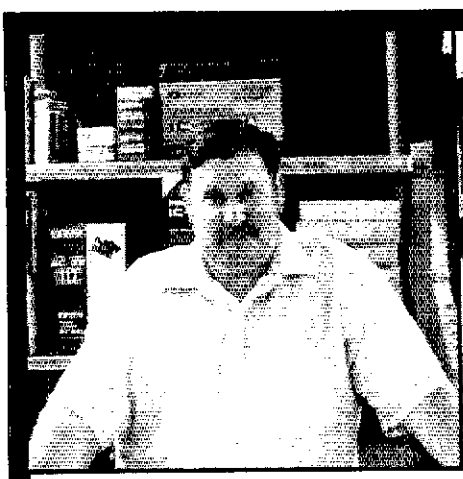

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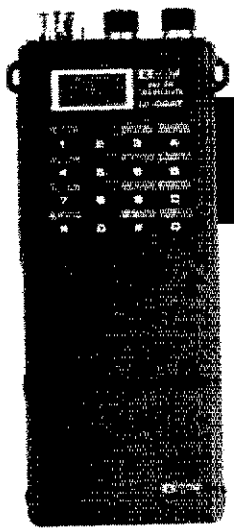

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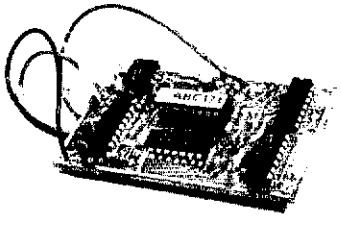

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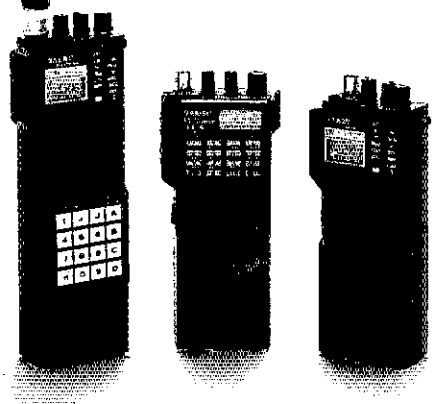
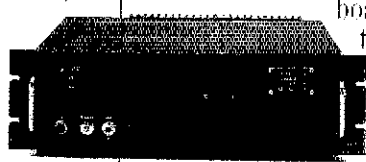


1 Maximum singleband HT performance. Yaesu's compact, 2 meter FT-411 gives "sophisticated HT operation" a whole new meaning. With 49 memories. Dual VFOs. Keyboard frequency entry. Automatic repeater shift. DTMF autodialer (10 memories, 15 digits each). Built-in PL encode/decode. Extended receive. "Do-re-mi" audible command verification. Backlit display and keypad. Battery saver. Automatic power-off feature. Rotary channel selector. 2.5-watt battery pack (optional 5-watt pack available). Much more.

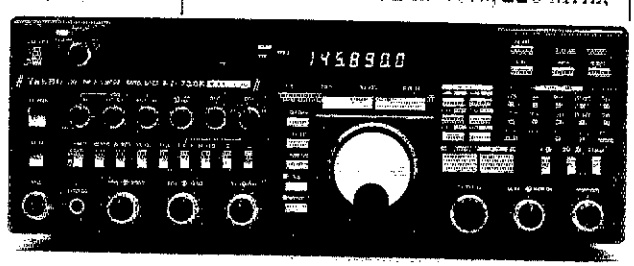
2 Mini HT packs big performance. Choose Yaesu's miniature FT-23R Series for serious pocket-size performance. 2 meter, 220-MHz, and 440-MHz models. Includes 10 memories (7 store odd splits). Memory scan at 2 frequencies per second. High/low power switch. LCD power output and "S"-meter display. Lots of PL features. Auto battery saver. Aluminum-alloy case. Water-resistant seals. Variety of battery packs available, from 2 to 5 watts. More.

3 Interchangeable HT options. To help save you a bundle of money, many HT options are interchangeable throughout Yaesu's HT line. Choose the FNB-12 12 volt, 500-mAh battery pack. The miniature FNB-9 7.2-volt, 200-mAh battery pack. FBA-9 battery case for 6 AAA-size cells. FBA-10 battery case for 6 AA-size cells. DC car adapter/charger. Mobile hanger bracket. External speaker/microphone. Battery chargers. More.

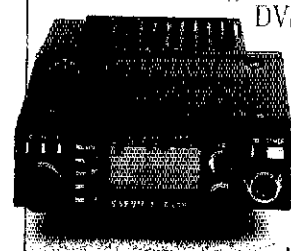
4 FM Repeaters. Looking for a repeater? Look no further. Our 2-meter and 440-MHz models feature 10 watts output. Glass-epoxy circuit boards. Plus they're FCC type accepted and ready for 19" rack mounting. Yaesu repeaters are the perfect building block for a complete repeater station.



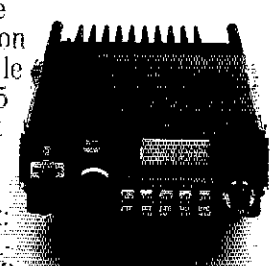
5 Space Station. Work satellites, moonbounce, troposphere, aurora, and meteor scatter with our FT-736R VHF/UHF base station. SSB, CW, and FM on 2 meters and 70 cm (430-450 MHz!) standard. Slots for optional 50-MHz, 220-MHz, or 1.2 GHz modules. Crossband full duplex capability. Satellite frequency tracking function. 25 watts on 2 meters, 220 MHz, and 70 cm (10 watts on 6 meters and 1.2 GHz). 100 memories. RF speech processor. IF shift. IF notch filter. CW and FM wide/narrow IF filters. VOX. Noise blanker. Three-position AGC selection. Much more.



6 Mobiles that double as answering machines. Our FT-212R Series mobiles take messages just like an answering machine (with DVS-1 option)! 2 meter and 440-MHz models. 45 watts output (35 on 440-MHz). Autodialer DTMF mic with 10 memories (22-digit memory each). 18 memories. Multiple scanning routines. "Do-re-mi" audible command verification. High/low power switch. Oversize amber display. Much more.



7 Mobiles you can take on foot. Our FT-290R Mark II Series (2-meter, 430-450 MHz, and 6-meter models) come standard as mobiles. But remove the heat sink and snap-on the optional battery pack, and you're ready to take your operation on foot! Mobile operation: 25 watts output (10 watts, 6 meters). Battery pack: 2.5 watts output. With SSB, CW and FM. 10 memories. Dual VFOs. LCD display. Offset tuning. Relative power-output/S meter. More.



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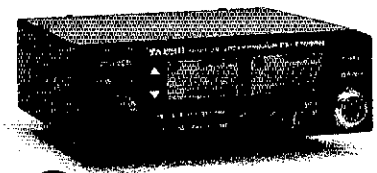
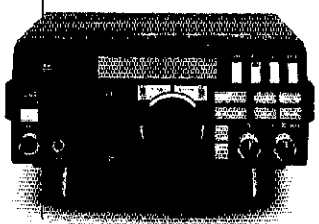
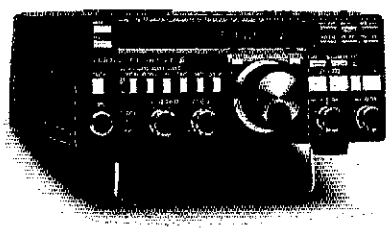


8 **Dual-band mobile with remote control head.** The FT-4700RH mounts almost anywhere—the "brains" on your dash, visor, or door, the "muscle" under your seat. 50 watts output on 2 meters, 40 watts on 70 cm. Full crossband duplex. Simultaneous monitoring of each band. Volume balance control for dual receive operation. 9 memories (each band). Extended receive coverage. Reverse repeater shift. Bright dual-band display. 10 memory autodialer mic (option). More.



9 **HF price/performer.** Don't let the FT-747GX's affordable price fool you. This rig really works the DX! 100 watts RF output on 160 to 10 meters. Continuous receive from 100 kHz to 30 MHz. LSB, USB, CW, and AM. Slot for optional FM unit. 20 memories. Split-frequency operation. CW and AM filters. Plus one-touch noise blanker. All-mode squelch. RIT. 20-dB attenuator. Great receiver with superb overload protection. More.

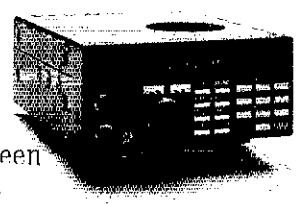
10 **HF field-day favorite.** Contesters appreciate the portability and performance of Yaesu's FT-757GX Mark II. 100-watt output. 10 memories. Dual VFOs. Slow/fast tuning selection. IF notch filter. Iambic keyer. 600-Hz CW filter. AF speech processor. 500 kHz to 30 MHz receive. 10 to 160 meters transmit, including WARC bands. All-mode coverage. QSK operation. Continuous RTTY operation up to 30 minutes. More.



11 **Flex your RF muscle.** Cut through pile-ups with our FL-7000 power amplifier. 160 to 15 meter coverage. Built-in power supply. Automatic tuner. Fast turnaround for break-in (QSK) CW, HF packet, and AMTOR. 70 watts excitation for full output, 1200 watts PEP input. More.

12 **World's first HF/VHF/UHF base station.** Talk about complete. The FT-767GX gives you 160 to 10-meter transmit standard. Optional plug-in modules for 6-meter, 2-meter and 70-cm operation. 100 kHz to 30 MHz receive. AM, FM, SSB, CW, AFSK modes built in. 10 memories for frequency, mode, and CTCSS info. Dual VFOs. VFO tracking. Digital display in 10 Hz steps. Slow/fast main dial tuning. Synthesizer step programming at up to 99.99 kHz per step. Digital RF power/SWR meter. Built-in RF preamplifier. And these are just a few highlights!

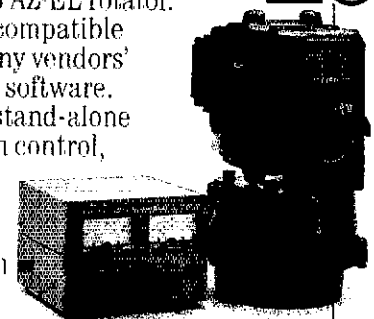
13 **Serious VHF/UHF Receiver.** Our FRG-9600 is a smart way to monitor. 60 to 905 MHz coverage. USB, LSB, CW, AM, FM wide and narrow. Optional NTSC video module. Scanning steps of 5, 10, 12½, 25 and 100 KHz. 99 memories store frequency and mode. Memory scan (also scans between memories). Keyboard frequency entry. 24 hour clock. Multiplexed output. Fluorescent readout. Signal strength graph. AC power adapter. Much, much more.



14 **World-class HF receiver.** The FRG-8800's perfect for keeping up with the world. Continuous coverage from 150 KHz to 30 MHz. Expanded coverage with optional 118-174 MHz VHF converter. USB, LSB, CW wide/narrow, AM wide/narrow, FM. 12 memories. Also programmable scanning routines. Keyboard frequency entry. LCD display. SINPO signal graph. Computer interface capability. Two 24-hour clocks. Recording functions. Much more.

15 **Antenna rotators for your application.** Our G-1000DX, G-800SDX/G-800S, and G-400RC models feature 360° "radio compass" control heads, and are compatible with most tower-plate configurations. Plus G-1000SDX and G-800SDX models feature 450° rotation and presets.

16 **AZ-EL rotators for space applications.** Into OSCAR or moonbounce? Choose our G-5400B or heavy-duty G-5600B AZ-EL rotator. Each is compatible with many vendors' tracking software. And for stand-alone elevation control, choose our G-500A elevation rotator.



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Auto-dialer	**90 phone numbers**	None	None
Last number redial	**Yes**	No	No
Hook flash	**Yes**	No	No
Programming keyboard	**Built-in**	Plug-in	None
Programming digital display	**Yes**	No	No
Noise filter	**5 pole**	2 pole	2 pole
Regenerated DTMF dialing	**Yes**	No	No
DTMF decode LED	**Yes**	No	No
Selectable VOX simplex, sampling simplex, duplex and repeater controller operating modes	**Yes**	No	No
Number of keyboard selectable sampling mode VOX enhancement ratios	**8**	2	None
Operates through repeaters	**Yes**	No	No
Method of connection to base radio	**Internal or External**	Internal Only	Internal Only
CPU program memory	**8k**	2k	2k
Busy signal disconnect	**Yes**	No	No
Dialtone disconnect	**Yes**	No	No
Selectable three digit repeater mode on/off code	**Yes**	No	No
Remotely controllable internal aux relay	**Yes**	No	No
Optional CTCSS board available	**Yes**	No	No
Optional voice delay board available	**Yes**	No	No
Warranty	**1 Year**	6 Mo.	6 Mo.

When you compare Private Patch V to the competition, the choice is clear!

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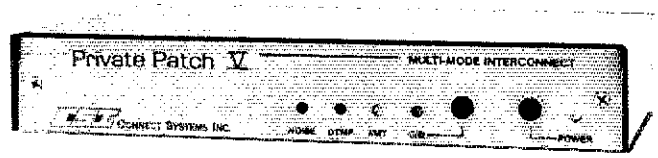
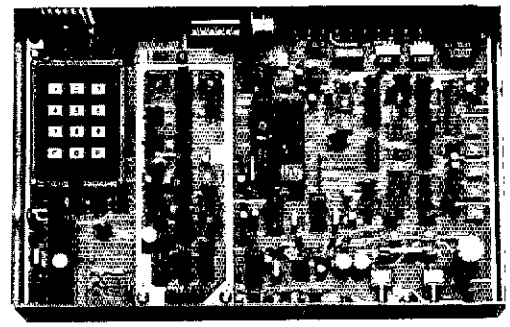
- **DIAL ANY PRE-SELECTED NUMBER BY PRESSING THE MIC BUTTON FIVE TIMES.**
- **COMPLETE PATCH STATUS BEEPS**
- **FRONT PANEL STATUS LEDS**
- **HALF DUPLEX PRIVACY MODE** (with beeps)
- **SELECTABLE CONNECT CODE 1-5 DIGITS**
- **SELECTABLE TOLL OVERRIDE CODE 2-5 DIGITS**
- **SELECTABLE DISCONNECT CODE 1-5 DIGITS**
- **SELECTABLE TOLL RESTRICTION:**
  - First digit lockout
  - Prefix lockout
  - Digit counting
- **SELECTABLE ACTIVITY/TIMEOUT TIMERS**
- **RINGOUT**
  (Receive your calls in the mobile)
- **RING COUNTING**
  (Ringout alerts after pre-selected no. of rings)
- **REMOTE BASE**
  (Use your base radio from any telephone)
- **LAND TO MOBILE SELECTIVE CALLING**
- **INTERNALLY SQUELCHED AUDIO**
- **MOV LIGHTING PROTECTORS**
- **SELECTABLE TONE OR PULSE DIALING**





Note built-in programming keyboard and digital display just above keyboard.

CONNECT SYSTEMS INC.

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Phone (805) 642-7184 • FAX (805) 642-7271

KENWOOD

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All-mode tri-bander!

Warp Drive!

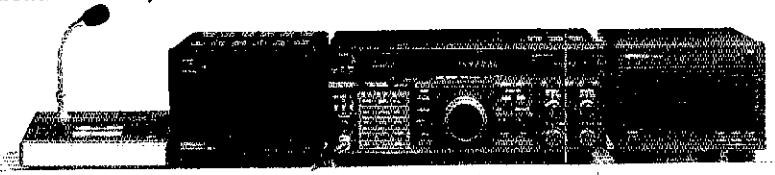
TS-790A
Satellite Transceiver

The new Kenwood TS-790A VHF/UHF all-mode tri-band transceiver is designed for the VHF/UHF and satellite "power user." The new TS-790A is an all-mode 144/450/1200 MHz transceiver with many special enhancements such as Doppler shift compensation. Other features include dual receive, automatic mode selection, automatic repeater offset selection for FM repeater use, VFO or quick step channel tuning, direct keyboard frequency entry, 59 memory channels (10 channels for separate receive and transmit frequency storage), multiple scanning and multiple scan stop modes. The Automatic Lock Tuning (ALT) on 1200 MHz eliminates frequency drift. Power output is 45 watts on 144 MHz, 40 watts on 450 MHz, and 10 watts on 1200 MHz. (The 1200 MHz section is an optional module.)

- **High stability VFO.** The dual digital VFOs feature rock-stable TCXO (temperature compensated crystal oscillator) circuitry, with frequency stability of ±3 ppm.
- **Operates on 13.8 VDC.** Perfect for mountain-top DXpeditions!
- **The mode switches confirm USB, LSB, CW, or FM selection with Morse Code.**
- **Dual Watch allows reception of two bands at the same time.**
- **Automatic mode and automatic repeater offset selection.**
- **Direct keyboard frequency entry.**
- **59 multi-function memory channels.** Store frequency, mode, tone information, offset, and quick step function. Ten memory channels for "odd split."
- **CTCSS encoder built-in.** Optional TSU-5 enables sub-tone decode.
- **Memory scroll function.** This feature allows you to check memory contents without changing the VFO frequency.
- **Multiple scanning functions.** Memory channel lock-out is also provided.
- **ALT—Automatic Lock Tuning—on 1200 MHz eliminates drift!**
- **500 Hz CW filter built-in.**
- **Packet radio terminal.**
- **Interference reduction controls:** 10 dB RF attenuator on 2m, noise blanker, IF shift, selectable AGC, all mode squelch.
- **Other useful controls:** RF power output control, speech processor, dual muting, frequency lock switch, RIT.
- **Voice synthesizer option.**
- **Computer control option.**

Optional Accessories:

• **PS-31** Power supply • **SP-31** External speaker • **UT-10** 1200 MHz module • **VS-2** Voice synthesizer unit • **TSU-5** Programmable CTCSS decoder • **IF-232C** Computer interface • **MC-60A/MC-80/MC-85** Desk mics • **HS-5/HS-6** Headphones • **MC-43S** Hand mic • **PG-2S** Extra DC cable



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P.O. Box 22745, Long Beach, CA 90801-5745

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation.

KWM / HF-380 *COLLINS* TRANSCEIVER PARTS

INVENTORY REDUCTION SALE

Military quality antennas and accessories for HF frequencies

AC-2810 **2 to 30 MHz 16' base station vertical.** Three section vertical includes base insulator, guy ring and nonconductive rope. Price $145

AC-2811 **1.6 to 30 MHz 35' base station vertical.** This seven section vertical includes base insulator, two guy rings and nonconductive rope. The AC-2810 and AC-2811 can be used with a matching network. Price $225.

AC-2812 **1.6 to 30 MHz dipole kit** includes 300' 14 AWG stranded copperweld, a center feed insulator and two ceramic end insulators. Dipole must be cut for operating frequency. Price $45

AC-2813 **3.2 to 30 MHz dipole kit** includes 150' 14 AWG stranded copperweld, a center feed insulator and two ceramic end insulators. Dipole must be cut for operating frequency. Price $32

AC-2818 **Lightning arrestor.** This highly efficient *COLLINS* (minimum insertion loss up to 300 MHz) arrestor has SO-239 connectors, a 2" square mounting plate and a 1.25" x 2.875" body. The AC-2818 discharges to ground high voltage current surges on the inner conductor of attached coax cables. Such surges can be produced by direct or nearby lightning strikes. Price $89.

AC-2819 **Grounding kit.** Includes three 6' copper clad ground rods (to be installed 10' apart in a triangle), clamps, 40' wire and hardware. This kit can be used with antennas or lightning arrestor listed above. Price $45.

AC-2828 **Foot switch.** This 20 amp.rated, heavy duty foot switch can provide hands free keying of the transmitter. Price $39.

AC-2830 **Headphones.** This lightweight comfort-designed headset with 500Ω impedance works well with the KWM-380. Price $49.

MM-280 **Mobile microphone.** A handheld dynamic omni-directional microphone Low impedance, PTT and black in color. Price $35.

SM-281 **Desktop microphone.** Dynamic omni-directional microphone with low impedance, noise canceling characteristic and cardioid sound pattern. PTT and black in color. Price $69.

AC-3802 **Speech processor** for the KWM-380. Price $299.

AC-3810 **360 Hz CW filter** for KWM-380. Price $199.
AC-3811 **140 Hz CW filter** for KWM-380. Price $249.
AC-3812 **1.7 KHz SSB or RTTY filter** for KWM-380. Price $199.
293-1337-010 **2.1 KHz SSB filter** for KWM-380. Price $166.
AC-3813 **6.0 KHz AM filter** for KWM-380. Great replacement for wider 8 KHz filter used in many rigs. Price $129.

AC-3809 **Adapter control interface.** Plugs into 25 pin D on rear (control interface) and provides standardized 25 pin output for coupler control, plus 15 pin output for key-pad connection. Price $65.

638-6910-001 **Control interface** provides 25 pin D connector on KWM-380. Complete and ready to install. Price $75.

AC-3802 **ROM Modification Kit** is used to provide transmitter coverage of MARS and new Amateur bands for the KWM-380. Price $18.

351-8870-060 **ROM used in HF-380** which provides full transmit coverage. A3 filter board must be installed to use this ROM. Price $49.

638-6904-001 **A3 Low-Pass Filter** board allows proper filtering when transmitting outside Amateur bands. Necessary addition to a KWM-380 when changing ROM. Complete and calibrated price $299

638-6918-001 **Oscillator / Oven** used in HF-380 for ultra stable operation. Can be added to the KWM-380. Complete and calibrated price $275.

638-6929-00 **Control Board.** Complete (less U2 & U17). Price $125.

638-6775-001 **PA Board,** 80% complete HF amplifier. Price $45
Final Transistors, Matched pair. Price $110
Driver Transistors, Matched pair. Price $21.95

AC-2821 **DC power cable** for 12 volt operation. Price $45.

365-0068-010 **Power plug,** plug for AC or DC use. Price $12.95

266-5424-010 **AC power switch,** 20 amp toggle. Price $12.95

281-0659-xxx **Spare Knob Set** includes all 13 knobs on the KWM-380. Limited supply. Complete set for $95.

662-0650-020 **Power transformer,** two 18 volt @ 15 amp windings. Multi-tap primary (105,115,125,210,220,230,240,250 vac). Price $95.
183-1511-010 **Power supply capacitor,** 72,000µF @ 25vdc. Price $18
183-1511-020 **Power supply capacitor,** 12,000µF @ 25vdc. Price $ 9

450-0158-020 **KWM-380 Panel meter.** Price $75.
229-9702-010 **Frequency encoder** for main tuning control. Price $75

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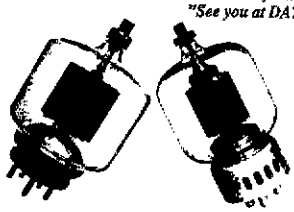
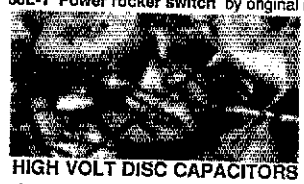


ORDERING INFORMATION: Enclose $2.50 for UPS on first three lbs. and 30¢ per pound after upto 70 lbs. Add $3 for CODs. Foreign orders sent via Airmail and payment can be made by charge card to allow shipping chgs. VISA, MASTERCARD, AMERICAN EXPRESS, MONEY ORDERS, CHECKS and COD are acceptable forms of payment. Excess funds will be credited to your account. Free supplement 5A with any order. Catalog 6 available soon.

