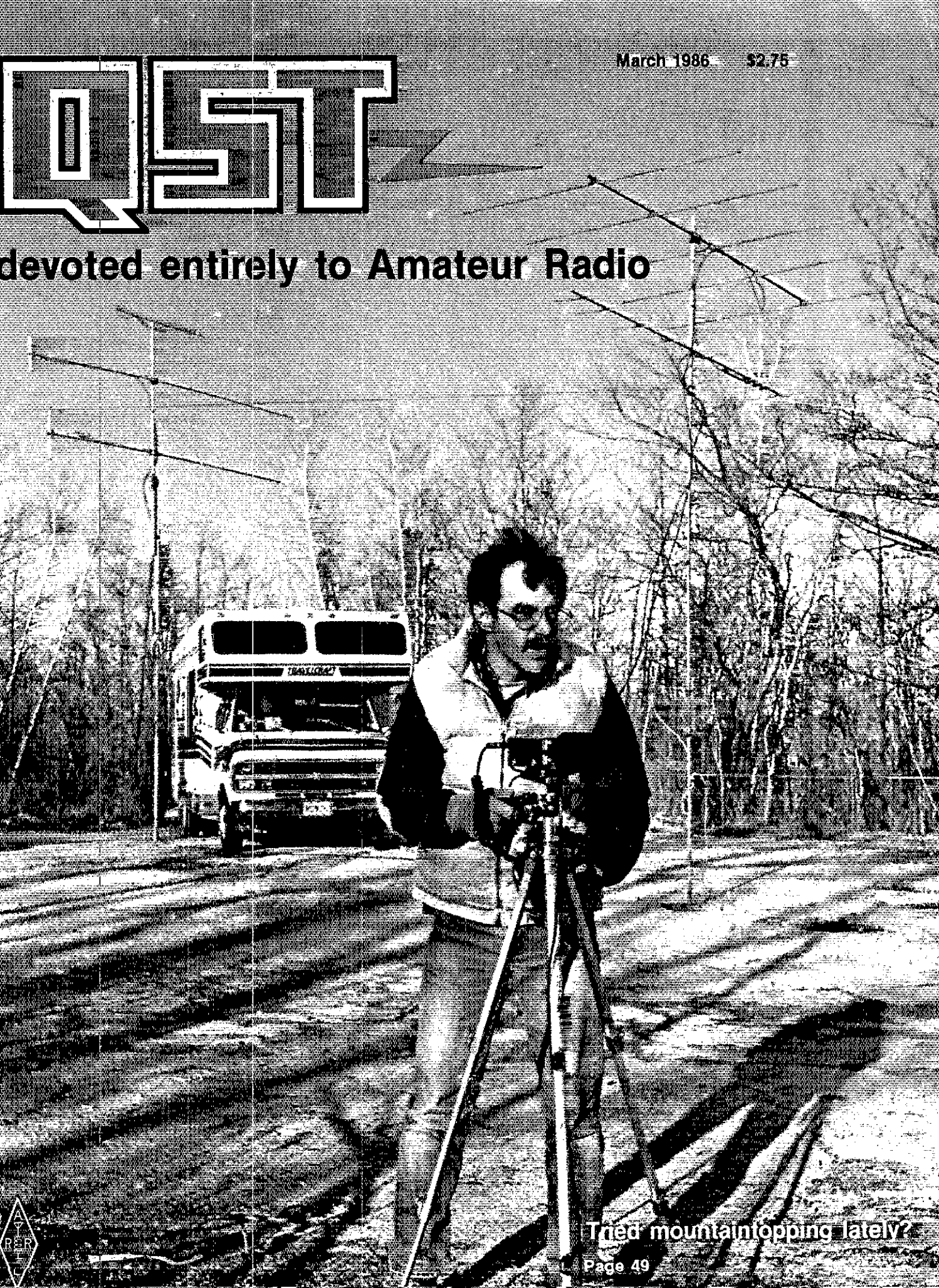
QST

March 1986 $2.75

devoted entirely to Amateur Radio



Tried mountaintopping lately?

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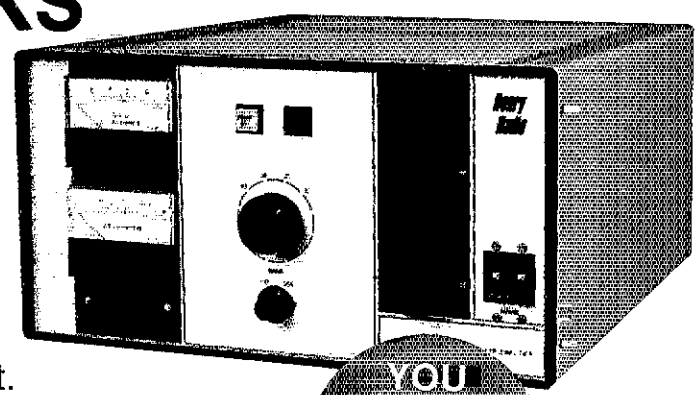
HENRY REPORT #4

NEW!!

...RF DECKS WITHOUT POWER SUPPLY



A long time need has been met.
Thousands of Amateurs own power supply components, but need high quality state-of-the-art RF modules.
Here are six new models derived from our current amplifier line that will fill that need.

- **2K Classic "X" RF - *3.5 to 30 MHz**
- **3K Classic Mk II "X" RF - *3.5 to 30 MHz**
- **2002A RF - 144-148 MHz**
- **2004A RF - 420-440 MHz**
- **3002A RF - 144-148 MHz**
- **3004A RF - 420-440 MHz**

*10 meter band deleted in U.S.

You can now have the bands you need at the price you can afford. We provide the RF deck! You provide the power supply. Let us send you a brochure providing complete technical information.

Of course, all our present model complete amplifiers are still available. This new group of RF modules simply strengthens and expands what was already the best and broadest line of Amateur power amplifiers.

Henry amateur amplifiers are available from Henry Radio and select dealers throughout the U.S. and are being exported to amateurs all over the world. In addition to our broad line of commercial FCC type accepted amplifiers we offer special RF power generators for industrial and scientific users. Call or write Ted Shannon or Mary Silva for full information.

We stock these plus many other fine names:
AEA • ARCO • ARRL • ASTRON • B & K • B & W • BIRD • CDE • CONNECT-SYSTEMS • CUSHCRAFT • EIMAC • HAL • HUSTLER • HY-GAIN • ICOM • KENWOOD • LARSEN • NYE • ROBOT • TEMPO • VIBROPLEX • YAESU

58 YEARS OF SERVICE

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KENWOOD

...pacesetter in Amateur radio

WAIT! 220 MHz Coming soon!

Power-Full...70 Watts!

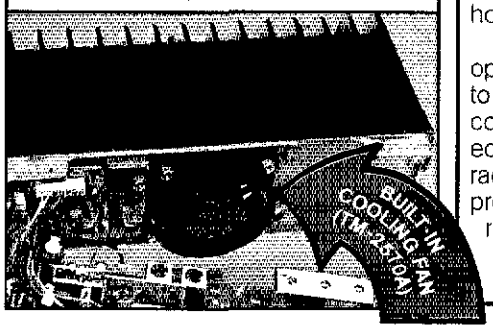
TM-2570A/2550A/2530A

Sophisticated FM transceivers

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 three power versions to choose from: The TM-2570A 70-watt model, the TM-2550A for 45-watts, and the 25-watt TM-2530A.

- **First** 70-watt FM mobile (TM-2570A)
- **First** mobile transceiver with telephone number memory and auto-dialer (up to 15 telephone numbers)
- Direct keyboard entry of frequency
- Automatic repeater offset selection according to the ARRL 2-meter band plan —**a Kenwood exclusive!**
- Extended frequency coverage for MARS and CAP (142-149 MHz; 141-151 MHz modifiable)
- 23 channel memory for offset, frequency and sub-tone
- 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
- HI/LOW Power switch (adjustable LOW power)
- Compact DIN size

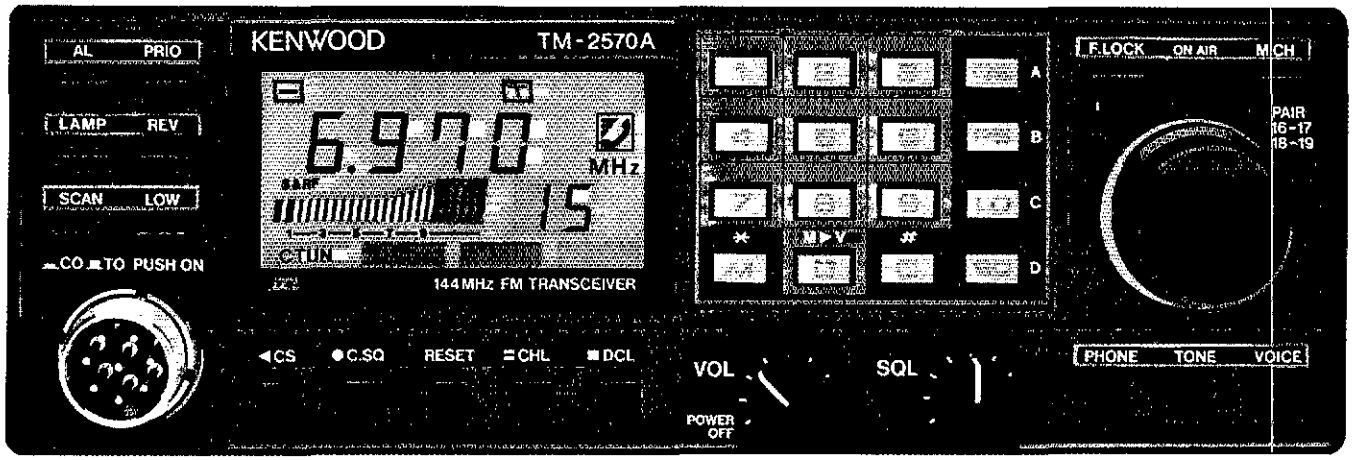
Large heatsink with built-in cooling fan (TM-2570A)



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-255OA/2530A
- **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

KENWOOD

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1111 West Walnut Street
Compton, California 90220

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

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.

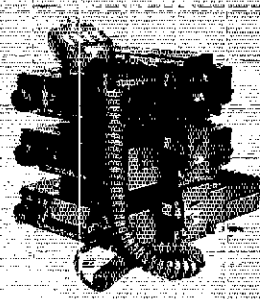
More Features. Other IC-27A/37A/47A standard features include a mobile mount, IC-HM23 DTMF mic with up/down scan and memory scan, and internally adjustable transmit power. An optional IC-PS45 slim-line external power supply and IC-SP10 external speaker are also available.

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.

ICOM

First in Communications

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

March 1986 *Volume LXX Number 3*

QST (ISSN: 0033-4812) is published monthly as its official journal by the American Radio Relay League, Newington, CT USA. Official organ of the Canadian Radio Relay League.

Offices
225 Main St, Newington, CT 06111 USA
Telephone: 203-666-1541
Telex: 650215-5052 MCI

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Second-class postage paid at Hartford, CT and at additional mailing offices. Postmaster: Form 3579 requested.

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OUR COVER

The place: Buck Hill (elev 735 ft), Rhode Island
The contest: January VHF Sweepstakes
The station: W1XX multiop
The band: 10 GHz
The ham: Jon, WB1DNL
The bottom line: Pick your spot and your gear carefully, and have a ball mountaintopping on VHF/UHF
Photo by: George Barker, NA1F

CONTENTS

TECHNICAL

NEWS AND FEATURES

DEPARTMENTS

TOO GOOD TO BE TRUE?

PAKRATT™ Model PK-64
shown with enhanced HFM-64 option installed

★ MORSE ★ BAUDOT ★ ASCII ★ AMTOR ★ PACKET ★

FIRST FIVE MODE DATA CONTROLLER

The Pakratt model PK-64 by AEA is the world's first computer interface that offers Morse, Baudot, ASCII, AMTOR *and* Packet all in one box (hardware *and* software included) at a price many competitors charge for Packet alone (from $219.95 Amateur net). Do not let the low price fool you; coming from any other company but AEA it WOULD be too good to be true. The PK-64 works with virtually any voice transceiver. The Pakratt is the easiest of any to hook up and have operating in just a few minutes.

In Packet mode, the PK-64 offers virtually all the features of every other Packet controller on the market, plus many important features left out by others due to cost constraints. For example, we have included a hardware HDLC, true Data Carrier Detect (DCD), multiple connect with up to ten stations simultaneously and full implementation of version 2.0 of the AX.25 protocol.

Because the PK-64 was designed specifically for the Commodore 64 (or C-128 and SX-64) computer, we have been able to do many things not economically feasible with general RS-232 interface controllers. For example, the Pakratt includes true split screen operation with on-screen status indicators and an on-screen tuning indicator.

ENHANCED HFM-64 MODEM OPTION

The standard PK-64 will operate all modes with a phase-lock-loop (PLL) detector roughly equivalent to all popular packet modems in the marketplace (except we have included extra filtering). The enhanced HFM-64 modem option offers true independent dual channel filtering with A.M. detection (like the famous CP-100 Computer Patch™). The enhanced HFM-64 option also offers a hardware LED tuning indicator (like the CP-100) and a front panel variable threshold control for setting maximum sensitivity under various band conditions. We recommend the HFM-64 option for anyone keenly interested in weak-signal heavy-QRM HF operation. For anyone desiring to operate FM RTTY with the standard North American tone pair or CW receive, the HFM-64 is required. The HFM-64 is field installable with no soldering or test equipment required.

WORKS WITH THE POPULAR C-64 COMPUTER

AEA designed the PK-64 around the low-cost C-64 because of the special architecture features making it especially suited to Amateur Radio applications. The C-64 should not be viewed as a mainframe, but rather a very economical accessory to your data communications system. Many owners of expensive computers such as IBM, TANDY, APPLE, KAYPRO, ATARI, etc., are now buying the low cost C-64 and dedicating it to their operating position. They simply cannot find software for their machine that even approaches the power and user friendliness of the PK-64. Plus, think of the convenience of having only one controller and keyboard to go from one mode to another without having to redo cabling!

The PK-64 is so complete that all you need to do is wire up a microphone connector to the end of a cable (provided) and you are ready to go. There is no need to track down special terminal software, cabling or even a power supply. It all comes with the PK-64. So do not be the last on your block to own the most exciting new product in years. See the PK-64 at your favorite dealer or write for our specification sheet now.

Prices And Specifications Subject To Change Without Notice Or Obligation

Advanced Electronic Applications, Inc.
P.O. Box C-2160, Lynnwood, WA 98036-0918
(206) 775-7373 Telex 6972496 AEA INTL UW

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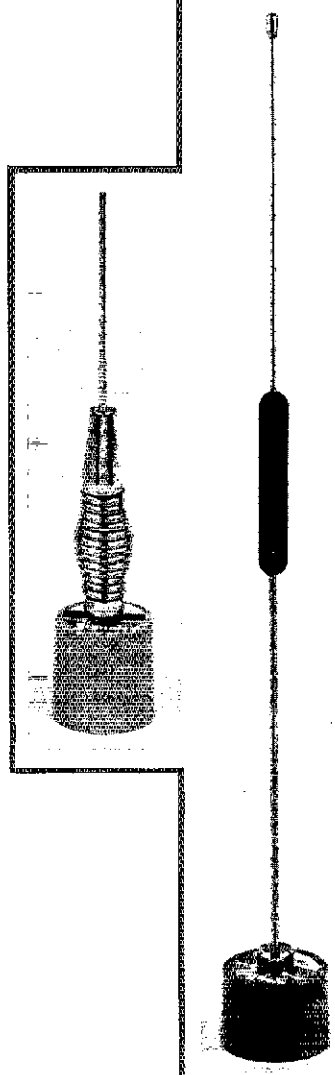

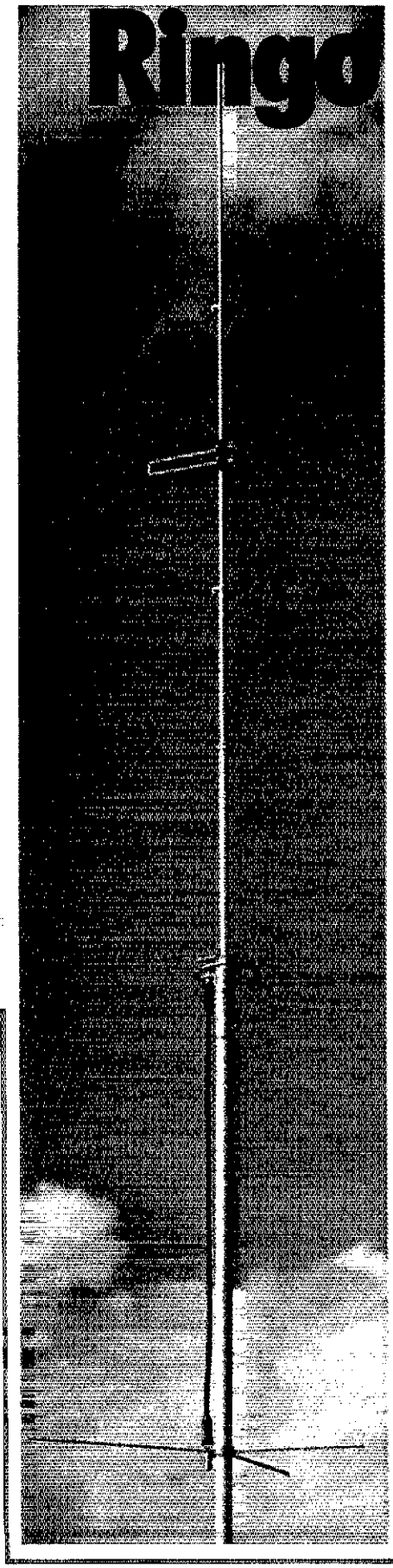

Ringo Ranger II

Simply the best

The best combination of gain, bandwidth and low angle radiation for simplex or repeater operation.

Quick easy assembly and installation

Mount anywhere with compact dimensions and neat appearance

Proven performance and durability in all environments

Complete FM band coverage

One year warranty

Cushcraft antennas created the FM antenna revolution by making the best performance and value available to every ham. We continue to set the pace with a broad line of antennas for every FM application. Tune across the band and you will find the overwhelming majority of hams using one, two, or more Cushcraft antennas. The reason is very simply that they are the best. Now is the time for you to enjoy the value of a Cushcraft antenna. See your nearby dealer today.

RINGO RANGER II

ARX-2B 134-164MHz
ARX220B 220-225MHz
ARX450B 435-450MHz

MOBILE ANTENNAS

CS50M 46-54MHz Magnetic Mount
CS147M 144-174MHz Magnetic Mount
CS220M 220-225MHz Magnetic Mount
CS450M 435-470MHz Magnetic Mount

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- **EACH COMPLETE WITH CABLE, CONNECTORS AND THREADED BASE TO TAKE EITHER THE**
- **STAINLESS STEEL SPRING OR STRAIGHT WHIP**
- **CHOICE OF 3 MOUNTING OPTIONS**
  1. **90 POUND MAGNET MOUNT**
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  3. **¾ INCH HOLE MOUNT**

ONLY **CUSHCRAFT/SIGNALS MOBILE ANTENNAS** GIVE YOU ALL OF THESE IMPORTANT PERFORMANCE FEATURES.

KENWOOD

...pacesetter in Amateur radio

NEW! Computer Interface

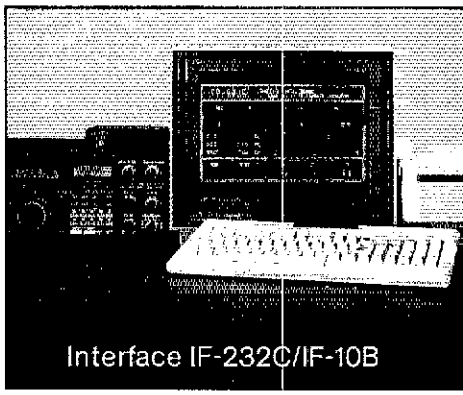
"DX-cellence!"

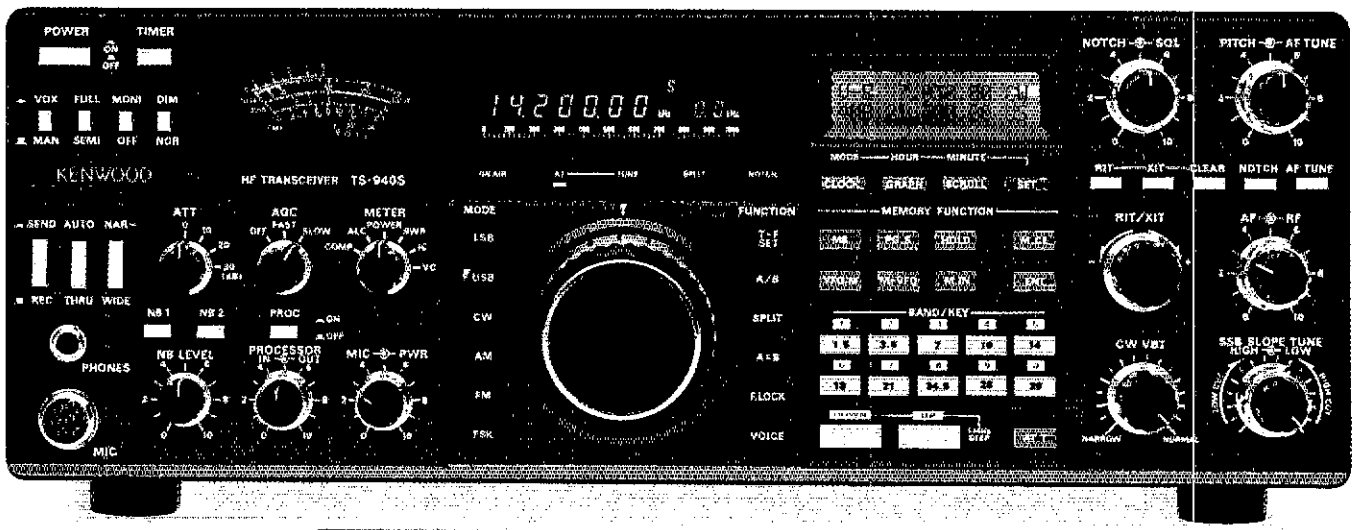
TS-940S

The new TS-940S is a serious radio for the serious operator. Superb interference reduction circuits and high dynamic range receiver combine with superior transmitter design to give you no-nonsense, no compromise performance that gets your signals through! The exclusive multi-function LCD sub display graphically illustrates VBT, SSB slope, and other features.

- **100% duty cycle transmitter.** Super efficient cooling system using special air ducting works with the internal heavy-duty power supply to allow continuous transmission at full power output for periods exceeding one hour.
- **High stability, dual digital VFOs.** An optical encoder and the flywheel VFO knob give the TS-940S a positive tuning "feel."
- **Graphic display of operating features.** Exclusive multi-function LCD sub-display panel shows CW VBT, SSB slope tuning, as well as frequency, time, and AT- 940 antenna tuner status.
- **Low distortion transmitter.** Kenwood's unique transmitter design delivers top "quality Kenwood" sound.
- **Keyboard entry frequency selection.** Operating frequencies may be directly entered into the TS-940S without using the VFO knob.
- **QRM-fighting features.** Remove "rotten QRM" with the SSB slope tuning, CW VBT, notch filter, AF tune, and CW pitch controls.
- **Built-in FM, plus SSB, CW, AM, FSK.**
- **Semi or full break-in (QSK) CW.**
- **40 memory channels.** Mode and frequency may be stored in 4 groups of 10 channels each.
- **Programmable scanning.**
- **General coverage receiver.** Tunes from 150 kHz to 30 MHz.
- **1 yr. limited warranty.** Another Kenwood First!

Optional accessories:
• AT-940 full range (160-10m) automatic antenna tuner • SP-940 external speaker with audio filtering • YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filters; YK-88A-1 (6 kHz) AM filter • VS-1 voice synthesizer • SO-1 temperature compensated crystal oscillator • MC-42S UP/DOWN hand mic. • MC-60A, MC-80, MC-85 deluxe base station mics. • PC-1A phone patch • TL-922A linear amplifier • SM-220 station monitor • BS-8 pan display • SW-200A and SW-2000 SWR and power meters.





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

More TS-940S information is available from authorized Kenwood dealers.

KENWOOD

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KENWOOD

...pacesetter in Amateur radio

NEW! Computer interface!

Complete Control...

IF-232C Level translator

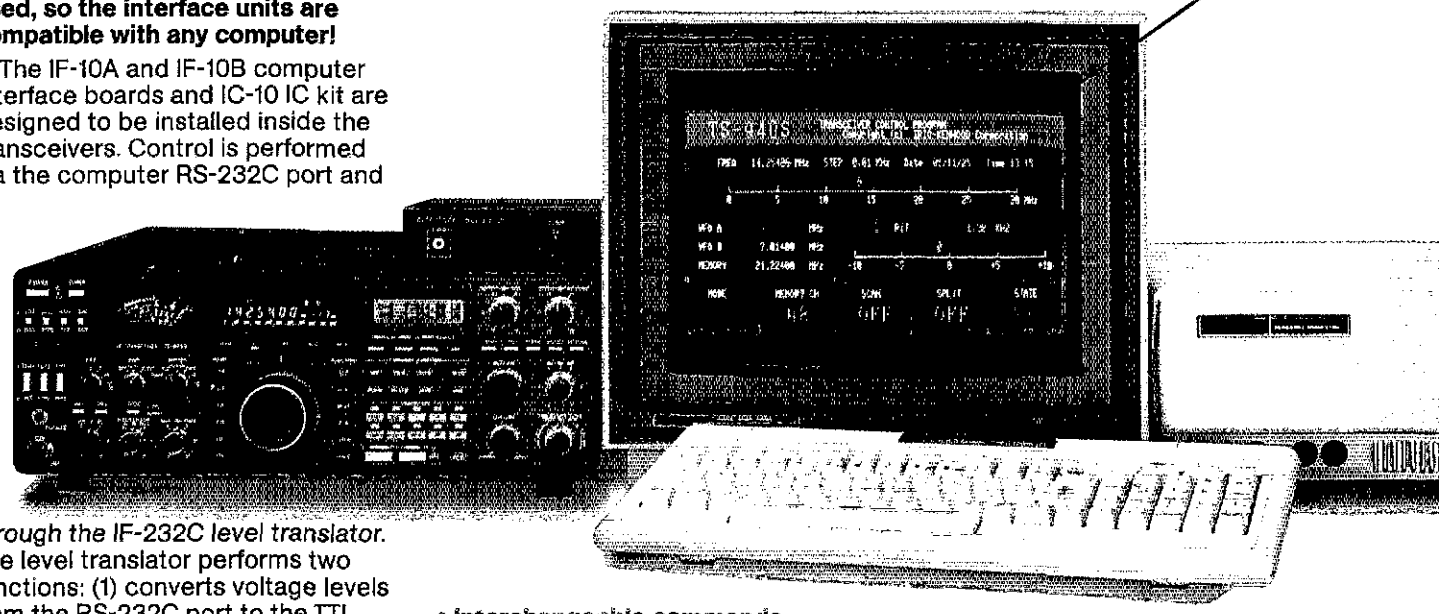
IF-10A Computer interface for TS-711A/TS-811A
IF-10B Computer interface for TS-940S
IC-10 IC kit for TS-440S computer control

Attention "computing" hams! The Kenwood IF-Series computer interface units will enable you to connect your TS-711A, TS-811A, TS-940S, or TS-440S transceivers to your home computer. RS-232C standard is used, so the interface units are compatible with any computer!

The IF-10A and IF-10B computer interface boards and IC-10 IC kit are designed to be installed inside the transceivers. Control is performed via the computer RS-232C port and *through the IF-232C level translator.* The level translator performs two functions: (1) converts voltage levels from the RS-232C port to the TTL levels in the transceiver, (2) and acts as a noise supressor. A complete interface "kit" would include the appropriate computer interface units (IF-10A, IF-10B, or IC-10) and the IF-232C level translator.

Short Wave Listener's map and directory—simply select the QTH you'd like to listen to, and the pre-programmed frequency is "dialed up."

Display frequency, band, and mode data. Control your rig via keyboard!

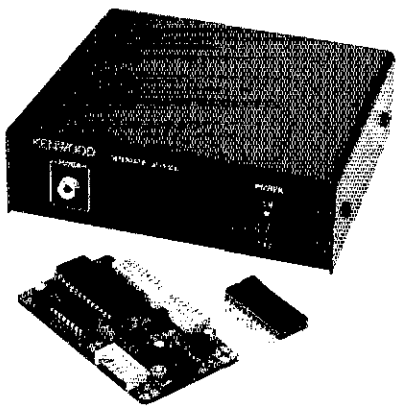


The applications of automated station control are almost endless! Just imagine...work DX from your hand-held...operate OSCAR "automatically"...remote operation of your station...or put together the "ultimate" contest station....

CRT display shown is a sample program, not available from Trio-Kenwood Communications.

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

- **Interchangeable commands**
This means that one program may be used with several rigs, to minimize program changes.
- **Simultaneous operation of the computer and transceiver is possible**



- **Powerful, easy-to-understand instruction set**
- **Wide variety of commands**
Memory input and recall, frequency selection, frequency step, sub-tone frequency, offset, antenna tuner, DCS, scan, and many, many more functions are accessible with the Kenwood computer interface unit!
- **AC-10 AC power adapter (optional)**

More IF-232C and computer interface information is available from authorized Kenwood dealers.

KENWOOD

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1111 West Walnut Street
Compton, California 90220

Directors

Canada

THOMAS B. J. ATKINS, VE3CDM,
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Vice Director: Wayne Overbeck, N6NB, 900 Avenida Salvador, San Clemente, CA 92672 (714-492-8025)

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Vice Director: Thomas W. Comstock, N5TC,
1700 Dominik, College Station, TX 77840 (409-693-1181)

*Executive Committee Member

Section Managers of the ARRL

Reports Invited: The ARRL Board of Directors (see list at left) determines the policies of ARRL. The 16 divisions of the League are further arranged into 73 administrative "sections," each headed by an elected Section Manager. Your SM welcomes reports of club and individual activity. ARRL Field Organization appointments are available covering a wide range of Amateur Radio volunteer interests. Whatever your license class, your SM has an appointment available. Check with your SM (below) for further information.

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British Columbia — H. E. Savage, VE7FB, 4553 West 12th Ave, Vancouver V6R 2R4 (604-224-5226)
Manitoba — Jack Adams, VE4AJE, 227 Davidson Ave E, Dauphin R7N 2Z4 (204-638-9270)
Maritime-Nfld — Donald R. Welling, VE1WF, 36 Sherwood Dr, St. John, NB E2J 3H6 (506-696-2913)
Ontario — L. P. Thivierge, VE3GT, 34 Bruce St W, Renfrew K7V 3W1 (613-432-5967)
Quebec — Harold Moreau, VE2BP, 80 Principale, St Simon Co, Bagot J0H 1Y0 (514-798-2173)
Saskatchewan — W. C. "Bill" Munday, VE5WM, 132 Shannon Rd, Regina S4S 5B1 (306-586-4963)

Atlantic Division

Delaware — Harold K. Low, WA3WIY, Rte 6, Box 66, Millsboro 19966 (302-945-2871)
Eastern Pennsylvania — James B. Post, KA3A, 15 Monarch Rd, Wilkes-Barre 18702 (717-825-3940)
Maryland-DC — John A. Barolet, KJ3E, 108 Elliott Ct, California, MD 20619 (301-862-3201)
Southern New Jersey — Richard Baier, WA2HEB, 1226 Audubon Dr, Toms River 08753 (201-270-9292)
Western New York — William Thompson, W2MTA, RD 1—Rock Rd, Newark Valley 13811 (607-642-8930)
Western Pennsylvania — Otto Schuler, K3SMB, 3732 Colby St, Pittsburgh 15214 (412-231-6890)

Central Division

Illinois — David E. Lattan, WD9EBQ, RR 1, Box 234, Makanda 62958 (618-529-1578)
Indiana — Bruce Woodward, W9UMH, 6208 Bramshaw Rd, Indianapolis 46220 (317-251-5606)
Wisconsin — Richard R. Regent, K9GDF, 5003 South 26th St, Milwaukee 53221 (414-282-0312)

Dakota Division

Minnesota — George E. Frederickson, KCØT, RR #2—Box 352, South Haven 55382 (612-558-6312)
North Dakota — Mike Mankey, WBØTEE, 516 E. Columbia Dr, Bismarck 58501 (701-258-5114)
South Dakota — Roland Cory, WØYMB, 1010 7th St, W, Mobridge 57601 (605-845-2400)

Delta Division

Arkansas — Joel M. Harrison, Sr., WB5IGF, Star Rte 3—Box 306, Judsonia 72081 (501-729-3301)
Louisiana — John M. Wondergem, K5KR, 600 Smith Dr, Metairie 70005 (504-837-1485)
Mississippi — Paul Kemp, KW5T, 3581 Beaumont Dr, Pearl 39208 (601-939-7612)
Tennessee — John C. Brown, NO4Q, PO Box 37, Eva 38333 (901-584-7531)

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Michigan — James R. Seeley, WB8MTD, 21815-29½ Mile Rd, Springport 49284 (517-857-2013)
Ohio — Jeffrey A. Maass, K8ND, 9256 Concord Rd, Powell 43065 (614-873-3234)

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NYC-Long Island — John H. Smale, K2IZ, 315 Kensington Ct, Copiague 11726 (516-226 4835)
Northern New Jersey — Robert R. Anderson, K2BJG, 69 Page Dr, Oakland 07436 (201-337-7858)

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Kansas — Robert M. Summers, KØBXF, 3045 North 72nd, Kansas City 66109 (913-299-1128)
Missouri — Benton C. Smith, KØPCK, 3301 Sinclair, Rte 3, Box 196-A, Columbia 65203 (314-443-5168)
Nebraska — Vern J. Wirka, WBØGQM, Rural Route, 81 Capehart Rd, Papillion 68133

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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 — Ralph T. Stetson, III, KD1R, PO Box 123, Milton 05468 (802-893-4856)
Western Massachusetts — R. Donald Haney, KA1T, RD 1—Box 237, Myrick La, Harvard 01451 (617-772-4126)

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Idaho — Lemuel H. Allen, W7JMH, 1800 S. Atlantic St, Boise 83705 (208-343-9153)
Montana — L. C. "Les" Belyea, N7AIK, PO Box 327, Belgrade 59714 (406-388-4253)
Oregon — William R. Shrader, W7QMU, 2042 Jasmine Ave, Medford 97501 (503-773-8624)
Washington — Gene E. Sprague, KD7G, 10716 23rd Dr SE, Everett, WA 98204 (206-337-3459)

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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
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. Felgley, W3ATQ, 135 The Main—RR #1, Williamsburg 23185 (804-253-0658)
West Virginia — Karl S. Thompson, K8KT, 5303 Pioneer Dr, Charleston 25312 (304-776-4352)

Rocky Mountain Division

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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 — Phillip O'Dwyer, WF4X, 543 Mooney Rd, NE, Fort Walton Beach 32548 (904-862-2353)
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

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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)

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Oklahoma — Dave Cox, NB5N, 1812 S Umbrella Ct, Broken Arrow 74012 (918-250-2285)
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.

All 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 (user name: ARRL)

"It Seems to Us ..."

Spirituality

January 29, 1986. The American flag in the front parking lot at ARRL HQ was flying at half-mast as this writer arrived for work at 9 AM. You know the reason. Seven of us had embarked on a quest the previous day, never to return. Another of us, the President of the United States, had eulogized them later on that terrible day. "We will never forget them," Ronald Reagan said, "nor the last time we saw them, this morning, as they prepared for their journey and waved goodbye, and slipped through the surly bonds of earth, to touch the face of God."

They rose aboard a species of machine, a machine called Shuttle *Challenger*. We have had great success with machines. Less than a week before *Challenger* took to the sky, we'd ohhed and ahhed images brought us by another stupendous machine: Voyager 2, away from Earth for so many years, chugging out those stunning vistas of Uranus and its moons, signals taking so many minutes to reach us, pictures so clear. What a machine! Some of us—radio amateurs, we're called—may even have witnessed the retransmission of some of those images in our amateur bands, from the Jet Propulsion Laboratory, from W6VIO, just as many of us may have heard Amateur Radio signals emanating from *Challenger* so few months ago, when several of our number were part of her crew—all brought us by our collective handiwork: wondrous machines, systems going well, networks holding together. But recall that there were cold eyes in a mindless construct feeding us those images; it took *our* imaginations and intellects, after *our* eyes and brains had scanned the images from Voyager, to do the ohing and ahhing, the dreaming—and the going on.

This is why there were seven people aboard *Challenger* on January 28, 1986. It's too inhospitable out there near Saturn and Uranus, sure—our machines haven't yet been perfected to the point where they'll get any of us out there to do the real-time real-space dreaming and get us safely home again. So we send a machine and prepare to be thrilled from afar. We don't stand for this "thrilled from afar" stuff any longer than we need to, though. The idea is to get out there and do it ourselves. The intent is to feel the real hands grasping the actual controls, to let the true light fall on the living retinas. Why? Because our push into space is arguably the greatest spiritual quest on which humans may collectively embark. It's in the blood, it's built into our cells.

"Whoa, *QST*'s talking spirituality; break out the fire extinguishers!" Not at all. The first experiments trying to crack the radio "nut" last century were part of the same spiritual quest to which the Challenger crew were committed. Our first lispy blurps on 5 meters were more of the same. We got there with machines of wire and glass, and—deceptively—with little apparent risk, but with machines no less wondrous even if tossed together on a kitchen shelf. The goal, this writer insists, is primordial: humankind, Us with a capital "u," expanding beyond where and what we are—an enormous slow yearning over myriad generations to push from the known into the unknown. The expansion of mankind right before its own eyes. If that isn't spirituality, what is? Sure, our society is vast, the means through which we individually participate in the push into space democratic and bureaucratic —long concatenations of taxes, politicians and specialists between each of us and those chosen to "push back the envelope"—but the quest is what it has always been: utter spirituality, everything on the line.

That's why the slug in the gut when we saw *Challenger* fall. *That's* why the dazedness, the anger, the flags at half mast. Seven of us we *instinctively* realize we had utterly accepted—and loved—as our proxies in that quest, gone. No rejoicing, as we'd planned—but still the dreaming, and the going on.

January 28, 1986

Gregory B. Jarvis Ellison S. Onizuka
Christa McAuliffe Judith A. Resnik
Ronald E. McNair Francis R. Scobee
Michael J. Smith

—David Newkirk, AK7M

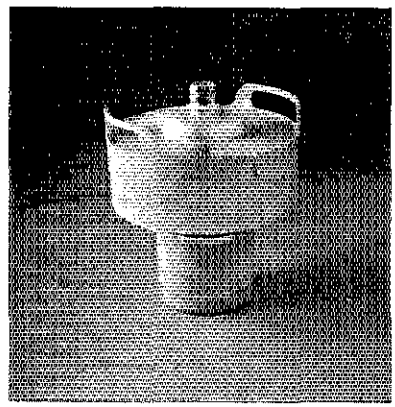
EIMAC Tubes Provide Superior Reliability at radio station KWAV — over 112,000 hours of service!

Ken Warren, Chief Engineer at KWAV reports that their 10 kW FM transmitter went on the air in November, 1972, equipped with EIMAC power tubes. The original tubes are still in operation after over 13 years of continuous duty!

Ken says, "In spite of terrible power line regulation, we've had no problems with EIMAC tubes. In fact, in the last two years, our standby transmitter has operated less than two hours!"

Transmitter downtime means less revenue. EIMAC tube reliability gives you *more* of what you need and *less* of what you don't want. More operating time and less downtime!

EIMAC backs their proven tube reliability with the longest and best warranty program in the business. Up to 10,000 hours for selected types.



Quality is a top priority at EIMAC, where our 50-year charter is to produce long-life products.

Send for our free Extended Warranty Brochure which covers this program in detail.

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UP FRONT in QST

Members of the Arapahoe Radio Club, of Morrison, Colorado, are convinced that Amateur Radio can be great when you're high. One weekend last summer, various club members ventured to the summits of three mountains, where they made two-ways with one another. The group shown in the photo operated from atop 14,264-foot Quandary Peak, the state's 14th highest. They were able to work the others on 20-meter CW, 2 meters and 70 cm using 5 watts of power supplied by two 6-volt lantern batteries and a 100-foot long wire about 5 feet up. The hams had so much fun, they plan to expand participation and make the climbs an annual event. Pictured are (front row, l-r) KDØTX, NØDA and WNØEHE, and (back row, l-r) prospective hams Rich, Peru and Brian. WØYZ (not shown) was busy on 2 meters. If mountaintopping is the kind of activity you or your club are looking for, the article on page 49 tells you everything you need to know to get in on the fun.

RFI, Public-Service Agreements, 160 Meters, Repeater Coordination Among Board Meeting Topics

Among the items discussed and acted on at the ARRL Board of Directors annual meeting in Hartford, Connecticut, January 23-24, were:

- the RF-susceptibility labeling of home-entertainment equipment;
- the establishment of public-service agreements between the ARRL and the National Weather Service and the Civil Air Patrol, as well as similar agreements between amateur emergency and local disaster groups;
- a modified 160-meter band plan; and
- implementation of a national repeater data base at ARRL HQ.

See the Board Meeting report, and the full text of the meeting minutes in Moved and Seconded, elsewhere in this issue, for complete details.

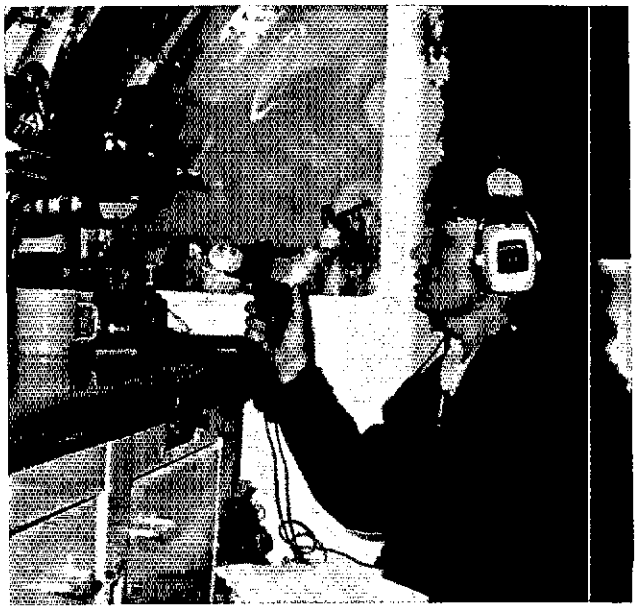
The Challenge Continues

The results of the 1985 Club Challenge for the '80s are in, and three affiliated clubs have been recognized. Each of the three earned the top spot in its classification: a solid-state, state-of-the-art transceiver. By size category (large, medium, small), they are the West Coast ARC (Fountain Valley, CA), the Amador County ARC (Pine Grove, CA) and the Georgia Tech ARC (Atlanta, GA).

The competition has begun anew for affiliated clubs in 1986. The Challenge awaits. Your club will earn $5 for each *new* regular ARRL member you bring aboard. And if you promote the greatest number of new ARRL members in 1986, you'll earn a transceiver at the end of the year!

For details, call Leo Kluger, WB2TRN, Club Program Manager, at ARRL HQ.

Amateurs are familiar with operating from remote islands, from atop some of the highest mountains and even from space—but underwater? After several years in underwater research, curiosity got the best of Dr. Mary Lou Coulston, KV4KD, and she decided to find out if Amateur Radio works as well below water as it does above it. As Science Coordinator for the Hydrolab, a diving habitat operated by the West Indies Laboratory-Fairleigh Dickinson University as part of NOAA's Underseas Research Project, she was in a perfect position to conduct such a test. Getting equipment into the Hydrolab was the tricky part. The radios were placed in pressurized cylinders and then pulled down into the Hydrolab, which was in a canyon about 50 feet below the water's surface off the coast of St Croix, US Virgin Islands. An antenna was attached to a buoy on the water's surface, but one antenna feed line had to be fed down the Hydrolab's umbilical along with the air and electrical supplies. Mary Lou swam another feed line down to the Hydrolab and inserted it through an entrance and exit "hat." All the work paid off, though, as Mary Lou reported more than 50 contacts on 40 and 20 meters, including two-ways with hams from Canada to Venezuela and the island nations throughout the Caribbean. One QSO was with NM5I, who told her that now he had made contact with both inner and outer space, having talked with a Shuttle Astronaut/Ham and now an "aquanaut." Mary Lou says she is looking forward to her next mission aboard a bigger and better-equipped Hydrolab, and the opportunity to take Amateur Radio to greater heights—at greater depths.



For Frank Wen, KM2X (ex-C1BC), of Woodside, New York, China will always be a special place. Frank left China many years ago, but recently his Amateur Radio interests brought him back to his native Shanghai. In December, he visited old ham radio friends who were now active at club station BY4AOM, at the Shanghai Institute of Electronics, and BY4AA, club station at the Shanghai Branch of the Chinese Radio Sports Association. Among them are BY4AA Chief Operator R. Xu (second from right) and BY4AOM members (l-r) J. Tom (ex-XU8WM), J. Xie (ex-C1TH) and Y.T. Feng (ex-C1RB). Today, Amateur Radio operation in The Peoples Republic of China is a club activity. Other Chinese club stations on the air are BY1PK, BY1QH, BY1SK, BY5RA, BY5RF, BY8AA, BY8AC and BY0AA.

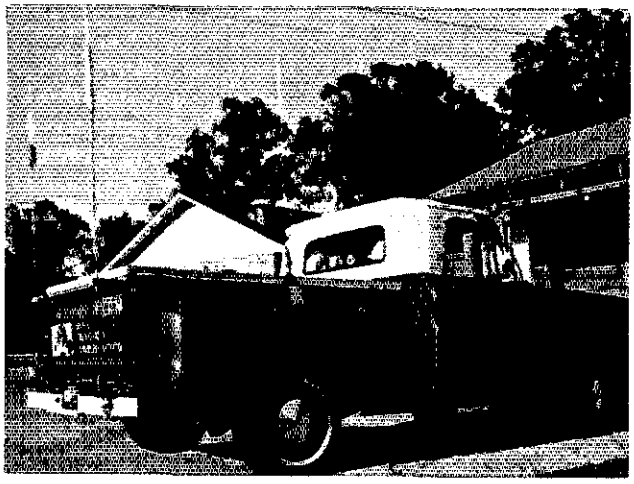
Financial Help Available to College Students

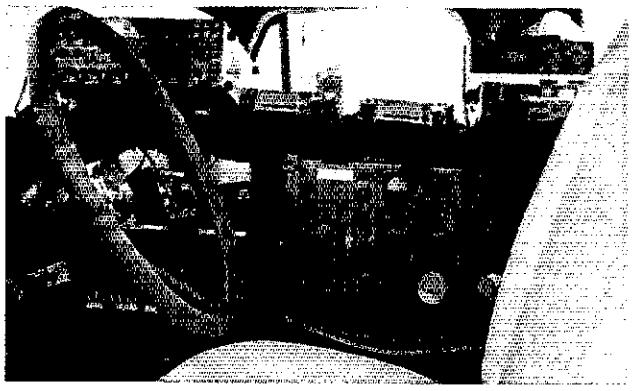
Last month in this column, we announced some ARRL-sponsored scholarships that are available to radio amateurs. Add another to the list: the ARRL College Scholarship to honor Senator Barry Goldwater, K7UGA. The $5000 scholarship is intended solely for educational use by providing assistance with tuition, room/board or other costs essential to advanced education. Applicants must be licensed amateurs who are enrolled in a communications program at an accredited institution of higher education. The application deadline is June 1 for the following academic year. More information and application forms can be obtained from ARRL Foundation Scholarships, 225 Main St, Newington, CT 06111.

Over the years, a number of clubs have achieved 50 years of affiliation with the ARRL, but how many can boast that their first and current presidents were present to accept the honor? The Tri-County Radio Association, of Scotch Plains, New Jersey, can! At year end, immediate past-Hudson Division Director George Diehl, W2IHA (center), had the honor of presenting the ARRL 50-year Affiliation Certificate to current club President James Montllor, W2GRO (left), and first TCRA President William Cowperthwait, W2FJG. *(WA2WDJ photo)*

There are plenty of firsts to be achieved in Amateur Radio, and Thomas Braidwood (left), of Biloxi, Mississippi, has at least one to his credit: He's ARRL's **first 70-year member.** We're talkin' 1915 here! ARRL Delta Division Director Clyde Hurlbert, W5CH, had the pleasure of presenting the plaque to Tom at the 1985 Mississippi State Convention in Jackson. League representatives sharing in the presentation were (l-r) Mississippi Section Manager Paul Kemp, KW5T, and ARRL Counsel Chris Imlay, N3AKD.

South Australia is celebrating its 150th birthday this year, and radio amateurs there would like amateurs worldwide to share in the event. Any amateurs who contact special-event station VK5JSA from January 1 through December 31, 1986 will receive this souvenir QSL card from the Wireless Institute of Australia (WIA). Also, radio amateurs accumulating 150 points over the course of the year through contacts with amateurs Down Under will be awarded the Jubilee 150 Award, courtesy of the WIA, the South Australian Department of Tourism, Qantas Airlines and Estrow Civil Engineering Consultants. For rules and more information, contact Rowland Bruce, VK5OU, GPO, Box 1234, Adelaide, South Australia 5001. Fair dinkum, mate!





For years, Calloway County ARRL Emergency Coordinator Ray Evans, KA4USB, felt that a mobile emergency-communications vehicle was needed in western Kentucky—which is often the target for tornadoes and ice storms. Recently, he did something about it. Using mostly his own gear as well as some donated equipment, Ray converted an old pickup truck into a mobile emergency station that covers all police, fire, commercial, industrial, marine, aircraft, civil, amateur and government frequencies. The same frequencies are available at the base station, where auxiliary power is supplied by an 18.5-kVA generator. The vehicle has a total of 12 mobile and three portable antennas. For areas not accessible to land mobile, some members of the Marshall County Amateur Radio Club, of which Ray is a charter member, use their airplanes, which are equipped for two-way communication on 2 meters, to provide a radio link. On Ray's drawing board is another mobile vehicle that will accommodate four radio operators simultaneously.

ARRL Seeks 1989 National Convention Site to Celebrate League Diamond Anniversary

The 1989 ARRL National Convention will be one of the main activities to mark the 75th, or Diamond, Anniversary of the American Radio Relay League. Accordingly, in addition to the usual criteria, the following will be used in selecting the site and the sponsoring local organization for this convention:

1) The convention shall give attendees a historical perspective, and a look ahead to the last quarter of the League's first century. Applicants should address as specifically as possible their plans in this regard.

2) The convention shall provide attendees with a commemorative souvenir that will form a lasting part of their Amateur Radio memorabilia.

3) The convention shall provide nonattendees with an opportunity to share in the experience through QSOs with a special convention station, through videotaped highlights for distribution by ARRL to its affiliated clubs, and through other means to be proposed by the convention committee at the time of application.

4) The convention application shall demonstrate financial and personnel resources sufficient to accomplish these aims, in addition to the usual high caliber of National Convention programs and exhibits.

5) The location will be selected so as to provide for a relatively large attendance.

Applications received by the ARRL Secretary by July 1, 1986 will be circulated to Board members, and the selection made at the 1986 Second Meeting of the Board from among the applications received. If no fully qualified applicant steps forward by July 1, the application process will be repeated prior to the 1987 Annual Meeting of the Board. The application itself, and supporting documentation addressed specifically to the above-listed criteria, will be duplicated for Board members at League expense; for other supporting material, such as Convention and Visitors Bureau pamphlets and letters from local officials, the convention committee should supply 24 copies of each at the time of application.

Amateurs Assisted in the Development of Radio Communications in Canada

Until the mid-1930s, communications in Canada's Arctic were hit-and-miss. Major communities along the coast had government or Army Corps of Signals stations located nearby, but for the far north the link to the outside world was an occasional dog sled loaded with supplies. In 1934, D. Graham Sturrock, VE5LD (shown in photo), was hired by the Hudson Bay Company as an apprentice fur trader, and eventually joined a small number of northern hams. After receiving training at Hudson Bay Company headquarters in Winnipeg, Sturrock was assigned to a store in the far north. On his journey down the Mackenzie River to the Arctic Ocean, Sturrock took his amateur station and a license obtained for him by the Hudson Bay Company to operate the first "private-commercial" station in the far north, CZ2L. While at Tuktoyaktuk, in July 1934, Sturrock successfully communicated with hams in Australia, Japan and in North America. Because of Sturrock's success as the first amateur/private-commercial operator, the Hudson Bay Company carried out experiments that eventually led to the establishment of the Fur Trade Radio Network, which linked all of Hudson Bay posts with its headquarters. The net changed life in the far north in many ways. It provided a link to family and friends for Hudson Bay employees, brought medical advice to the sick and injured, and provided the Canadian government with meteorological data that was used during WW II to guide transatlantic flights. *(Information courtesy Tom Roach; Hudson Bay Company photo)*

League Lines

FCC has released a *Report and Order* in PR Docket 85-105, allowing ***automatic control for digital operation on frequencies 50 MHz and above.*** The new privileges are effective March 14, 1986; automatic-control privileges continue for repeater, auxiliary and beacon operation. There is a dark lining in this silver cloud. A major goal in the securing of these privileges had been the facilitation of packet-radio data transfer, computer-to-computer communication and packet switching systems. Such operation has continued to be hampered by the requirement that a control operator oversee third-party traffic. ***FCC's 85-105 ruling provides no relief*** in this quarter. The Commission found that neither the speed with which a message is transmitted, nor the operating mode, justify any deviation from the rule requiring the presence of a control operator when third-party traffic is handled. Under these circumstances, the expanded automatic-control privileges gained through 85-105 are a hollow victory. By order of its Board of Directors, ARRL will seek the amendment of PR Docket 85-105 to correct its restrictive and crippling effect on packet radio. Stay tuned!

Another PRB-1 success. Directing that the City of Lakewood, Colorado, and its Board of Adjustment give effect to PRB-1, Judge Ruthanne N. Polidori demanded that Steven C. Salmon, K7OXB, be permitted to use his station's 65-foot tower. The judge sought to avoid heavy litigation costs in granting Salmon relief. The matter has been remanded to the City for resolution in consonance with PRB-1. The City previously had taken the position that a tower was the same as a building with roof, walls or columns, and had limited towers to a 35-foot height.

Is PRB-1 working? If you ask John Thernes, WM4T, he'll say "Yes"! The City of Lakeside Park, Kentucky, had said "No" to Thernes' request for permission to erect his amateur antenna, and Thernes initially lost his case for redress. Thernes appealed, and PRB-1, FCC's limited preemption of local and state regulation of amateur antennas, pulled it out of the fire: The case was remanded to the court which had ruled against him. We want to be sure we know about similar cases that occur anywhere in the country—cases involving either legal action or the adoption of local ordinances—where PRB-1 is used to good advantage by the amateur community. Share the details with Perry Williams, W1UED, at ARRL HQ.

FCC has ***adopted*** a ***Report and Order*** in PR Docket 85-104, allowing telephony operation at 7075-7100 kHz by General, Advanced and Amateur Extra licensees ***south of 20 degrees north latitude.*** The new privileges are expected to have minimal impact on nonvoice operation in this segment by stations on the US mainland, while granting relief from foreign broadcasting to telephony operation in Caribbean insular areas. This amendment to Part 97 is effective 0001 UTC February 28, 1986.

Yes, indeed, effective with the April issue, *QST* will be in your hands a bit earlier, as we reported in League Lines last month. No fooling, ***April QST will stand out for two other reasons,*** as well: (1) It will sport the Universal Product Code (UPC) on its cover—so we can sell *QST* at more newsstands, and (2) it will carry a cover price of $3.00—a figure better suited for newsstand sales. By spreading word of the wonders of Amateur Radio to a greater public audience, we're helping to ensure Amateur Radio's health and vitality for years to come. Fear not: The new cover price does not portend of any imminent increase in League membership dues! The new *QST* cover price will apply only to ***single copies.***

Speaking of earlier *QST* arrival, your ***Ham Ads are due*** in the HQ Advertising Department on ***the 13th of the second month before the issue date,*** effective with April *QST*. The Ham-Ad deadline for May *QST* is, therefore, March 13.

We're looking for your input. On page 92, you'll find a survey form that will give us your thoughts on the Public Service column. It's all part of the attempt to make *QST* more responsive to your needs. Please take a few minutes to fill it out and return it to HQ.

Now that you've learned and earned your way to the top, why hide the evidence in your wallet? ***Extra Class certificates,*** along the lines of those previously issued by FCC, ***are now available*** from the ARRL HQ Awards Branch for a nominal fee of $3.00. Enclose a photocopy of your Extra Class license—and prepare to gloat.

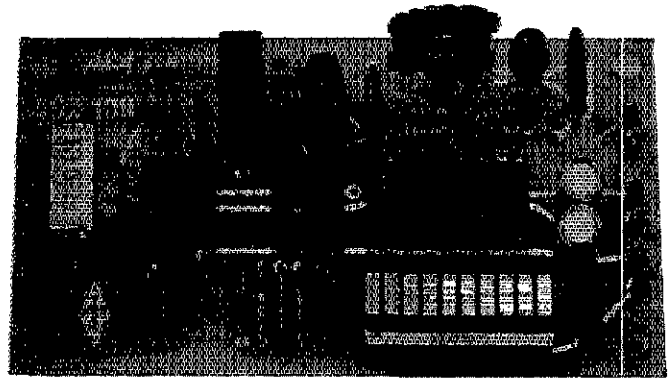
Worked all states via the moon? That's something to howl at! Show your membership in this select "club" with a handsome ***EME endorsement sticker,*** now available from the ARRL HQ Awards Branch to be applied to individually numbered UHF/VHF Worked All States awards.

Open house. The ARRL Headquarters building and W1AW, the Hiram Percy Maxim Memorial Station, will be open on ***Saturday, April 5, from 10 AM to 5 PM.*** If your club would like to schedule a visit to Headquarters on this date, please notify the Membership Communications Services Office. Be sure to bring a copy of your operator's license if you'd like to operate W1AW.

Real-Time HF WEFAX Maps on a Dot-Matrix Printer

With this simple computer interface and machine-language program, you've got weather maps—and more—on paper!

By Keith Sueker, W3VF
110 Garlow Dr
Pittsburgh, PA 15235



Amateur Radio is a multi-faceted hobby. You'll find amateurs using their unparalleled freedom to do everything from operating radio-controlled models to putting satellites into space. Keeping an eye on weather conditions the world over is an interest of many radio amateurs.

Years ago, a general-coverage receiver was considered a "that'd be nice" addition to the ham shack. Today, most amateur transceivers being manufactured have built-in general-coverage receivers. This makes it easy for the amateur to roam the frequencies outside the amateur bands and make new discoveries. The information presented by Keith Sueker in this article should prove interesting to many. We hope it will encourage others to modify and expand on this work.

Much of the information available to the local TV weather forecaster is also available to the public through facsimile (FAX) weather broadcasts on HF radio circuits. Other articles have featured techniques for presenting weather maps on computer displays in real time, but this article describes a system for printing facsimile maps on a dot-matrix printer in real time.[1,2] Maps can be printed continuously as long as the ribbon and paper supply holds out! The "how" of all this is an interesting marriage of radio receiving and computer-programming techniques that are not difficult to duplicate. The software is written for the Apple® II series of computers and an NEC PC-8023A-C dot-matrix printer, but with reasonable effort can be adapted to any 6502-based computer and accompanying printer.[3] The techniques themselves are applicable to nearly any computer and dot-matrix printer that can operate in the graphics mode.

Radio Facsimile

Most maritime nations broadcast facsimile weather maps to ships at sea. The maps cover a wide range of weather-related phenomena, including surface synoptic maps, pressure/altitude maps, forecasts, satellite pictures, surface precipitation summaries and a wealth of other information. In the US, transmissions are made primarily from NAM in Norfolk, Virginia, through the facilities of the Naval Fleet Weather Service. West Coast weather is broadcast by NMC at San Francisco, California, and Gulf of Mexico weather by WLO, Mobile, Alabama, through the facilities of the National Weather Service. Canadian weather transmissions are made by CFH from the Canadian Forces Metoc Centre in Halifax, Nova Scotia, and from CKN by the Maritime Forces Pacific Metoc Centre in Esquimalt, British Columbia. Other services broadcast in both countries, and many foreign countries broadcast compatible maps. A short list of major stations is shown in Table 1. More are listed in Robert Grove's book.[4]

Table 1
Principal Weather Facsimile Stations for North American Reception

Location	*Frequencies (kHz)*	*Agency*
Washington, DC	3357 4975 8080 10,865 16,410	US Navy FWS
San Francisco, CA	4346 8682 12,730 17,151	USCG/NWS
Halifax, NS, Can	4271 6330 9890 13,510 17,560	CF Metoc Ctr
Esquimalt, BC, Can	4268 6946 12,125	MFP Metoc Ctr
Mobile, AL	6852 9157 11,145	NWS
Additional Stations		
Pearl Harbor, HI	4803 9440 9445 12,362 16,398 16,400 21,785	
Guam	4975 7645 10,255 13,807 18,620 23,880	
Bracknell, UK	4610 4782 8040 9203 11,086 14,436 14,536 14,582	
Rota, Spain	3713 5206 7626 8100 12,184 12,903 15,941	
Tokyo, Japan	3622 3365 4902 5405 7305 9438 9970 13,597 14,682 18,130 18,220 22,270	
Darwin, Australia	5755 7535 10,555 15,615 18,060	
Pretoria, RSA	4014 7508 13,773 18,238	
Buenos Aires, Arg	5185 10,720 18,093	
Oslo, Norway	4642 5945 8057 11,097	
Cairo, Egypt	4526 5127 9043 10,123 10,560 17,365	

Note: These frequencies are subject to change from time to time. Also, FAX broadcasts might not be transmitted on a 24-hour schedule.

[1]Notes appear on page 20.

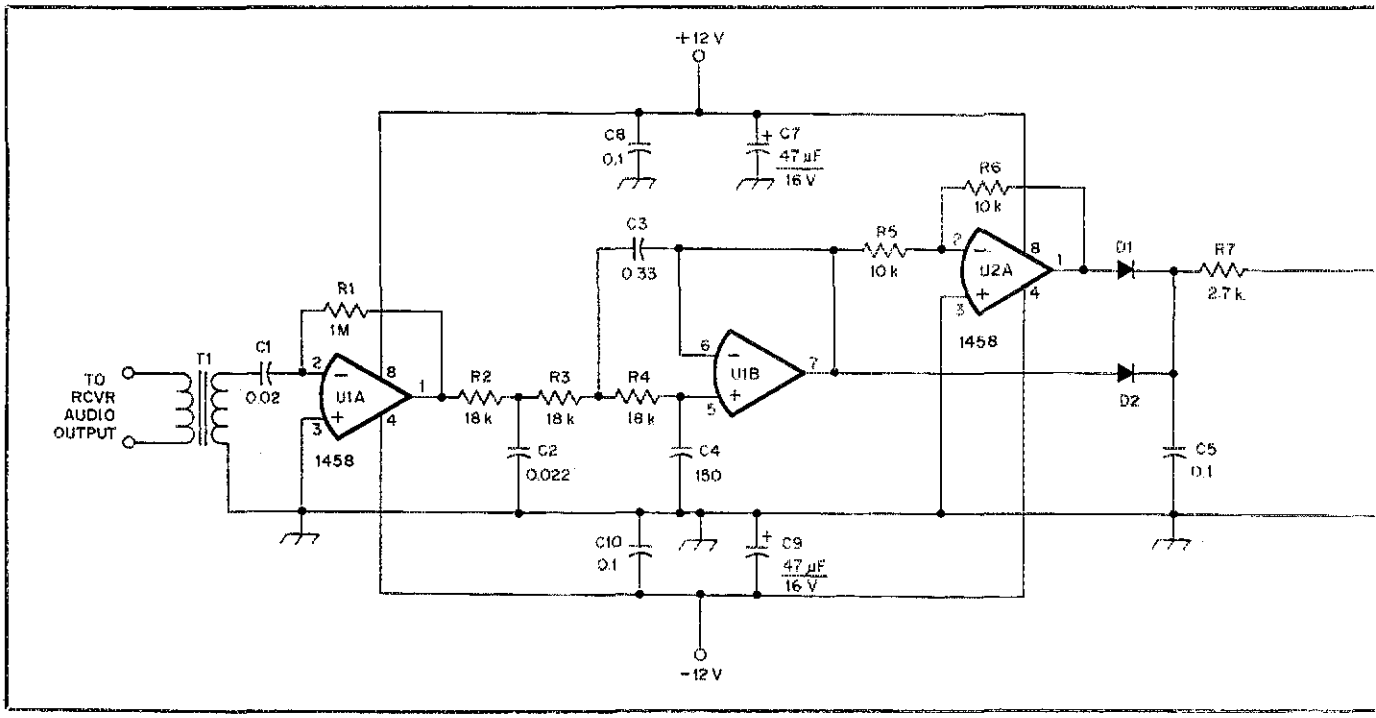


Fig 1—Schematic diagram of the HF FAX demodulator. If necessary, select the values of the resistors marked with an asterisk so that the first bar of DS2 lights when a 1200-Hz tone is present and bar 10 lights when a 2000-Hz tone is received. The output of the demodulator is connected to the Apple computer's game port, pins 2 (SWØ) and 8 (GND). Part numbers in parentheses are Radio Shack; equivalent parts may be substituted.

D1, D2—Silicon or germanium signal diode, 1N914, 1N34 or equiv.
D3—4.7-V, 500-mA Zener diode, 1N5230 or equiv.
DS1—Red LED (276-041).
DS2—LED bar-graph display, MV50164 (276-081).
T1—Audio transformer, 1-kΩ pri, 8-Ω sec (273-1380) or Mouser 42TLO13.
U1, U2—LM1458 dual op amp (276-038).
U3—LM3914 display driver (276-1707).

FAX transmissions use frequency-shift modulation similar to RTTY. Relative to a standard virtual carrier, black is 1500 Hz and white is 2300 Hz. A full gray scale is transmitted. Other modulating frequencies are used to start the motor on commercial FAX receiving machines and to synchronize receiving machines to the transmitting machine at the start of a picture. It is important to note that FAX transmissions run "open loop" in that they do not incorporate any signals analogous to the horizontal sync signals in TV transmissions.

Original maps are scanned at the transmitting site by a photosensitive detector that translates the map details into frequency shift at the transmitter. The scanner completes a scan line in exactly 500 ms and has a resolution that exceeds 1000 equivalent pixels in each line. The received picture is built up as a series of sequential lines in a fashion identical to raster generation on a TV set or monitor. A complete picture will require 5 to 20 minutes for transmission, depending on its size.

Receiving Adapter

To receive the FAX transmissions, you must have a receiver that is reasonably stable, has a BFO and, of course, can tune to the FAX frequencies. Additionally, you must be able to demodulate the incoming signal and convert it to a useful input for the computer. The demodulator circuit shown in Fig 1 is designed to provide a complete interface between the receiver and computer. After considerable experimentation, I offer it as about the simplest circuit that will yield good results.

Circuit Description

Audio from the receiver is isolated and boosted in amplitude by T1. A 24-ohm ballasting resistor may be placed across the input so that the interface can be used with the receiver speaker disconnected. U1A acts as a clipper that effectively removes any amplitude modulation from the signal. The input capacitor is deliberately made small to reduce the effects of low-frequency hum and noise. The next stage, U1B, is a three-pole, 3-dB-ripple Chebychev low-pass active filter that acts as a frequency discriminator. It has a corner frequency of 1200 Hz and a log-linear attenuation of 26 dB in the first octave. This particular configuration is chosen to provide a sharp cutoff with low-Q sections so as to minimize transient ringing.

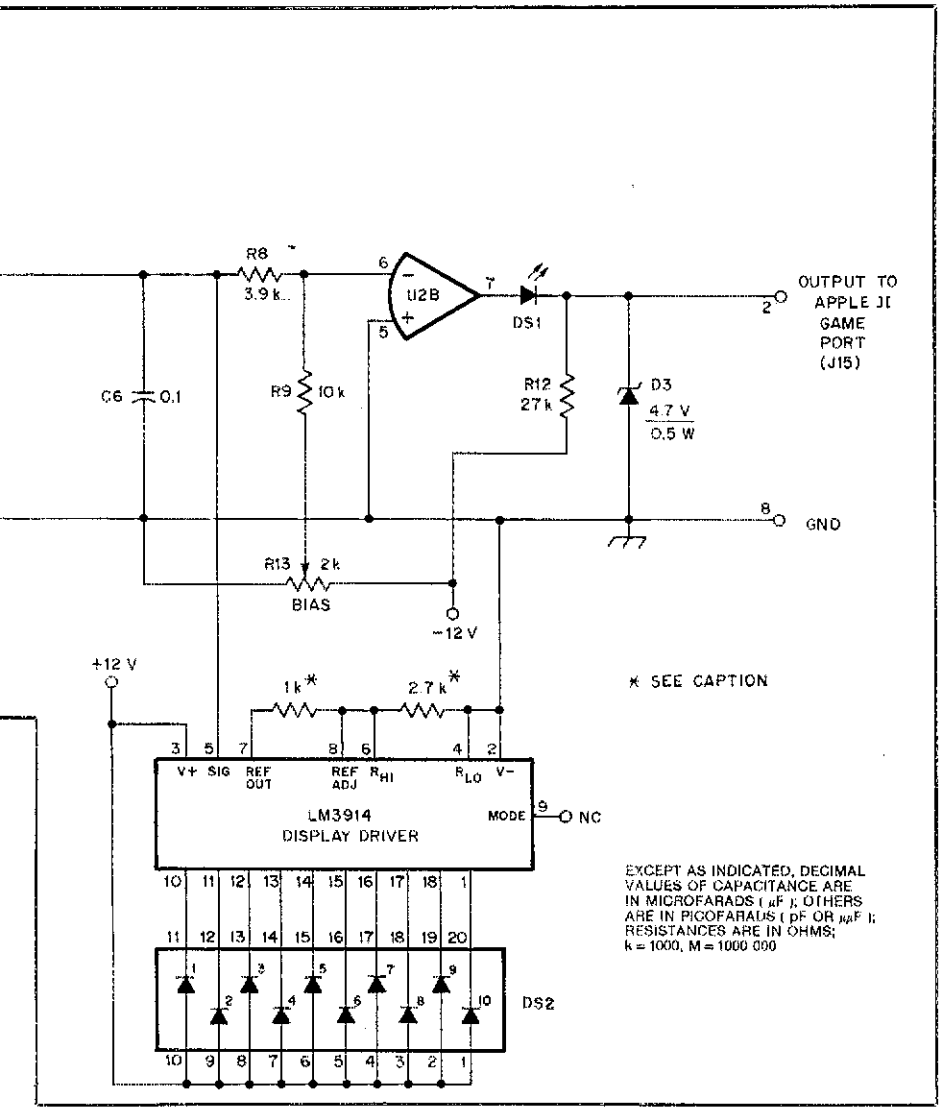
U2A is an inverter that, in conjunction with D1 and D2, provides full-wave rectification of the ac signal from the demodulator. A two-pole RC filter reduces ripple. The last stage, U2B, is a comparator. It compares the incoming demodulated, rectified and filtered signal to an adjustable dc reference. The reference is supplied through R13, which sets the bias level so as to allow adjustment of the print density. U2B transmits a TTL signal to the computer input—in this case, the Apple's game port. A series-connected LED, DS1, provides the operator with a visual aid in setting the print density. Note that U2B is driven into current limiting, which at 12 V supplies just about the right amount of current for DS1. R12 sinks current from the Apple's input (PBØ) port to assure a zero signal. A Zener diode (D3) maintains a 4.7-V maximum input level to the computer.

Tuning Indicator

Tuning in a FAX signal is not particularly easy without some sort of indicator. An oscilloscope can be used, but I have found the simple LED bar graph (DS2) is just as good. It is set up so that a 1200-Hz signal lights the first segment and a 2000-Hz signal lights the last one. Note that I've selected the received frequency range to extend from 1200 Hz to 2000 Hz rather than the usual 1500 Hz to 2300 Hz. This permits the use of the standard SSB receiver filter band-pass characteristics. The frequency range selection has no adverse effects on reception except for a slight degradation in picture resolution, but there is more detail there than we can use anyhow.

Demodulator Construction

The construction of the receiving adapter



is totally noncritical. The unit can be built on a perf, PC or prototyping board. PC boards and parts kits are available from A & A Engineering.[5,6] (An assembled A & A kit is shown in the title photo.) Supply voltages of from 10 to 15 can be used. At 12 V, the current drain is only 30-50 mA from the positive supply and 10 mA from the negative supply.

System Considerations

With the FAX signal in hand, we can consider what to do with it. Immediately, we bump into a rather fundamental limitation: Our incoming signal has over 2000 pixel equivalents per second, but our printer is rated for only 100 characters per second. That means it can print about 800 horizontal pixels per second continuously if it can ignore carriage returns. So, right off we must settle for less detail than is present in the transmitted picture. Further, we wish to operate the printer in the incremental mode rather than getting the one-dot offset that occurs with bidirectional printing; this also slows things down. But all is not lost. We are forced into a slower rate anyhow by another consideration—picture geometry.

Picture Geometry

The FAX scanner at the transmitting station advances from line to line with a spacing much smaller than that of the wires in our printer's print head. Thus, if we wish to render pictures geometrically correct so that circles print as circles and so on, we must either expand our printout horizontally (print only a part of each line) or print all of a given line, but only a certain percentage of the total lines (shrink the picture vertically). (This problem also occurs with FAX screen displays and is noted and explained in the referenced articles.) In this program, I have elected to print all of the horizontal portion of the map with poorer vertical (time dimension) resolution. The program samples every third transmitted line and renders a picture that is geometrically correct.

Synchronization

Another facet of FAX should be emphasized. As mentioned earlier, the transmissions have no synchronizing pulses. The receiver is phase synchronized to the transmitter at the start of a picture and then must have a precise speed match with the transmitter. This precludes recording signals on a tape recorder. It also means our printing program must execute in exact synchronism with the transmitted signal for every printed line, but there are no sync pulses! This places some interesting constraints on programming.

There are two basic approaches to solving this problem. The first is to have a precision frequency reference that provides synchronizing pulses to the computer and thereby controls the timing. This requires a crystal-controlled timer or timing hardware on a peripheral card in the Apple. This approach also requires additional hardware to control the initial phasing. The second method, the one I chose, is to handle all timing functions in software. Earlier work I had done on screen presentation of FAX required a simpler form of timing, but it verified the approach.

In order to have precise timing of the software, the programmer must have control at all times. There can be no need to make allowance for waiting for a printer to decide it is ready to accept a character. During the development of this program, two discoveries slowly emerged that seem obvious in retrospect: (1) The normal type of printer output routines cannot be used because they wait for a "printer ready" signal, which, in turn, depends on the state of the printer; and (2) printer timing itself is not precise because the printer (at least mine) apparently does not have a crystal-controlled clock. Further, although the printer is buffered, the rate at which it can accept characters for the buffer seems to be less when the printer is executing a carriage return. I elected not to do any fundamental research on this point, however.

The way to lick the printer timing problem is to jam graphics bytes directly into the printer port, making sure, of course, that the rate is acceptable to the printer at all times. With the Apple Parallel Printer Card I use, direct output can be made with an STA instruction to location C08Ø + nØ, where n is the slot number of the printer card. All software on the card is bypassed, and the output requires just the four machine cycles of an absolute-store instruction (STA). The printing is buffered in the program so that the printer does not have to be in synchronism with the received signal. This is the key to providing time for a carriage return, line feed and reset of the graphics inputs after each line is printed. Note that each printed line is 8 bits high and contains selected picture information from 24 transmitted lines.

Program Information

Table 2 is presented in an effort to clarify the data-handling techniques in this program. Since the program itself must

```
FAXPNT.OBJØ

2ØØØ-  AØ ØA     LDY  #$ØA
2ØØ2-  B9 74 21  LDA  $2174,Y
2ØØ5-  2Ø 21 21  JSR  $2121
2ØØ8-  88        DEY
2ØØ9-  DØ F7     BNE  $2ØØ2
2ØØB-  A9 1B     LDA  #$1B
2ØØD-  2Ø 21 21  JSR  $2121
2Ø1Ø-  A9 24     LDA  #$24
2Ø12-  2Ø 21 21  JSR  $2121
2Ø15-  A9 1B     LDA  #$1B
2Ø17-  2Ø 21 21  JSR  $2121
2Ø1A-  A9 53     LDA  #$53
2Ø1C-  2Ø 21 21  JSR  $2121
2Ø1F-  A9 3Ø     LDA  #$3Ø
2Ø21-  2Ø 21 21  JSR  $2121
2Ø24-  A9 37     LDA  #$37
2Ø26-  2Ø 21 21  JSR  $2121
2Ø29-  A9 35     LDA  #$35
2Ø2B-  2Ø 21 21  JSR  $2121
2Ø2E-  A9 3Ø     LDA  #$3Ø
2Ø3Ø-  2Ø 21 21  JSR  $2121
2Ø33-  A9 ØØ     LDA  #$ØØ
2Ø35-  8D FD 21  STA  $21FD
2Ø38-  8D FE 21  STA  $21FE
2Ø3B-  8D AØ 2Ø  STA  $2ØAØ
2Ø3E-  A9 15     LDA  #$15
2Ø4Ø-  8D A1 2Ø  STA  $2ØA1
2Ø43-  AD ØØ CØ  LDA  $CØØØ
2Ø46-  1Ø Ø8     BPL  $2Ø5Ø
2Ø48-  AD 61 CØ  LDA  $CØ61
2Ø4B-  3Ø FB     BMI  $2Ø48
2Ø4D-  8D 1Ø CØ  STA  $CØ1Ø
2Ø5Ø-  A9 ØØ     LDA  #$ØØ
2Ø52-  8D 5F 2Ø  STA  $2Ø5F
2Ø55-  A9 1Ø     LDA  #$1Ø
2Ø57-  8D 6Ø 2Ø  STA  $2Ø6Ø
2Ø5A-  AD 61 CØ  LDA  $CØ61
2Ø5D-  2A        ROL
2Ø5E-  6E EE 12  ROR  $12EE
2Ø61-  2Ø 3Ø 21  JSR  $213Ø
2Ø64-  2Ø 6D 2Ø  JSR  $2Ø6D
2Ø67-  9Ø F1     BCC  $2Ø5A
2Ø69-  4C 8F 2Ø  JMP  $2Ø8F
2Ø6C-  EA        NOP
2Ø6D-  18        CLC
2Ø6E-  EE 5F 2Ø  INC  $2Ø5F
2Ø71-  DØ Ø3     BNE  $2Ø76
2Ø73-  EE 6Ø 2Ø  INC  $2Ø6Ø
2Ø76-  A9 12     LDA  #$12
2Ø78-  CD 6Ø 2Ø  CMP  $2Ø6Ø
2Ø7B-  DØ ØA     BNE  $2Ø87
2Ø7D-  A9 EE     LDA  #$EE
2Ø7F-  CD 5F 2Ø  CMP  $2Ø5F
2Ø82-  DØ Ø8     BNE  $2Ø8C
2Ø84-  38        SEC
2Ø85-  BØ Ø7     BCS  $2Ø8E
2Ø87-  EA        NOP
2Ø88-  EA        NOP
2Ø89-  EA        NOP
2Ø8A-  EA        NOP
2Ø8B-  EA        NOP
2Ø8C-  EA        NOP
2Ø8D-  18        CLC
2Ø8E-  6Ø        RTS
2Ø8F-  A9 Ø5     LDA  #$Ø5
2Ø91-  CD FE 21  CMP  $21FE
2Ø94-  FØ Ø9     BEQ  $2Ø9F
2Ø96-  EE FE 21  INC  $21FE
2Ø99-  2Ø 6Ø 21  JSR  $216Ø
2Ø9C-  4C 5Ø 2Ø  JMP  $2Ø5Ø
2Ø9F-  AD 1E 15  LDA  $151E
2ØA2-  2Ø 21 21  JSR  $2121
2ØA5-  EE AØ 2Ø  INC  $2ØAØ
2ØA8-  DØ Ø3     BNE  $2ØAD
2ØAA-  EE A1 2Ø  INC  $2ØA1
2ØAD-  EE FD 21  INC  $21FD
2ØBØ-  A9 FA     LDA  #$FA
2ØB2-  CD FD 21  CMP  $21FD
2ØB5-  DØ E8     BNE  $2Ø9F
2ØB7-  A9 ØØ     LDA  #$ØØ
2ØB9-  8D FD 21  STA  $21FD
2ØBC-  A9 17     LDA  #$17
2ØBE-  CD A1 2Ø  CMP  $2ØA1
2ØC1-  DØ ØA     BNE  $2ØCD
2ØC3-  A9 EE     LDA  #$EE
2ØC5-  CD AØ 2Ø  CMP  $2ØAØ
2ØC8-  DØ Ø3     BNE  $2ØCD
2ØCA-  18        CLC
2ØCB-  9Ø Ø6     BCC  $2ØD3
2ØCD-  2Ø 36 21  JSR  $2136
2ØDØ-  4C 5Ø 2Ø  JMP  $2Ø5Ø
2ØD3-  A9 ØØ     LDA  #$ØØ
2ØD5-  8D E6 2Ø  STA  $2ØE6
2ØD8-  8D E9 2Ø  STA  $2ØE9
2ØDB-  A9 1Ø     LDA  #$1Ø
2ØDD-  8D E7 2Ø  STA  $2ØE7
2ØEØ-  A9 15     LDA  #$15
2ØE2-  8D EA 2Ø  STA  $2ØEA
2ØE5-  AD EE 12  LDA  $12EE
2ØE8-  8D EE 17  STA  $17EE
2ØEB-  EE E6 2Ø  INC  $2ØE6
2ØEE-  EE E9 2Ø  INC  $2ØE9
2ØF1-  DØ Ø6     BNE  $2ØF9
2ØF3-  EE E7 2Ø  INC  $2ØE7
2ØF6-  EE EA 2Ø  INC  $2ØEA
2ØF9-  A9 12     LDA  #$12
2ØFB-  CD E7 2Ø  CMP  $2ØE7
2ØFE-  DØ E5     BNE  $2ØE5
21ØØ-  A9 EE     LDA  #$EE
2102-  CD E6 2Ø  CMP  $2ØE6
2105-  DØ DE     BNE  $2ØE5
2107-  2Ø 4B 21  JSR  $214B
210A-  A9 1B     LDA  #$1B
210C-  2Ø 21 21  JSR  $2121
210F-  A9 24     LDA  #$24
2111-  2Ø 21 21  JSR  $2121
2114-  A9 ØD     LDA  #$ØD
2116-  2Ø 21 21  JSR  $2121
2119-  A9 ØA     LDA  #$ØA
211B-  2Ø 21 21  JSR  $2121
211E-  4C ØB 2Ø  JMP  $2ØØB
2121-  8D FC 21  STA  $21FC
2124-  A9 2Ø     LDA  #$2Ø
2126-  2Ø A8 FC  JSR  $FCA8
2129-  AD FC 21  LDA  $21FC
212C-  8D 9Ø CØ  STA  $CØ9Ø
212F-  6Ø        RTS
2130-  A9 ØD     LDA  #$ØD
2132-  2Ø A8 FC  JSR  $FCA8
2135-  6Ø        RTS
2136-  A2 Ø1     LDX  #$Ø1
2138-  A9 FE     LDA  #$FE
213A-  2Ø A8 FC  JSR  $FCA8
213D-  CA        DEX
213E-  DØ F8     BNE  $2138
2140-  A9 B7     LDA  #$B7
2142-  2Ø A8 FC  JSR  $FCA8
2145-  A9 11     LDA  #$11
2147-  2Ø A8 FC  JSR  $FCA8
214A-  6Ø        RTS
214B-  A2 Ø1     LDX  #$Ø1
214D-  A9 EC     LDA  #$EC
214F-  2Ø A8 FC  JSR  $FCA8
2152-  CA        DEX
2153-  DØ F8     BNE  $214D
2155-  A9 85     LDA  #$85
2157-  2Ø A8 FC  JSR  $FCA8
215A-  A9 ØE     LDA  #$ØE
215C-  2Ø A8 FC  JSR  $FCA8
215F-  6Ø        RTS
2160-  A2 Ø6     LDX  #$Ø6
2162-  A9 FD     LDA  #$FD
2164-  2Ø A8 FC  JSR  $FCA8
2167-  CA        DEX
2168-  DØ F8     BNE  $2162
216A-  A9 74     LDA  #$74
216C-  2Ø A8 FC  JSR  $FCA8
216F-  A9 ØD     LDA  #$ØD
2171-  2Ø A8 FC  JSR  $FCA8
2174-  6Ø        RTS
2175-  ØD ØA 36  ORA  $36ØA
2178-  31 54     AND  ($54),Y
217A-  1B        ???
217B-  5B        ???
217C-  1B        ???
217D-  45 1B     EOR  $1B
```

Fig 2—Disassembled listing of the HF WEFAX machine-language program for the Apple II computer. Enter this program using the Apple's built-in monitor or the miniassembler, then save it to disk with the command: BSAVE FAXPNT.OBJØ, A$2ØØØ, L$17F. The printer setup table lies between $2175 and $217E; ignore the mnemonics, "instructions" and question marks at these locations in the listing, they are a peculiarity of the Apple's disassembler. To get the program operational, you can then use the BASIC program loader of Fig 3 or BRUN the program from disk. If the program is already in memory, simply CALL 8192 from BASIC or enter 2ØØØG from the monitor. For those of you uncomfortable with machine-language entry, a BASIC program listing using POKEs and DATA statements to enter this program is available from the ARRL. A commented source-code listing may also be obtained from the ARRL. Please address your request to the Technical Department Secretary; include $1 for the BASIC listing, $2 for the source-code listing and a business-size SASE for each listing. Identify your request as Sueker WEFAX BASIC Listing/QS-3/86 or Sueker WEFAX Source Listing/QS-3/86. See note 5.

necessarily be machine and printer specific, I would prefer to present in some detail the logic and data flow so that you can adapt the program to your equipment. The main program listing is shown in Fig 2, and a BASIC startup program is presented in Fig 3.

