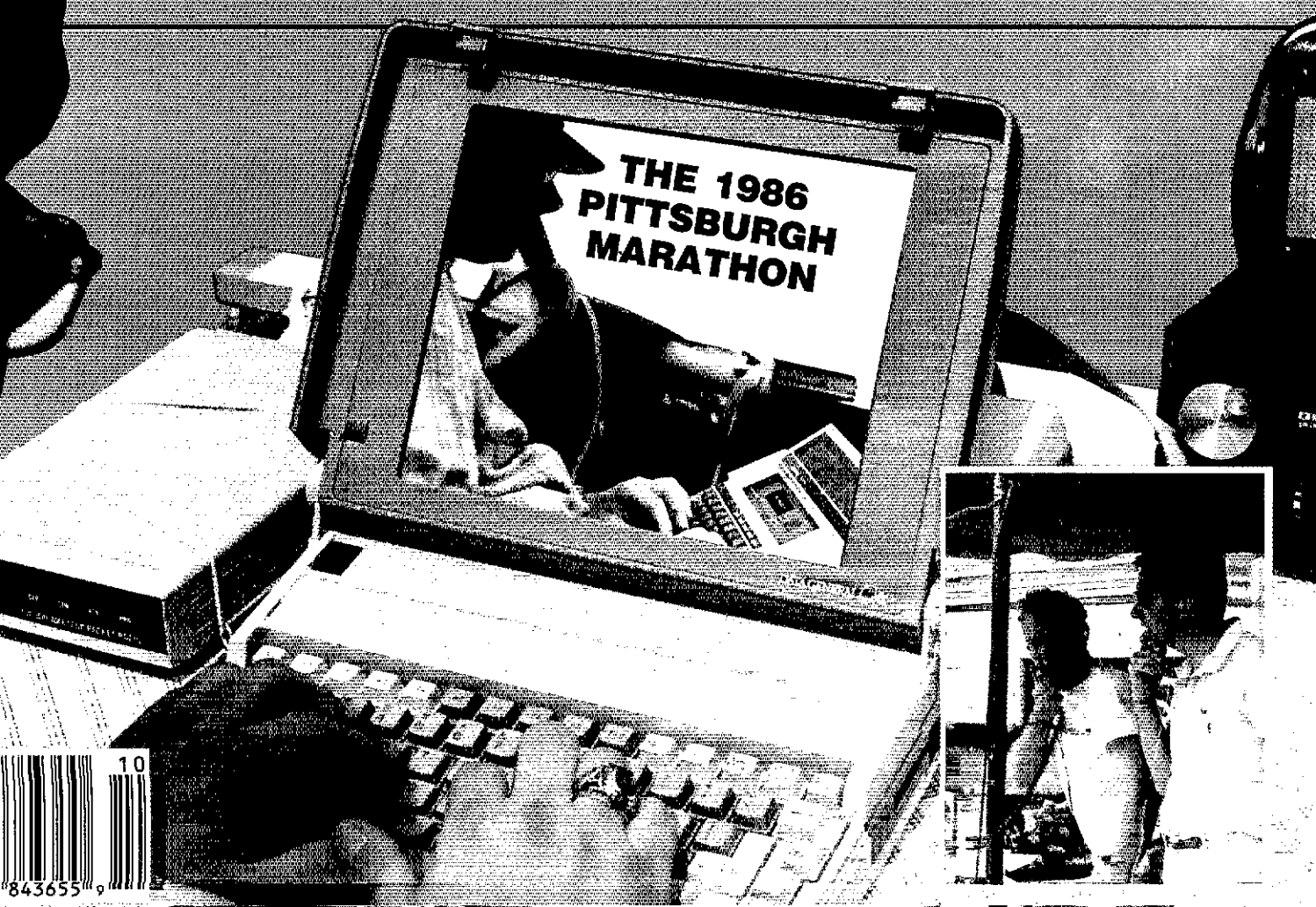
QST

October 1986 $3.00

devoted entirely to Amateur Radio



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the tempo S-15

...a no nonsense radio that provides more power, broader frequency range and simplicity of operation

...the kind of hand held most people want...simple rugged, reliable, easy to use. The S-15 offers a full 5 watts of power...power that extends your range and improves your talk power. Its state-of-the-art integrated circuitry provides fa more reliability and ease of maintenance than conventional circuitry.

Consider these features before you decide on any hand held:

- 5 watt output (1 watt low power switchable)
- 10 MHz frequency coverage: 140-150 MHz (For export only: B version 150-160 MHz, C version 160-170 MHz)
- Electrically tuned stages. Receiving sensitivity and output power are constant over entire operating range.
- Three channel memory. (1 channel permits non-standard repeater offsets. 200 micro amp memory maintenance (standby)).
- A new "easy remove" battery pack
- One hour quick charge battery supplied (450 ma/HR)
- Plug for direct 13.8 volt operation
- Speaker/microphone connector
- BNC antenna connector and flex antenna
- Extremely small and light weight (only 17 ounces).
- Ample space for programmable encoder.
- Fully synthesized
- Extremely easy to operate
- Its low price includes a rubber antenna, standard charger, 450 ma/HR battery (quick charge type) and instruction manual.

OPTIONAL ACCESSORIES: 1 hour quick charger (ACH 15) • 16 button touch tone pad (S 15T) • DC cord • Solid state power amplifier (S-30 & S-80) • Holster (CC 15) • Speaker/mike (HM 15)

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The CS-15 is a fine quality radio with 5 watt output, 10 MHz receiver coverage, is fully synthesized, and is 10 channel internally programmable. It's also sturdy, compact and affordable.

The new Tempo FMH-15S, FMH-44S & FMT-25S (mobile)
...all feature 16 channels, CPU controlled EPROM PLL, CTCSS encode/decode programmable per channel, priority scan to Channel 1, and time-out-timer.

FMH-15S... 138-174 MHz (10 MHz) frequency coverage
1 watt (low)/5 watts (high) RF power output

FMH-44S... 400-512 MHz (20 MHz) frequency coverage
1 watt (low)/4 watts (high) RF power output

FMT-25S... 138-174 MHz (10 MHz) frequency coverage
25 watts RF power output

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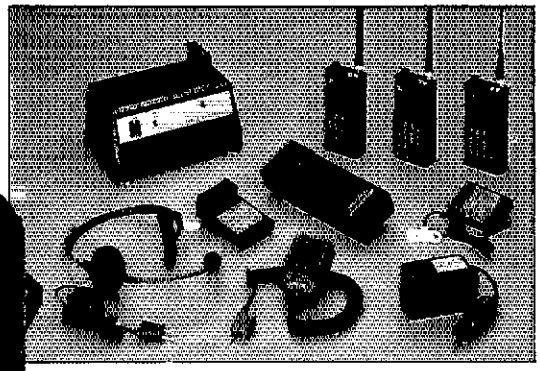
By Popular Demand!

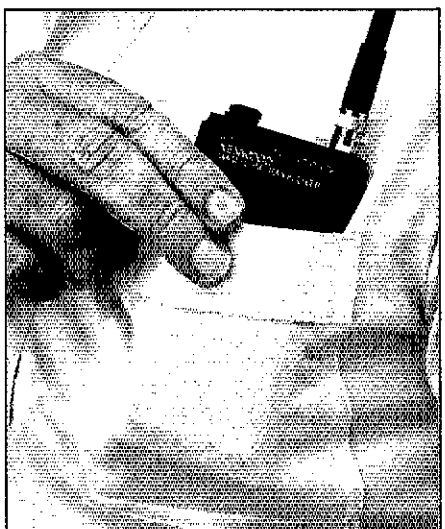
TH-21BT/31BT/41BT

The smallest HT™ is now even better! The new "BT-Series" gives you a plus—a built-in DIP switch programmable CTCSS encoder! Now you can access more than one "private line" over the air! The original TH-21A Series (The Smallest HT™) is still available from the VHF leader—Kenwood!

- **High or low power.** Choose 1 watt high—enough to "hit" most local repeaters; or a battery-saving 150 mW low.
- **Pocket portability!** Kenwood's TH-series HTs pack convenient, reliable performance in a package so small, it slips into your shirt pocket! It measures only 57 (2.24) W x 120 (4.72) H x 28 (1.1) D mm (inch) and weighs 260 g (.57 lb) **with PB-21.**
- **Expanded frequency coverage (TH-21BT/B).** Covers 141.000-150.995 MHz in 5 kHz steps, includes certain MARS and CAP frequencies.
  TH-31BT/B: 220.000-224.995 MHz in 5-kHz steps.
  TH-41BT/B: 440.000-449.995 MHz in 5-kHz steps.

- **Easy-to-operate, functional design.** Three digit thumbwheel frequency selection and top-mounted controls increase operating ease.
- **Repeater offset switch.**
  TH-21BT/B: ±600 kHz, simplex.
  TH-31BT/B: −1.6 MHz, reverse simplex.
  TH-41BT/B: ±5 MHz, simplex.
- **Standard accessories:** Rubber flex antenna, earphone, wall charger, 180 mAH NiCd battery pack, wrist strap.
- **Quick change, locking battery case.** The rechargeable battery case snaps securely into place. Optional battery cases and adapters are available.
- **Rugged, high impact molded case.** The high impact case is scuff resistant, to retain its attractive styling, even with hard use.





Optional accessories:
- **HMC-1** headset with VOX
- **SMC-30** speaker microphone
- **PB-21** NiCd 180 mAH battery
- **PB-21H** NiCd 500 mAH battery
- **BC-2** wall charger for PB-21H
- **BC-6** 2-pack quick charger
- **DC-21** DC-DC converter for mobile use
- **BT-2** manganese/alkaline battery case
- **EB-2** external C manganese/alkaline battery case
- **SC-8/8T** soft cases with belt hook
- **BH-3** belt hook
- **AJ-3** thread-loc to BNC female adapter
- **RA-8A/9A/10A** StubbyDuk antenna
- **TU-6** sub-tone unit (TH-21AT/A only)

More information on the Smallest HT™ is available from Authorized Kenwood Dealers.

KENWOOD

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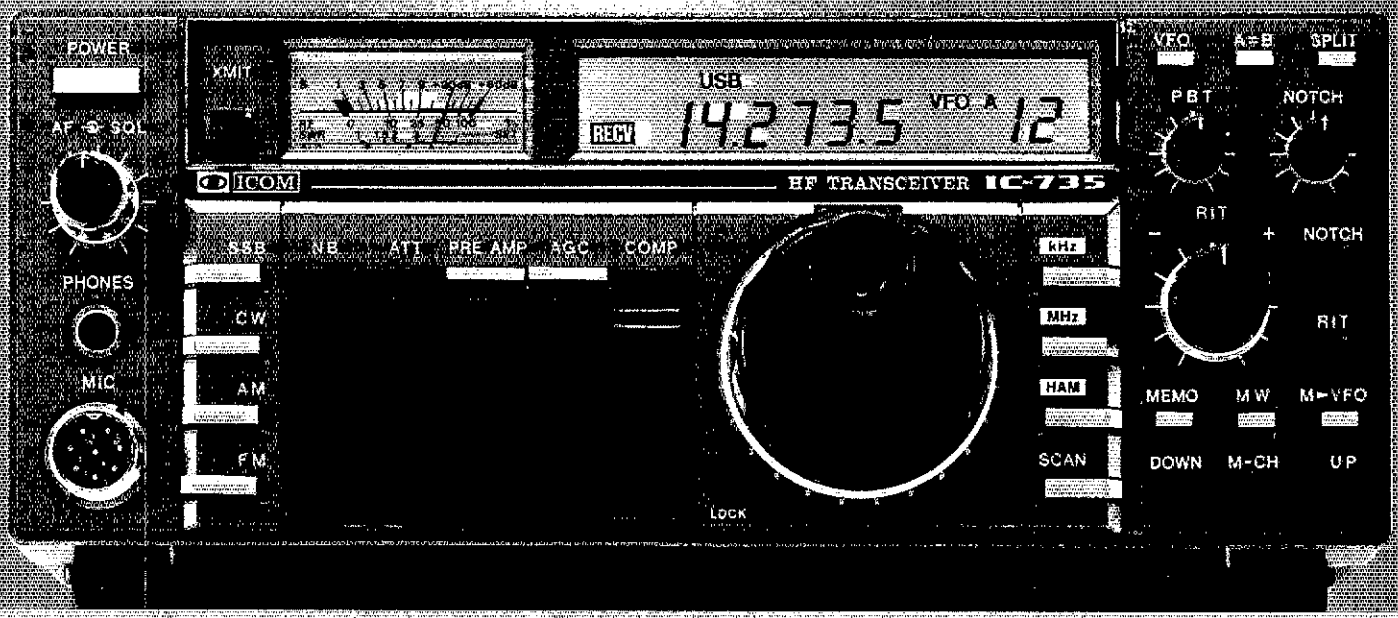
1111 West Walnut Street
Compton, California 90220

TH-series transceivers shown with optional StubbyDuk antenna.
Specifications and prices are subject to change without notice or obligation.
Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.

NEW! ICOM HF radio

IC-735



Ultra-Compact

The new ICOM IC-735 is what you've been asking for...the most compact and advanced full-featured HF transceiver with general coverage receiver on the market. Measuring only 3.7 inches high by 9.5 inches wide by 9 inches deep, the IC-735 is well suited for mobile, marine or base station operation.

More Standard Features

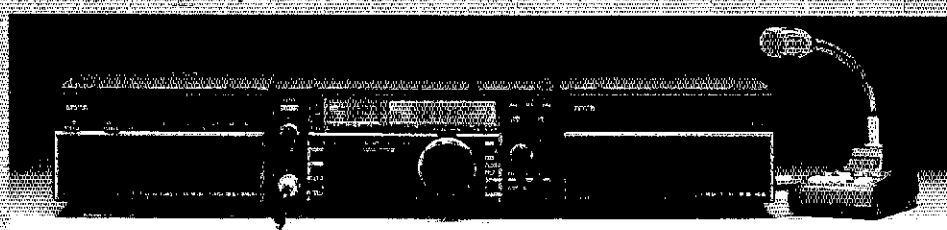
Dollar-for-dollar the IC-735 includes more standard features. FM built-in, an HM-12 scanning mic, FM, CW, LSB, USB, AM transmit and receive, 12 tunable memories and lithium memory backup, program scan, memory scan, switchable AGC, automatic SSB selection by band, RF speech processor, 12V operation, continuously adjustable output power up to 100 watts, 100% duty cycle and a deep tunable notch.

Superior Performance

It's a high performer on all the ham bands, and as a general coverage receiver, the IC-735 is exceptional. The IC-735 has a built-in receiver attenuator, preamp and noise blanker to enhance receiver performance. PLUS it has a 105dB dynamic range and a new low-noise phase locked loop for extremely quiet rock-solid reception.

Simplified Front Panel

The large LCD readout and conveniently located controls enable easy operation, even in the mobile environment. Controls which require rare adjustment are placed behind a hatch cover on the front panel of the radio. VOX controls, mic gain and other seldom used controls are kept out of sight, but are immediately accessible.



Options. A new line of accessories is available, including the AT-150 electronic automatic antenna tuner and the switching PS-55 power supply. The IC-735 is also compatible with most of ICOM's existing line of HF accessories.

See the IC-735 at your authorized ICOM dealer. For superior performance and innovative features at the right price look at the ultra compact IC-735.

ICOM

First In Communications

ICOM America, Inc. 2380-116th Ave NE, Bellevue, WA 98004 / 3331 Towerwood Drive, Suite 307, Dallas, TX 75234

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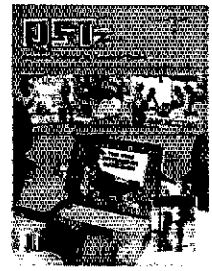

OUR COVER

Area amateurs used four-wheel (and disk) drives to ensure that everything ran smoothly during the 1986 Pittsburgh Marathon. The story begins on page 75. The photos are by Chuck Gessner, KC3ET.

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DEPARTMENTS

Or This Inexpensive

It Really Shouldn't Be This Easy

Remember just a few years ago, how it took a roomful of equipment just to work RTTY. And if you wanted more than one mode it took a dedicated computer system costing thousands of dollars. The new AEA Pakratts are proving it doesn't take lots of equipment or money to enjoy working all bands in five different modes.

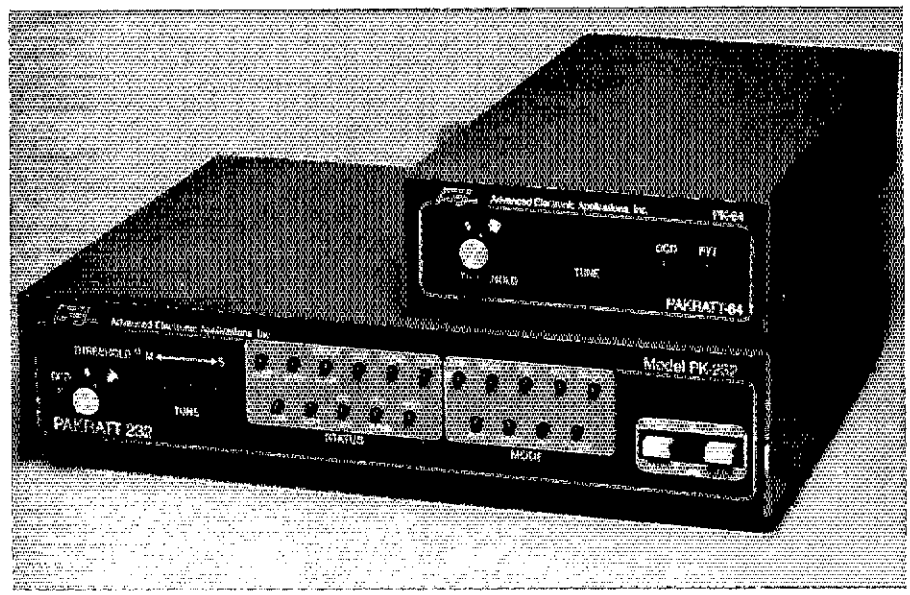
First, A Good Idea

The idea behind the Pakratt is very simple. One controller that does Morse, Baudot, ASCII, AMTOR, and Packet, and works both HF and VHF bands. Of course the decoding, protocol, and signal processing software must be included in the unit, and connection to the computer and transceiver have to be easy. The unit also has to be small and require only 12 volts, so it will work both in the shack and on the road.

Second, Computer Compatible

It doesn't matter what kind of computer you have, we have a Pakratt for you. The PK-64 works with the popular Commodore 64 or 128, and the PK-232 works with any other computer or terminal that has an RS-232 serial port. The PK-64 doesn't require any additional programs. Simply connect to the computer and transceiver and you're on the air. The PK-232 needs a terminal or modem program for your computer. The one you're using with your telephone modem will work just fine.

PAKRATT™ Model PK-64



PAKRATT™ Model PK-232

Third, Performance and Features

The real measure of any data controller is what kind of on-air performance it gives. While the PK-64 and PK-232 use different types of modems, both give excellent performance on VHF. The optional HF modem of the PK-64 uses independent four-pole Chebyshev filters for both Mark and Space tones, and A.M. detection. The HF option can be factory or field installed.

The PK-232 uses an eight-pole bandpass filter followed by a limiter discriminator with automatic threshold correction. The internal modem automatically selects the filter parameters, CW Fc = 800 Hz, BW = 200 Hz; HF Fc = 2210 Hz, BW = 450 Hz; VHF Fc = 1700 Hz, BW = 2600 Hz.

The PK-64 uses on screen indicators to show status, mode, and DCD (Data Carrier Detect) while the PK-232 uses front panel indicators. Both units use discriminator style tuning for HF operation. And that's just the tip of the iceberg. Features like multiple connects on packet, hardware HDLC, CW speed tracking, and other standard AEA software features are included in both the PK-64 and PK-232.

Fourth, AEA Quality and Price

Not many manufacturers like to discuss quality and price at the same time. AEA thinks you want high quality and low price in any product you buy, so that's what you get with the Pakratts. Ask any friend who owns AEA gear about our quality. The people who buy our products are our best salespeople. As for price, the PK-64 costs $219.95, or $319.95 with the HF option. The PK-64A, an enhanced software unit with a longer flexible computer cable, costs $269.95 or $369.95 with the HF option. The PK-232 costs $319.95 with the HF modem included. All prices are Amateur Net and available from your favorite amateur radio dealer. For more information contact your local dealer or AEA.

Prices and specifications subject to change without notice or obligation.

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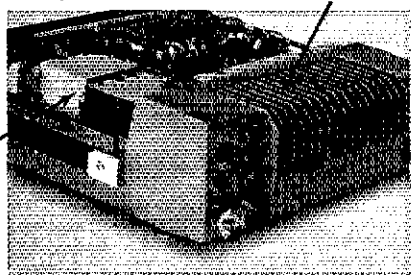
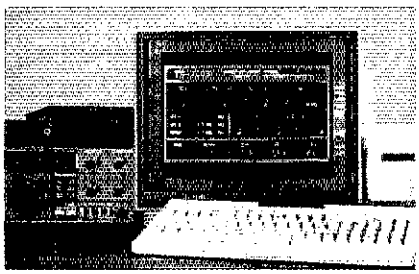
"DX-citing!"

TS-440S Compact high performance HF transceiver with general coverage receiver

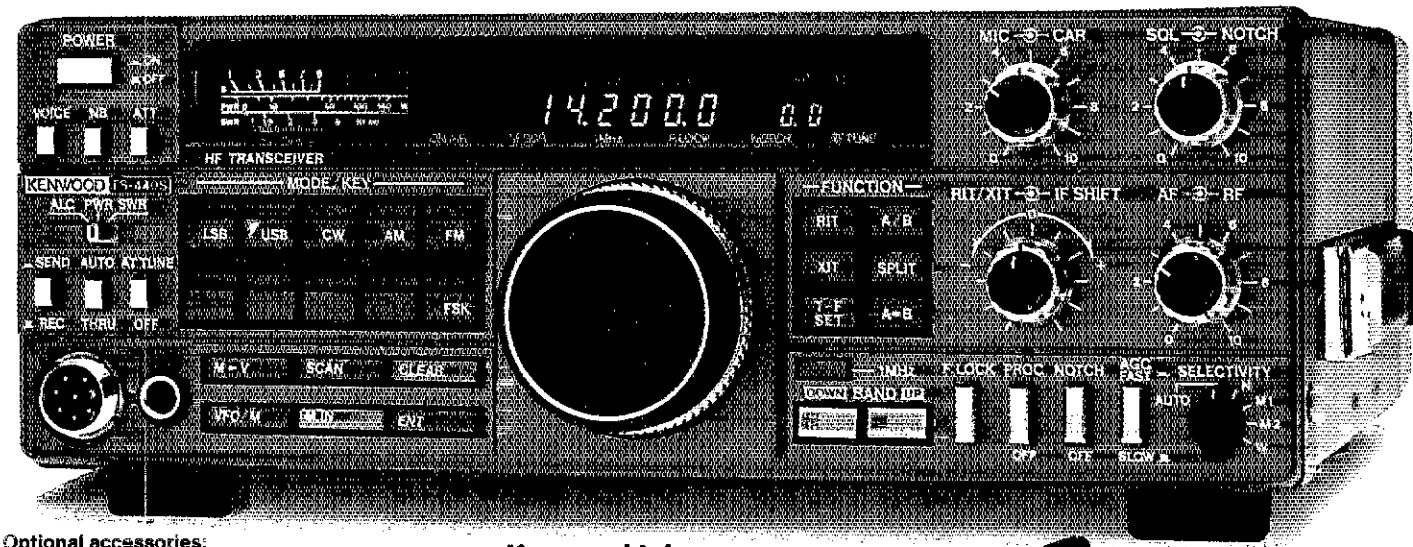
Kenwood's advanced digital know-how brings Amateurs world-wide "big-rig" performance in a compact package. We call it "Digital DX-citement"—that special feeling you get every time you turn the power on!

- **Covers All Amateur bands**
  General coverage receiver tunes from 100 kHz—30 MHz. Easily modified for HF MARS operation.
- **Direct keyboard entry of frequency**
- **All modes built-in**
  USB, LSB, CW, AM, FM, and AFSK. Mode selection is verified in Morse Code.
- **Built-in automatic antenna tuner (optional)**
  Covers 80-10 meters.
- **VS-1 voice synthesizer (optional)**
- **Superior receiver dynamic range**
  Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range. (500 Hz bandwidth on 20 m)
- **100% duty cycle transmitter**
  Super efficient cooling permits continuous key-down for periods exceeding one hour. RF input power is rated at 200 W PEP on SSB, 200 W DC on CW, AFSK, FM, and 110 W DC AM. (The PS-50 power supply is needed for continuous duty.)
- **Adjustable dial torque**
- **100 memory channels**
  Frequency and mode may be stored in 10 groups of 10 channels each. Split frequencies may be stored in 10 channels for repeater operation.
- **TU-8 CTCSS unit (optional)**
  Subtone is memorized when TU-8 is installed.
- **Superb interference reduction**
  IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and optional filters fight QRM.
- **MC-42S UP/DOWN mic. included**
- **Computer interface port**



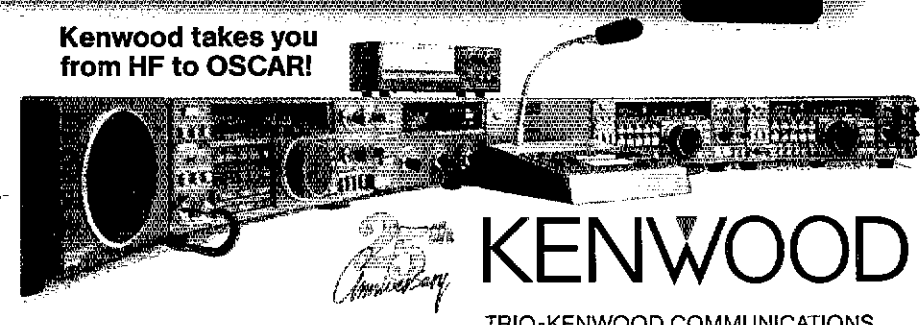


- **5 IF filter functions**
- **Dual SSB IF filtering**
  A built-in SSB filter is standard. When an optional SSB filter (YK-88S or YK-88SN) is installed, **dual** filtering is provided.
- **VOX, full or semi break-in CW; AMTOR compatible.**



Optional accessories:
- AT-440 internal auto. antenna tuner (80 m—10 m)
- AT-250 external auto. tuner (160 m—10 m)
- AT-130 compact mobile antenna tuner (160 m—10 m) • IF-232C/IC-10 level translator and modem IC kit • PS-50 heavy duty power supply • PS-430/PS-30 DC power supply • SP-430 external speaker • MB-430 mobile mounting bracket • YK-88C/88CN 500 Hz/270 Hz CW filters • YK-88S-88SN 2.4 kHz/1.8 kHz SSB filters • MC-60A/80/85 desk microphones • MC-55 (8P) mobile microphone • HS-4/5/6/7 headphones • SP-40/50 mobile speakers • MA-5/VP-1 HF 5 band mobile helical antenna and bumper mount • TL-922A 2 kw PEP linear amplifier • SM-220 station monitor • VS-1 voice synthesizer • SW-100A/200A/2000 SWR/power meters • TU-8 CTCSS tone unit • PG-2C extra DC cable.

Kenwood takes you from HF to OSCAR!



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

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Connecticut — John T. Ronan, K3ZJJ, 114 Old Redding Rd, Weston 06883
Eastern Massachusetts — Luck Hurder, KY1T, PO Box LL, North Eastham 02651 (617-255-2029)
Maine — Clevis O. Laverty, W1RWG, 17 Fair St, Norway 04268 (207-743-2353)
New Hampshire — William Burden, WB1BRE, 11 Briand, Nashua 03063 (603-882-0021)
Rhode Island — John Vota, WB1FDY, 41 Brookside Ave, Centerdale 02911 (401-231-1934)
Vermont — Frank I. Suitor, W1CTM, 727 North Ave, Burlington 05401 (802-863-5907)
Western Massachusetts — R. Donald Haney, KA1T, RD 1—Box 237, Myrick La, Harvard 01451 (617-772-4126)

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Nevada — Joseph D. Lambert, W8IXD, PO Box 1201, Boulder City 89005 (702-294-0505)
Pacific — Army Curtis, AH6P, PO Box 4271, Hilo, HI 96720 (808-935-8693)
Sacramento Valley — Robert H. Watson, W6IEW, 10994 Clinton Bar Rd, Pine Grove, CA 95665 (209-223-0101
San Francisco — Robert Odell Smith, NA6T, 320 Park St—PO Box 1425, Fort Bragg, CA 95437 (707-964-4931)
San Joaquin Valley — Charles P. McConnell, W6DPD, 1658 W Mesa Ave, Fresno, CA 93711 (209-431-2038)
Santa Clara Valley — Glenn Thomas, WB6W, 554 Simas Dr, Milpitas, CA 95035 (408-263-9450)

Roanoke Division
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South Carolina — James G. Walker, WD4HLZ, Rte 1, Box 5395, Marion 29571 (803-423-3645)
Virginia — Claude E. Feigley, W3ATO, 135 The Main—RR #1, Williamsburg 23185 (804-253-0658)
West Virginia — Karl S. Thompson, K8KT, 5303 Pioneer Dr, Charleston 25312 (304-776-4352)

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New Mexico — Joe Knight, W5PDY, 10408 Snow Heights Blvd, NE, Albuquerque 87112 (505-299-4581)
Utah — James R. Brown, NA7G, 865 Manchester Rd, Kaysville 84037 (801-544-0056)
Wyoming — Richard G. Wunder, WA7WFC, Box 2807, Cheyenne 82003 (307-634-7385)

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Georgia — Edmund J. Kosobucki, K4JNL, 5525 Perry Ave, Columbus 31909 (404-322-2856)
Northern Florida — Royal V. Mackey, N4ADI, 161 Shell Point W, Maitland 32751 (305-644-5905)
Southern Florida — Richard D. Hill, WA4PFK, 3800 SW 11th St, Ft. Lauderdale 33312 (305-583-6932)
West Indies — Alberto L. Valldejuli, WP4CSG, V-11 19 St, Berwind Estates, Rio Piedras, PR 00924

Southwestern Division
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Los Angeles — Eugene R. "Bob" Poole, AJ6F, 2059 Reynosa Dr, Torrance, CA 90501 (213-326-2801)
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 — Byron W. Looney, K6FI, 6540 Buckley Dr, Cambria, CA 93428 (805-927-8733)

West Gulf Division
Northern Texas — Phil Clements, K5PC, 1313 Applegate La, Lewisville 75067 (214-221-2222)
Oklahoma — William E. Goswick, K5WG, 12717 S. 124th E. Ave, Broken Arrow 74011
Southern Texas — Arthur R. Ross, W5KR, 132 Sally La, Brownsville 78521 (512-831-4458)

THE AMERICAN RADIO RELAY LEAGUE, INC

The American Radio Relay League, Inc, is a noncommercial association of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communications in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

ARRL is an incorporated association without capital stock chartered under the laws of the State of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1954. Its affairs are governed by a Board of Directors, whose voting members are elected every two years by the general membership. The officers are elected or appointed by the Directors. The League is noncommercial, and no one who could gain financially from the shaping of its affairs is eligible for membership on its Board.

"Of, by, and for the radio amateur," ARRL numbers within its ranks the vast majority of active amateurs in the nation and has a proud history of achievement as the standard-bearer in amateur affairs.

A bona fide interest in Amateur Radio is the only essential qualification of membership; an Amateur Radio license is not a prerequisite, although full voting membership is granted only to licensed amateurs in the US and Canada.

Membership inquiries and general correspondence should be addressed to the administrative headquarters at 225 Main Street, Newington, CT 06111 USA
Telephone: 203-666-1541 Telex: 650215-5052 MCI.
MCI MAIL (electronic mail system) ID: 215-5052

Canadian membership inquiries and correspondence should be directed to CRRL Headquarters, Box 7009, Station E, London, ON N5Y 4J9, tel 519-225-2188.

"It Seems to Us ..."

Those New Bands

Back in 1979, the nations of the world held a major international conference in Geneva, Switzerland. The conference, among other decisions relating to the use of the radio spectrum, determined that radio amateurs had earned new bands near 10, 18 and 24 MHz—and in the Americas, another new band at 902 MHz.

In the United States, we gained access to the new 10-MHz band in 1982. We got the 24- and 902-MHz bands last year. And on July 2, ARRL requested that amateurs be granted access to the 18-MHz band based on evidence that domestic Fixed Service operations in the band had been shifted elsewhere. It has since developed that the request was somewhat premature, but it may yet be possible for the government to permit some limited access in advance of the "official" date for full access of July 1, 1989.

We fought long and hard, prior to and during 1979, for these new allocations. How have they enhanced Amateur Radio? The answer is, not as much as they should. Tens of thousands of man-hours, and hundreds of thousands of dollars, were spent by the ARRL and its sister organizations in other countries in defense of the Amateur Radio position—not only to gain the new bands, of course, but also to protect existing ones. Despite that enormous investment, however, we've been a bit slow to take advantage of our new-found flexibility.

Part of the reason, to be sure, is that the first band we were able to use in the US—10 MHz—came with strings attached. We could operate in that 50-kHz-wide segment, but only if we avoided interfering with the primary Fixed Service. The US government and some of our neighbors have kindly moved the Fixed Service out of the band, so it's more useful in North America than it might otherwise be. But we still must be careful, and for that reason the ARRL and other Amateur Radio organizations worldwide have pledged to avoid competitive activities there. The FCC, with ARRL support, limits use of the 10-MHz band to 200 watts output, A1A and F1B emissions, General class and higher.

So, if you're primarily a contest operator or awards chaser, ten megs won't hold much interest to you. But if you're a CW or RTTY ragchewer or traffic handler and you're not taking advantage of the band, shame on you! That goes double if you complain about QRM on 40 or 20 meters during contest weekends or DXpeditions; here's a band that's ideally suited to your interests, and if you're not using it you have only yourself to blame.

The "competitors keep out" sign that hangs on 10 MHz does not necessarily apply to the other new bands (contest rules do not yet permit 24 MHz contacts, but awards credits are permitted), so one would expect activity there to be noticeably greater. For some reason, it isn't—despite the widespread availability of transceivers covering all of the new HF bands. At 24 MHz (actually, the band is closer to 25) we have a nice 100-kHz slice of spectrum space where one seldom hears more than a few signals. During Field Day, the hardy souls who set up for operation there quickly ran out of people to work. Being a lower frequency than the popular 10-meter band, 24 MHz is open appreciably more of the time. But, most of those who venture there seem to be making do with makeshift antennas—hardly necessary when one considers that a half-wave is less than 20 feet at this frequency—and are not getting its full benefit. Surely we're not all going to wait for the next sunspot maximum to add 24 MHz to our repertoire! The band is too useful to suffer that fate. About all that can be said for our use of the band to date is that it's already far greater than the Fixed Service ever made of the allocation. If you have TVI problems you have a special reason to be interested in 24 MHz: It has no harmonic relationship to any television channel below channel 7!

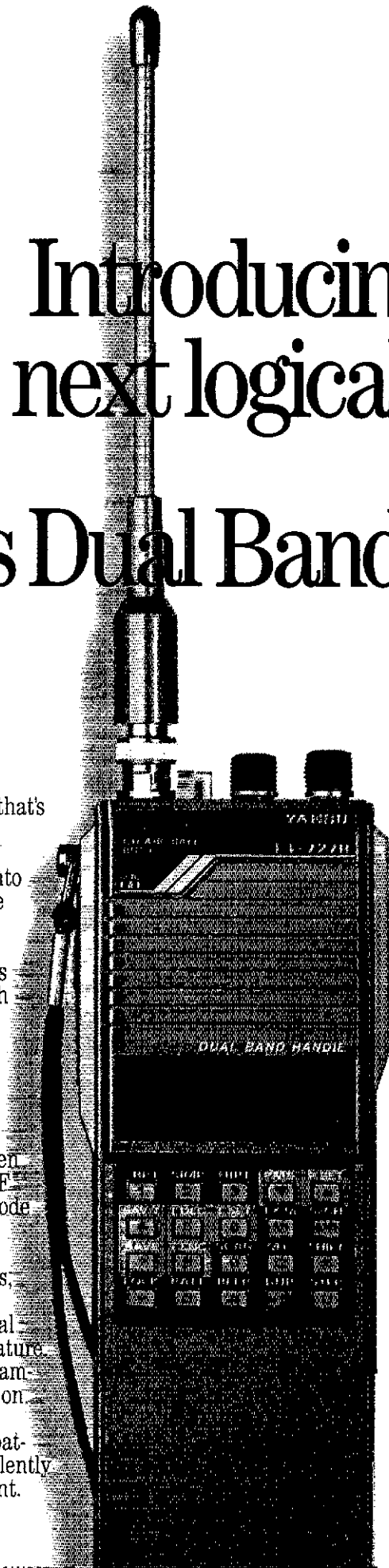
If your excuse for not getting on 24 is sunspots, you'll have to find another one to justify ignoring 18 MHz when it becomes available. A glance at the propagation charts shows many examples of the MUF falling somewhat short of 21 MHz, but being above 18. The latter band should be ideal for taking some of the load from our overworked 20-meter allocation, even during a sunspot minimum. It's too early to predict when US amateurs may join their counterparts in some 57 other countries who are already enjoying the band, but it's not too soon to address the antenna problem. Rotatable antennas are entirely practical for the bands above 10 MHz, but coming up with designs that will cover them all as well as the popular triband Yagi covers 20, 15 and 10 meters is a formidable challenge—as shown by our 1984 Antenna-Design Competition.

And what about 902? Considering the lack of commercial equipment designed for amateur operation in the band, we're not doing too badly. Quite a number of 902-MHz contacts were made in the June VHF QSO Party, and we've already heard of some noteworthy homebrewing of equipment and antennas. Some conversions of commercial land mobile and point-to-point gear have been made, mostly for FM repeater operation, and a number of transceivers designed for the Japanese Personal Communications Service have been put to use. The ATV community has shown some serious interest in the band, which is proving to provide better propagation than the 1240-MHz allocation. We expect the next edition of the ARRL *Repeater Directory* to show quite an increase from the 10 listings of the current edition.

If you're already active on one or more of the new bands, good for you! Talk it up at club meetings and on your excursions into the "traditional" bands, and you may win some converts!—*David Sumner, K1ZZ*

Introducing the next logical step.

Yaesu's Dual Band Handie.



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Prices and specifications subject to change without notice.

UP FRONT in QST

Gathering of VECs: The FCC recently hosted a second conference of Volunteer Examiner Coordinators, this time in Washington, DC on August 8, to discuss the status of the VE Program and plans for the future. The first meeting was held last year in Gettysburg, Pennsylvania. FCC's Chief of the Special Services Division, Ray Kowalski (shown at podium), hosted the conference and led the discussion. Kowalski's division oversees the Personal Radio Branch, of which the Amateur Service is a part. Chief concern among attendees was the transfer of the maintenance of written element question pools from the FCC to VECs (see related item, this page).

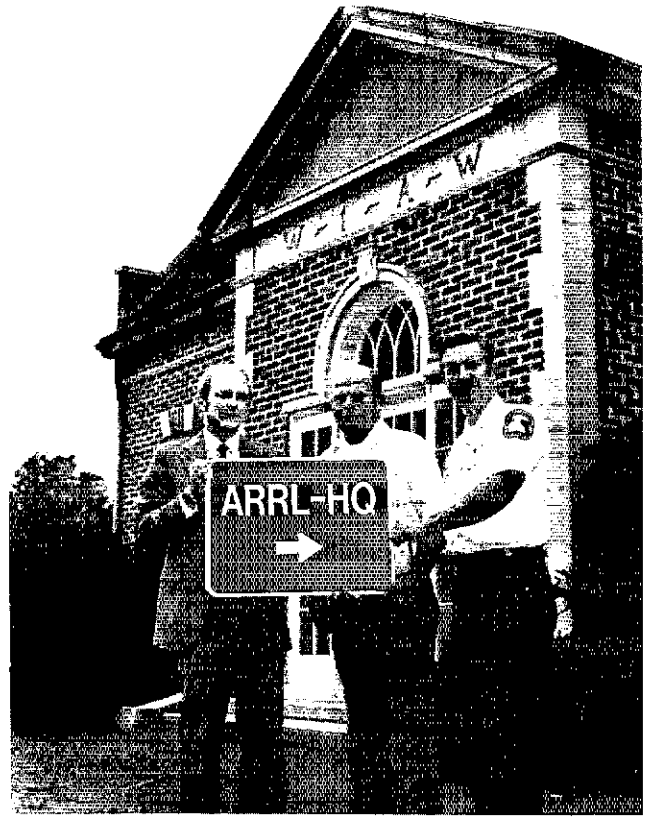
JAS-1 Achieves Orbit

Japan's radio amateurs have officially joined the space race. On August 12, Japan's first amateur satellite, JAS-1 (now called Fuji-OSCAR 12, or FO-12), rode into space and into its planned circular orbit around earth. Fuji is available for use on CW, SSB and packet. See this month's Amateur Satellite Communications column for details on this historic launch.

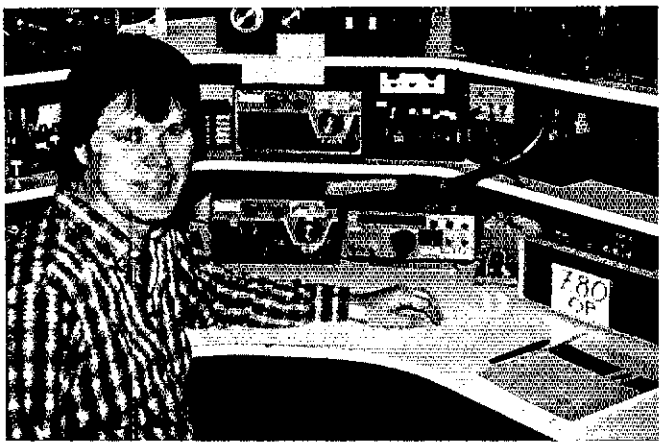
FCC Wants out of the Question Pool

Those who give Amateur Radio exams, not the FCC, should be responsible for maintaining the exam questions, according to a recent FCC Report and Order. For this reason, the FCC wants to turn over question-pool responsibility to Volunteer Examiner Coordinators. It's another step toward what the Commission calls the "privatization of examination functions" for the Amateur Service. See this month's Happenings for the applicable Part 97 changes.

Return of the JOTA: Recruiting young people into Amateur Radio doesn't have to be all work and no play. Why not invite some local Scouts into your shack during this year's Jamboree on the Air, October 18-19, and let them see just how much fun Amateur Radio can be? BSA HQ station K2BSA in Dallas and World Scout HQ station HB9S in Switzerland will be on the air looking for you. Frank Donahue, W3QNI (right), of Bethel Park, Pennsylvania, took part in last year's JOTA, much to the delight of Scout Troop 968, whose members were able to talk with hams and other Scouts across the country. Operating times and frequencies appear in this month's Contest Corral.



Follow the Arrow: Finding your way to ARRL HQ is a lot easier now, thanks to the efforts of Newington, Connecticut officials. Some time ago, ARRL Executive Vice President Dave Sumner, K1ZZ (left) asked Lt Bill Webster (center) and Chief of Police Tom Ganley to help in the directing of visitors to ARRL HQ. They gladly responded with seven of these signs, which have been put up by the town on major roads leading into Newington. For more information on visiting HQ, drop us a line or give us a call.



Look, No Hands: This past Field Day was a unique event for Larry "Tree" Tyree, N6TR. The Beaverton, Oregon ham may have been the first to use a completely automated, computer-operated Amateur Radio station during FD. He used a Z80-based computer and some experimental software that ran a TS-430 transceiver powered by a car battery. The software tunes the receiver, locates the station to call, completes the QSO, prints out a record of the contact and continues to scan for a new QSO. Larry didn't score many QSOs (even computers can't overcome bad conditions), but he did learn enough to make some improvements to his system. What was Larry doing while his computer was working? Pulling weeds in the garden and listening over the UHF link!

Highway Hypnosis: While motoring through VE1-land last June, Pete Pollock, NA1G, says he found out how RSTs are distributed in Canada. According to Pete, some of these trucks carry 579s, by far the most popular, to hams in New Brunswick. Others carry 599s to local DXers, who use most of them. Anything below 559 must be special ordered and is sent via the mail.

The League's Year in Review

Interested in how your membership dues were spent last year? You can get a copy of the 1985 *ARRL Annual Report* from HQ for $1, postage paid. In it you'll find reports from ARRL Officers, the Board of Directors and the HQ staff, as well as detailed financial statements.

Badge of Honor: What better way to let others know what official role you play in the ARRL Field Organization than to sport one of these badges on your lapel? They're available as part of the newly created ARRL Call-Sign Badge Program. For information on ordering your badge or how you can get involved with the ARRL Call-Sign Badge Program, contact your Section Manager (listed on page 8 of *QST*) or see the article on page 46 of July 1986 *QST*.

Calling All Young Artists

If you're an artist between the ages of 8 and 18 and have an interest in electronics, here's an opportunity you won't want to miss. We'd like you to showcase your talent and originality in our national art contest. And, if your entry is one of the winners, your artwork will be forwarded to a worldwide contest for judging. Our contest features awards along with the possibility of national and international recognition for you.

The ARRL is sponsoring a national art contest with the theme "Youth in Amateur Radio." It is a wide-open theme, which allows you to use your imagination in the following mediums: photographs, drawings, paintings and other illustrations (excluding written text). You choose the medium; all we ask is that no artwork be larger than 11 × 14 inches.

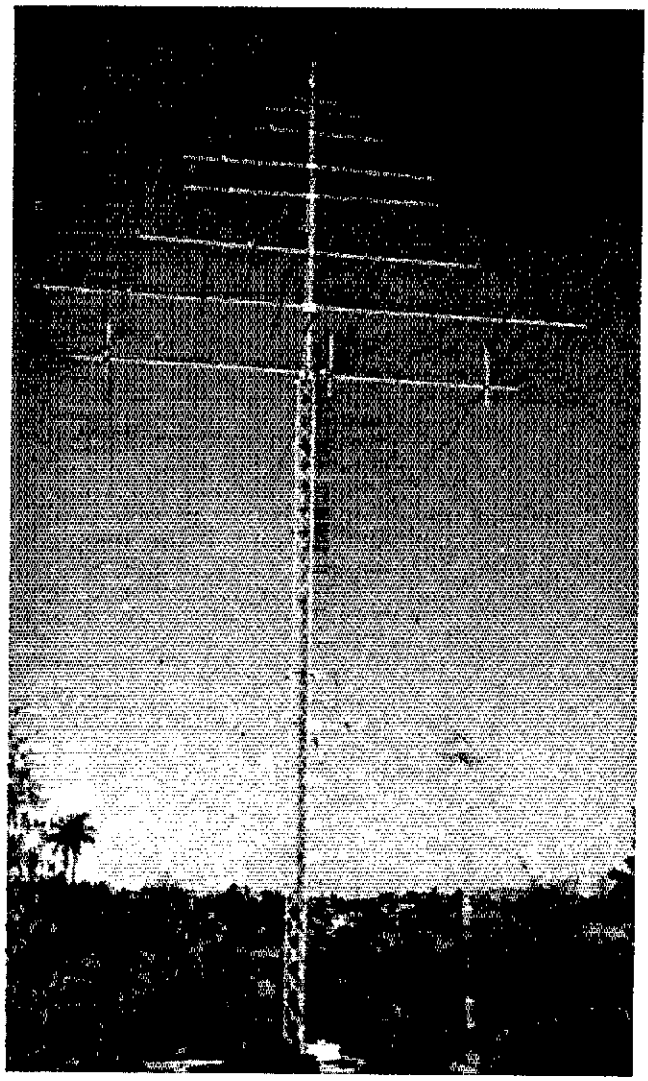
There are three age categories, and a first, second and third prize will be awarded for each one. They are: Group 1—ages 8-12, Group 2—ages 13-15, Group 3—ages 16-18. Forthcoming issues of *QST* will announce winning entries and awards. Winning entries and other entries deemed appropriate will be forwarded to the "Youth in Electronics" contest being sponsored by the International Telecommunication Union, Geneva, Switzerland.

Every contest needs some rules:

- All entries must be received at ARRL HQ no later than February 1, 1987.
- Entrants must be League members or be sponsored by a League member. (If you don't know any members, write to ARRL for a list of possible sponsors.)
- Each entry must be accompanied by a completed application form (available from ARRL).
- Each entry must be the original creation of the entrant.
- Entries become the property of ARRL, and cannot be returned.
- Artwork must be no larger than 11 × 14 inches.

We're looking for your impression of Amateur Radio—any way you see it. Send for an application today to American Radio Relay League, Dept Y, 225 Main St, Newington, CT 06111.

Good luck in the contest!



Sky High: Terry Dubson, W6MKB, of Escondido, California, doesn't have much trouble getting his signal out these days—23 cm through 80 meters! The performance and height (196 feet) of his antenna system are impressive enough, to be sure. But what's even more impressive is the fact that Terry, a mechanical engineer for Hewlett-Packard, designed and built the system himself, from the ground up! By the way, that's Terry giving us a "high five" near the top, and his house at the bottom of the photo.

Call for Messy Shacks

Is your shack a tangle of wires and equipment, a navigational nightmare—10 pounds of ham paraphernalia stuffed into a 5-pound shack? Why not capture it on film and enter *QST*'s Messiest Shack Photo Contest? The rules are simple. Aside from being an unofficial disaster area, your shack must be operational, not just a collection of junk or piles of paperwork. And no fair staging the photo. Be sure to include your name and call and some details about your shack. Winning photos will be used to clutter up a future issue of *QST*. The deadline for submissions is December 31, 1986. Send your entry to Messiest Shack Photo Contest, ARRL, 225 Main St, Newington, CT 06111. Sorry, the photos become the property of ARRL and can't be returned.

Trivia Quiz Answer

Last month, we asked you who authored *The Amateur's Code* and what two League positions he held. The author is none other than Paul M. Segal, W3EEA (ex-9EEA). Paul was Rocky Mountain Division Director from 1924 to 1931 and ARRL General Counsel from 1928 to 1961. He became a Silent Key in 1968. Although he authored the six "commandments" nearly 60 years ago, the *Code* holds just as true today. *The Amateur's Code* has appeared in the ARRL *Handbook* since 1929.

Want to QSO a Robot?

A robot station, IY4M, is now operating on 28,195 kHz. To contact IY4M, listen for the beacon sending "IY4M Robot QRV." Send your call twice, being careful not to leave any extra space between characters. If the robot hears you, it will ask for a signal report, then send you a report and a greeting in English or one of several other languages.

Operation Jungle: These modest accommodations served as a ham shack for Jim Farrior, W4FOK (top photo), during his stay in the jungles of Guatemala earlier this year. He was asked to join in a dig at a Maya archaeological site called Rio Azul, which seemed to Jim like an ideal time to put Amateur Radio to public service. To offset the variety of unpleasantries a jungle can offer, Jim helped boost the morale of the archaeology team by keeping them in touch with friends and family at home through regular skeds on the "Rio Azul Net." One of the archaeologists used the opportunity to tell her child all about the jungle birds and animals she had seen. Although the article on the dig that appeared in April 1986 *National Geographic* (and on the cover) didn't mention Amateur Radio, everyone who benefited from Jim's operation went away from the project with their own special treasure. Shown with Jim (left) are the camp doctor (center) and the project director.

League Lines

Open House: The ARRL HQ building and W1AW, the Hiram Percy Maxim Memorial Station, will be open on Saturday, October 25, from 10 AM to 5 PM. If your club would like to schedule a visit on this date, please notify HQ. Be sure to bring a copy of your operator's license if you'd like to operate.

Director, Vice Director Elections: There will be contested elections for ARRL Director and/or Vice Director in 5 ARRL Divisions. These are:

CENTRAL DIVISION
Director: James J. Coleman, KA6A
Edmond A. Metzger, W9PRN
Bruce B. Woodward, W9UMH
Vice Director: Kenneth A. Ebneter, K9EN
Howard S. Huntington, K9KM

HUDSON DIVISION
Director: Vincent J. Biancomano, WB2EZG
Linda Ferdinand, N2YL
Stephen Mendelsohn, WA2DHF
Vice Director: Gary J. Ferdinand, W2CS
Paul S. Vydareny, WB2VUK

NEW ENGLAND DIVISION
Vice Director: Clevis O. Laverty, W1RWG
Robert B. Weinstock, KN1K

NORTHWESTERN DIVISION
Director: Rush S. Drake, W7RM
Mary E. Lewis, W7QGP
Vice Director: William R. Shrader, W7QMU
Bradley Wells, KR7L

WEST GULF DIVISION
Director: Jim D. Haynie, WB5JBP
Raymond B. Wangler, W5EDZ

Ballots are being sent to all full members who reside in these Divisions, accompanied by a 300-word statement by each candidate.

Attention Field Appointees: So far three official Participating Badge Engravers have signed up to supply you with your official ARRL Field Organization Badge (see July 1986 *QST* for information on the ARRL Official Call Sign Badge Program). They are:

Bond Engraving Co, 15 East Camden Ave, Moorestown, NJ 08057. Cost is $5.95 per badge (NJ residents add 6% sales tax).

Arch Engraving, 106 North Kirkwood Rd, St. Louis, MO 63122. Cost is $5.50 per badge (includes sales tax and postage); discounts on orders over 10.

The Sign Man, 879 Castle Kirk Dr, Baton Rouge, LA 70808. Cost is $5.25 plus 40 cents postage per badge.

See Up Front In *QST* for a look-see at the badge that could adorn your shirt pocket or coat at the next hamfest!

A study on how to improve the functioning of ARRL Advisory Committees is underway. Current and former Advisory Committee members are especially invited to comment, and inputs are welcome from any League member. Address your comments to First Vice President Jay Holladay, W6EJJ (address on p 9) or to Karl Muller, W3UBQ, at ARRL HQ.

Attention 160-meter enthusiasts: Note the ARRL Midnight Special on 160 from 0500Z until 0700Z October 12. First hour, CW contacts only, second hour, phone. Exchange state and power output. For further information, see Contest Corral on page 93.

The DXCC desk is looking for an Assistant Manager. This full-time HQ staff position processes DXCC applications. A General class (or higher) license is required. Interest in DXing and DX call signs is helpful. Salary range from $11,622-$15,652. Contact Don Search, W3AZD, at ARRL HQ.

ARRL has submitted its reply to comments filed in the "Novice Enhancement" FCC proposal, PR Docket 86-161. In its reply comments, the ARRL stated, "Most in the amateur community seem to agree that some expansion of the privileges available to Novice class licensees is desirable ... The level of support in the comments for the Commission's proposals was high ... it would thus appear that the Commission's proposal is on the 'right track' and should be finalized essentially as is." The ARRL further commented that "The limited scope of the additional privileges would not reduce the incentive to upgrade one's license class. It would, however, offer a more exciting introduction to the avocation for the newcomer, encouraging more extensive involvement in Amateur Radio generally. The ARRL's comments requested the Commission change the proposed Novice subband at 1246-1260 MHz to 1270-1295 MHz to correspond with the existing voluntary band plan. The ARRL also requested that a two-examiner requirement for the Novice class license be established by the Commission, in view of the increased privileges to be made available to Novice licensees. "One examiner is no longer sufficient. There is no question but that the character of the Novice class license will be ... more desirable than heretofore. The incentive to obtain such a license without a full demonstration of qualifications is thus greater."

ARRL concluded that, with the above two modifications, the Commission should implement its proposed rule changes at the earliest opportunity.

The W2PV Four-Element Yagi

Here is unpublished design data for a high-performance antenna, and a practical example for the 24-MHz band.

By Bill Myers, K1GQ
ARRL Contributing Editor
Box 501
Hollis, NH 03049

In the 1970s, the late Jim Lawson, W2PV, began studying Yagi-Uda antenna performance using computer programs that he had designed for this purpose. Eventually, he completed a systematic study, soon to be published in the book *Yagi Antenna Design*.[1] One of the conclusions he reached was that designs with equally spaced elements and equal-length directors perform as well as any alternative design, for a fixed boom length. A second conclusion was that boom lengths near an odd number of quarter wavelengths produce good patterns with high front-to-back (F/B) ratios.

During this study, Jim also developed an exceptional design that violates both of these principles. This four-element Yagi has radically uneven element spacing, and the boom length is near 0.6 λ. Quite a few of these antennas have been built by amateurs in the Northeast, using recipes for 20, 15 and 10 meters provided by Jim.

The PV4, as I shall call it, provides very good gain and excellent F/B on a physically manageable boom length. At 20 meters, for example, the boom length is a convenient 40 feet. This length has two advantages: The boom itself is nonresonant in the amateur bands (if the elements are isolated from the boom), minimizing the possibility of interaction between the boom and other antennas; and irrigation tubing suitable for boom material is commonly available in 40-foot lengths. Furthermore, the four-element arrangement has an open space at the center of the boom, so the antenna can easily be side-mounted on most towers.

The PV4 does have some disadvantages. The array has a pronounced weathervane characteristic caused by the non-uniform element spacing. The driven element is mounted so far toward the reflector end of the boom that it is unreachable from the tower except in the 10-meter design. Finally, the design is narrowband, both in F/B and in input impedance.

The bandwidth limitation is unimportant for the new WARC bands, since they are quite narrow. This point is illustrated by Fig 1, which shows a chart of the fractional bandwidths of the amateur bands through 450 MHz. "Fractional bandwidth" is simply the width of the band divided by its center frequency. The PV4 bandwidth for greater than 20 dB F/B is about 1.5 percent. Thus, the PV4 is an excellent design choice for the new WARC bands, whereas compromises are necessary for any of the other ham bands.

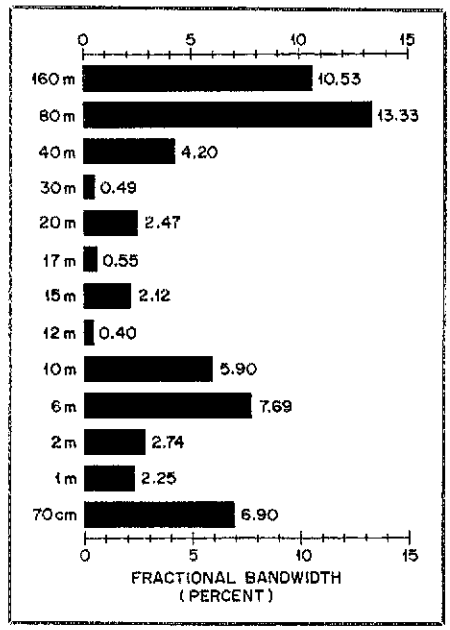


Fig 1—Fractional bandwidths of the amateur bands from 1.8 to 450 MHz.

Jim never published this design. Construction recipes for 20, 15 and 10 meters were printed in the newsletter of the Yankee Clipper Contest Club in May 1982 (*Scuttlebutt* No. 39), and later reprinted in the *National Contest Journal* and other specialized publications. This article provides updated design and performance information for the PV4. To illustrate the procedures for converting the normalized design into a real antenna, I will show an example for the 24-MHz band. These procedures are explained in complete detail in *Yagi Antenna Design*, so the presentation here is abbreviated to the essentials.

Free-Space Performance

Element spacings in wavelengths, measured from the reflector, are:

driver : 0.1235 λ
director 1 : 0.3240 λ
director 2 : 0.5735 λ

All elements have the same uniform diameter, 0.001 λ. The element half-lengths are:

reflector : 0.2535 λ
driver : 0.2375 λ
director 1 : 0.2325 λ
director 2 : 0.2240 λ

Fig 2 is a view of the antenna from above (or, if you don't like heights, from below). It shows all important dimensions and is drawn to scale.

Free-space gain and F/B for this design are plotted versus normalized frequency in Fig 3. The central design frequency corresponds to normalized frequency = 1.0, so you can see how gain and F/B vary over a range of frequencies above and below the design frequency. The data for these curves were computed using the Numerical Electromagnetics Code, version 3.[2]

The gain of the PV4 is about 9.6 dBi. For quick comparisons, I use a rule-of-thumb formula developed by curve-fitting experimental data:

$$\text{Gain} = 3 \ln(\text{boom length}) + 12 \text{ dBi} \quad \text{(Eq 1)}$$

where the boom length is in wavelengths.[3] The remarkable quality of the fit for Eq 1 is shown in Fig 4, where I have plotted the measured gains (converted from dBd to dBi) for six different boom lengths. The rule-of-thumb formula gives 10.3 dBi for the PV4 boom length, well within the combined tolerance of the experiments and the computer model.

The F/B curve in Fig 3 shows a very pronounced peak, and the frequency range over which the F/B remains high is much smaller than the bandwidth indicated for the gain curve. If we arbitrarily select a threshold of 20 dB as defining "F/B bandwidth," the PV4 performance bandwidth is about 1.5 percent. From Fig 1, you can

[1]Notes appear on page 19.

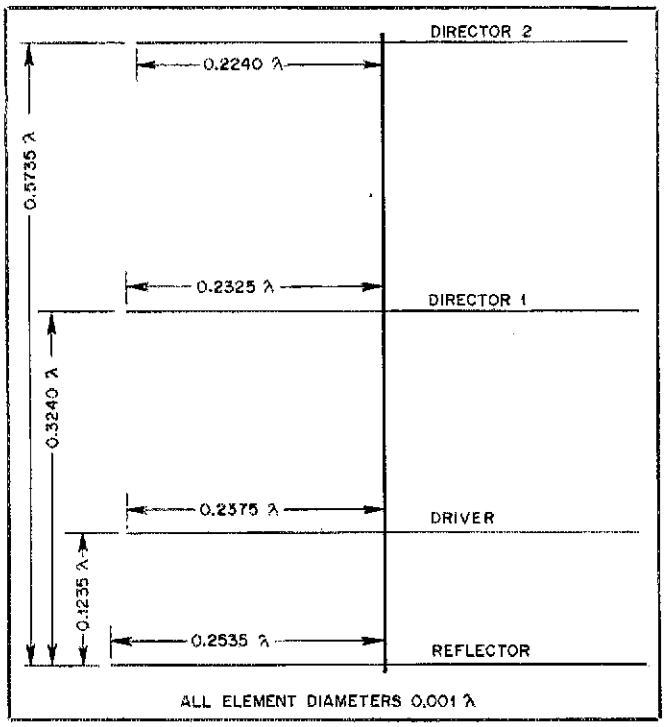


Fig 2—Diagram for the normalized PV4 design. This drawing is to scale.

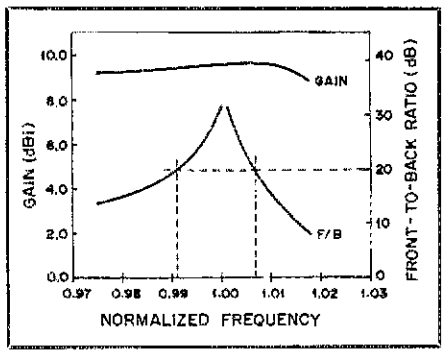


Fig 3—Gain and front-to-back ratio for the PV4 in free space.

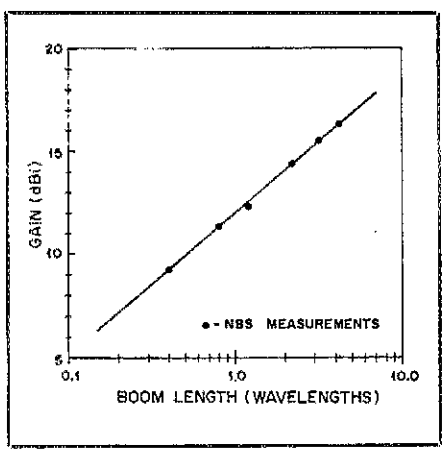


Fig 4—Rule-of-thumb gain-versus-boom length chart. Actual NBS measurement points for different boom lengths are included for reference.

see that the F/B bandwidth is less than the width of any of the amateur bands except the WARC bands.

Of course, the central design frequency could be selected to place the F/B maximum at some favored frequency within any amateur band. The performance of the PV4 changes rapidly above the central design frequency, however, so a CW-band design is likely to perform poorly in the phone band. A phone-band design, though, will perform reasonably well on CW, since the gain doesn't drop very much. The F/B will suffer, however. Thus, unless you don't own a microphone, it is best to center the design in the middle or upper part of the wider ham bands, rather than in the bottom half.

Matching

Fig 5 charts the PV4 input impedance and SWR versus normalized frequency. The reactance is zero (that is, the driver is resonant) at F = 1.0197 because I deliberately shortened the driven element to yield capacitive reactance at the central design frequency. The length of the driver affects only the input impedance—gain and pattern are not changed when the driver length is modified. The match changes slowly below the design frequency, but it rises steeply above the design frequency. The 2:1 SWR bandwidth extends from 2.5 percent below the central design frequency to just 0.8 percent above. This is another reason to favor centering the PV4 higher in the band rather than lower.

I use the hairpin match in my homemade Yagis. This system splits the driver at the center and shunts the feedpoint with an inductive reactance (the hairpin). The adjustable parameters are the length of the driver and the reactance of the hairpin. I have found that I can calculate these parameters accurately enough that the adjustments don't need tweaking in the air![4]

Designing a hairpin matching network is an iterative procedure. Accurate results depend on having a good estimate of the antenna input impedance at the central design frequency as a function of the driver length. This information is plotted in Fig 6, with detailed scales to allow reading values directly from the chart.

First, guess the antenna input resistance, R_a, and calculate the matching reactance, X_m, from:

$$X_m = R_{in}\sqrt{R_a/(R_{in}-R_a)} \qquad \text{(Eq 2)}$$

where R_{in} is the transmission line characteristic impedance. For R_{in} = 50 ohms, and R_a guessed to be 20 ohms, the result is X_m = 40.8 ohms. Next, calculate the antenna input reactance, X_a, from:

$$X_a = -R_aR_{in}/X_m \qquad \text{(Eq 3)}$$

which yields −24.5 ohms. Now, find the driver half-length corresponding to this antenna input reactance from Fig 6; the dotted line shows the answer to be 0.233 wavelengths. Finally, determine the antenna input resistance for 0.233 λ driver half-length; Fig 6 shows this to be 20.2 ohms. The initial guess for R_a was close enough; otherwise, the preceding steps would be repeated with another guess. The matching network design can be checked by evaluating the following expression for the transformed antenna input impedance:

$$Z_{in} = -X_m(X_a - jR_a)/[R_a + j(X_a + X_m)] \qquad \text{(Eq 4)}$$

For the example above, the result is 50.0 + j0.0 ohms.

I make the hairpin inductor using a shorted section of "open wire" transmission line constructed from two parallel

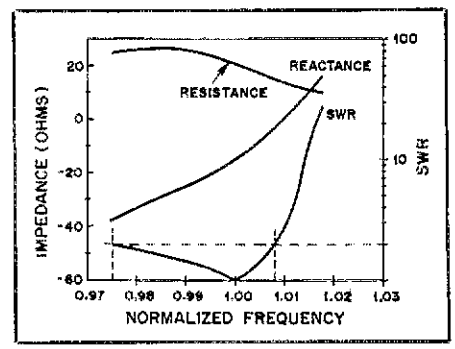


Fig 5—Input impedance and SWR for the PV4 antenna.

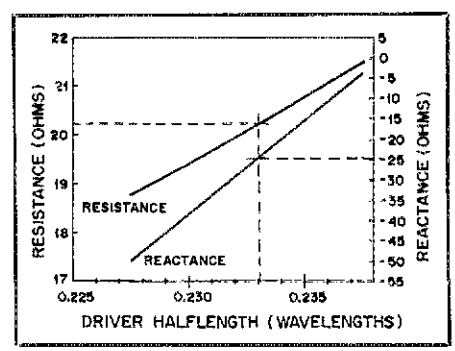


Fig 6—PV4 input impedance versus driver halflength at the central design frequency.

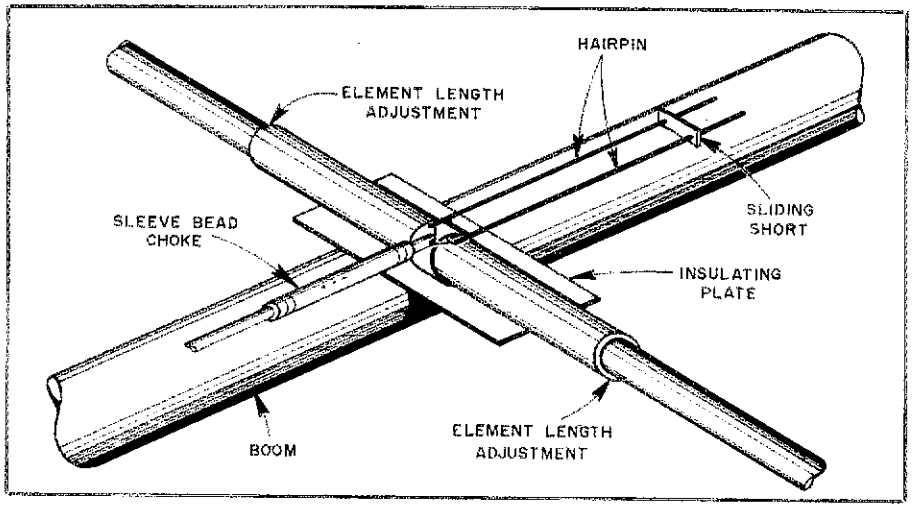


Fig 7—Details of the hairpin matching section for the PV4 driver.

Fig 8—Elevation radiation patterns for the PV4.

Normalized Frequency	Gain (dBi)	Front-to-Back Ratio (dB)	Input Impedance (Ohms)
0.9750	9.16	14.15	24.96 – j37.82
0.9775	9.18	14.84	25.70 – j35.48
0.9800	9.21	15.57	26.25 – j33.29
0.9825	9.24	16.37	26.58 – j31.20
0.9850	9.28	17.28	26.65 – j29.19
0.9875	9.31	18.35	26.43 – j27.20
0.9900	9.36	19.68	25.90 – j25.17
0.9925	9.41	21.42	25.04 – j23.03
0.9950	9.46	23.82	23.88 – j20.71
0.9975	9.51	27.38	22.45 – j18.12
1.0000	9.56	31.74	20.79 – j15.20
1.0025	9.60	28.81	18.98 – j11.89
1.0050	9.63	23.30	17.12 – j8.16
1.0075	9.62	19.18	15.30 – j4.01
1.0100	9.57	15.95	13.60 + j0.54
1.0125	9.44	13.25	12.10 + j5.45
1.0150	9.21	10.88	10.86 + j10.66
1.0175	8.85	8.74	9.93 + j16.10

pieces of tubing running along the boom, as shown in Fig 7. The support for the ends of these tubes can be connected to the boom, providing a path to ground for electrostatic charges built up on the driver. Since this feed arrangement is symmetric (that is, balanced), it is useful to isolate currents on the outside of the transmission line by inserting a choke made of sleeve beads at the connection to the driver. I highly recommend this "balun," as described by Walt Maxwell, W2DU.[5]

The length of hairpin transmission line needed to yield the matching reactance X_m is:

$$\ell = (\lambda/2\pi)\arctan(X_m/Z_0) \qquad \text{(Eq 5)}$$

where the transmission line characteristic impedance is found from:

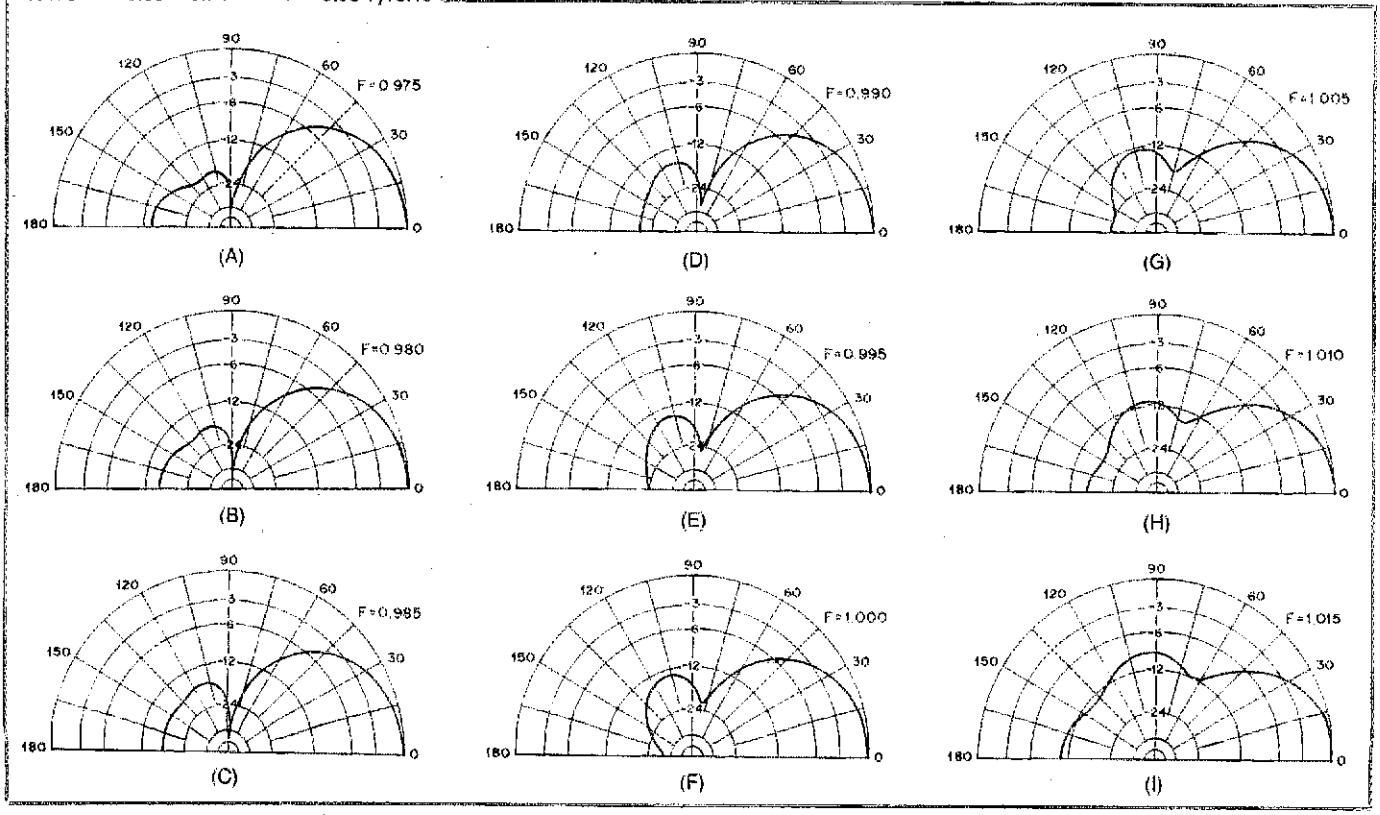
$$Z_0 = 276\log(2s/d) \qquad \text{(Eq 6)}$$

For spacing, s, equal to 1¾ inches and tubing diameter, d, equal to ½ inch, the characteristic impedance is 233 ohms. The length of line that produces 40.8 ohms inductive reactance is 0.0276 λ, or 1 foot, 1-1/8 inches at 24.9 MHz.

Radiation Patterns

Fig 8 contains a sequence of radiation patterns, in the vertical plane containing the boom, for different frequencies around the central design frequency. These patterns are normalized to the peak gain at the corresponding frequency, which occurs along the boom for a Yagi in free space. The values of the peak gains are given in the figure legend. The high-angle backward lobe is of no consequence because propagation for frequencies higher than 14 MHz rarely supports such high wave angles. The backward lobe directly along the boom is responsible for the behavior of the F/B ratio plotted in Fig 3. This lobe "tucks in" to some minimum value just above the central design frequency (F = 1.000), corresponding to the peak shown in Fig 3. When mounted over real ground, the wave angles of interest are between some very small value, say two degrees, and 10 to 20 degrees, depending on the frequency. The sequence of elevation radiation patterns suggests that F/B ratio is maximum between F = 1.000 and F = 1.005.

Azimuthal radiation patterns for the



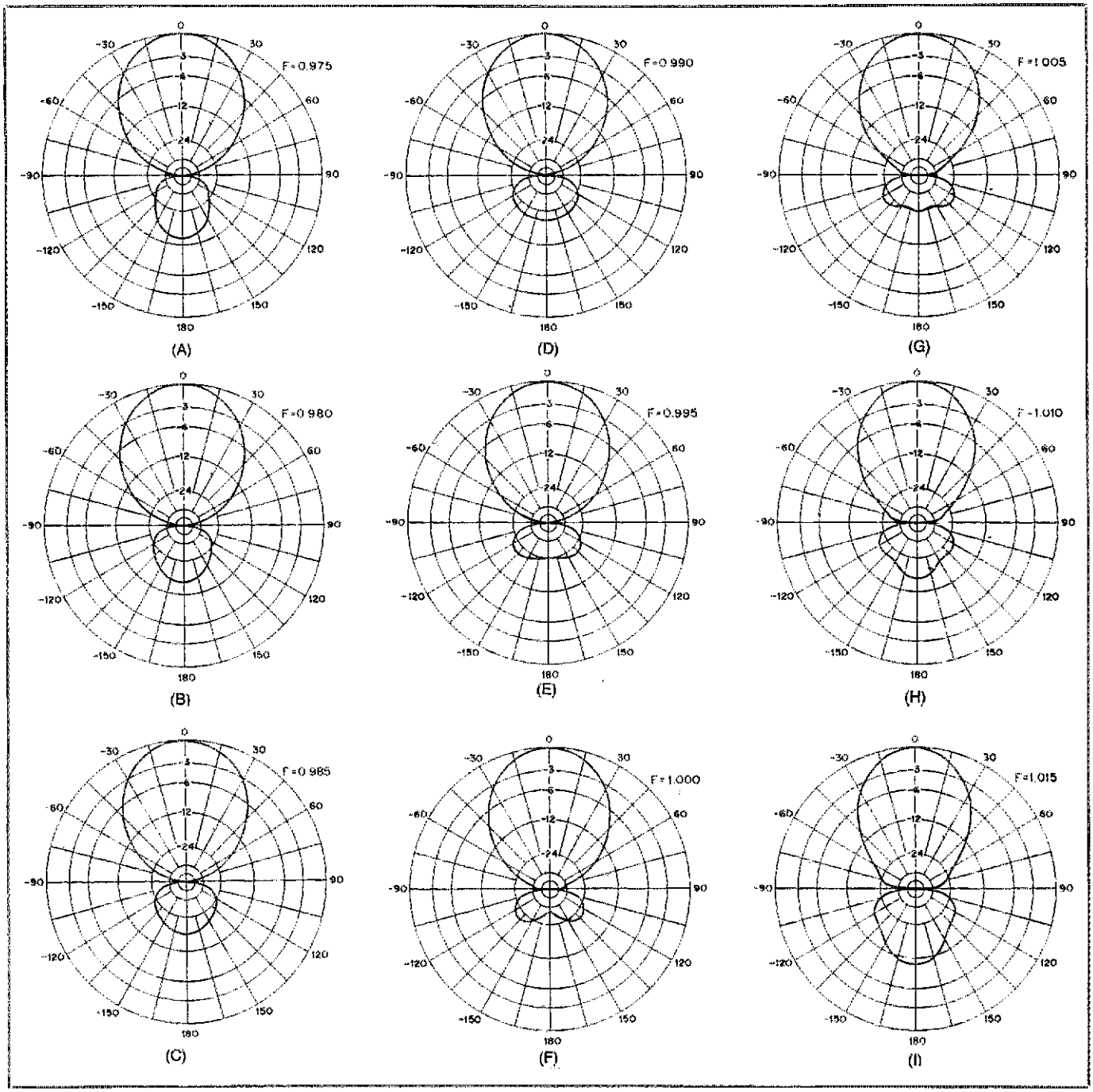


Fig 9—PV4 azimuth radiation patterns.

same sequence of frequencies are shown in Fig 9. Like all Yagis with single drivers, the antenna has very deep nulls off the ends of the elements. The backlobe along the boom diminishes as the frequency increases towards the central design frequency, until the lobe is entirely within the −20 dB contour. Then, the lobe splits into two lobes, with the null in between falling along the boom, producing the maximum in F/B near the central design frequency. This null immediately begins to fill in with a third backward lobe above the central design frequency.

24-MHz Design Example

The steps for converting the design parameters into a recipe for constructing a real antenna are:

1) Select the central operating frequency.

2) Convert element lengths and spacings from wavelengths to physical units.

3) Adjust the element lengths to account for radius scaling and tapering.

The 24-MHz band extends from 24.89 to 24.99 MHz. As pointed out earlier, the fractional bandwidth is very small, so that any frequency within the band can be taken as the central design frequency with no effect on the final antenna. For convenience, let's take 24.9 MHz as the central design frequency. The wavelength at this frequency (using speed of light = 299.79 meters per microsecond) is 39.5 feet. The dimensions given below are rounded to the nearest ¼ inch, which is about 0.0005 λ.

The boom length, 0.5735 λ, converts to 22 feet, 7¾ inches. The boom should be about 23 feet long to allow space for mounting the end elements. I would use a single section of 3-inch-OD irrigation tubing. At 24 MHz, the elements are short enough that a boom made from this material wouldn't need any special mechanical supports or reinforcements. The element positions along the boom are:

reflector : 0′ 2″
driver : 5′ ½″
director 1 : 12′ 11½″
director 2 : 22′ 9¾″

The element half-lengths (using 0.2330 λ for the driver) convert from wavelengths to physical units as follows:

reflector : 10′ ¼″
driver : 9′ 2½″
director 1 : 9′ 2¼″
director 2 : 8′ 10¼″

Radius scaling accounts for the difference between the design element diameter and the actual average diameter. The taper correction accounts for the effect of variations in element diameter with telescoped-tubing construction. Additional corrections can be made to account for the effects of the boom and boom-to-element mounting structures, but these effects are negligible at 24 MHz unless the elements pass through the boom.

I use a simple home-computer program, TAPER, to calculate the radius scaling and tapering corrections. TAPER uses the algorithms described in *Yagi Antenna Design*. The program listing is included in the appendix to this article. It is written in Microsoft® BASIC, so it should be easily adaptable to most home computers.

A very rugged element for 24 MHz can be made by telescoping lengths of ¾-inch-OD tubing into the ends of a single 12-foot length of 7/8-inch-OD tubing. The 7/8-inch tubing must have a wall thickness of 0.058 inch (a standard size). Other thicknesses will not telescope properly. The elements for the PV4 24-MHz beam can be made from four 12-foot lengths of 7/8-inch and three 12-foot lengths of ¾-inch tubing.

The lengths of the ¾-inch element end pieces are calculated directly by the TAPER program:

reflector : 49½″
driver : 38½″
director 1 : 38¼″
director 2 : 33¾″

Allowing for four to five inches of overlap at the telescoping joints, these end pieces can be cut from the three 12-foot lengths of ¾-inch tubing as follows:

1) From the first piece of tubing, cut one 54-inch piece and two 45-inch pieces. This yields one reflector tip and the two driver tips

2) Cut the second tube in the same way, yielding the second reflector tip and the two director 1 tips

3) Cut two 38-inch pieces for director 2 from the third tube; you will have 68 inches left for your next project.

Summary

Although I have not constructed a 24-MHz version of the PV4, I am confident that it will perform as specified for two reasons. First, I have built several PV4s for other bands. Measured performance—patterns and SWR curves—of these antennas agrees well with the computer predictions. Second, I have applied all of the practical construction techniques discussed here, such as the hairpin match, with equally good results.

Notes

[1]J. L. Lawson, *Yagi Antenna Design*, to be published by ARRL.

[2]G. J. Burke and A. J. Poggio, "Numerical Electromagnetics Code (NEC)—Method of Moments," Naval Ocean Systems Center, *Technical Document 116*, Jan 1981. All results reported here were prepared with each element modeled with 20 segments, a number that represents a compromise between convergence in the input impedance values and computer runtime. The gain results are within 0.2 dB, and the F/B results within 1 dB, of the values that were computed with 32 segments per element at the central design frequency. The data points in Fig 3 required more than 20 hours of CPU time using a MicroVAX I.

[3]P. Viezbicke, "Yagi Antenna Design," National Bureau of Standards, *Technical Note 688*, Dec 1976.

[4]G. L. Hall, ed., *The ARRL Antenna Book*, 14th Edition (Newington: ARRL, 1982), p 5-16.

[5]W. Maxwell, W2DU, "Some Aspects of the Balun Problem," *QST*, Mar 1983, pp 38-40.


```
10 '*************************************************************************
20 '                                T A P E R                                *
30 '                                                                         *
40 '       Convert a cylindrical half-element to an equivalent tapered       *
50 '       half-element by computing the length of the end piece using       *
60 '       Lawson's method (Yagi Antenna Design).                            *
70 '                                                                         *
80 '  Microsoft BASIC Version 5.28                          Feb 86 K1GQ      *
90 '*************************************************************************
100 '
110 '  Reserve arrays.  MAXPARTS% establishes the maximum number of
120 '  pieces per half-element.
130 '
140 '************************************************************************
150 MAXPARTS% = 9
160 DIM PARTD(MAXPARTS%), PARTL(MAXPARTS%), LP(MAXPARTS%), F(MAXPARTS%)
170 DIM M(MAXPARTS%), THETA(MAXPARTS%+1)
180 '************************************************************************
190 '  Define functions for differential reactance, DELTAX, and
200 '  total reactance, X.  Coefficients are changed to use natural
210 '  logarithm instead of base-10 logarithm.  CAPK (CAPital K) is
220 '  the ratio of wavelength to radius.
230 '
240 '************************************************************************
250 DEF FN DELTAX(CAPK) = -18.7 * LOG(CAPK) + 33.9
260 DEF FN X(CAPK) = 33.25 + 1.385 * LOG(CAPK) - .066 * LOG(CAPK) ^ 2
270 '************************************************************************
280 '  Constants.
290 '
300 '************************************************************************
310 C = 11802.85          ' Speed of light in inches/microsecond
320 PIO2 = 2 * ATN(1)     ' pi / 2
330 '************************************************************************
340 '  Get design data and element tubing dimensions.
350 '
360 '************************************************************************
370 INPUT "Frequency (MHz)"; FREQ
380 INPUT "Cylinder half-length (wavelengths)"; HOL
390 INPUT "Cylinder diameter (wavelengths)"; DOL
400 PRINT "Number of pieces per half-element ( <="; MAXPARTS%; ")" ;
410 INPUT NPARTS%
420 IF NPARTS% > MAXPARTS% GOTO 400
430 FOR I% = 1 TO NPARTS% - 1
440     PRINT "Part"; I%; " length (inches), diameter (eighth-inches)";
450     INPUT PARTL(I%), PARTD(I%)
460     PARTD(I%) = PARTD(I%)/8
470     NEXT I%
480 PRINT "part"; NPARTS%; "                    diameter (eighth-inches)";
490 INPUT PARTD(NPARTS%)
500 PARTD(NPARTS%) = PARTD(NPARTS%) / 8
510 LAMBDA = C / FREQ


520 '************************************************************************
530 '  Alter half-length to scale from design diameter to the
540 '  geometric average of the root and end piece diameters.
550 '
560 '************************************************************************
570 AVGDIA = SQR(PARTD(1) * PARTD(NPARTS%))
580 ADOL = AVGDIA / LAMBDA
590 CAPK = 2 / DOL
600 ACAPK = 2 / ADOL
610 SML = 2 * HOL
620 ASML = .5 + ( FNX(CAPK) - FNX(CAPK) - 28 * FNDELTAX(CAPK) *
                ( .5 - SML ) ) / ( 28 * FNDELTAX(ACAPK) )
630 HAOL = ASML / 2
640 HA = HAOL * LAMBDA
650 '************************************************************************
660 '  Set up Lawson's F functions for each piece.
670 '
680 '************************************************************************
690 FOR I% = 1 TO NPARTS%
700     PDIA = PARTD(I%) / LAMBDA
710     CAPI = 2 / PDIA
720     M(I%) = FNDELTAX(CAPI) / FNDELTAX(ACAPK)
730     NEXT I%
740 '************************************************************************
750 ' Set up initial guess for the length of the end part.
760 '
770 '************************************************************************
780 PARTL(NPARTS%) = HA
790 FOR I% = 1 TO NPARTS% - 1
800     PARTL(NPARTS%) = PARTL(NPARTS%) - PARTL(I%)
810     NEXT I%
820 THETA(NPARTS%+1) = PIO2
830 '************************************************************************
840 '  Compute the cylindrical element which is equivalent to the
850 '  assumed tapered element, adjust the end piece length proportionally
860 '  to the error between the computed cylinder length and target length
870 '  (HA), iterate until the error is small.
880 '
890 '************************************************************************
900 DELTA = 1
910 WHILE ABS(DELTA) > .0008!*HA
920     '************************************************************
930     ' Find the total half-length of the tapered element.
940     '
950     '************************************************************
960     S = 0
970     FOR I% = 1 TO NPARTS%
980             S = S + PARTL(I%)
990             THETA(I%) = 0
1000            NEXT I%
1010    SRAD = S / PIO2
1020    '************************************************************
1030    ' Compute the positions of the joints in radians.
1040    '
1050    '************************************************************
1060    FOR I% = 2 TO NPARTS%
1070            THETA(I%) = THETA(I%-1) + PARTL(I%-1) / SRAD
1080            NEXT I%
1090    '************************************************************
1100    ' Evaluate Lawson's F function and determine the
1110    ' equivalent length of each piece.
1120    '
1130    '************************************************************
1140    FOR I% = 1 TO NPARTS%
1150            F(I%) = ( SIN(2*THETA(I%+1)) - SIN(2*THETA(I%)) )
                        / ( 2 * ( THETA(I%+1) - THETA(I%) ) )
1160            LP(I%) = PARTL(I%) * [ M(I%) + 1/M(I%)
                         + ( M(I%) - 1/M(I%) ) * F(I%) ) / 2
1170            NEXT I%
1180    '************************************************************
1190    ' Find the error between the sum of the equivalent
1200    ' piece lengths and the target length.
1210    '
1220    '************************************************************
1230    DELTA = HA
1240    FOR I% = 1 TO NPARTS%
1250            DELTA = DELTA - LP(I%)
1260            NEXT I%
1270    '************************************************************
1280    ' Add the error to the end piece and loop back.
1290    '
1300    '************************************************************
1310    PARTL(NPARTS%) = PARTL(NPARTS%) + M(NPARTS%) * DELTA
1320    WEND
1330 '************************************************************************
1340 '  Show the results, then go back to do another case with the same
1350 '  design parameters except half-length, and the same tubing schedule.
1360 '
1370 '************************************************************************
1380 PRINT USING "=> End piece length = ###.#### inches <<"; PARTL(NPARTS%)
1390 INPUT "Another case (y or n)"; ANS$
1400 IF ANS$ = "n" GOTO 1430
1410    INPUT "Cylinder half-length (wavelengths)"; HOL
1420    GOTO 610
1430 END
```

An All-Band, 1500-Watt-Output 8877 Linear Amplifier

Part 2: Here's what you've been waiting for: detailed instructions for building a 1500-W RF deck and power supply.†

By Jerry Pittenger, K8RA
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Last month I described the circuitry and parts required for the 8877 linear amplifier and high-voltage power supply. This month I will cover the construction of both units. The power supply construction details are given first. Assuming that we have all the required parts in hand, we can determine the physical design of the power supply. To avoid costly mistakes, it is important to do adequate up-front planning *before* the first hole is drilled.

Power Supply Construction

Meter Selection and Labeling

Any meter with a movement from 100 μA to 5 mA can be used for the high-voltage meter. This meter measures the voltage across the 25-ohm resistor at the bottom (B−) end of the bleeder string (see Fig 5 in Part 1). The more sensitive the meter, the higher the resistance setting of the variable 1-kilohm calibration resistor. The setting of the resistor is a simple Ohm's law problem. The maximum power-supply voltage on the meter scale causes a current equal to the meter-movement rating to flow through the meter, and thus give a full-scale reading. For example, the maximum scale on the meter in this supply is 5 kV dc. The meter has a 5-mA movement; therefore, if the supply is at 5 kV, 5 mA must flow through the calibration resistor and the meter for a full-scale reading. Looking at the complete bleeder string, the total resistance is the sum of the two 103-kΩ bleeder resistors plus the 25-ohm resistor, or 206,025 ohms. At 5 kV, approximately 24 mA (5000/206,025) flows through the string. The value of the calibration resistor, therefore, was selected to allow 5 mA through the meter and 19 mA through the 25-ohm resistor. Using Ohm's law, the value of the resistor should be approximately 95 ohms (19 mA × 25 ohms/5 mA). The required wattage rating of the resistor is 0.23 W (I^2R = 0.005 × 0.005 × 95), and a 1-kΩ, 2-W potentiometer was used. The meter used originally had a 0-50 scale. The scale was changed to read 0 to 5 kV.

Panel/Chassis Layout

I do all my layouts with an Apple® Macintosh computer. An example of this layout is shown in Fig 6. A manual method may be used, instead. Cut out a piece of poster board the size of the front panel or chassis, as well as all the major components. Shuffle the pieces until you get an acceptable layout. This may seem like a lot of extra work, but "one picture's worth 1000 words." You will save time in the long run by going through this procedure, and not have to correct errors that otherwise are certain to occur. The panel layout should be symmetrical. Align switches and center meters. Make sure that components are properly spaced to accommodate the physical size of the parts behind the panel.

The computer-generated or manual layouts serve as a guide during construction, but are by no means sacred. Once you start putting the parts in place, you probably will

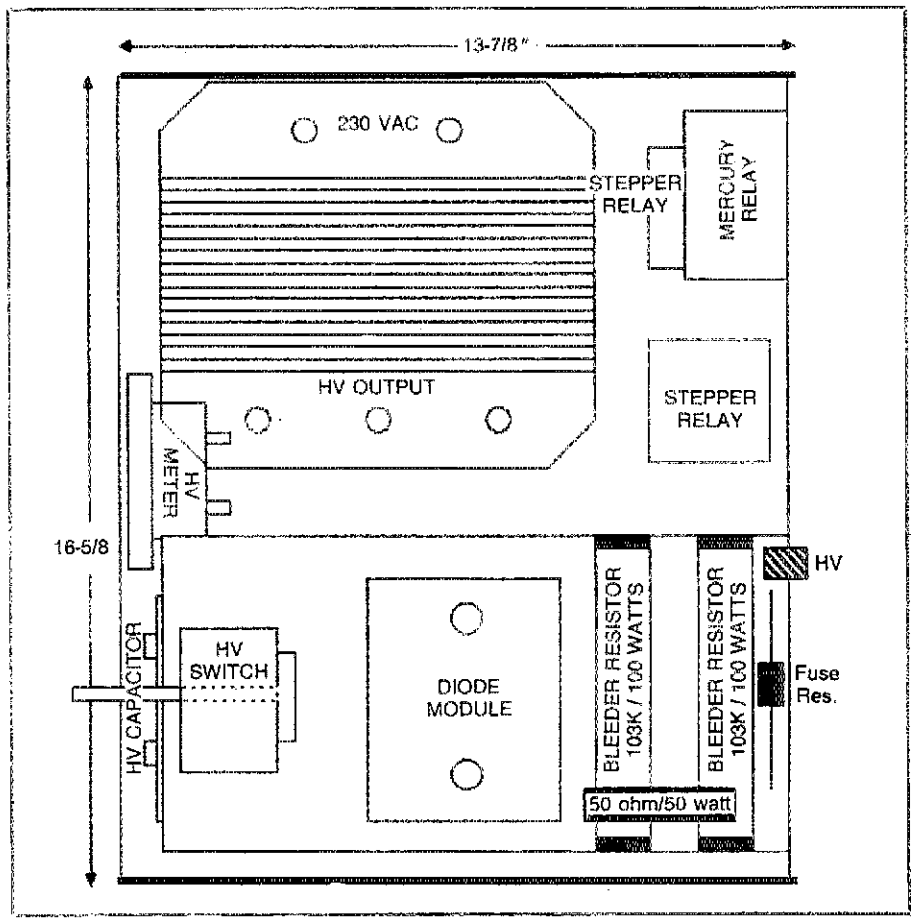


Fig 6—Typical computer-prepared layout drawing. Some component labels have been enlarged for legibility.

†Part 1 appeared in Sept 1986 *QST*, pp 15-21.

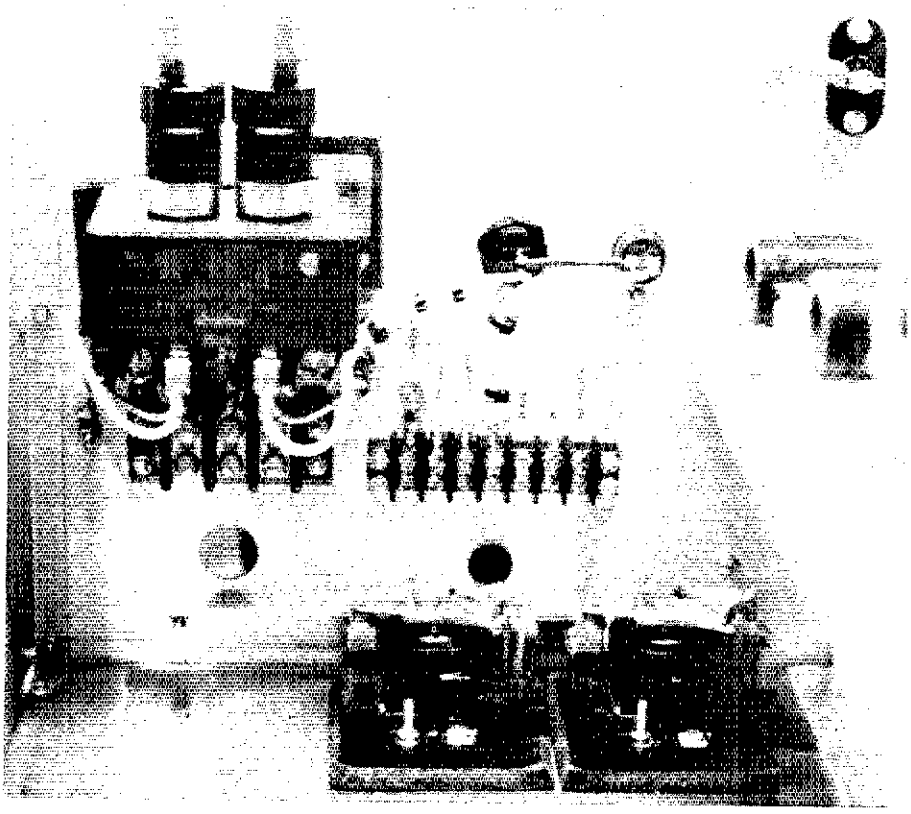


Fig 7—Interior view of rear panel. Note the mercury plunger relay mounting. Relays K2 and K3 are at the lower right.

make minor changes. Go ahead and make the changes, but always update the documentation.

Front-Panel Assembly

You probably will not be ready to cut metal until you are 3 to 4 months into the project. Do the front panel first, since the parts locations are fixed for symmetry. Parts behind the front panel can be moved to accommodate the front-panel design.

Cover the front panel with 3-inch-wide masking tape. The tape not only protects the panel from scratches, but also provides a way to lay out the panel with a pencil or pen. Before any holes are drilled, place all the major parts in their proper place in the cabinet to be sure that nothing obstructs the area behind the panel. *Remember you have only one chance.* Miss and it means a new panel, or cabinet!

Remove the front panel from the cabinet and center punch the panel where holes are to be drilled, as marked on the tape. Carefully drill a very small hole at each punch mark to serve as a guide, then cut the holes to final size. Holes up to approximately 7/16 inch can be drilled with either a hand drill or a drill press. Holes larger than 7/16 inch should be made with chassis punches. The meter hole is rectangular and is cut with a nibbler after drilling an access hole. Cut the meter hole about 1/32 inch smaller than needed and finish with a large file to straighten the edges. Be careful using the file—it is very easy to let the file slip out of the hole and make a big scratch in the panel. The meter hole doesn't have to be perfect since a meter bezel is used.

After the front-panel metal work is complete, carefully remove the masking tape. The front panel should be labeled before mounting the components. Labeling is done with dry-transfer lettering available from art stores or Radio Shack. Apply the labeling by laying the letter or figure on the panel in the proper position and rubbing over it with a soft pencil. The character will be transferred to the panel. If a mistake is made, the character can be removed with masking or Scotch® tape. There is a matte-finish spray available to protect the lettering. I do not recommend using this spray. It will peel if bumped and does not work well.

The parts can now be mounted on the panel. The cabling to the front panel is connected through nylon multipin connectors (available from Radio Shack) to allow easy panel removal. The same technique is used in the RF deck.

Rear-panel Assembly

Placement of parts on the rear panel is not as critical as on the front panel. Attention should still be paid to symmetry, however. I have found that it is best to mount rear-panel parts after the major parts have been mounted inside the cabinet. The rear panel is drilled and labeled in a manner similar to the front panel. The black rear panel requires white lettering. White lettering kits are available at art supply stores and some electronics suppliers.

Fig 7 shows the inside rear panel of the power supply. The control and power cables enter the rear panel and are routed directly to barrier strips. Each terminal is labeled for clarity. The rear panel is accessible by removing the front panel and the transformer. It sounds like a big job, but it can be accomplished in about 10 minutes. It is necessary to provide good strain relief for the cables. Immediately inside the rear panel, a piece of ¾-inch aluminum angle stock is mounted, to which each cable is clamped. Large rubber grommets are used in the holes for cable protection.

Major Chassis Assembly

Power-supply components are extremely heavy and a good supporting structure is required. The 1/16-inch-thick bottom cover supplied with the cabinet is replaced with a ¼-inch-thick base plate to provide an adequate foundation. The heavy plate is cut to size on a commercial metal shear. After the transformer, relays and filter capacitor are mounted, rubber-wheeled casters are bolted to the bottom so that the supply can be rolled, rather than carried from place to place.

The cabinet sides are formed by two removable panels. Parts can be mounted to the inner panel using countersunk screws and then covered with the 1/8-inch painted cover plate to provide a professional appearance. A ¼-inch-thick sheet of Plexiglas® is mounted above the filter capacitor to support the high/low voltage switch, the diode bank and the bleeder resistors. The Plexiglas is supported by drilled and tapped holes for no. 6-32 countersunk screws in the rear and side panel. A post of ½-inch aluminum bar stock supports the front-left corner of the Plexiglas.

The mercury-wetted power relay is mounted on the rear panel and must be positioned vertically. Mercury-wetted relays have a tendency to buzz if mounted on a solid surface. Use a rubber grommet to make a bushing in each mounting hole, or mount the relay on a rubber pad. The step-start relays, K2 and K3, are also mounted on ¼-inch-thick rubber sheet to minimize noise.

Once the major components are mounted, wire them together, performing as much testing as possible along the way. Front- and rear-panel components are mounted and wired before those that are mounted to the cabinet sides and base plate.

Power-Supply Testing

When you are satisfied that the power supply has been correctly wired and carefully checked, go have a cup of coffee and come back later when your mind is fresh and check the wiring one more time. *Remember that this power supply can be a lethal device. One wrong move could be fatal.*

Final testing of the power supply is accomplished in three steps. Remove the wiring from the primary of the transformer and place a temporary line cord with a small variable autotransformer directly from a

117-V ac line to the primary. Turn the 117 V on and slowly run the variable autotransformer up. At 117 V, the power supply should be reading half-scale voltage. This test verifies that the diode bank and filter capacitor are correctly wired. Now is a good time to calibrate the front-panel meter. Using the variable autotransformer, set the output voltage at a level that another VOM can measure accurately. For example, most VOMs can measure 1 kV. Adjust the calibration resistor so that the front-panel meter reads the same as the VOM.

The second test checks the primary 234-V ac circuitry. With the 234-V lines still disconnected from the primary, plug the power-supply line cord into a 234-V source. Remember that the shorted two-contact plug must be inserted into the rear-panel socket. Turn the power supply on with the test switch and listen for a 3- to 4-second time delay for the step-start relays. Check that 234 V appears across the two wires disconnected from the primary.

The final test is to try the entire power supply with 234 V applied to the primary. Check the high- and low-voltage indications on the front-panel meter.

Power-Supply Performance

The design results in a husky supply that delivers about 4.6 kV and 3.8 kV (no load) on the high- and low-voltage positions, respectively. In either position the power supply drops less than 400 V under full load. This is the performance you need to achieve full-power capability and good linearity.

RF Deck Construction

The physical design of the RF deck requires planning long before construction begins. Again, I used the Macintosh computer for my initial "paper design," but the same process can be done using paper and pencil. The important thing is to lay out the major components so that everything fits properly before starting to drill holes and cut metal. You must have all the major components in hand before doing the physical design, so you know what you have to work with.

Fig 8 shows the scaled Macintosh designs for the front, top and bottom views of the amplifier. It is necessary to match the designs so that the front-panel controls end up at the right place on the panel. Everything must be drawn to scale to obtain the relative positions of the components. When designing the bottom and top layouts, only the major circuit boards and components like the grid trip, input network, low-voltage power supply, coils, capacitors and filament transformer are considered. The smaller components can be fitted in later. It is important that the unit be designed with maintainability in mind. Every component, large and small, must be accessible after the unit is completed. The amplifier was constructed in the following steps. Each major step is discussed in more detail later.

- Fabricate, build and test all printed-circuit boards for the RF deck.
- Cut the holes in the front panel.

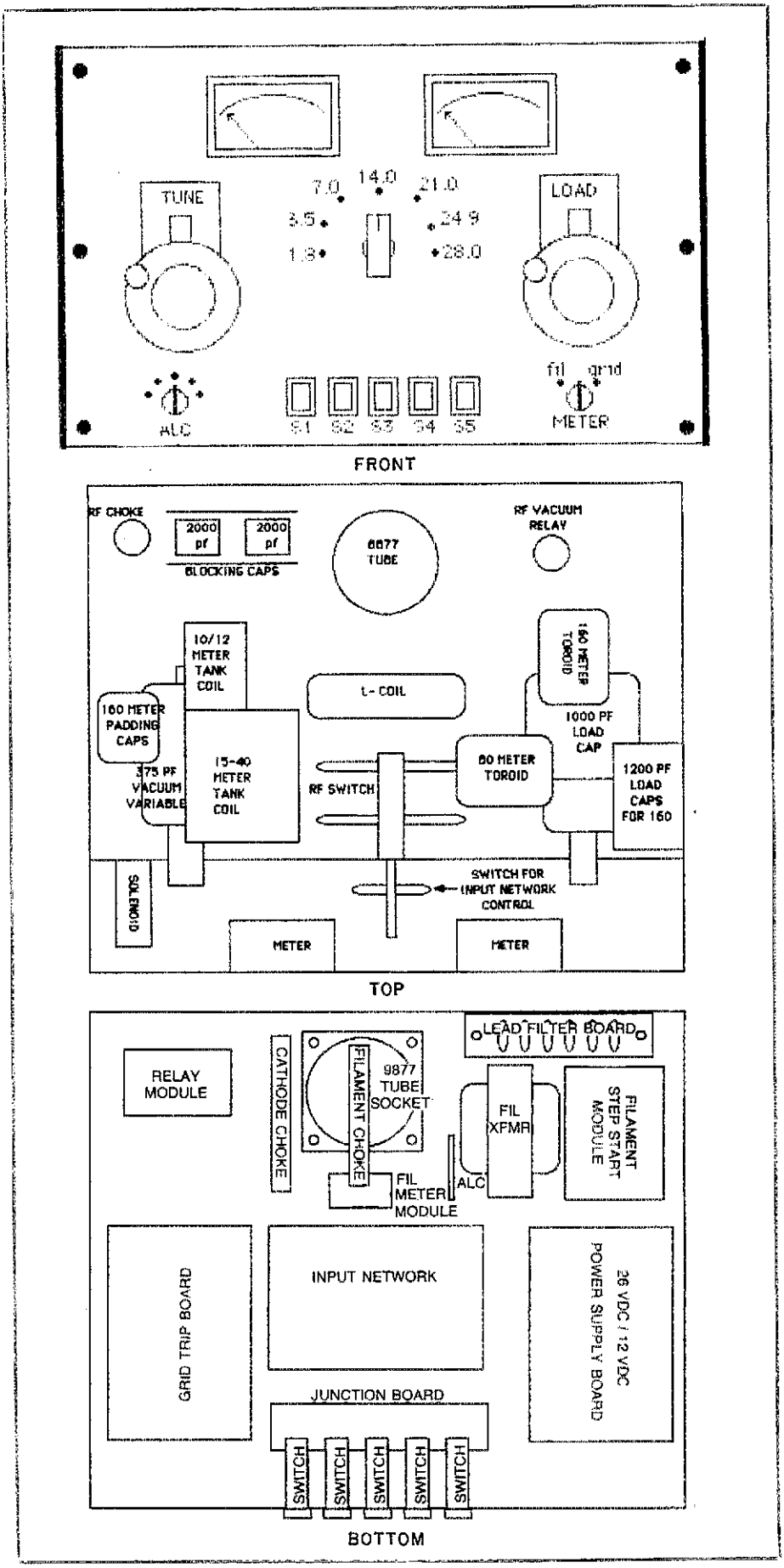


Fig 8—Scale layouts of the RF deck front, top and bottom views, as prepared on the Macintosh computer. Some component labels have been enlarged for legibility.

• Perform the major metal work on the subpanel and chassis plate.
• Mount the vacuum capacitors and band switch to the subpanel.
• Mount the PC boards, filament transformer and tube socket to the chassis plate.
• Wire and test the under-chassis control circuits.
• Fabricate and install the RF tank circuit.
• Label and calibrate meters.
• Complete the front panel and mate it to the chassis and cabinet.
• System test the amplifier with the power supply.

Printed-Circuit Board Fabrication

Making PC boards can be tedious, but with a little practice, good results can be obtained. Grouping interconnected circuits on the same PC board minimizes the cable harness between modules in the amplifier. In this design, nine PC board modules are required.

	Board Size
1) Input network	4" × 6"
2) Low-voltage power supply and timer circuit	4" × 6"
3) Grid-trip and bias circuit	4" × 6"
4) Switch bank harness interface to front panel	1" × 6"
5) Filament step-start circuit	2¾" × 3¾"
6) RF input/output relay timing circuit	2¾"
7) Line filters for control cable and blower	1¾" × 5¼"
8) Filament-voltage-meter circuit	1-1/8" × 2"
9) ALC circuit	1¾" × 2¼"

All boards, except nos. 4, 7, 8 and 9, are mounted on ½-inch channel to the chassis plate. Therefore, the PC board layouts include a ground strip on the edges of each board to mount the boards to the channel.

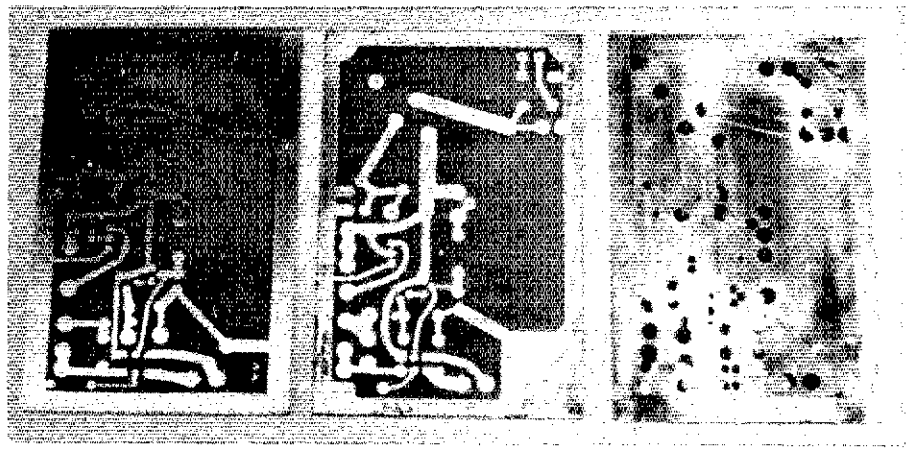


Fig 9—Things don't always work out. Three attempts were made to fabricate the grid-trip and bias PC board. The good board at left was subsequently damaged, requiring a fourth effort.

The Macintosh computer, with a software package called "Draw," was used to lay out the circuit boards. The design of PC boards with the computer is beyond the scope of this article. PC boards can also be laid out using pencil and paper. Once the design is laid out to scale, the layout must be transferred to the board. First wash the board with a mild detergent to remove all grease and dirt. Using tape and special dry transfers (Radio Shack p/n 276-1577), copy the design onto the board. The transfers are not exact, and the hand drawing only serves as a guide. Submerge the board into an etching solution to remove the exposed copper. I use ferric-chloride etchant. A flood lamp over the etching tray warms the solution and speeds the etching process. Agitate the solution occasionally. The final result should be a nicely etched board ready for drilling the holes for mounting parts. Believe me, however, it doesn't always go as planned. Fig 9 shows three tries at making the grid-trip and bias board. Actually the third board, on the left, was damaged, and a fourth was necessary. However, once you get the hang of it, it usually goes well.

After etching the board, polish it with fine steel wool and drill the component mounting holes with a small drill. Use dry transfers to label the connections required to the board, before mounting parts. This will avoid wiring mistakes when the wiring harness is installed. Finally, mount and solder the components onto the board.

Test each board as much as possible before final assembly. For example, Fig 10 shows the input network being tested by

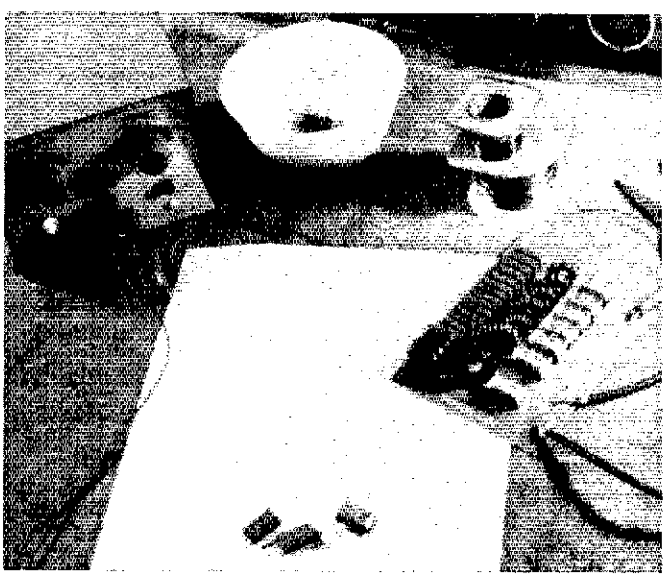


Fig 10—In-process testing of the input-network PC board. Each coil was trimmed to produce a 1:1 SWR into a 50-ohm load. Note the power supply required to actuate relays.

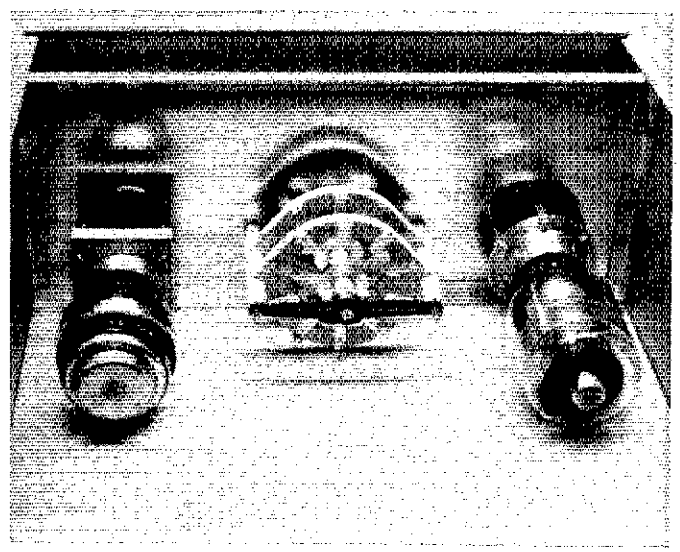


Fig 11—Subpanel installation in the cabinet. Note position of chassis plate, vacuum variable capacitors and band switch. Aluminum angle stock is used to mount the subpanel to the chassis plate and cabinet sides.

hooking up coaxial cable and running 100 W through each section into a 50-ohm dummy load. The coils were adjusted at this time to give a flat 1:1 SWR. A power supply is needed to energize the relay for the pi-section being tuned.

Front-panel Fabrication

Cover the front panel with masking tape to protect it from scratches, and mark the mounting positions of the components. Take your time with this step since it is hard to recover if an error is made. Mark the front panel where the holes are to be cut and carefully drill a small pilot hole followed by the correct hole size. The holes for the band switch, capacitor control shafts, ALC control and multimeter switch are 3/8-inch diameter and can be made with a regular drill bit. The holes for the power switches are 5/8-inch diameter and require a chassis punch. The meter-mounting holes are the most difficult to make. The rectangular cutouts are marked about 1/32-inch smaller than required to protect against overcutting. Use a nibbler to cut the holes carefully, then file them to the exact size of the meter bezels. Be careful that the file doesn't slip and scratch the panel (disaster!). Using a large file will help avoid this tragedy.

I recommend doing all the front-panel metal work at one time to ensure proper component layout. When the metal work is complete, leave the masking tape on the panel for protection as it will be used as a template to locate the parts mounted behind the front panel.

Chassis and Subpanel Metal Work

This amplifier design has very little metal work that requires more than a hacksaw and a file. The chassis plate was purchased with the cabinet. The only other panel, except for front and rear panels, is the subpanel that mounts perpendicular to the chassis plate, and 3 inches behind the front panel. The subpanel shields the meter compartment from RF and serves as a mounting support for the band switch, vacuum capacitors and 80-meter toroid coil.

The chassis is mounted 3½ inches from the bottom of the cabinet to allow room under the chassis plate for the filament transformer. Therefore, the subpanel is cut to 6¾ × 16½ inches. Referring to Fig 11, ½-inch aluminum angle is attached with screws to each edge of the subpanel to provide a mounting flange to the chassis plate and cabinet side walls. The top piece of angle stock provides a mounting surface for a piece of gold-plated finger stock that seals the subpanel to the cabinet top plate.

Two large holes are required. A 3-inch-diameter hole is required in the chassis plate for the tube socket. A 5-inch-diameter hole is cut in the cabinet top plate and aligned directly above the tube socket to vent the air flowing from the tube and chimney. Use a large fly-cutter, available at most hardware stores. For safety, the fly-cutter should be used only on a drill press—never with a hand drill. Therefore, if you don't have a drill press, find a friend who has one. Before cutting the large holes, use 3-inch masking tape to cover the chassis plate and top panel to mark where the holes are to be drilled, and to protect the surfaces. For safety, clamp the panels onto a board and the base of the drill press before drilling.

Cut a piece of perforated aluminum stock to be slightly larger than the hole in the cabinet top panel. Clean the perforated metal well, and spray with paint to match the cabinet color. Fasten the perforated piece to the inside top panel with several small countersunk screws painted to match the cabinet.

Mounting Vacuum Variable Capacitors and Band Switch

The vacuum variable capacitors and band switch are mounted to the subpanel, but their control shafts must be aligned with the front panel design. Allow enough slack in the positioning of these components to perform precise alignment with the front-panel holes when the front panel is installed. To mark the hole positions on the subpanel, slide the subpanel against the rear of the front panel while both the front panel and chassis plate are bolted into place in the cabinet. Cover the subpanel with masking tape and mark the exact centers of the holes for the components. Drill the two holes in the subpanel for the vacuum variable capacitors with hole saws. Mount the vacuum variable capacitors and band switch on the subpanel.

Mounting Major Components to the Chassis Plate

The major components (PC boards, filament transformer and tube socket) are mounted to the chassis plate as shown in Fig 12. The PC boards are first mounted to ½-inch aluminum channel using sheet-metal screws for easy removal. Cover the bottom of the chassis plate with masking tape. Position and mark the PC boards, filament transformer and tube socket according to the planned physical layout. Drill the mounting holes in the chassis plate, then redrill the holes from the top with a countersink bit to allow flat-head countersunk screws to be used for mounting. This retains the flat surface on top of the chassis plate. With the ½-inch channels on the PC boards, mark the hole positions on the bottom of each channel with a pencil, using the predrilled chassis-plate mounting holes as a template. Remove the channels from the PC boards, mount the channels on the chassis plate, and remount the PC boards on the channels.

Under-Chassis Wiring

Complete the under-chassis wiring, according to the schematic diagram, using Teflon® -insulated wire. The nylon connectors near the front of the chassis connect to the front-panel power switches, the ALC potentiometer and the multimeter switch. This allows the front panel to be easily removed for rear-panel access. The small board in the front center of the chassis provides an easy way to mate the 12-pin nylon connector going to the power switches with the wiring harnesses under the chassis plate (see Fig 13). When making the PC boards, try to put all the connections to the board on one side. This allows access to the boards for maintenance without removing the wiring. Just unscrew the board from the channel and fold the board upward.

Each wire is labeled at each end with numbered tags, because the Teflon wire used

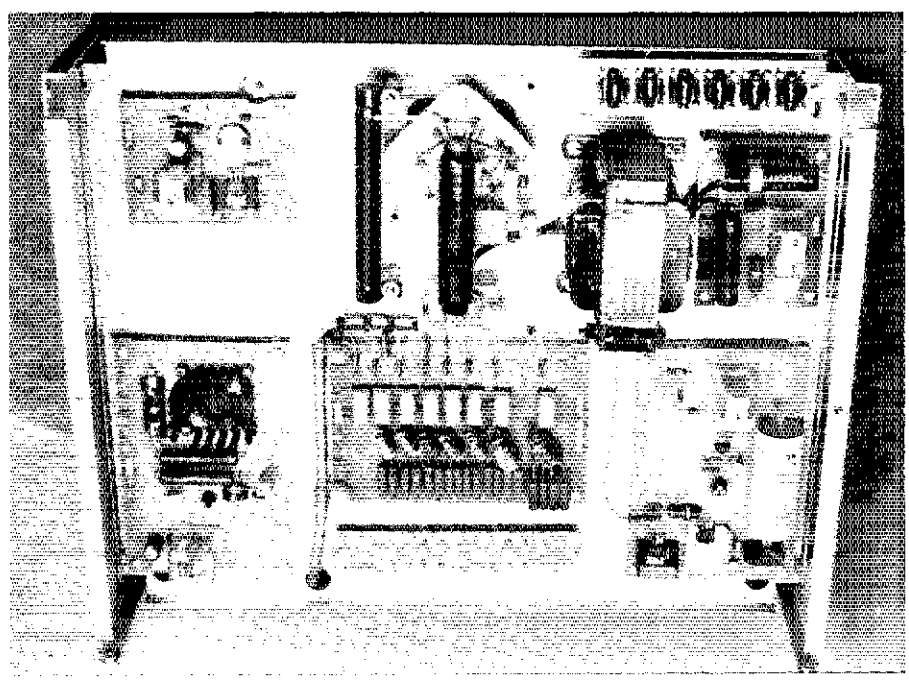


Fig 12—Bottom view of the RF deck showing placement of PC boards, transformer and tube socket.

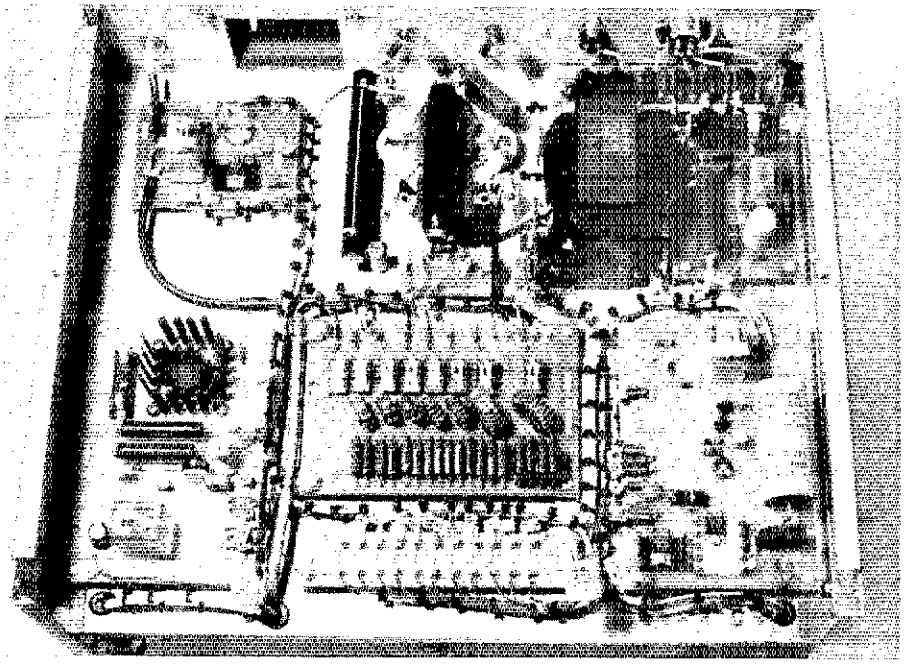


Fig 13—Bottom view of the RF deck showing harness wiring in place.

is mostly the same color. A version of the schematic diagram was maintained with the wire numbers noted for easy wire tracing. The final wiring is cabled into harnesses with plastic cable ties. Don't be afraid to use plenty of ties, but at first only put a tie every inch or two. The ties will undoubtedly be cut several times during wiring to put in missing wires that are overlooked. When all wiring is complete and tested, put a cable tie every ½ inch on the major harnesses.

Amplifier Tank Circuit

The plate tank-coil set is shown in Fig 14. Before making the coils, determine the tank-circuit parameters for the given tube plate impedance. The plate impedance can be determined from Eq 1.

$$\text{Plate impedance} = \text{plate voltage} / (1.57 \times \text{plate current}) \qquad \text{(Eq 1)}$$

Assuming the amplifier runs at 60% efficiency, the input power required for 1500-W output is approximately 2500 W. With 3200 V on the 8877 plate, plate current will be approximately 781 mA. From Eq 1, a tank circuit designed for approximately 2600 ohms is appropriate. A table of pi-L network component values is contained in Hoff's article, and the values used in this amplifier are summarized in Table 2.[10]

The 80- and 160-meter coils are wound on an assembly of three T225-2 toroid cores taped together with Scotch no. 27 glass-cloth tape. Use plenty of tape to provide good voltage insulation from the cores. The 80-meter coil is wound with 11 turns of no. 10 wire covered with Teflon sleeving. The 160-meter coil is wound with 19 turns of no. 12 wire, also covered with Teflon sleeving. The cores of both coils are mounted from 1 to 2 inches from the mounting wall on ceramic insulators. Each coil is sandwiched between two pieces of fiberglass material held together by a ceramic standoff running through the middle of each toroid (see Fig 15). Wind all coils in the same direction (clockwise or counterclockwise), to avoid a "bucking" action between coils.

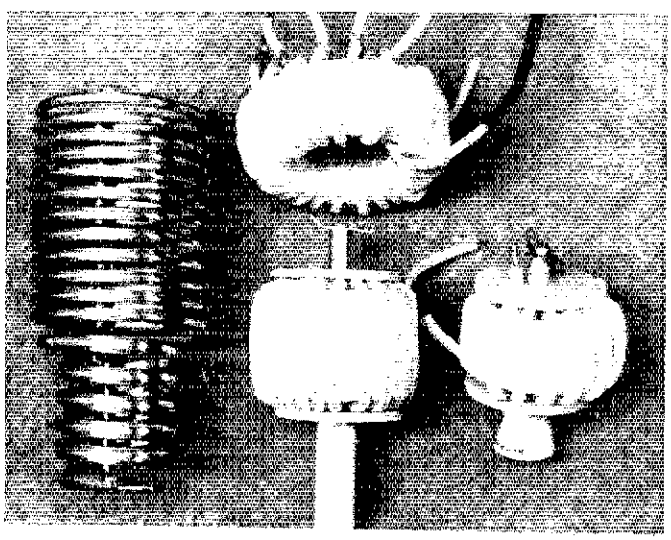
The 10- through 40-meter coil is made from ¼-inch soft copper refrigerator tubing. Clean the tubing using fine steel wool (000) until the surface is smooth and bright. Use a piece of pipe with an OD equal to the desired coil ID and carefully wind the copper tubing around the pipe. After the smaller diameter part of the coil has been wound, change the pipe to a larger diameter, and wind the larger part of the coil. The inductance of the coil can be easily checked using a known fixed-mica capacitor with low internal inductance and a dip meter. After determining the resonant frequency, calculate the inductance using Eq 2.

$$\text{Inductance} = 1/(4\pi^2 f^2 C) \qquad \text{(Eq 2)}$$

Always wind the inductor with a few extra turns and then remove turns until the desired inductance is achieved. The inductance measurement is only an approximate value because there is always stray inductance introduced by the interconnecting leads and the band switch.

The copper tubing is silver plated only after the ends are configured to match the mounting lugs in the amplifier. Silver plat-

[10]I. M. Hoff, "Pi Network Design for High Frequency Power Amplifiers," *Ham Radio*, Jun 1978.