3-500Z (EIMAC) $135 each (Import) $120 each
811A. Finally an 811A that operates horizontally. $24 ea. 4/$8
6146B for use in Collins, Kenwood, etc.$15 ea. $38/ matched pr

COLLINS VINTAGE S-LINE and KWM2-A REPLACEMENT PARTS

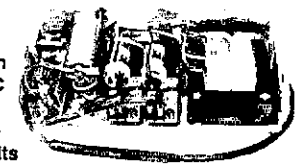
PANEL METERS All new. We stock meters for all Collins equipment. Your choice, any meter $85
PAINT, Fresh in 12 oz cans. #126 trimring, #180 cabinet, #250 front panel, $270 St. James Gray. $12
Crystals. All regular frequencies in stock!! $8 each, 5 or more $7 each BFO's(453.650,456.350,456.8 KHz only $15
Plug-in Relays for KWM2. 970-2439-010 (X96) or 970-2439-020 (X97) $49.95 each. Replace your old.....
Open frame relays with our modification kit which includes both relays, mount bracket & sockets only $125
500 Hz CW Filter brand new plug in type! 526-9494-00 filter for S-Line receiver. Factory fresh! $259
Oak AC on/off switch 10070-4 used for repairs on KWM2 and S-Line gear. Stock up for future use! $15
Trim Ring for small power supply and monitor cabinets (609-1254-001). Dress it up! Limited quantity $29
30L-1 Power rocker switch by original manufacturer. Brand new item to our inventory. $19



HIGH VOLT DISC CAPACITORS

.001µF	1 KV	$0.15 ea	50/ $5
.001µF	6 KV	$1.10 ea	11/ $10
.001µF	10 KV	$1.50 ea	8/ $10
.0014µF	10 KV	$1.20 ea	10/ $10
.0015µF	1.4 KV	$0.50 ea	12/ $5
.0015µF	4 KV	$1.10 ea	11/ $10
.002µF	1 KV	$0.25 ea	24/ $5
.0025µF	6 KV	$1.50 ea	8/ $10
.0033µF	2 KV	$0.50 ea	12/ $5
.008µF	4 KV	$1.20 ea	10/ $10
.01µF	500 V	$0.25 ea	24/ $5
.01µF	1 KV	$0.50 ea	12/ $5
.01µF	3 KV	$1.00 ea	12/ $10
.01µF	10 KV	$2.00 ea	6/ $10

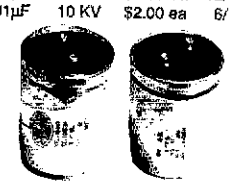
DELTRON LINEAR POWER SUPPLY



- √ Triple Output
- √ Rugged Design
- √ Two 12-15 VDC 2.5 amp & One 5VDC @ 8 amp seperate circuits

Easily converted to variable 7-30 VDC supplies! Uses popular 723 type regulator for each seperate supply that includes a current limiting circuit. Multi-tap primary allows several voltage configurations between 100-250 VAC! Compact unit measures 2.5" x 5" x 11". New in the box.
Part# 10656X $49.95 each • 3 or more $45

ATTENTION BROADCASTERS: We have a fresh supply of oil , ceramic doorknob & vacuum capacitors on hand . Give us a try for your hard-to-find parts!



Sangamo CE71C472H M39018/04-1184

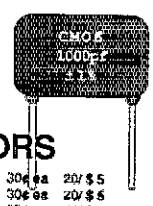
ELECTROLYTIC CAPACITORS

100µF	450 vdc	Sprague 1718	1"x3.1"	axial	$7.25 ea	6/ $40
200µF	250 vdc	Sprague 39D	1"x2.5"	axial	$1.95 ea	6/ $9
120µF	300 vdc	Sprague 36D	1.2"x2.2"	radial	$1.95 ea	6/ $9
3,000µF	75 vdc	Sprague 673D	1"x3.5"	radial	$2.95 ea	4/ $9
4,700µF	100 vdc	Sangamo CE	3"x4.5"	radial	$5.95 ea	4/ $20
6,600µF	75 vdc	Sprague 80D	3"x4.5"	radial	$5.95 ea	4/ $20
9,500µF	75 vdc	M39018/04	3"x4.5"	radial	$6.95 ea	4/ $22
10,000µF	25 vdc	Sprague 80D	1"x2"	radial	$1.95 ea	6/ $9
12,000µF	25 vdc	Sprague	1.25"x 4"	radial	$9.00 ea	3/ $24
72,000µF	25 vdc	Sprague	3" x 4.2"	radial	$18 ea	3/ $45

AC motor start CAPACITORS

16 - 22µF	250 vac	GE 35F280	1.5"x2.7"	$5 ea	4/ $17
72 - 88µF	250 vac	Mepco 3535	1.5"x3.5"	$10 ea	3/ $26
270 - 324µF	125 vac	Mepco	1.5"x3.5"	$15 ea	3/ $40

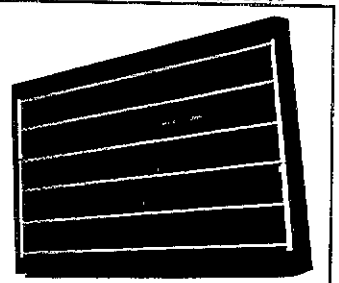
DIPPED SILVER MICA CAPACITORS



10 pF	300 vdc	10%	30¢ ea	20/ $ 5
12 pF	100 vdc	20%	30¢ ea	20/ $ 5
22 pF	100 vdc	10%	25¢ ea	20/ $ 4
24 pF	500 vdc	5%	45¢ ea	20/ $ 7
27 pF	100 vdc	20%	30¢ ea	20/ $ 5
41 pF	300 vdc	5%	40¢ ea	20/ $ 6
58 pF	300 vdc	5%	40¢ ea	20/ $ 6
72 pF	300 vdc	10%	30¢ ea	20/ $ 5
174 pF	300 vdc	5%	40¢ ea	20/ $ 6
185 pF	300 vdc	5%	40¢ ea	20/ $ 6
200 pF	100 vdc	5%	50¢ ea	20/ $ 8
210 pF	300 vdc	1%	60¢ ea	20/ $10
295 pF	300 vdc	2%	50¢ ea	20/ $ 8
300 pF	100 vdc	5%	50¢ ea	20/ $ 8
330 pF	1000 vdc	5%	95¢ ea	12/ $10
370 pF	100 vdc	5%	50¢ ea	20/ $ 8
411 pF	100 vdc	5%	50¢ ea	20/ $ 8
1200 pF	100 vdc	5%	50¢ ea	20/ $ 8

ARCO SOLAR PANELS

M25



ARCO Model	Output Watts	Output Current	Voltage (Loaded)	Dimension Overall	Limited Warranty	Self Regulating	Cost Each
M65	42	2.9 amps	14.5 vdc	1.4" x 13" x 42.5"	10 years	yes	$425
M22	22	1.5 amps	14.6 vdc	1.4" x 13" x 22.4	10 years	yes	$245
G100	5.0	.35 amps	14.5 vdc	.5" x 13.1" x 13.7"	3 years	no	$ 89
G50	2.5	.17 amps	14.5 vdc	.41 x 13.1" x 13.7"	3 years	no	$ 59
G25	1.0	.075 amps	14.5 vdc	.38 x 7.1" x 7.8	3 years	no	$ 47

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DX-cellence!

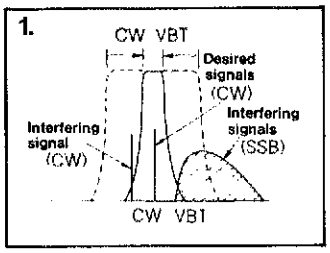
#1 Rated HF!

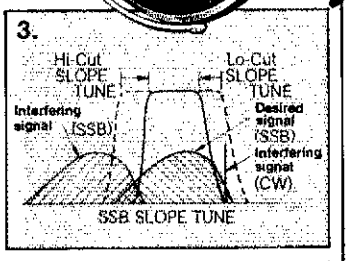
TS-940S

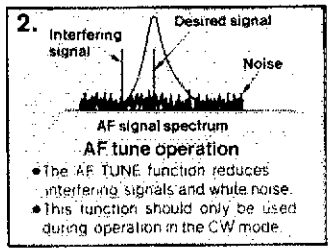
Competition class HF transceiver

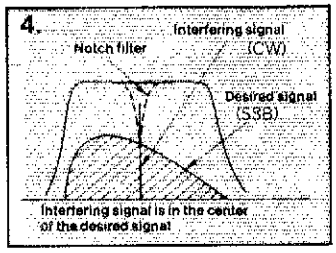
TS-940S—the standard of performance by which all other transceivers are judged. Pushing the state-of-the-art in HF transceiver design and construction, no one has been able to match the TS-940S in performance, value and reliability. The product reviews glow with superlatives, and the field-proven performance shows that the TS-940S is "The Number One Rated HF Transceiver!"

- **100% duty cycle transmitter.** Kenwood specifies transmit duty cycle ***time.*** The TS-940S is guaranteed to operate at full power output for periods ***exceeding one hour.*** (14.250 MHz, CW, 110 watts.) Perfect for RTTY, SSTV, and other long-duration modes.
- **First with a full one-year limited warranty.**
- **Extremely stable phase locked loop (PLL) VFO.** Reference frequency accuracy is measured in ***parts per million!***









1) CW Variable Bandwidth Tuning. Vary the passband width continuously in the CW, FSK, and AM modes, without affecting the center frequency. This effectively minimizes QRM from nearby SSB and CW signals.

2) AF Tune. Enabled with the push of a button, this CW interference fighter inserts a tunable, three pole active filter between the SSB/CW demodulator and the audio amplifier. During CW QSOs, this control can be used to reduce interfering signals and noise, and peaks audio frequency response for optimum CW performance.

3) SSB Slope Tuning. Operating in the LSB and USB modes, this front panel control allows independent, continuously variable adjustment of the high or low frequency slopes of the IF passband. The LCD sub display illustrates the filtering position.

4) IF Notch Filter. The tunable notch filter sharply attenuates interfering signals by as much as 40 dB. As shown here, the interfering signal is reduced, while the desired signal remains unaffected. The notch filter works in all modes except FM.

- **Complete all band, all mode transceiver with general coverage receiver.** Receiver covers 150 kHz-30 MHz. All modes built-in: AM, FM, CW, FSK, LSB, USB.
- **Superb, human engineered front panel layout for the DX-minded or contesting ham.** Large fluorescent tube main display with dimmer; direct keyboard input of frequency; flywheel type main tuning knob with optical encoder mechanism all combine to make the TS-940S a joy to operate.
- **One-touch frequency check (T-F SET) during split operations.**
- **Unique LCD sub display indicates VFO, graphic indication of VBT and SSB Slope tuning, and time.**
- **Simple one step mode changing with CW announcement.**
- **Other vital operating functions.** Selectable semi or full break-in CW (QSK), RIT/XIT, all mode squelch, RF attenuator, filter select switch, selectable AGC, CW variable pitch control, speech processor, and RF power output control, programmable band scan or 40 channel memory scan.

Optional accessories:
• AT-940 full range (160-10m) automatic antenna tuner • SP-940 external speaker with audio filtering • YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filters; YK-88A-1 (6 kHz) AM filter • VS-1 voice synthesizer • SO-1 temperature compensated crystal oscillator • MC-43S UP/DOWN hand mic. • MC-60A, MC-80, MC-85 deluxe base station mics. • PC-1A phone patch • TL-922A linear amplifier • SM-220 station monitor • BS-8 pan display • SW-200A and SW-2000 SWR and power meters • IF-232C/IF-10B computer interface.

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation.

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CELEBRATE

the 75th anniversary of ARRL with a new Handbook!

1989 marks the 75th anniversary of the founding of the League. There's no better way of celebrating this momentous occasion, than with the new *1989 ARRL Handbook for the Radio Amateur*!

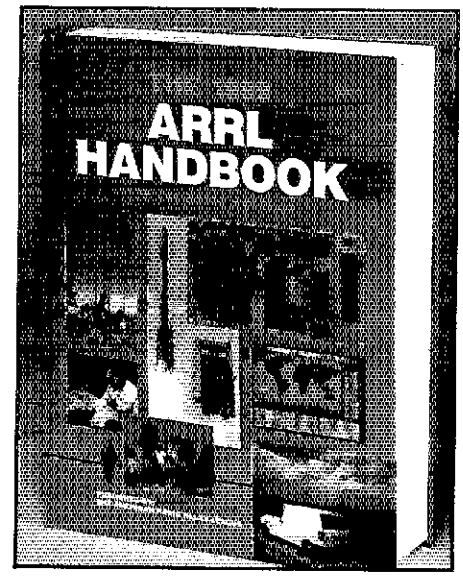
The 1200-page sixty-fifth edition contains over 2100 tables, figures and charts. The new *Handbook* is better than ever with revised information on phase noise measurement, direct frequency synthesis and spread spectrum communication techniques. The section on repeaters has been updated including a new CW identifier circuit. You'll find new spectrum analyzer and oscilloscope material, as well as several new projects in the test equipment chapter.

As always, we've added a host of new construction projects to this new edition. Just some of the new projects include: A 500-MHz frequency counter, 160 through 10 meter legal limit amplifier, simple CMOS keyer project, digital audio memory keyer and a L/Q meter for measuring coil inductance.

But that's not all. You'll find many other popular construction projects that can be built in a weekend such as power supplies and VHF/UHF preamps. For the more ambitious builder there are projects like the 1.8 MHz QSK transverter (there are VHF/UHF transverter projects too) and there are many amplifier designs to suit your needs from HF through microwaves.

The Handbook has always been famous as a reference for component data and you will find an entire chapter devoted to everything from transmitting tube and transistor specifications to aluminum tubing sizes. Satellite enthusiasts will find that the digital TR sequencer will add operating convenience to your station. Of course, you'll find the most up-to-date information on digital techniques, and the video communications chapter is packed with information not only on SSTV, ATV and FAX but Weather FAX as well. QRP enthusiasts will find the famous "Cubic incher" transmitter; not much bigger are the QRP SWR indicator and QRP Transmatch. There is also a VXO-controlled 6-watt CW transmitter for your favorite band between 80 and 15 meters. There are a number of useful station accesories that you can build like DTMF encoders and decoders, PIN-diode TR switch, digital PEP wattmeter and SWR calculator, Transmatches and dummy loads.

For $21, *The ARRL 1989 Handbook for the Radio Amateur*, remains an exceptional value for a hardcover technical publication. The price outside the US is $23. For postage and handling, add $2.50 (or $3.50 for insured mail or UPS—please specify)



Here is a description of what is covered in the Handbook:
The first 5 chapters serve as an introduction and cover: basics of Amateur Radio, electrical fundamentals, radio design technique and language, and solid state fundamentals. Vacuum tube principles as they pertain primarily to high power amplifier design are also presented in these introductory chapters. There are 12 chapters devoted primarily to these radio principles: power supplies, audio and video, digital basics, modulation and demodulation RF transmitters, receivers, transceivers, repeaters, power amplifiers, transmission lines and antenna fundamentals. Another 4 chapters cover voice, digital, image and special modulation techniques. The RF spectrum, propagation and space communications are covered in 2 chapters. The construction and maintenance section has 12 chapters of useful projects ranging from power supplies and antennas through digital equipment. You'll find up-to-date component data that the Handbook is famous for. The final 5 chapters cover how to obtain your license, station design and operation, interference, monitoring and direction finding. An abbreviations list, huge index and etching patterns make up the balance of the book.

The American Radio Relay League, Inc., 225 Main St., Newington, CT 06111 USA

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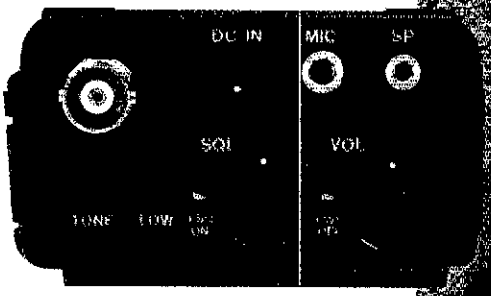
220 MHz TH-315A Here Now!

This HT Has it All!

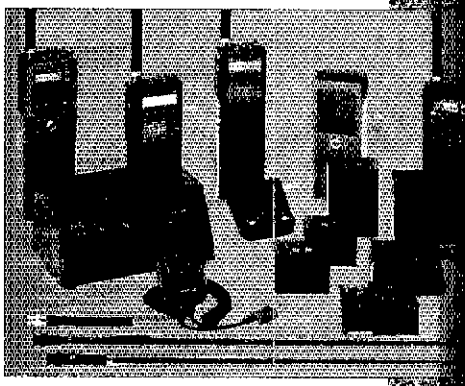
TH-215A/315A/415A

Full-featured Hand-heid Transceivers

Kenwood brings you the greatest hand-held transceiver ever! More than just "big rig performance," the new TH-215A for 2 m, TH-315A for 220 MHz, and TH-415A for 70 cm pack the most features and the best performance in a handy size. And our full line of accessories will let you go from hamshack to portable to mobile with the greatest of ease!

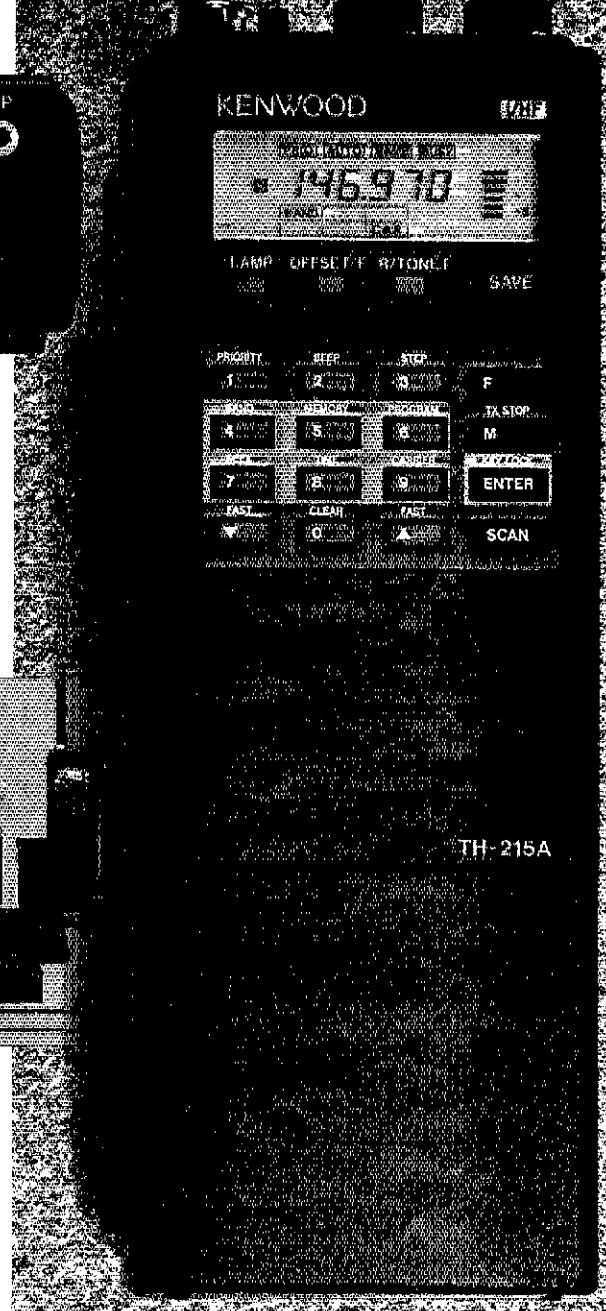


- **Wide receiver frequency range.** Receives from 141-163 MHz. Includes the weather channels! Transmit from 144-148 MHz. Modifiable to cover 141-151 MHz (MARS or CAP permit required).
- **TH-315A covers 220-225 MHz, TH-415A covers 440-449.995 MHz.**
- **5, 2.5, or 1.5 W output, depending on the power source.** Supplied battery pack (PB-2) provides 2.5 W output. Optional NiCd packs for extended operation or higher RF output available.
- **CTCSS encoder built-in.** TSU-4 CTCSS **decoder** optional.
- **10 memory channels store any offset, in 100-kHz steps.**
- **Odd split, any freqency TX or RX, in memory channel "0."**
- **Nine types of scanning!** Including new **"seek scan" and priority alert.** Also memory channel lock-out.
- **Intelligent 2-way battery saver circuit extends battery life.** Two battery-saver modes to choose, with power saver ratio selection.
- **Easy memory recall.** Simply press the channel number!
- **12 VDC input terminal for direct mobile or base station supply operation.** When 12 volts applied, RF output is 5 W! (Cable supplied!)
- **New Twist-Lok Positive-Connect™ locking battery case.**
- **Priority alert function.**
- **Monitor switch to defeat squelch.** Used to check the frequency when CTCSS encode/decode is used or when squelch is on.
- **Large, easy-to-read multi-function LCD display with night light.**
- **Audible beeper to confirm keypad operation.** The beeper has a unique tone for each key. DTMF monitor also included.
- **Supplied accessories:** Belt hook, rubber flex antenna, PB-2 standard NiCd battery pack (for 2.5 W operation), wall charger, DC cable, dust caps.