Let's assume a picture transmission has started with line number 1. Our program repeats in sets of 24 received lines, so we can jump in with the start of set two at line 25. The reason for doing this is that the processing and printing of data are a full set out of sync, and it is confusing to start at the beginning. Such is often the case with iterative processes; it is easier to see the logic once the starting transients are gone.

The program uses the game port location PBØ to take 750 samples from line 25. If the sampled bit is a 1, it sets the carry flag; if a Ø, it resets the carry. The carry flag is then rotated into the appropriate byte of a 750-byte picture (PIX) buffer. Each byte will ultimately have a one-to-one correspondence with the printed graphics byte in one print-head pass. At the end of sampling line 25, the program generates a time delay of about 1000 ms so that the next sample will be taken precisely at the start of line 28. This process is repeated for the first 15 received lines. During this time (7.5 seconds), the printer is allowed to complete carriage-return and line-feed operations. Line 40 is received and processed in the same fashion, but at the end, 250 graphics bytes are sent to the printer. These bytes are the first 250 from a 750-byte printer buffer that represents the previous set of lines (1-24). We sample only every third line, so we have a full second to send the 250 bytes to the printer. They are sent out with a fixed time delay that is

Table 2
Program Action

Picture Line No.	*Action*
23	(prior set)
24	. . .PNTR buffer | Do resets | CR LF | TD*
25	Sample 750 pixels—write bits to PIX buffer
26	then start time delay
27	to total 1500 ms from start of line 25
28	Sample 750 pixels—write bits to PIX buffer
29	then start time delay
30	to total 1500 ms from start of line 28
31	Sample 750 pixels—write bits to PIX buffer
32	then start time delay
33	to total 1500 ms from start of line 31
34	Sample 750 pixels—write bits to PIX buffer
35	then start time delay
36	to total 1500 ms from start of line 34
37	Sample 750 pixels—write bits to PIX buffer
38	then start time delay
39	to total 1500 ms from start of line 37
40	Sample 750 pixels—write bits to PIX buffer
41	Send first 250 bytes to printer from PNTR buffer then
42	start time delay to total 1500 ms from start of line 40
43	Sample 750 pixels—write bits to PIX buffer
44	Send second 250 bytes to printer from PNTR buffer then
45	start time delay to total 1500 ms from start of line 43
46	Sample 750 pixels—write bits to PIX buffer
47	Send final 250 bytes to printer from PNTR buffer then
48	write PIX buffer to PNTR buffer | Do resets | CR LF | TD* |
49	Sample 750 pixels. . .
50	(next set)

*TD—Time delay to total 1500 ms from start of second prior line. Lines 25 through 48, inclusive, represent one printed line eight bits high.

```
10Ø  REM   APPLE FAXPRINT PROGRAM
11Ø  REM   BY K. H. SUEKER, W3VF
12Ø  REM   110 GARLOW DRIVE
13Ø  REM   PITTSBURGH, PA 15235
14Ø  REM   412 793 8909
15Ø  REM   REFER TO QST, MARCH 1986 FOR DETAILS
16Ø  HGR : PRINT  CHR$ (21): TEXT : HOME : VTAB 10
17Ø  PRINT "RESET PRINTER AND PRESS ANY KEY TO BEGIN"
18Ø  HTAB 18: PRINT "---> ";: GET X
19Ø  VTAB 10: PRINT "PRESS <RETURN> FOR 12Ø SCANS/MINUTE,"
2ØØ  PRINT
21Ø  PRINT "PRESS ANY OTHER KEY FOR 6Ø SCANS/MINUTE."
22Ø  GET X$
23Ø T$ = "12Ø SCANS/MINUTE": IF X$ <  >  CHR$ (13) THEN
     T$ = "6Ø SCANS/MINUTE"
24Ø  PRINT : PRINT "YOU CHOSE ";T$
25Ø  PRINT : PRINT "WAIT FOR PROGRAM TO PRINT."
26Ø  PRINT  CHR$ (4);"BLOAD FAXPNT.OBJØ"
27Ø  IF X$ =  CHR$ (13) THEN  GOTO 43Ø
28Ø  REM
                POKES FOR 6Ø SCANS/MINUTE

29Ø  POKE 8497,2Ø
3ØØ  POKE 85Ø3,Ø7
31Ø  POKE 85Ø5,255
32Ø  POKE 8513,213
33Ø  POKE 8518,Ø7
34Ø  POKE 8524,Ø7
35Ø  POKE 8526,255
36Ø  POKE 8534,142
37Ø  POKE 8539,16
38Ø  POKE 8545,12
39Ø  POKE 8547,255
4ØØ  POKE 8555,14Ø
41Ø  POKE 856Ø,Ø6
42Ø  REM
              START THE PROGRAM

43Ø  CALL 8192
```

Fig 3—This BASIC "HELLO" program performs several functions. It permits you to select 60 or 120 scans per minute, BLOADs the FAX program and POKEs any necessary changes into the proper memory locations.

acceptable to the printer. A time-delay routine fills out the time to exactly 1500 ms from the start of line 40. Line 43 is received next and processed, followed by transmission to the printer of the next 250 bytes from the printer buffer and an accompanying time delay. The last sample from this set, line 46, is handled in the same fashion and the last 250 bytes are sent to the printer. Now, we have sent all 750 bytes from the printer buffer and have completed all eight sampled lines from the current set of 24 to fill out our picture buffer. The final steps are to write the picture buffer to the printer buffer, get ready for the next set by doing resets where required and set the printer for the next line of 750 graphics bytes. A carriage return and line feed are also initiated. Again, a time-delay loop is used to fill out the 1500-ms period.

The BASIC "HELLO" program provides you with a selection of 60 or 120 (standard) scans per minute. If you select 60 scans per minute, several POKEs alter the machine-language routine before the program is started. The 60-scan-per-minute rate is used, for instance, by Russian FAX and by commercial radio stations sending pictures. It is possible to copy such pictures with this program.

Operating

Connect the demodulator between the receiver and computer. Use shielded wire for the interconnections. Since most computers can be expected to radiate some RF hash, a good signal level from the antenna will help reduce the effects of this interference. A random-length long wire or dipole antenna will suffice, but the better the antenna, the better the results.

Receiving conditions can be expected to vary considerably. HF-signal propagation is nothing to write home about these days, but perseverance on your part should pay off. On occasion, signal strength may be good, but multipath distortion will ruin maps. Some off-the-air pictures I've captured are shown in Fig 4. The stations listed for North America in Table 1 are on the air often enough so that one of them should be available to you nearly any time of the day or night. FAX transmissions may alternate with RTTY on some frequencies.

Load and run the program. Place the receiver in the SSB mode for FAX reception. Sideband selection and tuning should be chosen so that the first segment of the LED bar graph is lit most of the time, and the remaining segments flash with the incoming signal. The receiver audio level should be set to deliver about 500 mV to the demodulator. Use of the opposite sideband will invert black and white in the printed picture.

The start of each FAX transmission is signalled by a sync signal of about 25 lines, each of which is 95% black and 5% white. During this time, tuning-bar segments 1 and 10 should light in correspondence. The sync signal can be recognized as a steady

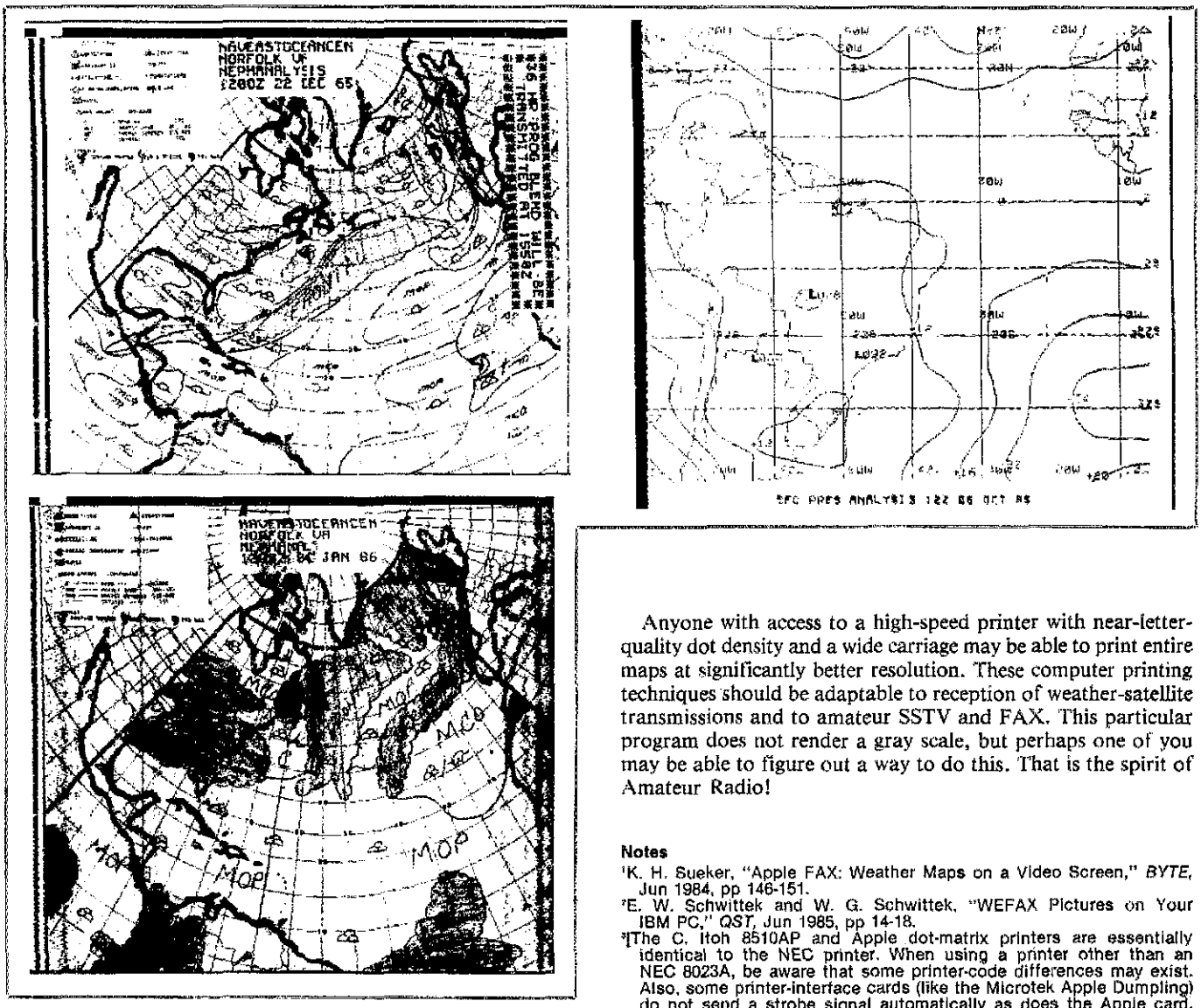


Fig 4—Some weather maps produced on the author's dot-matrix printer.

tone interrupted every half-second by a short burst of a second frequency. If you miss this, you will have to take pot luck on phasing and get out the glue and scissors. The map will be rendered correctly, but will wrap around the page. Synchronization can be accomplished manually by pressing any key on the computer while the sync signal is being transmitted. Print density is adjusted by means of R13, which varies the trigger point of the comparator, U2B. R13 can be used to aid in noise rejection and for optimizing the contrast on satellite photos. The satellite photos are computer enhanced with geographical features and political boundaries, but the print density is rather critical for best reproduction of these faint details.

Other Aspects

I must confess that the receiving adapter and programming form my major interest in FAX weather maps. For those of you interested in pursuing the meteorological aspects of the maps, I recommend "A Mariner's Guide to Radiofacsimile Weather Charts" by Dr. Joseph M. Bishop. It is available from Alden Electronics.[7] Alden manufactures a complete line of facsimile machines for general use. Surplus FAX machines and more FAX information are available from Atlantic Surplus Sales.[8]

Anyone with access to a high-speed printer with near-letter-quality dot density and a wide carriage may be able to print entire maps at significantly better resolution. These computer printing techniques should be adaptable to reception of weather-satellite transmissions and to amateur SSTV and FAX. This particular program does not render a gray scale, but perhaps one of you may be able to figure out a way to do this. That is the spirit of Amateur Radio!

Notes

[1]K. H. Sueker, "Apple FAX: Weather Maps on a Video Screen," *BYTE*, Jun 1984, pp 146-151.

[2]E. W. Schwittek and W. G. Schwittek, "WEFAX Pictures on Your IBM PC," *QST*, Jun 1985, pp 14-18.

[3][The C. Itoh 8510AP and Apple dot-matrix printers are essentially identical to the NEC printer. When using a printer other than an NEC 8023A, be aware that some printer-code differences may exist. Also, some printer-interface cards (like the Microtek Apple Dumpling) do not send a strobe signal automatically as does the Apple card. These differences must be taken into account when adapting the program to different equipment types as the timing loops are certain to be affected.—Ed.]

[4]Robert B. Grove, "Confidential Frequency List," Gilfer Associates Inc, Park Ridge, NJ, pp 68-71.

[5]A & A Engineering, 7970 Orchid Dr, Buena Park, CA 90620, tel 714-521-4160. (PC board only, $8.35 plus $1 shipping and handling; complete kit, $24.15 plus $1.50 shipping and handling; assembled unit, $31.40 plus $1.50 shipping and handling. California residents add 6% sales tax.) All of the programs associated with this article are available on disk from A & A Engineering for $5. These programs include a "HELLO" program with a unique billboard written in machine language, the BASIC loader, the main program and a commented source-code text file.

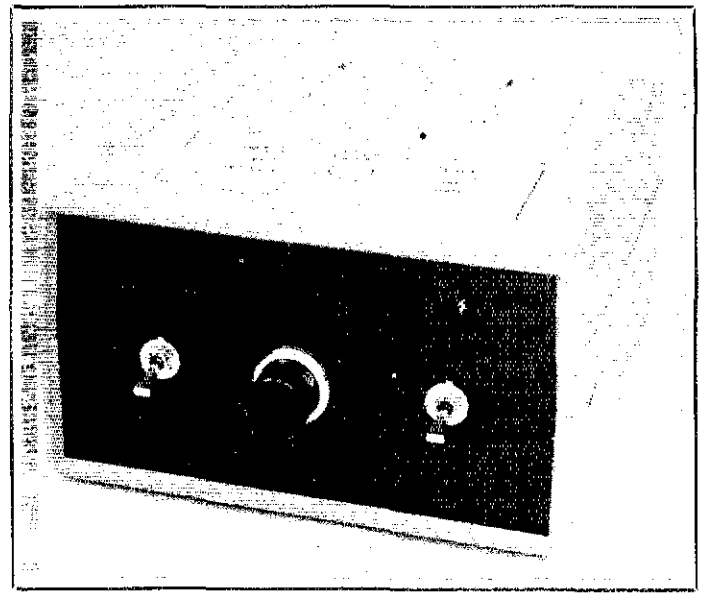
[6]PC-board templates *(this is a double-sided board layout)* and a parts overlay are available from the ARRL for $3 and an SASE. Address your request to the Technical Department Secretary and identify your request as the HF FAX Demodulator/QS-3/86.

[7]Washington St, Westborough, MA 01581, tel 617-366-8851. The book price is $9.95 plus $2.50 shipping and handling.

[8]"Weather FAX Guide," Atlantic Surplus Sales, 3730 Nautilus Ave, Brooklyn, NY 11224. [Some of the information contained in this guide was also published in A5, May 1982. Readers will also find occasional WEFAX coverage in *SPEC-COM* (formerly A5). For information, contact Mike Stone, WB0QCD, SPEC-COM Communications, Inc, PO Box H, Lowden, IA 52255-0408.—Ed.]

Keith Sueker has been continuously licensed since 1941, when he received the call W9SQZ. Other calls he's had include WØSQZ and W3TLQ. Keith obtained his Extra Class ticket in 1969. Employed by Westinghouse Electric Corp for 19 years, Keith is presently the Engineering Manager, Power Systems, for Robicon Corporation, where he's worked the past 16 years. In his present position, he is engaged in the design and manufacture of high-power SCR apparatus. Keith holds a BEE from the University of Minnesota and an MSEE from the Illinois Institute of Technology. In addition to writing for QST, *Keith's had articles published in* Ham Radio Magazine, BYTE *and* Electronics World.

The Romscanner



Here's an easy-to-build, low-cost source for SSTV images!

By Dr. Ralph E. Taggart, WB8DQT
602 S Jefferson St
Mason, MI 48854

A few minutes spent tuning around 14.230 MHz on 20 meters will confirm the extent to which full-color operation in both standard and high-resolution formats has captured the fancy of the SSTV community. Currently available commercial equipment for SSTV, in the form of the Robot™ Research 450C and 1200 digital scan converters, provides operating features undreamed of only a few years ago. Unfortunately, while such equipment performs flawlessly, the cost of this technology, coupled with the price of color monitors and cameras, appears to limit the options for those who would like to start SSTV in a modest way.

Alternatives for multimode SSTV reception do exist in the form of microcomputer-assisted SSTV scan converters that are far less expensive than their commercial counterparts.[1] While such systems do an excellent job of displaying SSTV, their capabilities for transmission are typically limited to retransmitting an image already in memory, or relatively simple graphics for call signs, CQs, etc. Upgrading to "live" camera operation involves additional hardware, and, of course, a standard TV camera that serves as the source from which the digital circuits capture or "snatch" the SSTV image. The time-honored option for new operators is to have an active SSTV station prepare a set of taped images using pictures supplied by the newcomer. This provides basic image material for the new station, but tape handling is clumsy (you have to locate the precise picture you want), tapes decline in quality with continued use and RF feedback is an ever-present possibility because of the minimal shielding of small cassette recorders.

Newcomers to SSTV are not the only ones with problems. The casual or part-time operator needs a source of pictures for occasional QSOs without the fuss and bother of firing up the camera, adjusting the lights and composing a good-looking picture. Many operators have such a small area devoted to the station that it is impractical to have lights and cameras out and ready at all times for the sake of an occasional contact. As a consequence, many—perhaps most—SSTV-equipped stations simply "look in" without actually getting on the air. There is even a problem with the *gung-ho* SSTV types who have the latest in color scan converters. The average amateur may not feel particularly colorful, and there is a tendency to transmit flashy color pictures rather than pictures of the operator, shack or family. This is unfortunate because Amateur Radio represents people-to-people communications, and it seems a shame not to see the operator on the other end, particularly in the case of a first QSO.

The Romscanner is a device created to meet all these problems. Basically it is a digital "black box" that performs a single function—the transmission of standard-format SSTV images (128 line/8.5 seconds) that have been preprogrammed into read only memory (ROM). The Romscanner can handle as many such canned pictures as you wish, and since the images are stored permanently, they are available for immediate transmission at the flick of a switch. For the newcomer or casual SSTV operator, the Romscanner can provide the primary source of pictures. For the fully equipped operator, it holds all the basic CQ and ID images and pictures of the operator, shack or family. Any of these can be sent at a moment's notice, while the station camera is devoted to color material. The Romscanner is a stand-alone unit that will function with any SSTV station, from a simple P7 monitor to the most elaborate camera/color-scan-converter system.[2] It is extremely simple to construct, with only eight ICs plus a ROM for each picture you wish to store. Finally, it incorporates all of the fundamental principles of digital-image storage and thus provides a good lesson in digital SSTV fundamentals at a low cost.

Circuit Description

Refer to Fig 1. Five circuit modules, or subsystems, will be described—the memory, clock and address counters, sync circuits, data output and subcarrier modulator.

Memory

The "standard" SSTV format uses a 128-line picture that is transmitted at the rate of 15 lines/second for a total frame time of 8.5 seconds. To provide acceptable resolution in the basic format, each line is digitized into 128 picture elements (pixels), each of which is coded as one of 16 possible gray-scale values ranging from 0 through 15. The memory capacity required to store one SSTV picture is related to the total

[1]Notes appear on page 27.

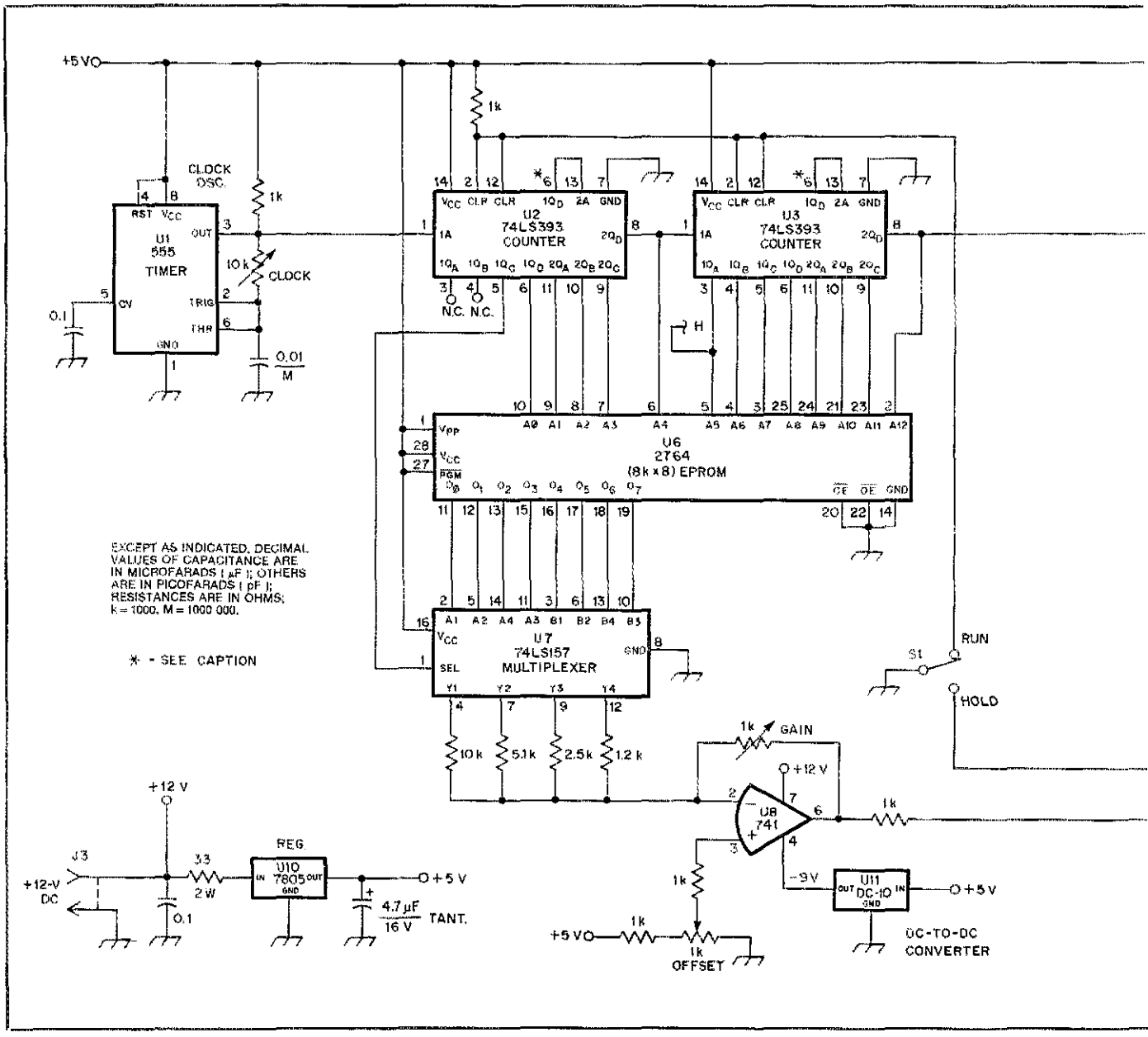


Fig 1—Schematic diagram of the Romscanner circuit. Individual IC bypass capacitors are not shown (see text). An * next to an IC pin number indicates that the number is repeated for clarity. Look for the same pin number elsewhere on the same IC diagram.

U1, U4, U5—NE555 timer.
U2, U3—74LS393 dual 4-bit binary counter.
U6—2764 (8K × 8) UV erasable PROM.
U7—74LS157 quad 2-line to 1-line multiplexer.
U8—741 op amp.
U9—EXAR 2206 monolithic function generator.
U10—7805 5-V regulator.
U11—Mostek DC-10 voltage converter.

number of pixels in the image, and the number of bits required to code the gray-scale value for each pixel. The total number of pixels is 128 (pixels/line) × 128 (total number of lines) or 16,384. The 16-step gray scale requires 4 bits/pixel, so the total memory requirement is 4 × 16,384, or 65,536 bits. The Romscanner uses *erasable programmable read only memory* (EPROM) that is typically organized in terms of 8-bit units (bytes). Our storage requirement, expressed in bytes, is thus 65,536/8 or 8192 bytes/image.

Two available EPROM chips, the 2764 and 68764, both meet this requirement exactly since they contain 8192 × 8 memory cells, and thus will hold one SSTV image. The 68764, a 24-pin device, was used in the prototype, since they were available as leftovers from another project. This chip presently costs about $14 in unit quantities, compared to only $5 for the 28-pin 2764. Fig 1 shows the circuit based on the 2764 chip. Table 1 shows the equivalent pinouts for the two devices. Functionally the two chips are identical.

Each byte of EPROM will store data for two pixels, since only 4 bits are required for each pixel. Each pixel pair is formatted as follows with reference to the eight data-output lines of the EPROM.

High Nibble	O7—Pixel 2 (MSB)	One Byte
	O6—Pixel 2	
	O5—Pixel 2	
	O4—Pixel 2 (LSB)	
Low Nibble	O3—Pixel 1 (MSB)	
	O2—Pixel 1	
	O1—Pixel 1	
	O0—Pixel 1 (LSB)	

Essentially the first pixel of each pair

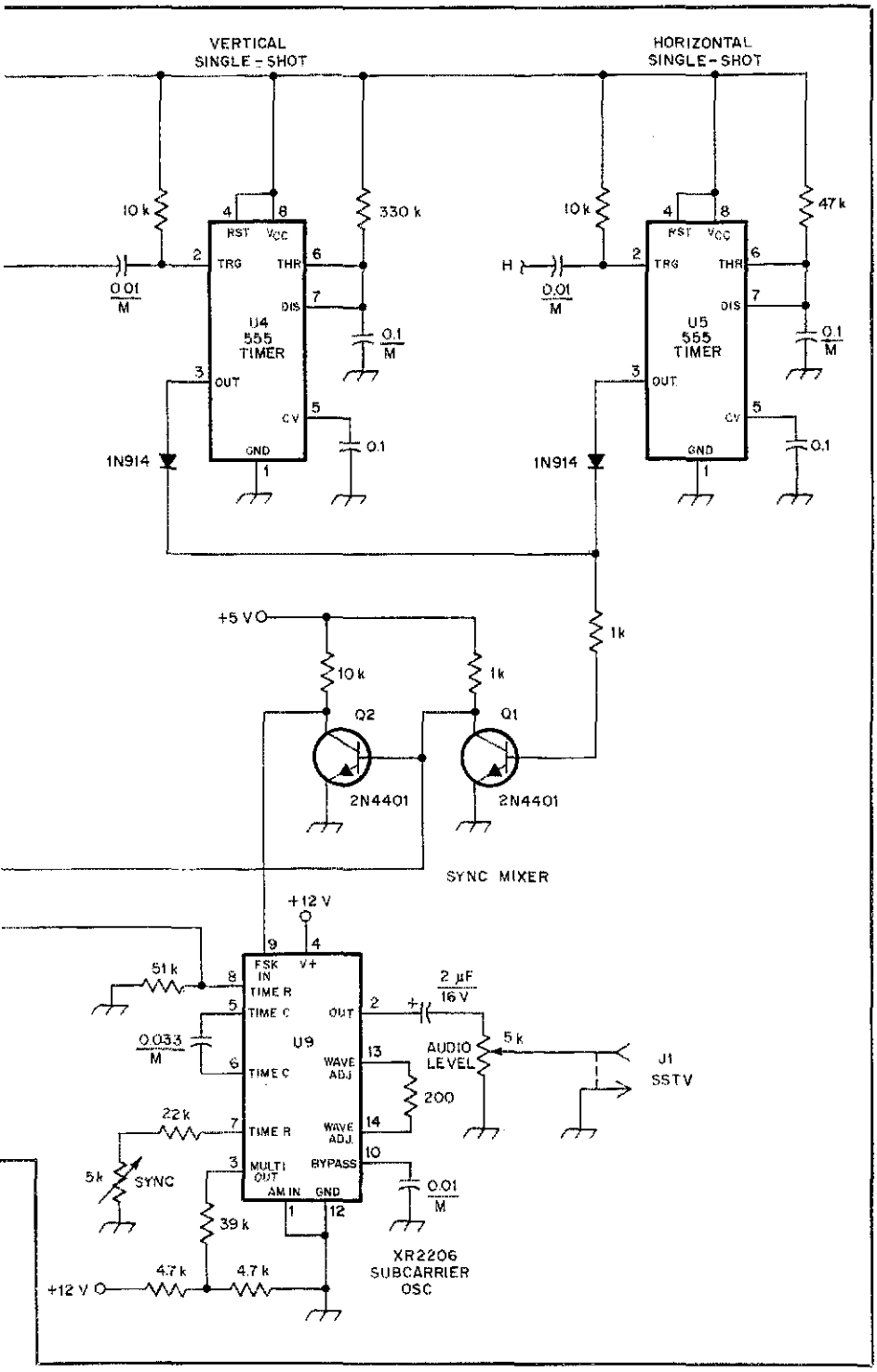


Table 1
Comparison of Pinouts for the 2764 and 68764 EPROMs

Function	*2764*		*68764*
A0	10		8
A1	9		7
A2	8		6
A3	7		5
A4	6		4
A5	5		3
A6	4		2
A7	3		1
A8	25		23
A9	24		22
A10	21		19
A11	23		18
A12	2		21
O0	11	(DQ0)	9
O1	12	(DQ1)	10
O2	13	(DQ2)	11
O3	15	(DQ3)	13
O4	16	(DQ4)	14
O5	17	(DQ5)	15
O6	18	(DQ6)	16
O7	19	(DQ7)	17
Enable	20,22		20
Ground (V_{ss})	14		12
+5 V (V_{cc})	28		24

resides in the low "nibble" (4 bits) of each byte while the second pixel is in the high nibble. The pixel pairs are arranged sequentially with the first pair (upper left corner of the display) located at memory address 0 ($0000) and the final pair (lower right corner of the display) at memory address *8191 ($1FFF).*

Getting the data out of the EPROM requires a total of 13 address lines (A0-A12), which are generated by a series of binary ripple counters. If the clock that feeds the counter chain is properly adjusted, the *output of data will be at the proper rate to* provide the required 15 lines (128 pixels) each second.

We have not discussed how the image data get into the chip to begin with. We will cover this later in the Image Programming section.

Clock and Address Counters

The system clock and address counters are extremely simple, but effective. U1 is used in an astable configuration and adjusted to a frequency of 7680 Hz by the 10-kΩ CLOCK potentiometer. This signal is routed through a total of 16 binary divider stages contained in two counters, U2 and U3. The outputs of the first two counter stages (pins 3 and 4 of U2) are not used. Output 3 (pin 5 of U2) provides a 960-Hz signal that is used to differentiate the individual pixel data in the output multiplexer (see Data Output). Output 4 (pin 6 of U2) is the basic byte clock frequency (480 Hz) *and functions as address line A0 with all* of the remaining outputs providing lines A1 through A12. The address counters are controlled by the HOLD/RUN switch, S1. In the HOLD position, the counter reset lines are pulled high by a 1-kΩ resistor. To retrieve a picture, the switch is set to RUN, *which pulls the reset lines low and triggers* the counters. This arrangement assures that you always start at the beginning of the image in memory. As long as the switch remains in the RUN position the image data will output continuously, beginning with the first memory location and proceeding to the last, after which the cycle will repeat until the switch is returned to the HOLD position.

Sync Circuits

The standard SSTV format requires that the signal have a 5-ms burst of 1200-Hz horizontal sync at the start of each line (15-Hz rate) and a 30-ms burst of 1200-Hz vertical sync at the start of each frame. Address line A5 toggles at the required 15-Hz line rate and drives a 5-ms single shot (U5) that provides a TTL high at the start of each line. Address line A12 toggles once every 8.5 seconds (0.117 Hz) and drives a 30-ms single shot (U4) that produces a 30-ms TTL high at the end/beginning of

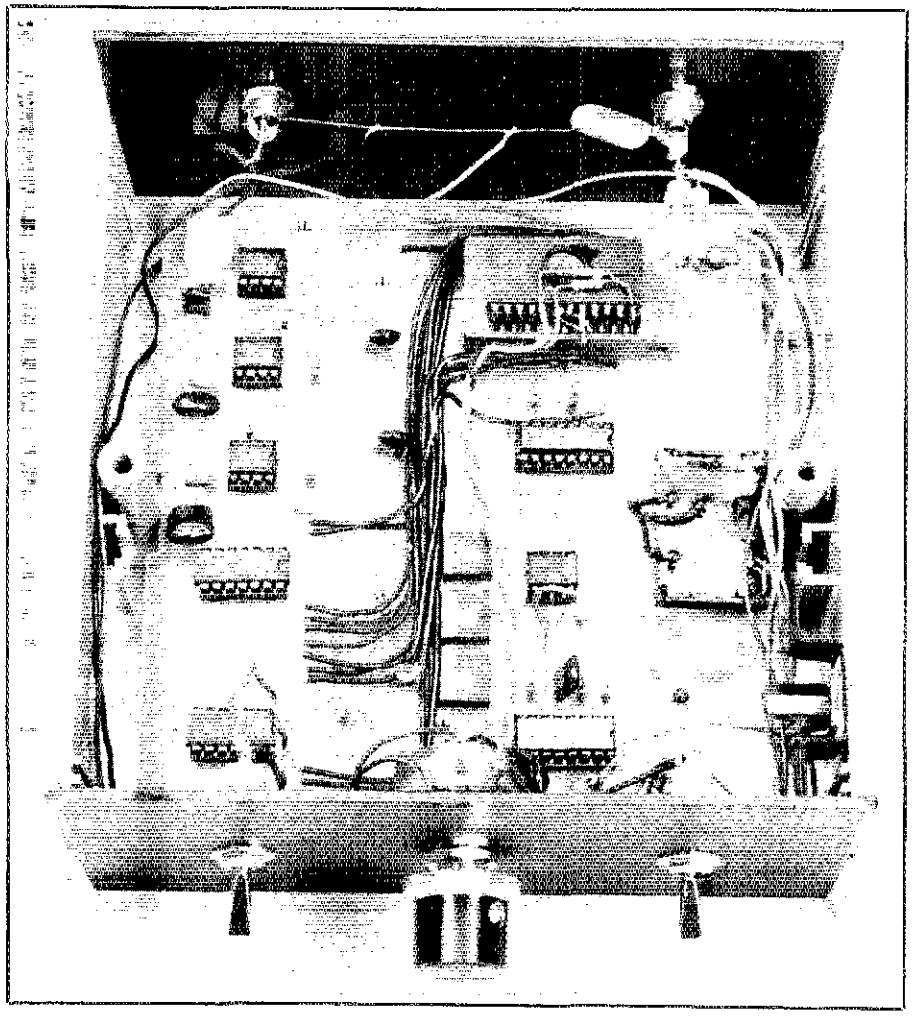


Fig 2—An internal view of the prototype unit showing the general parts layout and the simplicity of the overall circuitry. The rear apron has only two jacks—one for +12- to 14-V dc and the other for SSTV output. Front-panel controls include an image selector switch on the left, a central LEVEL control and the HOLD/RUN switch on the right. The clock oscillator, single shots and address counters are aligned along the left side of the board, and most of the visible wiring represents the 13 address lines for the EPROM bank. Two stacked EPROMs, in a zero insertion force socket, are visible in the upper right. The output multiplexer is immediately below the EPROM stack—below that are the op amp and subcarrier generator. The large, square black module is the Mostek DC-10 voltage converter that supplies negative voltage for the op amp.

each memory scan or frame. The two TTL sync pulses are mixed by Q1 and Q2 to provide a composite TTL signal that is high for the duration of both the 5-ms horizontal and 30-ms vertical sync pulse intervals. This composite signal provides the sync drive to the subcarrier modulator (U9).

Since the vertical sync pulse is produced at the end of each memory scan, the first image out of memory would normally lack a pulse to reset the display at the other end. This is prevented by using the HOLD contact of S1 to ground the collector of Q1 and the base of Q2 when the switch is in the HOLD position, forcing the subcarrier oscillator to 1200 Hz (sync). This ensures that the display system at the receiving end will be reset at the start of the first image scan when the HOLD/RUN switch is set to RUN.

Data Output

Each time the address lines toggle by one count (referenced to AØ), eight bits of output data are available from the new memory location on lines OØ-O7. These eight data bits represent two pixels of image data and must be sorted out if we are to reproduce the image as stored in memory. This is achieved using an 8- to 4-bit multiplexer (U7) that is connected to the memory data lines. This chip functions as a 4PDT switch, controlled by the 960-Hz signal applied to pin 1 from the timing chain. Wired as shown, the lower four bits of each output byte (pixel 1) are routed to the four output lines during the first half of each byte cycle while the upper four bits (pixel 2) are routed to the output lines during the second half of each address cycle. The required digital-to-analog conversion is accomplished by a summing amplifier (U8) that is driven by the four multiplexed output lines through a weighted resistor network. The output of U8 is thus one of 16 possible discrete voltage levels, based on the coding of the 4-bit pixel data. Gain and offset of the summing amplifier are adjustable to provide the voltage required to swing the subcarrier modulator from 1500 Hz (black) to 2300 Hz (white).

Construction

The circuit is extremely simple, by digital SSTV standards, and can be constructed using perf board. There is nothing particularly critical about layout, since everything operates at mid-range audio or lower. The CLOCK, GAIN, OFFSET and SYNC potentiometers should be mounted on the board and the LEVEL potentiometer located on the front panel. Ideally, the LEVEL control should be an audio-taper unit to minimize level-setting sensitivity. The other essential front-panel control is the HOLD/RUN switch as well as a selector switch if you want multiple EPROMs (see Multiple EPROM discussion that follows). The use of a zero insertion force socket for the EPROM is recommended so that EPROMs can be checked out without damaging either the chips or the socket with repeated removals and insertions.

The prototype unit is powered from a 12- to 14-V dc supply with the +5 V provided by a 7805 (LM340T-5) regulator. The prototype, with two 68764 EPROMs, draws approximately 170 mA, and a 33-ohm, 2-W resistor was placed in series with the 7805 to reduce regulator power dissipation to the point where a small heat-sink was sufficient for cooling. Using multiple EPROMs will increase the current demand. The proper value for the series resistor should be calculated, based on the current drawn, to provide approximately 7 V at the regulator input. The accuracy of your calculation is not seriously affected if you assume that all the indicated power supply current is drawn by the 5-V bus since only a few milliamperes at 12 V is required by the 741 and the subcarrier generator. The −9 V required to bias the 741 op amp (U8) is obtained using the Mostek DC-10 voltage-conversion module operating from the +5-V line. Since the output voltage swing of U8 is entirely positive, you may be able to get by with simply grounding pin 4, but I included a negative supply for greater flexibility later, should I desire to experiment with additional circuit configurations.

Adequate bypassing is critical for stable operation. In addition to the bypass capacitors indicated in Fig 1, each chip should also be bypassed at the supply pin with a 0.01- or 0.1-μF, 50-V disc capacitor. You may be able to get by with fewer bypass capacitors, but don't be surprised if you have instability or digital noise effects if you scrimp too much in the bypass department. If you bypass each chip, the system will be unconditionally stable and immune to RFI, even in an unshielded cabinet. The prototype Romscanner was

packaged in a small plastic utility box as shown in Fig 2.

Setup

The only setup adjustments for the Romscanner involve setting the clock and subcarrier frequencies. Wire a 28-pin header plug as shown in Fig 3A and insert it into the EPROM socket. If you are using a 68764 layout, use a 24-pin header wired by consulting Fig 3A and Table 1. The switch in the header circuit will allow you to switch the system output from black to white levels and greatly speeds the setup procedure. Connect a 12- to 14-V dc supply to the POWER jack, (J2). If a frequency counter is available, proceed as follows:

1) Connect the counter to pin 3 of U1 or pin 1 of U2 and adjust the CLOCK potentiometer for a frequency of 7680 Hz.

2) Transfer the counter to the SSTV output (J1) and set the LEVEL control for maximum output.

3) Set the HOLD/RUN switch to HOLD and adjust the SYNC control for a frequency of 1200 Hz.

4) Set the HOLD/RUN switch to RUN and preset the GAIN control for minimum resistance between pins 2 and 6 of U8.

5) Set the test header switch to black and adjust the OFFSET control for a frequency of 1500 Hz.

6) Set the test header switch to white and adjust the GAIN control for a frequency of 2300 Hz.

Note: Go back and forth between steps 5 and 6 several times, as there will be some control interaction.

At this point you can connect the SSTV output to a display system, and you should be able to shift the display from black to white by toggling the header test switch.

If no frequency counter is available, align the system using your SSTV display. Proceed as follows:

1) With the HOLD/RUN switch in the HOLD position, adjust the SYNC control for maximum indication on your SSTV tuning indicator.

2) Set the HOLD/RUN switch to RUN.

3) Beginning with the maximum setting of the CLOCK potentiometer, adjust the control until the interval between vertical sync pulses is 8.5 seconds. The adjustment can be fine tuned by "tweaking" to obtain a picture of normal width on your display once alignment is complete.

4) With the GAIN control set to minimum and the test header switch to black, connect a high-impedance voltmeter to pin 6 of U8 and adjust the OFFSET potentiometer for a reading of 2.25 V.

5) Toggle the header switch to white and adjust the GAIN potentiometer for a reading of 1.9 V.

6) Repeat steps 4 and 5 several times to minimize control interaction.

7) Connect the SSTV output to your display and repeat steps 4 through 6, tweaking for a good black to white shift as you toggle the header switch.

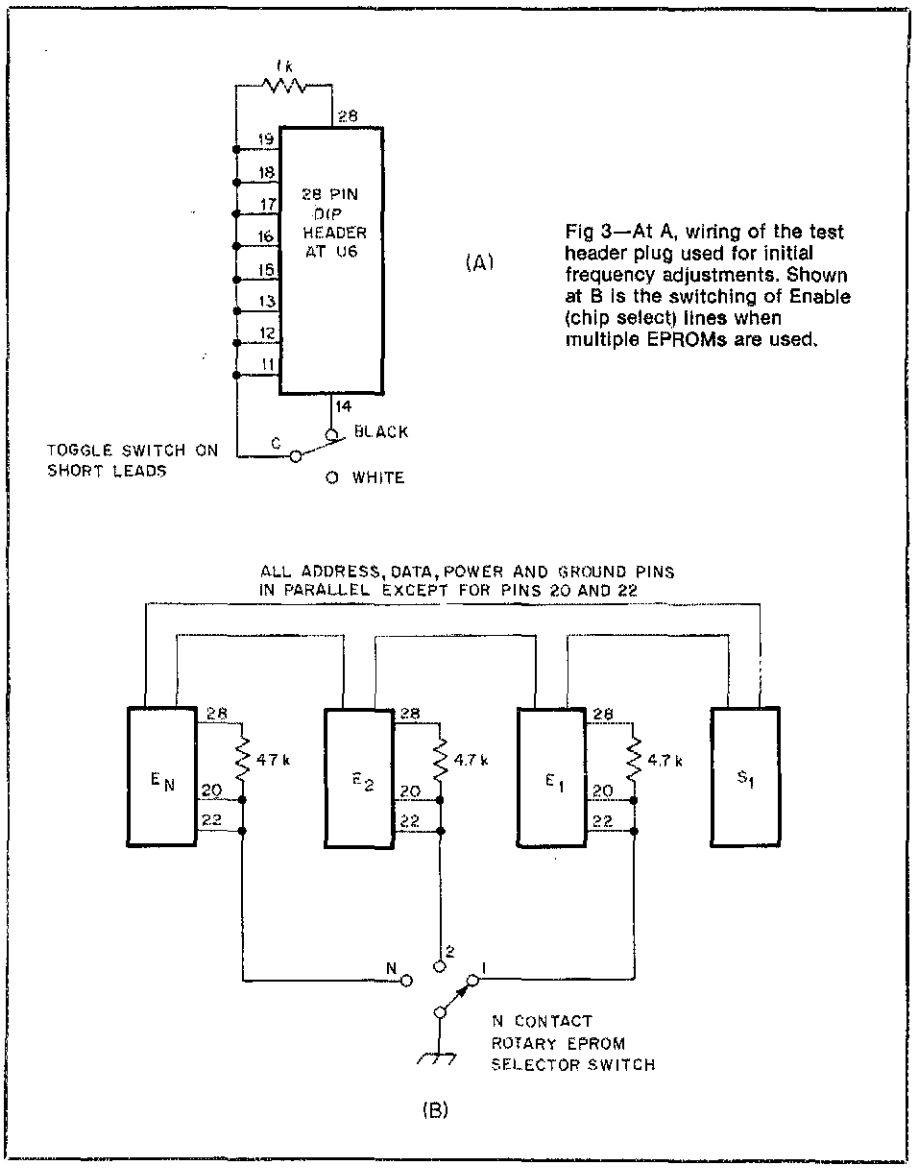


Fig 3—At A, wiring of the test header plug used for initial frequency adjustments. Shown at B is the switching of Enable (chip select) lines when multiple EPROMs are used.

Once you have your first programmed EPROM installed, you can tweak the GAIN and OFFSET controls as required to obtain the same contrast range obtained when the original taped version of the image is played into your display.

Multiple EPROMs

Up to this point we have assumed that the system has only a single EPROM (U6), but there is no real limit to how many you can use. A small board can be wired to contain multiple EPROM sockets (28- or 24-pin sockets depending on the device chosen), with all address, data, ground and 5-V lines in parallel. A small 28- or 24-conductor ribbon cable, equipped with header plugs at each end, can then serve to interconnect the EPROM socket on the main circuit board with one of the sockets on the EPROM board. The only pins that are not paralleled are pins 20/22 (the chip select or enable) of the 2764 (see Table 1 for the 68764 equivalent). The enable pins should be pulled high with a 4.7-kΩ resistor to +5 V on each EPROM socket. Run a wire from the enable pins of each socket to a selector switch (typically a rotary type) on the front panel as shown in Fig 3B. The switch is used to ground the enable pins of the selected EPROM, making it the active chip. The other chips will simply "float" on the address and data lines in a high-impedance state and will not affect image output.

If you require only a few programmed chips, another alternative is available. Once the chips have been verified for proper image output, bend out the enable pins and stack your chips so that the pins overlap. Carefully solder the pins together and install a 4.7-kΩ resistor and switch lead to each enable pin. The +5-V side of the resistors can be tied together and returned to the common V_{cc} (+5 V) pin of the chip

stack. This will be pin 28 for the 2764 or pin 24 for the 68764. The enable-pin switch leads can then be routed to a selector switch that will ground the enable pin(s) of the chip you want. The entire chip stack is then inserted into a single EPROM socket on the main circuit board. My unit contains two chips (a CQ/ID image and my picture), and the chip stack can be seen in Fig 2. This arrangement works well for a modest number of chips (2 to 4) if you know you will use the programmed chips for some time. It is inconvenient, however, to unsolder the stack to remove a specific chip for erasing and reprogramming, so you should go this route only if you are perfectly satisfied with each programmed image.

EPROM Programming

If you already have a microcomputer integrated into your SSTV station, programming the chips can be educational, and even fun. If you have little or no computer gear, or the wish to use it, you can link up with a local hacker for some assistance at this point.

Programming requires a microcomputer, an EPROM programming system compatible with the computer and a hardware/software system for transferring an SSTV image into memory in the proper format. Scan converters that use a microcomputer as part of the display system are ideal, since the image data are already in the computer memory as part of the normal system operation. In the case of the K6AEP system described in reference 1, the image is already in the proper format. In the case of recent-vintage commercial scan converters, such as the Robot 450C and 1200, the units are designed for easy computer interface and programming, and it is a relatively easy task to move the image from the scan converter memory to the computer memory. In principle, the programming of a chip involves the following steps:

1) Display the primary image using the scan converter.

2) Reformat (if required) in the case of a microcomputer scan converter, or transfer and format in the case of a scan converter interfaced with the computer.

3) Save the image data to tape, or disk, in the form of a machine-language program.

4) Configure the computer with the EPROM programming hardware and software.

5) Load the image machine-language program.

6) Program and verify the EPROM.

How each of these steps is accomplished in practice will depend on the type of computer, scan converter and EPROM programmer used. A program listing for the Robot 450 scan converter using the Radio Shack Color Computer™ is available from the ARRL Technical Dept. Send a business-size SASE to ARRL-TD, 225 Main St, Newington, CT 06111, and ask for "Romscanner."

For those who wish to avoid the hassle completely, I will provide a chip-programming service. I am equipped to program images from standard SSTV tapes and can also generate CQ and ID images and other graphics material. I will be happy to furnish details if you contact me, and include an SASE.

Color

The Romscanner can be used to transmit frame sequential (RGB) color pictures by storing each color separation image in its own chip, with provisions to switch the enable lines in sequence. To transmit color, simply transmit the desired number of frames of the red image, switch to green and repeat the process, and then finish with the desired number of frames of blue.

Graphics

To say that most of the alphanumeric graphics used on SSTV today are crude is a great understatement. The primary lette and number symbols used by most com puter and dedicated SSTV terminals wer developed when memory was scarce an expensive so the symbols are quite elemen tary in form. One interesting aspect of th Romscanner is that you can develo programs with much more perfectly formed letters and numbers to create a more pleasing effect when used on ID slides and the like. It takes some effort to develop the character fonts, but the programs can be written in BASIC to create your ID slides and other material. If the program is set up properly, it will place the graphic image precisely where you want it in memory so that you can create your machine-language program directly from the graphics program. A little ingenuity here will go a long way toward improving the stick-type letters and numbers you see so often on the bands today. A modest example of such enhanced graphics can be seen in Fig 4.

Results

The image output of the Romscanner is essentially identical to the source image and cannot be distinguished from direct camera output. Figs 4 and 5 show an example of a CQ slide created by one of my graphics programs and burned into EPROM. The Romscanner output is shown as displayed on a Robot 450C monitor in Fig 4. Fig 5 shows the same signal displayed on an old P7 analog SSTV monitor. A continuous-tone image is shown in Fig 6, as displayed on the Robot 450C, and Fig 7 shows the same continuous-tone image displayed on the P7 monitor. As you might expect, digitization effects are evident on the Robot display, enhanced slightly because the 128 pixels generated by the Romscanner can never precisely match the 128 samples taken by the Robot. In contrast, the image on the P7 monitor looks as if it were derived from an analog source because of the roll-off effects of the analog monitor circuits.

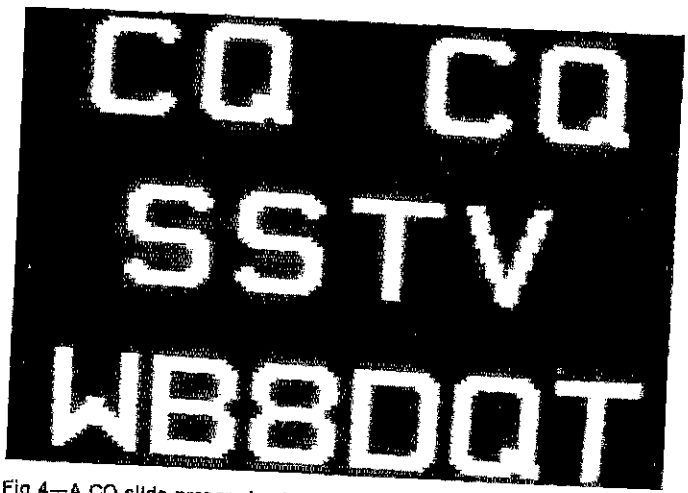


Fig 4—A CQ slide prepared using a graphics package developed by the author to provide a more pleasing alphanumeric display, as shown on a Robot 450C display.

Fig 5—The CQ slide of Fig 4, as shown on an analog P7 monitor.

Fig 6—Romscanner output of a continuous-tone image displayed on the Robot 450C scan converter. This picture of the author was created using the 450C. The image was transferred from the scan converter to a Radio Shack Color Computer™ and programmed into EPROM.

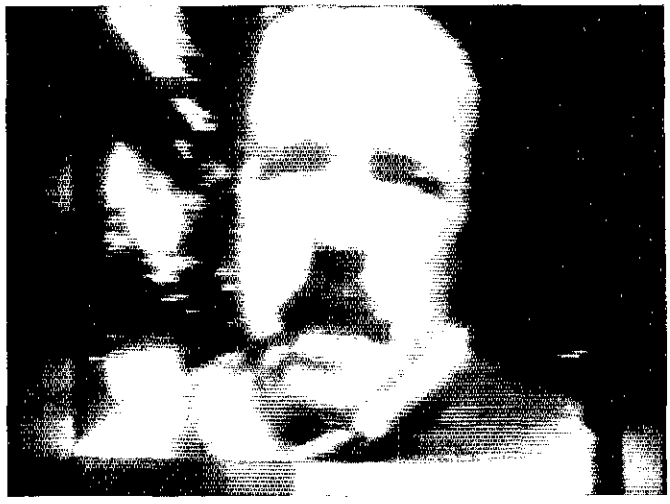


Fig 7—The continuous-tone image of Fig 6 as displayed on an analog P7 monitor. Note the gray scale at the bottom of the image. The 450C creates a 120-line image, while the standard format is 128 lines. An author-developed image transfer program inserts an 8-step gray scale in the final eight lines not used by the Robot format. The gray scale is not visible when displayed on Robot 450C or 1200 scan converters, but is visible on all other display systems that use all 128 lines of the standard format.

In operation, the HOLD/RUN switch is normally kept in the HOLD position when not transmitting pictures. This will cause a 1200-Hz tone output from the unit. If your Romscanner output is routed to the transmitter, you can use the LEVEL control to set the proper audio-drive level for the transmitter. To transmit an image, simply select the desired chip, key in the Romscanner and set the HOLD/RUN switch to RUN. The frame will start at the beginning and will repeat until you set the switch back to HOLD. If the switch is cycled to HOLD and back to RUN during a transmission, the frame will reset and begin again. If you change the image-selector switch during a transmission, the unit will simply switch from one picture source to the other. Depending on the pictures you have in memory, this can create interesting special effects such as call signs at the top or bottom of photographs, etc.

The Romscanner is an extremely useful SSTV accessory, and you will soon wonder how you got along without one. My present mode of operation is to get on the air with the unit, and only in the case of an extended QSO do I take the time to fire up the lights and camera. I also find it very useful for contests as well as vacation portable operation, since the amount of gear that is transported is quite reasonable. Lest you think that SSTV is a kilowatt activity requiring a huge antenna farm to counter band conditions and QRM, I should explain that all of my HF operating is with a 5-W Ten-Tec Argonaut using dipoles and long-wire antennas. On SSTV this has netted me 36 confirmed states and 13 countries, with most of that on 20 meters! If you have a sideband station of any sort, SSTV represents a logical extension into the "video age."

While it may appear that higher-resolution formats are now the dominant mode, standard 128-line monochrome pictures have a number of operating advantages. The short time required to transmit a single image (8.5 seconds) makes it more feasible to dodge QRM, compared with the longer frame times required for color and high-resolution formats. With modern gear, 128-line images can be of quite good quality, meeting the needs of most amateurs, and the gear itself can be fairly simple and quite inexpensive. There is a tremendous amount of 128-line equipment available, ranging from P7 monitors and sampling cameras to the Robot Model 400 scan converters. All of the newer equipment, regardless of its color and high-resolution capabilities, can handle standard-format imagery. If you can find some of this gear, or have it on hand, by all means get on the air! There is very little activity on 15 and 10 meters, yet these bands are superb for SSTV with very little QRM when open. If you would like more information on SSTV and the many operating options now available, check in or listen to the SSTV net on 14.230 MHz at 1800 UTC every Saturday.

There is no doubt that SSTV is now a fully digital mode. What is needed is more basic, easy-to-construct SSTV gear to encourage new operators, both here and abroad. The Romscanner is one step in this direction.

Notes

[1]C. Abrams and R. E. Taggart, "Color Computer SSTV, Part 1," *73 Magazine*, Nov 1984, pp 10-21.

[2]The term "P7" refers to the type of high-persistence phosphor used in CRTs originally adapted to SSTV. The P7 phosphor could hold an image for the 8.5 seconds required for a single frame.

Strays

I would like to get in touch with...

☐ any hams with a portable OSCAR station willing to give Amateur Radio demonstrations to the general public at the Neil Armstrong Air and Space Museum's annual Festival of Flight in Wapakoneta, OH in July. Contact John Zwez at the Neil Armstrong Air and Space Museum, I-75 and Wapak-Fisher Rd, Wapakoneta, OH 45895.

☐ anyone using a Magicom RF speech processor and a Kenwood TS-130S. Russ Smith, W6ONK/7, PO Box 141, Brownsville, OR 97327.

☐ anyone with a manual or circuit diagram for an EICO 239 solid-state FET-TVM. E. H. Strieter, W6FZO, 3040 Rohrer Dr, Lafayette, CA 94549.

☐ anyone who can help identify an H. H. Scott receiver with a missing model number. Dave Schoepf, WØOZG, 418 Lake Forest, Vicksburg, MS 39180.

☐ anyone with a service manual for a Measurements Corp 84-R standard generator, or information on converting a T-282 GR army transmitter for operation on 450 MHz. Bob Sondack, VE2ASL, 260 Bellerive, Ile Ste Helene, St Luc, PQ J0J 2A0.

Gaining on the Decibel

Part 2: Money is power, and the decibel is an expression of a power ratio. Wouldn't you like to receive a 3-dB increase in spending money?†

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In the first part of this article we introduced the decibel, a logarithmic expression of *power* ratio, and demonstrated why it is inappropriate to apply this measurement tool directly to changes in EMF or current. We also presented standards for the proper capitalization of dB and explained how it can be used to express either absolute or relative power. You may wish to review the previous part before reading further.

In this part we will explore various applications, both proper and improper, of the dB to electronic communications in general and Amateur Radio in particular.

Antenna Gain

Most of us have considerable difficulty in visualizing how an antenna can have gain. Being a passive device, there's just no way an antenna with an applied input of 100 watts can possibly put out anything greater than 100 watts! The whole idea of antenna gain relates to the fact that the same 100-watt transmitter can deliver varying amounts of power *in a specified direction*, when connected to different antennas. Similarly, a receiver of specified sensitivity may recover widely varying signal-to-noise ratios, from a specific distant station *in a certain direction*, when fed with different antennas.

If you get the impression that antenna gain involves the performance of a particular antenna as compared to that of a specified reference antenna, you're absolutely right! The problems start in trying to specify the appropriate reference antenna.

A popular reference antenna for theoretical evaluations is the isotropic radiator, the only truly omnidirectional antenna. (Remember, "omnidirectional" means that the antenna radiates equally poorly in all directions.) An isotropic antenna connected to a transmitter disperses the radiant energy in a perfectly uniform sphere. An isotropic receiving antenna will similarly respond uniformly to applied signals from any direction in three-dimensional spherical space.

The only problem with referencing the performance of any physical antenna to that of an isotropic radiator is that the perfect isotrope doesn't really exist. You cannot build one, buy one or observe one in nature. Nothing is that uniform.[6]

An antenna whose radiation pattern is *nearly* uniform, in *most* directions, is the half-wave dipole. Simple to visualize and easy to implement, the half-wave dipole radiates a fairly uniform pattern in all directions except off its ends, where deep nulls appear. Does a dipole have gain, relative to an isotrope? Yes! All of the power fed to a properly matched dipole system must be radiated. And since there are nulls off the ends, the energy that would have gone into those nulls, if the dipole were an isotrope, has to go in some other direction. In actual fact, it adds to the power radiated *broadside* to the dipole, making its familiar "doughnut" radiation pattern a little fatter. Redirecting the energy from the nulls makes the signal available from a dipole, in the direction of its maximum radiation (broadside), about 2 dB greater than that from an isotrope.

Knowing the above, we now have a way of determining an antenna's gain, relative to an isotropic radiator, even though we do not have an isotropic reference antenna lying around the shack. Simply compare the signal power received from a distant station with the antenna under test to that received from the *same* station with a dipole.[7] The resulting power ratio can be converted to dB just as you've always converted power ratios to dB, by calculating 10 times its common log. The resulting figure is antenna gain in dB *relative to a dipole*, or dBd. Since you know the relationship between a dipole and an isotrope, you can now find antenna gain in dBi (decibels relative to an isotropic reference) simply by adding 2 dB to dBd.

The most common mistake made in antenna-gain measurements is that of not specifying the reference to which the antenna under test was physically or mathematically compared. An antenna gain of +10 dBi means something very different from a gain of +10 dBd. And an antenna gain expressed simply as +10 dB means something else again. It means the person specifying the gain was either trying to mislead and deceive, or he simply doesn't understand dB!

Free-Space Path Loss

Even before Congress passed the Inverse Square Law, it was well known that S-meter readings vary inversely with the distance to the DX station. To understand the relationship between distance and attenuation, we need to consider two points (A and B) of a communications path, separated by distance D and communicating via electromagnetic waves of wavelength λ. And to remove from the analysis the effects of antenna gain, beamwidth, radiation pattern or effective aperture, we will assume that both the transmitter (at Point A) and the receiver (at Point B) are connected to perfectly matched, ideal, lossless isotropic antennas.

As long as the distance D is great relative to the wavelength λ (the far-field restriction mentioned in Ref 7), it can be shown that the EMF recovered by the receiving antenna is a fraction of the EMF applied

†Part 1 appears in Feb 1986 *QST*. Part 3, the conclusion, will appear in a subsequent issue.

[6]Notes and references appear on page 31.

to the transmitting antenna, which varies with the ratio λ over D. The equality is:

$$Av = \frac{\lambda}{4\pi D}$$

where

Av is the voltage ratio $\frac{\text{(V received)}}{\text{(V transmitted)}}$

and the constant 4π comes to us from spherical trigonometry, representing the number of steradians in a sphere.

Of course, since Av is a unitless ratio (volts over volts cancels), it is important that λ and D be expressed in the same units.

Since we defined our antennas as being ideal, they are perfectly matched to free space. Thus, the potentials transmitted and received are measured across the same impedance, and power ratio becomes the square of potential ratio. We can therefore say

$$Ap = Av^2 = \left(\frac{\lambda}{4\pi D}\right)^2$$

And we know how to convert power ratios to dB:

$$dB = 10 \log Ap$$
$$= 10 \log \left(\frac{\lambda}{4\pi D}\right)^2$$

This yields a *negative* number, since path gain is less than unity. If we change the sign, it follows that free-space path *loss* α (the Greek letter alpha, lower case) would be:

$$\alpha = -10 \log_{10} \left(\frac{\lambda}{4\pi D}\right)^2$$

Since $-10 \log (x) = 10 \log (1/x)$, it follows that

$$\alpha = 10 \log_{10} \left(\frac{4\pi D}{\lambda}\right)^2$$

This relationship allows us to predict free-space path loss at any frequency, over any line-of-sight distance, as long as we measure distance and wavelength in the same units. It is certainly easier to employ than the various nomographs provided for that purpose in the literature, and is far easier to remember than those published equations that contain fudge factors to compensate for distance expressed in, say, miles, and wavelength in inches. Furthermore, if you understand the meaning of the decibel (and you should by now), the above equation should allow you to visualize the relationship in a physical sense.

Effective Isotropic Radiated Power

Moonbouncers use EIRP a lot. This is total output punch, measured in dBm. Think of it as a measure of the goo you have going out, in dB relative to a 1-milliwatt transmitter, connected through a lossless transmission line to an ideal isotropic antenna.

EIRP is calculated by adding together transmitter output power in dBm, feed-line loss in *negative* dB and antenna gain in dBi. Thus, a transmitter output of +40 dBm, applied through a 6-dB lossy transmission line to an antenna whose gain is +10 dBi, will generate an effective isotropic radiated power of (+40 dBm) + (−6 dB) + (+10 dBi) = +44 dBm.

It bothers some that we can mix such obviously diverse units as dB, dBi and dBm, but in each case, we are comparing a particular signal level to a *specified* reference. Only the reference changes for each element analyzed; the units of measure, dB (10 times the log of a power ratio) remains consistent throughout the calculation. Note that the transmitter output in the above example is 40 dB more than a milliwatt, the feed-line gain is 6 dB less than a lossless transmission line, and the antenna gain is 10 dB more than that of an isotrope. The resulting EIRP is then a power level, measured in dB relative to a specified (though perhaps elusive) reference power, or 44 dB more than the power radiated in a given direction, if 1 milliwatt were applied through a lossless transmission line directly to an isotropic antenna.

Actually, we mix units in other fields of endeavor with minimal confusion. Consider the technician earning $12 an hour, who receives a 10% raise. What is his new hourly salary? If you've been paying close attention, you might be tempted to say, "Wait a minute. You can't mix percents with dollars!" But of course you can. The final unit of measure will still be *dollars*. Percent simply signifies a *change*. Similarly, a power level in dBm (or dBW) can be thought of as an absolute level, like a wage in dollars. Cable loss in dB, path loss in dB, antenna gain in dBi (or dBd) and amplifier gain in dB all represent changes to the original signal level, much as a 10% raise represents a change in salary. The resulting power level, after all these changes have been accomplished, is of course measured in the original unit, dBm or dBW.

Receiver Sensitivity

A previously published article defines the major factors affecting receiver sensitivity.[8] Here we shall concern ourselves with how receiver sensitivity can be measured in dB.

In the absence of interference, any signal applied to the input of a receiver is competing with noise. For a signal to be heard, its power must exceed the total noise power by a specified amount (called signal-to-noise ratio) that varies as a function of modulation type, modulation percentage, signal conditioning, any special coding on the signal and the type of detector circuitry employed. Given the required signal-to-noise ratio, the receiver sensitivity is limited by the amount of noise power the signal has to override.

The noise power present at the input of a theoretically perfect receiver (that is, one which generates in its circuitry no additional noise above that occurring naturally in the environment) is a function of heat and bandwidth. Mathemagically,

$$Pn = kTB$$

where

Pn represents noise power in watts
k is Boltzmann's Constant (1.38×10^{-23} joules per kelvin)
T is the temperature of the receiver circuitry, in degrees absolute (or kelvins)
B represents the narrowest bandwidth (typically the IF bandwidth) of the circuitry preceding the detector stage, in Hz.

Since noise power can be calculated in watts, we can further convert it to milliwatts (simply multiply by 1000) and express it in decibels compared to a milliwatt, or dBm.

Consider the sensitivity of an ideal, noiseless receiver with a bandwidth of 1 Hz, operating at a temperature of 290 K (an accepted standard temperature for earth-based equipment). The resulting noise power with which any signal would have to compete will equal:

$$Pn = kTB$$
$$= (1.38 \times 10^{-23} \text{ joules/K}) \times (290 \text{ K}) \times (1 \text{ Hz})$$
$$= 4 \times 10^{-21} \text{ watts}$$
$$= 4 \times 10^{-18} \text{ mW}$$
$$= -174 \text{ dBm}$$

You may have read that the noise threshold (that is, the sensitivity at unity signal-to-noise ratio) of an ideal, noiseless receiver is −174 dBm per Hz of bandwidth, and you can see where this figure came from—except for one thing. The above value holds *only* at the so-called standard temperature of 290 K. The same receiver in the cold depths of space will experience significantly less thermal noise, and thus will exhibit higher sensitivity than the "−174 dBm/Hz" approximation would indicate.

Until now we have been talking about an ideal, noiseless receiver. In truth, the receiver circuitry itself is going to contribute some noise to its own input; thus the actual sensitivity of any receiver will be less than we have predicted by kTB. We can quantify the noise contribution of the receiver circuitry (and its resulting impact on sensitivity) in three different ways: noise factor, noise figure or noise temperature.

Noise factor (often abbreviated F) is a measure of the degree to which the receiver's internal noise increases the noise power, kTB. It represents a power ratio. Thus, if kTB, in watts or milliwatts, is

known, multiplying it by noise factor yields the actual noise power level which the applied signal must override. In the preceding example of a receiver with a 1-Hz bandwidth operating at standard temperature, a receiver noise factor of 2 would raise the actual noise threshold to:

$$\begin{aligned} Pn &= F \times (kTB) \\ &= 2 \times (4 \times 10^{-18}\ mW) \\ &= 8 \times 10^{-18}\ mW \\ &= -171\ dBm \end{aligned}$$

Noise figure (usually abbreviated NF) is simply noise factor expressed in dB. Since noise factor is a power ratio, we can convert it to dB by multiplying its common log by 10. To find a receiver's noise threshold when NF is known, simply add NF (in dB) to the dBm equivalent of kTB, that is, 10 times the common log of (kTB × 1000).

In the previous example, NF = 10 $\log_{10}$ 2 = 3 dB. Thus, the actual noise threshold was:

$$\begin{aligned} Pn &= 10 \log_{10}(kTB \times 1000) + NF \\ &= (-174\ dBm) + (3\ dB) \\ &= -171\ dBm \end{aligned}$$

You can see from this calculation that the 3-dB NF effectively degraded the sensitivity of our sample receiver by exactly 3 dB.

If a receiver's internal noise is expressed in noise temperature, we know that the equivalent thermal noise to which the receiver is subject exceeds its physical temperature by a specified amount. To find a receiver's noise threshold when noise temperature (sometimes called T_{eq}) is known, simply *add* noise temperature to 290 K (or whatever other physical temperature may apply) and utilize this sum when calculating noise power from kTB.

If noise temperature equals 290 K (equivalent to a 3-dB noise figure, or a noise factor of 2) and the receiver is operated at standard temperature, then the receiver's noise threshold is:

$$\begin{aligned} Pn &= k \times (290 + T_{eq}) \times B \\ &= k \times (290 + 290) \times B \\ &= 8 \times 10^{-18}\ mW \\ &= -171\ dBm \end{aligned}$$

The preceding three examples illustrate that when calculating receiver sensitivity, whether employing noise factor, noise figure or noise temperature, proper use of the decibel yields consistent results.

Link Analysis

Link analysis, perhaps the most elegant application of decibel calculations in electronic communications, allows us to quantify all of the elements of a communications system and predict its success. It combines all of the foregoing examples, in an attempt to predict the overall performance of a communications link. It is also the one application of decibels least favored by the Amateur Radio community.

The true ham, so legend has it, shuns any calculation that might dissuade him from any desired endeavor. After all, it is through analysis that the engineering community has determined that this or that objective is impossible, and thus expends no effort toward achieving it. The ham, it is argued, by not knowing that something is impossible, simply sets about accomplishing it . . . and frequently succeeds.

The argument is certainly appealing. If you want to know how far you can communicate with a particular combination of equipment and conditions, the time-honored method is to point your antenna and call CQ. Who ever bothered to calculate EIRP, path loss, receiver sensitivity and required signal-to-noise ratio before getting on the air?

Yet there are applications where the analytical approach does make sense. Consider the world of communications satellites, where countless thousands of hours and hundreds of thousands of dollars may be expended in preparing a payload for orbit. There is certainly an advantage to making our OSCARs accessible to the greatest number of experimenters, and this can be assured by predicting, in advance of a launch, the precise user equipment necessary to access the satellite. If we wait until after a spacecraft achieves orbit, only to discover that its transponder is not accessible to stations operating within legal amateur power limits, we have done the user community a disservice.

Link analysis can be performed through multiplication of power ratios, that is, by multiplying transmitter power by antenna gain by path loss by receiving-antenna gain by required signal-to-noise ratio, and comparing the resulting power level to the receiver noise threshold, kTB. But this becomes awkward in the extreme. A far better approach might be to add logarithms. After all, isn't that why they were developed in the first place?

If we express transmitter power in dBm, transmitting-antenna gain in dBi, path loss in dB and receiving-antenna gain in dBi, the sum of these four quantities (less any feed-line losses along the way, in dB) will give us an accurate picture of the power level, in dBm, available to the distant receiver. We can compare this figure to the receiver sensitivity, in dBm, found from k, T, B, required signal-to-noise ratio and noise figure, and discern the available signal margin in the link, in dB. If this figure happens to be negative, we can explore various ways of improving link performance, before investing significant resources in what might otherwise prove a fruitless effort.

Of course, there will always be times when simply pointing the antenna and calling CQ is the appropriate way to quantify a communications path. But when prior knowledge of performance is required, proper use of the decibel can make

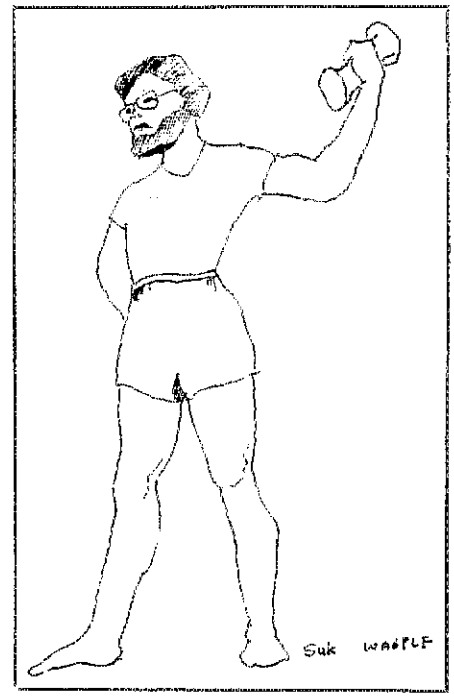


Fig. 2—The author lifting one Db (see text). *(drawing by WA6PLF)*

the mathematics almost painless.

More Creative Misapplications

Gruchalla has cited a number of examples of creative misapplication of the decibel.[9] His powerful presentation bears some amplification, if we are to gain a full misunderstanding. Recognizing that using decibels is a way of expressing power ratios, consider the following case studies.

Case 1: Finance

A gallium-pesticide transistor delivers 12 dB of gain in a particular application and costs $9. A GLASSFET delivers 16 dB of gain in the same circuit and sells for $18. Which active device is the more cost effective?

The hollow-state device delivers a 4-dB gain advantage, at twice the unit cost. Ten times the common log of (twice the cost) equals 3 dB. Thus, the latter device delivers 4 dB of additional performance for 3 dB more dollars, for a net cost vs performance advantage of 1 dB. And the analysis is easily justifiable on the obvious basis, confirmed by countless economists, that money is power.

Case 2: Time Management

An engineer toils from 9 AM to 6 PM. Can you express his workday in dB? Let dB equal 10 times the common log of (time out over time in). Dividing 1800 hours by 0900 hours, and solving the above relationship, yields a 3-dB work day.

Except that the engineer takes an hour off for pretzels and bridge. Dividing 1300 hours by 1200 hours, we find that the

employee has enjoyed a 0.35-dB lunch hour, and thus should be paid for only 2.65 dB of labor.

The proof of the above relationship derives from a simple syllogism. Since time is money (just ask any busy executive), and money is power (see Case 1 above), and power is measured in dB, time can be measured in dB. If you don't understand this completely, come back in 10 dB and I'll explain it again.

Case 3: Athletics

You may recall our discussion about proper capitalization in Part 1. Fig 2 depicts an athlete lifting 1 Db.

During the Los Angeles Olympics, a weightlifter from West Hernia beat the world's record in his event by 0.6 dB. This figure was found in the usual way, by first dividing the weight he lifted by the previous record, then taking 10 times the log. And of course, dB is the appropriate unit, since the West Hernian was a power lifter.

Case 4: Municipal Planning

The mayor of the booming metropolis of Hictown (pop 37) comes to the startling discovery that not a single radio amateur resides within his jurisdiction. Upon researching the matter, he attributes this phenomenon to an obscure law, one that has been on the books since colonial times, prohibiting "the erection of any flagpole, standard, mast or similar structure, which exceeds the height of the Giant Sycamore gracing the town square." Said sycamore was struck by lightning in the Great Storm of '08, with only a gnarled stump remaining. Hence, all antennas but TV rabbit ears are prohibited.

Recognizing the many public service benefits of ham radio, this astute leader promptly and permanently rescinds all antenna ordinances. Obviously, Hictown soon becomes a mecca for our brethren, who immigrate in significant numbers, erect impressive towers, swell the population to 138,214 and change the name of their town to Antlerville.

What, you may ask, was the population gain in dB in the above example? Ten times the common log of the ratio (population now over population then) equals 35.7 dB, but is this a valid application of the dB? It is if you, as I, were a college student during the turbulent '60s, when the watchword was "Power to the People!"

Case 5: Literature

This last example will constitute your homework assignment; please complete the analysis and turn it in at the beginning of the next class period. You are asked to assess the extent to which this article has expanded the available literature in the area of dB analysis. Count the number of words in both parts of this article, as well as those in Gruchalla's paper (Ref 9). The number of dB by which this paper increases human knowledge can be estimated as 10 times the common log of the quantity (words here) divided by the sum (words here plus words elsewhere).

Why is dB notation appropriate here? It was Thomas Hobbes who wrote, "Knowledge is Power." Furthermore I remind you, as is mentioned every month in *Reader's Digest*, "It Pays to Enrich Your Word Power."

Notes and References

[6]The sun's radiation pattern comes close, but remember that the sun is not perfectly spherical. Because of its rotation on its axis, the sun is oblate, like the earth (that is, fatter around the equator than at the poles). Since the sun's radiation pattern is closely correlated to its shape, the sun cannot be a perfect isotropic radiator. Neither is any physically realizable antenna.

[7]For meaningful measurements to result, the antenna under test must be evaluated at *far-field*—that is, at a measurement distance which is very great, relative to both wavelength and antenna aperture.

[8]J. R. Fisk, "Receiver Sensitivity, Noise Figure and Dynamic Range—What the Numbers Mean," *Ham Radio*, Oct 1975, p 8. This article, penned 10 years ago by the late W1HR, represents *the* definitive work on the subject of receiver performance. I consider it to be one of those landmark papers that should be reviewed (and hopefully reprinted) periodically.

[9]M. Gruchalla, "Defining the Decibel," *Ham Radio*, Feb 1985, p 51.

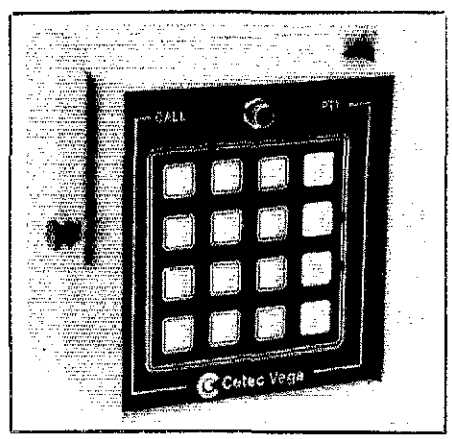
New Products

CETEC VEGA MODEL ED-707 MOBILE DTMF ENCODER/DECODER

☐ Cetec Vega's new Model ED-707 dual-tone, multifrequency (DTMF) mobile encoder/decoder is designed for tough service. It has a comprehensive set of operational features, including: (1) selective, group, and all call (2- to 6-digit messages); (2) single-tone transpond; (3) full DIP-switch programmability; (4) command reset; (5) audible encode sidetone; (6) fully sealed keypad with 12 DTMF digits as well as horn, speaker, and "T" switch; and (7) wrong-digit reset or wrong-digit lockout (jumper selectable).

Construction features include: (1) rugged aircraft-alloy case; (2) fully sealed DTMF/control switch keypad; (3) water-tight Neoprene™ panel gasket; and (4) stainless-steel fasteners.

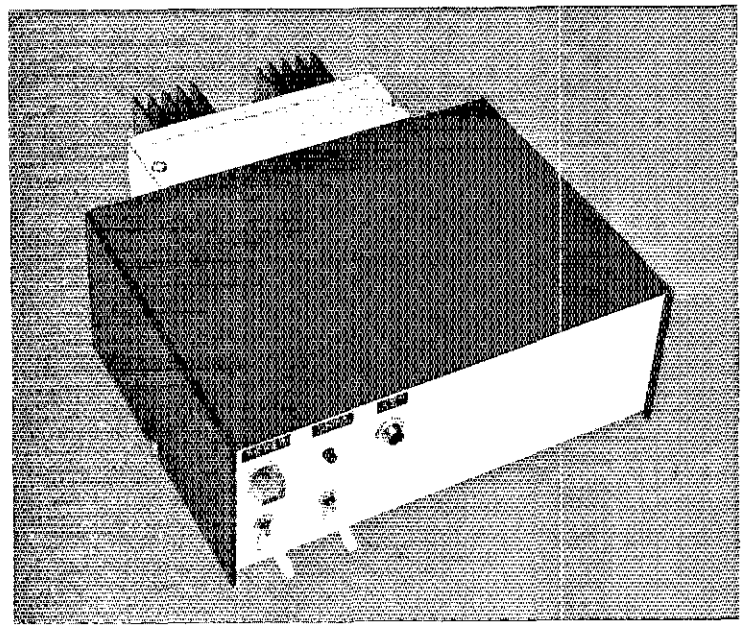
The unit provides a resistive load for the radio's single-ended audio output or bridge-output power amplifiers when the speaker is switched off through the ED-707, as well as adjustable timers for sounder/horn, tone-burst transpond, off delay, PTT delay and interdigit time. For additional information contact Cetec Vega, 9900 Baldwin Pl, El Monte, CA 91731, tel 818-442-0782. —*Bruce O. Williams, WA6IVC*



Next Month in *QST*

Several construction and tutorial articles await you in April *QST*. Among them is an article on SuperSCAF and Son—a team of switched-capacitor audio filters that can't be beat, and Part 1 of a four-part series on OSCAR operation. The first installment introduces you to some basic satellite terminology and concepts. And no April issue would be complete without a variety of antenna projects. Having trouble meeting the code requirements for that Extra Class ticket? Check out the article on one ham's system for cracking the 20-WPM barrier. Also, if contests are your thing, you won't want to miss the results from the 160-Meter and EME contests and Straight Key Night, and the rules for the Great Armadillo Run.