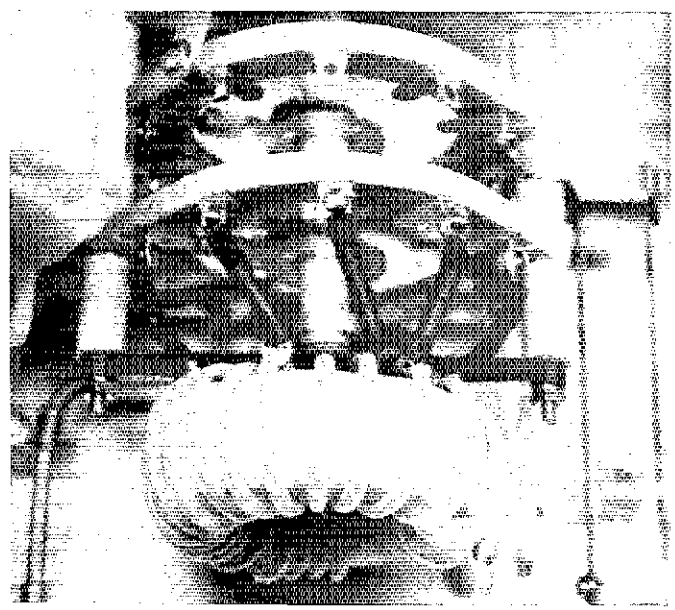


Fig 14—Plate tank coil set. Above: the various coils of the tank circuit. Right: the L toroid mounted on the rear of the band switch.

Table 2

Pi-L Network Design Parameters (See Fig 3, Part 1)

Freq (MHz)	C1 (pF)	L1-L4 (μH)	C2 (pF)	L5 (μH)	Q
1.8	462	22.02	2121	8.90	13.1
3.5	244	10.99	1132	4.45	13.4
7.0	113	6.03	503	2.44	12.4
14.0	55	3.08	245	1.24	12.2
21.0	37	2.05	164	0.83	12.2
24.9	30	1.70	130	0.70	12.0
29.7	26	1.48	112	0.60	12.0

L1, 10-12 meters—6 turns ¼-inch silver-plated copper tubing, 2-inch outside diameter, 2 inches long. 10-m tap at 3 turns.

L2, 15-40 meters—12 turns ¼-inch silver-plated copper tubing, 2-inch outside diameter, 4 inches long. 15-m tap at 2 turns, 20-m tap at 4 turns, 40-m tap at 12 turns.

L3, 80 meters—11 turns of no. 10 wire in Teflon sleeving over two T225A-2 iron-powder toroidal cores taped together with Scotch no. 27 glass-cloth electrical tape.

L4, 160 meters—19 turns of no. 12 wire in Teflon sleeving over two T225A-2 toroidal cores taped together with Scotch no. 27 glass-cloth electrical tape.

L5, L Coil—20 turns of no. 20 wire in Teflon sleeving over two T300-2 iron-powder toroidal cores taped together with Scotch no. 27 glass-cloth electrical tape. Tap as follows:

Band	10-12	15	20	40	80	160
Turn no.	2	3	4	6	10	20

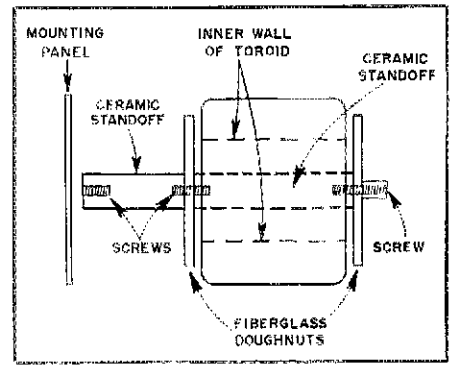


Fig 15—Mounting details of 80- and 160-meter toroids.

ing is simple with the right materials. Go to a photographic lab and get a couple of gallons of used *fixer solution*. Fixer solution is not usable when it becomes saturated with silver. The labs usually sell the spent fixer for silver recovery, so you may have to pay for it. Clean the coil by giving it another brushing with steel wool, wash it thoroughly in a mild detergent and rinse it well before plating. Put the fixer solution in a large plastic container and submerge the coil in it. A bright silver plate will form within seconds. The silver plate is not very thick, but it is sufficient to keep the copper from tarnishing. The coil taps are small wrap-around clamps made from silver-plated ½-inch-wide copper strap. Plate about 2 inches of copper strap, then drill a hole in one end for a no. 8-32 screw. Using a short piece of ¼-inch tubing as a jig, bend the end sharply around the tubing with a pair of duckbill pliers. Drill a second, matching hole, but squeeze the clamp in to provide a tight fit around the coil stock. Install the clamp with a flat washer on each side to provide a compression fit. The clamp should fit tightly. Don't solder the clamps until after the amplifier is tested. When the tap location is verified, heat the clamp and coil with a large solder gun and flow solder into the connection. After soldering the coil taps, spray the coil with a thin coat of clear plastic to retain the bright silver finish.

The L coil is wound on a pair of T300-2 toroid cores taped together with glass-cloth tape. The coil is mounted on the back of the band switch and supported by the connections to the coil. The leads are not soldered to the band switch, but are held in place with no. 6-32 screws.

Other major considerations in the RF tank circuit are the TUNE and LOAD capacitors. The TUNE capacitor is a 375-pF vacuum variable. Table 2 shows that though this capacitor will easily cover 10 through 80 meters, it is too small for 160 meters. One solution is to use a 500-pF vacuum variable, but units in this size class are not readily available in the surplus market, and you probably don't want to buy a new one at approximately $500. I solved the problem by switching in an additional 160-pF capacitor in parallel with the vacuum variable for 160 meters.

A 24-V dc solenoid, mounted on the subpanel, grounds a pair of 80-pF fixed vacuum capacitors. The solenoid is powered by a small 12-V relay that is energized by the 160-meter control line on the input network control switch. The grounding strap is made from a stiff piece of brass stock obtained at a hobby shop. A hinge is made by soldering a small piece of brass tubing to the strap and putting a solid rod through the tubing. The rod is supported on each end by a small piece of Plexiglas and allowed to pivot, thus forming a hinge. A piece of flexible braid is connected from the brass strap to ground for a good connection. The strap is held in the open position by a small spring pulling the strap back toward the subpanel. The contacts on the strap and the vacuum capacitors are from a 25-A power relay and soldered in place. A piece of ¼-inch brass bar stock is used to mount the contact on the vacuum capacitor side and to absorb the shock from the closure. A rubber grommet on the brass strap, where the rod from the solenoid hits the strap, also absorbs some of the shock. This scheme works smoothly and once thought out, took about one evening to install.

The LOAD capacitor is a 1000-pF, 3-kV unit with a fixed 100-pF, 5-kV fixed mica transmitting capacitor in parallel. This provides a total of 1100 pF for 80 meters. On 160 meters, the band switch adds an additional 1200 pF in parallel to provide a total of 2300 pF. The 1200-pF capacitor consists of three 400-pF mica transmitting capacitors in parallel.

Marking and Calibrating Meters

Any meter with a movement from 100 μA to 5 mA can be used for the front-panel meters. Use two identical meters, if possible, for esthetic reasons. In a very clean environment, begin by removing any internal meter shunts (on ammeters), or any series resistors inside the meter (on voltmeters) to obtain only the basic meter movement. Nothing else need be done for the multimeter, since the calibration resistors are a part of each metered circuit. A shunt resistor must be made for the plate-current meter. Wind about 2 feet of no. 22 enameled wire on a 2-W resistor of any value over 50 ohms, soldering the wire ends to the resistor terminals. Mount the resistor across the meter terminals to form a shunt. Connect the meter in series with another meter of known calibration and an adjustable power source. Trim the enameled wire 1 inch at a time until the meters read the same. If the meter being calibrated reads too low, the wire is too short. When the meters read the same, slip a piece of heat-shrink tubing over the resistor and seal the shunt.

Carefully remove the plastic face cover and the calibrated face plate from the meter. Do this in a clean environment because the magnet in the meter will attract metal shavings that could damage the movement. With a pencil eraser, rub off the original meter lettering, but not the analog scale tick marks. With small dry-transfer letters put

(continued on page 37)

Broadband Dipoles—Some New Insights

The search for a broadband 80-meter dipole has continued. Efficiency, often ignored, plays an important role.

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Andover, MA 01810

Antennas that provide a good impedance match over a wide frequency range have been a topic of interest to hams for many years. Interest has been highlighted by several recent articles and a recent patent.[1-5] The advantages of a broadband antenna are obvious: fewer adjustments during tune-up, and, for some of the new broadband transceivers and amplifiers, no tune-up at all; after setting the band and frequency, one is "in business."

The topic of broadbanded antennas is fraught with misconceptions and impressive claims. In an attempt to gain further understanding, I wrote a computer program that analyzes the performance of the half-wave dipole with various kinds of bandwidth-broadening schemes. The program, written in BASIC for the Commodore™ 64 computer, is user friendly and well documented. (It may be translated to run on other computers.) Appendix 1 contains a description of the program and the assumptions and equations used in the analysis. Appendix 2 shows how one can design some of the broadband antennas described in this article.

The Half-Wave Dipole

In order to provide a foundation of comparison for some new approaches, first let us briefly review the performance of some previously reported bandwidth-broadening schemes.[6] The reference antenna used for comparison is the uncompensated half-wave dipole. The SWR versus frequency plot for a typical 80-meter horizontal wire dipole is shown in Fig 1. The data shown with the drawing gives the parameters of the dipole.

Most modern amplifiers are designed to match an antenna system with an SWR of better than 2:1. Therefore, in this article, the frequency band over which the SWR is better than 2:1 will be used as the comparison bandwidth. For the typical, uncompensated dipole of Fig 1, the bandwidth is 220 kHz.

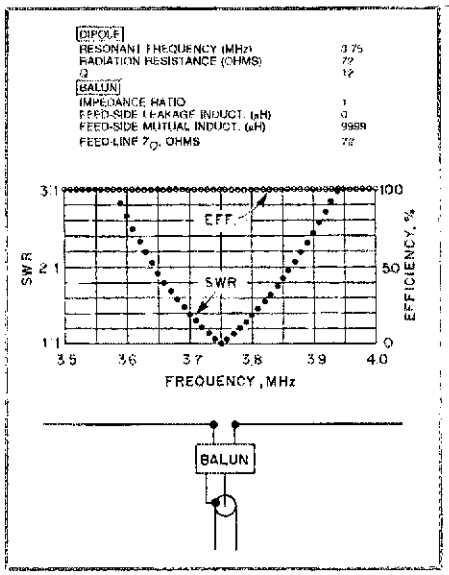


Fig 1—The 80-meter uncompensated half-wave dipole.

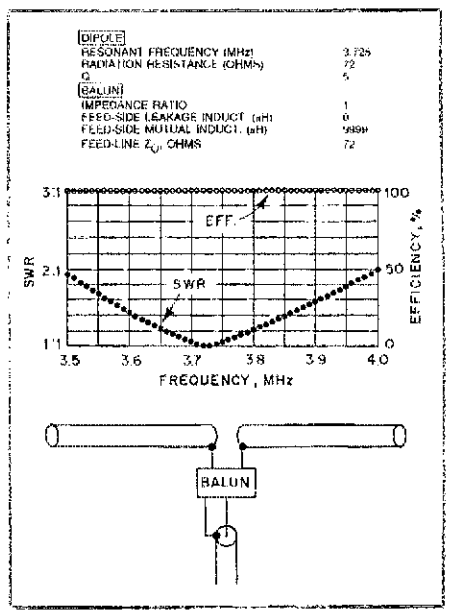


Fig 2—The cage dipole gives very efficient broadbanding, but poses practical problems on 80 and 160 meters.

Cage Dipole

Fig 2 shows what can be done by lowering the Q of a dipole. In practice, this is accomplished by fattening the dipole conductor, as in the case of the cage dipole. This technique is usually not a practical approach for 80 and 160 meters, where bandwidth widening is desired, because of the required cage dimensions. For example, in the case of an 80-meter dipole, it would be necessary to make a cage 3 feet in diameter in order to achieve the characteristics of Fig 2.[7] The bow-tie and fan dipole make use of the same Q lowering principle to obtain increased bandwidth.

Importance of Efficiency

When one augments a dipole with some matching scheme to acquire increased bandwidth, a factor frequently overlooked is the efficiency of the antenna system. When the SWR at the antenna end of the transmission line is less than 2:1, the transmission-line losses are virtually the same as those from the length of a matched line. Thus, for the part of the band over which the SWR is less than 2:1, one need only consider losses in the matching network when computing efficiency. Hence, the efficiency definition used here is:

$$\text{Efficiency (\%)} = \frac{100 \times \text{Power radiated by dipole}}{\text{Total power delivered to the antenna plus matching network}}$$

In what follows, not only will the SWR versus frequency be calculated, but so will the efficiency versus frequency.

Efficiency is related to resistive or ohmic losses in the matching network. The lower the losses, the higher the efficiency. However, ohmic losses in the matching network will broaden the response of a dipole system beyond that possible with a lossless or ideal matching network. Users must

[1]Notes appear on p 37.

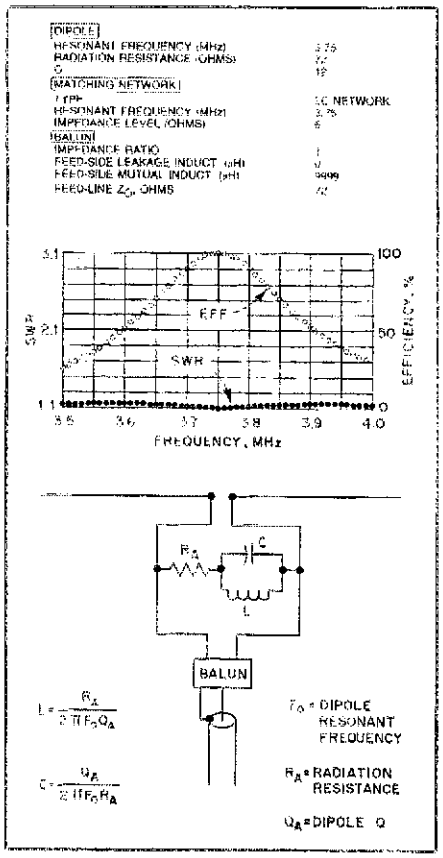


Fig 3—Matching the dipole with a complementary RLC network greatly improves the SWR characteristics, nearly 1:1 across the 80/75-m band. But the relative loss at the band edges is greater than 5 dB.

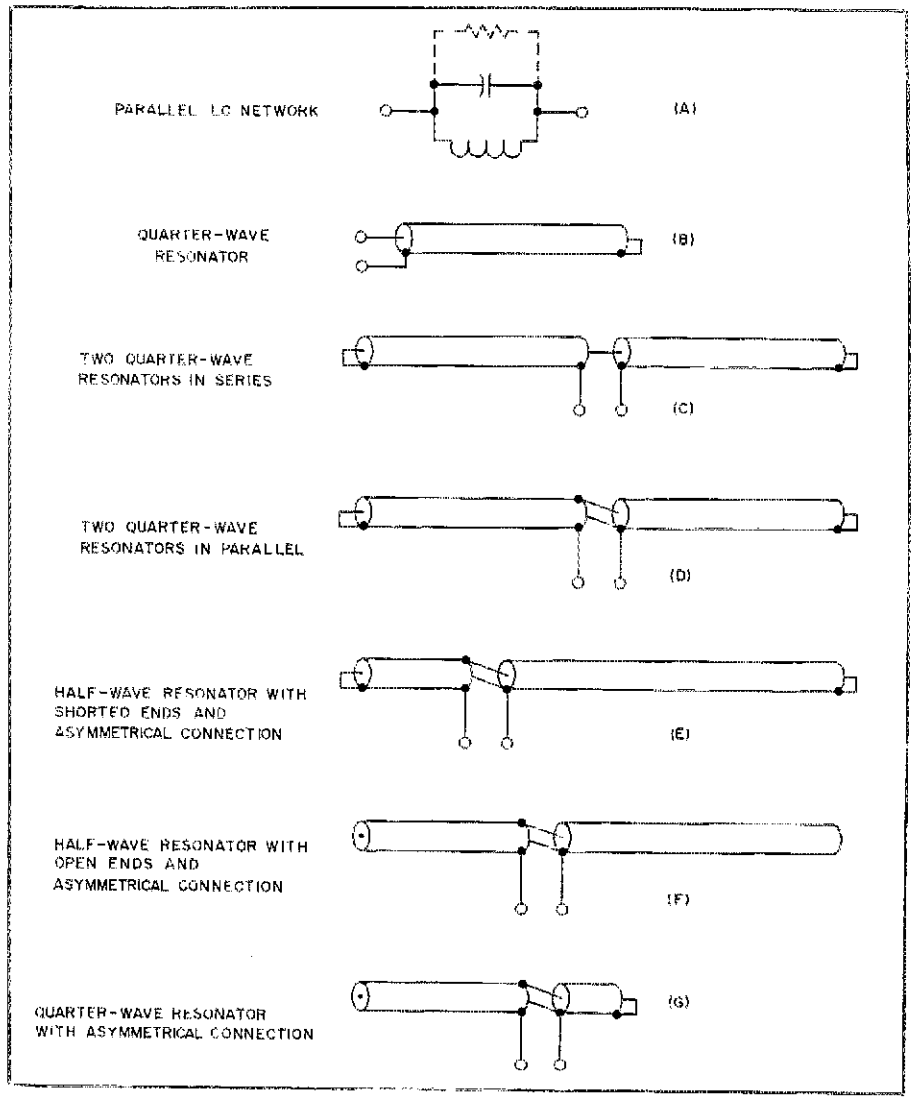


Fig 4—Types of resonators for broadbanding resonant antennas.

decide whether they are willing to accept the lower efficiency in trade for the increased bandwidth.

An extreme degree of bandwidth broadening is illustrated in Fig 3. The broadening is accomplished by adding resistive losses. One may resort to some network theory and derive the RLC (resistor, inductor, capacitor) matching network shown there. The network is called the complement of the antenna impedance. Note that the SWR is virtually 1:1 over the entire band, but the efficiency falls off dramatically away from resonance. Another way of interpreting the band-edge efficiency of 25 or 30% is that the antenna has about 5 dB of loss relative to an ideal dipole:

$$\text{dB (loss)} = -10 \log \frac{\text{Efficiency}}{100}$$

Also note that at the band edges, 70 to 75% of the power delivered down the transmission line from the transmitter is heating up the matching-network resistor. For a 1-kW output level, the resistor must have a power rating of at least 750 watts! Use of an RLC complementary network for broadbanding is not recommended, but it does illustrate how resistance (or losses) in the matching network can significantly increase the apparent antenna SWR bandwidth.

In the cases that follow, the designs are based on using reactive components (transmission-line resonators or inductors and capacitors) to achieve bandwidth widening. The nonideal nature of real-world components leads to less than 100% efficiency.

Resonators as Matching Networks

The most practical broadbanding network for a dipole is the parallel LC tuned circuit connected directly across the antenna terminals. This circuit may be realized by using a coil in parallel with a capacitor or by using a coaxial resonator. Fig 4 shows the various resonators used for analysis in this article. For the horizontal dipole cases shown below, the stubs are assumed to be made of RG-58A.

The Double Bazooka

The response of the somewhat controversial double bazooka antenna is shown in Fig 5. This antenna actually consists of a dipole with two quarter-wave coaxial resonators connected in series, Fig 4C. Not much bandwidth enhancement is provided by this resonator connection because the matching network has too high an impedance level. Note the negligibly small bandwidth improvement over the uncompensated dipole of Fig 1. For comparison, it is useful to define *bandwidth improvement factor* (BWIF) as follows:

$$\text{BWIF} = \frac{\text{2:1 SWR bandwidth of broadband antenna}}{\text{2:1 SWR bandwidth of uncompensated half-wave dipole}}$$

The double bazooka BWIF equals 1.14.

The Crossed Double Bazooka

In earlier articles, the crossed connection of a double bazooka antenna has been described.[5] The response of this antenna is

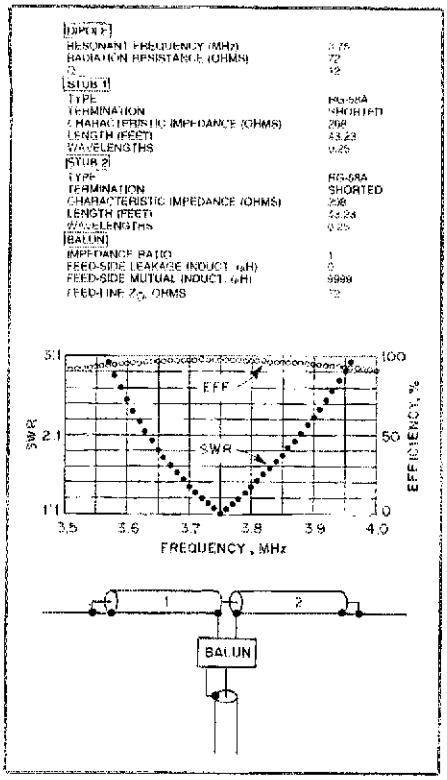


Fig 5—The double bazooka, sometimes called a coaxial dipole. Because the BASIC program assumes that the two stubs are in parallel, the characteristic impedance of the line for each stub is set to 208 ohms. This is equivalent to two 52-ohm stubs connected in series.

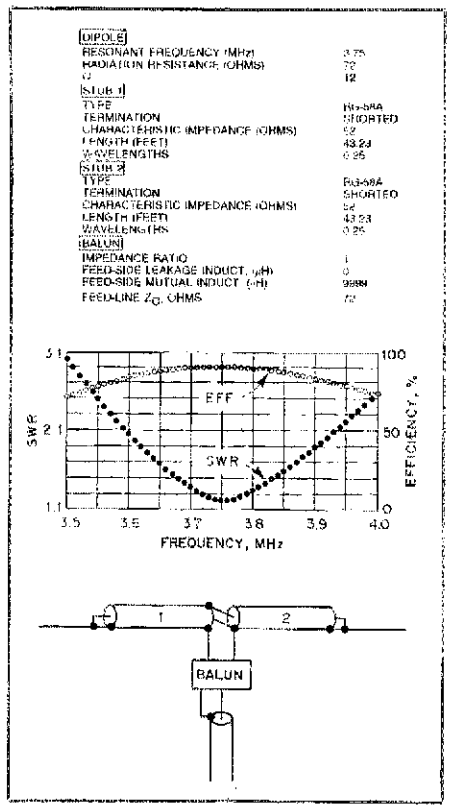


Fig 6—The crossed double bazooka yields bandwidth improvement by using two quarter-wave resonators, parallel connected, as a matching network.

variant of this antenna is shown in Fig 8. The half-wave resonator has open ends, permitting even lower matching-network impedance levels to be physically realized. For this case the BWIF equals 2.29.

An even more practical asymmetrical crossed double bazooka antenna may be produced by using a tapped quarter-wave resonator. In this case, one end of the stub is open-circuited while the other end is shorted. This case is shown in Fig 9. The BWIF is again 2.29. Note that the efficiency drops to only about 45 to 55% at the 2:1 SWR limits.

The asymmetrical stubs unbalance the dipole antenna unless the wire portions are made the same diameter as the stubs. The magnitude of this unbalance has not been analyzed, but could be compensated by making the dipole "halves" unequal in length.

It is interesting to note that the effective Q that can be obtained with a quarter-wave resonator is the same as that of either the open- or short-circuited half-wave resonators. The only reason for choosing the longer resonators would be their higher power-handling capability.

Of interest is the Q that can be acquired when resonators are made from coaxial cable. Table 1 summarizes the resonator Q one obtains from different types of coax at 80 and 160 meters. Appendix 2 shows how the Q of coaxial-cable resonators may

shown in Fig 6. In this case, the impedance level of the matching network, Fig 4D, is reduced to be one-fourth the impedance level of the network of the standard double bazooka. The lower impedance level provides more reactance correction, and hence increases the bandwidth by a noticeable amount. The BWIF equals 1.55. Notice, however, that the efficiency of the antenna drops to about 80% at the 2:1 SWR band edges. The broadbanding, in part, is caused by the resistive losses in the coaxial resonators, which have a remarkably low Q (only 20).

The Asymmetrical Crossed Double Bazooka

The matching network of the crossed double bazooka may be viewed as a half-wave coaxial resonator with the connection made at the midpoint. The impedance level of the matching network may be reduced to an even lower level by, in effect, tapping the half-wave resonator of the crossed double bazooka at a point off center. This case is shown in Fig 7. Note that by using a lower, more optimum impedance level for the resonator, even more broadbanding is obtained. The BWIF in this case equals 2.16. Notice also that the dimensions of this kind of resonator are still practical since the velocity factor of the coax (0.66 for RG-58 and RG-8) leads to shortened stubs. A

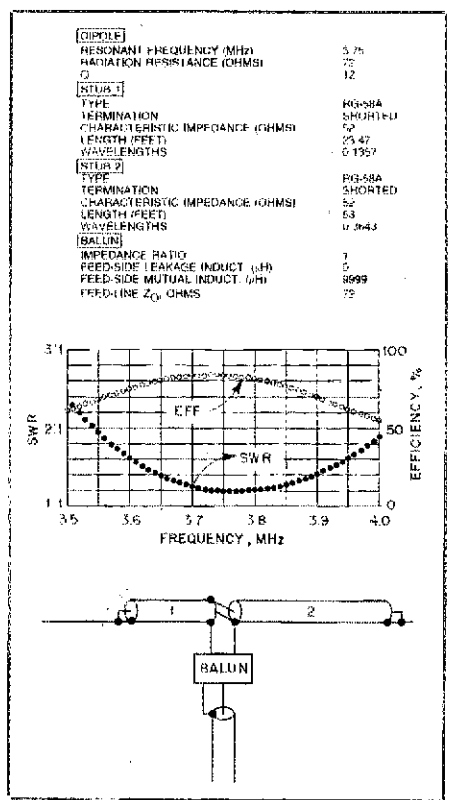


Fig 7—The asymmetrical crossed double bazooka displays even lower matching-network impedances. The resonator may be viewed as a half-wave resonator with shorted ends.

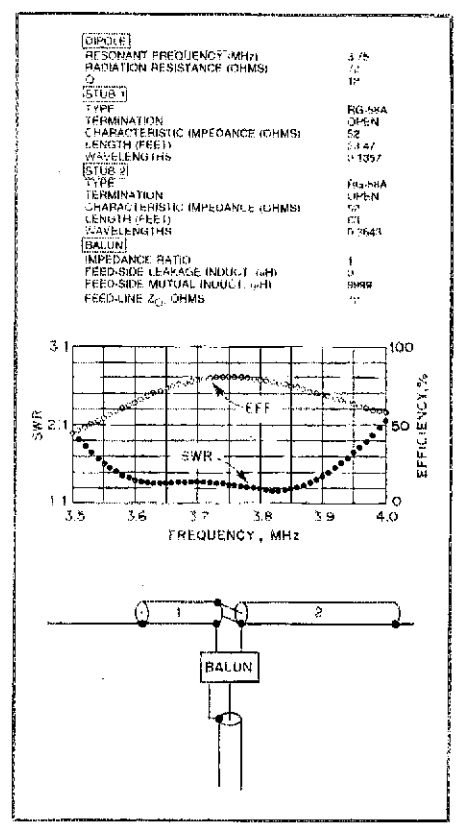


Fig 8—Another form of the asymmetrical crossed double bazooka uses a half-wave resonator with open ends to obtain more optimum impedance levels.

Table 1

Resonator Q for Various Types of Coaxial Cable

Cable Type	*Resonator Q*	
	80 Meters	*160 Meters*
RG-174	6.5	4.5
RG-58A	20.0	15.1
RG-141	22.5	16.1
RG-8	41.0	30.6
½-in Hardline	75.5	53.9
¾-in Hardline	109.1	77.1

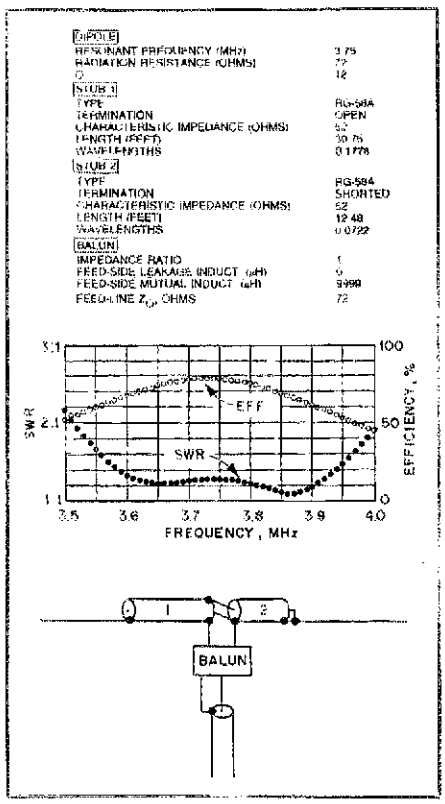


Fig 9—The asymmetrical crossed double bazooka uses a single quarter-wave resonator to achieve essentially the same characteristics as the antenna of Fig 8.

be derived from a knowledge of the cable loss.

Effect of Mismatching

An interesting and useful observation was made during the course of the work described in this paper. The SWR curve of Fig 1 is obtained when the dipole resistance at resonance matches the feed-line characteristic impedance. It is not always convenient to achieve this condition. The feed-line impedance is often either too high or too low. It turns out that mismatching in one direction is far more desirable than in the other. Fig 10 shows how the BWIF is affected by mismatch at resonance. Too high a feed-line impedance actually improves the BWIF up to the point where center-frequency SWR is 1.5. In contrast, a feed-line impedance which is too low, but

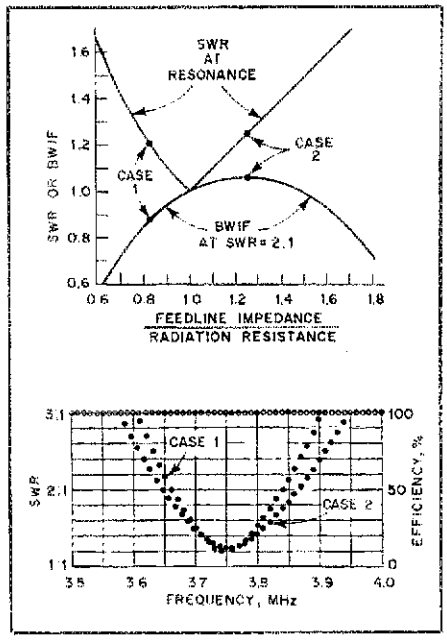


Fig 10—The influence of mismatch on an uncompensated dipole having a radiation resistance of 60 ohms at resonance. Both bandwidth improvement factor (BWIF) and SWR at band center are shown. For Case 1, the feed-line Z_0 is 50 Ω, while for Case 2 it is 75 Ω.

also yielding an SWR of 1.5 at resonance, causes the dipole bandwidth to drop to ⅔ of the matched bandwidth.

The conclusion to be reached is that greater bandwidth is obtained when an uncompensated dipole is fed with a feed-line impedance that is higher, not lower, than the resistance of the dipole at resonance. For example, a dipole in the inverted-V configuration with a radiation resistance of 60 ohms will have 20% more bandwidth if it is fed with 75-ohm line than if it is fed with 50-ohm line. This result is independent of the dipole Q.

Chebyshev Matching

It is possible to widen the bandwidth further by again resorting to network theory. However, in contrast to the matching with a complementary network (Fig 3), no resistors are introduced. The matching-network parameters are chosen to yield a Chebyshev (often called equi-ripple) approximation. See Appendix 2. The simplest way to make use of this theory for broadbanding the dipole is to deliberately mismatch the dipole at the center of the band by adding a transformer to the matching network. This transformer must provide a voltage step-up between the transmission line and the antenna. The result is a W-shaped SWR characteristic. Low SWR is sacrificed at the band center to obtain wider bandwidth. Incidentally, the Snyder Antenna makes use of this principle.[9] Similar techniques are described in other publications.[10,11]

A broadband dipole using a Chebyshev

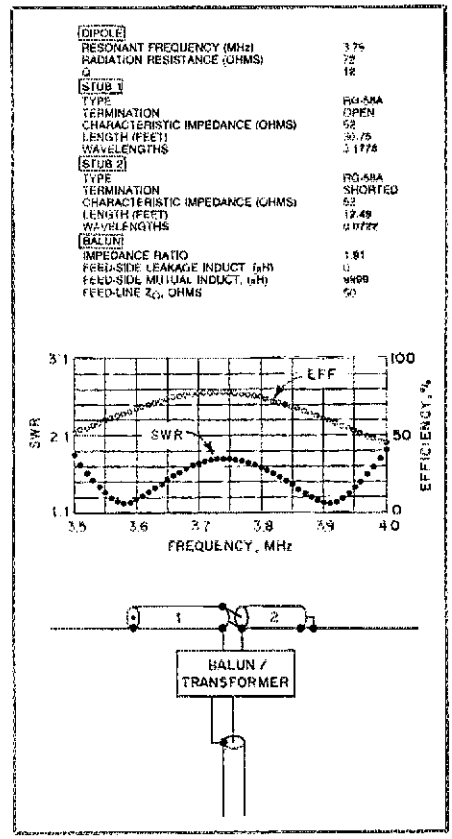


Fig 11—Chebyshev matching provides greater broadbanding by trading midband matching for increased bandwidth. Except for the transformer, this structure is the same as that of Fig 9.

matching network with a step-up transformer is shown in Fig 11. The transformer can also serve as a balun. Notice that the resonator is the same quarter-wave type as used in Fig 9. The SWR is better than 1.8:1 over the entire 80-meter band, and the BWIF is 2.50—not bad for about 43 feet of RG-58A coax and a slightly modified balun.

Okay, what's the hitch? Are we getting something for nothing? Not really. Notice that the efficiency in Fig 11 falls to only 45% and 52% at the 80-meter band edges. Only half of the available power is radiated. This low efficiency is directly attributable to the low Q of the coaxial resonator.

LC Matching Network

The efficiency can be improved by using lower loss coax or by using a matching network made up of a high-Q inductor-capacitor parallel-tuned circuit. However, the increase in efficiency is achieved at the expense of bandwidth, as will be seen.

Unfortunately, the very low impedance level required cannot be easily realized with practical inductor-capacitor values. Hence, some form of impedance transformation must be used, as shown in Fig 12. The taps on the coil serve to reduce the impedance level of the matching network, while still

permitting the use of practical element values.

The LC network used to provide these impressive broadbanding results utilizes the following: (1) a tuned circuit of very low impedance level, (2) deliberate mismatching at band center to achieve the W-shaped SWR characteristic, and (3) the balun function; that is, balanced (the dipole) to unbalanced (the coax cable) transformation. This network is very similar to one recently proposed, but not tried, by Alan Bloom, N1AL.[12] The difference is that the capacitor is connected across the entire coil in order to obtain practical element values.

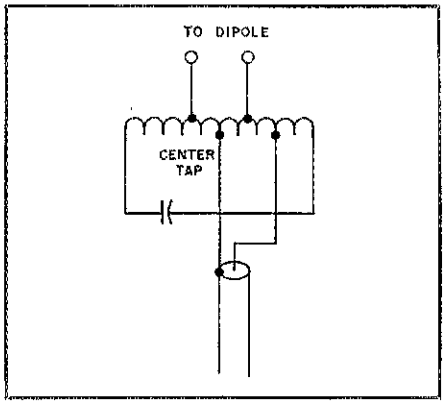


Fig 12—A practical LC matching network which provides reactance compensation, impedance transformation and balun action.

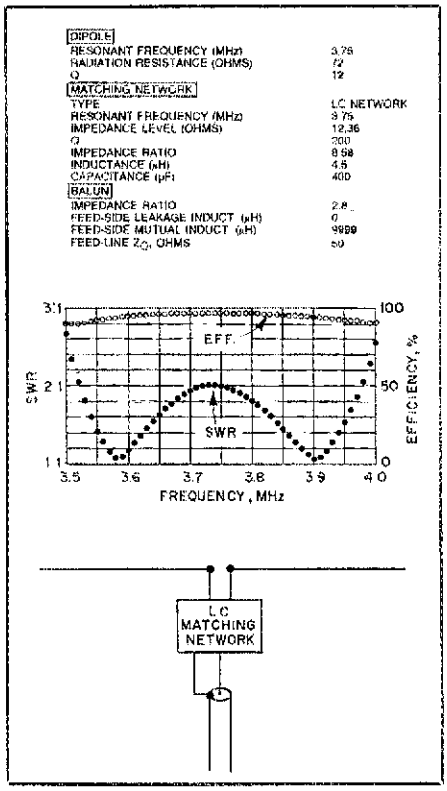


Fig 13—Efficient broadbanding with an LC matching network.

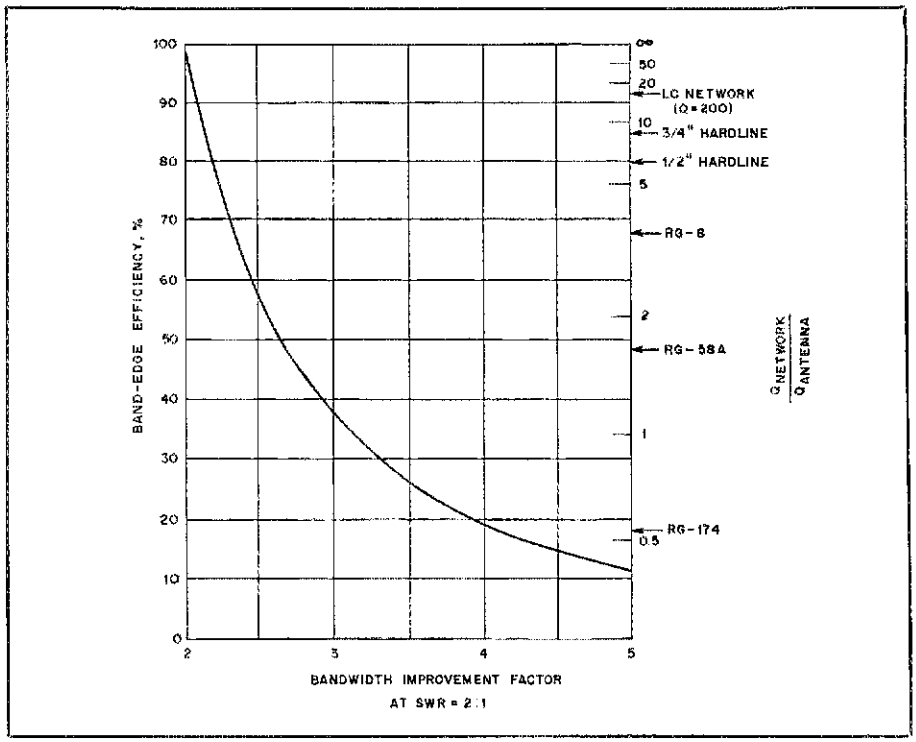


Fig 14—Trade-off between efficiency and bandwidth improvement factor. The points shown for various coaxial cables apply to the case of an 80-meter antenna with a Q of 12.

Fig 13 shows the degree of broadbanding obtainable with a high-Q LC matching network. The BWIF is 2.09. Notice that the bandwidth is not as great as that provided by the coaxial resonator in Fig 11, but the efficiency is better than 90% over the frequency range within the 2:1 SWR bandwidth.

Bandwidth Versus Efficiency Trade-Off

As is apparent in the preceding section, there is clearly a trade-off between bandwidth enhancement and efficiency. This is true because the broadbanding results from two causes: reactance compensation and resistive loading. Pure reactance compensation would be achieved with resonators having infinite Q. The resistive loading caused by nonideal resonators further enhances the bandwidth, but the price paid is that some of the output power heats up the resonator, leading to a loss in efficiency.

The trade-off is clearly depicted in Fig 14, where efficiency versus bandwidth improvement factor is shown for the specific case of Chebyshev matching and a maximum SWR of 2:1. (See Appendix 2.) Note that the best one can do with 100% efficiency is to double the bandwidth. Larger improvements are accompanied by efficiency loss. For example, a tripling of the bandwidth would be obtained with an efficiency of only 38% at the 2:1 SWR band edges.

The graph also shows (on the right hand ordinate) the ratio of the network Q to antenna Q. For the case of an 80-meter dipole with a Q of 12, one can see where on the curve various kinds of commonly used coax would land. For example, RG-8 would yield 68% efficiency and RG-58A gives only 48% efficiency. However, an LC matching network with a Q of 200 would have 92% efficiency.

It should be pointed out that Fig 14 applies for the simple Chebyshev matching that gives a W-shaped SWR plot. It is possible to design a more complex Chebyshev matching network and obtain greater reactance compensation. For example, if an additional inductor and capacitor were added, the bandwidth improvement factor (infinite-Q case) would increase from 2 to 2.8. This rather dramatic improvement could be achieved only at the expense of a more complex matching network which would be more critical to adjust, and the SWR versus frequency plot would have more wiggles.

Experimental Verification

A number of the new ideas presented here were verified by using an inverted-V half-wave dipole with its apex at 60 feet and a 90° included angle. In each case the antenna was made from no. 12 wire. The SWR measurements were made with Bird model 43 and Daiwa model CN-520 (cross needle) SWR meters. Close agreement was obtained with the two meters. All data were corrected for the loss of the transmission line between the SWR meter and the antenna.

The Uncompensated Inverted-V Dipole

Fig 15 shows the measured data for an

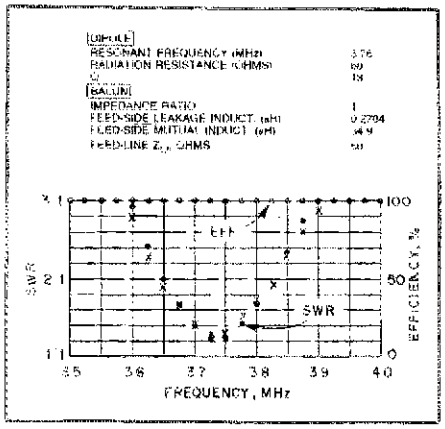


Fig 15—Predicted versus measured SWR for the uncompensated inverted-V dipole. The Xs are plots of the experimental data, while the solid dots are the computer-simulation results.

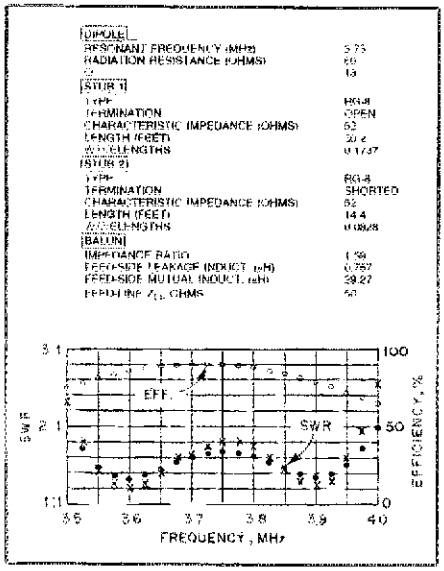


Fig 16—The inverted-V dipole broadbanded with a quarter-wave resonator. In the computer simulation, solid dots, the length of the coax was increased by 3½ inches to account for the physical connection. The Xs are plots of experimental data.

uncompensated inverted-V dipole with a W2AU balun, fed with 50-ohm RG-213 coax. The dipole was 123 feet long. Analysis of these data yielded a dipole Q of 13 and a radiation resistance of 60 ohms at resonance. If this antenna were perfectly matched at resonance, the 2:1 SWR bandwidth would have been 204 kHz.

Inverted-V Dipole with Quarter-Wave Resonator

Shown in Fig 16 is an inverted-V dipole with a quarter-wave resonator. This antenna showed a substantial improvement in bandwidth, to 465 kHz. RG-8 stubs comprised the resonator; a homemade balun transformer with a 1.59:1 impedance ratio was used. A description of the technique

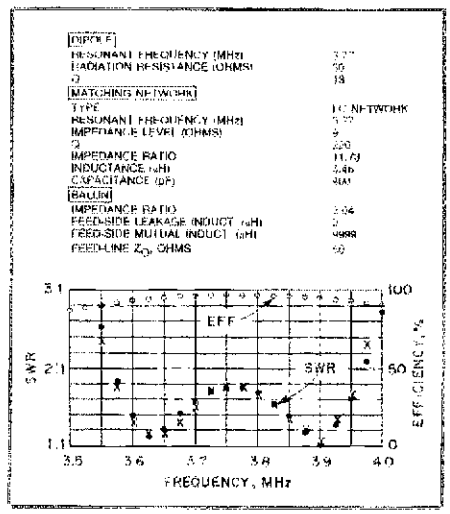


Fig 17—The inverted-V dipole with an LC matching network. Notice the efficiency improvement over that of Fig 16. The solid dots are plots of computer simulation, and the Xs show experimental data.

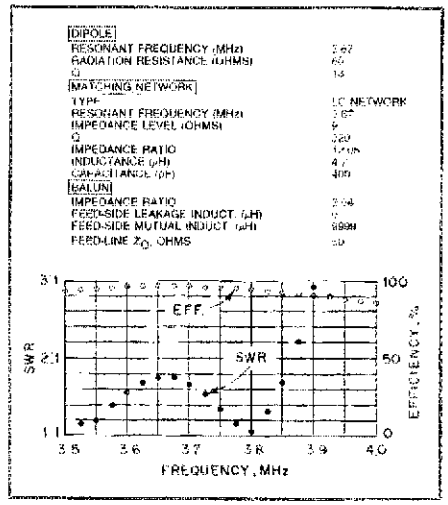


Fig 18—The 80-meter DXer's Delight.

for designing and constructing this balun transformer was published earlier.[13]

The overall length of the antenna was 130.8 feet. This substantially increased length was necessary to achieve resonance because the coaxial stubs and wire act electrically like an antenna made of tapered material. Taper is known to lead to longer resonance lengths.

No attempt was made to fully optimize the parameters. The computer program was used to calculate SWR and efficiency. The close agreement shows how useful the program is for simulation prior to antenna construction.

Inverted-V Dipole with LC Matching Network

As predicted, the inverted-V dipole with LC matching network, shown in Fig 17, was not as broadband as the coax resonator version. Its 2:1 SWR bandwidth was 405 kHz. The measured Q of the matching network was 220, while the calculated efficiency at the 2:1 SWR band edges was 91%. The antenna length was 122 feet.

Fig 18 shows the calculated SWR and efficiency of a compensated dipole based on a frequency-translated version of the dipole described in Fig 17. It has the SWR minima near 3.5 and 3.8 MHz. This design will hold appeal for 80-meter DXers. A single antenna permits operation with a near-perfect match on interesting parts of the phone and CW portions of the band, with no antenna matching network.

Presented in Fig 19 are photographs of the LC matching network and its weatherproof package. Approximately 8½ turns of B&W coil stock, type 3029, are used for the inductor (6 turns per in, 2½-in diam, no. 12 wire). The primary and secondary portions of the coil have 1¾ and 2½ turns, respectively. The coil is resonated at midband with a 400-pF capacitor. The capacitor is of the transmitting mica variety, with a breakdown rating of 3000 volts and an RF current rating of 4 amperes.

One must be careful with the selection of a capacitor for this application, especially if high power is to be used. For the capacitor described above, the allowable peak power (limited by the breakdown voltage) is 2450 watts. However, the allowable average power (limited by the RF current rating) is only 88 watts! These limits apply at the SWR = 1.75:1 band edges.

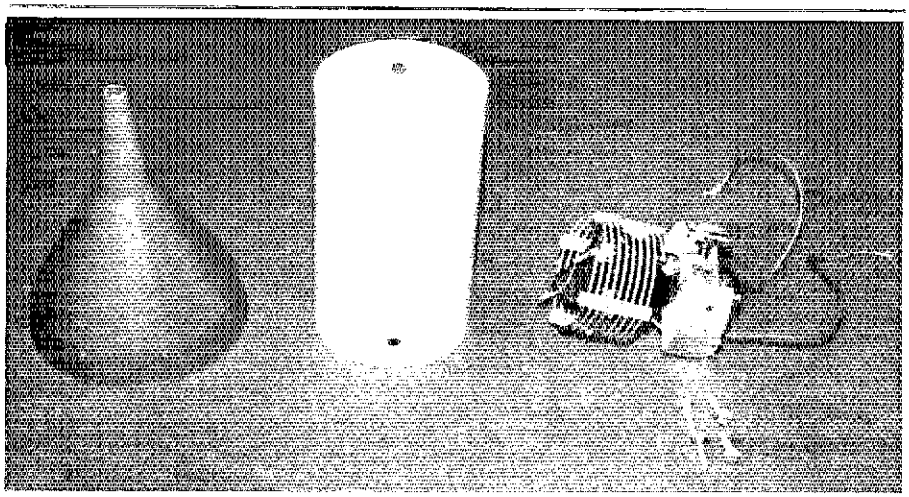
Inverted-V Dipole with Transmatch

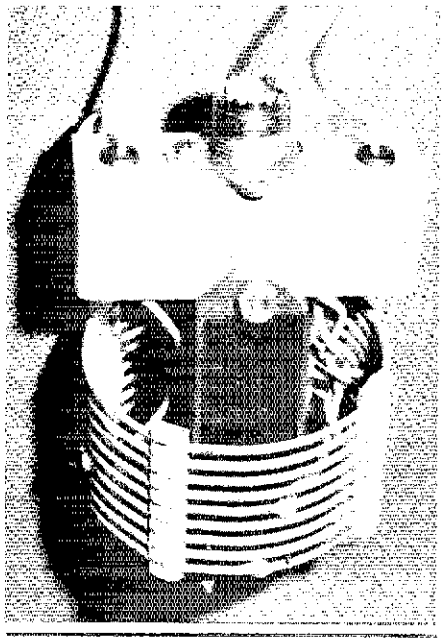
For purposes of comparison, the efficiency of an antenna system using no matching at the antenna, but with a lossless Transmatch at the transmitter end of the feed line, has been calculated. See Fig 20. Here, the efficiency definition is different because the source of loss is different. Remember that in all the cases considered earlier, the efficiency was of concern primarily over the part of the band for which the SWR was less than 2:1. Hence, in those cases the SWR on the feed line was low enough so as not to affect the results significantly. Now it is necessary to take into account the losses caused by the high SWR on the feed line away from antenna resonance.[14]

The particular case considered here is an 80-meter inverted-V dipole fed with 250 feet of RG-213 coax, which has about 1 dB of loss in the matched (SWR = 1:1) case. In this situation, the only lossy element in the antenna system is the feed line. Hence the efficiency of interest is defined as:

$$\text{Efficiency (\%)} = 100 \times \frac{\text{Total power delivered by transmitter minus power lost because of high SWR}}{\text{Total power delivered by transmitter}}$$

This efficiency, plotted in Fig 20, which may be compared with the other efficien-





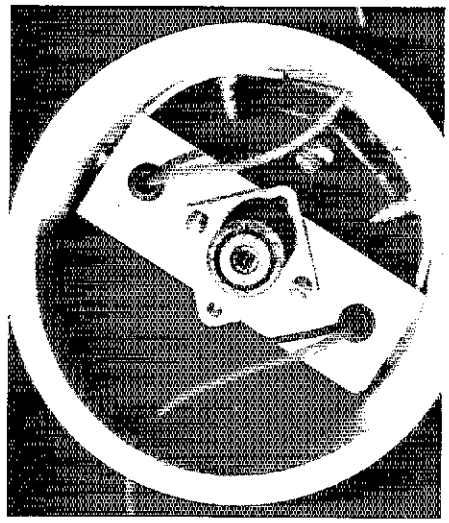


Fig 19—The AI1H matching network follows the circuit diagram of Fig 12. Components must be chosen for a high Q and must have adequate voltage and current ratings. See text for component information.

cies calculated earlier (even though the definition is different), drops to about 74% at the band edges. The result is not bad, especially when compared to the dipoles that use coaxial resonators for broadbanding. Of course, in making the comparison one must recognize the operational inconvenience of having to adjust the Transmatch. Furthermore, some baluns will not handle the large mismatch at the edges of the band and will be destroyed when high power is applied.

Other Bands and Antennas

The computer program is designed to analyze antennas at arbitrary frequencies. For example, a 160-meter half-wave dipole with an LC matching network for broadbanding is shown in Fig 21. Because of the smaller percentage bandwidth of the 160-meter band (compared to the 80-meter band), it is possible to obtain excellent SWR and efficiency performance over the entire band with an LC matching network.

Other resonant antenna systems, such as monopoles and full-wave loops, may be broadbanded by using the same procedures described in this article. For the analysis to apply, it is necessary only that the model

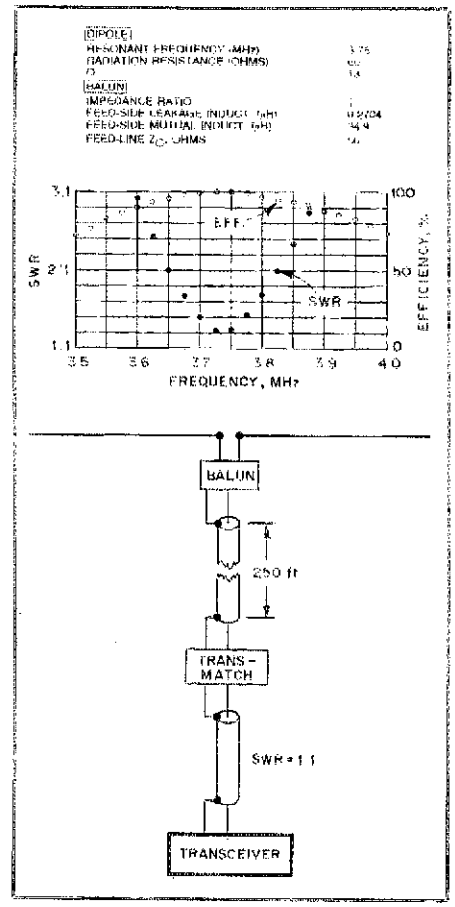


Fig 20—The uncompensated inverted-V dipole fed with 250 ft of RG-213 coax, used with a Transmatch for operation over the entire 80-meter band.

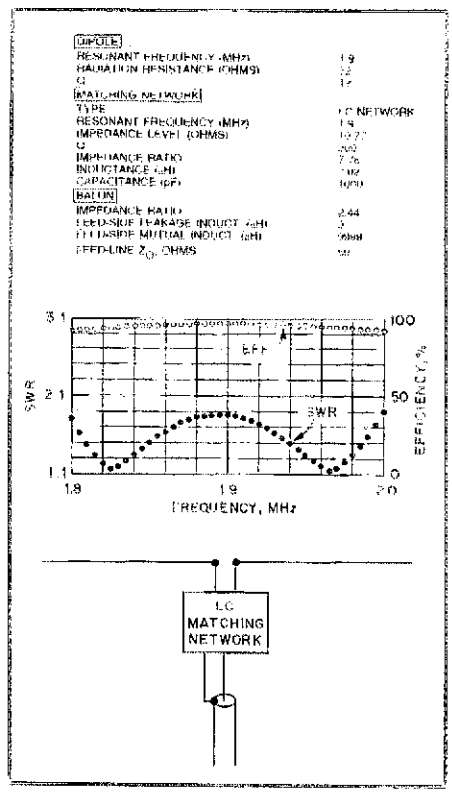


Fig 21—A 160-meter half-wave dipole with an LC Chebyshev matching network.

of the antenna near resonance be valid. See Appendix 1.

Conclusion

A number of dipole broadbanding schemes have been compared. A major point which has been brought out is the importance of evaluating broadbanding techniques not only by comparing SWR results, but also by comparing efficiencies. The superiority of LC matching (compared to transmission-line resonator matching), especially when efficiency is a consideration, has been covered. Design equations which enable one to calculate the optimum broadband matching parameters are presented in Appendix 2.

I hope that this article is viewed as another example of how well the Amateur Radio and home computing hobbies complement one another. I am indebted to my wife, Barbara, N1DIS, to John Kenny, W1RR, and to Joe Reisert, W1JR, for their interest and encouragement during the course of this project.

APPENDIX 1

A by-product of the investigation of dipole broadbanding methods is a flexible, user friendly program which runs on the Commodore 64 computer.[15] The flexibility is partially illustrated by the many examples presented in the article.

The program was written using SIMONS BASIC, which adds 114 commands to the set of BASIC commands built into the C-64.[16] This enhanced BASIC provides a number of commands which simplify the programming process. Of particular value in this application were:

1) Procedures. This feature allows one to call and execute procedures by name (instead of subroutines by line number).

2) Menu processing commands. Coding of menus is simplified by the ON KEY and PLACE commands.

3) Graphics. SIMONS BASIC has a rich set of high resolution graphics commands which enable one to mix graphics and alphanumeric data on the screen.

4) Screen dumps. Both low and high resolution screen dumps are obtainable with single commands.

Many other commands are available with SIMONS BASIC; for example, sprite and sound generation and powerful string-handling commands are provided, but were not used.

The user sees two kinds of presentations when using the program: menus and output data. Three menus are presented. The main menu, Table 2, shows the major tasks to be performed. Another displays the input parameters for the calculation. It is through interaction with this menu that the user can modify the antenna, matching network, balun and feed-line parameters. All of the data associated with the SWR/efficiency versus frequency graphs are replicas of this menu. The frequency menu, also Table 2, allows the user to change the frequency range and the number of points in the band where the analysis is performed.

Output data is provided in two forms: tabular and graphical. An example of the tabular output is given in Table 3, which shows the data associated with Fig 15. The graphs shown in this article were redrawn, but are similar to those available on a video monitor or on a dot matrix printer. The original graphs were produced on a Panasonic KX-P1090 printer with a Cardco +G serial to parallel interface unit.

The sections that follow cover the basic assumptions and equations that were used in the analysis. Anyone desiring to extend the application of the program, to modify it, or simply to better understand the subject of antenna matching should find this material interesting.

Table 2

Menus Presented in the BASIC Program, BROADBAND

Main Menu

BROADBAND DIPOLE
SWR & EFFICIENCY CALCULATION

1 EXAMINE OR CHANGE PARAMETERS
2 CALCULATE SWR & EFFICIENCY
3 PLOT SWR & EFFICIENCY
4 SELECT FREQUENCY RANGE

BAND	80 METERS
LOWEST FREQUENCY	3.5
HIGHEST FREQUENCY	4
STEP SIZE	.05

5 QUIT

Frequency Menu

FREQUENCY RANGE

1	BAND	80 METERS
2	LOWEST FREQUENCY	3.5
3	HIGHEST FREQUENCY	4
4	STEP SIZE (MHz)	.05
5	NO CHANGE	

Table 3

Tabulated Output of Author's Computer Program, BROADBAND

Frequency (MHz)	*SWR*	*Efficiency (%)*
3.500	5.88	100.
3.525	4.98	100.
3.550	4.19	100.
3.575	3.50	100.
3.600	2.91	100.
3.625	2.42	100.
3.650	2.00	100.
3.675	1.66	100.
3.700	1.39	100.
3.725	1.22	100.
3.750	1.24	100.
3.775	1.42	100.
3.800	1.68	100.
3.825	1.98	100.
3.850	2.33	100.
3.875	2.73	100.
3.900	3.18	100.
3.925	3.66	100.
3.950	4.20	100.
3.975	4.77	100.
4.000	5.39	100.

The Dipole Antenna

In order to broaden the SWR bandwidth of a resonant antenna by means of a matching network, it is necessary to have a valid electrical equivalent circuit for that antenna. The half-wave dipole has been analyzed extensively by many researchers over a long period of time. An outstanding summary of the current state of understanding is given by Elliott.[17] Unfortunately, the available theoretical results fall short of our needs. The analyses usually deal with a straight antenna of specific physical dimensions in free space or over a perfectly conducting ground. Some analyses do treat the inverted-V dipole and some take into account a nonideal ground plane, but the real-world antennas we use have steel towers, trees, other antennas and an uncharacterized earth surface nearby.

Fortunately, the real-world dipole can be adequately modeled in the vicinity of resonance by choosing only three parameters: resonant frequency, radiation resistance at resonance, and Q. The equivalent circuit used in the program is shown in Fig 22. It consists of a frequency-dependent resistor in series with an open-circuited quarter-wave transmission line. This model is similar to the familiar RLC series-circuit model, but it is accurate over a wider frequency band. The assumed frequency dependence of the resistor in the model is also shown in Fig 22. It is assumed to vary linearly with frequency; the slope is consistent with data presented by Elliott for thin-wire antennas.[18]

The three model parameters (resonant frequency, radiation resistance and Q) are best determined by simply measuring the SWR of the dipole with no compensating network and using

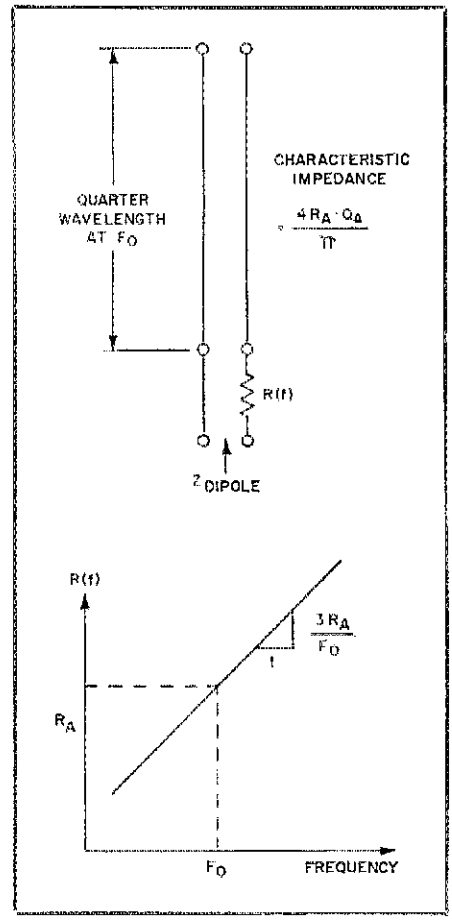


Fig 22—Dipole equivalent circuit. This transmission-line model is more accurate than the often-used RLC equivalent circuit. See Appendix 2 for definitions of terms.

this information to calculate the parameters. This procedure was used to find the dipole parameters of Fig 15. For long feed runs, it is important that the SWR measured in the shack be corrected.

Coaxial Resonator Matching

The transmission-line equations used in this analysis were derived from those in the *Radio Engineers' Handbook.*[19] It turns out that resonators realized from coaxial transmission lines have a very low Q. Hence, it is better to use the more complete formulation which involves complex hyperbolic tangent and cotangent functions to adequately model them. A simpler equivalent parallel RLC tuned-circuit model of the transmission line resonators could have been used, but some accuracy is lost away from resonance.

The program contains the parameters for a wide variety of coaxial cables, including RG-8, RG-58A, ½-in and ¾-in Hardline and RG-141 (Teflon® dielectric).

LC Matching

Since the impedance level required to obtain any significant broadbanding of the dipole is very low, a simple parallel LC model will not lead to practical component values. Thus, taps on the inductor are used, as shown in Fig 12, to obtain transformer action. The program is designed so that the impedance transformation ratio, the inductance, the capacitance, the impedance level of the matching network and its resonant frequency and Q may be prescribed. The effect on other parameters when one element value is changed is automatically determined.

Balun Transformer

An important ingredient in obtaining maximum broadbanding is deliberate mismatching at band center. Thus, a transformer is required. Since the feed line is usually (but not necessarily) coaxial cable, a balanced-to-unbalanced transformation is also required and can be performed by the same physical transformer. It turns out that in this application the nonidealness of real transformers must be taken into account in order to obtain a close match between calculated and measured results.

Fig 23 shows the equivalent circuit used in the program. Much insight may be gained by assuming that the leakage inductance is zero and that the mutual inductance is high enough to have no effect. However, the calculations for real antennas described in the article make use of measurements made on the balun transformers which were used.

It is usually the leakage inductance which has the strongest unintentional influence on broadbanding. Fortunately, the effect of nonzero leakage inductance can be compensated by detuning other antenna parameters. The program permits one to perform such compensation.

In the case of the LC matching network of Fig 12, the functions of matching, impedance transformation and balanced-to-unbalanced conversion are combined in one network. However, these functions are separated in the model on the computer. No loss of accuracy results, but it is important to set the balun mutual inductance to a high value (9999 microhenrys will do), since that element is already modeled by the LC matching network. The leakage inductance of the LC matching network is small enough that it was assumed to be zero for the simulation.

SWR and Efficiency Calculations

SWR is calculated by the computer program

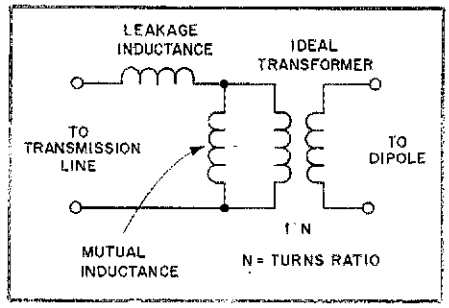


Fig 23—Transformer equivalent circuit.

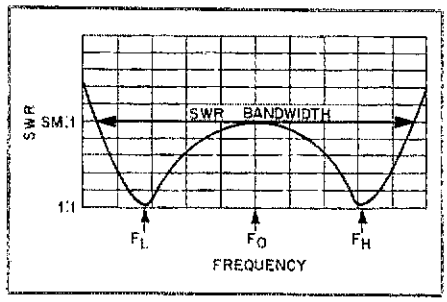


Fig 24—Chebyshev SWR characteristic.

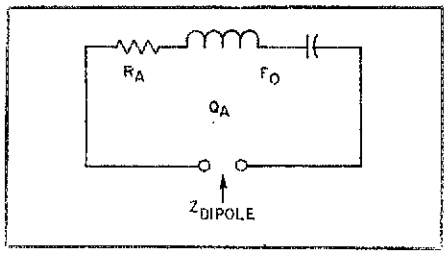


Fig 25—Simplified dipole equivalent circuit.

at the point in the antenna system where the feed line connects to the balun transformer.[20] The only dissipative elements in the model of the antenna system are the radiation resistance in the dipole model and the ohmic losses in the matching network. In the program, these elements are converted to shunt conductances at the antenna terminals and the efficiency is calculated as follows:

$$\text{Efficiency (\%)} = \frac{100 \times GD}{GD + GN}$$

where

GD = Dipole conductance and
GN = Network conductance

APPENDIX 2

The computer program described in Appendix 1 analyzes the broadband dipole. It may be used in a "cut and try" procedure to determine the matching network parameters. However, this is a tedious process which may not yield optimum results.

Fortunately, the optimum matching-network parameters (coaxial stub lengths or LC resonator element values and transformer ratios) may be calculated. Fig 24 shows the desired Chebyshev SWR characteristic.

For the purpose of computing the matching network parameters, it is sufficient to use the simple RLC dipole model shown in Fig 25. The differences between this model and the one given in Fig 22 are that a series LC circuit is used to represent the reactive part of the antenna impedance and that the radiation resistance is assumed to be independent of frequency. These simplifications make the mathematics tractable and provide adequate accuracy. The equations given in this appendix are the results of the analysis.

Definition of Terms

Input Data

FO = dipole resonant frequency (MHz)
QA = dipole Q
RA = dipole radiation resistance (ohms)
SM = maximum SWR over band (achieved at band center and band edges)
ZT = transmission line characteristic impedance (ohms)

For Coaxial Stub Resonators

ZS = stub characteristic impedance (ohms)
VF = velocity factor
K, M = attenuation constants

For LC Matching Network

QN = LC resonator Q

Unknown Parameters

BWD = SWR bandwidth of uncompensated dipole (MHz)
BW = SWR bandwidth of compensated dipole (MHz)
BWIF = bandwidth improvement factor
EFC = efficiency at band center (%)
EFE = efficiency at band edges (%)
ZN = matching network impedance level (ohms)
NZ = transformer impedance ratio
FL = lower perfect match frequency (MHz)
FH = upper perfect match frequency (MHz)

For Coaxial Stub Resonators

A = attenuation/100 feet (dB)
QN = resonator Q
L1 = length of first stub (feet)
L2 = length of second stub (feet)

For LC Matching Network

LN = inductance (microhenrys)
CN = capacitance (picofarads)

Dipole Bandwidth

For reference, it is always useful to know the 2:1 SWR bandwidth before compensation:

$$BWD = \frac{FO}{QA\sqrt{2}}$$

Bandwidth after compensation:

$$BW = \frac{FO}{QN \cdot QA} \times \left\{\frac{(QN + QA)[(2QN + QA) \cdot SM - QA](SM - 1)}{SM}\right\}^{1/2}$$

$$BWIF = \frac{BW}{BWD}$$

Efficiency:

$$EFC = 100\left[1 - \frac{QA}{SM\cdot(QN+QA)}\right]$$

$$EFE = \frac{100\ SM\cdot QN^2}{(QN+QA)[SM\cdot(QN+QA)-QA]}$$

Matching Network Impedance Level:

If the matching-network impedance level and the dipole resonant frequency are known, the matching-network parameters are readily determined.

$$ZN = \frac{RA\cdot SM}{QA} + \frac{RA(SM-1)}{QN}$$

Transformer Impedance Ratio:

$$NZ = \frac{RA}{ZT}\left(SM - \frac{QA}{QN+QA}\right)$$

Perfect Match Frequencies:

$$FL = (FO^2 + FM^2)^{1/2} - FM$$

where

$$FM = \frac{FO}{2QA}\left[\left(SM-1\right)\left(1+\frac{QA}{QN}\right)\right]^{1/2}$$

$$FH = \frac{FO^2}{FL}$$

Coaxial Stub Lengths

In order to determine the lengths of the coaxial stubs,[21] it is first necessary to compute the loss and the Q of the coaxial resonator:

$$A = K\cdot FO^M$$

$$QN = \frac{2.78\ FO}{A\cdot VF}$$

Half-Wave Resonator with Shorted Ends (Fig 4E):

$$L1 = \frac{492\ VF}{\pi\ FO}\sin^{-1}\left(\frac{\pi\ ZN}{2\ ZS}\right)^{1/2}$$

$$L2 = \frac{492\ VF}{FO} - L1$$

Half-Wave Resonator with Open Ends (Fig 4F):

$$L1 = \frac{492\ VF}{\pi\ FO}\cos^{-1}\left(\frac{\pi\ ZN}{2\ ZS}\right)^{1/2}$$

$$L2 = \frac{492\ VF}{FO} - L1$$

Quarter-Wave Resonator with One Shorted End and One Open End (Fig 4G):
For the shorted end,

$$L2 = \frac{492\ VF}{\pi\ FO}\sin^{-1}\left(\frac{\pi\ ZN}{4\ ZS}\right)^{1/2}$$

For the open end

$$L1 = \frac{246\ VF}{FO} - L2$$

LC Matching Network Parameters:

The inductance and capacitance of the parallel-tuned LC matching network are given by:

$$LN = \frac{ZN}{2\pi\ FO}$$

$$CN = \frac{10^6}{2\pi\ FO\cdot ZN}$$

Bandwidth Versus Efficiency Trade-Off:

The equations used for Fig 14 are based on simplifications of the BWIF and EFE equations given earlier, for the case SM = 2:

$$EFE = \frac{200}{\left(\frac{QA}{QN}+1\right)\left(\frac{QA}{QN}+2\right)}$$

$$BWIF = \left[\left(\frac{QA}{QN}+1\right)\left(\frac{QA}{QN}+4\right)\right]^{1/2}$$

Design Spreadsheets

The above analysis can be conveniently put to work with the aid of a spreadsheet program. Table 4 shows a specific result which contains, among other things, the dimensions of the coaxial resonator stubs and transformer impedance ratio used in Fig 11. By simply changing the maximum SWR, a new spreadsheet can be created which yields the LC matching network impedance level and transformer impedance ratio used in Fig 13. Or the frequency and maximum SWR can be changed to obtain the parameters for the 160-meter antenna of Fig 21. The specific spreadsheet program used on the Commodore 64 is PRACTICALC II.[22]

Table 4

Broadband Dipole Design Spreadsheet

The data shown here are for the 80-meter dipole of Fig 13. Changing any of the input data values results in recalculation of all data values in the entire sheet.

BROADBAND DIPOLE DESIGN AI1H

	Dipole Center Frequency =	3750 kHz	
	Dipole Q =	12	
INPUT	Dipole Radiation Resistance =	72 ohms	INPUT
DATA	Maximum SWR over Band =	1.7:1	DATA
	Trans Line Char Impedance =	50 ohms	
	LC Matching Network Q =	200	

Dipole Bandwidth (for SWR = 2:1) = 220.97 kHz

Matching Network Type	Bandwidth (kHz)	Efficiency (percent) Band Center	Band Edge	Matching Network Imp Lev (ohms)	Transf Imp Ratio	Freqs Where SWR = 1:1 (kHz)	
SWR =	1.7:1						
RG-174U	731.73	61.89	20.03	17.93	1.62	3536	3977
RG-58AU	495.58	77.96	50.16	12.72	1.91	3588	3919
RG-141U	482.28	79.55	53.49	12.44	1.95	3592	3915
RG-8U	432.82	86.69	69.06	11.43	2.12	3604	3902
.50 in hl	404.51	91.93	80.99	10.87	2.25	3612	3893
.75 in hl	393.95	94.17	86.19	10.66	2.31	3615	3890
LC	383.03	96.67	92.07	10.45	2.37	3618	3887

Matching Network Type	Stub Char Imp	Stub Length (feet) Half Wave —Shorted Ends—		Half Wave —Open Ends—		Quarter Wave —Shorted— End	Quarter Wave —Open— End
RG-174U	50	23.36	63.10	19.87	66.59	15.40	27.83
RG-58AU	52	18.40	68.06	24.83	61.63	12.49	30.75
RG-141U	50	19.60	71.58	25.99	65.19	13.29	32.30
RG-8U	52	17.28	69.18	25.95	60.51	11.79	31.44
.50 in hl	75	20.77	110.43	44.83	86.37	14.37	51.23
.75 in hl	75	20.55	110.65	45.05	86.15	14.23	51.37

LC—Inductance = .44359562 microhenrys
Capacitance = 4060.5835 picofarads

Notice that the SWR plots of Figs 11, 13 and 21 do not exactly match the ideal Chebyshev characteristic. The small differences arise because the BROADBAND analysis program uses more accurate models of the transmission line resonators and the dipole than those used in the calculations of this appendix. However, the differences are small enough to have no significance in practice.

Notes

[1]Jerry Hall, "The Search for a Simple, Broadband 80-Meter Dipole," *QST*, Apr 1983, pp 22-27.
[2]Jerry Hall, "Maxcom Antenna Matcher and Dipole Cable Kit," Product Review, *QST*, Nov 1984, pp 53-54.
[3]Richard D. Snyder, "The Snyder Antenna," *RF Design*, Sep/Oct 1984, pp 49-51.
[4]Richard D. Snyder, "Broadband Antennae Employing Coaxial Transmission Line Sections," United States Patent no. 4,479,130, issued Oct 23, 1984.
[5]William Conwell, "Broadband Antennas Employing Coaxial Transmission Line Sections," *QEX*, Apr 1985, pp 8-9.
[6]See note 1.
[7]See note 1.
[8]See note 1.
[9]See notes 3-5.
[10]Richard C. Johnson and Henry Jasik, *Antenna Engineering Handbook*, 2nd ed (New York: McGraw-Hill, 1984), pp 43-27 to 43-31.
[11]R. M. Fano, "Theoretical Limitations on the Broadband Matching of Arbitrary Impedances," *Journal of the Franklin Institute*, Jan 1950, pp 57-83, and Feb 1950, pp 139-155.
[12]Alan Bloom, "Once More with the 80-Meter Broadband Dipole," Technical Correspondence, *QST*, Jun 1985, p 42.
[13]Frank J. Witt, "Top-Loaded Delta Loop Antenna," *Ham Radio*, Dec 1978, p 60.
[14]*The ARRL Handbook* (Newington, CT: The American Radio Relay League, 1985 or 1986 eds) Chap 16, Fig 23.
[15]The BASIC analysis program (called BROADBAND) described in Appendix 1 is available on disk from the author. Also on the disk is the PRACTICALC II spreadsheet file for generating customized BROADBAND DIPOLE DESIGN charts of the form shown in Table 4. Send an SASE to the author for details. A photocopy of the 11-page BASIC program listing is available from ARRL HQ for a $5 copy fee.
[16]*SIMONS BASIC* (Commodore Business Machines, Inc, 1200 Wilson Dr, West Chester, PA 19380).
[17]Robert S. Elliott, *Antenna Theory and Design* (Englewood Cliffs, NJ: Prentice Hall, 1981), pp 277-321.
[18]See note 17.
[19]*Reference Data for Radio Engineers*, 5th ed. (Indianapolis: Howard W. Sams & Co, subsidiary of ITT, 1968), Chap 22, "Transmission Lines," pp 22-1 to 22-42.
[20]See note 19.
[21]See note 19.
[22]PRACTICALC II (PractiCorp International, The Silk Mill, 44 Oak St, Newton Upper Falls, MA 02164).

Frank Witt holds a BSEE and an MSEE from Johns Hopkins University, and has been a licensed amateur since 1948. He has held the calls W3NMU, K2TOP, W1DTV and, presently, A1IH. His ham radio interests have involved a variety of homemade projects, including an RF clipper, a 6502 microprocessor-based controller for modernizing his Heath 2036A 2-meter transceiver and a variety of antenna projects. His top-loaded delta-loop design (referenced in note 13) has received high marks as a vertically polarized DX antenna for 80 and 160 meters.

Frank's wife, Barbara, and three of their sons, Mike, Chris and Jerry, are licensed amateurs, with calls N1DIS, N1BMJ, N1BDT and N1BEB, respectively. A fourth son, Tom, plans to get his license soon. Frank can be found on 75 meters (around 3,820 MHz) most Thursday nights, 9:30 Eastern Time, talking to W3OWN and VP9HK. QST

8877 Linear Amplifier

(continued from page 26)

the new numeric scale on the meter. Be careful not to bend the pointer when reassembling the meter.

Mounting the Front Panel

Remove the masking tape from the panel, and carefully label the front panel with dry-transfer lettering before mounting any components. Mount the meters, potentiometer and switches in place, and complete the wiring. Wire nylon connectors to the power switches, ALC control, multimeter switch and meters to mate with the connectors in the RF deck. This will result in a totally removable panel.

When mounting the front panel to the cabinet, give careful attention to aligning the vacuum-capacitor and band-switch shafts. Loosen the component mounting screws and mate the shafts, then retighten the screws. Continue the alignment process until the controls operate smoothly.

Rear-Panel Assembly

Up to now, nothing has been done to the rear panel. Mount the panel and decide where the components should mount to obtain short connections. Lay the rear panel out in the same way as the front panel, and cut the necessary holes.

Mount the blower off the rear panel, located to allow good circulation of air up to the front of the under-chassis area and back to the tube socket. Positioning of the blower is not critical as long as air is not directly blown across the tube socket, which could cause backpressure.

Mount all components to the rear panel, and mount and wire the panel to the RF deck. The rear panel is not easily removable like the front panel.

Testing the Amplifier and Power Supply

Testing is the *big* moment and the climax of several months' work. First hook up the power-supply control cable and the ground cable. Leave the high-voltage cable off. Test the control circuits to ensure that the power supply can be turned on from the RF deck and the 3-minute time delay works. Make sure that the tube filaments are on. This isn't as easy as with a glass tube, which allows you to see the filaments glow. Let the tube run for about 10 minutes, then turn the power off. Immediately remove the tube and feel if the base is hot.

Test the amplifier first on 20 or 40 meters, since these bands use the midrange of the TUNE and LOAD capacitors. With high voltage applied to the tube, first key the amplifier with no input drive power. The resting idle current should be between 100 and 200 mA on the plate-current meter.

Now apply a little drive power to the tube. The plate current should rise. Move the TUNE and LOAD controls until power output is indicated on a wattmeter. Increase the drive while adjusting the TUNE and LOAD controls to achieve about 20 mA grid current and 650 to 700 mA of plate current, to realize 1500 W output. If the amplifier works properly on this band, proceed to the other bands and repeat the tests.

Efficiency should be at least 60% on all bands, except perhaps 10 and 12 meters, where efficiency may drop to 55%. If efficiency is poor, try moving the coil taps, but recognize that moving the taps also changes the Q of the coil. Decreasing the inductance and increasing the capacitance in the tank circuit will increase the Q. The amplifier may provide more power output over a larger frequency range with a lower tank-circuit Q, but harmonic suppression will also decrease and the amplifier could start generating interference or not meet FCC standards.

I must warn you one last time. *This device could kill you in one instant if you get tied into the high-voltage circuit. Put a good ground on both power supply and RF deck, and treat the equipment with proper respect!*

Conclusion

I have spent many enjoyable hours operating with this amplifier/power supply combination, with nothing but good signal reports. It was an exhausting task, but now that it's finished, I'm glad I did it. Try building one and you'll see what I mean. QST

Strays

CALL FOR ARTICLES

Space—the final frontier. How many times have you heard this phrase? With the launch of JAS-1, you'll be hearing even more about satellites. What does OSCAR communication mean to you? Or rain scatter on 10 GHz, or earth-moon-earth communications?

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Electromagnetic Pulse and the Radio Amateur

Part 3: In Part 2, we told how the EMP transient-protection devices were tested individually under isolated conditions. Now, the protectors are connected to Amateur Radio equipment and retested.†

By Dennis Bodson, W4PWF
Acting Assistant Manager,
Technology and Standards
National Communications System
Washington, DC 20305-2010

The tests described in the previous installment subjected 56 selected protection devices to several different injection pulses that simulated the waveforms and energies associated with EMP and lightning discharges. Those protective devices found acceptable during the first test program were then connected to several types of radio equipment and tested for their effectiveness in a typical Amateur Radio installation.

Since there is a large number of possible combinations of protection devices and radio equipment, low-cost devices were evaluated first. If they were found unacceptable, higher-cost protection devices were installed and tested until an acceptable protection scheme was developed. After completing the testing of the low-cost commercial devices (see Table 6), several homemade units, assembled from previously tested components (see Table 7), were checked. This was done with an eye toward finding a very low-cost protection device that could be built by the radio amateur. Six of these units will be described in the next installment of this series.

Sixteen system configurations (see Table 8) were tested at frequencies from 1.8 to 435 MHz. These systems included both new and old gear (some no longer manufactured, but available on the used-equipment market), and tube-type and transistorized radios. The equipment tested was manufactured by Drake, ICOM, Kenwood, Swan and Yaesu.

Measurements were taken of the radio system's performance before and after each pulse or pulse series to compare the radio's

Table 6
Commercial Protection Devices Tested

Manufacturer	*Part Number*	*Description*
Fischer	FCC-250-300-UHF	Coaxial line suppressor
Fischer	FCC-250-350-UHF	Coaxial line suppressor
Fischer	FCC-250-150-UHF	Coaxial line suppressor
Fischer	FCC-250-120-UHF	Coaxial line suppressor
Fischer	FCC-450-120-UHF	Coaxial line suppressor
Joslyn	2031-35-B	Miniature gas-tube surge protector (MSP)
General Electric	V36ZA80	Metal oxide varistor (GE-MOV)
Polyphaser Corp	IS-NEMP	Coaxial line protector
Polyphaser Corp	IS-NEMP-1	Coaxial line protector
Polyphaser Corp	IS-NEMP-2	Coaxial line protector
TII	Model 428	Plug-in power line protector
Siemens	S14K130	Metal oxide varistor (SIOV)
Siemens	B1-A350	Button type surge voltage protector
Alpha Delta	Transi-Trap R-T	Coaxial line protector
Archer	61-2785	Three-outlet ac power strip/protector

Table 7
Homemade Transient Protection Devices Tested

Device Name	*Description*
SIOV ac test box	Three Siemens MOVs (S14K130) installed in an ac receptacle box. One MOV wired from hot to ground, one from neutral to ground and one between hot and neutral
GE MOV	One GE MOV (V36ZA80) installed across the 12-V dc power line between hot and ground.
SIOV RF test box	The Siemens MOV (S14K130) installed in a metal box. The box had UHF connectors attached to both ends and a wire connected between the center conductors of the two connectors. The MOV was connected to the wire on one side and to the box on the other side.
Siemens UHF test box	Two Siemens gas-gap tubes (BI-A350) installed in the UHF connector box described above. The tubes were wired in series from the center conductor to the side of the box.
Joslyn UHF test box	Two Joslyn gas-gap tubes (2031-35B) installed in the UHF connector box in series from the center conductor to ground.
UHF coaxial T	Two Siemens gas-gap tubes (BI-A350) installed in series between the center conductor and case, on one leg of a coaxial T connector.

†Parts 1 and 2 appear in the Aug and Sep issues of *QST*, respectively. Part 4 will appear in a subsequent issue.

Table 8
Amateur Radio System Configurations and Ancillary Equipment Tested

System 1
Yaesu FP-757HF power supply
FT-757GX all-mode transceiver
FC-757AT antenna matching network

System 2
Yaesu FP-757HF
FT-757GX

System 3
Yaesu FT-726 VHF/UHF all-mode transceiver

System 4
ICOM IC-745 HF Transceiver
IC-PS35 internal power supply
IC-SM6 desk microphone
IC-AT100 antenna matching network
IC-SP3 external speaker

System 5
ICOM IC-745 HF transceiver
IC-PS35 internal power supply

System 6
ICOM IC-27A 2-m mobile transceiver

System 7
ICOM IC-02AT 2-m hand-held transceiver

System 8
ICOM IC-271A 2-m transceiver

System 9
ICOM IC-471A 430- to 450-MHz transceiver

System 10
Kenwood TS-430S HF transceiver
PS-430 power supply
MC-80 desk microphone
AT-250 antenna matching network
ST-430 external speaker

System 11
Kenwood TS-430S HF transceiver
PS-430 power supply
MC-80 microphone

System 12
Kenwood TR-7930 2-m mobile transceiver

System 13
Kenwood TR-2600 2-m hand-held transceiver

System 14
Drake T-4XC HF transceiver
R-4C HF receiver
4B power supply

System 15 (Not tested)
Collins KWM-2A HF transceiver
KWM-2A power supply

System 16
Swan 250 HF transceiver
117Z power supply

Antennas
Mosley JRS TA33 3-element tribander
Cushcraft AV-5 80- to 10-m vertical

Other Items
Astron VS-35 power supply
Honda EG 650 generator

transmitter power output and receiver sensitivity. First, stand-alone (equipment unwired) radio systems were subjected to a field-pulse wave. This disclosed any inherent design weaknesses and identified the internal areas that required protection. Damaged equipment was repaired and returned for further testing. After a series of field-only pulse tests, the simultaneous field and injection pulse tests were made.

Test Program

Threat Definition

The peak values used in these tests were:

EMP simulator pulse field:	50 kV/m
RF drive pulse:	275 A, 13.75 kV
Ac drive pulse:	130 A, 6.5 kV

In the *Simulator Field Tests,* the radio system was placed in the working volume of a large parallel-plate EMP simulator. The simulator's Marx pulse generator was discharged into the pulser wire elements with sufficient energy to produce a 50 kV/m field strength with a 10-nanosecond pulse rise time. For the *Simultaneous Field and Injection Pulse Tests,* the radios were kept in the same environment and two L-shaped wires were attached to the equipment.

Transient Injection Methods

The working volume of the parallel-plate simulator used for these tests, while large, was not sufficient to house an entire radio station including an antenna and residential power-line drop. Therefore, the station equipment was placed in the chamber, and pulses were injected that simulated the stresses carried to the equipment by the power lines and antenna. The maximum transient expected from the power line was about 6 kV since household wiring should limit the transient to this level. Antenna connections, however, are limited only by the spark-over levels of the installed antenna cabling.

Power-Source Transient Injection

Power for the systems in the test chamber was provided by an isolated generator that would prevent interaction with the pulser and data links used in the experiment. To simulate the connection of a typical residential supply, the neutral and ground leads of the isolated system were grounded to the pulser ground plane at a single supply box within the transient field. A transient injection pulse was generated by an L-shaped wire antenna within the test chamber. The antenna was connected to the hot lead of a power plug inserted close to the protective device under test. When a commercial plug-in device was used, the transient was injected into the same receptacle into which the device was plugged. If a fabricated protection device was used, the transient was injected into the device receptacle alongside the equipment power plug. This maximized the stress on the equipment while offering an opportunity for the free-field transient to couple with the equipment power cord after the protection device. The dimensions of the L-shaped antenna were adjusted until a current of 130 A was produced in a 50-ohm load.

Antenna Transient Injection

A larger L-shaped antenna was constructed within the test chamber for evaluation as an injection pulse generator for the antenna port of the equipment under test. Current, measured through a 50-ohm load resistor, was limited to about 80 A when two short lengths of coaxial cable were used between the antenna and load. Results of the removal of the cable from the transient path led to the conclusion that the coaxial cable and connectors greatly limit the magnitude of the transient imposed on radio equipment. The L antenna used in this test was considered adequate to stress any antenna connection terminal (at the equipment end) with a pulse as large as the coaxial cable could transmit. A possibility exists in a real transient situation that the coaxial cable itself may be damaged if not protected at the antenna end, but this condition could not be tested by the configuration used here.

Test Equipment

A parallel-plate EMP simulator 24 feet long, 20 feet wide and 11 feet high (Fig 11) was used. The Marx generator was charged by a high-power dc power supply and discharged through a spark-gap bank and output capacitor into the simulator's wire elements. These wire elements extended from the Marx generator through a 16-foot-long transitional section to a bank of copper-sulfate load resistors, which provided a termination load resistance (110-130 ohms) for the pulser. A 30-kV charge to the Marx generator was sufficient to provide a 50-kV/m field strength with a pulse rise time near 10 ns inside the working volume. The 30-kV charge to the Marx generator produced a 240-kV charge on the pulser elements.

A round and a square H-field sensor were used to provide daily calibration of the simulator and to measure the field strength during each test. Normally, only one sensor was used during the actual test. Four current sensors measured the output of Amateur Radio antennas erected in the

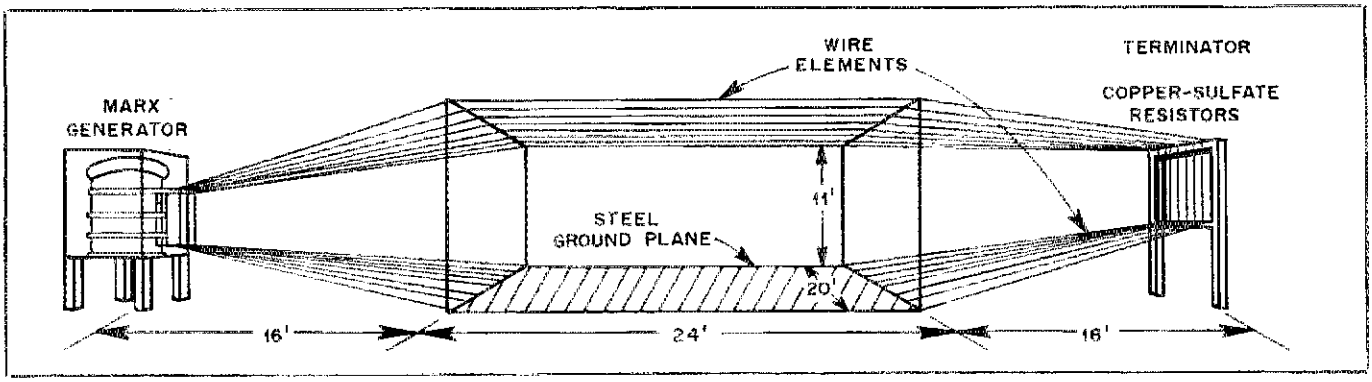


Fig 11—A drawing of the large parallel-plate EMP simulator used in the tests. The Marx generator is a high-voltage pulse generator in which several capacitors are charged in parallel through a high-resistance network. When the charge reaches a critical value, discharge occurs through spark gaps.

pulser field. The sensors also measured the output of the L-shaped wire antennas that were used to drive the ac power lines and antenna coaxial cables. A shielded coaxial probe and a fiber-optic system with a battery-powered, shielded transmitter took H- and E-field measurements. Sensor measurements were recorded on an oscilloscope. Photographs of the oscilloscope display were taken for each simulator pulse. Other test equipment included four signal generators and a wattmeter.

Radio System Tests

Each radio system was checked before and after each pulse. Transmitter power output was measured in the CW mode. This was done with and without any transient-protection devices in the feed line. That provided an evaluation of the protection device's suitability for that particular radio system, by showing its ability to pass the transmitted signal without clamping or without contributing a substantial loss of power output. Voice modulation was checked by observing the deflection of the wattmeter needle while speaking into the microphone. In some tests, the transmitter was monitored on a similar radio.

Receivers were placed on a set frequency in the USB mode with the RF amplifier on (if selectable) and the RF gain control set to maximum. The output of a signal generator was increased until the receiver's S meter read S5. (Receivers without an S meter were measured by listening for an audible signal in the speaker.)

Series A

For these tests, the radio equipment was placed on wooden carts 34 inches above the simulator floor. No interconnecting wires were attached to the equipment. All permanently attached external wires (such as power cords) were coiled and placed under the case of the radio equipment. This test evaluated the susceptibility of the radio's internal wiring and components to self-generated transient pulses resulting from exposure to a field pulse. All radios (with the exception of one, System 15, that was dropped from the test for prolonged maintenance problems) passed these tests with no measurable degradation.

Series B

Again, the radios were placed on the wooden carts. They were unpowered and ungrounded, but this time the interconnecting wiring and power cords were in place. This second test was designed to evaluate the radio's susceptibility to transient pulses generated by the internal wiring, and any external wires including microphone and power cords. All radios passed this test except for two, Systems 3 and 8. The receivers in these two systems exhibited decreased sensitivity: that of System 3 by 26 dBm and 8 dBm for System 8. Since a strong signal was still audible, the two systems were considered not to be seriously degraded and were accepted for further testing.

Series C

Only System 2 was used for this test. The transceiver was placed on the pulser floor and grounded to the pulser ground plane. All wiring was attached except for the coaxial feed line to the antenna. Tests were performed first with no ac power applied, then with power on. No degradation of the transceiver performance was measured.

Series D

This was a power-on test of the equipment with all external wiring and peripherals in place, including the coaxial antenna cable. Commercial transient-protection devices were installed in the ac power and antenna feed lines. Then, the ac power line and coaxial antenna cable were driven by an injected signal at the threat levels described earlier. All the devices, except one, provided adequate protection. System 2 sustained some internal damage during a test when the Alpha Delta R-T Transi-Trap was in the circuit. The Transi-Trap devices had performed satisfactorily during the first test program. [Note: As a result of this report, Alpha Delta has a new "EMP series" R-T and LT design. The new version has a clamping level three times lower than previous designs for maximum safety—Ed.]

Another protective device failed a post-test check. The Fischer FCC 450-120-UHF would not pass RF signal power. It was replaced.

Series E

Now, five assembled (experimental) transient-protection devices were tested (see Table 7). Of these five, one was an ac-line unit and four were RF assemblies. These tests were designed to find a low-cost solution to the transient-protection requirements of the radio systems under test. All of the units provided adequate protection of the radio equipment during the test pulse. Further testing revealed that three of the devices blocked the transmitted signal. The Siemens Metal Oxide Varistor (SIOV) RF Test Box containing a large-capacitance varistor blocked the signal over a wide frequency range. The Siemens UHF Test Box and Joslyn UHF Test Box containing the gas gaps were adequate at HF, but blocked the signal at higher frequency ranges. Although these three devices are adequate for receiver use, they are not recommended for use with a transmitter.

The UHF coaxial T was the best assembled device; it provided transient protection and could pass the transmitted signal over the full range of test frequencies. Also, the SIOV AC Test Box repeatedly provided necessary power protection required by the radio equipment. These two devices will be discussed in more detail in the next installment.

Series F

This series of field and injection tests had three configurations. First, the radio systems were fully protected. Then, transient protection was removed from the coaxial feed line. Finally, protection was removed from the ac power line as well. As expected, some equipment damage was experienced. However, the most surprising

result of this test series was that only one radio system (System 2) experienced significant, permanent performance degradation. The other radios suffered various amounts of lowered transmitter power output and receiver sensitivity, but were still operational in their damaged state. A contributing factor in the survivability of the equipment was the influence the RG-8 coaxial cable had on the RF injection pulse (discussed later).

Antenna Tests

Measurements were taken of the response of two amateur antennas to the simulator pulse field in several different configurations. These included measurements taken with a 75-foot length of RG/8 cable attached and with a connection to the pulser ground plane directly through a 50-ohm resistor. The Mosley JRS TA33 Jr antenna generated a maximum of 152 A through 50 ohms for a 7.6 kV pulse level. The Cushcraft AV-5 produced a maximum output of 170 A through the 50-ohm resistor for an 8.67 kV pulse level.

An L-shaped wire antenna was placed in the pulser field to generate a drive current that could be injected into the coaxial cable attached to the radio equipment under test. The maximum measured output of this antenna was 175 A through a 50-ohm resistor for a maximum pulse level of 13.75 kV.

Two "rubber ducks" were tested. The maximum measured current was 8 A producing 400 V through 50 ohms. This low current was not sufficient to cause any degradation of the hand-held transceivers.

Coaxial Cable Effects

Measurements were made to determine the response of RG/8 coaxial cable in the pulse field alone and when attached to three different antennas: two amateur antennas and the RF-drive antenna. At the antenna side of the cable, large currents (250-290 A) could be found, but at the opposite end—with the 50-ohm resistor connected to ground—only 50-110 A was measured. We suspected that the coaxial cable was arcing. To test this, a piece of RG/8 cable was connected to a high-voltage dc supply and the supply voltage was slowly increased. Arcing between the center conductor and the coaxial connector began at a potential of 4 kV; the cable began arcing internally at 5.5 kV. We concluded that the RG/8 cable was acting as a spark-gap protector for the equipment under test. Given this condition, the protection devices installed in the feed line were needed only to suppress the approximate 4.4-kV pulse that would get through the cable.

Observations

Most of the solid-state, and all of the tube-type, radios were not susceptible to the simulator field pulses until long, external wires were attached. Short wires—microphone, power cord and internal wiring—did not generate sufficient transient pulse energy to produce observable damage to the radio equipment. When power lines and antennas are attached to radio equipment, however, protection must be provided. With long external wires attached and no protection provided, a single pulse could cause disruption of the microprocessor-controlled displays, cause frequency shifts and permanently damage the radio's internal components. Two notable exceptions are the handheld and mobile radios. Even with antennas attached, no equipment degradation was noted.

Other equipment used by the radio amateur can be damaged by transient pulses. A line-operated dc power supply (Astron VS-35) failed when pulsed with an unprotected power source. A hand-held transceiver's (ICOM IC-02AT) display was permanently damaged when the radio was plugged into its battery charger and then into an unprotected ac power source. The battery charger was also damaged. A Honda portable power generator was fully stressed with field and injection pulses and was unharmed. System 1 sustained damage to its antenna matching network, but the attached transceiver was unhurt. (In this case, the matching network may have protected the transceiver.) When System 4 was pulsed in an unprotected configuration, its matching network did not provide adequate protection for the transceiver; the transceiver's frequency display was temporarily disrupted.

Conclusions

Most Amateur Radio equipment should be protected from lightning and EMP to prevent damage that can degrade the equipment's performance. Adequate transient-pulse protection for most radio systems can be obtained by adding the proper protection devices to the ac power lines and the transmission line. Battery chargers for hand-held transceivers and line-operated dc power supplies should also be protected. With a minimum amount of protection, radio systems should survive transient pulses produced by lightning strikes and EMP. A direct lightning strike is another matter.

[Editor's Note: This series of articles is condensed from the National Communications System report (NCS TIB 85-10) *Electromagnetic Pulse/Transient Threat Testing of Protection Devices for Amateur/Military Affiliate Radio System Equipment.* A copy of the unabridged report is available from the NCS. Write (no SASE required) to Mr Dennis Bodson, Acting Assistant Manager, Office of Technology and Standards, National Communications System, Washington, DC 20305-2010, or call 202-692-2124 between the hours of 8:30 AM and 5 PM Eastern.]

Strays

I would like to get in touch with...

☐ radio operators who served aboard the *USS Norwalk*. Joseph Strolin, K1REC, 21 Ellen St, Norwalk, CT 06851.

☐ packet-radio operators in Louisiana. Contact Louisiana Amateur Packet Radio Society, c/o Jack Coffee, WD5ELJ, 10026 Hackberry, Baton Rouge, LA 70809.

☐ anyone with a manual or schematic for a 2-m linear amp, Model V-1 90 PL, made in Pasadena, Texas. Myron Travis, 111-C Via Estrada, Laguna Hills, CA 92653.

Next Month in *QST*

Palms sweaty, you turn on the rig, tune it up, tune around the band for an open spot. By now your hands are shaking, your throat is dry. Does Jack see how nervous I am, you wonder. It's a scenario that's familiar to all of us—*the first contact.* An article in November *QST* is sure to bring back memories of your own initiation into Amateur Radio.

November technical articles offer a feast of construction projects: inexpensive transient-protection devices, a 160-meter top-loaded vertical antenna and a memory keyer designed for meteor-scatter operation.

And, the results are in: from the Making Waves survey, and from the balmy, mosquito-filled weekend called Field Day '86. Photos, reminiscences and final standings will appear in November *QST.*

Please note: Although we try our best to include in the next issue all the items we've advertised, from time to time we have to postpone publication for a month or two. If the item you're looking for doesn't appear "next month," it most likely will be in the following month's issue.

Under Construction

WWV and CHU in Your Workshop

Part 12: Equipment calibration is a frequent exercise in the ham workshop. Having a time-standard receiver available will hasten your frequency-calibration chores.

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

What an annoyance it is to disconnect the station transceiver or receiver and haul it to the workshop in order to receive the time-standard stations CHU or WWV! How much nicer it is when we have a special receiver in the shop for reception of WWV or CHU. A receiver for these services makes it easy for us to calibrate our amateur receivers and frequency counters during routine maintenance. It is not cost effective to buy a general-coverage receiver for this purpose...at least not if we are casual denizens of the workshop. A logical alternative is to build a simple receiver for WWV or CHU. This month, we will consider two approaches to building our own receiving gear for those time stations. Radio propagation forecasts may also be obtained from WWV, just in case you are a DXer at heart!

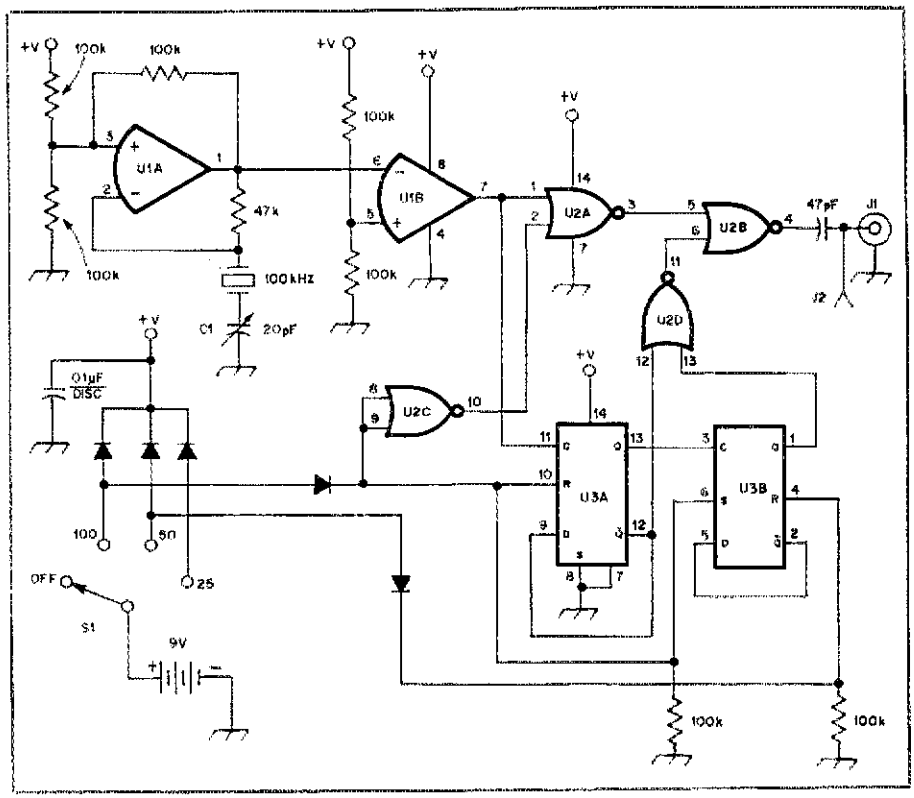


Fig 1—Schematic diagram of a secondary frequency standard. It produces markers at 25, 50 and 100 kHz. S1 is a single-pole, 4-position rotary switch. U1 is an LF353N, U2 is a 4001 IC and U3 is a 4013 IC. C1 is a 20- or 30-pF ceramic trimmer (NP0 type recommended). Diodes are 1N914 types.

Measurement Methods

For years, amateurs have relied on secondary frequency standards to check transmitter operating frequencies in an effort to stay within the allocated ham bands, or within license-class segments of the various bands. Some transceivers contain built-in secondary frequency standards that consist of stable crystal oscillators operating at 100 kHz. We may also use outboard standards of this type. Most of these units contain dividers that produce markers at 10, 25 or 50 kHz. These secondary standards need to be checked periodically against WWV to ensure that they are accurate. When they are not, we must adjust a trimmer in the crystal circuit to "rubber" the crystal to the desired frequency. Normally, the frequency is just a matter of a few hertz from being zero beat with the WWV signal. A typical circuit for such a secondary standard is shown in Fig 1.[1]

Primary frequency standards, such as used in laboratories or at CHU and WWV, may be founded on (1) atomic-beam devices that use cesium or thallium and (2) gas-cell devices, most of which use rubidium. Four standards of time are in use today: Ephemeral, atomic, sidereal (0) and Universal Time Scales (UT).

WWV, WWVH and CHU

WWV (Ft Collins, Colorado) transmits on 2.5, 5.0, 10.0, 15.0 and 20.0 MHz. WWVH (Kekaha, Kauai, Hawaii) transmits on all of the foregoing frequencies except 20 MHz. CHU (Ottawa, Ontario, Canada) broadcasts on 3.330, 7.335 and 14.670 MHz. The WWV and WWVH stations are normally Q5 on one or more of the listed frequencies, owing to power levels of 2.5 kW (2.5 and 20.0 MHz) and 10 kW (5, 10 and 15 MHz).

[1]See *The 1986 ARRL Handbook*, p 25-16.

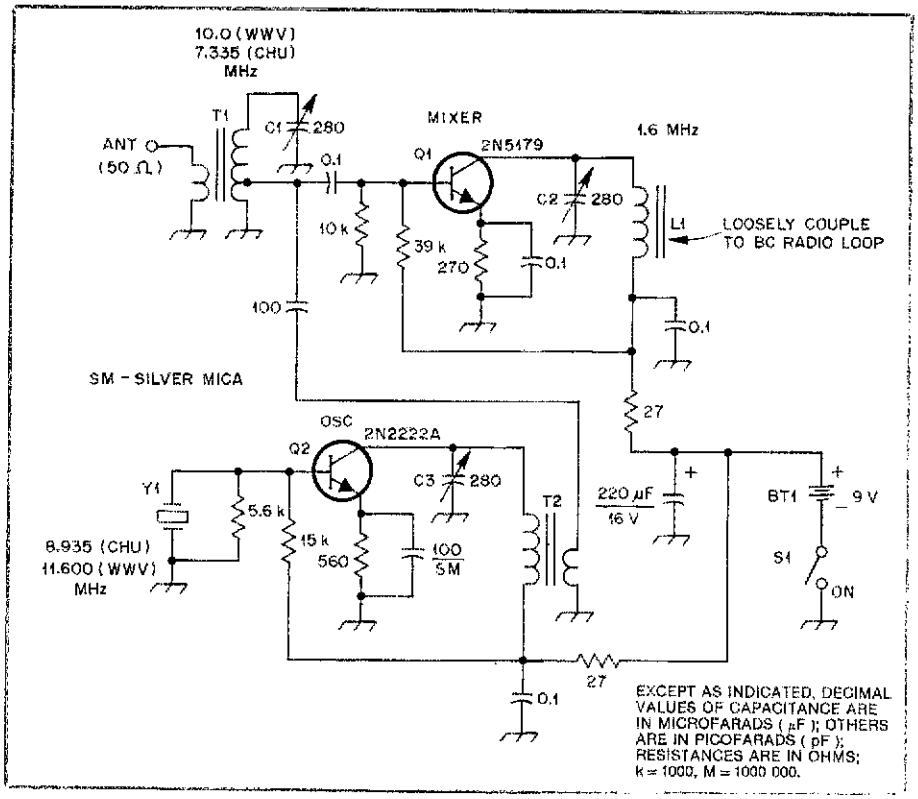


Fig 2—Suggested circuit for a WWV or CHU converter to be used with a small BC-band AM radio (see text). Fixed-value capacitors are disc ceramic. SM is silver mica. Fixed-value resistors are ¼- or ½-W carbon-composition types.

BT1—Transistor radio 9-V battery.
C1, C2, C3—280-pF mica compression trimmer (ARCO 464 suitable).
L1—Small ferrite loop antenna from BC-band radio (see text).
S1—SPST toggle or slide switch.
T1—RF transformer, 2.2-µH secondary. Use 22 turns of no. 26 enam wire on an Amidon Assoc T68-6 toroid core. Tap secondary 6 turns above grounded end. Primary has 2 turns of no. 26 enam wire.
T2—RF transformer. Use 20 turns of no. 26 enam wire on a T68-6 toroid core. The secondary consists of 2 turns of no. 26 enam wire.
Y1—Fundamental crystal, general-purpose type, 30 pF load capacitance. International Crystal Mfg Co, type GP or equiv.

Typically, the 10-MHz frequency for WWV and the 7.335-MHz frequency for CHU are the most reliable ones for around-the-clock reception in the USA. These are the frequencies we will concentrate on in the practical part of this article. WWV data may be obtained by telephone by dialing 303-499-7111; WWVH's number is 808-335-4363.

Homemade Receiving Equipment

Most of us have one or more pocket-size AM radios in the house. Why not use one as part of our simple WWV or CHU receiver? Since WWV and CHU transmit in the AM mode, a BC-band receiver is tailor-made for the application. All we need to complete the package is a crystal-controlled converter that has an IF at, say, 1600 kHz.

To keep things simple, let's design our WWV converter for 9-V battery operation. This makes the package suitable for Field Day, camping and other portable use. Also, we will have one less cord to clutter our work area in the shop if everything operates from battery power!

A suggested converter circuit is presented in Fig 2. It is based on the design of proven converters for other frequencies. Only a mixer and oscillator are used to convert 10.0 or 7.335 MHz to 1.6 MHz.

The circuit of Fig 2 is designed to provide reception on 10.0 or 7.335 MHz with no changes other than the crystal frequency (Y1). The range of the tuned circuits L1, T1 and T2 covers both frequencies by adjustment of the related trimmer capacitors.

L1 can be a flat ferrite loop from a discarded pocket radio. If the converter is built in a plastic box, we can simply place L1 close to the built-in loop antenna of the portable AM receiver we will be using, and the signal transfer between the two units will be ample. For this reason, there is no direct connection between the converter and the portable AM radio. Should you desire a direct connection, merely wind a 10-turn link on the lower end of L1 and connect it to a similar link that you have wound on the loop antenna in the portable radio. This method enables you to place the portable radio in a shielded box to prevent unwanted pickup of AM broadcast stations. I chose 1600 kHz as the converter IF because there is not much chance of interference on that frequency from strong BC stations. Most AM radios tune as high as 1610 kHz, so you may want to play it safe by using a converter crystal that permits WWV or CHU to fall into an IF of 1610 kHz. If you desire a permanent WWV receiver, I suggest you build the converter into a metal box that also contains the AM receiver. This will screen out AM broadcast signals and minimize problems with reception of CHU or WWV. An earth ground to the metal case will further reduce stray-signal pickup.

Simple Direct-Conversion Receiver

A method for developing a composite WWV receiver of simple design is illustrated in Fig 3. A synchrodyne or direct-conversion (D-C) receiver may be built with four stages to permit headphone volume of the received signal.

Q1 is the detector. Think of it as a product detector in a superheterodyne receiver. It changes RF energy to audio-frequency (AF) energy. Q4 is the BFO for the product detector. Injection voltage for gate 2 of Q1 is taken from the crystal side of Q4 in order to obtain a cleaner sine wave than is available at the collector of Q4.

T2 is an audio transformer that functions as a matching device between the Q1 drain and the base of Q2. Audio amplification takes place at Q2 and Q3 to raise the signal to headphone volume. An LM386 audio IC can be added after Q3 if you desire to use a loudspeaker. If this is done, an audio-gain control (10 kΩ) should be used between Q3 and the LM386 IC. If this modification is made, BT1 will have a short life (greater current drain). Therefore, use of an ac-operated 9-V dc power supply is suggested.

WWV or CHU reception with this type of receiver requires tuning the signal for a zero beat. A beat note will otherwise be heard. If you wish to use a short antenna (hank of wire, etc) with this receiver, or with the converter in Fig 2, an RF amplifier may be added between the antenna and the input stage of either circuit.

You may want to consider using the circuit of Fig 3 for a fixed-frequency receiver to copy W1AW bulletins and code-practice sessions. You may even have a favorite ham-band net frequency that you would like to monitor when camping or traveling. If so, a receiver of this type is suitable. It can copy CW and SSB in good style!

I should mention that in order to have ample headphone volume with any D-C receiver, we should ensure that the overall gain of the receiver (product detector and audio amplifiers) is between 80 and 100 dB. This relates mainly to weak-signal

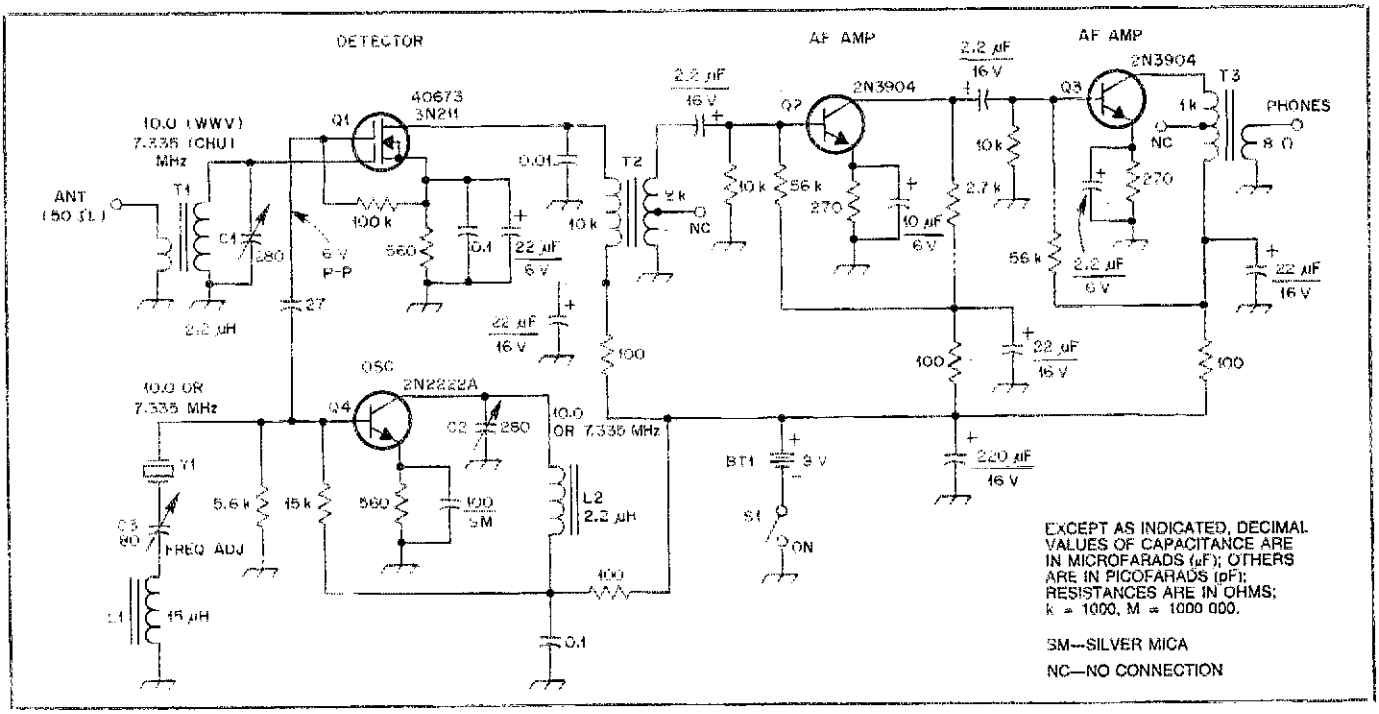


Fig 3—Schematic diagram of a suggested circuit for a WWV or CHU direct-conversion receiver. C3 is used to set the receiver frequency. Fixed-value capacitors are disc ceramic. Resistors are ¼- or ½-W carbon-composition types.

BT1—Transistor radio 9-V battery.
C1, C2—280-pF mica compression trimmer (ARCO 464 suitable).
C3—80-pF compression trimmer (ARCO 462 suitable).
L1—16 turns of no. 26 enam wire on an Amidon FT37-61 ferrite toroid.
S1—SPST toggle or slide switch.
T1—Same as T1 of Fig 2, but no tap.
T2—Miniature audio interstage transformer, 10-kΩ primary, 2-kΩ secondary. Center tap not used (Mouser Electronics 42TU002).
T3—Audio output transformer, 1-kΩ primary, 8-ohm secondary (Mouser Electronics 42TU013).
Y1—Fundamental crystal, general purpose, 30-pF load capacitance (International Crystal Mfg Co, type GP suitable).

reception: Let's think of such signals as being S2 or weaker. The circuit of Fig 3 is marginal in terms of overall gain, but it is adequate for WWV or CHU reception during average-to-good band conditions. Since the audio gain is somewhat marginal, I did not include an audio-gain control. You may add one by placing it between Q2 and Q3. A 10-kΩ or 25-kΩ control will be satisfactory. This is not a critical part of the circuit.

Construction Hints

The rules for the WWV converter or receiver are the same as for any HF-band RF circuit: The signal leads should be short and direct in order to prevent unwanted self-oscillations and reactance-related losses. Certainly, the use of perf board and flea clips is acceptable if you want to get the job done quickly. If you are endowed with patience, you may prefer to lay out and etch a PC board for these projects. The use of PC boards may be more practical if either of the circuits will be used as a club project.

Don't overlook junked AM or AM/FM radios as a source for many of the parts these circuits require. If there are NPN transistors in the scrap radio, they should work fine as Q2 and Q3 of Fig 3. Many of the ceramic capacitors can be salvaged for use in these circuits. Don't forget the audio output transformer from the radio. It can be used at T3. Some radios may contain an audio interstage transformer. If so, use it as T2 of Fig 3.

How to Use the Receivers

Apart from the convenience of being able to set our clocks and watches accurately from the time-standard stations, how can we apply the receivers for workshop use? Let's suppose your frequency counter needs to be calibrated. First, you tune in WWV by means of the converter/AM radio, or by adjusting your D-C receiver so that no beat note is present, as mentioned earlier. The counter to be calibrated must be allowed to warm up for an hour to ensure stability. Now, you may place a piece of insulated hookup wire near the crystal oscillator in the counter. The other end of the wire is located near T1 of Fig 2 or Fig 3. We must assume that your frequency counter has a clock-frequency crystal for 1.0, 2.5, 5.0 or 10 MHz. The harmonics of these frequencies (other than the 10-MHz case) will fall at 10 MHz. Listen to the receiver output. If a heterodyne or slow pulsing is heard, adjust the counter calibrating trimmer until a zero-beat condition exists. The calibrators in amateur receivers or transceivers may be aligned in the same fashion. Be sure to sample enough energy from the crystal oscillator of these units to ensure an audible beat note between the sampled signal and that of WWV. If not, you will not be able to find the beat note and make the adjustments. Some experimenting will be necessary. Move the probe wire around the oscillator circuit until you find a "hot spot."

As you get close to a zero-beat condition during calibration, the beat note will pulse slower and slower (as heard in the receiver output) until no pulsing is heard. That will indicate that the two signals are on the same frequency (zero beat).

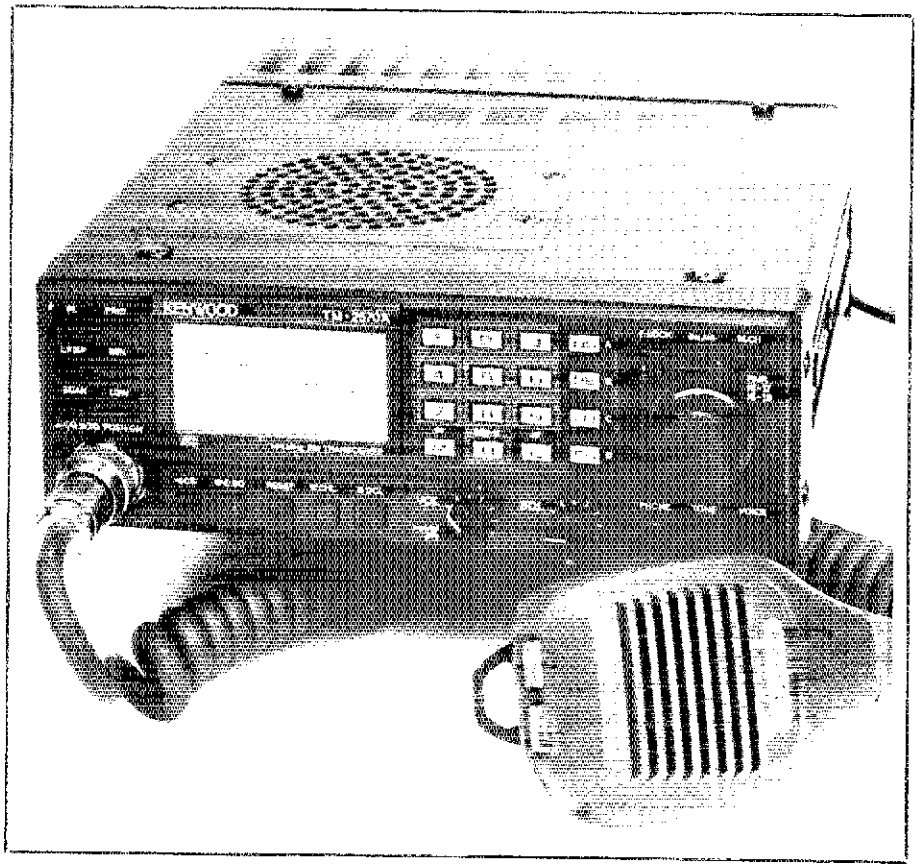
Summary

I have outlined the principles of how to build simple receiving gear for WWV or CHU. We have reviewed the basics of primary and secondary frequency standards in an effort to acquaint you with how these things operate. Detailed data on the broadcast formats of the two stations can be obtained by writing to the National Bureau of Standards (NBS) at Boulder, Colorado, or to the Research Council of Canada at Ottawa, Ontario.

Conducted By Bruce O. Williams, WA6IVC
Assistant Technical Editor

Trio-Kenwood TM-2570A 2-Meter Transceiver

Trio-Kenwood's 2500-series 2-meter transceivers cover a wide power range (TM-2530, 25 W; TM-2550, 45 W; TM-2570, 70 W) and bring several new features to the VHF scene. They are the first *dual*-microprocessor-controlled VHF radios. Memory functions cover not only storage of frequency and offset information, but also continuous-tone-coded squelch system (CTCSS) tone control and dual-tone multifrequency (DTMF) telephone-number transmissions. Finally, there is a sophisticated Digital Channel Link (DCL) system that provides for automatic, simultaneous transfer of two stations to a clear frequency once contact has been established on a calling frequency.



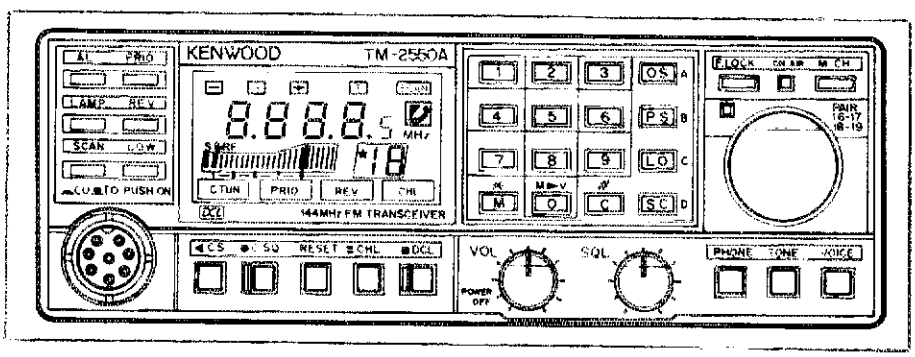


Fig 1—Front view of the Kenwood TM-2500-series panel, showing all controls and indicators.

Controls

The most prominent control feature is the multifunction 4½ digit LCD panel (see Fig 1). It shows the operating frequency (when MHz is lit), Digital Coded Squelch (DCS) code, ASCII values for the call sign sent with DCS data, CTCSS tone frequency (when Hz is lit) along with channel and telephone-number information during telephone-memory operation. Symbolic indicators display the activity of CTCSS tone (T); transmit-frequency offset (–, S, +); center tuning (C.TUN indicates that the squelch is open); PRIority-alert operation; REVerse-offset operation; memory channels locked out of scanning (more on this later); completion of a DCL operation (DCL); SCAN operation and telephone-number transmission (an icon of a handset). A bar graph at the bottom of the display serves as an S meter during reception, as a power output meter during high-power transmission and a microphone input-level meter during low-power transmission. A memory-channel display shows the active memory channel (numbers 1 through 19, plus letters A, b, d or U) and whether that channel is locked out of scan operations.

Next to the LCD is the 16-key pad. The numerical keys (0 to 9) are used to enter various numeric data and send DTMF tones during transmission. The right-hand column of four buttons and the "*" and "#" buttons provide the following controls:

OS—Transmit offset. The transmit offset is selected automatically (per the ARRL bandplan) when a frequency is entered. This button steps through a sequence of offsets (–600 kHz, simplex, +600 kHz) when pressed to allow selection of standard offsets that are not consistent with the bandplan.

PS—Priority select. This key is used to select the priority channel for alert operation. It also resets the microprocessors if pressed as the power is turned on.

LO—Lock-out key (Skip). This key is used to designate memory channels to be skipped during memory scan. The locked-out channel is indicated by a star next to the memory channel indicator.

SC—Scan. Initiates the scan operations.

C (#)—Clear. Clears the keypad frequency to the previous entry, or halts scan operations.

M (*)—Memory. This key is used to store frequency and offset.

To the left of the display are two columns of push-button switches. ALert selects the alert mode, where the priority channel is checked every six seconds. A double beep sounds repeatedly when the squelch is broken on the priority channel. LAMP turns on the control-panel illumination. The '2500 series features back illumination of all major controls; only the volume and squelch knobs and the DCL-system keyboard are not illuminated. SCAN selects either the time-operated (internally adjustable from 0 to 5 seconds) or carrier-operated mode of scanning. PRIority switches operation immediately to the priority channel. REVerse reverses the frequencies used for duplex operation. LOW switches the transmitter to low-power operation. The low-power output is adjustable from approxi-

Trio-Kenwood TM-2570A Transceiver, Serial No. 7011501

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 144-148 MHz.	Receive and transmit approx 142-149 MHz.
Mode of operation: FM (F3E) with F2D "DCS" system.	As specified.
Frequency display: 4½-digit LCD.	As specified.
Frequency resolution: 5 kHz.	As specified.
Frequency stability: less than ±15 ppm	Not measured.
Transmitter	
Power output: 70 W high power, low power adjustable 5-60 W.	77 W, minimum. As specified.
Spurious signal and harmonic suppression: −60 dB or less.	−70 dB. See Fig 2.
Receiver	
Receiver sensitivity: less than 0.25 μV for 12 dB SINAD.	0.19 μV.
Squelch sensitivity: less than 0.125 μV.	0.05 μV min, 1.0 μV max.
S meter: LCD, sensitivity not specified.	1.6 μV for S9 indication.
Audio output: 1.5 W (8 Ω) for 5% total harmonic distortion.	2.25 W.
Power requirements: 13.8 V dc, receive 0.6 A, transmit 16 A.	Receive 0.44 A, transmit 13.5 A.
Color: Gray.	
Size (height-width-depth): 2.4 × 7.1 × 9.9 in.	
Weight: 5.2 lb.	

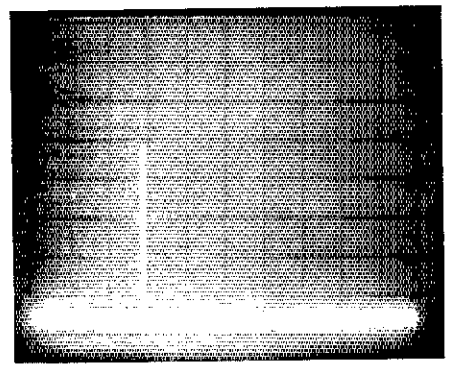


Fig 2—Spectral display of the Kenwood TM-2570 2-m transceiver. Frequency is 144.0 MHz, with an output power of approximately 72 W. Vertical divisions are each 10 dB; horizontal divisions are each 50 MHz. The fundamental (pip at the left of the photo) has been reduced in amplitude approximately 32 dB by means of a notch filter to prevent spectrum-analyzer overload. All harmonics and spurious emissions are at least 70 dB below peak fundamental output. The '2570 complies with current FCC specifications for spectral purity.

mately 5 W to 60 W. Below the buttons, at the lower-left-hand corner of the front panel, is an eight-pin microphone connector for Kenwood's line of scan-control microphones. The connector is angled slightly for easier access, but I did not notice any improvement in access compared to a straight connector.

At the right of the microphone connector is the five-key DCL keyboard. Its operation is discussed later. Below the DTMF keypad are the VOLUME and SQUELCH controls.