Optional Accessories:

• PB-1: 12 V, 800 mAH NiCd pack for 5 W output • PB-2: 8.4 V, 500 mAH NiCd pack (2.5 W output) • PB-3: 7.2 V, 800 mAH NiCd pack (1.5 W output) • PB-4: 7.2 V, 1600 mAH NiCd pack (1.5 W output) • BT-5 AA cell manganese/alkaline battery case • BC-7 rapid charger for PB-1, 2, 3, or 4 • BC-8 compact battery charger • SMC-30 speaker microphone • SC-12, 13 soft cases • RA-3, 5 telescoping antennas • RA-8B StubbyDuk antenna • TSU-4 CTCSS decode unit • VB-2530: 2m, 25 W amplifier (1-4 W input) • LH-4, 5 leather cases • MB-4 mobile bracket • BH-5 swivel mount • PG-2V extra DC cable • PG-3D cigarette lighter cord with filter



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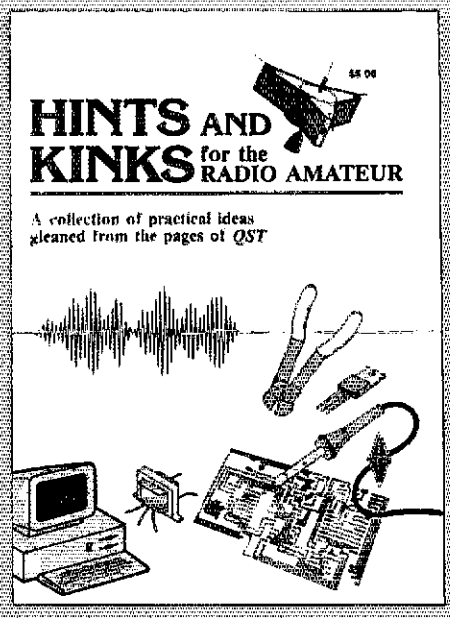
Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

ARRL Publications

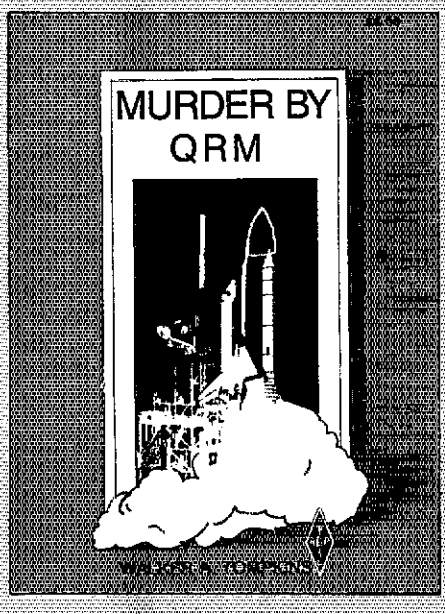


"A terrorist agent, representing an unknown foreign power or an internal subversive group, is bent on crippling or destroying America's space program by operating an illicit radio station from somewhere inside our Lost Padres National Forest wilderness area. A terrorist who has somehow gained access to our secret digital codes, launching schedules and classified radio frequencies required to cause our birds to self-destruct, during or after launch." And so begins a new adventure for Tommy Rockford, K6ATX.

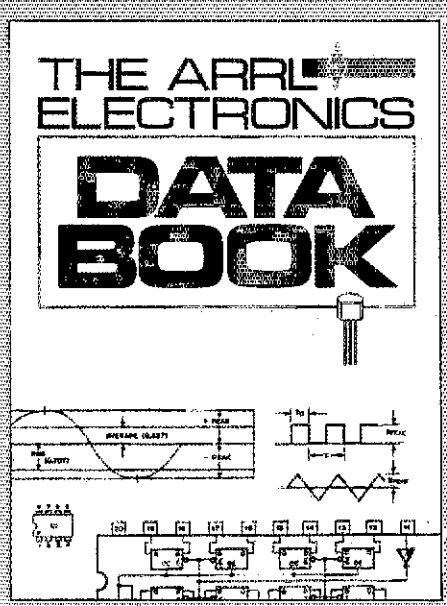
Murder by QRM is packed with action. Join K6ATX on an ill-fated search using motorized hang-gliders and then as he backpacks through the wilderness in search of the hidden transmitter site. With the launch of the space shuttle *Conquistador* only hours away will Tommy be able to ferret out the culprits before the fatal destruct signal is sent?

This is the sixth and final ham radio adventure by Walker Tompkins (the real K6ATX) who became a silent key just before the book was published. 194 pages, $5.00*

*For postage and handling add $2.50 ($3.50 for insured parcel post or UPS—please specify)



The ARRL Data Book is back by popular demand! Doug DeMaw, W1FB has completely revised and expanded the material in this handy reference for the RF design engineer, technician, radio amateur, and experimenter. This *one* source has all of those regularly used tables, charts, and those hard-to-remember formulas. You'll also find hundreds of popular circuit diagrams of oscillators, mixers, amplifiers, other active devices and their operating



parameters. This book can be used alone or to complement **The ARRL Handbook** and belongs in every technical library. Here's a brief summary and chapter lineup: **Symbols, Conversion Factors and Tables**, **Components and Materials** includes color codes, standard values, toroid selection charts; **Inductors and Transformers**; **Time and Frequency Measurement**; **Networks and Filters** covers attenuators and matching network design information; **Digital Basics** is 88 pages of logic, TTL Circuits, specific device descriptions, linear ICs, op-amp applications, and regulators; **Antennas and Transmission Lines**; **Catalog of Circuit Building Blocks** including audio amps, RF and IF small-signal amplifiers, mixers, FM detectors, oscillators, dc switches and amps, and frequency doublers; **Workshop and Lab Practices**. 234 pages, $12.00*

"Gimmicks and Gadgets, Tricks of the Trade." Since 1933, those words have been used describe **Hints and Kinks for the Radio Amateur**, but it has been almost seven years since the last edition appeared. Well, H&K fans, the long wait is over. The 12th in the series of the most popular *QST* "Hints and Kinks" contributions is now available, and hams like yourself share their innovations and wizardry. Like its predecessors, this edition has been said to be almost like having a radio club meeting on your bookshelf!

Here's just a sample: **In and Around the Station:** A Universal Equipment Stand, Safe Power Wiring Practices, Stop the Fire, Not Your Gear. **Transmitting and Receiving:** A Two-Transistor Transmitter for 30 Meters, Improvements for the HW-8, FT101ZD, TS830S, SB200, and SB220. **CW Hints:** Magnetic Switch for CW Tune Up, The Sneaky Knee Key for Mobile CW. **Computers and Digital Modes:** A Message-Waiting Indicator for TNCs, Tips for the VIC 20, TRS80 and Apple II. **Antennas and Feedlines:** Inexpensive 30 and 12-Meter Arrays, Retuning Traps for the WARC Bands, Baluns, Tower and Rotator tips. **Shop Secrets:** Tips on soldering and making PC Boards and more! **Tips on Testing:** Simple Logic Probe, plus 11 pages of test equipment and tips. **Portable and Mobile:** Power supplies, antennas, mobile installation tips. **VHF and UHF:** Antennas, amplifiers, CTCSS Tone Generator and more. **Power Supplies:** Power Supplies from Old Battery Chargers, High-Voltage Supply for Mobile Amplifiers. **Taming Interference:** Telephone RFI, TVI, CATVI cures. **Miscellanea:** COR and Timer Circuit, World-Time-Finder Slide Rule, AFSK System for FAX and more. 160 pages, $5.00*

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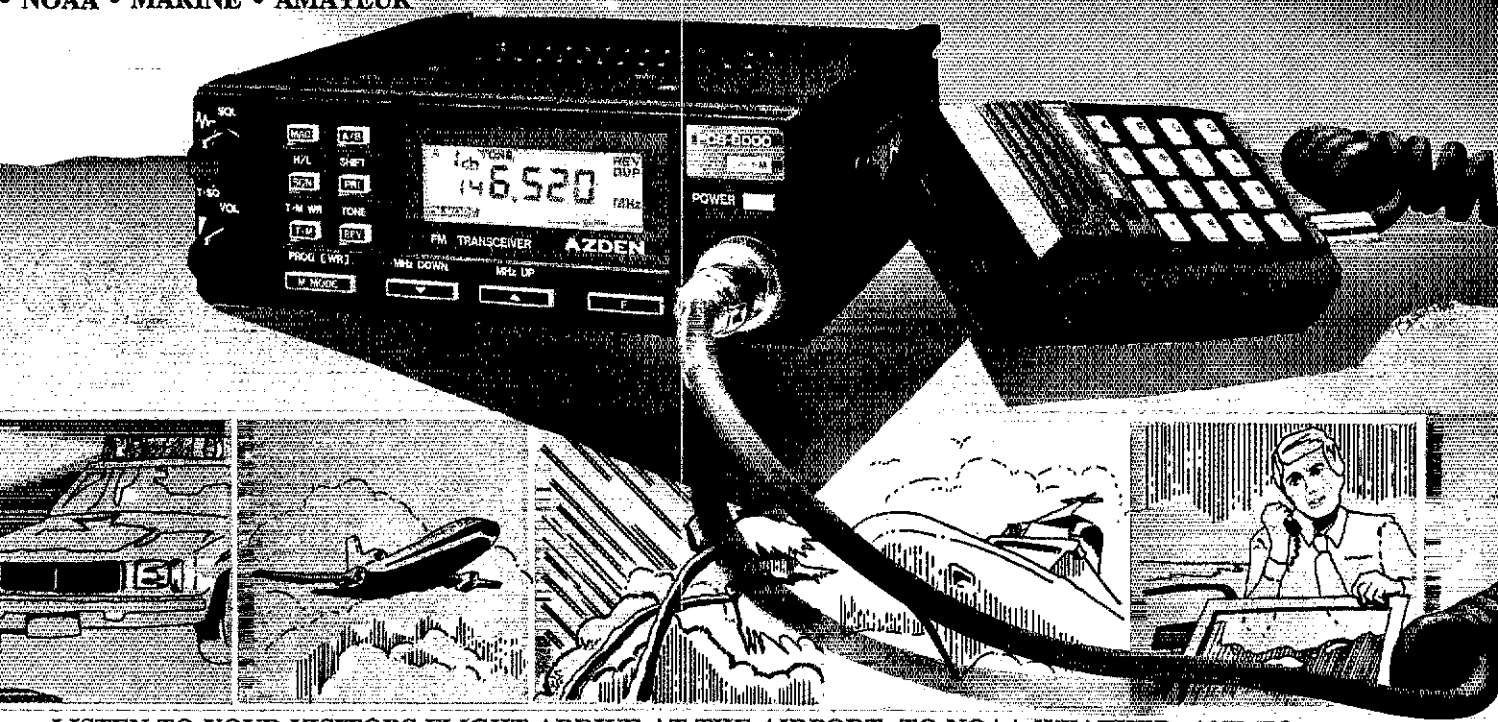

LISTEN TO YOUR VISITORS FLIGHT ARRIVE AT THE AIRPORT, TO NOAA WEATHER, AND TO PUBLIC SERVICE, POLICE, FIRE, FORESTRY AND MARINE FREQUENCIES

MODELS: PCS-6000/PCS-6000H (25W/45W). *Also coming soon PCS-6200 220MHZ, PCS-6300 70CM and PC-10 10 Meter FM Handheld.* **CMOS AND ADVANCED SURFACE MOUNT TECHNOLOGY PROVIDE UNPRECEDENTED COMMERCIAL QUALITY AND RELIABILITY.**

UNPRECEDENTED WIDE REQUENCY COVERAGE: The PCS-6000 receives 118.00 to 135.995 MHZ AM Aircraft/136-173.995 MHZ FM and transmits 140.100 to 150.000 MHZ. Modifiable to **ALL** MARS and CAP frequencies (proof of authorization/license required)

TINY SIZE: Only 2 inches high, 5¼ inches wide and 7¼ inches deep!! Easily fits anywhere, even in the smallest car!

20 CHANNEL MEMORY IN TWO BANKS PLUS 1 TEMPORARY CHANNEL (TM): Two memory banks, A and B have 10 memory channels each. The memories store frequency, shift width, offset information, and PL tone frequency as programmed. *An extra memory channel (that we call TM-temporary memory) is provided to allow you to store any operating condition instantly again and again!!*

UP TO 21 NONSTANDARD SPLITS: Program any split in any channel.

VERSATILE SCANNING FUNCTIONS: Dual memory scan, programmable band scanning, hold scan and delay scan functions are provided, with selectable delay time. **ALL** memory channels are tunable independently.

PRIORITY CHANNEL MONITORING: Memory Channel BØ(the first channel in memory bank B) is monitored every four seconds regardless of any operating condition. When a signal is received, a beep is heard.

DISCRIMINATOR CENTERING (AZDEN EXCLUSIVE PATENT): Always stops on frequency desired when scanning.

PROGRAMMABLE FREQUENCY STEPS: In memory, frequency steps can be set at 5KHZ to 20KHZ in any increment.

BUILT-IN PROGRAMMABLE TONE ENCODER: 57 different tones are built in for instant programming of PL tones into memory channels and microcomputer. Tone frequency can be entered independently in RX and TX. A tone decoder is available as an option.

LITHIUM BATTERY BACKUP: Memory information can be stored for up to 5 years even if power is removed.

FREQUENCY REVERSE: Allows you to listen to repeater input frequency.

FEATHER-TOUCH TUNING CONTROL KEYBOARD: The LED backlighted light touch keyboard performs all tuning operations simply by pushing the key(s) and key actuation is audibly verified.

LARGE LCD (LIQUID CRYSTAL DISPLAY): The LCD display shows the operating frequency, S/RF, memory channel in use and various other operating functions. The LCD is back-lighted by green LEDs, making it possible for you to read the display even in total darkness.

FULL 16 KEY TOUCHTONE PAD MICROPHONE: DTMF Microphone functions as auto-patch when transmitting.

DIGITAL S/RF METER: Shows incoming signal strength and relative transmitter power.

MICROPHONE CONTROLS: Up/Down memory and frequency control.

TRUE FM, NOT PHASE MODULATION: Unsurpassed intelligibility and audio fidelity. High/Low Power: 25W/45W or 5W/10W (6000/6000H). Output-Fully adjustable.

SUPERIOR RECEIVER: Sensitivity is better than 0.15 Microvolt for 20-DB quieting. Commercial-Grade design assures optimum dynamic range and noise suppression.

AUDIO OUTPUT: 2 Watts or more.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

OTHER FEATURES: Rugged dynamic touchtone DTMF microphone, built-in speaker, mobile mounting bracket, remote speaker jack, and all cords, plugs, fuses and hardware are included.

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Top performance for less than 80 cents a watt

DX-ing, contests, pile-ups, traffic handling. When you need to command attention, you will with the SB-1000 Linear Amplifier from Heath. And you'll do it for a cost that no one else can match.

From our recent DX-pedition to Taiwan, operators easily controlled pileups with the SB-1000 and nothing more than a dipole antenna. This means that when conditions are tough, you know you can depend on your SB-1000 to lift your signal above the rest. Whether you're using a dipole or stacked monoband beams.

Proven output power

We don't play games by using old rating methods to make you pay for input power you don't get at the antenna. What you do get is 1000 watt output of peak envelope power on SSB and 850 watts on CW. Even 500 watt output on RTTY.

On the chance that someone might doubt our claims, at hamfests we demonstrate that with only 80 to 100 watts of drive, our SB-1000 develops more output than even the world-famous Heath SB-220!

Designed for today, the SB-1000 offers quiet, compact tabletop operation at rated output. That's only 1.7dB (or about ⅓ of an S-unit) below the maximum legal power limit.

"I built it myself!"

Because you build the Heathkit SB-1000 Linear Amplifier yourself, you not only enjoy cost savings, you have the unique opportunity of knowing your equipment inside and out.

A top quality amplifier, cost savings, bragging rights, plus industry-recognized Heathkit manuals and technical assistance from our licensed ham consultants, should you ever need it. An offer that's hard to pass up.

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The PARAGON, Performance Plus...

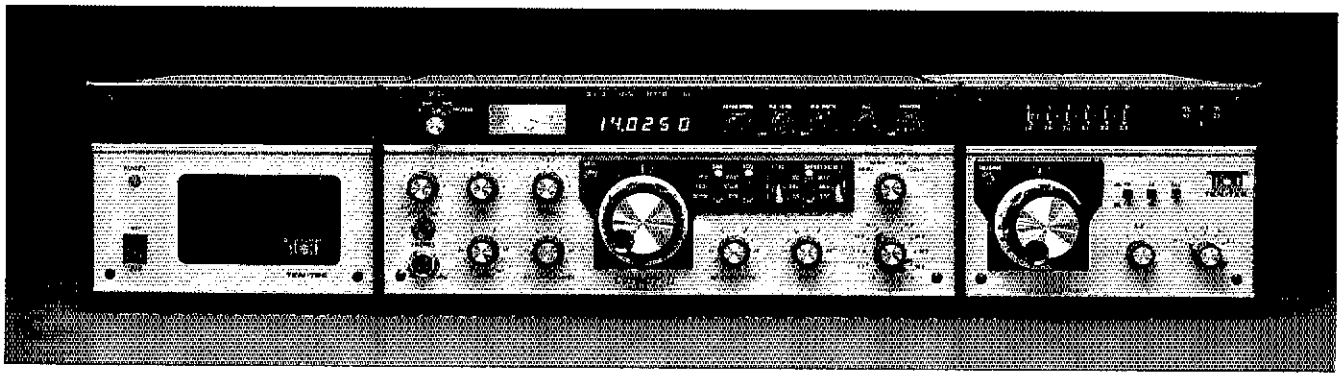
All mode versatility and a transmitted signal you will be proud of. A receiver that has set new standards for sensitivity and quietness. Receives from 100 kHz to 29.999.99 MHz. Transmits on all bands from 1.8 MHz to 29.999.99 MHz with 100 watts output. SSB, CW, real FSK and optional FM. Standard equipment includes speech processor, noise blanker, dual VFOs, TX split, RX split and QSK with a changeover time of 30 ms or less. Five I-F filter positions with the 6 kHz AM filter and 2.4 kHz SSB filter, standard. Optional 1.8 kHz, 500 Hz and 250 Hz filters are selectable independent of mode. Two selectable tuning rates. Passband tuning, notch filter, audio bandpass filter, tone control, squelch and more!

Sixty-two programmable memories that store frequency, mode, filter selected, channel number and a 7 character alpha-numeric "tag" for entering channel I.D. Scan rate is selectable and as each memory is scanned all of the stored information is displayed (what a light show!). Alternately, the memories can be tuned with the main tuning knob.

Frequency selection is with the main tuning knob, direct keypad entry or up/down buttons that will shift in 100 kHz or one MHz increments or to the next ham band. DISPlay button selects 24 hour clock or date or tag. VOICE button causes a voice frequency announcement with optional synthesized voice board installed.

Rear panel controls are provided to adjust the VOX, cw monitor level and tone, and SSB sidetone monitor level. Switching is provided to control conventional linear amplifiers and of course, high speed switching for QSK linears, such as the Titan or the Hercules II. Other rear panel inputs and outputs for transverters, FSK (170 Hz shift), fixed level audio out, audio in, external speaker, aux dc jack and provision for the optional RS-232 control interface. An absolute delight for the all mode operator.

The Paragon is the result of a three year engineering effort. We are proud of the Paragon and we think it has set new standards of excellence in synthesized rigs. Check it out yourself. We think that you will share our pride in the Paragon.



The Classic CORSAIR II...

Unique in all the world, the CORSAIR II is the only ham transceiver available that uses a crystal mixed, permeability tuned oscillator. The ability of this scheme to reject strong adjacent signals and to dig out weak signals under the most adverse conditions is legendary. The 95 dB of dynamic range is all useable!

Frequency tuning is also unique. The main tuning is 18 kHz per turn. Dual range offset tuning can control transmit, receive or transceive. Selectivity is enhanced with a 16 pole crystal ladder filter and pass band tuning. The 50 + dB notch filter virtually eliminates carrier type interference. An eight pole audio filter is standard and the I-F filters are selectable independent of mode for superior operation on the digital modes.

The transmitter is well known for outstanding audio quality on SSB and QSK CW performance is simply beyond comparison. All ham bands are covered, 160 through 10 meters with WWV at 10 MHz. The front panel is a thoughtful and spacious arrangement with only the controls that you need.

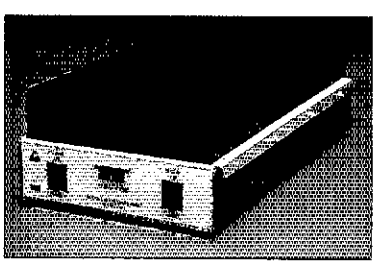
If your number one priority is outstanding performance on the ham bands, and simplicity is still a virtue, you may be the kind of punst who deserves the classic CORSAIR II.

Add Satellite Communications To Your HF Station

Model 2510 B

The Model 2510 B, mode B, satellite station is a 70 cm, 10 watt SSB and CW transmitter with a super-sensitive, low noise, 2 meter to 29 MHz receive converter. The receive conversion idea takes advantage of the excellent selectivity and sensitivity that you already have in your HF station. Frequency tuning is with the PTO in the 2510B and the transmitter automatically tracks the receive frequency for "transceive" operation. "Split" operation is also provided. Two bands are included for full coverage of Oscar 10 and Oscar 13.

The Model 2410 is an all mode, broadband, 100 watt, 70 cm amplifier that adds 10 dB of gain to your up-link signal. Tx/Stby control can be hard-wired or automatic when the drive signal is present. Primary power is 12 to 14 Vdc at 20 amps.



Model 2410

TITAN: A Gallon And A Half Out! (5.68 Liters)

The TITAN has it all! 1500 watts output with ease, all legal bands 160 through 15 meters including MARS frequencies (10 meters after owner mod), lightning fast QSK for full break-in CW or the digital modes and a two speed blower for quiet operation on SSB. This awesome performance from a 17 lb desk top amplifier is made possible by a pair of Eimac® 3CX800A7 ceramic triodes and an external 45 lb power supply that is an absolute "horse."

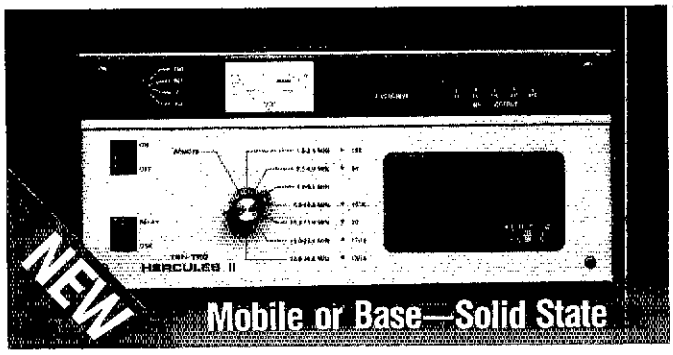
The heart of the power supply is our own tape wound, four core Hypersil® transformer that weighs in at an impressive 41 lbs. The transformer is conservatively rated at 2.5 kva CCS. (9.5 kva IVS.) The power supply is housed in a separate utility enclosure and is nearly noiseless even at full power.

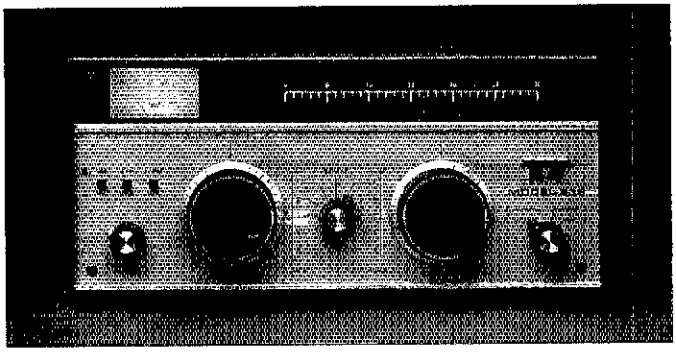
Front panel features include a ten element LED bargraph that displays peak power, a multi-meter selectable to read plate voltage, forward or reverse power and grid current. A matching meter is dedicated to display plate current. The TUNE and LOAD controls use 3:1 vernier drives which, in combination with a great RF deck design, make the TITAN a real "pussy cat" to operate.