A CW Transmitter for 902 MHz



This easy-to-build project is the perfect companion to the receiving converter and antenna described earlier in *QST*.

By Donald L. Hilliard, WØPW
ARRL Contributing Editor
PO Box 563, Boulder, CO 80306

The 902-MHz band, made available to the Amateur Service last September, can provide many stimulating challenges to the amateur who enjoys constructing equipment. Experimenters with some VHF and UHF building experience should have no trouble getting equipment for 902 MHz into operation. Many of the construction techniques used on 432 MHz still apply.

The project described here is a multiplier-type, crystal-controlled CW transmitter. Output power is 10 W. It is relatively simple to build and can be tuned up with readily available test equipment. Amateurs familiar with VHF and UHF techniques will see that stages of this transmitter design can be used along with the 902-to-144 MHz receiving converter I described in October 1985 *QST* to build a 902- to 144-MHz transverter, if tunable operation is desired.[1]

Block Diagram

I designed the transmitter with many similarities to the 902- to 144-MHz receiving converter. Fig 1 shows a block diagram of the transmitter. The low-level exciter section uses four 2N5179 transistors. These devices are relatively inexpensive and are readily obtainable. The oscillator is tuned to approximately 112 MHz. The crystal frequency used depends on where in the 902-MHz band you want to operate. Three doubler circuits multiply the oscillator signal to the 902-MHz band. Output power is a few milliwatts. A simple band-pass filter cleans up the exciter output.

[1]Notes appear on page 39.

The power amplifier section consists of two prepackaged, class-C gain blocks from Toshiba. The driver requires about 1-mW of input power for 100-mW output, and the final amplifier requires about 100-mW drive for 10-W output. Another bandpass filter ensures a spectrally clean signal. A single power supply provides operating voltages for the various stages.

The transmitter is built in modules for maximum flexibility and ease of construction and troubleshooting. First, I will describe the design, construction and testing of the exciter. Then I will move on to a complete description of the RF power amplifier, followed by a discussion of filtering. Last, I will describe a suitable power supply and control circuitry.

The Exciter Circuit

Fig 2 is a schematic diagram of the exciter. The oscillator (Q1) is a standard overtone circuit. A fifth-overtone crystal, 80.545 MHz, is operated on the seventh overtone, 112.763 MHz. Typically, fifth-overtone crystals work well up to the eleventh or thirteenth overtones. They are usually less expensive than higher-mode crystals and are more readily available.

C6 couples the output of the oscillator to Q2, which operates as a doubler to 225.5 MHz. A double-tuned circuit (C7, L2, L3, C10) is used in the collector of Q2 to reduce the level of the 112-MHz oscillator signal. This type of filtering is required if the spurious components at the output frequency are to be adequately suppressed. The output of Q2 is capacitively coupled (C11) to the base of Q3. This method of coupling may not be optimum, but it is simple and works adequately in this circuit. The double-tuned circuit in the collector of Q3 (C12, L4, L5, C15) is tuned to 451 MHz.

A small capacitance, 2.7 pF, couples the 451-MHz signal to the base of another 2N5179, Q4, which doubles the signal to 902 MHz. Originally I tried an MRF911 in this circuit. However, the MRF911 was rather unstable and its output somewhat low. After spending a couple of hours trying to stabilize it, I tried a 2N5179. It proved to be stable and had considerably more output. Undoubtedly the MRF911 could have been made to function well, but the main purpose in designing the exciter was to provide a circuit that is stable, easily adjusted and inexpensive. Considering these goals, the 2N5179 is a better choice in this circuit.

The output of the 902-MHz doubler has a triple-tuned circuit (C17, L6, C19, L7, C20, L8) in its collector. Using only a double-tuned circuit, the signals 451 MHz on either side of the carrier were down only about 40 dB below the carrier (−40 dBc), and the second harmonic was down only about −40 dBc. The addition of another tuned circuit reduced the 451-MHz component to −44 dBc and the 1353-MHz component to −64 dBc. A 50-ohm pi attenuator (R7, R8, R9) at the exciter output reduces the power level to that required to drive the next amplifier stage.

Building the Exciter

The enclosure that houses the exciter is made from unetched pieces of 0.062-inch, G-10 glass-epoxy circuit board. The base piece is 6 × 1¾ inches, and the sides and ends are ¾-inch high. This provides a strong, well-shielded box.

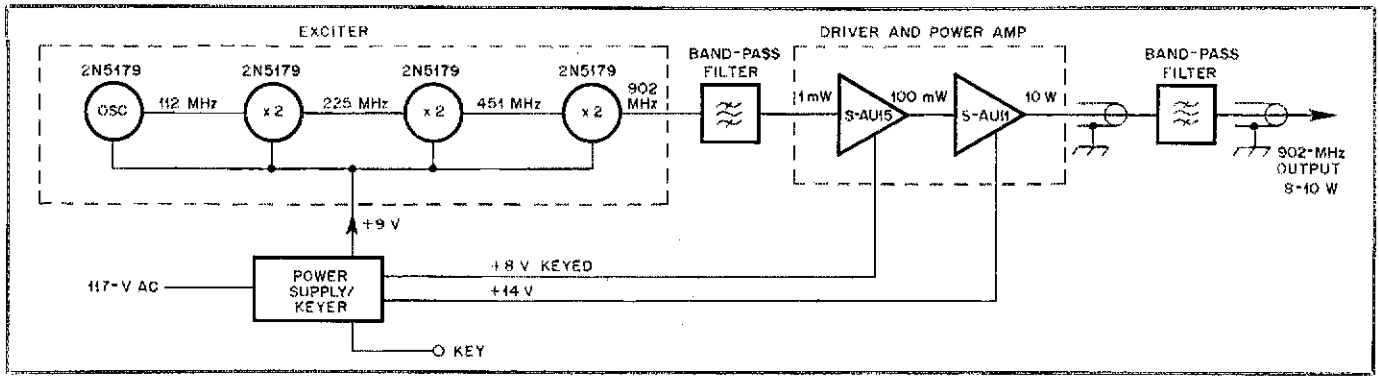


Fig 1—Block diagram of the 902-MHz CW transmitter.

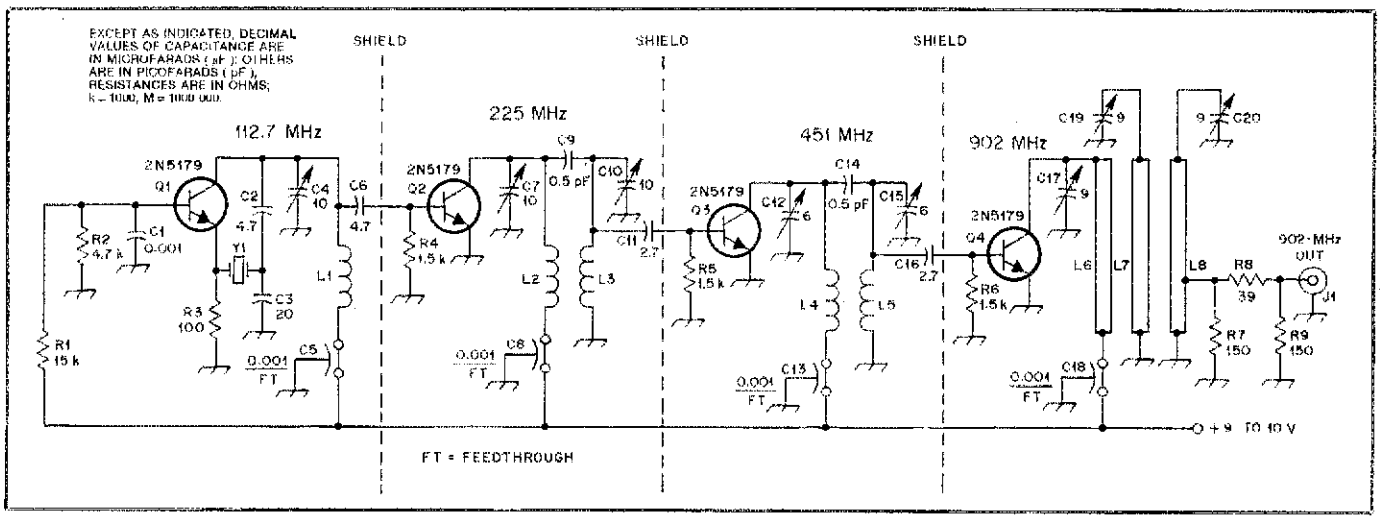


Fig 2—Schematic diagram of the exciter. Resistors are ¼-W carbon composition. Capacitors are 50-V epoxy-coated ceramic types unless otherwise noted.

C4, C7, C10—1.5-15 pF miniature air-variable capacitor (Trim-tronics 10-1120-25015-000 or equiv).
C5, C8, C13, C18—470- to 1000-pF ceramic feedthrough capacitor, solder-in type preferred.
C9, C14—0.5-pF "gimmick" capacitor (see text).
C12, C15—1-6 pF miniature air-variable capacitor (Trim-tronics 10-1120-25006-000 or equiv).
C17, C19, C20—0.6-9 pF ceramic piston trimmer capacitor (Voltronics EQT9 or equiv).
J1—Chassis-mount female BNC connector (UG-1094 or equiv).
L1— 5t no. 22 tinned wire, 0.228-in ID (no. 1 drill), spaced 1 wire dia.
L2, L3—4t no. 18 tinned wire, ¼-in ID, spaced 1 wire dia.
L4, L5—2t no. 18 tinned wire, ¼-in ID, spaced 1 wire dia.
L6, L7, L8—Inductor made from copper strap, 1-in long × 1/8-in wide. See text and Fig 3 for details.
Q1-Q4—2N5179 transistor.
Y1—Fifth-overtone crystal, 80.545 MHz, or seventh-overtone crystal, 112.763 MHz, HC-25 holder, series resonant, 0.005% (avail from JAN Crystals, 2400 Crystal Dr, Ft Meyers, FL 33906 tel 800-237-3063).

Figs 3 and 4 show the general layout. Unless you have had experience laying out UHF circuits, I strongly recommend that you follow the described layout. Build the oscillator section first, then the first doubler, and so on. This allows you to test the circuits individually as you build.

All components except J1, the output BNC connector, are mounted on the foil side of the board. Ground connections are made directly to the copper ground plane. Using Fig 3 as a guide, first install the components that mount through holes in the circuit-board box. The four transistors mount in 0.190-inch-diameter holes. The feedthrough capacitors should be of the solder-in type and must have good UHF characteristics. The piston trimmers used in the 902-MHz output circuit mount in ¼-inch holes. The output connector, J1, mounts in a 3/8-inch hole.

Components such as resistors and capacitors that make up the circuit are soldered together and supported by their leads. Keep in mind throughout the construction phase that all leads should be kept to a minimum length. Stray capacitance and inductance can be troublesome in a circuit such as this. All resistors are ¼-W carbon types. Do not use metal-film resistors.

The 0.5-pF coupling capacitors in the 225- and 451-MHz tuned circuits are of the "gimmick" type. They are made from short lengths of small, plastic-covered hookup wire twisted tightly together. The twisted length is 1/4 to 5/16 inch.

Refer to Fig 4 for layout specifics. L2 and L3 are mounted approximately 1/2 inch apart, center to center. L4 and L5 are mounted approximately 3/8 inch apart, center to center. Details of L6, L7 and L8 are given in Fig 3.

After the oscillator circuit is finished, solder in place the shield that separates the oscillator and first doubler. In the unit shown in Fig 4, this shield is made from thin brass stock. This brass may be obtained from most hobby and hardware stores. If you wish, however, you could use circuit-board scraps instead of brass. There are similar shields between the other stages.

Exciter Adjustment

If you're experienced in tuning up UHF equipment and have a spectrum analyzer, you can probably tune up this exciter in two to three minutes. It is best to adjust one stage at a time, starting with the oscillator. First adjust C4 for maximum output at 112.7 MHz. A dip meter may be used to

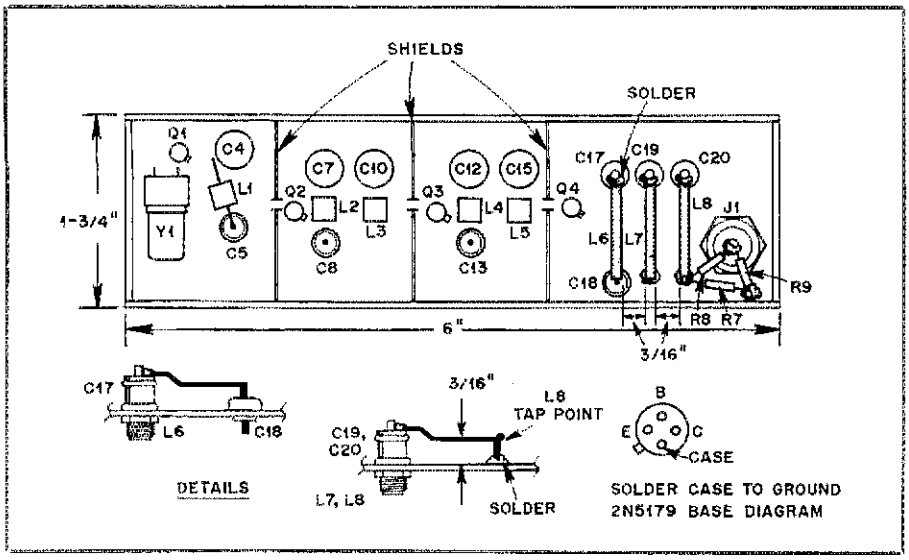


Fig 3—Suggested layout and construction details for the 902-MHz exciter.

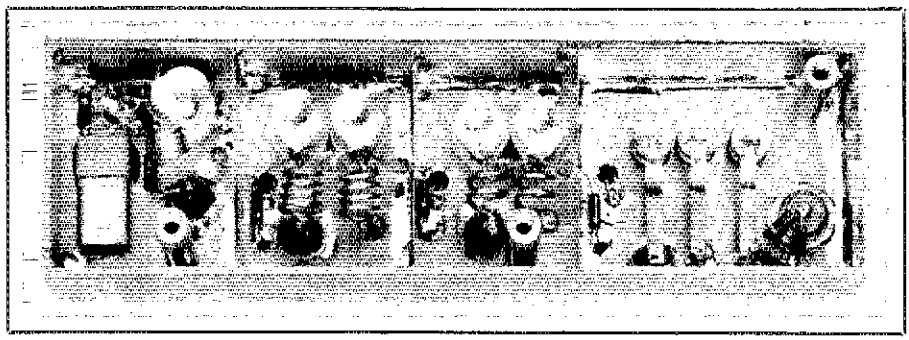


Fig 4—The exciter is built on a piece of copper-clad circuit-board material. Component leads are soldered together; lead lengths are as short as possible. Shields are used between each stage. Study this photo and Fig 3 for additional details.

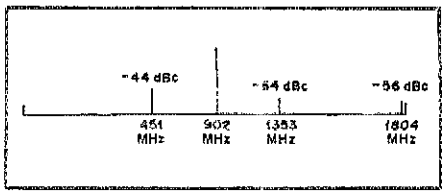


Fig 5—Spectral output of the 902-MHz exciter with no external filtering.

specified is 3 mW, so a pi attenuator is used to reduce the exciter output to the right level. The exact output power will vary from unit to unit, so the values of resistors R7, R8 and R9 that form the pi attenuator may have to be changed to obtain the desired output level. Resistor values may be obtained from Chapter 25 of *The 1986 ARRL Handbook*.[2] Keep in mind that a bandpass filter will be used between the exciter and driver stage, and the attenuation in this filter will also reduce the exciter output level.

Driver and Power Amplifier Stages

During the development of this transmitter, I initially decided to use tuned amplifiers and a 20-W power block to amplify from the milliwatt level to a reasonable amount of power. The units were constructed and tested, and they worked well. The power block used as a

Fig 6—Schematic diagram of the driver and power-amplifier stages.
C21-C25—470-pF, 50-V ceramic chip capacitor.
C26, C27—470- to 1000-pF ceramic feedthrough capacitor, mounted with nut.
C28—470- to 1000-pF ceramic feedthrough capacitor, solder-in type preferred.
J2, J3—Chassis-mount female BNC connector (UG-1094 or equiv).
RFC1-5—3t no 28 tinned wire, 0.10-in ID, spaced 1 wire dia.
U1—Toshiba S-AU15 driver module (see text).
U2—Toshiba S-AU11 power-amplifier module (see text).

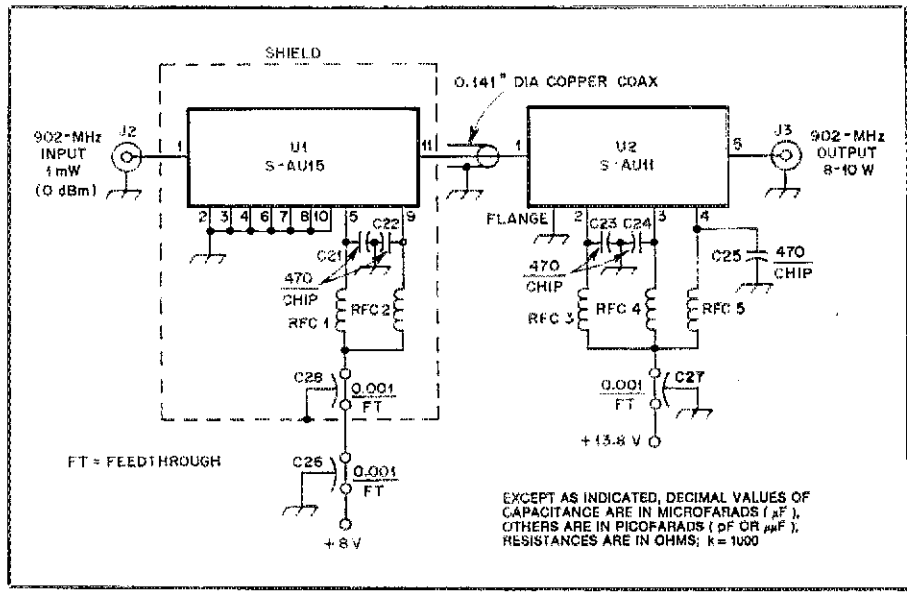
determine this. Check to see that the oscillator starts readily by removing and reapplying the 9-V supply.

Once you're satisfied with the oscillator performance, apply supply voltage to C8 also. Again, using a dip meter or some other indicator, peak C7 and C10 for maximum output at 225 MHz. Similarly tune the next doubler by adjusting C12 and C15 for maximum output at 451 MHz.

Now adjust the 902-MHz doubler stage. Your dip meter probably does not cover this high a frequency, so you need another way of monitoring power. A simple diode detector such as an RF probe on your VTVM will work well. Touch the RF probe to the center pin on the output connector, J1, and tune C17, C19 and C20 for maximum output. This point will occur with all three capacitors near minimum capacitance if the circuits have been constructed properly. A power meter such as the Hewlett Packard 430, 431 or 432 series may also be used as an indicator.

Repeak all the tuning capacitors for maximum output at 902 MHz. Once this is done, the output should be approximately 4 to 6 mW. Fig 5 shows what the output should look like on a spectrum analyzer.

This power level is still more than the 1 to 1.5 mW needed to drive the S-AU15 amplifier. The maximum drive power



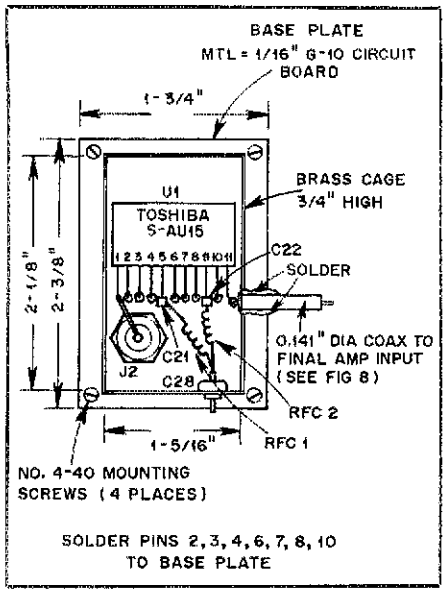


Fig 7—Construction details of the Toshiba S-AU15 driver subassembly.

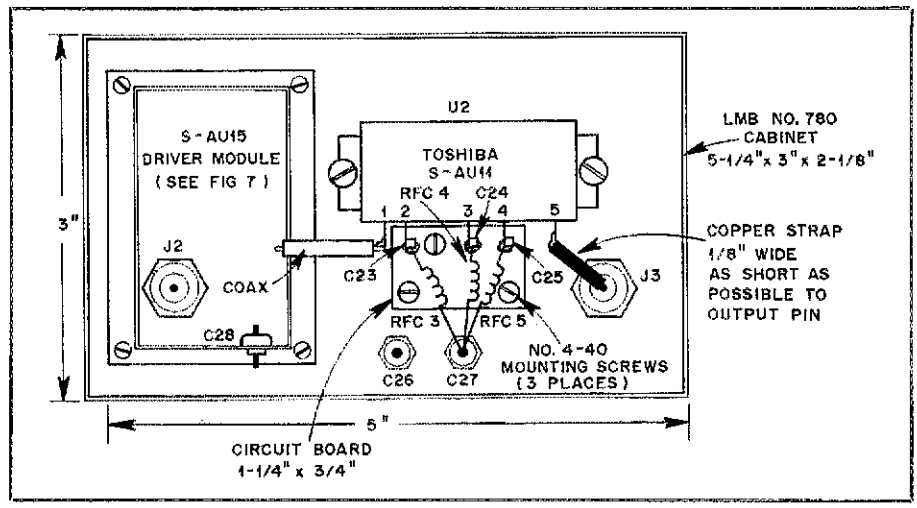


Fig 8—Construction details of the Toshiba S-AU11 final amplifier and the driver subassembly.

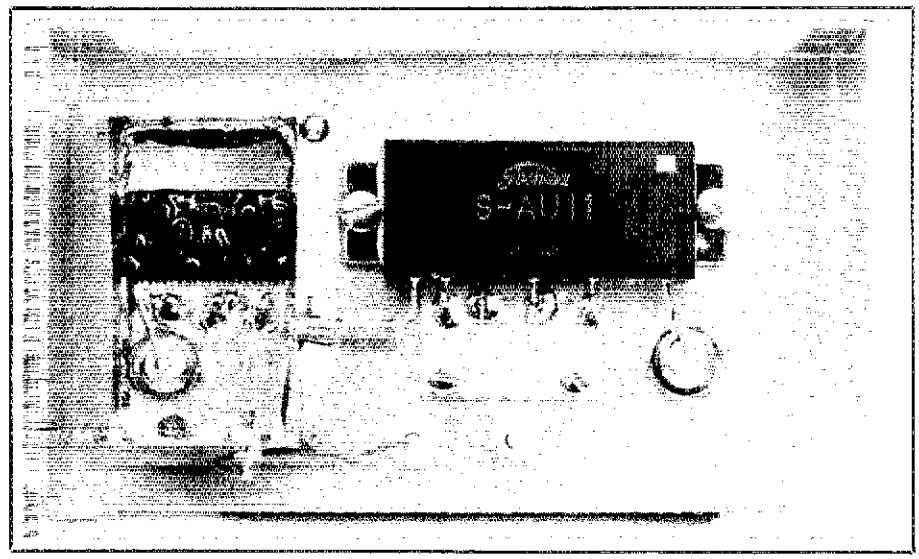


Fig 9—The driver and power amplifier mount in an LMB-780 Minibox. A heat sink is necessary for the final-amplifier module.

final amplifier was rather expensive, however, so I looked for a better, less expensive way.

In mid-1984, Toshiba started producing power amplifiers for 900 MHz. The Toshiba S-AU15 driver stage and S-AU11 final stage appeared to be just what was needed. The S-AU15 is a small, multi-lead package that delivers up to 200-mW output with only 1.5-mW drive. It requires 8-V dc. The S-AU11 power module is rated at more than 9-W output with 100-mW drive. A check with the West Coast distributor for Toshiba yielded single-quantity price information of $9.95 for the S-AU15 and $31.50 for the S-AU11.[3] Wow, I thought—10-W output and 40-dB of gain for just over $40! The day after receiving them, I spent two hours building the amplifier unit described here.

Fig 6 is a schematic diagram of the driver and power amplifier stages. The Toshiba modules are encapsulated "black boxes" with leads. The only additional components are input, output and power connections, and some RF chokes and bypass capacitors on the power leads. No adjustments whatsoever are required. Just apply dc and RF drive. This is so much simpler and easier than building up discrete component amplifiers and struggling to get them working properly!

Initially, I had some reservations about building one box with 40 dB of gain in it. I decided to give it a try, however, and tried to use adequate decoupling. Maybe I could get away with it. I connected power supplies to the completed unit and apprehensively applied 1 mW (0 dBm) of 902-MHz power to the input. The wattmeter on the output registered 10 W. The unit appears to be unconditionally stable.

Building the Driver and Power Amplifier

Figs 7, 8 and 9 show construction details of the driver/power-amplifier module. The driver amplifier is built as a subassembly, as shown in Fig 7. A 2-3/8- × 1-3/4-inch piece of 0.062-inch-thick G-10, glass-epoxy circuit-board stock is used as a base plate. An enclosure 3/4 × 2-1/8 × 1-1/4 inches (HWD), constructed of "hobby-shop" brass sheet, is soldered to this base plate. This is the same brass material that I used for the shields in the exciter. It can be cut with regular scissors and bent into shape easily. It may be easier to cut or punch the holes for C28 and the output coaxial cable before this enclosure is soldered to the base. The completed driver subassembly is mounted in place by four no. 4-40 screws, one in each corner of the plate.

Fig 8 details the general component layout. A small piece of 0.062-inch-thick G-10 circuit-board material is mounted with three screws immediately under the leads of the S-AU11. This allows for easy soldering of chip capacitors C23, C24 and C25 to the ground plane.

The S-AU11 device must be capable of dissipating a few watts, so the heat sink shown in Fig 9 is necessary. This heat sink is held in place by the two no. 6-32 screws used to mount the S-AU11 module. Holes are drilled and tapped in the heat sink to accommodate this type of mounting.

Again, there are no adjustments to make to the Toshiba power modules. Just apply power and RF drive, and you're on the air. Output power should be between 8 and 10 W, depending on the drive level from the exciter.

RF Filtering

Amateur-designed equipment often will not be spectrally clean. Although the FCC does not specify a minimum level for harmonics and spurious signal components at 902 MHz, good amateur practice dictates that they should not exceed −60 dBc. When class-C amplifier stages are added,

the spurious levels may increase significantly. Additional output filtering is required for this transmitter. I recommend that a filter be used at the output of the exciter and another at the power amplifier output.

I built and tested three different filters for possible use with this transmitter. They vary in performance and complexity. Two of the designs have relatively high loss and would make good choices for filtering the exciter output. The third filter, although a bit more difficult to build, has much lower loss than the other two (only 0.2 dB) and would make a good choice for an output filter. Using either of the first two filters between the exciter and power amplifiers and the third filter at the output, all spurious levels are greater than −60 dBc.

Fig 10 shows the construction details of a simple bandpass filter. It uses a box constructed from circuit-board material, much like the box the exciter is built in. The one drawback of this filter is that it uses two rather expensive (about $3 each) piston trimmer capacitors for C1 and C2. Perhaps a redeeming feature is that it has a wide tuning range. Fig 11 shows what inserting this filter at the exciter output does. The 451- and 1353-MHz components are reduced significantly. The 3-dB bandwidth of the filter is approximately 7.6 MHz, and the insertion loss is approximately 1.7 dB with the coupling loops positioned as shown in Fig 12.

The second filter is similar to one described by Rick Campbell, KK7B, in a paper presented at the Estes Park, Colorado 1296/2304 Conference held September 19-22, 1985. It is based on a computer-aided design that recently appeared in *Ham Radio* magazine.[4] This interdigital filter has only 1-dB loss at 902 MHz. It does not require any tuning if built according to the description. Small errors in the dimensions, however, will degrade performance, and this usually means that losses will increase.

Fig 13 shows the construction details. The top and bottom plates of the enclosure are made from 0.062-inch-thick circuit-board material. The side and end plates are made from 0.032-inch-thick brass sheet. Inside dimensions of the enclosure are critical and must not be modified. Solder all contacting edges at final assembly.

This filter uses short lengths of 0.141-inch miniature Hardline for the resonators. The KK7B design used SMA connectors, but I opted for the BNC connector. Although inferior to the SMA series, the BNC series is adequate at this frequency if the connector has not been physically abused. The center conductor will be removed from the Hardline during final assembly, leaving the Teflon® dielectric in place in the copper tube. When assembling the filter, you may find it convenient to partially remove the inner conductor wire and use it to hold the resonator in place while making the soldered connections. Save the center conductor. If you want to tweak the filter for optimum performance, make small tuning changes by inserting the inner conductor into the open end of the resonator.

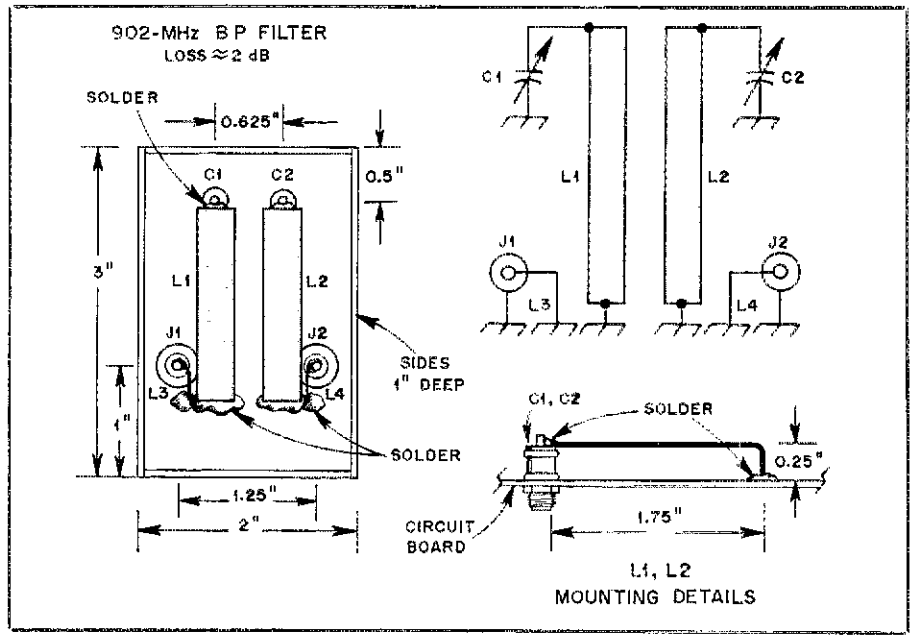


Fig 10—Schematic diagram and construction details of the simple 902-MHz band-pass filter. The base and sides are made from 0.062-in copper-clad circuit-board material.

C1, C2—0.6-9 pF ceramic piston trimmer capacitor (Voltronics EQT9 or equiv).
J2, J3—Chassis-mount female BNC connector (UG-1094 or equiv).
L1, L2—Copper strap 2-in long × 11/32-in wide × 1/32-in thick.
L3, L4—Coupling loop, no. 18 wire, spaced 1/16 inch from L1 and L2.

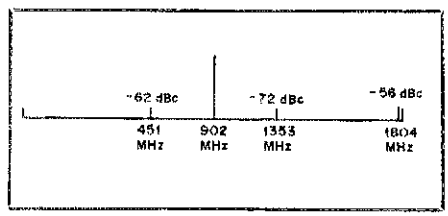


Fig 11—Spectral output of the 902-MHz exciter with the simple band-pass filter shown in Fig 10 on the output.

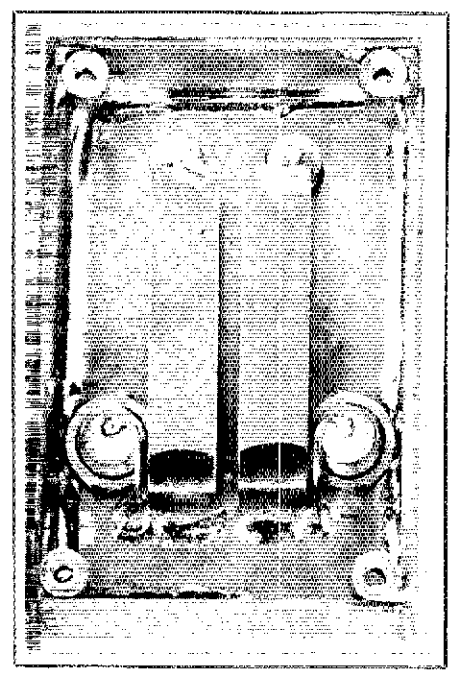


Fig 12—The simple bandpass filter is built in an enclosure made from circuit-board material.

This interdigital filter has an advantage over the simple tunable band-pass filter. Depending on the load impedance, the capacitors in the tunable version may arc if power levels of several watts are used. The interdigital filter does not use capacitors, so this limitation does not apply.

Fig 14 shows the effect that this filter has on the exciter output. The 451- and 1353-MHz components are reduced significantly, and the second-harmonic level at 1804 MHz remained about the same, −56 dBc. This filter has a 3-dB bandwidth of 26.5 MHz and an insertion loss of 1 dB. The finished, sealed filter is shown in Fig 15.

The third filter is shown in Figs 15 and 16. It is a variation of one described in *QST* some years ago.[5] Although somewhat larger than the previous two filters, it has relatively low loss and a considerably higher power-handling capability.

Again, it is important to follow the dimensions carefully if you expect the best performance. The resonator and coupling elements are made from brass rod, and the end plates are rectangular aluminum bar stock. The top and bottom plates are aluminum sheet. Good contact between the

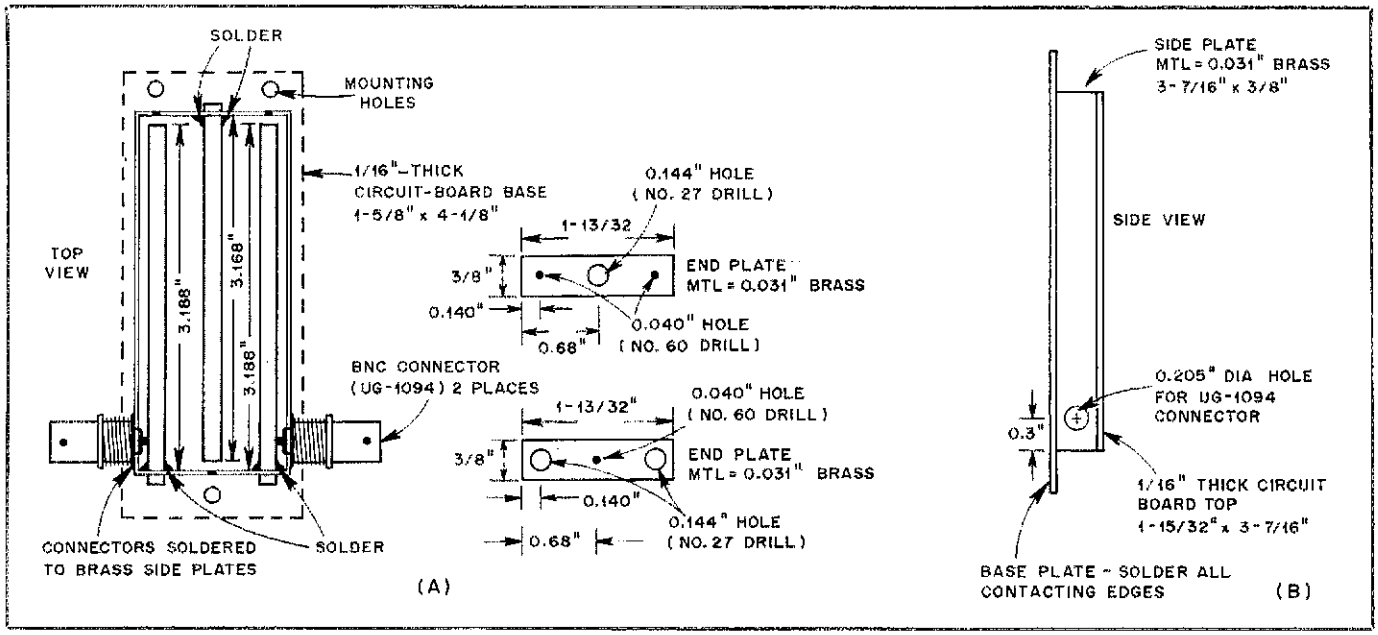


Fig 13—Construction details for the three-resonator interdigital filter. No tuning is required if you follow the dimensions given. The inside dimensions of the box are critical.

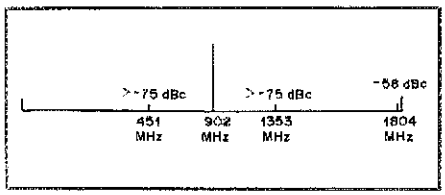


Fig 14—Spectral output of the 902-MHz exciter with the three-resonator interdigital filter shown in Fig 13 on the output.

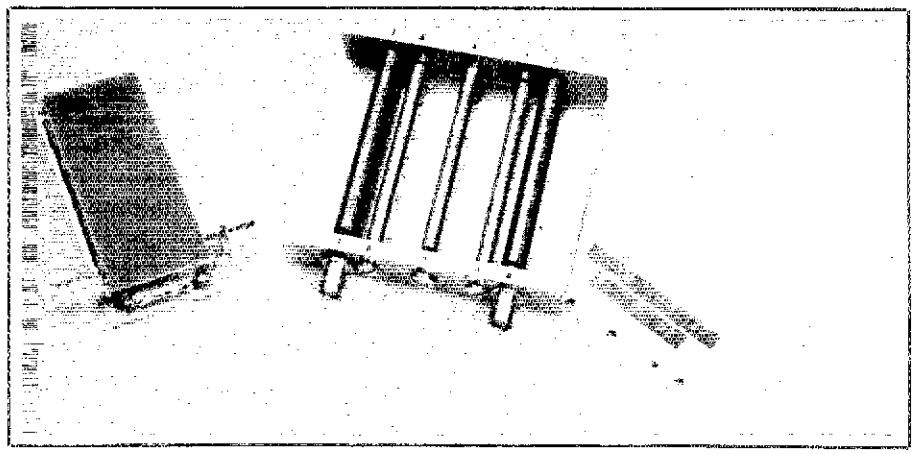


Fig 15—The three-resonator interdigital filter (Fig 13) with the cover soldered in place and the five-element filter (Fig 16) with the cover removed.

resonator rods and the end plates is essential to reduce losses. Note the number and placement of machine screws. The top and bottom plate mounting screws are positioned so that there is a good connection at each of the filter element rods.

Long-term performance may suffer if the electrical connections between the filter parts deteriorate. I'm fortunate to live in a dry climate where corrosion is not a problem. If you live in an area where exposed metals tend to oxidize, you should probably make all of the metal parts from brass. Have them silver-plated before assembly. Another alternative is to make the parts from brass and solder the connections after assembly and testing. If you can't find them locally, brass and aluminum sheet, and rod and bar stock are available in small quantities from Small Parts, Inc.[6]

The resonant frequency of this filter may be lowered by turning the no. 10-32 screws at the ends of the resonator elements or raised by shortening each of the elements. The 3-dB bandwidth is 68.9 MHz, and the insertion loss was measured at 0.2 dB.

Power Supply and Keyer

The power-supply schematic diagram is shown in Fig 17. The transformer/bridge, rectifier/capacitor combination delivers the unregulated dc voltage to three separate adjustable 3-terminal regulators and a fixed 12-V regulator. U1, a 7812 12-V regulator, is included to supply a matching receiving converter and preamplifier. U2, a 317-type of adjustable regulator, is set to supply a keyed voltage of approximately 8 V through Q1 to the Toshiba S-AU15 driver stage. U3, another 317-type regulator, is adjusted to supply 9 to 10 V to the exciter stages. You can vary the voltage of this supply to adjust the transmitter power output. U4, a higher-current 317K-type of regulator, supplies 13.5 V at approximately 1.5 A to the Toshiba S-AU11 final-amplifier package.

The keyer transistor, Q3, is a PNP power device. I used a Radio Shack 276-2027. Almost any PNP transistor capable of handling a collector current of 100 to 125 mA can be used here.

The regulators require adequate heat sinking. The power transformer shown in the photographs has a 24-V secondary, resulting in an unregulated output of approximately 37 V. This means that the regulators must dissipate quite a bit of power. A much better choice would be a transformer with a 13- to 15-V secondary. This would reduce the voltage drop in the regulators and allow them to run cooler. The LM317K shown in the photographs runs rather warm, and more of a heat sink should have been used than just the corner of the cabinet.

The keyer circuit provides a clean-sounding CW note. If desired, an RC network could be used in the base of the

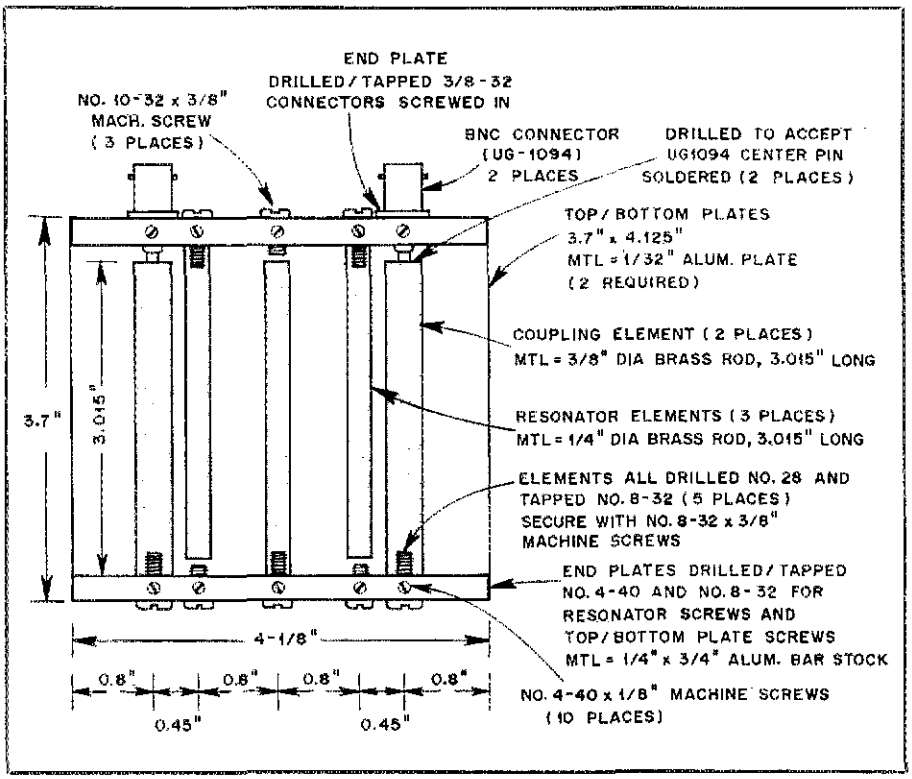


Fig 16—Construction details for the five-element interdigital filter.

keying transistor to alter the attack and decay times of the keying wave form.

Packaging

I tend to build things without thinking much about how the end product will be packaged. This should be obvious from the pictures. There are X number of boxes to be combined into one unit, with power supply and so on. I packaged them as shown in Fig 18 because I happened to have the cabinet. It would be wise to estimate in advance what area you need and acquire an appropriate case. For convenience, you may want to package the receiving converter, preamp, transmitter and power supply in the same cabinet, along with antenna-changeover relay and other control circuitry. Consider these options as you decide on the final packaging.

Conclusion

Although 10 W is a rather modest amount

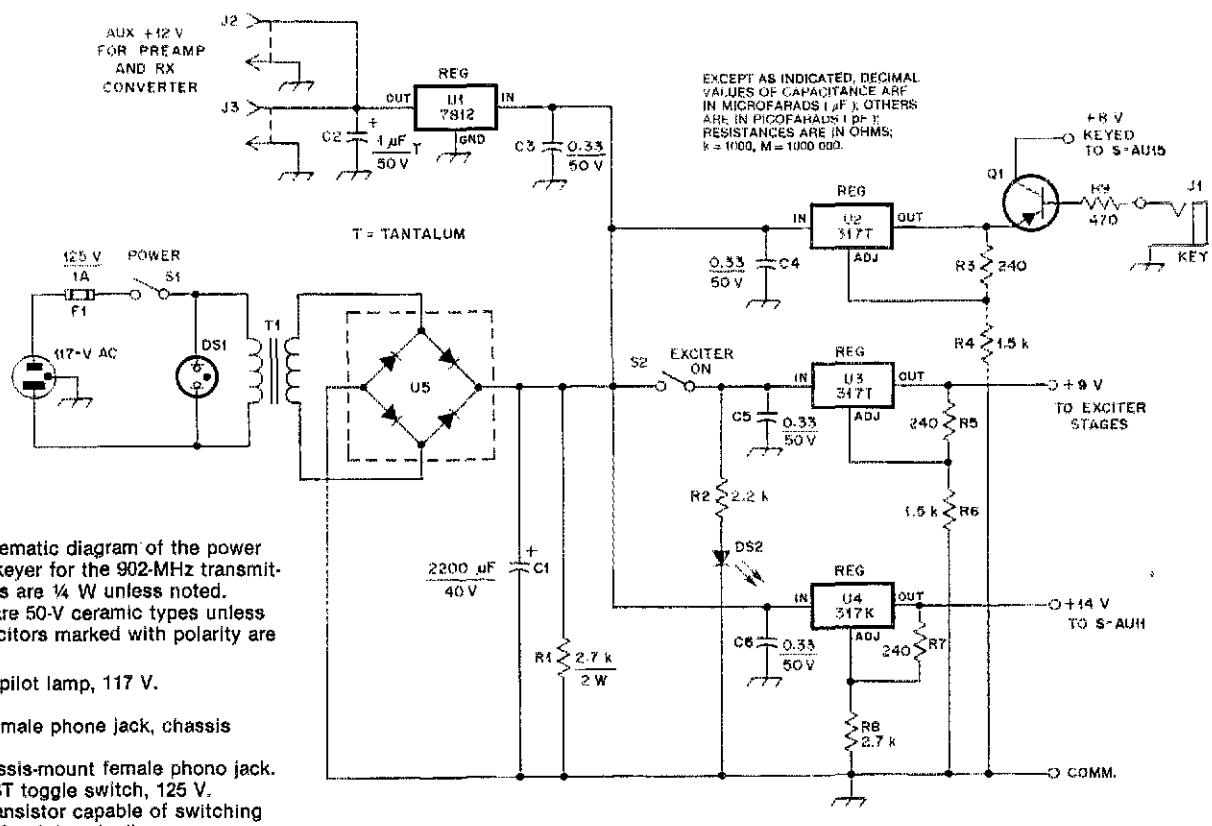


Fig 17—Schematic diagram of the power supply and keyer for the 902-MHz transmitter. Resistors are ¼ W unless noted. Capacitors are 50-V ceramic types unless noted. Capacitors marked with polarity are electrolytic.

DS1—Neon pilot lamp, 117 V.
DS2—LED.
J1—1/4-in female phone jack, chassis mount.
J2, J3—Chassis-mount female phono jack.
S1, S2—SPST toggle switch, 125 V.
Q1—PNP transistor capable of switching 10 V at 150 mA (see text).
T1—Power transformer; primary, 117-V; secondary, 15-24 V, 2 A (see text).
U1—12-V, 1.5-A 3-terminal regulator (LM7812 or equiv).
U2, U3—Adjustable 1.5-A 3-terminal regulator (LM317T or equiv).
U4—Adjustable 3-A 3-terminal regulator (LM317K or equiv).
U5—50-PIV, 4-A bridge rectifier module.

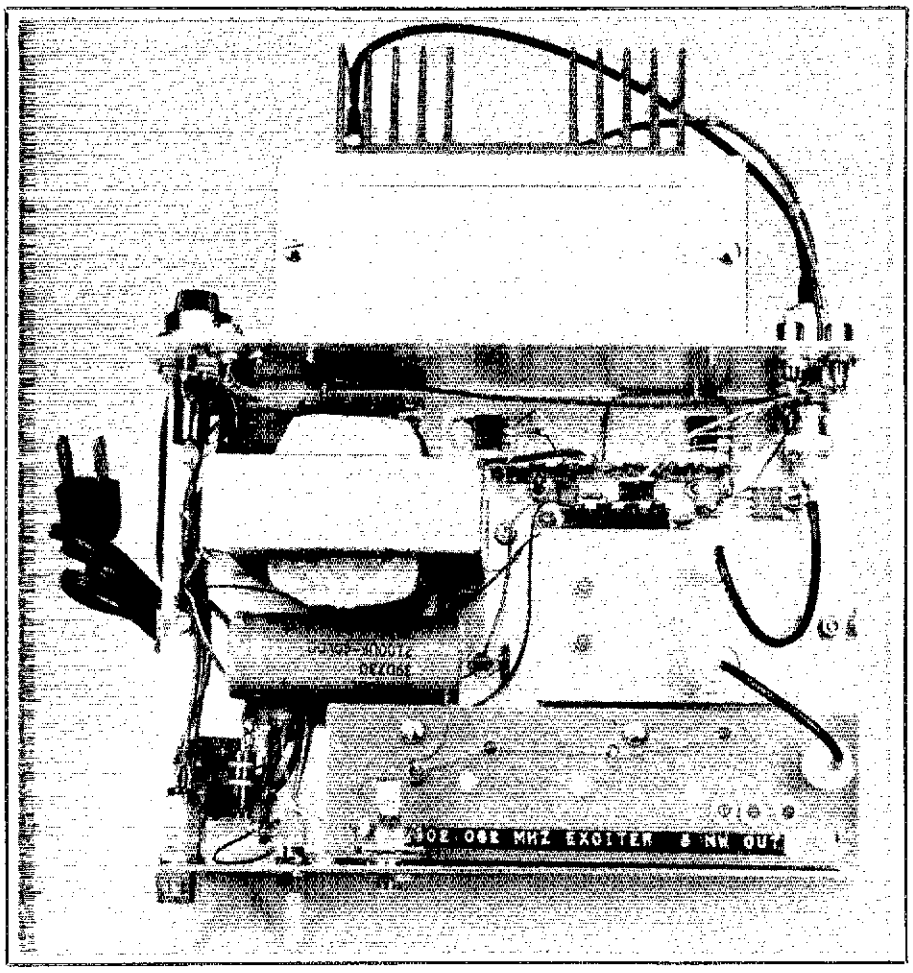


Fig 18—Interior view of the completed 902-MHz transmitter.

of power on 902 MHz, many interesting things can be done. When used with a good antenna system, contacts out to 200 to 300 miles should be easy with stations of similar or better capability. This assumes a good location with the antenna above surrounding objects and trees. During periods when tropospheric ducting is present, contacts at distances greater than 1000 miles might be made. Of course, this unit can be used to drive a higher power amplifier.

Give 902 MHz a try and be among the first to explore our new band!

Notes

[1]D. Hilliard, "A 902- to 144-MHz Receive Converter," *QST*, Oct 1985, pp 21-26.
[2]M. Wilson, ed, *The 1986 ARRL Handbook* (Newington: ARRL, 1985), p 25-44.
[3]Toshiba modules are available in single-lot quantities from Matcom, Inc, 4505 San Antonio Rd, Palo Alto, CA 94306, tel 415-493-6127.
[4]J. Hinshaw and S. Monemzadeh, "Computer-Aided Interdigital Bandpass Filter Design," *Ham Radio*, Jan 1985, pp 12-26.
[5]R. Fisher, "Interdigital Bandpass Filters for Amateur VHF/UHF Applications," *QST*, Mar 1968, pp 32-33.
[6]Small Parts, Inc, 6901 NE Third Ave, PO Box 381736, Miami, FL 33238, tel 305-751-0856.

QEX

QEX: THE EXPERIMENTERS' EXCHANGE

☐ Wonder what you've been missing by not subscribing to *QEX*, the ARRL newsletter for experimenters? Among the features in the February issue were:

- Eric J. Grabowski, WA8HEB, describes a "TI-99/4A Keyboard Conversion for the TS-1000 Computer."
- Bill Conwell, K2PO, brings us up to date on "Microwave Patent Summaries."
- The 1985 QEX Index.

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.

Strays

CALL FOR *QST* ARTICLES

Hamming is easy for most of us. We're blessed with our senses of sight and hearing and the abilities to move about and easily manipulate equipment controls. We tend to forget there are many amateurs who require assistance to do the things we take for granted. With computers having established their presence in the amateur's shack, perhaps some readers have developed human/computer/radio interfaces for the handicapped. We'd like to hear about them, and so would other *QST* readers. Jot down your ideas and send them to Paul K. Pagel, N1FB, Senior Assistant Technical Editor, ARRL, 225 Main St., Newington, CT 06111.

I would like to get in touch with...

☐ former personnel of the Ft Monmouth, NJ Signal Corps Engineering Lab Development Det, 9400 Tech Service Unit, WW II. Dr John Bradley, K2BAY, Rte 60, Upper Montclair, NJ 07043-1605.

☐ any hams who attended Paul Smith's College. Ted Steinhorst, KA2BIG, 134 Burkeshire Dr, Horseheads, NY 14845.

☐ any hams who served in the 7th AAF Radio Sq, Mobile, during WW II. Dave Seiler, N6ELM, 175 Alta Dr, Watsonville, CA 95076.

☐ any hams who attended SSB radio repair school at Ft Monmouth, NJ in 1950 or served in the 71st Signal Bn in Japan 1951-1952. Richard Pann, W1SUJ, 2447 Yates Dr, Augusta, GA 30906.

☐ any hams who served in the AF, 436th Troop Carrier Gp, 80th TC Sq, WW II. Leon Lustyk, W2PZU, 50 Cinnabar Rd, Rochester, NY 14617.

☐ any hams interested in starting a net for the Tandy 1000 or IBM PCs. Brad Bradford, WB9LFD, 906 Parkway Dr, E Peoria, IL 61611.

• *Under Construction*

Field Tester for Antennas

Part 5: Avoid bringing ac power and heavy test gear to the antenna site. Cut your burden with a portable QRP transmitter and resistive bridge.

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

Is antenna adjustment in the field or backyard a drag because of the test equipment needed out of doors? Perhaps you're weary of using the indoor station for SWR measurements, then trotting back and forth between the house and yard to check the progress of antenna adjustments. Having agonized through both impractical routines, I can understand how one might find the exercise less than appealing!

Being a person who does a substantial amount of antenna design and test work, I chose to build a small portable RF source for checking the SWR at the antenna site. Battery-operated equipment seemed to be the best choice, thereby eliminating the need to run an ac extension cord to the test site. The RF-power source should be QRP in order to minimize battery drain and to reduce the possibility of causing QRM to amateurs who might be operating on or near the test frequency. A transmitter power-output level of 100 to 200 mW should be ample, provided a sensitive SWR bridge is included in the setup. Since most of my antenna-development work is done from 1.8 to 7.3 MHz, I built a three-band tester. There is no reason why the circuit described here can't be expanded to include the 30-, 20-, 15-, 12- and 10-meter bands.

Circuit Philosophy

Fig 1 contains the circuit for my three-band test unit. A VFO seemed more appropriate than a crystal oscillator for Q1. Although we could develop a versatile tester by having three or four switchable crystals per band (Fig 2), the cost would be high and there would be gaps in the frequency coverage. Practically, it is better to be able to cover all of a given band, since this permits us to find the frequency of the lowest SWR, which coincides with the frequency at which the antenna is resistive (resonant). This helps indicate whether the antenna needs to be lengthened or shortened to provide resonance at a chosen frequency.

I made no attempt to design a highly stable VFO. Although the oscillator drift is not great, with a fairly constant ambient temperature, it would be prohibitive for use in a conventional transmitter. A few kilohertz of drift, in a worst-case example, has little significance for most antenna testing. Therefore, no special measures were taken when designing the VFO section of this tester. NP0 ceramic capacitors are recommended for C5, C6 and C7 as a step toward stability.

Inductors that have trimmers in parallel with them are switched into the circuit at S1. C4 serves as the main-tuning control for all three bands. After toroidal inductors L1, L2 and L3 are wound, you should give them at least two coatings of coil cement, such as GC Corp polystyrene Q Dope®. You may make your own high-dielectric cement by dissolving small pieces of polystyrene tubing or sheeting in carbon-tetrachloride. Use enough polystyrene stock to provide a thick consistency. *Caution: Do not allow the carbon tetrachloride to come in contact with your skin, and do not breathe the fumes.* This chemical can cause liver damage!

I chose a broadband, linear amplifier for the buffer stage, Q2. This avoids the need for switching resonant circuits at the Q2 output side. A 2N5179 CATV transistor, or equivalent UHF device, will ensure equal gain for each band, owing to the use of heavy feedback and an untuned collector circuit.

A broadband amplifier without feedback is my choice for Q3. Like Q2, it operates class A. A 2N2222A is suitable for this stage, since it has a high f_T. T1 is a broadband step-down transformer. A key jack (J2) is included in the emitter lead of Q3 to permit proper station identification during test periods.

Our PA section contains another low-cost 2N2222A. It is possible to obtain up to 250 mW (¼ W) from this transistor in the HF spectrum. R15 helps prevent unwanted self-oscillations by swamping T1 (to reduce the transformer loaded Q). R16, on the other hand, provides emitter bias for the class-C PA, Q4. This improves the efficiency while lowering the collector current. I measured the Q4 efficiency at 70 percent with the circuit values provided in Fig 1.

Half-wave filters are used between S2A and S2B. They are designed to transform the Q4 collector impedance to 50 ohms (the SWR-bridge impedance). These harmonic filters are essential in order to minimize harmonic currents at the output of the test set. If harmonics of significant magnitude reach the antenna, erroneous SWR readings can be observed. This is frequently the situation when we are unable to obtain an SWR of 1:1. The harmonics are reflected from the antenna and cause false readings.

The half-wave filters are designed to use standard-value capacitors. They are not optimized in accordance with Ed Wetherhold's (W3NQN) computer derivations for standard-value capacitors, but they will provide adequate harmonic suppression for our purposes. Exercise care in the layout of the filters and S2. Try to provide as much physical isolation as possible between the input and output sides of the filters. If this is not done, leakage will occur across the filters, which will degrade their effectiveness. I recommend a two-pole, three-position wafer switch that has *two* wafers (SP3T per wafer).

SWR Bridge

Not all SWR indicators are true *bridges*, but the one in Fig 1 qualifies as a bridge. The antenna represents the missing leg of

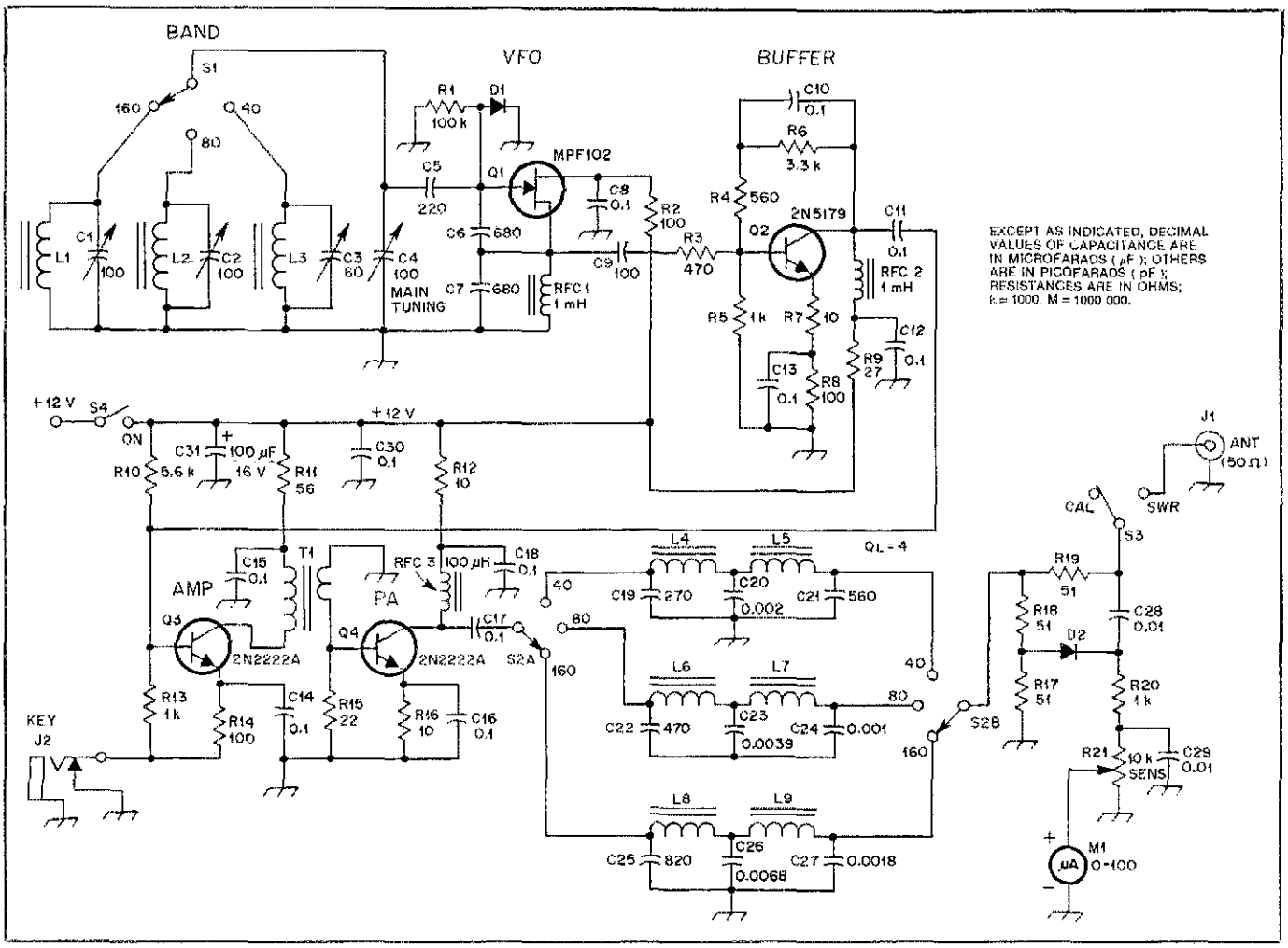


Fig 1—Schematic diagram of the antenna test unit. Fixed-value capacitors are disc ceramic unless otherwise noted. Polarized capacitors are electrolytic or tantalum. Fixed-value resistors are ¼- or ½-W carbon composition. Numbered components not appearing in the parts list are numbered for PC-layout purposes only.

C1, C2, C3—Ceramic or air-dielectric trimmer
C4—Air variable, 100-pF maximum capacitance. Double-bearing type recommended for best stability.
C6, C7, C9—NP0 ceramic or polystyrene.
C19—C27, incl—Silver mica or polystyrene.
D1—1N914 or equiv.
D2—Germanium diode, 1N34A or equiv.
J1—SO-239 coaxial connector.
J2—Phono jack or 1/8"-dia jack
L1—28-μH toroidal inductor. 20 turns of no. 24 enam wire on an Amidon FT-50-61 ferrite core, 125 μ.
L2—7.0-μH toroidal inductor. 35 turns of no. 26 enam wire on an Amidon T68-2 powdered-iron core (red).
L3—2.2-μH toroidal inductor. 21 turns of no. 24 enam wire on a T68-6 core (yellow).
L4—1.88 μH. 20 turns of no. 24 enam wire on a T50-2 core.
L5—0.47 μH. 10 turns of no. 24 enam wire on a T50-2 core.
L6—3.34 μH. 25 turns of no. 26 enam wire on a T50-2 core.
L7—0.83 μH. 13 turns of no. 24 enam wire on a T50-2 core.
L8—6 μH. 35 turns of no. 26 enam wire on a T50-2 core.
L9—1.5 μH. 17 turns of no. 24 enam wire on a T50-2 core.
M1—Dc panel meter, 100 μA full scale (see text).
R21—Carbon-composition control, 10-kΩ, linear taper, panel-mount.
RFC1, RFC2, RFC3—Miniature RF choke.
S1—Single-pole, three-position wafer switch, ceramic or phenolic.
S2—Two-pole, three-position ceramic or phenolic wafer switch, two sections.
S3—SPDT toggle or wafer type.
S4—SPST toggle or wafer type.
T1—Broadband transformer. Primary = 15 turns of no. 26 enam wire on an FT37-43 (850-μ) ferrite toroid. Sec. = 4 turns.

the circuit. The bridge is balanced when the antenna presents a 50-ohm impedance at J1. A 100-μA indicating meter provides a good response to the low-power signal from the QRP transmitter. A 50-μA instrument would be even better, if you have one available.

Construction Suggestions

Instability is often caused by excessive lead lengths in an RF circuit, so we should keep all signal leads as short as practicable. This includes the pigtails on resistors and capacitors in the RF part of our circuit. This practice must be kept in mind if you lay out your own PC pattern.

Similar care must be exercised in laying out the SWR-bridge portion of this test instrument. It is especially important to minimize the pigtail lengths of R17, R18, R19 and C28. Short, direct leads between S2B and R18, along with a short connector from C28 to S3, are necessary. If these leads must be more than 1 inch in length, use RG-174 miniature 50-ohm coaxial cable between the points of concern. Ground the shield braid at each end of the coaxial lines. RG-174 should be used also between S3 and J1.

Packaging is a matter of personal choice. Since this unit is meant for out-of-door use, it is wise to house the circuit in a dust-proof enclosure that will also keep moisture from reaching the circuit. A homemade cabinet can be fashioned from sections of PC-board material, or you may consider building a box from scraps of galvanized-iron furnace-ducting material. A 100-W soldering iron will work nicely for joining

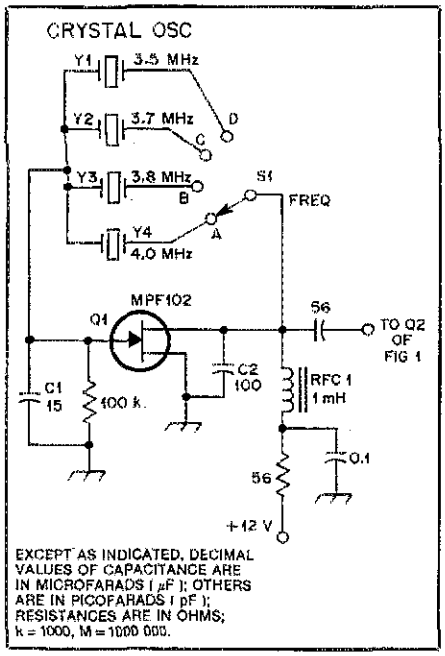


Fig 2—Circuit example of a crystal oscillator that can be used in place of the VFO in Fig 1. Three such oscillators, with appropriate crystals for the bands of your choice, may be integrated into the antenna tester. Each oscillator could be activated by means of a band switch, such as using three sections for S2 of Fig 1. Crystals for use below 20 MHz are fundamental types, 30-pF load capacitance (International Crystal Mfg Co type GP or equiv). Overtone crystals are needed for the 15, 12 and 10-meter bands, plus a different oscillator circuit.

the seams of either style of cabinet. Contact paper may be used to cover the completed cabinet, or you might consider gluing Formica on the exterior surfaces to impart a professional look. There is no reason why a wooden cabinet can't be used for the tester. As an inveterate scrounger (and miser), I try to avoid purchasing expensive project boxes and cabinets! Circuit boards and parts kits for this antenna tester are available.[1]

Adjustment and Use

Connect a 51-ohm, 1-W carbon-composition resistor across J1 as a dummy load. Set S1 and S2 for 160-meter operation. Place S3 in the CAL position. Apply operating voltage via S4. Adjust sensitivity control R21 for a full-scale indication on M1. If the tester is working correctly, you should have no difficulty obtaining a full-scale meter reading. Now, switch S3 to the SWR position. M1 should read zero to indicate an SWR of 1:1. Repeat the foregoing procedure for the two remaining bands.

Calibration of the VFO can be done by monitoring the tester signal with a calibrated ham-band receiver. Set C4 for maximum capacitance, then adjust the related trimmers (C1, C2 and C3) so that the low end of each tuning range falls at zero on the dial plate of the vernier mechanism.

When adjusting antennas for resonance, connect the 50-ohm feed line to J1, then sweep the tuning range for the lowest meter reading at M1 with S3 in the SWR position (the calibration procedure should be carried out just prior to this step). The lowest meter reading will indicate antenna resonance. Now you may adjust your feed-point matching system for a low SWR (1:1) by observing the reading on M1 (tune for the lowest meter indication). A portable receiver should be used to ensure that the frequency is unoccupied before proceeding with the measurements. (This is, after all, a low-power transmitter.)

Power Supply

This test unit draws between 50 and 60 mA. I suggest the use of eight series-connected size-D flashlight cells to provide a 12-V power supply. A 12-V motorcycle or NiCd battery might be a wise investment if you anticipate a lot of antenna testing. This would permit recharging the batteries between testing periods.

Of course, it is practical to use an ac-operated 12-V power supply if you don't object to bringing ac service to the test site. A 100-mA regulated supply would be entirely suitable for the purpose.

In Summary

This is but one more piece of handy test gear you can add to the workshop. Chances are that when your friends learn about your new gadget, it will be on loan more than it is at home! If your preference is for experimenting with antennas for higher frequencies (20, 15, 12 and 10 meters), you may restructure the VFO section of the circuit by changing the L and C constants, or by converting the VFO to a VXO or straight crystal oscillator. The emphasis here has been to illustrate a foundation unit and to mention how the circuit can be used in a practical application.

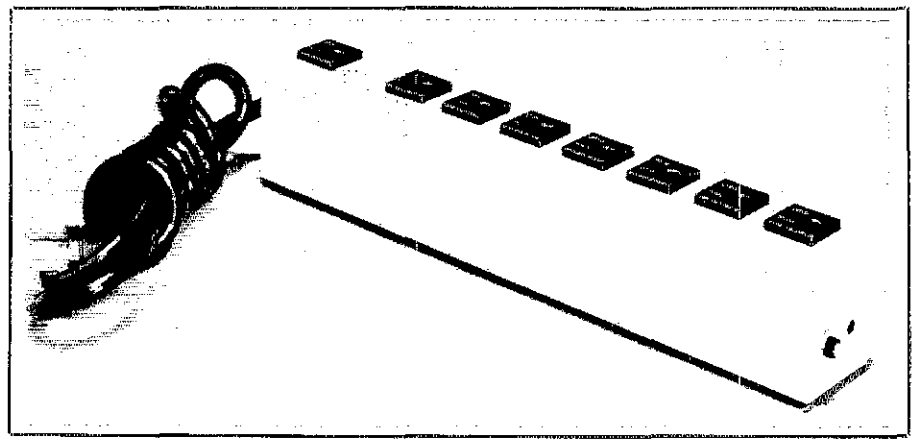
[1]PC boards and parts kits for this project are available from A & A Engineering, 7970 Orchid Dr, Buena Park, CA 90620, tel 714-521-4160.

New Products

HEATH COMPANY GD-1495 SMART OUTLET BOX

☐ The Smart Outlet Box, a device that allows single-switch control of seven ac outlets and provides protection from line surges and transient spikes, has been introduced by the Heath Company. Turning on any device plugged into the GD-1495's control socket will cause power to be sent to six more ac outlets. An eighth socket is unswitched for a clock or other device that requires a constant ac source. The unit provides superior surge and noise suppression and, in addition, has a UL-approved power tap. It includes a new surge absorber that opens under direct surge conditions to eliminate the "hot-to-chassis" ground problems that can result from use of the usual MOV surge suppressor. The Smart Outlet Box is available in kit or assembled form.

For additional information contact your local Heath distributor or Heath Company, Dept 150-589, Benton Harbor, MI 49022, tel 616-982-3210.—*Bruce O. Williams, WA6IVC*



Conducted By Bruce O. Williams, WA6IVC
Assistant Technical Editor

Heath HW-99 Novice CW Transceiver

About a year ago, the Heath Company introduced a new rig that is truly elegant in its simplicity. The HW-99 CW transceiver is a thoroughly modern, HF, CW-only radio that owes much to the lessons learned in developing the HW-9 QRP transceiver. This is *not* a warmed-over HW-16 from the 1960s. The Heath HW-99 is VFO controlled, tuning the bottom 250 kHz of the 80, 40, 15 and 10-meter bands (sorry, *no* 20-meter coverage!). It seems to be targeted primarily for Novice and Technician class operators using CW on the four HF Novice bands, but it should appeal to veteran brass pounders who think 50-W output is enough to work the world.

Like any good CW rig, no matter how simple or complex, the HW-99 has a sensitive and stable receiver, a solid and comfortable tuning dial with no apparent backlash, a tuning rate that is neither too slow nor too fast, a mellow-sounding sidetone and a well-keyed waveform. We have one major complaint about the documentation on the HW-99: We looked through the ½-inch-thick manual several times and never did find a block diagram of the circuit. Reading the more-detailed schematic diagram is no problem for the experienced person, but the block diagram is crucial for the beginner to get a handle on how the circuits interact.

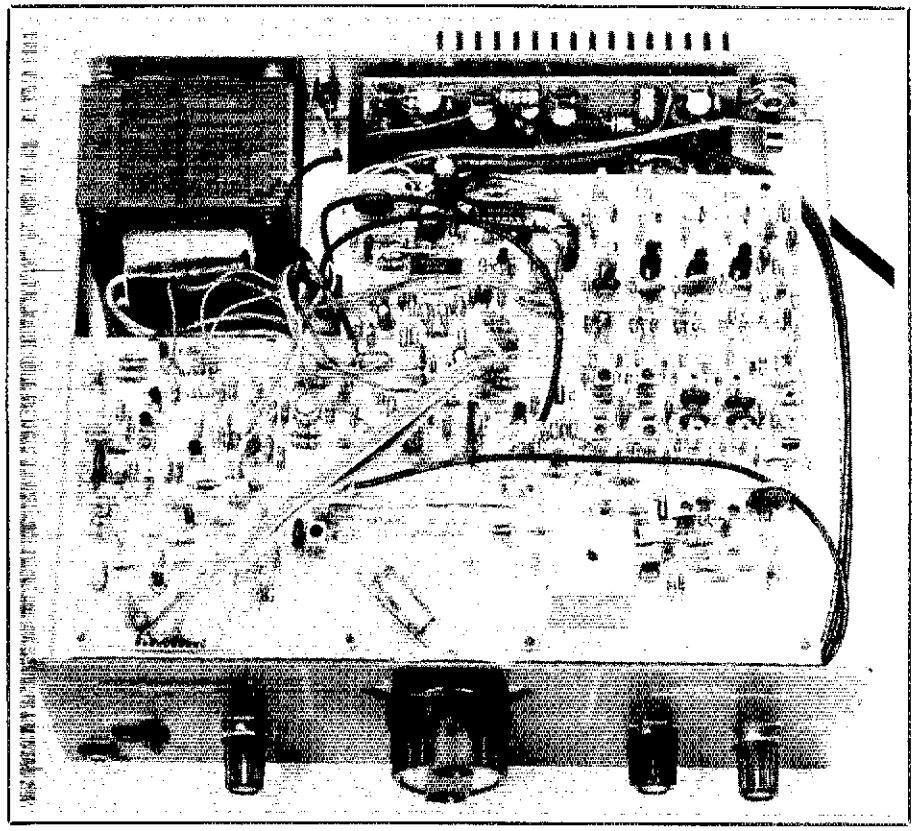


Fig 1—Top view of the Heath HW-99 transceiver. The main oscillator circuit board is on top of the chassis, the small power-amplifier board is on the rear wall (with shield removed), and the T-R board and power supply (not shown) are accessed from the bottom. All circuit boards are spaciously arranged, making assembly easy.

Circuit Description

Both the transmitter and receiver feature broadband circuitry so that no user-actuated preselector or final tuning are required during normal operation. This makes the rig simple to use—a nice feature for Novices. A transmitter using a solid-state output stage, however, requires a low SWR for proper operation. Therefore, the industry trend to broadband rigs brings with it the requirement for antenna matching networks and SWR meters, and thereby adds costs and complexity to setting up a beginner's Amateur Radio station. An ALC circuit in the HW-99, however, does provide protection to the transmitter power amplifier if the antenna SWR is too high.

The HW-99 may look simple on the outside, but some very sophisticated circuitry lies within the dark-brown case. A separate low-pass filter is included for each band in both receive and transmit modes, providing optimum rejection of received spurious signals and transmitted harmonics. The receiver features a doubly balanced ring mixer, for a cleaner mixer-stage output. This results in fewer spurious responses (known as "birdies," those mysterious carrierlike signals that sometimes appear here and there on the band). The receiver's IF strip does an excellent job of rejecting signals on one side of zero beat, but isn't particularly sharp otherwise. We have no problem receiving and understanding Canadian USB phone stations operating on the low end of 40 meters. Even in weak-signal situations, we rarely have to run the volume control more than two-thirds of the way up before the speaker is overdriven! This rig has plenty of gain.

Heath claims that the HW-99 can be used in the full-break-in mode up to 30 WPM. Our experience indicates this may be the upper limit. There is a noticeable audio thump in switching from transmit to receive, but even when using earphones it is not objectionable. A relay disconnects the antenna from the receiver and solid-state switching handles all other functions when the key is closed. An internal variable resistor sets the time delay for return to the receive mode.

Building the Kit

Since Heath plugs the HW-99 as a Novice rig, we gave it the acid test—we let a relative newcomer to Amateur Radio build it. Edie, N1CZC, has been licensed less than three years, although she already holds an Advanced class license. Her busy life-style prevents her from spending much time inside ham gear, however. She was the perfect candidate to see if the HW-99 is truly a kit for the Novice builder.

Heath's reputation for high-quality instructions continues in the thick manual that comes with the HW-99. Heath's packaging of components is better than ever, which really helps inexperienced builders succeed. There is always that necessary step of getting the parts out and arranging them in some orderly fashion. *Do not skip this step!* The HW-99 kit has a lot of parts, and the time and care of checking though the parts list will be of great help later during the assembly process.

Since the HW-99 is a new product, and ours was shipped during the first two months of production, we were not too surprised at a fairly extensive list of corrections and modifications to the manual. It is important to incorporate this information into the manual carefully before assembly begins.

The HW-99 circuitry is fairly sophisticated, and the kit takes a long time for a beginner to build, but the inside of the radio is spacious enough for inexperienced hands to have little trouble during the construction phase. See Fig 1. Even if you're a veteran tinkerer, don't expect to grab this kit from the mail on Friday afternoon and have it on the air by Sunday evening. Edie spent 30 hours unpacking and building about two-thirds of the kit before she ran out of time—I needed another 20 hours to finish the job.

Alignment was relatively easy, although for accurate dial calibration a 10-MHz frequency source is *required*. The instructions caution the builder to not push down on the slugs

Heath HW-99 Novice CW Transceiver, Serial No. 01-55615

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 80 m, 3.5-3.75 MHz; 40 m, 7.0-7.25 MHz; 15 m, 21.0-21.25 MHz; 10 m, 28.0-28.25 MHz.	As specified.
Modes of operation: CW.	As specified.
Frequency display: Analog dial.	As specified.
Frequency resolution: Not specified.	5 kHz per division.
Frequency stability: Less than 200 Hz/h drift after 30-minute warm-up.	2.5 kHz after 1 h.
Transmitter	*Transmitter Dynamic Testing*
Power output: 50 W, except on 10 m; 40 W on 10 m.	80 m, 50 W; 40 m, 45 W; 15 m, 30 W; 10 m, 22 W.
Spurious signal and harmonic suppression:	See Fig 3.
Keying waveform: Not specified.	See Fig 4.
Receiver	*Receiver Dynamic Testing*
Receiver sensitivity: Less than 1.0 μV for 10 dB signal + noise/noise.	Minimum discernible signal (noise floor) (dBm): *80 m* *15 m* −123 −116
Receiver dynamic range: 70 dB.	Blocking dynamic range (dB): *80 m* *15 m* 117 112
	Two-tone, third-order intermodulation distortion dynamic range (dB): *80 m* *15 m* 91 87
	Third-order input intercept (dBm): *80 m* *15 m* 13.5 14.5
Receiver audio output at 10% total harmonic distortion: 1.0 W.	1.16 W.
Color: Dark brown.	
Size (height, width, depth): 4-5/8 × 11-1/2 × 10-3/4 in.	
Weight: 13 lb.	

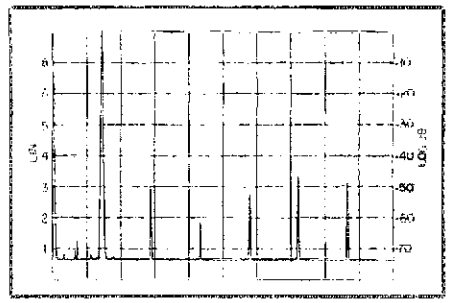


Fig 3—Worst-case spectral display of the HW-99 transmitter. Power output is 45 W at 7 MHz. Horizontal divisions are each 5 MHz; vertical divisions are each 10 dB. All spurious and harmonic emissions are at least 46 dB below the fundamental output. The HW-99 meets current FCC requirements for spectral purity.

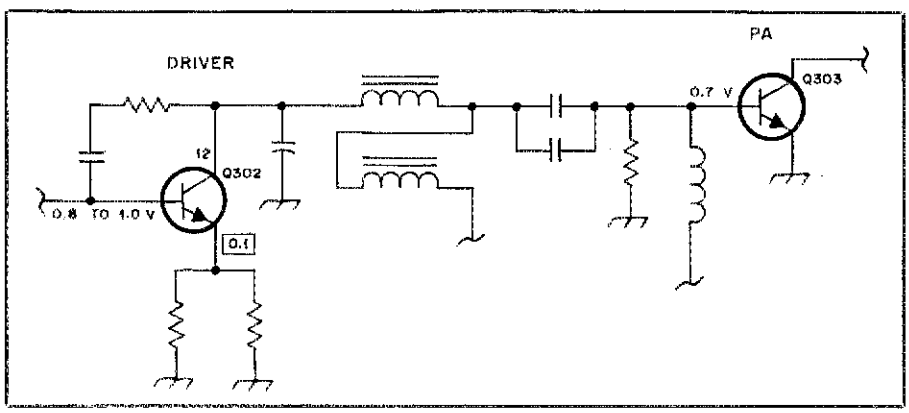


Fig 2—Schematic diagram of the HW-99 power-amplifier stage showing correct voltages.

while adjusting the coils. They're *not* kidding! The slugs are quite delicate, and I managed to crack two of them; be very gentle.

Some Problems

Take special care when assembling the large tuning capacitor for the VFO. When you put the shield around the capacitor, be sure the metal can does not short circuit the wire coming out of the capacitor housing. Another problem: When shipped, the band-switch wafers were rotated 180° from their proper orientation. Once the band-switch wafers were reoriented, however, the receiver sprang to life, and we could proceed with alignment. The errata sheet from Heath corrects this problem on the drawing, but makes no mention of the correction in the step-by-step instructions.

After the power-supply subassembly was wired, we did the chassis subassembly tests prescribed in the book. The fuse blew immediately upon applying line voltage. It turned out that instead of the 2.2-megohm resistor that goes from the power-supply line cord to ground, a 220-ohm unit had been supplied on the component part strip. Of course, 220 ohms to ground on the line cord *will* cause the fuse to blow. We installed the correct resistor, and the power-supply checkout continued with no apparent problems. We then proceeded to install the large oscillator board. We still don't know why, but a filter capacitor in the power supply began to smoke, and finally went SNAP! That power-supply breakdown caused the 12-V regulator to fail—in addition, an IC and a transistor were lost on the oscillator board. All components were easily replaced after a quick trip to Radio Shack. The power-supply problems did not return with the new components, although some additional ICs failed over time, probably from the stress of the initial problem.