PHONE, TONE and VOICE buttons are at the lower-right-hand corner of the front panel. PHONE activates the telephone-number memory mode. TONE switches on the optional control tone. On American models (suffix A), the subaudible tone for the selected memory channel is transmitted. On European models (suffix E), a 1750-Hz tone is transmitted for repeater control. VOICE enables the optional voice synthesizer. Above these three buttons is the memory-select knob. It selects the memory channels for all modes, including the operating frequency when the radio is in the memory mode. It does *not* allow manual tuning of the operating frequency. When the radio is not in the memory mode, the operating frequency may be entered *only* from the keypad or by changing frequency with the up/down buttons on the microphone. Above the memory-control knob are the frequency lock (F.LOCK) button and LED, memory/keypad control selector (M.CH) and on-the-air LED indicator (ON AIR).

There are only three connectors on the rear panel of the TM-2500 series transceivers: An SO-239 antenna receptacle, a 1/8-inch miniature phone jack for an external 8 Ω speaker and a dc power connector. Dc power is fed through a connector configured like two spade connectors arranged in a T shape to prevent incorrect connection.

The DCL System

This system combines the features of the previous Kenwood Digital Coded Squelch system with those of the new Channel Link (CHL) system. Both systems require the MU-1 modem option for operation. (This seems odd to me. Kenwood builds the modem for DCS operation into their $300 handheld, but made it an extra-cost option on their $500 mobile radio.) The review radio did not include the option, so I could not try either the DCS or CHL system. Further, the manual explanation is difficult to understand, particularly when there is no working model on which to experiment. Within those limitations, here is my understanding of the system.

During DCS operation, a digital code and the transmitting-station call sign are sent at the beginning of each transmission. (One can review the active transmit code by pressing the CS key.) There are 100,000 possible five-digit codes, the radio can keep up to 10 codes in memory simultaneously, and any of the memorized codes may be locked out at the operator's discretion. Only those stations transmitting a memorized identification code are heard, although other signals show on the S meter, and operation of the alert feature overrides DCS. The optional CD-10 call-sign display can show call signs of received stations using DCS. The capability offered by this system is roughly equivalent to having 10 simultaneous PL tones in a tone-squelch radio.

The DCL system provides for automatic QSYing of two DCL stations that are already in contact. When the system is operating, there is a 0.2-second burst of digital data (1200 baud, minimum-shift keying) at the beginning of each transmission. This data burst is used to relay information from one station to the other when a frequency change is initiated by pressing the CHL button. (Kenwood has allowed extra space in the data format to allow for future expansion of the system.)

Once the operator presses the CHL button, his station reads the frequency stored in memory A and commences a search for a clear channel at preselected, discrete intervals from that frequency. (The frequencies of the searched channels are displayed as the search continues.) A clear channel is one with no signal over 0.2 μV for 1.5 seconds. The search interval is either 15 or 20 kHz, selectable by a diode jumper inside the radio. According to Kenwood's manual, the radio may occasionally transfer to an occupied channel because of transients in the microprocessors.

Upon finding an open frequency, the radio returns to the original frequency. If in simplex operation, and the frequency is clear, the digital information is sent immediately to the other station, and both stations move to the new, clear frequency. If in repeater operation, or the simplex frequency is busy, the radio returns to the receive mode and repeatedly emits three audio beeps until the operator permits transmission of the digital information by pressing the PTT button. (The information is actually sent when the PTT button is released.) Communication on the new frequency is simplex, with no tone, regardless of the settings at the original frequency.

If no open frequency is found, the search (and DCL operations) may be ended by keying the PTT line or pressing the RESET button. If the transfer is not completed successfully, the transfer information may be repeated, by pressing the RECALL button until the transfer is completed. A single press of the RESET button ends CHL operation at both stations. This allows either station to end DCL operation, or execute another CHL search (by pressing RESET, then CHL). The initiating station may return to the original frequency (in case the transfer cannot be achieved) by pressing RESET twice.

If DCS is used during DCL operations, both stations must use the same DCS code. Kenwood warns that time delays in some repeaters may prevent successful DCL operation.

Other Special Features

American models of the TM-2500-series allow memory storage of 15 seven-digit telephone numbers for DTMF transmission over the air. To use the feature, select an operating frequency, press the PHONE button to ac-

cess the phone memory, select the desired memory with the memory knob, press PTT to transmit and press PHONE again to send the tones. I found this feature particularly useful with the W1AW 2-meter repeater. The repeater incorporates an Advanced Computer Controls Model RC-850 controller that uses some rather complex codes to control its many features. Such codes are easily programmed into the TM-2570 for one-touch control of those functions that can be legally controlled on the repeater receive frequency.

When American models have the TU-7 tone-encoder option installed, one subaudible tone frequency may be stored with each memory operating frequency. The tone is added to the modulation whenever the tone feature is on.

Special repeater offsets other than the standard 600-kHz split can be operated using two memory-channel pairs: Channels 16/17 and 18/19. To operate, store the transmit and receive frequencies in one of the pairs. The receive frequency is selected by setting the M.CH to memory mode and selecting either channel. This becomes the receive frequency. Transmission takes place on the frequency stored in the other channel of the pair. Standard splits or simplex operation do not work from these channels unless the appropriate split is stored as if it were a special split.

Scan Operations

All scan operations stop on an occupied channel for either a predetermined time period (3 to 15 seconds, internally adjustable) or until the carrier drops. All scan operations can be stopped by: (1) pressing the PTT button, (2) pressing the C (Clear) button, (3) turning the power off, (4) activating the priority channel or (5) pressing the F.LOCK button. The scan direction is selected with the UP and DWN buttons on the microphone. The scan speed increases when the button is held down.

In the keyboard mode, the radio scans according to upper and lower scan limits programmed in memories "U" and "d," respectively. When the SC button is pressed, the radio begins scanning. If the radio was set to a frequency between the limits when scanning began, scanning continues within those limits. If the radio is set to a frequency outside the limits when scanning begins, scanning takes place outside the limits. This allows the operator to either select or exclude a band for scanning. When the frequencies in U and d are equal, the radio scans its entire frequency range.

In the memory mode, all memory frequencies are scanned except those that are locked out. A memory channel can be locked out of the scan by selecting the channel and pressing the LO button prior to commencing the scan.

The priority and alert functions are complementary. Any of the memory frequencies can be selected as the priority channel. Once a priority channel is chosen, it can be monitored with the alert function. When the ALERT key is pressed, the priority channel is checked for activity every six seconds. If there is activity, a double beep sounds each time the priority channel is checked. The operator can immediately change operation to the priority channel at any time by pressing the PRIORITY button.

The Manual

The operating manual is complete, but instructions are less than clear in some areas. Specifically, the DCL system defies explanation on paper. Also, the manual gives the owner instructions for installing the optional modem, voice synthesizer and tone encoders, but not for changing the lithium battery. Kenwood covers that procedure in the Service Manual (but not in the Operating Manual) because it involves soldering in CMOS circuits.

The mobile bracket uses large rubber jaws to grip the radio. It makes installation and removal quick and easy.

Operation

I am very satisfied with the radio. Its performance is excellent. It has plenty of bells and whistles to satisfy the most dedicated "engineer." When received, the radio did not transmit with full output power, but the Kenwood technicians were extremely helpful and prompt in providing us with information to correct the fault. A capacitor had been improperly installed in the final amplifier circuitry during manufacture. Kenwood was aware of the problem and has issued a service bulletin covering correction of the defect. Following proper installation of the capacitor, it was a simple matter to adjust the radio for the full 70 W+ output. The 70 watts definitely helped during a recent March of Dimes Walkathon, where some other rigs had trouble reaching the repeater.

Manufacturer: Trio-Kenwood Communications, 1111 West Walnut St, Compton, CA 90220. Price class: TM-2530A $430, TM-2550A $470, TM-2570A $560, MU-1 modem unit $35, TU-7 tone unit $30, VS-1 voice synthesizer $45, CD-10 call-sign display $100.—*Bob Schetgen, KU7G*

Strays

SPREAD SPECTRUM AND THE EXPERIMENTER

☐ If you are interested in developing a practical spread-spectrum station, you will be interested in reading Andre Kesteloot's, N4ICK, article in October 1986 *QEX*. The article offers technical details and schematics of an external reference synchronization method to get you started in spread-spectrum experiments. Information on a pseudo-random generator, designed along FCC guidelines, is included.

Since June 1986, US radio amateurs are authorized to use spread-spectrum techniques. In addition to applying conventional modulation mehods to an RF carrier, It is possible to alter either the phase of that RF carrier (direct-sequence spread spectrum) or its frequency (frequency hopping) in accordance with a pseudo-random code. This code is generated at a certain clock frequency.

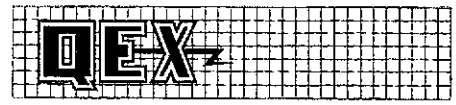
To receive a spread-spectrum transmission, it is necessary to know the frequency on which the transmission is taking place, the particular pseudo-random code used (announced or agreed on in advance) and the frequency and phase of the clock used to generate the pseudo-random code. To the casual listener who does not know these four variables, the spread-spectrum transmission sounds like mere noise.

How can an operator recover clock information from a signal not heard in the first place? One solution, suggested in July 1983 *QST* by William Sabin, WØIYH, tells of synchronizing both the scheme proposed by Sabin. Dedicated experimenters such as N4ICK and other AMRAD members helped to convince the FCC that Amateur Radio experimenters are ready for spread-spectrum privileges. (*Tnx N4ICK*)

I would like to get in touch with ...

☐ anyone with a schematic for a CE 20A. Tony Bodo, WA9YOZ, 4623 East 25th Ave, Lake Station, IN 46405.

☐ anyone with a manual/schematic for a Conar Model 212 VOM made by NRI. Don Lacy, NV4V, 2915-B Battle Mountain Way, Tallahassee, FL 32301-3657.



QEX: THE EXPERIMENTERS' EXCHANGE

☐ Calling all experimenters! Do you want the latest on high-level technical developments taking place in Amateur Radio? QEX will bridge this gap if you are interested in playing a role to extend the technical frontiers of Amateur Radio.

The September issue includes articles on:

- "How to Tailor Signal Coverage with Beam Tilt" by Steve Weinstein
- "Padding Calculations Made Easy," by Jacob Z. Schanker, W2STM
- "A Crystal Oscillator for Digital Circuits," by Paul Newland, AD7I
- "Xerox 820-1 Compendium—Part 4," by AMRAD

Other features include: Tips on handling and using chip capacitors in a project and two alternatives for acquiring bias circuitry for triode grounded-grid amplifiers.

QEX is edited by Paul Rinaldo, W4RI, and Maureen Thompson, KA1DYZ, and is published monthly. The special subscription rate for ARRL members is $6 for 12 issues; for nonmembers, $12. There are additional postage surcharges for mailing outside the US; write to Headquarters for details.

Hints and Kinks

Conducted By Bob Schetgen, KU7G
Assistant Technical Editor

WRAP YOUR GUY LINES!

☐ I had been worried for some time about the guy lines in my yard. They are difficult to see, and I thought that someone might be injured by walking into them. My solution to the problem provides padding and makes the guys much more visible.

I went to the local hardware store and bought three foam-rubber insulating sleeves for ½-inch water pipe. Each sleeve is 4 ft long and silver in color. The sleeves are slit along one side and slip easily onto the guys. I spray painted the sleeves fluorescent yellow to increase their visibility, but they must be painted very lightly as the paint solvents can melt the foam.—*Earl P. Anderson, WD9DID, Milwaukee, Wisconsin*

A MECHANICAL AUTOMATIC MORSE ID GENERATOR

☐ Most automatic call-sign generators use magnetic tape or logic chips. The one shown in Fig 1 uses a circular printed circuit with contacts for Morse pulses etched along the circumference. The remainder of the copper is left solid, except for a bare segment that follows the end of the message. A motor and worm drive (from a battery-operated toy) rotate the disk. The drive shaft is soldered to the upper foil surface and grounded. One brush, which is connected to the transmitter key line, scans the signal track. Another brush is the motor-circuit ground return path. When the second brush reaches the bare segment, the motor stops. A push-button switch is wired from the motor-circuit brush to ground. Press the button to start the motor, which then runs until the brush again reaches the bare segment.

One can etch the "record" to taste. I picked two straight repetitions of my call sign, but one can add CQs or DEs—or etch several different tracks that are selected by switching between different brushes. This entire contraption cost me about $2. Its "fist" leaves something to be desired, but it can be improved by careful spacing of the character contacts and experimenting with different kinds of brushes.—*Alex Comfort, MD, KA6UXR, Santa Barbara, California*

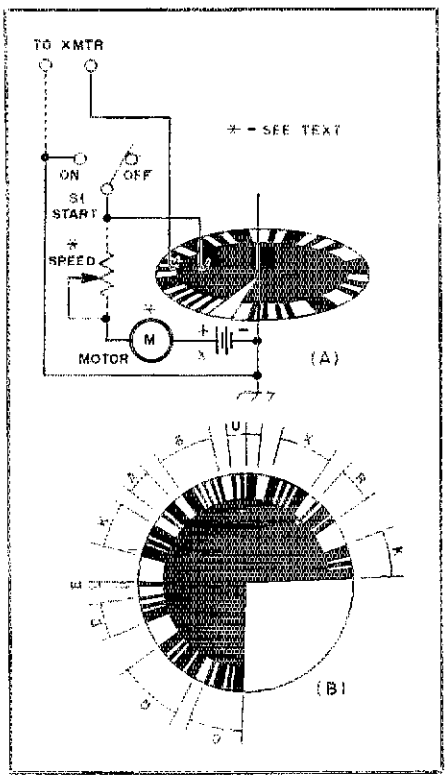


Fig 1—A schematic (A) and example disk (B) for KA6UXR's motorized automatic keyer. Dark areas of the disk are unetched copper.

A T-BOOM QUAGI

☐ Recently I built an eight-element 2-meter quagi according to instructions in the *ARRL Handbook* with a tapered 14-foot, 1- × 3-inch boom.[1] As it bent and flexed in the wind, I was convinced that there must be a better way to construct the boom. Because it is impossible to buy a straight 14-foot 1 × 3 locally, no matter what one is willing to pay, I decided that a T-shaped boom would be stronger and keep itself straight. The local lumber yard had utility-grade pine 1 × 2s in 8-foot lengths for 6 cents per foot, and I obtained three with which I could work. One had a hook at one end, another was straight but warped and the third was pretty good. I sorted through only about a dozen in the pile to find these three boards.

I cut off and discarded the one hooked end, to get 6 feet of straight wood, then pegged (with ¼-inch dowel) and glued it to the end of the good piece to form a 14-foot 1 × 3. The 3-inch dimension forms the upright portion of the T shape. Next, I centered the warped board on one of the 1-inch faces, for the top of the T. This left 3 feet at each end of the boom without a crossbar. The top is glued and pegged to the upright portion every two feet as well as on both sides of the joint in the upright. Enough wood was left over for one of the quad-element supports.

Uncoated manganese-bronze welding rod (available from just about any large auto-parts or welding-supply store) is excellent director-element material. It comes in 3-foot lengths and is 1/8 inch in diameter. Manganese bronze is slightly more expensive than brass, but it is stronger. Cut the rods almost to length and trim them with a file or grinding wheel.[2] Drill through the vertical part of the T boom (take care to drill at right angles to it), and push the elements through. Secure them with silicone sealant.

This method of construction produces a straight, strong boom that withstands fall and winter weather with no flexing, bending or warping. The dimensions given should work fine on 220 MHz as well as 144 MHz, but they should be scaled down for use at 432 MHz or 1296 MHz. The only problem I have encountered is that of solidly mounting the boom to the mast. A better grade of wood in the boom would help, but a spacer block and mounting plate should work with the wood I have.

I have since built another quagi and stacked them for extra gain. They work great, squirting 15 W (SSB or CW) across the Cascade mountains into the Seattle area (over 100 miles) and yielding consistently good signal reports.—*Robert W. Whitford, WA7STA, Ellensburg, Washington*

FEED-LINE TESTS

☐ A bad section of coaxial cable, with intermittent connections, loose connectors, faulty crimps or broken braid can cause many puzzling problems. Simple dc continuity checks are usually unsatisfactory because they may not show all such troubles.

I was thinking about building a cable test box with suitable connectors when I realized that I already had an excellent test set consisting of equipment that most hams own. Perform the test like this: (1) Connect the suspect length of cable between the station SWR meter and a 50-Ω dummy load. (Since little power is required for the measurement, a dummy load may be made from an SO-239 and several carbon resistors.) (2) Set the transmitter to the 10-meter band and adjust the drive (in the TUNE or CW mode) for the minimum power level that gives a valid meter reading. (3) Lock the key down; then twist, wiggle and bend the cable while watching the SWR meter. Any faults show as fluctuations in the SWR (reflected power).—*Warren Laufer, K2FG, Buffalo, New York*

WILL A SPARK PLUG PROTECT YOUR STATION FROM LIGHTNING?

☐ While going over the new (11th) edition of Hints and Kinks for the Radio Amateur (ARRL: Newington, 1982), I ran across "An Old, but not Forgotten, Lightning Arrestor Idea" (p 5-13). The idea is to use spark plugs as a protective spark gap in the transmission line. This might seem like a good idea, but after seeing a few smoking, burned-out transmitters, spark gaps and all, I wonder about the effectiveness of spark gaps as protective devices.

Let us consider the operation of a spark-gap lightning arrestor. A 50-Ω line carrying 1 kW develops about 250 V [RMS, 316 V peak—Ed.] across the conductors with a 1:1 SWR. A 600-Ω line develops about 800 V [1095 V peak—Ed.], under the same conditions. Any lightning arrestor must withstand at least these minimum voltages before breaking down. A spark gap of 0.01 inch has a breakdown voltage of about 1 kV [The di-

[1] J. Rusgrove and G. Woodward, editors, *The Radio Amateur's Handbook* (Newington: ARRL, 1981), p 21-8.
[2] Rusgrove and Woodward, p 21-9.

electric strength of dry air is 80 V per 0.001 inch.—Ed.] in clean, dry air so we can assume that this is the minimum practical gap.

As the antenna system is generally used for reception as well as transmission in an amateur installation, a minimum gap of 0.01 inch could place 1000 V across the receiver antenna terminals. This would easily destroy most transistors. A vacuum-tube front end might withstand such voltage, but vacuum-tube military and commercial receivers often have a neon lamp (striking voltage about 100 V) across the input for protection. Spark-gap devices, even with the neon lamp, would not protect a transistor RF stage very well. You can increase the protection of your station by installing a switch in the transmission line that disconnects the equipment and simultaneously grounds the antenna—then pray that the switch is never needed.—*Wayne W. Cooper, AG4R, Miami Shores, Florida*

[Editor's Note: Remember, no device can protect your station against a direct lightning strike. The only complete lightning protection is to disconnect the station from all conductors (antenna, rotator, ac power and ground) when not operating. New information about lightning protection appears in a series of *QST* articles by Dennis Bodson, W4PWF, beginning in Aug 1986. Also, a book about lightning protection is available from Poly-Phaser Corporation, 1425 Industrial Way, PO Box 1237, Gardnerville, NV 89410; tel 702-782-2511, for $4.95 (Technical Correspondence, July 1986 *QST*, p 43.)]

A CURE FOR ARCING IN THE HY-GAIN 402BA YAGI ANTENNA

☐ In talking with other amateurs, I find that several of us have experienced arcing around the driven-element insulators on the 402BA 40-meter beam. This apparently occurs because the use of linear loading causes high voltage to develop at this point. At the suggestion of a friend, W8VSK, I solved the problem as follows: Have an 8-inch length of 2-inch-diameter Plexiglas® rod turned to the dimensions shown in Fig 2. Cut a 1-inch section from the antenna boom about 8 inches from the driven element. Slip the machined rod into the two sections of the boom so that it replaces the 1-inch section. Thus, none of the beta-rod dimensions change. Align the elements and tighten the hose clamps. Then, drill holes for the ¼-inch pinning bolts, insert the bolts and tighten everything. Finally, wrap the exposed Plexiglas shoulder with electrical tape to shield it from sunlight.

All parts are easily obtainable locally, and my total cost was about $13 (excluding the lathe work). This modification eliminated the arcing problem and caused no change in performance.—*Stephen P. Hart, K8EJ, Troy, Michigan*

AN AUXILIARY AUDIO OUTPUT FOR THE YAESU FT-101ZD

☐ As an avid RTTY operator, I needed an auxiliary source of audio from my FT-101ZD that does not cut out (as the speaker does) when headphones are used. An examination of the schematic suggests three or four possible solutions; but a look at the underside of the rig reveals one that also eliminates the need to add another jack or convert one already existing.

Open the rig and place it upside-down with the front panel toward you. There is a four-terminal strip on the right side, near to and aligned with the right chassis wall. Connect the center conductor of a shielded cable to point X and the shield to point Y (see Fig 3).

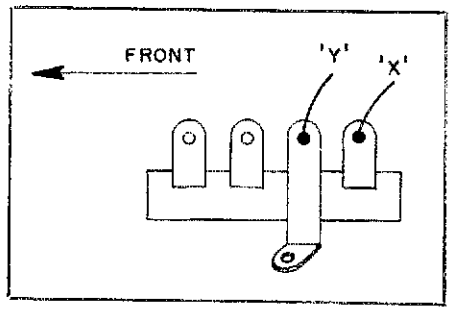


Fig 3—Connect to points X and Y for NØEVC's audio-output modification of the Yaesu FT-101ZD.

Route the shielded cable to the rear apron and connect the center conductor to the formerly unused pin 11 of the ACC jack (J8). Take the shield a bit farther left and ground it to the lug of the PO ADJ potentiometer that terminates a black lead.

This modification has been performed successfully on two FT-101ZDs that have moderately different serial numbers.—*Russ Martin, NØEVC, Kansas City, Missouri*

[This modification provides an 8-Ω audio source from the '101. A hint in Feb 1980 *QST*, p 43, uses a miniature audio transformer to match a 500-Ω load. Anyone needing a source impedance greater than 16 Ω should combine these two hints.—Ed.]

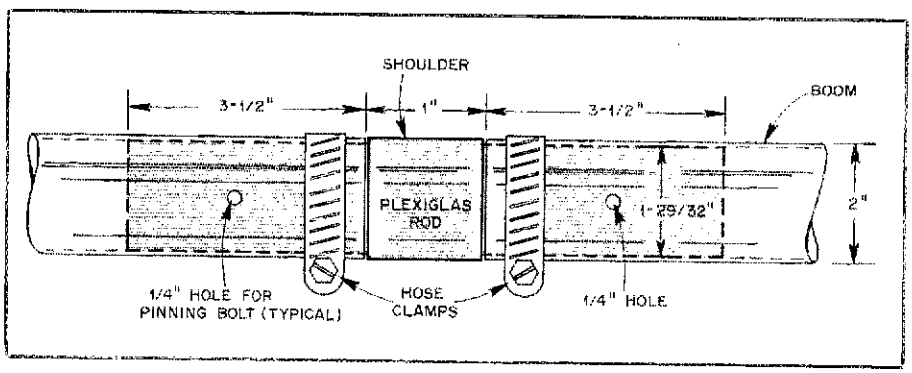


Fig 2—K8EJ's boom insulator to prevent arcing in the 402BA beam.

FT-101ZD MODIFICATIONS

☐ Here are some problems that I have experienced with the FT-101ZD, and their cures:

Final-Amplifier Band-Switch Arcing

Arcs may occur in the final-amplifier band-switch sections S2A and S2B because of the small spacing between the front and rear switch-rotor-ring holding tabs and the rings themselves. The rotor of the rear switch section, S2B, is connected directly to the final-amplifier tuning capacitor. This places the rotor at a high RF potential and promotes arcing.

The problem may be remedied by disconnecting C9 (100 pF) and C3 (460 pF) from ground. Install a single terminal strip using the mounting hole and screw that holds the output power-meter rectifier components and remount the meter-rectifier strip in its original position. Be sure the single terminal just mounted has adequate clearance from surrounding wires. Connect the free leads from C3 and C9 to this terminal.

Locate the clear-plastic-insulated lead which runs from the final-amplifier tuning capacitor to switch section S2B. Remove this lead from S2B and connect it to the newly installed terminal strip and solder in place. Connect a short piece of wire to the terminal on S2B from which the clear-plastic-insulated lead was removed and solder it in place. There is an RF choke (L4) just to the rear of the final-amplifier band-switch sections. Solder the other end of the short lead just installed on S2B to the point where the RF choke is soldered to the chassis wall. This completes the modification and places the S2B rotor at ground potential, which prevents any further arcing. Be sure to clean the switch thoroughly and use a small, pointed tool to remove any arcing deposits which may be present between the rings and tabs of S2A/S2B.

Noisy Preselector Tuning

Noise may be caused by dirt in the permeability tuner. Moisten a cotton swab with good quality tuner cleaner that contains a lubricant. Use the swab to clean thoroughly all bearings in the permeability tuner. Pay particular attention to the points where the coil-tension springs attach to the tuner frame and slug bar. When the slug bar does not make good electrical contact with the tuner frame, erratic tuning (similar to a dirty tuning capacitor) results.

RFI to the Audio Circuits

Audio distortion that occurs as a result of RF in the shack can be remedied as follows: Connect a 0.001-μF capacitor between pins 1 and 3 at the mic jack. Adjacent to the mic jack is a terminal strip. Ground the shield of the cable, which runs from the terminal strip to the audio circuit board, at the terminal strip. Install a 0.001-μF capacitor from the center conductor of the cable to ground at the terminal strip.[3]—*Bruce L. Mackey, KD2CY, Cortland, New York*

[3]A similar modification was implemented at the factory for FT-101ZDs with lot numbers of 12 and higher; this fix is discussed in Hints and Kinks (May 1980 *QST*, p 40). A more extensive cure is described by Cliff White, WB5DYA, in the November/December 1979 issue of the Fox-Tango Newsletter. —Ed.]

Technical Correspondence

Conducted By Paul K. Pagel, N1FB
Senior Assistant Technical Editor

MORE ON COAXIAL SWITCHES AND LIGHTNING PROTECTION

With regard to the letter from David Jones, I believe a clarification is in order since Mr Jones made his assumption based on only one type of station configuration.[1] His letter describes a ground at the antenna and another at either the rig or through the ac line.

If a coax switch is inserted exactly as he described, with no other grounds installed, his assumption is correct. In that case, the lightning surge current would be shunted from the coax center conductor to the shield through the switch and to the rig. However, an internally grounded coax switch is a mechanical crowbar when in the grounded position, and can serve as an effective lightning surge protector (for near misses, not direct hits) when the station arrangement is changed as follows:

1) Attach a separate, external ground wire to the switch itself and run the wire to the station ground system (not the chassis).

2) Ground the coaxial cable shield to an external ground where the cable enters the building.

Since our line of Transi-Trap™ coaxial surge protectors and our DELTA-4 gas-tube-protected coaxial switches are electronic crowbar devices, we list the same precautions in our installation sheets. It is true that *no* protector or switch should be tied back to the equipment chassis or depend on the chassis ground wire only to provide a proper surge-current return path. In so doing, a chassis can be raised many hundreds of volts above ground, causing serious component and equipment damage.

Most equipment damage comes from lightning-generated surge voltages from distant, out-of-sight storms, so a good protector has a definite place in a communications station. During nearby thunderstorms, however, it is always good practice to disconnect all cables.—*Don R. Tyrrell, W8AD, Alpha Delta Communications, PO Box 571, Centerville, OH 45459*

DAMAGING AMPLIFIERS BY OVERDRIVE

There are many 25- to 70-W output VHF and UHF transceivers on the market. Some owners of these transceivers are attempting to use them with THL Corp (Tokyo Hy-Power Labs) amplifiers that require only 10 W of drive, and are experiencing problems. These operators either set the low-power switch on the transceiver to the 10-W position, or adjust the high-power level to 10 W so that they will not overdrive the following amplifier. This is bad practice and can damage the transistors in the amplifiers.

An explanation of the problem is simple. Some of the VHF and UHF transceivers use an ALC circuit for power control. It may take several milliseconds for the power control to act. During this time, the transceiver power output may be allowed to rise to near its full rated output before the power-control circuit takes over and drops the level to that set by the power control. This effect may not be observable except by means of a very wide bandwidth oscilloscope. Such a brief application of excess power will destroy transistors in amplifiers that are not rated to handle the full output of the exciter. Such damage is not covered by warranty. A 50- to 70-W output transceiver that exhibits the described characteristic will cause damage to an amplifier rated for 25 W of drive, even when the exciter output is turned down to the 25-W level.

If you are uncertain of your transceiver's operational characteristics, you should have the unit checked by a technician using the proper test equipment. If it exhibits the high-power transient, you should not use it with THL Corp amplifiers unless the transceiver is modified to eliminate the transient.

The two most common causes of amplifier failure are overdrive and overvoltage. Failures from other causes are very rare. Use of radios capable of more drive than the amplifier is rated for or use of power supplies that do not have overvoltage protection is not recommended.—*Mike Kilgore, KG5F, Customer Service Manager, ENCOMM, Inc, 1506 Capital, Plano, TX 75074*

BEWARE THE ONE-TURN LOOP!

Many texts illustrate a means of determining the inductance of a toroidal inductor by use of a known-value capacitor and a dip meter. The capacitor is placed in parallel with the inductor and the resonant frequency of the combination determined by means of the dip meter. The dip meter is coupled to the toroid either through the capacitor loop or by means of a one-turn loop through the toroid core.

I recently dipped a toroidal inductor at the capacitor loop; the resonant frequency was 1.85 MHz. Although I had never before used the loop-through-the-toroid method, I tried it: The resonant frequency was 3.0 MHz! In this case, the toroid had only 5 turns on it. I suspect that a shorted turn might not have much effect on an inductor with many turns, but it certainly could be a source of serious error in many cases.—*Charles J. Michaels, W7XC, 13431 N 24th Ave, Phoenix, AZ 85029*

[Mr. Michaels' letter prompted us to do some testing in the ARRL Lab. It appears the shorted turn *does* have an effect on the inductor and, hence, the resonant frequency obtained. However, the test results indicate that the shorted turn has an effect *opposite to that suspected*: It has a greater effect on cores with *more* windings on them. Table 1 shows the results of the ARRL Lab tests performed by Zachary Lau, KH6CP, ARRL Laboratory Engineer.—Ed.]

THE CAT AND THE COMMODORE

Response to my article on computer control of the Yaesu FT-757GX transceiver has been encouraging.[2] Many owners of Commodore 64™ computers have asked how their machines can be programmed to perform the CAT control job. Thanks to cooperation of Jim Grubbs, K9EI, and George Wood, SMØIIN, I can now offer a working solution. Replace program lines 100-110 with the following three lines:

```
...
100 OPEN 1,2,0, CHR$(128):
  POKE 665,208:POKE 666,0
105 GOSUB 3000
110 H = 16
...
```

This modification works as is with C64 versions made for the PAL TV system. Computers designed for use with the US NTSC system have a slightly higher clock frequency, so the timing number to be POKEd into address 665 may need to be increased. If this is the case, a number in the neighborhood of 216 may be appropriate. The documentation on this point from Commodore is not very clear, so the field is open for experimentation.

A different interface circuit is also needed because Commodore's "RS-232-C" signals are inverted and are TTL levels. Theoretically, the C64 could be connected directly to the FT-757GX. However, the load is heavier than

[1] "Coaxial Switches and Lightning Protection," Technical Correspondence, QST, Jul 1986, p 43.

[2] K. Strom, "A CAT Control System," QST, Oct 1985, p 38; Feedback, QST, Apr 1986, p 42.

Table 1
One-Turn Loop Effect

Inductor Type	No Loop		With Loop		% L Change
Turns/Core	L	Q	L	Q	
49t T-50-2	14.2	188	12.8	117	-11
10t T-37-2	0.52	107	0.44	102	-18
8t T-37-2	0.48	113	0.46	112	-4
5t T-37-2	0.239	107	0.203	105	-3
4t T-37-2	0.209	111	0.207	111	-1
3t T-37-2	0.185	102	0.183	104	-1
2t T-37-2	0.151	88.1	0.150	87.9	-0.7

Inductances are in microhenrys. An HP 4342A Q Meter was used to make the measurements.

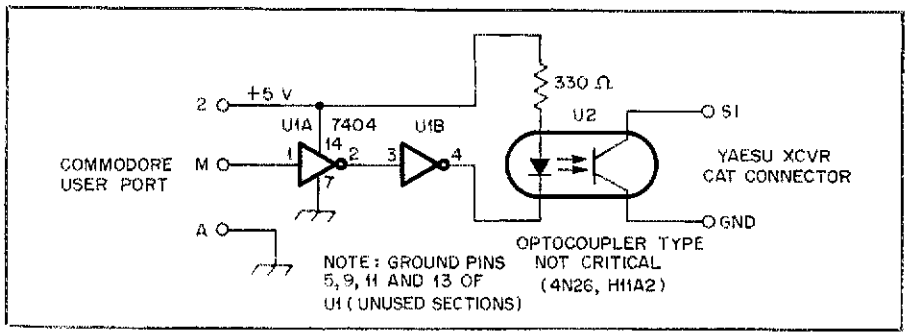


Fig 1—Schematic diagram of the Commodore/CAT interface. Only two sections of the 7404 hex inverter are used; all unused inputs are grounded.

that specified as safe for the output IC and there is the additional danger of conducting computer noise into the radio, so I suggest the little interface circuit of Fig 1 be used.

The foregoing program lines should also work with the VIC 20™, but even in that case, you may have to POKE different numbers into address 665 (line 100). On a European-made VIC 20, a value of 238 was found to work properly.

Congratulations to Richard Myers for getting the program to run on his Atari computer.[3] His finding that the CAT system works in his case only when he sets the format to *one* stop bit lends further support to my complaints that the microcomputer manufacturers have allowed themselves to deviate considerably from the EIA RS-232-C standard. The timing diagram in the Yaesu manual (Fig 1 of my article) shows a stop bit of double the length of the other bits in the word, ie, in reality *two* stop bits. This is the correct format, verified on several different microcomputers. But if Richard Myer's Atari works only with *one* stop bit, that is the correct format for his computer and I am sure that fellow Atari owners have profited from his observation.—*Kjell W. Ström, SM6CPI, PO Box 2, I-28041, Arona, Italy*

INPUT IMPEDANCE OF LPDA ANTENNAS

☐ The log-periodic dipole array (LPDA) has intriguing possibilities, some of which have been explored by Uhl.[4] Unfortunately, some misleading information in *The ARRL Antenna Book* has kept the subject from being more accessible to the amateur.[5] The design procedure called out by *The Antenna Book* and by Rhodes refers to graphs of R_0, the mean antenna input resistance, versus the log-periodic design parameters τ and α.[6] It would appear that R_0 is dependent solely on these parameters; such is not the case. As shown by Eq 2 and 4, R_0 is dependent on τ, σ, Z_{av} and Z_0. This relationship is demonstrated by Carrel.[7] The graphs in question are from the seminal experimental study of the LPDA by Isbell, and are used to demonstrate the effect on R_0 of changing τ and σ; Z_{av} and Z_0 were constant.[8] Since τ and σ are usually chosen to provide the desired antenna geometry and directivity (gain), R_0 should be controlled by either Z_{av} or Z_0. Z_{av} is usually constrained by mechanical considerations, which leaves Z_0 as the easiest parameter to adjust for desired R_0.

The erroneous procedure determines R_0 from a graph. The correct procedure is to calculate the necessary Z_0 based on the *desired* R_0. For most practical LPDA antennas, this results in a Z_0 of less than 100 ohms, if an R_0 of 50 ohms is chosen. Impedances in this range are difficult to achieve with open-wire line, the kind normally used in an LPDA, because thick conductors and/or close spacing are needed. For this reason, it is usual to design for a higher R_0 and use an impedance-transforming balun between 50-ohm coaxial cable and the antenna feed point. This is the method chosen by Uhl. Assuming a 4:1 balun, an antenna-input impedance of 200 ohms is required. Z_0 is then calculated (using Eq 9 and 11 from p 6-25 of *The ARRL Antenna Book*) as follows:

$$Z_0 = \frac{R_0^2}{8\sigma' Z_{av}} + R_0\sqrt{\left(\frac{R_0}{8\sigma' Z_{av}}\right)^2 + 1} \qquad \text{(Eq 1)}$$

where

$$\sigma' = \frac{\sigma}{\sqrt{\tau}} \qquad \text{(Eq 2)}$$

$$Z_0 = \frac{200^2}{8(0.065)\,(937.26)} + 200\sqrt{\left(\frac{200}{8(0.065)\,(937.26)}\right)^2 + 1}$$

$$= 298.26 \text{ ohms}$$

The actual impedance of the feed line used by Uhl can be computed from the formula on p 3-16 of *The ARRL Antenna Book:*

$$Z_0 = 276 \log\left(\frac{2S}{d}\right) \qquad \text{(Eq 3)}$$

where S is the spacing between conductors, 0.75 inch, and d is the conductor diameter, 0.081 inch for no. 12 AWG wire. Therefore:

$$Z_0 = 276 \log\left(\frac{2(0.75)}{0.081}\right)$$

$$= 349.86 \text{ ohms}$$

Although this appears to be considerably in error, recasting Eq 1 to solve for R_0 based on the true value of Z_0 gives:

$$R_0 = \frac{Z_0}{\sqrt{1 + \frac{Z_0}{4\sigma' Z_{av}}}} \qquad \text{(Eq 4)}$$

$$= \frac{349.86}{\sqrt{1 + \frac{349.86}{4(0.065)\,(937.26)}}}$$

$$= 224.17 \text{ ohms}$$

which, when transformed by the 4:1 balun, results in a load impedance of 56.04 ohms; this is close to the design impedance. From this, we can infer that the actual Z_0 used is not critical, although it isn't negligible, either.

The design Z_0 values listed in the Uhl article are incorrect, since they were produced using the erroneous procedure from *The ARRL Antenna Book*. The values should be 298.26 and 308.56 ohms for the 80- and 40-meter antennas, respectively. In addition, R_0 could be made closer to the design value of 200 ohms by using a different feeder spacing to change the feeder impedance. From Eq 2:

$$S = \left(\frac{d}{2}\right)10^{(Z_0'/276)}$$

$$= \left(\frac{0.081}{2}\right)10^{(298.26/276)}$$

$$= 0.488 \text{ inch}$$

Rounding this value to 0.5 inch results in a Z_0 of 301.26 ohms and an R_0 of 201.46 ohms for 80 meters and 196.62 ohms for 40 meters. These translate to load impedance of 50.37 and 49.15 ohms, respectively.—*Jon Bloom, KE3Z, ARRL Lab Supervisor*

[3]Technical Correspondence, *QST*, Apr 1986, p 41.
[4]J. J. Uhl, "Construct a Wire Log-Periodic Dipole Array for 80 or 40 Meters," *QST*, Aug 1986, p 21.
[5]G. L. Hall, ed., *The ARRL Antenna Book* (Newington: ARRL, 1982), pp 6-24 to 6-26.
[6]P. D. Rhodes, "The Log-Periodic Dipole Array," *QST*, Nov 1973, pp 16-22.
[7]R. L. Carrel, "The Design of Log-Periodic Dipole Antennas," *1961 IRE International Convention Record, Part 1, Antennas and Propagation*, pp 61-75; also PhD thesis, University of Illinois, Urbana, 1961.
[8]D. E. Isbell, "Log-Periodic Dipole Arrays," *IRE Transactions on Antennas and Propagation*, Vol AP-8, No. 3, May 1960, pp 260-267.

Feedback

☐ Please refer to "Under Construction," *QST*, Aug 1986, p 31. The first sentence of the last paragraph, first column, should read: "Broadband transformers of the type in Fig 1 are not suitable for matching impedance values greater than approximately 600 ohms." ☐ See Fig 2, p 15, of "SuperSCAF and Son—A Pair of Switched-Capacitor Audio Filters." The digital and analog ground symbols connected to pins 11 and 15 of U2 should be reversed to coincide with the pin-out identification. Thanks to Lew Goodfriend, WB2LLN, for pointing out the transposition.

Happenings

Conducted By Phillip Sager, WB4FDT
Manager, Regulatory Information Branch, ARRL

FCC Issues NOI for Possible Identification System for all Transmitters, Including Amateur

The Commission, in General Docket 86-337, has proposed establishing an automatic transmitter identification system (ATIS) signal on all satellite video uplinks and asked for comments in a Notice of Inquiry on an ATIS system for all services and radio transmitters.

ATIS is a unique, unchangeable identifying number assigned to each transmitter at the time of manufacture, plus some correlation of the number to a data base identifying the licensee. This signature is automatically added to the unit's transmission and provides positive identification of each radiated signal.

The Commission commented that almost all "voice system" users wanted identification alternatives to their assigned call signs, and a review of rulemakings over the past decade "discloses a constant chipping away of the basic identification rules based on unique circumstances, undue hardship, and lack of interference considerations. The dilution has been substantial, but indeed necessary."

An ATIS system could take the place of all existing voice identification requirements, and the Commission believes that it will meet the provisions of the ITU regulations and will not pose any international difficulties.

The Commission said that an ATIS system would not only be able to help its enforcement efforts, but also discourage potential violators from operating outside of their authorized frequencies. "For example, synthesized multi-channel transceivers make it so easy to select a new frequency that some owners of the equipment are tempted to, and do, operate on unauthorized channels to the detriment of others." If synthesized transceivers were equipped with ATIS, the operator would have an incentive not to misuse the built-in channel flexibility since his identity would immediately be known.

The Commission asks the following questions in its inquiry:

In what services would ATIS be beneficial? Should it be imposed on all services?

Could ATIS be mandatory in some services and voluntary in others? For example, ATIS may be valuable in the Marine and Aviation services, but unnecessary or impractical in the various Industrial Radio Services.

Would ATIS be practical for a service such as the Amateur Radio Service where there is no equipment authorization requirement or the equipment may even be homemade? The Commission suggests that all new amateur transmitters contain an ATIS identification system as of January 1, 1993.

Would it be feasible to permit stations to ignore normal call-sign requirements if those stations employed ATIS? Would this work in some services, such as Broadcast Auxiliary, but not others? Would this be confusing, or would it provide sufficient incentive for all stations to eventually install ATIS?

Should the code be tamperproof from the station operator? How could it be made tamperproof?

The Commission also asks a number of technical questions concerning ATIS, as to what type of system should be selected with such specifics as the type of keying rate, code system to be used, error checking and a time schedule for implementation. The date of filing comments is October 20, 1986, and the Commission noted in its inquiry it was willing to extend the comment period if requested.

VECs TO MAINTAIN QUESTION POOLS

If rules adopted by the FCC in PR Docket 85-196 take effect, the FCC will no longer involve itself in maintaining the question pools for Amateur Radio examinations. Under the new rules, Volunteer Examiner Coordinators (VECs) would maintain the question pools. The effective date of these rule amendments will be announced in a future FCC public notice, upon routine Office of Management and Budget (OMB) approval of the new procedures. The Commission has indicated that quick OMB approval is expected.

Transferring the question pools to the VECs results in the deletion of PR Bulletins 1035A, B, C and D which contain the question pools for each license class. Since FCC rules now specify the scope of the written examination for each element, the topics and percentage of questions that should be selected for each element topic, PR Bulletin 1035, the Study Guide for FCC Amateur Radio License Examinations, is also eliminated.

This FCC action is contrary to the ARRL's position. The League, in its formal comments, had urged the FCC to continue to maintain question pools to ensure a single, high-quality pool of questions for each examination element. Since there are numerous VECs, a number of different question pools could evolve, which would differ in quality, consistency and difficulty. The FCC partially disagreed, saying that there has been a high degree of standardization in the examinations which had been brought about through mutual cooperation of the VECs. Furthermore, "VECs are capable of satisfactorily performing the task and are in the best position to do it in their role as coordinators." However, the Commission agreed that the matter of standardization was important and stated that the standards and algorithm used by the Commission to assemble the question pools would be codified in the rules. The Commission noted that VECs may continue to use the FCC question pools for the time being. However, the Commission also noted that it does not intend that the pools remain static, but they "should track the dynamism in Amateur Radio technology."

At its August 23 meeting, the ARRL Executive Committee authorized the filing of a petition for reconsideration and petition for stay of the effective date on the grounds that the Commission lacks the authority to relinquish responsibility for amateur examinations to this extent, and that the new rules are insufficiently specific with regard to the scope and content of the four respective written examination elements.

The Commission also finalized new rules making it permissible for a Volunteer Examiner (VE) to design his own examinations, or to continue to obtain the examinations from their VECs. The VE may also elect to use pre-packaged question sets and telegraphy messages obtained from other sources as long as they are prepared in accord with standards set forth in the new Section 97.21.

The new rules clarified that Volunteer Examiner Coordinators can specify additional requirements for their accredited examiners if needed. Also VEs solely have the responsibility for determining the correctness of a candidate's answer to the questions (without appeal) as part of their duty to grade each examination element.

The current VE will now be referred to as an "Administering VE," one of three VEC-accredited amateur operators who administer examinations to candidates for amateur operator licenses. A "Preparing VE" is one who submits questions or prepares written or telegraphy examinations for amateur operator licenses. He need not be VEC accredited, but must hold an amateur operator license of a class higher (if one exists) than the examination being prepared. A Preparing VE is also permitted to supply (market) pre-packaged question sets and telegraphy messages to Administering VEs if they are consistent with the coordinating VEC's published instructions and design formulas. Preparing VEs are not permitted to provide specific test designs to applicants since Part 97 rules require that these be held secure against disclosure.

This FCC action is a further step in what it calls the privatization of examination functions of the Amateur Radio Service. The following are the exact Part 97 changes. (Keep in mind that these

new rule changes will not go into effect until OMB approves them. When that approval occurs, WIAW, *ARRL Letter* and the Happenings column will carry their effective date.)

97.21 Examination elements and standards.

(a) A telegraphy examination shall be such as to prove that a person has the ability to send correctly by hand and to receive correctly by ear texts in the International Morse code at the speed listed for the appropriate examination element.

(1) Element 1(A): Five (5) words per minute;

(2) Element 1(B): Thirteen (13) words per minute;

(3) Element 1(C): Twenty (20) words per minute.

(b) A telegraphy examination shall consist of a prepared message containing all the letters of the alphabet, numerals 0-9, period, comma, question mark, AR, SK, BT, and DN. No telegraphy message known to the candidate shall be administered in a telegraphy receiving examination.

(c) A written examination shall be such as to prove that a person possesses the operational and technical qualifications required to perform properly the duties of an Amateur Radio licensee. Each written examination shall consist of a question set, as follows:

(1) Element 2: At least 20 questions concerning the privileges of Novice Class licensees;

(2) Element 3: At least 50 questions concerning the additional privileges of Technician and General Class licensees;

(3) Element 4(A): At least 50 questions concerning the additional privileges of Advanced Class licensees;

(4) Element 4(B): At least 40 questions concerning the additional privileges of Amateur Extra Class licensees.

(d) The topics and percentage of questions in each question set shall be that listed for the appropriate examination element:

Topics	Elements 2	3	4(A)	4(B)
(1) Federal Communications Commission's Rules for the Amateur radio service..	35%	18%	12%	20%
(2) Amateur station operating procedures...	5%	12%	2%	10%
(3) Radio wave propagation characteristics of amateur frequency bands.....	5%	12%	4%	5%
(4) Amateur radio practices.....	15%	18%	8%	10%
(5) Electrical principles as applied to amateur station equipment.....	15%	8%	20%	15%
(6) Amateur station equipment circuit components.....	5%	6%	12%	10%
(7) Practical circuits employed in amateur station equipment.....	5%	4%	20%	10%
(8) Signals and emissions transmitted by amateur stations.....	5%	8%	12%	10%
(9) Amateur station antennas and feed lines.....	10%	14%	10%	10%

97.27 Volunteer examiner examination preparation.

(a) Each examination administered for the Novice operator license shall be prepared by the administering volunteer examiner.

(b) Each examination administered for the Technician, General, Advanced or Amateur Extra operator license shall be prepared by the administering volunteer examiners according to instructions from their coordinating VEC, or obtained by the administering volunteer examiners from the coordinating VEC that accredited them. See Section 97.517.

(c) Neither the same telegraphy message nor the same question set may be readministered to the same person.

(d) Each VEC and each volunteer examiner must hold telegraphy messages and question sets for current and future examinations in confidence. No examination which has been compromised shall be administered to any candidate.

97.29 Examination grading.

(a) Each examination element shall be graded separately by the examiners. The examiners are responsible for determining the correctness of the candidate's answers.

97.517 Examination materials provided by a VEC.

(a) The coordinating VEC may provide telegraphy messages and question sets to the administering volunteer examiners it accredits for use in examination sessions it coordinates. See Section 97.27.

(b) Each telegraphy message provided by a VEC shall be prepared by volunteer examiner of the proper operator class, as follows:

(1) Element 1(C): Amateur Extra class;

(2) Element 1(B): Amateur Extra class;

(3) Element 1(A): Amateur Extra class, Advanced class or General class.

(c) Each question on each VEC question pool and question set shall be prepared by a volunteer examiner of the proper operator class, as follows:

(1) Element 4(A) and 4(B): Amateur Extra class;

(2) Element 3: Amateur Extra class and Advanced class;

(3) Element 2: Amateur Extra class, Advanced class, General class or Technician class.

The present heading and text of Section 97.521 are removed in their entirety. A new Section 97.521 is added, as follows:

97.521 VEC question pools.

Each VEC must maintain a question pool for each written examination element. Each question pool must contain at least ten times the number of questions required for a single examination. See Section 97.21. No question in a question set may be used for a written examination in an examination session coordinated by a VEC unless it appears on the question pool of that coordinating VEC. The question pool must be published and made available to the public prior to its use for making question sets.

AMATEUR 902-928 MHz LIMITATIONS CLARIFIED, PULSE EMISSIONS PERMITTED

The Commission has clarified certain frequency privileges and power limitations on the use of the 902-928 MHz frequency band by amateur operators in PR Docket 85-23.

The action partially granted a petition for reconsideration filed by David B. Popkin, W2CC.

Specifically, FCC amended Sections 97.7(g)(8) and (9) to clarify that the secondary status of Amateur Radio does not bear any relation to certain geographic areas of prohibited operation on the 902-928 MHz band. Additionally, the FCC clarified that pulse emissions by amateur stations are permitted in the 902-928 band and adopted rules to reinstate the definition of the National Radio Quiet Zone, which was adopted previously in this proceeding as Section 97.3(k), but which was inadvertently superseded in PR Docket No. 85-22.

These rules become effective 0001 UTC October 4, 1986. The following are the specific rule changes:

97.3 Definitions.

(k) *National Radio Quiet Zone.* The area bounded by 39 degrees 15 ′ N on the north, 78 degrees 30 ′ N on the south and 80 degrees 30 ′ N on the west.

(dd) *Coordinated Station Operation.* The repeater or auxiliary operation of an amateur station for which the transmission and receiving frequencies have been implemented by the licensee in accordance with the recommendation of a frequency coordinator.

In paragraph (g) of Section 97.7 subparagraph (8) and (9) are revised to read:

97.7 Frequency privileges.

(g) *Limitations:*

(8) In the 902-928 MHz band, amateur stations shall not operate within the states of Colorado and Wyoming, bounded by the area of latitude 39 degrees N to 42 degrees N, and longitude 105 degrees W to 108 degrees W. Also in this band, amateur stations shall not operate in those portions of the states of Texas and New Mexico bounded on the south by latitude 31 degrees 41 ′ N, on the east by longitude 104 degrees 11 ′ W, on the north by latitude 34 degrees 30 ′ N, and on the west by longitude 107 degrees 30 ′ W.

(9) This band is allocated on a secondary basis to the Amateur service subject to not causing harmful interference to the operations of government stations authorized in this band or to Automatic Vehicle Monitoring (AVM) systems authorized under Section 90.239. Stations in the Amateur service are not protected from any interference due to operation of industrial, scientific and medical (ISM) devices, AVM systems or government stations authorized in this band.

97.61 Authorized emissions.

(c) *Above 144.1 MHz:* Amateur stations are authorized to

transmit the following emissions on amateur frequencies above 144.1 MHz: NØN, A1A, A2A, A2B, A3E, A3C, A3F, F1B, F2B, F3E, G3E, F3F, H3E, J3F, and R3E. PØN emissions (the emission letters "K, L, M, Q, V, W, and X" may also be used in place of the letter "P" for pulsed radars) may be transmitted at all amateur frequencies above 902 MHz, except in the 1240-1300 MHz and 10.0-10.5 GHz bands. In the 902-928 MHz band F8E emissions may also be used.

97.67 Maximum transmitting power.

(i) In the 902-928 MHz frequency band the transmitter power shall not exceed 50 watts for operation outside of the White Sands Missile Range but within 150 miles of its boundaries. Its boundaries are those portions of Texas and New Mexico bounded on the south by latitude 31 degrees 41 ' N, on the east by longitude 104 degrees 11 ' W, on the north by latitude 34 degrees 30 ' N, and on the west by longitude 107 degrees 30 ' W.

Paragraph (g) of Section 97.85 is revised by changing the cross-reference in the first sentence after "coordinated" to read: (see §97.3 (dd)).

HAM WINS RFI CASE

The Superior Court of California, county of San Francisco, has ruled in favor of a radio amateur in an RFI case. Mary Matheny, KB6CLL, was sued by a neighbor for allegedly causing radio frequency interference. The court ruled that the state court lacks power to regulate and control Amateur Radio operators, radio emissions and radio frequency interference, and that maintenance of a state court action which would permit the state court to regulate and control Amateur Radio operation and radio frequency interference is prohibited by federal law. The court stated, in part, "The Federal Communications Commission has the exclusive right and power to regulate, control and sanction amateur radio operations and radio frequency interference."

The court then granted KB6CLL's request for a summary judgment. Although this case was tried in a state court and carries no precedent, it is still an important reference for amateurs facing similar legal actions.

1986 FOUNDATION FOR AMATEUR RADIO SCHOLARSHIP WINNERS

The Foundation for Amateur Radio is pleased to announce the 1986 winners of the 19 scholarships it administers.

John W. Gore Memorial Scholarship ($900)—James H. Baker, KI4YN, Alexandria, Virginia.

Richard G. Chichester Memorial Scholarship ($900)— Richard F. Westenberger, N9DKR, Springfield, Illinois.

Edwin S. Van Deusen Memorial Scholarship ($350)—David P. Tancrell, KB4GIA, Palm Bay, Florida.

QCWA Memorial Scholarships ($600 each)—Michael Kazigian, KA2MRK, Park Ridge, New Jersey; Leslie Ann Redman, KA9PCV, Highland Park, Illinois; Michael I. Silverglate, KR9Q, Sheboygan, Wisconsin; David J. Swiatlowski, KA2KLM, Camillus, New York; Diane E. Willemin, KE8DJ, Elyria, Ohio; Tony C. Wood, Jr., KB4DNE, Tuscumbia, Alabama.

QCWA Robert S. Cresap Memorial Scholarship ($500)— Douglas E. Swiatlowski, KA2KMT, Camillus, New York.

Radio Club of America Scholarship ($500)—Francis P. Horan, KA3CJR, Drexel Hill, Pennsylvania.

Edmund B. Redington Memorial Scholarship ($500)—Joy M. Davis, KE8EG, St Louis, Michigan.

Young Ladies' Radio League Scholarship ($500)—Carol A. Dunlap, KA1NCX, Southwick, Massachusetts.

Amateur Radio News Service Scholarship ($750)—Michael Krensavage, KA3CUP, Marietta, Georgia.

Columbia Amateur Radio Association Scholarship ($750)—Bernard F. Collins, KA3FGV, Baltimore, Maryland.

Baltimore Amateur Radio Association Scholarships ($500 each)—Christine Gray, KA3NAR, Elkton, Maryland; Eric J. Smith, KA3KJO, Silver Spring, Maryland.

Dade Radio Club Tropical Hamboree Scholarship ($500 each)—David R. German, N4FAD, Sarasota, Florida; Todd E. Wiggins, KB4BDK, Marianna, Florida.

These scholarship were open to all radio amateurs meeting the qualifications and residence requirements of the various sponsors. The Foundation is a nonprofit organization representing 50 clubs in Maryland, the District of Columbia and Northern Virginia. It is devoted exclusively to the scientific, literary and educational pursuits that advance the purpose of the Amateur Radio Service.

Announcement of the 1987 awards will appear in the April or May issues of the major Amateur Radio publications.

GOLDWATER SCHOLARSHIP FUND

The following have contributed $25 or more to the Senator Goldwater Scholarship Fund: in memory of Rose Ellen Bills, N2RE, by Janice R. Scheuerman, WB2JCE; in memory of Henry Warren, K7ORF, by Arizona Repeater Association; in memory of Lynsie Lewis, WB7BYK, by Arizona Repeater Association; in memory of Wallace Austin, KE2F, by SCARS (Southern Catskill Amateur Radio Society); in memory of Fred Fuller, NØFF, by Clinton Amateur Radio Club; in memory of Howard Bivins, W7DRI, by Arizona Repeater Association; in memory of Glen Alfast, K2IZL, by the Bergen Amateur Radio Association; John A. Kiener, W8AVH; Six Meter Club of Chicago, Inc; Julio C. Perez, EA4DDJ/W4; and Stephen G. Gaspar, WA2QZD.

SECTION MANAGER ELECTION NOTICE

To all ARRL members in the Montana, Mississippi, Iowa, Arizona, Orange, Northern Texas, Arkansas, Kentucky and Wyoming Sections: You are hereby solicited for nominating 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 signature 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 the petition. It is advisable to have a few more than five signatures on each petition.

Petition forms (FSD-129) are available on request from ARRL Headquarters, but are not required. The following is suggested: Field Services Manager, ARRL, 225 Main St, 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.

Petitions must be received at Headquarters on or before 4 PM Eastern Local Time December 5, 1986.

Whenever more than one member is nominated in a single Section, ballots will be mailed from Headquarters on or before January 2, 1987. Returns will be counted February 24, 1987. SMs elected as a result of the above procedure will take office April 1, 1987.

If only one valid petition is received for a Section, that nominee shall be declared elected without opposition for a two-year term beginning April 1, 1987.

If no petitions are received for a Section by the specified closing date, such Section will be resolicited in April *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 North Dakota Section by the petition deadline of June 6, 1986, as a result of notices in April and May *QST*, nominating petitions are herewith resolicited. See the above notice for details on how to nominate.

SECTION MANAGER APPOINTMENT

In the North Dakota Section, Lois Jorgensen, WAØRWM, has been appointed to complete the term (until March 31, 1987) of Mike Mankey, WBØTEE (deceased).

SECTION MANAGER ELECTION RESULTS

Balloting Results: In the Oklahoma Section, William E. Goswick, K5WG, received 324 votes and O. C. Elfers, WA5OUV, received 263 votes. Mr. Goswick was declared elected. His term of office begins October 1, 1986.

Moved and Seconded ...

Minutes of Executive Committee Meeting No. 424
St Louis, Missouri
August 23, 1986

Agenda

1. Approval of Minutes of June 13, 1986 meeting.
2. FCC Matters:
2.1 Consideration of ARRL action regarding General Docket 86-337, Automatic Transmitter Identification.
2.2 Consideration of ARRL response in PR Docket 85-196, Report and Order released August 8, 1986, Amendment of Part 97 of the Commission's Rules to Permit Volunteer-Examiner Coordinators to Maintain Pools of Questions for Amateur Operator Examinations.
2.3 Consideration of ARRL response in General Docket 85-301, Further Notice of Proposed Rulemaking relating to terminal devices connected to cable television systems (released August 20, 1986).
3. Consideration of ARRL response in the Environmental Protection Agency's Docket A-81-43, Federal Radiation Protection Guidance; Proposed Alternatives for Controlling Public Exposure to Radiofrequency Radiation.
4. Local antenna/RFI matters.
5. Review of progress on Board directives:
5.1 By the vice presidents and/or chairmen for the committees.
5.2 By the Executive Vice President, on Board directives affecting Headquarters.
5.3 By the Executive Vice President, on the proposed museum and visitor center.
6. Certification of candidates for Director and Vice Director, and review of candidates' statements.
7. Study of Article 9 requested of the Executive Committee by the Board at its 1986 Second Meeting.
8. Recognition of new Life Members.
9. Affiliation of clubs.
10. Convention matters:
10.1 Approval of division, state and section conventions.
10.2 National Convention matters.
11. Date and place of next meeting.
12. Other business.

Pursuant to due notice, the Executive Committee of the American Radio Relay League met at 8:38 AM, Central Daylight Time, Saturday, August 23, 1986, at the Marriott Airport Hotel, St. Louis, Missouri. Present were President Larry E. Price, W4RA, in the Chair; First Vice President Jay A. Holladay, W6EJJ; Executive Vice President David Sumner, K1ZZ; and Directors Frank M. Butler, Jr., W4RH, Paul Grauer, WØFIR, Hugh A. Turnbull, W3ABC, and George S. Wilson III,W4OY1. Also present were Secretary Perry Williams, W1UED, Director Edmond A. Metzger, W9PRN, Vice Director Richard Ridenour, KBØZL and Counsel Christopher D. Imlay, N3AKD.

1) On motion of Mr. Grauer, the Minutes of the June 13-14, 1986, meeting were adopted as printed.

2) FCC Matters:

2.1) The Committee considered General Docket 86-337, a Notice of Proposed Rulemaking and Notice of Inquiry in the matter of an Automatic Transmitter Identification System (ATIS) for Radio Transmitting Equipment, released August 19, 1986. With regard to the Proposed Rulemaking portion of the docket, it proposes rules only for video satellite uplink stations regulated under Part 25; there is no need for ARRL comment. The Inquiry, however, raises questions concerning ATIS in other services including amateur. After discussion, on motion of Mr. Grauer, Counsel was directed to file comments opposing ATIS in the Amateur Radio Service as inappropriate.

2.2) On motion of Mr. Wilson, Counsel was directed to file a petition for reconsideration and stay of the effective date in PR Docket 85-196, Report and Order released August 8, 1986, to preserve the right of appeal should the Board decide to appeal to the U.S. Courts. (The Report and Order transfers responsibility for maintenance of the volunteer examination question pools from the Commission to the Volunteer Examiner Coordinators [VECs]. The adopted Rules are insufficiently specific with regard to the degree of difficulty appropriate to the respective written examination elements. This creates a likelihood that amateur examinations over time will drift away from the standardization that the Commission itself acknowledges is essential to the examination program.)

2.3) On motion of Mr. Grauer, Counsel was directed to file comments in General Docket 85-301, opposing any relaxation of standards for terminal devices connected to cable television systems.

3) On motion of Mr. Butler, Counsel was authorized to file comments in Docket A-81-43 of the U.S. Environmental Protection Agency, "Federal Radiation Protection Guidance; Proposed Alternatives for Controlling Public Exposure to Radiofrequency Radiation," based on the recommendations being developed by the ARRL Committee on the Biological Effects of RF Energy.

4) Local antenna/RFI matters:

4.1) Counsel Imlay reported on the status of the Thernes case, in which the Federal preemptive statement in PRB-1 provided the basis for the case being remanded to the District Court by the Court of Appeals. In defense of its ordinance, the city of Lakeside Park, Kentucky, has attacked PRB-1. Counsel Imlay observed that this was to be expected, inasmuch as it is the only defense available to the city, and should not be a cause for undue alarm.

4.2) Without dissent, Counsel was requested to write a letter to Field Operations Bureau Chief Richard Smith, requesting a copy of the Bureau's recently adopted policy under which amateurs may be placed on "reduced power hours" in cases where radio frequency interference has been reported; the letter should inquire specifically about the regulatory foundation for the new policy. The Committee was in recess from 10:30 to 10:44 AM.

5) Review of progress on Board Directives:

5.1) Vice President Holladay reported briefly for the Special Study Committee on Advisory Committees. The group met after the Board Meeting in July, and authorized a further questionnaire seeking specific information from present and past Advisory Committee chairmen. It plans to meet again in November. Mr. Metzger, as chairman, reported for the Administration and Finance Committee; its first post-Board Meeting session is planned for October.

5.2) Mr. Sumner reported briefly on Board directives affecting Headquarters, primarily on matters concerned with publications.

5.3) Mr. Sumner reported on progress in response to Minute 45 of the 1986 Second Meeting of the Board, authorizing further work on the subject of a proposed ARRL Museum and Visitors' Center. It was agreed there would be a monthly report on this subject to the Administration and Finance Committee.

6) The Committee then proceeded to examine the qualifications and candidates' statements of those nominated for Director for the 1987-1988 term. The Committee found a valid petition nominating Fred Hopengarten, K1VR, as a candidate for Vice Director in the New England Division. A question was raised as to his occupational eligibility under Article II of the ARRL Articles of Association. Without dissent, consideration of this candidacy was deferred until Item 12 of the Agenda, so as to allow time to seek additional information from Mr. Hopengarten by telephone.

On motion of Mr. Turnbull, the Committee found the following candidates to be lawfully nominated and eligible. In the case of uncontested positions, the candidates were declared elected without membership balloting pursuant to the Bylaws, the terms of office to begin at noon on January 1, 1987. In the case of contested positions, the candidates' names were ordered placed on ballots to be sent to Full Members of the respective Divisions, accompanied by the candidates' statements of no more than 300 words.

Central Division
Director: James J. Coleman, KA6A
Edmond A. Metzger, W9PRN
Bruce B. Woodward, W9UMH
Vice Director: Kenneth A. Ebneter, K9EN
Howard S. Huntington, K9KM

Hudson Division
Director: Vincent J. Biancomano, WB2EZG
Linda Ferdinand, N2YL
Stephen Mendelsohn, WA2DHF
Vice Director: Gary J. Ferdinand, W2CS
Paul S. Vydareny,WB2VUK

New England Division
Director: Tom Frenaye, K1KI
Vice Director: Clevis O. Laverty, W1RWG
Robert B. Weinstock, KN1K

Northwestern Division
Director: Rush S. Drake, W7RM
Mary E. Lewis, W7QGP
Vice Director: William R. Shrader, W7QMU
Bradley Wells, KR7L

Roanoke Division
Director: Gay E. Milius, Jr., W4UG
Vice Director: John C. Kanode, N4MM

Rocky Mountain Division
Director: Marshall Quiat, AGØX
Vice Director: Hugh Winter, W5HD

Southwestern Division
Director: Fried Heyn, WA6WZO
Vice Director: Wayne Overbeck, N6NB

West Gulf Division
Director: Jim D. Haynie, WB5JBP
Raymond B. Wangler, W5EDZ
Vice Director: Thomas W. Comstock, N5TC

During the course of the above, the Committee was in recess for lunch from 12:08 to 1:11 P.M.

7) The study of Article 9 concerning advance notice of proposed amendments to the Articles of Association and Bylaws, requested of the Executive Committee by the Board, was continued to the next meeting.

8) On motion of Mr. Butler, the names of 58 newly elected Life Members were recognized, and the Executive Vice President was directed to list their names in *QST*.

9) The names of the following clubs, all in category I except where noted, were presented for affiliation:
Anza Valley Radio Club, Anza, CA; Ascension Amateur Radio Club, Inc., Gonzales, LA; Bellaire High School ARC, Houston, TX (Category III); Cherokee Amateur Radio Club, Cherokee, IA; Dayton Area Amateur Radio Team, Dayton, TX; Hangtown Amateur Radio Club, Placerville, CA; Inland Empire ARC, Ontario, CA; Kimberling Amateur Radio Club, Kimberling City, MO; LOMA Pioneer Radio Club of San Jose, San Jose, CA; Northwest Texas Amateur Radio Club, Borger, TX; Rice County ARC, Inc., Lyons, KS; River Raisin Repeater Association, Dundee, MI; Siskiyou Repeater Association, Fort Jones, CA; Ski Country ARC, Carbondale, CO; Tri-County Amateur Radio Society, N. Miami, FL; TRIAD Amateur Radio Association, Mount Airy, NC; US AIR Amateur Radio Club, Beaver Falls, PA (Category II); Westside ARC, Los Angeles, CA; Women Radio Operators of New England, West Hartford, CT (Category II); World Bank Amateur Radio Club, Washington, DC.
The Committee noted with pleasure that the Tri-County Amateur Radio Society was a 100% ARRL club at the time of its application.

It was moved by Mr. Wilson that all of these clubs be affiliated except the Women Radio Operators of New England (WRONE), observing that WRONE's constitution bars males from membership; but there was no second, so the motion was

(continued on page 61)

Correspondence

Conducted By John Hennessee, KJ4KB
Regulatory Information Assistant, ARRL

GIL: THE LEGEND LIVES

☐ Back in 1961, I was a young SWL and I was starting to develop an interest in ham radio. A ham friend of my parents heard about my interest and gave me a copy of the 1957 *Handbook*. To this day I can still remember my two immediate reactions: "You mean I have to know all of this to be a ham?" and "Say, there is something very special about these Gil cartoons in the chapter Operating a Station." Later I ordered a copy of *Operating an Amateur Radio Station* from HQ and I was pleased to see more "Gil" cartoons. After I got my Novice license in 1965, HQ sent a reprint of "Your Novice Accent" from November 1956 *QST*—even more Gil cartoons! I was in ham heaven!

Today I find it impossible to look at a Gil cartoon without having pleasant thoughts and good memories. I enjoy the hobby more, and I am a better operator because of all the operating hints and lessons he put into his work. Thanks for publishing the Gil collection. It is a welcome addition to my collection of League publications.—*Bill Parmley, KR8L, Plainfield, Illinois*

ROBBING THE CRADLE

☐ I just finished reading an article by David Koch, W8LNJ, on his method of robbing the cradle of 9-11 year olds for ham radio. The article really hit home, and I feel it was right on target: Recruit the pool of elementary school age youngsters before other activities distract them later in high school and college.

Like all other hobbies of a technical nature, the earlier children are exposed to Amateur Radio the better. Some will advance their interest; some will not. But those that do will form a base from which the ranks will increase greatly and with years worth of headstart.—*Timothy P. Brown, KA8CIZ, Cininnati, Ohio*

THAT POWERFUL AERIAL...

☐ On behalf of the entire amateur community, I would like to thank George, VE3ERP, for reintroducing us to the aerial. I learned about the concept back in about 1978, after spending the better part of a day off trying to hang a dipole.

Taking into account the fact that any antenna built during a period of fair weather cannot possibly work, I waited for an appropriate amount of precipitation. The big day dawned cloudy and damp. I had planned well and was prepared for a quick and simple job. The antenna went together like a dream. Came the time to simply droop the ends over some branches and hoist 'er up. Wait, what's this warmth on my back? The reassuring drizzle was gone, and the bright sunshine had taken its place. I knew I was in for trouble. After losing most of my tools, my temper and a couple of my friends, I finally got it up. By then the weather was hot, and so was I.

As luck would have it, I managed to produce a mediocre signal and was soundly dressed down by most of my friends for having a signal that, while not unreadable, was also not characteristic of what they were used to.

Then a small miracle took place. I checked into my usual 2300Z traffic net, and the accolades began pouring in. I was getting reports even better than the good old days of a month before. Things like "Best signal in the state." I thought something was wrong.

But, something was very, very right. Upon checking, I discovered that I had lost a leg of the dipole. The wire was now entangled in the fence which surrounded the back yard. With a little added inductance and some deft antenna matching, I was up there with the big boys.

I have named this radiator the "potentially grounded" aerial and have not used a dipole since. For a time I considered applying for a patent and selling the rights to Sears as an adjunct to their hurricane fencing, but decided that it was in the best interest of all to share the information with all of the ham radio fraternity.—*Wells M. Farr, WB3CUF, Central Bridge, New York*

STAMPS AND AMATEUR RADIO

☐ Being an avid DXer and relishing the thought of receiving a QSL card from exotic DX stations and finding that, time after time, the wanted QSL was so slow in coming or never came, I was looking for a way to speed up this process. Discovering the philatelic window at the local post office (that is the place where the new commemorative US stamps are sold) I became intrigued with the idea that maybe if I used stamps that were a little different from those ordinarily used in mailing QSL cards, I might enhance my chances of getting quicker and better responses.

So, I proceeded to purchase my first different stamps and to place them on QSLs going overseas and believe it or not, the results were surprising. Responses came back quickly. Thanks were given for the stamps. My excitement grew in their usage. Now, every QSL that goes overseas has a multitude of different denominations of stamps on them depicting various and sundry themes.

After discovering that stamps of various varieties and themes could be acquired at the philatelic window, I further discovered that many local stamp dealers offered older varieties of stamps, that had no value as far as stamp collectors were concerned, at face value. So, I began to purchase some of these to use in my mailings. Good results!

My return rate increased, and the thanks still came in. Having missed the boat in buying the Amateur Radio stamp issued in 1964 which depicted our great hobby, I wondered if any could be found. I could not find any at face value, but had to pay a few cents premium from stamp dealers for them. It is a thrill to me to be able to place one of them on the envelope going overseas, knowing that maybe the recipient might be getting his first Amateur Radio stamp from the USA.

Hopefully, this may whet your appetite for looking into the use of our great resource of US stamps in starting a fun hobby, creating goodwill with amateurs in foreign countries and providing an exciting and informative means of exchange.—*Dick Tesar, WA4WIP, Sarasota, Florida*

WHAT HAS THE LEAGUE DONE FOR YOU?

☐ What has the League done for me lately? Strange you should ask, for just today one of your lab technicians, Jon Bloom, saved me untold hours of laborious mathematical calculations in designing a new antenna.

I am among that vanishing breed of hams who don't own a computer, and my last exposure to a table of logarithms was 31 years ago when I graduated from college. But the story by KV5E on his LPDAs for 80 and 40 [in August *QST*] prompted me to try one for 30 and 20.

After struggling with the computations and finally throwing in the towel (not to mention my little pocket calculator), I phoned headquarters and asked for the Technical Department. Explaining my plight to Jon, he asked if I would consent to be put on hold a couple of minutes.

Thinking he was going to have to look up something, I was quite surprised when he came on the line in a moment with complete dimensions for a two-band LPDA! It was a quick and simple matter for the lab computer to run up the calculations.

Sure, the call cost a couple of bucks; but the effort it saved me in tedious (and probably error-filled) work was worth the $25 ARRL membership fee.

But I really shouldn't have been surprised at this service. About three years ago, a neighbor's ceiling fan speed control was creating so much hash it wiped out the entire 160-meter band on my receiver. Another call brought the same fast, sure results. I was given the brand name, supplier and even catalog number of a filter that cured the problem.

Sure, the League represents me in Washington, at WARCs, keeps my QSLs coming and going to DX, and all those other good things that we tend to take for granted. But when this antenna is finally up and radiating RF to points around the world, I can look out the window at it and say, "That's what the League has done for me."—*Drayton Cooper, N4LBJ, Bishopville, South Carolina*

KEEP THE TONE

☐ I enjoy reading the different opinions expressed in the Correspondence column in *QST*, and I would like to comment on WØYBV's remark in May *QST* on dropping the T from the report.

I think some of us forget that in some countries professionally manufactured rigs are not readily available. When I lived in Czechoslovakia, almost no rigs were available, other than home built ones. I built my own CW gear then and greatly appreciated a T of 8 or lower (yes even 7) from those who knew what it was.—*Istvan Agg, KD9WY, Glendale Heights, Illinois* QST

How's DX?

Conducted By Ellen White, W1YL/4
19620 SW 234 St, Homestead, FL 33031

Bits and Pieces

Drew Givens, GM3YOR

Licensed in 1969, GM3YOR operates mainly CW on all bands from his home QTH in Kirkcaldy, Fife, Scotland. Drew holds the following CW awards: 160-meter WAC, WAE 1, WAS, WAZ, DXCC (257 confirmed), 6BWAC, 5BWAZ (181 confirmed) and 5BDXCC. GM3YOR/4S7 will be in Sri Lanka this month, concentrating on 3.503 7.003 14.033 21.033 28.033 (and, perchance, some sideband during CQWW phone).

Thanks!

N6VO/FOØWVR wants to thank the hams of Tahiti and French Polynesia for their warm hospitality and friendship during his recent vacation trip: FO8JP and wife, Elizabeth, for being outstanding hosts and good friends, snorkeling guides, hobie sailors and Bora Bora guides; FO8KS for the entertaining day and astronomical observations at night; FO8BI for the surprise BBQ and explanation of Tahitian culture; FO8AG for his assistance in locating someone to repair his rig; and to FO8LP for his wonderful explanation of sailing the South Seas. [Your column editor is willing to check all of this out first hand!—Ed.]

Trinidad Island

The Radio Club Mar del Plata will be operating from Trinidad Island (east coast of Argentina) October 20-25 in honor of the 9th IARU Region 2 meeting. AZ1D is eligible for IOTA (Islands on the Air Award) and will be operating as follows: CW, 3510 7005 14020 21020 28020; phone, 3690 7090 14200 21300 28600; VHF, 50.110 146.520 144.300—and OSCAR 10. Cards via the Radio Club Mar del Plata, Independence 1193, Mar Del Plata, 7600 Buenos Aires, Argentina.

China

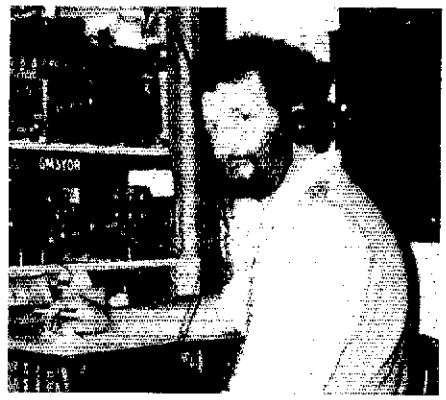
JA1UT reports that BY4RB, at the Children's Palace of Zhen Jiang City, was to open this past summer. JA1UT JA1UPA JF1WQC JG1TSG JK1KHT were invited to attend the opening ceremonies and assist with building the stations. (Yoshi and his crew have donated an FT-77 and IC-551.) BY4RB will probably be operational on 14.180 and 50.110 MHz. QSL via Box 413, Zhen Jiang, China. This is the group's third project in China, following BY5RA and BY5RF, in Fuzhou! At BY5RF, 20 primary school pupils (9-12 years of age) study CW and SSB conversation three times a week. Some of them can now QSO in simple English. FB!

DJ6SI

At the May 17 FOC meeting in Asenburg, DJ6SI was presented with his induction into *CQ*'s DX Hall of Fame. Baldur has conducted over 30 DXpeditions to 20 different DXCC countries over the past decade, including the disastrous trip to Spratly. He is the sixth European to achieve the award.

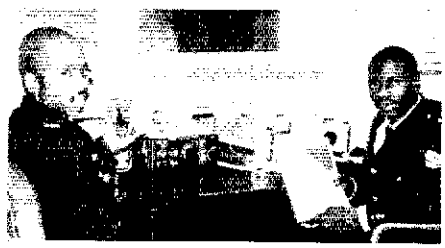
W2QHH

Your July article took me back to the days when Howy was my first ham hero. He helped me get licensed in 1936 (W8PWT), making me the first high-schooler in the area to get an amateur license. I bought his old National SW-3 (but could never find the DX that Howy could hear!). After 50 years I've started all over again, but as a gross novice, due to 50 years of technological changes. (But, I'm back up to Tech!) I'm writing because Howy is the classic example of a highly qualified ham who took the time to boost beginners.—*Gordon Gaylord, N6NTW*



GM3YOR

Miss Ruan and Mr Jiang with their students at BY5RF. *(JA1UT photo)*



On the right is 3D6DX, along with soon-to-be licensed Douglas M. Dlamini. Both work in communications with the Royal Swazi Police. *(WA4PAV/3D6AN photo)*

DX Vacation?

After two consecutive years of operating special-event stations, 4X5DS (from the lowest point on earth, the Dead Sea) and 4X5J (from the walls of the Old City of Jerusalem), the Israel Amateur Radio Club (IARC), through the Holon Bat-Ham Club, is planning a further event to take place during the 1987 Easter season. During "Easter 1987 in the Holy Land," it is intended to establish special-event stations at the following five historic places: Bethlehem, Jerusalem, Nazareth, Mount Tabor and the Mount of Beatitudes. If you're interested in participating in this unique operation, please contact the Holon Bat-Ham Club via the Israel Amateur Radio Club, Box 4099, Tel-Aviv 61040, Israel.

Memories Evoked By A Photo In August *QST* ... de W9LYN

The warmth from the rig had displaced the coolness of the early spring evening. The operator settled into his old swivel chair in the small shack and began tuning. He heard a vaguely familiar voice, then a call sign he remembered. Suddenly, there is a surge of memories. From somewhere in the recesses of his mind, he recalled a picture of a 20-meter beam in *QST*. In the background below the beam were drooping palm fronds. (It is a memory of the 40s, when a license is only a dream for the operator and 4-element 20-meter beams are rare.) The picture in the magazine is offered as a splendid example of the homebrewer's art. Quickly, a second memory appeared, of a contact in the first major DX contest after upgrading to General class. In rapid succession, other memories followed. Leaning back in the chair, there are other memories of the accomplishments of the man whose voice he now remembered. As in partial summary, one in particular comes through like an etching. In the foreground it shows stately tall palms above an outrigger canoe, with Diamond Head in the background. Along the bottom is "Extra Class License #5, April 1952." Across the top is "First Hawaiian WAZ WAS DXCC." Only the last award has yet appeared on this operator's own shack wall. He reflects on his flood of memories and of the influences on him over the decades—the influences of one grand operator a quarter of the globe away. Such are the memories of this ham, tuning across 20 meters and hearing the somewhat raspy voice and proficient keying of the legendary Katashi Nose, KH6IJ.

WB6GFJ 1986 South Pacific DXpedition

Summer '86 saw Ross operating from his favorite place, as FOØFB in French Polynesia. His journey then took him to the South Cook Islands, ZK1XE, followed by ZL VK 3D2 and KH6. VHS video and 35-mm slides will be available via the Northern California DX Foundation.

Swaziland

Missionary WA4PAV/3D6AN and XYL 3D6AM are now on furlough after doing a particularly effective job in helping enlarge the 3D6 ham ranks. Fred notes, "In addition to having the benefits of a lovely mountainous

country with ideal propagation characteristics, Swazi amateurs enjoy a warm and friendly relationship with the PTT Director, Mr C. S. Motsay, a 'Nkhosi' (friend) of ham radio." A return is scheduled for next year, and in the interim Fred hopes to acquire five good, reliable, used rigs to distribute to Swazi citizens studying the code in preparation for being licensed. This is truly a people-to-people move in the highest traditions of Amateur Radio. If you're interested, please write Fred Maxell, Box 34011, Richmond, VA 23234.

More Woodpeckers

KL7J, ex-KL7PI, notes that the June issue of *Alaska* magazine indicates that a powerful new radar system planned for Alaska, to be built in two locations about 100 miles apart, "will cause interference for shortwave radio users, but not as much as does the Soviet's rat-a-tat-tat."

Mickey Mouse

W6CF's vast lore of radio amateur memorabilia includes an early-40s copy of *Mickey Mouse and the 'Lectro-Box*. This obviously wasn't a typical "Mickey Mouse operation" because ham radio operator Mickey noted that he had to listen for transoceanic signals. Ahhhh, that DX compulsion—we know it well! (In his "spare" time, Jim now edits *The NCDXC DXer* magazine.)

Thailand

HS1AOL/AH2AK updates Amateur Radio in the Kingdom of Thailand. The principle has passed the National Security Council, and the Post and Telegraph Department was expected to unveil the draft of the regulations to the Radio Amateur Society of Thailand (RAST) this summer. At the time of Bruce's letter, the final form wasn't known, but it was expected that foreign amateurs would be able to operate in Thailand via reciprocal licensing procedures, arranged with individual countries. At present, operation can take place, with prior approval, in international contests and selected special events. Under present conditions, visitors from other countries with valid licenses are welcome to guest operate during operations. HSØA is planning major contest operations. Prospective visitors can get directions to the station, etc, via RAST, Box 2008, Bangkok, Thailand.

Saint Honorat

F6HIZ, F6HJR, F6HMJ and F9ER operated from Saint-Honorat Island in April. The island is 1530 meters long and 400 meters wide, and is the second largest of the Lerins

Troster's Tips for Easy Listening:

Acknowledgment

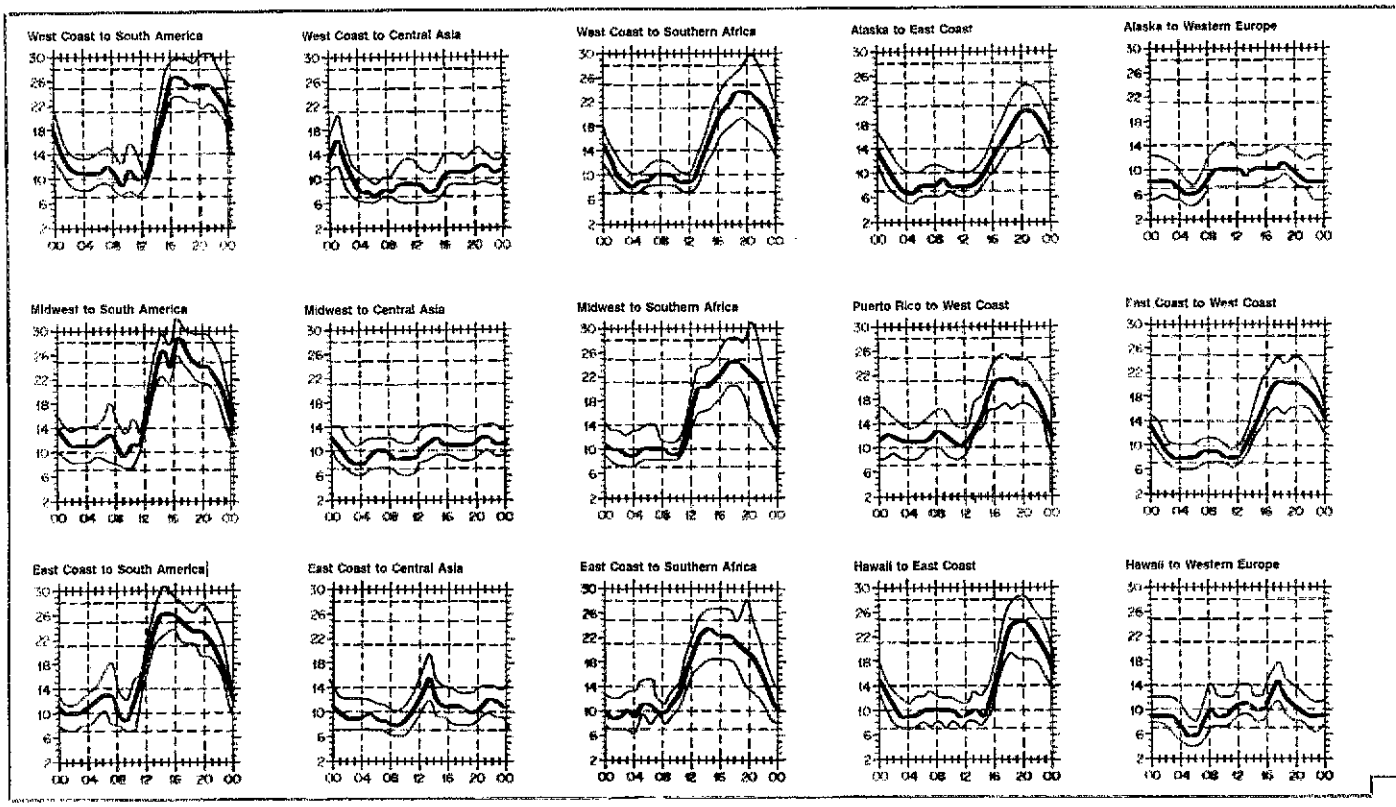
You are the DX station, properly working split operation, and there is a big pileup calling you. But, there are always a few lids who insist on calling you on your own frequency. So, your callers may find you hard to copy through the continuous calling QRM on your frequency.

It is important that you use a quick, but easily understandable method of acknowledgment, to assure the op you just worked that you do indeed have him (her) in the log. Say you hear and call: "W1YL/4 . . . 599K" W1YL/4 replies: "W1YL/4 599K" or, simply, "599K." Now, you must let W1YL/4 know you received your report okay. Different operators use different means to let the caller know he is in the log. You could use "QSL," or "R," or "73," or "SK." Some DX ops just sign their own calls. But be consistent in your acknowledgment so the listeners will become accustomed to knowing how you signify to them that you have indeed received them okay, and that you're ready for the next call.

If conditions are poor or QRM is very bad, you might reduce the number of repeats (in this case, calling you again *after* you have worked them) by saying: "W1YL/4 73 QRZ." That is always the safest way to confirm the QSO, but it does take more time and you're trying to log as many contacts as possible.

Adapt the reply technique that will let you work as rapidly and accurately as you can under prevailing conditions.

Continued next issue.

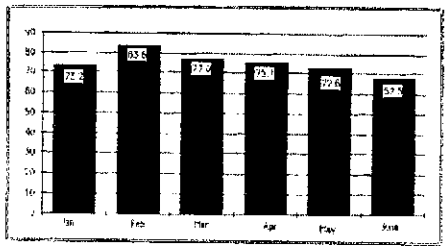


When are the bands open? These charts predict this month's average propagation conditions for high-frequency circuits between the U.S. and various overseas points. One chart for East Coast to West Coast is also included. On 10 percent of the days of the month, the highest frequency propagated will be 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

Islands after Sainte-Marguerite. (It is 1.5 km from Cannes.) The island is private, belonging to the abbey which was founded in 410. It has been occupied since 1869 by the monks of the Cistercian community. The group had a pleasant weekend on four bands, for over 500 contacts in 57 countries. A special *thank you* from them to Father Marie-Bertnard de Terris for welcoming them during the weekend at a peaceful and beautiful place.

BULLETIN BITS

Southern California DX Club *Bulletin:* Sad news in the June issue. W6RW (a former club president twice over and recipient of the club's DXer of the Year award) has joined the ranks of Silent Keys. W6HX took the SCDXC April DX Activity award, working 43 different countries on phone. Nice going, Ted. (This is a particularly good club activity during the low part of the sunspot cycle—Ed.) **The Long Island *DX Bulletin:*** Harvey, W2IYX, states that prominent authorities are reporting that their computers gave June 20, 1986, as the date when the present solar cycle bottomed out (but NASA puts the low in late 1987). Meanwhile, ***KH6BZF Reports*** that early July solar observations indicated a new solar region (4734) has a reverse polarity. Lee notes that this may indicate that the end of the cycle is anywhere from one to five years away. **The Totem Tabloid** (from May 1976 *QST*, by former DX editor W9BRD): "Sunspot computers are glowing, the researchers look wise and knowing, but it's clear to me, they barely can see, where we've been—much less where we're going." **Northern California DX Foundation *Newsletter:*** W6RJ is new president, W6OAT vice president, W6SZN newsletter editor. Special kudos to outgoing president W6ISQ. WB6ZUC of NCDXC maintains a foundation lending library which includes VHS tapes of XU1SS, 7J1RL, VK9ZR/JD1YAH/JD1YAK, Frankford Radio Club ARRL phone 1981 parody, Okino Torishima 1979 and the Australian travelog about the climb of Big Ben mountain on Heard Island. The **DX Bulletin,** early June, notes the new name for Annobon (3CØ) is Pagalu Island.



1986 Average Solar Flux, thanks to *KH6BZF Reports* (and your editor's computer!).

THE CIRCUIT

☐ **Carolina DX Assn:** New Pres WA4VCC and VP KF4NO of the CDXA invite area amateurs to join their quarterly meetings in the Charlotte area. Check AA4SC/RPT on 147.78/147.18 for info. Further details from new Secy/Treas KD4RH.

☐ **TV5SDP/TV6SDP:** This special-event station during the early March Telecommunications Show gets confirmed direct only via FC1JEN, Luder BP 200, 13300 Salon de Provence, France, or via the radio club, FF6KRJ.

☐ **HC8E:** WA6UAP indicates that those needing this one for OSCAR 10 or 160 should send an SAE and IRCs to the Quito Radio Club, Box 289, Quito, Ecuador.

☐ **KP2:** As a result of increasing cruise-ship activity, the weekly noon luncheon meeting of the Virgin Islands Amateur Radio Club has been changed from Tuesday to Monday. The friendly event takes place at the Delly Deck, Havensight Mall, Charlotte Amalie.

☐ **Help!:** K5HGX is looking for likely routings for T32AB, V47M, ZK1XR, V3DA.

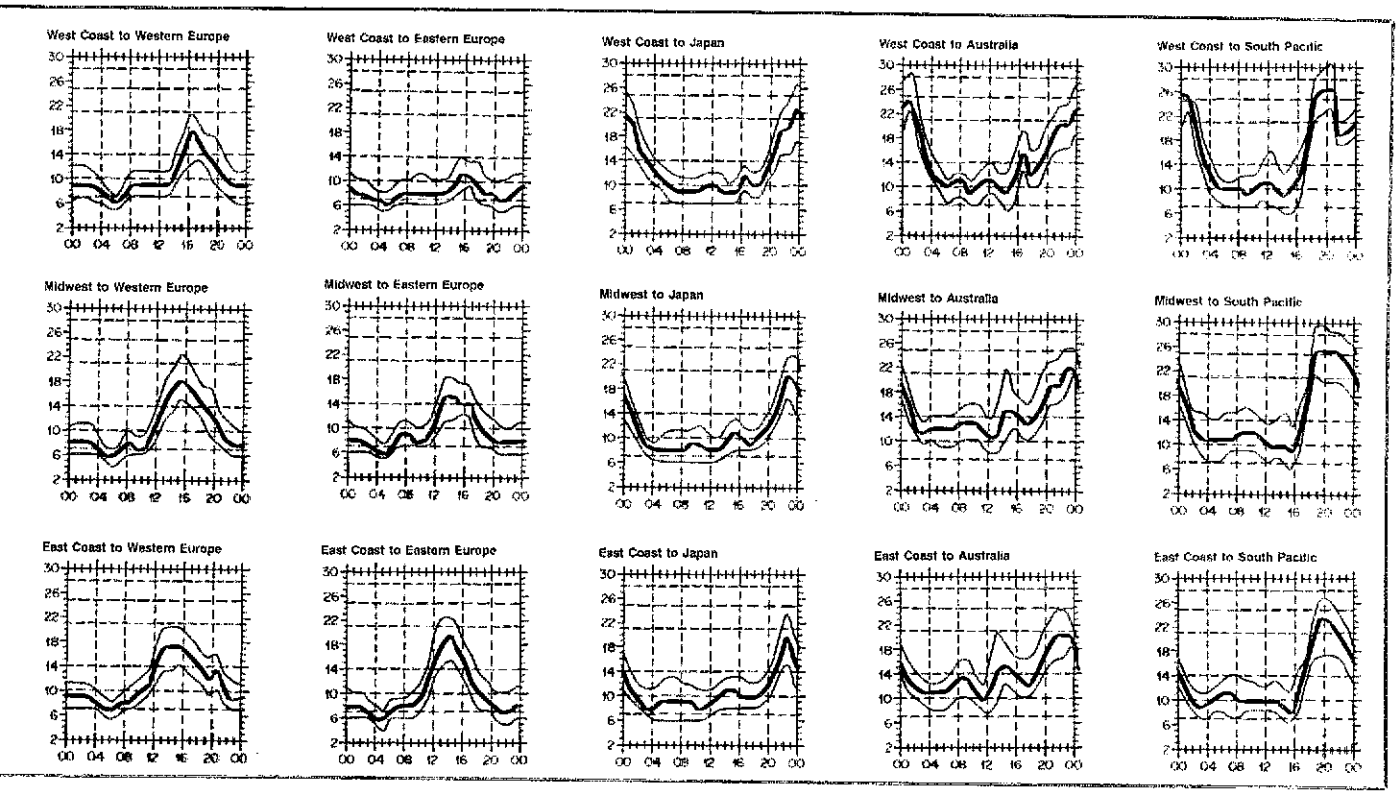
☐ **VU2TTC:** India's national newspaper, *The Hindu,* ran an interesting article last summer, nicely telling the story of ham radio and what it means to those without sight—in particular reference to Chak, VU2TTC, first licensed in 1978. *(tnx W5KNE and NG6W)*

☐ **St. Pierre:** K8BXD is on the lookout for routes to FP8JO (Mar '83) and FP8HR (Sep '84).

☐ **Honors:** ZL2AZ received his MBE for services to Amateur Radio, in this the 60th year of the NZART.

☐ **VO2DX:** The Zone 2 DX Group (headed by KA1BC and VO1CA) planned a Labrador operation last month, all-band QRO. QSL route to be announced.

☐ **HI6ØRCD:** This special call commemorates the 60th anniversary of the Radio Club Dominicano, Inc, and will be active throughout the year. QSL via Apartado Postal 1157, Santo Domingo, Dominican Republic.



month, it will be at least as high as the lowest curve (optimum traffic frequency, or FOT). See April 1983 *QST*, page 63, January 1977 *QST*, page 58, September 1977 *QST*, page 35, and January 1979 *QST*, page 11, for a complete explanation. The horizontal axis shows Coordinated Universal Time (UTC); the vertical axis, frequency in MHz. Data are provided by the Institute for Telecommunication Sciences, Boulder, Colorado. These predictions, for October 16 to November 15, 1986, assume a sunspot number of 9, which corresponds to a 2800-MHz solar flux of 71.

DX Century Club Awards

Administered By Don Search, W3AZD

The ARRL DXCC is awarded to amateurs who submit written confirmations for contacts with 100 or more countries on the official ARRL DXCC List. You may also submit cards to endorse your award in 25-country increments through 250, 10-country increments through 300 and 5-country increments above 300. The totals shown below are exact credits given to DXCC members from July 1 through July 31, 1986. An SASE will bring you rules and application forms for participation in the DXCC program.

New Members

Mixed

CO2AL/123 JA1UTN/106 JF2BAV/164 UB5UAT/313 K2VM/116 KF4CI/118 W4ZCT/103 W6FRM/102 AD9S/109
F6ENU/121 JE1VPC/243 JE3EDJ/155 YC4FRX/103 N2CS/125 KF4IX/147 KF5EA/110 W6LDE/121 KD9LG/101
HB9CEY/158 JJ1EGE/103 JA7YAF/209 K1MZB/101 WA2QZD/101 KF4ZP/111 W5HL/100 W6TZA/105 NF9V/133
IK2FCZ/144 JK1SQJ/120 JA9CWJ/213 KA1LZR/110 AA4ER/153 KI4Y/100 W5QKR/321 W7KSK/102 WB9VTF/115
I0VVQ/116 JM1GAW/132 KD7P/KH2/221 KK1A/100 AA4IK/109 KJ4MR/104 W5RA/328 NA8G/137 WB9WEJ/107
JA1KRW/107 JR1SSH/271 SM5NWX/112 K2BEV/130 K4OQK/115 W4OUE/281 K6DYP/110 W8MGV/188 KØVW/101

Radiotelephone

G4GIZ/106 I4YNO/293 JA1UTN/106 JA7YAF/129 YU1AST/201 4Z4MJ/225 KE4XY/161 KD5LP/101 NBEKS/108
HK7BEI/108 IK8CNT/200 JE1VPC/243 KD7P/KH2/207 YV5IVI/154 5N8KBM/110 KF4ZP/110 NJ5L/101 AD9S/107
IK2FCZ/144 I0VVQ/117 JL1IHE/106 PY4OY/118 4X6AS/115 W1GMX/102 WN4R/100 W6WPK/110 N9BOK/175
I4UJI/171 JA1KRW/107 JR1SSH/271 VK5QW/152

CW

DJ6TK/220 F6ENU/101 I7TYK/114 JA9CWJ/194 ON7CS/210 K4GSK/106 K7OZ/106 WD8PKF/186 W0LYM/100
DJ9IW/108 HB9CEY/128 JA5IU/238 KD7P/KH2/113 NG2U/105 N4CC/218 KD7P/166 WB9PAV/147 WAØJRB/109
FE2VV/107 I3ZRL/228 JA7YAF/169 LA7SI/204 WA3VPL/134 K7KH/101 KC8PX/102 KY0A/152

RTTY

NJ0M/102

160 Meters

F8VJ/104 UA9CBO/101 W3RCQ/101 W8UVZ/101 W8LRL/201

Satellite

W2RS

5BDXCC

YU1AST UK4HBB UZ9CWW UB5UAT NI2V KQ3S K2EK W6GEL UY5XE
UB5ZAL UC2WO KD7P/KH2 KY2W W2XL DF2UU FM5WD HB9BYZ UD6DC
UA4HFK

Endorsements

Mixed

DJ5AV/126 NL7J/270 VE1YX/319 K2JF/290 N3CYC/177 N4JF/343 WN4G/133 K7KH/250 WA8SXM/150
DK6NN/293 OH3RF/272 VE2DWH/202 K2QIL/294 W3NB/317 NN4R/288 WW4Q/175 KD7P/263 WD8PKF/300
DL5NO/126 OH3TQ/312 VE4IU/264 K2TV/312 W3OP/338 NQ4T/179 K5KR/318 NQ7X/239 AG9S/295
F6CKH/319 PAØBEA/151 XE1MDX/299 KX2A/138 W3YFI/202 NU4D/276 KC5M/302 W7HRD/294 KD9QQ/160
G3AAG/179 PAØOI/246 XE1OX/308 N2AMS/267 W3YQ/280 W4AI/285 W5EW/149 W7MI/326 NJ9O/150
G3BKG/175 PAØRLF/277 YU1AST/231 NG2S/250 K4DLI/291 W4DXI/318 W5SL/213 KC8PX/238 W9BW/345
G3KMQ/301 PY1JN/292 ZP5LOB/157 NI2V/253 K4GFI/317 W4OO/351 W5WF/154 KD8WX/129 W9FU/324
G4OBK/203 PY1LW/308 ZS6BOK/249 WA2AOG/263 K4GPX/300 W4PKA/189 K6NL/302 KI8B/179 W9NGA/324
HA4XX/272 PY7ZZ/325 4Z4UX/259 WA2DSC/252 K4ICH/267 WB4HSA/282 KB6WI/246 KR8N/300 W9WAQ/290
IKØAZG/265 SM5BRW/320 K1ITS/243 AE3C/295 K4MQG/345 WD4FWE/297 KD6WW/260 W8AN/225 KØLD/313
JI1MNT/280 SV1JG/303 KB1U/282 KN3P/265 KC4OH/267 WD4HRO/250 N6ET/332 W8CBA/296 KY0A/314
JA6RIL/294 UA3FT/308 W1GKJ/317 KO3B/135 KE4HX/289 WF4G/299 W6CSI/260 W8GIO/312 NIØG/182
JE8CIS/199 UB4WZA/302 WA1SMH/155 KY3V/162 KE4UC/225 WI4K/277 W6MEL/289 W8YMB/250 WBØHAD/312
LA7SI/216

Radiotelephone

C53EK/158 I2PQW/270 PAØLOU/311 ZP5LOB/157 K4CKS/305 W4OUE/281 KC5M/301 K7KH/213 AG9S/292
DJ3VM/203 I4WZK/312 PZ5ES/163 4Z4UX/258 K4DLI/290 W4PKA/177 NK5Y/281 KB7SU/290 KC9YX/200
EA5BYP/225 IKØAZG/259 SM5BRW/293 5B4MF/230 K4GFI/317 WA4FHQ/301 W5SL/132 KD7P/241 W9AG/263
EA7ABV/186 J73PD/219 SV1JG/300 W1GKJ/289 K4MQG/340 WA4QHN/267 KD6WW/254 WA7ECU/201 W9BW/338
EA7GW/128 JA6RIL/282 TG9HH/222 W1WXZ/305 KA4GYU/203 WA4VCC/305 KI6T/340 WA7OIJ/275 KY0A/285
EA8YK/151 LU3AJW/315 VE1YX/319 WA1WWH/202 KB4IT/306 WB4HSA/282 N6ATS/295 KR8N/296 KØJRG/240
F6CKH/317 OZ1ACB/202 XE1MDX/299 K2TV/293 KE4HX/288 WF4G/283 N6ET/324 W8CBA/294 KØLD/309
F6FYD/162 OZ1BQA/196 XE1OX/308 KN3P/257 KN4H/301 WI4K/276 W6MDH/280 W8GIO/310 WA0GUD/262
G4LMO/154 OZ4ZT/203 YB6MF/125 KY3V/142 N4JF/340 K5KR/316 K7EHI/230 WD8PKF/291 WBØHAD/307
I2PEI/289 PAØBEA/128 YC5NOF/174 AD4E/201

CW

EI9CZ/166 JH2TPI/227 WP4F/150 W1GKJ/200 W2FXA/250 WF4G/232 WE6V/144 W9AG/255 NIØG/152
G2GM/231 PAØLOU/279 YU1AST/181 K2JLA/156 WB2IVO/194 K5KR/297 KD8WX/126 W9FU/231 W0ULU/125
HA7RB/223 SM5BRW/267 ZL1AMO/176 K2OWE/270 N4JF/301 W5SL/176 AG9S/168 W9WAQ/277 WA0GUD/177
JI1MNT/151 SM6CVX/265 K1ITS/235 K2TWI/245 WB4FOT/165 W5ZPA/299 NF9V/130

160 Meters

DJ8FW/130

RTTY

W1GKJ/167 WA2JBV/150 WA4WIP/127 KA5CQJ/165 W5ZPA/125

DXCC Notes

Correction: WD5ELJ/128 should have been listed as RTTY Endorsement.

FM/RPT

Conducted By Stan Horzepa, WA1LOU
75 Kreger Dr, Wolcott, CT 06716
CompuServe ID no. 70645,247

To Catch a Jammer

Mobiling on 220 the other day, I had a discussion with one of the locals who runs a 2-meter repeater that is plagued with jammers. My friend, who will remain nameless for reasons that will be obvious later, has devised a plan to catch his repeater's jammers. Our "Catch A Jammer Kid" plans to tie old-fashioned direction finding together with packet radio to create an automated jammer trap. The plan is simple, but clever.

One problem using direction finding to locate a jammer is that you need two or three stations on the air at the same time the jammer is on the air, monitoring the input frequency of the repeater for the jammer's transmissions. When the jammer transmits, our monitoring stations must try to get their antennas on beam with the jammer in order to get a bearing.

It is difficult enough to coordinate two or three stations under such circumstances and come up with some kind of usable data. It is even more difficult (usually a lot of luck is required) to get these stations on the air when the jammer appears. You cannot expect these guys to sit around monitoring the repeater night and day.

What you need is an automated system. Automated direction-finding equipment is available. For example, there is the Dick Smith Electronics K-6345 Radio Direction Finder that was reviewed in August *QST* (page 41). The Catch A Jammer Kid's plan is to install these automatic units around his repeater's coverage area. Once installed, he will convert the output of each unit to a form of data that can be transmitted on a VHF/UHF channel using packet radio.

A central data-collection site would receive the packets from the monitoring stations and transfer the data to a computer (the same computer that is connected to the packet-radio equipment), where it will be juggled with a few algorithms to come up with the approximate point of origin of each monitored transmission. The central-site operator would check his log for the times of the jammer's transmission and cross-reference the computer's output to determine the jammer's transmission site.

That is the basic system. It is in the planning stages now. I will keep you posted on its progress. If any readers have similar or different experiences with jammer trapping, let me know and I will share your experiences in this column.

REPEATER LOG

According to June 1986 reports received, repeaters were used in the following public-service events: 206 vehicular emergencies, 13 drills/alerts, 10 fire emergencies, 9 public-safety events, 9 weather emergencies and 7 medical emergecies.

The following repeaters were involved (followed by the number of events): WA2ZWP 12, W4BDC 1, WA4BVW 1, WD4JWO 4, WB4MDI 5, WB4PZA 1, K4VLY 1, WA6BJY 4, W6FNO 199, K8DDG 11, WD8IEL 8, WØBLK 4, WAØIVW 3. QST

Moved and Seconded ...

(continued from page 55)

lost. On motion of Mr. Butler, all of the societies named above were declared affiliated; Mr. Wilson requested to be recorded as voting opposed.

With this action, the League now has the following number of active affiliated clubs: Category I, 1590; Category II, 13; Category III, 115.

10) Convention Matters:

10.1) On motion of Mr. Wilson, the holding of a Georgia State Convention in Warner Robins on October 11-12, 1986 and of a Kentucky State Convention in Louisville on October 25-26, 1986, was approved. On motion of Mr. Turnbull, approval was given to the Atlantic Division/New York State Convention in Rochester, May 16-17, 1987. On motion of Mr. Wilson, the West Gulf Division Convention planned for August 7-9, 1987 at Austin, Texas was approved. The Southwestern Division Convention at Scottsdale, Arizona, on October 9-10, 1987 received approval on a motion by Mr. Grauer. Also on his motion, the Midwest Division Convention at Des Moines, Iowa, September 26-27, 1987 was approved.

10.2) National Convention matters:

10.2.1) Mr. Holladay reported that all rooms blocked out for the 1986 National Convention September 5-7 in San Diego have been reserved, and an excellent convention is anticipated.

10.2.2) The 1987 National Convention and the summer Board meeting are presently scheduled a week apart in Atlanta, Georgia and the vicinity of Newington, Connecticut, respectively, which could be inconvenient for Board members. On motion of Mr. Grauer, the Secretary was directed to pose the following question for mail vote of the directors, in accordance with Bylaw 25:

Should the 1987 Second Meeting of the ARRL Board of Directors, now scheduled for the vicinity of Newington, Connecticut on July 16-17 be moved to July 9-10 in the vicinity of Atlanta?

10.2.3) The ARRL Diamond Jubilee National Convention is presently scheduled for some time in the month of August, 1989, at Las Vegas, Nevada. The staff was authorized to seek concurrence of the sponsors that the Convention be held August 25-27.

11) The next meeting of the Executive Committee will be held at the call of the president, in accordance with Article 6.

12) Other business:

12.1) Without dissent, Vice President Stevens and Directors Grauer and Turnbull, with Director Metzger as alternate, were named as the Committee of Tellers to count the ballots November 20, 1986, in the current elections for Director and Vice Director.

12.2) On motion of Mr. Butler, the following resolution was unanimously adopted (Applause):

Whereas, Andy Clark, W4IYT, has for thirty years devoted countless hours and a significant amount of personal resources to the publication of *Florida Skip*, the monthly journal of Amateur Radio in that state, and

Whereas, his efforts in that publication have contributed significantly to the healthy condition of Amateur Radio in Florida, especially in its preparation for service to Florida in natural disaster, and

Whereas, *Florida Skip* has repeatedly won national recognition for editorial excellence, and

Whereas, W4IYT has retired as editor and publisher of the paper, now, therefore,

Be it resolved, by the Executive Committee on behalf of the Members, Directors and Officers of the American Radio Relay League this 23rd day of August, that Andy Clark, W4IYT, is heartily commended for sustained excellence and devotion in the publication of *Florida Skip* and is extended best wishes upon retirement; and

Be it further resolved, that a suitable plaque expressing these sentiments be presented to W4IYT on an appropriate public occasion.

12.3. On motion of Mr. Butler, the Volunteer Resources Committee is requested to study making ARRL standard call-sign badges in distinctive colors available for those members of ARRL's volunteer force not presently eligible (e.g., QSL Bureau workers, Technical Advisors, Volunteer Examiners, and Volunteer Counsels) and report at the 1987 Annual Meeting of the Board.

12.4. The Committee was in receipt of an MCI message supporting the eligibility of Fred Hopengarten, K1VR, for the office of vice director, from New England Division Director Tom Frenaye, K1KI, which was read to the group. The President and Executive Vice President reported on telephone conversations with Mr. Hopengarten. After extensive discussion, on motion of Mr. Wilson, the Executive Committee with great regret declared that Mr. Hopengarten's occupation made him ineligible for the office of vice director under Article 11 of the ARRL Articles of Association.

There being no further business, on motion of Mr. Wilson, the meeting adjourned at 4:15 PM.

Respectfully submitted:
Perry Williams, W1UED
Secretary

Life Members Elected
August 23, 1986

Marilyn R. Bolnick, N6GIL; Janice Bond, KA2CQX; Pat Carlson-Yearian, KA7PHR; Nancy E. Cook, WD4IYH; William H. Cowan, W5HNV; Carter W. Craigie, KA3IME; Kay C. Craigie; KC3LM; Robert C. Cranford, WA4SSI; Harvey Dzodin, K8PXI; Traudel Eslaire, WD6CTL; David E. Earnest, W7KJJ; I.A. Elliot, W7JMX; Gary W. Fagan, KD7IQ; Brian J. Feltz, KA9RWU; Judy Flickinger, KA7YXY; M. S. Lumban Gaol, WBØWR; Ruth G. Gibson, KA5YSN; Frederick C. Grant, AA4NG; Tadashi Hakamada, JA1CFJ; Susan B. Harris, WB2ZZJ; Rodman T. Hayes, KAØSQH; Firmin A. Hickey Jr, ND5G; Martha S. Hirsch, KA2PNF; James L. Holmes, KA2RCF; Julian E. Jetzer, KR9S; Dayton K. Johnson, WA8YST; Joan M. Johnson, N4LJO; Marsha Eileen Johnstone, KA1ONT; Edward J. Kabak, KA3DRD; Maria Krause, WA2IHQ; James A. Larson, KK7A; Betty P. Lundrigan, N7FCR; Elaine Lucietto, WB9TZW; Katherine J. Mason; Leon Matula, WB5EDN; Dennis E. Mejia, W9AJI; Stuart E. Mendel, KA7FNQ; Phyllis Morgan, KA4ZRS; Dorthy I. Nellans, N9ECC; Vaunda F. Olmsted, KA7JUQ; Alexandra P. Perrot, N3DZG; Eleanor C. Pyne, KS8F; Matthew A. Reece, KA9VMU; Edward C. Roney Jr, N8COY; James W. Runge, WA6ZUF; Judith K. Rybak; J. Schallenberg, PA3AUB; Katherine J. Selley, N6JXD; J.B. Smith, WB3CIX; Gladys Spear, WB9UDT; Hal Sprague, KH6GPI; William D. Stenson, NA2Y; Frances E. Vrooman, KE8GB; Esther Watkins, KA4GPE; Lindy Watkins K4ASF; Sandra Ann Whitehurst, KA5DAT; Phyllis B. Wolf, NØBNL; Shirley Wondergem, N5GGO. QST

The World Above 50 MHz

Conducted By Bill Tynan, W3XO
Send reports to PO Box 117, Burtonsville, MD 20866,
or call 301-384-6736 to record late-breaking information.

The 1986 E_s Season in Review

Great predictions were made for this past summer's Sporadic-E season. This conductor, for one, wondered in The World Above 50 MHz for June whether we might be in for one of the greatest seasons ever. This speculation was based in part on reports from Australia telling of record-breaking conditions in that part of the world during their summer months of November and December 1985 and January 1986. Another contributor to the optimism was a widely held speculation concerning a possible inverse relationship between E_s and solar activity.

So much for our ability to outguess Mother Nature's E clouds. At this juncture, the name "sporadic," as applied to this type of propagation, seems particularly apt. Not that the past season can be classified as "poor," but neither can we consider it to have been "one of the best." Probably more than most, it had pronounced ups and downs, with a few days of very good conditions followed by up to a week of almost nothing. In this part of the world, it began with a bang on May 10 with a widespread and lengthy opening affecting both 6 and 2 meters. According to the counterpart column to this one, which appears regularly in the Radio Society of Great Britain's monthly journal *Radio Communication*, Europe experienced a good 2-meter E_s opening as early as the end of April. The E clouds put on another great show for the 6-Meter Sprint May 17, and then openings seemed to trail off and disappear altogether for about the next two weeks. About the time that many of us were ready to conclude that the 1986 E Season might be confined to mid May, substantial openings reappeared June 10 and 11. These also reached to above 144 MHz. Many double-hop contacts were made on 6 meters, which was also enlivened by the presence of the team of W6JKV and N4HSM operating from St Vincent. From that much needed QTH, they made several hundred contacts stretching across the country as far as the Pacific Northwest. These two were also active from the same J88 location for the June VHF QSO Party, during which most of the country, with the exception of the Far West, was blessed with many hours of E_s propagation which appeared to hop around considerably, resulting in lofty grid-square totals for many 6-meter contesters. Also adding to the excitement of the contest was the presence of the likes of VP2MO, 8P6LL and 8P6JW, PJ2DEW, YV4UY, HC1BI as well as several KP4s and KP2s. Even OX3LX was worked by about 20 East Coast stations. After the contest, the E_s openings seemed to again all but disappear until toward the end of June. Thus, the super E conditions that often visit Field Day did not materialize. Only a few spotty 6-meter E_s contacts were made by the insect-repellant bunch and, as far as I know, there were no 2-meter E-Skip exchanges during the event.

A few days prior to Field Day, W6JKV, this time teamed up with KB6AFZ, arrived at the Azores for a two-week stint of 6-meter operation. While they were favored with propagation nearly every day of their stay, there was little time in which they were in solidly in this country for appreciable lengths of time. Thus, generally, it was those who could spend the time waiting for propagation to develop often for only a few minutes at a time, that were successful in adding the universally needed country to their rosters. Nevertheless, Jim and Cal completed QSOs with some 150 different stations, including all US call areas except W6. In addition, they worked VE1, G, CT1, KP2 and KP4 plus an EA via crossband. Considering the distance from most of the US, these results are indeed impressive and represent more evidence pointing to the existence of long-haul E_s propagation at 50 MHz, a substantial portion of the time, during mid-summer. See the 6-meter section for more details on the results of this ambitious and widely appreciated operation.

The 1986 season produced other instances of our latest E_s thrill, 6-meter openings to Europe. The phenomenon of long-haul VHF E_s was first observed only about 10 years ago when West Coast operators first experienced summertime propagation to Japan. Several years later, a few openings to Gibraltar showed that it could also occur between the East Coast and Europe. Over the past few years, we have had some quite good openings to the UK, allowing contacts with holders of special limited-operating-hours 6-meter permits. This is the first year in which any British Class A licensee can get on the band with no time restrictions. Severe power limitations do exist for UK 6-meter operators, however. This surely makes for tough going when signals are weak. Nevertheless, there were at least three days during this past summer on which some two-way 6-meter work was accomplished between stations on this side of the Atlantic and a number of G stations. July 9, 12 and 21 seem to have been the best. See the 6-meter section for details. At least one case of E_s propagation to Europe involved a station not located along the East Coast. That occurred July 18, when WB8YFE/9 in Indiana reported reception of the ZB2VHF beacon for about 20 minutes beginning about 1645Z and again briefly at 1751. There was also a rumored contact, during the ARRL VHF QSO Party, between Iowa station NØEKT and G4YLO, said to be located north of London, but no confirmation of this has been forthcoming so far. Although they can be expected to get far fewer European openings than those located along the East Coast, Midwesterners, nevertheless, do have a chance to work European 6-meter stations.

As of early August, when this is being written, the 6-meter openings seemed to again be on the increase, and 2-meter openings were reported in several parts of the country.

Thus, although it can't be put in the "best ever" category, with day after day of wide-open band conditions, this year's E_s season, nevertheless, cannot be considered a "bust" either. We experienced several, lengthy 2-meter openings and many more short-duration ones. The 6-meter band certainly had more than a normal season's share of choice DX available. One had to be there, alert and ready, when it appeared, but that's often the way with DX. Isn't that what makes working it fun, on any band?

Yes, I think we can place the 1986 E_s in the "interesting but not super" category; begin looking forward to next year, possibly with improved stations, better operating practices, a fresh supply of rare DX stations to try for and, just maybe, better conditions.

ON THE BANDS

6 Meters—The 6-meter section was missing from last month's column due entirely to a goof on the part of this conductor. I apologize and will try to make up for that lack of coverage this month.

First, and foremost, is a report from W6JKV and KB6AFZ on their trip to the Azores. Jim says that he and Cal set up Monday, June 23, and almost immediately heard the ZB2VHF beacon, followed shortly by several W1s, with W1QXX and K1JRW being among the first into the log. In the next two weeks, W6JKV/CT2 worked all US call areas but W6. The breakdown was 42 W1s, 24 W2s, 8 W3s, 26 W4s, 17 W5s, 4 W7s, 8 W8s, 1 W9 and 2 WØs. In addition, they hooked up with 2 VE1s plus one station in Puerto Rico and one in the US Virgin Islands. In three separate openings to the UK, they snagged 8 Gs, a GI and a GW besides working CT4KQ. They completed one 6- to 10-meter crossband contact with a Spanish station. Altogether, they completed approximately 300 QSOs with some 150 different stations. Best DX was W7US in Arizona. One of the biggest disappointments was not working a W6. They did hear W6UXN for about 30 minutes, but were not able to make it a two-way, due to QRM on 50.110. Jim says that one of the surprises observed from the operation was that most of the openings to the US were during the morning hours here. He notes, for example, that when he worked K7KV near Seattle it was before 6 AM Pacific Time.

Earlier, from St Vincent, W6JKV in company with N4HSM made 300 contacts, including a goodly number during the ARRL VHF QSO Party. The combination of the FK93 grid square and new country were doubly welcome during that event. From that QTH also, no W6s were worked with K7KV representing the best DX. In addition to W6JKV/J88 and N4HSM/J88, the contest was made much more interesting by the presence of other Caribbean calls such as VP2MO, 8P6s LL and JW, PJ2DEW and YV4UY. Much of this activity was apparently due in no small part to the missionary work turned in by W6JKV and N4HSM.

Once again, 6-meter operators in many parts of the world owe a debt of gratitude to W6JKV and all of those who help him on his many DXpeditions. What next? Anyone for 6-meter EME?

Another rare country and grid square to show up during the QSO Party was OX3LX GP60. Bo appeared Sunday afternoon during the contest and worked K4IXC, W3OTC, WB4MIC, W3EP/4, K1TOL, WB2OTK/4, WD4FLF, WD4KPD, KS4S, KA4DAP, WB4BZZ, AB4L, N4AVV, VE1BPY, WB4ERO, N4EJG, KA1PE and K1GPJ. Other activities from Greenland include a June 20 opening when OX3LX worked VE1YX, WA1OUB, VE1BNN, K1DXA, K1JRW and WA1TPO along with repeat QSOs with K1TOL, K1GPJ and KA1PE. On June 24, he contacted G4GLT, G3UUT, G4BAD and G2ADR. Bo apparently has some kind of problem on the low end of the band, possibly TV1. On the evening of July 18, while in a 10-meter QSO with KS2T, he asked Jay to meet him on 51.4! This done, they exchanged 559 signals on CW. For those fortunate enough to have

23- and 13-Cm Standings

Listings are call, state, US states worked, call areas worked, grid squares worked and best terrestrial DX worked in miles. Call areas are the 10 US call areas plus KH6 and KL7, plus each VE and XE call area, plus DXCC countries not located within the continental limits of the US, Canada or Mexico. In order to make the standings a true reflection of stations currently active on 23 and 13 cm, those not reporting activity within the past two years are subject to being dropped. They will be reinstated upon written presentation of continuing activity. It is not necessary to have worked additional states or grid squares in order to remain in the standings or be reinstated, merely an indication of continued activity and interest. Compiled August 5, 1986. Deadline for next update is February 5, 1987.

23 Cm

W2SZ/1	MA	17	8	34	—
K1FO	CT	15	7	21	468
W1JR*	MA	13	9	31	655
K1PXE	CT	13	5	—	448
WA1JOF	MA	12	4	18	725
W1RIL	MA	11	6	19	—
K1LPS	VT	7	5	—	288
W1QXX	MA	6	3	—	260
K2UYH*	NJ	22	32	—	770
WA2LTM*	NJ	17	6	—	770
W2VC	NJ	16	7	26	537
K2YCO	NY	11	8	—	570
N2BJ	NY	11	5	17	—
K2EVJ	NY	10	6	—	426
W2PGC	NY	6	6	—	473
WA2FUZ	NY	5	3	—	125
K2OVS	NY	3	2	—	135
WA3JUF	PA	14	5	20	300
W3IP	MD	11	7	18	369
WA3NZL	MD	11	7	—	780
K3HZO	MD	9	—	12	—
K83QM	DE	7	—	7	—
K4OIF	VA	15	6	—	790
WB4NXY	KY	14	5	25	730
WS4F	GA	8	3	12	625
W3IY/4	VA	7	5	—	481
WA4OFS	FL	5	2	13	—
K4NTD	FL	4	2	—	847
WB5LUA*	TX	20	23	49	1073
W5HN	TX	12	4	39	1071
KD5RO	TX	9	3	35	650
WB5AFY	TX	8	2	25	685
W5DFU	OK	7	3	13	600
WA5VJB	TX	7	3	—	952
WA5TKU	TX	5	3	18	1112
K5DHU	TX	5	1	12	—
W5NZS	OK	5	—	20	—
W5ASH	TX	4	2	9	1066
W5HPT	TX	4	1	—	571
W5UWB	TX	3	2	—	720
WB5LBT	LA	3	2	—	—
W5RCI	MS	3	2	—	—
N5BBO	TX	2	2	3	1042
K5SW	OK	2	1	4	—
W5UKQ	LA	2	1	—	365
WA5DBY	TX	2	1	—	—
WA5HNK	TX	1	1	5	250
WA5TBE	TX	1	1	—	571
W5GVE	TX	1	1	—	366
N6CA		8	10	30	2472
K6ZMW		4	3	—	402
W6KGS		3	2	—	362
W6XJ		2	3	—	250
WB6NMT		1	1	—	296
KC6A/6		1	1	—	130
N6TX		1	1	—	112
K7GNV/7	AZ	5	3	6	426
N6NB/7	UT	4	2	—	295
WB5TCO/7	AZ	2	2	2	403
WA7JUO	NV	2	1	—	—
W8YIO	MI	17	13	36	551
K8WW	OH	16	7	32	448
WA8TXT	OH	15	8	20	604
WB8BKC	MI	15	7	33	650
NI8O	OH	12	6	21	422
W8IDU	MI	5	4	—	—
WB8PAT	OH	4	3	—	405
W9ZIH	IL	23	9	—	790
WB9SNR	IL	14	8	25	760
WA9FWD	WI	8	3	8	—
W9UD	IL	5	4	—	760
WØUC/9	WI	3	2	4	—
WBØDRL	KS	16	6	48	—
WØHAP	IA	13	4	35	678
WØOHU	MN	12	5	18	814
WAØTKJ	KS	9	3	18	—
KØALL	ND	6	2	—	283
KCØQR	NE	6	1	6	430
KXØO	CO	41	2	4	653
WØYZS	MO	4	2	—	425
WØPW	CO	3	2	3	97
KØTLM	MO	3	1	7	—
WØZJY	KS	3	1	—	170
NOØY	KS	2	2	4	170
WØRT	KS	2	2	3	—
WØMDL	MN	2	2	—	340
WØVB	MN	2	2	—	290
KH6HME		2	2	—	2472
VE3LNX		7	5	18	—
VE4MA*		7	11	16	800
XE2BC		1	1	—	370

13 Cm

W2SZ/1	MA	6	3	10	—
W1JR	MA	3	1	2	100
WA3AXV	PA	6	3	11	194
WA3JUF	PA	5	3	10	—
W4HHK*	TN	8	5	8	582
WB4NXY	KY	2	2	2	360
WB5LUA	TX	9	3	23	624
WA5VJB	TX	3	1	13	185
W5UC	TX	3	1	12	163
W5HN	TX	3	1	10	230
KD5RO	TX	2	1	11	220
WB5AFY	TX	2	1	7	—
W5NZS	OK	1	1	2	—
WA5DBY	TX	1	1	1	65
K5PJR	OK	1	1	1	271
W8YIO	MI	6	5	11	—
WA8TXT	OH	3	3	4	291
W9ZIH	IL	7	4	—	340
WB9SNR	IL	6	4	7	—
WBØDRL	KS	2	1	3	—

*some stations worked via EME
—information not supplied

worked OX3LX, his address is Bo Cristensen, Box 187, DK-3920 Julianehaab, Greenland.

A report from N4VA details the week he spent from July 7 through 12 on North Carolina's Outer Bank in grid square FM25. Larry took along gear for both 6 and 2 meters, which certainly paid off. On 6 meters, he netted 32 states, 108 grid squares and 7 countries. Not bad for 150 W from a Mirage amplifier and an old Finco 5-element beam about 15 feet above a sand dune. The most exciting evening was, obviously, July 9 from 2232 to 2310Z when GJ3YHU, EI6AS, GU2HML, G4PBP, G4GLT, G6NB, G3XBY and G2BSJ were all worked with signals averaging S5. Three days later, on the 12th, W2CAP/1 on Cape Cod is also reported to have worked a number of Gs. The other big night for transatlantic work came July 21, when WA1OUB New Hampshire reportedly worked 22 Gs and K1JRW Massachusetts QSOed 15. I have not received detailed reports on specific calls, times and what may have been worked by other stations on these occasions. However, a letter from G3COJ mentions K1JRW, WA1OUB and K1GPJ all being heard at his QTH between 1955 and 2025Z July 21.

While many of us were attending the Central States VHF Conference in St Louis July 25-27, 6 meters apparently put on a good show for the stay-at-homes. W4CKD reports, on the 25th, H18DAF in for several hours with a good signal, the FY7THF and the 6Y5RC beacons along with the Colombian FM repeaters all heard. The next day, Bob says, featured one of this season's better double-hop openings to the West Coast. He notes that signal levels were reminiscent of the "good old days."

2 Meters—N4VA's operation from FM25 on the coast of North Carolina paid off on this band as well as on 6 meters. In the five days he was there, Larry bagged 21 grid squares, with most of the activity coming 2200Z July 6 - 1400Z July 7. The best DX was between 0030 and 0220 July 9 when Florida stations WA4OFS EL98 and WA4VLQ EL99 were worked. All of this was accomplished between 6-meter openings and other vacation activities using an IC-260A into a Mirage 150-W amplifier feeding an 11-element beam at 20 feet.