The low drive requirement of the TITAN (65 watts for 1500 watts output, typical) makes life much nicer for your exciter too. This is especially comforting when operating keydown modes such as RTTY. Two product review articles have been published, see QST April 1986, CQ February 1986.

If you are ready to choose your dream amplifier the TITAN has everything but the highest price. Check it out!

THE TITAN IS BACKED BY A THREE YEAR LIMITED WARRANTY.





Hercules II No Tune 550 Watt HF Amplifier

The HERCULES II, Model 420, is an amplifier design that offers a combination of unique features that can only be achieved using modern solid state technology. Instant on, 12 - 14 Vdc operation, no-tune broadband final and compact size. General coverage operation from 1.8 to 22 MHz (to 29.999 MHz with authorized modification). Add to that lightning fast QSK cw, remote control, superb linearity and a low drive requirement. Outstanding!

The HERCULES II will interface nicely with virtually all transceivers. The front panel includes an analog multi-meter for collector current, voltage, forward power and SWR. A 10 element LED bar-graph display indicates peak output power. Band selection is made from the front panel switch or remotely controlled through a rear panel connector. Accessories are available for mobile remote control and automatic band tracking when using a Paragon. A front panel speaker is built-in.

The Model 9420 115/220 Vac power supply is in a separate utility enclosure and connects to the RF deck using a 6 foot power cable. It provides 80 amps to the amplifier plus 20 amps at 13.8 Vdc to power a 100 watt output exciter.

Two KW Antenna Tuner

The latest version of the highly regarded Ten-Tec antenna tuner is now the Model 238. The 238 has been re-styled to match our transceivers and looks great in your shack, whether your layout is "look alike" or "mix and match." This tuner adds a great deal of versatility. It will load virtually any unbalanced (coax fed or long wire) antenna. The high power balun is built in as standard which allows the use of balanced feeders also. Full coverage from 1.6 to 30 MHz. The modified "L" network will tame an SWR of at least 10:1, any phase angle, without false load problems. The lighted slide rule dial and calibrated tuning knob skirts make it possible to log settings and quickly QSY to the same frequency and antenna, without going through the tuning process again. Lighted multi-meter reads power in two ranges, plus SWR. A great way to operate all bands, including WARC and MARS, with something less than a world-class antenna farm.

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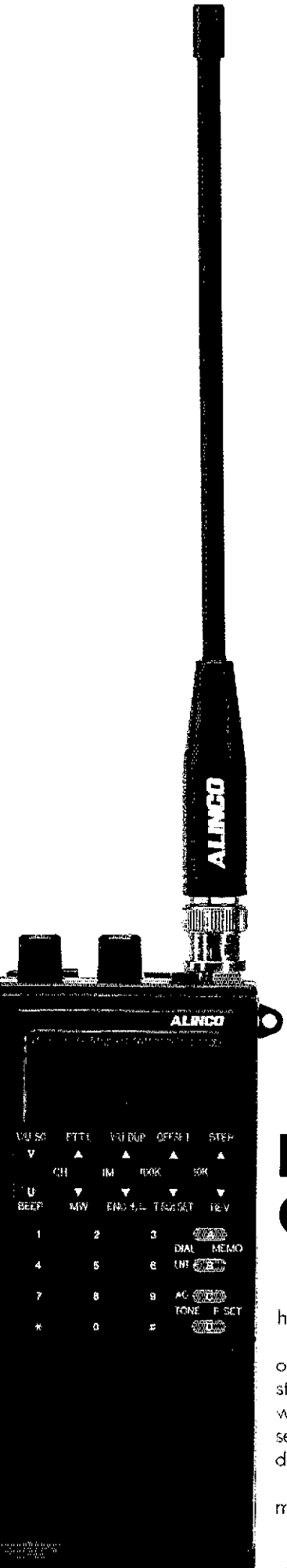

MEGA WATTS.

Alinco's new DJ-500T hand held dual bander really puts out.

Like 6.5 watts with the optional 12 volt battery. Or our standard 3.5 watts VHF and 3 watts UHF with a local power setting of .5 watts. No other HT delivers such power.

The DJ-500T also comes with mega features.

It's the only HT with a 37 tone encoder/decoder as standard equipment. You get cross band/full duplex operation. Twenty memory channels (10 apiece on VHF and UHF). Programmable offsets. A single memory 16 digit auto dialer and modifiable CAP/MARS capabilities*.

In short, the DJ-500T comes without any high priced add ons because everything is standard. That includes our exclusive two year limited warranty.

Alinco's new DJ-500T hand held dual bander. Mega power. Mega performance.

Call (213) 618-8616 for your nearest local dealer.

*Permit required.

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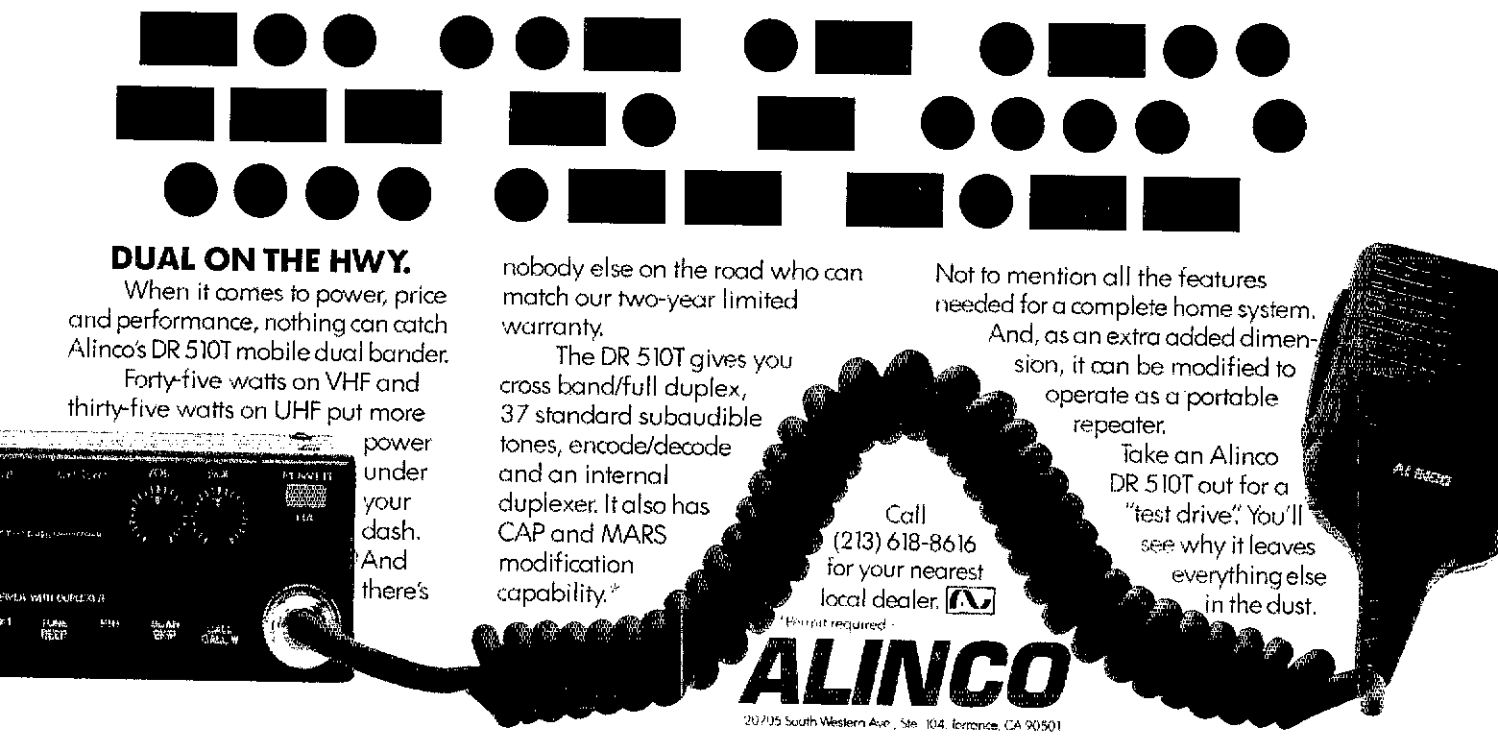
20705 South Western Ave., Ste. 104, Torrance, CA 90501



DUAL ON THE HWY.

When it comes to power, price and performance, nothing can catch Alinco's DR 510T mobile dual bander.

Forty-five watts on VHF and thirty-five watts on UHF put more power under your dash. And there's nobody else on the road who can match our two-year limited warranty.

The DR 510T gives you cross band/full duplex, 37 standard subaudible tones, encode/decode and an internal duplexer. It also has CAP and MARS modification capability.*

Not to mention all the features needed for a complete home system. And, as an extra added dimension, it can be modified to operate as a portable repeater.

Take an Alinco DR 510T out for a "test drive." You'll see why it leaves everything else in the dust.

Call (213) 618-8616 for your nearest local dealer.

*Permit required

ALINCO

20705 South Western Ave., Ste. 104, Torrance, CA 90501

Ham-Ads

(1) Advertising must pertain to products and services which are related to Amateur Radio.

(2) The Ham-Ad rate is 85 cents per word. This includes firms or individuals offering products or services for sale. A special rate of 25 cents per word applies to individuals seeking to dispose of or acquire personal station equipment, and to hamfest and convention announcements.

3) Remittance in full must accompany copy since Ham-Ads are not carried on our books. Each word, abbreviation, model number, and group of numbers counts as one word. Entire telephone numbers count as one word. No charge for postal Zip code. No cash or contract discounts or agency commission will be allowed. Tear sheets or proofs of Ham Ads cannot be supplied. Submitted ads should be typed or clearly printed on an 8-1/2" × 11" sheet of paper.

(4) Closing date for Ham-Ads is the 13th of the second month preceding publication date. No cancellations or changes will be accepted after this closing date. Example: Ads received May 14 through June 13 will appear in August *QST*. If the 13th falls on a weekend or holiday, the Ham-Ad deadline is the previous working day.

(5) No Ham-Ad may use more than 100 words. No advertiser may use more than two ads in one issue. A last name or call must appear in each ad. Mention of lotteries, prize drawings, games of chance, etc. is not permitted in *QST* advertising.

(6) New firms or individuals offering products or services for sale must submit a production sample (which will be returned) for our examination. Dealers are exempted, unless the product is unknown to us. Check with us if you are in doubt. You must furnish a statement in writing that you will stand by and support all claims and specifications mentioned in your advertising before your ad can appear.

The publisher of *QST* will vouch for the integrity of advertisers who are obviously commercial in character, and for the grade or character of their products and services. Individual advertisers are not subject to scrutiny.

The League reserves the right to decline or discontinue advertising for any reason.

CLUBS/HAMFESTS/NETS

PROFESSIONAL CW operators, retired or active, commercial, military, gov't., police etc. invited to join Society of Wireless Pioneers—W7GAQ/6, 146 Coleen Street, Livermore, CA 94550.

IMRA—International Mission Radio Association helps missionaries by supplying equipment and running a net for them daily except Sunday, 14.280 MHz, 1:00-3:00 PM Eastern Time. Rev. Thomas Sable, S.J., University of Scranton, Scranton, PA 18510.

THE Veteran Wireless Operators Association, a non-profit organization of communications people founded in 1925, invites your inquiries and application for membership. Write VWOA, Ed F. Pleuler, Jr., Secretary, 45 Murdock Street, Fords, NJ 08863.

FCC EXAMS. Novice-Extra Class, Walk-In's only. Sunnyvale VEC ARC, POB 60142, Sunnyvale, CA 94088-0142, 408-255-9000, 24/hr. Gordon, W6NLG, President. Flea Market, March-Sept, Foothill College, Los Altos Hills, CA.

MARCO: Medical Amateur Radio Council, operates daily and Sunday nets. Medically-oriented amateurs (physicians, dentists, veterinarians, nurses, therapists, etc.) invited to join. For information, write MARCO, Box 73's, Acme, PA 15610.

JOIN The Old Old Timers Club, an international non-profit organization. If you operated a radio station, commercial, amateur or Armed Forces 40 or more years ago, and have an Amateur license at present you are eligible. Join the real pioneers of ham radio. Write O.O.T.C., 1409 Cooper Drive, Irving, TX 75061.

LITTLE Big Horn Nets Sundays: 14.057-2200Z, 21.150-2230Z. Native American Indians and Others Welcome. Info WA2DAC.

PUT THE "MAGIC" back into Amateur Radio! Join the thousands of Amateurs who have, through "free" membership in the Society for the Promotion of Amplitude Modulation. Write: S.P.A.M., WB6TRQ, P.O. Box 27, Potrero, CA 92063 or call 619-478-9347. (LSASE please.)

SPAR—Society for the Promotion of Amateur Radio invites you to join our objectives and goals in doubling the United States amateur ranks within the next five years. Society ID certificates will be important for future membership activities. Society certificates are life memberships. Your donation is $10 payable to SPAR-President Al Viduka, NR9F, 518 30th Street, South Bend, IN 46615. Further information about SPAR can be obtained by sending a SASE to the above address or by calling 219-288-3182.

GOOD SAM RV Radio Network, largest int'l group of hams that are Good Sam's, M-F 0830 Central 7.292, Sunday 1400 Central 14.240, Tuesday 2000 Central 3.880. Info send 9x4 SASE to KG5IO, P.O.B. 207, Golden, TX 75444.

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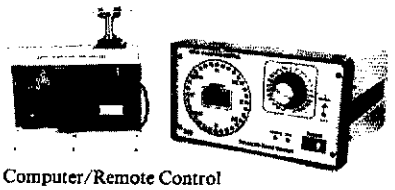

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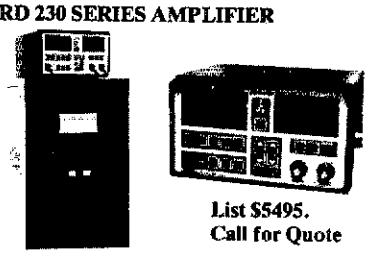

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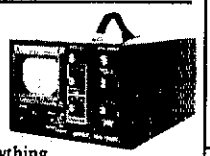

SPECTRAL DISPLAY UNITS (SDU) Allow user to "SEE" up and down the band for activity or lack of. You won't miss anything.

- Sweep width 50 KHz - 10 MHz
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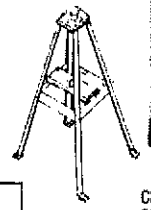
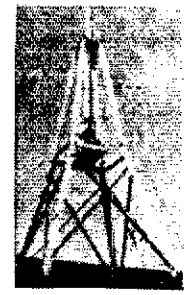
ROOF TOWERS



CR-18

CR-30



CR-45

ALINCO ROOF TOWERS

Model No Specifications	ETS-210
Spacing Between Legs At Roof	2'10"
Actual Height	6'6"
Max. Vertical Load	350 Lbs.
Max. Rotational Torque	135 Foot Lb
Max. Mast Length-from Rotor Plate	5'6"
Roof Mounting Pads	Adjustable For Roof Pitch
Weight	38 Lbs

roof towers require guy wires for safety.

$140.00

CREATE ROOF TOWERS CONSTRUCTED OF HIGH GRADE ALUMINUM WITH GALVANIZED STEEL BRACING FOR ADDED STABILITY AND STRENGTH WILL EASILY ACCOMMODATE YOUR ANTENNA REQUIREMENTS. THREE SIZES OF ROOF TOWERS WILL SUPPORT VHF ANTENNAS, HF TRI-BANDERS, AND OSCAR SYSTEMS. ROTATORS EASILY MOUNT INSIDE THE TOWER. AN OPTIONAL THRUST BEARING (CK46) IS RECOMMENDED. SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE OR OBLIGATION.

*SUBJECT TO AVAILABILITY

MODEL	HEIGHT	MAXIMUM ANTENNA WIND LOAD IN FT 2	BASE WIDTH	MAX. VERT. LOAD LBS.	TOWER WEIGHT LBS.	PRICE
CR-18	5'10"	21 @ 90 MPH	31-1/3"	440	28	
CR-30	9'10"	27 @ 90 MPH	39"	1,322	39	224.00
CR-45	14'9"	23 @ 90 MPH	39"	881	55	328.00
CK46	Thrust Bearing For CR-18, CR-30, and CR-45 Maximum Acceptable Mast Diameter 2½"					52.00

*BUYING IS REQUIRED ON ALL ROOF TOWERS. UPS SHIPPABLE

ROHN

20G	10' sect.	56.95
20AG	top sect. 9'	69.95
25G	10' sect.	69.95
25AG2	top sect 9'	83.95
45G	10' sect.	166.95
45AG2	top sect. 9'	173.95
AS25G	access shelf	28.95
AS45G	access shelf	64.95
TB-3	thrust bearing	66.95
M200	10' mast	19.95
SB25G	short base	33.95
SB45G	short base	71.95
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6BTV	6 band trap vert.	147.95
5BTV	5 band trap vert.	125.95
4BTV	4 band trap vert.	95.95
G7-144	Fix stat. 2mt collinear	125.95
MO-1/MO-2	mobile masts	22.95
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RM10S/RM15S	super resonator	17.95
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RM75S/RM80S	75 or 80 super	37.95
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SSM-2	stainless ball mt.	18.95
SSM-3	spring	16.95
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FX2	2mt 5/8 mag mt	24.95
HOT	trunk mt. w/swivel ball AND MORE!	17.95

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PD8010	80-10 dipole kit	35.95
PD8040	80-40 dipole kit	33.95
PD4010	40-10 dipole kit	31.95
SD80	80 shortened dipole	29.95
SD40	40 shortened dipole	26.95
ALL BANDER	160-10mt.	28.95
GR5V	AND MORE!	49.95

KLM

KT34A	triband 4 el.	
KT34XA	triband 5 el.	
2M-14C	2mt. satellite	
2M-22C	2mt. satellite	
435-18C	70cm satellite	
435-40CX	70cm satellite	
432-30LBX	70cm satellite	
2M-13LBA	2 meter	
2M-16LBX	2 meter	

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Belden 9913	Low Loss	.54
RG213 50 Ω (OHM)		.37 cts
RG8/U	Foam	.30cts
RG 8X	Mini	.22 cts
RG59/U	72 OHM	.14 cts
PL259/Silver		.99/1.49
N-Male for 8/U		4.50
BNC/M/UHF/F		5.55
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CUSHCRAFT ARX2 — CALL!
ALLIANCE HD73 — CALL!

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25BXUU	25' cable	9.95
50BXUU	50' cable	15.95
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PHF10	10m resonator	18.95
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AR5	5 band kit	89.95
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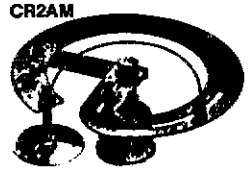

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CR2A	2M Mag MT	41.00
CR3A	220MHz Mag MT	37.00
CR4A	140MHz Mag MT	34.00
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A3	3 el. triband	CALL
AV5	5 band trap vert.	128.95
32-19	19 el. 2mt. boomer	128.95
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424B	24 el. 70cm boomer	92.95
416TB	16 el. OSCAR 435 MHz	71.95
A144-10T	10 el. OSCAR 145.9 MHZ	61.95
A0P-1	OSCAR pack 2mt. & 70cm	178.95
AR-2	2mt. vert. ringo	28.95
ARX-2	2mt. vert. ringo ranger	CALL
ARX-2B	2mt. vert. ringo ranger II AND MORE!	42.95
R5	5 band vert AND MORE!	245.95

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HF2V	80-40 vertical	131.00
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MPS	mtg. post sleeve	7.00
HF5B	HF mini beam	220.00

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TH5MK2S	5 el. triband	C
EX-14	4 el. triband	A
TH3JRS	3 el. 750W pep	L
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14AVQS	4 band trap vert.	
V2S	2mt. omni-direct	F
V4	70cm omni-direct	O
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MR750E	16 sq. ft.	319.95
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MAY 21, 1989, The Wabash County ARC will hold its 21st annual hamfest at the Wabash County 4-H Fairgrounds on State Road 13. Donations are $3.50 in advance, $4 at door. Inside tables are $10, tables sold in advance or on a first come basis only. Unlimited outdoor flea-market space. Free parking. Gates open 5:30 AM. Radio exams included between 8 AM - 12 PM. Talk-in on 147.63/03, 146.52 and 146.94/94. For advance tickets write to Don Spangler, W9HNO, 235 Southwood Drive, Wabash, IN 46992, tel. 219-563-5564. Free overnight camping.

KARS HAMFEST: the annual Hamfest sponsored by the Kankakee Area Radio Society will be held at the Will County Fairgrounds, Peotone, Illinois; on May 21 from 8AM-3PM. ARRL Booth, large flea market, many exhibitors. $2.50 in advance; $3.00 at the door. Take exit 327 off 157 east to Peotone, Fairgrounds one mile on left. Talk in 146.34/94. For further information contact Frank DalCanton, KA9PWW, RR #1, Box 361, Chebanse IL 60922. Phone 815-937-2452 Days or 815-932-6703 Evenings.

QSL CARDS/RUBBER STAMPS/ENGRAVING

CANADIAN QSL Cards, send $1 for samples refundable with your order. M. Smith, VE7FI, 18610 - 62nd Avenue, Surrey, BC CANADA V3S 4N9.

BE SURPRISED—get a variety of cards—100 for $8 or 200 for $13. Samples $1 refundable. Add $2 S&H. All three colors, fast service, satisfaction guaranteed. Constantine, 1219 Ellington, Myrtle Beach, SC 29577.

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QSL Samples—25 cents. Samcards, 48 Monte Carlo Drive, Pittsburgh, PA 15239.

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QSL's—Quality for less is back! See our display ad in this issue of *QST*. Harry A. Hamlen, P.O. Box 1, Stewartsville, NJ 08886.

QSLs Samples $1 (refundable) (stamps okay). M. Dakin, Winzj Press, P.O. Box 265, Revere, MA 02151.

QSLs & RUBBER Stamps. Top quality QSL samples and stamp information $1 (refundable with order). Ebbert Graphics D-3, Box 70, Westerville, OH 43081.

QUALITY QSLs. Samples $.50. Olde Press, WB9MPP, Box 1252, Kankakee, IL 60901.

LOW Cost QSL's Samples SASE. Koepke, 6 Katherine Road, Albany, NY 12205.