We found an error in the transmitter's power-amplifier circuit board and the associated voltages on the schematic. The 220-ohm resistor that ended up in the power supply came back to haunt us when we noticed that the transmitter had no output. It turned out that the 220-ohm resistor belonged in the power-*amplifier* circuit, but the power supply's 2.2-megohm resistor was there instead. Once we corrected that problem, the transmitter output was fine. Moral: Check the values of the components as you install them, don't depend on the strip packaging of components. Murphy's law applies everywhere!

In troubleshooting the power-amplifier problem, we discovered that the voltages, as indicated on the schematic, were wrong. A quick call to Heath's excellent technical information service confirmed the error. The proper voltages are noted in Fig 2.

The HW-99 worked perfectly with our old keyer using a relay output, but a newer transistor-output keyer caused the keying circuit to hang up halfway between the transmit and receive modes. The fault is in our keyer, not in the HW-99. The manual says to use a contact to ground for transmit—our homemade transistor output keyer was designed for grid-block keying and applied 5 V to the keying line. We will have to add a relay to that keyer to use it with the '99.

Some Modifications

We live in an apartment where space is limited. The HW-99 appeals to us because of its small size—therefore we did not buy the matching speaker. Instead, we installed a small 3-inch speaker in the grillwork on the cabinet top. It works and sounds just fine.

To make the HW-99's key jack compatible with our other ham gear, we used a ¼-inch headphone jack instead of the phono jack furnished by Heath. No modification of the hole is required. Just be sure to connect the wiring to the tip-contact lug, not to the ground lug.

Another HW-99 owner felt that the dial illumination was inadequate, and devised an ingenious solution. He used the reflector from

a camera flashcube to focus more light on the dial (see Hints and Kinks, Feb 1986 *QST*).

Heathkits have always been fair game for those who would modify their ham gear because the owner can so easily become acquainted with the insides of the radio. Our HW-99 is likely to see two modifications: The 10-meter band is ripe for conversion to the much-missed 20-meter band; another possibility is to do something about the 30-V final output transistor so the rig can operate off a 12-V battery supply.

Using the Rig

On-the-air QSOs resulted in good signal reports. Everyone we contacted said the keying sounded fine, with no clicks or chirp. Once the rig has about an hour to stabilize, drift is not a problem. The front-panel controls are easy to use. I have fat fingers, though, and sometimes I turn the volume up while changing the band switch.

As mentioned earlier, the HW-99 needs some kind of antenna matching network and SWR meter to be useful throughout its full range of frequencies. If you don't roam around the bands too much, however (as in the case of Novices who must stay inside the Novice bands), you can probably fine-tune your antenna for your favorite frequency and do without the matching network and SWR meter.

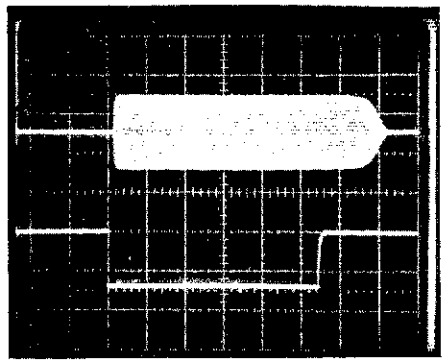


Fig 4—CW keying waveform of the HW-99. The lower trace is the actual key closure, the upper trace is the RF envelope. Each horizontal division is 5 ms.

By the way, Edie and I live two blocks from W1AW. The code-practice and bulletin schedules, sometimes with over 6000 W total being transmitted on several bands, make it a tough situation for many receivers. Not so with the HW-99—we get on the air and enjoy QSOs while the code practice and bulletins are hammering along only a few kilohertz away.

The hams at Heath have made a good move with the HW-99, satisfying those who like the smaller HW-9 QRP rig, but who wish for a bit more output power. Perhaps, someday, there will be a HW-99A with 20 meters and a WARC-band expansion option. Other than that, Edie and I are really enjoying this latest addition to the Heathkit stable of Amateur Radio equipment.

The HW-99 is available from the Heath Company, Benton Harbor, MI 49022, tel 616-982-3411. Price class: HW-99 transceiver, $300; SP-99 station speaker, $30. (Special offer for Novices: Get a $100 gift certificate good on any Heathkit product when you mail Heath Co a photocopy of your license and the HW-99 registration card.)—*Curt Holsopple, K9CH, and Edith Holsopple, N1CZC*

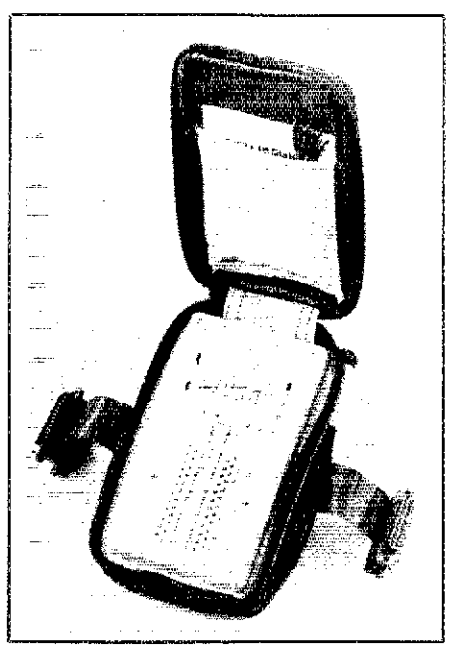
New Products

MODEL 650 DC/VOM TEST SET FROM DATACOM

☐ In addition to all of the features of their industry-standard Model 600 Tri-state test set, the self-contained Datacom Model 650 includes accurate dc-voltage measurements with an easily read, built-in, digital VOM for easy logic level analysis and a full RS-232-C breakout in one compact, rugged instrument.

Twenty-four center-mounted DIP switches allow any of the interface signals, except pin 1 (frame ground) and pin 7 (signal ground), to be interrupted. Two special function switches reverse pins 2 and 3 to create a null modem. Line-monitoring functions are isolated from the data/control lines so the possibility of line loading or disturbance is completely eliminated. Four-state signal status (Mark, Space, Clock, OFF) is provided by 12 tristate (red, green, off) LEDs. There are 25-pin dual-gender connectors on each side of the Model 650 for easy in-line connection with the DTE and DCE.

Suggested retail price is $299. The unit is packaged in a unique Soft-Pak for a lifetime of protection to go with the lifetime guarantee. For information, contact

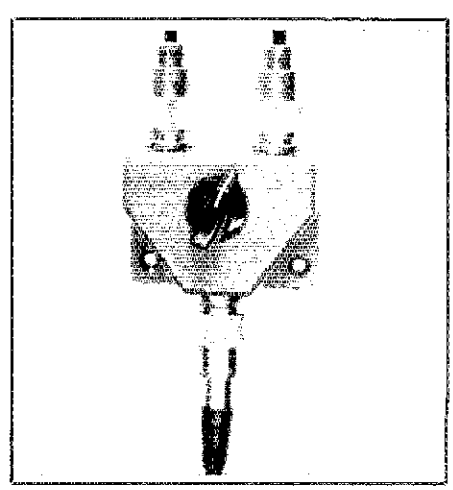


Datacom Northwest, Inc, 3303 112th St, SW, Bldg 100, Everett, WA 98204, tel 206-355-0590.—*Bruce O. Williams, WA6IVC*

MFJ ENTERPRISES TWO-POSITION COAXIAL SWITCH

☐ The MFJ-1702 two-position coaxial switch has one pole, two output positions and a claimed low insertion loss—less than 0.2 dB. Designed for high performance at a reasonable price, its maximum frequency range is 500 MHz. It has a VSWR of 1:1.2 and exhibits better than 60-dB isolation at 300 MHz and better than 50 dB at 450 MHz. Power rating is 2.5-kW PEP, 1-kW CW. Unused terminals are automatically grounded for static/lightning/RF protection.

Priced at $19.95, the '1702 has an unconditional one-year guarantee, with an additional 30-day money-back guarantee if the product is purchased directly from MFJ. MFJ Enterprises, Inc, PO Box 494, Mississippi State, MS 39762.—*Bruce O. Williams, WA6IVC*



Technical Correspondence

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

900-MHz PROPAGATION

☐ On the basis of some limited tests, Helfrick states "... 900-MHz FM propagation is definitely line-of-sight: If you can't see it, you *can't hear it!*" and "*Its line-of-sight nature* limits mobile communications and the band is more suited to point-to-point links."[1]

There have been more propagation studies at 900 MHz than perhaps any other band. Most of these have involved paths in which neither station could see the other. The entire November 1973 issue of *IEEE Transactions on Vehicular Technology* is devoted to propagation on this band.[2] Recent studies include propagation into suburban houses and metal buildings.[3-5]

Propagation is not much different at 900 MHz than at 432 and 1296 MHz. Anyone seriously interested in mobile propagation at 900 MHz should examine the past 15 years of *IEEE Transactions on Vehicular Technology* (available at many city libraries). Those interested in the DX potential of this band should expect propagation similar to 432 and 1296 MHz.

The 902-MHz band has much to offer in the way of interesting propagation for both the weak-signal and FM enthusiast. High-gain antennas are very small, signals pass through ordinary house windows with little attenuation, almost anything makes a good reflector (mountains, airplanes, water towers, the moon), and the fading rate (150 Hz for a vehicle moving at 55 mi/h) is low enough that both FM and SSB mobile communications are possible.—*Richard L. Campbell, KK7B/8, Rte 1, Box 115, Chassell, MI 49916*

SUPER DUPER POOP

☐ I congratulate Mr. Allison on his excellent article in the November issue of *QST*.[6] After reviewing the program and the accompanying article, I would like to offer a few simple suggestions that will greatly improve the speed and memory efficiency of the program.

The extensive use of FOR/NEXT loops is done in single precision numbers. These numbers consume 4 bytes per variable and require much more processor overhead than the simple 2-byte integer. Since no precision calculations are required, we are safe to define all variables as integers and capture a significant speed increase. See line 1007 in Fig 1.

```
Add these lines:

1005 DEFINT A-Z
1007 DIM I(500)
3315 FOR I = 0 TO C - 1: I(I) = I: NEXT I        'INITIALIZE ARRAY

Replace  lines 2370 and 2380 with:

2370 PRINT Q$(I(I),1); TAB(14); Q$(I(I),7); TAB(19); Q$(I(I),2);
     TAB(29); Q$(I(I),3);
2380 PRINT TAB(38); Q$(I(I),4); TAB(46); Q$(I(I),5); TAB(53);
     Q$(I(I),6)

Replace lines 2510 through 2640 with:

2510 ' NEW INDEXED BUBBLE SORT ROUTINE BY WB9NDM
2520 FOR I = 1 TO C - 1                ' INITIALIZE THE INDEX
ARRAY
2530       I(I) = I
2540 NEXT I
2550 FOR I = 1 TO C - 1
2560    LOCATE 20,41: PRINT USING "#####";I;
2570    F = 0
2580    FOR J = 1 TO C - 1 - I
2590       IF P$(I(J)) > P$(I(J + 1)) THEN SWAP I(J), I(J + 1):
           F = 1
2600    NEXT J
2610 IF F = 0 THEN GOTO 2630
2620 NEXT I
2630 ' END OF SORT
2640 ' CONTINUE

Replace line 2710 with:

2710     IF Q$(I(I),7) < > Q$(I(I + 1),7) THEN PRINT

Replace line 2960 with:

2960     IF Q$(I(I),7) < > Q$(I(I + 1),7) THEN H = H - 1: LPRINT
         'BAND SEPARATION

Replace lines 3100 and 3110 with:

3100 LPRINT Q$(I(I),1); TAB(14); Q$(I(I),7); TAB(19);
     Q$(I(I),2); TAB(29); Q$(I(I),3);
3110 LPRINT TAB(38); Q$(I(I),4); TAB(46); Q$(I(I),5); TAB(53);
     Q$(I(I),6)
```

Fig 1—Suggested changes to the Super Duper program.

As written, the program does not take advantage of one of the important features of the bubble-sort routine: One item "bubbles" into its final position after each sort. With this in mind, we can compare one less item in the list after each pass through the array. While this may seem somewhat insignificant, this could result in as much as one half of the comparisons having to be made. A simple benchmark test shows that taking advantage of this fact can make the sort routine run in less than half the time for a worst-case sort (one in which the list to be sorted is completely backwards).

Another item that can be changed in the sort routine is the swapping of a numeric array that indexes the string arrays, rather than swapping all eight string arrays each time. This technique, known as "indexed bubble sorting," leaves the string arrays in their original order and thus avoids string swapping, which takes more time and consumes more memory.

My final comment concerns the use of a 7 × 500 array to store the string data. Since each item in a string array consumes 3 bytes of memory in addition to the data, this array consumes 12024 bytes (8 × 501 × 3) in pointers alone! I suggest that the program be modified to use just one string array and take advantage of the 10521 bytes that would be freed. Also, do not forget to use the zero subscript of the array. In this case, it would have saved 1503 bytes. Because of the extensive nature of these array changes, I chose not to include them in Fig 1. I hope these suggestions will allow all users of this helpful program to realize even more of its potential. —*Glenn B. Schulz, WB9NDM, 2356A North 65th St, Wauwatosa, WI 53213*

[1]Helfrick, A. D., "The 900-MHz Band—What's in Store for Amateurs?" *QST*, Jan 1985, p 27.
[2]IEEE Transactions on Vehicular Technology, Vol VT-22, No. 4, Nov 1973.
[3]Cox, D. C., R. R. Murray and A. W. Norris "800-MHz Attenuation Measured in and Around Suburban Houses," AT&T Bell Laboratories Technical Journal, Vol 63, No 6, Jul-Aug 1984, pp 921-954.
[4]Cox, et al, "Measurements of 800-MHz Radio Transmission Into Buildings With Metallic Walls," *AT&T Bell Laboratories Technical Journal*, Vol 62, No. 9, Part 1, Nov 1983, pp 2695-2717.
[5]Walker, E. H., "Penetration of Radio Signals Into Buildings in the Cellular Radio Environment," *AT&T Bell Laboratories Technical Journal*, Vol 62, No. 6, Part 1, Nov 1983, pp 2719-2734.
[6]G. Allison, "The Super Duper," *QST*, Sep (p 27) and Nov 1985 (p 44).

Feedback

☐ The carrier-generator for the SSB series by W1FB Fig 3 (Oct 1985 *QST*, p 29) may re quire a series trimmer for netting the crystal *depending on the crystal traits. A wide nettin*g range can be had by placing a 4.7-μH miniature RF choke between the serie trimmer and ground. Also, should oscillatio be weak when using series crystal tuning make sure Q2 has ample gain. A 2N2222/ is better than a 2N2222 or PN2222 device

Hints and Kinks

Conducted By Bob Schetgen, KU7G
Assistant Technical Editor

RF PROBES REVISITED

[Since "Match Your RF Probe to Your Meter" appeared in Hints and Kinks (May 1985), I have received some enlightening correspondence about RF probes and the resistive divider that I added to Mr. Mann's letter. Here are some excerpts—Ed.]

☐ Most VTVMs have a 10-MΩ input resistance and a 1-MΩ resistor in the probe tip. Thus, the typical circuit is as shown in Fig 1A. E_M is the dc voltage as read on the VTVM scale, and E_M' is the actual voltage across the voltmeter terminals. Notice that E_M' is only 0.909 of E_M, the meter reading. For example, when E_M is 15 V,

$$E_M' = 15 \times 0.909 = 13.636 \text{ V}$$

When E_M' is known, the meter reading can be found from:

$$E_M = \frac{E_M'}{0.909}$$

We must consider this characteristic when choosing the resistance for a crystal-diode probe that replaces the standard dc probe.

Fig 1B shows a common RF probe. E_{RF} is the RMS voltage at the probe tip. E_{pk} is the peak value of E_{RF}. E_M' is the actual dc meter voltage required for a reading of E_{RF}. Further, assume that the diode is perfect, and that the time constant of C and R1 + R_M is long with respect to the period of the incoming signal. Now, let us consider an example where E_{RF} is 10 V:

$$E_{pk} = 1.414 \times E_{RF} = 14.14 \text{ V}$$

$$E_M' = 14.14 \times \frac{10}{14.7} = 9.619 \text{ V}$$

$$E_M = \frac{9.619}{0.909} = 10.582 \text{ V}$$

Notice that E_M is greater than the 10 V (RMS) applied, but that perfect rectifier and filter action was assumed. The actual voltmeter reading would probably be closer to 10.0 V because of the rectifier forward voltage drop and reverse leakage. This is why crystal-diode probes are not accurate to better than 3%.—*Franklin Swan, W9SIA, Oak Forest, Illinois*

☐ The RF probe suggestion by Steven Mann should prove useful; however, the 10:1 resistive divider will work only at very-low frequencies. To see this, consider that the diode "sees" a 1-MΩ impedance from the divider. Any stray capacitance at this point will reduce the frequency response. For example, at 30 MHz, it will take:

$$C = \frac{1}{2(\pi)f(R)} = 0.005 \text{ pF}$$

to reduce the probe response by 3 dB! It would be difficult to avoid stray capacitance several orders of magnitude larger than this.

A better scheme would be to use a capacitive divider (Fig 2). The divider will load a circuit under test somewhat. With the values shown, circuits having impedances less than 100-200Ω should not be unduly loaded at frequencies up to 30 MHz. At higher frequencies, scale the capacitances accordingly and remember to consider stray capacitance.—*Gordon Hardman, KE3D, Boulder, Colorado*

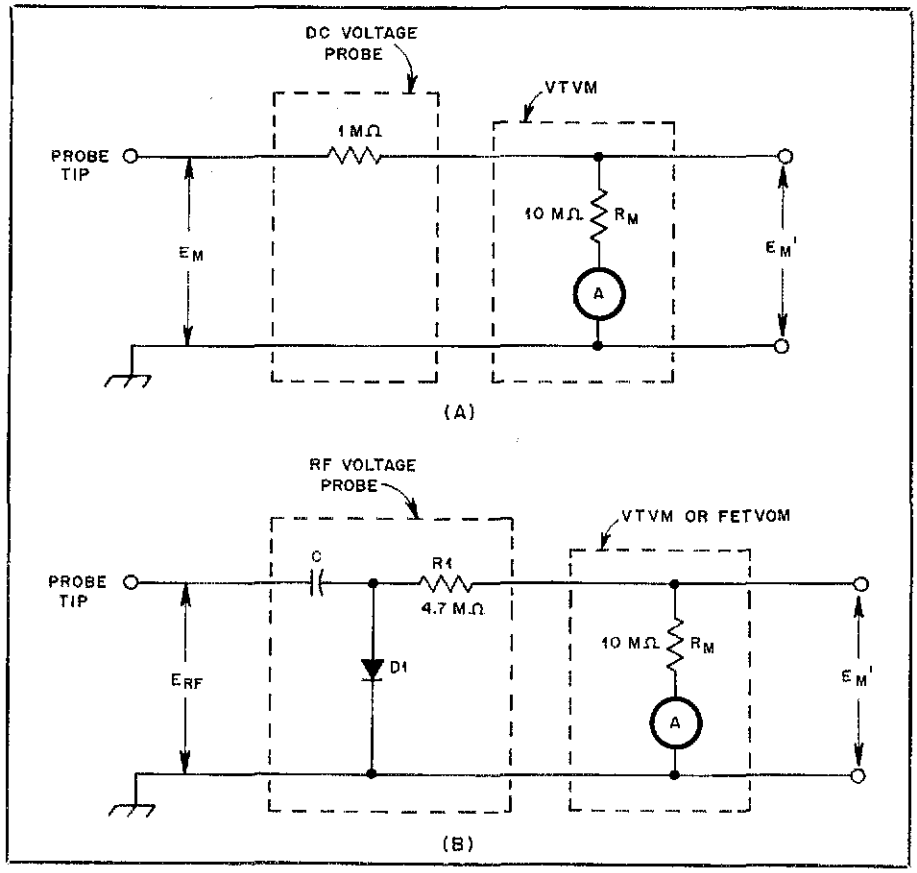


Fig 1—The equivalent circuit of a typical VTVM is shown at A. B shows the voltmeter with an RF probe substituted for the dc probe.

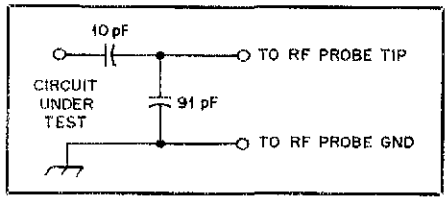


Fig 2—A 10:1 capacitive divider for measuring voltage up to 200 V (RMS) in circuits of 200 Ω or less up to 30 MHz.

☐ The 10:1 resistive divider and calibration suggestion in May 1985 Hints and Kinks are incorrect. When the diode is reverse biased, the divider could be adjusted so the voltmeter would read 1 V. This adjustment, however, would not hold for RF. At 10 MHz, a probe shunt capacitance of only 2 pF has a reactance of only 8 kΩ, which would load the circuit under test and prevent an accurate measurement.

The correct divider uses a high capacitance across the probe and a low capacitance in series. This arrangement cannot be dc calibrated, but capacitors whose capacitances were measured at 1 kHz would do pretty well.

In considering the basic probe circuit, the effect of the capacitor, C, is important. If the time constant, C(R1 + R_M), is considerably greater than the period of the waveform being measured, the dc output voltage is proportional to the peak voltage of the waveform: with sine waves, 1.414 × V (RMS). The diode conducts for only a very short time at the peak of the wave. For an explanation, I suggest Terman and Pettit's *Electronic Measurements* or *The 1975 ARRL Handbook*.[1,2]

The big problem with ac voltage measurements at high frequencies is shunt capacitance—but you cannot avoid it. To reduce capacitance effects at very-low frequencies, some bioelectric probes use feedback methods. Resistive capacitance-compensated dividers are used in oscilloscopes and in amplifier-before-rectification

[1]F. Terman, F. and J. Pettit, *Electronic Measurements*, 2nd ed (New York: McGraw-Hill, 1952) pp 17-18.
[2]R. Myers, ed, *The 1975 Radio Amateur's Handbook*, 52nd ed (Newington: ARRL, 1974), pp 513-514, Fig 17-13B.

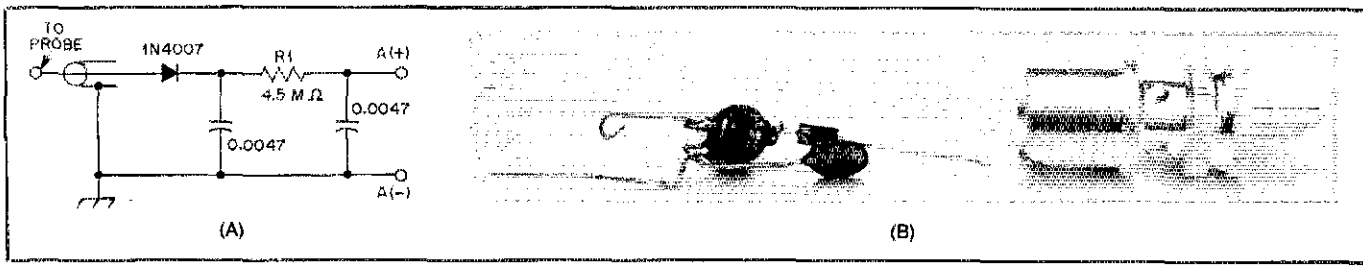


Fig 3—A schematic of the W2DVG/W2CJN RF sampler probe (A). B shows an assembly that fits into a PL-259 connector.

voltmeters. Internal terminal effects limit the minimum capacitance of such instruments to about 10 or 15 pF, at the terminals. Tektronix® states, in its 1985 catalog, that input capacitances of high-voltage, capacitance-compensated, resistive-divider probes (100× or 1000×) can be reduced to approximately 3 pF. Their 50-Ω probes, however, can achieve 1 pF. Active probes for RF are not yet a solution for input capacitance. The best Tektronix lists is the P6230, which presents 450 Ω in parallel with 1.3 pF.—*James A. Cronvich, W5FZW, Harahan, Louisiana*

. . . And here is another solution:

A HANDY RF SAMPLER FOR COAXIAL TRANSMISSION LINES

☐ George Klaus, W2CJN, and I have been working on an RF probe to work with voltages that would destroy the typical small-signal diode used in most RF probes. Our objective was to design a device to measure RF voltage on a coaxial transmission line with a high-impedance dc voltmeter. The sampler in Fig 3 is adequate up to 30 MHz. We also worked on a 150-MHz version, but the effort was unsuccessful.

In the conception stage, the goal seemed simple enough to apply the "KISS" principle: Simply tap the coax cable with a diode, bypass the output, attach a dc voltmeter and read the voltage.[3] But, this approach did not work. So much RF appeared on the dc output terminals, and the voltage regulation was so poor, that the reading was meaningless.

Short of developing mental hernias, our experimenting continued and led to several conclusions: (1) Effective RF filtering is essential; (2) The dc voltmeter should be one of high input impedance (Z), 10 MΩ or more; and (3) the voltage reading should be an RMS value, to facilitate power calculations.

These criteria, for a load Z of 50 Ω, and power levels of up to 150 W (typical for the ubiquitous transceiver), require components capable of withstanding 100 V or more and fairly high peak currents. We tried both parallel and series diode connections, and while both work, we selected the series circuit because it places less RF voltage on the input capacitor. A 1N4007 diode proved useful to 30 MHz. An RC pi network does the necessary filtering. R1 does double duty as part of a voltage divider that places the RMS value of the peak voltage across the voltmeter. Its value is calculated by:

$$R1 = R_M \left(\frac{1.4142}{k} - 1 \right) \qquad \text{(Eq 1)}$$

where

R_M = voltmeter resistance

k = scale factor of voltmeter (see letter from Swan, above—0.909 for the instrument in Fig 1B)

In our case, R_M is 10.8 MΩ and k is 1. Thus, R1 should be 4.47 MΩ. This theoretically correct value for R is not too critical, however. A tolerance of 5% changed our voltage reading by about 1%.

A schematic for a 2- to 30-MHz version of the sampler, built entirely into a PL-259 connector and used with an FET voltmeter having an input Z of 10.8 MΩ, is shown in Fig 3A. To assemble the probe, connect two capacitors, a diode and resistor as shown in the schematic. Slide that assembly all the way into the PL-259 connector. Solder the diode lead to the center pin of the plug and the capacitor leads to the plug shell. A pair of leads for the voltmeter can be soldered to points "A," and secured to the plug with packing and epoxy.

To use the probe, a coax "T" connector is inserted in the feed line and the sampler is plugged into the third port of the T. The voltmeter is then connected to the dc output terminals of the sampler. The voltmeter shows the RMS value of the RF voltage.

If the load is matched to the feed line and purely resistive, the voltage can be converted to power with the formula:

$$P = \frac{E^2}{R}$$

—Robert M. Forster, W2DVG, Southern Pines, North Carolina

[Editor's Note: This letter has been edited somewhat from the way it appeared in *CQ de WA2LQO*, the monthly bulletin of the Grumman Aerospace Corporation Amateur Radio Club. Particularly, I changed Eq 1 to reflect the information in Mr. Swan's correspondence above.

The sampler shown in Fig 3B was constructed and tested in the ARRL lab. (R1 is 4.7 MΩ.) Output power and RF voltage from a TS-820S transceiver were measured simultaneously with a Bird Thruline® Model 43 wattmeter and the RF sampler connected to a Heath IM-13 VTVM. The sampler response was +1.6 dB at 1.945 MHz and −0.86 dB at 28.720 MHz. Useful probe frequency range is considered to be the area where the response is within 3 dB of the true value. While the response of the sampler falls within those limits, the response error should be considered when RF voltage is to be accurately measured.

For example, if an amplifier were adjusted to show 274 V (RMS—corresponding to 1500 W fed to a 50-Ω load) at 28 MHz, with the lab-built sampler, the actual voltage would be 322 V (RMS—2076 W). Whenever a homebuilt device is used for critical measurements it should be calibrated against another instrument of known accuracy.]

MORE RFI/TVI TIPS

☐ Here is some advice for hams operating in apartments and restricted to indoor antennas. If you are experiencing TVI/RFI or are aware of such a condition in another apartment, the following techniques may provide some relief:

1) Use the least possible number of ac-powered accessories. Use battery-powered keyers and install good low-pass and ac-line filters. Sell your high-power amplifier.

2) Eliminate any rat's nest of wire and cable from behind the operating position by keeping cables and leads as short and as neat as possible: Suggest the same to a complaining neighbor. It is amazing how many 48-inch cables are used when 18 inches will do. Twenty-foot speaker leads often feed stereo speakers that are only separated 8 or 10 feet.

I discovered, quite by chance, that TVI/RFI to my downstairs neighbor resulted from my own television when connected to the ac line—even though the set was off during ham operation. Both apartments are served by CATV, and my neighbor has many CATV lines, including one to his stereo system. Nevertheless, I was the source of interference to both TV and stereo. The problem dogged me for nearly a year before I pulled the plug of my own CATV-connected television.

3) If you are using an indoor antenna, try moving it a bit. A small change in position can make a large difference. Avoid random length antennas. Run a couple of λ/4 "counterpoise" wires along the baseboard for each band used and attach them to the ground post of a quality Transmatch.

Do not ignore any possibility when searching for an RFI solution, no matter how absurd it may appear. If operating while standing on your head eliminates interference, you may have to install leg straps on the radio room ceiling!—*Dick Downey, KA2JIZ, Amsterdam, New York*

A HIGH-CURRENT TEST LOAD

☐ Save a couple of discarded dual-beam headlamps that still have one good filament. They can be used as dummy loads for testing low-voltage power supplies. A typical lamp draws 50-60 W, or about 4 A at 13.8 V. Several can be connected in parallel to test high-current supplies; switch one or more of the lamps in and out of the circuit to check regulation.—*Hugh Turnbull, W3ABC, College Park, Maryland*

[3]Technicians and engineers often refer to a "KISS" principle, an acronym for "Keep It Simple, Stupid!"

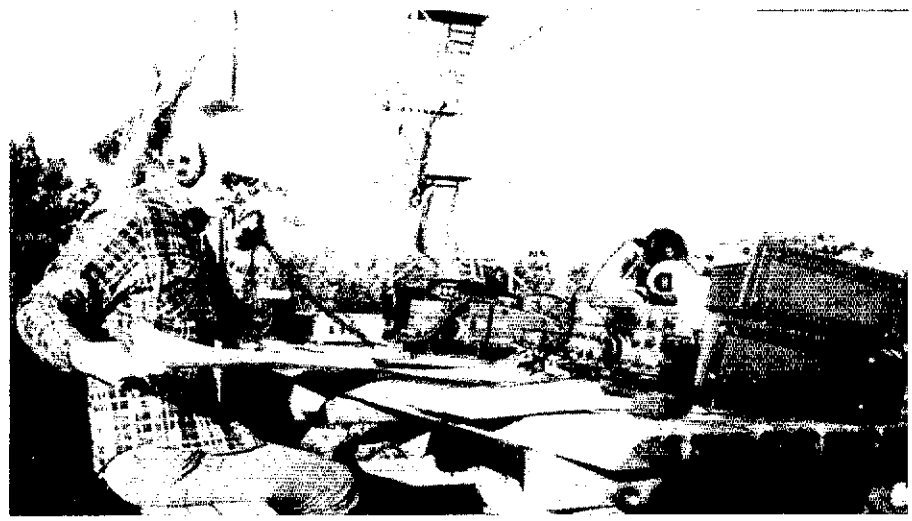
VHF Mountaintopping for the '80s

By playing "king of the mountain" you can have a booming VHF signal with simple equipment and low power.

By John F. Lindholm, W1XX
Manager, ARRL Membership Communications Services

Recently, VHF has seen a resurgence of an activity as old as VHF itself—mountaintopping. Few are blessed with a home operating location that facilitates a total command of the frequency. Consequently, ardent VHFers construct bigger and bigger arrays and amplifiers for the home station in order to produce that booming signal. Some, however, use the "great equalizer" to compete on an equal footing with the big home QTHs—namely, a mountaintop location. Here, perched high above all the home stations, a small portable rig with a single Yagi antenna only a few feet off the ground suddenly sounds like a kilowatt feeding a killer antenna at home. Simple equipment performs amazingly well from a mountaintop QTH on VHF.

A mountaintop expedition can vary from a spur-of-the-moment Sunday afternoon picnic to a full-fledged weekend contest. Quick trips can also be conducted during band openings. Since a contest optimizes the opportunity to work a lot of stations on VHF, this article is mostly a "how to" for weekend contest operation conducted by one or two people. But this can be scaled down to a mountaintop stay of shorter duration.



Author W1XX, operating /2 from Overlook Mountain, New York (FN22) checks the dupe sheet during the September 1985 VHF QSO Party. Also part of the all-important bookkeeping is to maintain a grid-square map for each band. As worked, the square is colored in with a highlighter. In the past two years, John has operated on VHF/UHF from eight different grid squares, from Rhode Island to California, and holds VUCC no. 40 on 432 MHz. *(photo by Gregory Greenleaf)*

The Times Are a Changin'

Old-timers will remember the drudgery in decades past of lugging "boat anchors" up rocky crevices. Dragging equipment and generators weighing hundreds of pounds up steep mountainsides was no picnic. Those who suffered sprained backs soon gave it up. The advent of solid-state equipment, however, has made mountaintopping a far less strenuous activity. With a greater selection of such compact, commercially available equipment, VHF has become a hotbed of activity. Even some of the highly competitive HF types have found new worlds to conquer above 50 MHz. A key factor in this revival has been the introduction of a worldwide grid-locator system, now much in vogue on VHF. The use of grid squares in the major VHF contests has tickled the innermost secret desire of every radio amateur—to be on the receiving end of a DX pileup.[1,2] Now, instead of going on safari to some distant DX land, you can head for the mountains—some nearby mountaintop located in a rare grid square.

Choosing a Site

Choosing a mountaintop site involves considering how far you want to travel to get there, accessibility to the top of the mountain and its all-important grid-square location. Ideally, your mountain is only a short driving distance away, towers into the cirrusphere, sports a six-lane interstate to the top and rises within a grid square that has never been on the air before!

Obviously, some of these considerations may have to be compromised. Your first step to finding VHF heaven involves extensive study of a road atlas. How far do you want to travel? Where are the mountains? How high are they? Can you drive to the top? Draw in the grid-line boundaries so you can tell which square it is in. Ask some active VHFers which are the difficult squares to work. When you start zeroing in on a potential site, you may want to get a topographic survey map of the area to determine access roads and direction of "drop-off" from the summit.

I've never operated from a mountaintop without first scoping it out in person. Access is most important. Thus far, I've operated from sites I have reached by car, ferry, gondola, 4-wheel drive, motor home and hiking. Unless you are going with mini-radios and gel-cells, you want to get there without backpacking it. A passable road to the top is ideal. When checking out a potential site, bring a compass and a 2-meter FM hand-held rig. A call on 146.52-MHz simplex should tell you how good the location is. Are you blocked in any direction? Is it already "RF-city" with commercial installations—a potential source of interference? Will you be able to clear any trees with a lightweight mast? Then the

[1]Notes appear on page 51.

prime requisite: Is there a picnic table permanently at the site? If not, plan on bringing an operating table and chair—which adds considerable bulk and weight to transport.

Once you've selected an operating site, be sure you have secured the necessary permission to use it. This may simply require verbal permission from some authority or the owner, or it could involve a lengthy exchange of correspondence with a state environmental agency of forests and parks and the signing of a liability release. But be sure you have permission. The last thing you want is the local sheriff shining a flashlight in your eyes at 2 AM, rousting you out of a fantastic tropo opening on 2 meters. You'll find rangers on fire watch most helpful in pointing out how to obtain necessary permission.

Power Source

Unless you are awfully lucky to find a location that will permit you to just "plug in," make plans for providing your own power. With a single-band operation from a car (with antenna mast mounted just outside the car window), the car battery will probably suffice. Run a set of heavy-duty jumper cables directly to the car battery. Even a solid-state "brick" amplifier can be run off the car battery without ill effects. Better to be safe than sorry, however; park the car facing downhill!

For a more serious effort using several VHF and UHF bands, a small generator is recommended. If the word generator conjures up an image of an ugly engine block from a 1947 LaSalle, then tune in to the modern world. Small, even attractive, generators in the 500-1000 W category that look more like American Tourister luggage are now available. Mine is a 650-W beauty that weighs in at 43 pounds and runs for four hours on a half gallon of petrol. And quiet? You can hear the wings of a Monarch butterfly flutter at 50 paces. A not-filled 5-gallon jerrican provides more than enough flammable juice for a contest weekend.

Equipment

A mountaintop location effectively places your antenna atop a natural tower of hundreds or perhaps thousands of feet. With this height advantage, compact, lightweight, low-powered radios that can be boosted up to the 50- to 100-W range with solid-state amplifiers will perform nicely. Low-powered portable transceivers are manufactured for just this purpose. The popular 10- and 25-watt multimode rigs are also quite adequate. Many discontinued models can be obtained at a substantial savings through the Ham Ads section of *QST*. Using transverters operating with mobile-type HF radios should also be considered.

If you don't have any sizable trees to get over, you can use simple mast sections that fit together. I use 5-foot sections, available

A Checklist of Typical Items Needed for a Weekend Portable Mountaintop Operation

Radio Equipment
- ☐ Transceivers for each band
- ☐ Solid-state amplifiers
- ☐ Antennas
- ☐ Coax (Belden 9913 or equiv)
- ☐ Keyer
- ☐ Paddle
- ☐ Antenna masts
- ☐ Earphones
- ☐ Coax connector cables
- ☐ Coax adapters
- ☐ dc cables with plugs
- ☐ Power supply (ies)
- ☐ Fuses
- ☐ Antenna rotator crosspiece
- ☐ Microphones
- ☐ Key line with plug
- ☐ Multi-ac plug outlet
- ☐ SWR meter
- ☐ VTVM
- ☐ Multi-dc plug box
- ☐ Clip leads

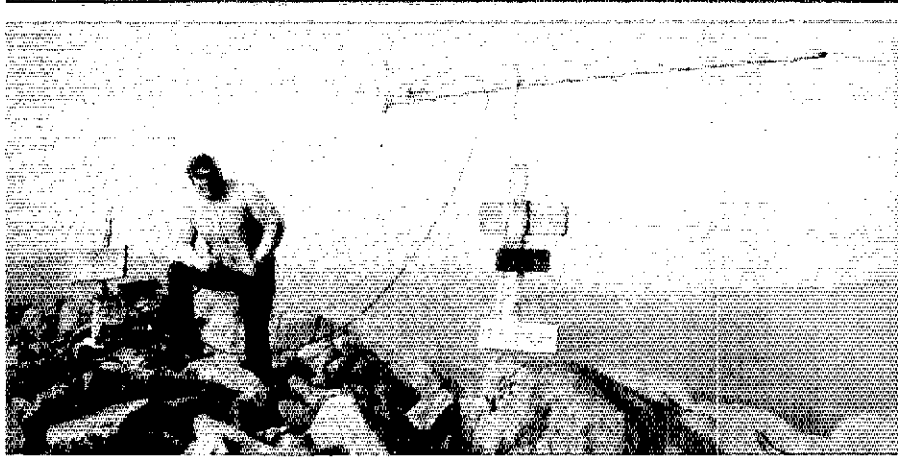
Tools
- ☐ Wrenches
- ☐ Pliers
- ☐ Screwdrivers
- ☐ Hammer

Power Source
- ☐ Generator
- ☐ Power cable
- ☐ Gasoline
- ☐ Oil
- ☐ Jumper cables (if on car battery)
- ☐ Gas funnel

Personal
- ☐ Toothbrush and toothpaste
- ☐ Soap
- ☐ Towel
- ☐ Suntan lotion
- ☐ Change of clothes
- ☐ Rain gear
- ☐ Hat
- ☐ Warm jacket
- ☐ Alarm clock
- ☐ Bug spray
- ☐ Insect repellant
- ☐ Electric shaver
- ☐ Toilet paper

Camping Equipment
- ☐ Matches
- ☐ Tent stakes (enough for tent and masts)
- ☐ Tarpaulin canopy
- ☐ Tent
- ☐ Ground cloth
- ☐ Extra rain cover
- ☐ Cot
- ☐ Lantern
- ☐ Flashlight
- ☐ Pot and pan set
- ☐ Pot holder
- ☐ Spatula
- ☐ Can opener
- ☐ Water bottle (5 gal)
- ☐ Rope
- ☐ Charcoal briquettes
- ☐ Table and chair (if needed)
- ☐ Sleeping bag
- ☐ Food and drink
- ☐ Knife and fork set
- ☐ Paper plates
- ☐ Paper towels
- ☐ Paper cups
- ☐ Cooler with ice
- ☐ Cook stove
- ☐ Stove fuel
- ☐ Funnel for fuel
- ☐ Fluorescent-type battery lantern
- ☐ Old newspaper
- ☐ Coffee cup
- ☐ Aluminum foil
- ☐ Trash bag

Miscellaneous
- ☐ Compass
- ☐ 24-hour clock
- ☐ Black plastic tape
- ☐ Masking tape
- ☐ Logs
- ☐ Grid-square maps
- ☐ Pencils (many)
- ☐ Clipboard
- ☐ Highlighter



Bob, WA1YKM, who enjoys backpacking to mountaintops, is operational on 2 meters from Mount Moosilauke, New Hampshire, elevation 4802 feet.

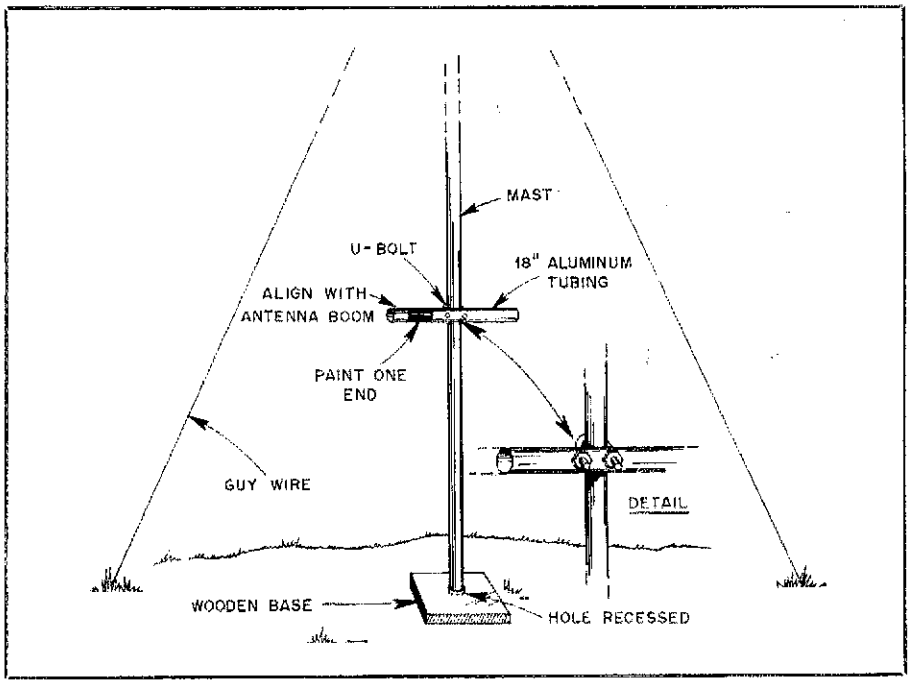


Fig 1—A close-up of the "Armstrong" rotator, used for quick peaking of signals.

at the popular shack of radios. They are easily transportable. Important, too, is the method of antenna rotation. If you can install the antenna mast right next to the operating position, do it. It will save all the hassle of installing motorized rotators. Nothing beats the "Armstrong" method for speed and simplicity. I use a crosspiece of aluminum tubing mounted with U bolts to the mast at arm level. See Fig 1. This provides instantaneous antenna-peaking capability—a necessity on V/UHF. While home stations are twirling their antennas in every direction trying to peak a weak signal, I've already worked him!

Installing antennas for several bands on the same mast is recommended. They should be oriented in the same direction. Many contacts on UHF are the result of moving stations over from other bands. For example, in a contest if you move a multiplier to 432 MHz after first working on 2 meters, and both antennas are on the same mast, you will first want to peak the signal on 144 MHz. Then, when you QSY to 432 MHz, where the antennas are probably a bit more sharp and propagation perhaps marginal, both antennas will be pointing at each other for maximum signal. This can make the difference in whether the contact is made.

If your mountaintop operation involves staying overnight, additional attention must be paid to having the proper survival equipment. The most luxurious way to go is a van or RV. Otherwise, a tent will be required. For the rugged, outdoors type, this can be as appealing as the radio part. I find that cooking steaks over a campfire with a canopy of stars overhead (while a programmable keyer is calling CQ) is half the fun. But keep this aspect of the operation as simple as possible. Champagne and caviar can be held for another time. I've also found out the hard way that one can

This photo of W1XX/2, taken from atop a nearby fire tower, shows all the equipment lined up on the on-site picnic table. A tarpaulin is always in readiness in case of inclement weather. Two masts of different heights are at opposite ends of the operating table. *(photo by Daran Ostrover and Bill Thomas)*

VHF and UHF Contests†

Early January	ARRL VHF Sweepstakes
Mid April	ARRL 2-meter Sprint
Late April	ARRL 220-MHz Sprint
Early May	ARRL 432-MHz Sprint
Early May	ARRL 1296-MHz Sprint
Mid May	ARRL 6-meter Sprint
Mid June	ARRL June VHF QSO Party
Mid July	*CQ* Worldwide VHF WPX Contest
Early August	ARRL UHF Contest
Mid September	ARRL September VHF QSO Party

†See Contest Corral in the appropriate issue of *QST* for operating details.

expect heavy winds on mountaintops. Large tents blow down easily in such weather.

Further on the subject of weather, just because you're topping it in July or August, don't expect it will always be T-shirt and shorts weather. No matter what the season, expect to need a heavy jacket after dark. I always bring a heavy flannel shirt and ski jacket for night, and shorts in the daytime. And bring lightweight raingear, just in case. And depending on the habitat, don't be surprised to be introduced to a critter or two, especially after dark!

Getting Started

Okay, you've read this far and are beginning to say to yourself: "Self, I think I'd like to try that." But there is a little voice of caution in you that says: "Don't go bonkers until you've sampled a little first." Good advice!

Start out by setting up on an easily accessible mountain for an afternoon during a contest period (see table) on a single band. For a first effort, I recommend 2 meters. With so many 10-W multimode rigs out there in radioland, 2 meters is your "bread and butter" band. Using a multielement Yagi a few feet off the ground of a strategically located mountain or hill can whet your appetite. I first got hooked by operating from the side of a highway on Hogback Mountain, Vermont, with a 3-W portable 2-meter radio to a 30-W brick and 11-element Yagi. I was astounded by the results, with contacts hundreds of miles away. This launched my interest in acquiring more equipment for portable mountaintop use, each operation adding a new band or better antenna. The basic formula of keeping it lightweight and simple has prevailed, however.

Now what's holding you back from operating from Mount Everest?

Notes

[1]A grid-square locator is a four-character designation of location encompassing a 2° longitude by 1° latitude square. The first two letters define the "field" (20° × 10°), followed by two numbers that indicate the unique square.

[2]J. Lindholm, "VHF/UHF Century Club Awards," *QST*, Jan 1983, p 49.

Club Involvement in the Volunteer Examiner Program

One ARRL-affiliated club describes its system for success in giving Amateur Radio exams.

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One of the most exciting and challenging things to happen in the history of Amateur Radio has been the creation of the Volunteer Examiner Program. As a result of action by the Federal Communications Commission, radio amateurs all over the country are now conducting test sessions that lead to new and upgraded Amateur Radio licenses. The ARRL has been the leading force in ensuring that the process is uniform and of a high quality.

This article describes the experiences of the Bryan (Texas) Amateur Radio Club, an ARRL-affiliated club. We have established and developed a successful system for conducting test sessions under the Volunteer Examiner (VE) Program. We hope the information provided will be useful to other clubs in starting or improving their local VE Teams.

Establishing a VE Team

Our community was fortunate in getting started with the VE Program because we had a pool of ARRL-accredited Volunteer Examiners very early in the game. Shortly after the League announced its involvement as a VEC, five local radio amateurs became accredited by the League's Volunteer Examiner Coordinator (VEC) office. As a result of our first test session, two more persons upgraded and became examiners. We now have 10 ARRL-accredited VEs in the club.

Local radio amateurs were anxious to conduct examinations from the very beginning. The five League-accredited VEs from the Bryan Amateur Radio Club decided to take the plunge and schedule a session. The club agreed to handle logistical support for the VEs, providing facilities, publicity and the application processing.

The First Session

It would be nice, but not accurate, to say that the success of the first session was due to good organization and extensive planning. Such was not the case, although the session *was* a success—things went fairly smoothly, resulting in 13 new or upgraded licenses.

All of us were new at the game, though, and we operated by the "seat of our pants." We were successful for two reasons: One was the superb support of the ARRL/VEC. The League's *VE Manual* was an invaluable how-to-do-it source. The timeliness and quality of the ARRL/VEC's materials provided were also excellent.

The second reason we were successful was because of the dedication, innovativeness and cooperativeness of the members of the VE Team. These people overcame all obstacles with patience, and good humor and with smiles on their faces. *[Experience has shown that the local VE Teams have proven their excellence in handling the many unexpected twists and quirks that have developed in conducting successful test sessions—Ed.]*

Public announcement of an Amateur Radio exam is not only required by the FCC, it's a vital part of ensuring good attendance at your test session. In addition to seeking coverage by local newspapers and radio and television stations, many Volunteer Examiner Teams post this sign at businesses and in civic buildings. The sign appears on the back of the ARRL's *VE Manual*.

Learning from Experience

We learned several valuable lessons from the first session, especially that the coordination of an overall VE Team effort in the community should be the responsibility of the local club. We established, therefore, a permanent group to serve as a focal point of the long-term VE Program. Qualified club members have the opportunity to serve as accredited VE Team members, but we need more than this.

Others in the club provide the support services essential to the ongoing success of running test sessions. We believe that a club standing committee needs to be formed. The committee should consist of the following positions: Chairperson (or Team Liaison), Publicity Coordinator and Team Contact Person.

The Club's Standing Committee

Chairperson

The most important step in forming a VE Team committee is to select a chairperson with an Extra Class license who also has leadership and organization skills. He or she should be willing to work with a large number of people with different backgrounds, interests, motivation and desires. The coordination of the activities of a widely diverse group of persons requires a chairperson who is good at handling people. The complexity of coordinating the many tasks involved in running a test session also requires a leader who is a good organizer and pays attention to details.

Publicity Coordinator

One or more persons on the committee should have experience in acquiring publicity. A club member with extensive civil and business contacts often works well in this position. One of the more important qualifications for this job is en-

thusiasm; another is persistence.

Team Contact Person

The contact person is the point of contact for all potential candidates. Other people may communicate with the Team Contact Person simply because they're interested in Amateur Radio in general. In addition to being able to meet the public effectively, this person must be *available* to the public. Club members who are retired often are ideal for this job.

Get Organized—Use Checklists

The Bryan ARC conducts test sessions four times a year. The makeup of the VE and support teams varies with each session. Consequently, each session includes a mixture of experienced persons and some who are participating for the first time.

We designed several checklists that spell out the various tasks to be accomplished. Although the four checklists are not comprehensive, they contain enough information for a person to be able to function well in running a test session.

Facilities Checklist

An essential part of any good test session involves having an adequate facility. It is surprising how many possibilities exist in a community. Look around and you'll find free test sites in police and fire stations, libraries, schools, banks, churches, hotels and motels, community centers and Red Cross buildings. We used index cards to record the individual features of each potential site, such as size, access and the times each site is available.

When a potential test site is identified, a committee member should visit the site, make a visual inspection and check to see if the site is acceptable (see Site Selection box). The information card about a potential test site should also include the name and phone number of a contact person responsible for the test site, such as the building manager or custodian for a library.

In addition to obtaining the answers to the above questions, the committee member should carefully explain to the person in charge of the potential facility the purpose of Amateur Radio in general and what the Volunteer Examiner Program is all about in particular. This action will often result in free publicity for the event.

Administrative Checklists

Conducting a test session is not always something that comes by second nature. The Administrative Kit (see box) includes many important supplies that could easily be overlooked. *[The ARRL/VEC recommends that candidates be responsible for providing their own pencils and pens, but it never hurts for the VE Team to have some spares handy!—Ed.]*

Administrative Kit

- ☐ $20 in change
- ☐ ARRL *VE Manual*
- ☐ Calculator
- ☐ Checklists
- ☐ Two extension cords
- ☐ File folders
- ☐ Black markers for signs
- ☐ Red pens for grading
- ☐ Packing tape
- ☐ Paper clips
- ☐ Pencil sharpener
- ☐ Pencils (20)
- ☐ Ballpoint pens (5)
- ☐ Scissors
- ☐ "No Smoking" sign
- ☐ "Amateur Exam" signs (3)
- ☐ Stapler
- ☐ Tape player
- ☐ *Spare* tape player

The Publicity Checklist (see box) helps the VE Team meet the FCC's requirements that a test session be announced publicly in advance. It includes a kit containing sample news releases, letters, signs used to publicize the event (from the back of the ARRL's *VE Manual)* and lists of agencies (such as clubs, electronics stores and industrial firms) that should receive examination announcements. By the way, we have had excellent success in getting public-service announcements aired during prime time on local radio and television stations.

Publicity Checklist

- ☐ Sample news release
- ☐ Mailing list of local newspapers
- ☐ Mailing list of local radio and TV stations and local cable-TV offices
- ☐ Mailing list of local clubs, schools, electronics stores and industrial firms
- ☐ Publicity posters advertising session

Table 1 lists the Team Contact's jobs in a "countdown" format. This is keyed on how many days before or after the test day something is to occur. The Team Contact's prime responsibility is to handle inquiries from candidates and prepare them for the day of the test.

Table 2 (see page 53) is a master "countdown," the Exam Session Time Table, also keyed on the number of days before or after a session something is to occur. This is adapted from a similar checklist that appears in the ARRL/VEC's *VE Manual.* Our version shows the person responsible for each activity and takes into account FCC, ARRL/VEC and local requirements.

The Exam Day Support Checklist (see page 53) highlights the important things that must be done during the day of the examination. This is very helpful when you can use Advanced Class Volunteer Examiners and non-accredited helpers to really make your test session shine!

Conclusion

All of these items are found in the ARRL's *VE Manual.* We found, however, that arranging them in simple checklist form greatly assists the process of knowing

(continued on page 53)

Site Selection

- ☐ Quiet location
- ☐ Good acoustics
- ☐ Number of rooms
- ☐ Room capacity
- ☐ Type of seating
- ☐ Additional space, if needed
- ☐ Proper lighting
- ☐ Restrooms
- ☐ Drinking fountain
- ☐ Handicap access
- ☐ Good ventilation
- ☐ Access to copy machine
- ☐ Site for talk-in station
- ☐ Waiting area
- ☐ Building supervisor

Table 1
Team Contact's Responsibilities

Duty	*Activity Time Period*	*Completion Deadline*
Publicity distribution	−45 to −30 days	−30 days
Distribute Form 610	−45 to −30 days	Test Day
Collect preregistration Form 610s and fees	−45 to −27 days	−27 days
Forward preregistered 610s and fees to Team Liaison	−27 days	−27 days
Mail session appointment confirmation letters to preregistered candidates	−45 to −7 days	−7 days
Notify Liaison of postage costs for reimbursement	−3 days	Test Day
TEST DAY	Day zero	Day zero
Mail post-test letters to candidates, if needed	Test Day	+5 days

The ARRL License Manual Series—The Complete Study Guide

The most up-to-date amateur-license-exam study materials ever are now available from the ARRL. With copies of *The FCC Rule Book* and our manual for the license class of your choice, you will have all of the information necessary to pass your next FCC written exam.

By Larry Wolfgang, WA3VIL
Assistant Technical Editor, ARRL HQ

About a year ago, we announced a new series of study materials for Amateur Radio licenses. At that time *The ARRL Technician/General Class License Manual* had just come off the presses, and work was under way on *The ARRL Advanced Class License Manual* and *The ARRL Extra Class License Manual*. Since then, thousands of hams have used those manuals to upgrade. Your response to these books has been so favorable that we have also revised our popular Novice training package, *Tune in the World With Ham Radio*, to include many of the same teaching concepts used in the *Advanced* and *Extra Class License Manuals*. The new (5th) edition of *Tune in the World* should prove to be even more useful and popular than the previous editions.

We have now begun work on the second editions of the books in the *License Manual Series*. The FCC released a new Element 3 (Technician/General) question pool in October 1985, and that began the cycle of revision needed to keep the books up to date. The second edition of *The ARRL Technician/General Class License Manual* has been reorganized to include the popular idea of directing the reader to the question pool to study small groups of questions as the appropriate portions of text are covered. This new organization also better reflects the organization of the FCC Study Guide, making the license manuals much easier to follow.

Each chapter of the books in our *License Manual Series* now begins with a list of *key words* with definitions. These *key words*, many of which appear in exam questions, are explained in the text for that chapter. If you are familiar with all of these terms, chances are you have properly prepared for the exam.

We still receive quite a few inquiries about what manual to use, or why we decided to split the one manual into three individual ones. The main reason for producing three license manuals (four, if you count *Tune in the World With Ham Radio*) is the FCC schedule for releasing revised question pools. With a different question pool being released every three months, it just is not practical to produce a new edition of a single book every time a new question pool is released. But each book in the *License Manual Series* can be updated once a year. Another consideration is that even if all license classes were included in a single book, if you purchased the manual to study for the Technician or General class license, the Advanced and Extra Class question pools would probably be outdated before you got to study for those licenses anyway!

So what is the publication schedule for the manuals, and how can you determine if you have the correct book? The key is to understand the FCC schedule for releasing new question pools. Table 1 summarizes these schedules for easy reference. Once a question pool has been released by the FCC, Volunteer Examiner Coordinators (VECs) have up to six months to begin using those questions, although they may begin using the new questions immediately. We can't tell you what other VECs are doing, but the ARRL/VEC announces well in advance the dates when they will begin using the new questions on exams. Generally, the ARRL/VEC waits at least five months before using the new questions. This ensures adequate time for all publishers to update their study materials and have the new books available for students. Keep in mind that these dates are dependent on the actual dates the FCC releases the question pools.

The cover of each *ARRL License Manual* includes the year, such as 1986 for *Tune in the World With Ham Radio* or 1985/1986 for *The Advanced Class License Manual* and *The Extra Class License Manual*. The date on the second edition of *The ARRL Technician/General Class License Manual* is 1986/1987. When the second editions of *The Advanced* and *Extra Class License Manuals* are released, the cover dates will also be 1986/1987. When a new edition is released, there may still be a few copies of the old books on the dealer's shelves for some time. This is why it is important to know when the VEC coordinating your

Table 1
Important Question Pool Dates†

License Class	*Deadline for Comments to FCC*	*New Question Pool Released by FCC*	*New ARRL License Manual Available*	*New Questions Used on ARRL VEC Exams*
Novice	July 1	August	January	February 1
Technician/ General	October 1	November	February	April 1
Advanced	January 1	January	May	June 1
Amateur Extra	April 1	May	August	October 1

†All of the dates listed are tentative. They are as accurate as possible at the time of this printing, but depend on the actual dates the FCC releases new Question Pools and on final printing schedules for the *License Manuals*.

exam will begin using the new questions. If you are taking the exam before the new pool will be used, the first edition of the appropriate manual is the one you need.

The (green) 80th edition *ARRL Radio Amateur's License Manual* (and all of the larger—8½- × 11-inch—editions) are now outdated and should not be used to study for any exam. If you are ready to begin studying for your Technician or General exam, and will be taking the exam sometime after April 1, you should look for a copy of the *second* edition of *The ARRL Technician/General Class License Manual*. The question pool released by the FCC in October 1985 has been included in the second edition of this book.

Any book is bound to have a few typographical errors, no matter how carefully it was proofread. Sometimes, we even find that an answer to a question printed in a license manual is incorrect. What can we do about that, and how can you find out about it? We have prepared an Errata Sheet for each book in the *License Manual Series* as soon as we become aware of any significant errors. You can obtain a copy of the Errata Sheet for your manual (if one exists) simply by writing to the License Manuals Editor at ARRL HQ. If you have a specific question about something in the book, state your question clearly.

Other solutions to the problem of how to provide the Errata information, such as including an Errata Sheet with each book when it is sold, or printing the information in *QST*, are just not practical. We have these books printed in relatively small quantities, so as errors are discovered they can be corrected in subsequent printings. When you open your book to the Copyright page, at the bottom of the box on that page you will see the edition number and the printing number listed. If there is no printing number, then you have a first printing of the book. Any way you look at it, the *ARRL License Manual Series* gives you the best study material you can buy!

Getting the Amateur Radio license of your choice has never been easier! Exam opportunities are available much more often and in many more locations than ever before. There has never been a set of study materials as complete and easy to use as the *ARRL License Manual Series*. To earn your Novice license (or to help an interested friend earn a license) just pick up the *Tune in the World With Ham Radio* package with Morse code teaching tape (or the ARRL or AEA Morse University™ Amateur Radio Starter Kit for the Commodore 64® or C128 computer). Then, to upgrade to any license through Amateur Extra, purchase a copy of *The FCC Rule Book* published by the ARRL, along with the appropriate *ARRL License Manual*. We also have code-practice tapes available to help build your code speed to the level needed to pass your exam. Register for that exam today, and start studying! QST

Club Involvement In the VE Program (continued from page 50)

what to do and when to do it. This is crucial for an inexperienced VE Team, but still very useful to veteran Volunteer Examiners.

Running a good test session is a learning experience for our club members. It also promotes fellowship and a sense of accomplishment among the persons that participate, both as examiners and candidates.

Like any "how-to" article describing a way to build and operate a piece of equipment, this is intended to spark your thinking. Your circumstances will be different, so adapt our suggestions to your local needs.[1]

[1]For specific information about the ARRL/VEC's test procedures, see page 90 of this issue. The ARRL/VEC welcomes qualified Advanced and Extra Class licensees who wish to become ARRL-accredited Volunteer Examiners. Write to ARRL for details.

Exam Day Support Checklist

Task	*Responsible Person (Assigned by VE Team)*
☐ Make and post signs	
☐ Room setup	
☐ Locate photocopier	
☐ Repeater talk-in operator	
☐ Check-in candidates	
☐ Copy licenses as needed	
☐ Bring candidates into exam room	
☐ "Go-fer" as directed by Liaison	
☐ Escort candidates to restroom	
☐ Clean and secure test site	

Table 2
Session Countdown for Team Liaison

Task to be Accomplished	*Starting Time*	*Deadline*	*Responsible Person*
Set test date and location; form VE Team	– 45 days	– 37 days	Club committee
Mail confirmation letters to candidates when Form 610s are received	—	– 7 days	Team Contact
Mail Session Registration to ARRL/VEC office	– 45 days	– 37 days	Team Liaison
Finalize membership of VE Team	—	– 27 days	Team Liaison
Preregistration ends; send 610s and fees to Liaison	—	– 27 days	Team Contact
Send Request for Materials, fees and roster to ARRL/VEC	—	– 25 days	Team Liaison
ARRL/VEC ships test materials	—	– 21 days	ARRL/VEC
Materials should have come from ARRL/VEC; call VEC office if they haven't	—	– 7 days	Team Liaison
Test materials received, immediately inspect materials for completeness and accuracy of shipment; call ARRL/VEC if any problems are noticed	– 7 days	– 5 days	Team Liaison
Team Contact notifies Liaison of postage costs to candidates	—	Test Day	Team Contact
TEST DAY—conduct session and complete summary paperwork		Day zero	VE Team and club support persons
Return all test materials and completed paperwork to ARRL/VEC	Test Day	+ 5 days	Team Liaison
ARRL/VEC forwards checked 610s to FCC/ Gettysburg	When received	No more than 10 days after receipt	ARRL/VEC
FCC issues licenses	+ 4 to + 6 weeks		FCC-Gettysburg

IARU Region 3 Meets in New Zealand

IARU delegates gathered in Auckland in November to find ways to make the Amateur Radio Service even stronger internationally.

By Richard L. Baldwin, W1RU
President, IARU

Quite often, there is a single aspect of a meeting or conference that is worthy of note, something truly outstanding in the arrangements or the conduct of the meetings or their results. In Auckland, excellence stood out on every side. Arriving delegates were met at the airport by local amateurs who delivered to each delegate, on the spot, a New Zealand operating permit with special call sign *and* a supply of preprinted QSL cards! The New Zealanders went out of their way to organize and carry out the logistic details of the conference so everything proceeded smoothly and according to plan. Thanks to the hard work and dedication of many, many people, the deliberations of the conference were successful. It was a conference that, while also tackling some of the immediate problems in ham radio, especially in Region 3, truly looked ahead and did some long-range planning.

To give you some idea of the stature of IARU these days, the conference was opened by Mr. Richard E. Butler, Secretary-General of the International Telecommunication Union (ITU). Not only did Mr. Butler open the conference, but he sat in on the meetings for the first couple of days, giving him an exposure to Amateur Radio he had not previously enjoyed.

IARU Triennial Conferences

The "business" of IARU is carried out at triennial conferences of the three regions, one being held each year by an individual region. These conferences are the ultimate decision-making authorities within their respective regions. In 1985, it was the Region 3 IARU Conference, held in Auckland, New Zealand. There, delegates from the various member-societies of Region 3 gathered during the week of November 13 to discuss mutual problems and to find common solutions.

Here's how these conferences function. Several months prior to the scheduled date of the conference, the secretary of the regional organization (in this case, Masayoshi Fujioka, JM1UXU) sends out a call for the meeting, naming the date and place, and calling for papers. The member-societies of the region are urged to prepare papers addressing topics of concern.

What concerns? Well, concerns range from matters affecting QSLing and contests to the adequacy of our preparation for some future ITU World Administrative Radio Conference (WARC). Whatever the topic, it is a matter of concern for the society presenting the paper, and the conference gives careful consideration to each submission. These papers are submitted to the secretary well in advance of the actual conference, and they are then distributed to each society in the region as well as to key IARU officials worldwide. This ensures that everyone attending the conference has an adequate opportunity to study the papers ahead of time and to give some thought as to how he might participate in the discussion at the conference. What the conference tries to avoid is "surprises"—that is, topics being brought up that the delegates haven't had time to study in advance.

At the conference, the papers are grouped by topic (often, more than one society will address a particular subject) and are discussed by those assembled. Invariably, rather than try to come up with a solution to a particular problem in the group as a whole (which might be rather cumbersome), smaller working groups will be formed. These working groups meet separately and work out solutions, which are then presented to the conference as a whole for approval or modification. There might be five or six working groups, each tackling a different problem or area of concern.

Then, the decisions taken at the conference are supposed to be implemented by those so designated by the conference. For example, some of the actions might be the responsibility of the individual member-societies, the regional officers, or requests made of the Administrative Council, and so on. What the conference has done is establish the policies that will guide the region for the next three years.

Region 3 Membership

Region 3 is the smallest of the three regions in terms of the number of member-societies, but has the potential of being the largest in terms of numbers of radio amateurs. Japan is a strong and influential member of Region 3, and has a large and active Amateur Radio population. Most of the other societies in Region 3, although enthusiastic and capable of providing excellent leadership, are somewhat smaller in size. But wait, there's a giant in the wings! The Chinese Radio Sports Association (CRSA), representing the People's Republic of China, has recently become a member of the IARU and of the Region 3 Association. The meeting in Auckland was China's first participation in IARU conference activities, and surely not the last. Presently, only club stations are permitted in China, although the number of these is growing constantly. But sometime in the not-too-distant future individual licenses will once again be permitted in China. Then there is the promise of considerable growth—growth that may be limited only by the economics of individual Chinese amateurs obtaining station equipment.

Indeed, the growth in China may be similar to that in Indonesia, which now has a number of amateurs approaching 50,000. Ten years ago, the number of amateur stations in Indonesia was small, and there was concern that economic conditions might limit Indonesian growth. That hasn't proven to be the case. Over the past several years, we have watched with considerable satisfaction as the number of amateurs in Indonesia has grown, and as the amateur organization there has become more and more involved with IARU activities.

NZART President/Conference Chairman Terry Carrell, ZL3QL (left), looks on as Chinese delegate Wang Xun addresses the group.

What Is the IARU?

The International Amateur Radio Union is a federation of national Amateur Radio societies representing the interests of two-way Amateur Radio communications worldwide. Founded in Paris in 1925, the IARU is governed by a Constitution and Bylaws. It has three regional organizations: Region 1—Africa, Europe, USSR, Middle East (excluding Iran) and Mongolia; Region 2—North and South America, including Hawaii and the Johnston and Midway Islands; Region 3—the rest of Asia and Oceania. The International Secretariat is located in Newington, Connecticut. To date, the IARU has 124 member-societies.

People

People are the heart of any organization—with good people the machine runs smoothly; with not-so-good people, there's sand in the bearings. Auckland was full of good people!

According to IARU tradition, the chairman of a conference is chosen from the host society. So it was that Terry Carrell, ZL3QL, was unanimously named chairman of the Sixth Regional Conference of the IARU Region 3 Association, Nov 13-17, 1985, Auckland. Terry, who is president of the New Zealand Association of Radio Transmitters (and who flies 737s for Air New Zealand), was an excellent chairman, doing his job in a thoroughly competent fashion. His right-hand man during the conference, Region 3 Secretary Masa Fujioka, JM1UXU, was always totally aware of what was going on and what needed to be handled next. As a result, the conference ran smoothly and efficiently.

Arthur Godfrey, ZL1HV (much better known as Jumbo), the immediately past president of NZART and a retiring director of the Region 3 Association, was responsible for most of the logistics planning for the conference. He had a great crew of ZL assistants, both OMs and YLs. Their care of delegates and delegates' wives was just super.

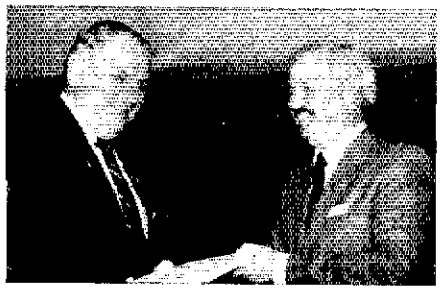
Those mentioned previously are only a few of those who were most influential in setting up the conference and making it go. In addition, there were the delegates, observers and assistants themselves, representing the member-societies of the region, including observers from the International Secretariat and the other two IARU regions. Their calls are listed here, by society:

American Radio Relay League (ARRL)
—W4RA, K1ZZ, W6ZM, N1CIX
Chinese Radio Sports Association (CRSA)—Wang Xun, Huang Yongliang
Japan Amateur Radio League (JARL)
—JA1AN, JA1HQG, JA1CLN, JR1ANP, JA0AD, JA1TZK, JH1UNS, JA1FUY, JA1GJE
Korean Amateur Radio League (KARL)
—HL1AFR
Malaysian Amateur Radio Transmitters' Society (MARTS)—9M2SS
New Zealand Association of Radio Transmitters (NZART)—ZL3NR, ZL2AMJ, ZL2AZ, ZL2NN, ZL2AKV, ZL2GX, ZL1BAD, ZL2SJ, ZL2SZ, ZL3TLB, ZL1BI, ZL1AOX
Organisasi Amatir Radio Indonesia (ORARI)—YB0MS, YB0BZZ, YB0JH, YB0CAR, YC0EBS
Papua New Guinea Amateur Radio Society (PNGARS)—P29CH, P29BP
Radio Society of Great Britain (RSGB)
—G3GVV, G3OUF
Wireless Institute of Australia (WIA)—VK3ADW, VK1RH, VK4ZXZ, VK2DEW
IARU Region 3 Association—9V1RH, JM1UXU, ZL1HV, JA1KAB, VK3KI, Tsuyako Miyagi
IARU—W1RU, W0BWJ
IARU Region 1 Division—PA0LOU, G3FKM
IARU Region 2—YV5BPG, HK3DEU, W7JIE, 9Y4NP
International Telecommunication Union (ITU)—Secretary-General Richard E. Butler

Decisions, Decisions!

What did the conference do? Lots of things, but I'm going to list only those actions that are, in the opinion of this writer, most important to the future of Amateur Radio as a whole. Of course, a *complete* record of the transactions of the conference will be found in the minutes of the meeting transmitted to each member-society in Region 3 and included in the *Region 3*

ITU Secretary-General Richard E. Butler addresses the opening ceremony. Conference Secretary Masayoshi Fujioka, JM1UXU, is seated at Mr. Butler's right.



ARRL President Larry Price, W4RA (left), and NZART President Terry Carrell, ZL3QL.

News (a periodical circulated to members of Region 3).

a) The conference adopted detailed plans for the 7, 10, 14, 18, 21, 24, 28, 50, 144, 430 and 1240-MHz bands, with the proviso that whenever there were conflicts between the band plans and national regulations, the latter should prevail.

b) All Region 3 members are to submit their proposals for the planning of the 1.8- and 3.5-MHz bands to the Secretary so a suitable paper may be presented to the next Region 3 conference.

c) IARU societies were encouraged to negotiate with their administrations for the allocation, on a local, noninterference basis, of the 10.15- to 10.20-MHz bands, in order to demonstrate the need for expansion of the present allocation to serve the needs of the Amateur Service.

d) All societies were encouraged to take appropriate action to ensure that the transfer procedures specified by ITU would be completed by July 1, 1989, so the 1979 WARC bands can be completely utilized by the Amateur Service.

e) Noting the importance of IARU representation at ITU conferences, the conference agreed that Region 3 should make every effort to provide appropriate representation by Region 3 observers at each ITU conference.

f) The conference adopted, with the understanding that no date has yet been set for another General WARC and that the next such WARC may be limited in scope, a preliminary set of goals and objectives for the Amateur Service that had been suggested by the IARU Administrative Council and are subject to refinement by future regional conferences.

g) The conference asked the IARU Administrative Council to initiate a continuing program of action, to be started forthwith, with the object of ensuring worldwide support for the interests of Amateur Radio before and at future ITU conferences.

h) The conference encouraged the continued participation of IARU in the work of CCIR, particularly in Study Group 8. (The CCIR is the arm of the ITU that provides the technical bases for decisions at ITU conferences.)

i) The conference agreed that sufficient funds should be made available so there could be adequate Region 3 participation in the Regional Administrative Radio Conference to "Establish Criteria for the Shared Use of the VHF and UHF Bands Allocated to the Fixed, Broadcasting, and Mobile Services in Region 3" sometime in the 1987/88 time frame.

j) The conference recognized the need for a number of improvements to the IARU Constitution and Bylaws, and recommended the adoption of some amendments. The IARU Administrative Council was asked to circulate the recommendations of the conference for discussion and appropriate action by the IARU membership.

k) The conference took action to ensure that there would continue to be two Region 3 representatives at the meetings of the Administrative Council, keeping in mind the need for continuity of representation and the desirability of giving broad IARU experience to those actively involved in the affairs of Region 3.

l) The conference recognized the importance of amateur satellites and resolved that IARU Region 3 members should consider funding of amateur-satellite projects, and further resolved that all frequency-planning matters of both the Amateur and Amateur Satellite Services be coordinated through the IARU organization and that both the Amateur and the Amateur Satellite Services be presented solely by IARU at international telecommunications conferences.

m) The conference, recognizing that the promotion of Amateur Radio in developing countries is an excellent way of encouraging technical and scientific training and knowledge of electronic techniques, as well as a way of strengthening international friendships, and further recognizing that there are different levels of support available and differing individual needs, decided to circulate a questionnaire to all Region 3 societies to determine on the one hand the needs and on the other hand the assistance available.

n) The conference agreed that member-societies should endeavor to limit the number of special prefixes.

o) It was agreed that in addition to the "Human Language System" developed by JARL, the IARU (Region 1) International Locator System, often referred to as the Maidenhead Locator System, be adopted by Region 3 societies.

p) The conference agreed to adopt ARDF rules based on the Region 1 rules, with this matter to be reviewed at the next conference.

q) The conference agreed to adopt in principle the Region 1 HF emergency procedure as adopted by Region 1 at its 1984 Cefalu conference.

r) The conference adopted the recommendations of the IARU Monitoring System Study Group (see IARU News, February 1986 *QST*).

s) The Administrative Council was asked to provide encouragement and coordination for the International Beacon Project.

IARU President Dick Baldwin, W1RU (left), shares a convivial moment with JARL President Shozo Hara, JA1AN.

t) The conference adopted the AX.25 protocol as an interim standard for packet radio and asked ARRL, through their Ad Hoc Committee on Amateur Radio Digital Communication, to act as the coordinating body, subject to the requirements of radio amateurs as expressed through IARU.

There you have a synopsis of some of the more significant actions of the conference. As mentioned earlier in this article, that's not all that happened, but we've outlined enough to give you an idea of the sort of IARU activity that will be taking place in the months ahead—all of it with the goal of making the Amateur Radio Service better and more secure in its international position.

Standard Bearers

For the next three years, David Rankin, 9V1RH, continues as the chairman of the IARU Region 3 directors. His fellow directors are Michael Owen, VK3KI; Keigo Komuro, JA1KAB; Fred Johnson, ZL2AMJ; and D. D. Devan, 9M2DD. Their terms of office are until the next Region 3 conference, which will be held in 1988.

Korea

Seoul, South Korea will be the site of the next Region 3 conference, to be held in October 1988, immediately following the Olympic Games. In the meantime, there will have been a Region 2 conference in Buenos Aires in 1986 and a Region 1 conference in the Netherlands in 1987. Thus, through the interchange of observers from the three regions, we will continue to have good international liaison.

Conclusion

And to what purpose this international liaison, and these conferences and all of the rest of the IARU activities? Purely to make sure that the Amateur Radio Service is properly represented on the international scene so that we may fare successfully at future international telecommunications conferences. Everyone has a stake in these activities, and everyone has some responsibility. *Your* way of supporting all of this activity is to support your national society, wherever you may live.

Board Braves Connecticut in January

Board concerns over FCC issues highlight the January Annual Meeting in Hartford.

By Steve Place, WB1EYI
Manager, Volunteer Resources

The 1986 Annual Meeting of the Board of Directors of the American Radio Relay League was held at the Parkview-Hilton Hotel in Hartford, Connecticut on January 23-24. Representatives from each of the 16 regional ARRL Divisions were present, including the newly elected Director from the Pacific Division. Attending a Board Meeting as an ARRL Director for the first time was Rodney J. Stafford, KB6ZV. (The names and addresses of all Directors appear on page 8 of *QST* under the headings of their respective Divisions.)

Elected for two-year terms were Larry E. Price, W4RA, President; Jay A. Holladay, W6EJJ, First Vice President; Leonard M. Nathanson, W8RC and William J. Stevens, W6ZM, Vice Presidents; and Tod Olson, KØTO, International Affairs Vice President. Replacing Mr. Olson as Dakota Division Director is the former Vice Director, Howard Mark, WØOZC. Also reelected were Executive Vice President David Sumner, K1ZZ, Secretary Perry Williams, W1UED, and Treasurer James E. McCobb, Jr, K1LLU.

Table 1
Board Committees

Executive Committee (Minute 14)
Larry E. Price, W4RA, Chairman
Paul Grauer, WØFIR
George S. Wilson, III, W4OYI
Frank M. Butler, Jr, W4RH
Hugh A. Turnbull, W3ABC
Jay A. Holladay, W6EJJ
David Sumner, K1ZZ

Administration and Finance Committee (Minute 48)
Edmond A. Metzger, W9PRN, Chairman
Clyde O. Hurlbert, W5CH, Alternate Chairman
Thomas B. J. Atkins, VE3CDM
James E. McCobb, Jr, K1LLU
Leonard M. Nathanson, W8RC

Volunteer Resources Committee (Minute 48)
Mary E. Lewis, W7QGP, Chairman
Rodney J. Stafford, KB6ZV, Alternate Chairman
Fried Heyn, WA6WZO
William J. Stevens, W6ZM

Publications Committee (Minute 48)
Raymond B. Wangler, W5EDZ, Chairman
Thomas W. Frenaye, K1KI, Alternate Chairman
Howard Mark, WØOZC
Richard Ridenour, KBØZL

Membership Services Committee (Minute 48)
Lys Carey, KØPGM, Chairman
Linda S. Ferdinand, N2YL, Alternate Chairman
Gay E. Milius, Jr, W4UG
Allan L. Severson, AB8P

In the thick of battle ... At the table, left to right, Directors Butler, Heyn, Wangler, ARRL Counsel Imlay and First Vice President-Elect Holladay. *(all photos courtesy N4MM)*

Directors Atkins and Turnbull work during a break.

FCC Matters

A number of issues considered by the Board involve actions with the FCC. After a lengthy and thorough discussion of the pros and cons of ARRL's possible role in the issuance of call signs, the Board instructed staff to continue its work on a proposal to FCC. The President was instructed to convey to the FCC the Board's strong sentiment that all VECs be held to the same high standards in meeting their administrative and clerical responsibilities. Also, the President was instructed to take the necessary action to correct the restrictive and crippling effect on the development of packet radio and, particularly, on packet-radio emergency communications caused by FCC Docket 85-105. Under this Docket a control operator is required to be present at each packet-radio relay point for third-party traffic to be passed, bringing into question the legality of relaying such traffic via unattended digipeater links. On another front, Counsel was instructed to file a petition with the FCC to require the labeling of home electronic equipment with regard to its susceptibility to RF energy.