The lead for this column, mentions scattered 2-meter E openings June 26. The report that prompted this came from WA4MJD Kingsport, TN, who noted working Amarillo stations W5SFW at 2012Z and W5MJD at 2034Z.

The Higher Bands—According to the August issue of *Spec-Com*, a magazine that bills itself as being devoted to amateur specialized communication, some of the Field Day gang in the Midwest were able to put on some good ATV demonstrations for those visiting the sites. Those groups which set up ATV stations on 439.25 MHz were fortunate to participate in a very good tropo opening that produced color pictures at up to 160 miles and black-and-white reception at distances approaching 400 miles. Participating stations with ATV setups included WØBXR Davenport, IA KS9Q Milan, IL; N9AB Ivanhoe, IL; NB9I (somewhere in Indiana); W6MGI/9 Palantine, IL; N9FRI Chicago; WB8ELK Findlay, OH; WA8ZAH, Cincinnati, OH; and WBØZJP St Louis, MO.

W1JR reports great success on the new 33-cm band. As of the end of June, Joe has worked 11 stations in 7 states (all of New England plus Pennsylvania) and 7 grid squares. This is with only 8 to 10 W. What will he be able to do when he gets his normal signal going? W1JR suggests that Friday evenings at 2100 be designated as the activity time for 903 MHz and then shift to 2304 at 2130.

Let's have some more 33-cm activity reports. QST

VHF/UHF Century Club Awards

The ARRL VUCC numbered certificate is awarded to amateurs who submit written confirmations for contacts with the minimum number of Maidenhead grid-square locators indicated in *italics* for each band listing. Initial qualifiers are shown first, followed by those with endorsements, for June 15, 1986 through August 15, 1986. An SASE will bring you the rules and application forms.

6 m (50 MHz)
100

126	KB3QM
127	WB2MKN
128	W6RXQ
129	KA9DZM
130	KA9LDS
131	KU8Y
132	W7US
133	WB8TGY
134	W7HAH
135	AA4FL
136	KS4S
137	W4HJW
138	WA4JNE
139	WDØBQM
140	NA4I
141	WBØTEM
142	AIØO
143	KA2GOJ
144	WB9MSV
145	KD9IV
146	KA5EBL
147	WA3CKA
148	W5QZI
149	N2AHN
150	KF5AL
151	W8QXO
152	WB9UQE
153	W8QOI
154	KI6O
155	AB9W
156	W9UB

WA1OUB	325
W2CUK	125
N2WK	200
N2AHN	125
N2DXP	150
N3COG	225
KB4CRT	250
K4RWP	125
KE5EP	175
W5OZI	125
W5FF	275
WA6BYA	250
WA6CRA/4	175
K8YAH	150
K8TGC	225
K8WKZ	325
KY9P	175
KA9DZM	150
WA9FYB	125
WD9FSA	150
NC9F	125
WBØTEM	125
KØTLM	275
KAØJGH	225

2 m (144 MHz)
100

111	W5NZS
112	LA9FY
113	WA4VCC
114	GØCHE
115	KR9U
116	G6XVV
117	N2AHN
118	YO2IS
119	WA5DBY
120	KMØA
121	W9JGV
G4WAD	125
GØCHE	125
N8BJN	125
KU8Y	125
AF9Y	150
N0LL	175
KMØA	125
KØTLM	150
WBØTEM	225

1.25 m (220 MHz)
50

10	KC4EG

70 cm (432 MHz)
50

54	WB9SNR
55	N5BHO
56	N8DJB
K4CAW	70
K5YY	90
WB5AFY	120
K8TL	60
WBØTEM	120

23 cm (1296 MHz)
25

24	KØNG
25	WB9SNR
WB5AFY	35

2.3 GHz
10

12	W8YIO

3.4 GHz
5

2	WA5DBY
3	WB5LUA
4	W5UC
5	KD5RO
6	WA5VJB
7	WB7UNU
8	WA3RMX

5.7 GHz
5

6	WB7UNU
7	WA3RMX
K5PJR	10

10 GHz
5

2	K2DNR/7 (DM41)
3	KCØW
4	K2DNR/7 (DM42)
5	WA7BBM
6	WB7UNU
7	WA3RMX

On Line

Conducted By Stan Horzepa, WA1LOU
75 Kreger Dr, Wolcott, CT 06716
CompuServe ID no. 70645,247

More Packet-Radio POPCORN

Last time, I described some packet-radio POPCORN don'ts. This time I will discuss basic operating procedures for the beginner.

In case you missed it, POPCORN in packet radio stands for Proper Operating Procedures Can Only Revive the Network. The network is getting bogged down by the sheer numbers of hams using it. Throw in some proper operating procedures and maybe we can debog the network.

Assuming you have made all of the proper connections between your TNC (terminal-node controller), radio and computer (or terminal), let's get on the air. (I will assume two things: Your TNC uses the TAPR TNC 2 command set [the majority of TNCs do], and you will operate on 2 meters.)

TNC to Suit Your Needs

Before you transmit your first packet, you must configure your TNC to your needs. Whether you are using a terminal or a computer running communications software that emulates a terminal, you should configure the TNC to be compatible with the terminal's operating parameters. First, set the baud rate (300, 1200, 2400, 4800 or 9600 bauds) of your TNC's serial port to the baud rate of your terminal by means of a rear panel DIP switch while the TNC is powered off. Next, set the radio baud rate of the TNC to the data rate you will use on the air (1200 bauds for 2 meters) by means of that same DIP switch.

All other parameters are set while the TNC is powered on, so power your TNC. A preamble identifying the TNC should be printed on your terminal's display. If nothing is printed or if what is printed is unreadable, you may have to set other parameters for compatibility between your TNC and terminal.

Echo causes the TNC to print on your display each character you type into your keyboard. If two characters are displayed for each one you type, type E OFF followed by a <CR> (a carriage return) at the "cmd:" prompt to turn off echo (all TNC commands are entered at the cmd: prompt). If nothing is displayed when you type into the keyboard, type E ON <CR> to turn on echo.

Next, set the TNC to the character length used by your terminal by typing AW 7 <CR> for 7 bits/character or AW 8 <CR> for 8 bits/character. Also, set the TNC to the parity used by your terminal by typing PAR 3 <CR> for even parity, PAR 1 <CR> for odd parity, or PAR 0 <CR> for no parity.

Configure the TNC for the number of characters displayed on each line of your terminal by typing SCREENLN n <CR> where n is the number of characters per line. If your terminal does not accept lowercase characters, the TNC may be set to translate all received characters to uppercase. Type LC ON <CR> if your terminal accepts both uppercase and lowercase characters, or type LC OFF <CR> if your terminal accepts only uppercase characters.

Automatic line feed causes the TNC to insert a line feed after each carriage return that is detected in received packets. If a blank line follows each line of received text, type AU OFF <CR> to turn off automatic line feed. However, if each line of received text is printed over the previous line, type AU ON <CR> to turn on automatic line feed.

Your terminal should now display text from your TNC in a clear, legible manner. If not, recheck these parameters.

Two additional parameters need tending to before you get on the air. One inserts your call sign in the TNC by typing MY WA1LOU <CR> where WA1LOU is your call sign. The remaining parameter needs setting only if you operate through a digital repeater. To avoid collisions with repeated packets, the DWait command causes your TNC to wait before it begins sending. The repeater has no delay, so it always transmits first to avoid colliding with nonrepeater stations that do delay their packets. To set this delay, type DW n <CR> where n is the number 0 to 250 representing a delay in 10-ms increments.

Listening First

Tune your transceiver to 145.01 MHz, where the packet action is. Type M ON <CR> (for Monitor On) and your terminal will display received packets such as "WA1LOU>KE3Z: HI JON—HOW'S TRICKS?"

In this example, WA1LOU sent KE3Z the message "HI JON—HOW'S TRICKS?" For casually monitoring, this is sufficient; you know who is talking to whom and what they are saying. However, if you wish to connect with one of these stations later, you need to know whether you are copying the station originating the packet or another station that is repeating the packet. To obtain this information, type MR ON <CR> (for Monitor Repeater On) and that same packet would be displayed as "WA1LOU>KE3Z, W1AW-5*: HI JON—HOW'S TRICKS?"

In this example, WA1LOU is transmitting indirectly to KE3Z by using W1AW-5 to repeat his packets. The asterisk following W1AW-5 indicates that you are receiving the packets that are being repeated by W1AW-5, not the packets originating from WA1LOU.

Talking to Yourself

Now that you know that you can receive packets, it's time to test your station by attempting to connect to yourself by typing C YOURCALLSIGN V W1AW-5 <CR> (for Connect to Your Call Sign Via digital repeater W1AW-5) and your transmitter will transmit a connect request which will be repeated by W1AW-5 and sent back to your station. If you are successful, your terminal will display "*** CONNECTED to YOURCALLSIGN."

Your station is now in the "converse" mode, and anything you type in the keyboard and follow with a <CR> will be sent as a packet over the air. To exit the converse mode, type CTRL-C and the cmd: prompt will be displayed. End the connection to yourself by typing D <CR> (for Disconnect), and your transmitter will send a disconnect request through W1AW-5 back to your station. The message "*** DISCONNECTED" will be displayed if you are successful.

The Real Thing

Now, use the C command to connect with a station you have monitored. For example, to connect with WA1LOU (which you monitored through W1AW-5), type C WA1LOU V W1AW-5 <CR>. If WA1LOU is available, a connection may be established and you may exchange packets. When the conversation is over, use the D command to disconnect.

Those are the basic operating procedures for 2-meter packet radio. Monitor the channel and you will learn the ropes from the veterans who got on packet radio a week before you. Have fun!

PX: The Fall Classic (Computers)

BASIC programs for the Texas Instruments TI-99/4A and the Radio Shack TRS-80® Model I are offered along with a Z80 assembly language program in this PX installment.

Program 131: Use a TI-99/4A as an audio signal generator with this program by John S. Davis, WB4KOH.

Program 132: TRS-80 Model I logging and QSLing is provided with this program by Matt Penrod, KA2TVX.

Program 133: KA2TVX also wrote this TRS-80 Model I program to design antennas.

Program 134: a contest duping program written in Z80 assembly language by Charles B. Nesbitt, WA3SKC.

To obtain a listing of any PX program, send a business-size SASE with 39 cents postage (unless noted otherwise) to ARRL, Dept PX, 225 Main St, Newington, CT 06111 (CRRL members can send their SASEs to CRRL, PO Box 7009, Stn E, London, ON N5Y 4J9). Use a separate SASE for each program request and write the PX program number of the desired program at the lower left-hand corner of the SASE. Please do not send correspondence other than PX requests to Dept PX.

A list of all 134 programs in the PX library is also available by sending a business-size SASE with 22 cents postage to ARRL, Dept PX, 225 Main St, Newington, CT 06111.

Conducted By Bob Atkins, KA1GT
103 Division Ave. Millington, NJ 07946

1296-MHz Activity from Colorado

Lauren Libby, KXØO, has written from Colorado Springs, Colorado with the following report of a DXpedition to Pikes Peak.

On July 4 at 11:40 AM Mountain Daylight Time, KXØO/Ø, contacted WB5LUA on 1296.1 MHz. Calls and signal reports were exchanged. As near as we can determine, the contact was via aircraft scatter. The distance was 653 miles. KXØO/Ø was located on Pikes Peak, Colorado, at 14,110 ft above sea level. Signals peaked at about S4 on the Pikes Peak end of the contact. WB5LUA was heard three times during the hour schedule. Thirty-second sequencing was used.

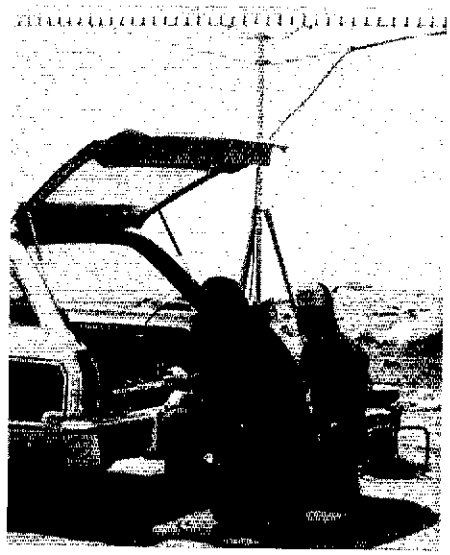
The same morning contacts were made between KXØO/Ø and WBØDRL at Salina, Kansas (385 miles) with 559 reports exchanged. Pete's 1296 signal had a rapid fade on it, but was extremely loud. However, WBØDRL is worked regularly from KXØO's home location with 10 watts and a 55-element Yagi antenna.

A contact was also made with WB5AFY at Vernon, Texas on the July 4 date (distance 490 miles). Dan's signal ran from an S2 to an S7. Dan was running 750-watts output and 4-23 element F9FT antennas.

Schedules were run with KØNG at Lincoln, Nebraska, and K5JL near Oklahoma City with no results.

Equipment at the Pikes Peak site included an ICOM-1271 with a GaAsFET preamp (0.9 dB NF) and a 3CX100A7 amplifier running about 80 watts to a 55-element F9FT single Yagi.

Other operators at KXØO/Ø were AAØL and WØMXY in addition to KXØO. We are finding that 1296 is a great DX band when a good antenna and some power are used. While a mountain is a great place to operate from, KXØO regularly works over 400 miles from his home QTH in Colorado Springs, Colorado.



KXØO (left) and AAØL operating on 1296 MHz from a site on Pikes Peak, Colorado at an elevation of 14,110-ft ASL. (*WØMXY photo*)

MICROWAVE SOCIETIES

It is often of great help to beginners (and indeed to those more experienced) in microwaves to belong to a local society where help and encouragement may be found. Many such societies exist throughout the country. The main problem to the beginner is finding out where they are! For those in Southern California, the San Bernardino Microwave Society (founded in 1955) provides a focus of activity. They can be contacted via Chuck Swedblom, PO Box 605, Ridgecrest, CA 93555. Their latest newsletter indicates that five of their members are gearing up for the 10-GHz Cumulative Contest (Sep 27-28 and Oct 10-11), and several hams in the San Diego area are also operational on the band.

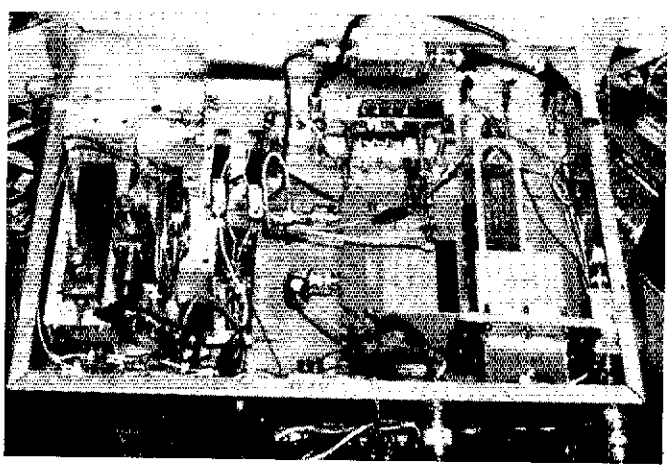
Microwave enthusiasts in the Philadelphia area have the Pack Rats (Mt Airy VHF Radio Club Inc). They meet on the third Thursday of each month at 8 PM in the Southampton Free Library, 947 E Street Rd, Southampton, Pennsylvania. Doc Cutler, K3GAS, is the publisher/subscription manager of their monthly newsletter (*Cheese Bits*) and can be contacted at 7815 New Second St, Elkins Park, PA 19117.

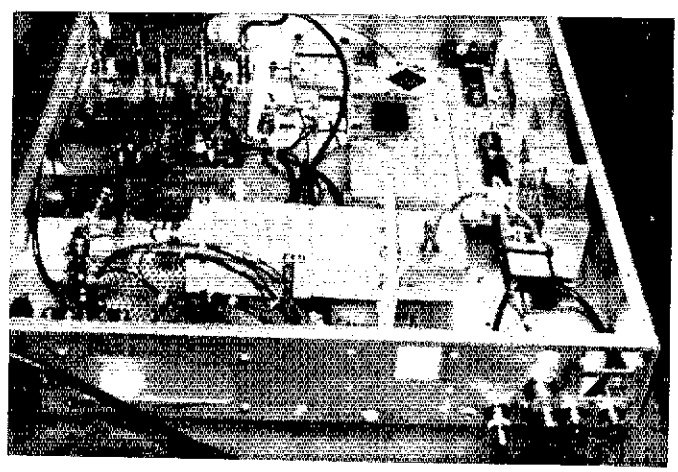
The Dallas area is served by the North Texas Microwave Society. They can be contacted through Kent Britain, WA5VJB, 5809 Stagline, Arlington, TX 76071.

Note that most societies operate on a limited budget, so a self-addressed, stamped envelope would probably be appreciated with all inquiries. If any other local microwave organizations would like to announce their presence to the readers of this column, please send details to me at the address at the top of this column, and I will reprint them at the first opportunity.

10-GHz CUMULATIVE CONTEST

The second leg of the 10-GHz Cumulative Contest will be held on the weekend of Oct 10-11 (the first leg was held on Sep 27- 28). Full details and rules can be found in June 1986 *QST*, page 84. Good luck to all those participating.





Following last month's report of 3456-MHz activity by the North Texas Microwave Society, readers may be interested to see these photographs of the home-brew transverters built by WA5VJB (left) and WA5TNY.

Washington Mailbox

Conducted By John C. Hennessee, KJ4KB
Regulatory Information Assistant, ARRL

The Wonderful World of Call Signs—Part 1

Few things are more important in our hobby than our call signs. We proudly display our calls on our license plates, in our shacks and on our shirts in the form of little plastic tags. We work hard to receive our licenses, so our call signs are highly valued. In the past nine years, US call signs have undergone some big changes. This month, we'll examine some of these changes. We'll wrap up the subject in the next installment.

The License

Before we address the issue of call signs, we must first look at the licensing process. After all, without licenses there would be no call signs!

Your ham ticket is actually two separate licenses: the operator license and the station license. They are both contained on the same piece of paper, but they are entirely separate. The operator license gives the FCC's permission for an *individual* to be the control operator of an Amateur Radio station. The operator license also gives the operator the class of license.

The station license, on the other hand, allows an Amateur Radio station to transmit from anywhere the FCC regulates telecommunications. The call sign is part of the station license; call signs are issued to stations, not to operators! This is an important distinction. The holder of a station license also holds the operator license, except in the case of clubs, military recreation and RACES stations, which are only issued station licenses.

Now that we have differentiated the two types of licenses, let's look at some questions frequently asked by amateurs.

The FCC Call-Sign System

Q. What is the present FCC call-sign assignment system?

A. Calls are assigned sequentially by an automated system. The Commission does *not* deviate from this system. The system selects call signs from blocks or groups of calls that reflect the licensee's operator class and mailing address and call-sign region. There are nearly 10.3 million call signs in four groups. Group A calls are issued only to stations licensed to Amateur Extra Class operators. Group A 2 × 1 calls, such as KR1R, are presently being issued. In the fourth call district, all 2028 Group A 2 × 1 calls have been issued. Amateur Extras are receiving Group A 2 × 2 calls, like AA4AT. Group B calls all use the 2 × 2 format and are assigned to stations of Advanced operation. An example of a Group B 2 × 2 call is KB9NM. Group C calls are issued to General and Technician class. These are 1 × 3 calls with N, K or W prefixes, such as N4JJJ. Group D calls go to Novice class operators, and they are always 2 × 3s with prefixes beginning with K or W, such as KB4OQL.

Q. How many calls are available for distribution?

A. There are approximately 99,000 unissued calls in Group A. In Group B there are 505,000, and in Group C 378,000 calls left for distribution. Group D contains over 8.8 million unissued calls! This should last for a while! The system selects only calls that have never been issued previously. The computer program used for the assignment does not have the capability to recover the call signs from those who become Silent Keys or who drop out. The system assigns from the next lower group after all calls from one group have been depleted. This is already happening in Alaska and Hawaii since Group A call signs ran out. Group B calls are being issued to Extra Class operators.

Q. Is it possible to find approximately where the system is in issuing calls in a particular call district?

A. Yes, at the beginning of each month the Gettysburg office of the FCC issues a public notice of the last call sign issued in each group. Gettysburg consumer assistance also maintains a call-sign hotline for obtaining this information. The consumer assistance phone number at the FCC is 717-337-1212. General inquiries regarding licensing may also be directed to this number. This same information is available from the Regulatory Information desk at ARRL HQ for an SASE. This information is also printed in *The ARRL Letter* and often in the Happenings column of *QST*.

Q. When are stations eligible for new call signs?

A. An amateur station is eligible for a new call only when the licensee upgrades the operator license or when changing the mailing address to a new call-sign region. A new call also may be obtained when your present call is not from the group for your present license class.

Q. When I upgrade, can I keep my present station call?

A. Yes, you may keep your present call if you desire to do so. Calls are changed only when specifically requested and you are eligible.

Table 1
FCC Call-Sign System

Group A Call Signs

Block no.	*Contiguous USA*
*1	K#$$
*2	N#$$
*3	W#$$
4-13	AA#$-AK#$
14-36	KA#$-KZ#$
37-59	NA#$-NZ#$
60-82	WA#$-WZ#$
83-92	AA#$-AK#$$
93	Group B

The following prefixes will *not* be assigned to stations in the contiguous 48 states: AH KH NH NL AL KL WL KP WP AP WH. Pacific-area stations will be assigned AH#s KH#s NH#s WH#s, then Group B. Alaska-area stations will get WL7$ AL7$ KL7$ NL7$, then Group B. Atlantic area stations will be assigned KP#$ NP#$ WP#$, then Group B.

Group B Call Signs

Block no.	*Contiguous USA*
1[1]	KA1$$
2-23	KB#$$-KZ#$$
24-46	NA#$$-NZ#$$
47-69	WA#$$-WZ#$$
70	Group C

[1]KA prefixes will be assigned only to persons living in the first call district. Others KAs are assigned to US personnel living in Japan. The following prefixes will *not* be assigned to stations in the contiguous 48 states: KH KL KP NH NL NP WH WL WP. Pacific-area stations will be assigned calls in the format, AH#$$, Alaska-area stations, AL7$$, and Atlantic-area stations, KP#$$. Once these blocks are used up, assignments will be made from Group C call signs.

Group C Call Signs

Block no.	*Contiguous USA*
*1	K#$$$
2	N#$$$
*3	W#$$$
4	Group D

Pacific-area stations will be assigned KH#$$ NH#$$ WH#$$, in that order; Alaska-area stations KL7$$ NL7$$ WL7$$; Atlantic-area stations NP#$$ WP#$$. After these are depleted, Group D will be used.

*Call signs using these prefixes are not currently being issued.

Group D Call Signs

Block no.	*Contiguous USA*
1-23[2]	KA#$$$-KZ#$$$
24-41	WA#$$$-WZ#$$$

[2]Except KC4AAA-AAF and KC4USA-USZ. The following call sign formats will *not* be assigned to stations in the contiguous 48 states: KH#$$$ KL#$$$ KP#$$$ WC#$$$ WH#$$$ WK#$$$ WL#$$$ WM#$$$ WP#$$$ WR#$$$ WT#$$$. Pacific-area stations will be assigned KH#$$$ WH#$$$; Alaska-area stations KL7$$$ WL7$$$; Atlantic-area stations KP#$$$ WP#$$$.

Canadian NewsFronts

Conducted By Harry MacLean, VE3GRO
500 Riverside Dr
London, ON N6H 2R7
Tel 519-473-1668

The Ravenscroft Case: A View from DOC

The following, by Brian Johnstone of DOC Winnipeg Regional Office, first appeared in the 1986 July *QUA Manitoba Amateur:*

"I have been asked to discuss the 'Ravenscroft Case' with you ... The difficulty in this case for the DOC was that interference to radiocommunications was not at issue and therefore our involvement, as indicated by the Minister, was not part of the case. Our position, however, has not changed with regard to situations which would involve interference to radiocommunications. The various sections of the Radio Act and the Radio Regulations could be applied, including suspensions, restricted hours of operation, etc. Also, our position of classifying certain devices as non-radio apparatus and therefore offering no protection has remained unchanged. We still offer technical advice to repair technicians and are working with equipment manufacturers to promote improved design techniques at the production stage.

"However, this case does raise some interesting points, the most important being that despite federal, provincial or municipal laws or by-laws, citizens still have recourse to the civil courts if they feel their rights or lifestyle is threatened by another person's behavior. The most common area seems to be situations classified as 'nuisance' and I suppose the legal interpretation of this can encompass any number of circumstances. "With this in mind, I can only stress what I have said before: As amateurs, you must live in neighbourhoods surrounded by people who may not share your enthusiasm for 'ham radio.' They have houses filled with all sorts of devices, many of which can be adversely affected by the RF energy you place into the air as you pursue your hobby. Therefore, regardless of how well your equipment performs, it is still your responsibility as a resident of the community to ensure that it does not affect people around you. I cannot stress too much the importance of good public relations for yourself and 'ham radio' in general. Sometimes you will not be able to please everyone, but if you can maintain a constructive environment, at least the possibility of a court case is less likely. In today's society of individual rights, many of our old thoughts about 'a man's home is his castle' must change and our actions along with them. In fact, we can't even refer to it as a *man's* home without raising someone's hackles! Perhaps the best way to approach this type of situation is to realize that you can affect others, and because of this you should go 'the extra mile' to keep harmony in the house.

"On the other side, don't feel that we have abandoned you. The DOC will continue to assist you as amateurs within the legal boundaries of the Radio Act and the Radio Regulations. You will not be unfairly restricted in the pursuit of your hobby and we will continue to rely on your support and cooperation to resolve any problems which might arise."

SECTION MANAGER ELECTION NOTICE

To all CRRL members in the Ontario Section: You are hereby solicited for nominating petitions pursuant to an election for Section Manager. Name of the incumbent appears on page 8 of this *QST*.

A petition, to be valid, must carry the signatures of five or more Full members of the League residing in the Ontario Section. It is advisable to have more than five signatures. Photocopied signatures are not acceptable. Signatures must be on the petition.

Petition forms, FSD-129-C, are available from the CRRL Headquarters office in London, Ontario, but are not required. The following form is acceptable:

(Place and date)
The CRRL Secretary
Box 7009, Station E
London, ON N5Y 4J9

We, the undersigned Full members residing in the Ontario Section, hereby nominate ... (Name and call sign) as Section Manager for this Section for the next two-year term of office.
... (Signatures and call signs) ... (Addresses including postal codes)

A Section Manager must be a resident of his or her Section and a licensed radio amateur holding a Canadian Amateur Certificate or higher, and have been a CRRL Full member for a continuous term of two years at a time of nomination. Petitions will be received at the CRRL Headquarters office until 1600 EST 1986 December 05. If only one valid petition is received by that time, the person nominated will be declared elected. If more than one valid petition is received, a balloted election will take place. Ballots will be mailed from CRRL Headquarters on or before 1987 January 02. Returns will be counted after 1987 February 20. A Section Manager elected as a result of these procedures will begin a two-year term of office on 1987 April 01.

If no valid petition is received, the Ontario Section will be resolicited in 1987 April *QST*.

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

Harry MacLean, VE3GRO
CRRL Secretary

CRRL NOTES

☐ A reminder: There will be a modest increase in CRRL membership dues, the first in five years, effective 1987 January 01. Regular membership (Full or Associate) will cost $39 for one year, $75 for two years and $105 for three years. Student or Senior membership (Full or Associate) will cost $36 for one year, $69 for two years and $96 for three years. Of course, you can beat the dues increase by renewing or extending your membership early. Expect an attractive offer in the mail very soon asking you to do just that.

☐ Finally, *Manual de Formation: Certificats de Radioamateur*, the French version of CRRL's *Canadian Amateur Radio Licensing Manual* by Ralph Zbarsky, VE7BTG, is now available. Many thanks to DOC for translating the *Licensing Manual* into French for CRRL as a special World Communications Year project.

☐ Did you know that CRRL has a two-price policy for CRRL, ARRL and RSGB publications? CRRL members can buy these publications at discounts of up to 10%. Purpose of this policy is to encourage amateurs to join CRRL. Please spread the word.

NOTES FROM ALL OVER

☐ TRC-24 (Telecommunications Regulatory Circular 24), the syllabus for DOC Amateur Radio examinations, has been reissued as RIC-24 (Radio Information Circular 24). The new circular includes information on examination fees, no regulations test for the Advanced Certificate and the use of attestation in place of a DOC-administered Morse code test. *It does not obsolete the information in TRC-24.* (DOC asked us to make this clear so they won't get a run on their limited supply of RIC-24. Please be gentle with them.)

☐ Here are the Amateur Radio statistics as of 1986 April 27—an increase of 137 amateur licences from March to April!

Prov	*Amateur*	*Repeater*
BC	3970	84
AB	1947	43
SK	770	26
MB	800	18
ON	8758	174
PQ	4001	144
NB	693	24
NS	1105	28
PEI	201	4
NF/Lab	480	6
YT	59	2
NT	86	3
Total	22,870	556

YL News and Views

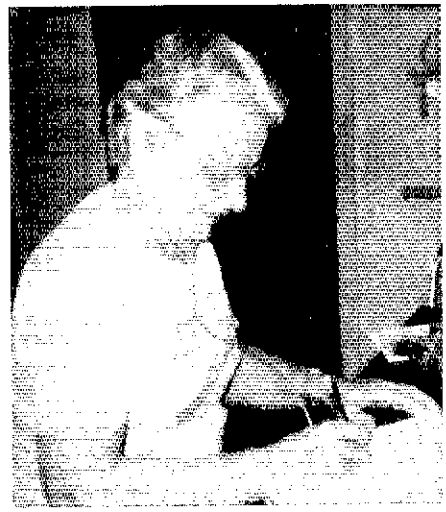
Conducted By Joan Gibson, KG1F
RR 1, Box 1465, Waterbury, VT 05676

Rose Ellen Bills, N2RE, Silent Key

Last November, at the WRONE luncheon in Nashua, New Hampshire, a tall, snow-haired YL came to the table where I was sitting and introduced herself. She reached out, took my hands in hers, and wished me well in my new role as editor of YL News and Views. Today, I am able to recall her gentle and warm manner vividly. I can still feel the energy and intense closeness of our brief meeting and conversation. Instinctively, I sensed that I had met someone special and that I was the lucky one! The lady was Rose Ellen Bills, N2RE. We made plans to meet again soon. She died on June 18.

Although I had known this special woman for less than a year, I was aware that she had a deep commitment to Amateur Radio and that she had made significant contributions. How important those contributions were and how much she was appreciated and loved by the Amateur Radio community became obvious to me during the first few weeks following her death. YLs and OMs from all parts of the country have written or telephoned to tell me of her death. Those who contacted me took a moment to say something about Rose Ellen, their relationship with her, what her life meant to them and what she did for the radio community. She touched so many lives.

Rose Ellen Bills was a person who strived for the top and did not settle for the halfway marker. Her sister, Florence Godfrey, of Sicklerville, New Jersey, recalls that Rose Ellen first became interested in Amateur Radio when she was a secretary with RCA in Cherry Hill, New Jersey. The company offered code and theory lessons, and she entered the course—the only woman to do so.



Rose Ellen Bills, N2RE, became a Silent Key in June. Her enthusiastic devotion to Amateur Radio served as an inspiration to many.

Morse code was no problem for a highly skilled secretary quite used to copying high-speed dictation! Her new hobby and the friends she made became very important to her. She tackled Amateur Radio with full force and got out of it all it had to offer, just as she did everything in life.

After her marriage to W2CDZ, she moved to Pennsville, New Jersey and became employed by Dupont. She was the first YL in her district to receive the Extra Class license. Being on the air wasn't enough for Rose Ellen. She wanted to tell the world about Amateur Radio, so she joined the Toastmistress Club. Through this group she learned to prepare and deliver presentations about her favorite subject—women in Amateur Radio. Her new talent as a public speaker was soon recognized, and she was invited to address amateurs at several national and regional Amateur Radio conventions.

Rose Ellen was a Life member of ARRL and assistant to the ARRL Atlantic Division Director. She belonged to the Association of Wilmington Amateur Radio Education, and was an associate member of the Ohio Buckeye Belles, the Old Timers Club and the Ontario Trilliums. As a member of the Penn Jersey Young Ladies group, she was working diligently on plans for the miniconvention scheduled for Hershey, Pennsylvania in April 1987 at the time of her death. N2RE was also PJYL's secretary and she founded the group's newsletter, *QRV*. She served as the secretary and treasurer of SAYLARC, and was a member of Society of Wireless Pioneers. N2RE was the only member of YLRL to have held all offices by the time she became president in 1984.

For all her devotion to the many activities of Amateur Radio she nonetheless had time to give to her church and belong to the American Association of Retired Persons (AARP), the Blood Bank of Delaware and the Salem County Stompers, a square-dance club.

My one brief moment with Rose Ellen in Nashua months ago now feels like only yesterday. Her words of encouragement and support remain with me always, and I am a richer person for having met her. Her light has not died; the flame has become a glow.

YL ANNIVERSARY PARTY

CW: 1400Z Oct 15, 1986-0200Z Oct 17, 1986
SSB: 1400Z Oct 29, 1986-0200Z Oct 31, 1986

Eligibility: All licensed women operators throughout the world are invited to participate. YLRL members only are eligible for the cup awards. Nonmembers will receive certificates. Only YLRL members are eligible for the Corcoran and Hager awards.

Procedure: Call "CQ YL."

Operation: All bands may be used. No cross-band operation. Net contacts, repeater contacts and contacts with OMs do not count. A station may be counted only once in each contest for credit. Participants may operate only 24 hours of the 36 hours of the contest. Operating breaks must be indicated in the log.

Exchange: Station worked, QSO number, RS(T) and country/state/province. Entries in log must also show time, band, date, transmitter power and operating breaks.

Scoring:

A) CW and SSB will be scored as separate contests. Submit separate logs for each contest.

B) All YLs within the United States (Hawaii and Alaska included) or within a Canadian province: Score 1 point for each QSO with another station located in a state or province. Score 2 points for each contact with a station not located within a state or province (ie, DX). Definition of DX: all stations not located within a state or province. DX YLs shall score 2 points for each contact with a station located in a state or province; 2 points for each contact with a station on another continent and 1 point for each contact with a station on their own continent. Multiply the number of contact points by the total number of different states/provinces/countries worked.

C) Contestants running 150 W or less on CW and 300-W PEP or less on SSB, at all times, may multiply the results of B by 1.25 (low-power multiplier).

Logs: All logs must show the state/province/or country to qualify for awards. Please print or type. Logs must be signed by the operator, and no logs will be returned. Remember to file separate logs for each contest. Logs must show claimed score, be postmarked by November 15, 1986, and be received by December 13, 1986 or they will be disqualified. Send logs to Mary Lou Brown, NM7N, 504 Channel View Dr, Anacortes, WA 98221, USA.

Duplicates: For each duplicate contact that is removed from the log by the vice president, a penalty of 3 additional and equal contacts will be exacted.

Awards:

A) The YLAP cups will be awarded for both the NA-YL and the DX-YL for the highest CW and SSB scores. Only YLRL members are eligible to receive cups. If the winner of either contest is a non-YLRL member, a first-place certificate will be awarded. If a DX-YL does not wish to receive a cup because of duty charges a first-place certificate may be awarded. Second-and third-place certificates will be awarded for each contest. The highest CW and phone scores in each state, province and country will receive a certificate. Certificates for the highest score in a state, province or country will be awarded only if there are at least two logs submitted from the district or country. Also, there must be a minimum of at least 10 contacts in the log.

B) Corcoran Award: a plaque given for the highest combined CW and phone score for YLRL members within a state or province.

C) Hager Award: a plaque given for the highest combined CW and phone score from North and Central America, including the Greater and Lesser Antilles; for YLRL DX members only. A duplicate plaque given for the highest combined CW and phone score from any other part of the world; for YLRL DX members only.

Suggested Frequencies: CW—3.540-3.570, 7.040-7.070, 14.040-14.070, 21.180-21.210, 28.180-28.210 MHz; SSB—3.940-3.970, 7.240-7.270, 14.280-14.310, 21.380-21.410, 28.500-28.610 MHz. Note: Since band allocations in other countries are often different than in the US, North American YLs should look for DX YLs in other parts of the bands, especially on 40 and 80 meters.

IARU News

Conducted By Richard L. Baldwin, W1RU
HC 60, Box 60, Waldoboro, ME 04572

Who Reads IARU News?

Not the majority of ARRL members, according to a recent survey by ARRL New England Division Director Tom Frenaye, K1KI. Tom's survey took an exhaustive look at the columns in *QST*, noting what percentage of New England Division members read the various columns, and further classifying the readership by age, class of license and years licensed, among other criteria. IARU wasn't quite at the bottom of the list in popularity, but it sure was a long way from the top! The most striking statistic, at least to this writer, was that those who found IARU News most interesting were those who held higher grades of license and had been licensed for longer periods of time.

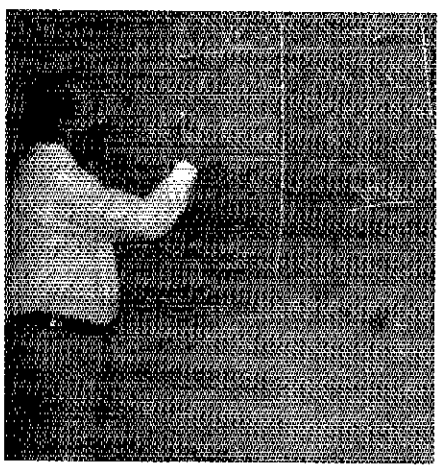
Such a result isn't entirely unexpected, for a couple of reasons. For one thing, those who hold the higher grades of license and have been licensed for longer periods of time perhaps feel that they have a greater stake in Amateur Radio and therefore are more concerned about what is happening on the international scene and how we are faring with international telecommunications conferences. For another thing, since this writer is what you might call a senior citizen ("over the hill" is a term I've heard bandied about), he may have a pedantic style of writing that turns off our younger readers. Sorry about that!

Well, surveys are surveys, and their conclusions are often quite instructive. Perhaps we will be able to liven up IARU News a bit and embrace (that's a figure of speech, dear) a wider readership by the time K1KI takes another of his surveys. Yes, surveys are surveys, and you can take them or leave them, but it's sort of difficult to ignore a letter from a *QST* reader that I received at almost the same time as the results of the survey. That fellow said he had been reading *QST* for five years, and he didn't have any idea of what IARU was all about—would I please explain?

In a nutshell, IARU has a number of objectives, quite carefully spelled out in its Constitution. Although we have addressed these one by one in past IARU News columns, we'll repeat the exercise in the months ahead. Hopefully, those of you who already know what IARU is all about won't be too bored, and others of you will become more acquainted with our hopes and aspirations.

So much for that. A photograph is worth 395 words anytime, so here are some photographs of the students and staff taking part in the second annual USTTI course in Amateur Radio Administration, held at Newington in early June. Maybe the photos caught your eye when you were flipping through the pages of *QST* and conned you into reading the preceding paragraphs.

Participants in the USTTI course in Amateur Radio Administration, Newington, June 1986. Left to right are Richard L. Baldwin, W1RU, instructor; Pricilla D. Franciso, Philippines; Dr George K. Tettah, Ghana; Rudolph Alexander Rowe, Jamaica; Pepe Vakalahi, Tonga; and Peter John Dewhurst, J73PD, Dominica.



Alberto Shaio, HK3DEU, Secretary of IARU Region 2, lectures on some aspects of Amateur Radio in the Americas, particularly in the Spanish-speaking countries.

A classroom scene. Shown (l-r) are Peter Dewhurst, George Tetteh, Pepe Vakalahi and Pricilla Francisco. Rudy Rowe was out of range of the camera, to the right.

George Tetteh and Pricilla Francisco try out a lab experiment on 10 GHz under the guidance of Assistant *QST* Technical Editor Chuck Hutchinson, K8CH.

QST Profiles

Conducted By Paula McKnight, N1DNB
Editorial Assistant, ARRL

Paul Horowitz, W1HFA: "E.T. Phone Harvard"

A small, purple sign hangs above an office computer at Oak Ridge Observatory in Harvard, Massachusetts. The sign shows a bony finger pointing at the computer and a request—"E.T., Phone Harvard." If extraterrestrials ever want to ragchew, Extra Class ham and Harvard University physics professor Paul Horowitz, W1HFA, hopes to be ready. Paul's current work involves searching for extraterrestrial intelligence through Project META, or Megachannel ExtraTerrestrial Assay. It is funded by the Planetary Society, a public membership space interest group that has over 100,000 members, many of them radio amateurs.

Searching for the "ultimate QSO," Paul Horowitz, W1HFA, of Project META, scans the skies for extraterrestrial signals using an 85-ft communications dish that will eventually cover 200 billion of the 400 billion stars in the galaxy.

Paul, tell us more about Project META.

It's a full-time search for radio signals from advanced civilizations "out there," using the 85-foot radiotelescope dish at Harvard, Massachusetts. The overall system is an 8.4-million-channel receiver (simultaneous, not sequentially scanned), with 400-kHz bandwidth. Also we've got various archiving schemes, in case we luck out with the ultimate DX. At microwave frequencies you could communicate almost anywhere in the galaxy with current technology; META has the power to receive a realistic signal from any of the 400 billion stars in the galaxy. Our search for extraterrestrial signals is the most powerful on earth.

What is the likelihood of a ham tuning across the bands intercepting an extraterrestrial message?

We don't know the prevalence of extraterrestrial civilizations, or indeed if there are any at all! So it's impossible to calculate any meaningful odds of the reception of a purposeful signal. I think hams have a chance, but I suspect you've got a much better chance if you own a 100-foot dish and some sophisticated signal-recognition hardware. Still, history has shown that persistence often pays off handsomely, so I wouldn't discourage anyone from trying anything in this business that makes any sense at all.

What about Amateur Radio first attracted you?

I got interested in ham radio when I was a kid of seven years old, following the example of my brother Pete (then W2LSJ). He taught me the ropes, and in 1951 I got my Novice ticket, setting a brief record as the youngest ham. The Novice license was new and opened up ham radio to toddlers, almost, for the first time. The idea that you could zigzag a length of double-cotton-covered wire around some wooden sticks, solder it together with some resistors, condensers (they didn't have "capacitors" back then) and other doodads, and of course a 6V6, and then talk to someone far away, was, and still is, miraculous. That's still the thrill of it for me, that eerie hollow crystal-filtered sound of hand-formed CW winning out over the atmospherics, going halfway around the world in response to your own handformed call.

Describe some of your early Amateur Radio projects.

We built those wonderful little projects from the *ARRL Handbook* and from *QST*—first the amplifier with the wooden sticks, something with an 807, then one with a pair of 6L6s, then really sophisticated stuff with 6146s, and finally a grounded-grid kW using one of those 304TL radar modulator tubes. I remember our curious little Lysco crystal exciter, replaced by a homebuilt VFO that was built like a Sherman tank but always drifted (as did our beloved HQ-129X). SSB exciters, the "filter" method, using those surplus crystals you could open up and rub pencil lead on, to move them around in frequency. Keyers—the original "Ultimatic" that used a zillion relays, then the all-tube version, about eight 12AU7s, I recall.

Who are some hams that encouraged you?

My brother, Pete, who's six years older, taught me code, electronics, how to use that wonderful "DCC" wire, how to make holes, solder things, call CQ—the works.

When I showed up at ARRL HQ with the first of what turned out to be a series of automatic keyers, George Grammer's eyebrows went up and down. He patted me on the back and gave me a few "attaboys."

Do you explore the Amateur Radio microwave spectrum?

META is the ultimate exploration, I suppose, though it isn't ham radio. If it succeeds, the hams will get into it quickly enough, I suspect! I've fiddled with some X-band communication schemes, too. But no real hamming up there.

How has Amateur Radio helped you in your career?

Ham radio gave me the opportunity to fool around at a formative age, and that really got me going in the direction of experimental science, which is now my profession. It also got me hooked on electronics, still my favorite hobby, which led to my first book (*The Art of Electronics*, now in 10 printings and five languages), a popular course I started at Harvard (Laboratory Electronics) and numerous little inventions, mostly photographic, a half dozen or so of which are in production. I don't know what I'd be doing if I hadn't gotten into ham radio as a kid, but it wouldn't be what I'm doing now.

What do you see in the future of Amateur Radio?

"It's difficult to predict, especially the future." My guess is that you'll see ham radio evolve in several directions, perhaps the most spectacular being satellite- or repeater-based worldwide automated message handling, with entry via VHF hand-held sets. There will also be more experimentation in wideband communication schemes using millimeter wave and perhaps optical carriers, both for line-of-sight and satellite communications. Computers will get increasingly into the act, with the distinction between hams and computer hackers becoming somewhat blurred. But, in spite of all this technological glitter, my guess is that good old HF over-the-horizon communication will be the glue that holds ham radio together. That magic of working DX, or ragchewing with someone 2000 miles away, isn't like anything else on earth, and the only way you can do it is to become a ham.

Silent Keys

Administered By Nancy A. Slipski

It is with deep regret that we record the passing of these amateurs:

N1BRP, Joseph I. Bluhm, South Easton, MA
WA1DLL, Addison E. Wilson, Brewster, MA
W1EZI, Irvin R. A. Cumming, Naples, ME
W1GAG, Carroll O. Peacor, Dover Foxcroft, ME
*W1HV, Robert L. Shea, New Haven, CT
WA1JQN, Lester W. Munsey, Dresden, ME
KA1JVH, Louis Kondos, Gardiner, ME
W1KCN, D. Walker Cheney, Brimfield, MA
WA1KLF, Edgar E. Lizotte, Cumberland, RI
W1KLY, C. H. Hastings, Groton, MA
W1LUD, John W. Farr, Littleton, NH
K1UVR, Eric Liebler, Clinton, CT
K1VVX, Frank Bartoli, Sr., Norwalk, CT
K1YSL, George W. Johnson, Methuen, MA
W1ZJB, Wyatt O. Ingalls, Lincolnville, ME
WA1ZXY, Chester M. Hushak, Enfield, CT
N2BHQ, William Wolven, Saugerties, NY
N2EKK, Robert S. Haviland, Manorville, NY
W2IGJ, Norma C. Olsen, Leesburg, FL
WA3BOS, John R. Holliday, Murrysville, PA
*W3HJB, Donald M. O'Brien, Hamilton Square, NJ
W3IBM, Edgar A. Weimer, Jr., Harrisburg, PA
WA3OMT, Dawson H. Mac Williams, Baltimore, MD
W3OSZ, John Wood, Easton, MD
W3OX, Anthony Maglioli, Bakerstown, PA
W3UCS, Miller Young, Summerville, PA
K3YQK, William Hutchins, Bryn Mawr, PA
WA4BXH, Dennis C. Horner, Bruceton, TN
K4DUZ, Albert C. Gifford, Bradenton, FL
WA4EPR, Cecil L. Rushing, Kernersville, NC
WD4FVY, Donald T. White, Largo, FL
WA4GDS, Francis G. Haines, Wilmington, NC
WB4GMA, James H. Retallick, Tampa, FL
WD4GQX, Charles W. Russell, Orlando, FL
W4GTH, David P. Tobin, Virginia Beach, VA
WB4HZK, Richard H. Dowst, Leisure City, FL
WB4KVG, James A. Griner, Savannah, GA
W4LLQ, John A. Malley, Virginia Beach, VA
W4MAY, Wyman H. Bailey, Virginia Beach, VA
WD4MLQ, James B. Shannon, Spring Hill, FL
W4PAT, Laurence Crooker, Portland, ME
WD4PIC, Robert L. Harrington, Jacksonville, FL
WA4TMT, Donald F. Smith, Largo, FL
W4TPU, Wayne B. Robinson, Nashville, TN
WB4WPW, Arthur E. Kimberly, Vienna, VA
W4YEJ, Laurence B. David, Worthington, OH
W5ESV, B. F. McCoy, Houston, TX
WD5FKY, Ralph C. Martin, Denton, TX
N5GMW, John Calton, Monroe, LA
W5GQZ, Billie B. McWhorter, Monroe, LA
KE5HQ, Cephus L. Freeman, West Monroe, LA
WB5JJO, Joe Dowlen, Sandia, TX
WA5LYY, Fred H. Prestage, Dallas, TX
KA5MJF, Mary Kassel, Plainview, TX
KA5NMC, Opal S. Cowden, Okmulgee, OK
W5NRU, H. F. Williams, Ellisville, MS
W5STS, Richard H. Karl, Deming, NM
WB5SYQ, Cecil R Sodd, Monroe, LA
W5TMG, William Murray, Jr., Broken Arrow, OK
*W5VE, Leonard O. Dansby, San Antonio, TX
W5YWD, Robert D. Sparks, Alamogordo, NM
K6BIF, William H. Klieman, Meadview, AZ
KH6BVS, Lawrence Villados, Pearl City, HI
W6CG, Carl F. Schultz, Anaheim, CA
K6CQ, Marson B. Hull, Los Gatos, CA
WB6FBN, John B. Dolman, Sparks, NV
WA6FNC, Lyman Watts, San Francisco, CA
W6GAO, Joseph H. Prien, Oakdale, CA
W6GEZ, William J. Wistuber, North Hollywood, CA
NH6G, Roger H. Parker, Honolulu, HI
W6IYU, Elber M. Shideler, Ventura, CA
N6KWM, David B. Lannes, Visalia, CA
N6LCZ, Jack E. Patrick, Redlands, CA
W6NBZ, Robert L. Richards, Sebastopol, CA
WB6TLF, Warren A. Root, Hacienda Heights, CA
WB6YPW, Allan E. Bayley, Carlshad, CA
WB7DZW, R V McGuire, Apache, AZ
W7FHB, Roger J. Houglum, Eugene, OR
W7YPZ, Earl Remsen, La Conner, WA
W7ZJI, Glen F. Harding, Ogden, UT
W8BPQ, Aidan Schaefer, Southfield, MI
W8BYE, Joseph E. Drum, Maysville, OH
W8CAA, Howard R. Stevenson, Mt Clemens, MI
W8DKM, Arthur C. Lawton, Steubenville, OH
*W8JLD, Warren Decker, Remus, MI
WB8MAY, Ernest H. Kuhlins, Massillon, OH
W8MD, Edwin J. Krook, Grand Rapids, MI
KA8MHN, Albert R. Young, Wheeling, WV
K8PBK, Harry Kauffman, Cincinnati, OH
WB8QXV, Paul V Maynard, Chesterland, OH
W8WSO, Hobart L. Smith, Fairfield, OH
*WA8ZSK, Eugene M. Flynn, Pleasantville, OH
WD9CRX, John D. Vaughan, Belleville, IL
W9EET, Gordon H. Starr, Elk Grove Village, IL
W9NEW, Sidney W. DeLong, East Alton, IL
W9YMV, LeRoy T. Waggoner, Indianapolis, IN
W0CVX, Stephen F. Wielgus, Columbus, NE
WD0HUA, Jack Pfister, Joplin, MO
WA0SOE, Hugh Robb, Belleville, KS
W0WYH, Wayne L. Besch, Lincoln, NE
VE2WH, Barney O'Brien, Greenfield Park, PQ
VE3EI, Dwight Field, Forest, ON
VE3EQG, Robert L. Miller, North Bay, ON
VE3EV, Arthur N. Lecheminant, Brockville, ON
VE3GC, C. Gordon Ruth, London, ON
VE3JTW, George Fennell, Hamilton, ON
VE3JUD, Oscar R. Smith, Burlington, ON
VE3LK, John Harris, Toronto, ON
VE3MFU, Clifford A. Lockwood, Apsley, ON
VE3OC, Tom Yates, St Catharines, ON
VE3TX, James Lou Stonehouse, Havelock, ON
VE4VG, Peter Vic Grant, Petersfield, MB
VE4VL, Barney Lemieux, Dauphin, MB
HR5RCA, Rodulfo Castejon, Copan Ruinas, Honduras

*Life Member, ARRL

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.

Note: 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*.

50 Years Ago

October 1936

Though restrictions are, in general, contrary to the basic freedom of amateur radio operation, Editor Warner believes that acceptance of a few would improve our overall capability and enjoyment. E.g., putting beginners in their own "training ground" band segment for the first year, forbidding local use of DX bands, and reducing power to the point necessary only to maintain reliable contact.

George Grammer's medium-power transmitter design covers an antenna coupling filter as well as the exciter and RK36 amplifier.

On the principle that $1 spent in the antenna is worth several spent on the rig, W9EFK built an efficient vertical for 7- and 14-Mc. operation, complete with a tuning system.

Clinton B. DeSoto's fascinating story of amateur radio history, *Two Hundred Meters and Down*, has now been published by the League. Twenty chapters detail progress in technical areas, developments in the regulatory field, and social problems such as the phone-c.w. conflict.

Paul Zottu of RCA, attempting to get more power output on u.h.f. than push-pull or parallel can provide, suggests multiple oscillators in radial fashion feeding a common tank in the center. The "pulling" effect keeps 'em all on the same frequency.

Starting with a 7-Mc. crystal, W1QP's transmitter ends up with 200 watts on 5 meters. The haywire lashup, in contrast with most *QST* presentations, perhaps is the mark of the true experimenter!

The League's request to F.C.C. to expand the 75-meter voice band to 3850-4000 kc. caused a rumpus among c.w. diehards, who flooded the Commission with opposing petitions. The Board of Directors decided to withdraw its request, "rather than stage a fight against several thousand" of League members.

Secretary Warner wisely adds comment warning of danger ahead if amateurs persist in petitioning Washington on each regulatory matter rather than working within the League structure to obtain the unity so important to our survival.

Those purveyors of high-power tubes, W6UF and W6QHE, demonstrate the flexibility of their 35Ts by using 'em as triode rectifiers in a power supply as well as oscillator through amplifiers in a kilowatt rig on any band from 60 Mc. down.

W9ERU copied 52.7 w.p.m. for two minutes, with only one error, to win the first truly amateur code speed competition at the Central Division Convention in Chicago.

The fourth Field Day was bigger than ever, with the York Radio Club topping group scores with an amazing 143 QSOs, and W5FHM taking individual honors.

W1DF's "high-performance" superhet in last April's *QST* was so popular he's added an outboard noise silencer and crystal filter.

25 Years Ago

October 1961

Senator Barry Goldwater, ex-6BPI, has introduced a bill into the Congress to establish a policy of reciprocal licencing. Some countries issue tickets to visiting U.S. hams as a courtesy, but most refuse because our nation's rules prohibit alien activity.

A tear-out card in this issue is designed for posting at the operating position, providing ready reference on what bands are available for what modes, a list of banned DX countries, third-party-traffic agreements, and such.

W9EVI describes the monumental efforts of a group of hams determined to overcome the hazards of reaching Malpelo Island, a big rock near Colombia, and thus activating a new country on the DXCC list.

Transistors need only low voltages, but good regulation is highly desirable. W3RXI describes a unit of modest cost which is both regulated and variable.

Compiling results of the 1961 DX fray has now been completed, showing W3MLW operating W3FCR in the top single-op spot, and seven operators at W3MSK amassing a total of 111 countries worked.

Two-million watts? That's what the new NAA installation at Cutler, Maine uses for transmitting info to the Navy's fleet worldwide. The antenna is one-inch solid copper wire!

Keeping an RTTY signal in tune often requires one hand constantly on the dial. K1RYY eliminates this problem with silicon capacitors working through a discriminator.

Telegraphy artist KH6IJ describes a semi-automatic key he built years ago when "I could not afford a real bug." A Sears jigsaw blade is the vibrator for dots.

W1ICP parallels two dipoles (half-waves for 80 and 40 constructed of open-wire TV line) to achieve operation on 15 as well. A filter reduces potential harmonic radiation.

W1HDQ evaluates the "big wheel" 2-meter array of W1IJD and W1FVY. The stacked bays provide excellent gain, but since there is no directivity, unnecessary QRM can be caused.

Hams of the fair sex again furnished communications for 97 contestants in the coast-to-coast air race better known as the "Powder Puff Derby."

The tedium of calling a CQ during a contest is alleviated by W8CJN's robot wheel: light falling through holes in a cardboard "record" actuates a photocell which controls a keying relay.

Widely used in hi-fi amplifiers, the "ultra-linear" circuit has been adapted by W2HTN for plate modulation, reducing distortion and improving regulation.

FCC Chairman Bartley presented the John Gore Award of the Foundation for Amateur Radio to Alexander Burr, K3NKX, for his high standing in his chosen field of physics.

The Lawton-Fort Sill (Oklahoma) Radio Club did a bang-up job of good public relations, especially on TVI matters, and a report on their accomplishments can be a guide for similar projects.—W1RW

In Training

Conducted By John Foss, W7KQW
Training Manager, ARRL

Motivated Instructors Motivate Students—Part 1

The key to successful courses is motivation—that is, student motivation *and* instructor motivation. Granted, the conventional wisdom demands that the instructor motivate the students.

Sure, you say, but what if I don't know how to motivate my students? Relax! You can do it. In fact, you *must* do it. But how?

From the Students' Viewpoint

First, don't underestimate the tension and pressure your students are under from the time the course begins until it ends. All want to pass the FCC exam; some want very, very much to pass. Given the opportunity, they will study as much as necessary—provided they are sufficiently motivated. Your encouragement day by day, in class and out of class, often is the most important factor in maintaining their motivation.

Therefore, compliment each student whenever you honestly can do so; do not dwell on a student's mistakes. Most students are already all too aware of them. Remember: You made plenty of mistakes when you were learning Amateur Radio. Remember, too, that junior-high-school students probably will put into the course effort commensurate with how well they like you, the instructor. A few high-school students also react this way, but, fortunately, most adults put less emphasis on how well they like you personally.

In other words, for adults, the *subject* is the center of attraction, but, for youngsters, the subject is often less important than the teacher. Therefore, it is worthwhile to examine some of the factors—in this case, instructor personality traits—that motivate students to try really hard. Here are some:

1) Knowledge of the subject being taught.
2) Enthusiasm for that subject.
3) Clarity of presentation of the various facets of that subject.
4) Care for and about each individual student.
5) Ability to keep the class discussion on target.
6) Real humility.

If you're not sure you possess these qualities, check with your friends and, especially, your spouse. If you find, heaven forbid, that you don't possess all of them, don't despair! All these qualities can be developed by any conscientious instructor—including *you*. Furthermore, the qualities of being a good instructor can best be developed *while* you are teaching a course.

Becoming a Good Instructor

Developing them, however, requires effort on your part. Your reward for that effort will be a successful course and happy, successful students. Beyond that, perhaps the most exciting result will be that you will have acquired personality assets easily usable and extremely valuable also in fields far removed from Amateur Radio! You'll be able to make excellent use of these assets for the rest of your life, both on your job and in social situations.

Knowledge

Try signing up for a correspondence course in electronics to expand your knowledge. Several excellent home-study courses are available for reasonable fees. (Be sure the correspondence school you select is approved by the National Home Study Council.)

A clear presentation of the facts is important. Bringing the class face-to-face with a good circuit demonstration is even better. *(KU7G photo)*

Enthusiasm

Are you getting bored with Amateur Radio? Spend a bit more time on the air and try a mode of operation you haven't tried before (or haven't used for a long time). Your newly found enthusiasm will rub off onto your students.

Clear Presentations

If your instruction lacks clarity, tape-record several class sessions—or, better yet, videotape them. Play the tape several days later, pretending that you are a student trying to learn the material under discussion. It might become evident to you then precisely where your presentation is unclear (or it might appear that your fears in this respect are unfounded).

Shepherding

If you lack interest in individual students, try spending a bit of time outside of class with *each* student separately and individually. Learn what the student's background and interests are and why he/she is *really* taking the course. Crucial here is the student's perception that (1) you care about him/her as an individual, apart from his/her enrollment in the course, (2) you believe that the student will indeed try hard to succeed, and (3) you, the instructor, are convinced that the student can succeed if he/she does try hard.

Beware in this respect, however, that you don't tell the student that the course is easy. By saying that the course is easy, you create a no-win situation. Should the student succeed, the success will not seem very important, because the course was "easy." Should the student fail—although few, if any, will fail—the effect on the student could be disastrous to his/her self- image: he/she failed at something "easy."

Who's in Control?

Adult students, especially, almost universally will do better if they feel that they, rather than you, control the learning process. They do not want to be treated like children. Therefore, it's a good idea to let them determine how much will be covered in the next class session—rather than, for example, telling them that you will cover the next five topics. Obviously, if you have in the course students of vastly different ages and backgrounds, you cannot let this "independence" trait take over completely.

Staying on Target

If you need help in keeping the discussion on target get a book on managing group discussions and read it. Anyone can learn the techniques; they are not esoteric. Few, however, are born with knowledge of these techniques and the ability to use them. The only prerequisite to learning them is to realize you don't already know them. This category includes the overwhelming majority of first-time instructors. They must acquire the tools of the trade, and this certainly is one of them.

Servanthood

Do you lack humility? Then try to act humble, and suddenly you will discover you've come a long way toward acquiring this trait. For example, a student questions the validity of an explanation or statement you make in class. Don't become angry. Admit that you don't know everything about the subject and that you wish you knew more. But add that you have thought about the matter under question, and you believe your explanation or statement to be valid. Then, if reasonably possible, explain briefly why you believe it to be so. Try not to make the questioner look foolish; after all, he/she has feelings too! Remember that you are the students' servant, not their master. (Of course, occasionally you will have to exert authority to maintain discipline, but seldom is this the time.)

There's More to Come

The story isn't over yet! This column appears every other month, so check back in December. We'll take a further look at the key importance of motivation in conducting a successful Amateur Radio course. QST

Strays

***QST* congratulates...**

☐ Doug Smith, KE4KP, of Montgomery, Alabama on receiving the Army Achievement Medal.

☐ E. R. "Chip" Angle, N6CA, of Lomita, California, for winning the 1985 ARRL Technical Excellence Award for the best *QST* technical article.

Conducted By
Vern "Rip" Riportella, WA2LQQ
PO Box 177, Warwick, NY 10990

Birth of a New OSCAR: First All-Japanese Project Debuts

The Japanese Amateur Space Program has produced its first successful all-Japanese satellite with the flawless launch and initial operation of Fuji-OSCAR 12. The new satellite was known as JAS-1 prior to launch. A joint project of the Japan Amateur Radio League (JARL), Japan AMSAT (JAMSAT), Nippon Electric Company (NEC) and the Japanese National Space Agency (NASDA), the newest OSCAR is the result of a half decade of planning. The overall specifications of FO-12 were provided in this column in June 1986. Now we report on the launch and initial operation of FO-12. Just locating FO-12 after launch turned into one of the most intriguing episodes in memory!

The launch from southern Japan occurred at 20:45 UTC August 12. At precisely 21:47:07 UTC, FO-12 was born. At the exact moment of deployment from the launcher, the FO-12 435.795-MHz beacon was activated as planned over South America. It was immediately heard by CE3GA at Santiago University and by Junior DeCastro, PY2BJO, in Sao Paulo. Twenty minutes later, amateurs in Europe got their first look at FO-12.

The AMSAT Launch Information Network Service (ALINS), organized for the FO-12 launch, was by all accounts the best ever provided for an OSCAR launch. A hybrid network of radio and telephone links established a network spanning the entire globe. Few, if any, areas were left without a live network feed providing information on the progress of the launch as it happened. JA1ANG in Tokyo provided countdown coverage as the H1 vehicle was launched, and he described progress of the launch. CE3GA in Santiago provided live pickup of the first FO-12 telemetry signals, which were relayed to W3IWI on 15 meters and then to the network. G3YJO provided similar telemetry coverage when FO-12 appeared over London. WØRPK provided continuity and background information as network control from Iowa. Transmitting the live telephone ALINS audio on the HF bands were WA3NAN, WA2LQQ, W6SP, WØRPK, W6GC, ZS6AKV and W3IWI with a bi-directional link on 21.390 to South America.

Initial reports on Mode JA indicated transponder performance was excellent. The receiver was superbly sensitive. NK6K reported satisfactory results with 1 watt to his uplink antenna. He suggested FO-12 could probably be worked with an "omni" if one cared to use a bit more RF at the antenna.

Most transponder users reported very deep fades on the downlink. This is due to the random spinning of the satellite in its early life. The tumbling will dampen out in a few weeks due to the passive stabilization used into FO-12. Like previous OSCARs, FO-12 has a simple bar magnet to dampen tumbling. The interaction with the geomagnetic field produces a small but persistent torque which reduces the tumbling motion of the spacecraft.

Initial tracking of FO-12 immediately after deployment was accomplished simply and accurately by adjusting the prelaunch estimates to account for the 14-minute delay of the launch from 2031 to 2045 UTC on August 12. Using these adjusted prelaunch estimates, amateurs tracked FO-12 easily.

Curiously, however, when NASA's first tracking data for FO-12 became available and was loaded into computerized satellite-tracking programs, the results were disappointing; they were off target by an uncharacteristically large degree. The adjusted prelaunch values continued to be the best available numbers until August 15. By then, it began to appear that NASA had mislabeled the satellites launched by the Japanese H1 vehicle. NASA was calling object 16908 the Experimental Geodetic Payload (EGP); 16909 was called JAS-1 and 16910 was labeled the rocket body. But there was accumulating evidence that 16908 might be JAS-1 (FO-12) and not EGP! This evidence included numerous observations by dozens of experienced satellite trackers, including NK6K, WØRPK, WA3WBU, W2RS and KA9Q.

In 1978, AMSAT-OSCAR 8 was confused with another object launched with it. AMSAT helped the authorities distinguish AO-8. In 1981, AMSAT helped sort out several of the Soviet RS birds that were launched in a flock of six (RS-3 through 8).

Table 1
Revised Orbital Elements†

Reference Epoch	86 230.26525652
Element Set	6
Inclination	50.0097
Right Ascension of Ascending Node (RAAN)	236.4938
Eccentricity	0.0011125
Argument of Perigee	233.7423
Mean Anomoly	353.0984
Mean Motion	12.44393428
Revolution	67
Drag (Decay rate)	−3.9e−07

†As of Aug 19, 1986

A possible answer to the puzzle of which object was really FO-12 came August 15. It came in two parts. First, a NASA employee at the Goddard Space Flight Center explained how the satellites get labeled. Normally, North American Air Defense (NORAD) labels the new spacecraft in the order in which they are observed. Thus, 16908 would have been the first observed by NORAD's radar. NORAD knew from NASDA, the Japanese launch authority, the first object to be deployed was EGP. So NORAD expected the first object spotted would be EGP. Thus, EGP became the name of the first object NORAD actually observed in the group.

Was it really EGP?

A second revelation came when Miki, JR1SWB, pointed out that JAS-1 was deployed downward or backwards. This meant it would have had a slightly lower altitude and thus a slightly higher mean motion than EGP and the rocket's second stage. Since JAS-1 had a higher mean motion, it had a higher angular velocity. Had it shown up first on NORAD radar even though it was deployed after EGP? It seemed true since NASA's revised data for object 16908 soon was found to fit almost exactly with precise radio observations of FO-12.

Then, on August 16, W3IWI reported that the EGP experimenters were getting excellent laser ranging from EGP and had fixed its time and position precisely. (EGP is loaded with mirrors and laser retro-reflectors specifically designed for this type of ranging and orbit determination.) The next event was a bombshell for the earlier hypothesis that FO-12 was actually 16908. W3IWI reported the EGP people had virtually a perfect fit between the NASA-supplied tracking data for 16908 and the actual, super-precise EGP laser ranging determinations! Did this mean that 16908 was really EGP and not FO-12 after all?

But how could the excellent fit of 16908 with the radio observations of FO-12 be accounted for? Objects 16909 and 16910 were thousands of miles away, so neither of them could possibly be FO-12. The dilemma was essentially this. Everyone knew precisely where 16908 was. But the EGP people had excellent data to show 16908 was actually EGP. On the other hand, AMSAT had excellent data to show 16908 was FO-12! How could both be correct?

KA9Q and this conductor concluded the most reasonable explanation that fit the observations was that 16908 was actually EGP after all, but that neither 16909 nor 16910 was FO-12. Furthermore, FO-12 had to be in the close vicinity of EGP. Perhaps it just hadn't been "seen" yet. Maybe it had not yet been cataloged by NORAD or NASA. To test this hypothesis, KA9Q ran another precise Doppler curve to detect TCA, the exact Time of Closest Approach. He calculated FO-12 was leading 16908 by 5 seconds at 08:37 UTC on 17 August. It was then that the big light bulb went on in several heads.

In W3IWI's EGP report, he mentioned the EGP experimenters had visually observed EGP quite easily. Significantly, they noted a small object leading EGP by about 3 seconds. Could it have been FO-12? The data seemed to suggest so. For the present, AMSAT believes object 16908 is in fact EGP to a high degree of certainty. Objects 16909 and 16910 are the launcher second stage and probably some debris from it. Certainly neither is FO-12. FO-12 is probably uncataloged at present, and is likely leading EGP by perhaps

(continued on page 89)

Affiliated Clubs in Action

Conducted By Leo D. Kluger, WB2TRN
Club Program Manager, ARRL

Herbert W. Gehring, N5FHR, sent HQ this photo and story.

The El Paso (Texas) ARC, W5ES, dedicated their new, ideally located clubhouse earlier this year. W5ES was organized in the 1920s and spent most of the last half century in a cinder-block building at the southern tip of the Rocky Mountains.

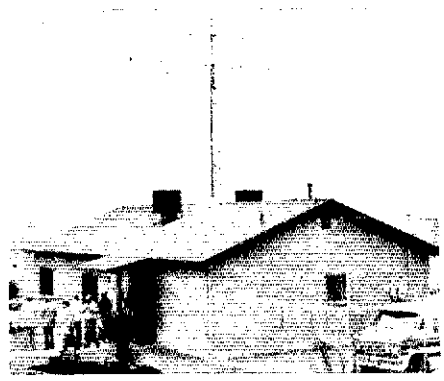
In 1982, local real-estate developers were interested in the club's property. In exchange for the property, the developers agreed to build a clubhouse to the club's specifications on another location near the city. In addition, all of the club's property would be relocated at the developer's expense.

The 1500-square-foot building was built over an 18-month period. Included in the site is fenced, lighted parking for 24 cars, a new 40-foot tower with 10- and 15-meter monoband antennas, and a complete fire and security alarm system. The radio room and separate workshop are isolated from the meeting room. Two restrooms, a complete kitchen and more-than-ample storage space allow the building to serve all club functions.

The power system is designed to disconnect from commercial power and reconnect quickly to emergency generators located in the workshop. Since the building is located on the side of Mt Franklin in the Rockies at about 5000 feet above sea level, the horizon is virtually unobstructed, broken only to the south by the Sierra Madre range in Mexico and to the east by the Hueco mountains, some 40 miles away.

President Jack Hedrick, KB5QV, notes proudly that the El Paso ARC is an ARRL Special Service Club. Licensing classes are held each week year 'round. The clubhouse is a focus for local ARES and RACES activities, and is where the El Paso Shortwave Listeners' Group meets.

With nearly 200 members, the El Paso ARC sets a high mark for Amateur Radio in the far west Texas/southern New Mexico area. And with the newly dedicated building, it's easy to see why.



The new El Paso ARC (W5ES) clubhouse, at 2100 San Diego, looking to the southeast. *WD5CUJ photo*

New Special Service Clubs

Becoming a Special Service Club (SSC) is not for every Amateur Radio group. It takes commitment, planning and, mostly, a membership that sets the highest standards for itself. A number of your fellow clubs have recently undertaken the commitment and become SSCs. Here's a rundown of these special groups, their city, state and number of members:

Delaware Valley Radio Assn, Inc, Mercerville, NJ (168)
Issaquah ARC, Bellevue, WA (43)
West Seattle ARC, Seattle, WA, (61)
Yakima ARC, Yakima, WA (57)

Renewing Special Service Clubs

After completing a year of Special Service, SSCs go through a review process with their respective Affiliated Club Coordinators (ACCs). With successful programs behind them, they plan their next 12 months of activities. Recently renewing SSCs are presented here, followed by their city, state and number of members:

Central Missouri Radio Assn, Columbia, MO (55)
Four Lakes ARC, Madison, WI (135)
Northeastern Indiana ARC, Auburn, IN (36)
Oregon Tualatin Valley ARC, Beaverton, OR (197)
Warminster ARC, Warminster, PA (141)
Westchester Emergency Communications Assn, Pound Ridge, NY (136)

Volunteer Examiner Information

from the ARRL/VEC, 225 Main St, Newington, CT 06111

Locating A Test Session: Sessions are advertised publicly via local Amateur Radio club newsletters and repeaters. A printout of sessions in any state and some overseas locations is available from ARRL HQ for an SASE. We list ARRL/VEC sessions plus those of other VECs who inform us of their testing schedules.

Registering to Take an ARRL-Coordinated Test: A completed FCC Form 610 application and a check or money order for the test fee, payable to the "ARRL/VEC," should be sent to the local VE Team where you intend to be tested. "Walk-in" candidates may be allowed at some sessions, but registering in advance helps. If you write to a VE Team, send an SASE to cover postage and handling.

Test Fee: For ARRL-coordinated sessions held during calendar 1986, the test fee is $4.25, payable to "ARRL/VEC." This fee is to cover expenses incurred by administering examinations. A check or money order is preferred.

What to Bring to the Session: Bring the *original* plus a photocopy of your current FCC-issued Amateur Radio license, and the *original* plus a copy of any temporary upgrade certificate issued by a VE Team less than 1 year prior to the test date. (Duplicates of lost licenses are available through the FCC's Gettysburg office.) Also bring two forms of positive identification (including a photo ID, if possible) and at least two pencils and a pen. Scratch paper and answer sheets are provided.

Calculators: Nonprogrammable and "scientific" calculators are welcome. Pocket computers that store words are not allowed. Programmable calculators will be allowed only at the discretion of the VE Teams; be prepared to demonstrate that the memories have been cleared.

Exam Format: Written element exams are four-choice multiple-answer tests. A score of 74% or more is required to pass a written element exam. Most VECs assemble tests based on the ARRL-issued multiple-choice question pool. Code test transmissions are played from an audio tape prepared by the ARRL/VEC with message contents similar in format to an Amateur Radio QSO. The code test is "fill-in-the-blank" style and may be passed by answering at least 7 out of 10 comprehension questions correctly *or* by copying on paper at least one continuous minute of perfect copy from the code test transmission. The ARRL/VEC does not require a code sending test, based on the FCC's recommendation. Code tests may be copied on typewriters, but prior arrangement with the VE Team is required so that other candidates are not disturbed.

Question Pool	*Revised by FCC*	*ARRL/VEC Tests Change(d)*
Element 2 (Novice)	Jul 1985	Jan 1, 1986
Element 3 (Tech/Gen)	Oct 1985	Apr 1, 1986
Element 4A (Advanced)	Jan 1986	Jul 1, 1986
Element 4B (Extra)	Apr 1986	Oct 1, 1986

ARRL/VEC Retest Policy: A candidate who fails a written element and who has exhausted all code test possibilities at a session may not be retested during that same session. If a convention or hamfest test session schedules multiple sittings, a failed candidate may request that the VE Team retest him or her at a subsequent sitting. Retesting is allowed *if* the VE Team has a *different* test version available and the VE Team determines that it has the time and resources available to accommodate the retest. A candidate for retest is required to pay another test fee, and may be required to complete a fresh application Form 610 at the Team's request.

Special Tests: Candidates who require special assistance, materials or equipment because of physical disability must attach to the application a signed and dated physician's statement certifying the nature of the disability, plus a letter explaining what special assistance, materials and/or equipment must be used to conduct the examination. (See Section 97.26[g] of the FCC Rules.) Be sure to notify the VE Team well in advance so that special arrangements can be made. If Braille or tape-recorded written tests or special-pitch code tapes are needed, contact the ARRL/VEC at least one month in advance to ensure materials will be available. Further questions about testing persons with disabilities should be addressed to the ARRL Program for the Disabled at HQ.

Conducted By Michael R. Riley, KX1B
Public Service Manager, ARRL

The 1986 Pittsburgh Marathon

It's 6 AM; the birds are just beginning to stir as you unload your car and carry equipment across the grass, still damp with morning dew, to the area in Point State Park assigned to Allegheny County ARES for the net control location of the 1986 Pittsburgh Marathon. Nat, W3SVJ, Dave, KA3KSD, Joe, KA3LSW/N, Sam, KC3TO, and Paul, W3GQ, are already setting up the spine of Amateur Radio communications for the day. Since Nat is net control chief, his call will be assigned to all net control stations for the day.

At the same time Don, WA3HGW, and Bob, N3CVL, set up their packet-radio stations nearby. Don, operating a mobile packet station from the rear seats of his Subaru Brat, will be following the last of the runners throughout the course and transmitting the numbers and locations of the runners who have dropped out to net control at Point State Park. The packet computers at the Point are tied into the Marathon's race computers and also will be used to notify the hams located in the family reunion area.

By 8 AM, other hams arrive on site along the planned race course, from start to finish line. There are over 70 hams, including a pair of brothers, a father and son, a husband and wife and four Novices taking advantage of the opportunity to see what other hams do in public-service communications. The weather is hot and humid, already into the upper 70s. A long, hot day is in store for the hams, race participants, officials, medics, volunteers and spectators alike.

Net control does a roll call of all operators on site along the 26.2-mile route. You now begin relaying questions along with status reports into net control. Marathon officials need information on where the water truck is along the route, what additional supplies are needed at checkpoints and aid and water stations, who needs water cups, and who has the valuable keys to the chemical toilets. Hams shadowing race officials are relaying last-minute instructions, and even in mid afternoon finding out, "When is the garbage truck coming?"

By 10 AM, you can begin to visualize what is happening at the start line at the Highland Park Zoo, thanks to reports of George, K3GP, and Will, W3LBV. You know that approximately 3000 runners have arrived and are being organized in groupings related to their known finishing times by race officials. Local broadcast-media coverage has been set up and on the air for listeners in the tri-state area. Police along the route are beginning to close off streets which intersect with the race route.

At 10:15, the wheelchair participants are off. They travel the same course the runners will take over the hills and through valleys, into historical and new neighborhoods, past steel mills and the gleaming towers, all reflecting the 200-plus years of Pittsburgh's history.

Shortly before the wheelchair participants begin their race, Bob Ferrey, N3DOK, Emergency Coordinator for the 1986 Pittsburgh Marathon, begins his tour of the route. He is setting out to thank each of the over 70 hams stationed along the race route for offering their time to Amateur Radio public service on one of the hottest spring days recorded here. By race time, the humidity is 70%, and the air temperature along the route is at 91° F. Conditions will take their toll before this day is over. As he travels the course, N3DOK remembers what has occurred during the past several months to make today possible.

Bob Hoffman, N3CVL, transmits up-to-date information on the runners who have dropped out of the race via mobile packet radio. *(KC3ET photos)*

Planning the Event

The purpose of meetings is to exchange information and plans, and to decide what kind of communications hams can and can't provide. Officials will be asking for operators to be assigned to certain points and persons. This is the time to obtain official maps of the race route, locations of mile markers, and water and aid stations. Several meetings will be required to work out our plans. As a coordinator for the event, it is important to know what will be happening before and after the race.

Once the blueprint of the race route has been received, indicating the locations and the designated race officials needing hams, you can then determine the number of radio operators you must recruit. Always over-recruit! Recruiting and planning for an event like this requires several months' work prior to the race. Some persons who have volunteered may find they must work that day or they may have other family obligations. Be prepared! If your number of volunteers drops on race day, you will have to provide for this contingency and for adequate staffing of all positions for the event.

The first place to begin recruiting is on your scheduled ARES Public Service Net. A three- to four-month period of recruiting is prudent to ensure a successful event. Plan to recruit by also visiting the radio clubs in your area as well as at hamfests, and of course use your roster of ARES volunteers. While recruiting, give a brief description of what is needed, how long volunteers are needed, and just what the ham can expect to do. Be prepared for questions like, "But I never worked a public-service event before," which is heard quite frequently. Your best answer is, "You're not alone. You will be working with other hams. It's enjoying ham radio by passing and receiving information along the course, as requested by race officials. It's like a big, well-organized net." Remember we are providing communications for others and their decisions—we're not there to do their job or make race decisions. This is also a good time to recruit Novice ticket holders and get them involved by pairing them with experienced hams. Four Novices took part in the 1986 Pittsburgh Marathon.

Along about now, expect to be contacted by race officials. They've changed the route, possibly due to road construction, or another official wants an additional radio operator with them. Now you can see that the use of a computer to keep things organized is almost necessary. You need a computer with good software that can help you list data including names, call signs, phone numbers, class of license, equipment, assignment area and at least one other miscellaneous data area. Don't be surprised if some hams volunteer several times over the recruiting period, and counting them twice will give you fits while planning manpower.

Logistics

Once you have recruits, where do you put them? You need to staff the mile markers, some half-mile markers, the water and aid stations, medical facilities, local command medical facilities, the start and finish lines, net control, officials, packet

Mike Kowalcheck, Jr, KV3L, intently watching the race.

radio and some more, here and there.

Net control is located at the finish line. This location is extremely busy with race officials, media and spectators. They create a lot of noise, and you can push an ear plug in your ear only so far! What did you say? Net control should be in an enclosed area that allows for a calmer environment as well as protection from the elements. Since intermodulation and other interferences are very much present (because of computers and other public-service radio in the area) a good directional VHF antenna system is important.

An operator will be needed for every frequency used. It will help you if you have additional operators to help at net control to provide relief, act as another set of ears, or be "go fers." It's a long, 12-hour day. The 1986 Pittsburgh Marathon network used five VHF/UHF repeaters and 145.01 simplex for packet radio.

Frequently, net control is asked to answer questions that require race officials to answer. Operators should be assigned to shadow specific officials throughout the day. In effect, these operators are acting as portable telephones to track down official answers all day long.

Staffing an operator at the hospital medical command post is very important. This can be vital, as we found during the '86 Marathon. An ambulance located at the 11-mile marker lost all power to its communications gear. The paramedic's words were, "I can't treat a person who needs medication without talking to a doctor." The ambulance was situated at the first big hill on the course and was indeed vital. A call to medic command through the designated amateur 2-meter medical frequency resulted in a back-up emergency-communications system being sent out to the unit at its location. A separate repeater was used for the medical traffic. If a medical emergency was spotted anywhere along the route by a radio operator, the information was relayed into Net and Medic Control who then passed the information on to the medical authorities for their immediate response.

Operators assigned to water and aid stations move back and forth between nearby stations. Upon arrival at their assigned site, the operator should report to the proper official and make himself or herself known. Information will have to be transmitted to net control before the race regarding supplies (ice, water, cups, etc). Once the race begins, radio traffic will tend to deal only with medical emergencies.

Since the operator assigned to the mile marker will be "sliding," you can cover the 27-mile markers and 20 water and aid stations with fewer numbers of hams. If you have the personnel available, it's better to overstaff than to rely on the "slide factor."

The Pace Car leads the front runners in the race. The operator in the car can use UHF gear to relay his reports of the lead of the race to net control on this dedicated frequency as needed.

The 1986 Pittsburgh Marathon used packet radio for the first time. A vehicle equipped with a mobile packet station followed the last runners in the race, and the hams transmitted the registration numbers of the dropped out runners back to net-control packet station. Information also sent from the mobile packet included the destination of the drop outs. This computer also tied into the Marathons' computers to aid in compiling race statistics. Packet Net Control relayed information to the family reunion area where Leo, KA3KUP, and Dave, N3BKV, were able to let families of contestants know where to meet their runners.

This system worked well for the first time employed. Not every dropout can be spotted, however. Preparations for using packet radio in an event of this type necessitates much planning and dry runs to test the system. Also included in the packet planning was the use of a digipeater dedicated to packet radio for this event.

In addition to local news media coverage, it is helpful to recruit a couple of hams with photographic interest. They can provide video and still photography coverage of the race for the amateurs' point of view. Video and still photographs are always of special interest at ARES meetings and club visits. Press ID badges must be obtained for these people so they have access to the race course.

All radio operators involved should be reminded that they are the eyes and ears along the route for the Marathon officials.

Watching and listening enables the net control station to run smoothly without unnecessary "chatter." Amateurs should ragchew after the net is secured. With a race using 26.2 miles of roads and 3000 participants, and the hot, humid weather, Pittsburgh experienced a May 18 that created emergency situations of all kinds.

N3DOK recalled sending out letters to the hams involved, which included a map of the race route with the assigned location marked, the repeater frequencies for the event, and the time and location of the briefing meeting required for all hams helping with the Marathon the day before the event. Efforts were made to assign hams to the positions they requested or to locations near their homes. The letters were mailed about 10 days before the briefing.

The race briefing meeting was scheduled for 1 PM at the starting-line area. Assignments were verified and questions answered. One or more of the race officials should attend. This is the time to hand out the ID badges supplied by the Pittsburgh Marathon and Amateur Radio and Pittsburgh Marathon '86 automobile signs.

Net-control operators should address this meeting of the troops at this time. It helps to identify them and answer any questions. Items covered include the use of a hand-held transceiver and/or a mobile rig, depending on location; having more than one fully charged battery pack; use of 5/8-wavelength antennas to help in fringe areas; headphone and earphones for noisy areas; dressing for appropriate weather; food, beverage, chairs and other supplies. Confidential sources of backup rigs, antennas and power supplies were also arranged.

Once the meeting is concluded, all operators should report to their assigned locations. Net control will conduct a roll call and iron out any difficulties, such as moving an operator slightly to improve communications. Operators should be reminded that they can only use the mobile radio in their car if the race official permits the car to be parked in the proper place. Operators should be prepared to work from a hand-held transceiver for more mobility. It should be remembered that the race official controls the site; we should be flexible to meet their communications need.

Race Time

By now on race day, all preparations are in place, net control is functioning smoothly and all locations have their needed supplies. At 10:35 AM, thanks to the keydown provided by W3LBV at the start line, all operators hear Mayor Richard Caliquiri fire the starting gun. The 1986 Pittsburgh Marathon is on with Amateur Radio providing the eyes and ears. Remember, it is now 91° F. As hot and sticky as you are, race participants have it even worse.

Widely scattered showers only serve to raise the humidity and create a massive need for medical communications. At one point, runners drop out of the race at the rate of one every 15 seconds. Situations typical of the one reported by KA3DLD at mile 24 occur all day long. He has a runner fall to the ground near him in obvious distress. The runner begs Al not to touch him as, "I'll be disqualified." A call to net control resolves this situation. At the conclusion of the race, Dr Freddie Fu, Medical Director of the Pittsburgh Marathon, reports that approximately 1500 runners were treated for heat exhaustion and dehydration at some point during the race.

In spite of conditions, Dean Matthews finishes in 2:18:18, and Laura Fogli in 2:37:06. Hams don't go home then. Net control secures the last location at 6 PM; all were on site since 8 AM. For this reason, when assigning locations for the 1987 Marathon, an effort will be made to put those hams who covered the end of the race in 1986 at the beginning in 1987, and honor requests for specific locations, if possible.

By day's end, 1998 participants cross the finish line, and permission is given to secure the net. It's good knowing you have done a marathon job participating in the ARES public-service net for the 1986 Pittsburgh Marathon in the nation's no. 1 most liveable city!—*Robert Ferrey, N3DOK, EC, Pittsburgh Marathon*

Field Organization Reports July 1986

ARRL Section Emergency Coordinator Reports

Twenty-nine SEC reports were received, denoting a total ARES membership of 16,223. Sections reporting were: AB, ENY, GA, IA, LAX, MDC, ME, MI, MN, MO, NFL, NH, NLI, NNJ, OH, OK, PAC, SC, SD, SDG, SFL, SK, SNJ, VA, WA, WMA, WNY, WPA, WV.

Transcontinental Corps

Area	Successful Functions	% Successful	TCC Function Traffic	Total Traffic
Cycle Two				
TCC Eastern	105	84.7	432	892
TCC Central	84	87.0	307	678
TCC Pacific	111	89.5	1769	870
Summary	300	87.6	3008	2440
Cycle Four				
TCC Eastern*	213	85.9	658	1303
TCC Central	48	76.2	229	507
TCC Pacific	110	88.7	602	726
Summary	370	83.6	1489	2536

*TCC Eastern operates both cycles 3 and 4.

TCC Roster

KA1AE N1BHH W1CE N1CVE W1EFW K1EIC K1EIR WA1FCD WB1GXZ K1GRP W1ISO KN1K W1NJM KT1Q W1QYY KA1T KW1U AK1W N2AKZ WB2EAG WA2FJJ W2FR W2GKZ KB2HM N2IC W2RQ N2XJ K2ZM W2ZOJ W3ATQ N3COY KK3F WB3GZU W3PQ KQ3T KB3UD AA4AT WA4CCK N4EXQ WD4FTK N4GHI WA4JDH W4JL WA4JTE WN4KKN WB4PNY WB4UHC W4UQ K4ZK N5AMK N5BB N5BT WB5CIC W5CTZ N5DFO W5GHP K5GM W5JOV AE5I AJ5K W5KLV KD5KQ K5OAF K5OU KD5RC ND5T N5TC W5TFB K5TL W5TNT W5VMP KB5W NQ5W KV5X WB5YDD KU6D W6EOT W6INH K6LL W6VZT K6UYK WF6O KA7CPT W7EP KB7FE W7GHT NN7H W7JMH KR7L W7LG W7LYA KF7R W7TGU KA7MUL K7OVK W7VSE W8BO KA8CPS KD8G WD8LDY W8PMJ W8QHB N8XX WB8YDZ W9EHS W9FC KA9FEZ W9JUJ KA9RII WB9UYU WB9WGD AD0A K0DJ K0EZ KA0EPY KJ0G W0GRW W0HI N0IA WA0OYI VE3AWE VE3FAS VE3GSQ

National Traffic System

Net	Sess	Tfc	Avg	Rate	% Rep	% Rep to Area
Cycle Two						
Area Nets						
EAN	31	708	21.40	.542	89.3	
CAN	31	781	25.20	.611	100.0	
PAN*	62	612	10.03	.457	98.3	
Region Nets						
1RN	62	387	6.20	.350	92.0	100.0
2RN	56	140	2.50	.225	68.4	87.1
3RN	31	219	7.10	.500	93.0	100.0
4RN	62	363	5.80	.289	77.9	93.5
RN5	62	513	9.89	.439	83.0	100.0
RN6	51	181	3.55	.300	100.0	98.3
RN7	62	627	10.10	.550	90.6	
8RN	62	255	4.11	.260	94.0	96.7
9RN	60	352	6.00	.355	88.0	100.0
ECN						58.0
TEN	62	638	10.30	.514	76.5	100.0
TWN	60	326	5.43	.408	74.6	
TCC						
TCC Eastern	105	892				
TCC Central	84	678				
TCC Pacific	111	870				
Cycle Three						
Area Net						
EAN	31	234	7.55	.368	87.1	
Region Net						
1RN	29	84	2.90	.290	76.0	93.5
2RN	31	173	5.60	.377	93.5	90.3
3RN	22	9	0.41	.062	47.0	93.5
4RN						80.6
8RN						77.4
ECN						87.0
Cycle Four						
Area Nets						
EAN	31	1188	38.3	1.031	97.8	
CAN	31	669	21.6	.823	100.0	
PAN	31	841	27.1	.763	100.0	
Region Nets						
1RN	60	509	8.50	.570	94.2	100.0
2RN	58	219	3.80	.382	90.0	96.7
3RN	59	174	2.95	.266	100.0	96.7
4RN	62	526	8.48	.320	100.0	100.0
RN5	62	628	10.13	.546	100.0	100.0
RN6	60	338	5.60	.670	97.0	98.3
RN7	62	424	6.80	.614	84.0	100.0
8RN	52	335	6.44	.361	80.0	96.7
9RN	62	400	6.45	.460	91.1	100.0
TEN	62	268	4.30	.337	69.6	100.0
ECN	60	143	2.38	.326	56.0	96.7
TWN						100.0
TCC						
TCC Eastern	213	1303				
TCC Central	48	507				
TCC Pacific	110	726				

*PAN operates both cycles one and two.
TCC functions not counted as net sessions.

ARRL Section Traffic Managers reporting: AL, AR, AZ, CT, DE, EMA, GA, IA, IL, IN, MDC, ME, MI, MN, MO, NC, NE, NH, NLI, NNJ, NTX, OH, OK, OR, ORG, ONT, RI, SB, SC, SD, SFL, SJV, SNJ, STX, TN, UT, VA, VT, WA, WMA, WNY, WPA, WV.

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, will be awarded a special PSHR certificate from HQ.

202
KK1A

161
W7LRB

156
KB4WT

149
N8EFB

146
WX4H

142
K4NLK

137
W8FPA

136
K3RXK

133
KA3DLY
N4GHI

132
KK3F
KE8BE

131
WB4HRR

129
N7BHL

127
WB2VUK

126
K0ZBJ

125
KD7ME
WB2OWO

119
WB7WOW

116
KW1U

115
WA2FJJ

114
WD4KBW
W2MTA
VE4AJE

113
AA4AT

111
KA9FFO
AA4UO
W7VSE
KA2MYJ

110
K2YQK
VE4LB

109
KF4U
WB1GXZ
NC9T
W3FA
W9JUJ

108
N3EMD
WF6O
WB8RFB
WD8LDY

107
KJ9L
AA4MP

106
W0IKT
WA2JBO
KT1Q
NG1A

105
W9YCV
NG1A
NQ2H
N8HBI

104
N6AWH
KA1GWE
WB5SRX
KA2SPH
KA4TLC
N3DPF

103
KA1JXH
KA0EPY
WA4JDH
WB1HIH

102
W4ANK
N5AMK
WD5GKH
WA1FCD

101
KA9RII
N4KFU
N7FXJ

100
N9BDL
WA2SPL
N8AHA
N1DMU

99
NG4J
WB2EAG
WB8SIW
KB0Z

98
KA1MKJ
N2XJ
K4ZK
WA4PFK
K2ZVI
WB8JGW
KA8TIK

97
W9EHS
WB8KWC

96
N4EXQ
W8JMD

95
NJ8R
KA2UBX

94
K4MOG
KA2UBD

93
K9CNP
K0GP

92
KI4YV
KE7MO

91
N3EGF
W0OYH
AE1T

90
WB1CBP
WA4EYU
NG2T
N0BKE
K6UYK
KB0Z

89
K5OAF
N3AZW
W9DM
VE3DPO
WA6ZUD

88
WD4ALY
WD8KQC

87
W6PW
N3COY
KA5SPT
W7GHT
KA2DQA

86
WA4QXT
N1CPX
KC2TF
K2YAI
KA8CPS

85
KC4VK
W5CTZ
K2VX
WD8OUO
KA7AID
KA8KHS

84
AJ5K
KT9I
NT4S
N7GGJ
AE5I
N8EVC

83
N1DNA
WA4EIC
WB4WII

82
NN4I
W9NXG
KN1K
N1BGW
N7BGW
NE2W
WB2IDS
K8UQY

81
WB2UVB
K0SI
W0FRC
WA6WJZ
W5VMP
ND2S

80
AA4HT
WB2QMP
WA4CCK
W2PKY
K2ZM

79
WA4RUE
KB1AF
KF8J

78
W0OTF
WA0TFC
K4VWK
KJ9J
NF8B
KA8TNT

77
N0DZA
K5MXQ
NR8C
K8ND

76
W4FMZ
WA3GYW
W4CKS

VE4IX

75
ND0N
W9CBE
N0CLS
KJ3E
VE3WM
W6INH
NK8B

74
N2FKA
WB5FQU
WD0GUF

73
KB7FE
WB7WVD

72
K6TP
N1AKS
KB0ZL
N4KSO
N6CVF
WB2IKL
VE4RO

71
W5KLV
K4JST
WB3ANC
WD8RHU
WA1TBY

70
W4HON
W9HBI
KA4GUS
W7LNE

69
N1EDD
N6HYM
KA8VQZ
N1DDC
K8JDI

68
WB4ADL
KB9LT
KB4LB
WB5EPA

KA7MUL
KC3Y
NJ4L
WD4NYL
N8FWA

67
AI0O
WA6QCA
WB6QBZ
W1RWG
K1SEC
W7JMH
N0DZA

66
WB4HXS/T
KF4FG
K0PCK
K9ZBM
KU2N
WB2NLU/T
WD8KBW

65
WA3UNX
WB5YDD
WA2VJL
KC3DW
KA1ON
K5EVI

64
N4PL
K6UXO
VE3POJ
N4JOA
WB9PFZ
N1CVE
WA7VTD
W2FR
KC8UZ
N8GJQ

63
W4JLS
W3YVQ
VE3GSQ
KB4BZA
W0YMB
WA4RNP
KP4DJ

KF7R

62
WB4TZR
N2DXP
KA0ODQ
WB0WNJ
NS7C
NA3Q
K4ZN
KA0KPY
N1DHT
WA0PTV

61
KA1HPO/T
VE3GT
N0GCC
WD6BZQ
WD8PAF
AB0Y
W2ZOJ

60
N4KRA/T
W0OUD
VE3CYR
KA4YHS
WA8DHB
WA4MNR

56
KA5QYV/T

51
N2EVG/T
N4MMM/T

47
WA2MGV/T
KA9RNY/T
KA7RFD/T

46
W1YOL/T

43
KA2CQX/T

42
KA2SJG/N

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.

Call	Orig	Rcvd	Sent	Dlvd	Total
W3CUL	859	871	1329	81	3140
WA0HJZ	0	952	33	677	2614
N0BQP	26	1084	40	781	1913
KK3F	3	620	570	50	1243
WB9YPY	0	696	52	487	1235
W3VR	298	287	394	27	1006
WA4JDH	1	430	374	2	807
N7BHL	0	321	361	33	715
K0RXK	0	330	343	31	704
KA7MUL	0	312	363	9	684
W9JUJ	0	343	335	3	682
N4GHI	67	292	289	33	681
WF6O	2	347	323	7	679
KA9FEZ					673
K6UYK	47	327	253	9	636
KW1U	3	363	264	5	635
VE7BNI	31	169	313	66	579
N4EXQ	37	262	257	12	568
K0JAN	0	316	31	204	551
N5AMK	0	281	222	1	504

BPL for 100 or more originations plus deliveries:

W0FIR	280
KA0TXX	224

Independent Nets

Net Name	Sess	Tfc	Check-Ins
Amateur Radio Telegraph Society	52	330	236
Central Gulf Coast Hurricane Net	31	106	1288
Clearing House Net	31	262	396
Early Bird Net	31	701	279
Empire Slow Speed Net	30	52	312
Golden Bear Amateur Radio Net	31	158	1744
Hit and Bounce Net	31	197	593
IMRA	27	922	1700
Mission Trail Net	31	117	854
NYSPTEN	31	64	520
Southwest Traffic Net	31	241	1310
West Coast Slow Speed Net	31	76	440
20ISSBN	27	301	812
75 Meter Interstate SB Net	31	331	908
7290 Traffic Net	50	484	2603

Results, 1986 ARRL International DX Contest

"This was my first single-op DX contest. Are you bored with VHF contests? Then try HF contesting!"—K6GSS

By Mike Kaczynski, W1OD
Contest Manager, ARRL HQ

and Billy Lunt, KR1R
Assistant Contest Manager, ARRL HQ

HF Contest activity is on the increase! Yes folks, activity in the 1986 ARRL International DX Contest is up from last year! This year, a total of 2391 logs were received. For those of you with score cards, that's 44 ahead of last year's 2347. As has been the case in past years, conditions tend to control the number of contest participants. Even better conditions in 1987 will produce a further increase in scores and entries. Now that conditions in Cycle 21 have just about bottomed out, we're preparing to make the climb toward the peak of Cycle 22. C'mon sunspots!

This year's statistics, as well as score listings, are presented courtesy of Data Base Manager 2 (copyright 1983, Alpha Software Corp). DBM2 has made it possible for us to generate leaders boxes more easily than ever before, hence their abundance in this writeup. This year's single-band super efforts are too numerous to note here. Let's let the boxes tell the story.

CW

Of the 2391 logs received at HQ for the 1986 DX Contest, over half (1169) were on CW. Of these, 1041 were single operator; 17 were multioperator, two-transmitter; 11 were multioperator, unlimited. Our most popular multioperator category, multi-single, boasted an even 100 entries.

When the green flag for the CW portion fell at 0000Z February 15, nobody knew quite what to expect. As things turned out, conditions didn't pack many surprises for the 1169 who reported. Because of a marked decline in high-band propagation, CW scores are down a bit this year. In fact, a total of only 59 10-meter QSOs were made by the entire W/VE Top Ten! Take heart—1987 will be better!

In the single-op Top Ten, KØDQ skippered W3GRF to a first-place finish with 1.49 million points. Another three-lander, K3ZO, finished second with 1.39 million.

CW multioperator, single transmitter leader N4WW took advantage of 15- and 10-meter propagation to sneak past K1YR for the plaque. Multi-two was won by W2REH and crew—N5AU was second.

Three was the number to be in the battle of the big guns. Unless you were K2TR, you had to be a 3 to make the multiop, unlimited box. W3LPL was on top, followed by K2TR, W3GM, K3OO and N3RS, respectively.

Propagation (or lack thereof) didn't get our DX CW winners down. N6TJ piloted 9Y4AA to a 4.12 million point first-place finish, landing a little more than 700k ahead of W1BIH's PJ9J

Sitting at the controls is Ben, DL6RAI, who operated single-band 80 on both modes.

Affiliated Club Competition

Unlimited Category	*Score*	*Entries*	*CW Winner*	*Phone Winner*
Frankford Radio Club	40,416,101	86	N2LT	KT3M
Yankee Clipper Contest Club	26,493,301	68	KC1F	K1KI
Medium Category				
Potomac Valley Radio Club	18,160,689	41	W3GRF	K3ZO
North Texas Contest Club	5,009,870	25	K5NW	K5RX
Mad River Radio Club	7,121,130	27	W8LNO	WD8IXE
Dixie DXers	6,852,654	23	K3KG	WX4G
Northern California DX Club	5,119,047	47	N6QR	N6QR
Texas DX Society	3,741,084	11	KN5H	NR5M
Southern California Contest Club	3,085,021	9	N6AA	W6MKB
Southern California DX Club	2,724,811	39	W6TMD	K6EID
Murphy's Marauders	2,662,245	16	K1ZZ	WA1LVW
Central Virginia Contest Club	2,563,305	5	WU4G	—
Western Washington DX Club	1,924,770	30	NN7L	N7TT
Kansas City DX Club	1,766,724	17	WØJLC	WAØTKJ
Southeastern DX Club	1,445,880	18	KX4R	KX4R
Albany ARA	1,377,684	7	K2VV	K2VV
Eastern Iowa DX Assn	1,128,222	10	WØWP	NGØW
Central Arizona DX Assn	859,275	10	K7OX	K7OX
Western New York DX Assn	828,675	9	WB2ABD	W2FXA
Colorado Contest Conspiracy	603,021	4	KØZX	WØOSK
Grand Mesa Contesters	457,746	9	WØGOR	KIØG
South Jersey Radio Assn	456,882	14	W2EA	K2JLA
Society of Midwest Contesters	425,586	13	WB9JKI	KM9L
Northern California Contest Club	284,952	8	K4TKM	WE6G
Western Pennsylvania DX Assn	247,335	8	—	K3MD
Long Island DX Assn	126,912	4	K2MFY	K2YGM
Boiled Owls of New York	82,443	4	W2GGE	—
Hampden County Radio Assn	19,800	4	—	—
Local Category				
Overlook Mountain ARC	3,561,039	8	K6NA	KY2J
San Diego DX Club	1,531,968	8	N6AW	N6AW
Hoosier Contest Club	1,278,567	4	W9RE	W9RE
Minnesota Wireless Assn	1,148,859	3	NØAT	NØAT
Carolina DX Assn	860,772	6	AA4S	KF4HK
Rochester (NY) DX Assn	785,307	10	W2TZ	W2TZ
Mississippi Valley DX/Contest Club	710,586	6	WØHBH	WØHBH
Northern Ohio DX Assn	685,020	5	N8BC	—
Dauberville DX Assn	589,179	10	—	WB3FYL
Grumman ARC	520,788	6	WA2LQO	NN2F
Fox Cities ARC	349,524	4	W9OP	N9ER
Northern Illinois DX Assn	337,674	7	K9QVB	K9RHY
River City Contesters	309,114	5	KV6H	K6SG
Willamette Valley DX Club	291,564	6	W7NI	W7GUR
Fox River Radio League	288,327	5	—	KC9UM
Arrowhead Radio Amateur Club	269,103	5	AF9T/Ø	—
Madison DX Club	199,323	4	—	NB9C
Ohio Valley ARA	163,518	4	K8SW	—
Intermedics ARC	150,510	4	—	WE5P
Gloucester County ARC	119,940	4	K2OWE	K2OWE
Northern New Mexico ARC	83,319	4	—	N5EPA
Northern Arizona DX Assn	80,850	3	KR7Y	—
Waterbury ARC	71,046	3	—	KA1ION
Redwood Empire DX Assn	64,053	3	K6ANP	—
Central California DX Club	53,760	4	W6BYH	W6BYH
Alamo DX Amigos	51,186	3	W5KCR	W5KCR
Woodbridge Wireless	48,024	5	NQ4K	KB4EUZ
Utica ARC	39,858	3	—	KK2B
Eastern Michigan ARC	37,548	4	—	N8CQA
Great South Bay ARC	24,864	5	—	WB2RNT
West Park Radiops	9,120	3	—	—

Top Ten—DX Phone

Call	Score	160	80	40	20	15	10
LU1BR	3,114,993	0/0	260/43	582/53	955/55	1450/57	762/51
K3UOC/YV4	2,804,301	90/31	468/47	233/43	1582/54	668/53	480/39
CE3BFZ	2,409,120	0/0	94/33	273/42	536/55	1213/55	1144/54
WB6FCR/KH6	2,398,440	15/6	433/47	882/52	1270/57	985/53	49/5
N7NR/KH6	2,158,065	22/8	348/45	500/49	1496/53	843/55	106/7
HC1OT	2,157,813	0/0	617/52	390/45	782/53	1138/55	160/28
VP5Y (N6EK, opr)	1,852,128	59/26	311/41	374/45	768/49	1299/50	21/7
PP2ZDD	1,592,889	0/0	75/30	122/37	481/54	1160/53	543/49
ZS6USA	1,460,844	0/0	96/23	444/51	765/50	977/39	95/7
EA9IE	1,303,416	0/0	237/40	85/25	797/56	1407/51	0/0

Top DX QRP Scores—Phone

Call	Score
K7SS/KH6	623,103
F9YZ	12,792
OK1DKS	10,656
4X6IF	7,161
JA1WSK	6,439
LZ2PO	6,417
JA2JSF	6,111
LZ2EW	5,214
YU1OWW	3,894
JR2BNF/1	2,613

Top Ten—DX CW

Call	Score	160	80	40	20	15	10
9Y4AA (N6TJ, opr)	4,121,715	161/40	589/55	1047/57	1304/56	1238/56	256/35
PJ9J (W1BIH, opr)	3,412,398	256/45	415/52	691/54	1252/56	927/56	276/35
N5AW/NP2	2,674,434	47/22	639/53	627/57	824/56	1050/56	55/16
K3UOC/YV4	1,940,634	121/35	322/47	416/49	962/56	550/50	98/25
N6EK/C6A	1,335,510	114/34	264/45	715/51	808/52	189/31	0/0
DL6FBL	1,229,211	42/21	165/31	763/50	1203/56	66/25	0/0
AH6AZ	1,178,658	46/29	231/41	571/51	586/51	360/47	0/0
C6ADR (N1EE, opr)	1,161,831	76/25	351/49	380/48	869/55	177/32	0/0
XE2MX	980,865	92/32	331/47	194/44	677/54	241/36	0/0
YV3AGT	769,986	0/0	271/49	184/43	385/45	518/52	0/0

Top QRP DX Scores—CW

Call	Score
YV3AGT	769,986
F9YZ	19,737
EA8BIE	16,050
YU4EZC	15,240
DL0FTZ/P	9,270
PA0ADT	7,128
OK1DZD	6,075
ON4JJ	5,916
OK1DKR	5,829
KH6CP	5,508

Top Ten—W/VE Phone

Call	Score	160	80	40	20	15	10
K1KI	1,885,482	14/12	106/50	120/58	1318/100	318/84	46/22
K3ZO	1,510,758	21/17	206/65	74/42	997/89	334/74	30/16
N2FB	1,269,238	14/12	97/44	90/49	742/87	436/88	44/22
KT3M	1,273,440	20/16	103/53	68/41	1079/97	210/58	36/15
K1DG	1,242,774	5/5	82/49	82/45	962/88	291/75	47/20
W9RE	1,241,280	23/19	90/48	117/56	425/92	557/82	61/23
N2LT	1,237,698	12/10	71/43	87/49	933/92	326/72	34/16
WX4G	1,217,640	17/15	111/55	98/40	623/92	497/75	44/15
K5ZD/1	1,134,027	13/13	116/59	88/50	762/82	267/72	33/16
W6MKB (N6TJ, opr)	1,095,687	8/6	81/37	396/34	453/72	492/63	73/31

W/VE Low Power Top Ten (<150 W)

Phone		CW	
VE1NG	720,390	VO1MP	592,200
VO1MP	315,882	W2TZ	339,636
W3UJ	286,836	KS1J	173,052
W2TZ	233,070	K9UIY	126,360
N5AW	178,416	W3HVQ	125,367
KG1D	117,558	K4MF	122,670
WA5OYU	106,533	K1VUT	107,238
W3ARK	102,600	KR8Y	105,216
N8ADK	88,275	WB2ABD	95,106
K4JHT	85,344	WD4AHZ	88,578

Top Ten—W/VE CW

Call	Score	160	80	40	20	15	10
W3GRF (K0DQ, opr)	1,490,952	17/14	199/61	464/71	771/78	216/65	12/7
K3ZO	1,393,728	25/24	229/59	368/60	920/77	162/48	4/4
KC1F	1,384,812	24/21	176/59	435/70	831/79	142/53	6/4
N2LT	1,383,936	12/10	142/48	452/74	946/79	137/55	7/6
K1AR	1,330,824	20/17	134/49	419/79	891/82	95/54	3/3
K3WW	1,198,773	23/19	168/59	455/70	807/69	76/42	2/2
K1DG	1,127,973	21/17	102/46	405/66	824/75	108/51	3/2
W3BGN	1,091,904	25/21	150/46	354/54	803/72	172/49	0/0
K3KG (K4FJ, opr)	1,060,884	26/21	108/46	306/74	537/73	266/60	11/8
K5NA	1,048,605	26/21	215/58	375/64	580/69	112/44	11/9

W/VE QRP Top Ten

Phone		CW	
K3WS	158,928	NN4Q	104,145
KB7VD	37,674	K3WS	87,108
K0GT	36,354	W8VSK	86,940
WA8AGH	35,028	N7IR	61,200
KB6KYB	33,858	WB2ENW	27,633
W6CN	24,111	N1AFC	22,794
N8COA	15,921	KW6Q	20,655
VE1CBF	13,650	KB4GID	14,868
W6YVK	5,382	WT4G	12,012
WA7KLK	5,148	N8CQA	8,184

operation. Point of interest: Statesiders operated six of the DX Top Ten on CW (including the four top slots). Additionally, an exceptional QRP effort by YV3AGT netted him 769k and a first-place QRP finish. Outstanding!

A stroll through the multiop boxes shows P40M on top of multi-single with 4.48M. V47A copped a second-place finish with 3.49M. Two-transmitter entries were headed by GB4DX, followed with a strong showing from Japanese stations JA7YAA, JA9YBA and JH7YAW (second, third and fourth, respectively). Similarly, it was another European team on top of the multioperator, unlimited category—followed again by a strong Asian showing. IO3F1Y, with 1.32M, defeated an outstanding effort by JA2YKA.

Phone

On the weekend of March 1-2, the CW bands were quiet. Now, it was time for the phone portion of the 1986 shootout. Conditions? Not too shabby! A majority of the 1069 who turned in an entry were surprised with far better propagation than what was experienced in the February brawl. As expected, Stateside entries outnumbered DX by almost 2 to 1. Foreign logs numbered 382, while 687 US/Canadian amateurs sent in summaries.

Entries by category are as follows: Single operator, 935 (608 W/VE, 327 DX); Multi-single, 106 (60 W/VE, 46 DX); Multi-Two, 18 (6 DX, 12 W/VE). Ten big guns went for it all, entering the multi-multi category (3 DX, 7 W/VE).

Who won? Glad you asked! In the single operator category, K1KI virtually ran away from the competition, putting together 1922 QSOs and 326 mults for a whopping 1.885 million points. K3ZO put in another of his notable performances to finish second. That's consistency, something we've come to expect from Fred over the years. N6TJ navigated West Coast superstation W6MKB to a top-ten berth. Check out the photo on page 13 and you'll see what a West Coast superstation looks like.

The multi-single race was almost too close to call, with numbers 1 and 2 less than 3k apart. When the dust cleared, K3TUP was on top, just edging out the K3WW team. Multi-two wasn't quite as close—KX4S tiptoed away from the N5AU crew with a 90k buffer.

DX single-operator entrants were led by South American entrant LU1BR, who made use of North-South propagation and outstanding conditions on 10 meters (762 QSOs and 51 multipliers) to outdistance the competition. K3UOC/YV4 fell in a close second, with 2.8 M. CE3BFZ was third, WB6FCR/KH6 was fourth. North-South wasn't the only available propagation path, however, as WB6FCR and N7NR operated "portable king henry six" to numbers 5 and 6 respectively. An effort not to be overlooked was N4NW, who operated ZS6USA to a number 10 finish. K7SS/KH6 racked up 623k, for top world QRP honors.

In the multi-single category, ZF2HI edged out KP4BZ by a mere 10,000 points. In multi-two, V47M topped the 10M mark for the top slot. PJ0B placed second, with 7M. Multioperator, unlimited was won by I3EVK, followed by JE2YRD and JA9YBA.

Affiliated Club Activity

One of the highlights of the ARRL International DX Contest is the affiliated-club competition program. Some questions have been raised about the program. Affiliated-club competition rules appear annually in January *QST*. Let's take a look at the rules, and see how the program works.

First, the club must be affiliated with ARRL. Contact the Club Services Department at HQ for details on affiliating. Second, the club secretary must send ARRL a list of all club members eligible to compete for the club. This list must include which category the club wishes to enter, and must be sent by the mailing deadline for each compe-

Top DX Multioperator Scores—Phone

Call	Score	160	80	40	20	15	10
ZF2HI	6,113,934	322/51	1070/56	1146/56	1610/58	2271/53	307/29
KP4BZ	6,102,816	203/43	904/53	1116/57	1389/58	2824/56	300/35
XE2XGY	4,307,280	143/42	1094/57	825/54	1850/57	1568/52	0/0
KH6XX	3,620,910	206/46	563/55	1157/56	839/54	1565/55	75/8
J34Z	3,251,745	99/35	790/52	563/53	637/49	1411/56	385/34
Two Transmitter							
V47M	10,543,500	332/54	1575/57	1969/57	2766/58	3271/57	737/47
PJ0B	6,936,393	163/42	1374/57	1097/54	1323/57	2610/58	820/45
JA7YAA	387,192	0/0	102/15	233/27	755/50	151/12	0/0
JA7YFB	356,076	0/0	43/9	273/40	657/47	126/12	0/0
JG1ZKO	104,823	0/0	2/2	91/14	340/31	180/10	0/0
Unlimited							
I3EVK	1,880,418	78/27	398/40	389/37	1487/55	751/43	0/0
JE2YRD	582,615	0/0	91/10	345/39	912/53	257/19	0/0
JA9YBA	464,508	0/0	146/15	130/19	1074/55	168/13	0/0

Top DX Multioperator Scores—CW

Call	Score	160	80	40	20	15	10
Single Transmitter							
P40M	4,478,643	208/43	509/56	1152/56	1588/57	1151/56	319/35
V47A	3,490,344	201/44	571/54	1190/57	1066/56	971/56	69/19
KH6XX	2,964,555	227/46	456/53	1059/56	1027/56	960/54	0/0
4U1UN	2,862,000	306/44	896/56	920/56	911/57	514/46	53/6
J34Z	2,678,808	146/39	367/50	924/56	814/53	875/55	86/25
Two Transmitter							
GB4DX	969,510	9/9	439/39	320/39	936/47	197/36	0/0
JA7YAA	407,160	8/7	147/31	216/23	536/51	137/18	0/0
JA9YBA	385,839	9/5	174/34	288/29	480/52	46/9	0/0
JH7YAW	264,504	15/7	72/16	259/29	436/47	42/8	0/0
OH1AF	137,088	2/2	27/12	9/5	460/49	46/16	0/0
Unlimited							
IO3FIY	1,321,677	15/9	370/40	676/47	841/52	429/41	0/0
JA2YKA	578,598	16/7	192/29	361/42	644/52	108/16	0/0

Top W/VE Multioperator Scores—Phone

Call	Score	160	80	40	20	15	10
Single Transmitter							
K3TUP	1,323,630	16/14	111/54	134/55	648/93	396/94	32/20
K3WW	1,320,948	22/19	87/51	92/56	829/96	288/83	41/19
WB8JBM	1,204,818	17/15	111/53	111/50	579/85	409/87	52/24
WB2ULI	1,020,672	6/6	74/52	39/28	1090/105	120/65	0/0
N4KG	968,175	27/22	100/55	110/54	388/90	310/88	40/22
Two Transmitter							
KX4S	2,457,450	30/25	188/63	139/62	1178/110	573/100	42/21
N5AU	2,391,168	47/32	179/66	408/67	614/112	556/104	112/35
N6ND	1,982,760	25/17	86/37	642/47	621/88	651/83	107/38
N3HS	1,945,026	20/16	93/51	189/68	856/110	602/100	28/17
K3OO	1,754,994	29/23	107/57	100/59	971/108	343/98	44/22
Unlimited							
W3LPL	3,019,302	47/33	163/65	251/60	1067/110	709/108	109/33
W3GM	1,923,108	30/24	113/55	138/65	1058/110	304/92	71/28
K3ZZ	1,019,424	9/8	96/49	90/47	699/87	244/76	46/20
K1EA	903,600	17/16	72/47	75/44	625/98	177/76	38/19
KM1C	901,167	15/13	76/45	75/44	689/91	177/72	37/16

Top W/VE Multioperator Scores—CW

Call	Score	160	80	40	20	15	10
Single Transmitter							
N4WW	1,446,882	21/17	105/51	417/83	746/76	298/68	10/7
K1YR	1,226,016	12/10	196/54	379/76	844/71	117/53	0/0
N2MM	1,162,200	22/19	186/67	379/76	589/75	116/54	8/7
K4VX/0	1,119,525	44/29	122/52	288/70	623/72	172/58	16/14
KM1C	1,102,302	22/19	136/53	319/71	769/80	89/46	6/5
Two Transmitter							
W2REH	2,128,386	27/22	240/66	445/88	1123/84	250/66	14/12
N5AU	1,851,696	58/28	158/52	609/79	655/85	329/76	28/16
K5LZO	1,308,066	30/22	133/52	464/75	482/81	269/65	24/16
K1XM	969,175	16/15	147/53	359/75	526/71	71/43	6/4
N2RM	953,451	6/6	109/36	401/65	639/69	180/56	6/5
Unlimited							
W3LPL	2,828,595	64/45	213/74	603/88	1117/94	362/79	28/15
K2TR	2,643,354	60/44	209/65	721/97	1111/91	206/68	24/13
W3GM	2,170,746	56/36	268/75	451/81	896/84	279/76	27/14
K3OO	1,822,065	37/30	234/70	423/76	903/86	207/67	9/6
N3RS	1,724,514	38/31	184/56	499/87	853/78	228/67	0/0

Overall Division Leaders

Phone	Division	CW
VE1NG	Canada	VO1MP
K3ZO	Atlantic	W3GRF(KØDQ)
W9RE	Central	KC9T
NØAT	Dakota	AF9T/Ø
K5MK	Delta	K5MK
WD8IXE	Great Lakes	W8LNO
N2LT	Hudson	N2LT
K4VX(KRØY)	Midwest	WØJLC
K1KI	New England	KC1F
N7TT	Northwestern	NN7L
N6QR	Pacific	N6QR
W3HHG	Roanoke	W3VT
N2IC/Ø	Rocky Mountain	KI3L
WX4G	Southeastern	K3KG(K4FJ)
W6MKB	Southwestern	W6TMD
NR5M	West Gulf	K5NW

Low Power Division Leaders <150 W)

Phone	Division	CW
VE1NG	Canada	VO1MP
W3UJ	Atlantic	W2TZ
NG9L	Central	K9UIY
WDØBHV	Dakota	WBØBJP
WA5OYU	Delta	WA5OYU
W8JRK	Great Lakes	KR8Y
K3FNW	Hudson	W2KHQ
WAØNOK	Midwest	NIØG
KG1D	New England	KS1J
W7YAQ	Northwestern	KU7Y
WE6G	Pacific	W6JTI
KB4EUZ	Roanoke	N3OS
W7LHO	Rocky Mountain	W7LHO
W9KTB/4	Southeastern	K4MF
N6ADK	Southwestern	N6IBP
N5AW	West Gulf	KY5N

QRP Division Leaders

Phone	Division	CW
VE1CBF	Canada	—
K3WS	Atlantic	K3WS
—	Central	
—	Dakota	—
—	Delta	—
WA8AGH	Great Lakes	W8VSK
—	Hudson	WB2ENW
KØGT	Midwest	—
—	New England	N1AFC
KB7VD	Northwestern	—
W6YVK	Pacific	—
—	Roanoke	NN4Q
KB7M	Rocky Mountain	—
—	Southeastern	KB4GID
KB6KYB	Southwestern	KW6Q
N5BA	West Gulf	—

tition. Additionally, at least three different entries from members of the club must be submitted. In all, 59 clubs had the required three entries to qualify for this year's competition.

Over half of the clubs in the listing (31) competed in the local category. To be classified in this category, all club members must reside within 20 miles of the club's center. This year's local club champ is the Overlook Mountain ARC. OMARC submitted eight entries totaling 3.56 million points for the local club gavel.

The medium club category is designed for clubs who submit 50 or fewer entries. All stations and all members must reside within 175 miles of the club's center. There are meeting attendance requirements for members residing more than 50 miles from the club center. This year's winner in the medium category really was a winner—the Potomac Valley Radio Club gathered in 41 entries for an 18.2 million point aggregate. The North Texas Contest Club was second, with eight million.

To participate in the unlimited category, a club must submit 51 or more entries. This year, two clubs topped the 51 entry mark: the Frankford Radio Club and the Yankee Clipper Contest Club. The Frankford crew took the gavel again, amassing 86 entries for a total of 40.4 million points. The Yankee Clipper sailed in with 68 entries totalling 26.5 million for second.

Club Secretaries note: Several of you failed to submit an eligibility list this time. Hence, some clubs that might have fallen in the local category were reclassified to the medium category. Please—send your rosters to the ARRL Contest Branch by the mailing deadline next time!

In closing, the 1986 ARRL International DX Contest was made a success because of the effort put forth by the numerous "Deserving DXers" who, despite the odds, gave it their all. We salute you.

CU in the 1987 contest, to be held on February 21-22 (CW) and March 7-8 (Phone). GL!