GAIL'S QSL'S, $6 first 100, $4 thereafter, stamp for samples, KA9YZT, 1150 Muenz, Wright City, MO 63390.

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QSLS Samples—SASE. Eric, WA6FOS, Box 2275, Culver City, CA 90231.

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RAISED Printed QSLs. Very unique. You can feel the type! Our new laser technology produces exotic callsign type effects. Super high quality. Standard designs or use your own artwork/computer graphics to create a really personal QSL. We now offer state outlines in 3-D. $1 for samples & information. Dennis, WA5QMM, Network QSLs, P.O.B. 13200, Alexandria, LA 71315-3200, 318-443-7281, FAX: 318-445-9940.

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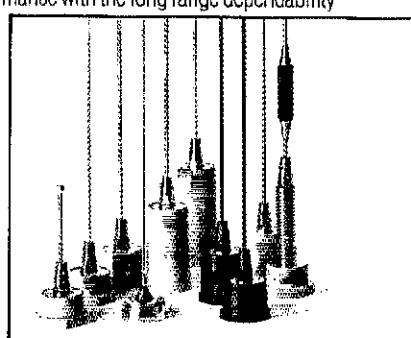

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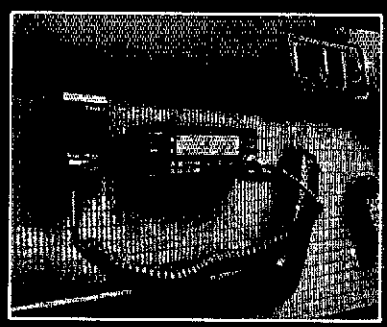
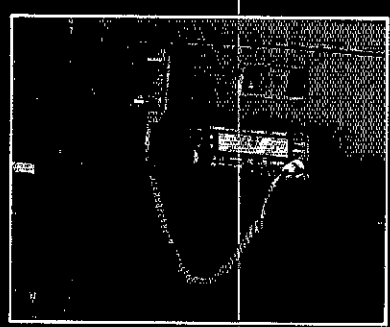
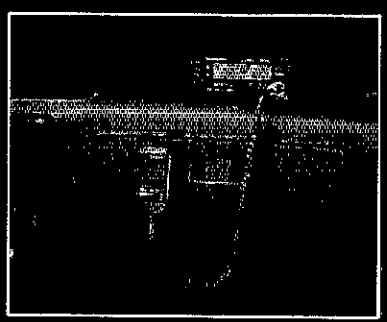
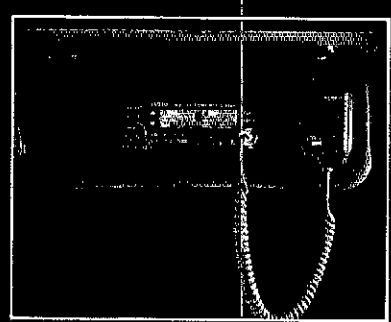
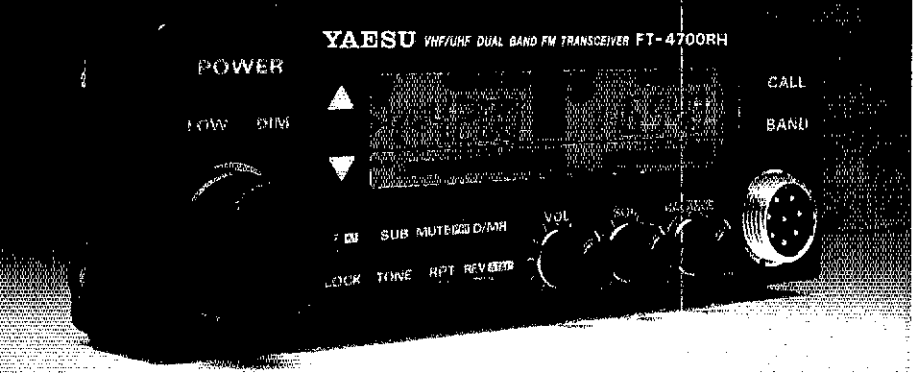
YAESU'S DUAL BANDER GOES PLACES OTHER MOBILES DON'T.











FT-4700RH control head
($1\frac{15}{16}$" x $5\frac{7}{8}$" x 1")

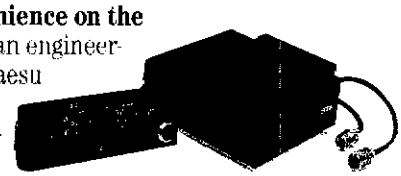
Introducing Yaesu's FT-4700RH dual-band mobile. Choose Yaesu's FT-4700RH, and you open the door to a lot of tight spaces.

While other dual banders just won't fit in today's small cars, the FT-4700RH utilizes a versatile "remote head" design. So you can mount the "brains" on your dash, visor, or door, and hide the "muscle" under your seat.

High-performance package. Packing a solid 50-watt punch on 2 meters (40 watts on 70 cm), the FT-4700RH includes Dual-Band Watch for simultaneous monitoring of both bands, with independent squelch settings on the main and secondary bands. When you transmit, opposite band monitoring goes on in a full-duplex mode.

You can adjust the relative volume of the two receive channels with the balance control, too. And with Yaesu's bright LCD display, transceiver status is clearly visible in sunlight or shade.

Convenience on the road. Human engineering, long a Yaesu specialty, is an important aspect of the FT-4700RH design. The ten-button front panel keypad includes a "do-re-mi" audible command verification, and all important controls are backlit for night operation. Plus you get extended receive coverage of 140-174 MHz (MARS/CAP permit required for transmit on 140-150 MHz), or 430-450 MHz on 70 cm. Nine memory channels on each band. High/low power selection (low power: five watts). One-touch reverse repeater shift button. Optional CTCSS module. And 16-key DTMF microphone.



Optional accessories. FTS-8 CTCSS unit. MH-15D8 Autodialer Microphone with 10-telephone number memory. SP-3 or SP-4 External Speakers. And YH-1 Headset/Boom Mic or MF-1A3B Flex-Arm Boom Mic, both with SB-10 PTT Switch Unit.

Discover Yaesu's FT-4700RH today. And see what "high performance" really means. For dual-band mobile operation, Yaesu's FT-4700RH really fits!

Yaesu USA 17210 Edwards Road, Cerritos, CA 90701 (213) 404-2700. **Repair Service:** (213) 404-4884. **Parts:** (213) 404-4847. Prices and specifications subject to change without notice. Specifications guaranteed only within amateur bands.

YAESU

WANTED: The entire 1934 "Z" and "H" line of Silver-Marshall Radios, any condition. Chuck Dachis, WD5EOG, The Hallicrafter Collector, 4500 Russell Drive, Austin, TX 78745.

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WANTED: Telegraph Keys and Bugs that are old or unusual, other early telegraph instruments, telegraph signs, related items. Telegraph collector will pay premium prices for rare items. Larry Nutting, WD6DTC, 4025 Slate Court, Santa Rosa, CA 95405, 707-539-1883.

WANTED: Old CW Keys. Jon, 814-226-9565.

E.F. JOHNSON Transmitters, Literature and Accessories wanted for my station. Will pickup. Len Crispino, Box 702, Hudson Falls, NY 12839, 518-638-8199.

WANTED: Pre-1930 *QSTs*. Richard Titus, NV2C, 231-9 Lucas Lane, Voorhees, NJ 08043, 609-772-0316.

TELEGRAPH Keys, Vintage Amateur Station, Photographs sought for private non-profit collection. Contact: John Hensley, WJ5J, 5054 Holloway Avenue, Baton Rouge, LA 70808.

COMMUNICATIONS RECEIVERS: The Vacuum Tube Era. Book covers history, specs on 700 receivers, 51 companies, 112 photos. $14.95 plus $2 P/S. Details SASE. RSM Communications, Box 218-Q, Norwood, MA 02062.

SELL: *QST* oldest 1933. Some CQ, 73, HR, and Computer Mags. $1 each plus shipping. LSASE for list. Robert Willsey, Box 10, Martha, OK 73556.

ANTIQUE *QST* Magazines For Sale. '31, '59, '62-'68. Make offer. Jim, 312-286-3232.

WANTED: Back issues of RF Design Magazine. Robert Mastin, K5AHI, P.O. Box 542766, Dallas, TX 75354, 214-691-0759.

SWAP / SWAP—*QST* Library—1930 + few 1929 issues to date. For Base All Mode 2 Mtr. Transceiver. Write W2DSG.

WANTED: Plastic Dial Cover for Echophone Commercial; QSLs prior to 1950. Dave Noon, VE3IAE, 19 Honeysuckle Cresc., London, Ontario, CANADA N5Y 4P3.

FOR SALE: Hundreds of military radio/radar manuals 1939-1965. Send SASE for list. Rainy Day Books, 44 Bertwell Road, Lexington, MA 02173, 617-861-8656.

WANTED: Guthman Equipment; Original Meissner Signal-Shifter; Homemade Bugs/Keys; Controlled-Carrier Am Transmitter. Nagle, 12330 Lawyers, Herndon, VA 22071.

WANTED: BC-1031 Panadaptor. Also want Hallicrafters S-35 Panoramic Receiver (1943-1946) has 5' Panadaptor above SX-28. Please correspond if you've seen or used one. Also need HRO-50 Coils and Cabinet for/from SP-600. Sam, W6HDU, Box 101, Alameda, CA 94501, 415-521-1429.

WANTED: Military Surplus Radio Equipment, we need ARC-164, ARC-114, ARC-115, ARC-116, ARC-150, ARC-182, ARC-186, ARN-127, ARN-118, RT-1158A, Collins 490T-1, 490T-9, 490S-1, 719A, 618M-3, 51RV-4, 51Y-7, top dollar paid or trade for new amateur gear. Write or phone Bill Slep, 704-524-7519, Slep Electronics Company, Highway 441, Otto, NC 28763.

FOR SALE: Unused vintage radio tubes including 3CX3000's, RCA 5691's, 6012's, 7360's & 7587's. Call Connie, 612-642-4202 weekdays.

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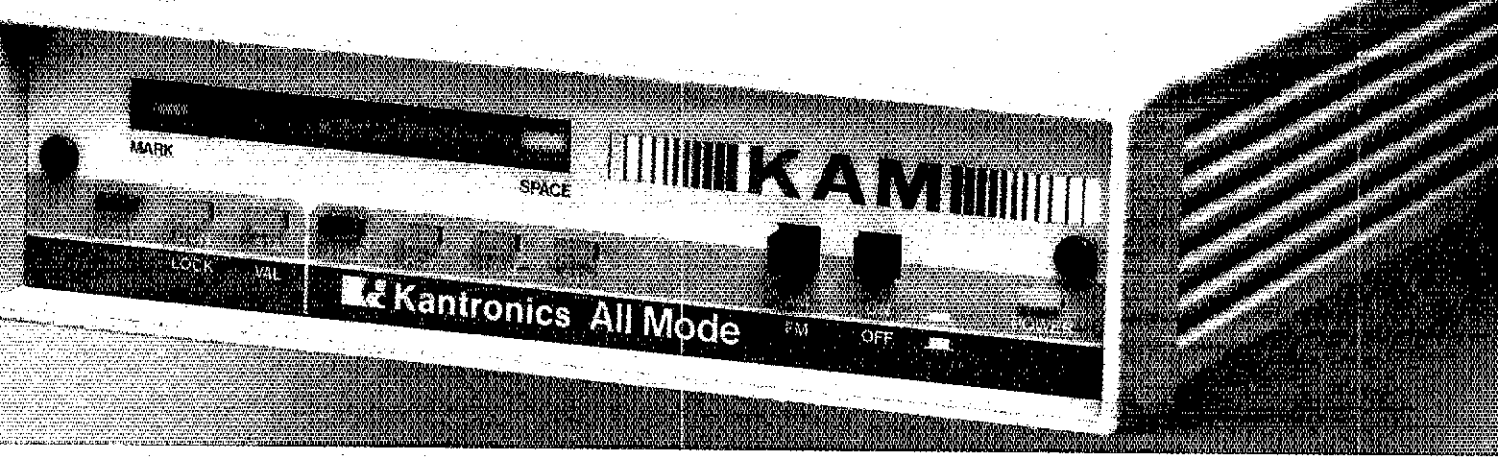
WANTED: Collins equipment, accessory, and material. Consider any condition down to junk for parts. Also interested in other vintage. I pay shipping. Have route from USA to Japan. Hiro Shiozawa, JA8JCJ, 7089 Oyasumi, Iida City, 395 JAPAN.



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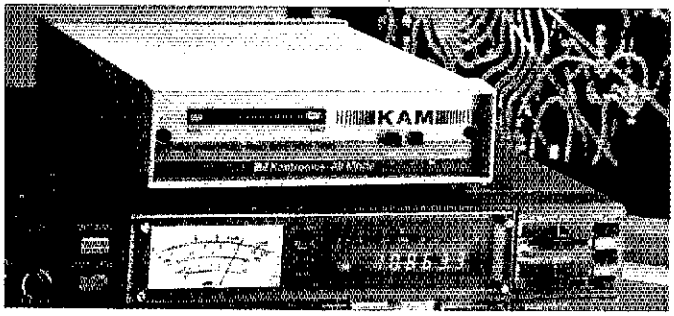

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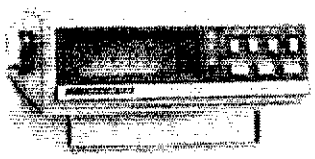

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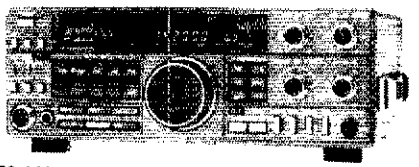

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Complete kit ••• CAT# REKIT-14 $17.00

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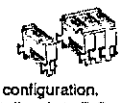
SMK# J-D0001 #1



Each switch has digits 0-9. Snap together to make up any necessary configuration. Designed to mount directly to P.C. board. Pins on .1" centers. Each switch is .64" high X .59" wide X .235" thick.
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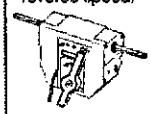

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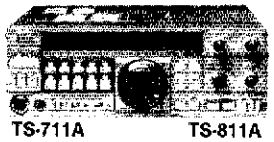

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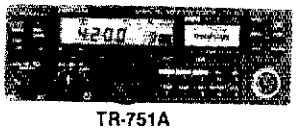

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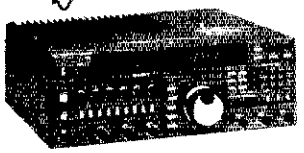

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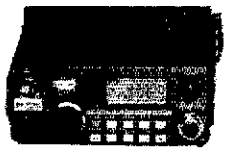

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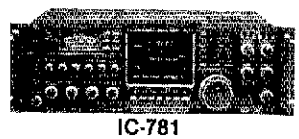

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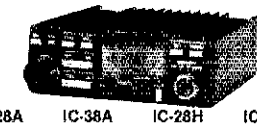

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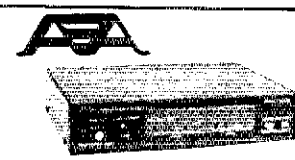

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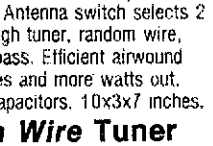
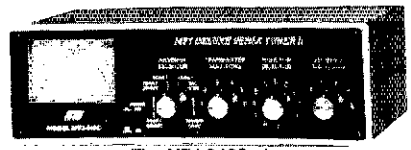
MFJ's *Random Wire* Tuner

MFJ-16010 **$39.95**



You can operate all bands anywhere with any transceiver when you let the MFJ-16010 turn any random wire into a transmitting antenna. Great for apartment, motel, camping operation. Install a wire anywhere! Tunes 1.8-30 MHz. 200 watts PEP. Ultra small 2x3x4 in.

MFJ's *Best 300 Watt* Tuner



MFJ-949C **$149.95** The MFJ-949C gives you more precise matches than any tuner that uses two tapped inductors. Why? Because you get two **continuously** variable capacitors that give you infinitely more positions than the **limited** number on switched coils.

This gives you the precise control you need to get your SWR down to a minimum. After all, isn't that why you need a tuner? Covers 1.8-30 MHz.

You also get MFJ's lighted 2-color Cross-Needle SWR/Wattmeter, 6-position antenna switch, 50 ohm 300 watt dummy load and a built-in balun - all in a compact 10x3x7 inch cabinet that fits right into your station. Meter light requires MFJ-1312, $9.95.

With MFJ's **best** 300 watt PEP tuner you get an MFJ tuner that has earned a reputation for being able to match just about anything - one that is highly perfected and has years of **proven** reliability.

MFJ's *Mobile* Tuner

MFJ-945C **$89.95**

Don't leave home without this **mobile** tuner! Have an uninterrupted trip as the MFJ-945C **extends your antenna bandwidth** and eliminates the need to stop, go out and adjust your mobile whip.

You can **operate anywhere in a band and get low SWR.** You'll get maximum power out of your solid state or tube rig and it'll run cooler and last longer.

Small 8x2x6 inches uses little room. **SWR/ Wattmeter and convenient placement of controls make tuning fast and easy while in motion.** 300 watts PEP output, efficient airwound inductor, 1000 volt capacitors. Mobile mount, MFJ-20, $3.00.

144/220 MHz VHF Tuners

MFJ-921 **$69.95**

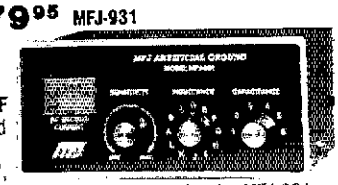
MFJ's new VHF tuners cover both 2 Meters and the 220 MHz bands. They handle 300 watts PEP and match a wide range of impedances for coax fed antennas. SWR/Wattmeter. 8x2½x3 in. **MFJ-920, $49.95.** No meter. 4½x2½x3 inches.

MFJ

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(601) 323-5869; TELEX: 53 4590 MFJSTKV

MFJ's *Artificial* RF Ground

$79.95 **MFJ-931**



You can create an artificial RF ground and eliminate RF "bites", feedback, TVI and RFI when you let the MFJ-931 resonate a random length of wire and turn it into a tuned counterpoise. The MFJ-931 also lets you electrically **place a far away RF ground directly at your rig** -- no matter how far away it is -- by tuning out the reactance of your ground connection wire.

Barefoot/1.5 KW Linear Tuner

MFJ-962C **$229.95** For a **few** extra dollars, the MFJ-962C lets you use your barefoot rig now and have the capacity to add a 1.5 KW PEP linear amplifier later. Covers 1.8-30 MHz.

You get two husky **continuously** variable capacitors for maximum power and minimum SWR. And lots of inductance gives you a wide matching range.

You get MFJ's **new** peak and average reading Cross-Needle SWR/Wattmeter with a **new** directional coupler for more accurate readings over a wider frequency range. It reads forward/reflected power in 200/50 and 2000/500 watt ranges. Meter lamp is front panel switched and requires MFJ-1312, $9.95.

Has 6-position antenna switch and a teflon wound balun with ceramic feedthru insulators for balanced lines. 10¾x4½x14 7/8 inches. Add $10.00 s/h.

MFJ's *smallest* Versa Tuner

MFJ-901B **$59.95**

The MFJ-901B is our smallest -- 5x2x6 inches -- (and most affordable) 200 watt PEP tuner --when both space **and** your budget is limited. Good for matching solid state rigs to linears.

It matches whips, dipoles, vees, random wires, verticals, beams, balanced and coax lines from 1.8-30 MHz. Efficient airwound inductor. 4:1 balun.

FOR YOUR NEAREST DEALER OR TO ORDER

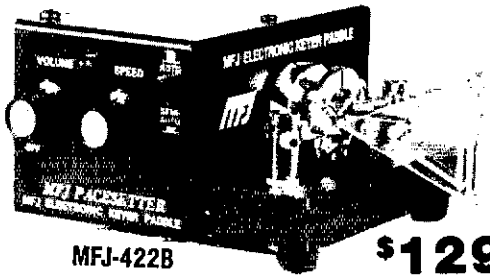
800-647-1800

• 1 year **unconditional** guarantee • 30 day **money back** guarantee (less s/h) on orders from MFJ • Free catalog • Add $5.00 s/h (except as noted)

MFJ . . . making quality affordable

BEST OF MFJ

MFJ, Bencher and Curtis team up to bring you America's most popular keyer in a compact package for smooth easy CW



MFJ-422B **$129.95**

The best of all CW worlds - a deluxe MFJ Keyer using a Curtis 8044ABM chip in a compact package that fits right on the Bencher iambic paddle!

This MFJ Keyer is small in size but big in features. You get iambic keying, adjustable weight and tone and front panel volume and speed controls (8-50 WPM), dot-dash memories, speaker, sidetone and push button selection of automatic or semi-automatic/ tune modes. It's also totally RF proof and has ultra-reliable solid state outputs that key both tube and solid state rigs. Use 9 V battery or 110 VAC with MFJ-1305, $9.95.

The keyer mounts on a Bencher paddle to form a small (4 1/8 x 2 5/8 x 5½ inches) attractive combination that is a pleasure to look at and use.

America's favorite paddle, the Bench, has adjustable gold-plated silver contacts, lucite paddles, chrome plated brass, and a heavy steel base with non-skid feet.

You can buy just the keyer assembly, MFJ-422BX, for only $79.95 to mount on **your** Bencher paddle.

Artificial RF Ground

MFJ-931 **$79.95**

You can create an artificial RF ground and eliminate RF "bites", feedback, TVI and RFI when you let the MFJ-931 resonate a random length of wire and turn it into a tuned counterpoise. MFJ-931 also lets you electrically **place a far away RF ground directly at your rig** - no matter how far away it is -by tuning out the reactance of your ground connection wire. 7½x3½x7 in.

Antenna Bridge

MFJ-204B **$79.95**

Now you can quickly optimize your antenna for peak performance with this portable, totally self-contained antenna bridge.

No other equipment needed - take it to your antenna site. Determine if your antenna is too long or too short, measure its resonant frequency and antenna resistance to 500 ohms. It's the easiest, most convenient way to determine antenna performance. Built-in resistance bridge, null meter, tunable oscillator-driver (1.8-30 MHz). Use 9 V battery or 110 VAC with AC adapter, $9.95.

Super Active Antenna

'World Radio TV Handbook' says MFJ-1024 is "a first rate easy-to-operate active antenna ... quiet ... excellent dynamic range ... good gain ... very low noise factor... broad frequency coverage ... excellent choice."

Mount it outdoors away from electrical noise for maximum signal, minimum noise. MFJ-1024 covers 50 KHz to 30 MHz

Receives strong, clear signals from all over the world. 20 dB attenuator, gain control, ON LED Switch two receivers and aux. or active antenna. 6x23x5 in. Remote unit has 54 inch whip, 50 ft. coax and connector. 3x2x4 in. 12 VDC or 110 VAC with MFJ-1312, $9.95.