Operating

The Board was concerned with more than regulatory issues, however, and it addressed a number of operating matters. One of the hot issues was the adoption of a voluntary 160-meter band plan. The result of lengthy discussion was the following recommendation: 1800-1840 kHz is to be used for CW, RTTY and other narrow-band modes, while 1840-2000 kHz is to be used for CW, SSB, SSTV and other wide-band modes; and the 1830-1850 kHz window recommended for intercontinental QSOs. Awards fared well, with the Board's authorizing ARRL awards credit (other than for 5-band awards) for all Amateur Radio bands except 10 MHz; and, because of the unique role Field Day plays in emergency preparedness, credit was also authorized for contacts made on all bands but 10 MHz. In addition, the Membership Services Committee was directed to develop a plan for a special Golden Jubilee DXCC

Table 2
Summary of Board Actions

Minute	Purpose	Disposition
ARRL Organizational (Regarding Articles of Association and Bylaws)		
55/68	Amendment of Bylaw 25, Board meeting dates	Postponed/Defeated
85	Amendment of Bylaw 24, recall procedures	Adopted
Other ARRL Organizational Matters		
6-13	Election of Officers	Adopted
14	Election of Executive Committee	Adopted
25	1986 Budget	Adopted
31	1989 Diamond Jubilee National Convention	Adopted
44/104	Election of ARRL Foundation Directors	Adopted
45	Study PIO/PIA/Clubs' public relations roles	Adopted
48/102	Appointment of Committees	Adopted
51	Section speakers bureaus under PIO	Adopted
56	ARRL Family Membership promotion	Adopted
57	Study ethics and government contact policy	Adopted
60	NWS and CAP Memoranda of Understanding	Adopted
65	Scholarships assigned to ARRL Foundation	Adopted
66	NTS Blue Ribbon study committee	Adopted
70	Local MOUs for ARES officials	Adopted
73	Special Study Committee on Advisory Ctes.	Adopted
74	Vice Directors' attendance at Board Meetings	Adopted
77	Legal Strategy Committee formation	Adopted
78	Forms and brochures to Section Managers	Adopted
80	Study availability of mailing lists from HQ	Adopted
89	Advisory Committee proceedings summaries	Adopted
95	HQ organization chart	Adopted
96	1986 Directors' Division budgets	Adopted
97	Committees' 1986 budgets	Adopted
98	QSL Bureau Manager travel budget	Adopted
99	National Traffic System travel budget	Adopted
100	1986 ARRL Foundation administrative budget	Adopted
101	Supplemental allocation for 1985 NTS travel	Adopted
Amateur Radio Operations		
26/61	160-m band plan	Tabled/Adopted
27	IARU awards-credit policy on 10 MHz	Adopted
28/50	ARRL awards-credit on all bands but 10 MHz	Postponed/Adopted
45	Study packet radio traffic channels	Adopted
45	Study VHF/UHF packet radio frequencies	Adopted
45	Study operating practices of W1AW	Adopted
52	Golden Jubilee DXCC Award planning	Adopted
63	Study reaction to elimination of QSO Parties	Adopted
67	Field Day credit for all bands but 10 MHz	Adopted
79/84	National Repeater Data Base and advisory	Adopted
86	Review three-tier club competition plan	Adopted
Legal and Regulatory (Non operating)		
53	Seek to amend FCC Docket 85-105/packet radio	Adopted
88	RF-susceptibility labeling home electronics	Adopted
92	Continue on possible issuance of call signs	Adopted
94	Equal standards required of all VECs	Adopted
103	US call designator precede foreign call	Adopted
Publications/Media		
45	Study listing packet stations in a directory	Adopted
45	Study diskettes of call directory info	Adopted
45	Study feasibility of ARES training videotape	Adopted
45	Study acquiring videotapes	Adopted
49	Study combining present ARRL newsletters	Adopted
54	Disaster Communications brochure	Adopted
64	*Repeater Coordinator's Newsletter* for sale	Adopted
69	Study tape-recorded telephone news service	Adopted
72	Board *QST* directives rescinded	Adopted
75	Convention and Hamfest Guidebook	Adopted
Miscellaneous		
45	Develop activity for youngsters in clubs	Adopted
45	Study plastic holder for ARES ID card	Adopted
45	Study club liability insurance	Adopted
71	Commend Mrs. Marjorie C. Tenney, WB1FSN	Adopted
76	Study membership "travel plans"	Defeated
81	Radio clubs at US military installations	Adopted
91	Commend Mr. Garfield A. Anderson, KØGA	Adopted

Award to commemorate the upcoming 50th anniversary of the prestigious DXCC Award. Finally, staff was directed to establish a computerized National Repeater Data Base for use by frequency coordinators. The Board was careful to point out, however, that granting access to such a data base does "not constitute nor imply endorsement or recognition of the authority of such coordinators," and it directed that League officials be reminded that "the League, as a matter of policy, takes no part in the (repeater) coordination process."

President Price and Executive Vice President Sumner work their way through a knotty issue. *(all photos courtesy N4MM)*

Other Matters

Along organizational lines, the Board created a Legal Strategy Committee to enhance the Volunteer Counsel Program by providing assistance in the areas of antenna ordinances, zoning restrictions as they relate to Amateur Radio operations, and deed restriction problems. Staff was directed to explore the possibilities of national Memoranda of Understanding (MOU) with the National Weather Service and Civil Air Patrol, and to implement a plan to promote Local MOUs for use by ARES officials. Staff was further directed, on the final authorization of the Volunteer Resources Committee, to institute a program that would permit ARRL Field Organization volunteers to purchase distinctive, official ARRL call sign badges; the badges will be patterned after the official call sign badges now worn by ARRL elected officals, officers and staff, but will have distinctive background colors that will identify the categories of volunteer service. Finally, the process for selecting the site of the 1989 Diamond Jubilee National Convention, marking the 75th anniversary of the ARRL, was initiated.

Following This Article ...

Tables summarizing the actions taken by the ARRL Board of Directors appear elsewhere in this article. As these charts are only thumbnail descriptions of what happened, we urge you to read the whole text of what interests you in the official Minutes, which follow this article under the heading, "Moved and Seconded."

Moved and Seconded ...

MINUTES OF THE 1986 ANNUAL MEETING OF THE BOARD OF DIRECTORS THE AMERICAN RADIO RELAY LEAGUE, INC. January 23-24, 1986

AGENDA

1) Roll Call
2) Moment of Silence
3) Consideration of the agenda for the meeting
4) Approval of Minutes of 1985 Second Meeting
5) Election of Officers
6) Election of Directors to Executive Committee
7) Supplementary oral reports by the Officers
8) Receive reports and consider recommendations of the committees
9) Appointment of committees
10) Election of Foundation Directors
11) Matters for Study and Directors' Motions
12) Authorizations of certain expenses for 1986

1) Pursuant to due notice, the Board of Directors of the American Radio Relay League, Inc., met in annual session at the Parkview-Hilton Hotel in Hartford, Connecticut, on January 23, 1986. The meeting was called to order at 8:35 A.M., EST, with President Larry E. Price, W4RA, in the Chair and the following directors present: Thomas B. J. Atkins, VE3CDM, Canadian Division; Frank M. Butler, Jr., W4RH, Southeastern Division; Lys J. Carey, KØPGM, Rocky Mountain Division; Linda S. Ferdinand, N2YL, Hudson Division; Thomas W. Frenaye, K1KI, New England Division; Paul Grauer, WØFIR, Midwest Division; Clyde O. Hurlbert, W5CH, Delta Division; Mary E. Lewis, W7QGP, Northwestern Division; Edmond A. Metzger, W9PRN, Central Division; Gay E. Milius, Jr., W4UG, Roanoke Division; Tod Olson, KØTO, Dakota Division; Fried Heyn, WA6WZO, Southwestern Division; Rodney J. Stafford, KB6ZV, Pacific Division; Hugh A. Turnbull, W3ABC, Atlantic Division; Raymond B. Wangler, W5EDZ, West Gulf Division; George S. Wilson, III, W4OYI, Great Lakes Division.

Also in attendance as members of the Board without vote were Leonard M. Nathanson, W8RC, First Vice President; Jay A. Holladay, W6EJJ, Vice President; Richard L. Baldwin, W1RU, International Affairs Vice President; and David Sumner, K1ZZ, Executive Vice President. Also in attendance at the invitation of the Board as observers were the following Vice Directors: Richard P. Beebe, K1PAD, New England Division; Thomas W. Comstock, N5TC, West Gulf Division; Rush S. Drake, W7RM, Northwestern Division; Evelyn D. Gauzens, W4WYR, Southeastern Division; John C. Kanode, N4MM, Roanoke Division; Howard Mark, WØOZC, Dakota Division; Stephen A. Mendelsohn, WA2DHF, Hudson Division; James M. Mozley, W2BCH, Atlantic Division; Lionel A. Oubre, K5DPG, Delta Division; Wayne Overbeck, N6NB, Southwestern Division; Marshall Quiat, ACØX, Rocky Mountain Division; Richard Ridenour, KBØZL, Midwest Division; and Allan L. Severson, AB8P, Great Lakes Division. There were also present Harry J. Dannals, W2HD, President Emeritus; Honorary Vice President Robert York Chapman, W1QV; Secretary Perry Williams, W1UED; Past Director William J. Stevens, W6ZM; Counsel Christopher D. Imlay, N3AKD; Canadian Counsel B. Robert Benson, Q.C., VE2VW; John F. Lindholm, W1XX, Membership Communications Manager; Stephen C. Place, WB1EYI, Volunteer Resources Manager; Paul Rinaldo, W4RI, Publications Manager; and Michael R. Zeigler, Controller.

2) The assembly observed a moment of silence in recollection of amateurs who have passed away since the previous Meeting of the Board, especially Harold Richman, W4CIZ, member of the RFI Task Group.

3) The Chair introduced Rodney J. Stafford, KB6ZV, new Director from the Pacific Division; James M. Mozley, W2BCH, new Vice Director from the Atlantic Division; and William J. Stevens, W6ZM, attending for the first time in the new role of Past Director. The Chair recognized Mr. Hurlbert who introduced Lionel A. Oubre, K5DPG, former Director from the Delta Division returning as Vice Director. The Chair presented apologies for the Treasurer, James E. McCobb, K1LLU, absent because of the press of business.

4) On motion of Mr. Butler, seconded by Mr. Milius, the agenda was adopted as presented.

5) On motion of Mr. Milius, seconded by Mr. Atkins, it was VOTED to approve the Minutes of the 1985 Second Meeting in the form in which they appeared in the September 1985 issue of *QST*.

6) The Board then proceeded to the election of Officers. The Chair appointed Messrs. Mendelsohn, Severson and Ridenour as tellers. The Chair declared that nominations for President were open. Mr. Turnbull nominated Mr. Price. On motion of Mr. Milius, seconded by Mrs. Lewis, it was VOTED that nominations are closed. On voice vote, Mr. Price was elected (applause).

7) The Chair declared nominations open for First Vice President. Mr. Wilson nominated Mr. Nathanson. Mr. Wangler nominated Mr. Holladay. On motion of Mr. Milius, seconded by Mr. Wangler, it was VOTED that nominations are closed. Voting was by secret ballot. The tellers found 9 votes for Mr. Holladay to 7 votes for Mr. Nathanson. Accordingly, the Chair declared that Mr. Holladay was elected as First Vice President (applause).

8) The Chair declared nominations open for an additional Vice President. Mr. Wilson nominated Mr. Nathanson. Mr. Stafford nominated Mr. Stevens. On motion of Mrs. Lewis, seconded by Mr. Olson, it was VOTED that nominations are closed. Voting was by secret ballot. The tellers found 9 votes for Mr. Nathanson, 6 votes for Mr. Stevens and 1 blank vote. Accordingly, the Chair declared Mr. Nathanson elected as a Vice President (applause).

9) The Chair declared nominations open for an additional Vice President. Mr. Stafford nominated Mr. Stevens. On motion of Mr. Milius, seconded by Mrs. Lewis, it was VOTED that the nominations are closed. Whereupon, on voice vote, Mr. Stevens was elected as a Vice President (applause).

10) The Chair declared nominations open for International Affairs Vice President. Mr. Atkins nominated Mr. Olson. Mr. Grauer nominated Mr. Butler. On motion of Mr. Milius, seconded by Mrs. Lewis, it was VOTED that nominations are closed. Voting was by secret ballot. The tellers found 9 votes for Mr. Olson, 7 votes for Mr. Butler. Accordingly, the Chair declared Mr. Olson elected as International Affairs Vice President (applause).

11) The Chair declared nominations open for Executive Vice President. Mr. Metzger nominated Mr. Sumner. On motion of Mr. Milius, seconded by Mr. Butler, it was VOTED that the nominations are closed. Whereupon, on voice vote, Mr. Sumner was elected as Executive Vice President (applause).

12) The Chair declared nominations open for Secretary. Mr. Turnbull nominated Mr. Williams. On motion of Mr. Butler, seconded by Mr. Wangler, it was VOTED that nominations are closed. Whereupon, on voice vote, Mr. Williams was elected as Secretary (applause).

13) The President declared nominations open for the office of Treasurer. Mr. Metzger nominated Mr. McCobb. On motion of Mr. Frenaye, seconded by Mr. Stafford, it was VOTED that nominations are closed. Whereupon, on voice vote, Mr. McCobb was elected as Treasurer (applause). Mr. Grauer requested to be recorded as voting opposed.

14) The Chair declared nominations open for four Directors to serve on the Executive Committee for one year. Mr. Atkins nominated Mr. Turnbull. Mr. Wilson nominated Mr. Carey. Mr. Hurlbert nominated Mr. Wilson. Mr. Wangler nominated Mr. Butler. Mr. Carey nominated Mr. Grauer. Mr. Butler nominated Mr. Wangler. Mr. Frenaye nominated Mrs. Ferdinand. On motion of Mr. Olson, seconded by Mr. Milius, it was VOTED that nominations are closed. With 9 votes required for election, at the end of the first ballot it was announced by the tellers that Messrs. Grauer and Wilson were elected. At the end of the second ballot, Mr. Butler was declared elected. At the end of the third ballot, Mr. Turnbull was declared elected. Accordingly, the Chair announced that Messrs. Grauer, Wilson, Butler and Turnbull would be Director members of the Executive Committee for one year (applause).

15) During the course of the above, the Board was in recess from 9:20 to 9:34 A.M.

16) Moving now to agenda item 7, reports of the Officers were presented. In his written report, Mr. Price pointed out that in 1985 the League had a near-record growth in membership, about 15,000, or 12% over 1984. Obvious, he said, are the gains that have been achieved in staff and management efficiency. Other achievements for 1985 are detailed in the editorial of January, 1986, which was made part of the report. In the coming year, the President said, we must have even more League members in order to enlarge our financial base and we must have even more radio amateurs if we are to continue to be seen by governmental decision makers as a growing and vital service. Sometime in the 1990s, Mr. Price warned, it may become necessary for radio amateurs worldwide to once again face the perils of an allocations conference of the International Telecommunication Union. In brief oral remarks, the President urged League officials to think positively about Amateur Radio's future and to "talk up Amateur Radio, to talk up ARRL."

17) First Vice President Nathanson, while acknowledging the growth of 15,000 in League membership, pointed out that this was a partial success, less than had been hoped for a year earlier. The Volunteer Examining program showed it could sustain itself and provide the amateurs of the country with more opportunities than had been possible under FCC administered examinations. An active campaign by ARRL led to a declaration by FCC of partial preemption over amateur antennas, in PRB-1. This was followed by victory in the case of *Thernes v. City of Lakeside Park, KY*, in the US Court of Appeals for the 6th Circuit, which remanded the case to the District Court to fashion a decision in consonance with PRB-1. Challenges remained, in the possibility of the League's administering the call sign program for FCC, in updating W1AW, in streamlining Advisory Committee procedures and in, especially, attracting new people to Amateur Radio.

18) A brief written report by Vice President Anderson was presented. It called attention to the progress of both the Volunteer Examining and Volunteer Monitoring programs and touched on the work of the Publications Committee on which Mr. Anderson served.

19) Next came the report of Vice President Holladay. The past year was the first in which amateur radio volunteers had complete responsibility for administering license examinations, he said. Other highlights were the favorable ruling on PRB-1 and the second amateur radio operation from space aboard the Space Shuttle *Challenger*. Areas in which the League should focus its energies in the coming year include attracting new radio amateurs by sponsoring a good "Elmer" program. Others are enhancing the public service aspects of Amateur Radio and fostering the application of new technology such as packet radio and satellites. Finally, we must continue to support and encourage local and regional frequency coordination efforts, Mr. Holladay said.

20) The report of the Vice President for International Affairs, Mr. Baldwin, focused on his other role as President of the International Amateur Radio Union. Its primary goal is to make sure that Amateur Radio is adequately represented at and between international telecommunications conferences. To this end, IARU was represented at the Geostationary Satellite Conference in August, at Geneva. The IARU delegation comprised W1RU, I1RYS, SP5FM, YU7NQM, HK3DEU and JM1UXU. In November there were meetings of the IARU Administrative Council in Melbourne, Australia and the Region 3 Triennial Conference in Auckland, New Zealand. IARU, he said, will begin WARC preparatory travel, explaining to IARU societies the necessity of adequate liaison with their government telecommunications authorities.

21) The Executive Vice President, Mr. Sumner, presented an extensive written report covering membership and amateur radio statistics, finances, personnel, publications (particularly improvements in productivity from even greater use of computers), the *Handbook*, many other items in the League library, an earlier schedule for the production of *QST* beginning with the April issue, DX Century Club application backlog status, Project Goodwill, the reorganization of Hq., draft criteria for the 1989 Diamond Anniversary National Convention, and the recruitment program. Appended to the report were charts showing the status of action items from the 1985 Second Meeting of the Board; a report on the possibility of using Amateur Radio in electronics and communications schools of the nation's armed forces; a study on a possible national repeater data base; a report on the feasibility of a national archive facility for Amateur Radio and a report on revitalizing the ARRL Instructor Program. During the course of the above the Board was in recess from 10:27 to 10:58 A.M.

22) The extensive report of Counsel Imlay covered maintenance of question pools, FCC Docket 85-196; the ARRL petition to enhance Novice privileges, RM-5038; frequency coordination of repeaters, Docket 85-22; deregulation of auxiliary operation, Docket 85-215; field disturbance sensors, General Docket 85-231; various TV interface matters; waiver for use of amateur radio frequencies for newsgathering purposes, PRB-2; F2A emissions in the 29.5-29.7 MHz repeater subband, PR Docket 85-168; cable television interference matters; F8E emissions above 928 MHz,

RM-5028; creation of a new radio service and allocation of spectrum for owners of personal computers, RM-5241; and a draft proposal for the labelling of home entertainment devices. The report also covered the Electronics Communications Privacy Act of 1985, S.1667 and H.R.3378. The twin victories of PRB-1 and *John Thernes v. City of Lakeside Park, KY* were covered as well.

23) Canadian Counsel Benson presented a short report concerning the Canadian trademark problem, now solved; corporate activities; membership contacts on tower and RFI problems, and several antenna By-Laws in Canadian cities.

24) Mr. Grauer, as President, presented the report of the ARRL Foundation. Highlight of the year was reaching the goal of $50,000 to endow the Barry Goldwater Scholarship Fund. Other scholarship activity was also covered in the report. Funds of the Foundation increased from $120,000 to almost $180,000 by yearend.

25) The Board then moved on to agenda item 8, reports of committees. Mr. Metzger, as Chairman, presented the extensive report of the Administration and Finance Committee. Highlights of his written report included the Committee's acceptance of the 1986 HQ operating budget and recommendation for its ratification by the entire Board of Directors; review of the Headquarters' staff job-classification system, performance evaluation program and "Employee Manual" revision; upgrades to the Headquarters' central Honeywell minicomputer; and the phase out of the Washington, DC, Development Office and staff, with the transfer of certain functions to the Headquarters in Newington, Connecticut. In an annex to its report, the Committee presented the results of its year-long feasibility study of relocating ARRL Headquarters. Its recommendation to the Board is to terminate the study as the Committee was unable to find a clear benefit to the League and its objectives, nor sufficient advantage to Amateur Radio generated by such a move to offset the costs of that move. Mr. Metzger further reported that the Treasurer's report had been presented to the Administration and Finance Committee at a meeting the day before by Mr. McCobb who would be unable to attend the Board meeting. It was moved by Mr. Metzger, seconded by Mr. Butler, that the report be received and the budget for 1986 adopted. After discussion, Mr. Hurlbert, seconded by Mr. Wilson, Moved the Previous Question. The Chair ruled that, on request of a member, in accordance with Board custom and practice, the question would be decided by roll call vote. Mr. Heyn appealed the ruling of the Chair. The assembly sustained the ruling of the Chair. Whereupon, on a roll call vote, the Board VOTED to terminate discussion of the budget, 13 votes in favor to 3 opposed. Those voting in the negative were Mrs. Ferdinand, Mr. Frenaye, and Mr. Heyn; all the other directors voted aye. Whereupon, a roll call vote again being called for, the budget was adopted 13 votes in favor to 3 opposed. All the directors voted aye, except Mrs. Ferdinand, Mr. Frenaye and Mr. Heyn, who voted no.

26) The Report of the Membership Services Committee was presented by its Chairman, Mrs. Lewis. It was moved by Mrs. Lewis, seconded by Mr. Frenaye, that a band plan for the 160 meter band be adopted as follows: 1.800-1.840 MHz, CW, RTTY, other narrow band modes; 1.840-2.000 MHz, SSB, SSTV, other wide band modes. Further, that because the segment from 1830 kHz to 1850 kHz is the most common international allocation on 160 meters, amateurs are encouraged to utilize that segment for intercontinental QSOs only. And further, to help ensure orderly use of the band, that Counsel file a petition with the FCC to revise Section 97.61 of the Rules to reflect the mode segments delineated above. It was moved by Mr. Hurlbert, seconded by Mr. Grauer, that the matter be referred back to the Membership Services Committee for further study with a report to be presented at the July Meeting of the Board. After discussion, the ayes and nayes being ordered on request, the motion to refer was defeated, 3 votes in favor to 13 votes opposed. Those voting in favor were Messrs. Grauer, Hurlbert and Metzger; all the other Directors voted against the motion to refer. It was moved by Mr. Butler, seconded by Mr. Heyn that the motion be amended to add "CW" to the upper portion, so it would read " . . . 1.840-2.000 MHz, CW, SSB, SSTV, other wide band modes." It was moved by Mr. Frenaye, that the amendment be amended by deleting specific modes and substituting "to restrict the wideband mode segment to 1.840-2.000 MHz," but there was no second, so the motion to amend the amendment was lost. It was moved by Mr. Olson, seconded by Mr. Carey, that the matter be laid on the table. On a point of order raised by Mr. Heyn, the Chair ruled that the motion to table was in order. Mr. Heyn appealed the ruling of the Chair and requested a roll call vote. All of the Directors voted to sustain the ruling of the Chair except Mr. Heyn and Mr. Milius. The question then being on the motion to table, the same was ADOPTED; Messrs. Frenaye and Milius and Mrs. Lewis requested to be recorded as voting no. During the course of the above the Board was in recess for lunch from 12:36 to 1:53, reconvening with all members hereinbefore mentioned present except Mr. Zeigler, who returned to the Hq.

27) It was moved by Mr. Frenaye, seconded by Mrs. Lewis, that the President is to actively pursue a uniform IARU policy regarding awards credit for contacts made on 10 MHz. After discussion, on motion of Mr. Olson, seconded by Mr. Atkins, it was VOTED that the motion be amended to read: "The President is to actively pursue persuading IARU to adopt a policy regarding awards credit for contacts made on 10 MHz, similar to that of ARRL." Mr. Frenaye requested to be recorded as voting no on the amendment. The question then being on the motion as amended, the same was ADOPTED. Mr. Frenaye again requested to be recorded as voting no.

Past International Affairs Vice President Baldwin, Canadian Counsel Benson, and Directors Atkins and Turnbull.

28) It was moved by Mr. Frenaye, seconded by Mrs. Lewis, that ARRL awards credit be recognized for contacts made on all amateur radio bands, with the exception of 10 MHz because of our secondary status to other services. After discussion, on motion of Mr. Wangler, seconded by Mr. Heyn, it was VOTED to postpone discussion of this matter until tomorrow. Mr. Frenaye requested to be recorded as voting against the motion to postpone.

29) Mr. Butler, as Chairman, presented the report of the Publications Committee, covering a reply paid feedback form, new membership stationery, *QST* index, changes in the 1986 edition of the *Operating Manual*, the publications master schedule, the forthcoming *Field Resources Directory*, *QST* contest coverage, shipping and handling fees, and price marking of ARRL publications.

30) Mr. Wilson, as Chairman, presented the report of the Volunteer Resources Committee, which had conferred the Herb S. Brier Instructor of the Year Award for 1984 on Mr. Gordon West, WB6NOA; 1984 Hiram Percy Maxim Memorial Award on Donald R. Santangelo, KA2RLW; and the 1985-1986 Goldwater Scholarship on Clark S. Barrow, KI4UT. Other matters in the report were the determination that no action was required on a proposal for a club-membership category; local Memoranda of Understanding; a favorable progress report on the technical information service; the timetable for the ARRL International Humanitarian Awards; distinctive call sign badges for field organization appointees; revised requirements for the Boy Scout Radio Merit Badge; volunteer monitoring matters; volunteer examining program matters; a new certificate for Special Service affiliated clubs and the recommendation to appoint a Blue Ribbon committee on the National Traffic System in light of the Mexican earthquake situation.

31) Mr. Price, as Chairman, presented the report of the Executive Committee. With reference to Minute 66, Second Meeting of 1985, the President will continue informal efforts to achieve standardization of both the Morse and the written tests. Draft criteria for selection of the site of the 1989 Diamond Jubilee National Convention were presented. On motion of Mr. Wilson, seconded by Mr. Wangler, the criteria were approved as follows:

The 1989 ARRL National Convention will be one of the main activities to mark the 75th, or Diamond, Anniversary of the American Radio Relay League. Accordingly, in addition to the usual criteria, the following will be used in selecting the site and the sponsoring local organization for this convention:

1. The convention shall give attendees a historical perspective, and a look ahead to the last quarter of the League's first century. Applicants should address as specifically as possible their plans in this regard.

2. The convention shall provide attendees with a commemorative souvenir that will form a lasting part of their Amateur Radio memorabilia.

3. The convention shall provide non-attendees with an opportunity to share in the experience through QSOs with a special convention station, through videotaped highlights for distribution by ARRL to its affiliated clubs, and through other means to be proposed by the convention committee at the time of application.

4. The convention application shall demonstrate financial and personnel resources sufficient to accomplish these aims, in addition to the usual high caliber of National Convention programs and exhibits.

5. The location will be selected so as to provide for a relatively large attendance.

Announcement of these criteria shall be made in March and April 1986 *QST*. Applications received by the Secretary by July 1, 1986 will be circulated to Board members, and the selection made at the 1986 Second Meeting of the Board from among the applications thus received. If no fully qualified applicant steps forward for July 1, the application process shall be repeated prior to the 1987 Annual Meeting of the Board. The application itself, and supporting documentation addressed specifically to the above-listed criteria, will be duplicated for Board members at League expense; for other supporting material such as Convention and Visitors Bureau pamphlets, letters from local officials, etc., the convention committee should supply 24 copies of each at the time of application.

32) Mr. Atkins, as Chairman, presented a brief report for the Ad Hoc Committee on the Strengthening of CRRL. Everything is right on schedule, and CRRL will be operating as a financially independent entity from January 1986 onwards. This is in accordance with the CRRL five year plan timetable, for the end of the third year.

33) Mr. Butler, as Liaison, presented the report of the Ad Hoc Committee on Amateur Spread-Spectrum Radio Communication. Effective June 1, 1986 the FCC has authorized spread-spectrum communication on the amateur radio bands above 420 MHz. Interim standards to assure interoperability between amateur stations using this new mode will be developed and presented in *QST* by the effective date for use of the new mode.

34) Mr. Turnbull, as Chairman, presented the report of the RFI Task Group. A voluntary standard for RF immunity in television sets and VCRs is about to be adopted by the American National Standards Institute (ANSI[9]). On another front, ARRL has opposed efforts to relax leakage standards for cable television. Studies of the "ingress" problem with NCTA, the National Cable Television Association, are continuing.

35) Mr. Wangler, as Chairman, presented the report of the ARRL Committee on the Biological Effects of RF Energy. The Committee continues to monitor FCC and other governmental activities in this area. Efforts are underway to educate Amateur Radio operators on the proper and prudent use of RF energy. Questions on RF safety will be submitted for addition to the FCC Volunteer Exam Question Pools.

36) Mr. Quiat, as Liaison, presented the report of the ARRL Committee on Amateur Radio Digital Communication. The number of Terminal Node Controllers (TNCs) in the hands of Amateurs had risen to 10,000 in late 1985 from 4,000 early in the year. Packet radio is essentially a one-frequency operation at present; efforts must be made to increase the frequencies available and the speeds in use so as to avoid congestion. Development of new protocols and new software for packet radio continues. The Board was in recess at 3:13 P.M., reconvening at 3:47 P.M.

37) Mr. Nathanson, as Chairman, presented a brief oral report for the Task Force on Federal Preemption. With the adoption of PRB-1 by the FCC and its confirmation in the federal courts in the case of *Thernes v. City of Lakeside Park, Kentucky*, the work of the task force is essentially complete. The Board demonstrated its appreciation of the work done by the Task Force on Federal Preemption with a round of applause.

38) The Board now turned to the reports of its Advisory Committees. Mr. Butler, as Liaison, reported on the work of the VHF Repeater Advisory Committee, including studies of band plans for 23 centimeters and 440-450 MHz.

39) Mr. Drake, as Liaison, presented a brief oral report for the Contest Advisory Committee. A number of matters continue under study including the 160-meter DX window, club competition rules changes, use of 10 MHz in contests, DX contest rules changes, use of spotting nets, and separate multiplier status for VE8 and VY1 stations.

40) Mr. Kanode, as Liaison, reported for the DX Advisory Committee which has studies underway on a golden anniversary DXCC operating event, Council of Europe country status, and updating and clarification of the DXCC country criteria.

41) Mr. Beebe, as Liaison, presented a report of the

Emergency Communications Advisory Committee. In answer to a question referred to it by the Board, the ECAC was prepared to support longer RACES drill periods, as proposed by Beverly, Massachusetts. That petition, however, has been dismissed by FCC. The Committee found no need to produce a new identification badge, but suggested a holder for the present ID card so it could be worn. The Committee's report included a draft of a proposed pamphlet on ARES. On motion of Mr. Hurlbert, seconded by Mr. Butler, it was VOTED to accept the report of the Emergency Communications Advisory Committee with thanks for a job well done.

42) Mr. Mendelsohn, as Liaison, presented the report of the Public Relations Advisory Committee, in which they stated a preference for the Marvel Comics group (Spiderman, Captain America, etc.) to produce an illustrated educational brochure for young people. Progress was reported on the slide show for served agencies. The Committee also outlined a possible approach to identifying ways to promote League membership.

43) Mr. Overbeck, as Liaison, reported briefly for the VHF/UHF Advisory Committee, essentially stating that its activity had been low and it had no formal report.

44) Proceeding next to the election of ARRL Foundation Directors, on motion of Mr. Olson, seconded by Mr. Butler, it was VOTED that Messrs. Metzger and Carey are reelected for another three-year term.

45) On motion of Mr. Carey, seconded by Mr. Atkins, it was VOTED, at 5:07 P.M., to recess for dinner, reconvening thereafter to continue the work of the Board. The assembly was called to order at 8:26 P.M. with the same persons present as the afternoon session, with the exception of Mr. Lindholm. Moving to Agenda item 11, Matters for Study and Directors' Motions, the following items were accepted without dissent, for assignment to committees for study:

a) By Mr. Wangler: Study designation of packet radio traffic channels; to the Membership Services Commmitee.

b) By Mr. Wangler: Development of activity for youngsters in radio clubs; to Volunteer Resources Committee.

c) By Mr. Frenaye (for the ECAC): Study plastic holder for existing ARES ID card; to staff.

d) By Mr. Butler: Study the Public Information Officer/Public Information Assistant and club public relations roles; to the Public Relations Advisory Committee.

e) By Mr. Grauer: Study the club liability insurance plan; to the Membership Services Committee.

f) By Mr. Wilson: Study listing packet stations in a Directory; to the Publications Committee.

g) By Mr. Wilson: Study costs of diskettes of Call Directory information; to the Publications Committee, for a report by the next Annual Meeting.

h) By Mr. Stafford: Study recommended operating frequencies for VHF and HF packet radio; jointly to the Membership Services Committee, the VHF-UHF Advisory Committee, and the Ad Hoc Committee on Amateur Radio Digital Communications.

i) By Mr. Stafford: Study feasibility of producing a videotape to train Emergency Coordinators and ARES members; to the Emergency Communications Advisory Committee.

j) By Mr. Grauer: Study operating practices of W1AW; to the Membership Services Committee.

k) By Mr. Olson: Study acquiring of videotapes which depict amateur radio activities/subjects; to the Volunteer Resources Committee.

46) On motion of Mr. Wilson, seconded by Mr. Carey, it was VOTED to recess at 8:45 P.M., reconvening on the morrow at 8:35 A.M., with all persons hereinbefore mentioned present except Messrs. Beebe and Zeigler.

47) The Chair reported the resignation of International Affairs Vice President Elect Olson as the Dakota Division Director and recognized Mr. Mark, who assumes the office of Dakota Division Director, both to take effect at the conclusion of the meeting (applause).

48) Moving to agenda item 9, Appointment of Committees, Mr. Price announced the following appointments:

Administration and Finance—Mr. Metzger, Chairman; Mr. Hurlbert, Alternate Chairman; Mr. Atkins; Treasurer McCobb; Vice President Nathanson.

Volunteer Resources—Mrs. Lewis, Chairman; Mr. Stafford, Alternate Chairman; Mr. Heyn; Vice President Stevens.

Publications—Mr. Wangler, Chairman; Mr. Frenaye, Alternate Chairman; Mr. Mark; Vice Director Ridenour.

Membership Services—Mr. Carey, Chairman; Mrs. Ferdinand, Alternate Chairman; Mr. Milius; Vice Director Severson.

49) Continuing with agenda item 11, on motion of Mr. Frenaye, seconded by Mrs. Ferdinand, it was VOTED that the Publications Committee study the feasibility of combining present ARRL newsletters into a single, inexpensively produced publication able to carry material in a more timely and cost-effective manner than separate newsletters, and be made more widely available to the ARRL membership.

50) It was moved by Mrs. Lewis, seconded by Mr. Frenaye, that ARRL awards credit other than for five band awards, be recognized for all Amateur Radio bands, with the exception of 10 MHz because of our secondary status to other services. After discussion, on motion of Mr. Olson, seconded by Mr. Stafford, it was VOTED that the motion is amended by striking all text after "10 MHz"; whereupon, the motion as amended was ADOPTED.

51) On motion of Mr. Stafford, seconded by Mr. Milius, it was VOTED that the job description for the Section Public Information Officer be modified to include the responsibility for establishing a speakers bureau within the Section to provide amateurs to present talks on Amateur Radio to non-amateur groups including schools, service clubs, civic groups, etc.

52) It was moved by Mr. Milius, seconded by Mr. Stafford, that the Membership Services Committee develop a plan for a special Golden Jubilee DXCC Award, and report back to the Board at the July 1986 meeting. Moved by Mr. Hurlbert, seconded by Mr. Wangler, that the motion be amended by substituting for "develop" the phrase "study feasibility of developing." After discussion, the motion to amend was LOST. The question thereupon being on the original motion, the same was ADOPTED.

53) On motion of Mr. Carey, seconded by Mrs. Ferdinand, it was VOTED that the President take such actions as may be necessary and appropriate to cause FCC Docket 85-105 to be amended to correct its restrictive and crippling effect on the development of packet radio and packet-radio emergency communications caused by requirements for the control operator to be present at domestic intermediary relay points for transmission of third-party traffic. Mr. Ridenour took the seat for Mr. Grauer at 9:17 A.M.

54) On motion of Mr. Heyn, seconded by Mr. Butler, it was VOTED that the Executive Vice President is instructed to have produced, in sufficient quantity to permit field testing, a brochure explaining amateur radio disaster communications capabilities. The brochure is to be similar in design and objectives to that proposed by the ECAC, and is intended for distribution to the media and served agencies.

55) It was moved by Mr. Wangler, seconded by Mr. Atkins, that By Law 25 be changed, the first sentence to read "Beginning on the 4th Friday of January," and the second sentence to read, "Beginning on the 4th Friday of July," effective January 1, 1987. After discussion, upon motion of Mr. Olson, seconded by Mr. Wangler, it was VOTED to postpone action on the motion to be among the first business after lunch. During the course of the above, Mr. Grauer returned to his seat at 9:30 A.M.

56) At 9:36 A.M. Mr. Oubre took the seat for Mr. Hurlbert. On motion of Mr. Oubre, seconded by Mr. Olson, the following resolution was ADOPTED:

WHEREAS, it is desirable to increase the percentage of ARRL members in relationship to the number of licensed amateurs in the U.S., and

WHEREAS, there is an ever increasing number of "ham families," and

WHEREAS, the ARRL has provisions for a class of "full member" without receipt of *QST*, and

WHEREAS, there has been very little information disseminated to potential family members,

NOW THEREFORE, BE IT RESOLVED that the Executive Vice President accomplish the following, using his discretion as to the most effective and appropriate means:

1. Notify all Life Members of the options available to members of their households who are also licensed amateurs to become Life Family Members or Annual Family Members. Family members selecting Annual Family Membership will be allowed to pay a number of years in advance. Upon the expiration of the membership period, Family Annual Members shall be notified in the same manner as other Annual Members.

2. Track and report to the Board on a regular basis the Family Member population by Division.

57) Mr. Severson took the seat for Mr. Wilson at 9:45. It was moved by Mr. Severson, seconded by Mr. Grauer that the provisions of Part II of the Directors Workbook ("Guidelines for Ethical Conduct of Officers and Directors") and of Part II-A ("Policy Governing Contacts with Federal Government Officials by Members of the ARRL Board") will be applicable to Officers, Directors, Vice Directors and Section Managers. After discussion, on motion by Mr. Holladay, seconded by Mr. Milius, it was VOTED to refer the matter to the Executive Committee. During the course of the above, Messrs. Hurlbert and Wilson returned to the meeting.

58) It was moved by Mrs. Ferdinand, seconded by Mr. Grauer, that it is the policy of the ARRL that ARRL booklets and reference cards intended to educate and assist in improving public service and operating skills be made available at no cost except for postage. After discussion, it was moved by Mrs. Lewis, seconded by Mr. Frenaye, that the motion be amended by striking the text and substituting: "Moved, that Section Managers receive Net Directories for their section leadership appointees at no charge." The Chair ruled that the wording of the motion to amend is not relevant to the original motion; whereupon, Mrs. Ferdinand, with the consent of her second, withdrew the original motion.

59) It was moved by Mr. Grauer, seconded by Mr. Carey that By-Law 13 be changed by substituting the word "General" for the word "Technician." After discussion, Mr. Grauer, with the consent of his second, withdrew the motion on the floor.

60) It was moved by Mr. Frenaye, seconded by Mr. Milius, that the following resolution be adopted:

WHEREAS, the amateurs of the United States have a long tradition of service in emergencies, to the people and their government; and

WHEREAS, agreements in advance to broad principles concerning emergency communications facilitate action in time of need; therefore,

BE IT RESOLVED that the ARRL explore the possibilities of Memoranda of Understanding with the National Weather Service (NWS) and Civil Air Patrol (CAP).

It was moved by Mr. Wilson, seconded by Mrs. Lewis, that the motion be amended by striking the words "and Civil Air Patrol (CAP)." After discussion, a roll call vote being requested, the motion to amend was LOST with 6 votes in favor, 9 votes against, and 1 abstention. Messrs. Atkins and Hurlbert, Mrs. Lewis, Messrs. Metzger, Olson and Wilson voted aye; Mrs. Ferdinand and Messrs. Butler, Carey, Frenaye, Heyn, Milius, Stafford, Turnbull and Wangler voted in opposition to the amendment and Mr. Grauer abstained. The question then being on the original motion, a roll call vote being requested, it was ADOPTED 9 votes in favor, to 6 opposed with 1 abstention. Mr. Butler, Mrs. Ferdinand, Messrs. Frenaye, Grauer, Heyn, Mrs. Lewis and Messrs. Milius, Olson and Stafford voted in favor. Messrs. Carey, Hurlbert, Metzger, Turnbull, Wangler and Wilson voted opposed, and Mr. Atkins abstained. During the above the Board was in recess at 10:30 A.M., reconvening at 11:11 A.M.

61) On motion of Mrs. Lewis, seconded by Mr. Olson, the matter of the 160-meter band plan was lifted from the table (Min. 26). The question then being on the pending amendment, it was VOTED to amend the original motion to read:

"Moved, that a band plan for the 160 meter band be adopted as follows: 1.800-1.840 MHz CW, RTTY, other narrow-band modes; 1.840-2.000 MHz CW, SSB, SSTV, other wide-band modes. Further, that because the segment from 1830 kHz to 1850 kHz is the most common international allocation on 160 meters, amateurs are encouraged to utilize that segment for intercontinental QSOs only. Further, to help ensure orderly use of the band, that Counsel file a petition with the FCC to revise Section 97.61 of the Rules to reflect the mode segments delineated above." On motion of Mrs. Lewis, seconded by Mr. Butler, it was VOTED to amend the amended motion by striking the last sentence. It was moved by Mr. Heyn, seconded by Mr. Milius, that further action be postponed until after lunch; the motion to postpone was LOST. The question thereupon being on the motion to amend the amended motion, a roll call vote being requested, the amendment was adopted with 10 votes in favor, 5 opposed, 1 abstention; Mrs. Ferdinand and Messrs. Frenaye, Milius, Wangler and Wilson voted against the amendment; Mr. Atkins abstained; all other directors voted in favor.

It was then moved by Mr. Hurlbert, seconded by Mr. Wilson, to strike the amended motion and substitute therefor the following: "Moved, that it is recommended that all amateur emissions authorized by FCC regulations in the amateur band 1.8 MHz to 2.0 MHz be voluntarily limited to 3.0 kHz or less in bandwidth." Mr. Frenaye raised a Point of Order questioning the relevance of the amendment to the motion on the floor. The Chair ruled the motion to strike and substitute to be germane and therefore in order. Mr. Frenaye appealed the ruling of the Chair; it was sustained. The question then being on the motion to substitute, it was LOST. The question thereupon being on the motion as amended, the same was ADOPTED. Mr. Milius and Mr. Carey requested to be recorded as voting no. Thus, the League recommends 1800-1840 kHz for CW, RTTY and other narrow-band modes, 1840-2000 kHz for CW, SSB, SSTV and other wide-band modes, and further recommends that only intercontinental QSOs take place in 1830-1850 kHz.

62) It was moved by Mr. Stafford, seconded by Mrs. Lewis, that a summary of all advisory committee proceedings be included in the publication *Field Forum*. After discussion, Mr. Stafford, with his second's consent, withdrew the motion.

63) On motion of Mr. Carey, seconded by Mr.

Butler, it was VOTED that the Membership Services Committee conduct a survey to determine accurately the reaction of members to the elimination of QSO parties cancelled under Minute 68 of the Second Meeting of the Board in July, 1985.

64) On motion of Mr. Atkins, seconded by Mr. Butler, it was VOTED that the Executive Vice President shall determine the costs associated with the reproduction of the Repeater Coordinators Newsletter and offer it for sale to the general membership of the League while continuing free distribution to repeater coordinators. The Chair declared a recess at 12:18 P.M. The Board reconvened at 1:16 P.M. with all persons hereinbefore mentioned present except for Messrs. Beebe, Chapman, Lindholm and Zeigler.

65) On motion of Mr. Wilson, seconded by Mr. Carey, it was VOTED that scholarships are not "awards bestowed by the Board" under By Law 40, and will be considered and awarded by the ARRL Foundation rather than by the Volunteer Resources Committee.

66) On motion of Mrs. Ferdinand, seconded by Mr. Wilson, it was VOTED that the recommendation of the Volunteer Resources Committee that the President appoint a Blue Ribbon Committee for study and recommendations as to methods of handling message traffic overloads during an emergency is approved, and the President is directed to appoint such a committee. The budget is amended to include funds for one in-person meeting of the Committee, to be charged to such account as may be directed by the Administration and Finance Committee.

67) On motion of Mrs. Lewis, seconded by Mr. Frenaye, it was VOTED that, in light of the unique role that Field Day plays in emergency preparedness, credit be recognized for contacts made on all amateur radio bands, with the exception of 10 MHz.

68) The Board then took up the matter of the revision of By Law 25, to begin Board meetings on Fridays rather than Thursdays, that had been postponed. A roll call vote being required with 12 votes necessary for adoption, the motion was LOST, 10 votes in favor, 6 opposed. All directors voted in favor except Mrs. Lewis and Messrs. Grauer, Metzger, Milius, Stafford and Turnbull who voted in opposition.

69) It was moved by Mr. Stafford, seconded by Mr. Heyn that the ARRL staff establish a tape-recorded news and information service to be accessed by telephone. After discussion, on motion of Mrs. Ferdinand, seconded by Mr. Butler, it was VOTED to refer the matter to the Membership Services Committee for study.

70) On motion of Mr. Carey, seconded by Mr. Frenaye, it was VOTED that the Executive Vice President is directed to implement the staff plan to actively promote Local Memoranda of Understanding for use by Amateur Radio Emergency Service officials, as approved by the Volunteer Resources Committee.

71) On motion of Mr. Turnbull, seconded by Mr. Frenaye, the following resolution was unanimously ADOPTED:

WHEREAS, Marjorie C. Tenney, WB1FSN, has served on the ARRL Headquarters staff for more than 20 years; and

WHEREAS, as ARRL Hamfest and Convention Coordinator she has been a friend to countless members of the ARRL Board of Directors, Field Organization members and hamfest and convention committees; and

WHEREAS, her personal touch over the years has made ARRL hamfests and conventions just that much more enjoyable for all; now therefore,

BE IT RESOLVED that this Board commends Marge for her contribution to the League and Amateur Radio and wishes her the very best for a richly deserved, long, healthy and happy retirement. (Applause)

72) Moved by Mr. Olson, seconded by Mrs. Ferdinand, after discussion, it was VOTED that existing Board directives with respect to mandatory monthly presentation of certain *QST* columns are rescinded. Mr. Heyn requested that he be recorded as voting opposed.

73) Moved by Mr. Hurlbert, seconded by Mr. Olson, the following resolution was ADOPTED:

WHEREAS, the present structure of national Advisory Committees was created by the ARRL Board of Directors in the course of implementation of recommendations of the Long Range Planning Committee; and

WHEREAS, in spite of the dedicated efforts of the appointed members of these Committees, Staff and the Board, the results obtained from these Committees have not reached expectations; and

WHEREAS, it appears that the Committees as now constituted and organized are too large and so underfunded as to prevent realization of expectations; and

WHEREAS, the matter is of such importance and concern that it requires special attention, treatment and expertise, now therefore,

BE IT RESOLVED by this Board that the President of ARRL is directed to appoint a Special Study Committee, empowered, funded and charged as follows:

a) to study the feasibility of reducing the size of each Committee to a more manageable number;

b) to study the method of selection of membership on the Committees, and their tenure in office;

c) to study funding of the Committees, and determine the feasibility of funding that would permit in-person meetings;

d) to study the structural concept and mission of each Committee and the need for each Committee;

e) to make its findings and recommendations known to the Board with all reasonable dispatch;

f) to make such further studies, findings and recommendations as the Special Study Committee may see fit and proper in the premises;

g) the Special Study Committee here created is hereby funded by an initial appropriation of $5,000;

h) the Special Study Committee shall serve at the pleasure of the ARRL President, and exist until it shall have completed the tasks assigned to it by the Board, unless earlier abolished by the Board.

74) It was moved by Mr. Wilson, seconded by Mr. Carey, that Standing Order No. 80 is amended to read as follows:

"The Board of Directors authorizes the attendance of Vice Directors at Board Meetings. Their attendance will be subject to the approval of the Division Director. Expenses will be chargeable to the Board Meeting account." A roll call vote being requested, the motion to amend was ADOPTED with all directors voting in favor.

75) On motion of Mrs. Ferdinand, seconded by Mr. Grauer, it was VOTED that the Headquarters staff be instructed to prepare, in consultation with experienced members in the field, a guidebook for sponsoring conventions and hamfests.

76) It was moved by Mrs. Lewis, seconded by Mr. Frenaye, that the Membership Services Committee is requested to continue its study of the desirability of ARRL members being offered vacation travel plans and credit cards, and to include in its study:

1) the determination of the level of membership interest in these and similar programs, and

2) a review of the products of various marketers serving the association field.

The Board was in recess from 2:26 P.M. to 2:43 with all persons hereinbefore mentioned present with the exception of Mr. Price; Mr. Nathanson assumed the Chair and discussion continued. On motion of Mr. Stafford, seconded by Mr. Heyn, it was VOTED that the motion is amended by striking the words "credit cards" and adding therefor the phrase "additional membership benefits." The question thereupon being on the motion as amended, a tie vote was found to exist, 7 votes for, 7 votes against the motion, with 2 abstentions. The Chair voted in the negative, so the motion as amended was LOST.

77) On motion of Mr. Stafford, seconded by Mr. Frenaye, it was VOTED that the ARRL Board of Directors create a "Legal Strategy Committee." The Committee shall be appointed by the President and shall work with the Volunteer Resources Committee to enhance the Volunteer Counsel Program by providing assistance in matters related to antenna ordinances, zoning restrictions as they relate to amateur radio operations, and deed restriction problems.

78) On motion of Mr. Stafford, seconded by Mr. Butler, it was VOTED that the staff be directed to forward to new Section Managers a complete sampling of all available forms, handouts, brochures and pamphlets relevant to the Field Organization that are available from League Headquarters. Further, that whenever a new form, handout, brochure or pamphlet is developed, it shall be promptly forwarded to all Section Managers.

79) On motion of Mr. Butler, seconded by Mr. Milius, it was VOTED that the report of the Executive Vice President in response to Minute 59 of the 1985 Second Meeting of the Board, the National Repeater Data Base, is accepted. The Executive Vice President is instructed to proceed with implementation. During the course of the above, Mr. Price resumed the Chair at 3:15 P.M.

80) On motion of Mr. Turnbull, seconded by Mr. Atkins, it was VOTED that the Executive Committee review the "Terms and Conditions Governing the Availability of Mailing Lists from Headquarters" policy and report recommended revisions to the Board at its 1986 Second Meeting.

81) On motion of Mr. Turnbull, seconded by Mr. Hurlbert, it was VOTED that the report of the Executive Vice President in response to Minute 76 of the 1985 Second Meeting is accepted; and further, that the Executive Vice President is instructed to develop a program of special encouragement and support to Amateur Radio Clubs located at U.S. military installations, particularly those at which communications and electronics training is performed, and to pursue with the MARS organizations the possibility of enhanced MARS operations at these sites, with training of new amateur licensees a primary objective.

82) On motion of Mr. Olson, seconded by Mr. Atkins, it was VOTED that the ARRL offer to host the 1989 Triennial Meeting of IARU Region 2 in the United States with special emphasis on coordinating the event with the Diamond Anniversary of the ARRL.

83) On motion of Mr. Wilson, seconded by Mrs. Ferdinand, it was VOTED that the Volunteer Resources Committee may authorize implementation, which shall begin forthwith, of a program for authorizing ARRL Field Organization volunteers to purchase distinctive, official ARRL call sign badges, such program to be implemented with the following stipulations:

a) that the design of the badge be patterned after the official call sign badges for ARRL elected officials, officers and staff;

b) that the background colors of the badges be distinctive and identify categories of volunteers;

c) that each badge manufacturer who wishes to participate must agree to meet and continue to adhere to quality standards; and

d) that the program operate at no cost to ARRL.

84) On motion of Mr. Wilson, seconded by Mr. Frenaye, the following resolution was ADOPTED:

To implement the Board's previous insulation of the League from repeater coordinating activities, BE IT RESOLVED that access to a League repeater data base or publication does not constitute nor imply endorsement or recognition of the authority of such coordinators. Upon being advised by a disputant of a *bona fide* dispute concerning the authority of one having access, further authority to input data as to the subject area of the dispute will be suspended pending its resolution.

Appropriate caveats will be made in the *Repeater Directory* as to the disassociation of the League from coordination and certification of coordinators, and pointing out that the coordinators and not the League represent the fact of coordination of repeaters in future issues of the Directory.

League Officials will be reminded that the League, as a matter of policy, takes no part in the coordination process and will be directed to govern their actions accordingly.

85) It was moved by Mr. Wilson, seconded by Mr. Frenaye, that By-Law 24 be amended as follows to be effective January 1, 1987:

"24. In accordance with the provisions of Article 7 of the Articles of Association, members of a territorial division may petition for recall of the director of their division. *Any League member may give notice of a proposed recall by mailing to the Secretary by certified mail a letter to that effect. The fact of receipt will be communicated only to Officers, the Director concerned, the sender and the Executive Committee.* The recall petition shall be presented to the secretary not later *than 75 days after the mailing of the notice of recall and not later* than June 1st of the second year of the term of office. A valid petition shall contain the *dated signatures obtained on or after the date of mailing of the notice to the Secretary, and will include* (of) not less than 10 percent of the number of Full members voting in the election at which the director was elected or not less than 10 percent of the Full members resident in the division on the preceding December 31st if the director was elected without membership balloting. Upon certification by the Executive Committee that the petition is valid, the Secretary shall prepare a ballot asking the single question, 'Shall the Director be recalled, yes or no?' If a majority of the votes cast are for recall, then the office of director shall be declared vacant. No director shall be subject to more than one recall *election* during a single term of office." (Note: Italicized words are added, words in parentheses are deleted. Other text remains as written.)

After discussion, a roll call vote being required, the question was decided in the affirmative; all Directors voted in favor, so the By Law is AMENDED.

86) On motion of Mrs. Ferdinand, seconded by Mr. Stafford, it was VOTED that the Contest Advisory Committee and the Membership Services Committee be requested to review the present three-tier club competition plan to ensure that the club categories are reasonable.

87) It was moved by Mrs. Ferdinand, seconded by Mr. Wangler, that it is the policy of ARRL that reference cards and pamphlets intended solely for recruiting and training radio amateurs in providing disaster and public service communications services be made available at no charge except the cost of postage. On motion of Mr. Carey, seconded by Mr. Hurlbert, it was VOTED to amend the motion by inserting "not to include Net Directories and Repeater Directories" after " . . . communications services," whereupon Mrs. Ferdinand, with unanimous consent withdrew the motion.

88) On motion of Mr. Grauer, seconded by Mr. Heyn, it was unanimously VOTED that Counsel is instructed to file with the FCC a petition requiring the

labelling of home electronic equipment with regard to its susceptibility to RF energy, along the lines of the draft prepared at the direction of the Executive Committee. The text of the petition shall be reviewed by the Executive Committee prior to filing with the Commission.

89) On motion of Mr. Stafford, seconded by Mrs. Lewis, it was VOTED that the standard operating procedures for all Advisory Committees be modified to require all Advisory Committee Chairpersons to submit a brief summary of the Advisory Committee proceedings at least twice per year for publication.

90) It was moved by Mr. Stafford, seconded by Mrs. Lewis, that the Volunteer Resources Committee study ways to improve the liaison between the Board and National Traffic System officials regarding matters dealing with traffic, both national and international, the Volunteer Resources Committee to report to the Board of Directors at the 1986 Second Meeting. After discussion, the Chair ruled that such matter falls within the scope of the Blue Ribbon Committee appointed to study the NTS, whereupon Mr. Stafford, with his second's consent, withdrew the motion. During the course of the above, Messrs. Mendelsohn, Severson and Oubre took the seats for Mrs. Ferdinand, Mr. Wilson and Mr. Hurlbert respectively at 4:20 P.M. Mr. Wilson returned to his seat at 4:24 P.M.

91) On motion of Mr. Olson, seconded by Mr. Holladay, the following resolution was unanimously ADOPTED:

WHEREAS, Garfield A. Anderson, KØGA, took office as Director for the ARRL Dakota Division in 1976, serving with distinction and honor until 1982, and

WHEREAS, he was in that year selected by his peers to serve as a Vice President, until the present meeting, and

WHEREAS, during his tenure as Vice President he led the way to development of the Volunteer Examining and Volunteer Monitoring Programs as chairman of the Ad Hoc committee, achievements of great credit to the ARRL, now therefore,

BE IT RESOLVED, that the Board of Directors of the American Radio Relay League in Annual Meeting assembled this 24th day of January 1986, does thank Garfield A. Anderson, KØGA, for his long, diligent service to ARRL and wishes him continued success in all his endeavors. (Applause)

92) Mr. Nathanson took the Chair at 4:28 P.M.; Mrs. Ferdinand and Mr. Hurlbert resumed their seats. It was moved by Mr. Wilson, seconded by Mr. Grauer, that after reconsideration and consultation with the members, the Board feels that it should proceed no further with the issuance of call signs at this time. After discussion, it was moved by Mr. Heyn, seconded by Mr. Holladay that the motion be postponed indefinitely. The motion to postpone FAILED. The question then being on the original motion, a show of hands being required, there were 5 votes in favor to 10 votes opposed, so the motion was LOST. Mr. Atkins abstained.

93) It was moved by Mrs. Ferdinand that the Net Directory be supplied free of charge to ARRL field appointees on request, but there being no second, the motion was LOST.

94) Mr. Ridenour then took the seat for Mr. Grauer at 5:21 P.M. On motion of Mr. Ridenour, seconded by Mr. Butler, it was VOTED that the President represent to the FCC that *all* VECs be required to equally perform all administrative and clerical functions required of any VEC.

95) On motion of Mr. Ridenour, seconded by Mr. Stafford, it was VOTED that the Executive Vice President publish, at least semi-annually, an up-to-date Headquarters organization chart, showing principal functions and organizational relationships, covering all supervisory personnel, for inclusion in the Directors Workbook. At this point, at 5:36 P.M., Mr. Price resumed the Chair and Messrs. Metzger, Nathanson, and Imlay departed from the meeting under the necessity of returning to their homes.

96) Moving now to item no. 12(a) on the Agenda, Directors' Administrative Expenses for 1986, on motion of Mr. Wangler, seconded by Mr. Milius, it was VOTED that the Executive Vice President is hereby authorized to reimburse the Division Directors for actual expenses incurred by them during the year 1986 in the proper administration of ARRL affairs in their respective divisions, and in accordance with Board policy, up to the amounts as follows:

Atlantic Division	$11,500
Central Division	7,500
Dakota Division	3,500
Delta Division	10,000
Great Lakes Division	11,000
Hudson Division	5,600
Midwest Division	6,500
New England Division	8,500
Northwestern Division	13,000
Pacific Division	10,500
Roanoke Division	10,500
Rocky Mountain Division	6,000
Southeastern Division	10,500
Southwestern Division	10,900
West Gulf Division	7,500

During the course of the above, Mr. Kanode took the seat for Mr. Milius.

97) On motion of Mr. Wangler, seconded by Mr. Carey, it was VOTED that the Executive Vice President is hereby authorized to reimburse the following Committees, Task Groups and Task Forces created by the Board for expenses incurred by them during the year 1986 in the proper execution of their duties, and in accordance with Board policy, as follows:

Ad Hoc Committee on Strengthening of CRRL	$6,000
Ad Hoc Committee on Spread Spectrum	2,000
RFI Task Group	2,500
Committee on the Biological Effects of RF Energy	3,500
ARRL Committee on Amateur Radio Digital Communication	14,000
Legal Strategy Committee	10,000

98) On motion of Mr. Heyn, seconded by Mr. Kanode, it was VOTED that to continue the Board's policy of reimbursing QSL bureau managers of the League for certain travel in furthering ARRL organizational objectives, the Executive Vice President is hereby authorized to pay during the year 1986 a total amount not to exceed $4,000 under terms prescribed by the general pattern established by the Board.

99) On motion of Mr. Butler, seconded by Mr. Wangler, it was VOTED that, to continue the Board's policy of reimbursing National Traffic System officials above the section level for certain approved expenses in furthering ARRL organizational objectives, the Executive Vice President is hereby authorized to pay during the year 1986 a total amount not to exceed $12,000 under terms prescribed by the Field Services Manager following the general pattern established by the Board.

Directors Hurlbert, Wilson, Ferdinand and Grauer study the reams of paper that deal with the thorny issues before the Board at its 1986 Annual Meeting.

100) On motion of Mr. Grauer, seconded by Mr. Turnbull, it was VOTED that to continue the policy of the Board to assume the administrative expenses of the ARRL Foundation, the Executive Vice President is hereby authorized to pay during the year 1986 a total amount not to exceed $2,000 in accordance with ARRL standing policies with respect to travel, accounting procedures and auditing.

101) On motion of Mr. Stafford, seconded by Mr. Kanode, it was VOTED that the additional sum of $147.65 is authorized to reimburse National Traffic System officials above the section level for certain approved expenses in furthering ARRL organizational objectives, as a supplement to the authorization provided at Minute 88 of the 1985 annual Meeting of the Board; and further, that National Traffic System officials above the section level are urged to continue their efforts to minimize travel-related expenses, in accordance with sound fiscal policy.

102) Returning to Item No. 9 on the Agenda, Appointment of Committees, Mr. Price announced the following appointments:

VHF/UHF Advisory Committee—Mr. Terry Van Benschoten, WØVB, Chairman; Vice Director Overbeck, Board Liaison;

Public Relations Advisory Committee—Mr. Richard Moseson, N2BFG, Chairman; Vice Director Evelyn Gauzens, W4WYR, Board Liaison;

Emergency Communications Advisory Committee—Mr. Joel Kandel, KI4T, Chairman; Vice Director Beebe, Board Liaison;

Contest Advisory Committee—Mr. Douglas Grant, K1DG, Chairman; Vice Director Kanode, N4MM, Board Liaison;

DX Advisory Committee—Mr. Robert W. Thompson, K6SSJ, Chairman; Vice Director Drake, Board Liaison;

VHF Repeater Advisory Committee—Mr. Joseph I. Eisenberg, WAØWRI, Chairman; Vice Director Oubre, K5DPG, Board Liaison;

Repeater Coordinator Newsletter Editor—Vice Director Mendelsohn, WA2DHF;

NTS Blue Ribbon Committee Chairman—Vice Director Comstock, N5TC; ARRL Committee on Amateur Radio Digital Communication—Mr. Paul Rinaldo, W4RI, Chairman; Vice President Olson, Board Liaison; Vice Director Quiat, Alternate;

Special Study Committee on Advisory Committees—First Vice President Holladay, W6EJJ, Chairman.

103) On motion of Mr. Baldwin, seconded by Mr. Olson, it was VOTED that the Commission be petitioned to modify Section 97.313 of the FCC Rules and Regulations so as to specify that, in accordance with IARU recommendations, when overseas stations are operating in the United States under terms of a reciprocal operating permit, the U.S. call area designator precede the foreign call sign—i.e. W4/DL6TJ rather than DL6TJ/W4. The following Directors wished to be recorded as voting opposed: Messrs. Hurlbert and Wilson and Mrs. Lewis. Mr. Atkins abstained.

104) On motion of Mr. Grauer, seconded by Mr. Turnbull, it was VOTED that Mr. Dick Eilers, WØYZV, is elected as Industry Director of the ARRL Foundation (applause).

105) There followed an opportunity for all present to make final comments, during which it was noted that with this meeting Mr. Baldwin was bringing to a close a 37-year span of attending Board Meetings as a staff member and officer, but that his relationship with organized Amateur Radio would continue. There being no further business, the Board adjourned *sine die* at 6:36 P.M. Total time in session as a Board: 14 hours, 44 minutes; direct authorization: $194,147.65.

Respectfully submitted,
Perry Williams, W1UED
Secretary

Minutes of Executive Committee
No. 421
Hartford, Connecticut
January 23, 1986

Agenda

1. Determination of date and place of next meeting
2. Consideration of correspondence concerning 1986 Northwestern Division Convention

The Executive Committee of the American Radio Relay League, Inc., met at 9:00 P.M. Eastern Standard Time, Thursday, January 23, 1986, at the Parkview Hilton Hotel, Hartford, Connecticut. Present were President Larry E. Price, W4RA, in the Chair; First Vice President Jay A. Holladay, W6EJJ; Directors Frank M. Butler, Jr., W4RH; Paul Grauer, WØFIR; Hugh A. Turnbull, W3ABC; George S. Wilson, III, W4OYI; and Executive Vice President David Sumner, K1ZZ. Also present were Vice President William J. Stevens, W6ZM; International Affairs Vice President Tod Olson, KØTO; Directors Lys J. Carey, KØPGM, Linda S. Ferdinand, N2YL, Mary E. Lewis, W7QGP, and Rodney J. Stafford, KB6ZV; and Counsel Christopher D. Imlay, N3AKD.

1) It was agreed to reschedule the next regular meeting of the Executive Committee to Saturday, March 22, 1986, in Charlotte, North Carolina.

2) Recent correspondence concerning the approval of a Northwestern Division Convention to be held May 30-31 and June 1, 1986, was reviewed. On motion of Mr. Wilson, the President unanimously was instructed to write the sponsors of a proposed event in Seaside, Oregon advising them that the Committee had discussed their concerns with the Division Director and that she had indicated she would consider favorably an application for state convention sanction for their events; and further, that in view of the incorrect dates for the Northwestern Division Convention that appeared in January *QST*, the sponsors are to be advised that if they apply for state convention sanction, a ¼-page advertisement in one issue of *QST* will be provided to them at no charge.

There being no further business, the meeting was adjourned at 10:00 P.M.

Respectfully submitted,
David Sumner, K1ZZ
Recording Secretary

Happenings

Conducted By David Newkirk, AK7M
Manager, Regulatory Information Branch

Gains and Losses at the Microwaves—and Major Part 97 Revisions

On January 10, FCC acted in PR Docket 85-23, the so-called "Microwave Access Docket," granting us new privileges in some Gigahertz bands and removing or modifying others. More frequencies are available to the Amateur-Satellite Service—anyone for Mode L? Our stance at 160 meters is clarified, and new 1810-1850 kHz privileges are granted for Region 1. There's quite a bit of Part 97 "editing." (Background on what 85-23 means to the Amateur-Satellite Service appeared in February 1985 Happenings; April 1985 Happenings covers more of the terrestrial 85-23 changes.)

The frequency-losses-and-gains aspect of the *Report and Order* in 85-23 aside, what's perhaps most striking about the action is the strong continuation of an increasingly important theme: Amateur Radio is but one in a community of services that *share* the electromagnetic spectrum, and it (we radio amateurs) must recognize that fact and operate accordingly. As you'll see when you read the Part 97 revisions resulting from 85-23, the bulk of the rules changes is specification of Amateur Radio's relationship to other services. Why is this? It's because we *share* so many of these new and modified bands. As soon as we share a given band, we, as operators in a radio service, must afford stations in other services on that band the proper protection from interference. Depending on our status in a given band, stations of other services may have to avoid stepping on our toes as well. You've already read wording to this effect in last month's *QST;* there, FCC added wording to Part 97 ordering us not to cause harmful interference to radiolocation at 1900-2000 kHz. Get ready for a whole bunch of similar wording in the 85-23 modifications to Part 97. It's "share," but not necessarily "share alike."

These changes are effective 0001 UTC March 1, 1986. While we're pleased that the release of the Report and Order in 85-23 hit the streets in time to make this (March) *QST*, there are two apparent "booboos" in the resultant Part 97 amendments you should know about. ARRL had hoped for correction of these errors right up to press time. Since this hasn't happened, we go to the presses with the text as it stands. Here are the points in question: (1) Through a typographical error, Technician class licensees are authorized telegraphy operation from 7100-7175 kHz. Don't you believe it; this should be 7100-7150 kHz. (2) In the table of emissions at Section 97.61, emissions H3E, J3E and R3E have been mistakenly authorized at 7075-7100 kHz for all FCC-licensed amateurs General class and above. Nope; these emissions should have been associated with Limitation 2 (a footnote to the table) or, alternatively, in a Limitation all their own. We're still "limited" to nonvoice emissions at 7075-7100 kHz, folks, if we're north of 20 degrees north latitude and east of 130 degrees west longitude. (See League Lines, this issue, for news on the authorization of 7075-7100 kHz radiotelephony for stations south of 20 degrees north latitude.) FCC is aware of these problems and is working on a correction. *Note: Operation under the color of any of these inadvertent "expansions" after March 1 is not recommended.* You may obtain a copy of the *Report and Order* in PR Docket 85-23 from HQ for a large SASE bearing 56 cents postage. To update your copy of *The FCC Rule Book*, make these changes to Part 97:

Paragraph (k) of Section 97.3 is revised to read:

(k) *National Radio Quiet Zone.* The area bounded by 39° 15′ N on the north, 78° 30′ W on the east, 37° 30′ N on the south and 80° 30′ W on the west.

Section 97.7 is revised in its entirety to read as follows:

§ 97.7 **Frequency privileges.**

The following transmitting frequency bands are available to amateur radio stations having a control operator of the license class designated, subject to the limitations of paragraph (g) of this section:

(a) *Novice class:*

Meter band	*Terrestrial location of the amateur radio station* ITU Region 1	ITU Region 2	ITU Region 3	Limitations (see para.[g])
		kilohertz		
80	3700-3750	3700-3750	3700-3750	1,3,32
—	—	5167.5	—	2
40	7050-7075	7100-7150	7050-7075	1,3,32
15	21100-21200	21100-21200	21100-21200	1,32
10	28100-28200	28100-28200	28100-28200	1

(b) *Technician class:* All of the frequency bands listed in paragraph (f), as well as the frequency bands in the following table:

Meter band	*Terrestrial location of the amateur radio station* ITU Region 1	ITU Region 2	ITU Region 3	Limitations (see para.[g])
		kilohertz		
80	3700-3750	3700-3750	3700-3750	1,3,32
—	—	5167.5	—	2
40	7050-7075	7100-7175[1]	7050-7075	1,3,32
15	21100-21200	21100-21200	21100-21200	1,32
10	28100-28200	28100-28200	28100-28200	1

(c) General Class: All of the frequency bands listed in paragraph (f), as well as the frequency bands in the following table:

Meter band	*Terrestrial location of the amateur radio station* ITU Region 1	ITU Region 2	ITU Region 3	Limitations (see para.[g])
		kilohertz		
160	1810-1850	1800-2000	1800-2000	3,5,21
80	3525-3750	3525-3750	3525-3750	3,32
75	—	3850-4000	3850-3900	3,32
—	—	5167.5	—	2
40	7025-7100	7025-7150	7025-7100	3,32
40	—	7225-7300	—	3,32
30	10100-10150	10100-10150	10100-10150	28,32
20	14025-14150	14025-14150	14025-14150	32
20	14225-14350	14225-14350	14225-14350	32
15	21025-21200	21025-21200	21025-21200	32
15	21300-21450	21300-21450	21300-21450	32
12	24890-24990	24890-24990	24890-24990	29,32
10	28000-29700	28000-29700	28000-29700	

(d) *Advanced class:* All of the frequency bands listed in paragraph (f), as well as the frequency bands in the following table:

Meter band	*Terrestrial location of the amateur radio station* ITU Region 1	ITU Region 2	ITU Region 3	Limitations (see para.[g])
		kilohertz		
160	1810-1850	1800-2000	1800-2000	3,5,21
80	3525-3750	3525-3750	3525-3750	3,32
75	3775-3800	3775-4000	3775-3900	3,32
—	—	5167.5	—	2
40	7025-7100	7025-7300	7025-7100	3,32
30	10100-10150	10100-10150	10100-10150	28,32
20	14025-14150	14025-14150	14025-14150	32
20	14175-14350	14175-14350	14175-14350	32
15	21025-21200	21025-21200	21025-21200	32
15	21225-21450	21225-21450	21225-21450	32
12	24890-24990	24890-24990	24890-24990	29,32
10	28000-29700	28000-29700	28000-29700	

[1]Apparent error; see text.

(e) *Amateur Extra class:* All of the frequency bands listed in paragraph (f), as well as the frequency bands in the following table:

Meter band	*Terrestrial location of the amateur radio station* ITU Region 1	ITU Region 2	ITU Region 3	Limitations (see para.[g])
		kilohertz		
160	1810-1850	1800-2000	1800-2000	3,5,21
80/75	3500-3800	3500-4000	3500-3900	3,32
—	—	5167.5	—	
40	7000-7100	7000-7300	7000-7100	3,32
30	10100-10150	10100-10150	10100-10150	28,32
20	14000-14350	14000-14350	14000-14350	32
15	21000-21450	21000-21450	21000-21450	32
12	24890-24990	24890-24990	24890-24990	29,32
10	28000-29700	28000-29700	28000-29700	

(f) *Frequency bands available to all amateur stations having a control operator of the Technician, General, Advanced or Amateur Extra class:*

Meter band	*Terrestrial location of the amateur radio station* ITU Region 1	ITU Region 2	ITU Region 3	Limitations (see para.[g])
		megahertz		
6	—	50-54	50-54	3
2	144-146	144-148	144-148	3,32
1.25	—	220-225	—	3,4,5
0.70	430-440	420-450	420-450	3,5,6,7,10,30
0.35	—	902-928	—	3,5,8,9
0.23	1240-1300	1240-1300	1240-1300	5,11,22
—	2300-2310	2300-2310	2300-2310	3,5,12,13
—	2390-2450	2390-2450	2390-2450	3,5,13,14
		gigahertz		
—	—	3.3-3.5	3.3-3.5	3,5,15,16,17
—	5.650-5.850	5.650-5.925	5.650-5.850	3,5,18,19,20
—	10.0-10.5	10.0-10.5	10.0-10.5	5,21,22,23,31
—	24.00-24.25	24.00-24.25	24.00-24.25	3,5,22,24,26
—	47.0-47.2	47.0-47.2	47.0-47.2	
—	75.5-81	75.5-81	75.5-81	5,21,22
—	119.98-120.02	119.98-120.02	119.98-120.02	15,25
—	142-149	142-149	142-149	5,15,21,22
—	241-250	241-250	241-250	5,21,22,27
—	above 300	above 300	above 300	15

(g) *Limitations*

(1) Novice and Technician class radio operators are limited to the use of international Morse code when communicating in this band.

(2) This band may only be used by Amateur stations in the State of Alaska or within fifty nautical miles of the State of Alaska for emergency communications with other stations authorized to use this band in the State of Alaska. This frequency band is shared with licensees in the Alaska-private fixed service who may use it for certain non-emergency purposes.

(3) Where, in adjacent regions or subregions, a band of frequencies is allocated to different services of the same category, the basic principle is the equality of right to operate. Accordingly, the stations of each service in one region or subregion must operate so as to not cause harmful interference to services in the other regions or subregions. (See International Telecommunication Union Radio Regulations, RR 346 [Geneva, 1979].)

(4) This band is allocated to the amateur, fixed and mobile services in the United States on a co-primary basis. The basic principle which applies is the equality of right to operate. Amateur, fixed and mobile stations must operate so as not to cause harmful interference to each other.

(5) Amateur stations in the 1900-2000 kHz, 220-225 MHz, 420-450 MHz, 902-928 MHz, 1240-1300 MHz, 2300-2310 MHz, 2390-2450 MHz, 3.3-3.5 GHz, 5.650-5.925 GHz, 10.0-10.5 GHz, 24.05-24.25 GHz, 76-81 GHz, 144-149 GHz and 241-248 GHz bands must not cause harmful interference to stations in the Government radiolocation service and are not protected from interference due to the operation of stations in the Government radiolocation service.

(6) No amateur station shall operate north of Line A (see § 97.3[i]) in the 420-430 MHz band.

(7) The 420-430 MHz band is allocated to the Amateur service in the United States on a secondary basis, but is allocated to the fixed and mobile (except aeronautical mobile) services in the International Table of Allocations on a primary basis. Therefore, amateur stations in this band must not cause harmful interference to stations authorized by other nations in the fixed and mobile (except aeronautical mobile) services and are not protected from interference due to the operation of stations authorized by other nations in the fixed and mobile (except aeronautical mobile) services.

(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° N to 42° N, and longitude 103° W to 108° W. 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. Stations in the Amateur service are not protected from any interference due to the operation of industrial, scientific and medical (ISM) devices, AVM systems or Government stations authorized in this band.

(9) In the 902-928 MHz band, amateur stations shall not operate in those portions of the States of Texas and New Mexico bounded on the south by latitude 31° 41′ N, on the east by longitude 104° 11′ W, on the north by latitude 34° 30′ N, and on the west by longitude 107° 30′ W.

(10) The 430-440 MHz band is allocated to the Amateur service on a secondary basis in ITU Regions 2 and 3. Amateur stations in this band in ITU Regions 2 and 3 must not cause harmful interference to stations authorized by other nations in the radiolocation service and are not protected from interference due to the operation of stations authorized by other nations in the radiolocation service. In ITU Region 1 the 430-440 MHz band is allocated to the Amateur service on a co-primary basis with the radiolocation service. As between these two services in this band in Region 1 the basic principle which applies is the equality of right to operate. Amateur stations authorized by the United States and radiolocation stations authorized by other nations in Region 1 must operate so as not to cause harmful interference to each other.

(11) In the 1240-1260 MHz band amateur stations must not cause harmful interference to stations authorized by other nations in the radionavigation-satellite service and are not protected from interference due to the operation of stations authorized by other nations in the radionavigation-satellite service.

(12) In the United States, the 2300-2310 MHz band is allocated to the Amateur service on a co-secondary basis with the Government fixed and mobile services. In this band, the fixed and mobile services must not cause harmful interference to the Amateur service.

(13) In the 2300-2310 MHz and 2390-2450 MHz bands, the Amateur service is allocated on a secondary basis in all ITU Regions. In ITU Region 1, stations in the Amateur service must not cause harmful interference to stations authorized by other nations in the fixed service, and are not protected from interference due to the operation of stations authorized by other nations in the fixed service. In ITU Regions 2 and 3, stations in the Amateur service must not cause harmful interference to stations authorized by other nations in the fixed, mobile and radiolocation services, and are not protected from interference due to the operation of stations authorized by other nations in the fixed, mobile and radiolocation services.

(14) Amateur stations in the 2400-2450 MHz band are not protected from interference due to the operation of industrial, scientific and medical devices on 2450 MHz.

(15) Amateur stations in the 3.332-3.339 GHz, 3.3458-3.3525 GHz, 119.98-120.02 GHz, 144.68-144.98 GHz, 145.45-145.75 GHz, 146.82-147.12 GHz and 343-348 GHz bands must not cause harmful interference to stations in the radio astronomy service. Amateur stations in the 300-302 GHz, 324-326 GHz, 345-347 GHz, 363-365 GHz and 379-381 GHz bands must not cause harmful interference to stations in the space research service (passive) or Earth exploration-satellite service (passive).

(16) In both ITU Regions 2 and 3 the 3.3-3.5 GHz band is allocated to the Amateur Service on a secondary basis. In the 3.3-3.4 GHz band amateur stations must not cause harmful interference to stations authorized by other nations in the radiolocation service, and are not protected from operation due to the operation of stations authorized by other nations in the radiolocation service. In the 3.4-3.5 GHz band amateur stations must not cause harmful interference to stations authorized by other nations in the fixed and fixed-satellite services, and are not protected from interference due to the operation of stations authorized by other nations in the fixed and fixed-satellite services.

(17) In the United States the 3.3-3.5 GHz band is allocated to the Amateur service on a co-secondary basis with the non-government radiolocation service.

(18) In the 5.650-5.725 GHz band, the Amateur service is allocated in all ITU regions on a co-secondary basis with the space research (deep space) service. In the 5.725-5.850 GHz band the Amateur service is allocated in all ITU regions on a secondary basis. In the 5.650-5.850 GHZ band amateur stations must not cause harmful interference to stations authorized by other nations in the radiolocation service, and are not protected from interference due to the operation of stations authorized by other nations in the radiolocation service. In the 5.725-5.850 GHz band amateur stations must not cause harmful interference to stations authorized by other nations in the fixed-satellite service in ITU Region 1, and are not protected from interference due to the operation of stations authorized by other nations in the fixed-satellite service in ITU Region 1. In the 5.850-5.925 GHz band the Amateur service is allocated in ITU Region 2 on a co-secondary basis with the radiolocation service. In the 5.850-5.925 GHz band amateur stations must not cause harmful interference to stations authorized by other nations in the fixed, fixed-satellite and mobile services, and are not protected from interference due to the operation of stations authorized by other nations in the fixed, fixed-satellite and mobile services.

(19) In the United States, the 5.850-5.925 GHz band is allocated to the Amateur service on a secondary basis to the non-government fixed-satellite service. In the 5.850-5.925 GHz band amateur stations must not cause harmful interference to stations in the non-government fixed-satellite service. In the 5.850-5.925 GHz band amateur stations must not cause harmful interference to stations in the non-government fixed-satellite service and are not protected from interference due to the operation of stations in the non-government fixed-satellite service.

(20) Amateur stations in the 5.725-5.875 GHz band are not protected from interference due to the operation of industrial, scientific and medical devices on 5.8 GHz.

(21) Amateur stations in the 1900-2000 kHz, 10.45-10.50 GHz, 76-81 GHz, 144-149 GHz and 241-248 GHz bands must not cause harmful interference to stations in the non-government radiolocation service and are not protected from interference due to the operation of stations in the non-government radiolocation service.

(22) Amateur stations in the 1240-1300 MHz, 10.0-10.5 GHz, 24.05-24.25

GHz, 76-81 GHz, 144-149 GHz and 241-248 GHz bands must not cause harmful interference to stations authorized by other nations in the radiolocation service and are not protected from interference due to the operation of stations authorized by other nations in the radiolocation service.

(23) In the 10.00-10.45 GHz band in ITU Regions 1 and 3 amateur stations must not cause harmful interference to stations authorized by other nations in the fixed and mobile services, and are not protected from interference due to the operation of stations authorized by other nations in the fixed and mobile services.

(24) In the United States, the 24.05-24.25 GHz band is allocated to the Amateur Service on a co-secondary basis with the non-government radiolocation and Government and non-government Earth exploration-satellite (active) services.

(25) The 119.98-120.02 GHz band is allocated to the Amateur service on a secondary basis. Amateur stations in this band must not cause harmful interference to stations operating in the fixed, inter-satellite service and mobile services, and are not protected from interference caused by the operation of stations in the fixed, inter-satellite and mobile services.

(26) Amateur stations in the 24.00-24.25 GHz band are not protected from interference due to the operation of industrial, scientific and medical devices on 24.125 GHz.

(27) Amateur stations in the 244-246 GHz band are not protected from interference due to the operation of industrial, scientific and medical devices on 245 GHz.

(28) Amateur stations in the 10100-10150 kHz band must not cause harmful interference to stations authorized by other nations in the fixed service. Amateur stations shall make all necessary adjustments (including termination of transmission) if harmful interference is caused.

(29) Until July 1, 1989, amateur stations in this band must not cause harmful interference to stations authorized by other nations in the fixed and mobile services. Amateur stations must make all necessary adjustments (including termination of transmission) if harmful interference is caused.

(30) Amateur stations in the 449.5-450 MHz band must not cause interference to and are not protected from interference due to the operation of stations in the space operation service, the space research service, or for space telecommand.

(31) In the United States, the 10.0-10.5 GHz band is allocated to the Amateur service on a co-secondary basis with the non-government radiolocation service.

(32) Amateur stations in these bands may be used for communications related to relief operations in connection with natural disasters. See Appendix 6 to this Part.

Section 97.61 is revised in its entirety to read as follows:

§ 97.61 **Authorized emissions.**

(a) *kilohertz*

Frequency band (kHz)	Emissions	Limitations (see Paragraph [d])
1800-2000	A1A, F1B, A3E, F3E, G3E, A3C, F3C, A3F, F3F, H3E, J3E, R3E	
3500-3750	A1A, F1B	1
3750-4000	A1A, A3E, F3E, G3E, A3C, A3F, F3C, F3F, H3E, J3E, R3E	
5167.5	J3E, R3E	
7000-7075	A1A, F1B	1
7075-7100	A1A, F1B, H3E,[1] J3E,[1] R3E[1]	1, 2
7100-7150	A1A, F1B	1
7150-7300	A1A, A3E, F3E, G3E, A3C, F3C, A3F, F3F, H3E, J3E, R3E	
10100-10150	A1A, F1B	
14000-14150	A1A, F1B	
14150-14350	A1A, A3E, F3E, A3C, F3C, A3F, F3F, H3E, J3E, R3E	
21000-21200	A1A, F1B	1
21200-21450	A1A, A3E, F3E, A3C, F3C, A3F, F3F, H3E, J3E, R3E	
24890-24930	A1A, F1B	
24930-24990	A1A, A3E, F3E, G3E, A3C, F3C, A3F, F3F, H3E, J3E, R3E	
28000-28300	A1A, F1B	1
28300-29700	A1A, A3E, F3E, G3E, A3C, F3C, A3F, F3F, H3E, J3E, R3E	

(b) *50-144.1 MHz:*

Frequency band (MHz)	Emissions
50.0-50.1	A1A
50.1-51.0	A1A, A2A, A2B, A3E, A3C, A3F, F1B, F2B, F3E, G3E, F3C, F3F, H3E, J3E, R3E
51.0-54.0	N0N, A1A, A2A, A2B, A3E, A3C, A3F, F1B, F2B, F3E, G3E, F3C, F3F, H3E, J3E, R3E
144.0-144.1	A1A

(c) *Above 144.1 MHz:* Amateur stations are authorized to transmit the following emissions on amateur frequencies above 144.1 MHz: N0N, A1A, A2A, A2B, A3E, A3C, A3F, F1B, F2B, F3E, G3E, F3C, F3F, H3E, J3E and R3E. P0N emissions (the emission letters "K, L, M, Q, V, W and X" may also be used in place of the the letter "P" for pulsed radars) may be transmitted at all amateur frequencies above 2300 MHz, except in the 10.0-10.5 GHz band. In the 902-928 MHz band F8E emissions may also be used.

(d) *Limitations:*

(1) Novice and Technician class radio operators may not use F1B emissions in this band.