DX Continental Winners—Phone

Single Opr	Africa	Asia	Europe	North America	Oceania	South America
All Band	ZS6USA	JH7DNO	GW4BLE	VP5Y (N6EK)	WB6FCR/KH6	LU1BR
160	—	—	IV3PRK	—	—	—
80	—	JA1XAF	HB9CXZ	4U1UN (K2GM)	ZL1AAS	HK3IXJ
40	ZS6DW	JA2BAY	I4AVG	—	KH6IJ	HC5EA
20	—	JF1SEK	F6CTT	KP4FI	K6GSS/KH6	HC1HC
15	CT3BM	JA9RPU	EA7AVU	VP2MU (K1CLN)	VK3GK	HK3MAE
10	ZS6P	—	—	—	—	LU1E (LU3AJW)
QRP	—	4X6IF	F9YZ	—	K7SS/KH6	—
Multiop						
Single TX	W6QL/Z2	JA1YWX	I5NPH	ZF2HI	KH6XX	LU1VZ
Two TX	—	JA7YAA	—	V47M	—	PJ0B
Unlimited	—	JE2YRD	I3EVK	—	—	—

DX Continental Winners — CW

Single Op	Africa	Asia	Europe	North America	Oceania	South America
All Band	ZS6USA	JA7FWR	DL6FBL	N5AW/NP2	AH6AZ	9Y4AA (N6TJ)
160	—	JA7NI	OK1JDX	V3DA (W3UM)	—	CX8DT
80	—	UA0ZQC	OK3TJI	NP4Z	—	OA4ZV
40	SM5ALJ/EA8	UH8EC	I0JX	HI8LC	KH6DW	PY4WAS
20	5Z4DE	JA3YBF	G3FXB	TE4T	K7SS/KH6	LU8DQ
15	EA8AVW	—	YU4ETF	—	VK4XA	ZP5XDW
10	—	—	—	—	—	PA0VDV/PJ2
QRP	EA8BIE	JA1KFX	F9YZ	—	KH6CP	YV3AGT
Multiop						
Single TX	W6QL/Z2	JE2YRD	YU4EXA	—	KH6XX	P40M
Two TX	—	JA7YAA	GB4DX	—	—	—
Unlimited	—	JA2YKA	IO3FIY	—	—	—

Top W/VE Single Band Scores—Phone

160		*20*	
K1ZM	8,400	K2VV	625,485
WB3GCG/4	5,724	KR2J	476,043
W0ZV	4,437	KS1L	459,510
N4SU	3,600	N2AA	454,215
W0KEA	3,332	W1WEF	337,737
AB1A	2,304	K3KG	293,436
K3UA	2,139	N7TT	280,872
W2FCR	1,425	WB9HAD	145,914
W4BAA	1,008	W1GG	139,680
K4TEA	630	W8TWA	110,079
80		*15*	
K2EK	54,315	K3RV	325,680
KM1H	48,300	N8II	206,094
KA1XN	41,391	K5LZO	102,051
K3NA	29,388	AI6V	100,548
WA4SVO	27,072	K6SVL	97,980
KQ3V	20,955	N4VZ	80,100
KM1R	17,808	AA4M	78,336
K3WGR	13,824	N4BP	68,373
KZ2I	12,555	KC7V	54,450
NG2X	11,205	K1EFI	48,618
40		*10*	
NZ5I	24,639	K4JRB	18,759
AD8C	17,901	VE1BNN	7,740
KD2RD	17,658	KR9G	6,318
W9CH	16,350	WB5N	5,100
W7FP	13,536	VE3FWQ	5,037
W4OWY	11,178	W3PWO	4,158
KB0U	10,206	W8AKS/6	3,672
NC2V	8,190	N4EJV	3,060
NJ8N	7,980	K9LA	2,592
W4PZV	6,882	K2OVS	2,295

Top W/VE Single Band Scores—CW

160		*20*	
K5UR	15,000	K2VV	363,768
N4SU	7,503	W1WEF	226,812
W0ZV	6,480	W1GL	225,018
N4PN	5,428	WA2OOS	182,880
K4TEA	4,653	WD8AUB	169,944
K6DDO	4,392	W1IHN	153,792
W4NL	3,600	KA2MXO	150,144
N4IN	2,349	WD8LLD	130,680
N6TR/7	2,054	KA3NED	117,783
N7DF	1,827	K9QVB	109,200
80		*15*	
W1FV	100,788	K3RV	107,994
W4MYA	42,480	K1RM	55,188
KE9A	15,150	WB4TDH	40,188
N3BJ	13,038	KV8Q	33,855
W0UO	11,514	K8XR	24,009
W1NH	11,025	K4TKM	18,270
KQ8M	8,856	NJ6P	10,836
K8DD	7,770	K3TW	3,588
K3SMQ	6,633	K7OVM	3,150
AA5C	5,760	KC4GR	2,754
40		*10*	
N6QR	181,260	KR1R	231
KR2J	162,000	K9LA	189
W6YA	152,205	KE2N	168
AA7A	129,375	VE2AEJ/3	72
N4ZC	80,145	WB2AMU	45
N4ZZ	68,670		
W5WQN	23,940		
KJ0H	17,138		
NJ8N	15,180		
W2HG	10,836		

Top DX Single Band Scores—Phone

160		*20*	
IV3PRK	1,479	KP4FI	549,594
CU2AF	396	HC1HC	420,039
80		F6CTT	406,812
4U1UN	265,842	K6GSS/KH6	365,400
XE1OX	109,548	CU2AN	297,165
HK3IXJ	87,900	I4RYC	270,180
VP5Z	71,736	LU6ETB	264,132
ZL1AAS	25,707	G4BWP	259,782
HB9CXZ	20,910	WB2PSD/HK2	242,385
VK2FAE	19,332	OK6DX	239,946
JA1XAF	18,600	*15*	
HG7B	13,104	HK3MAE	225,456
40		VP2MU	173,469
HC5EA	120,744	CT3BM	135,270
YV2NY	98,049	K2KTT/PJ7	101,385
ZY5OC	86,496	YV5IAL	78,000
JA2BAY	24,219	EA7AVU	74,718
I4AVG	22,032	PS7KM	58,608
YV6BTF	18,144	I5OYY	27,720
KH6IJ	13,938	IK2GSN	24,255
WH6W	11,340	EA5FCP	20,988
JH0LFE	10,872	*10*	
JH1AEP	8,532	LU1E	242,220
		LU8DPM	153,750
		CX2AAL	112,896
		W1BIH/PJ2	87,849
		ZS6P	6,570
		ZP5XDW	5,760

Top DX Single Band Scores—CW

160		*20*	
V3DA	40,770	K7SS/KH6	258,042
KL7Y	12,075	LU8DQ	254,040
FG/W2KN/FS	2,760	G3FXB	167,076
CX8DT	1,653	OH1AA	98,739
JA7NI	1,260	PY2RRG	96,513
JF1NZW	891	JA3YBF	91,143
JE1SPY	660	JF2EZA	82,521
OK1JDX	297	Y23DL	78,966
80		JH1AEP	72,504
NP4Z	106,530	JF1SEK	64,050
KØGVB/C6A	82,134	*15*	
OK3TJI	35,682	ZP5XDW	232,008
HG5A	34,965	VK4XA	38,829
DL6RAI	28,944	EA8AVW	22,089
KL7UR	22,575	YU4ETF	15,903
EA8AQS	19,980	I1XPQ	11,310
UA0ZQC	16,965	EI3DP	7,395
OA4ZV	16,032	OK2BCI	6,138
JA1YBK	15,390	I2QIL	5,934
40		OK1TW	5,280
I0JX	202,122	ON4XG	3,366
YU1EXY	121,950	*10*	
I2UBI	102,900	PA0VDV/PJ2	29,085
KH6DW	85,374		
VK2BQQ	69,336		
F6ARC	50,181		
PY4WAS	49,632		
YU2QS	45,264		
HA0LM	41,082		
G4CNY	35,175		

SOAPBOX

Come on solar flux! (WB1CNM). Biggest surprise was being called by KC6DM for country no. 263 (W2DW). It was really interesting operating 15 and 20 with the Yagi stuck at 120 degrees, but it still got its share (KW2J). Finally after ten years, off and on, propagation allowed us to compete with New England! (KØDQ). I was really surprised to work 26 countries on 40 meters running 3 watts! (K3WS). Compared to last year, conditions were very disappointing. Even the top band yielded very few European QSOs (W3VT). All JA and no Europe keeps the multiplier count low. Thank goodness for the Caribbean and South American multipliers. At least next year we'll be on the up side of the sunspot cycle! (KA5KWX). Ahh, snow static...I love it!! (KT5X). Looking at my log for the first night, I was about 20% ahead of where I've ever been before by morning on Saturday (W5WQN). Low sunspots and QRP yielded a low score and slow contest weekend. But at least it gave me more of a reason to get my tower up (KW6Q). Fortunately, my towers and antennas escaped hurricane winds that knocked out a commercial station's tower close to my QTH (W6BIP). Totally rotten WX. Spent a great deal of the weekend watching to make sure the antennas stayed up! (K6LRN). Unusual desert rain and high winds killed the first night on the low bands (N8BJQ/6). Murphy reigned...and rained, and rained to give over 8 inches during the contest and lots of rain static (N6GG). Who stole Europe on Saturday? (KU7Y). Conditions were excellent for QRP especially 40 and 80 (W8VSK). What are the odds of the driver and both 6146s going sour in the same contest in only 6 hours of operation? (KK9G). I discovered it's hard to work 160, 80 and 40 with the vertical down on the roof and the wire frozen to the drainpipe. I still managed two QSOs! (WB9HRO). With barefoot power and simple antennas, you really learn to appreciate good solar activity (KA0P). I only was using 40 watts to an all-band vertical antenna, but managed to work some good new DX (VE7EIE). Picking up two multipliers in the last 4 minutes was a surprise (KM1H). High winds gave me antenna-raising problems but I still managed 5 new countries (KA1DBK). My first contest after my upgrade to General at the age of 12 (KA2WLI). A fantastic finish! After working every continent except Asia, with a mediocre station from the East Coast, I finally heard a JH8 one minute before the contest ended and logged him at the end! (KØDI). I can't remember the last time I could hear North and South America, Europe, Africa and Hawaii all at the same time (K4BNC). Due to the propagation doldrums, I wasn't too inspired to mount a major effort this year (W3IQS). Heard W5s working VK, ZL and KH6, but except for Easter Island and FO8 this was an African/Americas party! (K4JRB). The generally good conditions on the high bands forced me to spend more time on the rig than I planned (KA5KWX). Had consecutive 30+ QSO hours only three times. It's rough in Texas from a city lot these days (K5RX). Enjoyed the contest as always, it's still my favorite! (N5AW). Three new countries on 160! (N8BJQ). Contests seem to have a magnetism all their own. European openings were very poor; where were the OHs and the Russians? (W6BYH). We worked every station we could hear, then ran into dupes (WD8QDQ). Propagation was strange this year: Forty-over signals from Europe, but they couldn't hear us! (NJ8N). Never did get a run on JAs! Will be glad when the spots are in again (N2BVJ/9). It took two whole days to get the 9U5! (VE3GRA). Thanks to D44BC and UV1OO, I got two new ones! (VE7EIK). Never expected *10 meters* to open. Next year I'll have an antenna (WB2ULI). Operating with JI6CUK and JM1CAX was a real pleasure. We beat last year's winning QSO total but

DX Plaque Winners—Phone

Category Single Op	Winner	Donor
World	LU1BR	North Jersey DX Assn
Africa	ZS6USA	Kenwood Employees Amateur Radio Club, WD6DJY
Asia	JH7DNO	Acadiana DX Assn
Europe	GW3BLE	Murphy's Marauders Contest Club
North America	VP5Y (N6EK)	Chod Harris, VP2ML
Oceania	WB6FCR/KH6	N7AVK Doc Sayre and DX Int'l Society
South America	LU1BR	Kenwood Employees Amateur Radio Club, WD6DJY
1.8 MHz	IV3PRK	Fred Race W8FR, CPO USN
3.5 MHz	4U1UN	Kenwood Employees Amateur Radio Club, WD6DJY
7 MHz	HC5EA	Central Arizona DX Assn
14 MHz	KP4FI	Don Wallace W6AM Memorial, Central CA DX Club
21 MHz	HK3MAE	Kenwood Employees Amateur Radio Club, WD6DJY
28 MHz	LU1E	Kenwood Employees Amateur Radio Club, WD6DJY
QRP	K7SS/KH6	Gerald Griffin MD, W8MEP/6
Multioperator, Single Transmitter		
World	ZF2HI	Gloucester County ARC
Africa	W6QL/Z2	David Vogel, NL7P
Asia	JA1YWX	Kenwood Employees Amateur Radio Club, WD6DJY
Europe	I5NPH	Metro DX Club
North America	ZF2HI	Nick G. Lash, K9KLR
Oceania	KH6XX	Society of Midwest Contesters
South America	LU1VZ	Kenwood Employees Amateur Radio Club, WD6DJY
Multioperator, Two Transmitter		
World	V47M	Kenwood Employees Amateur Radio Club, WD6DJY
Asia	JA7YAA	Kenwood Employees Amateur Radio Club, WD6DJY
Europe	—	Tom Middleton, WB4CKY and Joyce Middleton, KB4OMW
North America	V47M	John Brosnahan, W0UN
South America	PJ8B	Kenwood Employees Amateur Radio Club, WD6DJY
Multioperator, Unlimited		
World	I3EVK	"Mac" Crush, WB4UOI Memorial—Phil Sager, WB4FDT
Asia	JE2YRD	Kenwood Employees Amateur Radio Club, WD6DJY
North America	—	Willamette Valley DX Club

DX Plaque Winners—CW

Single Op	Winner	Donor
World	9Y4AA (N6TJ)	North Jersey DX Assn
Africa	ZS6USA	Kenwood Employees Amateur Radio Club, WD6DJY
Asia	JA7FWR	Alamo DX Amigos
Europe	DL6FBL	Clarke V. Greene, K1JX
North America	N5AW/NP2	Potomac Valley Radio Club
Oceania	AH6AZ	Tom Morton, KT6V
South America	9Y4AA (N6TJ)	Southern California DX Club
1.8 MHz	V3DA	Jim Dionne, K1MEM and Bill Poellmitz, K1MM
3.5 MHz	NP4Z	Mad River Radio Club
7 MHz	I6JX	Platinum Coast ARS
14 MHz	K7SS/KH6	Bencher, Inc.
21 MHz	ZP5XDW	Southern New England DX Assn
28 MHz	PA0VDV/PJ2	Kenwood Employees Amateur Radio Club, WD6DJY
QRP	YV3AGT	Woodbridge Wireless—KZ2E & KA2TPA
Multioperator, Single Transmitter		
World	P40M	George Schultz, W0UA and John Brosnahan, W0UN
Asia	JE2YRD	Kenwood Employees Amateur Radio Club, WD6DJY
Europe	YU4EXA	Kenwood Employees Amateur Radio Club, WD6DJY
North America	V47A	Kenwood Employees Amateur Radio Club, WD6DJY
Oceania	KH6XX	Southwest Idaho DX Club
South America	P40M	Vic Clark, W4KFC Memorial—Phil Sager, WB4FDT
Multioperator, Two Transmitter		
World	GB4DX	Tom Frenaye, K1KI
Asia	JA7YAA	Kenwood Employees Amateur Radio Club, WD6DJY
Europe	GB4DX	Texas DX Society
Multioperator, Unlimited		
World	IO3FIY	H. Stephen Miller, N0SM
Asia	JA2YKA	Kenwood Employees Amateur Radio Club, WD6DJY
Europe	IO3FIY	Schenectady Amateur Radio Assn
North America	—	Willamette Valley DX Club

W/VE Plaque Winners—CW

Single Operator		
All Band	W3GRF (K0DQ)	Frankford Radio Club
1.8 MHz	K5UR	Connecticut Wireless Assn
3.5 MHz	W1FV	Dayton Amateur Radio Assn
7 MHz	N6QR	Northern Arizona DX Assn
14 MHz	K2VV	Fox Cities ARC
21 MHz	K3RV	Carl Luetzelschwab, K9LA
28 MHz	KR1R	W5MYA
QRP	NN4Q	Hollywood Amateur Radio Club
Multioperator		
Single Transmitter	N4WW	Kenwood Employees Amateur Radio Club, WD6DJY
Two Transmitter	W2REH	Kenwood Employees Amateur Radio Club, WD6DJY
Unlimited	W3LPL	Colorado Contest Conspiracy

W/VE Plaque Winners—Phone

Single Operator		
All Band	K1KI	Frankford Radio Club
1.8 MHz	K1ZM	Butch Greve, W9EWC, Memorial
3.5 MHz	K2EK	Lance Johnson Engineering, K0CS
7 MHz	NZ5I	Dave Thompson, K4JRB
14 MHz	K2VV	Dayton Amateur Radio Assn
21 MHz	K3RV	Kenwood Employees Amateur Radio Club, WD6DJY
28 MHz	K4JRB	Windsor Amateur Radio Club
QRP	K3WS	Woodbridge Wireless—KA2TPA & KZ2E
Multioperator		
Single Transmitter	K3TUP	Kenwood Employees Amateur Radio Club, WD6DJY
Two Transmitter	KX4S	Kenwood Employees Amateur Radio Club, WD6DJY
Unlimited	W3LPL	Western New York DX Assn—W2RR

us "suffering sevens" can't match the Eastern half of the US for mults (K7LXC). Dead band conditions from 0600 to 1330 daily greatly reduced the score (ZS6USA). Although conditions were very poor, I enjoyed the contest very much (JA1XAF). I hope the conditions are better for next year's contest (JH7XGN). Because the propagation between the US and Ogasawara wasn't very good, all my contacts were on 40 meters (JM1WZP/JD1). Nature provided one of her great miracles Sunday evening with a magnificent opening to the States. We haven't experienced such exciting conditions in the Middle East in over a year. Who says there's no great DXing during a sunspot minimum? (4X6IF). I was invited to a party Saturday night and had to appear there. My physical condition afterwards allowed only 7 hours of operation, then I was closed down and fell into a deep sleep (although 40 and 80 were still open). I missed the alarm and woke up some time in the afternoon after 20 had been open for 3 hours (DL6FBL). This contest was very educational, especially in training to set up my antennas. I wasn't able to work the whole time because the bad WX caused my antenna to break four times. Anyway, I really enjoyed the contest (DL1HCM). The lonely wait for an opening was rewarded with WØHRU, my first ever SD! (EI3DP). Just been looking back in my first contest logs of 1939, and none of the calls appeared in this year's log! With 40 years of participation, it's still enjoyable! (GW3JI). In general, very bad conditions this year. Eighty was in good shape just a half an hour before the end of the contest (HB9AGA). It was again my great battle against powerful stations and poor conditions. I enjoyed the contest very much and kept the QRP flying! (OK1DKR). Very hard job with a QRP rig against EU KWs. See you again next year with the dwarf rig against the giant powers! (OK2PAW). Forty was by far the best band, 10 was dead, and 80 was noisy with JAs audible at times (VP2APK). A bit different from my first contest in 1931/1932. There was time to exchange pleasantries then (VK2DID). The QRN on 160 was a problem in getting better results (RAØFA). Hats off to American amateurs and many thanks to the European amateurs who showed such fine discipline in keeping all channels clear of QRM during the QRP contacts!! (4X6IF). Fine 15-meter propagation (EA5FHE). Once again a very enjoyable contest, a pleasure to work so many enthusiastic operators. If this is a time of low sunspots, I can't wait for the maximum years! (G4XKR). It was a pleasure to work stations in the US and Canada, as their general operating standards are very good. I may be placed last in the single-band-results table, but this is of secondary importance, as I believe that taking part in a contest is where much of the enjoyment lies (G4XOM).

Special Plaque Winners

Single Operator	Winner	Donor
W/VE Operator Combined Score	K3ZO	National Contest Journal
W/VE Low Power, Combined Score	VO1MP	Rochester DX Assn
Africa, Combined Score	ZS6USA	Tom Gregory, N4NW
Arizona (CW)	K7OX	Central Arizona DX Assn
Arizona (Phone)	K7OX	Central Arizona DX Assn
Atlantic Division (CW)	W3GRF (K0DQ, opr)	K2NY Memorial—Salt City DX Assn
Fifth Call Area (CW)	K5NW	W5GO Memorial—Red Stick DX Assn
Great Lakes Division (Phone)	WD8IXE	Livonia Amateur Radio Club
Great Lakes Division (CW)	W8LNO	Livonia Amateur Radio Club
Japan (Phone)	JH7DNO	Western Washington DX Club
Southeastern Division (Phone)	WX4G	Robert Garlough, KB4WU Memorial
USSR All-Band (Phone)	UQ1GWW	K1KI,WA2VUY,NC5K,KA6V,AA6BB,NE8K,WØZV
USSR All-Band (CW)	UW0LT	K1KI,W1DA,W3XU,WB4TDH,NC5K,KA6V,W9LOF, WØZV
Caribbean Multi-Single (Phone)	ZF2HI	W5MYA
Caribbean Multi-Single (CW)	P40M	The YASME Foundation
Multi-Multi Combined World	W3LPL	W2PV Memorial

FEEDBACK

Please note the following corrections to the results of the 1985 ARRL International DX Contest starting on page 78 of October 1985 *QST*.

On CW, N7IR's CW line score should have read 69,630-211-110-A MDC. K6DR should have been listed in the Sacramento Valley Section. W6JTI was the first place scorer in SF and W6NKR the second place winner in SV. AI5P/TF's line score should have read AI5P/TF 89,554-328-91-B.

On Phone, VP2EAG replaces HC1HC as the 20-m single-band winner. His score should have read 486,528-2896-56-C-20. KC7QP's 20-m single-band score was listed as an all-band entry. His score should have read 11,193-91-41-C-20. Frankford Radio Club's Phone winner was W3BGN.

Scores

The scores are listed by mode—phone and CW. For both W/VE and DX scores, single operators are listed first, followed by multioperator single transmitter, multioperator two transmitter, then multioperator unlimited. W/VE single transmitter scores are broken down by call area and ARRL Section. W/VE multi-single scores are broken down by call area only. All W/VE multiop two-transmitter and unlimited scores are grouped together in descending order by score. DX single-op and multiop scores are broken down by continent and country. Under each ARRL Section (and country for DX), single-op scores are listed in descending order by category. All-band scores are listed first, followed by 160, 80, 40, 20, 15 and 10-meter single-band scores.Each line score lists the follwing information: call, score, QSOs, multipliers, power output used (A = 10 W, B = 11-150 W, C = more than 150 W). The first station in each category (other than all-band) has a designator following the power indicator. Single-band entries are indicated by 160, 80, 40, 20, 15 and 10. For example, in Connecticut, the top all-band phone scorer is K1KI. The top low-power (150 W or less) entrant is KG1D. KM1R has the top 80-meter single-band score, KS1L has the top 20-meter single-band score, and K1EFI has the top 15-meter single-band score. There were no QRP entrants.

W/VE Phone

1

Connecticut

K1KI	1,885,482	1922	326-C	
W1QK	252,300	680	145-C	
WA1LVW	164,832	404	136-C	
KG1D	117,558	311	126-B	
K1IN	80,712	236	114-C	
K8HVT	78,084	241	108-C	
N1CC	72,000	200	120-B	
K1RM	57,120	272	70-C	
KA1ION	55,296	192	96-B	
W1DO	30,000	100	100-C	
N1JW	20,862	114	61-C	
K1ZZ	14,742	91	54-C	
KB1IZ	12,000	80	50-B	
WA2WIP	10,452	67	52-B	
KM1R	17,808	112	53-C-80	
KS1L	459,510	1445	108-C-20	
W1WEF	337,737	1093	103-C-20	
K1YXG	37,224	188	66-C-20	
K1BV	13,440	112	40-C-20	
KA1DSQ	5,552	78	28-B-20	
K1EFI	48,618	219	74-C-15	
WA1FGN	36,900	205	60-B-15	

Eastern Massachusetts

K5ZD/1	1,134,027	1289	291-C	
K1VR	909,468	1203	252-C	
W1CWU	331,788	643	172-C	
K5MA	171,828	444	129-C	
W1FJ	144,480	430	112-C	
AI3E	42,966	154	93-C	
W1AX	30,000	100	100-C	
W1IHN	29,400	100	98-C	
W1DOH	25,752	148	58-C	
NC1M	15,087	107	47-C	
K1MEM	6,000	50	40-C	
W1PLJ	3,483	43	27-C	
AB1A	2,304	32	24-C-160	
KA1EKR	20,124	129	52-B-20	

Maine

KB1VZ	759	23	11-B-10	

New Hampshire

K1DG	1,242,774	1469	282-C	
AK1A	793,914	1046	253-C	
W1RR	91,125	243	125-C	
K1TR	8,694	69	42-C	
AC1J	1,863	27	23-B	
KM1H	48,300	230	70-C-80	
KE1E	2,457	39	21-B-20	

Rhode Island

K1IU	721,752	986	244-C	
K1VSJ	206,016	464	148-C	
K1HMO	105,926	251	142-C	
KS1J	25,179	109	77-B	
W1RFQ	10,044	62	54-C	
K2MN	351	13	9-B-20	
KZ1A	2,940	35	28-B-15	

Vermont

K1HKI	60,027	187	107-C	
W3SOH	41,580	154	90-B	
KD2EN	7,503	61	41-B	

Western Massachusetts

KB1W	203,175	525	129-C	
NC1B	7,140	70	34-B	
KA1KPH	27	3	3-B	
KA1XN	41,391	189	73-C-80	
WA1ZAM	168	8	7-C-80	
W1GG	139,680	582	80-C-20	
KR1R	408	17	8-C-10	

2

Eastern New York

K2TR	379,200	632	200-C	
KY2J	208,590	409	170-C	
N2AIF	132,729	293	151-C	
W2XL	125,286	314	133-C	
W2KHQ	41,796	162	86-B	
W2GKZ	27,324	132	69-C	
KA2VZW	11,550	77	50-C	
W2DW	11,466	78	49-C	
WA2AXK	8,979	73	41-C	
K2XA	5,400	50	36-C	
K1ZM	8,400	70	40-C-160	
K2EK	54,315	255	71-C-80	
KR2J	476,043	1483	107-C-20	
K2IBW	82,824	406	68-C-20	

NYC & Long Island

KA2MXO	225,307	509	141-C	
K2YGM	55,100	197	100-C	
NN2F	52,416	208	84-C	
W2MOY	50,196	188	89-C	
WB2RNT	20,907	101	69-C	
NN2C	20,085	103	65-B	
N2FYA	12,825	95	45-B	
W2GGE	8,316	63	44-C	
N2FIG	147	7	7-C	
KA2WLI	108	6	6-C	
KD2RD	17,658	109	54-C-40	
K2MFY	50,301	243	69-B-20	
WA2OVG	2,574	33	26-B-20	
K2HPG	756	18	14-C-20	
WA2HQB	1,440	30	16-C-15	
WB2AMU	360	12	10-B-15	
K2OVS	2,295	45	17-B-10	

Northern New Jersey

N2LT	1,237,698	1463	282-C	
W2RQ	721,746	1191	202-C	
W1GD	192,864	392	164-C	
WA2VUM	115,056	408	94-C	
KY2P	100,224	261	128-C	
N2CS	63,480	184	115-C	
K8DI	62,604	222	94-C	
K3FNW	59,058	193	102-B	
W2HAJ	49,551	199	83-B	
K2BK	42,558	173	82-C	
W9NTU	30,336	158	64-B	
W2PHW	29,799	129	77-C	
KT2D	3,528	42	28-B	
W2FCR	1,425	25	19-C-160	
N3AHF	9,240	70	44-C-80	
WB2HJW	969	19	17-C-80	
WA2IFS	3,078	38	27-C-40	
N2AA	454,215	1415	107-C-20	
WA2ASQ	11,040	80	46-B-20	
K4BNC	21,450	130	55-C-15	
WB2DND	1,248	26	16-B-15	

Southern New Jersey

N2RM	1,074,840	1352	265-C	
N2MM	978,600	1185	280-C	
K8XR	546,165	795	229-C	
K2FL	238,680	442	180-C	
K2JLA	195,891	391	167-C	
N2MR	195,624	418	156-C	
N2SS	188,856	366	172-C	
NJ2D	84,501	229	123-C	
W2PAU	76,581	201	127-C	
K2OWE	69,300	210	110-C	
WA2OOS	55,596	226	82-C	
N2VW	28,548	122	78-C	
W2FGY	25,404	116	73-C	
N2DN	12,798	79	54-C	
WB2ERI	8,514	66	43-C	
WB2UVB	4,950	50	33-B	
WA2VYA	810	18	15-B	
WA2AWS	429	13	11-A	
KZ2I	12,555	93	45-C-80	
NC2V	8,190	78	35-C-40	
KA2JMM	49,344	257	64-C-20	
AB2Y	3,750	50	25-C-20	
W2CN	3,024	42	24-C-20	
N2CQ	960	20	16-C-20	
W2EA	726	22	11-B-20	

Western New York

W2TZ	233,070	457	170-B	
W2FXA	183,057	379	161-C	
KB2WN	121,695	305	133-C	
KB2SE	25,560	120	71-C	
KK2B	21,012	103	68-B	
W2FUI	18,720	104	60-B	
W2PHT	18,333	97	63-B	
NA2Q	11,220	68	55-B	
W2SNI	5,700	60	38-B	
W2HG	3,552	37	32-C	
WA2JBV	363	11	11-B	
NG2X	11,205	83	45-C-80	
W2HZ	9,636	73	44-C-80	
K2VV	825,485	1813	115-C-20	
NI2T	58,179	451	43-C-20	

3

Delaware

AA1K	555,093	693	267-C	
W3NX	165,330	330	167-C	

Eastern Pennsylvania

KT3M	1,273,440	1516	280-C	
KJ3R	322,095	545	197-C	
W3DHM	272,454	499	182-C	
WB3CIW	229,773	401	191-C	
WB3FYL	226,233	441	171-C	
KA3DSW	162,792	357	152-C	
N3NBA	148,347	311	159-C	
W3EVW	138,450	325	75-C	
AD3Z	109,980	260	141-C	
W3ARK	102,600	300	114-B	
W3OV	91,242	274	111-C	
KN3S	78,518	218	117-C	
W3KV	73,080	210	116-C	
N3CHL	68,670	218	105-C	
N3RW	54,372	197	92-C	
KC3NO	29,952	128	78-B	
N3HW	28,710	145	66-C	
KC3AF	26,847	157	57-B	
N3CIX	25,056	116	72-B	
KA3NJA	16,038	99	54-B	
WB3EPW	14,790	85	58-C	
W3YFV	11,760	80	49-C	
KA3LCF	10,578	82	43-C	
K3IPK	10,458	83	42-B	
K3DYX	7,254	62	39-C	
K3ZLK	4,512	47	32-B	
W3IQS	4,278	46	31-C	
KA3JJH	4,050	45	30-B	
KA3OAX	720	16	15-B	
W3FTG	75	5	5-B	
KQ3V	20,955	127	55-C-80	
K3WGR	13,824	96	48-C-80	
AI3Q	61,308	262	78-C-20	
KI3N	14,994	119	42-C-20	
WA3JXW	720	20	12-C-20	
WB3FPA	12,804	97	44-B-15	

Maryland-DC

K3ZO	1,510,758	1662	303-C	
N2FB	1,289,238	1423	302-C	
K3ZJ	768,687	997	257-C	
W3UJ	286,836	583	164-B	
K3WS	158,928	344	154-A	
WB3BRF	61,800	206	100-B	
KD8WX	20,736	108	64-B	
K3WX	18,483	101	61-C	
W3JPT	4,524	52	29-B	
W6AXX	4,182	41	34-C	
K3NA	29,388	158	62-C-80	
W3EE	2,250	30	25-B-20	
K3TW	14,766	107	46-C-15	
W3PWO	4,158	63	22-C-10	

Western Pennsylvania

K3MD	195,615	405	161-C	
W3CV	25,764	113	76-C	
W3HRF	24,735	97	85-C	
K3UA	2,139	31	23-C-160	
AD8J/3	18,648	111	56-C-20	
W3FGS	11,193	91	41-B-20	
KA3BTH	1,080	24	15-C-10	
WA3CGE	1,080	30	12-C-10	

4

Alabama

AA4LE	97,464	248	131-C	
KB4FAI	27,258	118	77-C	
WA4VEK	1,512	28	18-C-20	
K5RY	495	15	11-B-15	

Georgia

WX4G	1,217,640	1390	292-C	
W8ZF/4	761,388	947	268-C	
KX4R	347,976	537	216-C	
W1UA	160,821	321	167-C	
K4EZ	122,292	316	129-C	
NQ4I	102,366	242	141-C	
WI4R	90,360	251	120-C	
W4DXI	82,875	221	125-C	
W4MGX	80,304	239	112-C	
K4PI	74,676	196	127-C	
W9KTB/4	65,205	207	105-B	
K4BAI	54,540	202	90-C	
KC4GR	33,396	121	92-C	
K4GKV	30,336	128	79-C	
KE4XY	15,045	85	59-C	
K4TEA	630	15	14-C-160	
W4OWY	11,178	81	46-C-40	
K3KG	293,436	836	117-C-20	
N4VZ	80,100	300	89-C-15	
W4UYC	8,190	78	35-C-15	
WN4S	8,040	67	40-C-15	
K4JRB	18,759	169	37-C-10	

Kentucky

WB4FOT	35,607	143	83-C	

North Carolina

KF4HK	256,032	508	168-C	
K2SD	38,070	135	94-C	
WB3GCG/4	5,724	53	36-C-160	
N4SU	3,600	40	30-C-160	
W4UW	2,664	37	24-C-15	

Northern Florida

W4WKQ	101,517	247	137-C	
WA4SVO	27,072	141	64-B-80	
WC4E	33,630	190	59-C-15	

Southern Florida

W4BV	119,472	262	152-C	
K8UNP	64,074	181	118-C	
WK4F	44,982	153	98-C	
W4PC	13,680	80	57-C	
KA4UBC	13,158	86	51-C	
W2SDB/4	2,340	30	26-C	
KB4HGV	1,320	22	20-B	
W4BAA	1,008	21	16-C-160	
W4PZV	6,882	62	37-C-40	
W4YN	6,660	60	37-C-20	
N4BP	68,373	321	71-C-15	
N4EJW	23,010	130	59-C-15	
K4MF	15,933	113	47-B-15	
N4EJV	3,060	51	20-C-10	
K8FD	1,368	38	12-B-10	

Tennessee

K4JHT	85,344	254	112-B	
AA4MN	64,515	187	115-C	
KB4HU	46,206	151	102-C	
KE4HX	36,084	194	62-C-15	

Virginia

W3HHG	382,709	633	191-C	
N4MM	331,752	601	184-C	
N3JT	289,440	603	160-C	
K4GKD	136,458	342	133-C	
N4XD	85,581	257	111-C	
K4OD	76,923	231	111-C	
N3AVA/4	54,432	189	96-C	
WB4LNT	45,402	161	94-C	
N3RC	21,870	135	54-C	
KB4EUZ	17,955	95	63-B	
WA4MMP	1,440	24	20-C	
KJ4EX	972	18	18-C	
KE4MM	5,742	58	33-C-80	
W4KMS	2,886	37	26-C-80	
W4VAN	2,079	33	21-C-80	
W4YE	4,500	50	30-C-20	
K3RV	325,680	944	115-C-15	
KB4DFK	10,947	89	41-C-15	
N4JGQ	729	27	9-C-10	

5

Arkansas

K5FUV	139,062	301	154-C	
W5EIJ	18,525	95	65-C	

Louisiana

KE5LQ	24,642	111	74-B	

Mississippi

K5MK	263,007	459	191-C	
WA5OYU	105,533	267	133-B	
KF5AU	73,710	210	117-C	
N5IKA	40,851	153	89-C	
N5GRU	9,120	80	38-C-20	
KA5KWX	2,223	39	19-C-10	

New Mexico

KI3L	405,162	738	183-C	
N5EPA	66,456	214	104-C	
W7LHO	55,200	200	92-B	
AI9X	40,812	179	76-C	
N5ACP	8,261	63	49-C	
WA5VAL	144	12	4-B	
KT5X	2,394	38	21-C-40	

Northern Texas

K5RX	689,082	822	277-C	
K5NW	283,410	470	201-C	
KA5W	254,436	486	182-C	
N5JB	201,786	398	169-C	
N5AW	178,416	336	177-B	
K4VUD/5	165,648	408	136-C	
NI5M	147,465	339	145-C	
W5LMG	86,031	237	121-C	
N4QS	85,995	245	117-C	
N5RM	84,411	249	113-C	
N5UA	82,584	222	124-C	
K5WXZ	72,306	205	117-C	
K2SCU/5	24,708	116	71-C	
KY5N	3,906	42	31-B	
NZ5M	900	20	15-B	
K7CW/5	660	20	11-B	
W5BOS	5,508	68	27-C-20	
W5AE	882	21	14-C-20	
K9LA	2,592	48	18-C-10	

Oklahoma

KA5UDL	1,368	24	19-B	
W5VBE	2,508	38	22-B-15	

Southern Texas

NR5M	961,740	1170	274-C	
WE5P	94,380	260	121-C	
KC5CP	91,854	243	126-C	
WB5INB	79,758	211	126-C	
N5JJ	75,210	218	115-C	
W5PWG	53,406	207	86-C	
WA5IYX	48,594	182	89-B	
W5KCR	31,086	157	66-C	
WD5N	10,935	81	45-C	
K5RF	4,032	48	28-B	
KA5RZU	420	14	10-B	
K5BDA	2,304	32	24-C-80	
NZ5I	24,639	191	43-C-40	
NT5D	97,614	374	87-C-20	
K5LZO (NM5M,opr)	102,051	391	87-C-15	
WB5N	5,100	68	25-B-10	
N5BA	384	16	8-A-10	

6

East Bay

K6SIK	101,970	309	110-C	
WE6G	24,528	148	56-B	
K6CSL	4,914	63	26-B	
KS6Q	300	20	5-C-20	

Los Angeles

KM6B	1,067,256	1458	244-C	
N6AW	762,570	1374	185-C	
K6EID	413,595	707	195-C	
KG6IP	53,742	169	106-C	
W6MFC	40,317	151	89-C	
N6AA	39,732	172	77-C	
KB6HW	34,113	137	83-C	
KB6KYB	33,858	171	66-A	
K6OC	33,078	149	74-C	
W6CN	24,111	141	57-A	
KD6LV	22,464	104	72-C	
AI6Z	21,771	123	59-C	
W6OES	16,779	119	47-C	

N6LL 12,834- 93- 46-C
N6IBP 12,360- 103- 40-B
WA6LOD 9,120- 76- 40-B
W6ABW 8,370- 93- 30-C
KF6TG 7,992- 74- 36-B
KG6O 6,240- 65- 32-B
W6JII 5,952- 64- 31-B
KK6P 2,784- 32- 29-C
W6CBA 621- 39- 23-B
W6OK 32,250- 215- 50-C-20
JA6CVK/W6 180- 12- 5-C-20
W6RZ 48- 4- 4-C-20
K6SVL 97,980- 460- 71-C-15
W6AKS/6 3,672- 51- 24-C-10

Orange

W6TMD 240,408- 504-158-C
AB6R 161,916- 524-103-C
WN6J 19,278- 153- 42-C
W6HT 17,820- 110- 54-C
K6LEB 7,884- 73- 36-C
NM6L 8,217- 83- 33-C-20

Santa Barbara

W2KVA/6 48,969- 227- 69-C
N6VR 14,274- 122- 39-C

Santa Clara Valley

K6XO 129,837- 383-113-C
W6SZN 126,000- 420-100-C
K6LY (K6EJ,opr) 90,300- 430- 70-C
K6ITL 84,458- 276-102-C
N6AN 76,923- 259- 99-C
WA6TKT 46,740- 205- 76-C
KG6AM 13,356- 84- 53-C
K6HO 12,960- 90- 48-C
N6NF 10,413- 69- 39-C
W6YVK 5,382- 69- 26-A
W6ZKM 3,108- 37- 28-C
W6ISQ 2,430- 30- 27-C
WC6I 49,995- 303- 55-C-20
W6HXW 17,100- 100- 57-C-20
K6MA 5,220- 58- 30-C-20

San Diego

W6MKB (N6JJ,opr) 1,095,687-1503-243-C
N6ADK 88,275- 275-107-B
WB6OKK 79,254- 238-111-C
W6LUN 21,879- 143- 51-C
WN6L 18,584- 119- 52-B
N6JMV 7,854- 77- 34-B
K6MC 5,544- 56- 33-C
WA6VNR 1,680- 28- 20-C-80
AA6EE 990- 30- 11-B-20
AA4M 78,336- 408- 64-C-15

San Francisco

W6ZOK 714- 17- 14-B
K6LRN 855- 19- 15-B-20
NJ6P 17,028- 129- 44-C-15

San Joaquin Valley

KA6BIM 184,032- 432-142-C
N6BJQ 22,500- 125- 60-C
W6BYH 22,080- 115- 64-C
KB6KKL 8,694- 69- 42-C
N6OT 5,400- 60- 30-C

Sacramento Valley

N6QR 498,405- 745-223-C
K6DR 200,079- 473-141-C
K6SG 198,006- 541-122-C
N6JM 300- 10- 10-B
AI6V 100,548- 532- 63-C-15

7

Arizona

K7OX 364,182- 667-182-C
W7AYY 89,145- 283-105-C
KC7CE 22,968- 132- 58-B
N7BD 9,135- 57- 35-C
WA7KLK 5,148- 52- 33-A
KX7J 5,040- 60- 28-C
WA7NWL 540- 15- 12-A
KC7V 54,450- 242- 75-C-15

Montana

K5TT 98,226- 321-102-C
K7ABV 59,084- 303- 76-C

Nevada

KC7DB 40,545- 159- 85-C
WB7VVH 3,096- 43- 24-C
N7NV 18- 3- 2-B

Oregon

W7YAQ 80,088- 213- 94-B
W7GUR 55,704- 211- 68-C
AD7T 26,250- 125- 70-C
W7FP 13,638- 141- 32-C-40
W7TWL 828- 23- 12-C-40
AG7M 70,980- 338- 70-C-20
W7MLJ 39,204- 198- 66-B-20

Utah

W7HS 68,052- 214-105-C
W7MFU 24,180- 124- 65-B
WA7QCC 16,025- 119- 45-B
N7HUJ 2,442- 37- 22-B
WA7TUX 576- 16- 12-A

Washington

NN7L 105,540- 402- 90-C
K7DZ 86,688- 258-112-C
KB7VD 37,674- 182- 69-A
W7QN 29,172- 143- 68-C
WA7STA 11,934- 102- 39-B
W7IIT 4,941- 51- 27-B
K7DS 3,780- 45- 28-C
N7FTL 2,583- 41- 21-B
K17G 2,280- 38- 20-C-80
N7TT 280,872- 996- 94-C-20
N7RO 102,837- 581- 59-C-20
WA7GVM 48,312- 244- 66-C-20
KD7IK 46,656- 324- 49-C-20
W7LVI 36,234- 198- 61-C-20
W7BQG 1,800- 50- 12-B-20
K9GYW 1,260- 28- 15-B-15

Wyoming

KB7M 2,244- 34- 22-A

8

Michigan

W8JRK 21,698- 113- 64-B
N8CQA 15,921- 87- 61-A
W8VSK 816- 17- 16-A
W8TWA 110,079- 453- 81-C-20
K8KJH 11,931- 87- 41-C-20
N8ERV 2,550- 50- 17-C-20
K8NA 20,870- 130- 53-C-15

Ohio

WD8IXE 242,784- 562-144-C
K8MR 193,776- 367-176-C
WA8BIN 186,252- 374-166-C
WA8AGH 35,028- 139- 84-A
W8DWP 21,300- 100- 71-C
KA8KPK 21,105- 105- 67-B
W8UPH 7,938- 63- 42-C
W8IMF 6,612- 58- 38-C
N8EKS 6,450- 50- 43-C
K8EF 6,348- 46- 46-C
WA8IMF 5,304- 52- 34-B
W8IDM 1,320- 22- 20-B
AD8C 17,901- 117- 51-C-40
WD8QDO 6,195- 59- 35-C-40
W8LT (K3JT,opr) 22,137- 157- 47-C-20
N8BC 2,337- 41- 19-C-20
KA8OUT 1,514- 36- 14-B-20
WD8KTM 126- 7- 6-B-15

West Virginia

W8VEN 15,138- 87- 58-C
W8WVM 7,626- 62- 41-B
NJ8N 7,980- 76- 35-B-40
N8II 206,094- 701- 98-C-15

9

Illinois

KM9L 149,202- 307-152-C
KC9UM 108,540- 268-135-C
WB9JKI 88,842- 221-134-C
WD9GIG 54,935- 195-111-C
KV9S 38,412- 132- 87-C
W9LYN 24,750- 110- 75-B
W9TNZ 18,786- 101- 62-B
KC9OL 16,554- 89- 62-C
KD9KN 11,628- 76- 51-C
WA9ZOJ 10,350- 69- 50-B
W9ZGP 9,333- 61- 51-B
W9LNQ 9,288- 72- 43-B
N9CIW 4,620- 44- 35-C
WB9HYA 3,813- 41- 31-C
KG9Z 432- 12- 12-C
KE9U 5,508- 54- 34-C-80
KS9U 5,100- 50- 34-C-80
W9BW 1,500- 25- 20-C-80
W9CH 18,350- 109- 50-C-40
WB9HAD 145,914- 588- 83-C-20
K9RHY 91,512- 328- 93-C-20
W9NUF 52,320- 218- 80-C-20
K9UIY 8,640- 72- 40-B-20
KR9G 5,318- 81- 26-C-10

Indiana

W9RE 1,241,280-1293-320-C
WA9NPM 65,934- 198-111-C
NE9I 48,327- 181- 89-C
K9US 46,035- 155- 99-C
NE9O 45,792- 159- 96-C
W9PC 30,573- 129- 79-C
KC9FC 28,567- 127- 77-C
K9VQK 20,034- 106- 63-C
N2BVJ/9 47,328- 232- 68-C-20

Wisconsin

N9ER 125,685- 285-147-C
NB9C 104,250- 278-125-C
W9GXR 60,996- 221- 92-C
NG9L 32,076- 132- 81-B
WB9HRO 27,216- 126- 72-C
NI9C 12,561- 79- 53-B
WB9QFX 10,350- 69- 50-B
N9DMG 5,100- 50- 34-B
W9YCV 3,069- 33- 31-C
N9DHG 1,428- 28- 17-B
N9BUS 5,985- 57- 35-C-40
W9OP 65,268- 294- 74-C-20
W9GIL 33,660- 187- 60-C-20
KC9L 25,398- 166- 51-C-20

0

Colorado

N2IC/0 537,610- 943-190-C
KK0L 58,800- 200- 98-C
W0OSK 33,146- 202- 91-C
KI0G 37,989- 189- 67-C
K0GAS 37,386- 186- 67-C
KJ0G 24,882- 143- 58-C
W0BWJ 7,371- 63- 39-C
WA0JUA/0 3,456- 48- 24-C
W0GOQ 1,008- 24- 14-C
W0ZV 4,437- 51- 29-C-160
W0KEA 3,332- 44- 26-C-160
ND0E 8,208- 76- 36-C-80

Iowa

NG0W 305,184- 544-187-C
W0PLS 39,093- 157- 83-C
K0GT 36,354- 146- 83-A
W0PPF 34,425- 153- 75-C
W0VX 25,937- 123- 73-C
KA0SSZ 13,923- 91- 51-C
KA0HIB 13,860- 84- 55-B
WA0DCB 6,993- 63- 37-C

Kansas

WA0TKJ 236,964- 403-196-C
WB0ISW 79,650- 225-118-C
K0VXU 58,647- 173-113-C
NI0S 8,910- 66- 45-C
AB0X 4,200- 50- 28-C-80
KB0U 10,206- 81- 42-C-40

Minnesota

N0AT 215,670- 455-158-C
W0LP 14,469- 91- 53-C
WB0HJP 10,665- 79- 45-B
W0NGB 3,306- 38- 29-B

Missouri

K4VX (KR0Y,opr) 1,028,160-1071-320-C
W0HBH 274,620- 480-199-C
K0IFL 129,987- 303-143-C
WA0NOK 80,903- 201-101-B
WD0FSJ 38,304- 152- 84-C
KC0LX 25,986- 122- 71-C
KM0L 24,840- 115- 72-C
NI0G 24,255- 105- 77-B
W0PKO 14,256- 88- 54-C
K40USO 7,920- 55- 48-B
K0CS 1,350- 25- 18-B-80
KD0FW 3,042- 39- 26-C-20

North Dakota

KC0CU 63,300- 211-100-C

Nebraska

KD5CM 146,016- 338-144-C
N0FYM 43,326- 166- 87-B
W1VY 20,085- 103- 65-C-20

South Dakota

WD0BHV 24,570- 126- 66-B
K5LZT 60- 5- 4-B

VE

Maritime-Newfoundland

VE1NG 720,390-1298-185-B
VO1MP 315,882- 654-161-B
VO1AW 14,400- 100- 48-C
VE1CBF 13,650- 91- 50-A
VO1QU 37,800- 225- 56-B-20
VE1AGZ 14,715- 109- 45-C-20
VE1BNN 7,740- 86- 30-C-10

Quebec

VE2AYU 257,424- 496-173-C

Ontario

VE3XN 570,726- 813-234-C
VE3ST 144,615- 311-155-C
VE3IY 81,000- 250-108-C
VE3CWE 18,240- 80- 76-C
VE3GRA 11,040- 92- 40-B
VE3CUI 300- 10- 10-C-40
VE3NBE 96,672- 424- 76-C-20
VE3NXQ 20,574- 127- 54-B-20
VE3NYT 5,445- 55- 33-B-20
VE3FWQ 5,037- 73- 23-C-10
VE2AEJ/3 726- 22- 11-B-10

Manitoba

VE4JK 95,700- 319-100-C

Saskatchewan

VE5RA 249,912- 534-156-C

British Columbia

VE7AAQ 110,250- 350-105-C
VE7FJF 81,003- 403- 67-C
VE7EIK 34,560- 256- 45-C
VE7FTC 25,857- 169- 51-B

Multioperator Single Transmitter

1

AK1L (+KA1X) 591,528-1006-196-C
K1WA (+K1DM) 466,242- 653-238-C
KS1N (+KA1KVF,KB1EK,WB1EYL) 227,808- 452-168-C

2

WB2ULI (+N2BOW) 1,020,672-1329-256-C
KU2O (+K5NA,KA2ZPD) 794,508- 926-286-C
K2NJ (+KU2C,KY2O,N2CKC,WA8DSO) 723,216- 988-244-C
K2UR (+NJ2L) 447,387- 757-197-C
W2RR (K2UD,KA2s AJT,VYW,WIK,W2KKZ, WA2s AOG,DSC,MBM,WB2s ABD,CJL, IVO,oprs) 419,016- 632-221-C
WA2LQO (K2DOD,W2OKM,oprs) 289,938- 506-191-C
W2UI (+oprs) 185,484- 377-164-C
K2TD (+oprs) 139,965- 301-155-C
W2VJN (+N2BA) 66,144- 208-108-C

3

K3TUP (+KJ3L,N3BJ,AI8S,KB8IZ,W8CY) 1,323,630-1337-330-C
K3WW (+K3VW) 1,320,948-1359-324-C
WA3SPJ (+KS3F) 686,718- 942-243-C
W3AP (+NET) 674,163- 861-261-C
W3MA (+NET) 606,090- 890-227-C
W3GU (+NET) 282,240- 560-168-C
N3EC (+KA3NED) 257,925- 475-181-C
K3WJV (+WA3ZTR) 236,619- 431-183-C
N3ARK (+NET) 144,900- 345-140-C
WB3CAC (+NET) 117,504- 258-136-C
WA3IJZ (+NET) 20,204- 114- 82-C
W3BGN (+NET) 15,834- 91- 58-C

4

N4KG (+AA4s DO,NU,K4CEF,KC4ZV) 968,175- 975-331-C
W3YY (+NET) 145,530- 315-154-C
AA4S (+NET) 104,748- 203-172-C
N4JF (+oprs) 85,500- 250-114-B
N4TL (+oprs) 38,700- 150- 86-C

5

K5RVK (+W5ASP,WA9VLI) 306,153- 493-207-C
N3BB (+W3BGN) 155,961- 403-129-C
KD5RW (+KA5s BOO,DLM) 91,476- 252-121-C

6

WO6Q (+N6s KN,MU,WK6Y,WB6QPO) 389,550- 742-175-C
W6BIP (+WA6DJI) 304,278- 611-166-C
AK6T (+oprs) 285,600- 680-140-C
N6MNB (+KI6T,WA6OSX) 158,772- 404-131-C
KB6JK (+NET) 158,355- 391-135-C
N6CCL (+NET) 137,880- 383-120-C
KJ6V (+oprs) 106,029- 297-119-C
NY6Y (+N6s IC,LVD) 93,021- 307-101-C
KE6WL (+KD6NT) 58,768- 213- 92-C
NO6X (+NET) 48,720- 140-116-C
WA6AHF (+NET) 25,155- 129- 65-C

7

K7LXC (+JI6CUK,JM1CAX) 680,630-1159-190-C
NK7U (+NI7T) 438,615- 855-171-C
AG7J (+N7FDF) 77,319- 363- 71-C
KC7MM (+KE8DM,WB7NCN) 43,860- 215- 68-C
K7NWS (KC7CF,KE7HX,NS7O,oprs) 3,534- 62- 19-B
KA7FEF (+KA7FEE) 972- 36- 9-B

8

WB8JBM (KA8ETK,KC8MK,KV8M,KW8N, N8s ATR,DCJ,DMM,WD8AJF,oprs) 1,204,818-1279-314-C
WA8DXG (+oprs) 847,206-1082-261-C
N8CXX (+oprs) 642,864- 908-236-C
W8LNO (+KA0KFO) 278,588- 468-197-C
W8NGO (+W8s KR,ONA) 143,655- 305-157-C

9

K9BOL (+KA9QYA) 93,891- 263-119-C
NF9S (+N9AON) 87,000- 232-125-C

0

K0VVV (+oprs) 415,695- 739-185-C
KZ0C (+KF0H) 223,212- 418-178-C
KR0B (+AF9T,N9s DHG,DMG,K0ET, KA0JZV,N0s BKL,BKY,GFA) 207,405- 419-165-C

VE

VE4AA (VE4s CCC,IM,oprs) 142,175- 445-107-C

Two Transmitter

KX4S (+KI4GM,KG4W,N4s DCY,EHJ, MXT,NK4J,W4s MYA,XR,WB4BVY, WK4Y,WU4G) 2,457,450-2150-381-C
N5AU (+K5MR,KE5CV,KM5X,N5s RZ,TR,WB5VZL) 2,391,168-1916-416-C
N6ND (+NI6W,KM9L) 1,982,760-2132-310-C
N3HS (+N3s AD,RD) 1,945,026-1785-382-C
K3OO (+K3ZUF) 1,754,994-1594-367-C
N1AU (+K1AR,KC1F,W1FJ) 1,485,950-1624-305-C
K3II (+KY3N,WA3IMY) 683,865- 835-273-C
KS8S (NZ2K,KU8E,oprs) 619,614-1187-174-C
KQ1F (+K1XM,KM1P) 555,270- 830-223-C
K6TMB (+N6RO) 414,990- 954-145-C
K1RX (+NET) 195,339- 437-148-C
K5TYP (WA2LCV,KB4IU,KA5s SMM, VWN,KE5QO,WB5UAA,KA7VNN, N7HBR,N6FHL,oprs) 19,656- 158- 42-C

Unlimited

W3LPL (+K1RZ,AI3M,K3DI,KF3P,KM3T, KX3Q,W3FG,KC8C) 3,019,302-2346-429-C
W3GM (+K3s GM,ND,W3s FV,RJ) 1,923,108-1714-374-C
K3ZZ (+K3FT,KC3EK,N3AOE,WA3EKL) 1,019,424-1184-287-C
K1EA (+NET) 903,600-1004-300-C
XM1C (+KB1T,W1PH,WB8STH) 901,197-1069-281-C
KY1H (+WA1ZAM) 362,374- 657-194-C
W3UM (+NET) 51,102- 187-102-C

DX Phone

Africa

A22BW 437,076-1028-142-C
CT3BM 135,270-1002- 45-B-15
D44BC 815,811-1409-193-C
EA9IE 1,303,416-2526-172-B
EA9IB 101,154- 733- 46-B
TR8JLD 316,725-1025-103-B
TU4BR 1,009,557-2421-139-B
ZS6USA 1,460,844-2387-204-C
ZS6BRZ 594,789-1313-151-C
ZS6DW 1,092- 26- 14-C-40
ZS6P 6,570- 73- 15-C-10
JG1FVZ/5N8 156,190- 739- 70-C
9U5JB (N4HX,opr) 1,070,421-2189-163-C

Asia

HL9OB 58,179- 473- 41-C-20
HL1ABR 630- 35- 6-B-20
JH7DNO 513,540-1268-135-C
JA1ELY 350,649- 999-117-C
JE4VVM 81,162- 501- 54-C
JA8UMV 14,877- 171- 29-B
JE1ARO 8,075- 81- 25-C
JA1ASO 5,040- 80- 21-B
JE1AER 4,020- 67- 20-B
JR2BNF/1 2,613- 67- 13-A
JH3DEJ 2,277- 69- 11-B
JA2WZ 1,722- 41- 14-B
JA2ODS 1,080- 24- 15-C
JA1KFX 1,026- 38- 9-A
JH1MTR 431- 21- 7-B
JE2MDE 360- 15- 8-B
JA1WYQ 144- 12- 4-B
JA1XAF 18,600- 200- 31-C-80
JA2BAY 24,219- 299- 27-C-40
JH8LFE 10,872- 151- 24-C-40
JH1AEP 8,532- 158- 18-C-40
JA6YDH (JR6PKJ,opr) 3,312- 69- 16-B-40
JF3CEC 156- 13- 4-B-40
JF1SEK 104,775- 635- 55-B-20
JH1IED 59,220- 470- 42-C-20
JH8JYV 39,294- 354- 37-B-20
JE3ZFS 28,665- 273- 35-B-20
JR7CDL 11,310- 130- 29-B-20
JA8SW 10,368- 108- 32-C-20
JA1YXP (JI2DLF,opr) 9,658- 111- 26-C-20
JA7RXU 8,220- 137- 20-B-20

JF4GJB 7,353- 107- 23-C-20
JA1WSK 6,439- 103- 21-A-20
JA2JSF 6,111- 97- 21-A-20
JA6IP 5,834- 86- 23-B-20
JA1BNW 3,780- 70- 18-C-20
JA1VZM 3,564- 66- 18-B-20
JA6AKV 1,710- 38- 15-B-20
JA8CGJ 1,014- 26- 13-C-20
JA6VHI 504- 21- 8-B-20
JM1LRQ 420- 14- 10-B-20
JA7PCH 399- 19- 7-B-20
JA4PA 252- 14- 6-B-20
JA6RHH 240- 10- 8-B-20
JR4ISK 84- 7- 4-B-20
JA9RPU 4,860- 135- 12-B-15
JH1OBS 2,304- 64- 12-B-15
JH7WKQ 2,016- 84- 8-C-15
JE7HFQ 819- 39- 7-B-15
JA1QXC 504- 42- 4-B-15
JA8UJY 405- 27- 5-B-15
JA1AAT 84- 14- 2-B-15
JA3BBG 45- 15- 1-B-15
RA6FA 147,096- 681- 73-B
UW6MF 136,827- 661- 69-B
UA0ZDD 2,910- 97- 10-B-80
UW0CV 4,365- 97- 15-B-20
UA9FM 2,346- 46- 17-B-20
UG6JJ 12- 2- 2-B-20
RM8MA 1,014- 26- 13-B-20
4X6IF 7,161- 77- 31-A

Europe

CT4KO 267,676- 786-122-C
CS7AHU (CT1AHU,opr) 32,193- 219- 49-B
CT1DIZ 10,200- 100- 34-B
CT1UO 2,100- 50- 14-C-20
CR0TM (CT1TM,opr) 12,600- 140- 30-B-15
CR2EX (CT4EX,opr) 2,160- 40- 18-B
CU2AF 396- 12- 11-B-160
CU2AN 297,165-1801- 55-C-20
DL4UE 4,416- 64- 23-B
DL6RAI 10,366- 128- 27-C-80
DJ3HJ 71,136- 494- 48-C-20
DL3ZBJ 8,400- 100- 28-B-20
DL1MDW 3,249- 57- 19-B-20
DJ0BX 2,352- 56- 14-B-20
DJ3GE 1,911- 49- 13-B-20
DL8AAM 567- 21- 9-B-20
EA2QU 566,244-1284-147-C
EA3CCN 436,392-1254-116-C
ED1CI 281,360- 968- 90-B
EA3BOX 238,329- 873- 91-C
EA2BKT 41,220- 229- 60-B
EA1AW 15,729- 107- 49-B
EA3ELM 8,280- 92- 30-B
EA5DCL 7,448- 73- 34-C
EA2BMA 7,245- 69- 35-C
EA4BKE 58,515- 415- 47-C-20
EA3IN 13,068- 132- 33-B-20
EA5ELI 2,376- 44- 18-B-20
EA5AOJ 198- 11- 6-B-20
EA7AVU 74,718- 593- 42-C-15
EA5FCP 20,988- 212- 33-B-15
EA5CHT 3,906- 62- 21-B-15
EA5FHE 3,276- 52- 21-B-15
EA3CSK 2,046- 31- 22-B-15
EA6TC 15,996- 172- 31-B-20
EI8AU 6,000- 80- 25-B-20
FE6DZU 168,696- 568- 99-C
F6BEE 74,018- 257- 96-B
F6BVB 20,010- 145- 46-B
FE6DRP 17,400- 145- 40-B
F6GPG 14,847- 101- 49-B
F9YZ 12,792- 104- 41-A
FD1HWB 7,128- 88- 27-B
F6CLM 4,500- 60- 25-B
FD1JBZ 450- 15- 10-C
F6CTT 406,812-2338- 58-C-20
G2QT 115,200- 480- 80-C
G3SJX 5,124- 61- 28-C
G4GIR 3,432- 52- 22-B
G4BWP 259,782-1493- 58-C-20
G4XKR 70,200- 468- 50-C-20
G4XOM 2,898- 46- 21-B-20
GM4WEW 13,824- 144- 32-B-20
GW4BLE 654,456-1628-134-C
HA8XX 11,321- 107- 35-B
HA6UNX 3,780- 36- 35-B
HG7B 13,104- 156- 28-C-80
HA2KMR 90,258- 614- 49-B-20
HA5XW 8,343- 103- 27-B-20
HB9CXZ 20,910- 205- 34-C-80
HB9DX 11,160- 120- 31-C-20
HB9DCO 1,530- 35- 15-C-20
IK4CBM 8,370- 90- 31-B
IV3PRK 1,479- 29- 17-B-160
I4AVG 22,032- 216- 34-C-40
I8SAT 5,148- 78- 22-C-40
I4RYC 270,180-1580- 57-C-20
IN3XUG 36,900- 300- 41-C-20
I2TZK 30,444- 236- 43-C-20
IK2AEQ 22,914- 201- 38-B-20
IK1BBC 16,956- 157- 36-C-20
I4CSP 14,040- 130- 36-B-20
I5GCA 13,959- 141- 33-C-20
IK1DYU 3,240- 60- 18-B-20
I5QYY 27,720- 280- 33-C-15
IK2GSN 24,255- 245- 33-B-15
JW0E 11,625- 125- 31-C-20
LA4HW 8,343- 103- 27-C
LA8DY 2,250- 50- 15-C-20
LA3JAA 1,566- 29- 18-C-20
LA6DY 408- 17- 8-B-20
LX1WW 13,689- 117- 39-B
LZ2PO 6,417- 69- 31-A
LZ2VP 1,767- 31- 19-C
LZ1KWS 189- 9- 7-A
LZ1BJ 3- 1- 1-C-80
LZ2KZA (LZ2ESZ,opr) 4,851- 77- 21-B-20
LZ2QV 4,161- 73- 19-B-20
LZ2KDP 594- 18- 11-C-20
LZ1WY 144- 8- 6-B-20
LZ1BY 5,220- 87- 20-B-15
LZ2EW 5,214- 79- 22-A-15
OE1WWL 7,992- 74- 36-C
OH2KI 720- 24- 10-C
OH6YF 26,325- 225- 39-C-20
OH2BYS 4,416- 64- 23-B-20
OH1PY 4,290- 55- 26-C-20
OH3HS 405- 15- 9-B-20
OH1ZAA 216- 12- 6-C-15
OK1KZ 9,996- 98- 34-B
OK1DMA 5,544- 66- 28-B
OK6DX 239,946-1379- 58-B-20
OK3KII (OK3CDV,opr) 223,551-1263- 59-C-20
OK2BQL 46,092- 334- 46-B-20
OK1DKS 10,656- 111- 32-A-20
OK1JPH 8,526- 98- 29-B-20
OK1AJN 6,768- 94- 24-B-20
OK1AGN 6,000- 100- 20-C-20
OK1KAY 870- 29- 10-B-20
OK1AGA 405- 15- 9-B-20
OK2SWD 2,448- 48- 17-B-15
OK3YCA 1,638- 39- 14-B-15
ON8BK 139,536- 646- 72-C
ON8WN 4,602- 59- 26-B
ON8TX 3,672- 51- 24-B
ON4JJ 1,008- 24- 14-A
ON4ALL 2,508- 44- 19-B-80
ON5FV 231- 11- 7-B-15
OZ1BTE 70,560- 420- 56-C
OZ1FTE 1,581- 31- 17-C-80
OZ7HT 84,672- 504- 56-B-20
OZ5EV 5,400- 60- 30-C-20
OZ1DPW 2,832- 59- 16-B-20
OZ1INN 2,448- 51- 16-B-20
OZ1AXG 2,186- 38- 19-C-20
OZ7SG 1,392- 29- 16-B-20
OZ8T 120- 8- 5-B-20
PA3AAN 53,019- 411- 43-C
PA8DUO 14,592- 128- 38-B
PA3BDK 6,612- 76- 29-B
PA3DOD 122,271- 769- 53-C-20
PI4KST 26,691- 217- 41-B-20
PA0QX 10,296- 132- 26-C-20
PI1GOE 2,646- 49- 18-B-20
PA3DJC 3,990- 70- 19-B-15
SM5ALJ 1,710- 38- 15-B-20
SM0BDS 1,275- 25- 17-B-20
SM5AAY 756- 21- 12-B-20
SM7TV 412- 16- 9-B-20
SM5DAC 180- 10- 6-B-20
SM6FJY 180- 10- 6-C-20
SP9MQH 111,033- 507- 73-B
SP9KMM (SP7MTH,opr) 14,229- 153- 31-B-20
SP2EXN 4,731- 83- 19-C-20
SP3BYZ 3,888- 81- 16-B-20
SP6DVP 3,240- 54- 20-B-20
SP6JZG 1,443- 37- 13-B-20
SP9MRO 990- 33- 10-B-20
SP9IWO 924- 28- 11-B-20
TF1PS 1,170- 30- 13-B-20
TF3SD 312- 13- 8-B-20
UB5IFN 54- 6- 3-B-40
UB5UAT 46,363- 343- 47-B-20
RB5DX 9,912- 118- 28-B-20
UP2BO 24,108- 196- 41-B
Y41ZH 6,399- 79- 27-B
Y24SK/A 1,620- 36- 15-C
Y23DL 101,760- 840- 53-C-20
Y32KE 35,547- 289- 41-C-20
Y33TB 30,771- 263- 39-C-20
Y44ZK 21,060- 195- 38-B-20
Y54XL 5,292- 84- 27-C-20
Y25BL 4,758- 61- 26-B-20
Y43LO 2,805- 55- 17-B-20
Y21WI 1,980- 44- 15-B-20
Y24YH 1,404- 36- 13-C-20
Y36TG 75- 5- 5-B-20
YO8KOD 4,140- 64- 23-B
YO9DHZ 1,512- 36- 14-B
YO9DIA 1,404- 39- 12-B
YO6KBM 972- 27- 12-B-20
YO9HT 16,554- 178- 31-C-15
YT2W 34,425- 225- 51-B
YU1OWW 3,894- 59- 22-A
YT3A (YU3SO,opr) 234,726-1349- 58-C-20
YU7ORQ 60- 5- 4-B-15
4U1ITU (KC8ET,opr) 3,528- 49- 24-C

North America

W8KKF/C6A 771,803-1421-181-B
FM5CD 145,392- 932- 52-B
HI3AMF 247,808- 706-117-C
HI6RCD (HI8LC,opr) 84,600- 600- 47-B-20
HP1XHT 3,021- 53- 19-B
KL7LF 156,099- 853- 61-C
AL7CQ 186,006-1089- 58-C-20
KL7WP 13,225- 152- 29-C-20
KP4FI 549,594-3214- 57-C-20
K2KTT/PJ7 101,385- 751- 45-B-15
WA1TAE/TI2 576,810-1131-170-B
TI2ANL 486,240-1013-160-B
TI9RC 9,570- 110- 29-B-15
V3DG (N5DVY,opr) 575,792-1482-152-B
VP2MU (K1CLN,opr) 173,469-1091- 53-B-15
VP5Y (N6EK,opr) 1,852,128-2832-218-B
VP5Z (KC2RS,opr) 71,736- 488- 49-B-80
N4SF/VP9 339,090- 890-127-B
XE1VIC 698,328-1098-212-C
XE2NNZ 406,479- 989-137-C
XE1OX 109,548- 716- 51-C-80
4U1UN (K2GM,opr) 265,842-1841- 54-C-80

Oceania

A35WZ 292,617- 793-123-B
K4YT/DU1 4,554- 66- 23-C-20
WB6FCR/KH6 2,398,440-3634-220-C
N7NR/KH6 2,158,065-3315-217-C
K7SS/KH6 623,103-1229-169-A
KH6IJ 13,938- 202- 23-C-40
WH6W 11,340- 126- 30-C-40
AH6GR 8,343- 103- 27-B-40
KH6CP 54- 6- 3-A-40
K6GSS/KH6 365,400-2175- 56-C-20
W7PSO/KH6 109,551- 689- 53-B-20
AH6EK 28,314- 242- 39-B-20
VK2FAE 19,332- 179- 36-C-80
VK3GK 2,376- 72- 11-C-15
KA7KSY/YB8 117- 13- 3-B-40
ZL1ANJ 257,796- 682-126-C
ZL1IM 3,081- 79- 13-B
ZL1AAS 25,707- 209- 41-C-80
ZL2AFY 6,006- 77- 26-B-80

South America

CE3BFZ 2,409,120-3360-239-C
CE6EZ 431,604-2524- 57-C
CP6NU 130,815- 459- 95-B
CX2AAL 112,896- 784- 48-B-10
HC1OT 2,157,813-3087-233-C
HC5EA 120,744- 774- 52-B-40
HC1HC 429,039-2509- 57-C-20
HK3IXJ 87,900- 586- 50-B-80
WB2PSD/HK2 242,385-1469- 55-C-20
HK3MAE 225,456-1342- 58-B-15
LU1BR 3,114,993-4009-259-C
LU1FLY 437,541- 863-169-C
LU1ABT 82,125- 375- 73-B
LU6ETB 264,132-1518- 58-C-20
LU1E (LU3AJW,opr) 242,220-1468- 55-C-10
LU8DPM 153,750-1025- 50-C-10
OA4ZV 1,031,034-1514-227-C
W1BIH/PJ2 87,849- 681- 43-C-10
PP2ZDD 1,592,889-2381-223-C
PY4OY 712,746-1773-134-C
PT2TF 337,500-1125-100-C
PP2ZCP 98,193- 461- 71-C
PY7SSB 87,216- 318- 92-B
ZY5OC 86,496- 544- 53-C-40
PY4VD 6,300- 70- 30-C-20
PS7KM 58,608- 407- 48-B-15
PY4BA 19,320- 161- 40-C-15
K3UOC/YV4 2,804,301-3501-267-C
YV6BXN 118,272- 448- 86-B
YV2NY 98,049- 667- 49-C-40
YV6BTF 18,144- 168- 36-C-40
4M5J (YV5JEA,opr) 123,777- 809- 51-B-20
YV5IAL 78,000- 520- 50-B-15
ZP5KDW 5,760- 96- 20-C-10

Multioperator Single Transmitter

Africa

W6QL/Z2 (+W6KG) 313,956- 969-108-B

Asia

JA1YWX (JI1CUP,JJ1HJR,JM1MCF, JF2IWL,JI2GUT,JR4NIV,JH7PKU,oprs) 321,048-1092- 98-C
JH7YJF (JA7RHJ,JF7s IQA,JOV,JH7s LRS,VEP,XWT, JR7s DHY,FEK,oprs) 305,760-1040- 98-C
JA7YAB (JA7UMT,JA8-380,JF7SVH, JJ1NNJ,oprs) 284,544- 988- 96-C
JA1YCL (JL1s LNC,QOC,JO1GAD, JS1AFY,JH0NOS,oprs) 178,848- 736- 81-C
JA7YAF (JE7s IDA,MHM,PPC,RJZ, JG7BBY,oprs) 12,636- 156- 27-B
JA2YEF (JF2NFC,JI2s LPD,QVF, SIC,oprs) 12,462- 134- 31-C
JA1YCG (JN1TEO,JO1MMI,JP1NKT, JA5GHQ,oprs) 7,575- 101- 25-B

Europe

CQ1BZN (CT1s BZN,CVW,oprs) 55,566- 441- 42-C
G4ANT (G4s SDP,WTD,oprs) 237,048-1411- 56-C
G3XEP (G3s PSM,VMW,ZGA, G4s ATZ,ULC,oprs) 49,500- 330- 50-C
G3HKR (G1PXJ,G4s IUF,PDB,YEK,YGN, ZAT,G8s CJJ,CLY,CQW,G8/N0BZ,oprs) 22,638- 154- 49-C
G0AGH (+G4IEB,G6VAT) 16,263- 139- 39-C
HA3KMA (HA3s MN,PF,PQ,RD,RG,oprs) 224,322- 763- 98-B
HA1KRR (HA1s DRM,DRR,XO,XU,ZN, ZZ,ops) 212,610- 746- 95-B
HB9AUS (+HB9s EEX,SFD,HE9s ASD,UZX) 307,692- 924-111-C
I5NPH (+I5s MPN,SDG,IK5BAF,I8MPO) 2,270,580-3692-205-C
IK2DUU (+I2UIY) 369,600-1100-112-C
I2CZ (+I2s MYF,QEA,QMU,SLA,-2184, IK2s AGN,AHR,AVH) 77,814- 393- 66-C
OH8AV (OH8s DD,NW,oprs) 59,712- 311- 64-C
K9MN/OH8 (+OH1NX,OH2BH) 58,050- 430- 45-C
OK2KOD (OK2s BDI,BHM,WAZ,oprs) 6,375- 85- 25-C
OK1KNC (+oprs) 405- 15- 9-B
PI4TTC (PA3s CKY,DOX,DZP,EEX,PA0IA, PD0ORP,oprs) 6,048- 72- 28-B
SK6TW (SM6s AOU,CPY,DER,DOI,oprs) 70,290- 426- 55-C
SP9UOU (SP9s OJB,4945KA,oprs) 7,470- 83- 30-B
SP5PBE (+SP5ELA) 972- 27- 12-B
UZ6LWZ (UA6s 150-1184,150-1246,oprs) 29,070- 170- 57-B
UB4QWW (RB5QW,UB4QD,oprs) 26,208- 224- 39-B
UB4WZA (+UB5WBY) 9,720- 90- 36-B
UB4TWL (+oprs) 1,056- 32- 11-B
UQ1GWW (UQ2s OI,837-83,837-116,oprs) 209,196- 894- 78-B
UQ1GXN (UQ2s GID,GKA,GM,GN,oprs) 89,358- 562- 53-B
YT3T (YU3s BQ,DE,EIJ,W,oprs) 472,440-1240-127-C
YU4EXA (YU4s NW,RW,WIA,oprs) 391,680-1088-120-C
YU4CBC (+oprs) 1,833- 47- 13-B

North America

AA4NC/C6A (+AA4GA) 2,071,305-3015-229-B
F6HMQ/FM (+F6HLC/FM) 2,223,570-3154-235-C
J34Z (K4LTA,N4s FKO,LHN,MMV, NF5Z,WA8FSX,K8OSN, oprs) 3,251,745-3885-279-C
J87BM (+J87s BL,BN) 110,880- 618- 60-B
KP4BZ (+NP4s CC,Z,WP4s D,K) 6,102,816-6738-302-C
XE2XGY (K5s JX,TSQ,KD5GY,NA5C, W5VX,oprs) 4,307,280-5480-262-C
ZF2HI (KZ2E,N4MZJ,W2HPF,WA8TZS, WD4KKB,oprs) 6,113,934-6726-303-C

Oceania

KH6XX (+KH6ND,WH6BGI) 3,620,910-4406-274-C
AH6AZ (+AH6GR,VE7QO) 81,104- 584- 52-C

South America

LU1VZ (LU1s VD,VK,LU3DXL, LU7VCA,oprs) 664,644-1142-194-C

Multioperator Two Transmitter

Asia

JA7YAA (JJ1MVV,JN1VYN,JE3DDT, JG3s EDV,JRM,JE4KZZ,JE7s HLZ, QCQ,JH7s CVO,HWR, JR7s OMD,PGL, JH0s MRP,ORW,oprs) 387,192-1241-104-C
JA7YFB (JN1RON,JE7s JWB,MOY, JF7s AAD,TDN,GQK, JH7s XKI,XMO, JR7s GYC,JLU,OEF,RLB,WFH, JH0QNT,oprs) 356,076-1099-108-C
JG1ZKO (JH1DHI,JK1JQQ,JL1MWI, JM1s APN,HJG, JN1s IZR,NDY, JO1s JYX,RDV,JP1s FRD, PVH, JQ1s FAB,ITD,WHK,JS1KTR,oprs) 104,823- 613- 57-B
JH8YCT (JE8s BFO,MDF,JH8s JPK, WAH,WJY,oprs) 100,650- 550- 61-B

North America

V47M (K0GU,NI0E,WB0MIV,oprs) 10,543,500-10850-330-C

South America

PJ0B (K2s NG,SS,K3EST,oprs) 6,936,393-7387-313-C

Multioperator Unlimited

Asia

JE2YRD (JJ1BTC,JA2EZD,JF2s DQJ, XJE,JK2CZL,JI2KVW,JH4VBQ,JE7BIZ, JA9SSY,oprs.) 582,615-1605-121-C
JA9YBA (JE6JVJ,JH7UJR,JA9s LNJ, NFO,OTX,PPC,VDA,oprs) 464,508-1518-102-C

Europe

I3EVK (+I3s FIY,JSS,MAU,ON) 1,880,418-3103-202-C

W/VE CW

Single Operator

1

Connecticut

K1AR 1,330,824-1562-284-C
K1ZZ 342,108- 663-172-C
K8HVT 235,638- 494-159-C
K1IN 166,164- 454-122-C
KA1LZR 101,700- 300-113-C
K1BV 79,212- 322- 82-C
W1AB 64,512- 192-112-C
N1CC 60,990- 190-107-B
WA1LVW 43,290- 185- 78-C
WA2WIP 37,350- 150- 83-B
W1VH 30,450- 145- 70-C
W1ICH 7,224- 58- 43-C
KB1IZ 3,750- 50- 25-B
W1HUE 2,346- 34- 23-A
KB1H 3,150- 42- 25-C-40
W1WEF 226,812- 922- 82-C-20
W1QK 53,664- 344- 52-C-20
AA2Z 300- 10- 10-B-20
K1RM 55,188- 252- 73-C-15

Eastern Massachusetts

K5ZD/1 911,130-1255-242-C
K1VR 402,804- 804-167-C
W1FJ 340,560- 688-165-C
K5MA 327,699- 687-159-C
AI3E 115,062- 302-127-C
W1CWU 112,815- 327-115-C
K1VUT 107,238- 293-122-B
W1AX 97,812- 286-114-C
WB1CNM 85,050- 270-105-C
KR1B 24,480- 120- 68-B
K1MEM 12,780- 71- 60-C
W1OPJ 1,071- 21- 17-B
W1PLJ 855- 19- 15-C
W1BET 432- 12- 12-C
AB1A 240- 10- 8-C-160
W1FV 100,788- 454- 74-C-80
W1IHN 153,792- 712- 72-C-20

Maine

N1AFC 22,794- 131- 58-A

New Hampshire

KC1F 1,384,812-1614-286-C
K1DG 1,127,973-1463-257-C
AK1A 484,008- 938-172-C
KA1X 377,982- 759-166-C
W1RR 92,925- 295-105-C
K1PTF 42,570- 165- 86-B
KB1PZ 3- 1- 1-A
W1NH 11,025- 75- 49-C-80
W1END 936- 26- 12-B-40

Rhode Island

KS1J 173,052- 437-132-B
K1JYM 49,590- 190- 87-C
W1RFQ 3,774- 37- 34-B
W1GL 225,018- 926- 81-C-20

Vermont

W3SOH 49,680- 180- 92-B
WA1JVV 18,300- 100- 61-C

Western Massachusetts

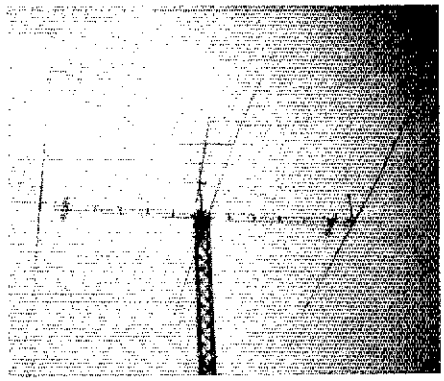
K1BW 1,047,033-1413-247-C
WA2CNF 98,649- 291-113-C
KA1KPH 12,087- 79- 51-B
NC1B 546- 14- 13-B
W1GG 57,420- 348- 55-C-20
KR1R 231- 11- 7-C-10

2

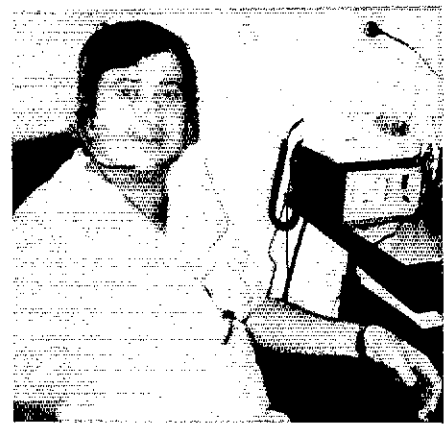
Eastern New York

K5NA 1,048,605-1319-265-C

AA4NC/C6A took the Sunday morning shift during their multi-single phone effort.



The band-opening 80-meter Yagi used to generate that *big* signal from I5NPH. The smaller of the two is a 6-element 20-meter beam.



Here is PY4BA, who operated 15-meter single band on phone.

K2UR 442,335- 797-185-C
W2XL 407,928- 739-184-C
K2QF 154,080- 428-120-C
W2DW 102,375- 273-125-C
KY2J 86,400- 240-120-C
N2AIF 84,672- 224-126-C
W2KHQ 57,600- 192-100-B
W2AWF 29,484- 156- 63-C
WA2AXK 4,164- 69- 45-B
KR2J 162,000- 600- 90-C-40

NYC & Long Island

WA2LQO (W2DKM,opr)
144,768- 377-128-C
W2GGE 49,395- 185- 89-C
WB2ENW 27,933- 151- 61-A
W2AYJ 24,219- 117- 69-C
W2GKZ 23,760- 110- 72-C
W2AFM 15,390- 90- 57-B
KD2HE 13,452- 78- 59-B
WB2RNT 2,262- 29- 26-B
K2SX 513- 19- 9-C-40
KA2MXO 150,144- 736- 68-C-20
K2MFY 17,343- 141- 41-B-20
KE2N 168- 8- 7-B-10
WB2AMU 45- 5- 3-B-10

Northern New Jersey

N2LT 1,363,936-1696-272-C
W2RQ 102,024- 327-104-C
N2CS 86,625- 231-125-C
WA2ASQ 50,232- 184- 91-B
KT2D 15,576- 88- 59-B
WB2DND 864- 18- 16-B
W1GD 72,243- 349- 69-C-20

Southern New Jersey

K2FL 134,541- 297-151-C
N2MR 121,539- 319-127-C
W2EA 57,600- 192-100-B
K2JLA 50,760- 180- 94-C
K2OWE 46,740- 184- 95-C
K2OSV 8,091- 93- 29-C
N2CQ 2,940- 35- 28-C
NC2V 5,616- 52- 36-C-40
WA2OOS 182,880- 762- 80-C-20
K8XR 24,009- 151- 53-C-15

Western New York

W2TZ 338,838- 682-166-B
WB2ABD 95,105- 262-121-B
W2FXA 66,126- 206-107-C
W2FTY 53,096- 196- 92-B
KW2J 47,250- 175- 90-B
KA2AJT 23,517- 117- 67-C
WB2CJL 18,630- 115- 54-C
W2PHT 17,289- 113- 51-B
W2FUI 15,582- 98- 53-B
WA2AOG 12,300- 82- 50-C
W2KKZ 10,560- 40- 33-C
KK2B 7,626- 62- 41-B
WB2DVU 216- 9- 8-B
N2RT 90- 6- 5-B-160
W2HG 10,836- 86- 42-C-40
K2VV 363,768-1318- 92-C-20

3

Delaware

W3XU 858,530-1310-221-C
AA1K 569,829- 769-247-C

Eastern Pennsylvania

K3WW 1,198,773-1531-261-C
W3BGN 1,091,904-1504-242-C
KQ3F 382,867- 803-163-C
W3OV 194,400- 480-135-C
WB3CAC 172,176- 422-136-C
W3KV 111,720- 280-133-C
K3WGR 101,370- 310-109-C
W3ARK 83,781- 261-107-B
W3EVW 78,660- 230-114-C
KW3F 75,600- 210-120-C
WA3IMY 65,100- 217-100-C
W3QIR 45,687- 157- 97-B
KN3S 45,090- 167- 90-C
AI3Q 28,689- 131- 73-C
WA3UJZ 11,280- 80- 47-C
K3IPK 10,560- 80- 44-B
N3RW 4,998- 49- 34-C
K3NTD 1,575- 25- 21-C
W3FTG 1,380- 23- 20-B
KA3OAX 108- 6- 6-B
KA3NED 117,783- 569- 69-C-20
N3CZB 189- 9- 7-B-20
N3DZG 27- 3- 3-C-20

Maryland-DC

W3GRF (K0DQ,opr)
1,490,952-1679-296-C
K3ZO 1,393,728-1708-272-C
K3ZZ 554,508- 876-211-C
N3RR 375,402- 703-178-C
K3NA 332,568- 598-186-C
K3SA 225,609- 479-157-C
W3AZ 136,764- 348-131-C
N3AM 125,610- 395-106-C
W3HVQ 125,367- 319-131-B
W3UJ 118,260- 292-135-C
K3WS 87,108- 238-122-A
N7IR 61,200- 200-102-A
W3GN 54,162- 177-102-C
KD8WX/3 45,198- 162- 93-B
WB3BRF 27,813- 127- 73-B
W3EE 16,848- 104- 54-B
W3FQE 12,705- 77- 55-C
W3FX 2,016- 28- 24-C
W3TFA 1,863- 27- 23-B
K3SMQ 6,633- 67- 33-C-80
K23B 21,900- 146- 50-C-20
K3TW 3,588- 46- 26-C-15

Western Pennsylvania

K3TUP 519,651- 957-181-C
KA3HIE 26,550- 118- 75-B
KJ3L 20,602- 134- 51-C
W3FGS 9,870- 70- 47-B
KA3HGR 390- 13- 10-B
K3UA 663- 17- 13-C-160
N3BJ 13,038- 106- 41-B-80
WA3CGE 2,346- 34- 23-C-80

4

Alabama

N4JF 24,168- 106- 76-B
WB4AKE 17,550- 90- 65-C

Georgia

K3KG (K4FJ,opr)
1,060,884-1254-282-C
WX4G 873,705-1099-265-C
W8ZF/4 863,328-1058-272-C
NQ4I 841,122-1126-248-C
KX4R 262,236- 533-164-C
K4EZ 168,453- 367-153-C
W4DXI 119,796- 268-149-C
K4BAI 53,667- 201- 89-C
KN4B 32,232- 136- 79-C
KB4GID 14,868- 84- 59-A
K4PI 9,450- 70- 45-C
AA4GA 3,534- 38- 31-B
W4JKC 2,673- 33- 27-A
N4PN 5,928- 52- 38-C-160
K4TEA 4,653- 47- 33-C-160
W4MGX 4,032- 48- 28-C-80
W4JFL 8,640- 72- 40-B-20
WB4WRM 297- 11- 9-C-20
KC4GR 2,754- 34- 27-C-15

Kentucky

WB4FOT 36,280- 145- 88-C

North Carolina

N4KMY 414,612- 699-198-C
AA4S 364,665- 756-161-C
K4PB 141,006- 331-142-C
NN4Q 104,145- 265-132-A
K2SD 17,112- 92- 62-C
N4SU 7,503- 61- 41-C-160
N4ZC (WA8MAZ,opr)
80,145- 411- 85-C-40

Northern Florida

W4WKQ 36,288- 144- 84-C

South Carolina

W3VT 756,668- 954-264-C
W6OKX/4 91,080- 253-120-C
W4NL 3,600- 40- 30-C-160

Southern Florida

K8UNP 358,176- 574-208-C
K4MF 122,670- 282-145-B
W4BV 120,951- 267-151-C
WD4AHZ 88,578- 259-114-B
W4YA 17,577- 93- 63-B
W4YN 15,000- 100- 50-B
WT4G 12,012- 77- 52-A
W2SDB/4 1,950- 26- 25-C
N4IN 2,349- 29- 27-B-160
W4BAA 1,425- 25- 19-C-160
WB4TDH 40,188- 197- 68-C-15

Tennessee

WM4Z 28,728- 126- 76-C
WF4G 20,933- 123- 57-C
AA4MN 6,120- 51- 40-C
K4XO 4,800- 50- 32-C
N4ZZ 68,670- 327- 70-C-40

Virginia

K4GKD 444,783- 857-173-C
K4PQL 354,375- 675-175-C
K4OD 111,792- 272-137-C
W4YE 78,624- 252-104-C
WB4LNT 74,469- 241-103-C
N4MM 61,110- 210- 97-C
N3OS 50,796- 186-102-B
K4FPF 43,596- 173- 84-B
NQ4K 27,225- 121- 75-C
WU4G 27,135- 135- 67-C
K4BAM 22,470- 107- 70-B
N3JT 13,860- 105- 44-C
K4JM 13,770- 90- 51-B
W4OEL 3,813- 41- 31-A
K4MSG 1,368- 24- 19-B
N3RC 1,152- 16- 24-C
N4LJS 432- 12- 12-B
W4MYA 42,480- 240- 59-C-80
KE9A 19,150- 101- 50-C-80
N4XD 8,400- 80- 35-C-40
K3RV 107,994- 439- 82-C-15

5

Arkansas

K5FUV 23,112- 107- 72-C
W5EU 4,773- 43- 37-C
K5UR 15,000- 100- 50-C-160

Louisiana

WA5IGD 146,880- 320-153-C
WC5D 76,014- 206-123-B
W5ZR 53,655- 245- 73-C
W5OB 29,766- 121- 82-C
KE5LQ 624- 16- 13-B

Mississippi

K5MK 199,692- 387-172-C
WA5OYU 81,789- 233-117-B
KA5KWX 19,116- 108- 59-C

New Mexico

KI3L 179,235- 569-105-C
AI9X 35,145- 165- 71-C
W7LHO 16,065- 105- 51-B
KT5X 5,208- 56- 31-C-40

Northern Texas

K5NW 346,092- 604-191-C
KA5W 315,843- 563-187-C
N5JB 225,032- 514-146-C
K5RX 215,172- 417-173-C
W6VGX 130,869- 333-131-C
K5WXZ 56,610- 185-102-C
N5UA 43,521- 163- 89-C
KY5N 9,996- 66- 49-B
NZ5M 6,438- 58- 37-B
AA5C 5,760- 60- 32-C-80
K9MK 4,752- 48- 33-B-80
W5BOS 36,093- 227- 53-C-20
NI5M 4,752- 66- 24-B-20
WF5E 3,591- 63- 19-C-20
K9LA 189- 9- 7-B-10

Oklahoma

KA5UDL 504- 14- 12-B

Southern Texas

KN5H 291,249- 483-201-C
K5TSQ 218,622- 439-166-C
N5JJ 85,668- 236-121-C
WE5P 26,103- 113- 77-C
W5KCR 16,068- 103- 52-C
WD5N 14,691- 83- 59-C
W5NR 3,321- 41- 27-C
WN4KKN 663- 17- 13-C-80
W5WQN 23,940- 140- 57-C-40

6

East Bay

K6ATV 24,645- 155- 53-B
K6CSL 11,988- 111- 36-B
WE6G 8,999- 101- 33-B
W6DNY 6,300- 105- 20-B
W6BH 44,250- 295- 50-C-20

Los Angeles

N6AW 299,403- 853-117-C
K6EID 197,124- 316-113-C
ND6G 79,968- 272- 98-C
N6IC 54,648- 207- 88-C
N6AA 52,452- 189- 93-C
AI6Z 43,675- 195- 75-C
N6IBP 19,584- 128- 51-B
K6OC 15,645- 149- 35-C
KG6O 12,400- 100- 38-B
W6RZ 6,804- 63- 36-C
KK6P 5,244- 46- 38-C
W6OES 4,032- 56- 24-C
W6ABW 2,856- 56- 17-C
N6VI 2,736- 38- 24-C
W6CBA 168- 8- 7-B
K6DDO 4,392- 61- 24-C-160
NE6I 2,499- 49- 17-C-80

Orange

W6TMD 353,925- 825-143-C
W6BA 114,708- 316-121-C
K6LEB 84,384- 293- 96-C
NW6S 24,840- 115- 72-C
W6HT 7,956- 68- 39-C
AB6R 2,508- 44- 19-B-40

Santa Barbara

W6OUL 57,919- 249- 77-C
WA6VGI 29,550- 197- 80-C
N6VR 5,394- 58- 31-C-40
WB6L 24,102- 206- 39-C-20

Santa Clara Valley

K6XO 101,505- 335-101-C
N6AN 65,175- 275- 79-C
W6ISQ 22,320- 124- 60-C
K6RQ 8,190- 70- 39-C
N6NF 4,092- 62- 22-B
K6MA 3,375- 45- 25-C
AG6D 855- 19- 15-C
WA6TKT 4,200- 56- 25-C-40
W6ATO 2,852- 53- 18-C-20

San Diego

K6MC 24,282- 114- 71-C
KW6Q 20,655- 135- 51-A
AA6EE 12,255- 95- 43-B
N6JMV 6,048- 63- 32-B
W6YA 152,205- 695- 73-C-40
W6ZT 6,141- 89- 23-C-20

San Francisco

W6WB 63,204- 229- 92-C
K6ANP 33,288- 146- 76-C
W6JTI 31,842- 183- 58-B
K6ZUR 30,051- 159- 63-C
W6BIP 21,105- 105- 67-C
K6LRN 7,482- 86- 29-B
K4TKM 18,270- 145- 42-C-15
NJ6P 10,836- 129- 28-C-15

San Joaquin Valley

KA6BIM 46,992- 176- 89-C
N6BJQ/6 33,648- 181- 62-C
K6YK 16,896- 128- 44-B
W6BYH 15,390- 90- 57-C
N6OT 10,890- 86- 55-C

Sacramento Valley

KV6H 84,639- 317- 89-C
K6DR 84,180- 305- 92-C
N6JV 80,190- 297- 90-C
W6NKR 58,596- 228- 82-C
KF6A 18,096- 232- 26-C
N6DM 1,887- 37- 17-C-80
N6OR 181,260- 795- 76-C-40
K6SG 4,140- 60- 23-C-40
N6GG 59,136- 352- 58-C-20
NB6G 4,233- 83- 17-C-20

7

Arizona

K7OX 261,837- 619-141-C
W7AYY 70,224- 266- 88-C
KX7J 28,728- 152- 63-C
W2GGL/7 24,750- 125- 66-C
NG7S 19,557- 123- 53-B
KC7V 7,854- 77- 34-C
WA7KLK 2,772- 44- 21-C
W7MID 2,331- 37- 21-B
WA7NWL 660- 20- 11-A
K7SP 1,554- 37- 14-C-180
AA7A 129,375- 625- 69-C-40
W7YS 6,120- 85- 24-B-40
KR7Y 55,173- 347- 53-C-20

Idaho

KA7T 5,180- 86- 20-C-80
KU7Y 35,508- 218- 39-B-20

Montana

KE7X 143,136- 496-112-C
KS7T 43,092- 228- 63-C
K7ABV 3,060- 51- 20-C-80
W6ALQ 1,404- 52- 9-C-20

Nevada

WA7UTM 59,520- 248- 80-C
N7NV 3,588- 46- 26-B

Oregon

W7TC 33,120- 240- 46-C
AD7T 16,335- 99- 55-C
W7GUR 10,209- 83- 41-C
W7QB 7,344- 79- 34-B
KA7FEF 4,815- 107- 36-B
W7TWL 3,381- 49- 23-C
N6TR/7 2,064- 36- 19-C-160
AG7J 23,985- 205- 39-C-20
AG7M 22,680- 210- 36-C-20
KS7P 5,700- 76- 25-C-20
K7OVM 3,150- 50- 21-B-15

Utah

N5CT (K0FX,opr)
153,180- 444-115-C
W7HS 62,886- 223- 94-C
WA7OCC 2,340- 39- 20-B

Washington

NN7L 226,981- 601-127-C
K7DZ 90,345- 317- 95-C
W7TS 63,609- 233- 91-C
W7EEJ 32,580- 181- 60-C

W7TSQ 23,712- 208- 38-C
W7QN 20,736- 128- 54-C
W7IIT 18,906- 137- 46-B
KT7G 12,543- 113- 37-C
K7RIE 11,628- 114- 34-B
NG7M 10,602- 114- 31-B
W7KT 10,506- 103- 34-B
W7CMO 9,324- 84- 37-C
KA7PDH 3,840- 80- 16-B
W7IEU 837- 31- 9-B
N7EPD 741- 19- 13-B
WA7UVJ 714- 34- 7-B
K7LXC 180- 15- 4-C-80
N7TT 85,344- 508- 56-C-20
WA7BPI 11,739- 91- 43-C-20
W7LVI 2,838- 66- 22-C-20

Wyoming

NC7O 867- 17- 17-C

8

Michigan

K8CC 110,532- 302-122-C
W8VSK 86,940- 252-115-A
NE8T 20,100- 100- 67-C
N8CQA 8,184- 62- 44-A
W8FEM 7,995- 65- 41-C
W8UVZ 1,071- 21- 17-C-160
K8DD 7,770- 70- 37-C-80
AC8W 5,673- 61- 31-C-80
W8TWA 23,715- 155- 51-C-20
K8QWG 1,530- 20- 17-B-20

Ohio

W8LNO 587,292- 898-218-C
WD8IXE 402,930- 605-222-C
N8AG 256,770- 634-135-C
KR8Y 105,216- 274-128-B
KA8HFO 101,097- 239-141-C
N8BC 91,773- 297-103-C
K8SW 77,250- 250-103-C
KF8K 67,620- 196-115-B
W8RSW 50,826- 187- 86-C
W8DWP 21,756- 98- 74-B
K8MR 20,700- 100- 69-C
W8GOC 16,950- 113- 50-B
W8YGR 15,120- 72- 70-B
N8EKS 14,760- 82- 60-C
N8ET 8,448- 64- 44-B
W8EE 7,353- 57- 43-C
W8UPH 5,400- 60- 30-C
WD8AJF 1,188- 22- 18-B
KQ8M 8,856- 72- 41-C-80
WD8AUB 169,944- 777- 73-C-20
WD8LLD 130,680- 605- 72-C-20
KV8M 24,444- 194- 42-C-20
W8QID 18,492- 134- 46-C-20
KV8Q 33,855- 185- 61-C-15

West Virginia

NJ8N 15,180- 110- 46-C-40
W8UMR 21,504- 128- 56-B-20

9

Illinois

KC9T 263,340- 532-165-C
KV9S 155,820- 371-140-C
K9UIY 126,360- 312-135-B
W9VA 73,920- 220-112-C
WB9JKI 58,905- 187-105-C
K9MMS 24,249- 137- 59-B
W9IL 22,500- 125- 60-C
W9LNQ 20,493- 99- 69-B
W9TNZ 9,024- 64- 47-B
KG9Z 1,302- 31- 14-C
W9REC 756- 18- 14-B
WB9HAD 1,680- 28- 20-C-160
W9BW 112- 22- 17-C-80
N9FFM 12- 2- 2-B-40
K9CVB 109,200- 455- 80-C-20
K9LJN 71,280- 360- 66-C-20
K9RHY 44,070- 226- 65-C-20
WA9YYY 2,112- 32- 22-B-20

Indiana

W9KTP 72,000- 240-100-C
W9RE 31,506- 118- 89-C
W9PC 26,781- 113- 79-C
NE9Z 25,506- 109- 78-C
KB8AC 3- 1- 1-B-160
KK9G 3,198- 41- 26-B-40
K9VQK 6,045- 65- 31-C-20
KJ9D 2,583- 41- 21-B-20

Wisconsin

W9OP 148,221- 383-129-C
WB9HRO 29,445- 151- 65-C
NI9C 23,544- 109- 72-B
W9GXR 20,979- 111- 63-C
W9NA 13,524- 98- 46-C
NG9L 8,840- 60- 38-B
W9YCV 816- 17- 16-C
NI9U 765- 17- 15-B
N9BUS 2,088- 29- 24-C-40
W9WAQ 41,664- 224- 62-B-20

0

Colorado

K0ZX 120,666- 338-119-C
W0GOR 48,888- 194- 84-C
K0IYF 46,620- 185- 84-C
K0UK 42,277- 211- 67-C
W0ZV 6,480- 72- 30-C-160
W0UO 11,514- 101- 38-C-80
AC0S 3,312- 48- 23-C-80
K0OST 2,862- 53- 18-B-40

Iowa

W0WP 400,668- 692-193-C
KE0Y 31,290- 149- 70-C
KJ0H 17,136- 119- 48-B-40

Kansas

W0RT 177,390- 438-135-C
WA0TKJ 171,588- 362-158-C
K0VXU 46,359- 153-101-C
WA0CFZ 18,810- 114- 55-C
W0WPL 5,184- 48- 36-B
N7DF 1,927- 29- 21-C-160
AB0X 945- 21- 15-C-80

Minnesota

N0AT 46,725- 175- 89-C
WB0BJP 28,968- 136- 71-B
K9WY! 7,740- 60- 43-B
W0LP 3,627- 39- 31-C
W0NGB 969- 19- 17-B
W0RXL 1,890- 30- 21-C-80
AF9T/0 53,280- 296- 60-C-20

Missouri

W0JLC 795,495- 905-293-C
W0HBH 200,490- 410-163-C
NI0G 42,930- 159- 90-B
KA0P 3,906- 42- 31-B

North Dakota

K0QQ 12,000- 80- 50-C
W0LHS 432- 12- 12-C

Nebraska

WB0SYV 4,455- 45- 33-B

VE

Maritime-Newfoundland

VO1MP 592,200-1128-175-B
VO1AW 45,069- 181- 83-C
VO1QU 40,296- 184- 73-B

Quebec

VE2AYU 283,206- 613-154-C

Ontario

VE3KP 149,328- 408-122-C
VE3ST 69,000- 200-115-C
VE3IY 68,040- 189-120-C
VE3XN 38,958- 151- 86-C
VE3CWE 18,360- 102- 60-C
VE3NBE 7,869- 61- 43-B
VE3NXQ 2,592- 32- 27-B
VE3CUI 2,331- 37- 21-C-80
VE3MVV 2,925- 39- 25-B-20
VE2AEJ/3 72- 6- 4-C-10

Manitoba

VE4IM 22,950- 150- 51-C-20

Saskatchewan

VE5RA 87,120- 264-110-C

Alberta

VE6ADK 18,666- 122- 51-B
VE6CB 41,022- 318- 43-C-20

British Columbia

VE7AAQ 40,560- 208- 65-C
VE7FJE 18,327- 149- 41-C
VE7EIE 9,315- 115- 27-B

Multioperator Single Transmitter

1

K1YR (+ K1RU,KQ2M,K8HVT)
1,226,016-1548-264-C
KM1C (+ KB1T,W1PH,WB8BTH)
1,102,302-1341-274-C
K1IU (+ KA1GOW)
947,232-1248-253-C
K1WA (+ K1DM)
732,555-1095-223-C
K1NYK (+ K1s DD,TO,KA1VC,KG1D)
271,320- 646-140-C
N1AU (+ NC1M)
100,203- 263-127-C

2

N2MM (+ KT3M)
1,162,200-1300-298-C
K2NJ (+ KU2C,KY2O,WA8DSQ)
732,186-1043-234-C
KQ2O (+ K2BK)
557,760- 630-224-C
NG2X (+ WB2EQR)
333,126- 597-186-C
K2QMF (+ KA2UJH)
279,822- 626-149-C
W2VJN (+ NET)
194,310- 381-170-C
W2UJ (+ N3KR)
155,832- 344-151-C

3

N3AD (+ NET)
816,966-1107-246-C
W3AP (+ NET)
514,818- 773-222-C
KB3MM (+ oprs)
480,591- 797-201-C
N3BNA (+ N3DTM,N6CQ)
300,825- 573-175-C
W3NX (+ NET)
257,922- 483-178-C
WA3SPJ (+ KS3F)
247,374- 509-162-C
K3WJV (K9MP,WA3ZTR,oprs)
227,385- 489-155-C
W3GW (+ NET)
207,792- 468-148-C
W3USS (K3s TW,ZJ,KZ4H,N3JT,
W4PBC,oprs)
191,316- 428-149-C
W3MA (+ NET)
178,929- 423-141-C
K3VPZ (KA3OGG,N3DZH,oprs)
448- 13- 12-B

4

N4WW (+ K0LUZ,N4SA,WY4A)
1,446,882-1597-302-C
N4KG (+ K4CEF,KC4ZV)
645,120- 840-256-C
AA4MJ (+ KB4HZ,W4GCB)
126,936- 328-129-C
N4AU (+ K4IZN,WA4MTG)
70,446- 199-118-C
WD4IIO (K1ADU,N4LYT,N8AWM,W1LKY,
W2IRF,W4ILE,WB4JJH,WB8EFZ,
WD4FNX,VE3HVQ,oprs)
40,734- 146- 93-B

5

W5ASP (+ N5EA,W5VAH)
396,640- 636-208-C
N5RM (+ WG5J)
323,565- 583-185-C

6

AA4M (+ KC4B)
223,872- 583-128-C
WK6V (+ K1TKL,WB0QPO)
61,893- 299- 69-C
KI6T (+ N6MNB)
46,200- 220- 70-C
KJ6V (+ NET)
32,160- 160- 67-C

7

W7NI (+ K7JF,KQ7I,ND7T,W7AGQ)
183,315- 605-101-C
W7YAQ (+ KE7HX,NS7O)
42,039- 173- 81-B

8

W8JGU (+ N8DCJ,W8s CZN,GWC,
WA8s BIN,DXB,DXG,RCN)
589,700- 900-211-C

9

N9WA (+ KA9SLM,WD9GVX)
118,818- 322-123-C

0

K4VX/0 (+ AH2U,K9BGL,KM9P)
1,119,525-1265-295-C
KJ0G (+ K0GAS,N0ZA,NN0M,
NQ0L,W7XG)
253,776- 622-136-C
W0NA (+ oprs)
129,687- 311-139-C
KM0L (+ K0UAA)
5,724- 53- 36-C

VE

VE8RCS (+ oprs)
4,020- 67- 20-C

Multioperator Two Transmitter

W2REH (+ K2BMI,KY2P,W2GD)
2,128,386-2099-338-C
N5AU (+ K5MR,KM5X,N5s RZ,TR,
WB5VZL)
1,851,696-1837-336-C
K5LZO (+ K2TNO,AK5B,K5s GN,TU,
KE5IV,N5RP,NM5M,NT5D)
1,308,066-1402-311-C
K1XM (+ KM1P,KQ1F,NB1B)
959,175-1225-261-C
N2RM (+ KB3TNI)
953,451-1341-237-C
KY1H (+ K1RQ,KB1s KE,W,KJ1K,KS1N,
WA1ZAM,WB1EYL,WB2VLM)
837,288-1203-232-C
N6ND (+ KV6O,KZ6E)
755,802-1194-211-C
KS8S (KD8NS,KU8E,oprs)
604,900-1100-153-C
K1RX (+ NET)
500,360- 948-190-C
W6LT (K3JT,NZ4K,oprs)
209,412- 554-126-C
K6ZM (+ AK6T,KB6KKH,N3FT,CE3AQI)
203,562- 526-129-C

Multioperator Unlimited

W9LPL (+ KA1GD,AI3M,K3DI,KF3P,
W3FG,KC8C,N8II)
2,828,595-2387-395-C
K2TR (+ K1ZM,K2s EK,LE,SX,WR,
XA,WA2SPL,WB2KMY)
2,643,354-2331-378-C
W3GM (+ AA3B,K3s GM,ND,N2BA,
W3s FV,RJ,WA2ZKY)
2,170,746-1977-366-C
K3OO (+ K3s NZ,ZUF,KJ3R)
1,822,065-1813-335-C
N3RS (+ KM3T,N3RD,WA3LRO)
1,724,514-1602-319-C
N6RO (+ K3EST,KT3Y,AI6V,K6TMB,
N6AUV,W6SZN,WA6VEF,WC6I,
W7MAP)
1,101,210-1562-235-C
W0AIH/9 (+ K9FVF,KM0O,KN0V,
N09SH,W0s UC,ZZ,WA0RBW,
WB9YXY)
886,464-1026-288-C
K1EA (+ NET)
689,520-1040-221-C

DX CW

Single Operator

Africa

EA8BIE 18,050- 107- 50-A
SM5ALJ/EA8
1,485- 33- 15-B-40
SM5AAY/EA8
75- 5- 5-B-40
EA8AVW 22,089- 199- 37-B-15
ZS6USA 733,890-1439-170-B
JG1FVZ/5N0
194,040- 588-110-C
5Z4DE 43,992- 376- 39-B-20

Asia

HZ1HZ 200,451- 613-109-C
JA7FWR 433,068-1102-131-C
JA1XAF 362,232- 938-129-C
JA2JW 309,270- 793-130-C
JA7DLE 261,405- 785-111-C
JH8QCO 56,233- 323- 57-B
JE4VVM 31,920- 280- 38-C
JH3AIU 30,360- 230- 44-C
JA9RPU 26,784- 186- 48-B
JE6JVJ 24,024- 182- 44-C
JE1ARO 22,950- 153- 50-C
JA8SW 17,028- 132- 43-C
JA3ARM 10,509- 113- 31-C
JA7ASD 6,075- 81- 25-B
JH1MTR 5,625- 75- 25-B
JA1KFX 5,214- 79- 22-A
JA1WYQ 4,680- 104- 15-B
JA2MYA 3,540- 59- 20-B
JR2BNF/1 3,216- 67- 16-A
JA2WZ 3,213- 51- 21-B
JH3JYS 2,304- 48- 16-C
JE7IVP 1,485- 33- 15-B
JA6GGD 1,260- 30- 14-C
JA1AAT 690- 23- 10-B
JA1VZM 528- 22- 8-C
JA2SAP/1 72- 8- 3-B
JA7NI 1,260- 30- 14-C-160
JF1NZW 891- 27- 11-C-160
JE1SPY 660- 22- 10-C-160
JA1YBK (JH0LFE,opr)
15,390- 171- 30-C-80
JN1AIF 3,420- 114- 10-C-40
JH7VHZ 3,024- 72- 14-B-40
JA6PWN 2,604- 62- 14-C-40
JA2UOT 1,530- 51- 10-B-40
JN1VUB 576- 32- 6-B-40
JG2LGM 414- 23- 6-B-40
JG1GGF 192- 16- 4-B-40
JJ1JHJ 156- 13- 4-C-40
JM1TTU 90- 10- 3-B-40
JI2NOS 72- 12- 2-B-40
JA0GZ 54- 9- 2-B-40
JL1EJO 30- 5- 2-B-40
JR4ISK 15- 5- 1-B-40
JA2ODS 3- 1- 1-C-40
JA3YBF (JE6BXJ,opr)
91,143- 533- 57-C-20
JF2EZA 82,521- 519- 53-C-20
JH1AEP 72,504- 503- 53-C-20
JF1SEK 64,050- 427- 50-B-20
JH7WKQ 46,980- 348- 45-C-20
JH8JYV 39,825- 295- 45-B-20
JA0CGJ 28,197- 241- 39-C-20
JA2EIV 20,091- 181- 37-C-20
JA1CSB 14,934- 131- 38-C-20
JH7XGN 14,553- 147- 33-B-20
JR7GDL 8,991- 111- 27-B-20
JA2DN 2,754- 51- 18-A-20
JA1BDI 1,560- 40- 13-B-20
JE1AER 759- 23- 11-C-20
JA6AKV 624- 26- 8-B-20
JA6RHH 552- 23- 8-B-20
JO1QZI 483- 23- 7-B-20
JH8SPE 432- 24- 6-B-20
JE2MDE 105- 7- 5-B-20
JM1WZP/JD1 1,215- 45- 9-B
JP1EMG/JD1 6- 2- 1-B-40
JM1LRQ/JD1 12- 2- 2-B-20
UW0LT 184,212- 714- 86-B
RA9FA 36,696- 276- 44-B
UA0ZI 27,848- 221- 42-B
UW0CM 1,332- 37- 12-B
RA6JD 588- 28- 7-B
UA9AIA 216- 9- 8-B
UA0ZQC 16,985- 195- 29-B-80
UA0SMM 284- 11- 8-B-40
UA9XR 21,285- 165- 43-B-20
UA9XDG 5,438- 74- 29-B-20
UA0BCK 3,381- 49- 23-B-20
RA0JB 1,755- 45- 13-B-20
UF6QAC 1,638- 42- 13-B-20
UH8EC 7,020- 90- 26-B-40
UM8MZ 378- 14- 9-B-40
4X6IF 43,737- 238- 61-B

Europe

CT4AT 180,999- 507-119-B
DL6FBL 1,229,211-2239-183-C
DL7ON 372,222-1017-122-C
DA1EW 42,222- 227- 62-B
DL7AEY 38,940- 220- 59-B
DJ4OE 28,026- 173- 54-B
DL8CM 23,691- 149- 53-B
DF3ON 13,800- 115- 40-B
DK8AX 12,636- 117- 36-C
DL6FTZ/P (DL4FN,opr)
9,270- 103- 30-A
DL6RAI 28,944- 268- 36-C-80
DL1HBT 7,800- 104- 25-C-80
DL1JF 5,796- 92- 21-C-80
DJ5JH 5,016- 76- 22-C-80
DL7YS 75- 5- 5-B-80
OK8LN 1,332- 37- 12-B-40
DK9MB 19,380- 190- 34-C-20
DL1MAJ 15,444- 156- 33-C-20
DF8XC 8,003- 87- 23-B-20
DL1TH 5,808- 88- 22-B-20
DL1HCM 5,229- 83- 21-B-20
DL1ZQ 3,477- 61- 19-B-20
ED1CI (EA1CIM,opr)
151,470- 495-102-B
EA2CR 30,015- 145- 69-B
EA5CLO 28,440- 158- 60-B
EA1DOD 21,420- 140- 51-B
EA5CKP 18,540- 134- 45-B
EA3AOS 19,980- 180- 37-C-80
EA2BUR 2,850- 50- 19-B-40
EA3DBO 1,872- 33- 18-B-40
EA1DOC 5,544- 77- 24-B-20
EA4BV 420- 14- 10-B-15
EA6GP 18,285- 115- 53-B
EA6VQ 5,460- 70- 26-C-20
EI9J 74,522- 307- 82-B
EI3DP 7,395- 65- 29-B-15
F6BEE 129,300- 431-100-C
F6EPQ 64,560- 268- 80-C
F8IJA 37,515- 205- 61-B
F6ERZ 35,208- 163- 72-B
F8RU 30,876- 166- 62-B
F9YZ 19,737- 153- 43-A
F9QE 19,050- 127- 50-B
F8TM 13,038- 106- 41-B
F9BB 12,936- 98- 44-B
FD1HRN 5,400- 75- 24-B
F6EPO 1,344- 32- 14-B-80
F6ARC 50,181- 389- 43-C-40
F6CCI 1,080- 36- 10-B-20
F8TQ 1,218- 29- 14-B-15
G3MXJ 365,715- 903-135-B
G3ESF 69,861- 319- 73-B
G2QT 68,493- 289- 79-B
G3APN 52,160- 259- 80-B
G4XRX 30,504- 164- 62-B
G6NK 12,099- 109- 37-B
G4CNY 35,175- 335- 35-B-40
G3FXB 167,076-1092- 51-B-20
GM3LYY 335,340- 828-135-B
GM3RAO 23,868- 221- 36-B-20
GU3HFN (GU3MBS,opr)
226,910- 833- 90-B
GW3JJ 88,110- 330- 89-B
HA8KCO 1,620- 36- 15-B
HA5MY 420- 14- 10-C
HG5A (HA5ML,opr)
34,965- 315- 37-C-80
HA8IE 14,850- 150- 33-B-80
HA0LM 41,082- 334- 41-C-40
HA3MB 1,575- 35- 15-B-40
HA2KMR 21,828- 214- 34-B-20
HA5FG 9,360- 120- 26-B-20
HA5HH 6,318- 78- 27-B-20
HA5UA 5,625- 75- 26-B-20
HA6ZQ 4,884- 74- 22-B-20
HA2MJ 1,260- 30- 14-B-15
HB9AGA 223,062- 658-113-C
HB9BFQ 61,270- 315- 86-C
HB9KC 32,208- 176- 61-C
HB9DX 25,575- 155- 55-C
HB9AGH 13,986- 126- 37-B
I2UIY 260,820- 690-126-B
I0JX 202,122-1182- 57-C-40
I2UBI 102,900- 700- 49-C-40
I2YKV 8,424- 117- 24-B-20
I1XPQ 11,310- 130- 29-B-15
I2QIL 5,934- 86- 23-C-15
IS0OMH 40,533- 229- 59-B
LA7SI 11,988- 108- 37-C
LA9PCA 1,344- 32- 14-C
LA2EG 1,053- 27- 13-C-80
LA9XG 15,162- 133- 38-B-20
LA1U 10,842- 139- 26-C-20
LA2HFA 7,425- 99- 25-B-20
LA9DK 2,184- 52- 14-B-20
LA4YW 2,025- 45- 15-B-20
LA0DY 1,512- 42- 12-B-20
LA4KG 189- 9- 7-A-20
LX1WW 6,417- 69- 31-C
LZ1KNP 24,255- 165- 49-B
LZ2SO 13,908- 122- 38-C
LZ2VP 10,413- 89- 39-C
LZ1BJ 2,160- 36- 20-C
LZ1RN 4,500- 75- 20-B-80
LZ1TR 30,873- 251- 41-C-40
LZ2AG 10,266- 118- 29-B-40
LZ2AX 12,276- 132- 31-C-20
LZ1DV 1,794- 48- 13-B-20
LZ2QV 36- 4- 3-B-20
LZ1WY 612- 17- 12-A-15
OE3ZOC 11,340- 126- 30-C-20

OH1AA (OH1XN,opr)
98,739- 621- 53-C-20
OH1AD 19,740- 188- 35-B-20
OH6YF 19,494- 171- 38-C-20
OH1PY 7,725- 103- 25-C-20
OH9UW 7,722- 78- 33-C-20
OH2EJ 2,310- 55- 14-B-20
OH3GD 1,974- 47- 14-A-20
OH7UV 1,526- 34- 13-B-20
OH6KI 1,080- 30- 12-B-20
OH0PA 6,996- 106- 22-B-20
OK1ALW 618,148-1392-148-C
OK3CEI 44,676- 219- 68-B
OK1KZ 21,996- 156- 47-B
OK3FQN 12,495- 119- 35-B
OK2ABU 9,984- 104- 32-C
OK3CEL 9,603- 97- 33-B
OK1DZD 6,075- 75- 27-A
OK1DKR 5,829- 67- 29-A
OK2BHQ 1,800- 40- 15-B
OK1JDX 297- 11- 9-B-160
OK3TJI 35,682- 313- 36-C-80
OK2FD 6,912- 96- 24-C-80
OK2PLH 3,060- 51- 20-B-80
OK2DB 1,820- 35- 15-B-80
OK3CUG 75- 5- 5-A-80
OK2EC 19,404- 198- 33-C-40
OK2BOB 3,135- 55- 19-B-40
OK3CQW 39,744- 387- 36-C-20
OK1JPH 26,641- 231- 37-B-20
OK2PGG 19,008- 192- 33-C-20
OK2BSG 13,536- 141- 32-B-20
OK3YCA 8,019- 99- 27-B-20
OK1AXB 5,675- 89- 25-B-20
OK2BGR 5,418- 86- 21-B-20
OK1MTA 4,200- 70- 20-B-20
OK1JDJ 2,400- 60- 16-B-20
OK1MHI 1,536- 32- 16-B-20
OK2PAW 1,152- 34- 12-A-20
OK3IF 936- 24- 13-B-20
OK1DXW 126- 7- 6-B-20
OK2BCI 6,138- 93- 22-C-15
OK1TW 5,280- 80- 22-C-15
OK2SWD 210- 10- 7-B-15
ON4JJ 5,916- 68- 29-A
ON5WL 13,668- 134- 34-B-80
ON4XG 3,366- 68- 17-B-15
OZ7HT 162,540- 602- 90-B
OZ1FGS 23,226- 158- 49-C
OZ1W 12,285- 105- 39-B
OZ7BG 2,622- 38- 23-B
OZ1FTE 7,200- 100- 24-B-80
OZ1NF 510- 17- 10-B-80
OZ7YL 8,400- 100- 28-C-20
OZ1AXG 5,460- 65- 28-C-20
OZ1JLX 4,554- 69- 22-C-20
OZ1DPW 2,925- 65- 15-B-20
OZ1FAO 1,440- 40- 12-B-20
OZ2NU 216- 12- 6-B-20
PA8LOU 62,451- 257- 81-B
PA8INA 47,439- 251- 63-B
PA3CBZ 17,197- 139- 41-B
PA3BNT 12,792- 104- 41-B
PA3BUD 11,400- 100- 38-B
PA3ACC 9,990- 90- 37-B
PA3EBT 9,180- 102- 30-B
PA3BTH 8,466- 83- 34-B
PA8ADT 7,128- 88- 27-A
PA3CXC 24,198- 218- 37-B-20
PA3BDK 9,114- 98- 31-B-20
PA3CWM 5,481- 87- 21-B-20
PA8UV 4,500- 75- 20-B-20
PA3AMA 2,400- 50- 16-B-20
SM7NJJ 78,732- 324- 81-C
SM8TW 5,850- 75- 28-C
SM5DAC 3,672- 51- 24-B
SM5CLE 2,805- 55- 17-A
SM8OFW 2,232- 31- 24-B
SM1CNS 1,485- 33- 15-A
SM6EEJ 13,188- 157- 29-C-20
SM6BZE 12,600- 150- 28-B-20
SM2BDS 10,575- 141- 25-B-20
SM6OLL 7,590- 110- 23-C-20
SM5DUT 6,279- 91- 23-C-20
SM5RE 5,520- 92- 20-C-20
SM8WQ 5,400- 90- 20-B-20
SM8BTS 5,220- 87- 20-B-20
SM6DUA 5,160- 86- 20-B-20
SM6PVB 3,744- 79- 16-B-20
SM5CAK 3,520- 80- 23-C-20
SM5CSS 3,000- 50- 20-C-20
SM7TV 2,548- 47- 18-B-20
SM6CDN 1,155- 35- 11-B-20
SM7LAZ 1,050- 35- 10-B-20
SM6CST 1,023- 31- 11-B-20
SM2GYP 270- 10- 9-C-20
SM7CVU 60- 5- 4-B-20
SP3BYZ 22,962- 178- 43-B
SP8FER 10,802- 116- 31-C
SP3AZO 4,608- 64- 24-B
SP9IGY 2,592- 54- 18-B
SP8MJ 1,935- 43- 15-B
SP9CVY 1,440- 32- 15-B
SP5JTR 1,482- 38- 13-B-80
SP9DAE 594- 18- 11-B-80
SP6HEK 13,755- 131- 35-B-20
SP4EEZ 7,056- 112- 21-B-20
SP9BBH 5,742- 87- 22-B-20
SP4GFG 4,104- 72- 19-B-20
TF3SD 2,268- 42- 18-B-20
UA1OT 26,832- 208- 43-B
UV1OO 20,382- 158- 43-B
UA2EC 1,776- 37- 16-B-20
UA6LTI 9,570- 110- 29-B-40
UA6BPM 2,160- 45- 16-B-40
RA3DX 4,902- 86- 19-B-20
UA4LBF 1,080- 30- 12-B-20
UB5UAT 52,863- 263- 67-B
RB5EX 19,152- 152- 42-B
RB5QL 9,570- 110- 29-B
UB5KDD 9,222- 105- 29-B
UB5HKW 7,650- 85- 30-B
UB5TN 7,020- 60- 39-B
RT4UF 2,142- 42- 17-B-80
UB5FWC (UB5FBV,opr)
17,949- 193- 31-B-40
UT4UI 14,586- 143- 34-B-40
UB5IFN 10,584- 126- 26-B-40
UB5FAN 10,140- 130- 26-B-40
UB5QJI 5,700- 100- 19-B-40
RB5GM 2,592- 48- 18-B-40
RB4III 360- 15- 8-B-40
UB5QIL 288- 12- 8-B-40
UB5NQ 47,670- 454- 35-B-20
RB5QW 21,480- 179- 40-B-20
UB5QKC 20,832- 224- 31-B-20
RB5WR 11,259- 139- 27-B-20
UB5BZ 7,176- 107- 23-B-20
UY5TE 4,104- 72- 19-B-20
UB5VK 825- 25- 11-B-20
UC2LB 828- 23- 12-B-80
UC2WM 288- 12- 8-B-80
UC2WBI 1,080- 30- 12-B-20
UC2AFZ 836- 26- 12-B-20
UP2BO 159,159- 583- 91-B
UP2BEI 8,448- 88- 32-B
UP2BKM 240- 10- 8-B-80
UP2BKA 12- 2- 2-B-40
UP2BBF 3,456- 64- 18-B-20
UP2BIJ 1,794- 26- 23-B-20
UP1BXA 1,326- 34- 13-B-20
UP2OU 1,176- 28- 14-B-20
UO2GKL 9,639- 119- 27-B
UO2GLW 4,266- 79- 18-B-20
UR2RMC 6,975- 103- 24-B
UR2RND 180- 10- 6-B-80
UR2RIY 1,188- 44- 9-B-20
YS4PL 117,990- 437- 90-C
Y47YN 63,630- 303- 70-B
Y22WF 32,292- 207- 52-B
Y24SK/A 29,058- 167- 58-C
Y36SG 28,674- 177- 54-B
Y24LE 26,754- 182- 49-C
Y42ZK 14,976- 128- 39-B
Y52TE 12,519- 107- 39-C
Y28QH/A 12,000- 125- 32-B
Y36TG 9,546- 86- 37-B
Y23RJ 5,313- 77- 23-B
Y33ON 4,818- 73- 22-B
Y66YF 4,140- 69- 20-B
Y71KH 3,960- 60- 22-B
Y24GF 3,750- 50- 25-B
Y63VN 2,907- 57- 17-B
Y25OE 2,700- 45- 20-A
Y25TG 2,480- 41- 20-C
Y37TM 2,280- 38- 20-B
Y38YE 2,166- 38- 19-B
Y68WG 1,632- 32- 17-B
Y35WF 1,326- 26- 17-B
Y21IM 1,326- 34- 13-B
Y37RB 360- 12- 10-B
Y51XE 8,625- 115- 25-C-80
Y21XH/A 570- 19- 10-B-80
Y49RF 540- 18- 10-B-80
Y22DK/A 297- 11- 9-B-80
Y22UO/P 231- 11- 7-B-80
Y24VF 168- 8- 7-B-80
Y24YH 1,932- 46- 14-C-40
Y24RU 1,836- 34- 18-B-40
Y22BK 288- 48- 6-B-40
Y23DL 78,866- 642- 41-C-20
Y32KE 38,850- 350- 37-C-20
YB7IQ 31,008- 272- 38-C-20
Y33TB 23,544- 218- 36-C-20
Y22TO 22,464- 208- 36-C-20
Y33VL 17,820- 165- 36-C-20
Y78VL 15,747- 181- 29-C-20
Y78UL 13,344- 139- 32-C-20
Y35UG 12,150- 135- 30-B-20
Y28XL/A 10,980- 122- 30-C-20
Y21NE 10,875- 145- 25-B-20
Y22LE 8,700- 116- 25-B-20
Y51ZE 8,568- 119- 24-C-20
Y23WM 7,332- 94- 28-C-20
Y36VM 6,675- 89- 25-B-20
Y75YH 5,214- 79- 22-B-20
Y71VG 4,488- 68- 22-B-20
Y51YJ 4,071- 59- 23-B-20
Y21UL 3,819- 67- 19-B-20
Y63UN 3,618- 67- 18-B-20
Y62RN 3,591- 57- 21-B-20
Y21UD 3,402- 63- 18-B-20
Y32EE 3,240- 54- 20-C-20
Y23HN 2,592- 48- 18-B-20
Y21DG/A 2,244- 44- 17-B-20
Y21IC 2,142- 42- 17-B-20
Y25DF/A 2,112- 44- 16-B-20
Y37ZE 2,040- 40- 17-B-20
Y23XE 1,989- 51- 13-B-20
Y26WM/A 1,248- 32- 13-B-20
Y24LA 1,218- 29- 14-A-20
Y21XC 1,188- 36- 11-A-20
Y37RL 990- 30- 11-B-20
Y61XM 792- 24- 11-B-20
Y24SH/A 756- 21- 12-B-20
Y25JA/A 720- 24- 10-B-20
Y27GL/A 669- 29- 8-C-20
Y67UL 432- 18- 9-B-20
Y23UA 360- 15- 8-A-20
Y31MB 351- 13- 9-C-20
Y25FH 306- 17- 6-A-20
Y22UO 252- 12- 7-B-20
Y59WF 252- 12- 7-B-20
Y24DG 189- 9- 7-A-20
YO8DDP 38,340- 215- 60-B
YO8FR 23,628- 179- 44-B
YO8DHC 3,564- 66- 18-B-40
YO8BSE 3,348- 62- 18-B-40
YO9CYD 2,304- 48- 16-B-40
YO4BEX 1,920- 40- 16-B-40
YO5VZ 288- 12- 8-C-40
YU7SF 89,498- 297- 78-B
YU4EZC 15,240- 127- 40-A
YU7BW 11,040- 92- 40-C
YU1OWW 3,807- 47- 27-A
YU2NW 5,148- 78- 22-C-80
YU1EXY 121,950- 813- 50-C-40
YU2QS 45,264- 368- 41-C-40
YU4BR 20,295- 205- 33-B-40
YU7NHT 3,720- 62- 20-B-40
YU1WR 57,582- 457- 42-C-20
YU2EU 8,175- 109- 25-B-20
YU1PQI 792- 22- 12-C-20
YU4ETF 15,903- 171- 31-C-15
YU3UPI 1,554- 37- 14-B-15

North America

N6EK/C6A 1,335,510-2090-213-B
C6ADR (N1EE,opr)
1,161,831-1853-209-B
N4RP/C6A 753,135-1357-185-B
K8GVB/C6A 82,134- 507- 54-B-80
FG/W2KN/FS 2,760- 46- 20-B-160
HI8LC 3,150- 50- 21-B-40
HP1AC 609,894-1093-186-B
KL7KE 6,640- 90- 32-B
KL7Y 12,075- 135- 35-C-160
KL7UR 22,575- 215- 35-C-80
N5AW/NP2 2,674,434-3442-259-B
KP4FI 357,048-2088- 57-C
NP4Z 106,530- 670- 53-C-80
TE6T 366,525- 905-135-B
TE4T 8,460- 94- 30-B-20
V3DA (W3UM,opr)
40,770- 302- 45-B-160
K4FW/V4 344,250- 850-135-B
VP9GD 457,380- 924-165-B
XE2MX 980,865-1535-213-B
ZF2IZ (NM8K,opr)
38,925- 173- 75-B

Oceania

A35WZ 240,957- 653-123-B
N7ET/DU7 9,000- 150- 20-C-40
FO8JP 26,622- 153- 58-B
AH6AZ 1,178,858-1794-219-C
KH6CP 5,508- 68- 27-A
KH6DW 85,374- 558- 51-C-40
KH6IJ 5,016- 76- 22-C-40
K7SS/KH6 258,042-1483- 58-C-20
W7PSO/KH6 24,288- 184- 44-B-20
WH6W 21,960- 183- 40-C-20
AH6EK 15,651- 141- 37-B-20
VK2APK 285,390- 755-128-B
VK2DID 4,290- 55- 26-B
VK2BOQ 69,336- 426- 54-B-40
VK2GW 12,573- 127- 33-B-40
VK5AGX 7,743- 89- 29-B-40
VK4TT 1,764- 42- 14-C-20
VK4XA 38,829- 301- 43-B-15
YB2FEA 648- 24- 9-B
KA7KSY/YB8 252- 14- 6-B-40
ZL2MM 3,314- 48- 23-B-15

South America

CX8DT 1,853- 29- 19-C-160
LU6UO 258,552- 648-133-B
LU8DQ 254,040-1460- 58-C-20
OA4ZV 16,032- 167- 32-C-80
PJ9J (W1BIH,opr)
3,412,398-3817-298-C
PA8VDV/PJ2 29,085- 277- 35-B-10
PY1HQ 245,097- 723-113-C
PY2RLQ 48,226- 321- 48-B
PY2UJJ 1,989- 39- 17-A
PT7CG 270- 10- 9-B
PY4WAS 49,832- 352- 47-B-40
PY2LQB 5,700- 76- 25-B-40
PY2RRG 96,513- 607- 53-C-20
PQ8ZZ 1,785- 35- 17-B-20
K3UOC/YV4 1,940,634-2469-262-C
YV3AGT 769,986-1358-189-A
YV7QP 13,248- 138- 32-B-40
ZP5XDW 232,008-1381- 58-C-15
9Y4AA (N6TJ,opr)
4,121,715-4595-299-C

Multioperator Single Transmitter

Africa

W6QL/Z2 (+W6KG)
472,386-1202-131-B

Asia

JE2YRD (JA2EZD,JA7RHJ,JE1JKL, JI2KVW,JK2AYR, JR2s SCJ,SQU, oprs) 442,092-1108-133-C
JA1YWX (JE1CKA,JG1IMM,JI1CUP,JM1s CAX,MCF,JF2IWL,JI2GUT,JR4NIV, JA6-9338,JH7PKU,oprs)
382,143-1003-127-C
JA7YFB (JN1RON,JE7JWB,JF7s AAD, GQK,TDN,JH7s XKI, XMO,JR7s GYC,JLU,JVO,OEF,QYW,RLB, WFH,JH8QNT,oprs)
358,380- 905-132-C
JA7YAB (JA7UMT,JR7CDI,JA8-3801,oprs)
203,448- 692- 98-C
JA1YXP (JN1OTG,JI2DLF,JR4HCV, JH9CAU,oprs)
193,434- 631-103-C
JA1YCL (JK1STT,JL1s LNC,QOC, JM1NKE,JN1WCS,JO1GAD,JS1AFY, JH8MHZ,JH9NDS,oprs)
155,664- 552- 94-C
UZ6CWA (UA6s CCD,CIJ,DA,UW6s CA,CN,CM,RW6CA,oprs)
132,192- 612- 72-B
UZ6CWO (UA6s CGL,CHG,UW6CS,oprs)
38,475- 285- 45-B
UZ6QWN (UA6s QFG,QGZ,QHB,QHT,oprs)
21,027- 163- 43-B
UZ6QWE (UA6s QG,QJ,098-107,oprs)
16,074- 141- 38-B
UZ9XWA/P (UA9s XCE,098-206,oprs)
672- 16- 14-B
UD7DWZ (UD6s DCA,DCF,00136,oprs)
2,100- 35- 20-B
UL8LWA (UL7s LER,-026-577,oprs)
336- 14- 8-B

Europe

DL8IU (DL4s AAA,AAE,oprs)
165,240- 540-102-C
DK7ZT (+DK7FP)
98,910- 471- 70-C
EA3MM (EA3s BEN,FAA,FHC, EC3CIB,oprs)
55,440- 240- 77-B
G3SJX (+G3s UFY,WRR)
186,668- 587-106-B
G3TBK (+G4HVC)
87,120- 362- 80-B
HA4KYN (HA4s XA,XH,ZZ,oprs)
149,625- 475-105-C
HB9Z (HB9s CSA,RE,oprs)
51,120- 260- 71-C
OK2KOD (OK2s BDI,BHM,WAZ,oprs)
33,630- 194- 59-B
OK2KMR (+OK2BQZ)
7,350- 98- 25-B
OK2KPS (+oprs)
2,880- 64- 15-B
OK2KHD (OK2s PFV,WCK,oprs)
1,296- 36- 12-C
OK3KFO (+oprs)
378- 14- 9-B
SK6TW (SM6s ALF,AOU,CPY,CVT, DER,OOI,OQO,oprs)
250,800- 760-110-C
SM6MNH (+SM6FKF)
140,616- 504- 93-C
7S2AT (SM2s LIY,MZD,ODB,oprs)
22,017- 179- 41-C
SP5PBE (+SP5ELA)
50,034- 269- 62-C
UZ4FWO (UA4s FAD,FDS,FZ,oprs)
164,268- 507-108-B
UZ6LWZ (UA6s 156-1163,156-1336,oprs)
152,712- 504-101-B
UZ3AXH (+oprs)
6,237- 99- 21-B
UB3IWA (RB5II,UB5s IFZ,IOK,oprs)
66,692- 389- 76-B
UB4QWC (UB5s QDU,QF,oprs)
3,195- 71- 15-B
UB4TWL (+oprs)
1,764- 60- 12-B
UC1LWN (3 oprs)
4,686- 68- 24-B
UC1AWA (UC2s ADM,188-2,188-185,oprs)
4,692- 68- 23-B
UP1BWW (UP2s BIJ,038-892,oprs)
48,024- 348- 48-B
UQ1GWW (UQ2s OIL,037-83,037-116,oprs)
338,709- 891-127-B
UR1RYY (UR2s RE,RQ,oprs)
11,520- 128- 30-B
Y42ZB (+Y42WB)
6,396- 82- 26-B
YO5KTB (YO5s AXF,CUQ,oprs)
1,035- 23- 15-B
YU4EXA (YU4s NW,RW,WIA,oprs)
600,498-1371-146-C
YT3T (YU3s BQ,DRW,EIJ,RM,oprs)
439,956-1111-132-C
YU2CKL (3 oprs)
221,604- 626-118-C
4N2X (+oprs)
158,112- 488-108-C
YU1ATA (YU1s NP,OVZ,RW,TT,oprs)
63,492- 286- 74-B
YU7AJR (2 oprs)
30,723- 209- 49-B
YU4CBC (+oprs)
8,988- 107- 28-B

North America

4U1UN (HB9RS,K2GM,K2SS,N2AA,oprs)
2,862,000-3590-265-C
J34Z (K4LTA,N6LHN,NF5Z,W5PWG, WA8FSX,oprs)
2,878,808-3212-278-C
KL7HFV (+KL7WF,N6IV)
393,300- 950-138-C
V47A (K8GU,NI0E,WB8MIV,oprs)
3,490,344-4068-286-C

Oceania

KH6XX (+KH6ND)
2,964,555-3729-265-C

South America

P40M (K9s GL,VV,KA9CJG,oprs)
4,478,643-4927-303-B

Multioperator Two Transmitter

Asia

JA7YAA (JJ1MVU,JN1VYN,JE3DDT, JG3JRM,JE4KZZ, JH7s CUO,HWR, JR7s OMD,PGL,JE7s HLZQCQ, JH0s MRP,ORW,oprs)
407,160-1044-130-C
JA9YBA (JH7UJR,JA9s LNJ,NFO,PPC, VDA,oprs)
385,839- 997-129-C
JH7YAW (JH7s AJD,LVK,JR7BTI,oprs)
264,504- 824-107-C
JA7YCQ (JN1LIG,JR7MZC,oprs)
127,974- 554- 77-C

Europe

GB4DX (G4s BWP,DRS,GIR,G5LP,oprs)
869,510-1901-170-B
OH1AF (OH1s EH,HS,KA,-160,oprs)
137,088- 544- 84-C

Multioperator Unlimited

Asia

JA2YKA (JE2VYM,JF2DQJ,JG2VTD, JI2JXR,JR2GMC,JE7BIZ,JA8s SSY, XXS,oprs)
578,598-1321-146-C
JA7YWD (JQ1s ENT,IIO,JE7XGQ,oprs)
6,630- 85- 26-B

Europe

IO3FTY (I3s FIY,JSS,JTC,oprs)
1,321,677-2331-189-C

CHECKLOGS

Special thanks to the following amateurs who submitted logs to assist in cross-checking entries:
CO7GC,CT1AVR,CT4AT, DF5WN,DL5IC,DL9HP,EA1BDB, EA3DGQ,EA3FKC,EA3PE,EA4AYQ, EA4BVE,EA4CGB,EA7NR,EA7XC,EA8ZI, F6HLB,G6NR,HA8HG,HA3KNA,HA5AHS, HK1IU,JA1NYV,K2KTT/PJ7,KB3UU, KB6IQW,KG6B,KO4D,KV8U,KZ3B, LA8EH,LA1HCA,LA4IFA,LA8CE, LU2DGZ,LU4MEE,LZ1AU,LZ1CW, LZ1KVZ,LZ1RW,LZ2SL,N1ACH,N2EAW, N6UW,N9EKG,OH1XX,OH2BKF, OH3BU,OH9PN,OK1AR,OZ1CAR,OZ2JI, OZ5MJ,OZ7L,PA6LF,PA8TV,PA3EBX, PT7AQ,PY1OL,PY2AC,PY2MT,PY3CJI, SM6CSX,SM3CVM,SM5ARL,SM5CVC, SM5EQW,SM6BWQ,SM6LPF,SM6NFK, SM6OOI,SM6OPM,SM7CZC,SM7EH, SP2BMX,SP4EAK,SP4KIE,SP5LM, SP6BEN,SP6MLR,SP8BVJ,SP9HZF, SP9MZH,SP9NLI,TI2CCC,UA6FEP, UA8KCL,UA6LFN,UA1OY,UA3ATV, UA3IDT,UA3TCJ,UA6PCH,UA9XR, UB4WZA,UB4XWB,UB5AKA,UB5DW, UB5IBM,UB5JLJ,UB5CKN,UB5UHE, UC1AWF,UD6DKW,UM8DX,UP3BO, UQ2GMC,UW8CN,UW8HC,UY5GG, UZ1ZWM,UZ1ZZZ,UZ8HXK,VE1RH, VE3XO,VE8RCS,VK3CKL,VK3KS, VO1OP,VP2MU,W1KRV,W2HAZ,W7KGE, W7KXH,W8CHV,W8FR,WA4GNW, WB8GOB,XE2AHQ,Y21CF,Y21NF, Y22VJ,Y22YO,Y23GB,Y23RB,Y23UL, Y24EA,Y31MO/P,Y38UF,Y44NO,Y75PN, YO7APA,YC8CEZ,YV5JEA.