MFJ-1024 **$129.95**

MFJ Coax Antenna Switches

$34.95 MFJ-1701 **$21.95** MFJ-1702 New **$59.95** MFJ-1704

Select any of several antennas from your operating desk with these MFJ Coax Switches. They feature mounting holes and automatic grounding of unused terminals. They come with MFJ's one year **unconditional** guarantee. **MFJ-1701, $34.95.** Six position antenna switch. SO-239 connectors. 50-75 ohm loads. 2 KW PEP, 1 KW CW. Black aluminum 10x3x1½ inch cabinet. **MFJ-1702, $21.95.** 2 positions. Cavity construction. 2.5 KW PEP, 1 KW CW. Insertion loss below .2 dB. 50 dB isolation at 450 MHz. 50 ohm. 3x2x2 in. **MFJ-1704, $59.95.** 4 position Cavity Switch with Lightening/Surge protection device. Center Ground position. 2.5 KW PEP, 1 KW CW. Extremely low SWR. Isolation better than 50 dB 500 MHz. Negligible loss. 50 ohm. 6¼x4¼x1¼ in.

"Dry" Dummy Loads for HF/VHF/UHF

MFJ-260 **$28.95** MFJ-262 **$69.95** MFJ-264 **$109.95** New

MFJ has a full line of dummy loads to suit your needs. Use a dummy load for tuning to reduce needless (and illegal) QRM and save your finals. **MFJ-260, $28.95.** Air cooled, non-inductive 50 ohm resistor. SO-239 connector. Handles 300 watts. Run full load for 30 seconds, derating curve to 5 minutes. SWR less than 1.3:1 to 30 MHz, 1.5:1 30-60 MHz. 2½x2½x7 in. **MFJ-262,$69.95.** Handles 1 KW. SWR less than 1.5:1 to 30 MHz. 3x3x13 in. **MFJ-264, $109.95.** Versatile UHF/VHF/HF 1.5 KW Dry Dummy Load. An MFJ first. Gives you low SWR to 650 MHz, usable to 750 MHz. You can run 100 watts for 10 minutes, 1500 watts for 10 seconds. SWR is 1.1:1 to 30 MHz, below 1.3:1 to 650 MHz. 3x3x7 inches. SO-239 connector

MFJ-1286 Gray Line DX Advantage

New **$29.95** MFJ-1286

Snag rare DX for only $29.95! The MFJ-1286 is a computerized DXing tool that predicts DX propagation. Even the casual DXer can work rare DX by knowing when conditions are best for DX. The Gray Line is the day/night divider line where the most amazing DX happens every day. Now you'll know **exactly** when to take advantage of i

Gives detailed world map. Shows Gray Line for any date/time, UTC in 24 user chosen QTHs, time zones and more. IBM compatible. Any graphics.

MFJ's Speaker/Mics

MFJ-284 or MFJ-286 **$24.95**

For Kenwood, Icom, Yaesu, Santec

MFJ's compact Speaker/Mics let you carry your HT on your belt and never have to remove it to monitor calls or talk.

You get a wide range speaker and first-rate electret mic element for superb audio on **both** transmit and receive.

Earphone jack, handy lapel/pocket clip, PTT, lightweight retractable cord. Gray. One year **unconditional** guarantee.

MFJ-284 fits Icom, Yaesu, Santec. **MFJ-286** fits Kenwood.

12/24 Hour LCD Clocks

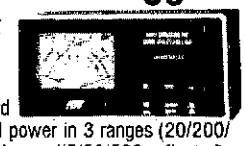
$19.95 MFJ-108B **$9.95** MFJ-107B

Huge 5/8 inch bold LCD digits let you see the correct time from anywhere in your shack. Choose from the dual clock that has separate UTC/local time display or the single 24 hour ham clock.

Mounted in a brushed aluminum frame. Easy to set. The world's most popular ham clocks for accurate logs. MFJ-108B 4½x1x2; MFJ-107B 2¼x1x2.

Lighted Cross/Needle SWR/Wattmeter

MFJ-815 **$69.95**



MFJ Cross-Needle SWR/ Wattmeter shows you SWR, forward and reflected power in 3 ranges (20/200/ 2000 watts forward/5/50/500 reflected). Push button range selection. 1.8-30 MHz.

Mechanical zero adjust for movement. SO-239 connectors. Light requires 12 VDC or 110 VAC with MFJ-1312, $9.95.

Deluxe Code Practice Oscillator

New

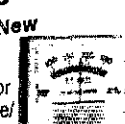
MFJ-557 **$24.95**

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base so it stays put on your table. Also portable because it runs on a 9 volt battery (not included) or an AC adapter ($9.95) that plugs into the side.

Earphone jack for private practice. Tone and volume controls for a wide range of sound. Speaker. The key has adjustable contacts and can be hooked to your transmitter. Sturdy. 8½x2¼x3¾ in. One year **unconditional** guarantee

MFJ AC Voltage Monitor

$19.95 MFJ-850 New



Prevent damage to rig, computer or other gear. Monitor AC line voltage for potentially damaging surge/ brown out conditions on 2-color expanded 95-135 volt scale.

Plugs into any AC outlet. 2% accuracy. 2¼x2¼x1½ inches.

• One year **unconditional** guarantee • 30 day **money back** guarantee (less s/h) on orders from MFJ • Add $5.00 each s/h • **Free** catalog

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HF-Amplifier arcs, pops and loud bangs are not normal

After hearing one of these unpleasant noises, did you discover: a dearly departed amplifier-tube, burned band-switch contacts, pitted tuning-capacitor plates, a shorted Zener bias diode, or other kaput amplifier parts? If the answer to one or more of these questions is *yes*, the damage was almost certainly ***not your fault and not the fault of the tube manufacturer***, even if the amplifier-tube was replaced under Eimac's® very generous warranty. It is quite likely that your amplifier has an intermittent, VHF parasitic-oscillation.

If you know how to solder, this problem is *easily* corrected by replacing the original, semi-effective [High VHF-Q] "parasitic-suppressors"(?) with ***Low*** VHF-Q parasitic-suppressors. **(For more information, see *QST Magazine*, Oct. 1988, page 36)** All materials, components, instructions, diagrams and a 430°F silver-solder kit included, nothing else to roundup. ***Low VHF-Q Parasitic-Suppressor™*** Retrofit-Kits are now available from the author of this article. Prices start at $12, delivered via First Class Mail®, for a (1) or a (2) 3-500Z amplifier retrofit-kit. For increased duty-cycle option, add $2. Retrofit-kits are also available for HF-amplifiers that use 572B, 8122, 8873, 8874, 8875, 3CX800A7, 3-1000Z, 3CX1200A7 and 8877 tube types.

➤➤➤ Also available: Telephone RF-Interference filter kits with diagram and instructions, four (4) for $5, delivered.

For detailed information and a price list, write to: Richard L. (Rich) Measures, AG6K, 6455 La Cumbre Road, Somis, CA, 93066, or ☎ 805-482-3034. Please include your home telephone number if you write or order a kit.

OFFICIAL Military-Type ID Tags—("Dog Tags")!!! Customized with your call letters, etc. 5 seventeen space lines. 20' nickel plated chain included. $4.29 postpaid. JPW Enterprises, P.O. Box 353, Logan, UT 84321.

FLOOD YOUR Mailbox! You get 100's of radio & electronic specialty catalogs. Send $5 with your name & address to: Electronic List Services, P.O. Box 1683, Dept. E, Brookline, MA 02146.

WANTED—Heath SB-220/1, mint cond. Jim, WA8CAJ, 702-827-3074.

FREE Ham Radio Gospel Tracts. SASE. N3FTT, 5133 Gramercy, Clifton Heights, PA 19018.

TOWERS: Aluma crank-up with hinged base, house bracket, mast. Mobile van, rooftop, trailer towers. Stack sections. Take amateur gear or computers on trade. McClaran Sales, P.O. Box 2513, Vero Beach, FL 32961, 407-567-8224.

OLDTIMERS! N6AW is writing a book about W6AM. If you have a story to tell about Don Wallace, take a few minutes to jot it down and send it to me. Jan D. Perkins, N6AW, 524 Bonita Canyon Way, Brea, CA 92621.

THE DX MAGAZINE is your monthly ticket to the DX game: Dxpedition reports, QSL managers, propagation, equipment reviews, more. Only $15/year. Box 50, Fulton, CA 95439, 707-523-1001.

DIGITAL Automatic Displays. Any radio. Be specific. Grand Systems, P.O.B. 3377, Blaine, WA 98230.

BEAM Headings, DX and WAS, from your QTH $7. Wagner, WD8SBB, 855 North Willowglen, Tipp City, OH 45371.

ROPE.ROPE.ROPE. Putting up an antenna? Tree top? Roof top? Tower? You need Rope.Rope.Rope. Best Quality - Best Price. Current Special: military specification, braided dacron polyester, minimum stretch, olive drab color, blends with trees. Resists: fire, fungus, ultraviolet rays. Super Value: $9.95 per 200', plus $2.50 postage. Whatever your rope needs contact us, no order too large. Send check or money order to: Rope.Rope.Rope., Box 6601, Portsmouth, VA 23703. Personal check allow 5 weeks. VA residents add 4.5% sales tax.

THE DX Bulletin provides all the DX, propagation, QSL, equipment, DXpedition information you need every week. SASE or call for samples. Box 50, Fulton, CA 95439, 707-523-1001.

WANTED: ICOM IC560, IC505, IC551, or IC551D 6M Multimode Radios. Reasonable. WA3RSP, 469 Jayson Avenue, Pittsburgh, PA 15228.

WANTED: Hallicrafters Mobile Power Supply PS-500-DC. KJ6KI, 714-686-5407.

SATELLITE Tracking Programs for C64, Amiga, IBM, VIC, Timex. Fastest, easiest to use programs available. Provides real time tracking on world map display. Instant switching of satellites, dates, times plus sheduling and printer output. Hundreds sold. VIC, Timex $18. C64, Amiga, IBM $24. Antenna aiming boards available for VIC and C64 $129.95. Neil Hill, K7NH, N H Enterprises, 22104 66th Avenue West, Mountlake Terrace, WA 98043.

WANTED: The newly formed Skyline Middle School Amateur Radio Club, a non-profit organization formed to enhance the education of our students, needs tax-deductible financial support and/or usable amateur equipment. Contact us at 302-454-3410 or write to: 2900 Skyline Drive, Wilmington, DE 19808.

WANTED: YL 35-50 to share life, ham radio, in new mountaintop home with WM widower, 52. WD4CPF.

CHIMNEY Wanted for 3-1000Z (SK-516). K8WZ, 913-258-3829.

IS MY ATLAS RADIO STOLEN? NYC supplier of "Atlas" radios shipped me a DD-6 Digital Display. Doesn't work. If it's yours and you can prove it call Don, 203-274-8625 after 6 PM.

COMTEK ACB-4 Phased Array Switch. For your 2 or 4 element phased vertical arrays. Comes complete with remote switchbox containing quadrature 90 degree hybrids, 180 degree phase reversals and relay matrix plus attractive inside console control box and directions. Get gain and directivity at the throw of a switch! Top quality throughout! Compete with the big boys. Only $295 US + $12 S&H. (Foreign add 10%.) ComTek, P.O. Box 202, Hopkinton, MA 01748, phone 508-529-6330.

BEAUTIFUL Rubber Jacketed, Silver Coated Control Cable Used in Missile Silos. 16 Conductor $.92/ft. 32 Conductor $1.75/ft. W0MNK, P.O. Box 8, Nortonville, KS 66060, 913-886-3235.

14 KARAT Gold Callsign Jewelry. Lapel pins, necklaces, more. Information: KB2MB, H&M Jewelry, 26 Edgecomb, Binghamton, NY 13905.

MICROWAVE Modules MMT 144/28-R deluxe linear transverter. Currently fully wired for ICOM 735. Easily wired for most transceivers. Factory modified to cover the entire 2 meter band. $300 includes UPS shipping. KF5NB, 512-272-8233 after 6 PM Central time.

FREQUENCY Directories: Press, Maritime, Aero, Military, Spy, SW/MW/FM Broadcast, Utes, Police, Federal Agencies, all modes, 10 KHz to 900 MHz. Free catalog. CRB Research, Box 56-QS, Commack, NY 11725.

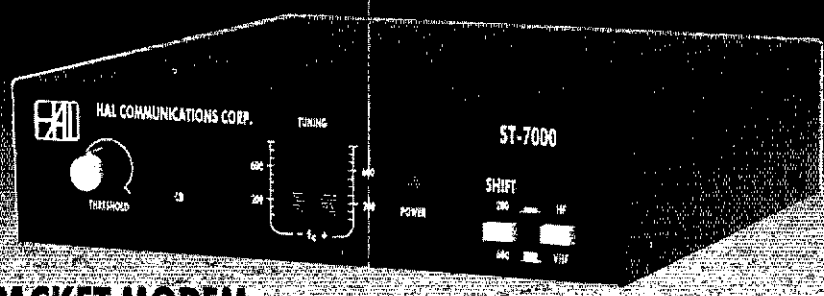
WANTED: Remote VFO for Kenwood TS-120S. KB1RZ, 207-353-6360.

LINEMAN Safety Belt $80. (State waist size.) Adjustable strap with snaps $45. Pair Gorilla Hooks $104. UPS paid. Personal check. Free info. Avatar/W9JVF, 1408 W. Edgewood, Indianapolis, IN 46217.

PRINTED Circuit Boards for projects in QST, Ham Radio and 73's. SASE for list. FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

KILOWATT Amplifier Ten Tec Hercules 444, Solid State, 160 thru 10 Meters, $750. Legal Limit Tuner Ten Tec 229, Factory Wired, $100. Both in new condition. Frank, W7IS, 1-206-426-0515.

GREAT HF PACKET DESERVES A GOOD MODEM



ST-7000 HF PACKET MODEM

The verdict is in and the opinion of HF Packet operators is clear . . . the HAL ST-7000 is a winner!

The HF Packet communications world is not forgiving. Selective fading, noise, and interference coupled with poor tuning indicators and simplistic phone line modems contribute to the poor performance of packet controllers on HF.

The ST-7000 makes HF Packet Work

The ST-7000 is designed specifically to greatly improve the 300 baud HF Packet performance of all packet and multi-mode controllers. Techniques developed for our government and military ST-8000 (MD-1232/G) HF modem are applied to the special problems of HF Packet radio. It's simple . . . just connect the ST-7000 to your existing packet or multi-mode controller . . . and you're ready to send data, **not** repeats.

The "standard" 200 Hz shift mode of the ST-7000 has a 6-pole input bandpass filter, an optimized detector circuit, plus a 40 db AGC system. These design features make 200 Hz HF Packet work!

The ST-7000 also includes a 600 HZ shift mode for even better performance than is offered by the 200 HZ "standard" shift mode.

Other features of the ST-7000 include:

- A new tuning indicator design assures quick and accurate tuning of HF Packet signals
- CD (carrier detect) and threshold level circuits designed specifically for 300 baud HF Packet
- A sine-wave synthesized transmit tone generator assures minimum phase distortion and splatter
- Easily interfaces with all packet and multi-mode controllers via RS-232C, TTL, or TNC VHF audio tones

Best of all, the ST-7000 is manufactured and tested entirely in the United States by HAL Communications, a company you've known and trusted for years.

The ST-7000 is available directly from the factory at a price of $299.00, which includes a 12VDC, 0.25A power supply.

WRITE OR, BETTER YET, CALL TODAY TO ORDER YOUR HAL ST-7000.

HAL COMMUNICATIONS CORP.
P.O. BOX 365 1201 W. KENYON ROAD
URBANA, ILLINOIS 61801-0365
PHONE: (217) 367-7373
FAX: (217) 367-1701

WANTED: Knobs for Heathkit HR-10 Receiver. N2BDU, 38 Chapin Street, Canandaigua, NY 14424.

WANTED: Azden PCS4500 or Yaesu FT627RA 6M FM Radios. Reasonable. WA3RSP, 469 Jayson Avenue, Pittsburgh, PA 15228.

HAM SOFTWARE IBM/Compatibles 10 disks $26.95. MC/Visa/Discover. N5ABV, EAPCO, Keller, TX 76248-0014, 817-498-4242.

'Q' PRODUCTS: 8877 QRO VHF Amplifier Kits. 50 MHz, 144 MHz, 220 MHz. HV power supplies, coaxial antenna relays. SASE for brochure. "Q" Products, Larry Price, N7BNJ, 10412 36th Street E., Puyallup, WA 98372, 206-841-7465 evenings.

IBM-PC SOFTWARE for PK-232! New CompRtty II/PK is the complete communications program for the PK-232/HK-232. Uses host mode of PK-232 for complete control. Text entry via built-in screen editor! Adjustable split screen display, including optional Triple Split(TM) in Packet mode. Instant mode/speed change. Hardcopy, diskcopy, break-in buffer, select calling, text file transfer, customizable full screen logging, 24 programmable 1000 character messages, mailbox facility. Ideal for MARS and traffic handling. Requires 256k PC compatible. $65. Non-PK-232 version still available. Send call letters (including MARS) with order. David A. Rice, KC2HO, 144 N. Putt Corners Road, New Paltz, NY 12561.

HOSS-TRADER ED says, "Shop around for the best price, then telephone the Hoss last for the best deal". Wm Nye 3KW MB-5 Antenna Tuner $675 cash price $569; new ICOM 735 Transceiver regular $1099 cash $935; newest ICOM Model 725 Transceiver regular $949 cash $825; call for lowest price in USA on newest model ICOM 765 Transceiver; used Collins S-Line complete mint condition $695; new Azden PCS-6000, $349; new ICOM 2-AT, $268; used Collins KWM-2A with AC Supply, $695; new Amp Supply LK-500-ZC 1500 Watt Linear regular $1595 cash $1335; sale on MFJ Products: some below cost. Visa/Master Card Accepted! Moory Electronics Co., P.O. Box 506, Dewitt, AR 72042, tel. 501-946-2820.

AZDEN Service by former factory technician. Rush service available. PCS-300 NiCads $36.95. Southern Technologies Amateur Radio Inc., 10715 SW 190th Street #9, Miami, FL 33157, 305-238-3327.

WANTED: G.E. Master-Pro 250 Watt UHF Base Station, or Amplifier with Power Supply, or Amplifier Alone. Taras Babenko, K8RUR, 46859 Ecorse, Belleville, MI 48111, 313-697-8888.

DIGICOM/64 Technical Operations Manual. Painless operating instructions. New edition. $6 ppd. Fuller, N3EFN, RD 2, Box 40-31, Guy Mills, PA 16327.

KW AMP—Johnson Viking 6N2, 50/144 MHz (new 4CX150A's), $800 OBO. W6PQS, 800-288-8223.

FREE: Magnolia Blossom QSL. Send stamp. K4NBN, "No Bad News".

WANTED: ICOM R-7000, Drake L-4B. W3CRH, Box 20, Macomb, IL 61455, 309-833-1809.

RADIO DESK Console Cabinet. Build your own. Drawings, photographs, list of materials, $7.95 ppd. Bill Morris, WA5RSC, P.O. Box 3, Temple, TX 76503-0003.

24 HOUR WALL CLOCK. Your callsign in 1" high gold characters. Handcrafted 9" x 13" pine with 6-3/4" dial, bezel, and eagle. $29.95 plus $2.50 shipping ($32.45 total). Ham Clocks, N1IW, Box 178, New Boston, NH 03070.

ELECTRONIC KITS & ASSEMBLIES—For our latest catalog send a large SASE (45 cents) to: A & A Engineering, 2521 W. LaPalma #K, Anaheim, CA 92801.

WANTED: All types of Electron Tubes. Call toll free 1-800-421-9297 or 1-612-429-9397. C & N Electronics, Harold Bramstedt, 6104 Egg Lake Road, Hugo, MN 55038.

FREE: 89 foot motorized tower, US Tower HDX589-MDPL, complete, 2 years old. You remove and pay all costs. KN2M, 1-716-837-8311.

17-METERS IS GREAT! But so are the 12 and 30M WARC Bands. Add all 3 to any FT-101 (except ZD) with new kit. Includes all crystals, parts, detailed instructions. Only $35 postpaid (US/Canada), $40 elsewhere. Fox Tango, Box 15944, W. Palm Beach, FL 33411, phone 407-683-9587.

UPGRADING Your Station? Cleaning out your shack? Sell your used equipment fast with an ad in "The LADAD ADletter, Amateur Radio's Classified Marketplace". Buy, sell, exchange. 24 issues annually $12, or 2 years for $22. Free 15 word ad with your subscription. Ads 25 cents per word for subscribers, 40 cents others. Route 5, Box 62, Lockport, IL 60441.

WANT: Sony CRF-1. WA2OHR, callbook, 516-482-4455.

DRAKE T-4XC/AC4 $225. R-4C $225. L-4B $745. 7075 Microphone $45. Stockton, 501-741-1825.

WANTED: Drake R7A Receiver. Preferably with cabling. Will pay cash. Call Mike Kelsey, 414-743-4412.

QUANTITY discounts on Tektronix Dual Trace #661 Scopes (DC-3500 MHz) excellent condition $80 ea. (lots of 10 - $50 ea.). Also: Hewlett-Packard Signal Generators 1.8-4 GHz excellent condition $50 ea. (lots of 10 - $40 ea.). Also: Various Signal Generators 1-7 GHz $50 ea. (lots of 10 - $40 ea.). FOB WW5B, P.O. Box 460, Brookshire, TX 77423, 713-934-4659.

450 MHz SPECTRUM ANALYZER—Adapted from Nov 85 QST article by Al Helfrick, K2BLA. Complete kit now available for $459.95 plus $5.50 s/h. CA residents add 6% sales tax. Foreign orders add 15% for shipping. Visa & MC accepted. A & A Engineering, 2521 W. LaPalma #K, Anaheim, CA 92801, 714-952-2114.

WANTED: Homebrew 4-1000, Drake C-Line, L-4B, L-7, etc. KS6O, 501-741-1825.

SUPERFAST Morse Code Supereasy. Subliminal cassette. $10. Learn Morse Code In 1 Hour. Amazing new supereasy technique. $10. Both $17. Moneyback guarantee. Free catalog: SASE. Bahr, 2535-G5 Marietta, Palmbay, FL 32905.