(2) Amateur stations located in Regions 1 and 3, and amateur radio stations located within Region 2 which are west of 130° West longitude may also use A3E, F3E and G3E emissions.

Section 97.67 is amended by revising paragraphs (a) and (b), and by adding new paragraphs (g), (h) and (i) to read as follows:

§ 97.67 **Maximum transmitting power**

(a) Amateur stations may use no more than the maximum transmitter power specified in this Part. Additionally, within the constraints of this section, amateur stations must use no more than the minimum transmitter power necessary to carry out the desired communications.

(b) Unless otherwise provided in this section, each amateur transmitter may be operated with a transmitter power not exceeding 1500 watts.

* * * * *

(g) On 5167.5 kHz the transmitter power shall not exceed 150 watts.

(h) In the 420-450 MHz frequency band the transmitter power shall not exceed 50 watts in the following areas unless expressly authorized by the Federal Communications Commission after mutual agreement, on a case-by-case basis, between the Commission Engineer-in-Charge at the appropriate District Office and the Military Area Frequency Coordinator at the appropriate military base:

(1) Those portions of Texas and New Mexico bounded on the south by latitude 31° 45′ N, on the east by longitude 104 ° 00′ W, on the north by latitude 34° 30′ N and on the west by longitude 107° 30′ W. (The Military Area Frequency Coordinator for this area is located at White Sands Missile Range, New Mexico.)

(2) The entire State of Florida including the Key West area and the areas enclosed with a 200 mile radius of Patrick Air Force Base, Florida (latitude 28° 21′ N, longitude 80° 43′ W), and within a 200-mile radius of Eglin Air Force Base, Florida (latitude 30° 30′ N, longitude 86° 30′ W).

(3) The entire State of Arizona.

(4) Those portions of California and Nevada south of latitude 37° 10′ N, and the area within a 200-mile radius of the Pacific Missile Test Center, Point Mugu, California (latitude 34° 09′ N, longitude 119° 11′ W).

(5) In the State of Massachusetts with a 160-kilometer (100 mile) radius around locations at Otis Air Force Base, Massachusetts (latitude 41° 45′ N, longitude 70° 32′ W).

(6) In the State of California within a 240-kilometer (150 mile) radius around locations at Beale Air Force Base, California (latitude 39° 08′ N, longitude 121° 26′ W).

(7) In the State of Alaska within a 160-kilometer (100 mile) radius of Clear, Alaska (latitude 64° 17′ N, longitude 149° 10′ W). (The Military Area Frequency Coordinator for this area is located at Elmendorf Air Force Base, Alaska.)

(8) In the State of North Dakota within a 160-kilometer (100 mile) radius of Concrete, North Dakota (latitude 48° 43′ N, longitude 97° 54′ W). (The Military Area Frequency Coordinator for this area can be contacted at: HQ SAC/SXOE, Offutt Air Force Base, Nebraska 68113.)

(9) In the States of Alabama, Florida, Georgia and South Carolina within a 200 kilometer (124 mile) radius of Warner Robins Air Force Base, Georgia (latitude 32° 38′ N, longitude 83° 35′ W).

(10) In the State of Texas within a 200 kilometer (124 mile) radius of Goodfellow Air Force Base, Texas (latitude 31° 25′ N, longitude 100° 24′ W).

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

Paragraph (f) of Section 97.85 is revised by removing subparagraph (2) and redesignating subparagraph (3) as subparagraph (2).

The last sentence of paragraph (d) of Section 97.87 is revised to read: "In such cases, the rules of Section 97.85 (f) (1) and (2) shall apply."

Section 97.185 is amended by removing Limitation 6 from the 420-450 MHz entry in the Frequency or Frequency Bands Table in paragraph (b), and by removing and reserving subparagraph (6) of paragraph (c) in its entirety.

(continued on page 89)

How's DX?

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

KH6BZF, "A Ham's Ham"

For almost as long as some of us can remember, KH6BZF has been around and active in just about every phase of Amateur Radio, retaining *his* love of the service and enhancing *our* enjoyment of it. Lee Wical, KH6BZF (the Bloomin' Zipper Flipper), lives off beautiful Kaneohe Bay, on Oahu, Hawaii, where you'll find not less than 16 antennas of various shapes and forms (stacked Yagis, phased arrays, slopers and dipoles, all rising skyward), enjoying his passions of DX/contest operation and his lovely XYL Laura (but not necessarily in that order! A look into Lee's shack finds it loaded with Collins, ICOM, Kenwood and Henry transceivers/amplifiers that permit him to consistently work 1.8-432 MHz. Not only is Lee a DX/contest man, but he's heavily into moonbounce and has run DX tropo tests with West Coast stations for the past 10 years.

An ex-SCM of Hawaii (10 years), KH6BZF is currently an Assistant Director from ARRL Pacific Division, an Affiliated Club Coordinator for Hawaii, and is also active in the Intruder Watch and with his solar-flux observances. (Lee writes a popular weekly propagation newsletter, *KH6BZF Reports*, which is widely quoted in ham radio newsletters worldwide.) This versatile ham is a Charter Life Member of ARRL, a Life Member of QCWA and a member of *many* clubs, and is

KH6BZF

a co-founder of the Honolulu DX Club. Professionally, he's a member of both IEEE and AFCEA, and holds FCC first-class commercial tickets with radar endorsement.

Lee now holds 7J1AAP (American Apple Pie), the first KH6 to receive a 7J1 call sign. Recent DX operations saw him operating as KH6BZF/OZ/SM/LA, while former DXing included Guam, Saipan, Wake, Midway and Southeast Asia. For years, he managed cards for KH6EDY (Kure). Attesting to his activity are Lee's DXCC, WAZ and WAS awards.

KH6BZF's professional background includes 32-years experience in communications planning, design, operations, transmission and systems management, encompassing radio transmission, systems interfacing and complex analog/digital radio systems. He has experience with many of the nation's leading high-tech firms (GE, Hawaii Telephone Co, the Army's Strategic Communications Command, the Air Force's Ground Electronics Engineering Installations Agency, Litton). Presently, Lee is a Section Chief at DCA-Pacific.

Lee's propagation weekly is an interesting sidelight on the man himself. The weekly sheet chronicles a day-by-day rating of conditions, flux level, geomagnetic level, Alpha and K indexes, and remarks (which analyze conditions in an easy-to-use manner). His newsletter's "thoughts from Rainbow Bay" tickle the reader's fancy, ie, "Propagation study is a perfume you cannot pour on others without getting a few drops on yourself."

This "ham's ham" has discovered one of the basic laws of life and has remembered to "put some of himself back into Amateur Radio, the reservoir he has derived such pleasure from." If you hear the Bloomin' Zipper Flipper on sideband, you'll know it!

APRIL 18-20 DX CONVENTION

Going, going ... March 31 is the preregistration deadline for this annual extravaganza, sponsored this year by the Southern California DX Club. The fee is $38, payable to SCDX Convention, and goes to Don Bostorn, N6IC, 4447 Atoll Ave, Sherman Oaks, CA 91423. (This covers the Saturday banquet, the Sunday brunch and several cocktail parties.) Room reservations at the Holiday Inn in Visalia go via 209-651-5000; ask for the convention reservation desk. The program will feature a DX forum with N6RJ, contest forum with N6AA, the peripatetic Colvins (see next item) and many others. Amateur Radio representatives from the People's Republic of China will be at the Saturday banquet.

THE COLVINS

As of holiday time, Lloyd and Iris (W6KG, W6QL) concluded operation in Lesotho as 7P8KG, making some 5k contacts with 137 countries. For the first time they operated from a casino hotel, the manager allowing them to put their antenna on an unused portion of the hotel some 600 ft from the main casino lounge. After everything was installed, however, they found reception terrible, caused by a 33,000-V transmission line some 1000 feet away. They promptly relocated everything some 1200 feet, to a small room in a quiet area. Swaziland was next on the agenda, as 3D6QL. Their stories at the DX Convention in April (see above item) should be interesting!

Troster's Tips for Easy Listening

Occasionally, when a DX station has about faded out with the skip, the listener will hear the signal begin to get stronger again—a sort of second peak. Sometimes, late at night, it is easy to QRT when the signal has faded. But, if you *really* need that DX station for a "new one," force yourself to listen a while longer to see if that occasional second peak might not get you through for that needed contact.

More next month from W6ISQ.

BEWARE OF THE SORCERESS

The following is courtesy of W6BDN.

I checked 14.195. Nobody there. Must be too early. Let's look around while waiting. Down 10 kHz is an awful pileup. I listened for about 15 minutes. With all that constant shouting and screaming, I couldn't even figure out the call of the target DX station. Might be an FR something. Could be a needed one, but the *Circe of DX* is obviously at work here. Best get back to my original objective.

While I was distracted down the band, DK9KX/S9 had started operating. There's already a fair pileup. He is handling the crowd efficiently, doing a fine job. I'm able to spot some of the stations he is contacting. He keeps moving around. He appears to be covering, and staying within, the stated 200-205 range. I can't determine exactly how he's moving, but maybe it would be prudent to stop analyzing and start calling before the pileup gets much bigger. Let's assume he's just cruising around. (For sideband it's a small spread for much of a pattern anyway.) As usual, most of the callers are near the low limit. It should be best to settle in the middle, or the upper end. I'll pick 14.205 (maybe even plus a bit).

Now, gotta try and get the timing. There's no sense calling when he's talking—you can't make contacts that way. He's tuning after each QSO. That takes a few seconds and causes a little delay. He's getting someone each time, maybe only a letter or two, but he gets 'em. Okay, wait for his QRZ, call twice, and then listen. He should hit my frequency eventually.

My timing is off. There is usually a lag before his reply. Should I delay, or call three times? Before I could decide, Hans called me. "QSL, 5 and 9, QSL?" "QSL!" That was that.

Let's check the other pileup down the band. Gone! The DX has been driven away. *Circe* scores again.

N4FKZ

Franco Capuano, N4FKZ, is also well-known as TG9NX (the first and only Spanish-speaking station on the CW DXCC Honor Roll, one of the best CW operators on the other side of the Rio Grande. Additionally, he holds 5BDXCC and 5BWAS, and is the first ham in Central and South America with a 5BWAZ plaque. Franco also operates N4FKZ/HR5 in Honduras (with a DXCC total of 257), N4FKZ/EA4 in Spain

TG9NX/N4FKZ. *(tnx TG9RB/W4)*

(with a DXCC total of 156) and from Italy as N4FKZ/IØ (DXCC total 130). Oh, yes, from home in South Florida he has 300 DXCC mixed, 260 DXCC CW and 5BDXCC!

Franco was born in Italy and lives in Guatemala, but his real estate company has him traveling worldwide. He started his DXCC in the Miami area in 1978 as TG9NX (where he is a member of the South Florida DX Association) and has since upgraded to Extra/N4FKZ.

Franco is now working on his 160-meter DXCC and his third 5BDXCC from a different country! You might guess it: His CW teacher (one of the best in the world) was K8CW.

THE CIRCUIT

☐ **VP2EHF:** Direct cards via Dave Mann, N4CVX, 1201 N Roosevelt St, Arlington, VA 22205.

☐ **Djibouti:** Dany's now back in France and reports on his Nov 7-10 Sawabia Islands expedition, 738 contacts. J28EI/S is J2 for DXCC, AF for WAC, 37 for WAZ, and Perin (AS16) for Islands on the Air. QSLs continue to go via manager Roger Luder, FC1JEN, 11 rue Belle D'Argent, 13300 Salon, France.

☐ **VK3MO:** WA9BXB now manages Ian's cards.

☐ **TF3XUU/8:** Martin notes that all contacts are sent cards via the bureau within two weeks of the contact. If you want yours sooner, send an SAE with 2 IRC's or equivalent to Martin Berkofsky, Gardskagi Lighthouse, 250 Gardur, Iceland. When the pileups are really large, Martin starts with the Ø call area!

☐ **WAC:** Two new certificates have been created: CW and phone (the latter replacing the sideband award to cover *all* telephony). You can keep pretty busy with bookkeeping for the following certificates/endorsements: mixed mode, CW, phone, SSTV, RTTY, FAX, satellite, 5-band, 6-band, QRP (for contacts on/after 1-1-85), and stickers for 1.8, 3.5, 50, 144 and 430 MHz, and higher-frequency bands. Drop an SASE to your society's HQ for full details!

☐ **GJØAAA:** During CQWW CW '85, GJØAAA was operated by G3s SXW TXF WVG to the tune of almost 4k contacts. This was the fifth successive visit of this same team to the Channel Islands. Their five visits during that contest weekend have now exceeded 15,000! QSL via Nigel, G3TXF.

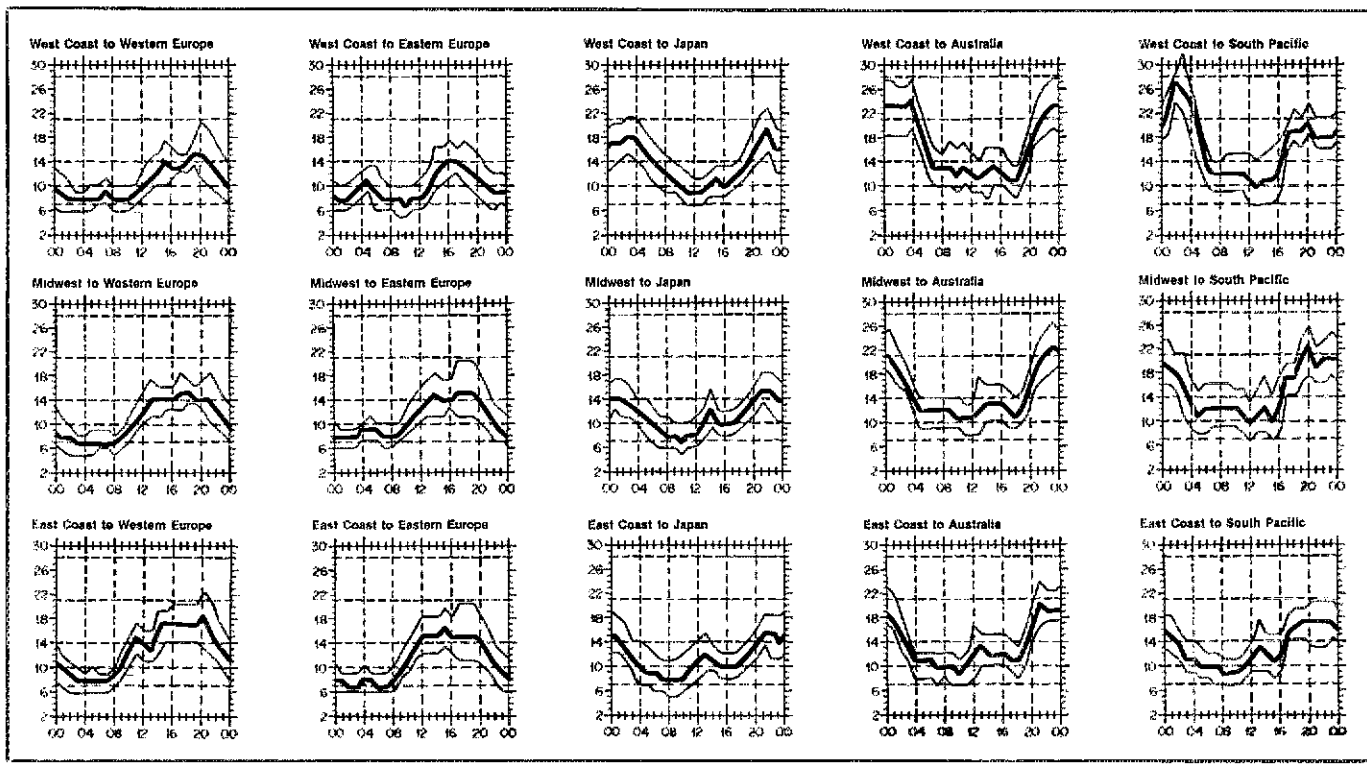
☐ **Panama:** HP1XKR (JA7ARW) and HP1XKT (JA7HLO) are now back in Japan. Cards for either Koichi or Akiko go via Takao Togashi, JA7AGO, 4-48 Shogunno Higashi 1 chrome, Akita-city, Akita, 011, Japan.

K2RDB (left) and YJ8MC during K2RDB's recent South Pacific business trip, which included a boondoggle to idyllic Vanuatu.

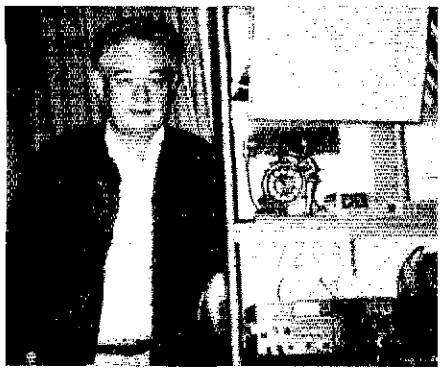
☐ **Montserrat:** At just about the time you get this, you may be hearing new DXer K1CLN/VP2M operating portable. Cards via Box 866, Truro, MA 02666.

☐ **DXAC:** New DXAC members from the Canadian and Great Lakes Divisions are VE3EJ and W8LU (committee chairman continues to be K6SSJ).

☐ **Gambia:** The Gambian Licensing Authorities are not issuing any "MM" licenses so those operators heard /MM should be considered suspect. C53 calls are only issued to *permanent*



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 month, it will be at least as high as



BV2DA (ex-XW8BP); QSL via DL7FT. *(tnx ZP5XDW, ex-XW8CR)*

residents of The Gambia and are valid only for the period of residence for fixed base operations.

QSL Corner

Administered By Joan Hushin, KA1IFO

ARRL-MEMBERSHIP OVERSEAS QSL SERVICE

Send outgoing cards: American Radio Relay League, QSL Bureau, 225 Main St, Newington, CT USA 06111.

This is an "outgoing" service that allows ARRL members to send DX QSL cards to foreign countries at minimum cost and effort. While QSLing direct to foreign amateurs is faster, it is also more tedious. Time spent searching for addresses in the foreign *Callbook*, addressing and stuffing envelopes and mailing could be better spent operating DX. And, the cost of IRCs, Airmail postage and envelopes can be prohibitive.

An unlimited number of QSLs may be sent for distribution 12 times per year. The fee is just $1 per pound or portion thereof (155 QSL cards average a pound). Recommended size of QSL cards is 3½ × 5½ in (90 mm × 140 mm).

The ARRL-Membership Overseas QSL Service operates *only* in an "outgoing" capacity. To receive QSLs from DX stations, see "The ARRL DX QSL Bureau System," Dec 1985 *QST*, page 73, or send an SASE to ARRL QSL Bureau, 225 Main St, Newington, CT 06111.

US amateurs may send SWL reports to foreign shortwave listeners. Unlicensed (associate) members may send SWL cards to foreign amateurs. QSL managers: Write for details.

Note: The ARRL QSL Service should not be used to exchange QSL cards within the 48 contiguous states.

Requirements

1) Presort your DX QSLs alphabetically by call-sign prefix (AP, C6, CE, DL, F, G, JA, LU, PY, 5N, 9Y, and so on).

2) Enclose the address label from your current copy of *QST*. The label shows that you are a current ARRL member.

3) Enclose payment of $1 per each pound (or less) of cards—approximately 155 cards weigh 1 pound. In other words, $1 is the *minimum charge* whether you send 1 card or 155 cards. Please pay by check (or money order) and write your call sign on the check. Do not send cash.

4) Include only the cards, address label and check in the package. Wrap the package securely and address it to the ARRL Outgoing QSL Service, 225 Main St, Newington, CT 06111.

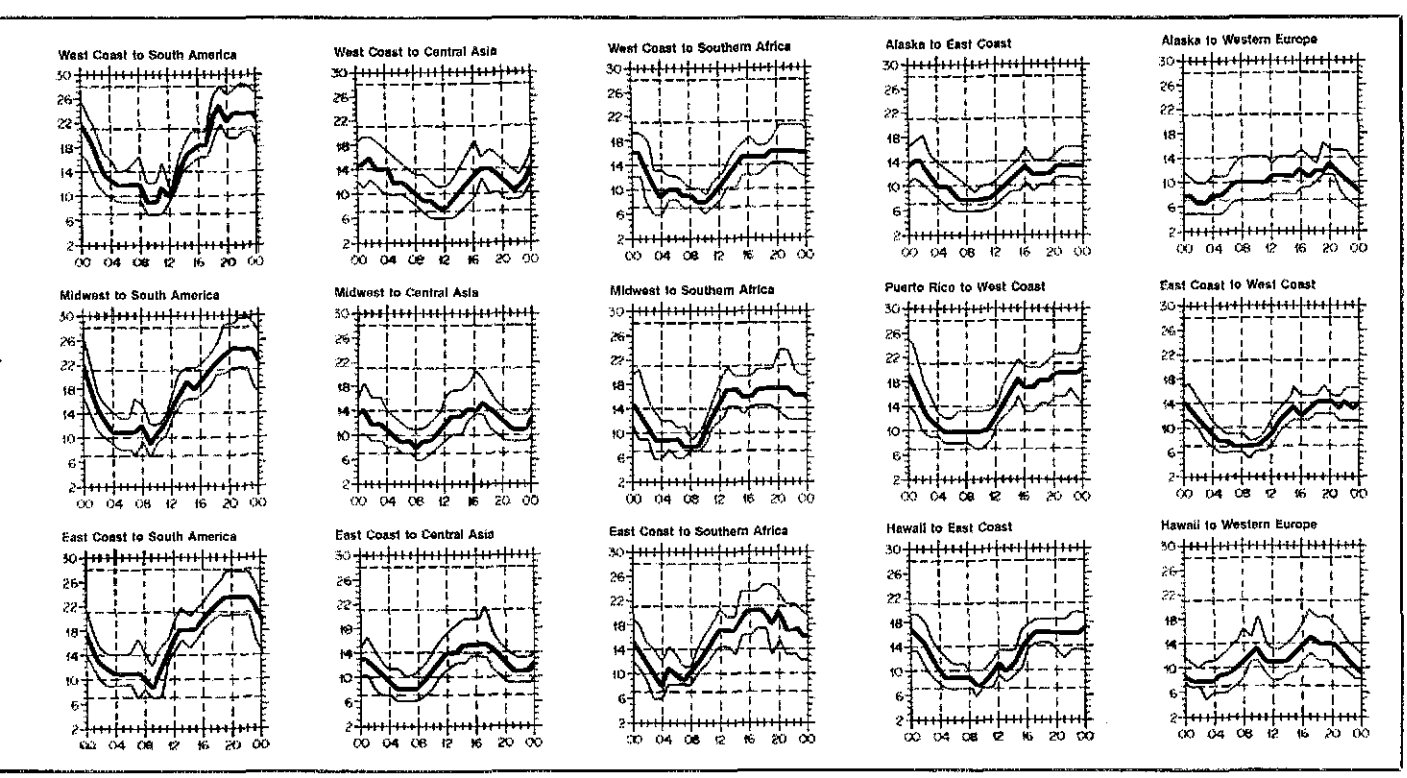
5) Family members may also use the service by enclosing their QSLs with those of the primary member. Include the appropriate fee with each individual's cards and indicate "family membership."

6) Blind members who do not receive *QST* need only include the appropriate fee along with a note indicating that the cards are from a blind member.

7) ARRL affiliated-club stations may use the service when submitting club QSLs by indicating the club name. Club secretaries should check affiliation papers to ensure that affiliation is current. In addition to sending club station QSLs through this service, affiliated clubs may also "pool" their members' individual QSL cards to effect an even greater savings. Each club member using this service must also be a League member. Cards should be sorted "en masse" by prefix, and a *QST* label enclosed for each ARRL member sending cards.

Countries Not Served

A5	Bhutan	TZ	Mali
A6	United Arab Emirates	V4	St Christopher and Nevis
A7	Qatar	VP2E	Anguilla
BV	Taiwan	VR6	Pitcairn Island
C9	Mozambique	XT	Burkina Faso
D6	Comoros	XU	Kampuchea
ET	Ethiopia	XW	Laos
HZ	Saudi Arabia	XX9	Macao
J5	Guinea-Bissau	XZ	Burma
KC4	US bases in Antarctica	YA	Afghanistan
KC6	Belau	ZA	Albania
KC6	Micronesia	ZD7	St Helena
KH1	Baker and Howland Is	ZD9	Tristan da Cunha
KH3	Johnston Is	ZK3	Tokelau
KH5	Palmyra and Jarvis Is	3C	Equatorial Guinea
KH7	Kure Is	3V	Tunisia
KH9	Wake Is	3W	Vietnam
KP1	Navassa Is	3X	Guinea
KP5	Desecheo Is	4W	North Yemen
P5	North Korea	5A	Libya
SU	Egypt	5H	Tanzania
T2	Tuvalu	5R	Madagascar
T3	Kiribati	5U	Niger
T5	Somalia	5X	Uganda
TJ	Cameroon	7O	South Yemen
TL	Central African Rep	7Q	Malawi
TN	Congo	8Q	Maldives
TT	Chad	9G	Ghana
TY	Benin	9N	Nepal
		9U	Burundi



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 March 16 to April 15, 1986, assume a sunspot number of 11, which corresponds to a 2800-MHz solar flux of 73.

DX Century Club Awards

Administered By Don Search, W3AZD

The DX Century Club certificate is awarded to amateurs who submit written confirmations for contacts with 100 or more countries on the official ARRL Countries List. There are now 316 current countries on the list. The DXCC Honor Roll includes those who are within 9 countries of that figure. The following annual Listing of the DXCC membership contains the call signs and exact country totals of those who have joined the DXCC or increased their country totals by endorsement during the two-year period from October 1, 1983, through September 30, 1985. Honor Roll members are indicated in bold face print.

MIXED

368
W1GKK

366
K6ZO
LU6DJX
W2AGW
W2BXA
W4EX
W6AM
W7MB
W8JIN

365
W1BIH
W4AIT
W5KC
W7KH
W8GT
W8QZ
W9ZM
W0ELA
ZL1HY

364
K6OJ
OE1ER
PY2CK
W3MP
W4BQY
W9NDA

363
VE7GI
VK4QM
W2JVU
W8BF
W8DMD
W8BW
W8DU
W8MLY

362
DL7AA
N4SU
OH2NB
ON4NC
W1AX
W1HX
W2AG
W2QHH
W3EVW
W4OM
W4YJ
W6ZO
W6EE
W8AX

361
DL1KB
G3AAE
G4CP
GW3AHN
W2LV
W3VT
W4GD
W5MMK
W6BZE
W6TZD
W7IR
W8LKH

360
I0AMU
K4KQ
K5UC
KH6CD
W1HZ
W2AYJ
W2GT
W2OKM
W5IO
W6KUT
W7PHO
W8JBI
W8MPW
W8RT
W9FKC
W9JUV

359
DJ2BW
DL3RK
G3FKM
G3FXB
G5VT
HB9MQ
K3GL
K4PDV
K6DC
VE3SR
W1DK
W1FZ
W2AO
W2GW
W2LPE
W5AL
W5PQA
W6CHV
W6BA
W6HX
W6PT
W6YK
W7OF
W8DAW
W8EWS
W9GIL
W8SYK
4X4DK

358
DL1BO
GW3AHN
K2BZT
K2FL
K4YR
ON4DM
SM3BIZ
W1JR
W2BOK
W2SSC
W3CWG
W4DR
W4EEE
W6BS
W8KZL
W8RT
W7GN
W7LDC
W8AH
W8KPL
W8QGI
W8PGI

357
DL6EN
DL7EN
HB9TL
IT9TAI
K4SM
K5DX
W1AXA
W1JNV
W2CR
W2HTI
W2QM
W2UE
W3GH
W5MMD
W6FSJ
W6ID
W6SQP
W7ADS
W7CG
W8NGO
W8PHZ
W9SFR

356
GI3IVJ
IT9ZGY
K2BK
K2LWR
K3II
K6CH
LU4DMG
OK3MM
W1NU
W2NUT
W4ML
W5KGX
W5NW
W6BSY
W6RKP
W9RKP
W8AIH
4X4JU

355
K3MO
K4LNM
K9AB
KH6IJ
LU5DO
PY1HX
OZ3Y
PA8FX
W1AA
W2AX
W2BHM
W2FZY
W2TQC
W4BAA
W5NUT
W7QK
W8QY
W9DWQ
W9TKV
ZS6LW

354
DL7AP
I8KDB
JA1DM
K5FJ
K5EC
K8LGF
KA1QY
OH2QQ
PA8LOU
PY1HQ
SM8AJU
W2FXA
W2GC
W2SAW
W2XN
W3AFM
W4AXR
W4EO
W4GXB
W4VPD
W5UN
W6BVM
W6GPB
W7AO
W7AQB
W8BKP
W8ZCQ
W9HB
W9RCJ
ZL3IS

353
DL1JW
DL3BK
DL9OH
I1ZL
K6KII
N7EB
UB5WF
VE3HD
VE5RU
W1HH
W2BMK
W2IRV
W3CGS
W3GRS
W4IF
W5AO
W5FFW
W5GO
W6ET
W6KG
W6KH
W6ONZ
W9DY
W8TJ
YS1O

352
F3AT
G3HCT
HB9MX
K6RQ
K8DR
SM7ANB
SM8KV
W1PM
W1WY
W2GLF
W4WV
W4ZD
W5QK
W6FF
W6SN
W6ZM
W8OK
W9YSX
W8LWG
ZS6RM

351
AE4X
DL1DC
DL7HU
F9RM
G3BDZ
G3FYT
HB9KB
HB9PL
K9ECE
N6EA
PT7YS
SM7QY
VE7AAQ
W1CKA
W4BYU
W4FX
W5GEL
W5LCI
W5OB
W6MUR
W6QNM
W6UQQ
W7CMO
W9GU
W8DEI
W8GKL
WA2DIG

350
DL1HH
GM3ITN
JA2JW
K2SHZ
K4AIM
K4RPK
K6GA
K6RF
K6RN
K8ONV
SM8CCE
VE3AAZ
VE3BWY
W2MJ
W2TP
W4BFR
W4HR
W4MGN
W4OO
W5HJA
W98M
W9TKD
XE1AE

349
G3FYT
HB9DX
I5UA
JA3DY
K2FB
K2TQC
K8CD
KP4RK
LA5HH
N6FX
OE1FT
VK3YL
W2YY
W4AVY
W4QM
W4SSU
W6QMF
W6ISQ
W7DX
W8CUT
W9CH
W9HJ
W8BTD
W8ZV

348
HB9MO
JA1BK
K4EZ
K35CK
NA8Y
ON4PA
PY4OD
W1AFF
W1IAS
W1RLQ
W1SP
W1UU
W3DJZ
W5FT
W5HDS
W6REH
W7BGH
W7JYZ
W9HZ
W9NA
YV5AIP

347
DL7BK
DL8CM
EA1BC
F9GL
JA1BN
JA7AD
K4JC
K6EV
K6WR
OH2QV
OK1MP
ON4IZ
OZ6SS
UR2AR
VE2WA
W1MIJ
W4BBP
W4NNH
W5RDA
W6YA
W9FD
W9HLY
W9KNI
W9LT
ZS6YQ
4X4FQ

346
DJ2AA
DL3ZI
DL7HZ
K2PXX
K6ZM
K8OHG
N8ZN
OK1ADM
PY1DH
W1DGJ
W1SD
W2CP
W4DRK
W4VQ
W5UR
W6EL
W6QNA
W7CSW
W7LLC
W8DA
W9IU
YV5BX
YV5BZ
ZL1AJU
ZL4BO

345
G3IOR
I7ZPB
K3AV
K4BVQ
K8FF
N6AR
N6GM
OE1LO
SM7MS
UA1CK
W1AB
W1ELR
W1GME
W2VJN
W5GJ
W5NO
W6FW
W6HFL
W6RJ
W6TWZ
W8YGR
W8ZET
W9HK
YV5ANF
ZS6IW

344
DL1CF
JA1AON
JA1AG
JA1BRK
K4ID
K4MQG
LA1K
N4XO
N5AR
OH2BH
ON4QJ
SM5CZY
SM6AOU
W1QJR
W2GKZ
W3CV
W4DHZ
W4UG
W5EJT
W5GC
W8KTE
W6YMV
W8PR
W8ZO
W9AZP
W9BW
W8NVZ

343
DJ7ZG
G3KMA
JA4ZA
K2BS
K2JMY
K2UVU
N6AV
OH2BZ
PY2PA
PY2PE
PY4OD
W1FTX
W2GK
W2LL
W3EYF
W3TV
W4KN
W6ARH
W6RSW
W9FID
W9PN
W9WM

342
DK8KQ
DL7FT
HB9IK
I2KMG
I2SM
I5ARS
K4FJ
K4KG
K4YYL
K6MA
K6PU
K6YRA
K8FL
LA8LF
OH2BC
VE3LGQ
W2AZX
W2NC
W3PN
W4QQN
W5HE
W6CF
W6ERS
W7KR
W9GRF
W8BN
W8PT
YU1HA
YU7BCD
ZL1AV

341
AI8J
DJ5DA
DL1PM
DL6MK
JA1BWA
K2LE
K2YLM
K4CIA
K5AAD
K6JG
K8DYZ
OH4NS
OH5UQ
PY2BKO
UA9VB
VE4OX
W5JC
W5QOU
W6EUF
W6PN
W6RGG
W6TXL
W8HN
W9AQ
W9EB
W9GB
ZL1AH

340
DJ5LA
DJ7CX
F2BS
G5RP
I1RB
JA6AD
K2MUB
K3KP
K5YY
K6DT
K6LEB
K6QH
K8EJ
K9CJK
K9SM
N1XX
N6DX
OZ3PO
OZ4RT
SM1CXE
VE3MJ
VE3WT
W1FJ
W1MM
W1OO
W2LNB
W2MZV
W4EEU
W4JVU
W4XJ
W4YN
W5DL
W6SC
W6YB
W8HZ
W8WW
WA4WIP
WA6GFE
WA6OET

339
DJ5VQ
DJ7CY
GI3OQR
I8AA
JA1IBX
JA8ADQ
K1YZW
K4DJ
K4IKR
K4MPE
K4XL
K6LU
K7ABV
K9RJ
KA1KI
PA0TAU
SP7HT
UA3CT
VE7SV
W1NHJ
W3AC
W5TO
W6KZS
W6MI
W6QL
W7DY
W7JYX
W8JQ
W9DH
W8AUB
ZL1ARY

338
DJ1XP
JA2XW
JA4BJO
JA9AA
K1DRN
K4MZU
K1NA
K4MZU
K6XW
K8AB
N4JF
N4TO
N6CW
N7NG
OK1MG
PY2CQ
PY2SO
SM5BHW
VE3BX
W2FG
W2HI
W2HZ
W4NKI
W4OWJ
W6PLK
W6YO
W6CT
W8DCH
W6ZCK
W9DC
W9KQD
ZS4MG

337
DL8NU
G3UML
JA1MCU
JA1MIN
JA3BG
K4DY
K4ISV
K5RC
K6AO
KY2Q
LA9CE
N4EA
OZ1LO
PY1APS
SM5AZU
SM6AEK
SM6CKS
SM6CWK
VE3NE
W3OP
W3XM
W4BRE
W4GTS
W4OEL
W5CKT
W6BYM
W6GR
W6KNH
W6PHF
W9DA
WA9NUQ
Z24JS

336
AA4MM
DJ4AX
DJ6RX
F2IU
F5II
F6RU
F9IE
HB9AHA
HB9QR
I8YRK
JA1MJ
JA8ZO
K1RM
K2CL
K4CEB
K6EXO
K6JG
K8MFO
K8RCM
K9AWK
K8BUR
N4MM
N4WW
N4ZC
N5DX
N9AF
SM3CXS
SM5API
SM5BBC
SM6AFH
SM7ASN
VE3WW
VE7IG
W1GG
W1OHA
W2QZZ
W2QK
W2VUF
W4NL
W6BFW
W6FET
W6KPC
W6KYJ
W6MUM
W7CB
W7RV
W8PAH
W6UD
WB2HXD
WB7ABK

335
AJ0X
DJ5JH
EA4DO
G3GIQ
G3JAG
HB9AAA
JA1ZZ
JA8JL
K1DFC
K2LGJ
K4AUL
K4XO
K5LIL
K9MM
K9OTB
N5NW
OE7EGL
OE8RT
OH3SR
ON4UN
ON8XA
PP5UG
PY3CB
SM5AQB
W1GX
W2PPG
W3EKN
W5MUG
W5SJ
W5LZZ
W6ABA
W6NNV
W6TPJ
W8ILC
W8KR
W8QFR
W8QWI
W9LNQ
W8CJZ
WA2CBB
WA3HUP
WA5IEV
YU2DX

334
CT2AK
DL3OH
DJ4PI
DL7CS
G3JEC
I3EVK
JA1FHK
JA1JRK
JA2AN
K2AGZ
K4II
K4KC
K4XG
K5UR
K6KA
K7KG
K8IP
K9RA
K9KA
N1GL
N5RR
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OH2VB
OZ6MI
PY2DFR
SM6CVX
SM6DHU
VK5WO
VE3GMT
W1JBW
W1YRC
W2VYX
W2SUA
W4ORT
W5IR
W5JW
W7JFO
W6OQK
W6SD
YV5AHR
YV6BBU
ZL1AMO

333
AD5N
DL1LD
EA3NC
G3HTA
GM3BQA
I2LAG
I7WL
I8JX
JA1AAT
JA1CRR
JA2AAQ
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K2UR
K4HJE
K5AQ
K8IFF
K8VUR
KV4FZ
N4KG
N4WF
N4UH
N6UC
N7TT
N9AB
OE1UZ
SM6VR
W1KGH
W1OT
W1JZ
W2ZZ
W3LPL
W6HYG
W7LFA
W8BE
W8CNL
W8GKM
W9ZR
W9ZRX
WA3ATP
WA8OAH
WB4OSS
YO3JU
YU3EY

332
DK3PO
DL6KG
G2DMR
IV3PRK
JA1DFQ
JA1EOD
JA1GV
JA1OCA
JA1UQP
JA2AIR
JA3AAW
JA4AFT
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K2CM
K5OS
K6OZL
K6XP
K9GM
K9PPY
N2LM
N8AA
OK2RZ
SP6RT
VE3XN
VK6HD
W2FP
W3GG
W3PVZ
W4FPW
W4UKA
W4XR
W5MQ
W6EJJ
W7NCO
W8SEY
W8AG
W9RF
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W8BL
W8CD
WA6DUG
4X4NJ

331
AA4S
AB4D
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G3LQP
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JA2BHG
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K4LTA
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K9IUF
K8GVB
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N6DX
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OK3EA
ON5KL
PY2ELV
SM5CAK
SM5FC
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W3GG
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W5RO
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W9TKR
WA2JBV
WA3IKK
WB8EUN
YO3AC
YV5AE

330
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I2DEZ
I4MKN
I7HH
JA2HNP
JA2JKV
JA3APL
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JA8AO
JH1EIG
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K4EWG
K5JW
K7NN
K6JR
K8CH
K8TL
K9JF
K8BS
KO5RP
KN8Z
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N4NO
N6ET
N7RO
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OH2BR
OH2VZ
OZ5DX
OZ6BZ
VE3GS
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W7ETZ
W7ORH
WA7BEV
WB2YQH
YU1EXY

329
AB4H
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JA9BJ
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K2KGB
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K6LQA
K8PYD
KE4I
KM2P
N4XX
N8OA
OE7UDH
ON5KD
PY2BW
SM4EAC
SP9PT
W1BR
W1EOA
W1HGA
W1OR
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W4TFB
W4WG
W4XQ
W6GC
W6OMR
W6ZYC
W7KSG
W8CFG
W9KB
W9MYN
XE1KS

328
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JA2AH
JA3AQ
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K4IR
K4RA
K4TO
K5GO
K6IR
K6OJO
K8RWL
K8IEA
K8YRX
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N4RA
N4SA
N5AU
N5TP
N6AN
N6HR
OH2BCV
OE3WWB
PT2BW
PY5ATL
SM2EKM
SM3RL
UB5WE
W3SO
W4CPZ
W4FLA
W4OMQ
W4OTX
W6JZU
W8YHT
W8AD
W9RN
W8IZ
WA4DRU
WA4FFW
WB2NYM

327
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F5VU
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JA2KLT
JA3BQE
JA8KB
JA8SZ
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K1ZSI
K2SB
K4BAI
K4EEK
K4SMX
K8CW
K9RF
K8IFL
KM2V
KR2Q
N3ED
OH2BGD
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SM7BIP
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W1ER
W2CC
W2SY
W4YA
W4VZB
W5VT
W8BJH
W8OB
W6XP
W9VNE
W9GW
WA4QBX
WA8KDI
YV5DFI

326
AA4CJ
DJ1CG
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DJ8UJ
DK5PR
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G3MCS
G3RUX
HB9RX
IT9AUA
JA1CJF
JA6BSM
JA7EHU
K2AGJ
K4UTE
K4LSP
K4ZYU
K5KX
K5LM
K6PZ
K6SVL
K7ZR
K8LJG
KK8J
N2AP
N4PN
N4WB
N6MU
OE1HGW
OH8SR
SP3DOI
VE4SK
VE7BD
W1DQH
W2GA
W2UI
W2YD
W4RIM
W5SP
W5HTY
W5ZWX
W6DN
W6UY
W7EKM
W6TC
W7TE
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WA9WJE
WB6APX
YU1AM

325
DJ2TI
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DK3GI
HB9AIJ
HB9AQH
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JA1JGY
JH1CJQ
JA3GM
JA3EMU
JA5EN
JA7HZ
JA8AYN
JA8EAT
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K2UU
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K5BZU
K5KX
K5RJ
K6XT
K8RA
K8ST
K9XJ
KG6V
KJ6V
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N4OL
N6RJ
N8RR
NF4A
OH2LU
OZ7BG
SM6CST
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W1KG
W2BAI
W2JB
W2REH
W3CDG
W3ZN
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W6VBI
W7CNL
W7KS
W7LZF
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W9KA
W9SS
WB6DXU
WB9EBO

324
AC8K
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JH1IFS
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K2UU
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K4UEE
K4XH
K6UFT
K9FN
LA3XI
N5EA
ON5NT
OZ7OP
PY7ZZ
SM4DHF
VE7HP
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W1UN
W2RS
W3BTX
W4BV
W4YKH
W7OM
W8GKE
W8SMV
W8SR
YS1RRD

323
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AF3E
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G3ZAY
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I2VGU
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JA1GO
JF1PJK
JH1QOJ
JK1OPL
JA3MNP
JA4RF
JA7FS
JA8BIO
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K1TN
K2UFM
K3WS
K5YCP
K6AAW
K8ZR
K9KU
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K8WWX
KD6PY
LA5UF
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SM7DMN
SP9AI
VE3CVZ
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W2IYX
W2MP
W3HNK
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W5DJ
W5UP
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W7UZA
W7XA
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W9RY

322
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DL8UI
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JA8BMK
JA8CXA
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K4XI
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K5DA
K5VT
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K7UR
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K9AJ
K8GSV
KB9EZ
N6MG
N6MM
N6QR
OK1VK
SM6CTQ
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W2MIG
W2SM
W3FM
W3YX
W4GYP
W5IJW
W6BJI
W8LYI
WA4CXZ
WB4QNP
YU7BB

321
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K6WC
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K7OXB
K8NN
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K6CT
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OZ1EV
PA8INA
SM7BBV
SM7TV
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W1VV
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W4TK
W6JRY
W6MJP
W7OAI
W7DQM
W9AND
W9FR
W9LW
W9NGA
W9RXJ
WA4JTI
4Z4DX
9H4G

320
AE4Q
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DJ4LK
DJ5IO
DJ9RQ
G3TOE
HB9AHL
I7TGT
JK1OPL
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JA8CDT
K2HVM
K3ND
K3UA
K4RO
K4RZ
K5JM
K6UD
K9UWA
K9VQK
K8CL
KL7PI
N4JJ
N5UD
N6HA
N9MM
NA4M
NS8C
OE6MKG
OH2KI
ON4FQ
SM6CMU
VE3XK
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W2HAZ
W2PD
W3VQ
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W5ZF
W7DQ
W9EQP
W9ZA
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WA9TVM
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YU1DD
YV5CWO
ZL4AW

319
DJ8FW
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EA4MY
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JA1OYY
JA1PCY
JA2MGE
JA3BXF
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JA7PL
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K2LQ
K4GJD
K4PVZ
K4XP
K6AXC
K7RLS
K7UT
K9IL
K8LUZ
KB9OC
KM6B
LA8CJ
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N4IA
N4VZ
N5OK
N6JV
N6VR
N7US
OK1AWZ
OZ9PP
W2GQF
W3VRT
W3XX
W5DOZ
W5IRG
W8CAW
WB2QMU
YU1OZ
YU2CBM
ZS1OU

318
AE5B
DJ3NW
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DL7EG
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JA1WSK
JA1WTI
JH1VRQ
JA4LXY
JA6GXP
JA7GLB
JA8DNZ
JA8IXM
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K1ZZ
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K4PI
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K6CBL
K9BG
K9HMB
KZ2I
N5UR
PP5YC
VE3II
VE6VM
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W3LMZ
W4LVM
W5DV
W6DU
W6HT
W8OMM
W8GS
W8NPF
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WA7FIG
WB2AIO
YO4WU
ZL2UW

317
DK8NG
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DL8XL
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F6BKI
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JA1RLV
JH1EDB
JA2DJH
JA3FYC
JA6EYD
JA7BJS
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K1MM
K4TEA
K6SMF
K7LAY
K7SP
K8CMO
K8IA
K8NA
KA4S
KH6CF
LA5YJ
N5FG
OY7ML
PY2TM
SM3EV
SM8BFJ
VE1YX
W2HN
W2KE
W3ACE
W7FP
W7FR
W9LF
WA1EOT
WA6WZO
WA8TKJ
WB4NDX
YU2TW

316
AE4Z
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DL7NS
FY7AN
F1SBU
IT9PUG
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JA1VN
JR1AIB
JR1FYS
JR7TEQ
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JA8XJF
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K1IK
K1UO
K3EH
K3FN
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KJ6Q
KN4B
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N5FW
N6OC
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NN6R
PY5WD
SM4CTT
SP2AJO
UW9MF
VE5YA
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W5VJP
W6GO
W6OKX
W7TVF
W8QBG
W9FU
W8KZV
WB2BNJ
WW4E
YU4TU
YU7BPQ
ZP6CE
9Y4VU

315
AD3Z
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F2NB
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JA1QXY
JA2APA
JA5PUL
JA8GZZ
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K8KTP
K8ZZ
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N4UU
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N6ND
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SP5BZ
VE7DP
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W1JJ
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WB4TDH
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314
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K8JN
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N4CQ
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VE6WQ
W2IQB
W2OL
W5ILU
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W6ZZ
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W6NB
W6WP
WA1JMP
WB4ZNH

313
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F6DCQ
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W3NV
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W7ZR
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W9ZWH
W8TRF
W8VX
WA9AZL
WB4EDD
YU2RJU

312
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DL8XL
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HB9HT
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K1VJH
K3LWM
K8GWN
K6LM
K8TWU
K8CB
KM1D
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W4OHZ
W4MWT
W5RJC
W5ZPA
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W6RDL
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W7OEV
W8HO
W8NS
WA4VDE
WA8ODK
WB4PAB

311
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KX4R
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VE7AHA
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W7GXC
W8CY
WA6IUM
WB8IGU

XE1GBM

310

AA4AR
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DJ2MN
DK5OK
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DL7MQ
HI8LC
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IT9JLA
JA3CSZ
JA5ANP
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K1SF
K1WJL
K2NJ
K2TV
K4YXJ
K6ANP
K9FD
K9GX
K9MFI
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K9ZO
KA5V
KA7AUH
KN6M
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KW9K
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N6OJ
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VE3HO
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W3GOH
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W3SOH
W3UJ
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W4RNP
W5CB
W6AN
W8GIO
W9SC
W9TY
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WA6GFY
WB4HOK
WB6RIU
WB9YXY
WD4RCO
WB4OSN
YU3AW
ZS2RM

309

AA4KA
AF5M
AI8S
CT4BD
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F6DZU
G3VIE
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JR1TNE
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K2ON
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K9QXY
KT1N
KV2S
KZ8Y
NØAT
OZ1CTK
PT7WA
SM5AQD
TG9AL
VE3DGX
VE3DR
W1HSB
W3TVB
W4DXI
W4ZMC
W6TFO
W7BCT
W8KKF
WØYK
WA2VEE
WB5SSD
YU2AKL
YU3QI

308

DK5WS
DL3IE
EA2HW
HB9AQA
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JR1EBE
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KØOO
KB2ZP
KB8KW
KP4EQF
KYØA
N2JV
N4TX
N5JR
N6AHU
N8MC
SMØCCM
UQ2MU
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W4DJJ
W7HR
W9XX
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WA3WJP
WB2CEI
WB8JEY
WX4A
ZL1BIL

307

DF6FX
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KB5GL
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KC9JP
KK2I
N4OI
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N6MB
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OK2DB
P29JS
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VE7DX
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W2JGR
W2MPI
W3UM
W3YT
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W6VW
W7AHX
W8QQH
WA4CTA
WA4DAN
WB2KPE
WB4GNT

306

DJ6BN
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K4CXY
K4KJZ
KA5W
KB5FU
KE4E
KB4RX
KFØH
KV4F
LA9GV
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N4BPP
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ON7EJ
PY1LW
PY6TM
SM4EMO
VE3DMC
VE5RA
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WA3LJP
WA4LOF
WA4OBO
WA4WPN
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WB2JBJ
WB4RFZ
WB6RSE
WD4NBX
WD8MGQ
WD9AHJ
XE1OX
YU3EF

305

AB2N
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K8JRM
K8MNG
K8MPF
KD4S
KE3A
KBØU
KQ2L
KS9Z
KT4G
N3RL
N4VB
N4AXR
N4GE
N5AX
N5TC
N6GG
N6OZ
N7UT
NN4Q
OE3EVA
OK1IQ
OK1TN
OK1ZL
ON7WW
PY2FNB
SM7BAU
SM7BOL
SM0BZH
W1TPK
W1TSP
W2LOG
W3EV
WA1URV
WA2MTI
WA3DVO
WA9VGY
WAØJYJ
WB9MSV
WD9IIX
YU3DJK

304

AA2A
AA4R
AA4NA
JH3DAE
K4NYV
K5JUC
K5TSQ
K8DS
K9BIL
K9LHA
KA8T
KB8IZ
KR9O
N2AC
N9NS
UW3DR
VE3IPR
W1ETV
W4IQ
W5QN
W6NLG
W6OU
W6TJI
WB8RJX
WT4T

303

AB8Y
AE5H
AI3Q
AI5I
CEØAE
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JA2IVK
K4TKM
K5AS
K6XN
K4XR
K7ZBV
KB2HZ
KB4FQ
KH6GS
KKØC
N3GB
N8AQV
N9AU
N9OK
OH3TO
OK2QR
ON7EM
PY5EG
W1AGA
W4MGX
W4WW
W6YQ
W7XN
W8HFN
W8LKG
WA3NGL
WA4BEC
WB3CQN
WB3HAZ
WB5SKQ
WD9ADB

302

ACØM
DK2XX
DL1EY
DL8MAG
G4BUE
JA1EF
JH1BZJ
JJ1DWT
K1VHS
K2LS
K2AIO
K4BIY
K6UJS
K8MN
K8ZO
K9HA
KB2EN
KB3XU
KB4BH
KC8JH
KDØQ
KE9A
KL7H
LA4DM
N1AJO
N4AVV
OK2RN
PAØTO
SV1IW
VE3MV
W1DGC
W1PNR
W2ARQ
W5CWQ
W5VSZ
W8WOJ
WA2MID
WB1EMN
WB2VPV
WB3DNA

301

AA1V
DK2UA
DL4FL
DL7WL
DLØAA
EA6BH
HB9NU
I1BUP
JA1IOA
JA3PXH
JH7BRG
K3BEQ
K4BYK
K4HIG
K6HHD
KB2RV
KF4BJD
KØBJ
N1AKX
N4AYO
N8DE
N9RF
NE5C
NIØF
PA8LEG
SM7FDO
UP2BAR
W2NJ
W9YT
WØUO
WA2OHD
WA9MAG
WB2CVL
WB2PMP
WB7CLU
WB9ZBE
YU7KV

300

AB1U
ACØA
AD1S
AD8I
AI8M
CE6EAT
DJ9ON
G3VKW
GW4BLE
HB9CIP
HB9KC
IV3TQE
I5EFO
JF1KKV
JA2GBO
JH2CJW
JA5FDJ
JA6GIJ
JA7BAL
K1DP
K5FA
K5FNQ
K6FM
K6GXQ
K6NM
KT6QM
K8UE
K8VFV
K9TI
KC4CT
KCØO
KN8COQ
KO8J
KO2O
LA5IU
LA9HC
LU8BA
N2JJ
N4AXT
NA4D
N4FKZ
NM8O
NS6B
SM7HCW
SP6AEG
SV1JG
UA3FT
VE3CE
VE3CPU
VE7OFW
W1PEA
W1WEF
W3BZN
W4WXZ
W4ZWE
W5ERY
W5KFV
W6MND
W8SIJ
W8TMD
W8NE
W9KXW
W9NUF
WØJIN
WA4JJW
WA4SKE
WA4VCC
WA5IGD
WA9EKA
WA9USE
WB1CCH
WB2OHD
WB4UBD
WB9HIP
WD4NKP
WD9HAW
WD9IIC
YU1GMN

299

AA4CM
AE3S
AJ8J
EA9IE
ISØLYN
JA1WAE
JH1NPX
JA8KSF
JA8MKZ
K2PLF
KB3OQ
KB4HU
KB4IL
KB8MR
KRØG
KT5A
N4BLX
N9ER
W2SR
W3YFV
W7QMU
W9DDX
WAØDCQ
WB3GPR

298

DL1QT
G4DDS
IT9TGO
JE1GMM
K5CSK
KB4I
OH4SH
XE1FR

297

DLØWU
HK3TL
JA5NG
K2OLG
K2QF
K4JPD
K4LNO
KB2RZ
KB8ZW
KE2C
KE9U
KR8N
N5IH
N9DJ
SM5AKT
VE3LDT
W1EP
W6DPD
WB4PRU
WB5LBJ/DU8
WB8ZRL
XE1OW

296

AF3T
OK1RV
GM3AWW
K1ER
K3IE
K5CON
K9MNT
KØCVD
KØJSY
KC5M
KG9N
KM9L
NØZA
OZ5CV
W1BWS
W2MT
W2PK
W7ID
W7NP
W7ZI
W8LZV
WB1GDG
WB8TRW

295

DJ6DU
DL7MAE
JH1BSR
K1RH
K2PZ
K5OTI
KB5AS
KH6BZF
LA1H
N4DAZ
VE3FEA
W1BFT
W3IRE
W4DMV
W4PRX
W4RA
W6CTL
WB8VPA
WB9NOV
WD4FWE
WF4G
YU2CAL
YU3DQ

294

A7IAD
AB1A
AK5B
F9CB
HKØHEU
JH1QFA
JA3RRN
JA4GXS
JA7HMZ
JH7MQD
JA9GPA
K4KPH
K5EE
K6GK
K6NL
K8DJC
KØHRF
KI3L
N2BJ
N4VG
W3KJ
W4OMY
W8CBA
W8GE
WA8VDC
WB1EAZ
WB2CJL
WB4KRH
WB4MAI
WD8CZA

293

AB6R
AD8O
AF2C
AF2O
AK4N
DL9TV
JA1WPX
JH6HYC
JA9NLE
K2TK
K4UWH
KA3R
KB1BE
KC3X
KG9J
KN8P
N2BIM
N8EL
ON4SW
SM5HYL
VE3CWE
VE7RG
W1HEO
W1ICV
W2NY
W5YH
W8YAH
WA3CGE
WB4NFO
WB6ZHD

292

AI9F
DF3FI
DJ3TF
DL7XS
HB9BLQ
JF1SEK
K2ENT
K2NT
K4TXI
K4WHN
K8CQ
K8ZTT
KB8JK
KB8LT
KC4B
KJ3L
KN1U
N7RU
ND5R
PY3EM
W2HUG
W4ZWZ
W9CA
WA1KUL
WA2UXC
WA4YOM
WA8SAE
WB5CRG
WD5GJB
YU7DX

291

AJ3H
DL7JY
I4JBJ
JA2JYP
JA4FWM
JH7BDS
JA9FPI
K4JLD
K5TA
K5WJ
K8MC
K8NWD
KØVV
KB2CB
KB3KV
KB4SA
KC4U
KN2N
N2RR
N4IB
NØAFL
OZ6ZZ
PAØWRS
W3KH
W6OK
W7GLU
WØULU
WA7GVM
WB3FID
WD8PKF
YU1GTU
YU2TS

290

AG4S
AJ6V
DF2HL
DJ5GG
DJ9UM
DL5BAN
F6EYS
HB9BZA
JA1NQI
JA1QOP
K1HDO
K1KTB
K2GAT
K2IGW
K2OWE
K4CNW
K4DLI
K6DG
K6FO
K6RQF
KB5DO
KB5WQ
KC4DY
KD5RO
KE5AX
KGØE
KN8R
KP4AZ
KS6A
KX5V
LA1ND
N4AJZ
N4IR
N6VI
OK1KRS
W1DYH
W1WAI
W2AXZ
W2FB
W4TL
W9MYG
W9OKL
W9RT
WA1ZLK
WA9OVU
WAØUWS
WB5ZGP
WB9POH
YS1SC
4X4UR

289

DF6CY
DK8AX
DL8VN
F6DYG
G3XTT
I2RFJ
JG1TSF
JA2IIG
K2SX
K8QXB
KØKES
KB5DN
KQ9W
KV8Y
N4CID
W2AK
W3ARK
W3MZG
W5JM
W5ODD
W6RO
W7OAX
WØBA
WØEJ
WA5ZIJ
WA8MOA
WD4R
WD4HLK

288

AE3Y
AI3N
DL7HT
F6CDJ
HB9BPP
HK3YH
I3TZP
JA5ALE
JA5THU
JA8KSD
JAØDAI
K4PR
K4SV
KB6Q
KB8LH
KF4L
KNØV
KR6W
NA5C
W1TN
W7HRD
W9TX
WØANZ
WB2QJY
XE1MDX

287

JA1BMA
JA1KYE
KB9I
N6YI
N9ALC
SM6AHS
WA1W1P
WA3DMH

286

JA1ATF
JH7FMJ
K6SD
K9RHY
KAØE
KC9TA
KE4HX
N4DRC
N6ADI
NW6S
VE3XO
W6TEX
W9QWM
W9WAQ
WD8NBD
XE1VV
YU3TKL

285

AG9S
DF9RM
DJ1ND
DK6NJ
G3COJ
JA1NLI
JH1KRC
JA3ANW
JA7AWZ
KØZQD
KA2BZS
KB2E
NI4Y
N2VW
W5JE
W7GSP
WB6FCR
ZL2ASM

284

AD1C
DL1LZ
G3TXF
IT9TQH
JH1AGU
K2TWI
K9BVY
K9CF
KØSW
KE5TF
KGØC
KM6K
KR9S
N6NF
NN4R
NZ4Y
W5EC
W7DAA
WØYZB
WA1YTW
WD6DKG

283

DL5FF
EA6DE
HB9G
JA1NAQ
JA2CXK
JA2DOU
JA8CFR
K3RV
K4GFH
K4XQ
K5SSB
K8TMB
KAØCPY
KC2RS
N3TO
N8BKF
VE2FEX
VE3NI
W1GVZ
W2CKR
W2HG
W6AYG
W6DBP

282

DL8AK
DL9YC
HB9WZ
JH4UVU
JH5FQO
JH7LMZ
K2QIL
K5KNA
K7GM
KC9CQ
KE6LT
NL7P
PY2DBU
SP6FER
W5OSH
W7SFF
W9GSB
WØICB
WA2CYQ
WA9YTO
WB2TKY
WB4PUD
YU2OM
4Z4AB

281

F6FGW
K1BJ
K1WJB
K5BDX
K9KK
KB7QC
KB9UV
KC4OV
KE2S
KR1U
KW7M
NA2J
OK1OLA
VE2AGP
W4LF
W6INH
W8SSC
W9GMS
WØGAX
WB3KAM
WB5YKD
WB5ZKR

280

AIØO
CX4CO
DF3AO
DJ1IK
DK6ED
G4GIR
JH1FDP
JA2JRG
JH8NYK
K1TUO
K3JGJ
K4NV
K5GDE
KØNN
KØTLM
KØUR
KC3AJ
KD8V
KS9K
KV2Y
N2CGB
N5DSK
N8AAT
N8FU
N9ANR
PY4ALC
PY4DD
SVØAA
W1WW
W2ELH
W3LDD
W4RXT
W7FY
W8CEU
WA2FUE
WA4JXI
WA5SUE
WB6WKM
WD5AAM
YU3VM

279

K2JF
K4FX
KB9JF
KF2F
KF2G
KO9Q
KP4V
OK3MB
ON5WQ
W2JWK
W6MEL
W8RV
WØJLC
WB8VKL

278

HC4JL
I1BWI
I8WY
K5FUV
KA1A
WØLSD
WA1LOU
WA7MOK
YV5BNR

277

DF8EX
K3SEW
K3TRM
K4PRT
K7CU
KA1HQ
KR5D
LZ1YE
N2WS
W1GY
W2TS
W6OUL
W7TS
XE1XF

276

DJ6GK
G3JFF
JA1SDV
K1YHM
K3ZO
K7AII
KØBX
KØHQW
KD8IW
KF9D
KJ9I
KN8M
N8ATR
NK4L
SM6BGG
W9NYW
WA8JOC
WB2KJL
WB8KFG
WD9GQV
WDØGML
XE2MX

275

I2QMU
IN3RZY
JH1WIX
JR3GWZ
K9DDO
KC7E
KD9M
N2US
N5DC
NG6W
NI4H
SLØAS
W1CNU
W2BTG
W2NZG
W4VWW
W5INL
W7LYO
WB8LFO

274

DL6UR
EI7CC
F6GXB
JA1SFL
K6FO
K6ZOR
KØVZR
KC7JO
KC8PG
KE1K
NM4L
VE7ML
W2UP
W2YC
W4MAF
W6ZID
WA4PSE
WA8LXW

273

EA3CTI
HB9BFQ
HKØEHM
IØMMI
ISØRZW
JA1CZI
JA1NVB
JE1HKW
JA2OZI
JH6RYY
KB2HK
NX5B
W6DUB
W8KBZ
WA2LMW
YU3DKS
4X6AG

272

K1KOB
K4ITV
K5DYZ
K6QS
KT6T
KX7J
N9AVY
SLØZG
W1GNE
W6UZ
W9UO
WA5TOS
WA9TAH
WB9GYU
YU3NP

271

AI8D
DF7VO
F6DYY
JH1IED
JJ3PR1
K2PK
K9JU
KA4PKB
KB3OM
KM6N
KM9Y
N1ALR
N5CB
N7BES
OH3SG
W4EJH
W6DH
W8PCS
W8VSA
WØRYW
WA9LEY
YU2CQ

270

AA2Z
AC8W
AD8J
AF9R
DK5JI
F9XL
G3KLL
HB9T
K4HTY
K4KKJ
K7WF
KB1U
KF6A
KR9P
KSØZ
N4BQD
N4BSN
N4TL
N6VO
NT4W
NB7R
NE8R
ON6YH
W3YQ
W4VUL
W5IB
W5ISF
W6GYM
W6LOI
W7MCG
W8GOC
WØJF
WA2MTR
WA4VDN
WD8IXE
WI4K
YU1NZW

269

I2MOV
JH6SOR
K4JAF
K8EFS
KB5EK
KF4YB
KZØE
N6HK
NA2K
PY1SJ
W8PBO
WA8CZS
WB5PLD

268

K4JEZ
KC8BK
N8BIB
N9AIB
SV1PL
VE4SN
WD5HRX

267

AK1N
OKØZR
JH2PYX
KB7VD
OZ7NJ

266

AI3Y
G3BWP
JA2BYW
JA2DN
K4ON
KC2X
KC8QT
KD5MD
KK9Q
N3AKD
NX4Y
W2HKE
W5EHY
WA1NSJ

265

EA6ET
JJ1HEY
K4PT
OE1ZL
ON4QP
VE5ADA
VE7DXN
W1HJF
W1NH
WB4HSA

264

JI1MNT
KC5CZ
KT4D
N2BAT
SM3BNV
SM6AVM

263

DL1MAJ
K3HBP
KC7ET
LA4YW
SM5IMO
W4FNS
W6RFF
WB4CSK
WD8OTZ

262

JA3DAY
JA7COE
JH7NRE
K1XA
K4QMU
K9BLY
K9GPN
KBØG
OH5OZ
VE4ADG
W2MOF
W6ALQ
W7JBS
W7MCU
W7ND
WØBX
WI4R

261

IT9QDS
JG1HND
K6ASI
K8ICE
KA1UT
KA3DDT
KB9VF
NO6H
KC5CR
KC9AT
KD2GB
NØAFW
SM5BMB
W8DWP
W8HNS
WA2PPV
WA6EZV
WB6SRK

260

DJ4XC
DL6CT
G3JJG
G3YBH
HB9AT
I4UFH
I8SCV
JA8CM
JA7MF
JA7XBG
K5PR
KB2VP
KC7G
KKØM
LA8PF
N1AFC
N3ACU
N6FT
N9CPW
NØJW
NL7J
NX4N
PT2VE
SP7KTE
VE4IU
W1CYB
W3GTL
W7ALZ
W9EIZ
WA2ISM
WA2LOG
WA4CCP
WA4NQG
WA6SIX
WB5FGI
WJ4T

259

AE1T
HB9AIB
KØJFN
KB4LX
KM1R
N2CIC
N3ARV
N4FAC
OK3WW
VE2DPJ
W3BBL
WD8IFH
ZS2U

258

AB1P
K1NLQ
OK1AFC
SM7CMY
W5UFL
W7HPI
WØJSN
4Z4UX

257

AC8R
AK1L
CX2CS
DL7FAH
JF2DJV
K4LW
KX1A
N4FKZ/HR
N5BA
W4FL
WA1FCN

256

AA5C
DJ3AS
DJ4BE
JM1MGP
JE3NWN
KB2CV
KB5IM
KD6WW
KT1J
SP2BRZ
VE7ZX
W2GND
W2GVX
WB4ETD
WD9BBL

255

DF2PW
F6BLP
JG1FVZ
K1FWF
K7RS
K8WWT
KA1ML
N4CIS
N4XM
NU4N
PY2ZM
VE4ADV
W9HAH
WB3IGR
WB4QFH
WB8PHO
WB9RNF

254

DF4FO
DF7VO
DJØLC
EA8RL
G4IJW
K4MRL
K8AC
KB2RA
KC9EW
KDØB
KM1E
NE4G
SM5EC
W1SG
W2AAN
W5KNE
WA9YZN
WAØADX

253

HB9TE
I2AOX
JE1TTI
K1NOK
K3OMX
K7WE
KA2CDE
KA9EMF
KG1M
N2AMS
OZ6EI
OZ8AE
PY4KB
W5EIJ
WA4BSN
WB3LGO
WD9BEG
YU1OHI
YU2QK

252

AG1C
AKØM
CT4YN
DJ5PA
DL3TJ
DL9JI
G3EFS
HB9CIR
J88AQ
JF2HPA
K8DD
K9RR
KAØFPK
KB5FV
KB7HH
KB7QD
KC2CO
KL7KJ
N4GFI
OK1AOR
VE1BWP
VE1CAW
SM6AVM
WA2AOG
WB2IVO
WD9BBI
YU4BM
YU7NZR

251

DJ4SO
DL1EV
HB9CJO
HB9CSA
I5NOZ
JA2DC
JA2HMF
JJ3AFV
JA5CKD
JA7WKG
KA1ED
KA1KD
KB7OD
KC5CR
KR4D
LA9OI
N9BUS
N9DOK
NI7E
OE2DYL
OH3RF
OZ2E
VE3LWL
VE4OP
W8ANM
WA3FWA

250

AC4U
DF3TN
DF6JC
DK3QJ
HL1SX
JA4ESR
JAØORM
JY5ZM
K2IBW
K4BOE
KØAXU
KA2GMT
KA8IQR
KB3MC
KB9M
KBØWM
KC4TJ
KC2UF
KC4ZH
KC7V
KN4F
KU5L
NY4X
SK4BX
VE5UK
W1JNN
W1OQP
W2SEN
W4GIO
W4NW
W5CSI
W7OC
WØMHK
WA5IPS
WA7IRD
WB3JNX
WB9EEE
WB9UKK
YS1GMV
YU3LF
YU3TFC

249

KA1ILA
KF3C
N6BOI
PY2JSF
W5CTM
WB6RSU
XE1VIC

248

JF1CKL
K6DR
KB2XL
KT4M
N9AW
NN4K

247

W4FHI
W8CD
W8GWC
WØIJN

246

AK8A
KN3P
WB5ZAM

245

JF1VST
VE7AVC

244

GU4EON
KA1X
KC9JH
KD7J
N7AYK
OE5KE

243

JL1BLW
K1RB
KC5CP
KCØXK
WB2FTK

242

F6FNU
K4CM
WA4SNI
YU7BJ

241

G2AJB
N2AIF
ON7TN

240

EA5CE
JH1WJR
JR7COO
KB1H
KB8NW
KG2T
N4KAD
ON8HF
OZ1FAO
W6BL
WC6I
WP4O
XE2AQ
YU1NR

239

JK1SAI
JA9IRH
SMØHEP
WA2UZB
WA6GTU
WB5UJO
WB6FDQ
WD8NVA

238

AA4AM
DJ2BV
K3WGR
K6SE
K7PM
KE4AP
NA6F
W4XS

237

GM3LYY
JF2GYH
ON6IT
PY4ZU
SK7AX
SM7IZL

236

KA3A
NE8Q
W1XK
WB2DZZ
WB7VNY
WBØRXF
WD8PFI
WD9AEU
YU3PO

235

I2QEA
JA3IYS
K6HLR
KC9XF
KI1G
SM6JHO
WA9RCQ

234

AG1I
G2AFQ
K1THP
KA1DOS
N4CRI
N9BUS
SM6JAO
W3OSE
WD8KZS
4Z4OL

233

HB9CDZ
K5GKC
K5XI
NJ5X
WA1AYS

232

AI6Z
KA2CYN
KBØYM
KE3W
NE6I
W2QJT
W8YNL
WØLNZ
WA7CGR
WAØECN

231

DF5DP
DL2QB
GM4KHE
JA1AFF
JA1BFF
JH1XUP
KA2HMJ
N1BHC
N3CYI
N6NO
N8BC
N9BAF
SM3LGO
WB3EFQ

230

AK1E
AL7BL
OJ1PT
JR3RRY
KB4HF
KY7M
N6PE
N7AIF
NK5Z
OE5SPW
OZ8WH
PY1DFF
PY2ZH
W2VP
W9MMJ
WA5HOD
WD5ELJ
YU3TUX
YU3UAR

229

AC2F
G4EDG
GM4FDM
HB9BYZ
IKØAZG
K5XE
KA2AJT
KJ9N
NN6W
PY1QQ
SM7IDF
V2AO
W2IIX
W3NQC
W7FOF
YU2CKH

228

DF6TC
DJ3XD
DJ4WP
DL1FBO
K2GBH
K3QIA
K4ZIN
K6UV
K9PNT/DU2
KA6DXY
KB9PY
KY2W
N1BRT
N9BOK
VE6KY
W6FAY
WD4CBA

227

AD4U
DL2KF
DL2AM
G4ISK
HB9BXE
K8IAI
KC8YW
KO3N
KS9Y
NA2G
SM5LPC
VE2PD
W3FAE
W5NF
W6PKB
W7BUN
W7CUS
W9KE
WD9JKZ
WF4I
YU3SE

226

DFØAFZ
DKØKO
HB9AUT
JP1BJR
JAØVHI
K5RPC
KA8IIC
KB2ST
PY6ABZ
VE3LAJ
W8KMC

225

DF1FX
DL1CP
EA1JO
G3FKH
I8TSL
K2OVS
K3PPI
K5PC
K7CE
K7EFB
K7WA
K9ALP
K9LA
K9LJN
KC4AQT
KC7GO
KC9DJ
KC8DA
KD9BG
KR1R
KU2X
N6DW
NA5S
ND4Y
NE8M
OH2LP
W3IVG
W4HLY
W4LZW
W5PD
W5TZN
W7YAQ
W8QID
W9PWM
W9ROK
WØMJA
WA1UDH
WA5TOD
WB4BBH
WB6FZN
WD4HRO
WS4E

224

DL5MBY
JJ2BBZ
K4BWU
KG6E
KO2Q
N2CPE
OH2BMC
W2RC
W9MP
ZS6BCR

223

DK6OR
JE2LQX
K7DOR
KCØD
N5FN
NG2S
PY2XX
W1RFW
W8AN
4X4JO

222

HA5KKB
KC4GR
LA4CW
OZ1CAH

221

AB9O
G3YMC
JK1PTF
SM5CSS
W2KKZ
W7CQR

220

DJ9HX
DL4FW
IØZUT
JA3AUO
KG9E
KJ7R
KN4KWO
N2IT
N4DDK
NB7Q
VE3JCV
VE5XV
VE6VW
YB4AOC

219

HB9CMZ
JA1AYC
N2CHD
WA4JZS
YU3DX

218

KA2CFH
SM7GCP

217

JF1WQC
N9CHN
W1HOF
YU7ORS
YV5HUJ

216

JA1CHN
JE1GBI
KE4MM
KEØC
OK3TMF
W4YK
W9KGW
ZS2DK

215

AF2K
JA2MNB
JR5PGB
K6MSK
N3CW
WA8IMO

214

I1YS
JA7REE
NY6M
W2FV

213

DK1EI
HB9BNX
JH5AUE
KG9Z
KK7Y
WB5DBT

212

KG6GF
KA2MBC
WB4SYP
ZL1IB

211

F6CXJ
JHØHWP
KB9V
KT6W
N3BNA
VE1UNB
WB6OTB
WB4CHR

210

AA4QZ
HB9AJY
JA9GPG
K8MR
K8ND
KB6WI
N4DSS
NA4J
NF2K
VE3BXF
W3HHG
SØMCY
WB6UZT

209

DK2UB
DL1FBQ
JAØED
K4YI
KC4OP
KCØMS
N2DHZ
VE3MFZ
W3EEK
WØIH

208

EA5AR
IK8AUC
KC4FW
KM8E
NO4N
PY3ZZ
SM5LI
WØLT
WA2DSC
XE1MMD

207

DL8MBS
DL9HN
HB9CCL
IØSNY
JA1OVF
K9BQL
KB6UI
KR9F
N2AWM
OE2KGM
OZ2NU
W8MFB
WB2ELV
WD9DID

206

DFØAA
DL6KC
G3OLU
I5UNA
JH2RWP
JA4HBP
K8MW
KC4HN
KC8AU
N9CIC
PP2BNQ
WA6O
6Y5HN

205

HB9BMW
JA1BAL
JA1JYZ
JH1LMG
JK1GDD
JA2ELA
JG3MBF
JA4JBZ
K3FB
KA3CTY
KB3GX
KCØDW
N4HBD
N4HOH
NA5U
NQ6N
XE1OD
XE1OZ
YV3BRF

204

G8GG
HA5LV
JE2PKD
KF4YH
KM9W
N9EJL
OZ8JD
WØMD

203

JA8BKI
KØARR
KA1CR
KA9BKW
KB8O
KC5NO
KC8JX
KD4NI
KI2P
KI9T
KQ3W
KV5Y
OZ5PA
SM6DEC
W1COI
W2KHO
W4ABV
W5MCH
W5PWG
W9NYG
WØTU
WB4LJP
WB9UIO
YU2RVF

202

DK5VP
I4FGG
K1DII
K2UFT
KB1CD
KB1W
KG6AM
KN2B
KR2J
KR8Y
KX9B
NQ6E
ON6RR
OZ7XG
VK6PP
SP9UH
W7FPT
W8FN
WØCON
WM4Z
YU1RK
ZS6ASW

201

DK2OY
DK9IP
EA4AXW
EA8AM
F6HWU
G3IMK
JH1MTR
JN1GQK
JA7RPC
JH7UJN
KA8ANQ
KC2WQ
KCØLG
KD7H
KS1G
KS2O
KV1S

KV9V
N2EDF
N9NB
SM6KQK
SP3BYZ
W8XS
W9XT
WA3AFS
WA4YED
WB4FLB
WB8WZT
WB9OJE
WB9ZNB
4X4IL

200
AD1V
DJ1XT
DK4DC
G3FVC
G3GWT
G4LDS
HB9AAH
JA1CLW
JE2KSM
JR3LGB
JA7EEI
JA8GRR
JA8CRG
JH0GTL
K1VSJ
K2EUH
K4KYI
K5MC
K7DXJ
K9UQN
KA4JMZ
KC8CK
KD5VU
KD8IL
KE3R
KE4UC
KG1V
KL7VZ
KN1I
KQ7H
ND8F
NF4Z
NI8C
NK8H
TI2BEV
VE3CUI
VE3EZU
VE3GGW4
W1AOQ
W1LMO
W1SE
W4HNK
W4JFL
W4NZR
W4WKQ
W7YS
W8MEP
W9HI
W9NO
W9IL
W9TGN
WI8I
WA2QWP
WA4GFG
WA9BXB
WA9NQJ
WB3AIT
WB5MJK
WB5NAA
WD9EJE
WC4B
WD4RAF

199
EA2LY
K1GVW
KD8AM
KL7VZ
KS3L
N9DPL
W1IHS
W4IMB
W5NOB
W6DSY
W7HS
W7QZI
WB1AGR
WB8WRU

198
DK5IZ
KA1SR

197
G3JYP
N4ENX
SM5FUG
SM6NJJ
W4KEB

196
KB2G

195
I4GHW
KJ4MD
KB8XN
N3CJW
NV4O
W4BZL

194
KB4FO
OH2ZAS
W7QN

193
AA4BK
JA7JND
JE1XMN
4x0KA

192
JA1BIN
WB4TAL

191
EA1NZ
W9LIH
WB4VJ

190
K4TP
K6VTD
KA4LRM
LZ1KOZ
OE6WK
WB4AGH

189
DL3DK
JD2KBK
K3NA
KT9P
N2DR
NK4Q
WD8DDU
5Z4YV

188
AJ8L
AK8Z
CT1YH
DL2FAG
EA8IR
JA1SJC
KF1J

187
AK6T
I8WYD
JA3UCO
K2GP
KC8FZ
SM6DUA
YV1CW

186
DL7MAT
DL8ZAW
JM1CAX
KA1Ui
KA4EMR
N6EBD
N8ASA

185
JE1BQE
KS8C/KH2
KX9B
N6QS
TN8AJ
W1JNZ
W7YF
WB1GBU

184
DJ8PX
GM4LHA
JA7FEX
K1TH
KA1JC
KB8TL
VE7YL
W5NUT/PJ7
W61CX
WB4VKW
WB6STZ
WB8YMQ
WC4K

183
6U3HFN
I2DMI
I8TIC
JA1QZC
KG8K
ND7B
W1OGZ
W4FCC

182
IT9FWD
JA3APV
JA4AFK
KC2CS
N5DMP
N6IZM
SM0KRN
WA4CTC

181
AA4DU
JA7BWT
JK1RJQ
JA9EEH
K1EUS
KA4HWG
KB1HY
KC8XH
KS2M
N9UN
N9BIZ
W4NNF
W5VJW
WB6APN
WB9IWN
WD5CPR

180
F8HB
IK8BQE
JI2MBN
K8UNP
KC3EN
KG6I
ND2K
VE4ADA
W6UXE
WA9CYG
WB2GYS
ZS6JZ

179
I2FTE
I8UZF
JI1RZG

JJ1UJK
KB9YW
KD8JL
N8AFV
OK1AWH
SK7GC
SP7AW
W9BB
WB1DLH

178
AG9V
KI7X
N6AX
W4UFH
W4VCS
W5UCY
W9CBE
WA1HXH
WD4RJQ
YU7BCF
Z56AZQ

177
DJ5PX
DL3NBL
JA1EMQ
JA3VOT
JW2CF
K7SPL
KA3IFX
KA8C
N8CKP
OK3YEB
W3TB
W6JAZ
W7TSQ
WB5ZDP

176
EA4CU
KA8CJL
KQ9O
KT1H
LA9SN
N1CBM
NJ8M
OE2BZI
OH2BJG
VE2DWH
W5HFN
W9GK
WA3JLD
WA3SPJ
WA8STV
WB4NMA
WD4W
YU2ARS
YU2CAY
4x6DF

175
DJ9ER
DL3WA
I2WTU
I8TOH
JH7CUO
K1HKI
K1JIU
K2DI
K2POF
K2RSG
K3JZU
K7OVM
KA9FYZ
KC2YI
KC9FF
KD4OM
KM5A
KM8Q
KU2C
KU9C
KX8N
WA2AHP
WB9EVH
WB8MWJ
WD4AFY
WD8QBP
YU1AST
YU4ZA
4X4LH

174
G3GMY
K4QE
KC2SB
N4KMY
N9ACD
NI8B
4Z4XW

173
AK4H
VE3JGC

172
AL7DN
WA1YFF

171
JA7DOT
K1AA
KC5UC
NJ2D
OZ4LS
W7AOL
WB1GQG

170
F5DE
JH1OVY
KA3FIB

169
DJ7OB
DJ8DT
DL1TH
HB9BMZ
JA8LRG
JK1PWQ
K8QYC

N2RB
W1EO

168
K4AOH
VE2FT
VE3HVJ
6Y5WC

167
GM4KLO
HB9CJX
K2IAB
KA2JMM
KY1O
W4GPA
W8LCU
WB8FRF

166
HA5HR
K1YIA
KA8CMR
SM6LPF
VE4AGR
YU1EFG
YU3THM
ZL1PF

165
JA2GCW
JA8AD
K7DRK
KA2GER
KC2PX
N1QY
N4FYF
OZ1HHF
W8RJL
WA4WZO
WD9HZK

164
AK7Y
KG7Z
N9EZ
W6RCL
WB8HIW
WD5DEQ

163
KE4NG
OZ1FVL
VE3IRF
W8EU
WA5OKI
WA8RUD
ZD8RH

162
JE2SPQ
JG2MVA
K8IYF
KE5PA
N1APE
N8JJX
N8TW
WA3TXV

161
KB1ER
N3IV
NO4T
WW4J
XE1JCL

160
I2CEX
JR2CFD
JE7BEX
JH7DFZ
KA3FUU
KM9G
NF6Y
SM7NDX
W8UE
W9YCV

159
IK8CAJ
KE4XY
N8CXX
SM5FNU
W9LYN
YU3DJR

158
A22ME
AJ3K
G4FCT
G4MVA
G5DSD
JR4QZH
JE6EGC
K1ZLA
K7DXD
KA2CDJ
KS8Q
KU2A
LA4O
N7BUP
SM5CAH
SM8BSB
W8QZV
WB9KQY
6Y5AG

157
HB9AQS
I8UAV
JA2GSQ
VE3NSJ
W6NVN
W8IBR
W8JM
W8OSK
WB9ZGY

156
DF2CD
DK6DK

JF1ERP
JJ1UDI
K6CZN
N4FKZ/EA4
NB6G
OH3BU
VK2AYK
W2OW
W6SIY
WZ4S

155
DK2JX
HB9NL
HL4XM
IK8EPC
JN1VNW
JN1XWO
JJ3WUG
JA4AOA
KA5HSA
KB3YJ
KO8PR
KK1J
KZ8I
N1DCM
OH7EU
W8WDW

154
CO2PY
DL1NP
EA8AGF
G4OBK
G3NOB
JE1QYI
JH1VHU
JO18MV
JF3PLF
JH4BUO
JH7RKT
KA1YP
KB1JU
KD4TQ
KX5L
N5CPG
OE2YGM
VE3FIU
W1AIM
W8NJR
XE2ADY