Disqualifications

Phone: K2BU
CW: N2ME

Get Ready, Get SET, Go!

Simulated Emergency Test Weekend is October 18-19.

Our annual "physical" in providing emergency communications is the Simulated Emergency Test, scheduled for the weekend of October 18-19. It is here that we test our capabilities, experiment with some new concepts and locate weak points—the end product being a better emergency response for the real thing. As in last year's SET, the scoring format will reflect some of the broad objectives: (1) Strengthen the VHF-to-HF link at the local level, insuring that the ARES and NTS aspects of the League's official program are working in concert with one another. (2) Encourage greater use of digital modes for handling high-volume traffic and point-to-point Welfare reports out of the affected simulated disaster area. (3) Operationally implement the Memoranda of Understanding between the League, the user and cooperative agencies. (4) Focus our energies on ARES communication at the local level, which includes increased use and recognition of "tactical" communications on behalf of served agencies.

Test messages should carry the word "Test" before the precedence, eg, TEST PRIORITY on phone and TEST P on CW. The text of such messages should also begin with the words, TEST MESSAGE. However, the word "Test" is not used in conjunction with Routine messages. Such messages are routine whether specifically for the SET or not.

Also, although October 18-19 is the official SET weekend, groups are free to conduct their SET anytime during the period September 1 through November 30 if this is more convenient. This may be done to coincide with already planned communications activity, such as a parade or festival, to provide greater mass-media exposure. The deadline for receipt of all reports is January 30, 1987.

How do you participate? If you are already an enrolled ARES member or active participant in an NTS net, your ARRL Emergency Coordinator or Net Manager is already making plans for your activity. All League Officials, affiliated clubs and station appointees in the ARRL Field Organization will automatically receive the details and reporting forms for conducting a successful SET in the mail. If you don't receive the information, write to ARRL HQ for the package and get involved in the SET action. Contact your local ARRL Emergency Coordinator, who will quickly plug you into his SET plans. If your thumbwheels are stuck and you don't know who to call, contact your ARRL Section Manager (page 8 of any *QST*) for direction.

ARRL public-service officials are planning an interesting weekend for you, so volunteer your services to put Amateur Radio's emergency communications capabilities to the test—The Simulated Emergency Test, October 18-19. Don't participate in SET for yourself; participate for your community.

Amateur Satellite Communications

(continued from page 73)

5 seconds or about 20 miles and diverging slowly from it. Stay tuned for further developments in the saga!

Amateurs have reported spectacular visual observations associated with the launch of Japan's H1 vehicle. At least one observer, VE3GSO in London, Ontario, reports having seen all three major objects launched, the EGP FO-12 and the rocket body. The rocket body was reported to have been enveloped in a bluish, iridescent cloud of gas. Similar reports made news headlines across North America. The gas was apparently ionized hydrogen released by the intentional venting of the launcher's tanks and the subsequent effect of solar radiation. The solar radiation ionized the hydrogen much as it does atmospheric hydrogen.

VE3GSO says he actually saw FO-12 with binoculars. It appeared bluish with a slight twinkle. Sources indicate the blue color results from the solar cells and their coatings. EGP is much more easily visible. Covered with dozens of laser retro-reflectors and plane mirrors, it is specifically designed to be ranged by laser and visually spotted. Its primary objective is to provide precise information on the position and movements of various observation sites on the earth. About 7 feet in diameter, the EGP can be as bright as a first-magnitude star when observed under optimum lighting conditions. According to W3IWI, its brightness can vary from 1 to 4 while most of the time being around 2, the apparent magnitude of Polaris, the North Star.

EGP should be visible between 15 minutes after sunset and through perhaps local midnight according to KA9Q. Similarly, it should be visible from up to four hours before dawn through about 15 minutes before dawn. According to VE3GSO, there was a prominent twinkle to EGP when he saw it due, he says, to the effects of the many mirrors on the large sphere. EGP was the primary payload on the H1 launch.

Next month, we'll talk a tour of basic FO-12 operating procedures.

Strays

I would like to get in touch with ...

☐ any hams who were B-29 radio operators at station 00V605 on Saipan, 1944-45. Thomas Anselmo, W1NYY, 14B Fairway Dr, Wethersfield, CT 06109.

☐ former radio operators, or members of their family, who served on these WW II ships: *USS Ancapa, USS Atik, USS Asterion, USS Big Horn, USS Captor, USS Irene Forsyte* and *USS Nancy* (formerly *USS Pelican*). H. C. Hansen, WA3YYR, 1327 Burleigh Rd, Lutherville, MD 21093.

☐ anyone having schematics for a Polamar 300A base or a Kris 300A mobile. Gerard Gaudette, WB4NNB, 511 S Bayshore Dr, Madeira Beach, FL 33708.

☐ anyone with a manual, a schematic or conversion information for a US Navy RBC-1 receiver (circa 1941). Mark Starin, KB1KJ, 457 Varney St, Manchester, NH 03102.

***QST* congratulates ...**

☐ the following radio amateurs on 50 years as ARRL members:

- Jack Davis, W3HRM, of Ellicott City, Maryland
- John Mitchell, WN4F, of Winter Haven, Florida
- Raymond Murphy, W4BNE, of Tampa, Florida

☐ Robert Casada, KC9TY, of Muncie, Indiana, on receiving the Outstanding Amateur Radio Operator of the Year Award from the Indiana Radio Club Council.

☐ Sidney King, DVM, W2UKO, of Suffern, New York, on being installed as an Honor Roll Member of the American Veterinary Medical Association.

☐ Commander Robert M. Harler, USN, K8MWO, on assuming command of the Christchurch Detachment, Naval Support Force, Antarctica.

☐ the following Amateur Radio operators on being elected as Fellows by the Radio Club of America, Inc: Leland F. Heithecker, W5EJ, of Irving, Texas; Herbert Hoover, III, W6ZH, of San Marino, California; John B. Johnston, W3BE, of Derwood, Maryland; and Brigadier General Leland Smith, W5KL, of Jasper, Arkansas.

☐ the following Amateur Radio operators on receiving these awards from the Radio Club of America, Inc: The Busignies Memorial Award—Frank A. Gunther, W2ALS, of Staten Island, New York; The President's Award—Archibald C. Doty, Jr, K8CFU, of Fletcher, North Carolina; and The Link Mobile Communications Award—Fred M. Link, W2ALU, of Pittstown, New Jersey.

53rd ARRL November Sweepstakes Announcement

The rules for this year's contest are similar to last year's. Note the 30- and 12-meter band exclusion (Rule 1) and the Suggested Frequencies listing. Don't forget that there is a three-QSO penalty for unremoved duplicate contacts and for miscopied call signs. Take the time to make sure you have the call correct before you move on. At four QSOs each (including the original QSO), bad calls reduce scores quickly.

Another point to remember is that you must receive a *complete exchange* for each claimed QSO. If you get everything except the check, that's not good enough. You must copy it *all* for a complete contact. QSOs with stations "not in the contest" are fine, too — *if* you can get all of the required information.

Official log sheets, summary sheets and dupe sheets are available from ARRL HQ. Send an SASE with one unit of First Class postage (US) for each five sheets requested. You'll need one summary sheet and one dupe sheet for each mode. Log sheets hold 100 QSOs each, so order accordingly. Order your official entry forms now; they not only make it easier on the log checkers, but also help make sure you submit all of the required information.

Logs must be postmarked by December 17, 1986. You should send them via First Class Mail to ensure timely delivery. Entries not postmarked by the deadline *will* be classified as checklogs; no exceptions. If you want to make sure your entry arrived safely, include a self-addressed, stamped postcard. We'll return it to you when we get the log.

Club officers: Remember to send us a membership roster by December 17, 1986 as detailed in the club competition rules (January *QST*). CU in SS!

Rules

1) **Object:** For stations in the United States and Canada (including territories and possessions) to exchange QSO information, as detailed in Rule 4, with as many other U.S. and Canadian stations as possible on 160 through 10 meters, excluding 30 and 12 meters.

2) **Contest Period:**

(A) **CW** — First full weekend in November.

(B) **Phone** — Third full weekend in November.

(C) **Time** — Begins 2100 UTC Saturday and ends 0300 UTC Monday. Operate no more than 24 of the 30 hours. Off periods may not be less than 30 minutes in length. Times off and on must be clearly noted in your log, and listening time counts as operating time.

3) **Categories:**

(A) *Single operator.* One person performs all transmitting, receiving, spotting and logging functions.

(B) *Multioperator*, single transmitter only. Those obtaining any form of assistance such as relief operators, loggers or use of spotting nets.

4) **Exchange:** A consecutive serial number, precedence ("A" if you run 150-W output or less, "B" if more than 150 W), your call sign, check (last two digits of the year you were first licensed) and your ARRL Section. For example, K5ZD answers W1AW's call by sending W1AW NR178 B K5ZD 73 NTX for QSO number 178, more than 150 W, first licensed in 1973 and Northern Texas Section.

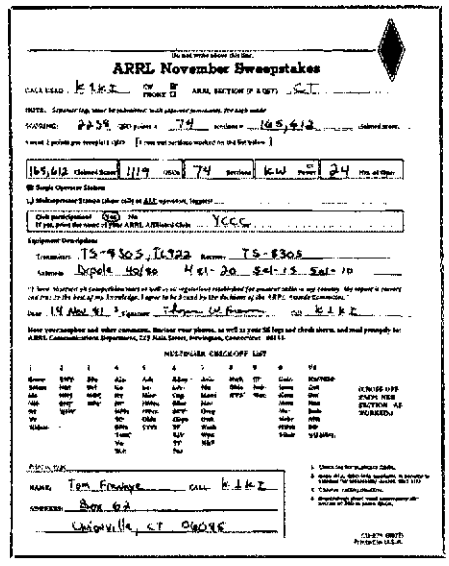
5) **Scoring:**

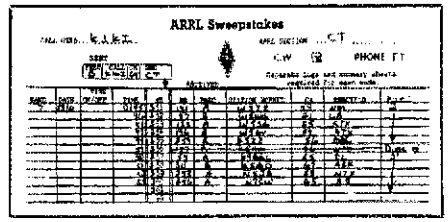
(A) *QSO points.* Count two points for each complete two-way QSO. No cross-mode contacts. Work each station only *once*, regardless of the frequency band.

(B) Multiplier. Each ARRL Section (listed on page 8 in this issue) plus VE8/VY1 — maximum of 74. KP4, KV4/KP2 and KG4 stations are in the West Indies Section, while KH6 and other US possessions in the Pacific count as the Pacific Section.

Please note that the new West Texas Section does not take effect until January 1, 1987, so it *does not* count as a multiplier in this contest.

(C) *Final score.* Multiply QSO points (two per QSO) by the number of ARRL Sections (plus VE8/VY1).


ARRL November Sweepstakes


ARRL Sweepstakes

6) **Miscellaneous:**

(A) A transmitter used to contact one or more stations may not subsequently be used under any other call during the contest period (with the exception of family stations where more than one call is assigned by FCC/DOC).

(B) One operator may not use more than one call sign from any given location during the contest period.

(C) The use of two or more transmitters simultaneously is not allowed.

7) **Reporting:** Contest forms (log sheets, summary sheet, dupe sheet) are available from ARRL HQ for an SASE. Official forms are recommended. Any entry claiming more than 200 QSOs must submit duplicate-checking sheets (check sheets). Incomplete or late entries will be classified as checklogs. Logs must include dates, QSO times, exchange sent/received, band and mode. Postmark your entry within 30 days after the phone portion of the contest (December 17, 1986).

8) **Club Competition:** ARRL-affiliated clubs for club gavels and awards in the local, medium and unlimited categories as described in January *QST*.

9) **Awards:** Certificates to the top single operator CW and phone scorers in both the "A" and "B" categories in each ARRL Section, and the top multioperator entry in each ARRL Division.

10) **Conditions of Entry:**

(A) Each entrant agrees to be bound by the provisions as well as the intent of this announcement, the regulations of his licensing authority and the decisions of the ARRL Awards Committee.

(B) Disqualifications. See January *QST*.

Suggested Frequencies

CW	Novice	Phone
1800-1810		1855-1865
3530-3600	3710	3850-3950
7030-7080	7110	7200-7250
14,030-14,080		14,250-14,300
21,050-21,100	21,110	21,300-21,400
28,050-28,100	28,110	28,550-28,650

Contest Period

	Starts	Ends
CW	Saturday, Nov. 1 2100 UTC	Monday, Nov. 3 0300 UTC
Phone	Saturday, Nov. 15 2100 UTC	Monday, Nov. 17 0300 UTC

Explanation of Exchange

	Number	Precedence	Call	Check	Section
Exchanges	Consecutive serial number	Power output more than 150 W PEP	Send your station call	Last two digits of year first licensed	Your ARRL Section
Sample	NR 178	B	K5ZD	73	NTX

Coming Conventions

CENTRAL DIVISION CONVENTION
October 18-19, St Charles, Illinois

The Fox River Radio League will sponsor their convention at the Norris Sports Center off Rte 64, about 35 miles west of Chicago. In addition to commercial exhibits and sales, there will be an indoor flea market and plenty of forums, seminars and technical demonstrations. VEC exams for all class licenses will be given and a Saturday night banquet at the Pheasant Run Resort will feature well-known guest speakers and important topics. Sellers may set up 7 PM-9 PM Friday and 7 AM-9:30 AM Saturday. Hours are 10 AM-4 PM Saturday and 9 AM-2 PM Sunday. Tickets are $3 in advance, $4 at door and good for both days. Talk-in on 144.87/145.47 and 144.61/145.21. For more info on tables or exams, send an SASE to Bill Heimann, KD9WE, 837 Lebanon St, Aurora, IL 60505, tel 312-859-1171.

GEORGIA STATE CONVENTION
October 11-12, Warner Robins

The Central Georgia ARC is sponsoring the Central Georgia Hamfest at the Recreation Center 8 AM-5 PM Sat and 8 AM-2:30 PM Sun. Free admission, free indoor/outdoor flea-market space, free dealer space, forums and demonstrations. FCC walk-in exams start at 9 AM, both days, $4 each day. Food available. Talk-in on 146.25/85. Stay at the nearby Downtowner Motor Inn, "special hotel rates." For more info, contact Curtis M. Carter, K4KKQ, 114 Belmont Dr, Warner Robins, GA 31088, tel 912-929-4390 or 912-926-2791.

KANSAS STATE CONVENTION
October 11-12, Wichita

The Wichita ARC and many other fine sponsors are having their convention at the Holiday Inn Plaza, 250 W Douglas. Doors open at 9 AM both days. Talk-in on 146.82. Activities will include flea market in the Gold room, commercial displays, Kansas QCWA meeting, ARRL forum, MARS, ACARA 1986 annual meeting, FCC booth, CPR demonstrations, Holidome access, emergency communications forum, VE exams and much much more. Women's lounge available 12 PM-12 AM Saturday and Wouff Hong Ceremony will start at 12 AM also on Saturday. Refreshments will be available. Admission is $5 in advance and $6 at the door. Non-Amateur admission is $3. Banquet is $12.50, and breakfast is $7.75 with large buffet from 7 AM-9 AM Sunday. Preregistered package deal is $21 (includes one registration, one banquet and one breakfast.) Package deal at the door is $26 (only if meal space is available.) Swap tables are $5 per 8 ft (shared tables okay.) You must make convention and hotel registrations separately. For more info, contact the Kansas ARRL Convention, c/o Clarence Reid, KØBHJ, 1520 W 16th, Wichita, KS 67203.

November 7-8
Nevada State, Las Vegas
November 16
Illinois State, Rockford

ARRL NATIONAL CONVENTIONS
July 10-12, 1987—Atlanta, Georgia
July 21-24, 1988—Portland, Oregon
1989—Las Vegas, Nevada

KENTUCKY STATE CONVENTION
October 25-26, Louisville

The Greater Louisville Hamfest Assn will present their 16th Annual Greater Louisville Hamfest and State ARRL Convention in the west wing of the Kentucky Fair and Exposition Center, I-65 at the Watterson Expressway. Hours are 8 AM- 5 PM Sat and 8 AM-4 PM Sun. Forums, women's programs and a huge flea market. Tickets are $6. Talk-in on 146.10/70. For more info, send an SASE to PO Box 34444, Louisville, KY 40232.

NEVADA STATE CONVENTION
November 7-8, Las Vegas

Plan to travel on Thursday. Exhibits and forums will be open 8 AM-5 PM Friday and 8 AM-4 PM Saturday, with an awards banquet at 8 PM. Activities include technical talks, exhibitors, giant flea market, free VEC exams, free cocktail party and women's programs. Every person taking part in the Ham/West must be registered. Advance registration is $12 before October 24 ($15 at the door) and includes admission to all Ham/West activities except the banquet. It is not necessary to be registered to purchase tickets for the Saturday evening banquet. Flea-market sellers must be registered. Outdoor spaces measure 16 × 20. Born in 1966 or later? Request complimentary "admission-only" tickets at the door. And, there's no fee for VEC exams taken at the convention. To guarantee your room, you must make your room reservations directly with Ham/West, payment due before October 1. Reservations not paid by that time will be accommodated on a space-available basis only. Call 702-361-3331. For RVs, call Camperland directly at 1-800-634-6942 to reserve a space with full hookups right on the hotel grounds. Be sure to mention Ham/West. For more info, contact Ham/West, PO Box 19675, Las Vegas, NV 89132, tel 702-361-3331.

NEW ENGLAND DIVISION CONVENTION
October 18-19, Boxboro, Massachusetts

The Federation of Eastern Massachusetts ARA will present the New England ARRL Convention at the Sheraton Boxboro Hotel, Rte 495 at Rte 111. Saturday's flea market opens at 8 AM, exhibit 9 AM-5 PM. Sunday's flea market at 8 AM, exhibit from 10 AM; both will close at 2 PM. Guest for Saturday night will be Douglas Edwards of CBS News. Activities include a dance and banquet, cocktail party and a special Wouff Hong Ceremony at midnight. Women's programs offered both days. FCC exams from Novice through Extra Class will be given Friday night, Saturday and Sunday. Brochures being mailed to every ham in the W1 area will carry the exact procedure that must be followed in order to sign up for an exam. For a brochure, call 617-595-0873 evenings. Fox hunt for hand-held transceivers 52. Registration is $6, full-course roast beef banquet, dance and show $16.50. For information and reservations, send an SASE to Arthur Tomkinson, W1THT, 9 Oliver Terrace, Revere, MA 02151. Make checks payable to FEMARA.

SOUTH FLORIDA SECTION CONVENTION
October 18-19, St Petersburg

The 11th Annual 1986 South Florida ARRL Suncoast Convention exhibits will be held at the National Guard Armory on 38th Ave S, about 200 yards west of 34th St S (Rte 19) in St Petersburg. The convention hotel is the Holiday Inn, I-275 which is a few blocks north of the hall on 3000 34th St S, just across the street from the Florida Power building. All exhibits will be indoors. A QCWA luncheon will be held at noon on Saturday, and a Western Barbeque will be held that night. Women's activities held at 12 PM Sunday. Ladies programs and ARRL forum hosted by ARRL Director Frank Butler, W4RH. Amateur exams given on Saturday; bring a copy of your license and $4. Registration tickets are $4 in advance and $5 at the door. The QCWA luncheon is $8, and the women's luncheon is $7. The barbeque is $15. Swap tables are $12 for both days. Rooms at the hotel are $38 per day. Plenty of parking and some space for RVs. Talk-in on 37/97, 96/36 and 224.94. Make all requests for tickets and hotel forms to FGCARC, 1556 56th Ave N, St Petersburg, FL 33703, and make checks payable to FGCARC. SASE requested. For additional info, write to same address.

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.]

†**Alabama (Montgomery)—Oct 25-26:** The Montgomery ARC will host the 9th annual Montgomery Hamfest and the South Net annual convention at the Downtown Civic Center. Free admission, free parking, all indoors, including the flea market. Flea market set-up begins 6 AM, doors open to the public 9 AM-4 PM. FCC exams on site, both days. Code testing begins 8 AM with all parts of written exams beginning 9 AM. Bring a copy of your current license and $2. Talk-in on 146.24/84. Ragchew 146.04/64, 147.78/18 and 449.50/444.50. Flea-market reservations not required. Hotel/Motel nearest to hamfest site are the Madison, 205-264-2231 (in Alabama, 800-356-1744) or the Sheraton Riverfront Station, 205-834-4300. For further info, write to Hamfest Committee, c/o 2141 Edinburgh Dr, Montgomery, AL 36116, or phone Phil at 205-272-7980, after 5 PM or any reasonable hour on weekends and holidays.

†ARRL Hamfest

Connecticut (North Haven)—Nov 9: The SCARA will be sponsoring their flea market on Lindly St. Vendors at 7 AM, buyers at 9 AM-2 PM. Admission for buyers $2, sellers $10 in advance, $15 at door. For more information, write to SCARA Flea Market, PO Box 81, North Haven, CT 06473.

Connecticut (Preston)—Oct 25: The Fourth Annual Tri-City ARC Auction will be held at the St James Parish Hall, Poquetanuck, 1½ miles east of Rte 12 on Rte 2A (south of Norwich). Set-up at 9 AM, auction from 10 AM until sold out. Free admission, food available. Bring your equipment to be auctioned. Talk-in on 52. For further information, call 203-464-6555.

Georgia (Lawrenceville)—Nov 1-2: The Alford Memorial Radio Club of Stone Mountain is sponsoring Ham Radio and Computer Expo '86 at Gwinnett County Fairgrounds, 20 minutes northeast of Atlanta. Hours are 9 AM-5 PM Sat and 9 AM-4 PM Sun. Admission $4 in advance, $5 at door. Forums, awards, VEC license exams both days, free cook-out Sat night. Many other activities for the entire family. Superb dealer facility, giant undercover flea market. Discount hotel rooms. Free parking for 3500 cars, RV sites with full hookup available. Talk-in on 146.16/76 and 449.25/4.25. For more info, contact Alford Memorial ARC, PO Box 1282, Stone Mountain, GA 30086, tel 404-925-7615.

†Georgia (Rome)—Oct 5: The Coosa Valley ARC is sponsoring their Rome Hamfest in the Civic Center on Turner McCall Blvd 9 AM-4 PM. Free admission. Table space $5 inside, $2 outside, dealers included. Camper spaces available on Sat night, no hook-ups. Talk-in on 147.90/30. FCC exams beginning 8 AM; reservations requested, but walk-ins will be accepted. For information, contact Buddy Waller, NO4U, 24 Wellington Way SE, Rome, GA 30161, tel 404-235-5417.

†Iowa (West Liberty)—Oct 5: The Muscatine ARC and Iowa City Ham Club is sponsoring their Southeast Iowa Hamfest at the West Liberty Fairgrounds 7 AM-3 PM. Admission $3 in advance, $4 at door. Activities include ARRL/VEC exams at 12 PM, walk-ins welcome. Sat night camping available with water and AC (nominal charge). Food and refreshments available. For ARRL/VEC exam, contact Ken Kucera, KAØY, RR2 Box 52A, Riverside, IA 52327. Talk-in on 146.25/85 and 52. Fairground directions are 6 miles off Interstate 80 at exit 259, follow the posted routes. For more info, contact Steve Goodell, 238 Dillaway St, Muscatine, IA 52761, tel 319-263-4675 after 6:30 PM.

Massachusetts (Framingham)—Oct 26: The Framingham ARA will hold its annual Fall Flea Market and exams at the Framingham Civic League Bldg, 214 Concord St, Rt 126. Doors open 10 AM. Sellers set-up 8:30 AM. Admission $2, tables $10, includes one free admission. Preregistration required for tables and exams. Talk-in on 75/15. For table reservations, contact Jon Weiner, K1VVC, 52 Overlook Dr, Framingham, MA 01701, tel 617-877-7166. To register for license exams, send completed 610 Form, copy of ham license and check for $4.25, payable to ARRL/VEC, to FARA, PO Box 3005, Framingham, MA 01701. Walk-in exams given on a space-available basis.

Michigan (Kalamazoo)—Oct 26: The Kalamazoo ARC is having their 4th Annual Hamfest and Radio Swap at the Kalamazoo County Fairgrounds, 2900 Lake St, halfway between Chicago and Detroit. Set-up 8:30 AM, doors open 9 AM-2 PM. Admission $2 in advance, $2.50 at door. Table space $6 for 8 ft, ($5 for Michigan tax license). Outside row tables must be paid for 2 weeks in advance. Talk-in on 147.00. Amateur license testing available. Testing fee checks to ARRL/VEC. For reservations, contact Ken, KA8RUA, 2825 Lake St, Kalamazoo, MI 49001, tel 616-345-4609. For more information, contact Al Nelson, K8OQB, 10603 Cora Dr, Portage, MI 49081, tel 616-323-3812.

Michigan (Lansing)—Oct 12: Ham Fair 86, sponsored by the Central Michigan ARC, will be held at the Michigan National Guard Armory, 2500 S Washington Ave 8 AM-3 PM. Talk-in on 145.390 and 146.940. Amateur radio equipment, publications, antennas, computers and good food all available. FCC exams will be offered 1 PM. Register no later than Sept 12. Send 610 Form, copy of license, no. 10 SASE and a check for $4.25, payable to ARRL/VEC, to Exam Committee, PO Box 13073, Lansing, MI 48901. No walk-ins. Include any copy of code certificate. Admission $3. Tables $1 per ft. Tables not paid for in advance will be rented at 9 AM. For information and reservations, contact Rowena Elrod, KA8OBS, 111 Lancelot Pl, Lansing, MI 48906, tel 517-482-9650.

Michigan (Southfield)—Nov 2: Oak Park ARC will be holding its largest ever 1986 Swap-n-Shop at a new location—the City of Southfield Civic Pavilion, Evergreen Rd, between 10 and 11 mile roads in the northwest Detroit suburb of Southfield. Ham radio and computer activities 9 AM-5 PM in the new, fully carpeted 30,000-sq-ft pavilion. The Detroit Area Repeater Team (DART) will provide food and refreshments. Admission $4, under 12 free, and VE3s at par. Tables $10. Fire regulations restrict the number of tables. Advanced reservations required. Talk-in on 146.04/64 and 52 For further information, send an SASE to OPARC Swap-n-Shop, 303 South Vermont Ave, Royal Oak, MI 48067, tel 313-399-3991.

†Michigan (Utica)—Oct 5: The Utica Shelby Emergency Communications Assn is sponsoring their Swap and Shop 8 AM-3 PM (6 AM for dealers) at the Eisenhower High School, located at 6500 25 Mile Rd, Utica, west of Van Dyke (M-53). Tickets $2 advance, $3 at door. FCC exams offered and food available. Talk-in on 147.78/18 or 55. Tables 10 ft and 12 ft in length, $1 a foot. No trunk sales, no refund on prepaid registrations. Tables assigned on a first-come first-serve basis. For hamfest table rental and information, please phone J. Hansman, 313-781-3800, or J. Moore, 313-739-0377, or USECA 313-739-7180.

†Minnesota (Richfield)—Nov 1: The Second Annual Hamfest Minnesota and Computer Expo, sponsored by the Twin City FM Club, will be held at the Richfield High School, 7001 Harriet Ave, 7:30 AM-3 PM. Admission $3 in advance, $4 at the door. Special guest speaker, Wayne Green, W2NSD. Two-hour DX seminar, FCC exams, expanded indoor flea market, commercial booths, food, ARRL, AMSAT, computer seminars and much more. Talk-in on 16/76. For more information or advanced registration, send a self-addressed, stamped envelope to Hamfest Minnesota and Computer Expo, Box 555, Minneapolis, MN 55440, or Lyle Vogt, KAØUDL, 5130 Willow La, Minnetonka, MN 55345.

New Hampshire (Deerfield)—Oct 4: The volunteer examiners of New Hampshire will be conducting an examination session in conjunction with the October 4 Hoss Trader's Flea Market. The examination will be conducted at the Northwood Elementary School gymnasium. For further information, please send a SASE to Don Clark, N1AKS, 2 Cortland St, Londonderry, NH 03053.

†New York (Syracuse)—Oct 18: The Radio Amateurs of Greater Syracuse will be holding their 31st Hamfest in the Arts and Home Mansion at the New York State Fairgrounds, just two miles east of Thruway Exit 39 on Rte 690, 9 AM-5 PM. Activities include tech talks, contests, entertainment, a giant indoor flea market, many commercial vendors, the famous Syracuse Hamfest breakfast and delicious lunch at very low prices; all of this in a pleasant, warm, well-lighted environment with plenty of comfortable resting areas. We are featuring an improved tailgating area at only $3 per car. Also improved free parking. Indoor flea market is $6 per table (furnished by us). General admission $4, under 12 free. VE walk-in exams start 12 PM for Novice through Extra; bring current license, two forms of ID and $4. Talk-in on 146.31/91 and 147.90/30. Programs for non-hams and a secret surprise for everyone.

†North Carolina (Maysville)—Oct 12: The Maysville Hamfest Club, Inc, is sponsoring their hamfest at the Maysville Community Center and Park 9 AM-3 PM. Free admission with FCC exams, tailgating, flea market and women's activities. Talk-in on 146.685 and 52. For more info, contact JoAnn Taylor, WD4JYR, 919-393- 2120 or 919-326-1131.

Ohio (Lima)—Oct 12: The Northern Ohio ARC will hold their annual Allen County Hamfest at the Allen County Fairgrounds 8 AM-3 PM. Set-up at 6 AM. Admission $3 in advance, $3.50 at door. Activities include VE exams. Talk-in on 52, 34/94, 07/67 or 63/03. Tables are $6 for full table, $3.50 for half table. Location of the fairgrounds is one mile east of I-75 exit 125A on State Rte 309 or 117. Free camping available, electrical hookup $7. For more info, send an SASE to NOARC, PO Box 211, Lima, OH 45802.

Ohio (Marion County)—Oct 26: The Marion ARC will hold its 12th annual Heart of Ohio Ham Fiesta 8 AM-4 PM at the Marion County Fairgrounds Coliseum. Large parking area available. Tickets $3 in advance, $4 at door. Tables $5. Talk-in on 52 or 147.90/30. For information, tickets or tables contact Ed Margraff, KD8OC, 1989 Weiss Ave, Marion, OH 43302, tel 614-382-2608.

Oklahoma (Alfalfa County)—Oct 5: The Salt Plains ARC will hold their annual Ham Social at the Salt Plains Lake in Northern Alfalfa County. Covered dish dinner. Talk-in on 147.90/30. For more info, contact Gary Gerber, KBØHH, 511 S Lincoln, Anthony, KS 67003, tel 405-842-5076.

Oklahoma (Lake Texoma)—Oct 24-26: An overview of the work being done by the special ARRL blue ribbon committee on emergency communication and traffic handling headed by Vice Director Tom Comstock, N5TC, and the "Homebrew" Techniques of David Horn, KK5I, will be featured during Hamrama '86 scheduled for Lake Texoma Lodge, on Catfish Bay near Kingston. Also, women's programs, Sat night dance, golf tournament and amateur exams will be featured. For more info, contact Texoma Hamorama Assn, PO Box 610892, DFW Airport, TX 75261.

†Pennsylvania (Carlisle)—Oct 12: The Cumberland County ARS is sponsoring their 3rd Annual Cumberland County Hamfest at the Carlisle Fairgrounds 7 AM-3 PM. Admission $3, XYLs and children free. Activities include 3rd QSL Bureau and VE exams. Talk-in on 145.27, 443.03 or 52. For more info, contact C-CARS, PO Box 448, New Kingstown, PA 17072.

Pennsylvania (Warrington)—Oct 4-5: The "Pack Rats" cordially invites all amateurs and their friends to the 10th Annual Mid-Atlantic VHF Conference to be held at the Warrington Motor Lodge, Rte 611, and our 15th annual Pack Rat Hamarama at the Bucks County Drive-In theater also on Rte 611. Admission to the flea market $5 per carload, with selling spaces $6 each. The gate will open 6 AM rain or shine. Bring your own tables. Advance registration $4. Send to Hamarama '86, PO Box 311, Southampton, PA 18966, or contact Pat Cawthorne, WB3DNI, at 215-672-5289.

South Carolina (Rock Hill)—Oct 5: The York County ARS is sponsoring their Rock Hill Hamfest at the Joslyn Park on Lake Wylie. Gate opens 7 AM. Preregistration $3, at the gate $4. Activities include dealer displays, flea market, concessions and lunch. Talk-in on 146.43 and 147.03. For more info, contact George Trunk, N4MCJ, 1158 Wendy Rd, Rock Hill, SC 29730, tel 803-327-4344.

†Tennessee (Memphis)—Oct 11-12: The Mid-South ARA is sponsoring their Greater Memphis Hamfest at the Agri-Center, International, 7777 Walnut Grove Rd and Germantown Rd. Doors open 8 AM-4 PM both days. Admission is $4.50 in advance, $5 at door. Nonhams free. Activities include flea market, ARRL Packet Radio coordination conference, Packet Radio 1 and 2 (advanced) seminars, DX seminar, radio control modelers seminar, computers and ham radio seminars and display MARS seminars Army and Navy. Sat night cocktail party and banquet. Women's activities and tours included. Talk-in on 28/88, 25/85 and 52. Campgrounds available at I-40, exit 20 (Lakeland). Some RV spaces usually available. No reservations on RV and trailers. For more info, contct Best Western Welcome Inn, c/o D. B. Nead, 1541 Sycamore View Dr (I-40 exit 12), tel 901-388-1300. Mention Hamfest rate.

†Texas (Odessa)—Nov 1-2: The West Texas ARC is sponsoring the Third Annual Odessa Hamfest at the Holiday Inn Centre. Doors open 8 AM-5 PM Sat and 9 AM-3 PM Sun, with Fri night set-up. Admission $5 in advance, $6 at the door. Tables $5 each. Activities include PCWA, ARRL forum, MARS symposium, VEC exams, packet forum and many other interesting and technical activities. Women's and children welcome. Services include RV parking. Talk-in on 147.62/02 and 146.10/70.

How To Register for Upcoming Exams

ARRL Nevada State Convention-(Las Vegas, NV)—Nov 7-8: Exams will be given at 9 AM-3 PM both days. Novice through Extra Class at the Hacienda Hotel. There will be no fee for license exams and there is no requirement to register at the convention to take an exam. Applicants are requested to send an SASE marked "VEC Exams" stating class of license desired to Ham/West, PO Box 19675, Las Vegas, NV 89132.

Flea-market space is 12000 sq ft. All activities will be at the Centre. For more info, contact the West Texas ARC, Box 7033, Odessa, TX 79760, or call Otis Brasfield, KA5REM, 915-366-0203.

†**Virginia (Falls Church)—Oct 11-12:** The National Capitol DX Assn is sponsoring their DXPO-86 at the Best Western Inn. Doors open 1 PM Sat and 3 PM Sun. Admission $10 ($15 for banquet). Activities include DX and contest programs, presentations and talks with slides. International banquet and ARRL forum. Services include motel with restaurant and fast food restaurants within walking distance. Talk-in on 147.42. For more info, contact Stuart Meyer, W2GHK, 2417 Newton St, Vienna, VA 22180, tel 703-281-3806.

Virginia (Richmond)—Oct 13: The Richmond Area Council of Computer Clubs and Virginia ARA is sponsoring their hamfest at the Country Peddler. Admission $4. For more info, contact Royce Overton, 8219 Tarkington Dr, Richmond, VA 23060, tel 804-771-3037 days or 804-262-8452 nights.

Correction: The Orange County ARC hamfest and auction will be held Oct 4 at John S. Burke Catholic High School in Goshen, New York. The town was listed incorrectly in Sep *QST*.

Contest Corral

Conducted By Billy Lunt, KR1R
Assistant Contest Manager, ARRL

OCTOBER

4-5

IRSA World Radio Championship Contest, Sep *QST*, p 101.

International DX-HC Middle of the World Contest, Sep *QST*, p 101.

VK/ZL/Oceania DX Contest, phone, Sep *QST*, p 101.

Concurso Ibero-Americano Contest, Sep *QST*, p 101.

5

OMISS QSO Party, Sep *QST*, p 101.

11

W1AW Qualifying Run, 10-40 WPM at 0200Z Oct 12 (10 PM Oct 11, EDT). Transmitted simultaneously on 1.818 3.58 7.08 14.07 21.08 28.08 50.08 147.555 MHz. Underline one minute of the highest speed you copied, certify your copy was made without aid and send to ARRL for grading. Please include your full name, call sign (if any) and complete mailing address. A large SASE will help expedite your award/endorsement.

11-12

Pennsylvania QSO Party, Sep *QST*, p 102.

GARTG-RTTY Contest, part 4, Sep *QST*, p 102.

GARTG-SSTV Contest, part 2, Sep *QST*, p 102.

VK/ZL/Oceania DX Contest, CW, Sep *QST*, p 101.

Minnesota QSO Party, sponsored by the Paul Bunyan Wireless Assn from 1500Z Oct 11 until 2400Z Oct 12. Phone and CW. Exchange RS(T) and state/province/-country (county for MN stations). Suggested frequencies: lower portion of the 80-6 General bands. Score 2 points per CW QSO and 1 point per phone QSO. MN stations multiply by total number of states/provinces/countries worked. Others multiply by total number of MN counties worked. Awards. Send logs before Nov 1 to Paul Bunyan Wireless Assn, Rick Paine, KCØYG, PO Box 354, Pequot Lakes, MN 56472.

Columbus Day Special Event, sponsored by the Columbus ARA, from 1400Z-2400Z, Oct 11-12. On Sat Oct 11 work 15-meter phone, suggested frequency 21.375. Sunday Oct 12 work 40-meter phone, suggested frquency 7.240. Work Columbus, Ohio, stations (Columbus stations work everybody). Exchange name, QTH and RST. Score 1 point per QSO, 6 points for QSO with CARA club station W8TO. A commemorative award will be issued to all amateurs and SWLs with a score of 10 or better. The highest scoring Columbus, Ohio, station will receive a plaque. Send logs within 120 days to Amateur Radio Station W8TO, Attn Special-Event Coordinator, 280 E Broad St, Columbus, OH 43215.

12

ARRL Midnight Special, from 0500Z until 0700Z Oct 12. First hour, 160 CW. Second hour, 160 phone. Work stations once per mode. Suggested frequencies: CW—1.800-1.840; phone—1.840-1.900. Participants are reminded that the segment 1.830-1.850 should be used for intercontinental QSOs only. Exchange state and power output. For example, W1AW might send CT 500. DX stations send RS(T) instead of state. Final score equals the total number of QSOs. No multipliers. Mail entries to arrive at ARRL HQ before Nov 12. Top scores will be listed in *QST*.

12-13

Illinois QSO Party, Sep *QST*, p 102.

18-19

ARCI QRP Fall CW Contest, Sep *QST*, p 102.

Simulated Emergency Test, this issue, p 89.

Jamboree on the Air (JOTA), sponsored by the World Scout Bureau, will be from 0000 local, Oct 18 until 2400 local Oct 19, although some activity will flop over from Fri to Mon. Scouts usually exchange their name, QTH, Scout rank and other hobbies, often becoming pen pals with their new-found radio friends. Look for K2BSA, the BSA HQ station in Dallas, Texas, and HB9S, the World Scout HQ in Switzerland. Suggested frequencies: CW-3.590 7.030 14.070 21.140 28.190; phone-3.940 7.290 14.290 21.360 28.990; RTTY, SSTV, ATV on normal frequencies; check Novice bands. No logs are necessary, but activity reports including Scout unit number, number of participants and interesting incidents are appreciated. Interesting photographs with captions are especially needed. Send reports to ARRL HQ, Club Services Dept, 225 Main St, Newington, CT 06111.

25-26

ARRL International EME Competition, part 1, Sep *QST*, p 100.

CQ World-Wide DX Contest, phone, sponsored by *CQ*, from 0000Z Oct 25 until 2400Z Oct 26 (CW contest 0000Z Nov 29 until 2400Z Nov 30). 1.8 through 28 MHz. Entry classes: single op, all bands; single op, single band; single op, QRP; multiop, single transmitter; multiop, multi transmitter. QRP is defined as 5-W output or less. Multi-single: Only one transmitter and one band permitted during a 10-minute period. Exception: one—and only one—other band may be used during the same 10-minute period if—and only if—the station worked is a new multiplier. Stations found in violation of the 10-minute rule will be reclassified as multi-multi. Multi-multi stations are allowed one signal per band maximum. All transmitters must be located within a 500-meter-diameter circle, or within the limits of the licensee's address property, whichever is greater. All antennas must be physically connected to the transmitters by wires. Exchange signal report and CQ zone number. A station in a different zone or country than indicated by its call sign must sign portable. QSOs between stations on different continents count 3 points. QSOs between stations on the same continent, but in different countries, count 1 point. Exception: QSOs between North America stations in different countries count 2 points. QSOs with your own country count for multiplier credit, but not for QSO points. Multipliers: Count one multiplier for each different CQ zone worked per band (max 40 per band). Count one multiplier for each different country worked per band (DXCC and WAE lists). Multiply QSO points from all bands operated by multipliers (zones plus countries) from all bands operated for final score. Single-band logs eligible for single-band awards only. Single ops must operate at least 12 hours (multiops, 24 hours) to be eligible for awards. Dupe sheets required for any band with more than 200 QSOs. Entry forms are available from the sponsor for an SASE, and all entrants are encouraged to send for a set. Each dupe removed by the CQ Contest Committee also carries a 3-QSO penalty. Phone logs must be postmarked by Dec 1, 1986, and CW logs must be postmarked by Jan 15, 1987. Logs go to *CQ* Magazine, 76 North Broadway, Hicksville, NY 11801.

26

W1AW Qualifying Run, 10-35 WPM, at 2400Z (7 PM EST) Oct 26. See Oct 11 listing for more details.

NOVEMBER

1-2

ARRL November Sweepstakes, CW this issue, page 90.

International Police Association Contest, sponsored by the IPARC German Section, from 0600Z to 1000Z and 1400Z to 1800Z each day, Nov 1-2. CW Nov 1 and phone Nov 2. Non-IPA stations work IPA members only. Exchange signal report and serial number. US stations also send state. IPA members send IPA with exchange. Phone and CW contests are separate. Work stations once per band on each mode. Count 1 point per QSO with non-IPA members and 5 points per QSO with IPA members. Multiply by sum of IPA countries/states worked per band. Suggested frequencies: phone—3.650 3.775 7.075 14.295 21.295 28.575 MHz; CW—3.575 7.025 14.075 21.075 28.075 MHz. Mail entries by Dec 31 to Anton Kohten, DK5JA, PO Box 40 01 63, D-4152 Kempen 1, Fed Rep of Germany. For more information, contact WA8VDC, 4828 Elm, Newport, MI 48166.

5

West Coast Qualifying Run, 10-35 WPM, at 0500Z Nov 6 (9 PM PST Nov 5). W6OWP prime, W6ZRJ alternate. Frequencies are approximately 3590/7090 kHz. Underline one minute of the highest speed you copied, certify your copy was made without aid and send to ARRL for grading. Please include your full name, call sign (if any) and complete mailing address. A large SASE will help expedite your award/endorsement.

8-9

European DX Contest, RTTY, sponsored by the Deutscher ARC, from 0000Z Nov 8 until 2400Z Nov 9. Work stations once per band, 3.5, 7, 14, 21, and 28 MHz only. Entry classes: single op, all band and multiop, single transmitter. Multi-single stations must remain on a band for at least 15 minutes, except for a quick QSY to work new multipliers. Single ops may operate a maximum of 36 hours. The 12 hours of off-time may be taken in one to three periods and must be noted in the log. Exchange signal report and serial number. W/K stations also give state. Count one point per QSO and one point per QTC (explained later). Europeans use the ARRL countries list. In addition, each call area in the following countries will be considered as a multiplier: JA, PY, VE, VO, VK, ZL, ZS, UA9/Ø. Each W/K-state will be considered a multiplier, but not W/K call areas. Contacts between all continents and also with one's own continent is permitted. Multipliers will be counted according to the European and ARRL countries list. QSO as well as QTC-traffic with one's own country (state for W/K; call area for VE, VO, VK, ZL, ZS, UA9/Ø) is not allowed. For example, K6WZ in California can work any W/K stations except those in CA for QSO points and multiplier credit. Multiply by number of "countries" worked per band (DXCC list, plus GM-Shetland, IT, UN1, and W/VE states). The multiplier on 3.5 MHz may be multiplied by 4, the multiplier on 7 MHz by 3, and the multiplier on 14-21-28 MHz by 2. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent to a station. A QTC contains the time, call sign and QSO number of the station being reported (eg, 1300/DJ1QQ/134). A QSO may be reported once, and not back to the originating station. A maximum of 10 QTCs to the same station are permitted; the same station may be worked several times to complete this quota. Only the original QSO, however, has QSO point value. Keep a uniform list of QTCs sent. For example, QTC 3/7 would indicate that this is the third series of QTCs sent, and that seven QSOs are reported. W/K stations may exchange QTCs with any stations except those in the same state. Awards. List 40 QSOs or QTCs per sheet. Use separate logs for each band. Dupe sheets must be submitted for bands with more than 200 QSOs. Mail before deadline, Dec 15 to WAEDC Committee, PO Box 1328, D-8950 Kaufbeuren, Fed Rep of Germany.

9

W1AW Qualifying Run, 10-35 WPM, at 0300Z Nov 10 (10 PM EST, Nov 9). See Oct 11 listing for more details.

15-16

ARRL November Sweepstakes, phone, this issue, page 90.

Oceania CW QRP Contest, sponsored by the CW Operators QRP Club from 0000Z Nov 15 until 2400Z Nov 16. CW only. 10-160 (no WARC). Work either: full period (48 hours); half period (any 24 consecutive hours). Work stations once per band in each 24 hour period. Classes: QRP single op, single band; QRP single op, multiband; QRP multiop, single band; QRP multiop, multiband; QRO single op, single band; QRO single op, multiband; SWL. QRP is 5 W output or less; QRO is more than 5 W output. Exchange RST and serial number. Scoring: 0-1 W—6 points per QSO; 1-2 W—5 points per QSO; 2-3 W—4 points per QSO; 3-4 W—3 points per QSO; 4-5 W—2 points per QSO; over 5 W—1 point per QSO (QRO to QRP only). Final score equals total QSO points times total number of ITU zones worked per band. Field stations multiply final score times two. Awards. Separate logs per band. Send logs before Dec 29 to Len O'Donnell, 33 Lucas St, Richmond, SA 5033, Australia.

AOEC 160-Meter DX Contest, sponsored by the Osterreichischer Versuchssenderverband, from 1800Z Nov 15 until 0700Z Nov 16. CW only. Suggested frequencies: 1.810-1.950. Work Austrian stations. Exchange RST and serial number (OE stations send RST and Austrian district locator). Count 1 point per QSO. Multipliers: each OE call area (max 9)—2 multiplier points; each Austrian district locators (ADL)—1 multiplier point; each different prefix—1 multiplier point. Total score equals the total QSO points times the total number of multiplier points. Awards. Send logs before Dec 31 to OVSV-AOEC 160 M, Theresiengasse 11, A-1180 Vienna, Austria.

22-23

ARRL International EME Competition, part 2, Sep *QST*, p 100.

24

W1AW Qualifying Run

29-30

CQ World Wide DX Contest, CW, see Oct 25-26 listing for more detail.

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 Nov 1 to make the January 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
Assistant Contest Manager, ARRL

Canon City, Colorado: The Royal Gorge ARC will operate KDØMY on **Oct 4,** 1500Z-2200Z, at the world's highest suspension bridge to commemorate Colorado Days. Suggested frequencies: phone—7.235 14.235 21.360; CW—7.110 14.110. QSL via KDØMY, 3049 Ute, Canon City, CO 81212.

Cincinnati, Ohio: The Greater Cincinnati ARA will operate W8DZ **Oct 4** to celebrate their 50th year of service. Operation will be in the General phone bands and 45 kHz from the band edges on CW. For certificate, send QSL, address label and 22-cent stamp to W8GS, 620 Woodsway Dr, Loveland, OH 45140.

Virginia Beach, Virginia: The Virginia Beach ARC will operate WA4TGF **Oct 5-6** to celebrate their 25th anniversary. Suggested frequencies: CW—3.540 7.040 14.040 21.040 28.040; SSB—3.890 7.240 14.250 21.340 28.560. For certificate, send 9- × 12-in SASE (39 cents) to R. C. Brown, 4821 Rosecroft St, Virginia Beach, VA 23464.

Spartanburg, South Carolina: The Spartanburg ARC will operate K4JLA **Oct 11,** 1400Z-2100Z, to commemorate the Fall Arts Festival. Suggested frequencies: phone—7.235 14.235 21.310; CW—7.115. Send a large SASE to Spartanburg ARC, 385 S Spring St, Spartanburg, SC 29301.

Lake Havasu City, Arizona: The London Bridge ARA will operate WB7DSW **Oct 11,** 1600Z-2000Z, from the home of the London Bridge. Suggested frequencies: phone—7.235 14.235; CW—7.120. For certificate, send QSL to Don Harrington, WB7ALO, 1208 McCulloch Blvd S, Lake Havasu City, AZ 86403.

Alcatraz Island, California: The Sacramento ARC will operate W6AK **Oct 11,** 1730Z-2300Z, from Alcatraz Island. Suggested frequencies: phone—3.950 7.270 14.300 21.400 146.52; CW—3.725 7.125 14.050 21.085; packet—145.01 (W6AK-5). SWL welcome. For special QSL, send SASE and QSO info to Sacramento ARC, PO Box 161903, Sacramento, CA 95816-1903.

Washington-on-the-Brazos, Texas: The Houston ECHO Soc will operate WB5INB **Oct 11-12** from the First Capitol to commemorate the Texas sesquicentennial. Operation will be 80-10 meters phone and CW, including Novice bands. For a special QSL and original pencil sketch of the field day site, send QSL and SASE via Houston ECHO Soc Special Events, c/o WB5INB, 7800 Bissonnet No. 215, Houston, TX 77074.

Evanston, Illinois: The Northwestern University ARS will operate W9BGX **Oct 11-12** to celebrate their 40th anniversary. Operation will be SSB and CW 30 kHz from the lower end of the 10-80 General bands. For certificate, send QSL and SASE to Northwestern Univ ARS, EE/CS Dept, 2145 Sheridan Rd, Evanston, IL 60201.

Denison, Texas: The Texoma ARC will operate K5GQD 1400Z **Oct 11** until 2400Z **Oct 12** from the birthplace of President Dwight D. Eisenhower to celebrate his 96th birthday. Operation will be SSB in the 2-meter and 10-80 General bands. For certificate, send QSL and large SASE to K5GQD, 1303 E Richards, Sherman, TX 75090.

Dalton, Georgia: The Dalton ARC will operate a special-event station **Oct 11-12,** 1400Z-1900Z, from the Praters Mill County Fair. Suggested frequencies: phone—7.250 14.250. Send QSL to Dalton ARC, PO Box 143, Dalton, GA 30722-0143.

T.H.E. Rallye, Texas: The Pro-Texas Foundation and the Sports Car COA will operate KA5JHT, N5IWA and N5OUK **Oct 11-18** in conjunction with the Texas Heritage Excursion Rallye. Operation will be on the 40 and 80 Novice bands and the 20, 40 and 80 General bands. For a commemorative QSL, send QSL and SASE via Hal Collins, KA5JHT, PO Box 473068, Garland, TX 75047-3068.

Ashland, Kentucky: The River Cities ARA will operate KD4SN **Oct 18,** 1200Z-2200Z, during Poage Landing Days to commemorate the 200th anniversary of the founding of Ashland. Operation will be in the lower 25 kHz of the 7- and 14-MHz General phone bands. For certificate, send SASE to PO Box 612, Ashland, KY 41105.

Gaithersburg, Maryland: The Bureau Radio Signal Soc will operate K3AA 1300Z **Oct 18** until 0100Z **Oct 19** and 2100Z **Oct 19** until 0200Z **Oct 20** in celebration of the 85th anniversary of the founding of the Bureau. Suggested frequencies: phone—3.900 7.235 14.235 21.360; CW—3.535 3.710 7.035 7.110 14.035 21.035 21.110; packet—20 meters. For commemorative certificate, send a large SASE to NBS BRASS, National Bureau of Standards, Gaithersburg, MD 20899.

Helena, Arkansas: The Helena HC will operate WA5CRE **Oct 18,** 1300Z-2100Z, during the King Biscuit Blues Festival. Suggested frequencies: phone—3.940 7.240 14.240. For a commemorative certificate, send QSL and an 9- × 12-in SASE via Bill Vining, WA5CRE, 300 Prairie, Helena, AR 72342.

Chattanooga, Tennessee: The Chattanooga ARC will operate W4AM **Oct 18-19,** 1400Z-2200Z, to celebrate Tennessee Homecoming '86 and the Fall Color Cruise. Suggested frequencies: phone—7.235 14.285 21.370 28.585. For certificate, send QSL and business-size SASE to Alice Jenkins, NR4R, 1 Mitchell La, Rossville, GA 30741.

Sharon, Connecticut, The Southern Berkshires ARC will operate W1BAA **Oct 19,** 1300Z-2000Z, from Sharon Valley Mountain to celebrate their 25th anniversary. Suggested frequencies: phone—3.870 14.315. For certificate, send QSL and no. 10 SASE to W1BAA, c/o Wilbur, RR Box 547, Sharon, CT 06069.

Lexington, North Carolina: The Healing Springs Mtn VHF Soc will operate WD4BBQ **Oct 25,** 1300Z-1200Z, to celebrate the 3rd Annual Lexington Barbecue Festival. Operation will be 25 kHz from the bottom of the 15, 20 and 40 General phone bands, 7.125 CW and local 2-meter repeaters. For a special Bar-B-QSL, send SASE to Healing Springs Mtn VHF Soc, PO Box 41, Lexington, NC 27293-0041.

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 Nov 1 to make the January 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-Events 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.

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*

Advisory Committee Members	May 1986, p 48	Novice-Enhancement NPRM	Jun 1986, p 49
Club Challenge for the '80s Rules	Sep 1986, p 58	OSCAR 10 Band Plan	Jul 1986, p 27
Club Contest Rules	Jan 1986, p 94	OSCAR 10 Locator	Sep 1986, p 90
DX Contest Awards Program	Feb 1986, p 83	QSL Bureaus Incoming	Jun 1986, p 56
Frequency/Mode Allocations	Jan 1986, p 62	Outgoing	Sep 1986, p 73
Golden Jubilee of DXCC Award	Sep 1986, p 60	Reciprocal-Operation Agreements	Jun 1986, p 52
Hamfest Calendar Rules	Sep 1986, p 84	Spread-Spectrum Rules	Apr 1986, p 45
License-Renewal Information	Jan 1986, p 62	Third-Party-Traffic Agreements	Jun 1986, p 52
Major ARRL Operating Events and Conventions—1986	Jan 1986, p 61	10th ARRL International EME Competition Rules	Sep 1986, p 100
MARS Information	Jul 1985, p 46	10-GHz Cumulative Contest	Jun 1986, p 84
		902-MHz Interim Band Plan	Jan 1986, p 74

Section News

Administered by Steven Ewald, WA4CMS

The ARRL Field Organization Forum

CANADA

ALBERTA: SM, Bill Gillespie, VE6ABC—A/SM: VE6AMM. SEC: VE6XC. OO: VE6TY. STM/DEC: VE6ABC. Alta. amateurs provided communications for Jasper/Banff Relay Race. Over 2100 runners. Red Deer picnic a great success. VE6WJ, Al, won a Icom hand-held. Calgary amateurs provide radio for bicycle tour—Banff to Radium to Golden and back to Banff. Various Alta Clubs participated in Field Day activities. Northern Alta Radio Club held their's in Kenton city park showing amateur radio to the public. VE6AFO, Ken Oelke named president of Calgary AR Association. Traffic: APSN QNI 987, QTC 25, Informal 91, ATN QNI 195, QTC 54. Personal totals: VE6CPE 38, VE6ABC 21, VE6CPP6, VE6BKP3, VE6EO 2, VE6BBI 1.

BRITISH COLUMBIA: SM, H. Ernie Savage, VE7FB—British Columbia Service Corp Net, 3729 kHz 0130Z daily. Net Manager VE7DDF, Ford, reports check-ins High 190 Low 100 Total 4358. BCEN Net Manager Ferdi, VE7EJU, and son Chris, VE7EJW, on an extended canoe trip. Ast. Net Manager Tom, VE7BNI, reports British Columbia Emergency Net, 3650 kHz 0200Z during summer. QNI 719 QTC 372 Burnaby ARC reports that the QSL Bureau for B.C. is now—Alex Ivsic, VE7CNE, #1107, 7434 Kingsway, Burnaby, B.C., V3N 3B7. VE5BAF Dave has moved to Kamloops BCEN will be happy. Must say thanks to all the NCS on both nets for their support. Traffic: VE7BNI 579, VE7CDF 267, VE7CCJ 98, VE7FB 78, VE7EJW 68, VE7EJU 66, VE7XA 65, VE7ANG 62, VE7FME 49, VE7BZI 12, VE7DJ 10, VE7FSP 8, VE7AVC 8, VE7EIR 6.

MANITOBA: SM, Jack Adams, VE4AJE—Wet weather did not dampen the activities at the International Peace Gardens Hamfest, except for the flea market. It was extremely difficult to set electronic equipment out in the rain. A big thank you to the hamfest committee, great job. Again I have to announce a Silent Key in this report the tragic death of Jimmy, VE4VJ, who apparently suffered a heart attack and lost control of his motorized wheelchair and plunged into the Assiniboine River. Jimmy will be missed, as many heard his bulletins many times a day on the Sinnipeg repeater society repeater links. Dauphins annual Ukrainian Festival is now history. Thanks to John, VE4ADX, and Chris, VE4NE, who manned the amateur radio station taking traffic and passing it on the Jack VE4AJE, who took traffic to ten and other outlets. Net reports CRRL evening phone net. 31 sessions, 1026 QNI, 13 QTC. MTN (CW) June: Sessions 17, QNI 131, QTC 18; July: Sessions 16, QNI 81, QTC 17. MMN: Sessions 31, QNI 905, QTC 31, 2 meter informational net 9 sessions 385 QNI. Traffic: VE4AJE 33, VE4TE 32, VE4RO 28.

MARITIME-NEWFOUNDLAND: ASM, Aaron D. Solomon, VE1OC—*ARRL Field Day*—HARC operated from Eastern Passage, N.S. with 15 operators. Committee VE1CAW, VE1FH reported great success with 900 ft. V- Beam. *EMO Search* for missing 10 yr. old boy at Beaverbank, N.S. 37 Hfx. metro amateurs assisted along with Liverpool Search and Rescue mounted largest S&R in province which lasted 8 days. *Dartmouth Highland Car Rally*—30 Hfx-Dart. and Truro amateurs supplied communication. Coordinator VE1JI. Operators VE1ADA and VE1FQ operated VE1QQ. VE1BBU won *NSARA Golf Tournament. Hospital*—VE1DE. *Visitors*—VE3PT, KB4JPN enjoyed visit to PEIARC. *Silent Keys*—VE1AFZ; "Hamey" Land, DOC Radio Inspector.

ONTARIO: SM, Larry Thivierge, VE3GT—BM: VE3LST. PGL: VE3AR. SEC: VE3GV. STM: VE3CYR. TC: VE3EGO. New EC appointments are: VE3MOL, Sault Ste Marie; VE3PK, Sarnia-Lambton; VE3NHZ, Geraldton and area. VE3KUK is a new member of CARTG. Congratulations to VE3AKR who celebrated his 50th anniversary as an amateur radio operator. VE3LZY is the newest member of the KWARC's Coffee Club while VE3EJP of that Club is the President-elect of the KWARC. VE3XN is the CRRL's Awards Manager. VE3PJF is working hard on his DXCC, VE3NGZ and VE3IHB have qualified for the Michigan Robin certificate, an award of the local 10-10 chapter of the 10-10 International. The certificates were presented by WD8PFD. The Section's Field Organization provides for a number of station appointments. If you are interested, please contact me on the air or drop me a note for further details. Traffic: VE3FAS 321, VE3GSO 239, VE3CYR 168, VE3GT 123, VE3DCX 75, VE3DPO 75, VE3ORN 72, VE3AJN 67, VE3WV 46, VE3BUO 45, VE3BAJ 27, VE3EAM 20, VE3POJ 15, VE3WM 14, (June) VE3FPI 2.

QUEBEC: SM, Harold Moreau, VE2BP—STM: VE2EDQ. BM: VE2ALE. TC: VE2ED. NM: VE2EDO. The evening net on VE2TA (repeater) has stopped for summer and will resume activity in the fall. VE7EXPO has been worked by VE2s in different bands and modes. Official Relay Stations (ORS) appointments are needed, if interested please contact your SM or STM. With regret, I have to report Russel, VE2PAR, a Silent Key. Les amateurs handicapes visuel ont perdu un ami, Russel, VE2PAR. Prompt retablissement a VE2AYH et VE2EC. Traffic: VE2BP 50, VE2JN 41, VE2WH 40.

SASKATCHEWAN: SM, W. C. Munday, VE5WM—SEC: VE5CU. EC: VE5AQ, VE5FF, VE5HG, VE5ACI, VE5WM. STM: VE5HG. NM: VE5EE, VE5EX, VE5HG, VE5AEM. TC: VE5GF. ATC: VE5XZ. BM: VE5WM. OBS: VE5CU, VE5JA. The field organization in the Saskatchewan section is undergoing a state of flux. Candidates for the following positions are now being solicited. Section Traffic Manager, CW Traffic Net Manager and Phone Net Manager. Net reports: SATN; 12 sessions, 28 QNI, 4 QTC; PWXN; 31 sessions, 773 QNI; ARG 2 meter: 30 sessions, 541 QNI. Traffic: VE5AGM 4.

ATLANTIC DIVISION

DELAWARE: SM, Harold K. Low, WA3WIY—SEC: K3PFW. EC: KC3JM KC3TI KA3LNK. PIO: WB3DPJ. SGL: AF3R. Amateur radio in Del. suffered a great loss with the passing on July 25 of Roger Cole, W3DKX. He was a former SM and most recently STM of Del., and was very active in emergency operations. Nanticoke ARC is now incorporated. Congrats to KC3XQ on upgrade. Also to KA3PVI of FSARC on his novice. The DTN needs checkins from NEW Castle county. Frequency 3.905 at 6:30 PM local time, please join us. DTN Stations 295 traffic 40 in 21 sessions. DEPN Stations 42 traffic 14 in 4 sessions. SEN Stations 32 Traffic 0 in 4 sessions. Traffic: WA3WIY 49, W3QQ 47, W3EKO 42, WB3DUG 21, W3FEG 19, K3JL 16, W3PVO 11, KA3IXV 10, N3AXH 8, KC3JM 8, late reports W3PQ Feb 6, Mar 30, Apr 42, May 32, June 59.

EASTERN PENNSYLVANIA: SM, Kay Craigle, KC3LM—ASM: WA3PZO, K3ZFD. ACC: KA3A. SEC: WA3PZO. STM: KB3UD. OOC: N3CWD. PIO: W3AMQ. TC: W3FAF. Please join me in thanking previous SM KA3A, who remains Affiliated Club Coordinator. This month we recognize our active Official Observers: N3CWD, K3WKK, W3KEK, K3UWJ, and W3FAF. Not band cops, they're advisors in keeping sigs clean and standards high. EPA now has OO capability on packet radio. Whether you're out for guts or giggles, the PA QSO Party, Oct. 11-12, needs your county on the air. Let's keep that club trophy on our side of the line and give our good friends out in Western PA some grade-A Eastern PA dust to munch! Thanks to WPA's Nittany ARC for sponsoring this great contest. When is a drill not a bore? When EPA is 5th-place Section in local activity for the 1985 SET and our Dist. 1 has the highest local score in the whole ARRL! Good luck on your SET in 1986. Please report your area's drills to SEC WA3PZO. At the Navy's request, WA3PZO and Dist. 1 DEC KA3DVY observed a National Disaster Medical System drill in the Washington, DC, area last summer; our NDMS drill this month will center in Dist. 1 but extend to other districts, too. As a Special Service Club, Warminster processes WAS and VUCC-UHF awards right here in EPA; their 1986 officers are KY3T, N3EJH, KA3JEF, and N3ESI. 1986 Pack Rats officers are WA2OMY, N2SB, W3CXU, WA3AQA, and K3GAS. Harrisburg RAC enjoys a ragchew net Sundays at 1330R on 146.58 simplex. Keystone VHF has been supporting an Amateur Radio Explorer Post. KC3LM spoke at a Penn Wireless Assn. meeting last summer and enjoyed handshaking at the PWA, Mid-Atlantic ARC, CPRA, and York hamfests. See you at the C-CARS 'fest on the 12th? Assistant Technical Coordinators make good speakers for your group; write W3FAF for the current list. You know, sugar, you don't have to be Doug DeMaw to be an ATC, just decently well-informed about one or more topics and ready to help your fellow hams. C'mon, contact W3FAF and join the team! Several Section leaders can be reached via packet radio bulletin boards. KC3LM and WA3PZO use K3PGB PBBS. N3CWD can receive messages sent to K3WKK and AK3P. KB3UD PBBS is the center of our NTS packet activity. All traffic handlers are encouraged to send/take traffic using this board. Tom's been working with EPA sysops and neighboring Sections to make NTS effective on packet. SECTION NETS, June (QNI/QTC): EPA 427/137; EPAEPTN 478/200; PTTN 194/101. LOCAL NETS, June (QNI/QTC): D3ARES 82/14; D6ARES 64/26; MARCARES 91/12; MARCTN 172/46; STARS 157/46. Full net sked in Sept. column. TRAFFIC, June: N3AZW 471, N3COY 240, N3CD 139, KB3FW 110, KU3R 108, N3AIW 76, KA3IME 70, W4UQ 56, AA3B 52, KA3DLY 47, N3DRM 36, KB3UD 36, W3KAG 31, W3AQN 31, K3TX 30, WA3CKA 23, W3TWV 21, W3FAF 18, W3ADE 17, W3CL 15, N3EFW 13, W3JKX 11, W3DP 9, W3VA 7.

MARYLAND-DC: John Barolet, KJ3E—Let's backtrack a bit. Did you read "It Seems to Us . . ." in August 1986 QST? Interesting, particularly the last line: "What have you done for ham radio lately?" Think about it. Ham radio has a lot of valuable radio frequency spectrum assigned ONLY BECAUSE IT QUALIFIES AS A SERVICE, an emergency service for disrupted or overloaded existing radio services. Ham radio is not a hobby. Be prepared to provide the service that permits us to use those very valuable frequencies. The annual ARRL Simulated Emergency Test (SET), scheduled in the month of October provides another excellent opportunity to practice for that service. Ask your ARRL Emergency Coordinator or me how you can serve in the SET. National Disaster Medical System 1986 (NDMS '86) report: KN3U, KX3C, WB4APR, N3AQG, KA3KIW and N5EV, the National Capital ARES Council NDMS Committee, were in charge of the preparations. Packet and voice traffic was passed during the exercise. An objective evaluation of the exercise was not available when this column was written, but some early reports make me believe the "handoff" of information from the served agencies to the radio amateurs was less than ideal. That is not unusual, amateur radio operators often practice emergency operation together but unfortunately practice with the personnel of the agencies to be served is much less frequent, and sometimes non-existent. KC3EK is the newly- appointed MDC Public Information Officer (PIO). Let's all give Glenn a hand in overcoming our stagnation in this business. Other appointments: WA3VPL/PIA, KA3T/ORS, and K3TEZ, K3VVV, WA3TOY, KB3WL, KK3F, WB3EFG, W3GOU and N3EKZ, all to OES. Two section leadership positions are vacant in MDC, State Government Liaison (SGL) and Bulletin Manager (BM). Become a leader! Do something for ham radio! Position responsibilities and requirements for appointment are available from KJ3E. Thirty-two 1986 annual reports have been received from ARRL Affiliated Clubs; don't let your club affiliation lapse! Ask KA3DRO or me to send you a list of the benefits available through ARRL club affiliation. N3CNJ and N3DSW were married in July. KC3TS is now NB3P. MDD Brass were W3FA/155, KK3F/88, W3QQ/72 and KJ3E/55. Net reports: Net/Mgr QND/QTC/QNI: MDD/W3FA 62/174/533, MEPN/N3EGF 30/103/780, MSN/KC3Y 31/56/384, WRPON/WB3BFK 22/15/221, MDCPON/W3OYY 5/4/61, WC2MN/KC3DW 5/0/71, BCN/KA3OFS 4/0/40. FREDCARES/K3RXK 5/23/87. PSHR: K3RXK 136, KK3F 132, W3FA 109, N3EGF 91, WA3GYW 76, KJ3E 75, KC3Y 68, KC3DW 65, W3YVO 63, NA3Q 62. Traffic: KK3F 1243, W3FA 149, KC3DW 139, KJ3E 107, KC3Y 97, N3EGF 68, K3NNI 51, K3RXK 36, NA3Q 36, KT3T 30, KX3U 30, N3RO 24, WA3GYW 20, KC3AV 18, W3ZNW 18, WB3BFK 17, W3FZV 15, W3YVO 15, W3DQI 13, W3LDD 12, KA3T 12, KA3IID 10, WA3VPL 9, WA2WDT 7, KA3JJN 4.

SOUTHERN NEW JERSEY: SM, Richard Baier, WA2HEB—SEC: K2QIJ. STM: WB2UVB. ACC: K2IXE. TC: KA2RAF. PIO: VACANT. SGL: KA2KMU. BM: WB2UVB. OOC: WA2HEB. ATCs: N2BQT, K2JF and KA2RJA. From our SEC comes the following: "With the publication of the next Burlco area telephone directory the public can find AMATEUR RADIO-ARES BURLCO listed in the white pages, under 'A' and in the Yellow Pages under the title of HOBBIES." The number will be 1-609-261- 7515 (the same as the input/output frequencies of the Mt. Holly repeater). The number will be in operation effective 7/24/86. Don't forget the annual Simulated Emergency Test (SET) will be held this month. I am hopeful of the section being active in this important operating event. A "simulated" disaster will strike our section and it will be up to the various county ARES staffs and the various NTS nets to see how well they are prepared to respond to a crisis situation. Sound interesting? For more information, please contact your county Emergency Coordinator, local Net Manager, or our STM and/or our SEC. Hope to CU during the SET. 73 until next month. Traffic: WB2UVB 240, NG2T 83, W2IML 52, N2FKA 42, WA2MGV 17, KA2CQX 14.

WESTERN NEW YORK: SM, William W. Thompson, W2MTA—ACC: N2EH. BM: W2GLH. OOC: W2AET. PIO: WA2PUU. SEC: KB2KW. STM: W2ZOJ. SGL: WB3CUF. TC: K2QR.

NYSEMO	3993.5	Su	N2AGO	077-003-04	0900
NYSR	3530.0	Su	W2MTA	019-003-04	0930
NYS/M*	3677.0	Dy	WB2EAG	322-197-31	1000
WDN/M*	146.64	Dy	WB2OWO	298-083-31	1100
Mike Fd	3925	Dy	VE2FMQ	147-020-28	1300
NYPON*	3913	Dy	WB2IDS	539-299-31	1700
NYSPTEN	3925	Dy	NS2Z	520-064-31	1800
ESS	3590	Dy	W2WSS	312-052-31	1800
Q Net	146.91	Dy	KA2CMQ	322-001-28	1830
OCTEN/E*	146.94	Dy	WB2HLY	594-086-31	1830
STAR*	146.73	Dy	N3DPE	219-048-31	1830
WDN/E*	145.17	Dy	WB2OWO	434-144-31	1830
BSN	147.33	Dy	WA2SEF	350-045-30	1900
NYS/E*	3677	Dy	KU2N	428-225-31	1900
JCARCN	146.70	Dy	WB2HBU	441-008-31	2000
NYTN	3720	Dy	KA2DQA	103-028-28	2030
BRVSN	146.655	Dy	WB2OFU	413-002-31	2100
CNYTN*	147.30	Dy	WA2PUU	270-061-31	2115
OCTEN/I*	146.88	Dy	WB2HLY	264-060-31	2130
WDN/L*	146.64	Dy	WB2OWO	441-122-31	2130
NYS/L*	3677	Dy	KU2N	361-215-31	2200

*NTS Net. Other Nets reporting: CVARCSEN, LCARESN, MVTN, VHF THIN. PSHR: N3DPF KA2DQA N2EVG WA2FJJ W2FR WB2IDS WB2IKL W2MTA KU2N WB2NLU WB2OWO WA0PTV ND2S KA2SJG KA2UBD KA2UBX NE2W K2YAI W2ZOJ. OBS Reports: WB2DSR WA2ZPE. GOOD SHOW! To the many club groups conducting classes and exams for Novices. A good sized group of graduates is indicated. HAMFEST finale with Syracuse on Oct. 18 at State Fair Grounds. Forty-one affiliated clubs have now filed their annual reports; fifteen to go! Has your club filed? The League needs them! Ask your President or Secretary if you don't know. Let N2EH or W2MTA know if we can be of help. Several college clubs have been lapsed for more than one year, do those want to reactivate and gain the benefits of affiliation? COMMS: Some sixteen participated in the Southern Tier's Y-Athlon in Tioga County—W2EWO; Oswego 10K Roadrun had some eight operators—KY2F; Champlain Valley ARC had eleven ops in an EMT exercise—KA2MLQ. Batavia Hamfest was again a big success . . . even with two years of rain . . . well over one thousand attended. K2KIR hosted FB Traffic Handlers Picnic at Verona, and is already planning next August's event! Traffic: WA2HSB 397, WB2OWO 295, WB2IDS 284, WA2FJJ 282, N3DPF 223, W2MTA 190, KA2UBD 167, K2YAI 124, N2ABA 122, KU2N 112, WB2QIX 112, ND2S 102, KA2DBD 91, WB2NLU 91, KA2UBX 89, W2ZOJ 86, WB2IKL 85, NE2W 77, W2FR 75, KA2DQA 54, KA2SJG 54, N2EBG 49, NN2H 49, WA0PTV 45, AF2K 41, WB2IJH 36, W2PPS 31, WA2JPB 27, WB3CUF 18, K2IUT 6, K2VR 6, WA2OEP 6. (June) KA2DQA 61. Get those antennas repaired . . . Happy Halloween!

WESTERN PENNSYLVANIA: SM, Otto L. Schuler, K3SMB—SEC: WA3UFN. ASM & STM: WN3VAW. PIO & ASM: KC3TO. OO COOR: KJ3Q. SGL: K3HWL. TC: K3LR. BM: KR3P. ACC: AK3J.

Net	1NI	QTC	SESS	kHz	T/D	MAN.
WPACW	262	140	31	3585	7:00 P	WA3UNX
WPAPTN	414	91	30	3983	6.00 P	WA3HLN
KFN	201	71	23	3958	1:00 P	N3EMD
PFN	182	109	31	3958	5:00 P	WA3THT
WPA2MTN	386	68	31	146.28/88	8:00 P	KA3BGC
NWPAPTN				144.63/45.13	10:00 P	KC3NY

It is with deep regret I have two Silent Keys this month, W3LVI and K3TFL. OUR sympathies are extended to their families. The PVHF Sec. has moved their repeater to the Carrick area of Pittsburgh for better area coverage. The Breeze Shooters officers for the 86-87 year are Pres. WA3TFS, Sec-Treas. KA3AVB, Checker N3DOS, Directors N3BPB, KA3JMU, KA3NQA, KA3AVA, KA3LNG, W3GVI. Please send your club's VEC sched to Doc Kump K3TL 38 Fawn Drive, McRocks, PA 15136. He has been listing all dates sent to him, I would like to thank Bob Myers, K3HWL, OUR SGL who must resign his appointment due to health concerns. He is facing surgery again and our prayers go with him. Bob has been helping not only the WPA SECTION but also the EPA Section. He has done an outstanding job, and I will miss his assistance. I hope he can return in due time. Our traffic has reached low levels the last two months. We need more stations in the Section especially in the areas that have few amateurs, also in the Pittsburgh area. We handle traffic for many amateurs who DON'T let their equipment hit the net frequencies. Traffic: W3EGK 229, N3EMD 157, N3AES 113, WA3UNX 104, WN3VAW 97, W3OKN 89, W3NGO 74, W3RUL 54, K3SMB 50, N3CZW 43, W3KMZ 39, N3FM 38, WA3DBW 36, KA3ETC 27, WA3GUK 25, WB3CIS 18, KC3JO 13, WA3QNT 12, W3SN 5, K3LTV 4, KB3NV 3. (Jun) W3RUL 35, W3TTN 2.

CENTRAL DIVISION

ILLINOIS: SM, David E Lattan, WD9EBQ— SEC: W9QBH. STM: OOC: W9TT. BM: K9EUI. SGL: W9KPT. PIO: K9IDQ. ACC: WB9SFT. TC: N9RF. ASM: AA9D.

NET	FREQ	TIMES (Z WIN)	QNI	QTC	SES
ILN	3690	0030/0400 DY	449	176	62
ITN	3705	0100 DY	133	27	28
ILPN	3915	1430 SN	87	2	4
NCPN	3915	1300 DY(X SN)	467	87	27
NCPN	7270	1815 DY(X SN)	283	50	23
IEN	3940	1500 SN	82	6	4
IARES	3915	2230 1 + 3 SN	56	2	
ISN	3905	0000 DY	620	176	31
CTN	147.69/09	0300 DY	512	136	31

Illinois was represented 90% to 9RN by stations N7DOY W9EHS KA9FEZ K9GMZ W9HBI KZ9I W9INZ KD9K KJ9L W9NXG WB8RFB and N9TN. D9RN was represented 100% to CAND, Illinois stations were W9HOT KA9FEZ W9EHS WDØAHO and KA9RZB. Terry, KA9FEZ will be leaving the state for a while beginning next month. He leaves us in fine style grabbing BPL this month with 673. Thanks for all your help Terry! After a leave of absence, Steve KB9X has decided to resign as STM. Steve was responsible for bringing a lot of new blood into the Illinois NTS program over the last several years. He was the originator and first NM of the ITN, and was instrumental in the birth of the ISN. His leadership and on-the-air wit will be missed by Illinois NTS participants. Logan Co. EC WB9CWE reports that the Railsplitter BBS whose SYSOP is Scotty, KG9Z has an active ham conference section

which includes ARRL news, propagation forecasts, equipment reviews and general announcements. The BBS is open to all who are interested. The system will operate 300 or 1200 BPS, with 7 or 8 bit word, even or no parity, and 1 stop bit. The number is 217/732-1407. Morgan Co. EC W9OES is still looking for some amateurs in Jersey Co. who would be willing to work with the Red Cross there and perhaps sign up as Jersey Co. EC. Anyone who is interested should contact W9OES and/or W9QSH. BM K9EUI will begin retransmitting ARRL and ILARRL bulletins on 80 meter baudot, ASCII and AMTOR sometime this fall. OBS stations may wish to contact him so a concensus may be arrived at for the best time. Also, Illinois is in need of additional OBS stations. KC9BD writes that the York Radio Club will operate W9PCS from 2300Z 9/5/86 to 1900Z 9/14/86 during the FOUNDERS WEEK celebration of the 150th anniversary of the City of Elmhurst IL. Operations will be in the lower part of the general phone bands on 80 40 20 15 and 10, the 40 and 15 novice bands and 147.42 FM. A commemorative certificate will be available. Traffic: KA9FEZ 673, NC9T 411, W9NXG 185, W9EHS 183, WB8RFB 154, W9HOT 151, W9HLX 133, KJ9L 91, W9LWH 82, W9HBI 72, W9KR 62, KD9K 40, K9EUI 34, WD0AHO 31, KZ9I 24, K9CNP 23, W9LNQ 22, K9EHP 20, WB9TVD 17, KA9BBV 16, K9WMP 14, W9VEY/M 9, WD9HOW 5.

INDIANA: SM, Hon Koczor, K9TUS—ASM: W9UMH. SEC: WB9ZQE. STM: W9JUJ. ACC: K9TUS. TC: K9PS. SGL: WA9VQO. BM: KC9TA. PIO: K9DIY. OOC: KJ9G. SRC: N9WB. Net Managers: ITN KD9DU, QIN KJ9J, ICN KW9D, VHF W9PMT, IWN KA9ERC.

Net	Freq	Time Daily UTC	QNI	QTC	QTR	Ses
ITN	3910	1330/2130/2300	3244	467	2368	90
QIN	3656	1430/0000/0300	540	323	1450	91
ICN	3708	2315	62	33	602	25
IWN	3910	1310	2138		376	41
IWN	VHF	Bloom./Kokomo	1963		445	62
Hoosier VHF Nets:			3604	53	3775	96

APPT: N9BHA, EC Huntington Cty; WB9QTX, EC Ripley Cty; N9DTG, DEC, District 1; W9UMH, ORS; K9ZBM, ORS; ANM, KD9ER, OO reports from N9CJT, KA9FFO, KB9DE. Silent Keys, K9CJE, WA9WUK. BPL: W9JUJ, ORIG, O; RCVD, 343; SENT, 335; DLVD, 3; TOTAL 682. SSC of the month is Tri-State ARS in Evansville. Contact is KA9EIV; newsletter is SPARKS, published monthly; TARS has 100 members, operates 2 two meter repeaters and an emergency net weekly; TARS supports local NWS during severe weather and provides communications to two local public service events. TARS is active in demos to high school students during Outdoor Curriculum Enrichment Days. Does your area school system have an OCED that you could support? Look into it! Beginners and old timers alike are welcome on the Indiana Code Net, nightly at 2315Z on 3708 KHz. Join NM, KW9D, and ANM, KD9ER, to learn the discipline and fun of a CW net. Hoosier Hills Hamfest is October 12 near Bedford. I plan to make it to that one. See you there! Congratulations to IRCC Amateur of the Year, KC9TY, Muncie. The ARRL VOLMON/OO program is a joint ARRL/FCC program which relies on our history of self-discipline. OOs are committed to helping other hams keep our service clean and first-rate. Members are not police...they are helpers. For more info, contact KJ9G or me. DX Advisory Committee is looking into revamping the DXCC program. Any input? Contact your DXAC representative. Traffic: W9JUJ 682, KJ9J 162, W9UMH 145, KA9FFO 104, K9WWJ 102, NJ9S 66, WA9QCF 54, WB9PFZ 50, KD9ER 46, KW9D 39, W9ZGC 28, W9UEM 26, KB9HH 25, K9KTB 23, WB9IHR 22, WD9DWD 20, K9TKE 17, K9SBW 17, W9PMT 16, W9EI 16, AB9A 9.

WISCONSIN: SM, Richard R. Regent, K9GDF—SEC: W9OAK. STM: K9UTQ. ACC: KA9FOZ. BM: WB9JSW. OOC: NC9G. PIO: K9ZZ. SGL: AG9V. TC: K9GDF. Milwaukee Volunteer Corps Group, with WD9JKZ in charge, received a special plaque from the W/K ARC and the ARRL for extensive volunteer work in giving license tests. Four Lakes ARC has qualified to renew their status as a Special Service Club; info on SSCs and ARRL Clubs available from KA9FOZ. W9MDG is now a Public Information Assistant; if you would like to be a PIA, contact K9ZZ. NK9O is a new Official Observer; if you would like to be an OO, check with NC9G. Sincere thanks and praise to radio operators who worked hard, under the direction of EC WB9SMM, to make the Milwaukee Circus Parade a success; especially since they also handled extensive severe-weather reports the day before. Check with your EC for information about public service and weather activities in your area or participate in the Simulated Emergency Test this month. October 12th, Kettle Moraine RA Swapfest, Waukesha County Exposition Center, 8 AM, with talk- in on 147.39+. Wisconsin Chapter QCWA meeting is tentatively planned for October 18th with a lunch and auction at the Green Bay Downtowner, social hour begins 11 AM, guests and visitors are welcome. New officers of Greater Milwaukee DX Assn.: Pres. W9RN; V. Pres. KJ9I; N4TZ Sec/Treas. and of Sheboygan ARC: Pres. WB9CXY: V. Pres. NI9Z; Sec. NR9R; Treas. W9IDG. Please send your monthly station activities reports to me by the 6th of the following month. Late starters are seldom winners.

Net	Freq	Time	Call	QNI	QSP	Sess.
BWN	3984	6 AM	WD9IID			
BEN	3985	Noon	KA9RII	722	200	31
WSBN	3985	5:30 PM	N0FKU	751	229	31
WNN	3723	6 PM	N9DGL	190	22	29
WSSN	3645	6:30 PM	N9BDL	214	30	30
WIN-3	3662	7 PM	WB9ICH	320	135	31
WIN-L	3662	10 PM	KC9CJ			
NWTN	34/94	6:30 PM	KD9VR	476	46	31
WCWTN	31/91	6:00 PM	KD9TT			

Traffic: WB9YPY 1235, KA9RII 319, K9GDF 202, W9YCV 183, N9BGE 145, W9CBE 120, W9DND 111, W9CKY 106, WA9WYS 105, W9UCL 100, WB9ICH 89, N9BDL 84, K9AKG 79, KD9XE 78, WB9RGO 72, KA9BHL 61, N9AUG 57, K9UTQ 55, KA9KLZ 49, N0FKU 37, KA9MSR 35, K9BED 25, K9FHI 22, KG9B 22, WD9DNQ 20, N9EAX 14, W9UW 9, KA9BHK 6, N9FTN 2. (June) KC9CJ 848, WD9IID 85, KG9B 22, K9VSO 16, KY9P 5, WB9NRK 4.

DAKOTA DIVISION

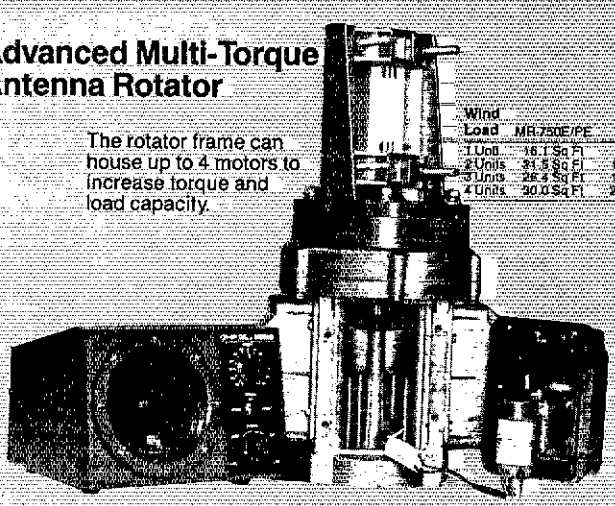
MINNESOTA: SM, George Frederickson Jr., KCØT—SEC: KAØARP. STM: KDØCI. Hello again! Field Day reports continue to come in and a few clubs say it was their best effort ever. The New Ulm ARC and Paul Bunyan Wireless Assn. reported to have very good results. The St Paul Radio Club operated from a site at the St Paul Ski Club. The St Paul RC is involved in virtually every facet of amateur radio and is a strong positive influence for our hobby in the Twin City area. Their Special Events and club call KØAGF has been heard on Field Day to Railroad Mobile over the years. Their newsletter "Groundwave" has been in the capable hands of Mary Mahre, WØMGI, for 15 years now. The club plans to hold its annual auction during the club meeting on Nov 1 and you're invited to attend. Call 777-6463 for details. It will be at the American Red Cross Building in St Paul. We are happy to salute the St Paul ARC this month in this column. It is a Special Service Club. Pres. Joe Koppi, NGØF, VP Bill Beaman, KAØIYS, Sec. Walt Johnson, WAØQQB, and Treas. Mary Kelzler, KAØOMX. Good news from the Warroad area. Plans are to establish a

Superior Ham Accessories

Advanced Multi-Torque Antenna Rotator

The rotator frame can house up to 4 motors to increase torque and load capacity.

Wind Load	MR-750E/PE	MR-300E
1 Unit	16.1 Sq Ft	5.92 Sq Ft
2 Units	31.5 Sq Ft	11.84 Sq Ft
3 Units	46.4 Sq Ft	17.75 Sq Ft
4 Units	60.0 Sq Ft	23.67 Sq Ft



Each motor is equipped with a Super Wedge and Clutch brake system (Slip clutch type) that works independently from the main frame gear train and protects the rotator mechanism from excessive torque.

Low voltage (24VAC) motors . . . Low-cost 6-wire control cable . . . can be installed on the same base as a TELEX unit.

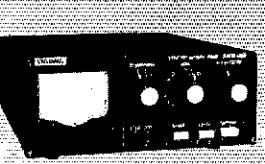
Specifications

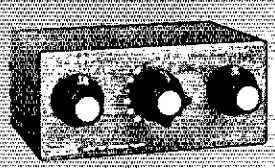
■ **Rotator Unit**

		MR-750E/PE	MR-300E
Rotation time	60 Hz	58 seconds (60 Hz input)	33 seconds (60 Hz input)
	50 Hz	70 seconds (50 Hz input)	39 seconds (50 Hz input)
Output torque Brake power	1 motor	610 lbs/inch 5,200 lbs/inch	220 lbs/inch 1,700 lbs/inch
	2 motor	1,200 lbs/inch 9,600 lbs/inch	440 lbs/inch 3,500 lbs/inch
	3 motor	1,800 lbs/inch 13,900 lbs/inch	650 lbs/inch 5,200 lbs/inch
	4 motor	2,400 lbs/inch 18,300 lbs/inch	870 lbs/inch 7,000 lbs/inch
Rotation angle		375 degrees	
Permissible mast size		1½ ~ 2½ inch (38 ~ 63 mm) < diameter >	
Control cable		6-wire cable 0.5sq—1.25sq (AWG16/18/20 etc.)	
Continuous running		5 minutes Max. permissible	
Dimensions		15.6" H x 8.43" W x 8.43" D (397 mm x 214 mm x 214 mm)	
Unit weight		16.5 lbs (7.5 kg) < with 1 motor unit fitted >	

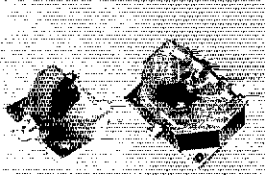
■ **Controller Unit**

	CR-4 (for MR-750E/MR-300E)	CR-4P (for MR-750PE)
Power source	117 V AC (50/60 Hz)	
Power consumption	200 W (with 4 drive motors)	
Motor running voltage	24 V AC	
Dimensions	4.9" H x 7.1" W x 6.9" D (125 mm x 180 mm x 175 mm)	
Weight	9 lbs (4 kg)	
Operation	Manual	Manual/Pre-set





Frequency Range:	CNW-518	CNW-419	CL-680 (no metering)	CNW-919
	3.5-30 MHz (8 bands)	1.8-30 MHz (17 bands)	1.8-30 MHz (17 bands)	140–150 MHz
Power Rating:	1 kW CW (50% duty)	200 W CW (3.5-30 MHz) 100W CW (1.8-3.4 MHz)	200W CW (3.5-30 MHz) 100W CW (1.8-3.4 MHz)	200W CW 10–250ohm
Output Impedance:	10-250/25-100 ohm (On 3.5 MHz)	10-250 ohm	10–250 ohm	



AUDIO FILTERS

AF-606K
Four stages of filtering . . . variable bandwidth over broad range . . . razor sharp CW reception . . . built-in speaker . . . PLL Tone Decoder circuitry.

ELECTRONIC KEYER DK-210

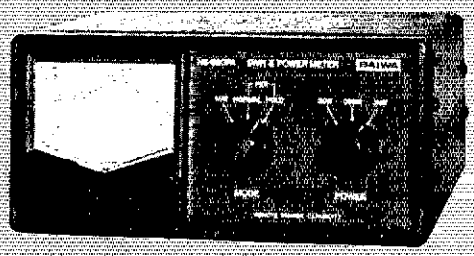
Sharpen your "fist" with Daiwa precision!

COAXIAL SWITCHES

PAT. No. 59-000803

	CS-201	CS-201G	CS-401	CS-401G	CS-4
	2position	2position	4position	4position	4position
Frequency:	600 MHz	1.3 GHz	600 MHz	1.3GHz	1.3 GHz
Connectors:	SO-239	N type	SO-239	N type	BNC type
V.S.W.R:	Below 1:1.2				
Insertion Loss:	Less than 0.2 dB				

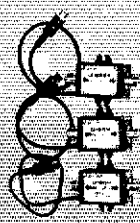
New Cross Needle SWR/Power Meters for All Bands



15° angle face for easy reading and operation

Model*	Freq. Range Int. Sensor	Forward Power	Tolerance Full Scale	Connectors
NS-660A	1.8-150 MHz	30/300 W/3 kW	±10%	SO-239
NS-660PA	1.8-150 MHz	30/300 W/3 kW	±10% Av Pwr ±15% PEP	SO-239
NS-663A/N	140-525 MHz	30/300 W/3 kW	±10%	SO-239/N Type
NS-668	900 MHz-1.3 GHz	1.5/15/60 W	±10%	N Type

*Optional sensors adapt each meter for use on other bands.



External Sensors (For Indoor/outdoor use)
Permit operation over range of 1.8 MHz through 1.3 GHz. Optional for use with NS-660 series meters.
U-66H, 1.8–150 MHz, Max 3 kW, SO-239 Connectors
U-66V, 140–525 MHz, Max 300W, SO-239 Connectors
U-66VN, 140–525 MHz, Max 300W, N Type Connectors
U-66ST, 900 MHz–1.3 GHz, Max 60W, N Type Connectors
SC-20 60 ft. Cable with connectors for use with remote sensors

SWR & POWER CROSS NEEDLE METERS

CN-620B and CN-720B
Frequency Range: 1.8-150 MHz
Power: 3 Ranges (Forward, 20/200/2000 W) (Reflected, 4/40/400 W)

NS-448
900 MHz–1.3GHz
(Forward 5/20 W)
(Reflected 1.6/6.6 W)
Separate Sensor Type

	CN-520	CN-550
Frequency Range:	1.8-60 MHz	144-250 MHz
Power Range:	200/2000 W	20/200 W

	CN-410M	CN-460M	CN-465M
Frequency Range:	3.5-150MHz	140-450 MHz	140-450 MHz
Power Range: Forward	15 W/150 W	15 W/150 W	15 W/75 W
Reflected	5 W/50 W	5 W/50 W	5 W/25 W

Back Lit, with mobile bracket

POWER AMPLIFIERS

Band:	LA-2035R 144-148 MHz	LA-2065R 144-148 MHz	LA-4040R 430-450 MHz	LA-2155W 144-148 MHz
Input Power:	0.5-3 W	0.5-5 W	10 W	10-35 W
Max. Output Power:	30 W plus	60 W plus	35 W	30-150 W

Pre-Amp (Gain) 15 dB

Model	Maximum I/ Continuous I	Output VDC
PS-30XM	31A/24A	1-15
PS-310M	31A/24A	3-14.6
PS-310MD*	31A/24A	13.8
PS-560MD**	56A/44A	13.8

*Sub-DC Outlets: 5.6A/5A, 3-14.6 VDC
**Sub-DC Outlets: 10.6A/1-15 VDC

POWER SUPPLIES

DAIWA® U.S.A. INC.,
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MADE BY DAIWA INDUSTRY CO., LTD., TOKYO, JAPAN

much needed 2 meter repeater for the area. Stay tuned for further details. Minnesota Amateur of the Month for July is Mike Mullen, NØBUI, of Winona. Mike is very active on MSN, and we congratulated him for a continued fine job. Upgrade to General NØGCJ, call sign change KBØCD now NTØB. It sounds as though the annual Uncle Herman's Horseradish Net picnic was another "fun" get-together. In case you don't know about this net, listen in on 3932 Sunday Mornings at 10 AM... I will say no more .73 de KDØCI.

NET	FREQ	TIME	QNI/QTC/SESS	MGR
MSN/RTTY	3620	6:30P	No Sessions	WAØLUT
MSN/1	3685	6:30P	318/89/31	KAØEPY
MSN/2	3685	10:00P	212/45/31	NCØE
MSSN	3710	6:00P	219/14/31	KAØODQ
MSPN/N	3929	12:00P	505/96/31	WBØWNJ
MSPN/3	3929	5:30P	874/111/31	WDØBGS
MNAMWXNT	3929	6:15P	No Sessions	KAØIZA
PICONET	3925	9:00A	3001/285/125	WDØBAC

EMERGENCY FREQ: 3929. BULLETINS: 3929, 3685 MN/MSO: 3620. Traffic: WAØTFC 396, WBØWNJ 322, KAØEPY 190, KT9I 124, W9DM 57, NØCLS 54, WØGRW 45, KAØODQ 40, KAØPQW 32, WDØBGS 29, WØKYG 23, NØFQO 21, KØOGI 21, KDØCI 19, KAØAJF 17, KDØNH 17, KCØT 17, WDØGUF 16, NØJP 16, KAØPDM 11, NTØB 6, NØEWA 6, KAØBFP 4, KAØTML 2. (June) KDØNH 16. (May) KTØR 14.

SOUTH DAKOTA: SM, R. L. Cory, WØYMB—STM: NØABE, Ole Johnson. SEC: KAØKPY, Warner Muns. A Brookings man faces manslaughter charges in connection with the death of a Watertown Area Ham, Randy Archer, KAØWOB. Randy was killed when his motorcycle was struck by a pickup. Our sympathy to Randy's family and also to NØDPF, Si Spisak, who's wife passed away. Sioux falls club has decided against hosting the 1987 Dakota Division Convention. LARK of Watertown is looking into it. More on this as it developes. KAØUEK is now NØHFH. KØERM and NØFUG of Mobridge Area ARC earned 47775 points with 91 CW QSOs in the ARMADILLO RUN. At the time of this writing I have not received any traffic reports for July. Black Hills ARES was activated on July 25 for a Tornado warning, 26 members responded—tornado went up no damage.

DELTA DIVISION

ARKANSAS: SM, Joel M. Harrison, WB5IGF—ASM: K5UR. SEC: N5BPU. STM: W9OK. ACC: NI5D. SGL: W5LCI. TC: W5FD. BM: W5HYW. Repeater Coordinator: WB5FDP. Congratulations are in order for each of our affiliated clubs and coordinator NI5D. All but one of the clubs have sent in an annual report form and have updated their status with the League. Official Bulletin Stations are needed in several areas of the State for liaison to two meter nets. If you are interested, please contact me. Are you not hearing what you want in this column? Drop me a line and let me know what you would like to hear more of. Packet Radio links have now been established to permit access from Fort Smith across the state of Memphis. Traffic: W5QFU 78, W9OK 31, W5UAU 12, WB5GQH 12, W9YCE 10, N5ECT 8, WB5IGF 8, K5GK 2, K5UR 2. Fall is here, prepare your antenna systems for winter.

LOUISIANA: SM, John "Wendy" Wondergem, K5KR—SEC: N5ADF. ACC: K5DPG. SGL: KD5SL. OOC: KE5QK. TC: N5JM. The Shreveport Amateur Radio Association conducted an outstanding hamfest and hosted the 1986 ARRL Delta Division Convention in their very fine Civic Center in August. Particularly noteworthy were the large number of well attended forums which covered Packet, 10-10, repeaters, Skywarn, LCARC, ARRL & AMSAT. Janie, N5ATD SARA President, Tony, K5KDQ Board President and Barney, N5EYK Ham-Com Chairman along with all the SARA "do-ers" deserve a "Well done". Clyde, W5CH ARRL Delta Division Director and Al, K5DPG Delta Division Vice Director conducted the Delta Division Convention with honored guests Leonard Nathanson, W8RC, ARRL Vice President, and David Sumner, K1ZZ, Executive Vice President in charge of ARRL Headquarters. During the banquet, Certificates of Appreciation were given to the tireless workers that made the hamfest a huge success. The SARA annual Golden Key Award went to Barney, N5EYK, for being the SARA member that did the most for the club. The Golden Mike Award went to Mel, KD5DE, in recognition of doing the most for amateur radio. Traffic: CAND report: 781 msg 35 sessions DRN-5 100%, DRN-5 report: 613 msg 62 sessions LA 94% by W5GHP, WA5LHL, K5WOD, WA5WBZ, WA5V & W5TQA.

MISSISSIPPI: SM, Paul C. Kemp, KW5T—ASM: K5QNE. SEC: K4HKD. SGL: AL7GQ. ACC: KC5VD. PIO: KA5VBE. OOC: W5VMC. VHF Coord: N5DWU. BM: AJØX. TC: WB5SXK. KC5VD named chairman of 1987 Jackson Hamfest; Don reports work already underway for next year's gathering, scheduled for May 2-3. N5GRW new manager of Hattiesburg Area Emergency Net. Congrats to N5JHH on upgrade to Extra. "IT CAN HAPPEN TO YOU" DEPARTMENT: Lightning damaged or destroyed 11 radios and antennas at the Harrison County Emergency Operations Center; how's YOUR lightning protection? Regret to announce that WD5JBP of Laurel is Silent Key. Packet update: Ackerman, Jackson, Laurel and Columbus AFB now up with new digipeaters. Six meter SSB enjoying high activity with frequent band openings; WJ5P staying busy on 6 with more than 100 grid squares worked in three months. Laurel ARC announces new repeater at Jones County Community Hospital for emergency communications. Hattiesburg ARC members backed up American Red Cross in wake of late-July propane plant explosions in Petal. Pine Belt Emergency Net organized and meeting 2nd and 4th Mondays at 7 PM on Laurel's 146.61 repeater; W5VKR is manager. W5UAW may be state's DX champion with 315 countries confirmed (of possible 316); AJØX is right behind Bob with 313. DRN5(WB5YDD) Sessions 62 QTC 613 (Mississippi represented 98% by N5AMK, KT5Z, W5HKW, KB5W, KE5EC and W5ACS). MSBN(WJ5P) Sessions 31 Qni 1659 QTC 61. MMN(WJ5L) Sessions 31 QNI 631 QTC 7. MTN(K5OAF) Sessions 31 QNI 141 QTC 50. MSN(W5YRX) Sessions 22 QNI 71 QTC 21. GCSBN(W5JHS) Sessions 31 QNI 949 QTC 21. LARES(N5HGN) Sessions 6 QNI 70 QTC 1. HAEN(N5GRW) Sessions 4 QNI 55 QTC 0. MLEN(WD5O) Sessions 4 QNI 61 QTC 0. Traffic: N5AMK 504, KB5W 430, K5OAF 238, W5WZ 56, KT5Z 45.

TENNESSEE: SM, John C. Brown, NO4Q—ASM/ACC: WA4GLS. OO/AA: W9FZW. PIO: N7EJI. SEC: WA4GZQ. SGL: WA4GZZ. STM: NG4J. TC: W4HHK. The Section Manager is now getting a monthly list of all the new amateurs and other changes. That has been a much needed list for many years. This list will be supplied to the STM and ASM/ACC for anything that can be done to welcome the new people entering this great hobby. We want to let them know about the various activities that take place in the section. Congratulations are sent out to all that are in this category. If you don't know about something that you are interested, let someone know about your interest. New talent is a most welcomed asset. We have three new net managers that need to be recognized, they are W4WXH as the new CW net, W4TYV as the early morning phone net and KB4MSB as the TN slow net managers. These people are much in need of your support and assistance. Just checking in will be a big help. All the net managers are in need of net control stations. It has been not-

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ed that a lot of the NCs are missing their schedules. This is especially noted in the summer periods as vacations and other things come along. A back-up is needed to help out. Contact the net manager and lend a hand. We wish to pay a special thanks to the outgoing NMs of WA4EWW and W4DDK for their many years at the helm of the EMTPN and CW nets. They deserve a rest for the many years they were present and kept things on the roll. Three people were on the CW net Honor Roll for this period—KB4MSB, NG4J and WA4CNW. Congrats go out to them. Your PIO has indicated that he will be around a bit more now in that all the travel on previous schedules has been cut. He is in need of a lot of assistance and needs some assistance. He will welcome your help and also the OO Coordinator, TC all the rest. We are about to finish up another fine year of hamfests. If you did not make one of the many, chances are we missed seeing this year. Section traffic for this period is as follows: LF, Sessions 87, QNI 3907, QTC 90; VHF, Sessions 81, QNI 823, QTC 414; CW, Sessions 42, QNI 106, QTC 67. The individual station activity for the period is a bit short but as follows: W9FZW 140, NG4J 135, WA4FMR 121, K4WWQ 96, W4DDK 79, W4WXH 64, NN4S 32, W4PFP 31, KA5KDB 16, KB4UA 13, W4PSN 8, W4TYV 7, WB4TDB 3. Much thanks to all for your services.

GREAT LAKES DIVISION

KENTUCKY: SM, Dale Bennett, WA4JTE—Looks like a good time was had by all at the Lexington Hamfest. Sure enjoyed meeting everyone. The Kentucky section meeting was well attended, hope we got some questions answered. We were scheduled to have net reports in this month's section news, but due to the busy schedule of WB4ZDU we are unable to have a complete list. If your net is not here please send a report to WB4ZDU or WA4JTE, and we will try and see that it is in the next column. Also, be sure to send in your station activity report as well as your PSHR. We still need better liaison to the regional nets. Anyone who can help out on D9RN or 9RN let me know. I will be glad to answer any questions you have about these nets.

		QNI	QTC
MKPN	JUNE/JULY	1060/1091	144/143
KTN	JUNE/JULY	844/814	41/62
KNTN	JUNE/JULY	XXX/188	XX/44

MICHIGAN: SM, James R. Seeley, WB8MTD—SEC: WB8BGY. STM: WB8SIW. OO Coord: NJ8S. ACC: K8SB. SGL: N8CNY. TC: W8YZ. From all reports, the U.P. Hamfest this year was a good one. I had to miss it, the first in nine years. SEC WB8BGY and STM WB8SIW both report good forums and lively interest in their presentations. Congratulations are in order for K8KMQ's 80th birthday and to W8IHX and bride for 50 golden years together. Re. the repeater interference litigation in the Saginaw area, progress is being made. Quoting a SVARA news release, but without naming any names or call-signs, since the matter has not been concluded at the time of this writing, "... in two separate lawsuits, an individual who allegedly was interfering with a club repeater and with other individuals has been held responsible for his actions in a civil lawsuit without any need for criminal prosecution." Awards have been by two MI Circuit Court Mediation Panel actions. The matter will come to formal trial in October, on lawsuits initiated in September, 1983. The wanderer, KB8GT, moved into Camp Grayling and set up a message center operation for the busiest two weeks of the year. Good public service and good PR. Clubs in the SE MI area, if you're not already with it, the S.E. MI V.E. Council needs your support. They publish a bulletin periodically which includes a listing of dates and places for exam sessions that have been registered with them—invaluable for coordination purposes and for "where can I try next" info for unsuccessful candidates. The schedule can be reprinted in club bulletins. FCC rules require public notice of VE sessions, and the council's schedule is an easy way to meet the requirement. A line dropped to Box 337, Wyandotte, MI 48192 or a call to Stan, K8SB, at (313) 676-6248 will get you full details. July net summary (QNI, Tfc, Sess.): QMN 611 184 58; MITN 571 170 31; MACS 524 89 31; UPN 1005 70 35; MNN 253 64 57; GLETN 536 49 31; WSSBN 709 36 31. Traffic: KA8CPS 457, W8QHB 258, NJ8R 123, N8AHA 87, K8GXV 72, WB8SIW 69, WA8DHB KA8VOZ 63, K6HAP 52, N8CNY WD8RHU K8UPE 45, N8EXS W8IHX WB8YDZ 44, WB8MTD WD8OUO 43, W8SCW 38, WD8KQC 29, K8OCP 27, KB8GT 26, W8YIO 25, WD8PAF 23, WD8EIB 22, WD8MJB 18, K8EQO 17, W8VIZ 16, W8RNQ 11, K8BXH 10, WA8MVH K8ZJU 5, WB8ITT W8URM 2.

OHIO: SM, Jeffrey A. Maass, K8ND—

NET	QNI	QTC	Sess.	Time(Local)	Freq.	MGR
BN(E)	203	111	31	1845	3.577	N8EVC
BN(L)	225	110	31	2200	3.577	K8TVG
BNR	170	77	31	1800	3.605	W8EK
BSSN	513	318	61	0945, 1900	3.873	K8OZ
ONN	211	47	31	1625	3.708	WD8KBW
OSN	309	103	31	1810	3.577	N8AEH
OSSBN	1990	752	93	1030, 1615, & 1845	3.9725	WB8JGW
OSSN	193	86	31	0845 M-F	3.577	KA8GJV
				0800 S-Sn	3.577	KA8GJV
OSMN	80	14	11	2100	50.16	WD8CTX
Ohio Section ARES Net				1500 Sun	3.875	WD8MPV

Hamfests for October: Marion Ham Fiesta, October 26. As hamfest season begins to wind down in Ohio, hamfest sponsors should make a point of sending me notice of your 1987 hamfest as soon as possible so that it can be added to my schedule. I distribute copies of my hamfest and convention schedule from the ARRL booth at hamfests and by including copies with my correspondence. If I don't know about your hamfest, I can't promote it! Exam sessions in October: Mentor, Oct. 4; Maumee/Toledo, Oct. 11; Akron Oct. 25; Marion Oct. 26; Elyria, Oct. 26. Contact me for details. The Simulated Emergency Test (SET) will take place in October, with the Ohio Section planning a statewide disaster for your local ARES organization to use as a central theme for your local SET activity. Your EC has details; plan on a 24-hour event! The SET is our opportunity to practice what we have learned in the past year and to learn new lessons which will serve us well when we face the real thing! Please allocate your weekend to allow you to play a part in upholding Amateur Radio's obligations for remaining prepared for communications emergencies! On July 8, 1986, a train carrying toxic materials derailed in Miamisburg, Ohio, and for 99 hours Amateur Radio Operators provided vital communications services for governmental and service organizations who were involved in the resolution of the ongoing hazard and in evacuating the area's residents to safe locations. 357 Amateurs participated in this communications emergency, and the national publicity generated showed the value of radio amateurs who are properly prepared and who have established good working relationships with local served agencies. Ohio District 3, under the leadership of DEC Ron Moorefield, W8ILC, was presented with a plaque in appreciation of their excellent efforts in preparing for disasters. Congratulations to all who participated in the Miamisburg effort! Affiliated Club Coordinator Joanne Solak, KJ3O, reports that the Ohio Section now has 10 ARRL Special Service Clubs (SSC), and two have recently completed their annual review to continue in this prestigious role: the Triple

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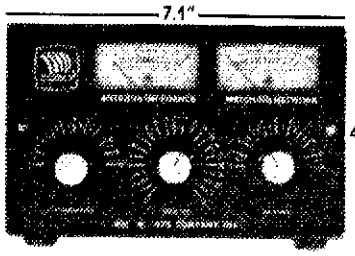
KDK FM 240	279.00



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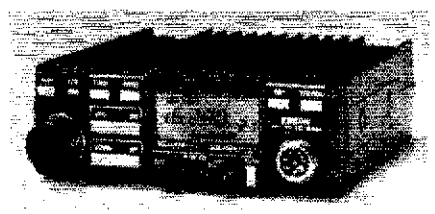

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50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
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States RAC (TSRAC) and the Portage ARC: Congratulations! For a no-obligation package of information about the SSC program, contact KJ3O! I am saddened to note that Richard Smith, WB8HMI, became a Silent Key on August 5. Name badges for ARRL Field Organization appointees (ORS, OO, PIA, ATC, OES, EC, etc.) are now available: drop a note to me and I will send you an order form. Chuck, NC8Q, Net Manager of the Dayton Area Traffic Net (DATN) gives four steps which are necessary to prepare properly for a communications emergency. In this SET month, they bear repeating: 1) Learn standard procedures: 2) Practice them: 3) Practice them: 4) PRACTICE THEM! See you in SET! Traffic: WD8KFN 333, W8JMD 288, WA8DYS 252, K8OZ 228, W8BO 218, K8TVG 214, KD8KU 204, WB8JGW 193, KD8FW 182, W8QZK 177, KA8KHS 167, KE8BE 166, W8SKP 163, K8ND 161, N8EFB 158, N8HBI 139, KA8GJV 124, N8GEC 122, K8JDI 116, N8EVC 109, WA8SSI 100, W8FPA 99, WD8KBW 96, N8XX 94, K8CMR 91, KF8J 90, N8AKS 82, KV8Q 80, KA8CGF 76, W8EK 76, NC8Q 72, KA8UYM 71, KC8YV 70, WB8MEK 66, N8AEH 65, WB8KWC 65, N8FPH 59, N8FWA 55, WA8HGH 55, K8BXT 49, W8DHD 45, KA8TNT 44, NF8B 42, KC8UZ 39, WD8JYE 37, NE8X 36, W8WEG 34, KJ3O 31, WB8BWY 28, K3RC 28, N8FBE 26, KV8M 26, WD8MPV 24, KC8D 23, KA8OQF 23, W9SWM 23, K8IOW 22, WA8HED 20, W8ZOL 19, KC8WH 18, WB8HHZ 16, KA8ILZ 16, NR8C 15, WB8KWD 15, WD8QZM 15, WB8RSM 15, NK8B 14, NK8C 14, WB8DMF 14, KD8WH 14, KBEF 13, KD8XL 13, N8GOB 12, NF8L 12, N8CW 11, WD8OYK 11, KD8WI 11, KD8IC 10, WD8IKC 10, WD8MIO 10, WB8MRL 10, KA8RIX 10, K8VOY 10, WD8CTX 9, WB8YFD 9, WD8ATN 8, K8DXZ 8, WB8HL 7, KA9DRR 7, WB8GDM 7, W8UQY 7, N8AJU 6, N8CJS 6, WD8CSP 6, W8RG 6, KA8SON 6, WD8DKO 5, N8GSM 5, WD8CKK 4, KBCKY 3, KA8VET 3, N8GID 2, N8GIY 2, KA8ZRH 2, K8EEN 1, N8HBF 1, KA8MFG 1, KA8MFH 1, WD8NED 1, KA8UPR 1, KA8FZH 1, WB8YYS 1. (June) W8PMJ 311, WD8MIO 288, KJ3O 72, NR8L 9, K8BXT 7.

HUDSON DIVISION

EASTERN NEW YORK: SM, Paul S. Vydareny, WB2VUK—ASM: K2ZM. STM: WB2MCO. SEC: AK2E. ACC & SC: N2BFG. BM: WB2EAG. SGL: KB2HQ. TC: KC2ZO. ATC: WA2VGM. NET LISTINGS (QNI/QTC) AESN 3 CDN 550/48 ESS 312/52 HVN 217/40 NYPON 539/299 NYSE 428/221 NYSL 361/215 NYSM 322/197 SDN 304/83. CLUB NEWS: Overlook Mountain ARC and Ulster RACES viewed KD2NE's tape of Field Day; also provided comm. with Red Cross at a fire with W2XL, W2MU, N2FS, KD2NE, WA3AFS, WA2RUW, WB9AZV assisting. Rip Van Winkle ARS heard KA2MYJ discuss the aspects of traffic handling and NTS. West ARA welcomes new members KB2ANV, KZ1Y, W2ENT. Yonkers ARC is working on plans for their electronics fair scheduled for Oct. 5th. From AK2E-SEC-9 out of 12 ECs reporting and all DECs. Special thanks to WB2JJE EC Rensselaer who has done such an excellent job over the years and has resigned. Welcome to WA2ZYM-new EC. I want to take this opportunity to thank the entire ENY staff and appointees for all their efforts in the past. Your voluntary efforts on behalf of the betterment of amateur radio are greatly appreciated. ENY can always use more help. Positions still open on the cabinet are PIO and OO Coordinator. If you would like to volunteer your time and effort, please let me know. Help is also needed by AK2E for several EC positions. There are appointments such as ORS, OBS, OES, etc. available. We need more stations to help with traffic. The VHF nets require a minimum amount of time-please try to participate when you can. Thank you. July PSHR: WB2VUK KA2MYJ WA2JBO NQ2H WB2EAG K2ZVI KC2TF W2PKY K2ZM. Traffic: KC2TF 201, WB2EAG 164, W2PKY 161, WB2VUK 120, K2ZM 106, KA2MYJ 82, K2ZVI 80, NQ2H 59, WA2JBO 52, N2FTR 16.

NEW YORK CITY—LONG ISLAND: SM, John H. Smale, K2IZ—ASM/ACC: WB2IAP. ASM/VE: W2NL. SEC: KA2RGI. OOC: NB2T. TCC/RFI: W2JUP. STM: WA2ARC. PIO: W2IYA. The following are traffic nets in and around the section:

NLI*	3630 kHz	1900/200	WB2EUF mgr
NCVHF	6 745 rpt	1930 m-f	K2MT mgr
BAVHF	6.67 rpt	2000 m-f	K2YQK mgr
SCVHF	5.37 rpt	2030 m-f	W2GZD mgr
ESS	3590 kHz	1800	W2WBS mgr
NYS/M	3677 kHz	1900	WB2EAG mgr
NYS	3677 kHz	1900/2200	WB2EAG mgr

*Denotes section net, all times are local, please try and check in whenever possible. When you read this you should have received your ballot for the Director/Vice Director election, ask yourself, who do you want to be represented by?, who among the candidates best represents your interests and has listened to your questions and tried to get an answer for you?, who works hardest for the Division?, who have you seen at clubs, flea markets and public service events?, have you seen the candidates lately or does it take an election to get the candidates out?, the future of the Hudson Division is in your hands, every election is a close election, please, vote. LIMARC will continue to conduct examination sessions on the second Saturday of the month at N.Y. Inst. of Technology, Rt. 25A, Old Westbury, in Salton Hall, Rm 2, applicants are reminded to bring 2 forms of I.D., original and a copy of your FCC license, check for $4.50, made payable to ARRL/VEC, 2 pens/pencils and a calculator for the math questions, for further info contact Woody Gerstner, WB2IAP, 42 Mohawk Ave. East Atlantic Beach NY 11561. Gt. South Bay ARC started their Novice and Upgrade classes, there are still several openings for instructors, if interested please call KA2RGI. KB7UV is the new editor for the POLI Parrot (Packeteers of L.I.). He would appreciate any articles to print. The following members of Metroplex were awarded recognition plaques at the May meeting: WB2MGB, K2KLN, WA2DVG. New officers for Radio Control are WA2MHZ Pres., K2VL V.P., K2VYD Rec. Sec., KB2XL Cor. Sec., N2FXG Treas. If you don't see any information about your club or group in this column, please remember I need at least 2 months lead time, names and calls are also appreciated so I can verify any info. Traffic: K2YQK 161, W2GKZ 62.

NORTHERN NEW JERSEY: SM, Robert R. Anderson, K2BJG—ASM (VE liaison): N2XJ. ASM (FO info): N2BFG. SEC: KB2ZM. STM: KA2HNQ. OO/AAC: (Open). ACC: KY2S. PIO: WB2NOV. SGL: W2KB. TC: K2BLA. BM: N2CXX. I am pleased to announce the new special leadership appointment of Rich Moseson, N2BFG, as ASM with duties as editor of a NNJ section field organization newsletter expected to be published quarterly starting later this year. Rich is chairman of the ARRL public relations advisory committee and prior to his move to NNJ was the ACC in the ENY section. Other new appointments are: DEC (Middlesex) KB2HM. Bergen county ECs KA2FBO (Richfield Pk.), Warren county ECs: KU2C (White Twp) and KZ2A (Lopatcong Twp). OESs KB2HM, KU2C, and KZ2A. ORSs: N2DXP. This is an extremely important month for all League members in the Hudson Division. Your ballots for Division Director and Vice Director should be arriving soon, if you haven't already received them. I urge every member to vote. Do it now so you don't forget. The biggest race is for Director, between incumbent Linda Ferdi-

nand, N2YL (running mate her husband, Gary, W2CS) and Vice Director Steve Mendelsohn, WA2DHF (running mate; ENY Section Manager Paul Vydareny, WB2VUK). If you know the candidates, ask yourself these questions. If you don't know them ask your friends or your club president: Who will best serve my interests? Who will be the best leader and the best representative? Find the answers to these questions, then mark your ballot and mail in your vote. Remember, the future of the Hudson Division is in your hands. Congratulations to the following who were newly licensed or upgraded during July sessions conducted by: NNJ VE Board, Bergen ARA, and Others. Novice: B. Biuack, Technician: KB2ADY, KB2AMX, KB2ARK, and T. Kelnov. General: KA2KJF, KA2UXQ, KA2UWB, KA2YCF, and KA2YPD. Advanced: KB2ACQ, WB2YHI, WB2HNE, and WB2NLH. Extra: KA2WPB, KA2ZKD, KC2IO, N2DHP, N2BSF, WA2QZD and WB2KNS. Please note that NJN/L has moved to 3707 kHz allowing novice operators to participate. This change was a recommendation by several NNJ traffic handlers who recently met in an effort to improve NTS operations in NNJ. July Data:

Net	Mgr.	Freq	Time	Sess	QNS	QNI	QSP
NJM	W2HRX	3695	1000	Dy	30	152	89
NJPN	W2CC	3950	1800	Dy	35	329	92
NJN/E	AG2R	3695	1900	Dy	26	186	94
NJN/L	AG2R	3707	2200	Dy	25	103	32
OBTTN	WB2QMP	147.12	2000	Dy	31	204	160
TCETN	KA2SPH	146.685	1930	Dy	31	51	17
NJVN	WB2ANK	146.49	2230	Dy	31	250	131
NJPTN	IP88SI	146.01	WA2SNA-1	and	WB2GWD-0		

NNJ Amateur Radio Public Info Line: 201-735-8550.
SAR/PSHR: N2XJ 154/98, N2DXP 92/62, K2VX 79/85, W2CC 29/ WB2QMP 86/80, W2XD 14/.