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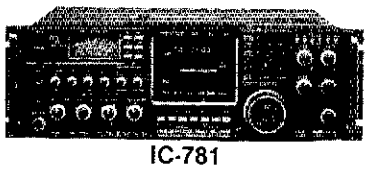
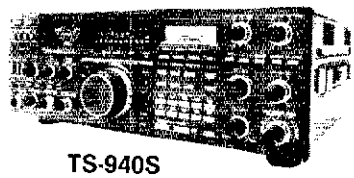


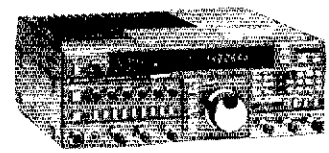
IC-781

HF Equipment	List	Juns
IC-781 Super Deluxe HF Rig	$5995.00	Call $
IC-765 New, Loaded with Features	TBA	Call $
IC-761 Loaded With Extras	2699.00	Call $
IC-735 Gen. Cvg Xcvr	1099.00	Call $
IC-751A Gen. Cvg. Xcvr	1699.00	Call $
IC-725 New Ultra-Compact Xcvr	949.00	Call $
IC-575A 10m/6m Xcvr	1399.00	Call $
Receivers		
IC-R7000 25-1300 + MHz Rcvr	1199.00	Call $
IC-R71A 100 kHz-30 MHz Rcvr	999.00	Call $
VHF		
IC-228A New 25w Mobile	509.00	Call $
IC-228H New 45w Mobile	539.00	Call $
IC-275A All Mode Base w/PS	1299.00	Call $
IC-275H All Mode Base 100w	1399.00	Call $
IC-28A FM Mobile 25w	469.00	Call $
IC-28H FM Mobile 45w	499.00	Call $
IC-2GAT, New 7w HT	429.95	Call $
IC-90D Six Band Mobile	639.00	Call $
UHF		
IC-475A All Mode 25w	1399.00	Call $
IC-475H All Mode 75w	1599.00	Call $
IC-48A FM Mobile 25w	509.00	Call $
IC-4GAT, New 6w HT	449.95	Call $
IC-4AT FM HT	349.00	Call $
IC-04AT FM HT	449.00	Call $
IC-448A, 25w Mobile	TBA	Call $
IC-32AT Dual Band Handheld	629.95	Call $
IC-3210 Dual Band Mobile	739.00	Call $
220 MHZ		
IC-375A All-Mode, 25w, Base Sta.	1399.00	Call $
IC-38A 25w FM Xcvr	489.00	Call $
IC-37A FM Mobile 25w	499.00	Call $
IC-3AT FM HT	349.00	Call $
1.2 GHz		
IC-12GAT Super HT	529.95	Call $



TS-940S

HF Equipment	List	Juns
TS-940S/AT Gen. Cvg Xcvr	$2499.95	Call $
TS-440S/AT Gen. Cvg Xcvr	1449.95	Call $
TS-140S Compact, Gen. Cvg Xcvr	949.95	Call $
TS-680S HF Plus 6m Xcvr	1149.95	Call $
TL-922A HF Amp	1649.95	Call $
Receivers		
R-5000 100 kHz-30 MHz	1049.95	Call $
R-2000 150 kHz-30 MHz	799.95	Call $
RZ-1 Compact Scanning Recv.	599.95	Call $
VHF		
TS-711A All Mode Base 25w	1059.95	Call $
TR-751A All Mode Mobile 25w	669.95	Call $
TM-231A Mobile 50w FM	TBA	Call $
TH-215A, 2m HT Has It All	399.95	Call $
TH-25AT 5w Pocket HT NEW	369.95	Call $
TM-721A 2m/70cm, FM, Mobile	729.95	Call $
TM-621 2m/220, FM, Mobile	729.95	Call $
UHF		
TS-811A All Mode Base 25w	1,265.95	Call $
TR-851A 25w SSB/FM	771.95	Call $
TM-431A Compact FM 35w Mobile	TBA	Call $
TH-45AT 5w Pocket HT NEW	389.95	Call $
TH-55 AT 1.2 GHz HT	524.95	Call $
TM-531A Compact 1.2 GHz Mobile	TBA	Call $
220 MHZ		
TM-3530A FM 220 MHz 25w	519.95	Call $
TH-31BT FM, 220 MHz HT	299.95	Call $
TM-321A Compact 25w Mobile	469.95	Call $
TH-315A Full Featured 2.5w HT	419.95	Call $



FT-767GX

HF Equipment	List	Juns
FT-747 GX New Economical Performer	$899.95	Call $
FT-757 GX II Gen. Cvg Xcvr	1129.95	Call $
FT-767 4 Band New	1929.00	Call $
FL-7000 15m-160m Solid State Amp	1995.00	Call $
Receivers		
FRG-8800 150 kHz - 30 MHz	759.95	Call $
FRG-9600 60-905 MHz	699.95	Call $
VHF		
FT-411 New 2m "Loaded" HT	399.95	Call $
FT-212RH New 2m, 45w mobile	459.95	Call $
FT-290R All Mode Portable	599.95	Call $
FT-23 R/TT Mini HT	344.95	Call $
UHF		
FT-712RH, 70cm, 35w mobile	499.95	Call $
FT-711RH FM Mobile 35w	449.95	Call $
FT-2311R 10w, 1.2 GHz, FM	559.95	Call $
VHF/UHF Full Duplex		
FT-736R, New All Mode, 2m/70cm	1749.95	Call $
FEX-736-50 6m, 10w Module	259.95	Call $
FEX-736-220 220 MHz, 25w Module	279.95	Call $
FEX-736-1.2 1.2 GHz, 10w Module	539.95	Call $
FT-690R MKII, 6m, All Mode, port.	569.95	Call $
Dual Bander		
FT-4700RH, 2m/440 Mobile	889.00	Call $
220 MHZ		
FT-312 RM, Mobile	TBA	Call $
Repeaters		
FTR-2410 2m Repeaters	1269.95	Call $
FTR-5410 70cm Repeaters	1289.95	Call $

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FOR SALE: Hallicrafters SX28, SX71, Johnson Viking, Heath HW-16 with accessories. All for $250. KA9FXT, 312-724-5105.

SELL: Kenwood TS-530SP Transceiver, SP-230 Speaker, MC-60 Mike, all mint, $600. Ameritron ATR-15 Antenna Tuner, 1500 Watt, mint, $200. Many extras - new tubes, etc. Carl Domanico, 5022 19th Avenue, Brooklyn, NY 11204, 1-718-331-7295.

CLEANING HOUSE: For Sale or Trade: 20 Meter 3L Yagi, KLM34A Tribander, 75' RG333U, 100' 75 Ohm Hard Line, Cosmophone 80-10 Transceiver, Super Pro Receiver, BW 1 KW Rotor Coil. Pick up only. Steve, W2MRM, 516-567-6980.

FT901DM, Amp Supply AT1200 Antenna Tuner, 4:1 Balun, Autek WM1 SWR/Pwr. Meter. Complete station, $700. Pick up only. Call Tom, 516-482-0519.

NICAD Battery Packs. Gordon West Tapes. Florida Nicad Specialties, 1-800-666-4223.

WANTED: Digital readout add-on for Kenwood TS-520. Jeff Wolf, WA6DAL, 710 Silver Spur, Rolling Hills Estates, CA 90274.

SATELLITE DISH: 9' perforated steel, 8 sections, polar mount. Good for WEFAX, mode-L, C-band. Pickup, $310. WA2OSA, 716-477- 1391.

ICOM-751-SM6-HM12 as new - $795. W2DOR, 201-349-1892.

WILL PAY for copy of Yaesu FT-207 booklet. Write Peter Hague, 10401 Gray Oak Lane, Fort Worth, TX 76108.

ALPHA 76CA, excellent condition, $1600. Wally, W9ZWH, 312-544- 1127.

SALE: my Collins KWM1 Transceiver, Power Supply, CW Filter. Excellent condition, aligned, new finals, $500. KC1LS, 207-778-2633.

TRADE: Heath 40 Meter Monobander for the 20 Meter Model. Free 19 inch rack cabinet. Chris, WB6OLJ, 818-992-5588.

WANTED: Manuals, Realistic DX-150A Navajo Pro. WBVUV, 1945 Goodman Avenue, Cincinnati, OH 45239.

WANTED—Non-Working "Oceanic" Type Zenith Radio or Older Grundig Satellite. Wade, KA3TVX, 657 14th Avenue, Prospect Park, PA 19076.

RADIO REPAIR: Ham Radios repaired at a reasonable rate with quality workmanship. Call Rich, KA1CXM, 203-485-9910, 364 Clearview Avenue, Harwinton, CT 06791.

WANTED: Copies of Assembly and Operating Manual for Conar Receiver Model 500 and Conar Transmitter Model 400. Jack Wallace, 5516 Gilbow Avenue, Fort Worth, TX 76114.

AM IS BACK! Get your old AM out of the closet and have Classic Radio Service(R) recalibrate, realign, clean and restore it to prime working condition. All work 100% guaranteed. FCC licensed. Contact Classic Radio Service(R), Box 764, Woodacre, CA 94973, 415-488-4596. Am is back!

FOR SALE: KLM 21-21.5-6LD Six Element 15M Yagi $200. KI4XY, 404- 979-4307 evenings.

WANTED: Swan 270, 270B or 300B Transceiver. Please state condition and price. Philip Schmitt, WJ8L, 800 S. Kendall Avenue, Kalamazoo, MI 49007.

ADOPTION. I have listened in the night and have heard, low against the ground the cry of lonely, orphaned, and forgotten Telegraph Keys and Bugs. Times past, they were loved, and used, daily, nay hourly, but now languish, almost unknown in many a dusty box or drawer. If you happen to find any of these unfortunates, please give them our address or telephone number and we would be overjoyed to pay the adoption fee and give them regular attention, care, and use. Thank you. Reno Telegraph Key Orphan Home, W7SK Headmaster, c/o Box 7415, Reno, NV 89510-7415, 702-356-0815 collect.

TRANSCEIVER, 100 Watts, 80 thru 10, NC100, AC Power Supply, DC Mobile Supply, Microphone, Power-SWR Meter, works great, $175. W2IXU, 305-485-5913.

WRITTEN EXAMS Supereasy. Memory aids from psychologist/engineer cut studytime 50%. Novice, Tech, Gen: $7 each. Advanced, Extra: $12 each. Moneyback guarantee. Bahr, 2535-G5 Marietta, Palmbay, FL 32905.

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DRAKE TR7 high s/n mint NB-7, FA-7, AUX-7, SL-1800, SP-75, 7047 mike, mint $850 + shipping. N4ULU, 904-688-8737.

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WANTED: Argonaut 515. Rick Wagner, 3237 Cranleigh, Tallahassee, FL 32308, 904-893-9682.

10 METER Monobanders. Work DX with the Big Guns. Available in 3, 4, 5, 6, 7, and 8 element models. Drake R4C Modifications. Call or write for more information. LTA Industries Inc., P.O. Box 92, Canfield, OH 44406, 216-533-0087.

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1180	RG8U Low loss 100% bonded foil shield 88% tin copper braided shield -per foot	$0.42

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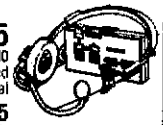

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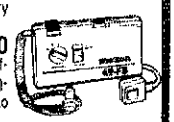

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TALKER $129.90
Record your own message, sequential LED's, audible alarm, superhet, X & K band, city/hwy, with 2 cords and carry case

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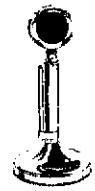
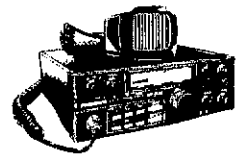


D104 Silver Eagle **$69.90**
Chrome plated base station amateur microphone, factory wired to be easily converted to electronic or relay operation. Adjustable gain for optimum modulation

ETS D104 SE **$84.90**
Same as above with end of transmission Roger Beep.

uniden



25 WATT 10 Meter Transceiver, all mode operation, backlit multi function LCD meter, frequency lock, auto squelch, NB, RF gain, PA, external speaker jack. 7¼Wx9¼Dx2½H.

HR2510 .... **$249.90**
HR2600 .... **$299.90**

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You've bought our replacement batteries before...
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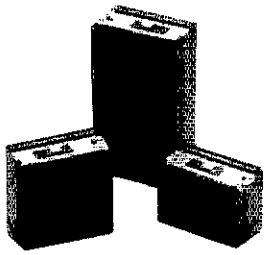

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CM2, PB2 7.2v @ 500MAH
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13.2v @ 1100MAH
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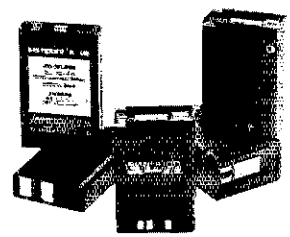

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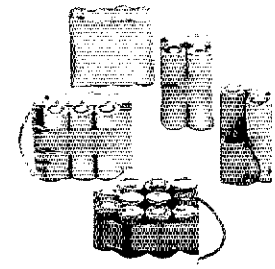

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Completely assembled ready to install, handles 2KW PEP, works all bands 3.5-30MHZ, may be installed in either horizontal or vertical configuration, work 160 by using the antenna in a marconi configuration

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Dual Element 160/80/40, 2KW PEP	41.95
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RG-213 97% Braid, Mil Spec	35¢/ft.
RG-214 Silver Dbl Shield, Mil Spec	150/ft.
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RS7A	48.95	RS35M	148.95
RS12A	67.95	RS50M	214.95
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160 Thru 10M Trap Dipole, Complete	110.95
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Balun 1:1 or 4:1	12.95
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MB-V-A Super Tuner	555.95
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R-390A RECEIVER Parts: Info SASE. CPRC-26 Military Manpack Radio, 6 Meter FM, with Antenna, Crystal, Handset: $22.50, $42.50/pair. CPRC-26 Radio-only: $9.50. Add $4.50/piece shipping, $9 maximum. Baytronics, Box 591, Sandusky, OH 44870.

WANTED: Drake B-1000 Balun. Steve Lare, N8KDV, 824 W. 25th Street, Holland, MI 49423.

ICOM 2AT, MFJ 284 Speaker/Mic, IC-BP3 with new insert and wall charger. All for $165. KA1SKG, 203-568-7856.

JOHNSON Matchbox and RBF-1A Wattmeter. W4OMC, 813-299-2450.

WANTED: Ham Equipment and Other Property. The Radio Club Of Junior High School 22 NYC Inc. is a nonprofit organization, granted 501(c)(3) status by the IRS, incorporated with the goal of using the theme of Ham Radio to further and enhance the education of young people nationwide. Your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax deductible contribution. Meet Joe, WB2JKJ, and two of The 22 Crew at The Knoxville TN Hamfest on May 5, 1989. Made possible by "The Knoxville Honor Roll". Please write us at: P.O. Box 1052, New York, NY 10002. Round the clock hotline: 516-674-4072. Thank you!

WIRE ANTENNA Headquarters—Wire, Coax, Rope, Connectors - Discount Prices, Why pay more? Silver/Teflon(r) PL-259, $12.95/10; Fresh, MilSpec RG-213 ($30/100'), 95% RG-8X ($14/100'), Low-loss 9086 (9913 equivalent) $42/100'. Ladder Line $10/100'. #14 stranded, hard-drawn $7.50/100';¼ mile #18 copperclad $19.95. Long-lasting UV and abrasion resistant Dacron(r) rope: 3/16" black double-braided $10/100'; Guaranteed MilSpec 3/16" green, #700, $9.95/200'. #1 rated 80-10 meter Carolina Windom, $89.95 (December 73, July WorldRadio reviews). 80-10 meter SuperLoop, $75: New 'Current-type(c)' Baluns, numerous models. 12% S&H ($4 minimum). Virginians add tax. MC/Visa. Mention ad receive 56 page catalog free. Radio Works, Box 6159, Portsmouth, VA 23703, 804-484-0140.

COLLINS R390A Receiver, good condition, will ship FOB Connecticut, $125. Want SB303 with AM Filter. AI7Y, 503-382-9162.

ROSS'$$$$ New May Specials: Kenwood TH-215A $309.90, TH-25AT $299.90, TM-721A $609.90, TS-940S/WAT $2059.90, TH-315A $294.90, Butternut HF6V-X $129, HF-2V $121.90, ICOM IC-228H $459.90, U4AT (Micro) $299.90, IC-471A $689.99, IC-471H $999.90, IC-38A/W-HM14 $338.99, O4AT $329.99, Yaesu FT-270RH $304.90, FT-411 $338.90, FV-707DM $242.90, NC-2 $49.90, FT-780 $587.99, FT-727R $349.90, FT-767GX $1645, FT-736R $1499.90. All LTO (Limited Time Offer). Looking for something not listed?? Call or write. Over 8780 ham-related items in stock for immediate shipment. MENTION AD. Prices cash, FOB Preston. Open Mon. 9-2, Tue.-Fri. 9-6, Closed Sat. & Sun. Ross Distributing Company, 78 South State, P.O. Box 234, Preston, ID 83263, 208-852-0830, FAX 208-852-0833.

SALE: Swan-500C w/PS/117X, 10-80M, CW/AM/SSB, clean, needs new finals, $225 you ship. B/W 6-posit. CO-AX SW $8. Model 375. Heath, keyer-only, HD-10, $10. 3 El. Beam, original box, Alliance Rotator w/Control Box and Thrust Bearing Assembly $100 you ship. W4PDT. 904-282-0749.

SOFTWARE Wanted: I want continuously graphed dot dash spacings. TRS-80 in Phil Anderson's 1982 book graphs code spacings continuously. Show me C64 or PC received Morse continuously graphed. I don't want alphanumeric printouts. Bob, N8IJZ, 3509 Leighton, Upper Arlington, OH 43221-1324.

1989 CALLBOOKS: Until 5/25; North American, $25; International, $27. Both, $49. Any four or more, $22. DXCCers Special: 1989 International and 1988 North American, both $30. Postpaid USA. Century Print, 6059 Essex, Riverside, CA 92504-1566, 714-687-5910.

HERO JR. Robot Wanted—Research project. Will pay. Dr. Henry Dobson, K3AKZ, Bloomsburg University, Bloomsburg, PA 17815, 717-389-4024.

SWAN 1040V Ant. Need 10 Meter Trap. Dave Kopel, 1224 Jackson, Denver, CO 80206, 303-333-6723.

FOR SALE: Kenwood TS-530SP w/CW & SSB Filters, exellent condition, $525. Digital VFO230, $75. Randall Kemp, KB1UU, 18 Old Farm Road, Trumbull, CT 06611, 203-372-2026 after 6 PM.

WANTED: Heathkit SB301, SB401 & SB101, working condx or not, state condx and price, will pay freight. Don Straley, K8DEO, 4272 Chippewa Tr., Jamestown, OH 45335.

FOR SALE: Kenwood TS-830S Transceiver with MC50 Microphone, CW Filters, Lowpass Filter, SWR Meter, Dipole Antenna. Excellent condition, $675. N5MHR, 501-885-3886 or 501-968-7989.

ICOM IC28A or IC28H Wanted. Reasonable. Walt Witten, KV3F, 134 Allan Drive, Beaver, PA 15009, 412-728-2975.

ICOM IC-471A 430-450 MHz all mode xcvr., with PS-25, EX-309 interface, mobile mount, CommSpec encoder/decoder. Xcvr. used/mint. Other items new. Ted Tsucalas, 1054 Finn Avenue, Littleton, CO 80124, 303-799-0833.

WANTED: Kenwood 120 or 130 with Kenwood P/S 30A, excellent condition, mike included & manual. Split shipping. "T" Bruno, WA2AET, 48 Sheridan Avenue, Metuchen, NJ 08840, 201-548-9520.

WANTED: Heath HW-5400 still in kit you bought and never built. KB8HG, 359 Stoneharbor, Holland, MI 49424, 616-399-5705.

SALE: MFJ Keyer, Deluxe Model 407-B, with Bencher, black, dual paddle key, $120. C-64, 1541C, MFJ Interface, 1228, with Kantronics, C-64, Hamsoft-Amtor, CW-ASCII-RTTY-Amtor, $300. Like new condition with original boxes. You ship. W4PDI, 904-282-0749.

ROSS'$$$$ Used May Specials: Kenwood TR-9500 $399.90, MC-50 $43.90, TM-411A $299.90, TM-401A/TU-3 $279.90, Collins KWM2 $499.90, 312B-4 $259.90, PM2 $129.90, ICOM 2KL $1395, IC-27H $299.90, IC-471A $589.90. Yaesu FT-901DM/W XF8.9HS, XF8.9HCM $599.90. FT-101E $499.90, FT-101ZD $599.90, YD-148 $25, NC-8A $65, FT-208R $189.90. Looking for something not listed?? Call or write. We have over 235 used items in stock. MENTION AD. Prices cash, FOB Preston. Open Mon. 9-2, Tue.-Fri. 9-6, Closed Sat. & Sun. Ross Distributing Company, 78 South State, P.O. Box 234, Preston, ID 83263, 208-852-0830, FAX 208-852-0833.

CRYSTALS—Build something, Spring is here, Summer ahead - Try QRP crystal portable, mobile on 30M, 10M or 17M. QRP DX is good now. It's easier with crystals - low-cost FT-243's made to your ordered frequencies. 9 MHz doublers to 17M $2.95, five or more $2.50. 30M $2.95, five or more $2.50. 40M fundamentals and multipliers from 40M to 20M, 15M, 10M $2.95, five $1.95 each. 80M $2.95, five $2.50. 160M $4.95, five $3.95. 10M, 12M, 17M overtones $4.95. Airmail 35 cents per crystal. Four stamps or $1 for listings-circuits package, 1700-60000 kilocycles. "Crystals Since 1933" W&LPS, C-W Crystals, Marshfield, MO 65706.

DRAKE TR5, PS75, SL500, NB5, mint, $450. MN-2700, mint, $335. 7077 Mic, $35. CW75 Keyer, excellent, $65. SL300 Filter, $25. Wanted TR7 Service Manual, Extender Cards, SL4000 Filter, Palomar Noise Bridge, Vomax SBP-3C or 4. Jim, WB4ZCD, 606-441-9684.

WANTED: Yaesu FT-757GX Transceiver and Kenwood TM-721A Transceiver. Thomas Walls, 6360 Montgomery Avenue, Philadelphia, PA 19151, 215-878-4032.

MOTOROLA Low Band SYNTOR Mobiles Wanted For Six Meters. N6LDJ, 901 Springfield Drive, Walnut Creek, CA 94598, 415-934-0686.

ESTATE SALE—Drake T4-X/R-4A $250, TR-4 $200, Triton IV $300, Hy-Gain TH-4 $75, Mosley TA-33 $75, 48-Foot Tower $300, Ham TR-44 Rotor $50, Test Equipment and Parts. SASE for complete list. Toni Harsh, 2887 Shasta Road, Berkeley, CA 94708, 415-848-2657.

FOR SALE: Kenwood TS-440S w/AT, $950. PS-50, $150. R-5000 Rcvr., $650. MC-50, $40. MFJ-494 Keyboard, $125. MFJ-482B Keyer, $40. MFJ-814 Wattmeter, $20. Heath IM-2320 DMM, $30. Robert E. White, K9LWA, 2501 Birch Drive, Richmond, IN 47374, 317-935-3966.