153
DL3GG
HB9APJ
HK3BFU
JJ1EEA
JR2MWZ
JA3PG
JR3WXA
K2AX
N3BOS
N4R6E
OE7HHW
OZ5EDR
VE1BWQ
VE2PT
VE4MT
W4UCF
W5YM
W8BCE
W8UY
WD4LOK
YU2JH

152
AA6EE
DL3GK
F6HKD
JF1RDC
K2KIQ
K6UXO
KA1CFA
KA1Q
KA5GHR
KA8CFD
KB4Q
KC4MJ
KD2BW
KD3C
N3CYC
N8DJJ
NB2Z
NJ5V
OZ1APA
PP7JR
W1ICH
WM4M
W6FL
WB1ATZ
6Y5EE

151
DL5RAL
DL8GAE
G4KHM
JA6JNF
K4DWO
K4YKZ
K8XB
KA1PF
KD9J
KD8HN
KF4SA
KZ6Z
LA7SP
N1BVZ
N1CNC
N4EED
N4EM
ND5M
PA3AWW
PW8ET
W1KDD
W6NOL
W8QGN
WA3LFU
WA4SAC
WA5WDB
WB5MTV
WD4FAB

150
CN8EL
D68AM
EA8HJ
G3BKG
JA1LKJ
K2QPM
K3OXS
K8JE
KA1EJ
KA2DYB
KA7V
KB8ZU
KC4N
KD4VN
KD8HX
KR8S
KS1J
KT8I
N3CTB
N8HH
NA2Q
NA9A
PY2ZJ
VE5BBQ
VE7EIK
W3HMR
W7KWI
WA2EUA
WA2LWA
WA3JBN
WA9AEA
WA9QVC
WA8UJQ
WB3LHY
WB6YJT
WD5DOM
YV5ENJ

149
DJ5FM
KB8CN
N7DDK
N8AID
NA2N
W9IAJG

148
AL7X
K4BXU
KE1E
W1FDR
W8LNL

147
DL3GG
HB9APJ
HK3BFU
JJ1EEA
JR2MWZ
JA3PG
JR3WXA
K2AX
N3BOS
N4R6E
OE7HHW
OZ5EDR
VE1BWQ
VE2PT
VE4MT
W4UCF
W5YM
W8BCE
W8UY
WD4LOK
YU2JH

146
EA1XC
JA8WOV
KC8MK
N9EAJ
WA4SFF
ZS6P

145
F8HLB
K5JII
K6ZFL
WA2LWA
WA8UHQ

144
DF6AT
GM4SID
JG1HUQ
PT2GG
W7CSW
WB9ZHS
4X4JJ

143
DL3ME
JH3CKP
JR1TXR
K4DHY
K6ICG
N8CUB
WA2SSV
WD9HMQ

142
F6FEQ
JA7AZY
KA9HTE
W7KKR
W9AUO
W9BZ
WA6TJM

141
DF6PK
IK6BOB
KB4EXO
KD6NR
N9BN
OZ1GRS

140
JA7DQS
JH6XSW
K1ICM
KA8BAI
KD8CG
SM5HDJ
W1BET
W6ZQK
W7OIH
WA4EMF
WB5LBR
9K2BE

139
AL7FG
CX2AQ
KE2B
KJ1N
KQ3E
KZ2H

OK3CFK
PY1DWM
W4PG
YV6ABM

138
DL4BBH
DL8SP
JH7GFO
K6JEY
K8CYV
KA4UPI
KM7L
KZ4Z
SM4DDS

137
DK7SL
DL9DK
F6GBK
KB3J
JH1EFA
K3APM
KF4IL
NG4W
W4WKB
9V1UQ

136
DL6EK
DL8YH
DL9GAU
HA3HZ
JA7MFL
JA8GTO
KC8FJ
N4DNJ
N8CQA

135
HA3HGJ
JR4ISK
K4ADV
KA1HFN
KY2D
N1ANX
W6EKQ
WA8FOH
YU1BEF

134
EA3DBO
JL1BYZ
JA9EYI
K9AJW
KE9Y
N4IQ
SM4JSF
VU2IJ
W4MAT/SV

133
AA4DO
DL1FBW
FD6IGH
JJ1LYS
KG1A
KQ8J
PA6MAW
SM5MNH
SM7LPY
VE3NBE
W1FOV
W3DKL
WB7BWZ
WB8WRL

132
JA2ITK
JA6SOD
K5HX
SM6NFK
VE3AZJ
W6MYJ
WD8RTW

131
DL7ABK
KA2HWY
KC3AI
NO8U
SM4HVB
W9HSQ
W9NT
WB9TFJ
WI4E

130
DL3FAP
EA8ANT
I2AYN
JA6YOV
K2HPV
K2HWY
KA6SWI
KA9MCQ
KG2G
KL7LF
N3TA
N4FKZ/I8
OE1ZDS
PA0BEA
W8HYQ
YO9ANV

129
AI2S
DL2GF
DL5TV
EA7KE
F6DK
GW3MRI
JA1FKY
JA8QR
JM1GYQ
JR1RBE
JA8DIY
K8XZ
KA4MPR
KC6TW
KD6GC

N1CLC
N5CCX
N5DVY
N6ZU
WA5YON
YU1NHG
ZS5OO

128
AP2HM
DL1SBF
DL8NBE
JF2RJV
JH4ELD
KA8CGI
KG1F
W4WYX
WD8FEN

127
AC3D
GU4XEA
HB9BOS
KA1MX
KD9FB
KT6S
LA8D
N2CQE
N4ERM
N5CFU
N9BSM
PA3BXC
W7BMM
WA2AXD
WA2AXD
WA4GOX
WA4KFF
WD5CCM
YU5GL

126
AA4FL
G3MCA
HB9AWS
HB9CMM
HB9O
IK1ADH
IK2BTI
JF1IRW
JH1KKT
JI3MZY
K1QPM
K4JO
KA4CMC
KA8NOR
KA9FGD
KB4EQR
KB8CLL
KQ9R
KX2T
LU1CLA
OK3CFF
OK3TKA
SP7ENU
W1PUO
W3BWU
WA6ODY
WB5TON
WE4U

125
DF4IE
DL4BO
HB9BIN
J20DU
JA4ENN
K2SCU
K4ZP
K6LRN
KA1KWD
KA3KZF
KA9HDA
KF4BA
KS2L
KU2W
KV5F
KY2O
N4JGI
N5BQO
N7FAK
N8FUL
N8BZP
NA8L
NB2T
PA3AFV
SM7KIL
W1LF
W3ENL
W3MQF
W4NM
W7PEW
W8ZN
WA2VUM
WA4HVL
WA5KBH
WD5BRR
WD9DZV
WM4W
WT4Z

124
JA1YIO
JA6TIT
KA8GOM
KA8OUT
KO1I
KW5E
N6BAD
N8BEF

NQ4K
OK1AXB
OY6FRA
VE5VJ
VE7DRI

123
AP2HM
DL1SBF
DL8NBE
JF2RJV
JH4ELD
KA8CGI
KG1F
W4WYX
WD8FEN

122
DL2GBM
K8DSL
KB8DFZ
KE4NA
OE2SNL
SM8MLL

121
CT2DO
DK8DO
DU1TV
JE6NPA
JA8UMV
K5PNR
NR6A
VK4ATQ

120
DL2GBB
DL5YBD
EA7BYM
F6HSI
JA1QLR
JM1KYK
JE3ENP
KB9NA
OE8NIK
WA2ABN
WB6VRE

119
CX4GL
FG7CB/FS
HA5JP
JA7HKO
N2CYH
SM6MSG
VO9DG
ST5RT

118
EA5CHT
JA7BE
JP1EVN
JA8JES
YU3LI

117
DL2HAZ
FY5BO
N3BIA

116
DF8DA
JA2IIT
K2AD
KA7OEM
WF4E
YU1PJQ
YU2ZZ
4X6DS

109
DK0UU
DL3WB
EA4AYD
G4JKS
HB9LF
IT9GSF
K6VRS
K8SVZ
KA1LEV
KA2AOT
KA7DNJ
KM2L
KC9ZV
KC8OH
KX8A
KY6I
N4DAD
OH5MO
OH9TJ
OK1KPX
OK3CKW
SM6EAT
SV1UG
VE3LSK
VE3NBG
VK9YB
W3FGS
W6KG/HC8
W6MED
W8MMG
W7HHP
WA1UCY
WA2VXQ
WA8SOV
WB4WXE/KL7
YO4ZL
3D6AL

105
AA4LL
AJ9G
DF2IS
DL1CQQ
DL4JV
DL5KBH
DL8YBS
G4XZX
HA2KMR

HA5PP
HB9BMU
I8WWV
JA1BCQ
JH1CTQ
JH3RNF
JJ3UJC
K4BOJ
K4NTY
K7BJ
K7OZ
KA1PE
KA1WV
KA2ARB
KA4ZUI
KA7LUK
KA8DES
KA8GAG
KE5PA
KI4BW
KI4WA
KI7W
KW7Z
N2WK
N3CRR
N4IQN
NE4H
NG7K
LU8AAS
N3CSL
N4DOF
N5CNX
N5EPA
N7AJ
N8BDX
N8FGH
N8DSG
ND2A
NI7U
TF5BW
VE7FKZ
VQ9JC
W4FON
W6TXK
W6QUCE8
(JFI)
W9OTE
WA3EYL
WB1AEL
WB4EHS
WB5GZQ
WD4KQD
YC6EBS
7P8CI

104
AC8Q
AB1N
AE2A
AK5G
DF9NB
DF3UB
DK8NB
OL6ON
EA4CQS
G3ZOH
G4DSY
GD3AAE
HG1SK
HI8JTB
HS1AMT
IT9EKI
JP1AOK
K1NFE
K4CGY
K4FGP
K8CQB
K8HA
K8RW
KA8JTR
KA8CUP
KA8AND
KB1CH
KB9L
KC8OD
KC8DY
KM1G
KM1I
KN1J
LA8LX
N1BJY
N2ERN
N2JW
N4DBJ
N5DIP
N6HYK
N6IFD
N8AZ
N8EBM
OA8CP
PY1EGB
SM5ENX
W3TI
W6YB/3D6
W8AKS
W9NIP
WA2SPL
WA4EVB
WA6NFC
WA7WEB
WB5TFM
WB9HRO
WD5JWG
YC8VCE
YU5FET
4X6IH

103
AD8G
DF7XD
DL2YBU
EA1TE
EI4FC
EL2ED
HB9ALZ
HB9BPU
HB9CWA
JR2MKQ
K1OXD
K2MFB
K2QMQ
K4NST
K8YMQ
KA1JJX

KA1VT
KA2DYC
KA7BRE
KA7NXV
KB6XR
KC5YB
KC5YH
KC9CZ
KD2CR
KC2ES
KD4YT
KF1C
KF4CM
KF6KR
KF9M
KG6IP
KI4DC
KT1S
KU9T
KU0A
KV7Q
KW7Z
N2WK
N3CRR
N4EM
N4IQN
NE4H
NG7K
LU8AAS
N3CSL
N4DOF
N5CNX
N5EPA
N7AJ
N8BDX
N8FGH
N8DSG
ND2A
NI7U
TF5BW
VE7FKZ
VQ9JC
W4FON
W6TXK
W6QUCE8
(JFI)
W9OTE
WA3EYL
WB1AEL
WB4EHS
WB5GZQ
WD4KQD
YC6EBS
7P8CI

102
AA8V
AD8Z
DA2EBF
DF5OC
DK8NB
EA4CQS
G3ZOH
G4DSY
GD3AAE
JA1CG
JA1KEV
K1PV
K4QF
K7JF
K8XE
K9COV
K8EFK
KA1EKR
KA9CZR
KA9JOL
KB4MD
KG2KK
KC4XA
KD8FU
KD9NT
KE1A
KF5AL
KG6I
KO02
KS4N
KT2Q
KU8B
KY9P
KZ2L
LA1NRK
LZ1HY
N4FLC
NB8C
NC9N
ND5H
NE8V
N6BCN
NJ5O
PY3OS
SM8DTG
VE2GHZ
W1CTF
W3GIS
W4TZC
W6NHU
W6QLHC1
W8UMH
WA1YXL
WA3JOJ
WA4BKD
WA7IIM
WB1FDY
WB3KHR
WB4MRH
WB8PRK
WD5CIG
WD5HRW
WD9EME
WD8HHM
WM4V
YU7JDE

101
AD1S/KH5
DF2LZ
DK0AK
EL7W
F8RR
G3HLF

WA4QHI
WA4UQC
WA5NTI
WA6MEM
WA6TMY
WA8SXM
WA8TSM
WA9VYB
WB2GAI
WB2STV
WB3ICR
WB4WRK
WB5HSB
WD8HDF

348
WD6L
WJ4S
YU5ELI
YV5IKU
Z62G
4Y5DX

PHONE

365
W8GZ

364
TI2HP
W2BXA
W4EX
W6AM
W6GVM
Z1.1HY

363
FY2CK
VK6RU
W8BF

360
I6AMU
W7PHO

359
G5VT
K4HEF
VK5MS
W4YJ

345
W5IO
W9NDA
W9WHM
W9CM
4X4DK

358
ON4DM
W2OKM
W4EEE
W8AH

357
KD8VM
PY4TK
W9RNX
W9BW
ZP5CF

356
LU4DMG
ON4DH
SM6BIZ
W1JFG
W1MMV
W1ONK
W2HTI
W3CWQ
W3DHM

355
DL6EN
FY5PA
HB9TL
K5UC
VE3QA
W4SKO
W5PQA

354
I8KDB
W1HX
W4DR
W4OM
W8JN
WB4MLY
ZS6JM
ZS6LW

342
DJ7ZG
I2SM
I5TDJ
I5WT
K4PDV
K6JEA
N6NA
W1CKA
W2QWS
W3SSU
WT0MO

341
F2MO
F9GL
W1FZ
W2GLF
W5KQX
W7ADS
4X4JU

351
F9RM
GI3IVJ
K2BZT
W2LV
W3QH
W5JWM
W6BAF
W8CHV

350
DJ2YI
K4AIM
K6LGF
K9ECE
W1GKK

W4PDL
W5RKP
W6YSX
W9MPW
W9GKL
XE1AE

349
I5UA
K2FL
W5LZW
W8BSY
W9HYG

339
EA7GF
I2KMG
I8AA
JA4ZA
K4MQQ
K4YYL
SM8AAJU
W1JWX
W2GKZ
W4JVU
W6ISQ
W7EPA
W7KH
WA4WIP

338
F2BS
F9MD
G3NLY
K1DRN
K5YY
KP4CL
PY2PC
VE3WT
W2FQD
W3FWD
W3JK
W4AXR
W4NKI
W5BZ
W6RGG
W9ILW
W9TKD
W9SFU

337
G3UML
JA2JW
K8DR
K9AB
N6AR
SM6CKS
UB5WF
W4EPZ
W4NYN
W5HE
W5RNG
W5UAW
W6GR
W6KNH
W7QK
W9HZ
WA5AJE
WA9NUQ

336
AA4MM
DL1JW
F5II
F5RU
I7SCA
I8YRK
JA1ADN
JA1BRK
JA1MIN
K6JQ
KH6BB
LA8LF
VE3WW
W3XM
W6ZKM
W9BEK
W9BW

335
AJ6X
DL1HH
DL5LA
K8BUR
K8EPE
ON4UN
ON8XA
PP5UQ
PY2CYK
SM5BHW
EA4DO
EA4JL
HB9AAA
I4ZSQ
IT9GAI
JA1BN
JA1IBX
K9LKA
UR2AR
W1AA
W3AC
W4EEU
W5LZZ
W6KPC
W7UPF
W8KST
W9DC

334
F5IE
G3JEC
IT9JT
K4FJ
K8ONV
KP4CK
OA4OS
OE2EGL
OH3SR
PY3BXW
SM5AZU
VE3GMT
VE3NE
W2FXA
W4BRE

W5QOU, W7JFO, W8JTD, WA5IEV, YV5AHR, YV5BBU

333
CT1FL, DL8NU, EA4LH, GM3BQA, I2AT, I2LAG, JA8ADQ, K4HJE, K4IKR, K6EC, K6GA, K9MM, N4WF, N8UC, N9AF, W1ICU, W1SD, W1SEB, W2GBC, W2QK, W4DPS, W4QAW, W5UR, W6TIX, W7LFA, W9LQ, WAØOAH, WB2HXD, YO3JU

332
CT1BH, DK2BL, JA1JRK, K2YLM, K4BVQ, K4KC, K9KA, N4MM, VE3UX, W1BIH, W1FXD, W2SUA, W5MQ, W6ARJ, W6KOE, W8GKM, W8NXF, W8PR, WA6AHF, YV1KZ

331
DL3RK, DL9DY, EA8JJ, F6AOI, I4LCK, I5FLN, JA1AAT, JA1EOD, JA2AAQ, JA2ADH, K4BFF, K5OVC, K5UR, K8IFF, K8VUR, K9CD, PY2EO, PY3CB, SM5FC, VE3BDB, VE3XN, VE7AAQ, W2FG, W5RO, W6KZS, W6YB, W8JXM, W8VHY, W9LA, WA3ATP, ZL1ARY, 6W1DY

330
G3TSW, G5AFA, HB9AHA, I1APQ, I7HH, JA1UQP, K4XO, K5OS, K6EXO, K6JR, K8BS, N4JF, N6AW, VE3GS, W1AX, W1DO, W3RX, W4AVY, W4BBL, W4DRK, W5SJ, W5YU, W6CCB, W6LQC, W9YDB, WA3IKK, WB2VEG, ZL3QN

329
DJ2AA, DJ9ZB, G3ZBA, I1GEA, I2LPA, JA1OCA, JA4AFT, JA7MA, JA7HZ, K8RF, K7NN, KN8Z, KV4FZ, N2SS, N4WW, SM4EAC, SM6AEK, VK6HD, W1HGA, W8ILC, W9DNE, W9ZR, WØMYN, XE1KS

328
DK3PO, DL6KG, EA7IR, JA1BWA, IX1BQJ, K5JW, K6IR, OE3WWB, SM6CVX, W2FP, W2MPK, W3GG, W4OTX, W5EDX, W8CNL, W9GU, W9ZRX

327
DJ1XP, DL8FL, G3KMA, I8OLK, JA2XW, JA3APL, JA9BJ, K4PQV, KE4I, K5AQ, K6OJO, K9SM, LA1ZI, ON5KL, PY2DSC, UB5WE, VK6LK, W2HZ, W2VO, W6XP, W8CFG, W8COG, W9DH, WB8EUN, XE3EB, YV5DFI, ZL1AAS, ZL1AV

326
DJ3QX, DJ8NKA, EA3NC, I2DEZ, JA2AH, JA1MCU, K1LHT, K1QMV, K2KER, K2KGB, K6SVL, K8AQ, K8LJG, KB5JX, KM2P, KM2V, N7RO, OZ3PZ, PY5GA, SM5DQC, SM6EOC, VE3BX, W1DNZ, W4PZV, W5HTY, WA6RTA, WB2NYM

325
DJ6VM, DJ9UJ, EA1IY, F6AJA, G3MCS, I2SLA, I5VRV, JA1JAN, JH1EIG, JA3BQE, JA7JH, JA8ZO, K1NJE, K2TQC, K4LSP, K4XG, K5GH, K6XG, K7EKM, K8PYD, LU1BR, PY2BU, W4BFR, W4ELB, W4VQ, W5RRK, W6AED, W8KON, W7EZ, W7OM, W9BM, W8SS, WA2VEQ, WB4DSS, ZS6BBP

324
CT1UE, D4CBS, DJ5VQ, EA4JF, F5JA, I1YG, I3ADI, JA2KLT, JA6BSM, K2UU, K3SGE, LU2DX, N4XX, ON5NT, SM2EKM, SM5AQB, SM6VR, SMØATN, VK5WO, VO1CU, W5AO, W9MWO, W9QLX, WA4MMO, YS1RRD

323
I1UW, I2VQU, I8JN, JH1IFS, K2UU, K4MG, K4YT, K9RF, LA3XI, N4CC, N4KE, OA4JR, UW4NH, W1NG, W2IYX, W6AXH, W8ZYC

322
AI9J, DK1FW, I2BOX, I2YBC, I3EVK, IV3PRK, I8JX, JA1ELY, K4XH, K6JAD, LU3YL/W4, N4ZC, OH2BAD, OK2RZ, VE4OX, VE7WJ, W1LQQ, W4BAA, W4TFB, W6FT, W8UY, W8YEK, W9AMM, W8UQD, XE1J, YV1KZ

321
AE4X, CT1RM, DJ2YL, G3SJH, JA3MNP, JA8BIO, K2GPL, K2UFM, K4MEZ, K5OA, K8SQE, K9BWQ, KB3PJ, N4KG, OZ5EV, PT2BW, W1JNV, W2CC, W2MIG, W2SY, W4BQY, W6GTL, W9LT, WA4CXZ, WA4QBX, WA7DRP, 9H4G

320
CT1UA, DK3HL, DL7FP, DL8KS, G3TOE, I7TGT, I8MPF, K1RAW, K5TV, K6DT, K7IRO, K8ZR, K9FN, LA7JO, N5AN, NS8C, N9RR, VE3ST, W7DQ, W7DQM, W9ABM, W9QQ, W8SR, WØYMH, WA1AER, WA4OPW, YV5CWO

319
DJ9RQ, DK6XR, DL8UI, EA3OJ, G3ZAY, JH1GZE, JA1OYY, JF1PJK, JA3CMD, JA6AD, JA8BAR, K4AEB, K4GJO, K6PZ, K8LZ, K8NN, KØALL, KB9OC, OE2GKL, TF3SV, W3HNK, W3IF, W6BJI, W7EOI, W9MMZ, WA4WTG

318
AE5B, DK3SF, I2ZGC, K2YIY, K3BK, K4DJ, K5RJ, K6AXC, K9IKP, PY2BW, VE4AS, VE7HP, W2GA, W3AP, W6KYJ, W9KOD

317
DK9KD, DK9KX, EA3TT, I2PJA, I5AFC, JA1FNA, JA4FHE, K1CMI, K4CEF, K5YCP, K7UT, K9DXO, K9HMB, K9PQG, KØWWX, KM6B, N7US, OK1AWZ, PY4VX, LU2AH, VE1YX, VE3MC, W2GQF, W3VJP, W6BCQ, W7FP, W9HJ, WA4JTI, WA6WZO, WB4NDX, WB6POP, WB6ZUC, XE1NI

316
DL6NX, G3RCA, I8SAT, JA4DLP, JA7QLB, JA7ZF, K6SMF, LA7ZO, NA4M, PY4AKL, VE3EJ, W2IOO, W8CD, W8LYI, WA7FIG, ZL1AMN

315
DJ7CX, DJ6FN, JA2APA, JA3DY, JA3GM, JA6GXP, JA8XJF, K1UO, K2AGJ, K2UO, K3BCG, K7OXB, K0KTP, LA8CJ, N6CR, N8OC, PAØKB, PP5YC, W1JJ, W2FCR, W6XI, WA6OEI, WB2BNJ, WB2QMU, WB9EBO, YO3AC

314
AA4V, DK8NG, DL8XL, EA8LD, IT9KZW, IØDUP, JR7TEQ, JA8IXM, K1MM, K5OR, K8NA, K8CMO, N5NW, PY6CN, UW9MF, VE3II, W3FDP, W4EBO, W8GO, W8MAW

313
DK4KL, G3DOG, I1FNX, I8ACB, IØCEP, JA5PUL, JA7BJS, JA7PL, K1MEM, K8NW, LA5YJ, LU3AJW, N4NX, N7NR, TI2CO, W2LZX, W2PSU, W3ACE, W3NV, W5DJ, W6TXL, W7YR, WA4TLI, WA6OGW, WF4V, ZP5CE, 4Z4DX

312
AA6AA, F6DLM, G4DYO, I4BAC, I1HAG, I7IVL, I7KBI, JA1WSK, JH1VRQ, JA7PL, K1ZSI, K4TO, K7SP, K8GWM, KU9I, N4CQ, N4PB, N4SR, N5FG, N6MU, PY2TM, WB4QNP, W5LQN, W6HXW, W8QBG, W8YGR, W9IFJ, WA8PYL

311
DL7NB, G3YJI, I4WZK, IT9HLO, K3KA, K3RX, K3UA, K5KR, TG9NX, VE3GJH, VE4BJ, W1BPM, W1VKQ, W2BOK, W4MWT, W6OMR, W7BKR, W8PCA, WA6IUM, YS9RVE, 8Y4VU

310
DJ3AR, DL6OW, F5OK, HI8LC, I5FCK, I8MBX, JR1AIB, JA8GZZ, K8CW, K9FYZ, K9GX, K6IUC, KA4D, N2LM, N3UN, N4JA, N4RA, N5AJW, ON5FU, VE3MRS, W1BFA, W1RR, W2FGY, W2NC, W4BKP, W4ZCB, W7GXC, W9XM, WB6RIU, XE1GBM

309
AA4AR, DL8XL, F6DZU, IC8EGO, JA1PCY, JA2JKV, JH1EDB, JH1OJU, JA2JSF, JY3ZH, K1ST, K2DSV, K6UD, KØGSV, N3ED, OE2VEL, SM5BFC, SM6CTQ, TG9AL, UA3CT, VE3DGX, W1KSZ, W3CDG, W5MUG, W6ZZ, W7LGG, W8CY, W8KKF, W8SET, W9RY, WA1KYW, WA2VEE, WA4VDE, WB1DQC

308
AI8S, DF1DB, DK5WS, EA1QF, EA3ALD, EA7LQ, I5WRI, JA1JWP, JE1MGE, K1IK, K1JO, K2EYJ, K4UAS, K6MA, K9HQM, KA7AUH, KV2S, KZ8Y, NØAT, W2GT, W2HXF, W5VT, W7BCT, W8GIO, W9TC, WA4DRU, ZL1BIL

307
AB9E, I1POR, DK8MZ, EA3AOC, EA8OZ, IV3VER, K2JLA, K3LWM, K4NJS, K4RSB, K9VAL, KØLD, KA5V, KB8DB, KD5RP, KJ8G, N2KW, N3US, N6MB, NF4U, PA0LOU, PY2OB, PY5WD, SM7BYP, W2MP, W6YO, W7ETZ, WB2CEI

306
AA4CJ, DK2WH, DL4YAH, F5RV, I2MQP, I5ZGQ, JA1GV, JH3TKM, K2HWE, K3WS, K4KJZ, K6EDA, K6EID, K6RN, K9BB, K8QQ, KC9JP, KR2Q, KT1N, N5UD, N6AHU, OE1PC, PY6TM, SM5AQD, SMØMC, VE6WQ, W1FJ, W1LTC, W2IJB, W2MPI, W4WMQ, W5AL, W6CN, W6SN, WØIZ, WA2JUN, WA2VUY, WA4BIM, WA6FPB, WB3CIW, WB4GNT, WBØCIW, XE1OX, ZL1AH

305
CE3GN, HK3DDD, IØRIZ, JA1GTF, K4LR, K4PI, K4SE, K5FM, K7ICW, K8TL, K9KU, K9QVB, KØFL, KB8KW, KC8CY, KD4S, KE4RX, KK2I, KS9Z, LA9GV, ND5N, NE4R, ON6MY, P29JS, W2LOG, W2NCL, W3EKN, W2QL, W4YN, W5AYZ, W5CB, W6ORD, W7GUR, W8PT, W9DMH, W9GBI, W9XX, WB4RFZ, WB4TIN, WB5CBJ, WD5DBV, WD8MGQ, WD9AHJ

304
DF6FK, DJ1BV, DL2AW, DL7SY, DL8CM, I2WTY, JI1QPU, K3EH, K6RK, K9UAA, KØGT, KB2ZP, KB5FU, KB8BS, N4AXR, N9RS, ON7EJ, W1TPK, WA4LOF, WA7KNK

303
I3DHN, IV3YRN, JA1FHK, JA1WTI, K7FE, K8MG, K9IW, KE4E, KR9O, KT4G, N2ATD, N4AVB, N5FW, ON5HU, W1PNR, W4DJJ, W4LVM, W6XH, W7DSZ, W7TE, W9CRN, W9ZWH, WØYK, WA1URV, WA4DAN, WB2NIC, WB5LBJ/DU

302
DJ4XA, I1BSN, I2JR, I2PKF, K3ZUF, K4CXY, K7GEX, KB4FQ, KE3A, KQ2L, VE3HO, VE3MV, W2JGR, W5EFA, W5LFK, W6CRE, WA1EOT, WA2MID, WA4BEC, WB4JLO

301
DK5BH, G3VIE, HB9NU, I8INW, IØZG, JA1GO, JA2KVD, K4RIG, K8DB, K8PCZ, K9HA, K9LHA, KB2VK, KB4IT, KB5GL, KC3KV, KG3K, KG4W, KT4P, N1AJO, N4NO, NE5C, OK1VK, ON7WW, PT7WA, PY5EG, W1YRC, W3FZE, W4WW, W5RJC

300
AA1V, ACØA, DJ3CP, DJ5JH, DL1EY, DL2KC, G3VKW, I3DSE, IN3ANE, IV3TQE, JA6BVU, K1EFI, K1SF, K5GZ, K7DS, K8JRM, K8VFV, K8ZO, K8ZZO, KB1I, KB2XS, KB9KD, KBØU, KD4BY, KG2U, KP4AM, KV4F, KV9R, KZ2P, LA4HW, N3RL, NN4Q, OZ2QL, PY2JY, PY5PS, SM5HPB, SM5VS, VE3IPR, VE4AT, W1WXZ, W2YTO, W4BIM, W4JHE, W5JME, W5LDH, W5WJO, W6BWG, W8ILH, W6NLG, W6MFC, W7ZR, W8GUS, W9LNQ, WA4OBO, WA4VCC, WA7ZWG, WA9VGY, WB2CVL, WB2DND, WB3BGI, WB3GOP, WB4UBD, WB5SSD, WB7CLU, WD6BSD, WD9ADB, YV1AJ

299
OK2XX, DK5AD, EA9IE, I2JQL, JA8CNL, K4URK, K7ZBV, K9BIL, KB2HZ, KB4HU, KB8MR, KC4CT, KM1D, N4AVV, N4BLX, N9BA, W2ARQ, W9DDX, WB2KPE, WB2VPV, WB4FQP, WB6VSK, WB6WSD

298
JA9AA, K9ZO, LA8IU, N4AXT, PAØLEG, SM7BOL, W6MUS, W8BE, W9ZA, WA4PLR, WA8HFN, WB3GPR, WB9HIP, WD8EMI, WT4T

297
AD1S, HK3LT, I5EFO, JR1EBE, JA8EL, K4BYK, K4LNO, K8ZZU, KA1DE, KB2RZ, KC5JW, KN4H, N4CRU, K7RLS, K7UR, UD6DER, W2IQB, W4UNP, W6DPD, WA5EZQ, WZ4I, XE1OW, YV3AZC

296
AA4S, IØSGF, K2OLG, K4WMB, K5CON, K5KLA, K6HHD, K9MFI, KØJSY, KB4UI, KH6BZF, KK7O, VE3CKP, VE7AHA, VE7DX, W2SM, W5LVD, W8DN, W8JJK, WB1GDG, Z21BP

295
AE5H, EA7AG, I8WES, JH1BSR, K1VHS, K6XN, K8UNV, K9MK, KC5M, KC7T, KC7TO, KF4M, N4FKZ, N8AQV, SV1IW, SV1JG, VE4JK, W4RNZ, W5ERY, W6OU, WB8VPA, ZL1AMO

294
A71AD, AD8I, HKØHEU, I4FAF, I8IHG, JA8BMK, K3KJ, K8DJC, K8GG, KA5W, KB6ZW, KF9J, KH6JEB, N4BYU, N5IH, W1PEA, W7FR, W8TN, W9CZI, WØRAO, WB1EAZ, WD8PUG, WDØAWL

293
AA2A, AF2O, I8ZAJ, JH1QFA, JJ1DWT, JA3CSZ, K2ARO, K4FY, K5RSG, K8CX, K9JF, K8HRF, KE9U, KL7H, LU7MAJ, OE3KTA, OH2BZ, SM7AZL, W1ICV

292
AD8O, AF3T, DK3PZ, G3VOF, I1BUP, JA1OND, K1EFS, K2ENT, K7LAY, KB1BE, KB3KV, KB6JK, KB9KB, KE2C, KM9L, KR8N, LU4MEE, N4BCV, N5AWS, N7TT, NØAFL, ND5R, W5VSZ, W6AN, W6TFO, W7AEP, W7OEV, W8CBA, W9DE, W9ZX, WA2MXW

291
AI3O, AK4T, DK8NP, HB9RG, I4JBJ, I5JHW, K4KUZ, KØJS, KB3KV, N2BJ, W1NM, W4BMJ, W4OWY, W4UW, W6SUN, WA2UXC, WA4GKT, WA9EKA, WB5CRG, WB5ROW, WB5TED, WB9NOV, YV1EAH

290
AA4M, AC8H, DF7NM, DJ9UM, DK8DB, I5HOR, JA3PXH, JH3DAE, JA5ANP, K2GAT, K2TV, K4KAK, K4WHN, K5TSQ, K6DG, K9TI, KA1ND, KB2CV, KC8EU, KC8YM, KN8R, N4AYO, N4VG, N9ER, VE3FEA, W1ENE, W4KHW, W4RA, W5SGI, W6PGK, W6SWM, W6VZZ, W7EDA, W9OKL, W9TEI, WØFF, WØULU, WA1ZLK, WA6DTG, WB2SZH, WB4SWI, WB8ZRL, WB9SYF, WD8CZA, YS1SC

289
AI8M, DK1RV, I2JSB, JA2JYP, JA3BG, K4DLI, KB2CB, KB3PY, KC4DY, SM7HCW, W6ZUM, W8UVZ, WØBA, WA3GVM

288
CP1FW, K1KTB, KB5DN, KG9J, W2EKO, W3YX, W6OK, W6RDL, WØNB, WA4ECA, WW4E, XE1MDX

287
CE6EAT, DL5BAN, IT9GCQ, K4II, K4UEE, KJ3L, KQ9W, PY3EM, W3IQS, WA1WTP, WA5ZIJ, WD5DIV

286
CN8AK, JH2CJW, K5GK, KB7SU, KC9TA, KF4L, KV8Y, N2BIM, N4CID, N6ATS, N7RT, VK9NS, W4DZZ, W7GLU, W8TWA, WA2IFS, WA6SLO, WB3ABS

285
CT3BM, DL6QT, F6CPO, I1XA, I3TZP, JA1NLI, JA2MTM, K5BG, K5MBE, K6DQ, K8JN, KB5DQ, KB8LH, KC4BR, KE4HX, N2VW, N9AUV, OE2WJL, OK1IQ, SM6AHS, W1VRK, W1WLW, W4JD, W7GSP, WD4KXB

284
DF4PL, DK8AX, HB9CIP, I1JQJ, I1ZFT, JA4FWM, JA9NLE, K2EY, K8LM, KØZQD, KT7V, N4DRC, NA5C, SM6AOU, VE3XO, W2PD, W9NUF, WA3CGE, WA4CTA, WA5ZGI, WD8PKF

283
AG9S, G4BUE, K6SD, K8MN, K8NWD, KA6CPY, W1BWS, W1ESN, W1HEO, WA4CNZ

282
F6CYV, JA1EF, JH5FQO, JA8KSF, JA9CXA, KB7UH, KC2KU, KI3L, N7ABJ, NØZA, VS6CT, W1JR, W5OSH, W8WOJ, W8HBH, XE1VV, YO3JW

281
AB8Y, AF2C, DF2HL, DLØWU, EA3AEA, JA2CXK, JA5NG, JA7BAL, K8ZTT, KC2RS, KE6LT, N1API, PT2TF, SM3DXC, VP2MO, W4OMY, W5LLU, W6ZPV, WB9JXT

280
AI9U, DK1YP, IØER, JA1NAQ, JH7MOD, K2MFY, K5SSB, K8CF, KB9I, KYØA, LU8MBV, N2CGB, N5DSK, N6BAK, PAØHBK, PY2FNB, SM5HYL, VE3KGK, W1KID, W4KN, WA1KUL, WA1PEL, WA1YTW, WA2BGE, WA2CBB, WB2TKY, WB6RSE, WD8RKT, ZL1BOQ, ZS6FU

279
I5ICY, IT9TQH, JH1BZJ, JA8MKZ, JH8NYK, KØCL, KC4OV, KC8NY, KM3Y, KN1U, KS9K, NØAMI, NL7P, W4YV, W6SSC, W9AG, WD5AAM, ZP5MJV

278
AA4KA, AJ1L, DL7MAE, DL9CQ, I1SBU, K4JLD, K4XQ, K9PSN, N1AKX, N6OJ, W4PKM

277
HB9BLQ, I4KDJ, JA2IIG, K2PLF, K2TK, K5IH, K5TGE, KØZZ, KA1HQ, KB8SY, KM6K, KR9G, N4UU, N7GMN, N8ANR, PT7WZ, PY4LJ, PY4OD, VE3LRU, W1GG, W2UI, W2US, W8JCB, WA4QQV, WA6LFN, WA6GKW, WB6FCR

276
I2PEI, K2PZ, K6TMB, K9KK, KØHQW, KN2N, N6OR, N8ATR, PAØTO, PY2WT, SM6BGG, VE3NI, WA4HNL, WB8KFG, WB8VKL, WF4G

275
DF3AO, EA7BLO, F6FWW, I6GAS, JA5FDJ, JH1KRC, JA9FPI, KØTLM, N3GB, VE3DOU, VK3DWJ, W6SEY, W8NDJ, W8SEY, WAØUWS, WB8LFO, WB8JBH, WD9FOE, WI4R

274
JA2GBO, K8BVY, KS1S, ON7FK, W2NZG, W4MOM, W5INL, W7OAX, W6QHG, WB9MSV, WD9GQV, XE1XF

273
HKØEHM, I5IGQ, K1EM, K1ER, K3RT, K4KQ, K6CBL, K9MGF, KC7JO, KQ6H, N4CFL, N6ADI, W4OUE, W7KOI, W9IU, YU2OM

272
KØVZR, KB2HK, OK2DB, W1TN, W3UM, W4CYJ, W5YH, WA1ZAM, WA4YOM, WA8MOA

271
AA5O, EI7CC, I4CSP, JA1NVB, JH1IED, JA2GHW, JH6RYY, JA7HMZ, JH7FMJ, K3LUE, KB2MY, KBØHJ, KC4BX, KT6T, N1ALR, N7AKQ, NG5X, NK5Y, PT7KW, SV8CS, W2ELH, W4JGD, W6HT, W6TGI, WB2CJL, WB2EZU, WB4MAI

270
AJ8J, DF9RM, DL1BS, G3KLL, JH8MXH, K5GOE, K7EG, KA1ACC, KA1BRD, KA4PKB, KB7HB, KD8V, KD9M, N9AVY, NE8R, NK4L, NP4CC, NT4W, NU4D, PY5OC, VE3BIF, VE4IS, W1AB, W3EYF, W5JM, W6GYM, W8VSA, W9TX, WØVX, WA2MTR, WA7OYL, WD8IPJ, WI4K, ZP5RS

269
HK3YH, JA7AWZ, JH8GWW, KB6OK, N7BES, NI4Y, W2CKR, W8GS, WA9WGJ, WB5LZG

268
HK8BVN, I5ZJK, JA1SDV, K1HDO, KB9JF, KV2Y, N2RR, N4BSN, ON5WQ, W3KHQ, W8OWI, WA2BDP, WA6LFF, WA9IVU, WB4YZC, WB6VIN, WBØCGJ, ZP5JCY

267
CE3BBW, DK2XZ, JA4GXS, K5MLG, K8EFS, KB7VD, N8BIB, NA2K, W2RS, WB4ZIM

266
AF5M, DL7QG, JG1TSF, JH2PYX, K1YHM, K8IQB, KC8BK, N4ETA, N6NF, W9CA, WA4OIB, WA8ZDL, WA9TAH

265
I1TLJ, JH1AGU, K2NJ, KØLUZ, KA2BZS, WA8CZS, WB4HSA

264
AA4H, I4AND, K5CTG, KC2FC, KC4U, KF2X, SM6AVM, VE7ML, WA2WDJ, WA8VPN, WD9IIC, ZL1SZ

263
AI9F, DF2AL, DF9RB, DJ6KH, HC1HC, JE2QWC, K8HSC, N2BAT, NG5L, W6MDH, WD8OTZ

262
AE5E, AK1L, EA5KF, HH5CB, K5SIN, KB2EF, LA4HH, NB7R, NI4H, WA1LOU, W2GZA, WA5BBR

261
GW4KGR, KC5CR, KE2S, KQ8O, N4TL, N5JR, NØAFW, OK1DLA, TG9VT, VE5ADA, W1HJF, W5BPT, WA6EZV, WB6SRK

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259
G3YBH, K6ASI, K8WOW, KDØQ, N2CIC, W1EQD, W4ZMC, WB5RCS, WD6EKR, WD8NMV, ZP5CBL

258
AB1U, JA4NHG, K3SEW, K8IP, N4FAC, W5UFI, W7HPI, WØPXM, WDØAQJ, 7X2LS

257
EA8VV, K2LS, KC7ET, PAØMA, W2REH, W7DAA, W6KBZ, 4Z4UX

256
DJ3HJ, EA5BW, KB5IM, W2MOF, W4PC, W4DMV, W9LW

255
G4BWP, JA1KYE, JA1SJV, K3RPY, KE1K, OK3EA, VO1AW, W4BV, W7TVF, WB4VQO, WD9BBL

254
JA7EPO, KD2GB, KM1E, OZ8EA, W4JZ, W8DOG, WA4UNZ, WB5RQM, WB5ZKR, 4Z4AB

253
AE6T, DK3KD, F8GPG, G4IJW, I2TZK, JF2DJV, K3QMX, K7RDH, KA2CDE, KB2RA, KT1J, NJ8N, NW4K, OZ1BOD, W3IOA, W5VVD, W5ZKJ, W8SC, WA6LOD

252
AA6BB, EA5BCX, G4GIR, JA1HEE, JA2BYW, K1NLQ, K4HTY, K4PR, K6BPP, KC4LQ, KD0B, KE4YD, LA3MCJ, LZ1YE, N3CQM, N4AJZ, W2HN, W3IGU, W6MND, WA6Z

251
AK1N, CT4RH, DL9JI, EA5AD, HI8JO, I2AOX, I2WZX, IT9YHR, JA2JRG, KB8WC, KD4NZ, KK9Q, KR8X, KR9R, KS9R, KV5E, PY4KB, SV8JE, W7FJE, W7LXR, W8ANM, WØZRA, WA1NSJ, WA2OEP, WD8IXE

250
AF1U, CX2CS, DK8JS, F6GXB, G3RUR, HL1SX, JH6SOR, K4JDJ, K4QM, K5WZ, KA6V, KB6BW, KC2JA, KC4ST, KC4TJ, KC4ZH, KC5PR, LA2TD, LU8DPM, N7RU, N6BLN, N8DE, N9CPW, NF8W, OZ1BNZ, W2EOE, W4BLB, W9IGK, WA2ISM, WA4PPS, WA8GUD, WB6UBR, WB8TRW, WB9GYU, WD5ABG, YS1GMV, ZP5MJO, 4X6AG

249
DF7OD, I3AAV, I7IEH, J88AQ, JAØORM, KC2CO, KC2UF, N9AIB, PY2JSF, PY3JC, XE1VIC

248
JF1CKL, I6IXJ, K1KOB, KKØM, KT4M, OE2DYL, WB5SKQ, WB5SVV, WB7WQE

247
KB9PC, KD8WW, ON4SW

246
JA8KSD, KL7KJ, WØGOQ, ZP5JAL

245
G3COJ, WDØDXY

244
DJ9MH, K1NOK, KB2XL, KM1R

243
DF3IN, I8ZTE, KØRDJ

242
EA6ET, EA7CEO, JM1MGP, K1FWF, K1RB, VK9NL, WB1BVQ, WB9UKK

241
F6FNU, HC2RG, JF1VST, K8MID, KG1M, WB4FQX

240
KA3BTH, WB7VHA, XE1XM, ZP5MJY

239
AG1G, EA7EU, I8QLI, JA3ANW, KB2VP, KB5PJ, KB8NW, WB3LGO, WB4LND, WD8NVA

238
AE6Y, DJ5RP, JA7OP, KA3HXO, KC7E

237
AJ3H, HC1HW, JA2HMF, KE4AP, KM9Y, KNØL, SLØZG

236
EA8AKN, KØMPR, NE8Q, PY2CSV, W6AEO

235
EA3DDP, G2AFO, HK8BUT, K2IBW, WJ4T

234
KØRRY, KN8M

233
K5XI, K7JXR, KA1X, KX7J, NG6W, NJ5X, ON6IT, SMØHEP, W5ZKK, WØJF, WA1AYS, WD8MRC

232
AA4AM, JF2HPA, KBØYM, KC9XF, KD2Z, KD5BM, N9BUS, ON6YH, SM5IMO, W9ZTP, WD8PFI

231
AA4NA, KE4FW, KG2T, WA4LBJ, WA6GTU, WA7COQ, WB9LEF, WD4FHD, WD5JFM, YU1NR

230
DF5KX, GM4KHE, JI1MNT, JR3RRY, KC8KE, KD7J, KS1Y, LA3WV, N4WJ, N6VO, N7AIF, N9BAF, N9DJ, SP6ECA, W5CRP

229
AC2F, G4GED, N4FKZ/HR, N8DBI, NØANJ, SM4IKL, SMØJOQ, VE3ZN, WA6TLA, W2GVX, W2IIX, W5HNS, W5IJE, WØGAX, WD9AEU

228
AH6AY, AL7BL, DJ9AS, G3UAS, JH1WJR, JF2GYH, KD4RH, KKØL, NY4H

V2AO
W3OSE
W6MKB
WA1SMI
WB2IJD
ZP5GDV

227
EL2AM
GM4FDM
JO1ABS
KN4F
N4BVP
VE2PD
VE2DPJ
W6FAH
W8JQT
W8HFK
WF4I
SP8OV

226
AD4U
AK1E
CE3TZ
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I8JLX
JY9RC
K3BYV
K4BFJ
K5GKC
KA1RE
KB5RA
KC5WJ
KC8X
KD7EC
KO3J
KC7XB
LA9TGA
N3AKD
N3IO
NE4G
PP2ZDD
SM3BSF
W2VP
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W7MCG
W0RTB
WA9OVU
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WD4CRG
WD8KZS

225
CO2HQ
CX4HS
DJ3EJ
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IK1AOD
I1NRF
IK1AOD
I2MOV
I8TSL
IS0NZA
K2QIL
K5RPC
K7CE
KA1PM
KB2XP
KC7GO
KF3C
KN3P
KR1R
N4AVR
N5WH
NA5S
NB8GE
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PY3DX
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W1WS
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W8NPF
W0WFB
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WA8YTM
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WB1GOO
WB6FZN
WB8HLI
YB2BOT

224
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JA5THU
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W5MQV
WA7JUJ
YV1CC

223
DJ4ZD
K2PWG
KF4NO
W4HLY
WA2RTQ

222
I2ADN
WB7CEH

221
AB8O
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KD9GJ
WB7VNY

220
W2MOY
W8RG

219
DL2DN

EA5CIX
JL1BLW
PS7JD
W4UYC

218
EA4CDZ
CE3DQR
JG1FVZ
JA3FYC
N8BKF
5R1RBF

217
CT4UW
KE4VU
W1JNN
W8QNF

216
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JA7XBG
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N9CHN
NQ5W
ON7TN
SM7GCP
W6DUB

215
CP8HD
HA5XW
KB4IY
KQ0J
W8KGW
WA5NQJ
WA8IMO

214
EA6MR

213
KB2ST
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NM8O
TR8DX
W1JCI

212
IK1AAW
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OH2FS
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W7LZA
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WD6HRK
WB5DBT

211
EA5BWU
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ZL2UW

210
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W1DOH
WB4SYP
YB4AQC

209
JA1SFL
JK1SAI
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N4DDK
WB5NTI

208
EA1AWW
EA3CCN
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JH7COO
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NE9I
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WA2AOG
WA4MJI
WD4CHR

207
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KA8I
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OK2QR
WA6IVO
WD8AFC

206
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WB4V
ZS1JD

205
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KA5DNP
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KB9LN
KB0V
KC6ZA
KC0MS
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XE1OZ
3D2DM

204
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203
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JR6PGB
JA7REE
JA8KFO
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KU7D
N1GL
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W9FI
WB4NCJ
WB9UIO
WM4O

202
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ZP5WU

201
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KC2WQ
KC4GR
KD4NI
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N0ABE
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200
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LZ1BY
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N4HBD
N5DC
N6DHX
NB8C
PY2XX
PY3CM
SM5LI
TI2KD
VE3FWQ
W3AX
W3WFM
W5PD

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199
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198
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197
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KA1KXI
N9DPL

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7P5RG

194
JH5AUE
KS3L
W7CSW
4X4IL

193
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KI1G
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WD8DXN
4X8KA

192
AI6Z
CP5AI
WA2LOG

191
JI1WLL
JA7CUK
K8PC
KC2X

190
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KB8XN
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KS2O
N0EKK
N2CHD
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W2HTW
WD5ELJ

189
KT9P
PJ3OO
WA4RXC

188
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JA1SYY
JA8UJY

187
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186
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JF2KBK
KA1SR
VE5AEC
W1MGP
WA2NBV
WB8WZT

185
CT2DR
DK4NU
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JK1GDD
K9LJN
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WA9YZN
WB1CTO

184
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KA1CNB
KB2TH
KF6AW
N2AIF
OH2ZAS
PY2ZDC
SV1MO
W5NUT/PJ7
SM5BDV
W8VSL

WB0YMQ
XE2AQ

183
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N5EBD
WB2OZZ
WB6STZ

182
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KD9CN
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WD5FHG
YV5HNI

181
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HZ1AB
IT9LYF
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KC2CS
KM2N
N5DMP
NE6I
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PZ5JR
WB4BBM
WB9IWN

180
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KA4EMR
KC8XH
KF1J
KS0C/KH2
WD4KWR
5Z4YV

179
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KB8XT
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PY4ZU
VY1CW
W3ARK
WA0ECN

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JF1PHJ
KB8GO
KB9YW
OK1VAM
N1AIS
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OE8JNK
W2EEO

177
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LU1VK
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WB5ZAM
WB8KRI

176
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W7JXP
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W9NTU
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WD9JKZ
YU6ZA

175
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JN1GOK
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K6WWA
KB2BC
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KT1H
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N8BNE
NM5O
OK3MB
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W8NGZ
W7TSQ
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WA1LZL
WA2VJL
WA3ZTE
WA4IAX
WB6FOQ
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XE1MEX

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4X4LH

172
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NV4O
OH2BMC

171
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SP6DVP
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WA1YFF
KC5UC

170
N8AFV
W0WJ

169
KC2SB
PT2PT
W3DYT
WB1GGQ

168
EA1JO
EA5IW
JK1PWQ
K8UNP
KA2PHO
NK5Z
W4ABV
W6WCA
6Y5WC

167
OE2BZL
W7PLK
WD8IFX

166
EA1AYO
I8IXO
JA1WAE
KA3A
NI8B

165
CT2DG
DJ2BV
EA1FP
HB9BVV
JK1RJQ
K8DHK
KB2XP/VE3
KC2PX
SM7IDF
VE4AGR
WD9HZK

164
EA4BKE
JF2AXT
OE2KGM
W0BX

163
K1YIA
KS1G
N6BXM
ON7TK

162
JG2MWA
KE5PA
LA9SN
N9ACD
OE2YMO
ON7CU
W7CQR

161
A4XJV
IV3UT
I4GKX
JA9EEH
K2IAB
KA2HMJ
KC9V
KR5D
N4FYF
VE2FT
WD4KWI
XE1JCL

160
HB9CJX
HB9CSA
JE2SPO
JM1SMY
K7JNB

KA2HHW
KB6HW
NX4B
PY2FFY

159
N9EJL
W1NBE
W7LZG
W0JLC
YC0DPO
6Y5AM

158
G4FCT
I8ZYA
K1ZLA
K7DXD
KO7PS

158
SM6KQK
W9ROK
WA1HXH
6W1HL

157
AF3R
CT2BV
EA4CFZ
EA5DHE
EA5JC
F3DE
KI2P
KR3J
N3KR
N7BUP
VE7YL
W0OSK
4Z4VG
6Y5AG

156
DF2CD
G3XTT
JA2GSQ
JR4QZH
JE7BEX
N4XM
N8EHW
W4DDP
WB6TJW
ZS3MS

155
AI7M
DJ4YH
EA8BB
JA4AQA
JH1MQC
JJ3WUG
KB3TC
KB4QR
KY1O
W6RCL
WD8LMU
XE1JIW

154
CT1TM
DJ8OW
JE2KSM
JA3UCO
JE6WVU
JJ3FOZ
K2DUX
K8INK
KC9QP
KA1ERN
W4GEH
W7QN
WA4PMF
WB6FSR
WP4D
YC3CEV

153
A22ME
EA5CGU
IK8EPC
JA3PG
JH2LLE
JE6WVT
K1JRE
K8NLD
K0GND
KB4CWO
KD6ZM
KW0H
SM6LPF
VE3FIU
W5EHY
WB9ZGY
ZP5JAF

152
G3BRD
HB9BMZ
I1XOI
I3FOM
JE6EGC
JH4BUO
IT9MAB
IT9WPO
K1NMZ
K5ABD
KA1YN
KK1J
W1AIM
W1SE
W8BCE
W8NE
8Y5EE

151
G3UZM
K3WGR
K7LYT
K8MR
KA1PF
KA1PU

KA9PJZ
KC4HN
KC0PR
KD2Q
KD4XN
KO0HN
KE6DN
KG7Z
KV4JC
KV9V
N2DNY
N2RB
NI5D
NJ5V
W1MGP
W8DN
W9LYN
W0DWU
W0UGV
W0YZL
XF4MDX

150
CN8EL
DK2JX
EL2AO
G4SKI
I8IGZ
I0ZUT
JR6RVG
JA9GXY
JA0AD
K0JZM
KA2CDJ
KA1JLK
KB2IL
KB3H
KC4MJ
KC0SV
KO2Q
N2BFH
N0HH
ND5M
PY2ZJ
OE1PPC
SM7NJJ
VE2DRN
W3FME
W8MLK
W8RNB
WA2POW
WA5PIE
WA8KMK
WB0CHS
YB3CDL
YC3BRY
ZS3TL
4Z4ZZ

149
JE1ZSK
K7GNC
K7ORK
KA2QYL
N3CWD
VE1JS
W1ICH

148
DK7NO
EC4BIR
K0GUM
KA3DLT
KB4JI
KB0CN
KL7XO
N9NB
PY3WW
WA9AEA
WB1AJG

147
I8UZF
K6CZN
KA2FAJ
N4DDZ
K9VTD
YV5ENJ

146
KC8MK
NB2Z
VP2AZE

145
KA2JMM
YB2BNJ

144
K9FD
N8CXX
WA4SFF

143
JA7DOT
KZ8Z
VE3BRG
WB2QJY

142
JR1TXR
K8ND
9G1MK

141
EA5GXS
K5KNA
KE1E
ON7RD
W0LEC

140
KB8ZM
KD2BW
SM6JHO
W5BAV
WD8JYF

139
DU6JM
EA7CWC

JA1ASO
KS2C
N1BPJ
N1DCM
N4FKZ/EA4
ND0F
WA5NFC

138
A35SA
AL7FG
IK6BOB
JA7AZY
N6HVZ
OE2YGM
PA3AAN
WB5NVZ
ZD9BX

137
EA1AIQ
W5VNB
W8NOL
WB2EOB

136
CT4VP
GM3LYY
JF3PLF
WB9ZHS

135
DF7DQ
K1ICM
KR4D
W1CED
W0JM
WA6TJM

134
AJ3K
DK1HG
G4HLS
LA8PF
N4KMY
WD8NNB
ZP5RAB

133
I5UKA
JA1JYZ
JN1XWO
LA5LT
9K2BE

132
EA7DTY
G4LMO
JA5CKD
JH7CUO
K6SE
KA2LIM
KF4IL
KM7L
KX4A
WA3GLA
WB7BWZ
WD5BYZ
ZD8RH

131
4E8N
DF8TK
EA1UO
EA5BYP
HK6DOS
IK1AIG
JA7WKG
JR4RHK
KR9F
N3BQS
N4BSH
VE1BWQ
W6KFV
WB9TFJ

130
DL3ZQ
EA8ANT
I2OGC
IK0EPS
KA2HWY
KK3W
LA1SEA
OE1ZOS
OE3IPW
SK7GC
WA6HWH

129
DK5PE
DL1BBP
JA4IPU
JA8OIY
JH0XSW
KA4MPR
KE4SN
NS8K
OY8R
W4WKB
W9HSQ
YB0BZZ

128
C2IBD
EA3CUO
G3NOB
HB9BIN
JL1BYZ
JH2KCE
JH4GNE
KB0ZZ
KC8AF
KC9ZZ
KD7TO
N4EMA
PY2CXH
W7YAQ
WO4O
ZS4AE

127
I1KGF
JA2ITK
KB0PY
KJ8Z
N2DXQ
OZ3ZK
W3AMQ
W3GEZ
W7IM
WA1OEZ
WA4WZO
WA5OXK
WA6HYI
WB5LBR
WD5CQG
YV5CMI
6W1CK

126
C53EK
CX1AW
DL3UY
F3PO
G4RAB
HL4XM
JI3MZY
K8JSK
KB2IN
KB8CLL
KC2EB
KC5UB
N2CQE
W7BMM
W9PVD
WD4KXM
XE1NJ

125
DU1KT
I1UWF
JA1DFQ
K3FNW
K8ZPY
KA1YK
KA9HDA
KD7LK
N1CWB
N6EVZ
UB5HAF
W1OJI
WA4BRM
WC4B
YS9HH
ZF2GE
9Y4RD/4X

124
CE6SC
KA1ION
KA1YO
NK7Y
VK7UA
W2FV
WD4HVE

123
IK2BTI
KA4CIZ
N8BEF
SM7LPY
W5MUA
WA4TJW

122
EA7DGO
I8AQZ
JF2RJV
W3MOF
W5UXR
YV7QP

121
F6FBE
K5PNR
WD5JDT

120
JM1KYK
KE8Y
KG1F
OK3KEX
PP8WV
WD9FEN
YV5JEA

119
DF8GQ
DL1KAU
KE4SQ
NA4J
SM7NDX
WA4GOX

118
CE4EBJ
HB9O
JO1BMV
JF7DZA
K4YEH
KA9FYZ
OE8NIK
SM5LPC
5T5RY

117
DH2EAJ
JM1GYQ
JP1EVN
KQ1I
9K2DZ

116
DF9SP
EA3BTO
FG7CB/FS
K4ZCQ
N5CCX
N6AVX
ON4AAC
W3EE

W7BQG
3X4EX
5Z4CL

115
DK8II
DK0DO
DL8NBE
F6HJS
G5BSW
I8JIA
I0UAV
JL1CHX
JE6NPA
JA9RFN
K6JEY
KA5GHR
KA4HSL
N2CYH
N4FKZ/I8
K4WOB
W5DZF

114
DJ0CP
DK8JB
DL6NT
EA7BYM
F6FYD
I2HLY
JM1XSA
KB9MH
KD7PK
N7CSH
OZ7BPX
W6ABC
YS9JY
ZP5LOB

113
DJ2BA
DJ7MD
DU6ZO
EA5CHT
JA2ODS
JE2VOG
KC7FS
WB2NJH
WB2ODH

112
DL6YAU
EA2QC
EA4CPK
EA6DE
EI9FE
F8HB/EA6
KA0CWM
KB4EXO
KB0WJ
KC8YW
OZ2RM
OX3AE
OZ4XW
PA0BEA
SK0HS
WB8VPQ
WD4ALW

111
C5ACO
JA1NQI
K8SGI
KA3GWD
KA4EQW
KC8GJ
N4HWD
OE3HCS
VR6TC
YC2BGZ

110
AH9AB
CP8IH
DF2IS
EA1BCL
EA5BRE
EL2AD
F6EUG
HC1OT
IK2AWT
I6KYL
IK1ABM
JA2QZY
JA5BLS
JA7MGP
JH7XGN
K2OXS/HH
K9LA
KA3GMP
KA7EBX
KD0MD
KF6EN
NR4R
OE6HCG
OZ1AUW
PA3DEY
PZ5ES
VE1BNN
VE3NUP
VK2DEJ
W4IUV
W6UVW
WA2HKO
WA4OBR
WA9CYG
WB7VON
WB9LAI
WD0FSV
WK4F
YV6VN
5N8HEM
9Y4RD/SU

109
AJ3N
DF4TI
DL8MAD
EA3OD
EA5OWO
EA8AFS

F3CY
F0OVIFC
G3YOW
G4KDV
GB3RSS
HH2WL
IK1AVW
JA1VYQ
JH1QYT
JM1KNT
JR1GSE
JH2AZP
JR2QUZ
JA4XZR
JF6BYA
K2RYI
KI8G
LZ1KOZ
LZ2KK
ND5G
SM0KRN
V2A2M
VU2DVP
W3EMV
W5BJD
W6YFW
XE1SWS
YO4PX

108
AL7X
DJ4NY
DL4MBD
DL5SBA
DL8LAM
EA7EMR
G4NXG
HB9AQA
JF1RDC
JH2IJD
JK3DGX
JR0AMD
KA2DRE
KA1FSO
KB1HC
KB7VY
KQ9R
LA5TBA
N5DUQ
PJ8DFS
SM6MSG
SV2QI
SV2UA
VP2MCG
VU2CVP
W3JV
W6TUN
W7GYX
W0LBR
WA9CLN
WK4R
XE1MD

107
EA3DHR
EA5AEN
EA5NQ
EA8ZI
I1CCA
J73PB
JA3BBG
JA6CBG
JI3AOD
K6JTJ
KA1HME
KC9LB
KD7DN
KG6FG
KI4LP
KJ6Y
KV9C
KY2J
LA3KBA
LA5BX
N6INJ
OZ2BM
PY6KW
WA8RYD
WB1FAK
WB2KSQ
WD8CCC
WT4I
WW4Q

106
CT1AHU
CT2CM
CX5CC
DL5HBL
DL8YH
EA5ALW
G4MIC
G4VOE
I6GKI
IK1BOD
K8DVW
KB1JZ
KB3C
KD5FL
KZ2H
LA3JT
LU4DM
N1AWJ
VE3HVJ
W1WAI
W4DGH
W9GMV
WB8QMU
ZD7CW
3D6AL
5Z4GM
9J2JI

105
A29EB
CP1PR
DF5DP
DL8ZP
EA3AWZ
EA4CTU
EA7ZE

HK8AQN
IK1CDR
J28DN
JH1CTQ
K1OVF
K9DCJ
KA1SK
KB1FE
KD0BO
KE5PA
KT5Y
N4HRZ
N8BRQ
NK0OA
NB5C
N5GGO
N9AZK
PA3BVU
PR7SM
TF5BW
W4RYG
W6PUW
WA2VXQ
WA4YLD
WB1BPU
WB7OHF
WD9CIR
WD0FHK
YU2SPT
7P8CI
Y2IQH

104
AK1V
AK5G
EI6EW
F3VX
F6EWX
HG5TL
HS1AMT
JK3AXT
K1NFE
KA4GYU
KB0YY
KC7QE
KC9SF
KD5RQ
KD7UZ
KE4TW
KS8Q
KY6I
N4FZH
N8CQY
NI4M
NM6L
PY6LE
T5EP
V2AN
VP6MT
W4AYQ
W4WWZ
W8NOF
W9IH
WB4ZAB
WB9WIC
WD4LJY
WD9INF
WE4F
WW4Z

103
CE5CFR
CX2CB
DK6UM
DK0UU
EL2ED
F6INJ
F8ZQ
G4LEA
GW4LPA
HG5AAP
I6TBI
JP1AOK
JR4OPU
K9TBT
KI8EW
KA1WV
KA5HSA
KD2GC
KD5YQ
KF4UB
KG6IP
KO1R
N3CRR
N4GKE
N4IQN
ND5H
NE0V
NG7K
OE3WQB
OK3TMF
PA6ZW
VK4BJD
VK4EJ
VQ9RS
W1KVM
W1EII
W4UIQ
W4JZA
W8AKS
WA3TUC
WA6EEO
WA6JOA
WA9OQT
WB6ALC
WB9YZE
WD8BKT
XE1JRV
YC2OK
YV5IMF
ZL2AQK
ZL2VR

102
CE4ETZ
DL3NAC
DL4OK
DL5FD
EA5EBT
G4HLC
G4HRV

GW4OFQ
HB9CFV
K4KST
K5UBZ
K9OFH
K0SVZ
KA1EKR
KA7KZS
KA7NLE
KA8CKA
KA0EDE
KB1AY
KB1CH
KB9SW
KB0XY
KC4LA
KC8TZ
KC9YE
KD6TO
KD7JI
KD9J
KF4VS
KF6KR
KL7IEN
KU8A
KV5Y
LU8AEJ
N4DDW
N5AWE
N5FYN
N6CAH
OK1AFZ
OK1ORA
OZ8KP
PT7SD
VE2GHZ
VU2CK
VU2PMP
W1YWP
W5GFM
W7ODP
WA1WMS
WA4APM
WA7PMS
WB1FQW
WB6VOV
WD4CPS
6W1LL
6W1NQ

101
A4XYQ
C53BI
CE8TY
DA2HT
EI8EM
EL7W
HI8JTB
JI2MBN
JM1IFB
JR2WCX
JH7GFO
K2HMY
K3NA
K0TDO
KA1IY
KA8DZT
KB3WF
KB4MD
KC4SR
KC5YB
KC0DJ
KE9C
KP4HC
KU2W
LA1PBA
N2BOW
N6FNT
N4EM
N7BJT
N8BDX
N0ERC
OE1MKW
OX3KM
SP8DYY
VE1BKG
VP8AQA
VU7WCY
W1IMV
W2EQO
W2GOB
W6LSF
W8KDL
WA2JQW
WA6OGH
WA8OLM
WB2SRL
WB2WEO
WD5IBX
WD0FSJ
YB6MF
YC3CGF

100
AC3T
AG0M
DL7ABZ
G3XEP/A/P
G4JMB/CT3
G4TLZ
GI4NKF
HA4ZZ
K2KTT/PJ7
K3APM
K8SIK
K8AZB
KA1GIP
KA1OA
KA5QXH
KA9MOM
KB1EW
KB4IZB
KC5HY
KC8QS
KC8UZ
KD7HH
KE4PE
KE4SX
KF4CM
KF8TE
KG6AO

KI4DV
KJ6V
KU9T
LA1XDA
LU1GLA
N3BCZ
N4EZA
N8DJS
NC2Q
OK1KPX
OZ7OP
W7HHP
W8EHX
W9FSZ
W0HSC
WA1WXI
WA2OYK
WA2PGH
WA4SNU
WA4UQC
WA5PTV
WA8VWJ
WA8SXM
WA8SOV
WB3HNK
WB8VMV
WD8RBW
WD9FSA
WS4R
WT4Z
WY4P
YB4FW
YC5NOF
6Y5KG
7X2HM
8P6QI
9M2MM

CW

320
W9KNI

318
K8GA

316
K9MM
N4WW

315
DL6EN
K2TQC
W8AH

314
K3FN

313
OJ2BW
JA1JRK
K2FL
W1DA
W6PT

312
K4PI
K5UR
SM5BHW

311
DL8AN
K6VT
K8MFO
ON5NT
W9DWQ

310
JA3FYC
K4XO
N4RJ
OZ1LO
SM3EVR
SM6AJU
W9ZM

309
AA6AA
JA1MCU
K9QVB
PY2TM
W1NG

308
F3AT
JA1BWA
JA1ELY
JF1PJK
JA6EAT
K1MEM
K8CW
K9AJ
OZ7BW
1G9NX
W4VQ
W8SFR
W8WP
WA6TLA

307
K1MM
K5KLA
K8WW
N0RR
W8RSW
W8BW
W9ZR

306
DL1PM
JR1FYS
JA8JL
K2UO
K8NW
N2KW
W2FP

305
AB9E
JA1GTF
JA6BSM

K8DYZ
N4MM
N4NX
N5JR
VE3CKF
W8SR

304
DK8NG
ON7EJ
W2NC
W6TC
W8RT
W8UVZ
WB6RSE

303
AA1K
K4CEB
K8ZH
OZ1CTK
W2MIG
W6BW
WB6ZUC

302
K8CBL
K9AB
LA8CJ
N4VZ
W1FZ
W4WJ
WA1AER

301
AA4KT
JE1JKL
JI1QPU
JA3BQE
JH7BRG
PY2ELV
W1GL
W2SM
WD9AHJ

300
JH1IFS
JA3GM
K5AQ
N4NO
N4OI
OK1MP
SM5AQD

299
K3KA
K4SE
K8JG
K8PYD
N4KG
W7LR

298
JA1BK
ON7WW
W5ZPA
W8ZCQ
W9TY

297
JA1BN
JA8ZO
K1JA
VE3BK
W9XX

296
I5XIM
K3UA
K4JC
K4KUZ
K9IW
KB9KB
LA9U
N6JV
W3AP
W3EVW

295
DJ1XP
JA1FNA
JA1MDK
K5AS
W3EKN
W5UR
W7IUV
W8OWI

294
HB9ALO
JA1JWP
K2RZT
K7ZR
N4BPP
N7CW
OK1MG
PY5WD
W2YY

293
DL8CM
JH1EDB
K1RH
K2D2V
K6DT
K9MFI
K5NW
OZ1FRR
W1JR
W1YY
W6GO

292
JR1EBE
SM5AKT
W4DJJ
W6JI
YS9RVE
YU2TW

291
JA3CSZ
K2AGJ
K4XG
K6XP
W1MLG
W2LZX
W8IZ
WA4JTI
WB8JEY

290
AA4CM
DJ5JH
DK5AD
DL1HH
HB9HT
JA1MRM
K1JO
K4FJ
N8MC
OH2BN
OZ3Y
W1WLW
W5JW
W6BJH
W6TFO
W0OQK

289
AB4H
JH1NMO
K8LJG
N56C
W5LVD
W9GW
W9KQD
W9RY
W0YK

288
AJ8J
JA2MGE
JA3MND
K9BQ
N5FW
SM6CST
SM7FDO

287
F6DCQ
JA1IBX
JA3DY
JR7TEQ
K1VHS
N2MF
GM5DQC

286
DF3SV
KC0Q
WB4OSN

285
JH1VRQ
K5KR
W1AB
WA9EKA

284
JH1EIG
JA3PXH
K5YY
K0OYD
ON5KD

283
AA4AR
DJ4XA
JA1QXY
N4JF
N6MU
VE7AAQ
WA6SXQ

282
DF3FI
JA4LXY
K3IE
KA5W
KT5A
WA4DAN

281
JH7LMZ
K9IL
NN4Q
WA8SAE

280
AA4M
DJ5VQ
DL3BK
F6CRT
JA1UQP
JF1KKV
JA2AAQ
JA3BG
JA7PL
K4CXY
K4NV
K6LM
K7ZA
K8JCF
K0KES
N7RT
N7UT
SM7BYP
W2HAZ
W3TVB
W4BFH
W4JD
W4KN
W5KC
WD9IIC

279
K5OR
W2SR

278
F2IU
115BU
JA6VA
K9GX
SM6CTQ
W6UY

277
JH2GJW
JH7BDS
K6EE
KA3R
KD9E
SM6CCE
W7EOA

276
AI8S
DJ7CX
JA5PUL
K2SHZ
K6RK
W2TQC

275
AD8I
JA1GO
JA2TK
JH6HYC
K1EFI
K5TSQ
K9KW
N4IR
PY2FR
W4BV
W9LNQ

274
JA1GV
JA6BVU
KJ8U
ON4SH
SL8AS
W1KSZ
W3ODJ
WA2HZB

273
AG4S
JA1HGY
JH1OJU
OK1IO
SM6CMU
4Z4DX

272
AD1C
AI1S
HB9WZ
W6JD
W7YE

271
DL3RK
DL7SY
DL7WL
G3KDB
K4ITV
K9JU
K9ZO
N4JJ
OH2BAD
OZ7OP
PA8LOU
W1RR
W4LVM

270
AE0K
I8WY
JA1EF
JA1VN
K2UFM
KV4F
SM6DYK
WA3NGL

269
K1SA
VE3II

268
DL1KS
JA3CMD
W6ID

267
DK6NP
JG1NBD
JA2GBO
JA6DNV
KA0E
KE4E
KE9U
W3EYF
W6BB
WSWAQ

266
AI8O
AJ3H
DL5FF
K1IK
K4XI
K5KV
KL7H
KZ8Y
W1BWS
W1LQQ
W6YQ
W9DH

265
N5TC
SM6CCM
W4MPY
W6NB

264
AA4KA
DL7MAE
K4UEE
KE9A
KF9D
N7MC
W5AL

263
PA6WRS
W8DA
W8GKM
W5ODD
W8CY
W8ULC

262
DF8ZH
JA7FS
KB6KW
LA5UF
N6AN
VE6WQ
WY4VU

261
DL1BS
K1ST
OZ6ZZ
VE3CVZ
W2QL
W3GG
W4CZU
W9NUF

260
DL7CW
JA7HMZ
K2OWE
K2SX
K9GUG
K9RP
KI3L
W6ZID
W8PT
WA2CBB

259
AE5H
K2PK
K4II
SV6AA

258
F6ELD
JR1TNE
K6WU
K6XN
N3ED
W6HO

257
JH4UVU
K3LWM
K5CX
NO6H
W2RS
W5IB
SM0BZH
W9IT

256
DL1ES
K7ZBV
K9BIL
W8DCH
W9KB
W6VX

255
AF5M
DL6QW
KR5D
N7US
ON4SW

254
DL7NB
JG1HND
KA8DJZ
N5DEE
N6VR
VE3IPR
VE7AHA
W1BFT
WB6RJX

253
AI3O
KA2DIV
N8ZA
W7QMU

252
AB8Y
DF3FJ
K7NN
K9VAL
KC8PG
KE2S
KN8Z
N5CID
VE7CNE
W1GNR
W7EKM
WB8TRW
WD5DBV

251
DJ2AA
DJ5DA
DL1TL
GM3YOR
JA5AUC
K5DYZ
K7UR
K9BWO
N4KE
W6JLC

250
DF8RM
DK6PR
JA1CZI
K4CEF
KBQXB
KD8V
N4RI
N8AQV
OK3EA
W3GG
W4BQY
W6SN
W8SEY
W9CAW
WB2KXD
YO3AC

249
JA1SVP
K4JLD
K8NA
W1TSP
W4BAA
W8NPF
WB4MAI

248
KM9L
KQ9W

246
K8IP
OK3MB
W8PR
WA4QBX

245
JA2ADY
K5FNQ
OZ1EUO
SM3DXC
UW3DR

244
K5QTI
OZ8AE

243
JA2IVK
W1TN
W6DN

242
I4AND
JA2JRG
VE7AVC
W3OG
W4DZZ

241
K7NO

240
K4AEB
KP9E

239
JA5THU
KG9J
SL6ZG
VO1AW

238
K2PZ
K2TV
W6TEX

237
JG1TSF
JA6DAI
K2LS
K8ZZ
KB7HH
N5FG
NI4Y
WD8IFX

236
JA1KYE
KC9T

235
K6FO
OE3EVA
W5YH

234
DL7HT
JA1NOI
JA2AIR
N4FKZ
YU1NZW

233
AC8W
JA1PCY
LA5LT
N8DE
W7TS

232
F6GXB
HK3DDD
I8SCV
JA1OND
JA2IIG
KC3X
NI4H
W8CD

231
GM3LYY
JA1SFL
JA2KVD
JA7JT
K2NJ
KM6N
N6IC
W3ARK
W6SC
W8ELE
WB8ZRL

230
HB9CDZ
IT9VDQ
JA7COE
JA8KSD
K2MFY
K7SP
OK1KRS
OZ1FAO
W2UI
W6OUL
W7XN
4Z4OL

229
AE2A
JF1SEK
JR3GWZ
JA7MF
JH7ARV
K2PLF
K8SW
K8TL
SV1IW

228
DL1EV
DL9TJ
G3XTT
K5BDX
K5XE
KB8BS
N6OZ
NG6W
SM6EOC

227
AA4V
G4BUE
HP1AC
JA5ANP
K2TK
K9LV
KD8Q
KK2I
N3KR
N4UU
WA4CTA

226
AE4X
DF2PW
G3TXF
HH2VP
JH1BZJ
JP1BJR
JE3NWN
JA7IC
KJ8G
KR8O
OH3RF
ON5WQ
OZ1DYU
SV1JG
W2FTY
W7MCG
W8YBV
YU3VQ
ZS6BSZ

225
AB6R
DK3KD
EA6RL
HA8UB
JA3DAY
K1XA
K2JF
K3ZUF
K6MA
K6UD
K8PXG
KQ2O
LA1ND
NA4D
NN6W
OH5OZ
PY2FNB
VE3CWC
W2HN
W4YN
W7EEJ
W9IU
W9EJ

224
I1BWI
K4BWU
OK1DLA

222
Cx4LO
DL8BL
PY4OD
W5OB

221
OK1RV
DK9MB
EA3CTI
K1VKO
OK3WW
W2FXA

220
DJ3XD

219
AK5B
KC2X
NW6S

218
DK8ZR
N2IT
OK1AFC
ON6YH
WF4G

217
JA4FHE
K9WWT
W6MUS

216
JA7AWZ
W9NGA
W8GAX

215
JA5SIX
WB3GPH

214
JE1HKW
JH2TPI
K5QM
PY2RO
W1ENE
W9RTD
W9TX
WD9BBI

213
AE3Y
JA2JYP
N6FT
W8YGR
WA2CDD
WB5ZKR

212
DJ2GW
OL9VR
HB9BTX
JA2DC
KA1DOS
KB9XG
KO5D
PT7WA
SM3LGO
VK9NS

211
IT9TQH
K1AP
KC5M
N6PE
OY7ML
SM5LPG

210
DF6ZK
HB9CMZ
I4EAT
JH8IVO
KN2N
KR8G
N6DW
OH2VD
PY2FK

209
N3FT
OZ2E

208
DK6NC
DL2HD
KA2HMJ
KJ9O

207
DJ5PA
N2AIF
VE7DX
WA4LOF
YV5HUJ

206
DF3EP
DF9FM
G2HFO
G4GIR
JA5MG
W4MLA
W8MCY

205
DF6CY
DL7XS
K7WA
K8DB
KB8G
KR1U
N2US
PT2ACZ
WT4T

204
AA4NA
AE8Y
AK6M
JA1BFF
JH1NPX
JJ3AFV
K6ZTT
KS1Y
KM6Y
WA4RRB

203
DF2HL
IT9GLJ
IT9ZGY
JA1WTI
K6ZUR
K8PCZ
KM1D
KI6O
KX7J
LA4YW
W8OB

202
DF2PI
DF6EX
DL1LD
DL1QT
HB9QM
JH2TPI
K5QM
N7TT
OZ1ABA
W1WAI
W5LW
WB8WRU

184
AA4V
I5UNA
K5MC
NA4J

183
JE3AUA
K6EID

182
AK1L
G3YMC
JA1DUH
N9ER
VE3JCV
W8KMC
K9UJN
KF8N
NA2M
PY2CAR
W2GVX
W4WXZ
W9RKP

199
GI3FXA
K9POG
KJ2O
W3UM

198
HB9BMW
JH7UJN
W1LY
W7YS
W9LT
WB4STU
WB9MSV

179
DJ1ND
JJ1UUK
K7WF
K8LNO
K8UJZ
W0NQ
WB8EEE

178
AB1U
HB9CGO
KU2X
NE6I
VE1BWP
W1OGZ
XE1VV

177
KBQQ
KW7N
KY2W
LA9XG
VE3FEA
W6PKB
W6SWM
W9LIH
WA7NXL
XE2AQ
4X6AG

176
AK2O
DL2AW
EA4AXW
JA1AAT
K1TG
KZ4V
K3WGR
K4MF
KB2FS
KE1K
KU7Y
NU4N
SM4CQW
SM4EMO
VE4AEX
W3JF
WC4K
WM4Z
Z24JS

175
AA2Q
AK2H
JH1LME
JA8GRR
K5PC
K9BLY
KA4JMZ
KA7BDA
LA7SP
N6ADI
NN4B
SM6JHO
VE3LWL
W1AOQ
W6TVP
W8FN
W8MYG
WA2CNF
WA8YTM
WD9EJE

174
EA1NZ
K6TMB
KC7V
ZS6BCR

173
JA1SJV
KB5EK
OH6EW
WA6VJP

172
EA1JO
I1QGZ
JA7JND
K9TI
W9FU
WD8IXE

161
AK9Z
DK2UA
JA1OVF
JA8KSF
KR8Y
LA7JO
N9OJ
SM5BDV

160
HB9BMW
JH7UJN
W1LY
W7YS
W9LT
WB4STU
WB9MSV

159
DJ1ND
JJ1UUK
K7WF
K8LNO
K8UJZ
W0NQ
WB8EEE

158
AB1U
HB9CGO
KU2X
NE6I
VE1BWP
W1OGZ
XE1VV

157
KBQQ
KW7N
KY2W
LA9XG
VE3FEA
W6PKB
W6SWM
W9LIH
WA7NXL
XE2AQ
4X6AG

156
AK2O
DL2AW
EA4AXW
JA1AAT
K1TG
KZ4V
K3WGR
K4MF
KB2FS
KE1K
KU7Y
NU4N
SM4CQW
SM4EMO
VE4AEX
W3JF
WC4K
WM4Z
Z24JS

155
AA2Q
AK2H
JH1LME
JA8GRR
K5PC
K9BLY
KA4JMZ
KA7BDA
LA7SP
N6ADI
NN4B
SM6JHO
VE3LWL
W1AOQ
W6TVP
W8FN
W8MYG
WA2CNF
WA8YTM
WD9EJE

154
EA1NZ
K6TMB
KC7V
ZS6BCR

153
JA1SJV
KB5EK
OH6EW
WA6VJP

152
EA1JO
I1QGZ
JA7JND
K9TI
KD7J
N3AKD
SM7IZL

151
AK5O
DK1GF
JA2GQF
JA3ARM
JR6APX
JR6CF
K1KOB
K6VZR
KB6WI
KC4HN
N6VO
LA9PCA
SM5CCT
W5HFN
W6NLG
WA6PES
WB4BBH

150
AA8EE
CT1AJW
DL1HBT
F6HKD
JA1LKJ
K2LFL
K6UXO
KU2Q
NF5Z
PA6TO
W4NZR
W4RHZ
W6ORM
W6ENZ
W9NO
W8II
WA8GUD
WB1GOO
WB4ZBI
WC4B
XE1XF

149
DK6NJ
I4YNO
KI6U
N4AJZ
W2ELH
XE10X

148
AK2L
KN6M
OE11KW

147
SM5CSS
W3EE

146
JR7BCQ
KK6M

145
DF1OF
W5MUG
W6SIY
ZS2U

144
JN1GQK
K2DI
W7KZK

143
JI1OSP
JO1BMV
JA2KPV
JA7DQS
DL3HAH
HB9BFQ
JA5FDJ
K9FD
K8HRF
LA3IBA
LA3UL
VE6CHW

142
F6FEQ
JH3CKP
KC9Q
WA4PSF

141
EA1XC
KI2P
PA3BWS

140
DL5GAG
JH7RKT
JG1RYO
KB1I
PA3BKZ

139
AC5K
KX9B
SM6HEP
VE1AWM

138
AI8D
JA1JYZ
K9HA
OH3BU
SM6KOK
VE3HO

137
GM4SID
HB9NL
K8IFL
NQ8N
VE3HVJ
WB6FDQ

136
CO2PY
DL1MAJ
KO3E
XE1MD

135
N4AVB
N6DAZ
ON8HF
SM6CVX
SM7EL
W6CTL
WA9TAH

134
DL8RE
JA3KWJ
JA7AZJ

133
JA1VDJ
K8MR
ND8F
NO4N
SM7KJH
W1BET

132
EA8IR
JH5AUE
JH7CUO
JA8SOD
N1CWU
W8MD

131
DL5BBT
IK5DEY
KE3A
KV8Q
N9FC
ND7K
W6CRE
WD5EJJ

130
JA7DOT
N7AIH
NA2G
ON5CW
SM5FNU
W1KEE
WA1ZIC
WA8DXU

129
AA9F
JA1DSI
JH1EBU
K6PZ
K7BLU
K7PM
KQ8J
ND6U

128
JA1SAI
JA2HMF
K1FWF
KL7PI
KD9M
SM6LWH
SM6NFK
WD8KZS

127
DL1VT
K1YHM
K3NA
K8JM
KA1X
KA2BZS
KX5L
LA1VL
N8AX
NQ6E
PA3BWQ
W6MND

126
AF3T
AK1E
DL8MBS
EI4BK
K4HTY
K8DF
K8IYF
KA9FYZ
KD6NR
KD9J
KR9F
N1CYA
VE4ADG
W8FWO
W8HBH
WB8ZOP
WB6VSK

125
AG2C
JE1BQE
K2HPV
K4PB
K9MK
K8HQW
KA4QZJ
KG4O
KD6WW
KN7B
KT2C
SM7NJJ
VE3IRF
W2LPV
W4ABV

124
KA7AUH
KB3J
VE3MFZ

123
JA9CXA
N4KMY
OE2BZL
SM6MNH

122
AI8M
K2OVS
K5JII

121
HK3YH
JA1OZG
KS8Q
SM4DDS

120
DF5DR
DL6ZAJ
I8SKK
KC3AI
VE1BLG
W2KS
W7KT

119
GM4LHA
NA5C
W8DN
WE8V

118
JA1CHN
JA7HKO
LA4DCA
OE2SNL
YU1AST
YU2LAW
ZS2WV

117
DL5TV
K7DV
N7NR
OH2LQ
WA8UHO

116
JK1SAI
JA2HMF
K1FWF
KL7PI
N1AFC
N6OJ
ON7CK
W7OAX

115
K9LA
KG8X
OK3TKA
OZ5PA

114
FO8FW
JA1WAE
KA0DXF
OZ5UR
WB4WRM

113
DK7HP
DL6GZ
SL6ZZI

112
CE3CEW
DL3KAG
DL3SAS
DL5YBU
HJ0J
JA1SYY
JR6CET
KA4RPI
LA4DM
YV7PF

111
AK7Y
JA8VUJ
N4ERM
NE6V
OH2BFV
PY2ZEB
VE3KYL
VP2MM
W6DH
WA8MAM

110
CX2AQ
F6HSI
JE2KSM
JJ2BBZ
JA6NSR
JH6HSW
JA7EDZ
K8TIQ
KA5FXX
KN3P
N9RW
OZ7KV
PA3BFH
SK7GC
WB1EXP

109
DL9HC
EA3EEE
F6EVS
G4LKM
JJ1EEA
JE3TAE
JH6XSA
KA1RE
KB4CTX
KC6VK
KS5M
LU4FDM
NS6B
OZ1CAR
VE1BNN
WD5DEQ

108
DF4XG
G3SWO
I2MOV
IK2CIH
JA1QLR
JG1RNL
JI1MNT
JR3WXA
JA4IYL
JA5LFB
K2JLA
KA8EBG
N7DGZ
NA2K
NA7Y
PY1QN
VE3DIT
W1YB
W8IRT
WB4FNH

107
AJ3N
CT4CH
DL1LT
DL3EAM
JE3LZB
JH7CNI
JH8NQV
KA4BIJ
KA9OKH
KC3Q
KC4GR
KB8RH
KS1J
KW9N
LA1CCA
NB8Q
OE2KGM
PA8JRW
PY2VW
SM7NDX
W8UFO

106
A4XJP
DF3ZE
JA1UTZ
JG3QWP
JA7BE
JR7COO
KF8I
LA4AA
LZ2KK
N3DLZ
N7DHA
NE4G
OK1AXB
OZ4ZU
YC2BDJ
WA5SOG
WB2WBU

105
DL1GR
DL1NR
DL5OAI
DL7AET
EA8ZS
F8HWM
F8IFE
G3NOB
G3VTY
G5DSD
JG1JWP
KA8IIC
KK3V
KK5K
N5FN
OE5SPW
OK2BYL
OK3BVX
OZ1JLX
SM6NJK
SM6OLL
WA2ABN
YO4CBT

104
DF3FR
DK7PS
DK9KD
DL4NN
DL7WJ
G4GBG
G4MWI
HA3MQ
HB9BMU
I8UZF
JJ1CZR
JA2UOT
JR2FKB
K1EGD
K5WGQ
K7RIE
KA8EPS
KA8AYN
KA8GGI
KB2MX
N7EPD
N8EJL
NE5I
NN4K
PY1DEA
SM0LJF
SM6MLL
W3GXK
WA1GOS
WA7HCE
WB3HOP
WF4I
XE1MDX

103
DL2GBB
DL2HBX
F5XL
G3NBZ/W8
G3RDU
HK1MY
HL9XM
I2HJD
I8AOF
K1NH
K2QN
K3APM
K8OST
KA4CHG
KA8CPA
KA5GHR
N3BQS
N8CQA
N9BN
KJ2Y
KM7Z
KP4GJ
KR9J
KR6S
KS2C
KU8C
KY8T
KY9P
LA1PBA
LA8LX
N5TV
N7DM
N9BRT
NF5P

102
DF1PN
HA5JP
HB9AUT
JA1EIA
JR2MKQ
K1NTR
K9BQL
KB9RN
KC8OD
KM1G
KS8U
KU8S
KY5B
LA8KV
N6BLN
N6IBP
N8BZK
N9ACD
NC5F
NG0A
OK3TMF
PY2KQ
PY2RRG
W4NDX
W7BI
W7ILE
WK0QN
WB5TKO
WD0ARX
6Y5HN

101
AA3O
AA4DO
AI3K
DF5KU
DL9XM
EA4BV
G4KGG
EI3DP
F6IJA
HB9BOK
I2EAY
I5EFO
JE2LQX
JA7WJU
JH7GFO
K2HVM
K7EG
KA1DDB
KA1EMQ
KA3GGB
KA6CYC
KC8UR
KD3C
KI2Q
KO7S
KW6Q
N4EM
N4GVT
N5CPG
N8AFV
OK2PFN
OK3TAY
PP2WV
SM5BIH
W4NM
W4PBC
W7MME
WB2CS
WB9AB
W9NNK
W9XD
WA8MLV
WB0ZSS

100
DL6EK
DL6MAW
G4LQN
HB9CBQ
HK0BKX
JR2IAC
K1PV
K4GFH
K4ZIN
K6MBV
K7BUY
K7EC
K8IU
K8YWI
K9VGB
KA1T
KA8OMX
KF9U
KI1G
KI8G
KJ8Y
KM7Z
KP4GJ
KR9J
KR6S
KS2C
KU8C
KY8T
KY9P
LA1PBA
LA8LX
N5TV
N7DM
N9BRT
NF5P

99
NN5H
NQ6U
NU4B
OK1ALQ
PA3CNI
VE7DRI
W1HJF
W3CEI
W3EBK
W4OHZ
W4OMQ
W4WNB
W6ULU
WA2ASQ
WA7ZWG
WA9CYG
WA9FWO
WA9VYB
WD9DUC

98
WI4E
WP4F
YU2RZF
YU3DV
YV5IKU
4X4JJ
9GIGE

RTTY

97
I5FLN

96
DL9KR
G3XTT
G3YUV
KA1PE

92
JA1DSI

93
JA2GOO
K2TQC
K3UA
OH1XX
W2JB
W3CV
4Z4DX

92
EA4MM
DJ4FW
K4AQQ
N1ACH
OE5KE
OZ7YY
UT6AB

91
F5JA

90
K4AGC
KA5COJ
W0HAH
WA2JBV

88
W8LYM

87
G3ZFC
K1ZZ
K4PI
K5GQ
N4NX
N4RJ
OZ1LO
W2SM
W5TO
W8ILC
W8JIN
4X4NJ

86
EA2RE
WA2PA

85
TG9VT

83
LA7AJ
W2JGR

82
OE3CEW
PA0LUS
K5KR
VK5RY
W8WYK
YU2OH

81
N5DSK
W4UG
WA6PJR
WB4UBD

80
AK2H
AE5H
KT1N
W1DA
W2FXA

160 METER

73
AA1K

71
N4WW

DXCC Notes

Honor Roll Reminder

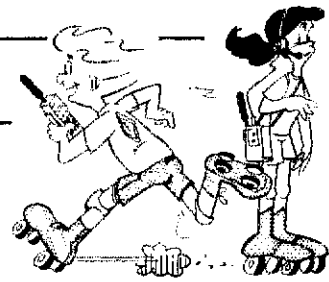
Those wanting to upgrade their standings or make Honor Roll must have their cards into HQ no later than March 31, 1986 to be listed.