MIDWEST DIVISION

IOWA: SM, Rollin Sievers, WB0AVW—SEC: KD0BG, BM: K0IIR, ACC: WB0QAM, PIO: NQ0W, TC: K0DAS, SGL: AK0Q, STM: KC0XL. The annual Des Moines Register RAGBRI event generated plenty of third-party traffic, enlisting the help of many amateurs. Congratulations to all who helped with the traffic and other related exercises. Enjoyed meeting many new faces at the Electronic Fair in Des Moines and the Hamvention at Cedar Rapids. Both had very good programs and of course lots of goodies new and used. Remember the Southeast Iowa Hamfest at West Liberty Oct. 5th. Thirty-eight people associated with the Davenport ARC helped with the July 4th parade in Davenport. The Siouxland ARC did an excellent job reporting the path of the severe weather and the tornado to the local news media. They were commended by the local TV networks. One cannot say it enough: be prepared for any emergency at all times.

NET	QNI	QTC	FREQ	TIME	DAY	MGR
75 meter noon	1078	45	3970	1730	Dy	WB0JFF
75 meter eve.	723	46	3970	2300	Dy	NC0AEF
ICN 12 sess.	46	11	3708	7:00 PM	MWF	NC0J
ITEN 4 sess.	89	33	3970	2300	Sun	KU0BG

TEN Report. 268 messages in 62 sessions. Ia represented 100% by W4JL, KA0ADF, N0CWW, W0FO, K0GP, N0SM, W0SS and W0YLS. The Ia. 75 meter nets sure can use more checkins from Cedar Rapids, Waterloo and the Northeast portion of the state. I have several order forms for badges available for those who hold appointments. Traffic: K0GP 203, KA0ADF 146, W0SS 65, KA0GSA 49, WB0AVW 30, W4JL 29, WB0JFF 17, K0BRE 16, K0EVC 12, W0BW 11, KC0XL 10, K0JGI 5, KA0JPX 4, W0LFF 2. Can use more checkins from C Rapids and Waterloo on the 75-meter nets.

KANSAS: SM, Robert M. Summers, K0BXF—SEC: N0BLD, STM: W0GYH. We are all sorry to hear of the passing of Wilbur, WA0RCY. He joined the list of Silent Keys July 8th. FIELD DAY messages must have taken a back seat this past year, only 8 messages received from clubs participating. I know there were more clubs participating than that! Hope your message did not get lost in the shuffle. Congrats to Chet, ex-KA0PVY now N5XO, a NCS on QKS- SS Wed nights. N0LL reports openings on 6 meters most every day since May 10. Looks like a good Sporatic E season ahead. HBAWATHA ARC operated FD on SOLAR low power only. ANY ONE ELSE? Net activity for JUNE. KSBN QNI 867 92. KPN QNI 365 QTC 27. KWN 1NI 617 QTC 568. KMWN QNI 734 QTC 588. CSTN QNI 1730 QTC 39. QKS QNI 161 QTC 17, a few more of you CW people out there could help this net perk up a bit! Drop in and do a dit/dot. QKS-SS QNI 30 QTC 17. Ks RTTY net QNI 30 QTC 5. New call signs in the Wyandotte County area are N0HAF, KA0WRO, KA0YBQ and KA0YBP. I hope you are all on the air and enjoying the fine hobby of HAM Radio by the time you read this congratulations. KC0XC is planning a Golf Tournament and Comedy show or was it a comedy Golf Tournament??? Traffic: (June) W0FIR 280, W0QBK 285, N0GCC 222, W0FRC 110, W0OYH 68, W0HI 65, K0BXF 59, K5OU 57, N0BZ 50, WA0HOZ 43, W0MYM 20, W0PB 8, W0CHJ 8, N0LL 2, WD0AAO 1.

MISSOURI: SM, Benton Smith, K0PCK—SEC: K9OCU, STM: K0SI, OO Coordinator: WB0RHK, Bulletin Manager: WB0TEG, ACC/PIO: KT5Y, TC: K4CHS. The Heart of America ARC operated a Special Event Station at the Kansas City Spirit Festival July 4. In charge of the station was K0VBU assisted by K0UAA, KS0N and K0UMK. KC0HV and WB8TVV provided the equipment for the station. About 50 QSOs were made on 40 and 20 meters. K0ORB has been appointed Net Manager of the MO SSB Net. Anyone with an ARRL Field Appointment that would like to have an ARRL Field Organization Call-Sign Badge send me an SASE, and I will send you an order form. If your club is planning FCC Exams or any special event send the information to WB0TEG Bulletin Manager, and a Section Bulletin will be sent out to help promote the event or exam. The State Emergency Management Agency conducted earthquake preparedness training sessions around the state this month. The amateur attendance at these sessions were good. State wide training exercises are scheduled for October. Amateurs are going to be a very important part of these drills, so we will need lots of participation from the amateur community. Contact K9OCU, Missouri SEC to learn how you can help. Nets reporting:

NET	Ses	QNI	QTC	Day	Time PM	Freq MHz	Mgr
MON	62	335	117	Dly	7:00/9:45	3.585	K0SI
MOSSB	31	711	86	Dly	8:00	3.963	K0ORB
MEOW	32	344	84	Dly	5:30	3.963	K0DSQ
HBN	23	284	23	Mon-Fri	12:05	3.880	K0DSQ
MITN	21	68	16	Mon-Sat	6:30	3.970	N0BKE
PHE	5	156	9	Mon	9:00	146.49	WA0KUH
ZAEN	7	96	4	Tue	8:00	147.84/.24	NO0E
SLAN	4	285	3	Mon	8:00	146.31/.91	K0WEX
RRABN	28	383	2	Dly	8:00	146.39/.79	KA0LLN
SMARC	4	49	2	Wed	7:00	146.31/.91	WB0TNX
LOZBC	27	297	0	Mon-Sat	6:00 AM	146.19/.79	W0RTL
CMEN	6	99	0	Wed	9:00	146.16/.76	K0PCK
LOZFM	4	66	0	Fri	9:00	146.13/.73	W0RTL
ARESN	5	63	0	Sat	9:00	147.855/255	N0FQW
MOFON	5	30	0	Wed	6:15	222.42/4.02	AI0O
JCCCN	5	19	0	Wed	8:00	148.40/7.00	WB0DZX
LOZCW	3	10	0	Sat	9:00	3.707	W0RTL
SARN	4	52	0	Thu	9:00	146.43/7.03	W0ENW

Traffic: NQ0G 260, K0SI 115, ND0N 108, K0PCK 105, KB0ZL 98, AI0O 87, WA0YJX 86, W0BMA 78, KC0AS 65, K0ORB 57,

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BP-7 425mA 13.2V NICAD Battery
BP-8 800mA 8.4V NICAD Battery
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DC-1 DC OP Pack
Leather Case for IC-2AT
HS10 Headset for HTs
HS10SA VOX Unit for IC-02AT
HS10SB PTT Switch Box

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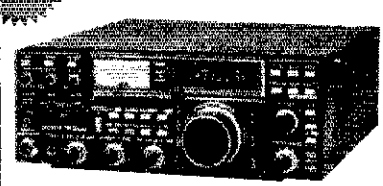
NEW



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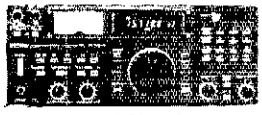

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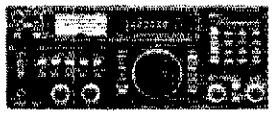

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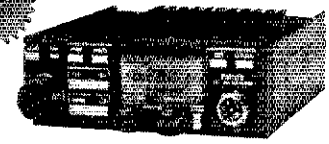

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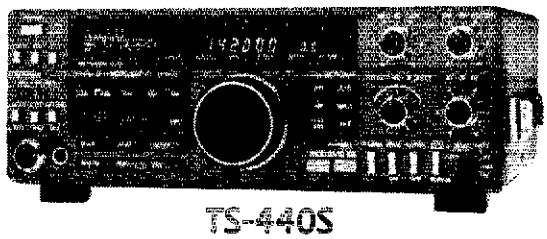

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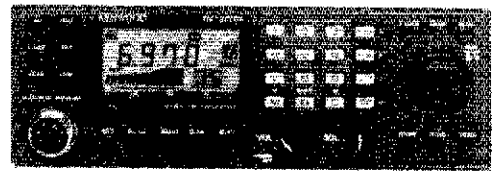

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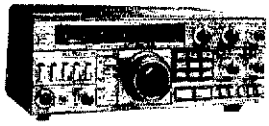

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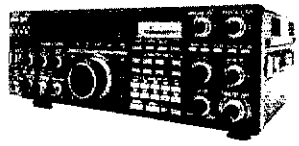

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NEBRASKA: SM, Vern Wirka, WBØGQM—STM: Jerry Kohn, WDØEGK. The Annual Victoria Springs Hamfest, had some very early arrivals this year. WØYFR and WØWKP were the first stations to check into the section nets from the Victoria Springs Park by the middle of July. The Victoria Springs hamfest is the largest outdoor gathering of amateurs in Nebraska and takes place the last weekend of July each year, sponsored by the Central Nebraska Amateur Radio Club, with help from several other clubs across the section. The Seward, Nebraska 4th of July parade received national television coverage this year. Amateurs that helped with communications for the parade in Seward were: WØZOU KDØXB KAØUSO WØOOU KØIBG WBØPKY KAØBOC. The Lincoln Amateur Radio Club was very busy the third weekend of July providing communications for the annual cornhusker state games. The games are an annual event that draw athletic participants from across Nebraska. There are several transmitter hunts sponsored by various clubs and groups throughout the Nebraska section. If you are interested in radio direction finding techniques or would like to sharpen your skills inquire at your local club meetings about transmitter hunts. The skills acquired are very valuable when the need arises to solve an interference problem

NEW ENGLAND DIVISION

CONNECTICUT: SM, Robert J. Koczur, K1WGO—STM: K1EIC. SEC: KA1ECL. BM: K3ZJJ. ACC: KG1M. OO/RFI: NA1I. TC: W1HAD. PIO: KX1B. SGL: K1AH.

NET	FREQ	LOCAL TIME	QTC	QNI	NM
CN	3640	1900/2000	226	250	K1EIR
CPN	3965	1800 m-s	100	282	KA1BHT
NVTN	22/88	2130	62	156	N1BOW
WCN	7818	2030	255	372	WB1GXZ
RTN	1373	2100	40	208	KA1JAN

WHARA would like for the following to appear in this month's column. "Congratulations to Caesar N1DCS, for being recently elected to vice-president of the Tri-State Amateur Repeater council. We feel this is a great step for repeater groups in Connecticut and would like to wish Caesar good luck and success. As a Connecticut director, he did an outstanding job. Keep up the good work." Congrats Caesar. I'm sure you'll do an excellent job. From Mary, WB1GXZ, the Connecticut section had 100% representation to FRN once again in July. I have received many encouraging Field Day reports. It seems that our section was active and enthusiastic this year as always. ECARA even had a bicycle rigged up driving a 12-volt generator and made the required 5 contacts on 75 meters for the 100 bonus points. They also set a new record for their club by making 619 contacts, beating their old record of 600 set back in the 60's. SARC reports good times, good food and good operating for this years Field Day. It sounds as though everyone who participated worked hard and had a fine time. The FCC seems to think that enhanced privileges for Novices is a good idea. Time will tell of course and I am going to keep an open mind about it. I appreciate all of the cooperation I have received from various individuals who have sent information they wanted to see printed in this column. At this time I will ask you to send this material to John Ranon, K3ZJJ, 114 Old Redding Rd., Weston CT from now on. That's all for now. 73s. Traffic: W1EFW 203, WB1GXZ 162, KA1MKJ 160, KA1GWE 154, N1EDD 148, N1DNA 117, K1EIR 101, N1DMV 73, KB1ZC 67, N1BOW 55, KA1K1H 49, KA1BHT 45, K1AQE 44, W1YOL 43, W1WP 33, W1BDN 32, WB1ESJ 13, W1CUH 10, WA1NLD 9, W1QV 6, WB4FDT 3.

EASTERN MASSACHUSETTS: SM, Luck Hurder, KY1T—ASM: K9HI. SGL: K3HI. OO/AA: KA1KF. SEC: KB1PA STM: KW1U. TC: KA1IU. PIO: K1HLZ.

NET	MGH	FREQ	TIME(LOC)/DY	QTC	QNI
EMRI	N1AJJ	3658	1900/2200 DY	266	356
EMRIPN	N1BGW	3880	1730 DY	119	200
EM2MN	KA1AMR	145.23	2000 DY	125	276
NEEPN	K1BZD	3945	0830 SN	6	47
HHTN	WB1CMQ	04/64	2230 DY	142	498
EMRISS	N1CVE	3715	1800/2030 DY	76	185
CITN	KB1AF	145/045	1930 DY	126	312

Congratulations to new Public Information Assts KA1EDY AND KA1LIK who will be helping to spread the word about Amateur Radio via the media. Do YOU have contacts in the media? Contact me if so PIO K1HLZ will be conducting Amateur Radio communications for the Governor's Cup Race as well as for the Tuft's 10K annual Columbus Day Women's race. Section traffic-handlers' picnic hosted by STM KW1U between visits to the vine- yard. Tom McGuire of National Wx Service in Boston gave very interesting talk/seminar to interested Amateurs and explained the need for Amateur assistance during severe Wx situations. WB1CMQ sporting new alias of NG1A-congrats, Fred FCC Amateur Aux. Regional Monitoring Stn reports a severe need for qualified Amateurs to assist with 2 meter monitoring and gathering of Amateur-to-Amateur interference data. Contact me for details on how YOU can help. Congrats to high scoring Public Service Honor Rollers KW1U, NG1A, WA1FCD, N1BGW and KN1K-good show! Traffic: KW1U 635, N1BGW 332, WA1TBY 313 KN1K 295, W1ZHC 272. WA1FCD 269, N1BHH 192, KB1AF 187, NG1A 130, N1CVE 130, KY11 122, K1GRP 111, N1AJJ 97, N1DDC 84, K1SEC 83, KA1AMR 72, K1BA 56, KA1EID 55, N1DVZ 54, KA1LIH 35, KA1ON 30 K1ABO 28, K1BZD 22, WA1FNM 11, WA1SNH 11 KA1LCQ 9, KA1KCU 1. Got suggestions for improvements in the way things are done? Give your Section Manager and Division Director a piece of your mind. 73.

MAINE: SM, Cliff Laverty, W1RWG—ASM: W1KX. SEC: KA8UVQ. STM: AK1W. ACC: KY1C. BM: W1JTH. OOC: W1KX. PIO: KY1E. SGL: K1NIT. TC: K1PV. Sally, KA8UVQ, has announced the appointment of Toby Strong, KB1VZ, as Emergency Coordinator for Hancock County. KA1LUN, Tom Winsor, EC for Oxford County is compiling a list of hams in Oxford, ur assistance appreciated as well as ur volunteer help. W1JTH, BM, reports 3 ARRL 2 Maine 8 propagation on 5 OBS for a total of 29 transmissions. Mid-Coast ran a weekend hamfest at Owls Head. K1HHC directed activities at St Albans Hamfest, and W1OLQ hosted the hamband at Bangor. Merrymeeting ARA sponsors and funds the auto patch for the use of all amateurs under FCC rules. Donations are appreciated. Traffic: WB1CBP 139, AK1W 89, W1RWG 54, W1KX 43, ND1A 23, W1JTH 6, WA1YNZ 17, KA1FIL 16. W1BMX 14, N1BIR 11, PSHR: WB1CBP 90, W1RWG 67. Guess everyone else was on vacation.

NET	SESSIONS	CHECKINS	TRAFFIC	MANAGER
Sea Gull	27	984	188	K1GUP
Acoostok E	5	76	1	WA1YNZ

NEW HAMPSHIRE: SM, Bill Burden, WB1BRE—TC: W1JY. SGL: N1AIX. Club activity continued high during July. I visited the Interstate Repeater Society in Derry. Club president W1HMT is working on affiliation for the IRS and I discussed the process and benefits with the group. The Twin State club in Hanover is moving closer to a working relationship with the Montshire Museum of Science, according to their latest newsletter. I am receiving newsletters from most of the clubs in the section now. If I'm not on your club's mailing list—I would like to be!! KY1N reports that the Mt Moriah Repeater Society

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in Salem held it's third in a series of Volunteer exams with 11 upgrades, including 2 new Novices. The Nashua Area Radio Club newsletter was highlighted in a 73 mag article written by N1BLH—congrats to NF1N and newsletter staff. Well, we finally got the NHARA newsletter mailed to all ARRL members in the section. Thanks to KI1M for all his help. I learned a lot about the process of distributing a large volume of newsletters (approx 1000). I'll be looking for comments and input from you—next time we'll avoid the time-critical material. From the SEC—the Rockingham County ARES net has been reactivated on the 25/85 repeater in Derry on Thurs nights, thanks to efforts of EC W4PAS and DEC KB1XI. K1ACL and KB1XI are working on the realignment of their districts so as to complete the coverage in the seacoast area. W1TN, our STM, reports that July was a very busy month for traffic handlers with four people making the PSHR—congratulations to KA1HPO/T, N1CPX, N1AKS and K6UXO for an outstanding job! If you are on packet, look for these section reports on the local bulletin boards along with comments and current information on section activities. A reminder—SET is just around the corner—plan now!! TO CLUB PRESIDENTS—watch the next issue of the NHARA state newsletter for a listing of program ideas for your club for the upcoming year.

NET	TIME	FREQ	MGR
GSPN	6:30 PM	3870	WA1YZN
NHN	7 PM	3547	N1NH
GSFMS	8:30 PM	146.94	K6UXO
GSFMN	8:30 PM	146.655	K6UXO

Traffic: NHN 165, GSFM 158, GSPN 62, MSOVTP 14, N1CPX 362, N1NH 294, W1PEX 189, W1QYY 154, K6UXO 119, W1ALE 74, K1PQV 63, N1AKS 59, W1TN 54, KK1E 54, NE1J 50, W1FYR 46, WA1YZN 42, K1TOY 37, KI1M 26, KB1XI 24, KA1HPO 23, WB1GXM 16, KA1LMR 11, K1ACL 11, KA1GOZ 8, (June) KA1LBH 68, K1PQV 49, W1LQQ 7.

RHODE ISLAND: SM, John (Bob) Vota, WB1FDY—Tnx to Dave, N1BED, for all his work putting together the ALL R.I CLUB SPECIAL EVENT STATION that was set up on the State House Lawn Sept. 23, 1986. Tnx to all the Clubs and Operators that worked the station. A Special Tnx to the Governor of our State for Proclaiming Sept. 23, 1986 as Amateur Radio Day. Another good day at the 76 Auction; hope you all got some good buys. There will be some changes in the Section Staff, I will send out a newsletter on this soon. No mail this month so cul. Traffic: KA1JXH 191, PSHR 103, W1EOF 213, WA1CRY 54, EM RIPM N1BGW Net very active. Tnx to all the traffic handlers.

VERMONT: SM, Frank I. Suitor, W1CTM—ASM: KD1R. STM: AE1T. Special tnx to KD1R for service to all of us over last 2 yrs & for helping my transistion into being ur SM. RALPH has agreed to continue his service by accepting the job of ASM. Section activity for July was fast & furious including the following: Numerous activation of the ARES wx net resulted in providing support to the NWS/RED CROSS. Key players in this activity were: NB1A, W1BRG, KA1CSB, WB1FWR, K1WML plus many local & vacationing hams who did a super job! NWS says "WELL DONE." Western Mass Section asked us to help with the Yankee-Rowe exercise held on 6/11. VT Section participation included utilization of NTS plus vhf/packet to keep EOCs informed of the exercise status. Tnx to KT1Q for his summary, plus list of participants: WA1MAG, WA2SPL, KA1DLK, KT1Q, W1JLZ, WB1ABG & WB1AJG. The annual VTN picnic was held at W1KRV's QTH with 35 attendees. Briefings on net operations & packet were held & PS awards given to KT1Q/WA2SPL. Silicon Jct ARC had a record setting performance of 2745 QSOs to help put VT on the Field Day map. CVARC also did their normal outstanding job on FD, complete with K1KMB's famous chili. BARC & CVARC continue to increase the ham population. The latest welcome is to: Techs KA1OOI, N1EFH, KA1NZA, Generals KA1NOU, N2FVM, N1EEV, Advanced N1DUX. NEW class started on 9/10 at Burlington Red Cross but will take late registrations—See me for info. VTN ops had a 91% rate on NTS 1rn/c3. AE1T/KT1Q take a bow! VE exams scheduled for 10/18 in Montpelier-contact K1HKI. New digipeaters are operational W1KOO-1 & W1BD-1. I am looking for anyone interested in the following Section jobs SEC, PIO, TC & ACC. If interested, pse contact me. Keep ur rig on 34/94 on MWF at 20:00 for news/social hour, plus 11:00 on Sundays for ARES net. Coming next month will be the BARC hamfest rpt. Net Rpts: VTN 31/214/188, CAR 27/742/62, GMN 27/368/40, VTPHN 4/67/6, VTSBN 21/193/35, VTRFD 3/18/1 TSEN 5/59/11. Traffic: KT1Q 534, WA2SPL 382, AE1T 152, N1DHT 82, W3OQ/1 47, WA1JVV 10.

WESTERN MASSACHUSETTS: SM, Don Haney, KA1T—OO/RFI: N1CM. PIO/ACC: K1BE. SEC/SGL: WB1HIH. STM: W1UD. TC: KA1JJM. The severe weather net on K1FFK and data collection on other repeaters had 5 sessions in July and were especially busy in early August as several storms generated tornado activity. Fortunately, most of the section saw no damage but information provided to National Weather Service was valuable in tracking storms. KA1JJM-2 packet BBS provides NWS forecast and alert information for western Mass and eastern NY. It is accessible on 145.05 via the KA1NEQ and KA1JJM-1 digipeaters. Pleased to appoint N1DMU as Net Manager of West Mass Phone Net. Hope to see many of you at New England Convention at Boxboro on October 18-19. This is the chance to get with hams from all over the Division for technical programs, flea market, and two days of eye-ball QSOs. And NOBARC club auction is the next week on October 26 at 7:00. PSHR: WB1HIH 103, N1DMU 100. Traffic: W1UD 152, KA1T 115, N1DMU 99, W1KK 40, WB1HIH 25, WA1OPN 7, W1ZPB 3.

NORTHWESTERN DIVISION

ALASKA: SM, Jim Moody, Jr., NL7C—SEC: KL7JIM. STM: KL7T. ACC: AL7AC. TC: AL7L. NM: KL7GID, KL7AF, KL7JKW DEC: AL7AC, KL7WM, KL7JFT. Everyone enjoyed the visit by the Division Director, W7QGP, during September. Ms Lewis was able to meet and visit with as many of the section members as possible during her annual visit to the section. September was also the month of the Arctic ARC and Anchorage ARC Flea-Markets. Both are annual events and provide the opportunity to meet and greet, besides the exchange of equipment. A big "Thank You" to all who made the flea-markets the events they were this year.

IDAHO: SM, Lem Allen, W7JMH—CLUB NEWS: Pocatello Club has Saturday Coffee hour at Butterburs at 9 AM—drop in and meet the gang. Boise Club has Coffee hour at 9:30 AM Tues at the Pantry, near K-Mart, Wednesday 11 AM lunch at North's, Fairview and 5- mile—all hams and XYLs welcome. WIMU Hamfest was sponsored this year by the Idaho Falls Club and was a great success. ARRL MATTERS: Rick Palm, (HQ), Lys Carey (HM DIR), Mary Lewis (NW DIR), Rush Drake (NW VD) attended WIMU and were part of the program. A big TNX to them! ARRL VE Exams were given by W7JMH, WA7USI, WA7ZZY, KE7MO, KB7JZ, with 18 testing. Congratulations to the following, who upgraded: Angela Babb, Jason Smith, Lorraine Ayre, KA7YZA, KA7ZGZ, KA7UAY, KA7MRC, KA7OGK, KE7MS. PEOPLE AND THINGS: W7JMH has a new Corsair. N7BI visited KD7HZ, W7JMH, attended AF MARS MTG in Boise. N7IFD visited EXPO,

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AFA-1 Rcv audio proc DEMO 49 m
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2-BQ Spkr/Q-mult $ 29 f
R-4B Ham Rcvr 179 m
R-4C Ham Rcvr 249 c
MS-4* Speaker 19 mv
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4NB Noise blanker 49 m
FL-500 500 Hz filter 35 m
FL-1500 1.5 KHz filter 35 m
SC-2 2m rcv conv 49 w
SC-6 6m rcv conv 49 wf
CPS-1 Conv ps 19 mwf
SCC-1 VHF calib 19 wf
CC-1 Conv console 29 w
R-7A Receiver 999 c
MS-7 Speaker 29 v
T-4X Transmitter 149 v
T-4XC Transmitter 219 mc
TR-4 Xcvr 189 mc
TR-4C/NB Xcvr 249 m
TR-4CW Xcvr 289 m
RV-3 Remote VFO 59 f
AC-3* AC supply 49 mf
AC-4* AC supply 69 mwfcv
*Not sold separately
TR-5 Xcvr 329 m
TR-5/1.8 filter 359 v
TR-7 Xcvr 469 c
TR-7/1.8/6/aux/nb 589 v
TR-7/300/6/aux/nb/fan 599 m
PS-7* Power supply 149 mfcve
*Not sold separately
PS-75 Power supply 89 m
TR-7 service manual 25 m
MN-2700/B-1000 Tuner/balun 229 w
Theta 9000E Terminal 369 mf
729SRD Microphone 19 m
7077 Desk mic 29 mv
UV-3 (2m/440) FM Xcvr 389 m
ETEK
FR-4 Dig disp; Drake C-line $ 49 m
ETO
Alpha 374A Linear 1569 c
HAL
ARQ-1000 Error terminal $499 m
CWR-6700 Rcv terminal 149 f
ICOM
IC-720A Xcvr $529 mf
IC-730 Xcvr 429 f
IC-730/FL-30 filter 459 m
IC-730/narrow cw filter 459 m
IC-730/2 ssb/2 cw/marker 569 m
IC-740 Xcvr 499 m
IC-740/FL-44/FL-45 599 f
IC-751 Xcvr 799 m
IC-751 w/PS-35 int ps 899 f
PS-15 Power supply 99 f
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IC-27A 2m FM Xcvr 279 c
IC-27H 2m FM Xcvr 319 m
IC-255A 2m FM Xcvr 129 w
IC-37A/voice syn 220 FM 369 m
IC-451A **440-450** Xcvr 469 m
SM-6 Desk mic 25 m
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KPC-2 Packet DEMO $179 v
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TS-130SE w/fan 429 f
TS-130SE/fan/ssb filt 459 f
PS-30 Power supply 99 m
AT-130 Ant tuner 99 m
VFO-120 Remote VFO 99 w
TS-180S/DFC Xcvr 399 m
VFO-180 Remote VFO 59 m
TS-430S Xcvr 569 c
TS-430S/fm/ssb filt 629 f
TS-430S/cw/ssb filts 629 c
TS-430S/fm/cw/ssb filts 659 w
AT-230 Ant tuner 129 m
TS-520 Xcvr 349 f
TS-520S Xcvr 369 mfc
TS-520SE Xcvr 399 mw
DG-5 Dig display 99 w
TS-530S Xcvr 469 m
TS-530SP Xcvr 639 m
TS-660 15-6m Xcvr 469 m
TS-820S Xcvr 469 mfc
TS-830S Xcvr 589 m
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DFC-230 (new close-out) 169^{95} m
VFO-230 Dig remote VFO 199 mw
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R-1000 SW receiver 269 mw
R-2000 SW receiver 369 f
R-2000/VC-10 VHF conv 449 mw
R-820 Receiver 399 f
TR-7625 2m FM Xcvr 169 m
RM-76 Microproc control 49 m
TR-9130/TTP 2m Xcvr 389 e
TH-21AT/BH-3 2m HT DEMO 179 v
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444 Desk mic wired 4-pin $ 39 m
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208A Notch filter 19 f
225 Power supply 89 m
570 Century/21 Xcvr 189 v
276 Calibrator 19 m
579 Century/22/226/679 319 m
979 Power supply 69 f
540 Xcvr 249 mv
240 160m conv 69 f
545 Omni-A Xcvr 249 m
546 Omni-D Xcvr 349 c
546C Omni-D series C 499 m
546C/2 cw filters 549 m
560 Corsair Xcvr 679 e
580 Delta Xcvr 369 mf
263 Remote VFO 139 e
252G Power supply 89 m
252M/O Power supply 79 m
255 Power supply 119 m
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FT-101ZD Xcvr 469 fv
FT-101ZD Mk II Xcvr 529 f
FT-101ZD Mk III Xcvr 529 v
FT-101ZD Mk III/cw filt 559 m
FV-101Z Remote VFO 59 mc
SP-101B Speaker 19 m
FT-301 Xcvr 229 f
FT-301AD Xcvr 329 f
FP-301 Power supply 99 f
YO-301 Monitor scope 169 f
FV-700DM Remote VFO 89 m
FT-902DM/cw filt Xcvr 729 v
SP-901P Spkr/patch 49 v
FV-901DM Remote VFO 169 fc
FT-102 Xcvr 589 f
FP-107E External ps 89 m
FT-707 Xcvr 369 c
FTV-707 Xvtr w/no module 89 m
FTV-707 Xvtr w/2m module 199 m
FT-757GX Xcvr 589 m
FT-757GX DEMO fact warr 699^{95} mv
FP-757GX Power supply 99 m
FP-757GX PS DEMO 157 v
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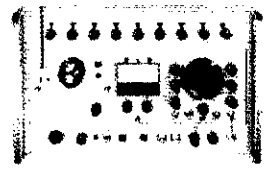

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N7AHQ moving to Florence, OR. N7BHL made BPL—congrats!

NET REPORTS:	Fq-Time	Sess	QNI	QTC
FARM	3937 Lsb 8P Da	31	1757	93
ID CD	3990 Lsb 830A M-F	23	654	50
IMN	3935 CW 9P Da	31	299	131
NW TFC	146.38/98 FM 730P Da	36	760	409

GENERAL: When using a repeater, train yourself to pause briefly before answering, to give someone else a chance to break in with possible emergency or urgent traffic—yours may not be the most important message of the moment. Traffic: N7BHL 715, W7GHT 127, KE7MO 105, W7JMH 114.

MONTANA: SM, Les Belyea, N7AIK—New officers for the Treasure State chapter of the QCWA are-pres, K7GK, VP-W7BOZ, sec'y-W7BC, historian-W7JMX. Upgrades reported: to Extra-WB7WVD, KA7FVQ, to adv-N7GDU, KA7WYU, N7IBG, N7IBJ, N7GXW, to gen.-WB7WVE, to tech-KA7VIF, KY7I of Charlo is campaigning hard for the state legislator, good luck. KB7BJ and N7BJS are new parents of a baby girl. Call changes: KA7YYH to NV7W, KA7BRB to NV7Y. PSHR: KF7R, WB7WVD.

NET	SESS	QNI	QTC	MGR
MTN	31	1631	169	KF7R
MSN	4	56	0	K0PP
IMN	31	309	134	WA7GQO

OREGON: SM, William R. Shrader, W7OMU—ASM: KZ7T. STM: W7VSE. SEC: N7CPA. PIO: KC7YN. SGL: KA7KSK. STC: N7ENI. ACC: KB7CC. OO: N7SC. RPI: AK7T. Upgrades: W7LBH, W7SS, KD7YB, WB7TPR, WA7LNR, KB8CY, W7ENW (Extra); WA7FRR, KA7FNF, N7IAR, W7VQS, N6FDP, KA7VGI, KA7TGY, N7HWV, KA7SON, N7FLE (Advanced); KA7YWS, KA7RAG, W7RGN, KA7VZF, KA7WXH, N7GRB, KA7WUA, KA7VVL, KA7OQQ, WN7KFZ, KA7WYF, KA7CRY, KA7SPZ, KA7SSS, KA7YLG, KA7YIL, KA7YTC, KA7WOH, KA7YLY, KA7VWR, KA7YHR, KA7YCD, KA7VTQ KA7ZCE, KA7UNW, KA7YVR, KA7YVQ, KA7GFZ, KA7YQR, KA7WZW, KA7VQD, KA7WTZ, KA7YMX, KA7ECY, KA7YLQ (Tech). It looks like everyone was working overtime, what a list. CONGRATULATIONS to ALL! Special note, KA7VZF is 12 years old. Randy, KZ7T, has been appointed as Assistant Section Manager. K0VIZ and KA7ECG have been appointed as VHF and HF awards Manager respectively for the McMinnville ARC. They will handle ARRL awards in their area. Umpqua Valley ARC has recently been affiliated with ARRL. New lead for the Portland ARC are Pres: WA8DIM, V Pres: KA7UQM. Sec: WA7VTD, Treas: W7VBH. KA7IPS was chosen as Employee of the Month at McMinnville Burger King. K7JF winner in OTVARC Rusty Key Nite. Mt Hood 145.27 repeater used in lost hiker search, WA7TIC was liaison. Traffic (JUN/JUL): W7VSE 505/478, K7OVK 167/149, W7ZB 155/201, N7FXJ 140/188, N7ELF 120/ , N7BGW 62/57, W7ODG 47/118, WA7VTD 18/18, W7LNE 14/16, KA7AID 30/15, KA7EEE 10/7.

WASHINGTON: SM, Gene Sprague, KD7G—OOG: N7IL, STM: KD7ME. TC: W7BUN. SEC: N7DRT. ASM: KR7L. ASM(East) & ACC: KC7PH. Congratulations to WA7LQV the winner of the ARRL International Humanitarian Award Design Contest for the "hands clasped in friendship" design. Column survey: Do traffic counts of individuals or nets have interest to anyone other than the participants? Are you interested in what the ARES has done, or the many other Amateur groups' accomplishments? Those fine Amateurs who have done these important good deeds already know what they have done, but is it of interest to the readers? Please let me know how you feel about some of the questions above or some other item you would like to comment on, concerning the column. Lets make this column worth the space it occupies. Present your ideas, comments, short articles, etc. GOAL: We need to get our good deeds/accomplishments known to the general public: to get them into the newspapers and on TV. We know how good we are but does the majority of the public? There are many spin-offs with good PR, such as new Amateurs, favorable public image of our service, etc. If you agree, I am looking for a Section Public Information Officer (PIO) who can get this important job done. By the time you read this the Hamfest season will be over for '86, but not too soon to give me the dates, locations etc. for next year, so we can get an early start on informing everyone of your events in '87. Starting this month a question of the month will become a part of the column. QUESTION: What counts as a piece of traffic handled on nets? Answer next month. WB7VSZ reports the Spokane County Amateur Radio Services participated with 21 members on a simulated disaster. These folks do great work! NETS: May, June and July activity.

Net	Freq	Time(local)	QNI	QTC	MGR
WIN	3987	0930			W7GNR
WEN	3987	1830	(Mon)		KD7G
NTN	3970	1200	3587	287	W7UU
EWTN	146.64	1730/2230	178	158	WA7CBN
PSTS	146.92	1730/2230	401	198	W7IEU
WARTS	3970	1800	8555	690	W7IGC
WSN	3590	1845/2145	1484	513	W7GB
NWSSB	3945	1830	1982	130	W7VDR

Note: Refer to the ARRL Net Directory for other nets. Also the start times may be earlier as band conditions change this fall. July '86 Traffic: WB7WOW 269, W7LG 255, W7IGC 168, W7GB 136, K7GXZ 133, K7SUX 100, N7GGJ 97, KR7F 89, N6EQZ 55, WA7CBN 44, W7IEU 40, W7APS 38, K7AJT 26, K7CLL 16, W7LBK 12, K7OXL 9, KA7AEF 6, N7FXM 5. No individual scores: KR7L, KD7ME. Congrats to all new Amateurs and up-grades, 73.

PACIFIC DIVISION

NEVADA: SM, Joe Lambert, W8IXD—New Field appointments: OBS: AF7I. BM: WB5PTO. ARES in S. Nev conducting organization and training meetings & nets. Thanks N7GXD, NK7N, WB5PTO, W4HMV. I attended July TARA Board Meeting and enjoyed their enthusiasm & hospitality. Sorry to hear of lightning damage to their repeaters but by this printing should be back up & running. LVRAC's 440 repeater continues to attract new users. Don't forget their meetings on Sun. 7:30 PM at Nev Power Bldg. SNARS reports a very successful garage sale. I attended an Informative Division cabinet mtg. in July. N7ALX is a real go-getter—operating portable VHF from 3 remote grid squares for contests; upgrading to Extra and being elected VP of FARS. Best wishes to N7GWR who has gone to Saudi Arabia for a year! FARS has been approved as the first "Special Services Club" in Nev. Hope to see you all at HAM-WEST CONVENTION in L.V. Nov. 7-8. Traffic: K7HRW 4, WB5PTO 54.

PACIFIC: SM, Army Curtis, AH6P— STM: KH6HIJ. SEC: KH6B. ACC: KH6BZF. PIO: KH6IJ. ECs: Hawaii-WH6BDH; Kauai-KH6S; Maui-KH6H; Oahu-KH6NP; Aloha and hafa adai to all of the Pacific. Hurricane Estelle gave the emergency circuits a good workout once again. Wave damage to the Puna coast, and lots of rain, but that was all. KH6MX, WH6AKB, KH6OB & KH6WA provided comm for Jr. Tennis tournament on Maui. AH6GG now on packet from Kula. AH6GJ spearheading efforts to put the '94 repeater back on the air. KH6H/R will QSY to 147.62/.02 by the time you read this. W6ORS just back from the big island to the east. Got a ride to San Diego via the Navy. Your SM has just moved to a new

QTH here in Hilo. Starting all over with antennas is a lot of work!! Traffic: KH6S 47, KH6H 24.

SACRAMENTO VALLEY: SM, Bob Watson, W6IEW—STM: WA6WJZ. SGL: N6IG. ACC & TC: W6RFF. DEC North: KF6KJ. DEC Sierra: KA6GHI. SECTION NET: First Sunday each Month, 8 PM, on 146.085, input up, Yuba/Sutter repeater WD6AXM/R. Net Control—W6IEW or W6RFF. The response has been underwhelming to say the least. Please remember the net and CHECK IN. For those that have asked me how to get publicity for their clubs in QST, Club Program Manager Leo Kluger, WB2TRN, tells me there will be published guidelines of what they are looking for. It is not easy because so little space is available for clubs, but carefully following the guidelines should help. River City ARCS is again holding their very successful license classes—contact Lyle Aufranc, WA6RPB, for info. Novice classes are to be given by Sierra Foothills ARC— contact George Steinkamp, KA6UDW. ORS and OES Vic Longmore is signing a new Advanced Class call—KI6GW (formerly KB6CFX). New Extra Class Calls: Dennis Gregory, WU6X (old KF6FM) and Josef Treiber, WU6J. There have been many recent reports of illness or operations among hams in the section. By the time this appears, it is hoped that all are recovered. Without details, those involved are: Ed Merritt, KF6EN; Cecil Gronvall, WB6ROS; Former SM Ron Monet, N6AUB; Nevada County ARC President Loren Young, WD6BZQ; Aloha Anderson, KB6LUX. Traffic: WB6CLD 265, N6LUY 256, WA6WJZ 185, N6CVF 180, K6SRF 74, WD6BZQ 60, W6RFF 41, WD6EEZ 18, KI6GW 9, WA6ZUD 7, WB6SRQ 4, WA6ERZ 4.

SAN FRANCISCO: SM, Bob Smith, NA6T—Pac Div Meeting at MARC Clubhouse was well attended by SF Section. Badge Letter es Applications are in the mail—if you are in the Field Organization and didn't receive yours notify me. LPH Ladies Aux. was out in force of FD '86 with a 6 YL FD effort, (ages 25-74 yrs.) what is this, ERA or Women's Lib? SCRA beat the pants off REXDA. Did they read the rules better than the local contesters? The VE program will be active at SCRA's Hamfest tnx to the able VE Team from Sonoma County. SFRC's FD was a two-fold success—a good time and good PR. All the visitors to the S.S. Jerimah O'Brien received info on both AMATEUR RADIO and the SFRCI RACES is off and running in Sonoma County with five training classes county wide tnx to the new "PENTAGON" leadership. Humbolt County now has TWO digipeters in operation. KA6NEO-1 (145.01 Horse Mt.) and N6IJB-1 (145.03 Rattlesnake Ridge,S. Humbolt Co.). Sorry to hear that Mel, K6TWJ, is a Silent Key, he will be missed by all of us. Traffic: W6PW 118, NA6T 35, KK1A 394, K6TP 66.

SAN JOAQUIN VALLEY: SM, Charles McConnell, W6DPD—SEC: WC6U. STM: N6AWH. TC: WA6EXV. ACC: N6ECH. Asst. SMs: W6TRP and K6YK. This is the month for the Simulated Emergency Test. Contact your Emergency Coordinator for more information on the test for your area. K6QOK, WA6LES, and W6PDD are Silent Keys. N6IWD has retired and left Mono County. WD6AFC is Extra. KB6LWZ is Tech. KB6NGC, KB6NAF, KB6NAL, and KB6NAM are new Novices. KB6LWZ is N6NYG. WB6FAP is WU6K. WA6JIH has an IC-02AT. W6JPU, N6MZF, and W6GR have TS 440s. WA6YAB has a TS 430S. WG6Q and KI6BT are OCWA members. The 1989 ARRL Diamond Jubilee National Convention will be held in Las Vegas. Congrats to K6ITL on his appointment as Vice Director. Traffic: N6AWH 180, N6MCY 29, WA6YAB 8, N6MXG 6, W6DPD 4.

SANTA CLARA VALLEY: SM, Glenn Thomas, WB6W—SEC:(vacant). TC: WA6PWW. STM: N6JLJ. PIO: WB6NLA. ASM: N6JQJ & NS6S. ACC: W6MKM. BM: (vacant). OOCORD:(vacant). Congratulations to our new Vice Director Knock, K6ITL! N6LJZ reports that the 146.895 ARES repeater on Crystal Peak is once again QRU. . . note that the SCV section HF net is every first Monday on 3985 KHz +/- QRM, check it out! . . . the Gilroy ARES group is helping the city of Gilroy set up a communications van and an operating position in the city EOC, good work guys! . . speaking of Gilroy, thanks to all of you who participated in the famous Gilroy Garlic Festival. Special thanks to the Gabillan ARS for coordinating it and also to WB6OML for assistance in staffing! . . . K6FS is working with the city of Menlo Park on an MOA between the city & ARES. . . WD6EKR reports that the city of Gonzales is planning a disaster drill that will include ARES/RACES, CDF, city fire & police, and other agencies. . . a number of us participated in the CW portion of the Armadillo run. WB6MLC sez, "It's difficult to send CW with a bug when you're mobile on a dirt road going over the mountians!" . . . The San Jose State ARS would like to make contact with other university clubs, contact WA6PGP if you're interested. . . both SPECS and SVECS held very successful breakfasts . . the EMARC group heard a talk by Jerry Abbenis about the Heathkit memory keyer . . Keep those club newsletters coming! OO reports: K6AYB. Traffic: W6YBV 132, W6KZJ 43.

ROANOKE DIVISION

NORTH CAROLINA: SM, Rae Everhart, K4SWN—MAJOR NEWS STORY THIS MONTH: Amateur Radio License Plate Bill, HB-952, is now LAW. Effective date Oct. 1. As of this writing, details are being worked out by DOT who will implement the law. Special thanks to KE4ML, SGL and KI4AN, lobbyist for all amateurs, and to Lt. Gov. Jordan, Sen. Rand, and Rep. Jeralds for guidance of bill through the Legislature to become reality. To W4LPL and WA4YMM who started the ball rolling in the House in '85. The Senate passage was a combined effort on everyone's part. All information I have shows that All votes were UNANIMOUS. Now let's get your callsign on license plate for immediate identification in an emergency. Make plans NOW for the SECTION EMERGENCY TEST—SET, third Saturday this month. Lexington BarBQ Festival Special Events Station, WD4BBQ, Oct. 25. KB4OGR now AA4UO. Do you have some spare time? Help your country. MARS is the answer. Very active groups in Section. Contact: KJ4AE, Army; WB4MXG, Navy/MC; KO4P, Air Force. Silent Key: KE4RN. Forsyth Co EC, N4MBI, activated ARES for Emergency Communications for Evacuees in dump fire with hazardous materials. KB4JO helped Red Cross. Again, Amateur Radio answered the call. STM quarterly traffic report for April, May, June 1986.

NET	QNI	QTC	TRC	QND	SESS.	NM
NCMN	1289	483	386	1350	91	WB4HRR
NCEN	1813	562	497	1931	91	WB4WII
CN	1720	614	767	3066	181	NJ4L
CSN	839	139	135	2211	91	N4LSI
CNCTN	2512	590	320	1524	91	WA4MNR
PCTN	1593	381	344	1291	91	NF4J
M2MEN	2022	103	100	2001	69	KF4MZ
CFARS	1111	73	72	1357	91	W4EHF
THEN	1402	108	90	1001	90	KB4IVV
PETN	598	198	167	975	86	WB4HRR
TOTALS:	16360	3424	3159	17753	1062	

Traffic: K4NLK 303, NJ4L 270, AB9Y 174, WB4HRR 158, KA4TLC 152, AA4MP 138, WB4N 89, WD4MRD 68, K4SWN 52, KA4EYF 47, WA4MNR 47, KI4YV 46, WB4WII 39, N4MOU 35, AA4UO 35, KA4YMY 35, NE4J 34, N4NOY 32, WD4EQK 31, NT4K 30, N4LUO 27, W4EHF 24, K3HXC 22, WD4HTE 19, N4MMM 19, WB4CYN 17, KB4NWX 14, N4NTO 13,

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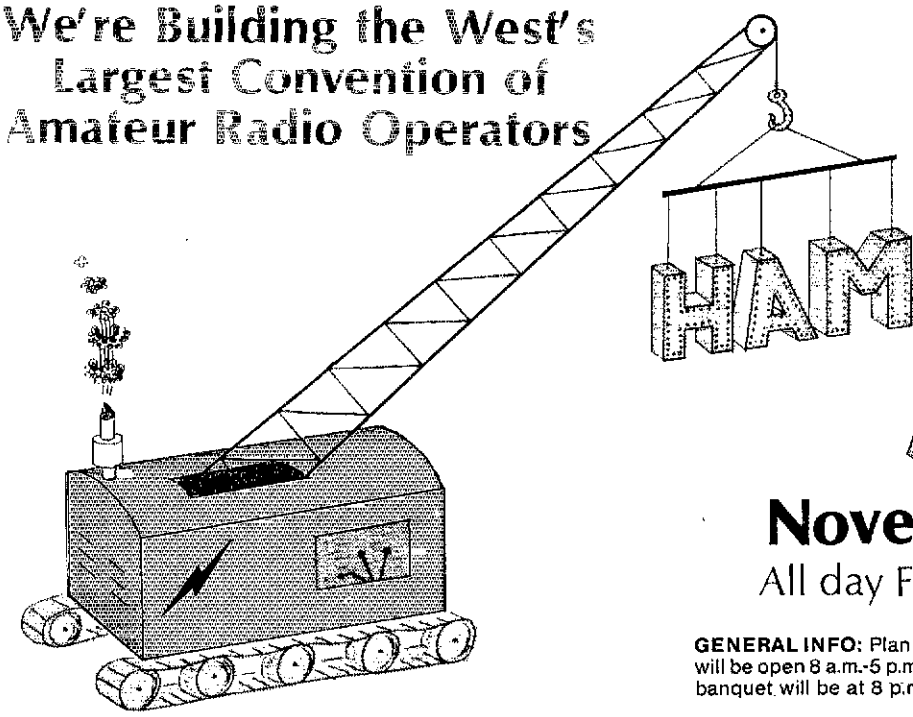

HAM/WEST

November 7–8

All day Friday and Saturday

GENERAL INFO: Plan to travel on Thursday. Exhibits and forums will be open 8 a.m.-5 p.m. Friday and 8 a.m.-4 p.m. Saturday. Awards banquet will be at 8 p.m. Saturday.

REGISTRATION INFO: Every person taking part in the HAM/WEST activities must be registered. Advance registration is $12 before October 24 ($15 at the door) and includes admission to all HAM/WEST activities except the banquet. It is not necessary to be registered to purchase tickets for the Saturday evening awards banquet. Flea-market sellers must be registered; outdoor spaces measure 16'x20' (two parking spaces). Born in 1966 or later? Request complimentary "admission-only" tickets at the door. And—there's no fee for VEC exams taken at the convention!

HOTEL INFO: To guarantee your room, you must **make your room reservations directly with HAM/WEST,** either on this form or by phone (if charging to a credit card), and **make payment in full before October 1, 1986.** Reservations not paid by that time will be accommodated on a *space-available basis only.* Call HAM/WEST at 702-361-3331.

RV INFO: Call Camperland directly at 800-634-6942 to reserve a space with full hookups right on the hotel grounds. Be sure to mention HAM/WEST. Call now. These spaces fill up early!

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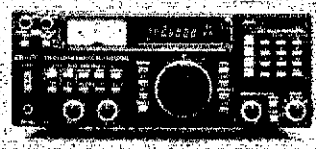

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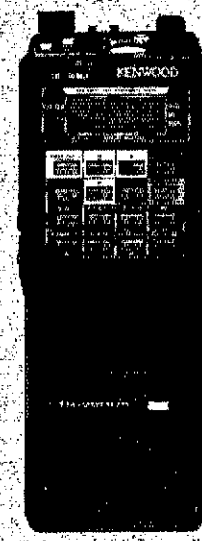

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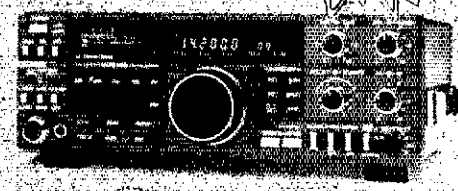

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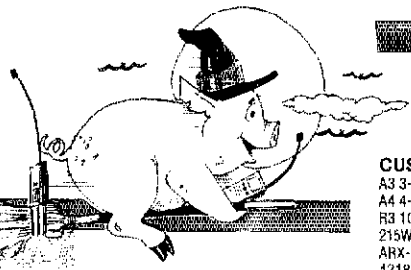

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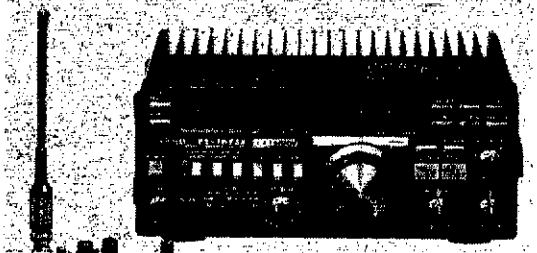

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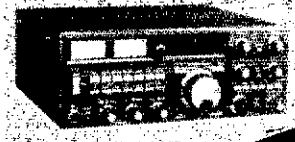
All Mode Transceiver
with CAT System



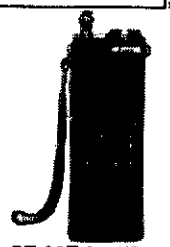
FRG 8800
General Coverage Receiver
All mode 150kHz-30MHz

FT 726R
2m Especially for Oscar
Optional modules for
full cross-band duplex.

FRG 9600
Scanning Receiver
for 60-905 MHz FM/AM/SSB

ASK FOR QUOTES ON RADIO/ ACCESSORY PACKAGES

SANTEC

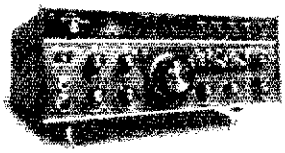


ST-20T 2m HT
ST-400ET 440 MHz HT
ST-200ET 220 MHz HT

KDK

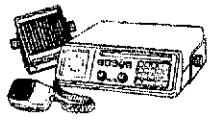
FM240 2m, 25-watt

TEN-TEC



CORSAIR II Model 561

Regency



SCANNERS

HX1500 55-ch Handheld	229.95
R1075 15-ch, 6-band	109.95
MX7000 25 MHz-1.2 GHz	429.95

CUSHCRAFT

A3 3-element 10-15-20m	217.95
A4 4-element 10-15-20m	292.95
R3 10-15-20m Vertical	268.95
215WB SSB/FM 2m Boomer	82.95
ARX-2B 2m Ringo Ranger	36.50
4218XL 2m Boomer	103.95
10-4CD 4-element 10m	111.95
15-4CD 4-element 15m	125.95
40-2CD 2-element 40m	296.95
Other Cushcraft models available	CALL

KLM

KT34A 4-element 10-15-20m	Call
KT34XA 6-element 10-15-20m	Call
2m-11X 11-element 2m	Call
2m-16LBX 16-element 2m	Call
432-30LBX 30-ele 440 MHz	Call
Fiberglass mast 5'	Call
Fiberglass mast 7'	Call

MOSLEY

CL-33 3-element Triband Beam	265.95
TA-33 3-element 10-15-20m	239.95
Pro 37 7-element 10-15-20m	465.95
Pro 57 10-12-15-17-20m	465.95
Pro 67 10-12-15-17-20-40m	579.95

HUSTLER

6-BTV 10-80m Vertical with 30m	128.95
5-BTV 10-80m Vertical	108.95
4-BTV 10-40m Vertical	87.95
G6-440 440 MHz Base Vertical	99.95
G7-144 2-meter Base Vertical	115.95
G6-144B 2m Base Vertical	87.95
MO-1/MO-2 Masts	21.50
BM-1 Bumper Mount	14.95
MOBILE RESONATORS	Standard / Super
10 and 15 meter	11.95 / 17.95
20 meters	15.50 / 21.85
30 and 40 meters	17.95 / 25.95
75 meters	19.95 / 36.95

HY-GAIN ANTENNAS

391S TH7DX 7-ele 10-15-20m	CALL
393S TH5DX 5-ele 10-15-20m	CALL
395S Explorer 14 10-15-20m	CALL
203S 3-element 2-meter Beam	CALL
208S 8-element 2-meter Beam	CALL
214S 14-element 2-meter Beam	CALL
BN86 Beam Balun	CALL
V2S 2-meter Vertical	CALL
V4S 440 MHz Vertical	CALL

MORE ANTENNAS

AVANTI HM 151.3G 2m On-glass	31.95
LARSEN LM-150 5/8 Mag Mount	39.95
MINIQUAD HQ-1	149.95
MINIQUAD HQ1-MKII	185.95
BUTTERNUT HF6V 10-80m Vert	115.95
BUTTERNUT HF4B 2-ele Beam	189.95
BUTTERNUT 2MCV5 2m	42.75
VOCOM 5/8-wave 2m Handheld	15.95

ANTENNAS FOR OSCAR

Cushcraft 416TB Twist	59.95
Cushcraft A14410T 10-ele	53.30
Cushcraft A14420T 20-ele	76.95
Cushcraft AOP1 Package	149.95
KLM 2m-14C 2m 14-ele Circular	88.95
KLM 435-18C 18-ele Circ Polar	111.19
KLM 2m-22C 22-ele Circ 2m	109.00

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HBX48 48-feet with Base	279.95
HBX56 56-feet with Base	349.95
HDBX40 Higher load with Base	259.95
HDBX48 Higher load with Base	339.95

Other BX, HBX, HDBX in stock

Guyed foldover towers:

FK2558 58-feet, 25G	940.00
FK4554 54-feet, 45G	1296.00

Other sizes at similar savings.
Foldovers shipped freight paid.
10% higher west of the Rockies.

Straight Sections:

20G Straight Section	39.95
25G Straight Section	49.95
45G Straight Section	110.95

Complete Tower Packages:

	25G	45G
40'	Call	Call
50'	Call	Call
60'	Call	Call

Each package includes top section, mid section, base, rotor shelf, guy brackets, guy wire, turnbuckles, equalizer plates, guy anchors, cable clamps, thimbles. Ask about substitutions and custom designs. Tower packages are shipped freight collect FOB our warehouse.

HY-GAIN TOWERS

HG37SS 37-feet tall	CALL
HG52SS 52-feet tall	CALL
HG54HD 54-feet/higher load	CALL
HG70HD 60-feet/higher load	CALL

Order Hy-Gain tower, Hy-Gain antenna, and Hy-Gain rotor and receive tree shipping on all.

tri-Ex

W36 36-feet tall	549.00
WT51 51-feet tall	929.00
LM354 54-feet/higher load	1575.00

Shipping not included. Shipped direct from factory to save you money

PHILLYSTRAN CALL

CABLE BY SAXTON

RB213 Mil Spec	.29¢/ft
RG8/U Foam 95% Shield	.25¢/ft
8-wire Rotator 2 #18, 6 #22	.17¢/ft
Mini-8 95% Shield	.13¢/ft

Cablewave Hardline CALL

ROTATORS

Diawa Rotators available	CALL
Alliance HD73	105.00
Hy-Gain Ham IV	CALL
Hy-Gain Tailtwister T2X	CALL
Hy-Gain Heavy-duty 300	CALL
Kenpro KR500 Elevation Rotator	182.95
Kenpro KR5400 azmth/elevat	299.95

MIRAGE

B23A 2m Amplifier 2-30	120.95
B1016 2m Amplifier 10-160	249.95
B3016 2m Amplifier 30-160	219.95
D1010 10-100 Amp for 430-50	299.95
D1010N UHF Amp/N connectors	299.95
B215 2m Amp: 2 in, 150 out	249.95
A1015 6m Amp: 10 in, 150 out	269.95

AMERITRON HF AMPS

ATR15 Ant Tuner 1500 watt	Call
ATR10 Ant Tuner 1 kW	Call
RCS8 Remote Coax Switch	Call
NEW AL1200 1.5 kW Amp	Call
NEW AL80A 1200 watt Amp	Call
AL84 HF Amp 160-15	Call

AMP SUPPLY

LA 1000A 160-15m Amp	429.95
LK 500ZBNT HF Amp no tune	1443.95
AT 1200A 1200 PEP Tuner	209.95
LK 500ZB 2.5 kW hipersil	1176.00

This is a partial list—
IF YOU DON'T SEE WHAT YOU WANT...CALL

DAIWA

LA-2065R 2m Amp, 2 in, 60 out	125.95
LA-2035R 2m Amp with preAmp	74.95

VOCOM AMPLIFIERS

2 watts in, 30 watts out 2m Amp	69.95
2 watts in, 60 watts out 2m Amp	107.95
2 watts in, 120 watts out 2m Amp	169.95
200mW in, 30 watts out 2m Amp	84.95

KENWOOD TL922 2kW CALL

ASTRON POWER SUPPLIES

RS7A	49.95	RS20M	104.95
RS12A	69.95	RS35M	149.95
RS20A	89.95	VS20M	124.95
RS35A	133.95	VS35M	169.95
RS50A	189.95	RS50M	209.95

BENCHER PADDLES

Black/Chrome	41.95/53.95

B & W

375 6-position Coax Switch	24.50
376 5-position Coax Switch	24.50
425 1 kW Low Pass Filter	28.50
593 3-position Coax Switch	25.25
595 6-position Coax Switch	29.95
AP-10 5-band Apartment Antenna	39.95
370-15 All-band Dipole Antenna	129.95

—Other antennas in stock—

DAIWA

CN-520/CN-540 Meters	59.95/69.95
CN-620B Meters	106.00
CN-630 Meter	126.00
CN-720B 2kW HF Watt Meter	120.00
CNW-419 Antenna Tuner 500 W	174.95
CNW-518 Antenna Tuner 2.5 kW	279.95
CN410M SWR/wt mtr 3.5-150 MHz	64.95
CS201 2-position Switch	21.95
CS401 4-position Switch	64.95

TELEX HEADPHONES

Procom 350 ultra light set	58.95
Procom 250 soft phone/mike	72.90
Procom 450 padded phones	35.50
Procom 400 desk mike	57.75
Procom 460 padded phones	37.20
SWL-610 light headphone	8.75
C-610 light headphone	7.95
Others in stock	Please Call

BIG DISCOUNTS

MFJ PRODUCTS

989 3 kW Antenna Tuner	295.95
962 1.5 kW Tuner switch/meter	189.95
949C 300-watt Deluxe Tuner	129.95
941D 300-watt Tuner swch/meter	89.95
1020A Active Antenna	69.95
202B Noise Bridge	48.95
752B Dual Tunable SSB/CW Filter	79.95
Keyers—407, 422, 484	CALL
Other MFJ products in stock	CALL

AMPHENOL CONNECTORS

83-1SP PL259 silver	1.10
83-1SP 1050 Nickel PL259	0.75
8261 Type N RG8	2.50
2900 SO239-BNC	2.99
3112 BNC RG59	1.35
312 BNC RG58	1.25
83-1RS Reducer RG58	0.25
83-1RS168 Reducer RG59/mini 8	0.25
83-1R UHF panel	0.79

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N4JEO 12, N4CJJ 11, WV4Z 10, AK1E 8, K4QXA 7, N4JRE 4, K4LZU 3, N4LUB 2 (June) NE4J 32, KU4W 23, N3KOZ 10. Totals: SAR's 39. TFC 2,092. All reports are welcomed, and remember I must have reports in hand by 5th of each month to meet OST schedule. Radiograms are the quickest way to communicate your reports. Exams: Kernersville Oct. 4. Lexington Oct. 18. Walk-ins both locations. NO Pre-registration required.

SOUTH CAROLINA: SM, Jimmy Walker, WD4HLZ— We welcome John, WD4PKZ, of Aiken as a new OBS covering North Augusta-Belvedere. Thanks to you, John, for your offer to assist with this important activity. OBS are still needed to cover Columbia, Spartanburg, Greenwood, Dillon, Myrtle Beach and other SC areas. Interested amateurs should contact our Bulletin Manager, W0IKT, or me for further information. N4LST's tour of duty as NM of CSN ended July 1. CONGRATS on an excellent job. Not many of use have the determination, drive and dedication to take on the reins of NM of CSN-N4LST had all the attributes. Taking up the challenge is AA4MP. I wish him the best of luck and know he will carry on the tradition and keep the momentum at a high pitch. As you know, NM CSN rotated between NC and SC and over the years it became difficult for SC to carry on the tradition with our limited number of CW operators. An agreement was struck between NC and SC to appoint an amateur willing to serve disregarding the rotation. If you wish to serve in this important position, contact me or W4ANK. Traffic: K4ZN 162, W4ANK 94, KB4BZA 79, W4FMZ 71, WB4UDK 53, KA4LRM 51, W0IKT 48, WD4FJP 10, KA4YEA 8.

VIRGINIA: SM, Claude Feigley, W3ATQ—STM: KB4WT. SEC: N4EXQ. ACC: NT4S. OOC: W4HU. BM: AB4U. TC: WB4MAE. The following are official "NTS" nets for the Virginia section. If you desire to have your net to be a "NTS" net contact the STM, KB4WT for details.

VTN	1 PM	3907	AA4AT
VSBN	6 PM	3947	K4VWK
VSN	6:30 PM	3680	NN4I
VN (EARLY)	7 PM	3680	N4GHI
VN (LATE)	10 PM	3680	K4AXF
VLN	10:15 PM	3947	KJ4MF
5VEN	7:15 PM	146/82/22	NT4S

It is with deepest regret that I announce the passing of another of the faithful amateurs of the Va. section on July 12, Joe Stern, W4LD became a Silent Key. WA4TNP reports that the Sterling Park ARC's course resulted in 17 students awaiting their Novice license from FCC. WA4RTS sez the Lynchburg ARES has permission to setup stations at the City of Lynchburg's Emergency Operating Center. Geep also reports that on June 30, the Lynchburg Emergency Communication Director requested their ARES group to man the City's Emergency Center because of a dangerous chemical spill. Sixteen amateurs responded and as part of the communications a Packet link was established to Richmond OES via N4GUX. Effective August 15, Earl Bishop, N4EXQ, assumed the post of Section Emergency Coordinator (SEC). Earl takes over from John, WB4UHC, who has served in this job for the past year. Under John's leadership the Section's ARES communication network has grown to an efficient operation but his present workload prevents him from devoting the time that the office of SEC requires. All DECs should submit their monthly report of N4EXQ, PSHR reports will continue to go to the STM, KB4WT. OOs W4HU and W8IRT report on the thankless but very important job, of scanning the bands for Rule and Regulation offenders. Thanks to the SPARK club for sending me a copy of their FB newsletter. Future VE EXAMS: Sept. 27, Richmond contact WU4G, Oct. 4, Sterling Park contact WA4NTP, Nov. 1 SPARK, Hampton contact N4IIC. It was nice seeing many of you at Berryville and the Traffic/Ares powwow was enjoyed by all. By this time the first issue of the revitalized Virginia Ham is out and the 2nd issue is being prepared send your input for it to NN4I, Mark Witt, 113 Par Dr., Salem, Va. 24153. Traffic for the month 3857 with 39 stns reporting. N4GHI and N4EXQ made BPL. Your SM is open for ur thoughts for the Sections operation. Traffic: N4GHI 681, N4EXQ 568, KB4WT 291, WB4PNY 276, AA4AT 249, WA4CCK 244, AA4GL 151, W3ATQ 149, K4MTX 137, WD4ALY 136, W4JLS 136, K4JST 89, WA4LJI 66, WB4KSG 75, K4VWK 75, KB4NGO 75, NN4I 74, K4AXF 73, WD4OCW 71, K4MLC 54, WB3ANC 42, NT4S 39, K3RZR 34, K4GR 25, WB4UHC 24, K4BGZ 16, W4TZC 13, N3RC 9, N4FNT 7, K4JUM 6, WB4DQZ 4, HC4HN 4, WB4KIT 4, WA4TVS 3, KA4IUM 2, N4KSO 2, W4YE 2.

WEST VIRGINIA: SM, Karl S. Thompson, K8KT—SEC: K8QEW. STM: KD8G. SGL: K8BS. ACC: WA8CTO. TC: K8CG. Rpt Coord is WB8GDY, director, WV Dist. CVRA. Whig H.F. held on July 20 was a big success. Congrats to K8AN and other committee members. Wrk RTTY? Join K8LG on WVRN at 6:30 daily on 3539.1.

Net	Freq	Time	QNI	QTC	Sess	NM
Hillbilly	14290	Noon su	97	17	3	W8YP
WVFN	3865	6:00	694	179	29	W8YP
WVMD	7235	11:45	604	24	29	W8FZP
WVN	3557	7:00	284	81	31	KZ8Q
WVRN	3640	6:30	183	35	31	K8LG
WVNN	3730	5:30	172	43	30	WD8LDY

Traffic: W8YP 305, WD8LDY 284, KD8G 222, W8FZP 154, KZ8Q 136, N8GJO 114, K8TPF 76, K8UQY 67, KA8WNO 66, K8KT 55, WA8KCJ 52, K8QEW 47, KA8TIK 39, KA8OGF 33, W8JWX 16, N8FXH 11, WD8DHC 9, WB8BMX 3.

ROCKY MOUNTAIN DIVISION

COLORADO: SM, Bill Sheffield, KQ0J—ASM: W0RSG, KA0MQA. SEC: WB0FQB. STM: N0DZA. OO: W0ACH. ACC: WB0DUV. PIO: N0FOE. SGL: WD0GQL. TC: NC0F. BM: KA0CZW. DEC: WB0TUB, ND0E. The new DEC for the Western Slope is ND0E, our thanks to KC0WR who has resigned due to job conflicts, his work & efforts in emergency services are appreciated. SET is scheduled for Oct, I hope that each ARES district in the state will be participating in an SET along with our section traffic nets. Be sure that your reports are filled out and sent to WB0FQB & N0DZA. Several months ago, I wrote in this column that CCARC had voted unanimously to retain the 15 kHz spread for two meters. Even though CCARC has been the only recognized frequency coordinator in our state and has handled the job for over 10 years, this vote was questioned. The State Frequency Coordinator for the CCARC mailed out a ballot on the 15/20 kHz issue to all of the 2 meter repeater owners and or trustees. There were 86 votes cast in the state, the results of this vote are as follows: 72 YES votes to retain 15 kHz spread, and 14 No votes, this is a 75% or 2/3rd's majority vote to retain 15 kHz spread on 2 meters. The vote is final and Colorado has made its decision, we will retain the 15 kHz band plan on our 2 meter repeaters. 73, KQ0J. Nets: Col QNI 717, QTC 28-Inf 84, 27 sess. CWN QNI 111, QTC 100, 30 sess. CWXN QNI 3101, QTC 2451, 31 sess. NCTN QNI 328, QTC 83, 32 sess. SCTN QNI 195, QTC 13, 19 sess. Traffic: WA0HJZ 2614, N6BQP 1931, K0RXK 704, K0IAN 551, W0ACH 462, KA0TXX 440, KB0Z 102, N0DZA 82, KA0NLI 42, WB0FFV 42, W5HRS 30.

NEW MEXICO: SM, Joe T. Knight, W4PDY—ASM: W5HD. DEC: KB5XO. STM: ND5T. NMs: WA5UNO K6LL W5VFQ. TC: W8GY. ACC: W5HD. Southwest Net (SWN) meets daily on 3583/7083 at 0230 UTC and handled 115 msgs with 173 stations in. New Mexico Roadrunner Net meets daily on 3939

at 0100 UTC and handled 50 msgs with 1262 stations in. New Mexico Breakfast Club meets daily on 3939 at 1330 UTC and handled 131 msgs with 827 stations in. Yucca 2-mtr Net 01/61 handled 12 msgs with 426 checkins. Caravan Club 2-mtr Net 66/06 handled 27 msgs with 150 checkins. SCAT 2-mtr Net 66/06 handled 4 msgs with 625 checkins. Good News Ltrs Fm Pecos Valley and Mesilla Valley ARC's & FB Rpt Fm KE5VH. Vy sorry to report the passing of W5SBJ, Father Clem, KN5D Mail Box/GateWay reports 487 connects with 49 Users. Traffic: W5DAD 62, & a final report Fm W6SX who is retiring Fm USAF and moving back to California, 19.

UTAH: SM, Jim Brown, NA7G—SEC: Rich Fisher, NS7K. STM: John Sampson, W7OCX. Scott, WA7WIB, accepted an opportunity to move to Pennsylvania and has left the area. Good luck, Scott, and hope to work you on the low bands. NS7K will be the new UCN manager. WIMU was fun, as usual. The XYL is not necessarily impressed with the treasures obtained from Jackson, but beauty is in the eye of the beholder... Wyoming has the honors next year for WIMU, again in Jackson. W7YPC has moved to a condo, is QRT on low bands for now. N7BQE reports Navajo Mtn Rpt W7RVY, is now 146.36/96, 73 de NA7G. Traffic: WA7KHE 84, WA7MEL 47, NA7G 26, NS7K 25, W7OCX 12, N7ASY 8, N7BQE 4.

WYOMING: SM, Dick Wunder, WA7WFC—SEC: Jim Anderson, W7TVK. ASM: Steve Cochrane, KA7AWS. The Wyoming Hamfest was a success again this year and many thanks to the Campbell County Amateur Radio Club for all the work. The Wyoming Hamfest will be held in Douglas again next year. W7MZW, Morres Morgensen, is the new Net Manager of the Wyoming Pony Express Net as I have retired as net manager. I hope you will give Morres the same support as given me during the past 10 yrs. NS7R reports the following upgrades at the Green River exam: KA7OGQ, KA7OGR, KA7WNX & KA7YKU to TECH and WB7WGF to EXTRA. Congratulations to all. KC7AR reports the Wyo. Cowboy Net held 23 sessions with 778 QNI & 34 QTC. Traffic: NN7H 338, W7HLA 84.

SOUTHEASTERN DIVISION

ALABAMA: SM, Joseph Smith, Jr., WA4RNP—STM: N4JAW. SGL: KA4WVU. BM: KF4VV. OO/A AUX: AA4BL. TC: N4AU. ATC: WB4BYQ. ACC: WA4RNP. It's time for the annual fall test of our emergency planning which is called the (SET) Simulated Emergency Test. And I hope everyone is going to find a group to work with this year. We have a new Official Observer in the section in the person of K4HJX, Jim in Tuskegee. I am still in need of a Public Information Officer to fill the need of getting all of the public-service information from all of the various clubs and other groups and getting it to headquarters. If you are interested in this, please contact me. It's nice to see OSCAR 10 back from the grave. A round of thanks are due all those who worked on the problem. Seven Three for now "Joe". Traffic: CAND reports 781 messages passed in 31 sessions with Alabama rep by WA4JDH, W4CKS and NW4X. DRN5 reports 613 messages passed in 62 sessions with Alabama rep by WA4JDH, W4CKS, NW4X, and W4WJF. AEND reports 50 messages passed in 31 sessions with other nets rep by WD4NYL, WA4JDH, KC4MG, W4CKS, N4DCS, WA4JAX and NW4X. AENB reports 51 messages passed in 31 sessions. Brass Pounders League: WA4JDH Public Service Honor Roll: WA4JDH, W4CKS, WD4NYL, and WA4RNP. Totals: WA4JDH 807, W4CKS 55, K4AOZ 48, WD4NYL 36, WA4RNP 36, W4DGH 14, W4WJF 11, WB4TVY 4.

GEORGIA: SM, Eddy Kosobucki, K4JNL—ASM & BM: K4VHC. SEC: NC4E. STM: WB4WQL. ACC: WA4ABY. OOC: NA4I. PIO: WB4DEB. SGL: W4BTZ. I hope that while ur reading this the WX has gotten back to normal. Sure has been a hot summer. This is the month for the annual Simulated Emergency Test (SET). If ur club or group hasn't made any plans u still have time. PLEASE if u do participate, please send results & comments to NC4E ASAP so he can compile for the section. Jack, W4PIM, is moving to the neighboring state of AL & WA4PNY will be involved with the 1987 National ARRL Convention which will be taking up most of his time for the next year. Both have resigned their respective positions as STM & PIO. Many tnx to both of u for the dedication given the GA section. Ben, WB4WQL, will succeed Jack as the GA STM & Hugh, WB4DEB, will replace Jack as the section PIO. Both appts become effective Oct 1st. The section is without a Technical Coordinator (TC). I am looking for a replacement. If u are interested in this position please write or contact me. PLEASE send me ur reports (PSHR especially) before the 5th of the mo. I have a new deadline, so please mail them early. The GA State Convention & Central GA Hamfest will be held in Warner Robins Oct 11 & 12. Walk-in Exams will be given at 9 AM each morning. The Royal Order of the Wouff Hong ceremony will be performed at 12 midnite on Oct 11. Some of the section affiliated clubs still haven't turned in their annual reports. Please check with ur officers to see that they mail them in. It was a pleasure to see many of u at the Atlanta Hamfestival. Traffic: W4PIM 172, K4MOB 122, AA4JV 87, W4JWO 76, WA4CBT 76, W4WXA 66, WB4WQL 52, KF4FG 47, K4NM 29, W4HON 24, KA4HHE 20, K4BAI 12, WB4ABE 11, W4OHH 9, W9NXC 6, KI4IG 3.

NORTHERN FLORIDA: SM, Roy Mackey, N4ADI—BM: KB4LB. OO/RFI: K4JJE. PIO: WA4PUO. SEC: WA4PUP. SGL: KC4N. STM: WB4GHU. TC: N4KF. Thanks to the following clubs for sending their newsletters! BARS, DBARA, HAMM-RAMM, HCARA, NOFARS and two SHARKS, the Spring Hill NET and Sky High's TALES. The invitation is still open and I hope more clubs will respond. 1986 officers for SKY HIGH ARC are: W4ABI, Pres; WE4C, VP; N4MFU, Sec; KJ4AP, Tres. SPRING HILL officers: W9KWD, Pres; N4LLU, VP; W1ZYR, Sec; N4BEH, Tres. HCARA officers: WA5OKX, Pres; W3AU, VP; KB4JWF, Sec; KB4OCJ, Tres. Central Florida RTTY net has become CF PACKET NET. WB4GHU is trying to see how to use our Packeteers in the NTS. Your SM has just gone on the air w/packet and will hope to get more SARs via that route. NOTE: Net Reports need to go to STM only. He sends the info to HQ. ARRL has advised that there are 28 registered instructors in our NOFL Section. We say thanks to all and good luck with classes. The Section is well covered from JAX to Pensacola to Gainesville to the East and West Coast and Central Florida. Let the SM know of your classes in case others need to know. W4IWT always did a super job getting out the word of classes, exams and other important news for Florida. We wish him a speedy recovery and hope SKIP can be kept active! Thanks Andy for a great job over the 30 years past. Traffic: N4PL 444, KB9LT 359, WX4H 290, WB4ADL 211, KC4VK 190, WA4QXT 158, WD4IUI 143, N4EDH 143, WA4EYU 139, KD4KK 121, N4GMU 110, KB4LB 106, WF4Y 104, N4JAQ 101, AA4HT 92, KF4U 89, WB4GHU 89, WC4D 81, KF4TM 71, WD4IIO 66, W4KIX 57, N4ADI 55, KB4MHH 54, WA4SXW 48, WB4FJY 45, W4DTV 45, KI4CQ 43, NS4C 35, NF4O 32, KB4FIY 31, WB4TZR 30, N2AOX 28, NQ4P 23, KA4KAH 22, W7YWF 22, AA4FG 22, N4JIH 18, N4IIP 15, KF4GY 14, KJ4PH 14, W8IM 13, KA2TFJ 12, WB4AWG 12, KJ4HS 11, WD4RJI 10, KJ4VT 6. (Jun) NF4O 58.

SOUTHERN FLORIDA:
SM, Richard D. Hill, WA4PFK—SEC: W4SS. STM: K4ZK. TC: KI4T. BM: WD4KRW. PIO: W4WYR. SGL: KC4N. OO: W4SS.

ACC: WA4NBE. WD4KBW, Bulletin Manager, reports a total of 264 bulletins received and sent during July by AA4BN 10, W4DL 51, WA4EIC 120, KA4GUS 40, K4IEK 17, W4ESH 8 and WD4KBW 18. Andy, W4IYT has sent 3862 first class letters plus a QNC relative to his having to discontinue Florida Skip. He is making a good recovery from his stroke but MUST give up all pressure activities. THANK YOU ANDY, W4IYT AND BETTY, W4GGO FOR OVER THIRTY YEARS OF SERVICE FOR HAMS EVERYWHERE! In view of Florida Skip no longer being published, I urge net managers and others to make greater use of this column—send me any news you have by the fifth of the month. Also, remember the ARRL Information Net is held on 3940 KHz each Saturday morning at 8 AM. K4ZK has had a loss of hearing in his left ear for several years—just recently he lost his hearing in his right ear. At this time it isn't known if the loss is temporary or permanent. Telephone and SSB are completely unintelligible for him and he has been able to communicate directly with me only on CW. Latest info just received indicates the medication is working and K4ZK's hearing is returning! WD4COL reports that he is moving to Waynesboro, Ga. Hate to see you and the family leave Florida John, but good luck in your new location! WA4EIC is presently in the Ft. Myers Community Hospital having tests run because of a high fever. Recent information indicates he is doing well. 73 de WA4PFK. Traffic: W3CUL 3140, W3VR 1006, WA4PFK 408, K4ZK 218, K4IA 201, K4EUK 182, KA4FZI 178, K4SCL 157, WA4RUE 145, KA4GUS 137, WA4EIC 134, W4DL 119, WD4KBW 111, KF4JA 104, WB4WYG 100, KA4NXF 91, N4KB 76, KI4ZW 70, N4ET 57, AA4BN 54, KF4RL 54, N4KFU 47, W3TLV 43, WD4CHO 39, WB4GCK 38, KJ4WJ 37, N4MML 33, KB4MON 33, W4TAH 31, KA4SIH 31, W4PKP 30, KY0T 28, N4JOA 27, K4FQU 26, W4SME 25, KB4LKT 25, KA4YHS 24, KY8Y 23, KD4GR 17, W4MFD 17, KB4LPL 17, W4ESH 16, W4WYR 16, K4JI 15, K4OVC 14, K4IRT 12, K4BLM 11, KB4KXV 10, W3UIR 10, KB4KAW 9, AA4CH 6, WA9VND 6, WK4F 6, KA4GDU 6, W4MPV 5, KA4KDD 4, NX5Q 3, W4DWN 2, W4NNW 2, KB4EWO 1, N4NHX 1. (June) WD4CHO 57, WD4NXK 25, K4FQU 20, W4SME 14, KD4GR 7, KB4KAW 5, W4PKP 4.

WEST INDIES: SM, Alberto L. Valdejuli, WP4CSG—Summer is over now, and we are back to our routines. Things have been slow since many of us have been gone on vacations, and as with most summers activities grind down to a practical halt. Now things are starting to liven up again. The PRARC conducted its hamfest during the weekend of September 26 thru 28; it also continues its volunteer examination sessions on the last Saturday every month. For additional details regarding these, contact Dr. Eugene Crommett, KP4GJ. Hurricane season is again upon us and now is a good time to consider joining other hams in organizing emergency situation programs. We are still moving slow towards having ARES groups organized in P.R. and the V.I.s. Several hams have expressed their concern about the lack of organized emergency programs within the Section, and we are still attempting to get together to set up some sort of emergency program. The task is not easy, and will require cooperation from many of us. Contact your local OEC, or your local Club if you wish to help in getting an emergency reaction program going in our area. We need you, for we might be needed next! WINE: Sessions 30, QNI 89, QTC 1, NM VP2VI. WINS: Sessions 30, QND 150 mins, QNI 86, QTC 4, NM KP4DJ. NCS: KP4DJ 29, VP2VI 1. Traffic: KP4DJ 11.

SOUTHWESTERN DIVISION

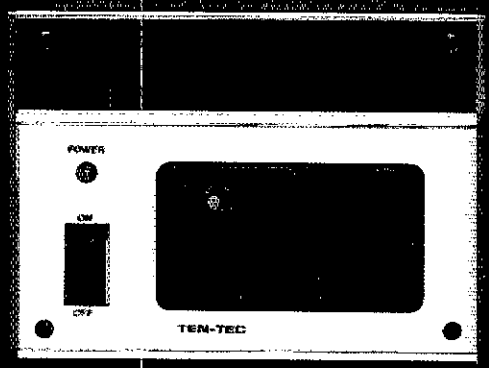
ARIZONA: SM, Jim Swafford, W7FF—STM: W7EP. NMs: K6LL, KA7HEV, WB7CAG. Ft. Tuthill hamfest was a great success. Congrats to Stan, K7KNP, and his ARCA committee for a good show. Attendance, estimated at 900 - 1,000, was about the best ever. Plenty of tailgaters and "good deals." Divn Director Heyn, WA6WZO and Curtis Holsopple, K9CH from HQ spoke at the ARRL forum. KA7MUL was presented with his BPL medallion by K9CH. "Ham of the Year" award went to Robin Conde, N7HTX for her public service accomplishments. Congrats. Bob, N7ECE and Bernie, WØYOY, VECs conducted exams resulting in ten new Extras, six Advanced, twelve Generals, and nineteen new Techs. The pass rate on thirteen WPM code was over fifty-five percent, and seventy-five percent on twenty WPM. Not bad! ARCA officers elected for coming year are: Mert, KB7NE, Ch'm; Adam, N7HCB Vice-Ch'm; Phyllis, K7SEC Sec'y; and Bobbie, KA7MIZ treas. Many thanks to the following members of the Coconino ARC who assisted the SM in manning the ARRL booth: NN7A, NN7D, KA7PZL, NO7D, KA7DXC, KA7WNY, N7CXF, N7HIF, NG7S, and N7GLT. Great work, gang! While in Flagstaff your SM was invited to visit NN7D's antenna farm. Quite a thrill listening to YU stations coming thru on twenty meters in middle of the afternoon using Rich's three-wavelength rhombic. A short get-together was held to introduce Section ECs and DECs to "Pappy", KX7P our new SEC. Attendees were Hank, N6HJ, Lloyd, AJ7I, and John, KQ7T. ARCA Frequency Coordinator, Ralph, W7HSG, did a fine job of organizing and strengthening the repeater coordination procedures at the Repeater Owners meeting. Following the Hamfest, your SM and XYL took off for northern New Mexico to further delay returning to the Tucson heat. We visited W5RM in Santa Fe and KC5ZC in Taos and had a very FB trip. Let's have another great hamfest next year in Flag! 73, Jim.

	QNI	TFC
Cactus HF	506	121
Cactus VHF	342	101
ATEN	808	105
(June)		
Apache JRN	37	14

Traffic: KA7MUL 684, NS7C 242, W7EP 204, W7AMM 164, KB7FE 127, WB7CAG 86, W7GAQ 64, N7ETP 33, KA7HEV 23, K7KXE 22, K7JKM 6. (June) W7AMM 16, K7NMQ 4

LOS ANGELES: SM, Bob Poole, AJ6F—ASM: K6IYK. SEC: AK6Y. STM: W6INH. ACC: KX7O. PIO: NJ6K. OOC: K6BMG. TC: WBØQPO. Welcome aboard to Carl Nelson, NJ6K, our new Public Information Officer; Carl brings new strength to the section by filling this important post. Who says that company sponsored clubs tend to be inactive? TRW, for example, has participated in the following activities this year to date: two VHF contests, Field Day, seven club- sponsored swapmeets, seven club meetings, five lunchtime picnics and the installation of the new station antenna tower (extrapolated from TRW Crosstalk/WA2KDL). W6FNO/R, again in the news, was used by DEC WB6MKA plus WA6EHY, WB6OSM, KR6Y and K6YNW to coordinate public service organizations who volunteered to clean up Santiago Canyon; over a hundred trash-picker-uppers were served by the FNO communications. Additionally, FNO/R became active to support mountain search and rescue operations thanks to WB6VXC, N6LGB, WA6QMW, W6LKN, KF6QR and WA6VXD. The FNO/R traffic report was as follows: 280 vehicular, 18 fire and 13 medical emergencies; thanks to Bill, KA6ZDL for his monthly submissions of the W6FNO/R activities. The Palos Verdes ARC continues to be a driving force toward the reality of an amateur radio museum and memorial station at the site and in memory of the late W6AM; stay tuned for details and further ARRL involvement. California ARES people are taking note

America's Best Kept Secret!



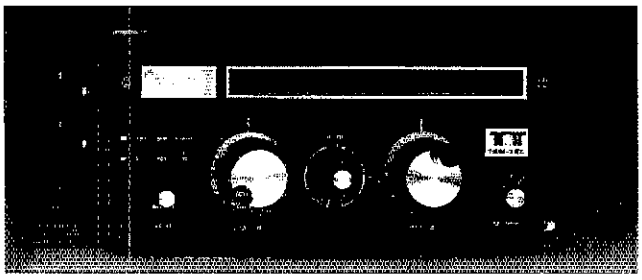
MODEL 260 POWER SUPPLY

MODEL 561 CORSAIR II

CORSAIR II HF TRANSCEIVER, Model 561
Receiver performance that only a permeability tuned oscillator can deliver . . . superb signal to noise ratio, outstanding adjacent signal rejection. QSK with a changeover time of 30 ms or less for superior CW or AMTOR operation. Twelve position band switch for operation on all nine HF bands, from 1.8 to 30 Mhz, plus 40 Khz overshoot on band edges.

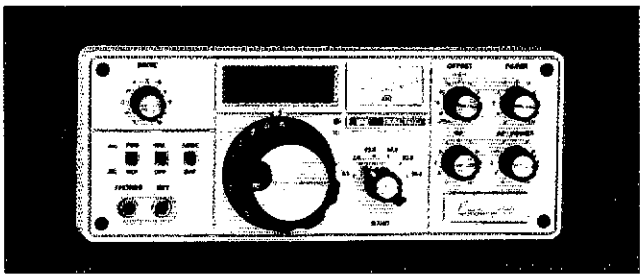
RECEIVER
Sensitivity: 0.25 µV for 10 dB S/N ratio.
Selectivity: 16 pole crystal ladder filter, 2.4 kHz bandwidth. 1.6:1 shape factor at 6/60 dB. Three position, mode independent, switch selects standard 2.4 kHz, optional 1.8 kHz, 500 Hz or 200 Hz filters.
Notch filter: Greater than 50 dB notch, adjustable from 200 Hz to 3.5 kHz.
Audio Bandpass filter: 8 pole, active filter centered at 750 Hz variable from filtered to flat response.
Passband tuning (PBT): Tunes 2nd IF frequency 3 kHz.
Noise Blanker: Switchable on/off with adjustable threshold and blanking width.
Offset tuning: Dual range, tune RX, TX or TRX.
PLUS: Built-in antenna pre-amp, spot button, selectable AGC and much more.

TRANSMITTER
RF Output: Broadband, solid state, self tuning with 85-100 watts out, all bands.
Built-in Iambic keyer. Speed adjustable 8-50 WPM with 40 character programmable memory.
Multi-meter: Selectable reading, Ic, power out, SWR, speech processing level.
Built-In speech processor, with level control, standard.
Variable ALC.
PLUS: Rear panel connectors for station control, AFSK, QSK, phone patch, auxiliary antenna, PTT, standard CW key, and more.
POWER REQUIRED: 13.8 VDC, Base or mobile at 20 A.
Size: HWD 5.25" x 15.25" x 15".



2KW ANTENNA TUNER, Model 229A
Designed to match your 50 ohm, un-balanced coaxial, transmitter output to virtually any, balanced or un-balanced antenna. General coverage from 1.8 to 30 MHz. Handles all the power the law allows.

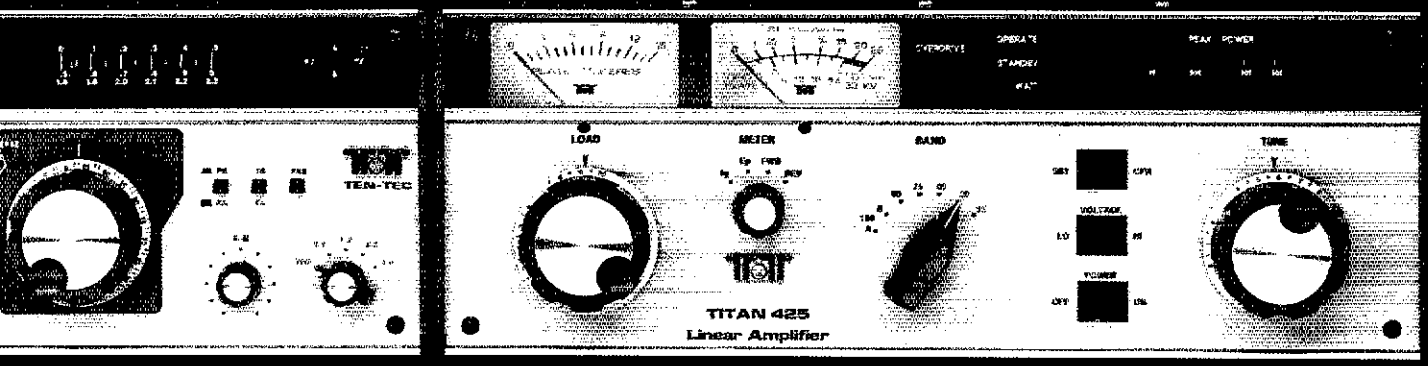
- Reversible "L" network circuit for best match and bandwidth, at either hi or lo, antenna impedance.
- Avoids false load indication.
- Ceramic insulators and coil forms throughout. Silver plated switch contacts and roller inductor coil.
- Built-in balun.
- System by-pass switch.
- 4 Position antenna select switch.
- Attractive Ten-Tec Corsair styling.
- Also available in kit-form. Model 4229.



CENTURY/22, CW Transceiver, Model 579
Put the fun back into hamming. This is a top notch, 50 watt, CW transceiver. Features found in only the best rigs are included. Full break-in QSK, excellent RX selectivity on CW (also tunes LSB/USB) and 100% solid state circuitry. Broadband "no tune" RF amp. Operates 80, 40, 30, 20, 15 and the lower 500 KHz of 10 meters. Power required, 12 to 14 VDC at 6A. Size HWD 4" x 10" x 10.5". Weight 6 lbs. Great for portable, mobile or base station operation.

THE ULTIMATE HF MOBILE ANTENNA SYSTEM
HF mobile is a world of compromise! Give yourself a chance. Choose the finest, environmentally protected, antenna system. Loaded to the best height for radiation efficiency, and to clear most overhead obstacles. Upper SS whip is vertically adjustable for "no tears" tuning. Lowest wind resistance too, less whipping and de-tuning. Standard ⅜" x 24 base fitting screws into all standard mounts. Typical height 78" or less.

Our outstanding SSB performance equals our CW and DIGITAL reputation!



MODEL 263G REMOTE VFO

MODEL 425 TITAN

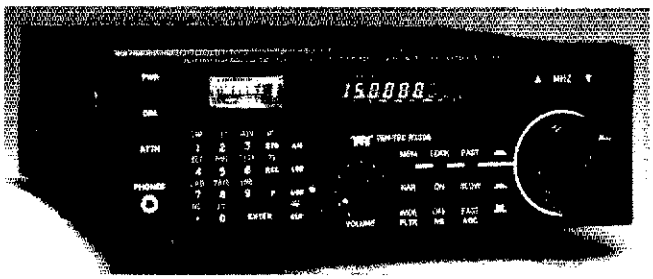
REMOTE VFO, Model 263
Uses the same PTO design as the CORSAIR. Adds complete TX/RX frequency control. Front panel switch selects, CORSAIR transceive, 263 transceive, CORSAIR TX/263 RX, 263 TX/CORSAIR RX. You can also listen to both frequencies simultaneously. A balance control is provided for priority adjustment. Also makes provision for Xtal control. Connects to CORSAIR with cables provided. Size is HWD 5.25" x 7.5" x 12".

MATCHING POWER SUPPLY, with built-in speaker, Model 260
A highly regulated and filtered, 20 amp. supply. Includes protective circuit breaker and primary power fuse. Can use either 115 or 230 VAC, 50/60 Hz. Size is HWD 5.25" x 7.5" x 12".

TITAN HF LINEAR AMPLIFIER
"BOOM BOX" EXTRAORDINAIRE! Remoted power supply makes possible, this compact, desk top linear amplifier. Puts out a solid 1500 watts SSB and CW. 1000 watts continuous power on RTTY, AMTOR or SSTV. Lightning fast QSK for "break-in" CW and super AMTOR performance.

RF DECK
Drive power: 80 watts typical.
Four LED status indicators, including "overdrive" warning.
Metering: Full time plate current meter. Multi-meter, selectable for plate voltage, grid current, power out or reflected power.
Peak power indicator: 10 element LED bar-graph display.
Amplifier tubes: Two Eimac® 3CX800A7, ceramic, external anode, air cooled triodes in grounded grid circuit. Plate dissipation, 1600 watts.
Frequency coverage: 160, 80, 40, 20 and 15 meter bands plus 18 and 24 MHz standard, 10 meter kit supplied upon proof of authority to transmit.
Size and weight: HWD 5.25" x 15.25" x 15". 17 lbs.

POWER SUPPLY (Supplied with TITAN).
Primary power: 220-250 VAC @ 20 amps, maximum.
Conservatively designed for cool operation under full load using a Ten-Tec, tape wound, Hypersil® transformer.
Size and weight: HWD 8.25" x 13.4" x 10.25". 45 lbs. UPS shippable.



...America's Best Kept Secret!

NEW! Model RX-325 General Coverage RCVR

Fully synthesized, the RX-325 is the latest from Ten-Tec. General coverage from 300 KHz to 30 MHz. Operates on 12 to 14 VDC or with 120 VAC adapter, supplied. You will hear it all, mobile or base. Look at these features:

- Keyboard entry or tuning knob frequency control.
- 25 Memories.
- AM, LSB (cs), or USB (CW).
- S-Meter with SINPO scale.
- Built-in quartz digital clock with timer feature.
- Noise Blanker.
- RF Preamp built-in.
- Programmable band or memory scan.
- Dual ceramic I-F filters.
- Hi and Lo impedance antenna terminals.

PLUS . . . switchable AGC, built-in speaker, 2 Watts audio power, epoxy-glass circuit boards throughout. Striking, high-tech appearance, finished in black. Size (HWD) 3.75" x 9.5" x 7" Weight 5 lbs. 5 oz.

TEN-TEC

Sevierville, Tennessee 37862

of the way the ground shakes from time-to-time; should you be involved with ARES or NTS? By the time you read this, the Westside ARC will have been elected as an ARRL affiliate: congrats WARC! The Rio Hondo Club holds T-hunts each third weekend of the month; contact RHARC PO Box 6008, Whittier, CA, 90609. By the time this is read, the National Convention will have been history; we in the LAX section are busily preparing for what we expect to be the finest National Convention ever! K6SVL reports that W6HX wins the May DX activity award for the So Cal DX Club; Ted worked 151 phone, 79 CW and reported 230 over the DX repeater for a total of 590 points (TNX SCDXC Bulletin). Our local ARRL VEC exams are sponsored by the Lockheed Club; exams are the first Saturday of each month—contact Marie, W6JEP, at (818) 848-9340. Welcome to the Mountain Repeater Assn. who have recently affiliated with the ARRL. Packet networks are becoming a reality; two experimental messages originated here were received in Newington. Aren't you on packet yet? The Downey club has formed an ARES committee to work with SEC AK6Y in establishing procedures for their club to interface with ARES. N6DBS reports that DCS (RACES) DCO, N6IQA, formulated "perfect plans" in conducting communications for the first Palos Verdes Bicycle Road Race; 500 cyclists were shepherded through a century mountain course by WA6OWM, N6IQA, N6DBS, W6OXX, W6TVB, W6FPJ, KB6GIT, K6SVL, W6ZWS, KE6FY, WB6MYD, N6ETJ, KI6E, K6QEC, WA6HXM, WB6OEX, WB6ICR and KB6FXS. N0KV and the "showcase" ham radio trailer served anchor duty for the race. Traffic totals very low the last couple months due to vacations and very very poor band conditions. I thought we had passed the bottom of the cycle but guess not. Traffic: K6YUK 636, W6INH 180, N6LHE 14.

ORANGE: SM, Joe H. Brown, W6UBQ—To provide the opportunity for more Amateur operators to become involved in organized public-service activities and for a more manageable Amateur Radio Communication System, the Orange Section is Reorganizing. Each county in the Section will be under the direction of an Ass't. Section Manager. His duties, to assist the SM implement League policies and programs. The District Emergency Coordinator is responsible for the Amateur Radio Emergency Service in his county. Taking over the helm in Orange Co is ASM Ralph Swanson, WB6JBI, 506 Hilda Circle, Anaheim, CA 92806 (714) 776-9272. DEC Corky Corcorran, N6HOI, 3113 South Rene Dr., Santa Anna, CA 92704 (714) 557-6230). The response areas will be expanded from four to eight in Orange Co. Riverside, ASM Bob Mann, W6LKN, 5127 Glenhaven AVE., Riverside, CA 92506 (714) 685-3823. DEC, Lee Brown, N6HGT, 5250 Tower Rd., Riverside, CA 92506 (714) 864-6720. San Bernardino Co. ASM Tony Petrone, WB6QHB, 125 Morgan Way, Upland, CA 91786 (714) 981-1836. DEC Tom Markely, WA6IKH, #70 17400 Valley Blvd., Fontana, CA 92335 (714) 350-2194). The new structure will increase flexibility and League Official availability for the Amateur Community. The Orange Section SEC, Jim AE6N, reports an ambitious undertaking. The Plan, to fly operators from the Los Angeles section to Riverside County (March AFB) on Air Guard Aircraft. Upon Arriving, they would be dispatched from Parris, CA. CDF/VIP control center to unmanned County Fire Stations in western Riverside County. This exercise will be part of the National Simulated Emergency Test (S E T.) LA Co Project Manager, Hank K6MYJ. Riv Co Project Manager John WA6QMW. *TC; JOHN KD7XG* asks the question. Is HAM radio into high tech? You BETCHA! Join the packet explosion into space. JAS-1 (Japanese Amateur Satellite-1) contains digital communications capabilities and technology being used for the first time on an amateur satellite. It represents a substantial achievement for Japanese amateurs who have been working on this project for several years. *STM; ERNIE* WA6QCA, PSHR WF6O, WB6QCA, WB6QBZ. Dan WF6O made BPL and sez am finally handling a lot of traffic on packet. It's a slick mode gang! I monitor 05:

NET	FREQ	TIME	SES	QNI	TFC	NM
SCN/1	3598	1830	22	218	192	WF6O
SCN/2	3598	2015	30	159	55	WF6O
SCN/V	146.645	2100	31	379	259	WA6QCA

Traffic: WF6O 679, WA6QCA 121, K6DD 119, WB6QBZ 106, N6GOT 102, K6ZCE 102, KA6HJK 100, AD8A 87, W6CPB 14.

SAN DIEGO: SM, Arthur R. Smith, W6INI—TC: N6NR. STM: N6GW. SEC: W6INI PIO: KG6LF. Join your local club. The Escondido ARS meets at 1930 on the fourth Monday at Glendale Federal S&L, 1505 E Valley Pkwy, Escondido. Visitors welcome. The club operates a repeater (W6MNH) on 146.88 (-) and supports an ARES group co-chaired by WF6K and N7HAW. The group is working with the city of Escondido in disaster planning. The large number of earthquakes in So Calif has spurred interest in emergency communications. ARES still needs many operators to fill assignments under the S D County Emergency Medical and Mass Care Plans. Assignments are being made to hospitals, Casualty Collection Points and Mass Care Shelters. Contact W6INI, 273-1120, for info. Attn Packeteers! The newly-formed S D Packet Radio Assn. warrants your support. The club meets at 1930 on second Tuesday at MA-COM Linkabit, 3033 Science Park Rd, San Diego. Officers are KB5MU Pres, WA2VFN VP, WD6HPY Sec, K1CT Treas. Upgrade: N6JMV to Extra. NCTN met 30 times, handled 93 msgs. ARES CW: 4 sessions 19 checkins. Traffic: N6GW 75. KU6D 48, N4KRA 46.

SANTA BARBARA: SM, Byron Looney, K6FI—Your SM finally made it into Eastern Ventura County and visited the Simi Settlers Club. It's encouraging to see many young faces in a group like this one. A big event in Ventura County is the annual Sea to Summit race. Communications were supplemented with packet this year and results were encouraging. Ojai is facing a possible antenna ordinance that could be very sticky. Ventrua County ARES also has a monthly EC meeting which I attended. Great idea for Santa Barbara and San Luis Obispo. I recently met an AEC who was a league member but not OES. If you are in that category, contact me for OES appointment and it will get you on SBAR Section News mailing list. By the time you read this, the San Diego Convention will be history. Hope you had a great time. Traffic: N6HYM 34.

WEST GULF DIVISION

NORTHERN TEXAS: SM, Phil Clements, K5PC—Asst. SM/ACC: NI5V. STM: AE5I. SGL: W5UXP. TC: W5LNL. BM: W5QXK. PIO: K5HGL. RFI: WB5JBP. There is an opening for Asst. Section Mgr. here in N. Tx. Someone who is a regular on TTN, TEX, and E/FW nets who can solicit and take Station Activity and PSHR reports the first five days of each month, and then forward to me. We have many active traffic handlers here in our section that do not report their activities and tfc count. We would really like to hear from you. The guys and gals that are in the trenches each day on the nets are that reservoir of trained experts we so vitally need in times of disaster. After the dust settles from our section restructuring here in Texas, (the new West Texas Section happens Jan. 1) we would like to put out a section ARES directory listing DECs, ECs and a by-county list of resources (including tfc. handlers) so that responses to disasters can be more tayiored to the needs of a particular location. Heavy recruiting will begin this fall in an effort to have an active ARES unit in every county in our section. This is a very reachable goal, but it will take lots of work to make it happen. We will also need several more

Announcing the HF/VHF/UHF base station you'll hear about on the air.

Listen for Yaesu's FT-767GX everywhere you might hear it: HF, 6 meters, 2 meters and 70 cm.

You'll hear operators calling it the ideal HF/VHF/UHF base station for small ham shacks and apartments.

And they'll rave about its full-featured performance and highly attractive price.

You see, the FT-767GX continues the price/performance tradition of our popular FT-757GX. But with even more features.

When you're ready to expand beyond HF coverage, just plug in optional modules for 6-meter, 2-meter, and 70-cm operation.

As standard equipment, you get a built-in HF automatic antenna tuner, AC power supply, digital SWR meter, digital power output meter, electronic keyer, and CW filter.

And operation is smooth and intuitive with keyboard frequency entry. Dual VFOs that tune in 10-Hz steps. A digital display in 10-Hz steps. And ten memories that store mode, frequency, and CTCSS tone information.

The FT-767GX is ready to operate full duty cycle at full rated power output for up to 30 minutes. And it listens from 100 kHz to 30 MHz.

Plus your station is really complete with full CW break-in, our patented Audio Peak Filter for CW operation, a CW TX offset variable 500/600/700 Hz, IF shift, an IF notch filter, a Woodpecker noise blanker, a VFO tracking system for slaved A/B VFO tuning, and optional CTCSS unit for repeater operation. And that's just a partial list!

But the best way to discover its full-featured performance is to visit your Yaesu dealer today.

Yaesu's FT-767GX. The affordable way to be heard on HF, VHF and UHF.

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Customer Service: (213) 404-4884
Parts: (213) 404-4847

Yaesu Cincinnati Service Center
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(513) 874-3100

Prices and specifications subject to change without notice.

Quick Response Teams in the eastern and southern portions of the section to complete the program. Then we can link all this up with packet radio! Dreams do become reality with a little hard work and dedication! PSHR for July: AE5I K5EVI W5VMP KA5SPT KA5QYV and K5MXQ. Traffic: W5TNT 206, KA5SPT 168, W9OYL 156, KD5RC 152, WB4HML 136, W5VMP 123, KA5AZK 80, AE5I 62, K5EVI 61, W5OU 60, N5IUI 56, K5MXQ 53, KA5QYV 24, KB5ADE 17, N5HEN 16.

OKLAHOMA: SM, Dave Cox, NB5N— ASM: K5WG. SEC: W5ZTN. STM: KV5X. ACC: NJ5Y. BM: W5AS. PIO: WD5IFB. OOC: K5WG. SGL: W5NZS. TC: W5QMJ. Rogers County Wireless Assoc. was presented their Charter of ARRL Affiliation at their August meeting, by West Gulf Div. AD, Ernie Buck, WB5CDW. The Edmond Amateur Radio Society (EARS) sponsored something new for Okla., a free seminar for the general public all about amateur radio; an excellent idea, especially when followed up by a new round of novice and upgrade classes as they did. Congrats to EARS member John Thomason, WB5SYT, on receiving a Certificate of Merit, from the Office of the Section Manager, for his many contributions to the Amateur Radio Service. Several Tulsa area hams donated their time and/or equipment to sponsor a booth at a hobby fair held at Spartan School of Aviation. Participating were: NJ5Z, WB5CDW, WN5D, WB5TEX, KB5VP, WB5IRY, N5HCC, WA5VWM, NF5M, N5IBM and NB5N. Texoma Hamarama, the last big hamfest of the year in Okla., is only about five weeks away. Finalize plans now for the biggest and best Hamarama in years. Only about two weeks left until I retire as Section Manager. All OK Section ARRL appointees should begin reporting to our new SM Oct. 1. Traffic: W5AS 286, NQ5W 220, WB5SRX 176, W5REC 110, W5RB 109, WA5OUV 73, NX5E 68, NB5N 58, N5IKN 57, WD5IFB 51, K5GBN 32, WA5OGC 31, W5VOR 25, W6VLW 20, K5CAY 18, WA5ZOO 12, KD5IS 6, KX5W 6, ND5S 4, AA6O 4, K5DLE 3, NQ5Y 3, N5DWN 3, KD5DL 1.

SOUTHERN TEXAS: SM, Arthur R. Ross, W5KR—SEC: KA5KRI. ASM: N5TC. STM: K5QEW. OOC: WA2VJL. BM: W5OVH. SGL: K5KJN. ACC: KS5V. PIA: WA5UZB. Art is on vacation so this column is de N5TC. As you know, a Blue Ribbon Committee is currently studying how amateurs can better respond to large scale emergencies. The work of the Committee is far from over but several things are already clear. (1) The various elements of public service need to interact with and understand each other better. Tornado chasers need to know how to handle formal traffic and how the NTS works. Traffic handlers need to understand the role that ARES members play and so on. (2) We need to be more flexible. Established procedures are great. They teach us discipline and how to be precise in what we do. However, sometimes procedures, routes, and formats need to be changed in the interest of getting the job done. (3) We are at the threshold of the greatest change that has ever taken place in amateur radio. The age of digital communications is here. A considerable amount of traffic is already being passed on packet radio, and computers are being used to interface with the agencies we serve. To keep up with the rapidly changing world, we need to do two things: (a) keep up with technological change, and (b) recruit computer whiz amateurs into public service activities. The final recommendations of the Committee will be given to the ARRL Board of Directors in January 1987. The implementation of the changes necessary to help us be better emergency communicators will be up to you. I am confident that you will meet the challenge. 73, Traffic: W5CTZ 332, WB5YDD 285, AJ5K 243, W5KLV 217, WD5GKH 116, WB5FQU 74, WA5VJL 65, WB5EPA 65, WD4PPG 20, K5HZR 19, WA5UZB 9, K5CVD 9. (June) W5KR 24, WA5UZB 12.

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 August 14 through September 13 will appear in November *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 their advertising before their 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 characters 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

QCWA Quarter Century Wireless Association is an international nonprofit organization founded in 1947. You are eligible for membership if licensed 25 or more years ago, and presently licensed. It is not necessary to have been licensed the entire 25 years. Members receive QCWA publications and participate in QCWA activities. Come grow with us! Write QCWA, Inc., 1409 Cooper Drive, Irving, TX 75061.

PROFESSIONAL CW operators, retired or active, commercial, military, gov't., police etc. invited to join Society of Wireless Pioneers—W7GAQ/6 Box 530, Santa Rosa, CA 95402.

IMRA-International Mission Radio Association Helps missionaries by supplying equipment and running a net for them daily except Sunday, 14.280 MHz, 1900-2000 GMT. Br. Bernard Frey, 1 Pryer Manor Rd., Larchmont, NY 10538.

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, 46 Murdock Street, Fords, NJ 08863.

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. 1417 Stoneybrook, Mamaroneck, NY 10543.

HAVE A-M capability? Join S.P.A.M. (Society for Promotion A-M) Membership is free. Write: F.A. Dunlap (S.P.A.M.), 14113 Stoneshire, Houston, TX 77060 (S.A.S.E. please).

FCC EXAMS, Novice-Extra. Sunnyvale VEC ARC. 408-255-9000, 24 hour. 73, Gordon, W6NLG, VEC.

FIND OUT what else you can hear on your General Coverage Transceiver or Receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter $1. Association of North American Radio Clubs, P.O. Box 462, Northfield, MN 55057.

GEORGIA (LAWRENCEVILLE) - 1-2: The Alfor Memorial Radio Club of Stone Mountain is sponsoring Ham Radio and Computer Expo '86 at Gwinnett County Fairgrounds, 20 minutes north-east of Atlanta. Hours: 9AM - 5 PM Sat.; 9AM - 4 PM Sun. Admission $4 advance, $5 at door. Forums, awards, VEC license exams both days, free cook-out Sat. night. Many other activities for the entire family. Superb dealer facilty, giant undercover flea market. Discount hotel rooms. Free parking for 3500 cars, RV sites with full hookup available. Talk-in on 146.16/76, 449.25/4.25. Information: Alford Memorial ARC, P.O. Box 1282, Stone Mountain, GA 30086 or call N8LM at 404-925-7615.

ADVANCED UPGRADE CLASS: free of charge. In Wellesley, MA. Sponsored by the Wellesley ARS. Oct 6 thru Dec. 15. Contact vern, ND1Z at 617-533-6822.

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CANADIANS: QSL samples $1 (refundable) M. Smith, VE7FI, Box 1376, Delta, B.C. V4M 3T3.

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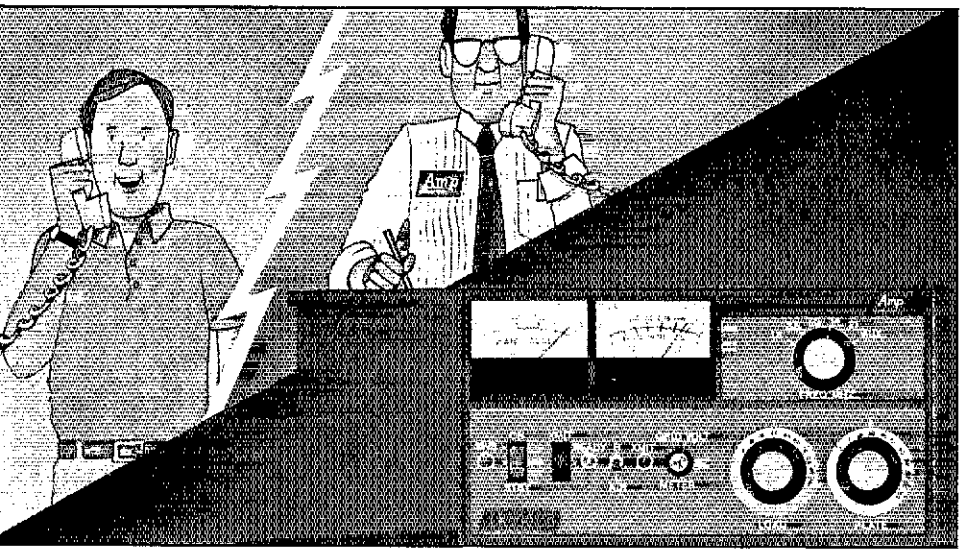


AND WE LISTEN.

Specifications

Frequency Range: 160 meters 1.8-2.2 MHz, 80 meters 3.5-4.5 MHz, 40 meters 7.0-7.5 MHz, 30 meters 10.1 to 10.15 MHz, 20 meters 14.0-18.2 MHz, 17 meters 1810-18.2 MHz 15 meters 21.0-21.5 MHz. Export models: 12 meters 24.8-24.9 MHz, 10 meters 28.0-29.7 MHz.
Drive Power: 100W Nominal for 1500 Watt SSB PEP output, 125W Nominal for 1500 Watt CW output.
RF Output SSB 1.5 KW PEP continuous, CW 1.5 KW Average continuous, RTTY, SSTV 1 KW Average 1.5 KW PEP.
Plate Voltage: RTTY/AM/SSTV/CW/SSB 3.2 KV DC
Harmonic Suppression: -50 dB minimum.
Intermodulation Distortion Products: -33 dB down minimum.
Circuit Type: Class AB, grounded grid. Type of Emission: SSB, CW, RTTY, AM, SSTV
Duty Cycle: Amateur continuous duty in all modes at specified output.
Output Circuit: Pi-network (silver plated tubing HF coil).
Tubes: 2 Eimac 3-500Z's.
Power Requirements: 115/230 VAC, 30/15 amps (230 VAC factory wired and recommended).
Dimensions: 8" H x 14" W x 16" D (including knobs).
UPS Shippable: 59 lbs.
Warranty: Two years on amplifier.

LK500ZB With QSK	**$1395.00**
LK500ZB Without QSK	**$1199.00**
LK500NTB No-Tune Version	**$1695.00**
Plug & Play Harness (Specify your radio)	**$ 9.95**
AT3000 Matching 3K Tuner	**$ 499.00**

Add an automatic SWR lock-out brain to your present amplifier (any brand). Self contained plug and play.
ALO-1 Accessory ..... **$ 94.50**

Trade in amps accepted. Reconditioned and guaranteed trade-in amps available. We now have a full line of wire antenna and accessories.

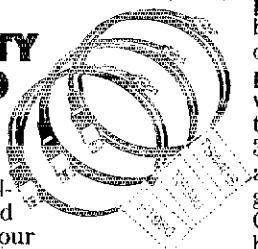
OUR CUSTOMERS ARE OUR BEST ENGINEERS

Building amplifiers is our main business. Listening to our customers is one way we plan our engineering. Dedicated to amateur radio, the people of Amp Supply Company have been designing and manufacturing amplifiers since 1974. Our most exciting designs have come from solving our customers' problems. Becoming a member of the Amp Supply Company family can add an important dimension to your communicating radio: an amplifier manufacturer.

INTERNAL POWER SUPPLY

All 500 Series amplifiers have a Peter Dahl Ripersil plate transformer and a separate filament transformer. The fullwave bridge rectifier system — unlike other systems that utilize weak voltage doublers — uses computer grade electrolytic capacitors. We listened to our customers years ago about heavy duty power supplies.

COMPATIBILITY GUARANTEED



Customer feedback in 1986 insisted on system compatibility. Responding to this challenge, a special Plug and Play Harness to hook your favorite radio to the LK500 is offered as an accessory. Of course, all Amp Supply amplifiers have our famous ATI-6 tuned input system, assuring a perfect 50 ohm load to your transceiver.

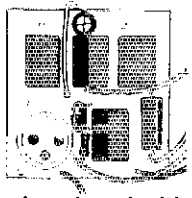
AUTOMATIC LOCK OUT

One of the major problems facing amateur radio users has now been solved by Amp Supply Company engineers. Just released, our automatic lock out is a brain that senses both currents and voltage. It will stop amplifier operation when it senses an unacceptable SWR or improper tuning, and activate an amber warning light.

2-SPEED FANS

Most manufacturers have had to compromise on fan speed, one of the noisiest and objectionable aspects of amateur radio operation. But, our 500 Series amplifiers are different; they are the result of our perfected system of customer communication and engineer response.

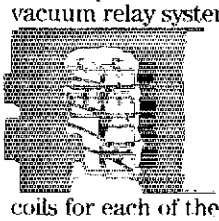
THE LK500ZB MODEL



This self-contained, high frequency linear power amplifier is capable of amateur continuous operation at output power levels of 1500 watts. It is manually tunable from 1.8-2.4 and 3.5-22 MHz continuous, and equipped with an ITT Jennings vacuum antenna changeover relay and a companion sealed relay QSK system. The HF tank coil and Centralab bandswitch are silver-plated.

A version of the 500ZB without the Jennings vacuum antenna changeover relay is available. Order the LK500ZB without QSK for $1199.00.

THE LK500NTB NO-TUNE



This no-tune amplifier is the same dependable amplifier as the LK500ZB with a QSK vacuum relay system, and completes our popular 500 Series. This desirable version allows you to merely switch to your favorite amateur band and transmit at full power. We have pre-set internal capacitors and coils for each of the traditional six amateur bands. The LK500NTB is also available for special MARS and commercial channelized frequencies.

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For fastest delivery, phone or send cashiers check, money order, or order by credit card. Indicate model number. MasterCard, VISA or American Express accepted (when ordering by credit card, include expiration date and signature). Personal checks, allow 18 days to clear. North Carolina residents, add 4½% sales tax. UPS surface charges and insurance in the continental USA are included. For two day UPS air service, add $25.

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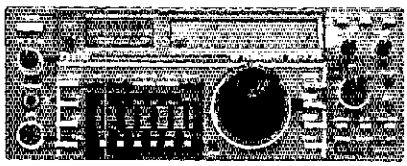
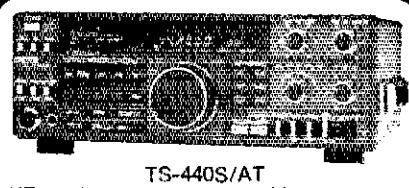


IC-735

HF Equipment	List	Juns
IC-735 Gen. Cvg Xcvr	999.00	Call $
IC-745 Gen. Cvg Xcvr	1049.00	Call $
IC-751A Gen. Cvg Xcvr	1649.00	Call $
Receivers		
IC-R7000 25-1300+MHz Rcvr	1099.00	Call $
IC-R71A 100kHz-30 MHz Rcvr	949.00	Call $
VHF		
IC-271A All Mode Base 25w	859.00	Call $
IC-271H All Mode Base100W	1099.00	Call $
IC-27A FM Mobile 25w	429.00	Call $
IC-27H FM Mobile 45w	459.00	Call $
IC-28A FM Mobile 25w	429.00	Call $
IC-28H FM Mobile 45w	459.00	Call $
IC-2AT FM HT	299.00	Call $
IC-02AT FM HT	399.00	Call $
UHF		
IC-471A All Mode Base 25W	979.00	Call $
IC-471H All Mode Base 75w	1339.00	Call $
IC-47A FM Mobile 25w	549.00	Call $
IC-4AT FM HT	339.00	Call $
IC-04AT FM HT	449.00	Call $
IC-3200A FM 2m/70cm 25W	599.00	Call $
220MHZ		
IC-37A FM Mobile 25w	499.00	Call $
IC-3ATFM HT	339.00	Call $
Repeaters		
IC-RP3010 440 MHz	1229.00	Call $
IC-RP1210 1.2 GHz	1479.00	Call $



TS-440S/AT

HF Equipment	List	Juns
TS-940SAT Gen. Cvg Xcvr	2249.95	Call $
TS-940S Gen. Cvg Xcvr	2049.95	Call $
TS-930S/AT Gen. Cvg Xcvr	1849.95	Call $
TS-830S Xcvr	1099.95	Call $
TS-530SP Xcvr	899.95	Call $
TS-430S Gen. Cvg Xcvr	819.95	Call $
TS-440S/AT Gen. Cvg Xcvr	1199.95	Call $
TS-440S Gen. Cvg Xcvr	1049.95	Call $
Receivers		
R-1000 200kHz-30 MHz	519.95	Call $
R-2000 150kHz-30 MHz	649.95	Call $
TS-670 All Mode Quad 6M	799.95	Call $
VHF		
TS-711A All Mode Base 25w	899.95	Call $
TR-751A All Mode Mobile 25w	599.95	Call $
TM-201B FM Mobile 45w	369.95	Call $
TM-211A FM Mobile 25w	399.95	Call $
TM-2530A FM Mobile 25w	429.95	Call $
TM-2550A FM Mobile 45w	469.95	Call $
TM-2570A FM Mobile 70w	559.95	Call $
TH-21AT FM, HT	249.95	Call $
TR-2600A FM, HT	359.95	Call $
UHF		
TS-811A All Mode Base 25w	1049.95	Call $
TM-401B FM Mobile 25w	399.95	Call $
TM-411A FM Mobile 25w	449.95	Call $
TH-41AT FM, HT	259.95	Call $
TR-3600 FM HT	369.95	Call $
220MHZ		
TM-3530A FM 220MHz 25w	449.95	Call $
TH-31AT FM 220 MHz HT	259.95	Call $
TL-922A HF Amp	1499.95	Call $

FT 757GX

HF Equipment	List	Juns
FT-ONE Gen. Cvg Xcvr	2859.00	Call $
FT-757GX Gen. Cvg Xcvr	995.00	Call $
FT-767 4 Band New	1895.00	Call $
Receivers		
FRG-8800 150kHz-30 MHz	599.95	Call $
FRG-9600 60 - 905 MHz	679.95	Call $
VHF		
FT-270RH FM Mobile 45w	439.95	Call $
FT-203R/TT FM Handheld 3w	259.95	Call $
FT-209RH FM Handheld 5w	359.95	Call $
UHF		
FT-770RH FM Mobile 25w	479.95	Call $
FT-703R/TT FM Handheld 3w	299.95	Call $
FT-709RH FM HT 4w	359.95	Call $
VHF/UHF Full Duplex		
FT-726R All Mode Xcvr	1095.95	Call $
6m/726 6m Module	269.95	Call $
430/726 430-440MHz	329.95	Call $
440/726 440-450MHz	329.95	Call $
HF-726 10-15-20M	289.95	Call $
SU-726 Sate Duplex	129.95	Call $
Dual Bander		
FT-2700RH FM 2m/70cm 25W	599.95	Call $
220MHZ		
FT-109 RH New HT	TBA	Call $
FT-103R/TT FM HT	279.95	Call $
Repeaters		
FTR-2410 2m Repeaters	1249.95	Call $
FTR-5410 70cm Repeaters	1289.95	Call $

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$99 *delivered.

70 CM ATV DOWNCONVERTER
FEATURES: Contains sensitive GaAsfet preamp & mixer - Tunes 420-450 MHZ down to ch. 2, 3, or 4. 120 Vac or 12vdc. Cabinet 4x2.5x7". TVC-2G tested board $59.

WHAT IS REQUIRED: It's EASY! Just connect your TV set, 70 CM antenna and coax to the TVC-4G and get ready to watch live action color video and sound.

ATV APPLICATIONS: See the shack, home video tapes, computer video, Space Shuttle, weather radar and other public service events. Many areas have ATV Repeaters; see ARRL Repeater Directory & 1986 Handbook chapters 20 and 7.

CALL (818) 447-4565 or write for our catalog. Give your amateur call if also interested in our transmitting equipment. We have all your ATV needs: antennas, coax, downconverters, transmitters, etc., 70, 33, & 23 CM.

*Includes UPS surface shipping in cont. USA

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Handy Handful...

TR-2600A/3600A

Kenwood's TR-2600A and TR-3600A feature DCS (Digital Code Squelch), a new signalling concept developed by Kenwood. DCS allows each station to have its own "private call" code or to respond to a "group call" or "common call" code. There are 100,000 different DCS combinations possible.

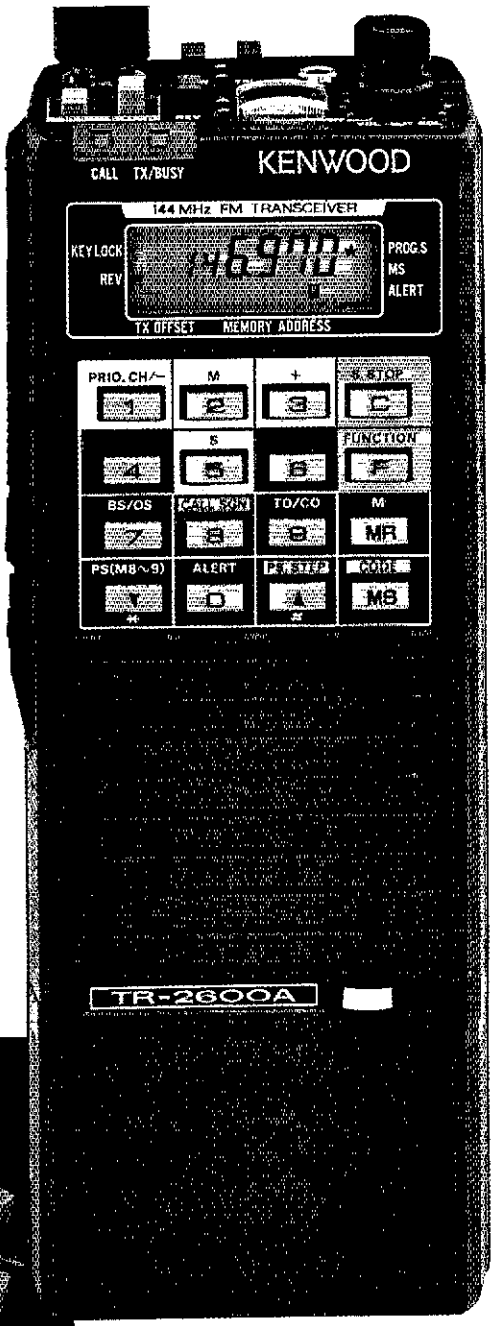
- **Simple to operate**
  Functional design is "user friendly." Built-in 16-key autopatch encoder, TX STOP switch, REVerse switch, KEYboard LOCK switch, high efficiency speaker.
- **Large LCD**
  Easy to read in direct sunlight or in the dark with convenient dial light that also illuminates the top panel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

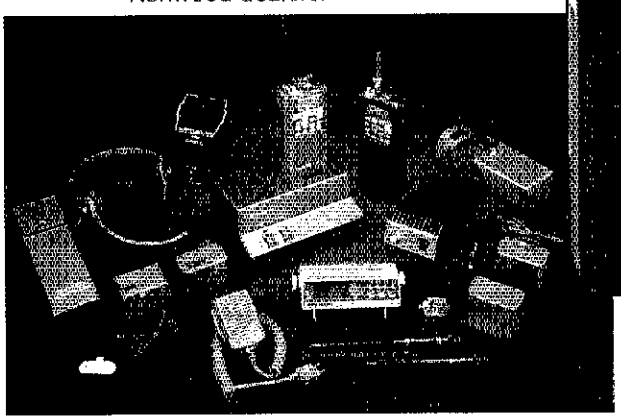
The Kenwood TR-2600A and the TR-3600A pack "big rig" features into the palm of your hand. It's really a "handy handful"!

Optional accessories:

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

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





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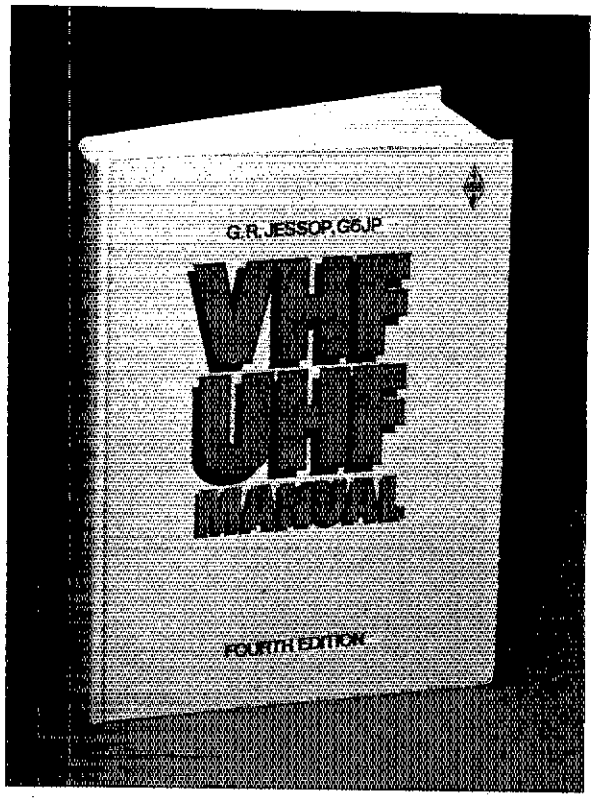
TR-2600A shown. TR-3600A is available for 70 cm operation.