WANTED: Kenwood Equipment in excellent condition TM-221A, TH-205AT, SP430, HC-10, SW2000, AT250, SM220. Also Marker Generator, Signal Tracer, Dummy Load and Antenna Noise Bridge. D. Marshall, 110 Rio de Paz, Punta Gorda, FL 33980, 813-629-8187, call after 6 PM anytime on weekend.

ICOM IC-740, IC-730, IC-720A, Service Manuals. $16 each. ICOM FL-32A 500 Hz Filter (used) for IC-735 etc. $30. Art Champagne, KC1NF, 262 Scott Drive, South Windsor, CT 06074.

WANTED—Tek TM-500 Modules: FG-501, 501A, 502; PS-503, 503A; DC-502. Steve, WA7HAA, 2715 N.E. 131st Avenue, Portland, OR 97230, 503-256-3495.

KENWOOD OWNERS: Enjoy the versatility of three tuning speeds in your TS-940, TS-930, TS-440 or TS-430. The Tuning Upgrader adds a new, slower, 2.5 KHz/revolution tuning rate and automatically selects higher-speed tuning rates when you tune faster. Easy to install. Only $34.95 + $5 S/H USA, $13 Elsewhere. International Radio & Computers Inc., 751 South Macedo Blvd., Port St. Lucie, FL 34983, 407-879-6868.

TS-940S OWNERS: Bank Controller 1 allows front panel memory bank control, eliminating need to go to top to slide open hatch each time to change memory bank. Direct plug-in substitution for Voice Synthesizer allows using front panel voice button, stepping thru all four memory banks. Easy to install. Only $24.95 + $5 S/H USA, $13 Elsewhere. International Radio & Computers Inc., 751 South Macedo Blvd., Port St. Lucie, FL 34983, 407-879-6868.

ARRL HANDBOOKS. All editions except 1, 4, 8 and 9. Good condition, $1200. Pierson KE93 Receiver. AC and DC Supplies, $125. Some other equipment, SASE. Bruce Mueller, K6KQT, 730 E. Harmony Lane, Fullerton, CA 92631, 714-992-2086 evenings.

50'S & 60'S Equipment Repair done by semi-retired Broadcast Engineer. Cliff Fleury, AI7Y, 64174 Tumalo Rim Drive, Bend, OR 97701, 503-382-9162.

YAESU FRG-7 Communications Receiver, orig. box & manual $225. K4MYY, 14 Queen Street, Charleston, SC 29401, 803-577-3597.

EXCELLENT National FB-7 with Power Supply and All Meter Crystals. Best offer. Call Steve Giancola, 602-985-7049.

SATELLITE GEAR: Amps - Mirage D1010N, Tokyo HL20U, HL30V; Ants - KLM 22C, 40C, Cushcraft Twins; Hamtronics Transverters, Power Meter, Converters, Preamps; Kenwood Twins R599D, T599D; Yaesu FRG 7700 RX; Astron VS-50 M; SASE for list. Cap Allen, 64 Ptarmigan Lane, Durango, CO 81301.

WANTED—Heath, AT-1, DX-20, DX-35, DX-60. Viking Adventurer. Thomas B. Walker, P.O. Box 67, Lisle, NY 13797, 607-692-2914.

GROUND RADIAL Wire For Verticals Or Slopers: Improves performance, new #16 bare solid copper. Lowest cost, 1000 foot spool, $38 includes shipping. Davis RF, P.O. Box 230-Q, Carlisle, MA 01741, 508-369-1738.

KENWOOD TS-530S For Sale, excellent condition, less than 100 hours great first rig. Have new rig on the way. One owner, manual included. $500 or best offer. I will ship. Call N8BYB, 906-341-6475.

FULL Tech info needed Hammarlund SP-400-X and Radiomarine (RCA) CRM R1A Receivers. K2LQB, 1023 Wool Avenue, Franklin Square, NY 11010.

TEN-TEC, new boxed latest 1989 production models, USA made, 561 Corsair II, 562 Omni V, 586 Paragon Transceivers, 425 Titan 1.5 KW and 420 Hercules II, 1 KW Linear Amplifiers, 238 Antenna Tuner 2 KW, 2510B Satellite Station, 2410, 100 Watt 430-450 Amplifier, Mobile HF Antennas, Keyers, and Accessories, take clean, working ham gear in trade, Visa/MC or check. For best deal, write or phone Bill Step, 704-524-7519, Step Electronics Company, Highway 441, Otto, NC 28763.

WANTED: Electro Voice Model 664 Microphone with stand. Write: Robert Bunar, 26 Sheridan Street, Brockton, MA 02402.

WANTED: Heath-Kit HW-10 or similar VFO for use with HW-16 CW Transceiver. Doug Mottern, KA1CWU, 205 Marie Drive, Dublin, GA 31021, 912-272-7262 after 6 PM EST.

TMC Transmitting Antenna Termination, 300 Ohm - 2.5 KW, (for Rhombic or Beverage Antenna Applications), $150 ea. Carborundum Non-Inductive Power Resistors, 600 Ohm - 900 Watts, 18"L/4"OD, $75 ea. A. Emerald, 8956 Swallow, Ftn. Vly., CA 92708, 714-962-5940.

SOMMER XP-707 Beam, never assembled, $700. Heath SB-300, $75. Dead Heath TX-1, $25. Pick-up only. Mike, W5FTD, Ft. Worth, 817-274-0595 nights.

G5RV Dipole Antenna, new, never used, $28. N1ELC, 5 Robinson Road, Woburn, MA 01801, 617-932-8495.

XCVRS For Sale—Kenwood TS-830S with crystal filters, $650 firm. Atlas 210X with Shure 404C mic. and mobile mount, $275. Heath SB-102 with SB-600 power supply and speaker, $250. All in mint condition. Bill Reeve, WB9DVV, 312-382-2162.

FOR SALE: Drake TR-4 with MS-4 Speaker/Power Supply and Manual. Good working condition, $275. W6KMB, 4143 W. Kelley, Fresno, CA 93722, 209-431-9683.

SIX ROOM Apartment For Rent—Includes Tower and Beam! In Palisades Park, NJ, one of NYC's bedroom communities. Luxury living in modern two family house. Three bedrooms, two bathrooms, formal dining room. Huge rooms. Giant closets. XYL will love it! Includes garage, laundry room, use of back yard, 60' tower with rotor, tribander at 55' and 6 meter beam at 60'. Owner moving to Florida, keeping bldg. Asking $1500. Call Greg, WB2GMK, 201-944-8334.

YAESU FT-1, All Filters, RAM, Keyer, FM, Internal AC upply, in mint shape, $1195. K8CV, 1-313-549-1846.

TOWER, Hygain 37 foot crank up with mast, Explorer 14 beam, Ham 4 rotor, $500. Ed, N1CCO, Guilford, CT, 203-453-8720.

WANT: Collins 75S3B 500 Cy Filter or Rx with Filters, Hy-Gain 5L20 Beams. Sell: Collins 30S1, mint, with extra tube, $1995. Paul Bittner, W0AIH, 1616 South Street, Eau Claire, WI 54701, 715-832-8510.

YAESU FT-980, Filters, Updates, SP-980P, MD-1, Dustcovers, all perfect, $1195. FC-757AT, $250. IC-AT-100, $250. LDA for IC-730, $20. FOB K1LEC, 802-886-8121.

QTH 10 Acres beautiful Waushara County Woods, WI. Secluded and private. Ideal for towers and dishes, has real potential. Call Cy, N9BEW, 715-228-4566.

HAL DS-2000/KSR, IRL FSK-1000. Mint. WA5OXK, 504-392-9101.

FOR SALE: Collins 75S3A, 32S3, both w/tubesters, mike, 312B, 516F, PR.6148 manuals, all $750. KC0BW, 314-677-3350.

WANTED: Ten Tec Signalizer S20/30. Stancor 20P Transmitter. Howard 430-435 Receiver. Gross Transmitter. Collins Pre-1940 Transmitter. Russ Olmsted, K4UJZ, 608 W. Thompson Lane, Murfreesboro, TN 37129, 615-893-5344.

SBE 34 Xcvr., Mike-VOX Service Manual, $120. W8TYK, 513-456-2072.

ANTENNA PARTS Catalog, Lowest Costs: Dipole/Quad/Ground Radial Wire, Insulators, Center Feeds, Open Wire Feed Line Coax, Relays, etc. Catalog: $2. Dipole/Quad Wire: new Hybrid Product, 168 strand copper "Flex-Weave", #14, strong, flexible, non-stretch, won't rust/kink like copper weld. $34 first 275' (minimum), $.12/ft. thereafter, includes shipping. Davis RF, P.O. Box 230-Q, Carlisle, MA 01741, 508-369-1738.

BEAM Headings from DXCC list! Your QTH, $6. N4GDJ, 1666 Ridgewood Street, Port St. Lucie, FL 34952.

WANTED: canvas cover, MT-836, and spares box for R/392, also want R/392 for parts. Robert Prahovic, KA1FZS, P.O. Box 465, 150 Cedar Street, Branford, CT 06405, 203-481-2058.

FOR SALE or Trade for General Coverage Receiver, Kenwood TH41AT 440 MHz Handie Talkie with Charger and Box. Used very little. WB8P, 419-726-0084.

WANTED: Dow Key, Lawson and other old bugs. Smiley White, P.O. Box 5150, Fredericksburg, VA 22403, 703-373-0996 collect. Thank you.

MICROWAVE 100 + Watt Linears and 2C39 Cavities for 2304 MHz, 1296 MHz and 902 MHz. HI-Spec, Box 387, Jupiter, FL 33468, 407-746-5031.

JOBS FOR HAMS

WANTED for summer of 1989. Instructors in Electronics, Ham Radio and Computers. Small boys' science camp in Pennsylvania. Apply: Donald Wacker, P.O. Box 356, Paupack, PA 18451.

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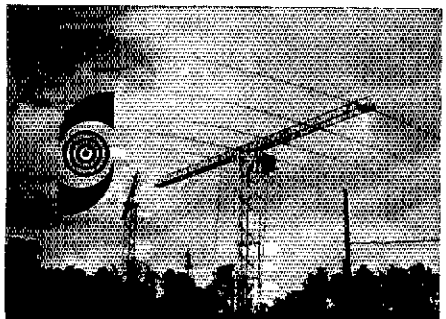
SENIOR Field Engineer: Cellular One Of Galveston seeking technical manager with knowledge of cellular, microwave, telephony. Minimum 3 years experience. FCC/NABER a plus. Relocation required. Resumes to 3128 Broadway, Galveston, TX 77550.



SABRE MODEL 610 LOG PERIODIC ANTENNA

The Sabre Model 610 Log Periodic Antenna covers the frequency range of 10-30 MHz continuous. The unique design which utilizes fore shortening techniques substantially reduces the overall physical size of the array with small sacrifices in operating efficiency. Mechanical features include a triangular truss all aluminum support boom and step tapered element design yielding very high strength/weight ratios. The antenna can be erected using simple hinge up flip over erection techniques without the need for cranes or lifting gin poles. The antenna has been designed to strict military specifications and utilizes stainless steel hardware with locknuts in the boom assembly. The 10-30 MHz continuous coverage provides an ideal antenna system for the avid ham operator.

Available options include guyed or self-supporting towers, complete rotation systems including E.I.A. RS 232 interfaces, rotary joints and erection kits. For further information and complete specifications, please contact Sabre Communications Corporation.

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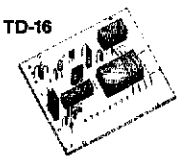
Speaker muting
Repeater control, etc.
Decodes 16 digits
Detects 4 digit sequence
Crystal referenced
12V D.C. @ 20ma

TD-16



KIT: **$44.95***
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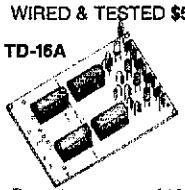
TD-16A



Adds 4 latched outputs to TD16
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Separate on & off codes
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Detects any one of 16 digits
Compact: 1⅜" x ¾" x 5/16"
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5 to 12V. DC. @ 10ma
Generates alert signal or switches external device when tone is detected

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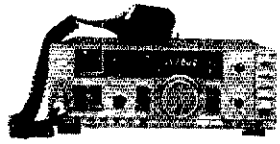

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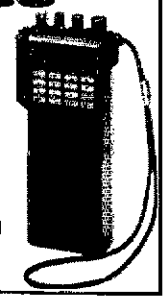

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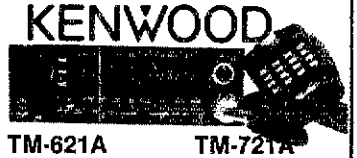

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- 30 Memories

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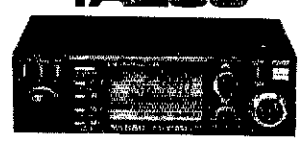

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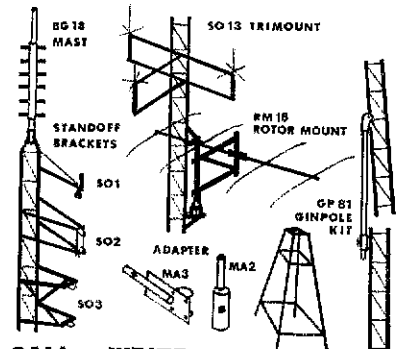

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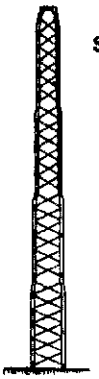

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Model	Height	Ant Load*	Weight	Delivered Price*
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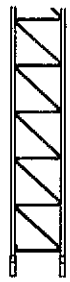
HBX48	48 ft	10 sq ft	303	$539
HBX56	56 ft	10 sq ft	385	$629
HDBX40	40 ft	18 sq ft	281	$519
HDBX48	48 ft	18 sq ft	363	$619

*Your Total Delivered Price Anywhere In Continental 48 States. Antenna Load Based on 70 MPH Wind.

ROHN

Guyed Tower Packages



- World Famous Rohn Quality and Dependability
- Rugged high wind survival-provides safe installation
- Multi purpose towers satisfy a wide range of needs
- Complete packages include: guy hardware, turnbuckles, guy assemblies, w/torq bars, concrete base, rotor plate and top section per manufacturers specs.

Packages shown below are rated for wind zone "B" (86 mph wind). Zone "C" (100 mph wind) design prices slightly higher. All tower packages shipped freight collect from our Plano, TX warehouse, in stock for prompt delivery.

	Model 25G	Model 45G	Model 55G
50'	$769	$1379	$1779
60'	849	1539	1989
70'	1029	1719	2199
80'	1099	2019	2559
90'	1169	2169	2759
100'	1399	2349	2969
110'	1489	2719	3159
120'	1569	2879	3399

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These rugged crankup towers and masts now available from Texas Towers!

Check these features:
- All steel construction
- Hot dipped galvanized
- Totally self-supporting-
- No guys needed

Coax arms, Thrustbearings Masts, Motor drives, Remote controls, Hinged bases, Rotor bases, & Raising fixtures also in stock.

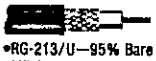
CALL FOR SALE PRICES!

Model	Min.Ht.	Max.Ht.	Ant.load*	Sale price
MA40 mast	21'	40'	10 sq ft	$529
MA550 mast	22'	50'	10 sq ft	969
TX438	22'	38'	18 sq ft	919
TX455	22'	55'	18 sq ft	1385
TX472	23'	72'	18 sq ft	2279
HDX555	22'	55'	30 sq ft	2079
HDX572	23'	72'	30 sq ft	3559

Note-US Towers Shipped Freight Collect From Visalia, CA Factory

**Note-towers rated at 50 mph to EIA specifications*

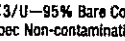
RG-213U



$.36/ft $349/1000 ft. Up to 600 ft via UPS

- RG-213/U—95% Bare Copper Shield
- Mil-Spec Non-contaminating Jacket for longer life than RG8 cables
- Our RG-213/U uses virgin materials.
- Guaranteed Highest Quality!

RG-8X



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- Non-contaminating Vinyl Jacket Foam Dielectric

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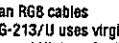

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- Same Specs as Belden 9913
- Lower loss than RG8U
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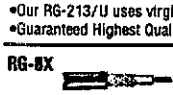

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select connectors below

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Coaxial Cable Loss Characteristics (DB/100 ft)

Cable Type	Imped.	10MHz	30MHz	150MHz	450MHz
RG-213/U	50	.6	.9	2.3	5.2
RG8X	52	.8	1.2	3.5	5.8
9086	50	.4	.64	1.7	3.1
½" Alum	50	.3	.5	1.2	2.2
½" Heliax	50	.2	.4	.9	1.6
⅞" Heliax	50	.1	.2	.5	.9

HELIAX® CONNECTORS

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FK4554	54 ft.	29.1 sq. ft.	1599
FK4564	64 ft.	28.4 sq. ft.	1699

25G Double Guy Kit.....$279.
45G Double Guy Kit.....$299.

*Above antenna loads for 70 mph winds w/guys at hinge and apex. All foldover towers shipped freight prepaid in 48 states. Prices 10% higher west of Rockies.

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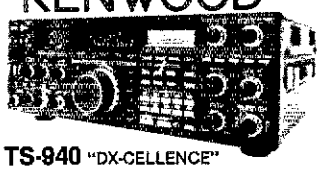

TS-940 "DX-CELLENCE"
- All Band, All Mode Transceiver
- Direct Keyboard Entry
- Engineered for the DX-Minded and Contesting Ham
- Its Got It All!

YAESU

FT-767GX HF/VHF/UHF BASE STATION
- Add Optional 6m, 2m & 70cm Modules
- Dual VFO's
- Full CW Break-in
- Lots More Features

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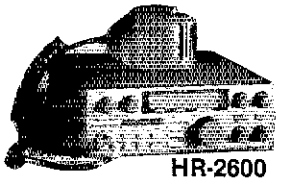
- Built-In Automatic Antenna Tuner and Power Supply
- 99 Memories • 100 W Output
- 160-10M/General Coverage Receiver
- Band Stacking Registers

uniden



HR-2600
- Mobile 10 Meter Transceiver
- SSB/AM/FM/CW
- 25 Watts PEP
- New FM Offsets & PL

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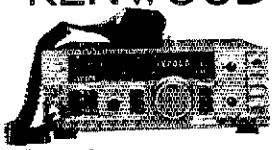

TS-140S AFFORDABLE DX-ing!
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- 100 W Output
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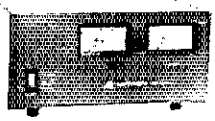

• RS7A $51	• RS35M . . $167
• RS12A . . . $75	• VS35M . . $179
• RS20A . . . $92	• RS50A . . $209
• RS20M . . $112	• RM50M . $235
• VS20M . . $129	• RM50M . $259
• RS35A . . $149	• VS50M . . $245

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- Front Panel DTMF Pad
- 5 Watts Output
- 14 Memories
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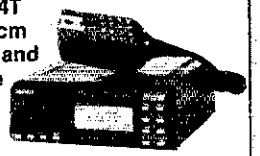

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- 5 Watts on Both Bands
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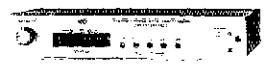

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Whether you're a novice or a veteran, it's a great way to start. And a great way to go.

DX ready. The 747 packs a full 100-watt RF punch on 160 to 10 meters, with continuous receive from 100 kHz to 30 MHz.

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Great receiver. Utilizing a directly-driven mixer, the FT-747GX receiver features superb overload protection. You also get factory-installed narrow CW *and* AM filters. A one-touch noise blanker. All-mode squelch. RIT. And a 20-dB attenuator for local QSOs.

Lightweight construction. Housed in a metallized high-impact plastic case, the FT-747GX weighs in at about 7¼ pounds! With the loudspeaker mounted on the front panel for maximum audio transfer. And internal heatsinking for the transmitter, rated at full power for FM, packet, RTTY, SSTV, and AMTOR when used with a heavy-duty power supply.

Available options. FC-1000 or FC-757AT Automatic Antenna Tuners. FL-7000 500-watt Automatic, Solid-State Linear Amplifier. TCXO-747 Temperature-Compensated Crystal Oscillator. FAS-1-4R Remote Antenna Selector. FRB-757 Amplifier Relay Box. FP-700 Standard Power Supply. FP-757HD Heavy-Duty Power Supply. MMB-38 Mobile Mounting Bracket.

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TH-75A

2m/70cm Dual Band HT

The new TH-75A Dual Band HT from Kenwood is here now! Many of the award-winning features in our dual band mobile transceivers are designed into one hand-held package.

- **Dual Watch** function allows you to monitor both bands at the same time.
- **One watt on 2 meters and 70cm: 5 watts when operated on 12 VDC (or PB-8 battery pack).**
- **Large dual multi-function LCD display.**
- **10 memory channels** for each band stores frequency, CTCSS, repeater offset, frequency step information, and reverse. A lithium battery backs up memories. Two memories for "odd split" operation.
- **Selectable full duplex operation.**
- **Extended receiver range:** 141–163.995 and 438–449.995 MHz; transmit on Amateur band only. (Modifiable for MARS and CAP. Permits required. Specifications guaranteed on Amateur bands only.)
- **Uses the same accessories as the TH-25AT (except soft cases).**
- **Volume and balance controls, plus separate squelch controls on top panel.**
- **Super easy-to-use!** For example, to recall memory channel, just push the channel number!
- **CTCSS encode/decode built-in!**
- **Automatic Band Change (ABC).** Automatically switches between main and sub band when signal is present.
- **Automatic offset selection on 2 meters.**
- **Tone alert system for quiet monitoring.** When CTCSS decode is on, the tone alert will function only when a signal with the proper tone is received.
- **Four ways to scan,** including ***dual memory scan,*** with time operated or carrier operated scan stop modes, and priority alert.
- **Automatic battery saver circuit extends battery life.**

- **Supplied accessories:** Dual band rubber-flex antenna, PB-6 battery pack, wall charger, belt hook, wrist strap, water resistant dust caps.

Optional Accessories

- **PB-5** 7.2 V, 200 mAh NiCd pack for 1.0 W output • **PB-6** 7.2 V, 600 mAh NiCd pack • **PB-7** 7.2 V, 1100 mAh NiCd pack • **PB-8** 12 V, 600 mAh NiCd for 5 W output • **PB-9** 7.2 V, 600 mAh NiCd with built-in charger • **BC-10** Compact charger • **BC-11** Rapid charger
- **BT-6** 6-cell AA battery case • **DC-1/PG-2V** DC adapter • **HMC-2** Headset with VOX and PTT • **SC-22 and SC-23** Soft case • **SMC-30/31** Speaker mics. • **WR-1** Water resistant bag.

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Complete service manuals are available for all Kenwood transceivers and most accessories.