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



VHF-UHF Manual by G. R. Jessop, G6JP. You will find the new fourth edition of ***VHF-UHF Manual*** jam-packed with practical theory and construction projects for the region above 30 MHz to 24 GHz. The microwave chapter has been expanded to 83 pages; and includes information on: converters, cavity amplifiers, Gunn diodes, waveguides, directional couplers, and antennas. Receivers and transmitters are covered in 181 pages. The balance of the 512-page book contains chapters on propagation, tuned circuits, space communications, filters, test equipment, antennas, and a handy data section. (Since this is a British publication, there is little coverage of the 6-meter band, but many of the 4-meter band projects can be adapted by the experienced amateur for use on 6-meters.) Copyright 1983 Hardbound $17.50

Under one cover, here is all you need to communicate through or pick up the signals from orbiting satellites. Whether your interest is in Amateur Radio, weather or TV-broadcast spacecraft, you'll find what you are looking for in ***The Satellite Experimenter's Handbook, 2nd edition.***

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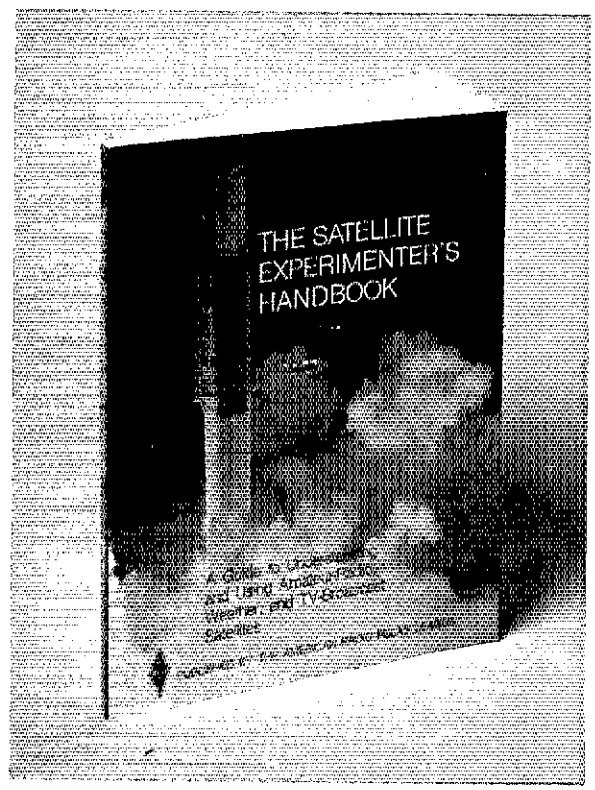

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Kenwood sets the pace again! The all-new "25-Series" brings the industry's *first* compact 70-watt 2-meter FM mobile transceiver. There is even an *auto dialer* which stores 15 telephone numbers! There are four versions to choose from: The TM-2570A 70-watt, TM- 2550A 45-watt, TM-2530A 25-watt and the TM-3530A 220 MHz, 25-watt.

- **First** 70-watt FM mobile (TM-2570A)
- **First** mobile transceiver with telephone number memory and auto-dialer (up to 15 seven-digit phone numbers)
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- Automatic repeater offset selection—**a Kenwood exclusive!**
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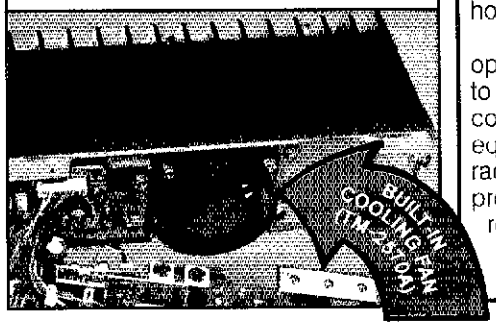
- Big multi-color LCD and back-lit controls for excellent visibility
- Front panel programmable 38-tone CTCSS encoder **includes 97.4 Hz** (optional)
- 16-key DTMF pad, with audible monitor
- Center-stop tuning—**another Kenwood exclusive!**
- Frequency lock switch
- **New** 5-way adjustable mounting system
- **Unique** offset microphone connector —relieves stress on microphone cord
- High performance GaAs FET front end receiver
- HI/LOW Power switch (adjustable LOW power)
- TM-3530A covers 220-225 MHz
- Digital Channel Link (optional)

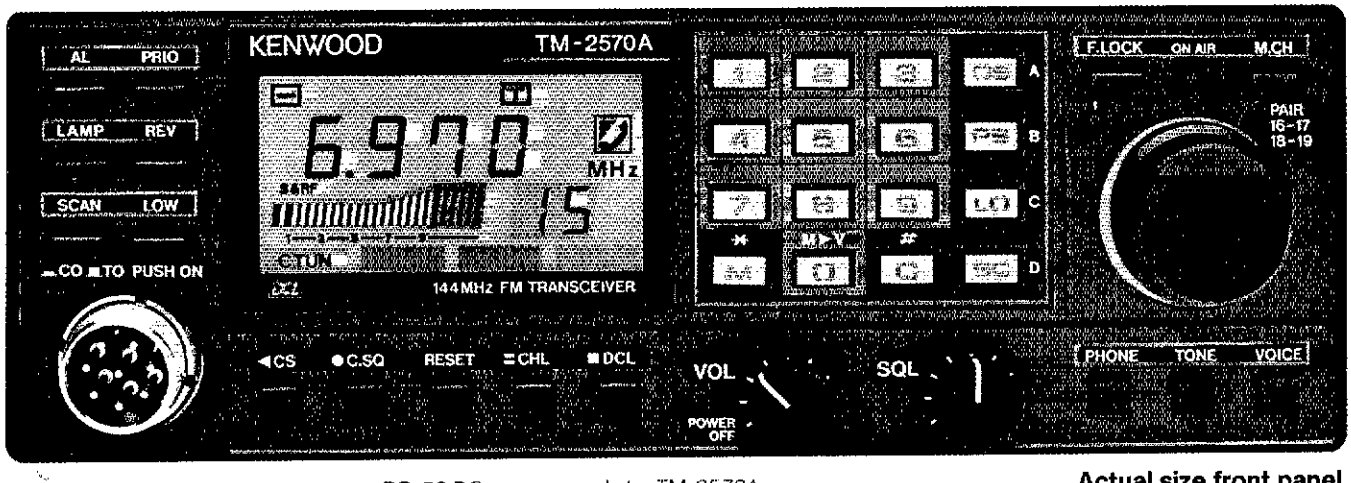
Large heatsink with built-in cooling fan (TM-2570A)



DCL **Introducing... Digital Channel Link**

Compatible with Kenwood's DCS (Digital Code Squelch), the DCL system enables your rig to **automatically** QSY to an open channel. Now you can automatically switch over to a simplex channel after repeater contact! Here's how it works:

The DCL system searches for an open channel, remembers it, returns to the original frequency and transmits control information to another DCL-equipped station that switches **both** radios to the open channel. Microprocessor control assures fast and reliable operation. The whole process happens in an instant!



Actual size front panel

Optional Accessories

- **TU-7** 38-tone CTCSS encoder
- **MU-1** DCL modem unit
- **VS-1** voice synthesizer
- **PG-2K** extra DC cable
- **PG-3A** DC line noise filter
- **MB-10** extra mobile bracket
- **CD-10** call sign display
- **PS-430** DC power supply for TM-2550A/2530A/3530A
- **PS-50** DC power supply for TM-2570A
- **MC-60A/MC-80/MC-85** desk mics.
- **MC-48** extra DTMF mic. with UP/DWN switch
- **MC-42S** UP/DWN mic.
- **MC-55** (8-pin) mobile mic. with time-out timer
- **SP-40** compact mobile speaker
- **SP-50** mobile speaker
- **SW-200A/SW-200B** SWR/power meters
- **SW-100A/SW-100B** compact SWR/power meters
- **SWT-1** 2m antenna turner

Complete service manuals are available for all Trio-Kenwood transceivers and most accessories
Specifications and prices are subject to change without notice or obligation.
Specifications guaranteed on Amateur bands only

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MORSE: The Code Machine

Program Description

This package consists of a disk and manual, used to teach and enhance your ability to send and receive code. It has a selectable sending speed of approx. 1-100 WPM.

The abbreviated and detailed manuals, approx. 10 and 38 pages long respectively, provide instructions for program operation, along with charts, figures and tables. The detailed manual discusses methods for learning and enhancing your skills.

The Text Generator creates text for program use, done automatically by computer or manually (using Text Processor). Characters created in text memory may be saved/loaded to/from disk. The View Mode displays the 8 page text memory, 1 page consisting of 24 lines by 40 characters.

The various packages available are based upon combinations of the modes discussed below.

Drill Modes
D1— Guess character for code sent and displayed on Lores Screen
D2— Guess code for Lores character shown

Practice Modes
P1— Code sent, but characters not displayed
P2— Character displayed on text screen, then its code sent
P3— Code sent, then character displayed on text screen

Teach Modes
T1— Display Lores character and send its code
T2— Hit key, chosen character is displayed on Lores screen with its code sent.
T3— Each chosen character is displayed on the Text screen consecutively the code sent as it's chosen
T4— Send code and display characters on Text screen from buffer consecutively
T5— Enter characters, hit RETURN, and code sent for each character along with its being displayed on the Text screen

Purchasing Information

This program has 6 versions which are the Fundamental, Basic, Classic, Deluxe, Super Deluxe and Elite packages. The Fundamental and Basic packages do not have Lores Graphics capabilities. All versions have disk commands and the View Mode. These versions are described below.

Note: The Computer Text Generator includes the Random Character Generator.

Fundamental Package
Random Character Generator
Mode P1
Abbreviated Manual $29.95

Basic Package
Computer Text Generator
Modes P3, T5
Detailed Manual $39.95

Classic Package
Computer Text Generator
Modes P1, T1
Detailed Manual $49.95

Deluxe Package
Computer Text Generator
Modes D1, P1, T1-2
Detailed Manual $59.95

Super Deluxe Package
Computer Text Generator
Modes D1-2, P1-3, T1-5
Detailed Manual $69.95

Elite Package
Computer Text Generator, Text Processor,
Modes D1-2, P1-3, T1-5
Detailed Manual $89.95

These programs run on the Apple II+/c/e computers with 48k memory and 1 disk drive. To purchase a package, send a check or money order to:
LARESCO, P.O. Box 2018, 1200 Ring Rd., Calumet City, Ill. 60409 1-312-891-3279
Orders outside the U.S. must include postage and handling.

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Good for Satellite Digital QSOs

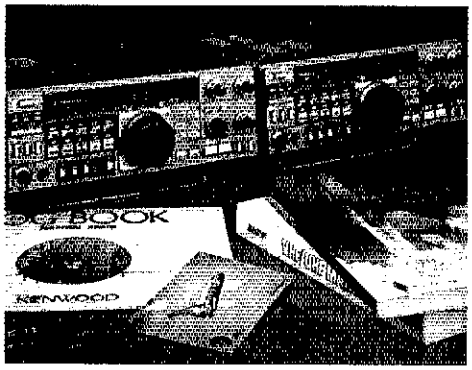
Matching Pair

Look for JAS-1 and PHASE III-C

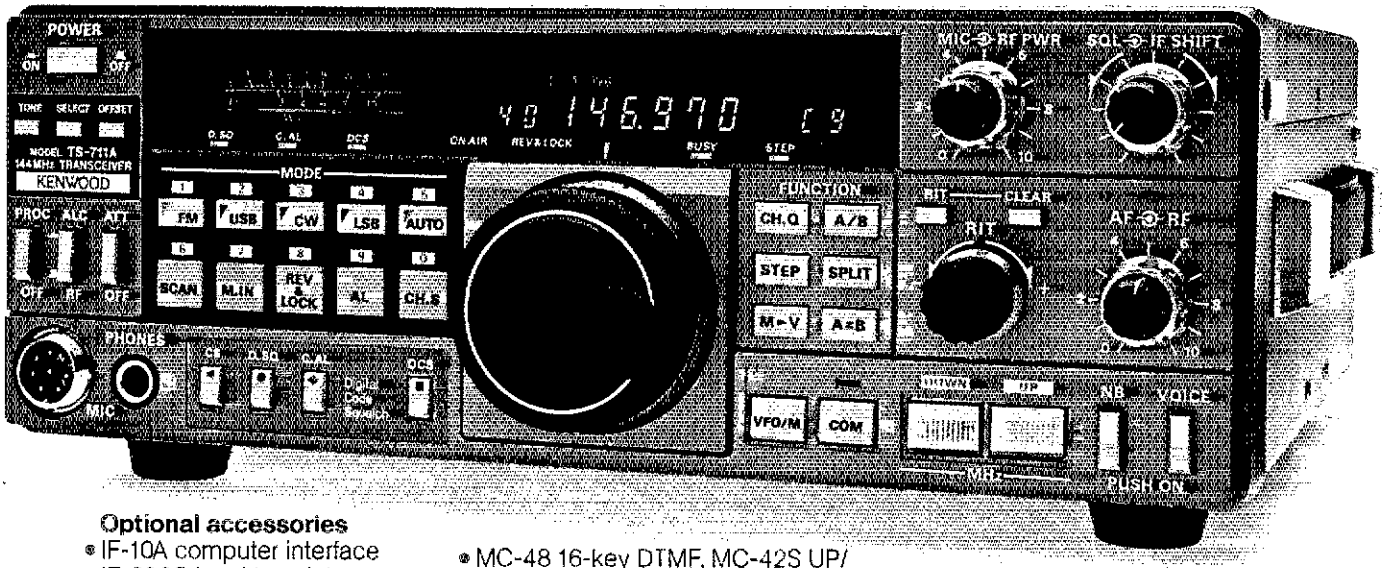
TS-711A/811A VHF/UHF all-mode base stations

The TS-711A 2 meter and the TS-811A 70 centimeter all mode transceivers are the perfect rigs for your VHF and UHF operations. Both rigs feature Kenwood's new Digital Code Squelch (DCS) signaling system. Together, they form the perfect "matching pair" for satellite operation.

- **Highly stable dual digital VFOs**
  The 10 Hz step, dual digital VFOs offer excellent stability through the use of a TCXO (Temperature Compensated Crystal Oscillator).
- **Large fluorescent multi-function display**
  Shows frequency, RIT shift, VFO A/B, SPLIT, ALERT, repeater offset, digital code, and memory channel.
- **40 multi-function memories**
  Stores frequency, mode, repeater offset, and CTCSS tone. Memories are backed up with a built-in lithium battery.



- **Versatile scanning functions**
  Programmable band and memory scan (with channel lock-out). "Center-stop" tuning on FM. An "alert" function lets you listen for activity on your priority channel while listening on another frequency. **A Kenwood exclusive!**
- **RF power output control**
  Continuously adjustable from 2 to 25 watts.
- **Automatic mode selection**
  You may select the mode manually using the front panel mode keys. Manual mode selection is verified in International Morse Code.
- **All-mode squelch**
- **High performance noise blanker**
- **Speech processor**
  For maximum efficiency on SSB and FM.
- **IF shift**
- **"Quick-Step" tuning**
  Vary the tuning characteristics from "conventional VFO feel" to a stepping action.
- **Built-in AC power supply**
  Operation on 12 volts DC is also possible.
- **Semi break-in CW, with side tone**
- **VS-1 voice synthesizer (optional)**
  More TS-711A/811A information is available from authorized Kenwood dealers.



Optional accessories

- IF-10A computer interface
- IF-232C level translator
- CD-10 call sign display
- SP-430 external speaker
- VS-1 voice synthesizer
- TU-5 CTCSS tone unit
- MB-430 mobile mount
- MC-60A, MC-80, MC-85 deluxe desk top microphones
- MC-48 16-key DTMF, MC-42S UP/DOWN mobile hand microphones
- SW-200A/B SWR/power meters:
  SW-200A 1.8-150 MHz
  SW-200B 140-450 MHz
- SWT-1 2-m antenna tuner
- SWT-2 70-cm antenna tuner
- PG-2J DC power cable

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

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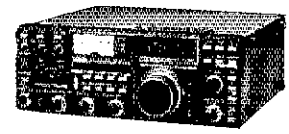

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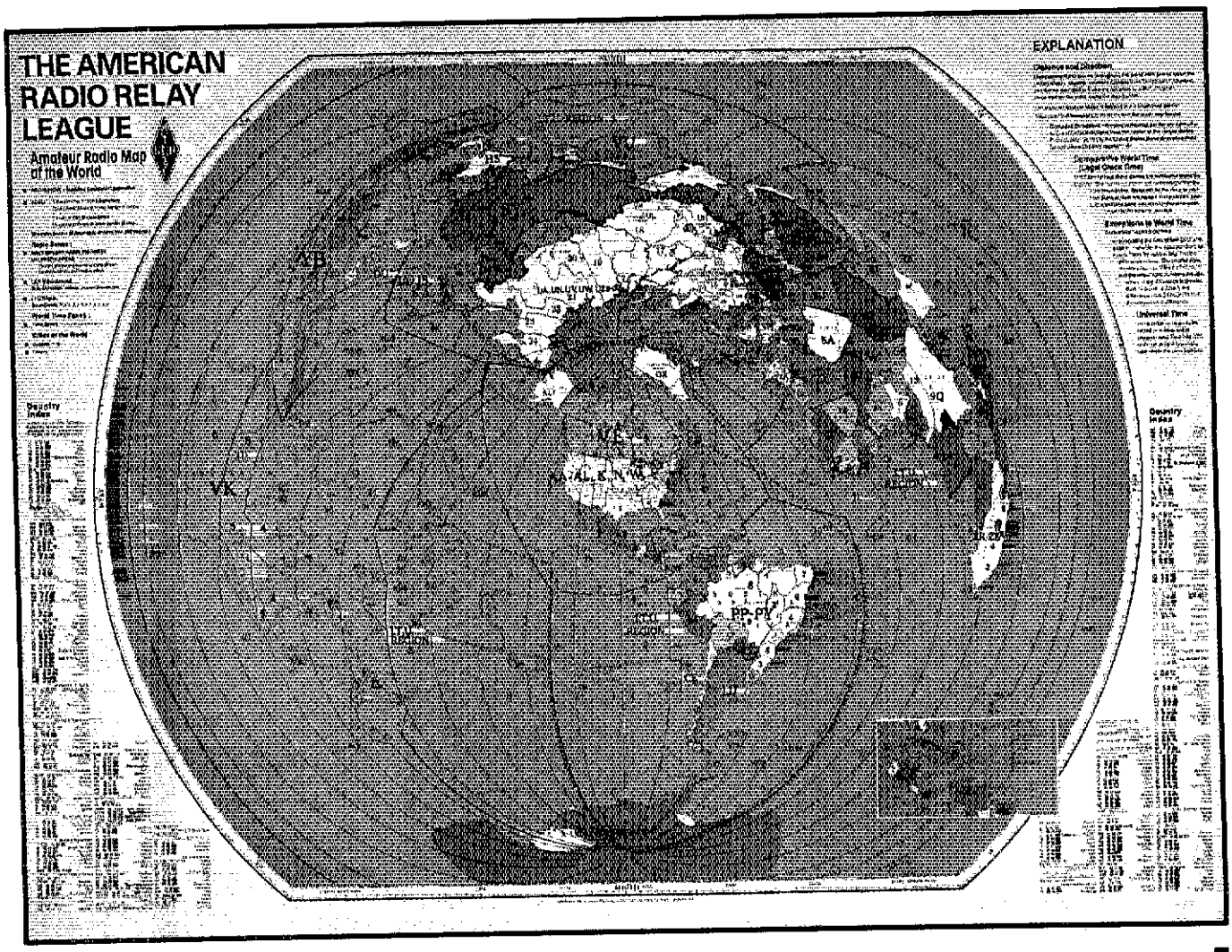

LATEST EDITION

DETAILED CARIBBEAN INSERT

The ARRL Amateur Radio Map of the World has been updated from the 1980 version by the League and Rand McNally. The colors are brighter and bolder, and we have added an enlarged and detailed insert of the Caribbean. The country index lists countries alphabetically by prefix and shows ITU and CQ Zones as well as continent. On the map itself you will find ITU Regions, time zones and great circle bearings centered on the United States as well as prefixes and call districts. The latest edition of ths popular Amateur Radio map will brighten any ham shack wall! Price is $8.00.

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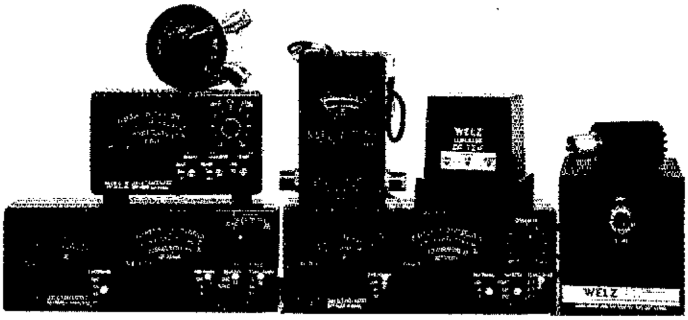

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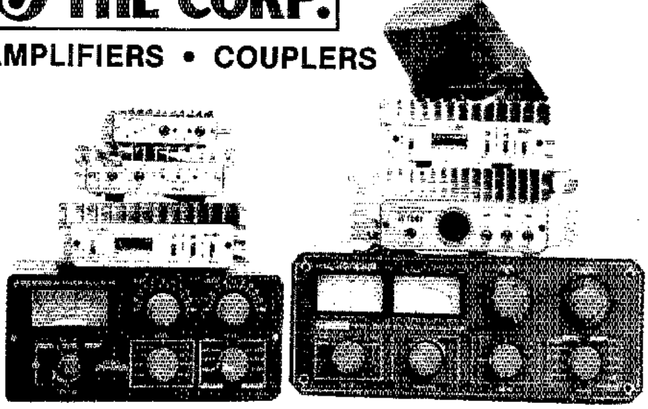

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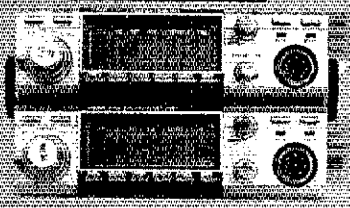

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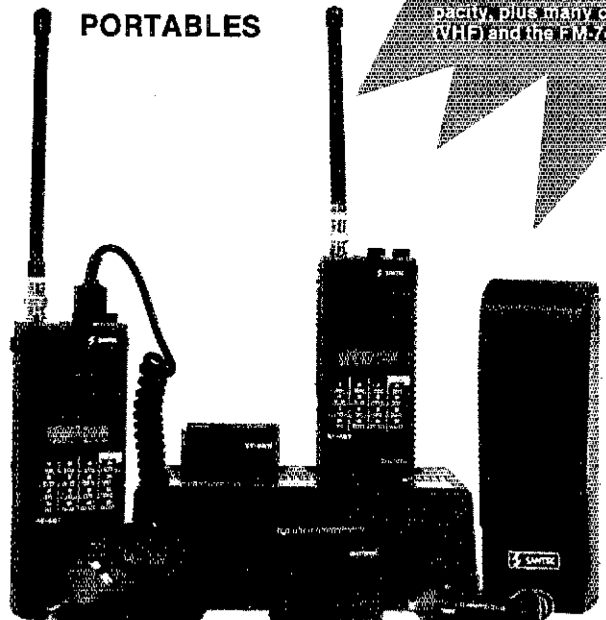

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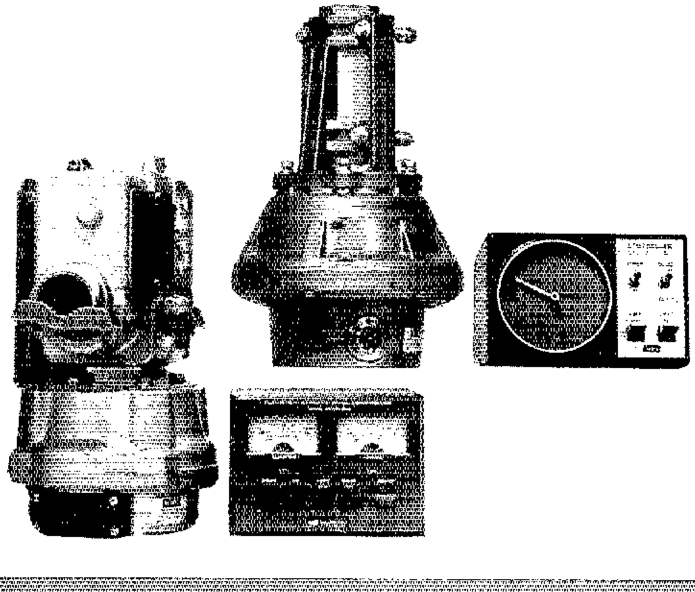

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ICOM

Optimizing with Accessories

In the same manner that belts, shoes, and neckwear coordinate and complement a basic wardrobe, mating station accessories also creates a smooth interworking amateur radio setup of exceptional flexibility. The "professional difference" resulting from inclusion of such items produces a station that can work DX with ease, turn a high score in any contest, and is a sheer dream to operate.

Recognizing that situation, ICOM complements each of its general coverage, HF, VHF and UHF receivers and transceivers with a full line of performance-optimizing accessories. Some of those items are small and comparatively inexpensive, others are larger and quite sophisticated. This arrangement provides individual equipment tailoring and the capability of assembling a truly personalized station.

As an example of deluxe station assembly, let's consider the unlimited versatility produced by combining an ICOM IC-2KL linear amplifier and AT-500 automatic antenna tuner with an IC-751, IC-751A, IC-735, or IC-745 HF transceiver. Each of these units interconnect with their host transceiver via a single multiwire cable: neat, simple, and easy to install in any location.

Both the IC-2KL and AT-500 are solid state in design and fully automatic in operation. You can switch on this top-of-the-line station, tune a desired DX station (on any band your antennas operate) and call him/her right "on the spot" without warmup or tuning delays. Meanwhile, other operators are still reaching for knobs and switches to swing their linear amplifiers and antenna tuners into action. You're moving up and down the band, even changing bands, and "kicking off" DX pileups while others can only follow your uncompromising lead. That's the ICOM advantage!

The IC-2KL amplifier features several capabilities that simply are not available in competitive units. Band selection automatically tracks with its host transceiver, and broadband circuits let you operate any 160 through 15 meter amateur frequency (including WARC) without pretuning.

The IC-2KL amplifier and its power supply are housed in separate cabinets for easy handling, and each is no larger than its mating transceiver. The unit is protected against antenna mismatching, overheating, overdrive, excessive RF output, and unbalance of its dual power amplifier sections. Its approximate 500 watts output is an optimum level for generating a strong signal, and it doesn't require a massive current 110 or 220 volt AC outlet for operation. It's also the ideal amplifier for condo or apartment use.

ICOM's AT-500 is actually two units in one small cabinet. It's an automatic 160 through 10 meters antenna tuner (including WARC bands) and an antenna switch which follows band selections from its mated transceiver. During operation, the tuner presets its variable capacitors for optimizing reception on a selected band. The application of RF energy then fine tunes adjustments for an optimum impedance match within one or two seconds time.

Up to four antennas can be connected to the AT-500's rear panel for automatic selection when the AT-500's AC switch is on. A 100 watt version of the AT-500 (AT-100) is also variable for use with "barefoot" ICOM transceivers, and a cabinet-matched AT-150 (100 watt antenna tuner) is available for the IC-735.

A variety of internal and "expandable" accessories are also available for ICOM's HF, VHF and UHF transceivers. A full discussion of the most popular of those items, additonal IF filters, was presented in a previous Tech Talk. A reprint of that information is available directly from ICOM America.

If computer control piques your interest, a connector is available for the IC-751, IC-751A, IC-271A/H, IC-471A/H and IC-1271A transceivers.The IC-735 needs no connector. Using minimim support hardware and software, frequency, mode, memory selection and scanning can be performed via your home computer.

Need power supply flexibility? ICOM's IC-PS35 (20A) AC supply can be installed inside the IC-751, IC-751A, or IC-745 transceivers for "single box" use. Alternately, the husky IC-PS30 (25A) can be used for simultaneously powering several transceivers (great for OSCAR use).

If your interests include mobile and portable activities, ICOM's all band and fully automatic AH-2 antenna system places unlimited operating pleasures right at your fingertips. This mobile whip and microprocessor controlled tuner combo accepts frequency information from its mated transceiver for simple "tune any station and give a call" convenience. The tuner includes eight internal memories for storing and immediately recalling impedance matching data of previously tuned frequencies, and a simple random wire can be substituted for the mobile whip for optimum mobile or field day operations.

Although space limitations preclude full discussions of all ICOM accessories, the overall message of the Tech Talk is quite apparent. Whatever HF, VHF, or UHF unit you use or plan to use, a glamorous line of complementing accessories are available for optimizing its capabilities in a personalized manner. If you're interested in top-of-the-line performance and operator-friendly gear, the obvious choice is, naturally, ICOM!

ICOM America, Inc., 2380-116th Ave NE, Bellevue, WA 98004 / 3150 Premier Drive, Suite 126, Irving, TX 75063
1777 Phoenix Parkway, Suite 201, Atlanta, GA 30349 / 3071 - #5 Road, Unit 9, Richmond, B.C. V6X 2T4 Canada

ICOM IC-751A

CAN YOU HANDLE THIS MUCH TRANSCEIVER?

All HF Band Transceiver/ General Coverage Receiver
New Design
100% Duty Cycle Transmitter
105dB Dynamic Range
All Modes Built-In USB, LSB, AM, FM, CW, RTTY
12 Volt Operation

The new IC-751A top-of-the-line base station transceiver is designed r the ham operator who demands high erformance. Whether contesting or SY'ing for pleasure, the 100 watt -751A incorporates the best features the IC-751, plus brings you to the refront with the following most-asked r additions.

More CW Control. For the CW thusiast, the new IC-751A includes an ectronic keyer unit, QSK rated at up 40WPM, standard FL-32A 9MHz/ 0Hz CW filter and CW sidetone to monitor your code in RX or TX modes... great for practice!

All Amateur Band Coverage. Plus general coverage reception from 100kHz to 30MHz. May be easily modified for MARS operation.

Improved Smooth Tuning. The IC-751A features a newly designed tuning knob for velvet smooth tuning.

Added LED Annunciator. For easily identifying if you're using the tuning speed, dial, or band switching functions.

32 Memories. Mode and frequency may be stored in any of 32 memories...all the memory capability that you'll ever need.

More Stable. Even in the receive mode, the IC-751A has a sophisticated thermal sensor to monitor the internal temperature. The sensor automatically activates the cooling fan which gives maximum stability ...critical for contesting.

Newly Designed Features. The IC-751A boasts a number of newly designed features for better performance ...new 9MHz notch filter to drastically reduce QRM, new AGC system, new compressor for better audio and a new AF gain control system to improve control of the CW sidetone volume.

Options Available. Options for the IC-751A include the IC-PS30 external AC system power supply, IC-PS35 internal AC power supply, IC-AT500 antenna tuner, IC-EX309 microprocessor interface connector, SM-8 or SM-10 desk mics, IC-2KL linear amplifier, RC-10 remote controller, SP-7 or SP-3 speakers, IC-EX310 voice synthesizer and GC-5 world clock.

Optional Filters. FL-52A CW 455kHz at 500Hz, FL-53A CW-N 455kHz at 250Hz, FL-63A CW-N 9.0106MHz at 250Hz, FL-33 AM 9.010MHz at 6000Hz, and CR-64 high stability 30.72MHz crystal filter.

ICOM
First in Communications

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All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 751A386

MOBILES

ICOM 144, 220 and 440MHz

The World's Most Compact Mobiles

ICOM's three ultra compact mobiles...the IC-27A 2-meter, the IC-37A 220MHz and the IC-47A 440MHz... are the smallest mobiles available.

Even in such a small package the 25 watt mobiles contain an internal speaker which makes them fully self-contained and easy to mount.

Size. The ICOM compacts measure only 5½"W x 1½"H x 7"D. (IC-47A is 9" deep)... which allows them to be mounted in various "compact" locations. Yet the compacts have large operating knobs which are easy to use in the mobile environment.

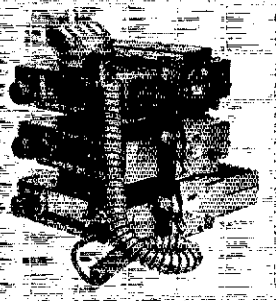
More Features. Other IC-27A/37A/47A standard features include a mobile mount, IC-HM23 DTMF mic with up/down scan and memory scan, and internally adjustable transmit power. An optional IC-PS45 slim-line external power supply and IC-SP10 external speaker are also available.

32 PL Frequencies. The IC-27A/37A/47A come complete with 32 PL frequencies.

9 Memories. The compact mobiles have 9 memories which will store the receive frequency, transmit offset, offset direction and PL tone. All memories are backed up with a lithium battery.

Speech Synthesizer. To verbally announce the receive frequency, an optional UT-16 voice synthesizer is available.

Scanning. The ICOM compacts have four scanning systems...memory scan, band scan, program scan and priority scan. Priority may be a memory or a VFO channel...and the scanning speed is adjustable.



Stacking Mobile Mounts. The IC-27A/37A/47A can be stacked to provide a three-band mobile station. Each band is full featured and will operate even when another band is in use.

The IC-27A/37A/47A provide superb performance in the mobile radio environment. See them at your local ICOM dealer.

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ICOM America, Inc., 2380-116th Ave NE, Bellevue, WA 98004 / 3331 Towerwood Drive, Suite 307, Dallas, TX 75234

ICOM 440MHz

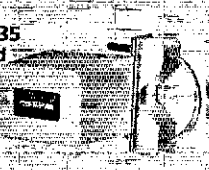
For a Total UHF System, Choose ICOM

ICOM offers a variety of UHF gear to meet your operating requirements... the IC-471H base station transceiver, IC-47A compact mobile, IC-04AT or IC-4AT handheld transceivers, and the RP-3010 crystal controlled repeater.

The IC-471H all mode 430–450MHz base station transceiver provides 10 to 75 watts of adjustable power. With 32 full-function memories, 32 PL tones, memory scan, mode scan and programmable band scan, the IC-471H provides maximum UHF base station performance. The IC-471A 25 watt version is also available.

The IC-47A 25 watt 440–449.995MHz ultra-compact FM mobile provides superb performance in the mobile environment. Measuring only 5½" wide by 1½" high by 9" deep, the IC-47A also features nine full-function memories, 32 built-in PL tones and a complete scanning system. Each unit comes standard with an HM-23 mic with up/down scan and a mobile mounting bracket.

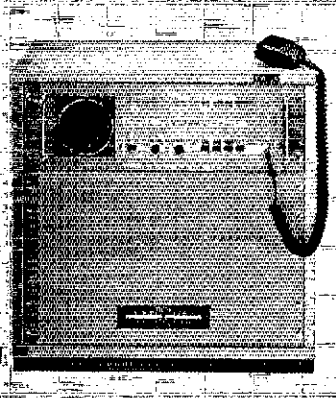
Optional AG-35 Mast Mounted GaAsFET Preamplifier for IC-471H



The IC-04AT top-of-the-line UHF handheld features DTMF direct keyboard entry, LCD readout, 32 PL tones, 3 watts standard (5 watts optional) and 10 memories which store duplex offset and PL tone.

The IC-4AT handheld features 440–449.995MHz coverage, a DTMF pad, 1.5 watts output and thumbwheel frequency selection.

The IC-04AT and IC-4AT come standard with an IC-BP3 NiCd battery pack, flexible antenna, AC wall charger, belt clip, wrist strap and ear plug. PLUS a wide variety of slide-on battery packs and accessories are available.



The RP-3010 crystal controlled UHF repeater covers from 430–450MHz and includes CTCSS, 3-digit DTMF decoder and CW ID'er.

See ICOM's full line of UHF gear at your local ICOM dealer.

ICOM

First in Communications

ICOM America, Inc. 2380–116th Ave NE Bellevue, WA 98005 1-3331 Towerwood Drive, Suite 307, Dallas, TX 75234

EARLY ELECTRONIC and Mechanical Television Sets, parts, literature wanted for substantial cash. Finder's fee paid for successful leads. Arnold Chase, 9 Rushleigh Road, West Hartford, CT 06117 203-521-5208.

BUY, sell, collect and restore early tube equipment? Early receivers, tubes and telegraph gear? Join AWA which sponsors old time "meets," flea markets, museum and journal with free want ads. Annual dues only $8. Write: Bruce Kelley, W2ICE, Rte. 3, Holcomb, NY 14469.

TELEGRAPH BUGS, old keys wanted. Collector needs most models and variations of pre-1960 Vibroplex, Martin, Clark-Rotoplex, Dow- Key, Brown Brothers, Melehan, Bunnell, McElroy, etc. including military, spark, wireless. Donations of parts, literature, damaged keys appreciated. Write: John Hensley, WJ5J; 5054 Holloway Ave; Baton Rouge, LA 70808.

WANTED: SPEEDX BUG. CONLY, 819 Henrietta, Sunnyvale, CA 94086

WANTED: McINTOSH Tube-type Audio Equipment, Accessories, and literature for personal collection. All inquiries answered; information and appraisals gladly given. Marcus Frisch, WA9IXP, Box 385, Elm Grove, WI 53122-0385. 414-545-5237

$100 for 6ACB or W6ACB QSL card prior to 1940. W6KU 303-371- 6159.

WE MAY HAVE the tubes you need. (Thousands in stock). Send S.A.S.E for our list. Fala Electronics, PO Box 1376-1, Milwaukee, WI 53201.

WANTED - WESTERN Electric tubes, amps, consoles, drivers, horns, speakers, microphones, parts. Radio tubes (2A3, 45's, 50's, 199, 280, 210, 211, 845) old speakers, drivers, horns, from Jensen, Altec, Trusonic, JBL, University, Tannoy, David Yo, PO Box 832, Monterey Park, CA 91754. Tel: 818-576-2642.

WANTED: OLD tubes, Western Electric, RCA, Cunningham, Radiotron, Telefunken, McIntosh, Marantz, speakers, amplifiers. 713-728- 4343, Maury Corb, 11122 Atwell, Houston, TX 77096.

R-390A RECEIVER: $195 checked; $115 reparable. Parts, tubes, sections. Info SASE. Baytronics, Box 591, Sandusky, OH 44870. 419-627-0460 evenings.

WANTED: BUYER for my 15 year collection of Hallicrafters Equipment - the largest in the world - over 400 units plus manuals, parts, accessories. Serious inquiries only please. SASE to Chuck Dachis, The Hallicrafters Collector, 4500 Russell Drive, Austin, TX 78745.

WANTED CROSLEY "Pup" K4NBN "No Bad News"

WANTED: WRL - Globe King 500C xmtr. Must be in good condition. Call 304-466-0225 collect. Tom - K8BUX.

WANTED - BANDSPANNER Broomstick Antenna. Write or call K8LJM 313- 792-2787.

QST's 1957-59, 1961-70 in binders; 1971-82 loose. $80. Pick up or meet halfway. Herry Vanaskey N8BM, N. Canton, OH. 216-494-1534.

WANTED: HALLICRAFTERS SR-400A, FL-1 1650kcs crystal filter part 049-00851. N2EG RD8 Box 552, Flemington, NJ, 08822.

BC1000 ANTENNA Type AN130 AN131 RC291, Japanese WW2 radios like Chi-Ichi Receiver JA1DNQ/KD2HB Tajima, care Toshiba, 111 Business Park Drive, Armonk NY 10504.

WANTED: HOWARD 430 or 438, RME 69, Stancor 10P, and Candler Code Course. Dan Killian, W4IUV, 6359 S.W. 114 St., Miami, FL 33156, tel. 305-665-1963.

FOR SALE. *QST* 1923 through 1985, Two issues missing April 1927 and Mar. 1928. Estate of W4EF. $10 per year, U ship. 205-383- 7554. Or write Owen, 711 North Jefferson Street, Tuscumbia, AL 35674.

WANTED: HALLICRAFTERS S-20R, SX-88, SX-115, SX-101A. Northwest Pickup. Vern Gray, 1922 N.E. 86th, Portland OR. 97220.

TELEGRAPH KEYS: Collector looking for each make and model of bug made before 1935. Vibroplex, Martin, Boulter, Brooklyn, etc. Also need spark keys and pre-1900 landline (keys, sounders, pocket sets). Visitors Welcome; 300 + items. K5RW Neal McEwn 1128 Midway Richardson, TX 75081 tel. 214-234-1653.

HEATH HW-16, HG-10 VFO, key, earphones, 4 spare tubes, and a speaker. All work excellently. $135. KB4KZE 803-359-7806.

LICENSE PLATES with call letters, especially 1950's, wanted for my collection. Have many for trade. Jim Estrup, RR 1, Box 908, Kennebunk, ME 04043.

QST'S 1957 to date. Many with binders, mint condition. W2IS, 370 Barrington Street, Rochester, NY 14607 716-244-5374.

ANTIQUE RADIOS, Schematics, Tubes & Literature. Send SASE to VRS(QS), 376 Colley Rd., Manchester NH 03103 for large list.

GALAXY III XCVR, Power Supply. Good condition. 300 Watt. Rcvr needs calibration. Original manual. $200 shipping. WA7MMM, 2744 NE37th Portland, OR 97212.

K4UJZ IS SELLING some of his old transmitters and receivers, SASE for list: Want 1920's Hammarlund, Grebe Russ Olmsted, 608 West Thompson Lane, Murfreesboro, TN 37130; 615-893-5344.

QST BACK ISSUES - total 200. Moving to Florica - name your own price for the lot - John Bess (W2YIX) 1149 Hillsboro Mile Hillsboro Beach FL 33064 - 305-427-7193.

WANTED, HALLICRAFTER power supply PS-150-120AC for SR-160. W6QD, please phone 213-598-2518.

GENERAL

WANTED: Squire - Sanders SS-1R Receiver and/or documents make offers. Broutin, 3 Rue Craque, 40600 Biscarrosse FRANCE.

ALINCO ELECTRONICS INC.

P.O. Box 20009 • Reno, Nev. 89515 Phone (702) 359-1414 • Telex 4993999 EGELECTR
44 Glen Carran Circle • Sparks, Nev. 89431

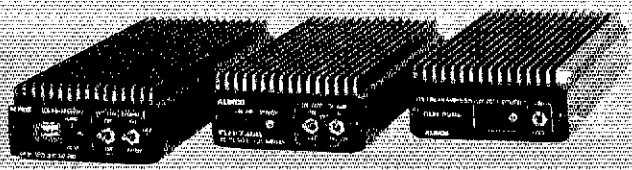
ALM-203T
List $345.00

2m FM Handheld Transceiver

- 2 Band HT
  Band A 140-150 MHz
  Band B 150-160 MHz (Receive Only)
- 10 Channel Memory
- Built-in Sub Audible Tones
- Battery Save Function
- 3 Watts Output Standard; 5 Watts with 12 V adapter
- Don't decide on a handheld until you have seen Alinco's newest!

ALR-206T List $345.00

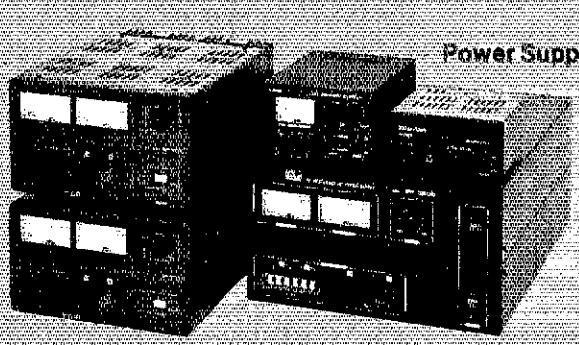
- 140-149.995 MHz Covers MARS and CAP
- Programmable Band Scan
- Programmable Non-Standard Repeater Offset
- Unique Control Knob
- Completely Programmable From Microphone
- 25 Watt High - 5 Watt Low
- Built in Lithium Back Up Battery
- Up/Down Control On Microphone
- 10 Channel Memory
- Built in Sub Audible Control
- Many Features, See Your Dealer



Linear Amps

List Prices From $69.95 to $156.00

- 2m, 1¼m and 70 cm micro linear amplifiers
- 3 watts in provide 30 to 50 watts out to convert your HT to a high power mobile radio
- Each amp includes a heavy duty heat sink, protection circuit and a low pass filter for a clean signal
- Some models available with a 15 db gain GaAsFET receive preamp, others with a 10 db gain FET receive preamp and one with an RF meter.



Power Supplies

Affordable performance is the final output of these work-horses. These high efficiency, high output, regulated supplies each comes with automatic current limit and shut down protection. Choose from 4.5 to 55 amps of output. List Prices From $69 to $333.

Memo:

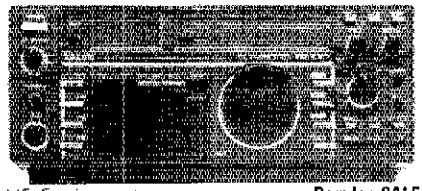
WATCH ALINCO GROW!

We will be introducing more new and exciting products in the very near future, NEW state of the art miniatures. 140-150MHz HT's, new miniature 440-450MHz HT's, new dual band mobile radio and new high power 2 meter and 70cm amplifiers.

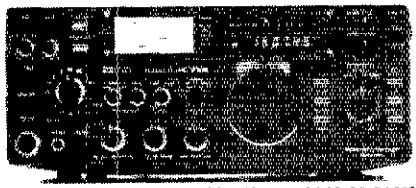
Remember Alinco's unique warranty program. If you have a failure within 30 days, your dealer (up to his inspection) will give you a new unit, provided it has not been abused or modified.

Thank you for your continued support.

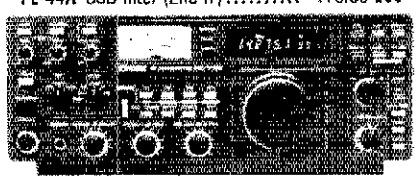
Everett L. Gracey
President



HF Equipment	Regular	SALE
IC-735 HF transceiver/SW rcvr/mic	999.00	849.95
PS-55 External power supply	199.00	179.95
AT-150 Automatic antenna tuner	445.00	359.95
FL-32 500 Hz CW filter	66.50	
EX-243 Electronic keyer unit	56.00	
UT-30 Tone encoder	17.50	



IC-745 9-band xcvr w/.1-30 MHz rcvr	1049.00	899.95
PS-35 Internal power supply	199.00	179.95
EX-241 Marker unit	22.50	
EX-242 FM unit	44.00	
EX-243 Electronic keyer unit	56.00	
FL-45 500 Hz CW filter (1st IF)	66.50	
FL-54 270 Hz CW filter (1st IF)	53.00	
FL-52A 500 Hz CW filter (2nd IF)	108.00	99.95
FL-53A 250 Hz CW filter (2nd IF)	108.00	99.95
FL-44A SSB filter (2nd IF)	178.00	159.95



IC-751 9-band xcvr/.1-30 MHz rcvr	1399.00	999.00
IC-751A 9-band xcvr/.1-30 MHz rcvr	1649.00	1399
PS-35 Internal power supply	199.00	179.95
FL-32 500 Hz CW filter (1st IF)	66.50	
FL-63 250 Hz CW filter (1st IF)	54.50	
FL-52A 500 Hz CW filter (2nd IF)	108.00	99.95
FL-53A 250 Hz CW filter (2nd IF)	108.00	99.95
FL-33 AM filter	35.25	
FL-70 2.8 kHz wide SSB filter	52.00	
RC-10 External frequency controller	39.25	

Other Accessories:	Regular	SALE
IC-2KL 160-15m solid state amp w/ps	1999.00	1699
PS-15 20A external power supply	169.00	154.95
PS-30 Systems p/s w/cord, 6-pin plug	299.00	269.95
OPC Opt. cord, specify 2, 4 or 6-pin	10.00	
MB Mobile mount, 735/745/751A	24.50	
SP-3 External speaker	61.00	
SP-7 Small external speaker	49.00	
CR-64 High stab. ref. xtal (745/751)	63.00	
PP-1 Speaker/patch	159.25	149.95
SM-6 Desk microphone	44.95	
SM-8 Desk mic - two cables, Scan	78.50	
SM-10 Compressor/graph EQ, 8 pin mic	136.25	124.95
AT-100 100W 8-band auto. antenna tuner	445.00	389.95
AT-500 500W 9-band auto. antenna tuner	559.00	489.95
OPC-118 Adapts AT-100/500 to IC-735	16.00	
AH-2 8-band tuner w/mount & whip	625.00	549.95
AH-2A Antenna tuner system, only	495.00	429.95
OPC-137 Adapts AH-2/2A to IC-751/745	16.00	

ICOM

Check the Prices at AES®!

Other Accessories - continued:	Regular	SALE
GC-4 World Clock (Closeout)	99.95	59.95
GC-5 World clock	91.95	

6-meter VHF Portable	Regular	SALE
IC-505 3/10W 6m SSB/CW portable	549.00	489.95
BP-10 Internal Nicad battery pack	89.00	
BP-15 AC charger	14.00	
EX-248 FM unit	55.50	
LC-10 Leather case	39.50	

VHF/UHF base multi-modes	Regular	SALE
IC-551D 80W 6-meter SSB/CW	799.00	699.95
EX-106 FM option	140.00	126.95
BC-10A Memory back-up	9.50	
IC-271A 25W 2m FM/SSB/CW	859.00	759.95
AG-20 Internal preamplifier	64.00	
IC-271H 100W 2m FM/SSB/CW	1099.00	969.95
AG-25 Mast mounted preamplifier	95.00	
IC-471A 25W 430-450 SSB/CW/FM xcvr	979.00	869.95
AG-1 Mast mounted preamplifier	99.50	
IC-471H 75W 430-450 SSB/CW/FM	1399.00	1169
AG-35 Mast mounted preamplifier	95.00	

Accessories common to 271A/H and 471A/H	Regular	SALE
PS-25 Internal power supply for (A)	115.00	104.95
PS-35 Internal power supply for (H)	199.00	179.95
SM-6 Desk microphone	44.95	
EX-310 Voice synthesizer	46.00	
TS-32 CommSpec encode/decoder	59.95	
UT-15 Encoder/decoder interface	14.00	
UT-15S UT-15S w/TS-32 installed	92.00	

VHF/UHF mobile multi-modes	Regular	SALE
IC-290H 25W 2m SSB/FM, TTP mic	639.00	569.95
IC-490A 10W 430-440 SSB/FM/CW	699.00	599.95

VHF/UHF/1.2 GHz FM	Regular	SALE
IC-27A Compact 25W 2m FM w/TTP mic	429.00	379.95
IC-27H Compact 45W 2m FM w/TTP mic	459.00	399.95
IC-37A Compact 25W 220 FM, TTP mic	499.00	439.95
IC-47A Compact 25W 440 FM, TTP mic	549.00	489.95
PS-45 Compact 8A power supply	139.00	129.95
UT-16/EX-388 Voice synthesizer	34.99	
SP-10 Slim-line external speaker	35.99	
IC-28A 25W 2m FM, UP/DN mic	429.00	379.95
IC-28H 45W 2m FM, UP/DN mic	459.00	399.95
IC-48A 25W 440-450 FM	459.00	399.95
HM-14 TTP microphone	55.50	
UT-28 Digital code squelch	37.50	
UT-29 Tone squelch decoder	43.00	
HM-16 Speaker/microphone	34.00	
IC-3200A 25W 2m/440 FM w/TTP	599.00	499.95
UT-23 Voice synthesizer	34.99	
AH-32 2m/440 Dual Band antenna	37.00	
AHB-32 Trunk-lip mount	34.00	
Larsen PO-K Roof mount	20.00	
Larsen PO-TLM Trunk-lip mount	20.18	
Larsen PO-MM Magnetic mount	19.63	
RP-3010 440 MHz, 10W FM, xtal cont.	1229.00	1099
IC-120 1W 1.2 GHz FM Mobile	579.00	499.95
ML-12 1.2 GHz 10W amplifier	379.00	339.95
IC-1271A 10W 1.2 GHz SSB/CW Base	1229.00	1079
AG-1200 Mast mounted preamplifier	105.00	
PS-25 Internal power supply	115.00	104.95
EX-310 Voice synthesizer	46.00	
TV-1200 ATV interface unit	129.00	119.95
UT-15S CTCSS encoder/decoder	92.00	
RP-1210 1.2 GHz, 10W FM, 99 ch. synth	1479.00	1299

MasterCard VISA

Hand-held Transceivers		
Deluxe models	**Regular**	**SALE**
IC-02AT for 2m	399.00	339.95
IC-04AT for 440 MHz	449.00	389.95
Standard models	**Regular**	**SALE**
IC-2A for 2m	279.00	249.95
IC-2AT with TTP	299.00	259.95
IC-3AT 220 MHz, TTP	339.00	299.95
IC-4AT 440 MHz, TTP	339.00	299.95
IC-12AT 1W 1.2GHz FM HT/batt/cgr/TTP	459.00	399.95
A-2 5W PEP synth. aircraft HT	569.00	

Accessories for Deluxe models	Regular
BP-7 425mah/13.2V Nicad Pak - use BC-35	74.25
BP-8 800mah/8.4V Nicad Pak - use BC-35	74.25
BC-35 Drop in desk charger for all batteries	74.95
BC-16U Wall charger for BP7/BP8	20.25
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

Accessories for both models	Regular
BP-2 425mah/7.2V Nicad Pak - use BC35	47.00
BP-3 Extra Std. 250 mah/8.4V Nicad Pak	37.50
BP-4 Alkaline battery case	15.25
BP-5 425mah/10.8V Nicad Pak - use BC35	58.50
CA-5 5/8-wave telescoping 2m antenna	18.00
FA-2 Extra 2m flexible antenna	11.50
CP-1 Cig. lighter plug/cord for BP3 or Dlx	13.00
CP-10 Battery separation cable w/clip	22.50
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EX-390 Bottom slide cap	5.50
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HS-10SB PTT unit for HS-10	23.25
ML-1 2m 2.3w in/10w out amplifier	SALE 99.95
SS-32M Commspec 32-tone encoder	29.95

Receivers	Regular	SALE
R-71A 100 kHz-30 MHz, 117V AC	$949.00	799.95
RC-11 Infrared remote controller	67.25	
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FL-63 250 Hz CW filter (1st IF)	54.50	
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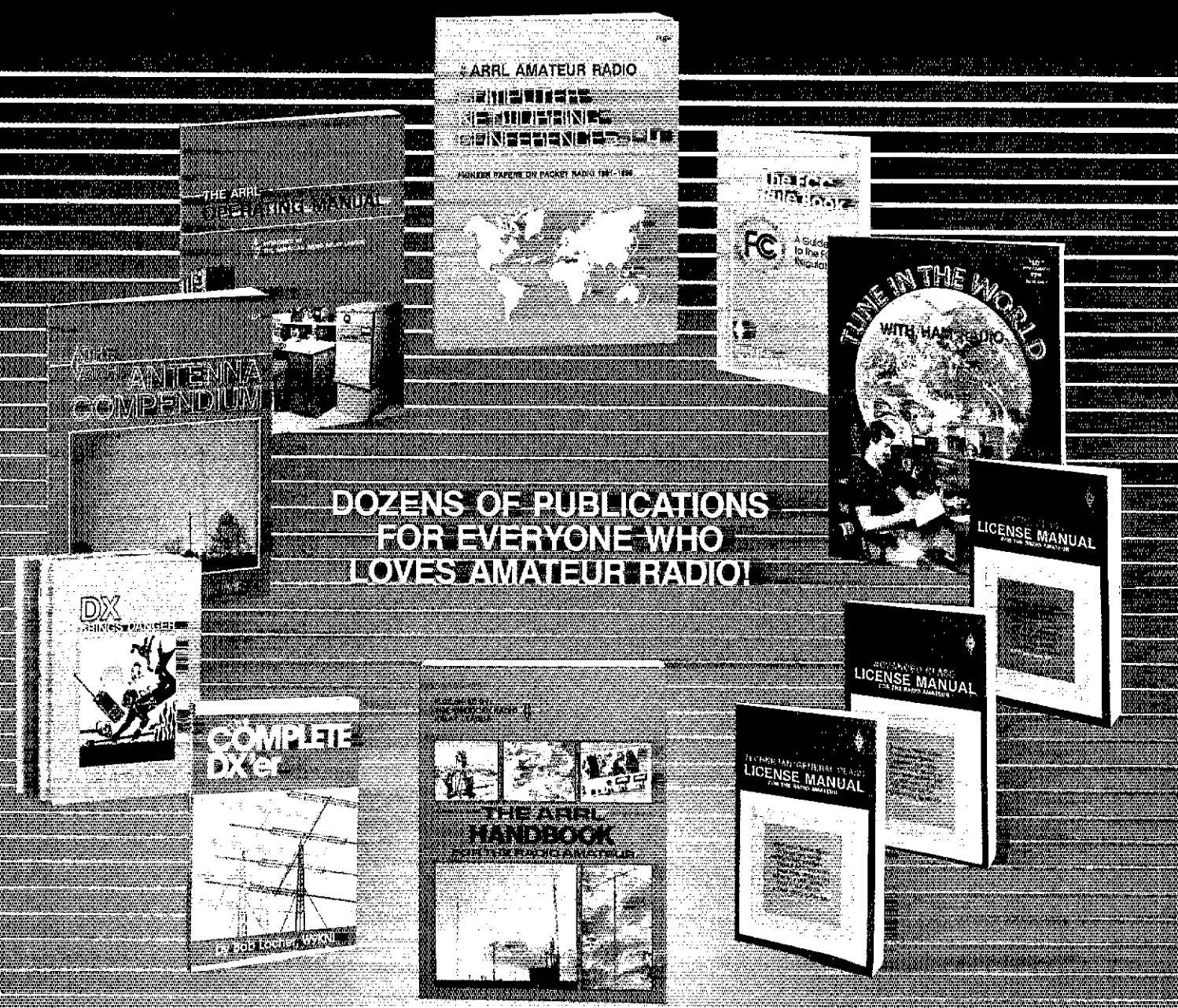

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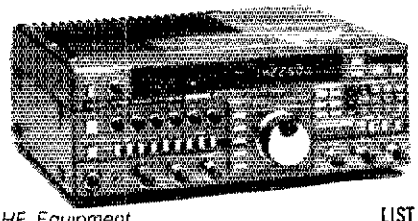

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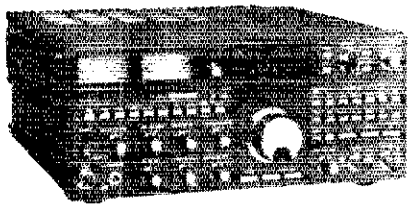
6M/767 6m module	179.95
2M/767 2m module	179.95
430/767 430-440 module	219.95
440/767 440-450 module	219.95
FT-ONE Xcvr/Rcvr/4 filters/RAM/FM	2859.00
KY-ONE Keyer unit	50.00
DC-ONE DC cable	15.00



FT-980 9-band CAT Xcvr/SW Rcvr	$1795.00
SP-980 Speaker with audio filter	99.95
SP-980P Speaker/patch	99.95
FC-757AT Automatic ant. tuner w/memory	359.00
FAS-1-4R Remote antenna selector	79.95
E-980 Interface cable; FT-980/757AT	46.50
XF-8.9HC 600 Hz CW filter (1st IF)	50.00
XF455.8MCN 300 Hz CW filter (2nd IF)	59.95
KY-ONE Keyer unit	50.00
FIF-65 Computer interface; Apple IIe	69.95
FIF-80 Interface; NEC PC-8001	119.00
FIF-232C for VIC-20/TI/most RS-232	79.95
FRB-1 External relay box	20.00
GC-980 General coverage kit	14.95

FT-757GX 9-band Xcvr/SW Rcvr/mic	$995.00
FP-757HD Heavy duty supply with fan	249.00
FP-757GX Compact power supply	235.00
FP-700 Power supply	209.95
FRB-757 External relay box	10.95
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MMB-20 Mobile mount	25.95
FIF-65A Interface; Apple IIe	59.95
FIF-232C for VIC-20/TI/most RS-232	79.95
GX Turbo/F01 Software; Apple II	59.95
GX Turbo/C01 Software; C64/128	89.95
GX Turbo/V01 Software; VIC-20	89.95

FTV-700 Transverter w/no module	175.00
2M/FTV 2m module only	189.00
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70 cm/FTV 430 module only	255.00
Misc. accessories	LIST
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SP-102P Speaker/patch	99.95
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MH-1B8 Mobile microphone	24.95
YS-60 1.8-60 MHz 2kw PEP wattmeter	84.95
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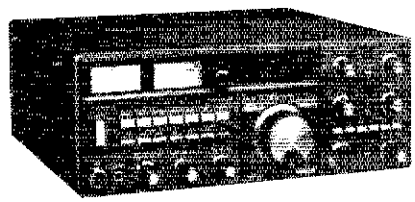

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6M/726 6m unit	269.95
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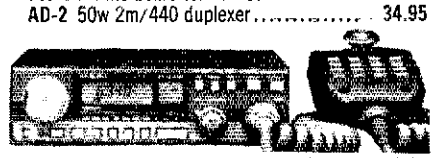
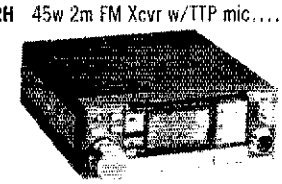
440/726 440-450 MHz unit (FM band)	329.95
SU-726 Satellite duplex module	129.95
XF-455MC 600 Hz CW filter	69.95
DC-726 DC cable for FT-726R	10.05
FTE-36 Tone board for FT-726R	58.00
AD-2 50w 2m/440 duplexer	34.95



FT-270RH 45w 2m FM Xcvr w/TTP mic 439.95



FT-2700RH 25w 2m/440 FM w/TTP mic	599.95
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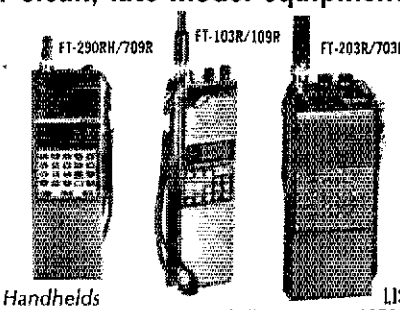

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FT-109R 220 FM HT/TTP/batt/cgr	TBA
FT-709R 4w 440 FM HT/TTP/batt/cgr	359.95
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MMB-21 Mobile bracket	14.95
PA-3 Mobile adapter and charger	39.95
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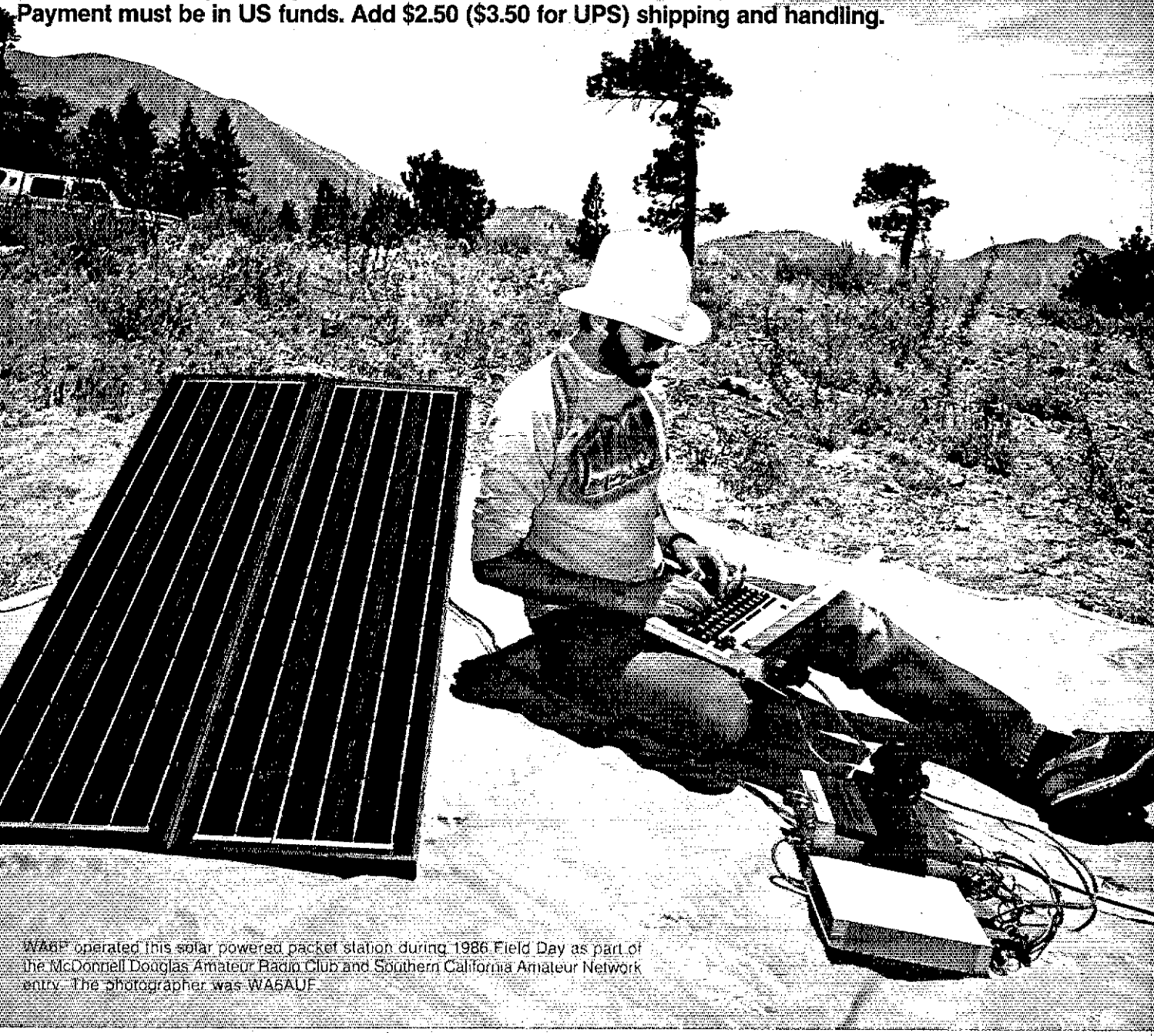

WA6AUF operated this solar powered packet station during 1986 Field Day as part of the McDonnell Douglas Amateur Radio Club and Southern California Amateur Network entry. The photographer was WA6AUF.

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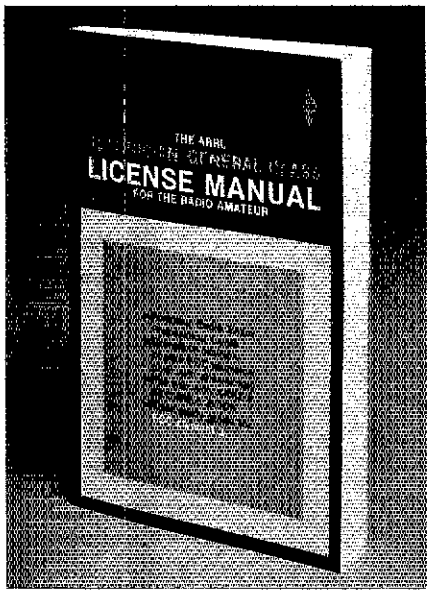

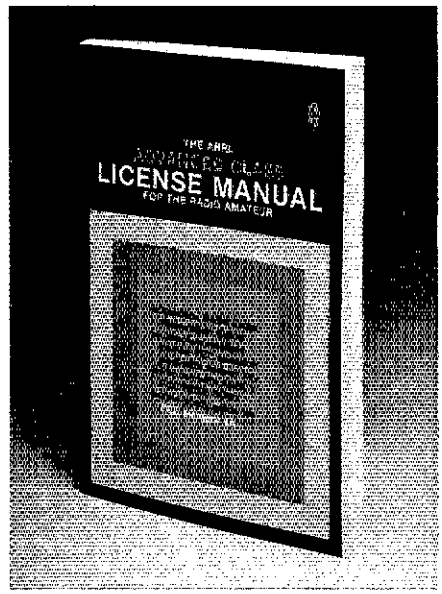

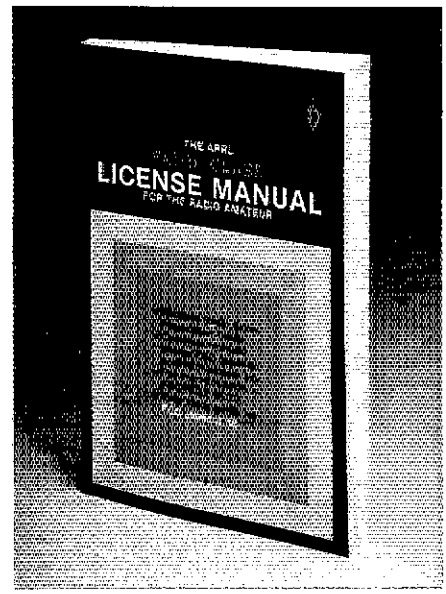

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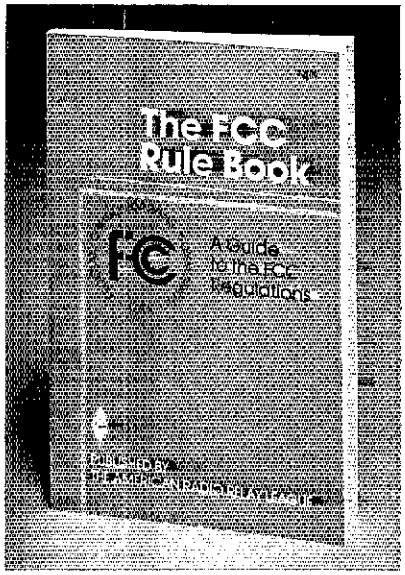

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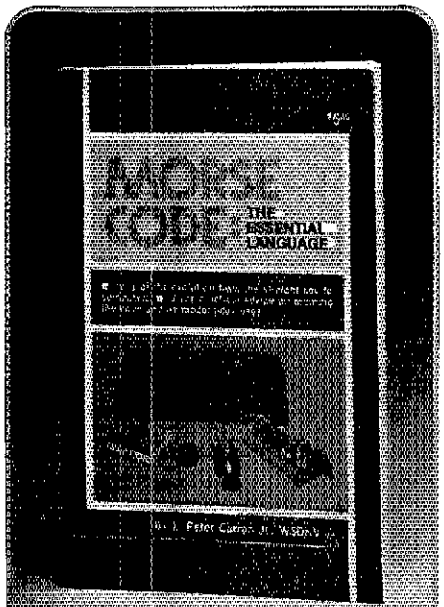

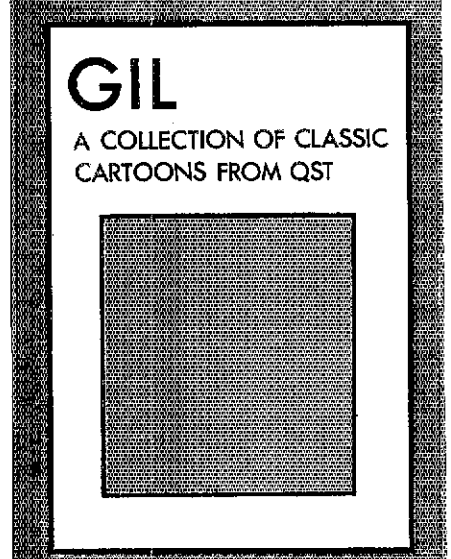

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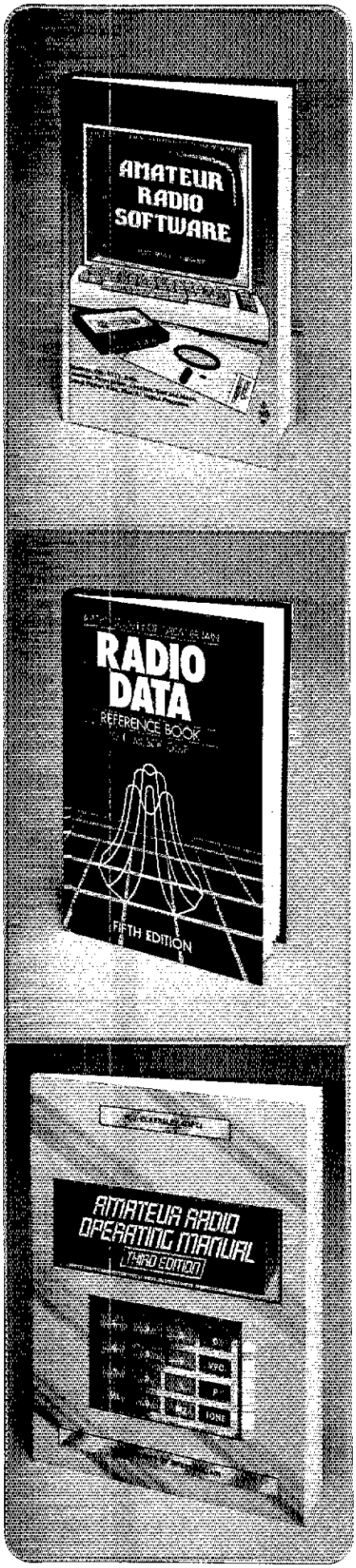

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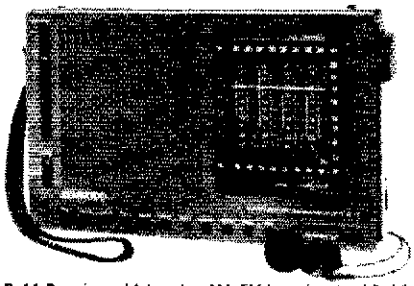

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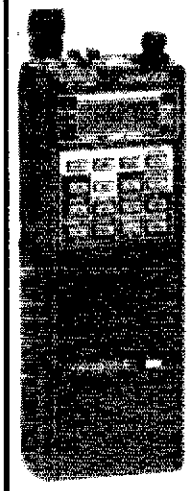

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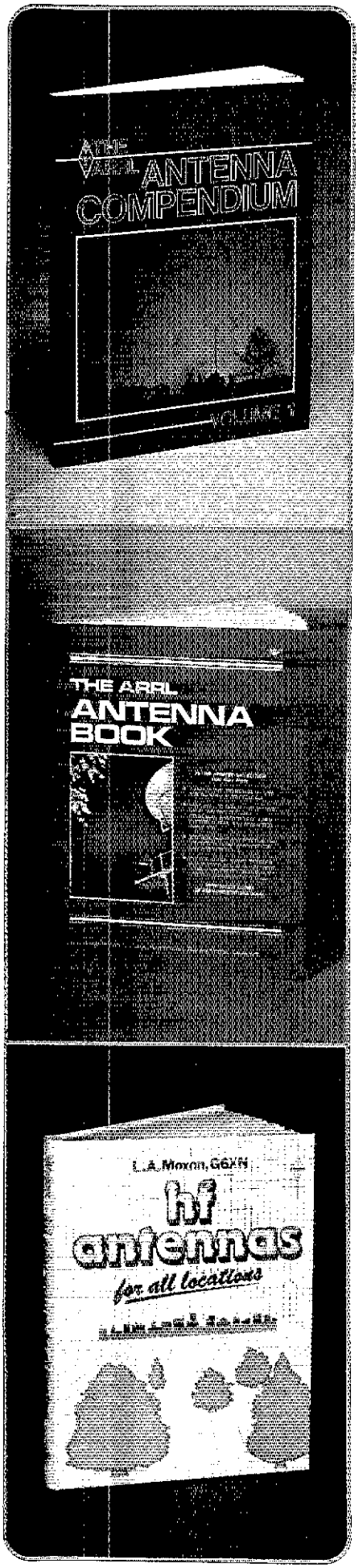

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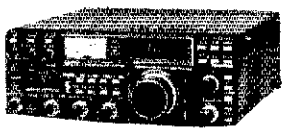

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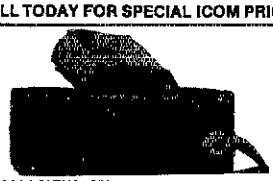

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RS35M	25	35	149
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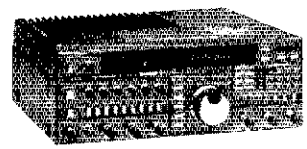

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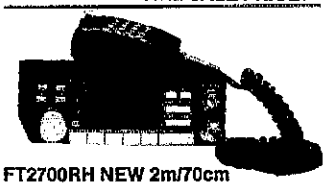

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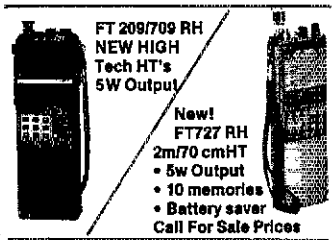

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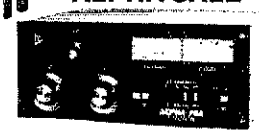

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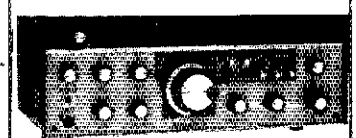

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F.O.B. SELL: Collins 75A4, 3.1, vernier, $375. 75A1, mint, $175, 75S-1, 500Hz, $175. mint Heathkit Mohican Receiver, 160-10, $85; mint Heathkit Marauder transmitter, 150 watt AM, CW, SSB, 80-10, $65; Hallicrafters SX-71, $75; Collins KWS-1, spare finals, $500; 100 foot pneumatic antenna mast, trailer, generator, compressor, guys, $2000. 1983 Signal-One Milspec 1030, most options, cover, $4950 mint Swan 700-CX, 117XC, VX2, $395. MFJ 941 tuner, $45; mint Drake TR4CW, RIT, MS-4, AC4, RV4C VFO, $495. WANT: RG218, RG17, Telrex 646, 845, 1044, 636,647,2M28, Rotor, rotor cable, want built, 20-15-10, high warc rfamp, using 6-450TH's. K8CCV-216-427-2303, 6 to 9 PM, weeknights.

ROBOT RTTY and CW Terminal unit - $375 - RCA 9-inch monitor $125 - Questions SASE - 203-378-0710 - you ship. Joeseph Rich K1IPW.

WANTED: ICOM 22A with crystals WA6AIZ 805-259-3485.

WANTED: HEATH HW 18 SSB CAP Transceiver N5DBQ 214-552-3218.

CRYSTALS, BUILD something. Ham radio is more than operating. Try QRP. Inexpensive FT-243's made to order. 40M $2.50, five or more $1.95. 30M $2.95, five $2.50, 80M $2.95, five $2.50. 160M $3.95, five $2.95. 12M overtones $3.95. Sockets 60 cents. Airmail 30 cents per crystal. Stamp or long S.A.S.E. for listings-circuits, 1700 - 60,000 kilocycles. "Crystals Since 1933". WØLPS, C-W Crystals, Marshfield, MO 65706.

FOR SALE or Trade for Ham Equipment: Atari 800 Computer with 810 Disk Drive and 850 Interface. 10 cartridges and 20 disks. Entire package $455 or trade. Epson QX-10 CPM Computer. 256K RAM. Monitor. 2 Disk Drives and software. $700 or trade. Ted, KU1Y, 225 Sulky Way, West Palm Beach, FL 33414, 305-798-4289.

HOME BREW Projects Wanted - Write - WB2BUF - Box 708 - East Hampton - NY - 11937.

DRAKE L-7 amplifier, 160-10 2 kW, mint with carton and manual, best offer over $800; Kenwood TS-530S, also mint, $450. KB2XG, 518-489-7254.

CLEANING OUT shack. Regency HR2A 2-meter FM, 12 positions, ideal for Packet. $50. HD-73 Rotor, Rotor new in box, Control Unit needs repair $60. Heath Spkr Phone Unit $30. KD4AJ, 404-396-6760.

MFJ TUNERS

This may be the world's most popular 3 KW roller inductor tuner because it's small, compact, reliable, matches virtually everything and gives you SWR/Wattmeter, antenna switch, dummy load and balun — all at a great price!

Meet "Versa Tuner V". It has all the features you asked for, including the new smaller size to match new smaller rigs-only 10¾"Wx4½"Hx14 7/8"D.

Matches coax, balanced lines, random wires—1.8 to 30 MHz. 3 KW PEP—the power rating you won't outgrow (250pf-6KV caps).

Roller inductor with a 3-digit turns counter plus a spinner knob for precise inductance control to get that SWR down to minimum every time.

Built-in 300 watt, 50 ohm dummy load, built-in 4:1 ferrite balun.

MFJ989B **$329.95**

Lighted Cross-needle Meter reads SWR, forward and reflected power all in one glance. Has 300 and 3,000 watt ranges. Meter light requires 12 VDC.

6 position antenna switch (2 coax lines, through tuner or direct, random/balanced line or dummy load). SO-239 connectors, ceramic feed-throughs, binding post grounds.

Deluxe aluminum low-profile cabinet with sub-chassis for RFI protection, black finish, black front panel with raised letters, tilt bail.

MFJ's Fastest Selling TUNER

MFJ-941D **$99.95**

MFJ's fastest selling tuner packs in plenty of new features. New styling! Brushed aluminum front. All metal cabinet. **New SWR/Wattmeter!** More accurate. Switch selectable 300/30 watt ranges. Read forward/reflected power.

New antenna switch! Front panel mounted. Select 2 coax lines, direct or through tuner, random wire/balanced line or tuner bypass for dummy load.

New airwound inductor! Larger more efficient 12 position airwound inductor gives lower losses and more watts out. Run up to 300 RF power output.

Matches everything from 1.8 to 30 MHz! dipoles, inverted vee, random wires, verticals, mobile whips, beams, balanced and coax lines.

Built-in 4:1 balun for balanced lines. 1000 V capacitor spacing. Black. 11 x 3 x 7 inches. Works with all solid state or tube rigs. Easy to use anywhere.

MFJ's 1.5 KW VERSA TUNER III

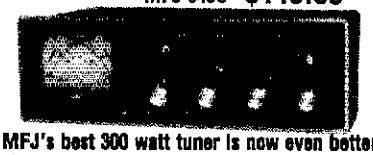
MFJ-962B **$229.95**

Run up to 1.5 kw PEP and match any feedline continuously from 1.8 to 30 MHz: coax, balanced line or random wire.

Lighted Cross-needle Meter reads SWR, forward and reflected power in one glance. Has 300 and 3,000 watt ranges. 6 position antenna switch handles 2 coax lines, wire and balanced lines. 4:1 balun. 250 pf, 6 kv variable capacitors. 12 position ceramic inductor switch. New smaller size matches new rigs: 10¾ × 4½ × 14⅞ inches. Flip stand for easy viewing. Requires 12V for light.

MFJ's Best VERSA TUNER

MFJ-949C **$149.95**



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

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

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

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

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

A large efficient airwound inductor—3 inches in diameter—gives you plenty of matching range and less losses for more watts out. 100 volt tuning capacitors and heavy duty switches gives you safe arc-free operation. A 4:1 balun is built-in to match balanced lines.

Order your convenience package now and enjoy.

2 KW COAX SWITCHES

MFJ-1702 **$19.95**

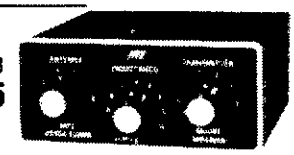
MFJ-1702. $19.95. 2 positions. 60 dB isolation at 450 MHz. Less than .2 dB loss. SWR below 1:1.2.

$29.95 MFJ-1701

MFJ-1701, $29.95. 6 positions. White markable surface for antenna positions.

MFJ's Smallest VERSA TUNER

MFJ-901B **$59.95**



MFJ's smallest 200 watt Versa Tuner matches coax, random wires and balanced lines continuously from 1.8 thru 30 MHz. Works with all solid state and tube rigs. Very popular for use between transceiver and final amplifier for proper matching. Efficient airwound inductor gives more watts out. 4:1 balun for balanced lines. 5 x 2 x 6 inches. Rugged black all aluminum cabinet.

MFJ's Random Wire TUNER

MFJ-16010 **$39.95**

MFJ's ultra compact 200 watt random wire tuner lets you operate all bands anywhere with any transceiver using a random wire. Great for apartment, motel, camping operation. Tunes 1.8-30 MHz. 2 x 3 x 4 inches.

MFJ's Mobile TUNER

MFJ-945C **$79.95**

Designed for mobile operation! Small, compact. Takes just a tiny bit of room in your car. SWR/dual range wattmeter makes tuning fast and easy. Careful placement of controls and meter makes antenna tuning safer while in motion.

Extends your antenna bandwidth so you can operate anywhere in a band with low SWR. **No need to go outside and readjust your mobile whip.** Low SWR also gives you maximum power out of your solid state rig—runs cooler for longer life.

Handles up to 300 watts PEP RF output. Has efficient airwound inductor, 1000 volt capacitor spacing and rugged aluminum cabinet. 8x2x6 inches. Mobile mounting bracket available for $5.00.

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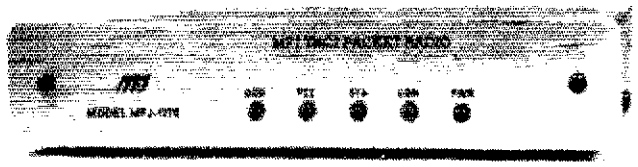


MFJ-1270
$139.95

Join the exciting packet radio revolution and enjoy error-free communication...for an incredible $139.95! MFJ brings together efficient manufacturing and TAPR's (Tucson Amateur Packet Radio) leading edge technology to bring you top quality and affordable packet radio.

You get MFJ's highly acclaimed clone of the industry standard TAPR TNC 2. Its in a new cabinet and includes a TTL serial port and an easily replaceable lithium battery for memory back-up.

All you need is your rig, home computer with a RS-232 serial port and a terminal program. If you have a Commodore 64, 128, or VIC-20 you can use MFJ's optional Starter Pack to get on the air immediately. You get interfacing cable, terminal software on tape or disk and complete instructions...everything you need to get on packet radio. Order MFJ-1282 (disk) or MFJ-1283 (tape), $19.95 each.

Unlike machine specific TNC's you never have to worry about your MFJ-1270 becoming obsolete because you change computers or because packet radio standards change. You can use **any** computer with an RS-232 serial port and an appropriate terminal program. If packet radio standards change, software updates will be made available as TAPR releases them.

Also speeds in excess of 56K bauds are possible with a suitable external modem! Try that with a machine specific TNC or one without hardware HDLC as higher speeds come into widespred use.

You can also use the MFJ-1270 as an excellent but inexpensive digipeater. You can use 12 VDC for portable operation or 110 VAC for fixed station operation.

It features AX.25 Level 2 Version 2 software, hardware HDLC for full duplex, true Data Carrier Detect for HF, 16K RAM, simple operation plus more.

Help make history! Join the packet radio revolution now and help spread this exciting network throughout the world. Order the top quality and affordable MFJ-1270 today.

Here are MFJ's latest and hottest products for improving your station's performance.

MEMORY KEYER

MFJ-484B
$139.95

The MFJ-484B "GRANDMASTER" Memory Keyer is **THE** choice of CW contesters. Why? Because it's so easy to use it's second nature...you don't have to remember how to use complex commands...**and** it has all the features you'll ever need for easy CW.

Features like these... you can store up to twelve 25 character messages that you can combine and send at whatever speed you want, you can repeat any message continuously or pause between repeats, you can change or insert into a playing message by simply sending and much more.

The MFJ-484B is RF proof, sends 8-50 WPM and measures just 8x2x6 inches. It uses 12 to 15 VDC or 110 VAC with MFJ-1312, $9.95.

HF SWR/WATTMETER

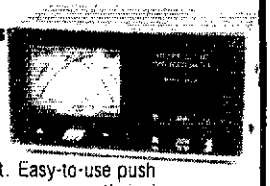
MFJ-816
$29.95

Want minimum SWR to maximize your antenna performance?

The MFJ-816 is our smallest -4½x2¼x3 inches-(and most affordable) SWR/Wattmeter that lets you read SWR, forward and reflected power (30/300 watt scales) from 1.8 to 30 MHz. Uses toroidal current pickup for uniform sensitivity.

CROSS-NEEDLE SWR/WATT METER

MFJ-815 $59.95



MFJ's cross-needle SWR/Wattmeter gives you SWR, forward and reflected power —all at a single glance! SWR is automatically computed —no controls to adjust. Easy-to-use push buttons select three power ranges that give you QRP to full legal limit power readings. Reads 20/200/2000 W forward, 5/50/500 W reflected and 1:1 to 1:5 SWR on easy-to-read two color scale. Lighted meter. Needs 12 V. ±10% full scale accuracy. 6½ x 3¼ x 4½ inches.

2 KW COAX SWITCHES

MFJ-1702
$19.95

$29.95 MFJ-1701

Instantly select any antenna or rig by turning a knob. Organizes coax cables and eliminates plugging and unplugging. Unused terminals are grounded to protect your equipment for stray RF, static and lightning. 2 KW PEP, 1 KW CW. For 50 to 75 ohm. Negligible loss, SWR, and crosstalk gives high performance. SO-239s. Convenient desk or wall mounting.

MFJ-1702, $19.95. 2 positions. Cast aluminum cavity construction gives excellent performance up to 500 MHz with better than 60 dB isolation at 450 MHz. Heavy duty, low loss switch has less than 20 milliohm contact resistance, less than 0.2 dB loss and SWR below 1:1.2. 2 x 2½ x 1 inches.

MFJ-1701, $29.95. 6 positions. White markable surface for recording ant. positions. 8½ x 1½ x 3 in.

ANTENNA CURRENT PROBE

MFJ-206 $79.95

This new breakthru MFJ Antenna Current Probe lets you monitor RF antenna currents—no connections needed! Determine current distribution, RF radiation pattern and polarization of antennas, transmission lines, ground leads, building wiring, guy wires and enclosures.

- **Indicate transmission line radiation** due to high SWR, poor shielding or antenna unbalance.
- **Detect re-radiation** from rain gutters and guy wires that can distort antenna field patterns.
- **Detect RF radiation** from ground leads, power cords or building wiring that can cause RFI.
- **Determine if ground** system is effective.
- **Pinpoint RF leakage** in shielded enclosures.
- **Locate the best place** for your mobile antenna.
- **Use** as tuned field strenght meter.

Monitors RF current by sensing magnetic field. Uses an electrostatically shielded ferrite core, FET RF amplifier, op-amp meter circuit for excellent sensitivity, selectivity. 1.8-30 MHz. Has sensitivity, bandswitch, tune controls, telescoping antenna for field strenght meter. 4 x 2 x 2 inches.

MFJ's Best VERSA TUNER

MFJ-949C
$149.95

MFJ's best 300 watt tuner is now even better!

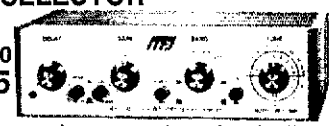
The MFJ-949C all-in-one Deluxe Versa Tuner II gives you a tuner, cross-needle SWR/Wattmeter, dummy load, antenna switch and balun in a new compact cabinet. You get quality conveniences and a clutter-free shack at a super price.

A new cross-needle SWR/Wattmeter gives you SWR, forward and reflected power—all at a single glance. SWR is automatically computed with no controls to set. Has 30 and 300 watt scale.

Run up to 300 watts RF output—and match coax, balanced lines or random wires from 1.8 thru 30 MHz. Tune out SWR on dipoles, vees, long wires, verticals, whips, beams/quads. 10x3x7 in.

RF PRESELECTOR

MFJ-1040
$99.95



Is your transceiver or receiver "hearing" all it could? Adding a MFJ-1040 RF preselector can make "lost" signals readable while reducing troublesome images and out-of-band signals. It adds 20 dB of low noise gain with a strong, sharp tuning front end and covers all HF amateur and shortwave bands through lower VHF from 1.8 to 54 MHz.

A built-in 20 dB attenuator prevents receiver overload. It has automatic bypass for transmitting, works with 2 antennas and 2 receivers, is 8x2x6 inches and uses 9-18 VDC or 110 VAC with optional MFJ-1312, $9.95

MOBILE ANTENNA MATCHER

MFJ-910 $19.95

Lower your SWR and Get more power into your mobile whip for solid signals and more QSOs. Your solid state rig puts out more power and generates less heat. For 10-80 meter whips. Easy plug-in installation. Complete instructions. Fits anywhere, 2½x2½in.

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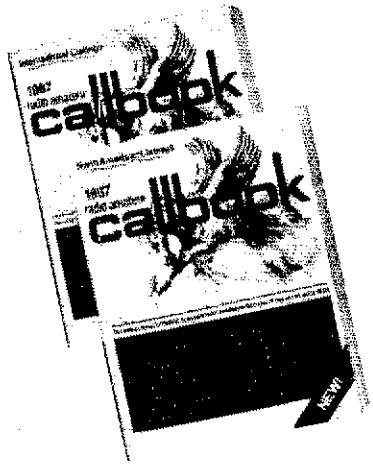
1987 CALLBOOKS



The "Flying Horse" sets the standards

Continuing a 66 year tradition, there are three new Callbooks for 1987.

The North American Callbook lists the calls, names, and address information for licensed amateurs in all countries from Canada to Panama including Greenland, Bermuda, and the Caribbean islands plus Hawaii and the U.S. possessions.

The International Callbook lists the amateurs in countries outside North America. Coverage includes South America, Europe, Africa, Asia, and the Pacific area.

The 1987 Callbook Supplement is a new idea in Callbook updates; it lists the activity in both the North American and International Callbooks. Published June 1, 1987, this Supplement will include all the new licenses, address changes, and call sign changes for the preceding 6 months.

Publication date for the 1987 Callbooks is December 1, 1986. See your dealer or order now directly from the publisher.

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incl. shipping within USA $28.00
incl. shipping to foreign countries 30.60

☐ International Callbook
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3 "	" " 160, 80, 40M	60 ft. "	$ 43	"
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3 "	NO-TRAP DIPOLE 160, 80, 40M	133 ft. long	$ 71	"
2 "	" " " 80, 40M	85 ft. "	$ 55	"
9-BAND	SPACE-SAVER DIPOLE 160 thru 10M*	66ft. long	$ 85	ppd

* Requires wide-range tuner (80, 40, 20, 15M without tuner)

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8241	1500B	RG59/U Poly 96%	13.00	.15
8267	1130B	RG213/U Poly 96%	53.00	.59
9269	1600B	RG62A/U Poly 96%	15.00	.17
8216	1450B	RG174/U Poly 96%	12.00	.14
9913	1180	Low Loss 50 ohm	46.00	.58

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1140	RG214/U Mil Spec. - Silver	155.00	1.65
1705	RG142B/U Teflon/Silver	140.00	1.50
1310	RG217/U 5/8" 50 ohm Dbl. Shield	80.00	95
1470	RG223/U Mil Spec. Silver	80.00	85

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8C1822	2-18 Ga 6-22 Ga	19.00	.21
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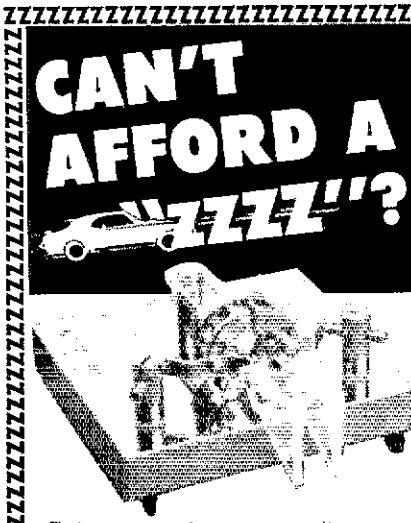

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SELL YAESU FT101F, CW Filter, excellent condition, original owner, manual. $425. K1NTR, 287 Ware Street, Mansfield, MA 02048.

WANTED: 10M SSB CB's! Mahagan 12-D Winding Creek Circle, Durham, NC 27705 919-477-6161.

FOR SALE: new RCA Tac Tec Multi-Charger with 4 new batterys $100, New Motorola MX350 R batterys WLN9726C $20 ea., Motorola NLN4569 and 4508 Chargers $20 ea., Motorola Handicomm on 39.9 MHz $50, Motorola railroad Micor on 159 MHz $50. call WA3JGI after 6PM DST 301-643-5181.

SPECIAL: BOOM Mike Head Set - $16.95 output level - 78B. Noise cancelling. Send check or money to: Innovations Unlimited, 109 Carpenter Drive, Tabb, VA 23602

FOR SALE: Mini Products 3 el Beam B24/RK3. $55 - Q Mult HD-11 $12 - BC453, PS $20 - RCA Color gen WR-64B $25 - Freq Meter TS- 323/UR $55 - Heath Yoke Flyback Tester IT-5235 kit never built $50 - + UPS P. Lelong, N6GO, 5408 Simpson Avenue, North Hollywood, CA 91607. TRI-EX TH354 Crankup, Folder Tower. Clean, like new. Will ship COD. $500. Estate of K1AYE, 617-653-7138.

FOR SALE 110-foot Aeromotor Inner Bilbey commercial tower -MP9X, 3-legs 21 feet between legs at base (self-standing), Telrex BT599RIS rotator-indicator, 28 foot masting with Telrex 40M346, 20M326B, 15M317, 10M313 Yagis, six-position coax antenna relay, RG14A/U cables, antennas and tower dismantled. All can be inspected at Continental Tower Co. Franklinville, NJ 08322 by appointment 609-629-2564 or call or write W2GWE 'Pete' Bach 3600 Washington Road, West Palm Beach, FL 33405 305-833-7559 price $7000 includes spare element sections and boom parts also 80 and 75 meter inverted Vs, Manuals.

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HELP ME complete my Ham Car-Tag collection. Need Idaho, Nevada, New Jersey, Oregon Utah, NW Terr., Nova Scotia, Ontario, Prince Edward, Yukon. Buy or trade. Willard Prentice, W3VBM, 2419 Chetwood Circle, Timonium, MD 21093.

XEROX 820 Computer Board, keyboard, and blank TAPAR FAD board. Sell $75 or trade for 2M linear. Warren Jochem WB2IPF/4, 1119 Braemar Court, Cary NC 27511.

OSCILLOSCOPE savings: Heath 4205 dual trace, assembled through initial tests, manual, plus Heath 4244 osc. calibrator, assembled & checked, manual - both $125, plus UPS. T. Parker 19293 Benson Lane, Fort Bragg CA 95437.

HEATHKIT HW-101 recently factory re-aligned U ship $225 KA8ZAW 419-599-8197.

HRO 500 Solid State-Synthesized from 5kc to 30MHz. In mint condition. Highest offer over $375 W1KQT 203-268-9775.

ELECTRONIC PROJECTS, Components, P.C. board Supplies, and Test Instruments. Oscilliscopes from $299, 2 Year Guarantee Call or send S.A.S.E. for your free catalog - T.O.R.C.C.C., Box 47148, Chicago, IL.

SELL - YAESU FT-901 DM LN $600 HyGain 205BA Yagi $150 Rohn 25G- 70 FT w/top sect. $210 K5CG, 918-543-2628 Inola, OK 74036

TEN-TEC ARGOSY I with CW filter, calibrator and manual, $25. Model 219 crystal 250Hz CW Filter. $28 KE7KN, 602-298-4820.

HW-2036 'A' mod installed, T.T. mike, $125. HW-2021, tone pad, case, 5 xtals installed, 1 extra, modified for 3 offsets, $65. HD-4040, HDA-4040-2, WA6DED firmware, $200. All items with manuals. Post paid 48 states. W.H. Craig, Box 311, Grayson, KY 41143 KF4JO.

DRAKE TR-7,power supply, VFO, allfilters, speaker, complete-with manuals-mint: inquire P.O. Box 1985 Eugene, OR 97440 $800. N7DOU.

COLLINS KWM-2 (RE), $475; PM2 AC Supply, $85; 516F2, $110. All absolutely mint. K8DR, 614-457-1486.

TRI-EX "SKY NEEDLE" (TM-370) telescoping tubular steel tower; four sections extend to 85' with electric raising/lowering winch includes ladder; CDR, Hy-Gain and Telrex rotator mounts; custom stainless steel covered and heated Telrex rotator; spare parts; and custom hinged base plate adaptable to any pre-existing concrete base. Rated 38 square feet of antennas- current list $12,000; sell $6000 or take in partial payment Henry 4K Ultra, Alpha 77DX or other late model equipment. Alan W3VL 215-295-6331.

DIGITAL AUTOMATIC DISPLAYS for FT-101's, TS-520's, Collins, Swan and all others Six ½' digits. 5' wide by 1¼' metal cabinet. Send $1 for information. Receive a $25 discount. Includes comparisons of the simple 'BCD' readouts found in new radios and our "Calculating Frequency Counter" readouts. Please be specific. Grand Systems, POB 3377, Blaine WA 98230.

FOR SALE - Collins KWM-2A & 516F-2 Power Supply with Station Control 312B-5 VFO Console (VFO Spkr, Fone Patch, SWR Watt Meter) excellent condition Serviced only by Collins & Rockwell $895. + UPS - If desired other 6146's available. W6CBF - 1332 Singingwood Ct. -2, Walnut Creek, CA 94595 415-933-2749.

TOWER 40' HD Gal. with rotor and 2 ? antennas. $450/BO. Bob Hvistendahl, 5355 Sierra Rd. San Jose, CA 95132.

LAMPKIN 107C Service Monitor. Very good condition, $850. Wallace Kincaid, W2PG, 130 Centerwood Dr., Rochester NY, 14616. 716-865- 2606 after 5:00 P.M. Eastern.

REPLACE RUSTED Antenna Bolts with Stainless Steel. Small quantities, free catalog. Elwick, Dept. 614, 230 Woods Lane Somerdale, NJ 08083.

HEATHKIT HW-100, CW Filter, HB Supply, Speaker, Microphone, and Manual. Clean $225. Includes shipping. John, W6MOK, 818-798-9345.

MINI-QUAD HQ-1 Modification Kits, Mini-Quads, Butternut Antennas, Low Prices, Free Shipping, Stamp for flyer, Hart Eastern Communications, 1444 Darlington, Derby, NY 14047.

HW-9 QRP TRANSCEIVER for sale with WARC bands. HB power supply, excellent condition: $195. Jim McGloin, KB9O, 919 State St., Apt. 2, Lemont, IL 60439.

ATARI CW Send/Receive Software. Works great! Described in February and November 1985 *QST*'s disk or cassette $10, cartridge $30. Electrosoft, 1656 South California Street, Loveland, CO 80537

FOR SALE TH3-MK3 Ant Trap Caps. $125 Rust Proof Hardware. WA2IDZ 305-269-2429; 2720 Mars Dr. Titusville, FL 32796

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Index of Advertisers

ANTENNA/TOWER SALE!

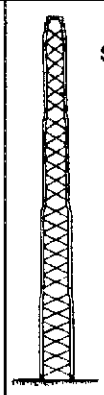
hy-gain CRANKUP SALE!

All Models Shipped Factory Direct—Freight Paid*!

Check these features:
- All steel construction
- Hot dip galvanized after fabrication
- Complete with base and rotor plate
- Totally self-supporting—no guys needed

Model	Height	Load	Sale Price
HG37SS	37 ft	9 sq ft	$CALL
HG52SS	52 ft	9 sq ft	$CALL
HG54HD	54 ft	16 sq ft	$CALL
HG70HD	70 ft	16 sq ft	$CALL

Masts—Thrust Bearings—Other Accessories Available—Call! Prices Shown Are Your Total Delivered Price In Continental U.S.A.!



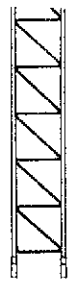
ROHN Self Supporting Towers On SALE! FREIGHT PREPAID

- All Steel Construction—Rugged
- Galvanized Finish—Long Life
- Totally Free Standing—No Guy Wires
- America's Best Tower Buy—Compare Save $
- Complete With Base and Rotor Plate
- In Stock Now—Fast Delivery

Model	Height	Ant Load*	Weight	Delivered Price*
HBX40	40 ft	10 sq ft	164	$329
HBX48	48 ft	10 sq ft	303	$429
HBX56	56 ft	10 sq ft	385	$499
HDBX40	40 ft	18 sq ft	281	$399
HDBX48	48 ft	18 sq ft	363	$489

*Your Total Delivered Price Anywhere in Continental 48 States. Antenna Load Based on 70 MPH Wind.

ROHN Guyed Tower Packages

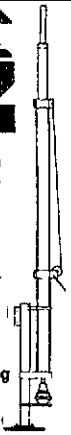


- World Famous Rohn Quality and Dependability
- Rugged high wind survival-provides safe installation
- Multi purpose towers satisfy a wide range of needs
- Complete packages include: guy hardware, turnbuckles, guy assemblies, w/torq bars, concrete base, rotor plate and top section per manufacturers specs.

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'	$ 579	1079	1439
60'	639	1209	1609
70'	689	1329	1759
80'	849	1479	1929
90'	919	1749	2089
100'	989	1899	2259
110'	1189	2019	2639
120'	1259	2179	2819

US TOWER CORPORATION



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	$ 849
MA50 mast	22'	50'	10 sq ft	899
TX438	22'	38'	18 sq ft	829
TX455	22'	55'	18 sq ft	1249
TX472	23'	72'	18 sq ft	2058
HDX556	22'	55'	30 sq ft	1879
HDX572	23'	72'	30 sq ft	3229

Note - US Towers Shipped Freight Collect From Visalia, CA Factory

*Note-towers rated at 50 mph to EIA specifications

RG-213U

$ 29/ft $279/1000 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

$.19/ft $179/1000 ft

- RG8X—95% Bare Copper Shield • Low Loss
- Non-contaminating Vinyl Jacket Foam Dielectric

9086

$ 39/ft $379/1000 ft

- Same specs as Belden 9913
- Lower loss than RG8U
- 100% shielded-braid & foil

HARDLINE/HELIAX™

Lowest Loss for VHF/UHF!

½" Alum. w/poly Jacket	$.79/ft
½" LDF4-50 Andrew Heliax™	$1.79/ft
⅞" LDF5-50 Andrew Heliax™	$3.99/ft

select connectors below.

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

HARDLINE & HELIAX™ CONNECTORS

Cable Type	UHF FML	UHF MALE	N FML	N MALE
½" Alum	$19	$19	$19	$25
½" Heliax™	$25	$25	$25	$25
⅞" Heliax™	$49	$49	$49	$49

COAX CONNECTORS

Amphenol Silver PL259	$1.25
UG21B N Male	$2.95
9086/9913 N Male Connector	$4.95

ANTENNA WIRE & ACCESSORIES

Stranded Copper 14ga. $.10/ft	16ga. $.09/ft
¼ mile 18ga copper-clad steel wire	$30
Dog bone end insulator	$.79 ea.

Van Gorden

1:1 Balun $11 Center Insulator $6
Dipole Kits D80 $31.95/D40 $28.95
Short Dipole Kits SD80 $35.95/SD40 $33.95
All-band Dipole w/ladder line $29.95
G5RV all band antenna $49.95

ALPHA DELTA

DX-A 160-80-40 Sloper	$49

CUSHCRAFT

A3 3-el Tribander	$229
A4 4-el Tribander Beam	$299
A743 & A744, 30/40 mtr KIT for the A3 & A4	ea$79
R3 20, 15, 10mtr Vertical	$275
AV5 80-10mtr Vertical	$109
D40 40mtr Dipole	$159
40-2CD 2-el 40 mtr Beam	$299
A50-5 5-el 6 mtr Beam	$85
215 WB NEW 15-el 2 mtr Beam	$85
230 WB NEW 30-el 2 mtr Beam	$229
4218 XL 18-el 2 mtr Beam	$105
3219 19-el 2 mtr Beam	$99
220B 17-el 220MHz Beam	$99
424B 24-el 432MHz Beam	$85
ARX2B 2 mtr Vertical	$39

hy-gain

Limited Quantities purchased at old prices. Call for current prices

CALL FOR SPECIAL PRICES!

Discoverer 2-el 40-mtr Beam	
Discoverer 3-el Conversion Kit	
EXPLORER-14 SUPER-SPECIAL	
QK710 30/40 mtr. Add-On-Kit	
V2S 2-mtr Base Vertical	
V4S 440MHz Base Vertical	
TH5MK2S Broad Band 5-el Triband Beam	
TH7DXS 7-el Triband Beam	
TH3JRS 3-el Triband Beam	
205BAS 5-el 20-mtr Beam	
155BAS 5-el 15-mtr Beam	
105BAS 5-el 10-mtr Beam	
204BAS 4-el 20-mtr Beam	
64BS 4-el 6-mtr Beam	
12 AVQ 20-10 mtr vertical	
14 AVQ 40-10 mtr vertical	
18 AVT/WB 80-10mtr Vertical	
18HTS 80-10 mtr Hy-Tower Vertical	
23BS 3-el 2 mtr Beam	
25BS 5-el 2 mtr Beam	
28BS 8-el 2 mtr Beam	
214BS 14-el 2-mtr Beam	
2BDQ 80/40 mtr Trap Dipole	
5BDQ 80-10 mtr Trap Dipole	
BN86 80-10 mtr KW Balun W/Coax Seal	

HUSTLER

6BTV 80-10 mtr Vert $129 5BTV 80-10 mtr Vert $109
4BTV 40-10 mtr Vert. $89 G7-144 2-mtr Base $119
G6-144B 2-mtr Base $89

Mobile Resonators	10m	15m	20m	40m	75m
400W Standard	$16	$17	$19	$22	$26
2KW Super	$20	$22	$25	$29	$39

Bumper Mounts - Springs - Folding Masts in Stock!

BUTTERNUT ELECTRONICS CO

HF6V 80-10 Mtr. Vertical Antenna $129. Delivered (Cont. USA)

- Full Legal Power 80/10 Meters
- Optional Stub Tuned Radial Kit Model STR II $29
- Optional Roof Mounting Kit Model RMK II $49 (includes STR II)
- Optional 160 Meter Resonator Kit Model TBR 160 $49

HF2V 80/40 Meter Vertical Antenna $129 Delivered (Continental USA)

- Optional 160 Meter Resonator Kit Model TBR 160 $49

Free Shipping On Butternut Accessories Also When Purchased With Antenna

HF4B "Butterfly"

$189. (del. cont. USA)

- Covers 10, 12, 15, 20M
- Compact Beam Design
- Max. Element Length of 12.5'
- Light Weight, Only 17 lbs.
- Use with TV Rotor

KLM

KT34A 4-el Broad Band Triband Beam	$Call
KT34XA 6-el Broad Band Triband Beam	$Call
2m-14C 14-el 2-mtr Satellite Antenna	$Call
2m-16LBX NEW 16-el 2-mtr Beam	$Call
2m-22C NEW 22-el 2-mtr Satellite Antenna	$Call
432-30LBX NEW 30-el 432 MHz Antenna	$Call
435-18C 435 MHz Satellite Antenna W/CS-2	$Call
435-40CX 435 MHz Satellite Antenna W/CS-2	$Call

ROTORS

Alliance HD73 (10.7 sq ft rating)	$119.95
Alliance U110 (3 sq ft rating)	$49
Telex CD 45II (8.5 sq ft rating)	$Call
Telex HAM 4 (15 sq ft rating)	$Call
Telex Tailtwister (20 sq ft rating)	$Call
Telex HDR3000 Heavy Duty (25 sq ft rating)	$Call
Kenpro KR500 Heavy Duty Elevator Rotator	$189
Kenpro KR5400 AZ/EL Rotor Package	$319

ROTOR CABLE

Standard 8 cord cables $.19/ft
(vinyl jacket 2-#18 & 6-#22 ga)
Heavy Duty 8 Cond cable $.36/ft
(vinyl jacket 2-#16 & 6-#18 ga)

ROHN GUYED TOWERS

10 ft Stack Sections

20G $39.50 45G $112.50
25G $49.50 55G $149.50

All 20G, 25G, 45G and 55G Accessories In Stock at Discount Prices - CALL!

Foldover Towers	Model	Height	Ant Load*	Price
	FK2548	48 ft	15.4 sq ft	$899
	FK2558	58 ft	13.3 sq ft	$949
	FK2568	68 ft	11.7 sq ft	$999
	FK4544	44 ft	34.8 sq ft	$1199
	FK4554	54 ft	29.1 sq ft	$1299
	FK4564	64 ft	28.4 sq ft	$1399

25G Foldover Double Guy Kit $249
45G Foldover Double Guy Kit $269
*Above antenna loads for 70 MPH winds and Guys at Hinge & Apex.
All Foldover Towers Shipped Freight Prepaid Continental USA! Foldover Prices 10% Higher West of Rockies

TOWER/GUY HARDWARE

3/16 EHS Guywire (3990 lb rating)	$ 15/ft
1/4 EHS Guywire (6650 lb rating)	$ 18/ft
5/16 EHS Guywire (11,200 lb rating)	$ 29/ft
5/32 7 × 7 Aircraft Cable (2700 lb rating)	$ 15/ft
3/16 CCM Cable Clamp (3/16" or 5/32")	$ 45
1/4 CCM Cable Clamp (1/4" Cable)	$ 55
1/4 TH Thimble (fits all sizes)	$ 45
3/8EE (3/8" Eye & Eye Turnbuckle)	$6.95
3/8EJ (3/8" Eye & Jaw Turnbuckle)	$7 95
1/2 × 9EE (1/2" × 9" Eye to Eye Turnbuckle)	$9 95
1/2 × 9EJ (1/2 × 9" Eye & Jaw Turnbuckle)	$10.95
1/2 × 12EE (1/2" 12" Eye & Eye Turnbuckle)	$12 95
1/2 × 12EJ (1/2" × 12" Eye & Jaw Turnbuckle)	$13.95
5/8 × 12EJ (5/8" × 12" Eye & Jaw Turnbuckle)	$16.95
3/16" Preformed Guy Grip	$2.49
1/4" Preformed Guy Grip	$2 99
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500 D Guy insulator (5/32" or 3/16" Cable)	$1.69
502 Guy Insulator (1/4" Cable)	$2 99
5/8" Diam - 8 ft Copper Clad Ground Rod	$12.95

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HPTG2100 Guy Cable (2100 lb rating)	$ 29/ft
HPTG4000 Guy Cable (4000 lb rating)	$ 49/ft
HPTG6700 Guy Cable (6700 lb rating)	$ 69/ft
9901LD Cable End (for 2100/4000 cable)	$8 95
9902LD Cable End (for 6700 cable)	$9 95
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Heavy Duty Steel Masts 2 in OD - Galvanized Finish

Length	5 FT	10 FT	15 FT	20 FT
12 in Wall	$29	$49	$69	$89
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- General Coverage Receiver

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- 100% Duty Cycle
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TM2570 "ALL NEW"

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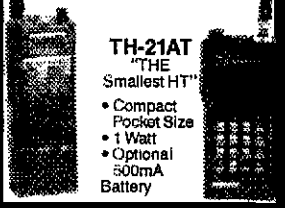
- First With Memory & Auto Dialer
- 23 Channel Memory
- Front Panel Programmable CTCSS

KENWOOD

TR2600 "SPECIAL"

- 2.5 W/300 MW 2 Meter HT
- LCD Readout
- 10 Memories
- Band And Memory Scan



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"THE Smallest HT"

- Compact Pocket Size
- 1 Watt
- Optional 500mA Battery

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FT-757GX "CAT SYSTEM"

- All Mode Transceiver
- Dual VFO's
- Full Break-in CW
- 100% Duty Cycle

YAESU

FT-767GX HF/VHF/UHF BASE STATION

- Add Optional 6m, 2m & 70cm Modules
- Dual VFO's
- Full CW Break-in
- Lots More Features

YAESU

FRG-9600

- 60 MHz-905 MHz Continuous
- 100 Memories
- Clock

YAESU

FT-727R
"DUAL BAND HT"

- 5 Watts on Both 2m & 440 MHz
- 10 Memories
- Battery Saver
- Remote Computer Control Capability

ICOM

IC-735 "NEW"

- HF Transceiver
- Ultra Compact Mobile
- Simplified Front Panel
- Continuously Adjustable output Power up to 100 Watts

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- 25 Watts
- 32 PL Frequencies
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- Easy Direct Interface to PC Compatibles or the VIC/C-64 Series
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ALR-206T
"More For Your Money"

- Completely Programmable From Microphone
- 25 Watt

ALM-203

- 5 Watt
- Subaudible Tone
- 10 Memories
- Built-in "S" meter

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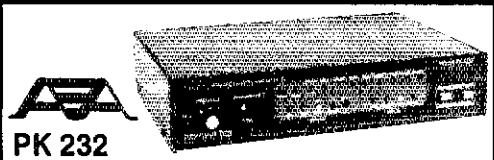
. . . . . HF2V $110.00	RG-8 Superflex .28/ft.
AEA . . . . . 144 SR $42.00	. . . . . 9913 Type .39/ft.
AVANTI . . . 151.3G $35.00	. . . . Rotor Cable .18/ft.
QUATRON	H.D. Rotor Cable .31/ft.

CALL FOR BEST PRICES



PK 232

- Make any RS-232 compatible computer or terminal a complete digital operating position.
- Morse, Baudot, ASCII, AMTOR, Packet
- Loaded with features.

ASTRON CORPORATION

Power Supply

• RS7A	$48
• RS12A	$68
• RS20A	$88
• RS20M	$105
• VS20M	$125
• RS35A	$153
• RS35M	$149
• VS35M	$165
• RS50A	$189
• RS50M	$215
• RM50A	$219
• VS50M	$229

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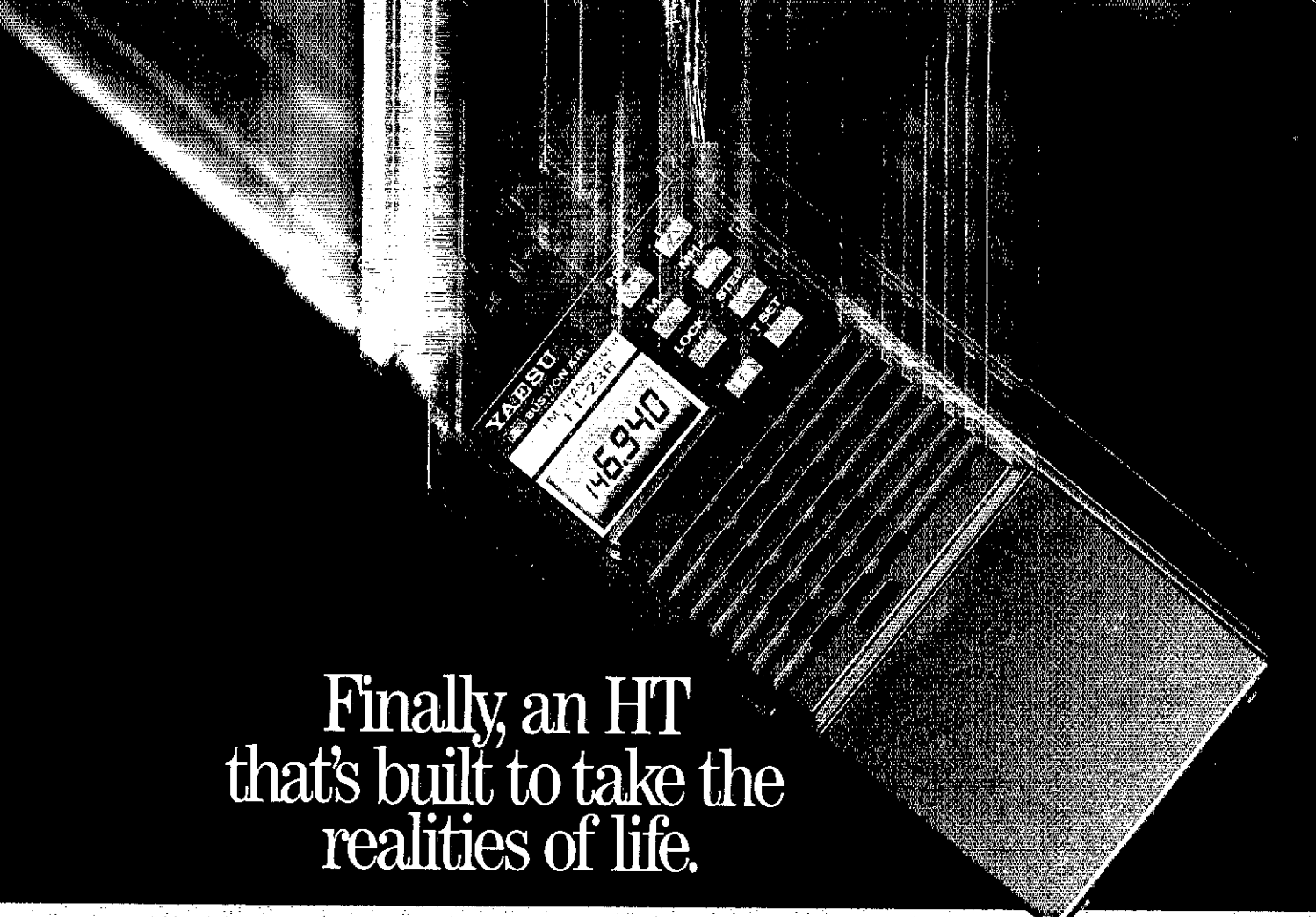
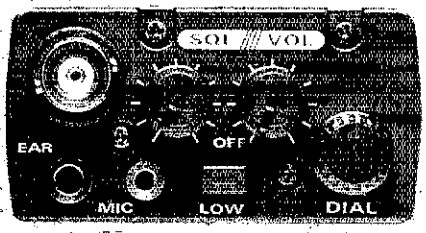


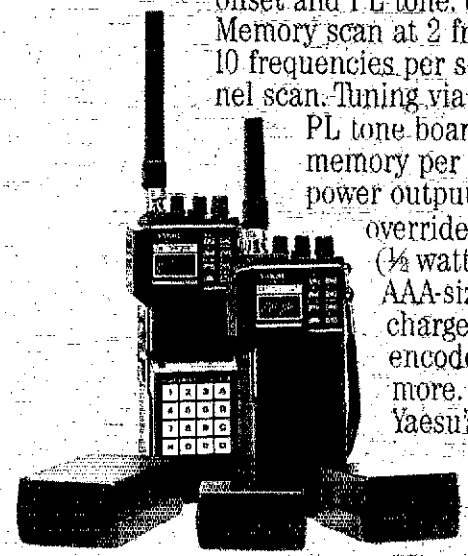
Finally, an HT that's built to take the realities of life.

Let's face it. It's easy to bump, drop, or get rain on an HT. ■ But if your HT is Yaesu's mini 2-meter FT-23R or 440-MHz FT-73R, such mishaps are a lot less worrisome. ■ They're built to last, with rugged aluminum-alloy cases that prove themselves reliable in a one-meter drop test onto solid concrete. Plus, their moisture-resistant seals really help keep the rain out.

Built for the realities of operating. Despite their miniature size, both radios have all the operating capabilities of larger microprocessor-controlled HTs. Yet operating them couldn't be easier. Consider: ■ You get a 10-volt, 2-watt battery pack. (Optionally, a 12-volt, 5-watt pack, or a 10-volt miniature 2-watt pack.) 10 memories that store frequency, offset and PL tone. (7 memories can store odd splits.) Memory scan at 2 frequencies per second. Band scan at 10 frequencies per second. Tx offset storage. Priority channel scan. Tuning via tuning knob, or up/down buttons.



Radios above shown actual size.



PL tone board (optional). PL display. External PL selection. Independent PL memory per channel. PL encode *and* decode. Expanded Rx coverage. LCD power output and "S"-meter display. Battery saver circuit. Push-button squelch override. Eight-key control pad. Keypad lock. High/low power switch (½ watt on low power.) ■ Options available: 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 much more. ■ So get the intelligent mini HT that's built for life's realities. Yaesu's 2-meter FT-23R, or 440-MHz FT-73R.

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Our 30th Anniversary.

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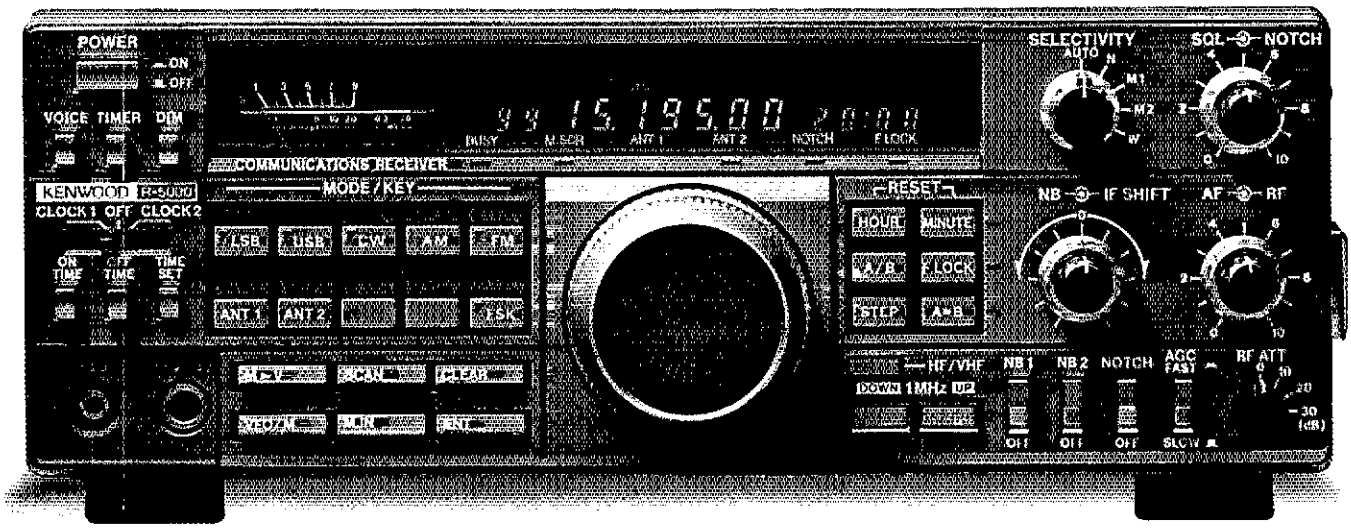
NEW

Listen Up!

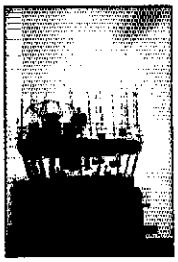


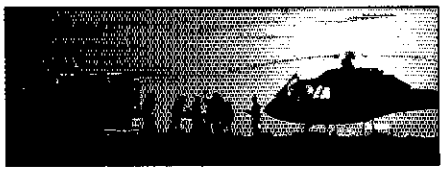
R-5000

High performance receiver

***THE* high performance receiver is here from the leader in communications technology—the Kenwood R-5000. This all-band, all mode receiver has superior interference reduction circuits, and has been designed with the highest performance standards in mind. Listen to foreign music, news, and commentary. Tune in local police, fire, aircraft, weather, and other public service channels with the VC-20 VHF converter. All this excitement and more is yours with a Kenwood receiver!**

- **Covers 100 kHz-30 MHz in 30 bands, with additional coverage from 108-174 MHz (with VC-20 converter installed).**
- **Superior dynamic range.** Exclusive Kenwood DynaMix™ system ensures an honest 102 dB dynamic range. (14 MHz, 500 Hz bandwidth, 50 kHz spacing.)





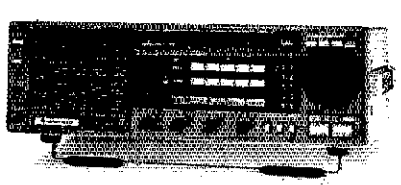
- **100 memory channels.** Store mode, frequency, antenna selection.
- **Choice of either high or low impedance antenna connections.**
- **Extremely stable, dual digital VFOs.** Accurate to ±10 ppm over a wide temperature range.
- **Kenwood's superb interference reduction.** Optional filters further enhance selectivity. Dual noise blankers built-in.
- **Direct keyboard frequency entry.**
- **Versatile programmable scanning, with center-stop tuning.**
- **Voice synthesizer option.**
- **Computer control option.**
- **Kenwood non-volatile operating system.** Lithium battery backs up memories; all functions remain intact even after lithium cell expires.
- **Power supply built-in.** Optional DCK-2 allows DC operation.
- **Selectable AGC, RF attenuator, record and headphone jacks, dual 24-hour clocks with timer, muting terminals, 120/220/240 VAC operation.**

Optional Accessories:

• VC-20 VHF converter for 108-174 MHz operation • YK-88A 1.6 kHz AM filter • YK-88S 2.4 kHz SSB filter • YK-88SN 1.8 kHz narrow SSB filter • YK-88C 500 Hz CW filter • YK-88CN 270 Hz narrow filter • DCK-2 DC power cable • HS-5, HS-6, HS-7 headphones • MB-430 mobile bracket • SP-430 external speaker • VS-1/VS-2 voice synthesizer • IF-232C/IC-10 computer interface.

More information on the R-5000 and R-2000 is available from Authorized Kenwood Dealers.

R-2000 150 kHz-30 MHz in 30 bands • All modes • Digital VFOs tune in 50 Hz, 500 Hz, or 5 kHz steps • 10 memory channels • Programmable scanning • Dual 24-hour digital clocks, with timer • 3 built-in IF filters (CW filter optional) • All mode squelch, noise blanker, RF attenuator, AGC switch, S meter • 100/120/220/240 VAC operation • Record, phone jacks • Muting terminals • VC-10 optional VHF converter (108-174 MHz)



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