DXCC Rule 5(b) Modification

Acting on the 15-1 recommendation of the DX Advisory Committee, the ARRL Awards Committee has unanimously ACCEPTED a modification of the wording of Countries List Criterion 5(b). The new language follows:

> 5(b). The following will not be eligible for consideration as a separate entity from the host country: Embassies, consulates and extra-territorial legal entities of all nature, including, but not limited to, monuments, offices of the United Nations agencies or related organizations, other inter-governmental organizations or diplomatic missions.

Making Waves



Conducted By Scott Springate, N7DDM
2095 Broadview, Eugene, OR 97405

THREE YOUNG HAMS HAVE WHAT IT TAKES

When I attended my first ham radio class, I felt terribly lost. I understood very little of the material and could have easily quit right on the spot. I stayed with it, however, and gradually some of the information began to stick. Not much made sense yet, but that was to come later. After what seemed like an eternity, I finally passed the code test and later went on to pass the written. That was five years ago, when I was 11. I am now a General, but receiving that Novice ticket was a very happy day in my life. I was very proud of my accomplishment at the time, and actually I still am. But then I didn't know about the following three young hams.

Deep in the Heart of Texas

Nathan Moore, KA5YCA, of Sherman, Texas, is one of many hams in his family. His grandfather, Sam Moore, Sr, is AC5D and lives in Stigler, Oklahoma. His father, Sam Moore, Jr, NX5Z, and mother, Carolyn, KA5WQX, are hams. Nathan got his license in September of last year, but the incredible part is that he was only *six years old* at the time.

Nathan got his young start in ham radio when his mother began studying for her Novice exam. At the same time she was working for her Novice ticket, she was also working with Nathan to teach him some of the material. Nathan's father even made up a program for their computer that asked sample Novice questions, making studying easier and more fun at the same time. After Nathan's mother was successful in her attempt for the Novice, Nathan began working with the code. He passed the test one week before his mother upgraded to General.

Nathan is now attending first grade at Fairview Elementary School. Aside from ham radio, Nathan also enjoys programming his computer and playing his chord organ. His younger sister, Janna, 2, will certainly have to study hard and early to get her license at a younger age than her big brother, but I'm sure he'll be pulling for her all the way!

Young Volunteer

The following story comes from Marsha E. Wait, KA4OKW, about her daughter, Bethany, AA4MU. Bethany's achievements are enormous; I wish I had buckled down and done what she has. The effort she put into ham radio to earn her ticket is highly commendable, but her continued volunteer work over the air is to be applauded as well.

Bethany Wait, AA4MU, of Geneva, Florida, is a third-generation ham who first became interested in Amateur Radio at the age of seven. She earned the Novice class license in 1981, shortly after her eighth birthday. Later that same year, she upgraded to Technician. At age nine, she upgraded to General and then to Advanced class. Nine weeks after her 12th birthday, Bethany passed her *Extra Class examination,* in August 1985.

Bethany is a member of both the RACES and ARES, and was one of the communications operators at two county shelters for emergency evacuation during Hurricane Elena. For this community service, she was presented citations by Florida Governor Bob Graham, as well as the Seminole County Board of Commissioners and the Seminole County Department of Public Safety. In May 1985, during the wild fires that ravaged central Florida, Bethany was in charge of a local command post, coordinating communication between the volunteer and county fire fighters.

For the past two years, Bethany has been the lead operator of the 20-meter-phone station of the Lake Monroe Amateur Radio Society (LMARS) Field Day entry. During the 1985 Orlando Hamcation, Bethany initiated and participated in the Young People's Forum, designed to interest youth in Amateur Radio.

Bethany has also received commendations from fellow Amateur Radio enthusiast Arizona Senator Barry Goldwater, K7UGA, Florida Congressman Bill McCollum and several government agencies, including the FCC Private Radio Bureau.

Bethany has been active both in DX and local communications. In addition to Amateur Radio activities, Bethany plays the flute in her school's marching band, writes stories and poetry, and plays with her cat, "CQ."

Bethany looks forward to continued growth and learning, not only about Amateur Radio, but also the world that is open to her because of this great hobby.

Six-year-old Novice Nathan Moore, KA5YCA, pauses between CW contacts.

Bethany Waite, AA4MU, tries out a new transceiver at the JAX Hamfest. *(WA4B photo)*

From Maine to MARS

Alex Clifford, NB1T, of Newport, Maine, is yet another ham who began young in this hobby and didn't stop upgrading until he made it to the top! He attained his *Extra Class license* in August 1985, at age 13. When he turned 14, in October 1985, he became a member of Navy-Marine Corps MARS and holds the call NNNØFSU. He bought a computer and an interface with part of his earnings from mowing lawns and various other odd jobs in order to operate RTTY. He also purchased a disk drive and printer to go along with the computer. Alex participates regularly in traffic nets on both CW and phone.

Aside from ham radio, Alex writes regular columns for a school newspaper and occasionally a local newspaper. He also plays trombone and sousaphone in the junior high/high school band.

These young people are a credit to Amateur Radio for the time and effort they have contributed. I hope to someday earn an Extra Class license, but that is still quite far off. However, when I do decide to try for it, only then will I fully appreciate the work involved in attaining this prestigious achievement. By the way, even though all three of these young people have accomplished a great deal at an early age, there may be some accomplished hams who are even younger. If you know someone who is, write to me via the address given at the top of the column and tell me about them!

Canadian NewsFronts

Conducted By Harry MacLean, VE3GRO
500 Riverside Dr,
London, ON N6H 2R7
Tel 519-473-1668

RABC

We've often run items on RABC, but we've never told you what it is or what it does. This month, we intend to correct that.

RABC, the Radio Advisory Board of Canada, consists of 25 member-societies representing those concerned with use of the radio spectrum. CRRL is a member. So is CARF. So are the Canadian Association of Broadcasters, the Electrical and Electronic Manufacturers of Canada, Telecom and Teleglobe Canada, and the Institute of Electrical and Electronic Engineers. These and the 18 other member-societies represent some 2000 commercial interests, 10,000 radio amateurs and 30,000 members of professional organizations.

Each member-society appoints one representative and an alternate. These—together with the General Manager, the elected Executive, the chairpersons of committees and the ex-officio representative of the Department of Communications (DOC)—form the RABC General Council, which meets in Ottawa twice each year. However, it is in committees, staffed by experts from the member-societies, that the detailed work of RABC is carried out. At the moment, RABC has five standing committees: Broadcasting; Land, Fixed and Mobile Radio; Marine Radio; Radio Relaying; and Electromagnetic Compatibility. That last committee deals with RFI—of vital concern to radio amateurs.

Radio amateurs were much in evidence at the 41st Annual Meeting of RABC, the Radio Advisory Board of Canada. From left to right are VE3HD (Electrical and Electronic Manufacturers of Canada), VE3ZS (Canadian Amateur Radio Federation), VE3ERQ (Motorola Canada), VE3FN (Canadian Radio Relay League), VE3WI (Telecom Canada), VE3TT (Consultant), Gerald Lutley (Royal Canadian Mounted Police) and VE3QO (Canadian Association of Broadcasters). RABC is recognized by the federal government as the industry's voice in radio spectrum affairs. *(VE3HD photo)*

What does RABC do? Basically, it advises DOC on anything and everything connected with the development, management and regulation of the radio spectrum. Through RABC, member-societies are able to receive early indications of changes in government standards, procedures and regulations. They are able to contribute to spectrum planning, help create standards for radio and radio-related equipment, and make recommendations about licensing and other regulatory matters. They are able to collectively respond to DOC actions. They are able to ensure that their views carry weight with DOC and the Canadian government because they are expressed through RABC.

CRRL's representatives on RABC are Ontario Director Ray Perrin, VE3FN, and Bill Loucks, VE3AR. Both are active members and experienced professional engineers. Of course, amateur input to RABC doesn't stop with Ray and Bill and the two representatives from CARF. Many of those representing commercial interests and professional organizations just happen to be radio amateurs! Amateur Radio has a strong voice in this powerful and respected body.

RABC membership is not free. For CRRL, RABC membership fees and cost of travel to meetings use up several hundred dollars each year—paid for by you, the CRRL member.

SECTION MANAGER ELECTION NOTICE

To all CRRL members in the Manitoba Section: You are hereby solicted 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 CRRL Full Members residing in the Section concerned. 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 CRRL Headquarters in London, Ontario, but are not required. The following form is acceptable:

(Place and date)

The Secretary, CRRL
Box 7009, Station E
London, ON N5Y 4J9

We, the undersigned Full Members of the Canadian Radio Relay League residing in the Manitoba Section, hereby nominate...as Manitoba Section Manager for the next two-year term of office. (Signatures...Calls...Addresses including postal codes...)

A Section Manager must be a resident of his or her Section, a licensed amateur holding a Canadian Amateur Certificate or higher and a Full Member of the League for a continuous term of at least two years prior to the receipt of the nominating petition at CRRL Headquarters. Petitions must be received at CRRL Headquarters before 1600 EST Friday, March 7, 1986.

If only one valid petition is received, the person nominated will be declared elected. If more than one valid petition is received, a ballotted election will take place. Ballots will be mailed from CRRL Headquarters on or before April 1, 1986. Returns will be counted on or after May 16, 1986. A Section Manager elected as a result of these procedures will begin his or her two-year term of office on July 1, 1986.

If no valid petition is received, the Section will be resolicited in July 1986 *QST*. A Section Manager elected after resolicitation will serve for 18 months.

Vacancies in any Section Manager office between elections will be filled by the CRRL Secretary, acting on advice from the CRRL Board.

You are urged to take the initiative and file a nominating petition immediately.—*Harry MacLean, VE3GRO, CRRL Secretary*

JACK RAVENSCROFT UPDATE

The trial of Jack Ravenscroft, VE3SR, is over. Testimony was presented on January 14, 15 and 16. Most observers felt the trial went well.

Jack is the Ottawa-area amateur who was sued for $35,000 for allegedly interfering with a neighbour's microwave oven, furnace control and home-entertainment equipment. At the trial, CRRL Director Ray Perrin, VE3FN, testified that Jack could not be held responsible for the interference. He said the problem was like rain entering through a hole in a roof. You can't stop rain; you have to fix the hole. The analogy was appropriate. DOC, which indicated that Jack's station was clean and that Jack had been operating within the law, testified that even their own hand-held transceivers could create problems in the plaintiffs' home. And when the plaintiffs produced a tape recording of a CW transmission, copied on their home entertainment equipment, it was found, to their embarrassment, not to be a transmission by Jack, but a transmission by another amateur living a block and one-half away!

At press time, the case had moved into written argument. Given what appears to be a successful trial, Jack should be cleared. However, things are rarely as simple as they seem. There could be a surprise decision. We'll all know the outcome by the end of February, when the final decision will be handed down.

(continued on page 81)

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.

Gs Get 6 Meters!

The event for which many have hoped has taken place. A major European country—actually a group of countries—has received an amateur allocation at 50 MHz. Beginning Feb 1, all Class A UK licensees gained access to a new band of frequencies from 50.0 to 50.5 MHz. No operating time limits are imposed, but power, antenna and location restrictions do apply, at least for the time being. British authorities state that they will reconsider these provisions over the next year. At that time, some of them may be relaxed, or possibly amateur use of the band could be withdrawn altogether. The decision will be based on interference reports (or the lack of them) received from nearby European countries.

What are the provisions and restrictions governing the British use of 6 meters? First, it applies only to Class A licensees. This is the grade of British license held by all of the Gs we encounter on the HF bands. It requires the passage of a code test. Many VHF operators in the UK have not been required to pass a code test. They are issued Class B licenses and may operate only above 144 MHz. Until recently, Class B operators were permitted voice operation only; however, an experimental program is underway to permit them to use CW. Not allowing Class B licensees to take advantage of the 6-meter allocation will somewhat limit the number participating. Indeed, this is one of the stated reasons for the restriction. Despite the limitation to Class A licensees, I believe that we will see a large number of G stations on the band, so great has been the anticipation of its availability.

The other major restriction facing British 6-meter operators is power. Normally, Gs are allowed a transmitter output of 100 W on CW and FM or 400-W PEP on amplitude-modulated voice. This may be distributed over both sidebands in the case of AM, or concentrated into one when operation is on SSB. On 6 meters, the power limit is defined in terms of effective radiated power, or ERP, rather than transmitter output, and the values are 25 W for CW and FM and 100 W-PEP for AM and SSB. Defining power in terms of ERP, rather than transmitter output, means that antenna gain and feed line loss must be considered. Thus, the Gs on 6-meters will be running quite-low power, probably about 10-25 W. A little easier to live with are several antenna restrictions. Antennas must be horizontally polarized, and their height above ground no greater than 20 meters (66 ft). In addition, mobile or portable work is out, as is operation from locations other than that specified in the license—no hilltopping.

The reason behind these restrictions is, apparently, the fear of interference to TV reception and other services on the Continent. Reportedly, the provisions for amateur use of 6 meters by G amateurs was worked out through extensive negotiations between British government officials and those of neighboring countries. The closest TV station to the British Isles, using the band, is a low-power station in Antwerp, Belgium. This station transmits with vertical polarization, which may explain the restriction to horizontal antennas. Other European Channel 2 stations operate in Germany, Norway and Sweden, with powers of up to 100 kW.

Despite the somewhat severe restriction, I am sure that our British colleagues will make good use of their new allocation. If sporadic-E openings in future summers approach those experienced during 1985, many contacts will be made across the Atlantic. Won't it be nice not to have to wait until 2230Z before two-ways can take place?

As good a piece of news as the British release of 6 meters is, its greatest impact may be as an example to other governments in the area. Already, there are indications of moves underway in several countries to permit some form of amateur 6-meter operation. As more and more countries come to the conclusion that 50 MHz is not a very good place for television, especially with another solar peak approaching, we may see additional hams on the band. It's interesting to speculate on how a 6-meter F2 opening might sound with a number of Europeans on the band.

ON THE BANDS

6 Meters—Although the winter E_s season has been in full swing during the period covered by this report, the major 6-meter news, other than that announced in this column's lead, comes from the regulatory front. One concerns a proposal filed by Donald Stoner, W6TNS, to take half of the band away from us to provide space for a new service. His petition calls for the reallocation of 52-54 MHz from the Amateur Service to what he calls "The Public Digital Radio Service." This is envisioned by Stoner as some kind of super packet system of specially designed transceivers attached to personal computers. He refers to them as "Radio Modems." These radio modems would exchange data at a very-high rate, which explains the "need" for 2 MHz of spectrum space to accommodate a single channel. Many users would be able to occupy one channel, presumably through time sharing. Data would be relayed through whatever series of radio modems would be necessary to get to the addressed unit. According to the proposal, the radio modems would include a power-management feature that each would adjust power from a maximum of 1 W down to a few milliwatts. This would be done automatically, and the level selected would be no more than would be necessary to maintain contact with the next unit in the net. One wonders what a person not having another radio modem within relay range would do. The 1-W power level and the use of vertical antennas are specified in an effort to eliminate the possibility of TVI. W6TNS's petition states that he selected the 6-meter band because, "it is essentially unoccupied" and because use of frequencies in this part of the spectrum would make the radio modems cheap.

ARRL has filed a strongly worded brief opposing the Stoner proposal. It takes exception to deleting half of the Amateur 6-meter band to create the proposed service. The League bases its opposition on two principal arguments: First, the proposed service is unnecessary because Amateur Radio already makes use of packet radio, which enables the interconnection of home computers. Second, the contention that the 6-meter band is virtually unoccupied is untrue. I am sure that readers of this column can also attest to the interest that a great many of us have in the 50- to 54-MHz band. The closing date for comments on the Stoner was Jan 6, but I'll let you know if any further action is needed.

The other regulatory item concerns a petition submitted by Albert D'Errico Jr, N4IXU, to allow Novice class licensees to operate voice and CW between 50.3 and 50.5 MHz. Under this proposal, Novices would be limited to a transmitter output power of 15 W. This is aimed at overcoming opposition that might result from fear of television interference, as well as providing an incentive to upgrade. No indication is forthcoming as yet as to how this proposal will be received by the Commission.

A number of good E_s sessions have taken place over the winter season. One—on Jan 5, between the Washington, DC area and Florida—lasted for several hours. Both W1DGA/3 and W3OTC reported working this column's originator, W1HDQ/4, during the opening. The VHF Sweepstakes also featured scattered openings that put a little more excitement into the contest than we are accustomed to experiencing during that particular event.

For those still awaiting a QSL from TF3T, it appears there is still hope. The latest to meet with success, to come to my attention, is WA6PEV. Apparently, after several unsuccessful attempts, Ron's use of the registered-letter approach, which has worked for several others, finally paid off. I understand that the current address is listed under the call TF1T. Good luck to all of those still trying.

K8UNV passes along an interesting piece of information picked up in a 75-meter QSO with V3FB. It seems that station is operational on 6 meters with up to 400 W. Those who believe that the band may be open in the direction of Belize may telephone V3FB. K8UNV says the country code is 011 and the number is 501-042602.

2 Meters—W7HAH comments that the Geminids was very good on the north-south path from his area. On Dec 14, Shep was able to complete contacts with eight stations: K6PVS, WA8LLY/6, K6HXW, K7ICW, AA7A, W6HDO, KF6NX and WA6LHD. Some of these were worked in less than 15 minutes. The

70-cm Standings

For WAS holders, listings are WAS number, call, state, call areas worked and grids worked. For others, call, state, US states worked, number of call areas worked and grids worked. Call areas are the 10 US call areas plus KL7 and KH6, plus each VE and XE call area, plus DXCC countries not located within the continental limits of the US, Canada or Mexico. Grids are those Maidenhead designators worked since the VUCC Award was instituted January 1, 1983. Those not showing some indication of activity or interest within the past two years are subject to being deleted. They will be reinstated upon providing an indication, in writing that they are still interested in being listed in the 70-cm Standings. It is not necessary to have worked any new states or grids in order to be reinstated. Compiled January 15, 1986. Deadline for next update is July 5, 1986.

WAS Holders

1	W0YZS*	MO	—	—	
2	K2UYH*†	NJ	55	—	
3	K5JL*†	OK	—	—	
4	WB5LUA*	TX	41	—	
5	W5FF*†	NM	28	—	
6	W1JR*†	MA	45	128	

K1FO*	CT	40	39	116
W2SZ/1*	MA	29	12	79
K1PXE	CT	25	11	—
K1LPS*	VT	22	12	—
W1RIL	MA	14	7	26
W1GXT	MA	13	6	—
W1QXX	MA	13	5	20
WA1JOF	MA	13	4	—
N1AIS	MA	11	5	—
K2RIW*	NY	28	12	—
W2VC	NJ	27	11	67
K2GK	NY	24	9	59
W2DWJ	NJ	22	9	—
WA2FGK	NJ	22	9	—
W2PGC	NY	20	10	—

*EME used for some contacts
†WAC
—information not supplied

K2YCO	NY	17	8	—
K2OVS	NY	16	6	13
N2WK	NY	15	9	41
N2BJ	NY	15	5	32
NB2T	NY	10	5	—
W2WW	NY	10	3	14
W3RUE	PA	30	10	47
W3IP	MD	27	7	—
KB3QM	DE	23	—	54
W3ZZ	MD	22	9	54
WA3FYJ	PA	22	9	45
AE3T	PA	21	7	—
K3HZO	MD	20	9	14
K3IUV	PA	19	5	—
W3XO	MD	13	5	12
WA3DMF	MD	10	5	11
WA4MVI*†	SC	43	25	—
K4QIF*	VA	39	21	—
W5HUQ/4*†	FL	36	39	—
WB4NXY	KY	29	8	89
WA4PCS	KY	27	9	—
W4FJ*	VA	25	8	—
W4ISS	GA	25	8	—
K4CAW	NC	23	—	—
WS4F	GA	22	8	51
KC4EG	KY	21	8	—
WA4SBC	VA	20	7	—
W3IY/4	VA	19	7	—

WB4NMA	GA	17	6	—
K4LHB	VA	13	6	—
K4KAE	SC	12	5	—
WA4OFS	FL	10	3	20
WB4RUA	GA	10	3	18
WA4OWC	FL	10	—	—
NI4Z	FL	9	3	—
KB4CRT	FL	9	2	31
WB4SLM	GA	6	2	13
WD4DGF	TN	5	3	7
W0RRY/5*	OK	41	35	—
K5FF*	NM	38	29	—
W5UKQ*†	LA	31	23	—
WB5AFY*†	TX	27	16	96
W5HN	TX	25	7	—
W5RCI	MS	25	7	—
K5YY	AR	23	6	91
K5SW	OK	22	7	66
KB5MR	OK	21	5	71
WA5HNK	TX	17	6	—
K5UR	AR	15	5	56
K5WE	OK	15	4	35
K5DHU	TX	14	5	44
WA5DBY	TX	14	4	—
WA5VJB	TX	13	4	—
N5BBO	TX	12	3	46
W5ASH	TX	11	4	38
W5DFU	OK	10	4	10

W5NZS	TX	6	3	—
W6ABN*		43	34	—
N6AMG*		9	16	—
K6JYO*		9	6	—
K6QXY		4	3	—
WA6HXM		4	2	—
W4WD/7*	UT	38	33	—
W7HAH*	MT	15	17	27
K7ICW	NV	4	2	—
N7EIJ	ID	2	1	—
K8WW*	OH	45	34	—
WB8BKC	MI	30	9	73
NI8O	OH	28	10	103
WB8PAT	OH	23	9	—
WB2DIN/8	WV	13	6	—
WB9SNR	IL	33	11	48
W9ZIH	IL	33	11	—
W9UD	IL	28	10	—
NC9F	IL	20	9	51
K9SM	IL	16	7	16
W9MSV	IL	14	5	49
W9YCV	WI	7	4	8
W0UC/9	WI	7	2	7
K0TLM*†	MO	47	24	74
W0RAP*†	IA	45	32	136
WB0TEM*	IA	42	—	—

KA0Y*	IA	40	9	—
W0PW*	CO	28	10	—
K0DAS	IA	26	7	—
W0FY	MO	24	8	46
WB0DRL	KS	21	6	74
K0ALL*	ND	20	12	
W0OHU	MN	20	6	—
KF0M	KS	16	5	60
WA0TKJ	KS	15	5	50
KC0QR	NE	14	5	53
WB0DGF	NE	10	3	25
W0JRP	MO	9	4	15
WA0NOK	MO	9	3	—
WB0ZKG	IA	9	3	—
WA0RWC	IA	8	3	—
KC0OG	NE	7	2	17
N0BTN	NE	4	2	7
KH6HME		2	2	6
KL7WE*†		28	25	—
VE1UT	NS	14	6	—
VE3LNX		15	6	43
VE4MA*†		43	40	—
G3SEK*		19	38	152
JA9BOH*		18	31	—

W7HAH QSO represented state number 12 for WA8LLY/6. Steve notes that Doppler was greater on this occasion than he had observed in many previous meteor showers. He observes that Doppler can be quite a problem when one or both stations are using transceive mode. They can walk across the band and never succeed in tuning each other in. He suggests that the transmitter frequency be kept constant and only the receive frequency adjusted. This can be accomplished by the use of RIT on transceivers. Of course, with separate receivers and transmitters there is no problem.

By the time you read this, another WA1JXN operation from the Bahamas should be well underway. Lance plans to operate from C6A during the last two weeks of Feb and will work both EME and terrestrial modes. Given reasonable tropo or meteor scatter, many stations in the eastern part of the US and Canada not equipped for moonbounce should be able to pick up a new country on 2 meters.

K7ICW writes that the grid system and the VUCC Award has been producing some interesting times in his part of the country. Al says that on Nov 9, N6ENU operated from near Mono Lake, California in DM08, which is about 320 miles over a very obstructed mountainous path from his Las Vegas QTH. This effort provided a new grid for him as well as N7BPA, K7ZOK and WA7JUO. A few days later, on Dec 3, WB6ODX Fresno in DM06 was worked by N7BPA, N7AJU and K7ZOK, with K7ICW not able to make the grade on this occasion. A few minutes later, however, WB6PTF, located 40 miles south of Fresno, was worked by K7ICW, N7AKU and K7ZOK. Al notes that this path into the San Joaquin Valley has been worked on 2 meters only a few times before.

WA4WKO writes from Seminole, Florida that many in his area lost their antennas in the recent storms, but apparently most have their stations back in operating order, as witnessed by the fact that 30 to 40 stations from Key West to Panama City regularly check in to the 144.160 SSB net, which meets Thursday evenings at 2100 local time. The net is normally called by W3ZR/4, with occasional help from WA4WKO, K4QXX or K4PBP. There are plans to start a 70-cm net in the area soon.

70 cm—G3SEK reports that he has now worked 19 US states via 70-cm EME. He notes that Europeans have a difficult task in working states, but much less in amassing grids and call areas. Ian has 152 grids to his credit. He hopes, as I do, that more DX stations will submit totals for listing in the Standings boxes. You may recall that one of the reasons for adopting a worldwide grid system was to enable VHFers everywhere to compare results on as equal footing as possible. G3SEK also notes the differences between operating in this country and Europe. He has put in a few contest stints at W2SZ, so is familiar with operation on this side of the Atlantic. He comments that during contests the activity level is higher in Europe than it is here, but that less use of CW and the higher QRM level over there result in not being able to work some of the more-remote stations. He says that generally it's during noncontest times that best DX, such as Eastern Europe, is accomplished.

K2UYH comments in the Jan issue of his *432 and Above EME News* that one of the major benefits of the ARRL EME Contest is the number of new stations it brings out. Many of them can be categorized as "super stations," which provide a great deal of encouragement for those trying moonbounce with minimal setups. Despite relatively poor conditions during the last running of the contest—a geomagnetic storm the first weekend and uncooperative Faraday the second—activity was quite good and some rather impressive scores were turned in. On 70 cm, DL9KR appears to be well in the lead with 86 contacts and a multiplier of 32. K2UYH had 71 contacts and a multiplier of 27. WA1RWU follows with 64 and 25, and K1FO with 61 and 23. On 23 cm, OE9XXI appears to be in the lead with 19 QSOs with a multiplier of 15. The Feb issue of the newsletter includes an item on—what must be quite unusual, if not a first—a three-way SSB-EME QSO on Dec 30 between K2UYH, DL9KR and SM4IVE. Signals generally ran 5 × 5 between the three stations—another sign of EME's coming of age.

The newsletter also notes that W4HHK has been recovering from heart surgery, but that he hopes to be back to his 13-cm EME activities before too long. We all wish Paul the best of luck.

N2WK says that he is active on all of the bands and looking for skeds, especially on 70 cm, 1¼ meters and 23 cm. Wayne's phone number is 716-247-7283.

Canadian News

(continued from page 79)

NOTES FROM ALL OVER

☐ DOC has informed CRRL that, effective February, there will no longer be a regulations test for the Advanced Amateur certificate. CRRL is checking how this will affect those writing examinations for the Digital certificate.

☐ Officials from both CRRL and CARF represented radio amateurs at a December meeting of RABC, the Radio Advisory Board of Canada. What was learned? DOC is making little progress in its major review of the Radio Act. New regulations governing radiation from power lines, digital equipment, and industrial, scientific and medical equipment are held up at the Privy Council Office. DOC is drafting regulations that will give them new powers to act in cases of excessive radiation from cable-television systems. There may be small increases in licence fees in 1987. Finally, AM broadcasting should move into 1605-1705 kHz by 1991.

☐ IARU Region 2, consisting of North and South America, will hold its triennial conference in October. CRRL will be sending the Canadian representatives. Main item on the agenda: preparations for the next General WARC (World Administrative Radio Conference), which might be held as early as 1992.

☐ CNIB has updated its Amateur Radio program for the blind. CNIB is now renting to blind amateurs Ten-Tec Argonaut IIs to replace the aging Heathkit HW-12s and HW-32s available previously. For more information, contact Fred Roberts, VE3AFA, CNIB National Office, 1931 Bayview Ave, Toronto, ON M4G 4C8.

☐ Congratulations to Malcom Timlick, VE4MG, who is the first amateur to earn the *Worked All "QST" Award*. Malcolm is a CRRL Official Bulletin Station and trustee of VE4QST. Now, what about the rest of you? Many of you are very close. We'll organize a "QST" QSO Party sometime this spring. Watch this column for an announcement.

☐ Canada's first repeater, VE3RPT, Toronto, recently celebrated its 20th birthday.

Conducted By Bob Atkins, KA1GT
103 Division Ave, Millington, NJ 07946

A 10-GHz Diode Detector/Mixer

A waveguide-mounted diode detector/mixer for use at 10 GHz is both inexpensive and easy to construct. It finds use in aligning filters, measuring power output, determining waveguide VSWR and even as a simple mixer. All this for a cost of a few dollars. A suitable diode is one of the 1N23 series. These are found with letter suffixes (eg, 1N23C), which denote the diode noise figure. The lowest noise figures are denoted by the latter letters of the alphabet. A 1N23C has a noise figure around 9.5 dB, while a 1N23G typically measures around 6.5 dB. In a diode detector, the noise figure is of no consequence, and so the cheapest (or most easily found) diode is the one to choose. If the device is also to be used as a mixer, then it is worth selecting a low-noise diode.

The package outline of the 1N23 series is shown in Fig 1A. To construct the detector, the diode is mounted across a short piece of closed-end waveguide, one quarter wavelength from shorted end as shown in Fig 2. One quarter wavelength, measured inside WG90, corresponds to about 9.5 mm at 10.368 GHz. In order to better match the detector to the waveguide, matching screws are inserted through the wall of the waveguide some distance in front of the diode. The distance between the diode and the matching screws is not important, but the distance between the screws themselves should be about $\lambda/8$ ($\sim$ 5 mm in this case). Usually, with a three-screw tuner of this type, only one or two of the screws will be required to provide a good match, but three positions are required, as it isn't possible to determine in advance just which of the screws will do the matching.

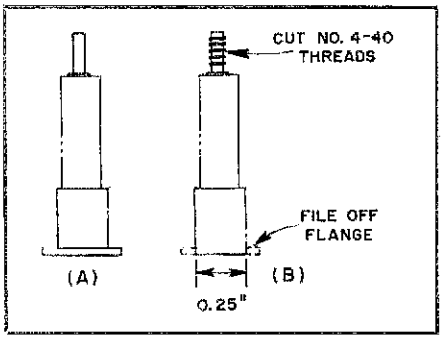


Fig 1—At A is the 1N23 series diode; at B is the 1N23 series diode after modification of package.

The construction of the detector is quite straightforward. First take a 3-inch length of brass waveguide and square off the ends with a file. Mark out a point in the center of the broad face of the waveguide exactly 9.5 mm from one end. Using a drill press or stand, if available, drill a 1/8-in-diameter hole through the waveguide wall at this point. Continue drilling through both broad walls. Open out the hole drilled in the opposite wall with a ¼-inch drill. Clean up the holes and remove any burrs from inside and outside the waveguide with a small file. Solder a flange on the end of the waveguide opposite the holes just drilled. A short length of the guide (< 1 mm) should protrude from the front face of the guide. After the guide has cooled, this should be filed back to produce a smooth face on the flange. Next, cut out a 0.5-inch × 1.0-inch piece of brass sheet (any convenient thickness). This brass sheet is now soldered in place to close off the end of the waveguide closest to the holes. About 2 inches from the closed end, mark out the positions for the three matching screws. These should be in the center of the broad face of the waveguide and 5 mm apart. Drill through the waveguide at these positions with a no. 50 (0.0700 inch) drill and tap these holes with a 2-56 tap. Using 2-56 screws (preferably stainless steel, which will not take solder), jig three 2-56 brass nuts to the waveguide over these three holes and solder them in position. Three brass screws with locknuts may be inserted into the three nuts until they are just flush with the inside wall of the waveguide.

The diode should now be prepared for mounting. Carefully thread the brass pin on one end of the diode with a 4-40 die. Take care, or there is a chance of damaging the diode by twisting the end off. The other end of the diode is ¼ inch in diameter, with a small flange. File off the flange to produce a uniform ¼-in-diameter end, as shown in Fig 1B. Next take two thin 4-40 washers and cover one side of each with a single layer of Scotch® tape. These will be used to form a capacitor to decouple the output of the diode to the waveguide. The last part to make is a brass disk, about ¼ inch thick, ½ inch in diameter with a ¼-inch hole through its center and a set screw through the side.

An alternative to making this piece is to take a plastic knob designed to fit a ¼-inch shaft. Choose one with a metal center. A sharp blow with a hammer will remove the plastic, leaving a suitably shaped brass piece complete with a set screw! This brass piece is soldered to the bottom of the waveguide so that the ¼-inch hole in the brass piece lines up with the ¼-inch hole in the waveguide.

Take the diode and insert it through the ¼-inch hole. With a pair of tweezers place one of the insulated 4-40 washers, with the Scotch tape side up, over the threaded end of the diode inside the waveguide. Push the diode up so that the threaded end pokes through the hole in the top of the guide. Place the second insulated washer, Scotch tape side down, and a small solder lug over the threads. Screw on a 4-40 nut and tighten it down. Make sure that the diode is centered in the hole in the waveguide and that it is not shorting to the wall. Tighten up the locking screw on the mount on the bottom of the waveguide. The detector/mixer is now complete.

(continued on page 83)

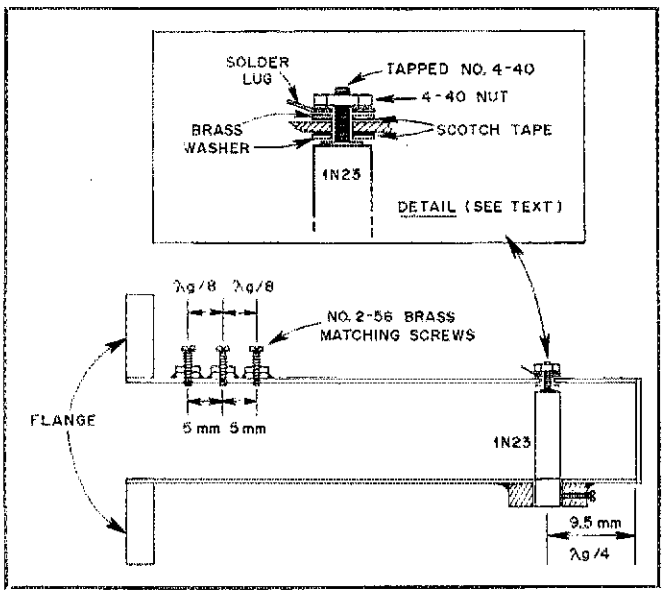


Fig 2—The microwave detector/mixer.

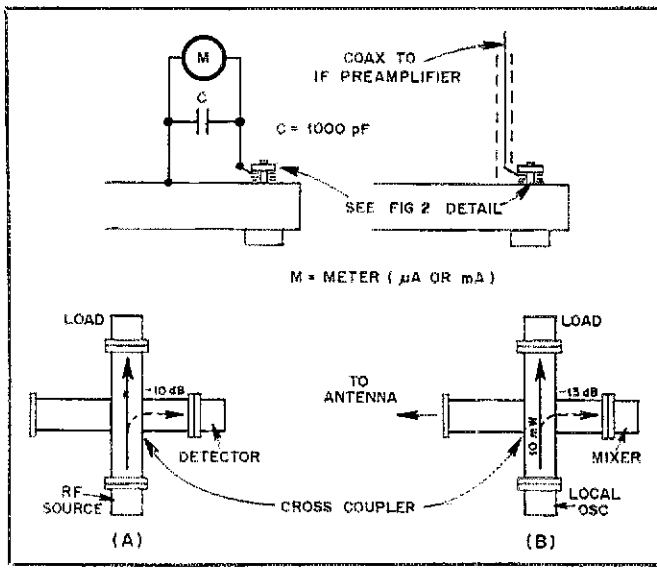


Fig 3—At A are the connections for use as a power meter. The connections for use as a mixer are at B.

FM/RPT

Conducted By Stan Horzepa, WA1LOU
75 Kreger Dr, Wolcott, CT 06716
CompuServe ID no 70645,247

2 Meters Is Alive and Well

The following are the views of Steve Wolf, NO8M.

In recent months, a number of authors have expressed the opinion that 2 meters is an unholy mess. There are too many repeaters! All of the repeaters are ego boxes! There is not enough simplex activity! So what if we lose a few repeaters with the new band plan!

Yes, 2 meters is very popular. Why is that so? It does not offer the thrill of nabbing a rare DX station. You will not learn about some particularity of a QTH many hundred miles away. What's the draw?

Communities—Lots of Them!

A sense of community belongs to Amateur Radio. Where does this sense of community come from? Not from 10-minute "How's the weather?" contacts with a person you will never talk to again. Not from working pileups. Not even from long ragchews.

How about 2 meters, on the repeaters? There are activities such as fox hunts, emergency-preparedness drills, public-service events, antenna parties and the like. A person gets to know the people they talk to, perhaps every day while commuting. Is this not a sense of community?

A DXer in the Cleveland area would find his community on the 7.36 repeater. We have at least two RTTY machines. Emergency preparedness in the making? No problem—dial up 5.29. More preparedness and Red Cross? Look to 6.82. SKYWARN? Yep, it's on 6.76. Want to work a station on a WW II submarine? Check on 7.15 for info. How about the adjoining counties? 7.21 to the east, 7.03 to the south and 5.23 to the west are among the many. There are a number of communities in Cleveland. Many of them are as different as day and night.

Let's Build a Repeater, Then Not Use It!

"Use simplex if possible; don't tie up the machine." I don't know of too many repeater-based clubs that say, "Don't use the repeater." This is exactly what the simplex phrase suggests. Most repeater operators say, "Join in! Join our community." And if we can't think alike, try one of the other machines. You'll fit in somewhere; we have quite a variety.

You see, we did not put our repeater on the air so it would sit idle waiting for the "proper" low-power station. We put it on the air so that it would be available 24 hours a day for emergency preparedness, meetings, forums, discussions, shared knowledge and a sense of community. To accomplish this goal, we had to put up a bunch of them because many of us do not think alike.

No Controversy

If you have an opinion, let's have it. We will talk. I'll know your thoughts and you'll know mine. If you still subscribe to the noncontroversial subject rule, try this method. You will be surprised to find how many of the many listeners become talkers.

Maybe that's why many authors are upset. Perhaps they disagree with this approach. Perhaps they subscribe to the censorship that noncontroversy brings. Maybe they dislike hearing anything with which they may disagree. Maybe they consider the repeater as being "tied up" and unavailable for their more lofty usage. There are repeaters for them, too.

You Still Don't Understand Why There Are So Many?

Wish you had been in Trumbull County, Ohio on June 1, 1985. Tornadoes destroyed a number of cities, and Amateur Radio became a key element in the initial response. Unfortunately, there was only one repeater available for emergency traffic. Yes, there were repeaters with overlapping coverage, but that didn't prove very effective. There was just too much area, too much traffic and too little repeater time.

All governmental and Red Cross traffic was coordinated through one repeater. The administration of net control took on a spiritual overtone. The builders did a good job; the repeater stayed on the air the whole time. The need for redundancy was not a problem.

How About Voice for Novices on 220?

Let's make 220 another 2 meters. Let's take the Novices and give them a sense of community that they never had before. Why do so many Novices drop their interest in Amateur Radio? Perhaps it is because we have relegated them to noncommunity CW contacts. We all have gone through that; many drop out. That was our loss. We lost people to help during Field Day. We lost people to help in our public-service events. We lost people to work in emergencies. Many could have been kept in ham radio. We never offered them a sense of community. With that sense of community would come a sense of belonging and, more importantly, support.

220 phone is the solution to this problem. Active, club-supported machines would offer these Novices the opportunity to be involved with Field Day, assist with public service, help in emergencies and open the door to a myriad of other activities. It would give them the opportunity to see what Amateur Radio can do in public service.

That's Why There Are So Many Repeaters

Why are there so many repeaters? We might need them. If the recent disasters were to strike a metropolitan area, we would need all the repeaters we could get and all of the people to provide the services. We would need the Amateur Radio community.

For now, I think I'll go over to 6.82 and see if I can catch a guy I have been meaning to talk to. He has a great idea for putting an Amateur Radio course on the air. Then I'll switch over to 7.36 and see if there is any word on TN8EE. Then, over to one of the RTTY machines to see if there is anything new about 220 phone for the Novices. Then it's over to 5.29 to see if anyone wants to talk about the Cel-Tel controversy.

REPEATER LOG

According to reports received in December, repeaters were involved in the following public-service events: 22 drills/alerts, 3 public-safety events, 13 vehicular emergencies, 3 weather emergencies and 1 fire emergency.

The following repeaters were involved (followed by the number of events): WB3GDH 7, WA4SWF 1, WB4UDS 3, K8DDG 5, KD8GL 7, W8ICN 4, WD8IEL 5, WA8ULB 8, KH6H 1.

The New Frontier

(continued from page 82)

When operated as a detector, a sensitive current meter is connected between the solder lug on the top of the diode and the body of the waveguide (see Fig 3A). A small (~1000 pF) capacitor is usually connected across the meter. Note that the total series resistance of the circuit is important. More sensitive meters generally have a higher series resistance, typically 1000 ohms for a 100-μA meter or 100 ohms for a 1-mA meter. These values vary considerably and should be determined for the meter in use. 1N23-type diodes have an absolute maximum CW power rating of about 250 mW.

The best way to measure power is with the use of a cross directional coupler, as shown in Fig 3A. In this configuration, the RF source operates into a matched load and a small fraction of the power (perhaps −10 dB) is coupled into the detector. The cross directional coupler is also useful when operating the detector/mixer as a mixer as shown in Fig 3B. Here the local oscillator operates into a matched load, and some of its output is directed to the mixer by the cross coupler. For optimum performance, a 1N23 series diode requires about 0.5 mW of local oscillator injection. This can be achieved using a 10-mW source with a 13-dB cross coupler. The output from the mixer in this case is taken to an IF amplifier via coax cable. In the case of the detector, the matching screws should be adjusted to give maximum output; in the case of the mixer, the screws should be adjusted to give minimum noise figure (best output signal-to-noise ratio). In either case, aim for minimum penetration of the screws into the waveguide. It may be found that one or more of the matching screws have no effect. This is quite okay. If none of the screws improve output, you are lucky: The device is already a good match!

ANTENNA-GAIN POSTSCRIPT

Editorial comments made in the January column about the results of the Central States VHF Society antenna-gain measurements should not be taken to imply that their measurements are in any way less meaningful than measurements made by the East and West Coast societies. None of the antenna ranges used would yield results to EIA standards. However, measurements made in previous years on different ranges by these three societies have shown fairly good agreement.

Silent Keys

Administered By Nancy A. O'Neill

It is with deep regret that we record the passing of these amateurs:

W1EAA, Bartholomew H. Healy, Eastham, MA
WA1EHG, Michael Pagliaro, Stratford, CT
K1GUV, Curtis "Chappy" L. Chapman, Waterford, CT
W1MLT, William Mansfield, Jr., Putnam, CT
W1UP, Philip L. Sprague, Bangor, ME
W1ZKL, Frank Hesdorfer, Jr., Waterville, ME
K2BEG, M. Thomas Burns, Kenmore, NY
N2CPX, Russ Lindquist, Carmel, NY
KA2CRW, Richard E. Tice, Burlington, NJ
W2HHU, Harold D. Brundage, Eggertsville, NY
WB2HST, Edward C. Greenwood, Fords, NJ
K2KXB, Gasper J. Penicaro, Lodi, NJ
W2OU, John H. Baile, Jr., Saddle River, NJ
W2PJL, Edward Green, Scarsdale, NY
KB2VE, Wallis Lovenberg, Morris Plains, NJ
*W2ZI, Edward G. Raser, Trenton, NJ
W3AK, Houston W. Hendrix, Malvern, PA
W3AWH, John J. Tinaglia, Ardmore, PA
N3CDC, Dave De Wire, Eagles Mere, PA
N3DRG, Charles A. Wagner, Jr., Levittown, PA
W3DVY, Henry R. Lenz, Abington, PA
K3HCT, L. Dale Squires, Zelienople, PA
W3HR, Harold R. Reiss, Exton, PA
WB3IOG, Walter Hoffritz, Narberth, PA
W3KET, Melvin Leibowitz, Wilmington, DE
W3QCV, Wynn Laurence Le Page, Ardmore, PA
WA3QDN, Frank Chesla, Mildred, PA
W3QLG, Ignatius W. Pitkiewicz, Baltimore, MD
K3QXC, Robert D. Engelhardt, Warminster, PA
N4BTK, John A. Buning, Charlotte, NC
W4CBK, Robert L. Stirk, Orlando, FL
W4CIZ, Harold R. Richman, Annandale, VA
KA4DDN, Harold G. Card, Sr., Winter Park , FL
N4DF, William Weisbord, West Palm Beach, FL
N4ENH, George E. Taylor, Hubert, NC
KB4EQA, Charles J. Chase, Fort Lauderdale, FL
K4FJS, Harold Geise, Pinellas Park, FL
WB4FYS, Victor Astolfi, Medeira Beach , FL
W4GXB, Charles G. Price, Greensboro, NC
WA4JJU, David M. Holloway, Rockwood, TN
W4JS, Hopkins K. Manley, Warner Robins, GA
W4KD, Bill Bettersworth, Memphis, TN
N4KRT, Charles R. Walker, Tampa, FL
W4OHD, Ramsey H. McDonald, North Palm Beach, FL
KF4WR, D. L. Abbey, Williamsburg, VA
*N4WT, Warren R. Torrington, Sun City, AZ
W4WYI, Robert H. Wolcott, Ocala, FL
W5ANM, Dempsey J. Burton, Belton, TX
W5BZB, Patricia Lowe, Roswell, NM
W5CSD, Joseph Hotard, Jr, New Orleans, LA
W5DNB, Russell E Buettner, Sr., New Orleans, LA
W5FBS, Charles R. Webster, Ocean Springs, MS
WA5FFE, Fredrick C. Von Wicklen, Weatherford, OK
W5HEP, Harold Callaway, China Spring, TX
W5LLH, Henry A. Rankin, Missouri City, TX
W5PED, Wilfred F. Waters, Dallas, TX
K5QPK, Frank W. Chambers, Odessa, TX
W5RYW, B. J. Smith, APO San Francisco, CA
KB5YO, Linus Nickerson, Sr., Colonial Beach, VA
W6CI, Alfred E. Johnson, El Cerrito, CA
N6DSM, Stanley W. Cogan, Yorba Linda, CA
KH6GT, Bunnie J. Chambers, Wahiawa, HI
K6HIQ, Walter D. Stewart, San Rafael, CA
W6HRS, George F. McGee, San Francisco, CA
K6MHU, Ila M. Jennings, San Jose, CA
KF6MM, Peter L. Waasdorp, San Marcos, CA
W6OQG, Hugo P. Norr, Newport Beach, CA
W6PGU, Westphal E. Willess, Santa Cruz, CA
WA6SHN, William G. "Jerry" Philipp, Napa, CA
W6TKN, Ernest F. Lasky, Lone Pine, CA
*W6TWP, George E. Reher, Denair, CA
K7AS, Lloyd W. Root, Sun City, AZ
W7AVM, J. Elmer Newell, Langley, WA
N7ERU, Richard L. Hardage, Carthage, MS
W7HIR, Frank J. Mc Cann, Northport, WA
WA7HNJ, Kenneth W. Miller, Milton Freewater, OR
KA7HSQ, Chester E. Burk, Butte, MT
W7KZF, Guy W. Scofield, Ogden, UT
W7MKW, Hugh Compton, Seattle, WA
WB7OGZ, George S. Watkins, Port Orchard, WA
WB7RYN, Oran L. Loshbaugh, Cheyenne, WY
W7UF, Lewis C. Beckman, Issaquah, WA
*W7WSW, Henry T. Espelin, Great Falls, MT
W8FFD, Ashton K. Hayes, Sr., Petoskey, MI
W8GIE, William G. Harris, Columbus, OH
WB8LOO, John L. Irvine, Detroit, MI
W8MTQ, William L. White, Berkley, MI
W8NNF, Wilburn A. Schattler, Dearborn Heights, MI
WB8QQO, Paul E. Allen, Marathon, FL
*WD8ROG, Phillip C. Brown, Neosho, MO
WA8VBK, Edwin J. Killear, Avon, OH
K9BQW, Clarence J. Dixon, Lansing, IL
WD9CJU, Harris D. Hall, Waterloo, IN
N9EV, Everett K. Leitch, Churubusco, IN
WA9IFO, James S. Ott, Springfield, IL
KD9IK, John L. Van Deventer, Atlanta, IL
W9KAS, Glenn R. Barr, Indianapolis, IN
K9KWE, Ralph Roehrig, Mounds, OK
WA9KWH, Ray E. Reichard, Butler, IN
W9UPI, Leroy A. Carey, Urbana, IN
*WB9VPC, John G. Carlson, Tomah, WI
AE9W, Robert L. Hicks, Milwaukee, WI
*WØCB, C. B. Frazer, Shawnee Mission, KS
WØCTR, Fred Feuerborn, St. Louis, MO
WØIAY, Edward Lowell Liebendorfer, Pawnee City, NE
KØMHZ, John D. Howard, Topeka, KS
WBØWGZ, Frederick G. Eyres, Hopkinton, IA
VE2FJR, Guy Robillard, Valmont, PQ
VE2HBM, M. Jean-Guy Bergeron, Anjou, PQ
VE3JUU, Alfred Hanke, Oakville, ON
VE7DNR, Ray E. Stevens, Penticton, BC
VE7DRO, Douglas R. Short, Masset, BC
VE7EHG, Frank Meadows, Penticton, BC
VE7PC, W. P. Corson, New Westminster, BC
HB9DH, Karl Meier, 8051 Zurich, Switzerland
ZL1HC, J. S. Clark, Paeroa, New Zealand

*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

March 1936

☐ Editor Warner decries the formula QSO (ge om tnx fr call ur RST 579 . . .) with little further chitchat. He suggests telling the person at the other end a bit about one's self, hopefully to start a real conversation. After all, he points out, personal contact is the very foundation of our avocation.

☐ He is also concerned that many 5-meter modulated oscillator and superregen receiver stations are coming down to 10 meters and messing it up with poor signals. Ten "is not an easier 5-meter band, it's a harder 20-meter band."

☐ Jim Lamb's noise silencing circuit in February *QST* received wide acclaim in the general as well as technical radio press. This issue, G. Grammer adds some pointers for adapting the circuit to present superhets.

☐ George also discusses the good and bad points of transmitter band changing systems—switching tanks, several tank circuits in series, or shorting portions of a large coil.

☐ A low-cost crystal transmitter design by W1JEQ uses a pair of 2A5 receiving tubes in the output but still produces a respectable signal. Bus bar connections with right-angle bends is his current wiring technique.

☐ The 80-meter transoceanic tests sponsored by the Radio Society of Great Britain were considered generally successful, with a good number of contacts and scores of calls heard.

☐ W9KUI's commercial power is 32-volts d.c., but he can get a suitable plate supply for his rig by using a Ford ignition coil in series with the primary of an h.v. transformer to produce a.c. output for rectifying and filtering.

☐ The problem of poor high- and low-frequency response in some microphones was solved by W8BBK, who added two tuned networks in the output of his speech amplifier to peak up those areas.

☐ W9UZ built an ink-pen recorder and copied a number of c.w. signals at random. He presents a pictorial sampling with comments on how the "fists" can be improved in most cases.

☐ The Federal Communications Commission expresses concern that too many voice operators are trending to become pseudo-broadcasters, so monitoring stations will be spending more time checking this area of amateur activity. F.C.C. has also turned attention to diathermy interference and will seek Congressional action to give the Commission authority to control such radiation.

☐ You can produce a really professional front-panel appearance with a new crackle-finish paint developed by Sherwin Williams.

25 Years Ago

March 1961

☐ The 6146 transmitting tube was designed specifically to fill League Hq.'s specifications for a much-needed tube in amateur work. RCA's W2YM shows us his design of a band-switching transmitter-exciter using the new product.

☐ The Editor recounts the history of amateur self-policing and reproduces a letter from the Chief of the monitoring division at F.C.C., tossing us a bouquet for performance in that field. At the same time it is felt more Official Observers should be enrolled, since these volunteers are really the key to self-policing success. There is also a need for club class instructors to imbue newcomers with a respect for high amateur standards.

☐ W1ICP stripped a broken-down old TV set and used the parts to provide most of the components in a low-cost 65-watt multiband rig of particular interest to the newcomer.

☐ V.h.f. pioneer Cal Hadlock has turned to wide-band f.m. emission to escape the stability regulations and avoid TVI problems. Amplitude modulation of an oscillator produces adequate frequency modulation at the transmitter output, and a limiter eliminates most of any remaining a.m.

☐ KZ5EG's quad design does not require a welded "spider," bamboo pole or other hard-to-get fittings. Standard TV hardware has been put to good use.

☐ You don't have to be a plumber or machinist to work on u.h.f., K6AVN points out, and supports that view with the design of a 1296-Mc. converter using basic circuits and construction.

☐ Mobilers will be interested in W8QFH's deluxe transistor power converter—independent 250- and 600-volt supplies for the stages of a 50-watt transmitter. Transient limiting is an important feature.

☐ The expansion of the 20-meter voice band to the 14,350-kc. end has caused a lot of problems for serious DXers. W2SKE proposes increased use of lower sideband as one helpful solution, since a switch to the other sideband is usually more effective to clear up QRM than trying to find a clear frequency.

☐ A combination monitor and code-practice oscillator unit was chosen by the Burris Amateur Radio Society (Indiana) both as a first construction project and as a practical gadget for everyday c.w. operating convenience.

☐ Robert McFarland has designed a pulsed, crystal-controlled signal generator to be used with an oscilloscope for adjusting your receiver and actually watching what happens to its gain and signal-to-noise ratio.

☐ The Washington, D.C. Television Interference Committee has published a very useful workbook on TVI causes, effects and solutions for this troublesome bugaboo. An s.a.s.e. will bring you one.—*W1RW*

Correspondence

Conducted By Bruce Kampe, WA1POI
Information Services Assistant

All letters will be considered carefully. We reserve the right to shorten letters selected in order to have more members' views represented. The publishers of *QST* assume no responsibility for statements made herein by correspondents.

COVENANT FEEDBACK

☐ Chester Brent, N4TV, really hit the nail on the head in his letter in the Correspondence section of January *QST*. The notion that we *voluntarily* sign away our rights to have an antenna when we buy property with restrictive Covenants, Conditions and Restrictions (CC & Rs) is a complete fallacy. It is the dream of every upward and mobile American citizen to someday have a new "dream house." But in California, and I suspect, eventually in every state of the union, all the new housing developments will have these CC & Rs banning antennas.

When we planned to move a few years ago, we spent over a year trying to find a property we liked where an antenna would be permitted. No luck at all: Anything decent had deed restrictions. Ham radio may be winning some battles with cities passing restrictive antenna ordinances. However, we are losing the war if all new construction in the future bans antennas.

Where we live, you can't park your car in your driveway. You can't have a boat, trailer or motor home on your property. No tree can grow higher than your house. You can't even put up a flagpole or paint your house without getting approval of the committee.—*John P. Elliott, WA6IOO, El Cajon, California*

☐ It appears our articulate Chester Brent, N4TV is correct. I surely hope the ARRL and the rest of us do all we can.

This, as he notes, could involve any of us in the future.—*Raymond P. Gascon, Salem, Oregon*

☐ I agree with N4TV about restrictive covenants. I don't think local real estate/homeowners' associations have any authority over radio communications installations beyond safety codes. I'd like to see the FCC petitioned to include those covenants in their decisions. Yes, please carry this message to the FCC.—*Bill Phillipson, W6PRI, Cupertino, California*

☐ Please, let's not take up the cause against the protective deed covenants. My own unrestricted neighborhood is comfortably cluttered with people, paraphernalia, i.e., old cars, boats, RVs, race cars, etc.

Many adjacent neighborhoods are fully restricted and the folks residing there enjoy beautiful quiet surroundings. Imagine us moving there and using the influential ARRL and the FCC to override the status quo and permit us to raise our antenna farms. Would we be tolerant of our neighbors who would want to work on their race cars on their front lawns, bring in their RVs and so on? I doubt if our sense of fair play equals our desire to fulfill our own selfish interests.—*Ron Desautels, KQ6X, Canyon County, California*

☐ I am in full agreement with Chester Brent, N4TV's, remarks that ARRL has a responsibility to carry the message about restrictive covenants to the FCC and request withdrawal of that part pertaining to covenant exclusion. —*Max W. Goldstein, K4EGZ, North Miami Beach, Florida*

☐ Regarding restrictive covenants, you should know before you buy what kinds of restrictions, if any, exist. To hams, there is nothing more beautiful than a tower with a set of beams shining in the sun. The same goes for a dog or cat lover, too, but there are people who do not like any of these examples, and they are looking for a place with those kinds of restrictions.—*John Gill, WDØFNE, Burkville, Texas*

A GOOD START

☐ I was not having any luck with my Novice/Technician adult education course until I changed my announcement.

Instead of announcing the *course*, I announced a *seminar*, a free seminar, including a short introduction to radio, an operating station, and a question-answer period.

Now plenty of prospective hams show up and sign up for my course.—*David F. Quagliana, K2MTW, Williamsville, New York*

THE ARRL HANDBOOK

☐ I finally got to look at the *1986 ARRL Handbook*, and it is super! You should be quite beside yourselves with joy! It is a pleasure to see something like this after so many years of mundane stuff. Really, I am not easily impressed, but I have to admit that I am overjoyed!

I believe that a new era of "construction" may evolve from this, and the ARRL has taken a positive step forward. May I ask one question? When will you produce Volume Two? Hi!—*Ralph C. Luellen, KB3PS, Westminster, Maryland*

HOT TUBES GREAT FUN

☐ Are you looking for a new thrill in ham radio, but can't afford packet or computer equipment? Does your super-duper all-mode transceiver do everything but fill out the QSL?

Have you chased your share of counties, countries and grid squares? Then, take a bold step backward and build a transmitter. Not a solid-state QRP rig, but a 25-watt tube rig that you can use every day.

After getting bored with guaranteed solid copy QSOs on my HW-101, I built a 6C5-6L6 rig on a breadboard. I run it at about 25 watts, and have worked 24 states with my eight crystals for 40 meters. I've never enjoyed ham radio so much, and I haven't felt like this since my Novice days.

If you're an old-timer, I'm sure you've built many such rigs in the past, but there are a lot of hams out there who, like me, were licensed in the past 15 years, and have grown up with appliances. If you are in that group, then dig out some old circuits, hit a few flea markets, and become a "born again ham." My transmitter cost me ten dollars, including the power supply. Send me a photo of your rig, and I'll send you a photo of mine!—*Greg Livingston, WA2EHV/1, Wellesley, Massachusetts*

COMPLIMENTS TO DOUG

☐ My compliments to Doug DeMaw, W1FB/8, for his many fine articles in *QST*. The printing of educational and informative articles of all aspects of Amateur Radio is the right policy and should be continued.—*Sam J. Tomaseli, N2EHR, Rochester, New York*

ARRL VEs

☐ I'm writing to express my feelings about the ARRL/VE program and of the VE team who recently administered my Extra Class exam.

Since I am paralyzed and confined to a wheelchair it was necessary to have an examination point that was fully accessible. I needed a table at a special height for my writing board to be set up within proper reach. I also needed someone to remove the used papers during the code test.

The VE team was just super. They came to my house and administered the test. Jim, KZ2P took on the task of removing the code-test papers and he did a great job. Bill, KK2G, and Ron, WA2HZT, were the rest of the team and they looked on as the test was administered. Ron interrupted his usual schedule to be at the test.

Thanks to the VE team and a little effort on my part I now hold the Amateur Extra Class license. Thanks ARRL/VE team! —*Stan Obritski, Jr., WB2TTY, Jackson, New Jersey*

[Editor's Note: The VE team mentioned above is from the Ocean-Monmouth Amateur Radio Club.]

6 METER SUPPORT

☐ The purpose of this letter is to add my voice to that of Mark Cobbeldick, KB4CVN, who in his letter published in the December 1985 *QST* lamented the lack of six-meter handie-talkies. Mark stated that six-meter FM is popular in the rural and mountain areas of the U.S., and I'm writing to report that it is growing equally popular in metro areas as well.

This is indeed a wide open market with substantial potential, which I'm sure some savvy radio manufacturer could tap into quite profitably. Right here in the New York metro area, a group of the locals have put a machine on the air that covers portions of seven (yes, seven) states. This is a region populated by tens of thousands of potential handie buyers! And it's only one of many repeaters throughout the country that are alive and well, both in rural *and* urban areas such as Philadelphia, Miami, New Orleans, Dallas and many other areas that are densely populated with hams.

With many "civilians" hooking up to cable TV and with our friends in the UK getting six meters in 1986, the band shows tremendous promise. If any electronics assembly operation ever decides to market a six-meter handie, they certainly have my order, along with, most likely, tens of thousands of my fellow six-meter users.—*Greg Gambor, WB2GMK, Palisades Park, New Jersey*

Washington Mailbox

Conducted By Katherine Hevener, WB8TDA
Information Services Assistant, ARRL

Potpourri

This month, we will examine some thorny issues that have developed from recent media events and FCC rule changes.

"Private" Conversations

Q. I've just listened on a government frequency to a most enlightening private conversation between President Reagan and the Secretary of Defense concerning methods of freeing American hostages in Lebanon. May I divulge this information?

A. No. According to Section 705(a) of the Communications Act, "No person receiving, assisting in receiving, transmitting, or assisting in transmitting, any interstate or foreign communication by wire or radio shall divulge or publish the existence, contents, substance, purport, effect, or meaning thereof, except through authorized channels of transmission or reception, (1) to any person other than the addressee, his agent, or attorney, (2) to a person employed or authorized to forward such communication to its destination, (3) to proper accounting or distributing officers of the various communicating centers over which the communication may be passed, (4) to the master of a ship under whom he is serving, (5) in response to a subpoena issued by a court of competent jurisdiction, or (6) on demand of other lawful authority."

Q. But what about information obtained from frequencies assigned to the safety services, such as police and fire?

A. Again, the same rules apply. You cannot divulge this information. (Section 705[a] of the Communications Act)

Q. I have heard Amateur Radio transmissions rebroadcast over local TV and radio stations. Isn't this in violation of Section 705 of the Communications Act?

A. No. This law does not apply to the receiving, divulging, publishing or utilizing of the contents of any radio communication transmitted by an Amateur Radio station. In fact, broadcasters are no longer required to obtain the amateur's permission to retransmit Amateur Radio transmissions. (Section 705[a] of the Communications Act)

Amateur Radio and the Weather

Q. Is it okay for amateurs to use frequencies assigned to the Amateur Radio Service to advise the Government National Weather Service (NWS) of severe-weather conditions?

A. For the time being, yes. This point was clarified in a November 8, 1985 letter to Joseph J. Conte II, of the NWS, from Robert S. Foosaner, Private Radio Bureau Chief, FCC:

> This concerns the use by the National Weather Service of amateur radio operators to engage in communications via amateur radio frequencies in the event of severe weather conditions. This system, known as Skywarn uses amateur radio operators in the field to provide information to central points. The system is activated only when the weather service determines that a threat of severe, damaging weather exists.
>
> A question about this system arose from the Commission's recent Report and Order in BC Docket 79-47, adopted June 7, 1985 (FCC 85-302). In that proceeding, the Commission reiterated that using an amateur radio station for forwarding ordinary weather reports for use in any broadcast context would continue to be expressly prohibited. In the same document, the Commission declared that emergency communications would be excepted from such prohibition and that a rule of reason would be applied when interpreting this emergency exception. Thus, there was no intent to disturb the Skywarn program of the NWS, which has a long tradition of minimizing loss of life and property when severe weather threatens.
>
> A petition of partial reconsideration has been filed in the referenced proceeding by the ARRL. In addition, a joint response to that petition has been filed by the National Association of Broadcasters and the Radio-Television News Directors' Association. Both filings request that the Commission clarify the present definition of emergency communications. The Skywarn program may continue to function as it has in the past, pending the Commission's action on reconsideration of the Report and Order.
>
> We feel that at some point in the consideration of this matter, it will be necessary to know whether the weather service can make use of government frequencies for its Skywarn program in much the same way as the Military Affiliated Radio Service makes use of amateur radio operators and government frequencies. Thus, we suggest that you explore this possibility with the Interdepartment Radio Advisory Committee. Therefore, while this matter is pending, you may use your amateur frequencies in the Skywarn system.

Q. Our local weather net regularly submits information collected from its members concerning routine weather conditions to the National Weather Service (NWS). Is this allowed by the rules?

A. No. Your net is actually facilitating the normal business operation of the Government National Weather Service. Hence, your group is engaging in business communication—a practice clearly prohibited under Section 97.110 of the rules for the Amateur Radio Service.

Q. A radio station would like to broadcast weather reports provided by Amateur Radio operators. Is this allowed by the rules?

A. Broadcasters and ham radio operators must not make special arrangements to use amateur frequencies to broadcast, or collect for broadcast, any type of reports, such as weather, traffic and the like. However, if broadcasters happen to overhear such information from Amateur Radio stations, they may broadcast it (97.113[b]).

Q. A repeater in a neighboring town is equipped to retransmit local NOAA VHF weather broadcasts as received on 162.55 MHz. Is this practice allowed by the rules?

A. No. The retransmission of programs or signals emanating from any class of radio station other than amateur is clearly prohibited under Section 97.113(c) of the amateur rules. However, there are at least two ways to make this information available legally. If the weather service has a recorded telephone message, you can have one of the autopatch functions encoded to dial that telephone number. Thus, it would not be a retransmission by automatic means, since it was never transmitted in the first place. The other way is to have someone speak the weather information from memory or from a script. And, of course, such a transmission should be addressed only to amateurs so that the transmission of the information is not intended to be received by the general public.

Third-Party Arrangements

The United States has arrangements to permit FCC-licensed amateur stations to exchange messages for third parties with amateur stations in these countries: Antigua and Barbuda, Argentina, Australia, Belize, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, The Gambia, Ghana, Grenada, Guatemala, Guyana, Haiti, Honduras, Israel, Jamaica, Jordan, Liberia, Mexico, Nicaragua, Panama, Paraguay, Peru, St Christopher and Nevis, St Lucia, St Vincent and the Grenadines, Swaziland, Trinidad and Tobago, United Kingdom (special-event stations with call-sign prefix GB followed by a number other than 3), Uruguay and Venezuela.

The United States also has an agreement with the United Nations, permitting third-party traffic with amateur stations 4U1ITU in Geneva, Switzerland and 4U1VIC in Vienna, Austria.

Note: Questions appearing in this column are typical of those frequently asked of the FCC and other agencies. Answers, prepared at ARRL HQ, have been reviewed by the FCC's Private Radio Bureau for agreement with current FCC interpretations and policy. Numbers in parentheses refer to specific sections of the FCC rules.

YL News and Views

Conducted By Joan Gibson, KG1F
RR 1, Box 1465, Waterbury, VT 05676

K4AOH: A Friend Indeed

The residents of Greenville, South Carolina and surrounding communities can rest assured that in an emergency they can count on the friendship and readiness of Amateur Radio station K4AOH. Dot Bedford has been serving her community, neighbors and friends since she was licensed as KN4AOH, in 1953. During the past 33 years, Dot has extended the hand of friendship to hundreds of people through Amateur Radio by running phonepatches and handling traffic during a myriad of weather and medical emergencies, including the Mexico earthquake in September 1985 and again a week later as Hurricane Gloria battered the Eastern Seaboard.

Even though her OM, Don, W4WIY, was licensed first, Dot says, "I knew nothing about radio and really cared less. But our house was small, and Don was forever in the basement, seemingly happy as he could be with his old Army surplus equipment and his radio buddies." Life was peaceful for the Bedfords, even with small children, until Don started operating CW at night, and the clackety clicks prevented Dot from sleeping. "It almost drove me nuts," she admits with a laugh. "When I went with Don to my first hamfest, I met many people and the event seemed just like a big family getting together." This was enough to inspire Dot to start studying for her Novice ticket so she could "became an insider rather than an outsider." In October 1953, Dot joined the ranks of the Amateur Radio community.

Through the years, K4AOH has reliably handled health-and-welfare traffic during the inevitable hurricane season and tirelessly participated in message handling during the famous Alaska earthquake. One of Dot's most personally rewarding moments as an Amateur Radio operator came as the result of her efforts on behalf of a little YL from Panama who had come to Greenville's Shriner's Hospital for surgery. With the hospital's cooperation and encouragement, Dot ran phonepatches to the child's mother, relaying information about the results of the surgery and the patient's recovery. What seemed like a simple example of routine Amateur Radio capability became an important lifeline for this Central American family.

In September, when the world was shocked to hear of the tragedy of the Mexico earthquake, again K4AOH was ready and willing to help out. When word reached local television and radio stations that Dot Bedford was in contact with Amateur Radio operators in Mexico City, the reporters flocked to her house to interview her and take pictures. "They asked me if they could give out my telephone number on the air; when they did, in a matter of hours I was swamped with calls. Don answered the phone, took down the information for me and even brought me my meals so I wouldn't have to lose a minute. I worked continuously from the time the bands opened in the morning until they closed at night." The tireless efforts of Dot Bedford brought emotional relief to so many families when they answered the telephone and heard Dot's voice say, "Your family is okay."

Dot Bedford, K4AOH, handled over 100 pieces of health-and-welfare traffic during the Mexico earthquake.

Joyce Bonner of Mauldin, South Carolina can attest to the joy of knowing that her brother, sister-in-law and son survived the earthquake, thanks to Amateur Radio and Dot. After trying for two days on her own to find out the welfare of her family in Mexico City and receiving no word, Mrs. Bonner called Dot to ask for her assistance. Approximately 11 hours later, she received the good news. "I couldn't believe it. We've been trying for two days, but we got no news," said Mrs. Bonner. "I'm just amazed at how fast that went through." Dot modestly commented, "That's my job when there's a disaster." K4AOH was responsible for handling over 100 pieces of traffic during the peak of the earthquake activity.

If handling traffic connected with a disaster the size of the Mexico earthquake wasn't enough, a few days later Dot was "on duty and on call" for Hurricane Gloria. The Emergency Coordinator for the local Red Cross, she was called to standby for yet more activity. On September 26, she packed up and headed for Myrtle Beach and Wilmington, North Carolina, again becoming the radio officer for the Red Cross chapter. Dot explains, "If a hurricane hits the South Carolina coast, our people go down to take the heavy load off the local chapter. We of the Red Cross go in and set up shelters. We have at least one ham in each shelter, and my job would be to stay with the Red Cross officials, once we get the shelters manned, and then to radio information back and forth between setups and shelters."

When hurricanes and earthquakes aren't invading the peaceful life of the Bedfords, Dot keeps busy as a director of the Special Service Radio Club, Blue Ridge Radio Society of Greenville. She is also a member of YLRL, AREA, RACES, YLISS, QCWA and WCWW charter member no. 82. An Extra Class licensee, she is an ARRL Volunteer Examiner.

Many of the world's amateurs would agree that people such as Dot Bedford give the hobby its magical and fantastical aura. Because of Dot's response to the plight of others in times of emergency—such as the Mexico earthquake and Hurricane Gloria—Amateur Radio again sees one of its finest hours.

EAST MEETS WEST SSB CONTEST

Date: 1800Z-2200Z Mar 22, 1986.

Eligibility: All licensed women operators throughout the world are invited to participate.

Procedure: Call "CQ YL West" or "CQ YL East." Those considered "East" are 1st, 2nd, 3rd, 4th, 8th and 9th US call districts, VE1-3, Europe, Africa, South America, Caribbean and Central America (except Mexico). Those considered "West" are 5th, 6th, 7th, Ø, KL7 and KH6 US call districts, VE4-Ø, Asia, Oceania, Australia, New Zealand and Mexico. Those classified "East" may count only those classified "West," and vice versa.

Operation: All HF bands may be used. No cross-band operation. Net contacts, repeater contacts and contacts with OMs don't count. A station may be worked only once.

Exchange: Stations worked, RS, QSO number, name, state/province/country. Entries in log must also show date, time and band.

Scoring: Score one point for each different YL worked. "Western" YLs may count only "Eastern" YLs; "Eastern" YLs may count only "Western" YLs.

Awards: Winner will receive YLRL postcards.

Logs: Please print or type logs. Do not send a carbon copy of your log. All logs must be signed by the operator. No logs will be returned. Indicate claimed score in the log. Logs must be received by *April 22, 1986* by Vice President Mary Lou Brown, NM7N, 605 Channel View Dr, Anacortes, WA 98221.

RESULTS, 1985 HOWDY DAYS

YLRL Member Winner: WD4NKP
YLRL Nonmember Winner: TI2IY

Scores

WD4NKP	144	SMØHNV	45
KM8E	121	SM5CXC*	44
TI2IY	116	PA3CEB	42
DJ1TE	116	VI3KS	42
WA3HUP	89	KD8SC	42
NM7N	86	DF2SL	42
CT1YH	81	WA1JYO	33
WA1UVJ	79	GMØAXX	32
KE5UO	79	G4EZI	31
KU7F	77	PA3CIS	30
4X6DW	74	N4DDK	29
VE1BWP	72	VP2MDY	27
GM4YMM	70	G4VFC	26
KD5MD	69	KA9CPW	25
SM5EUU	67	VK4ASK	17
WA2NFY	67	ISØSFZ	11
4X6KT	62	PA3DGF	6
WBØZQZ	56		

Checklogs: NY4H, W6NAZ

Coming Conventions

NORTHWESTERN DIVISION CONVENTION (VANCOUVER, WA)

The Northwestern Division Convention scheduled for May 31-June 1 in Vancouver, Washington has been canceled.

NEBRASKA STATE CONVENTION
April 5-6, Kearney

Nebraska (Kearney)—Apr 5-6: The Midwest ARC will sponsor the 10th annual Spring Convention at the Holiday Inn. Symposiums by Pete Eaton, WB9FLW, (packet radio); Roger Cox, WBØDGF, (antennas); *QST* editor Paul Rinaldo, W4RI (amplitude companded sideband); and Jerry Kreps (computers). Ham flea market, VE license testing, equipment exhibitors, women's schedule of events, ARRL forum and Army MARS events promise something for everyone. Our Saturday night banquet with entertainment will feature the Nebraska Cornhuskers "Biggest Fan"—Charlie Winkler. Information available from Midway ARC, Box 1231, Kearney, NE 68847-1231.

March 7-9
Florida State, Orlando

April 5-6
Nebraska State, Kearney

April 11-12
Michigan State, Saginaw

April 12-13
Missouri State, Kansas City

April 13
North Carolina State, Raleigh

ARRL NATIONAL CONVENTIONS

September 5-7, 1986—San Diego, California
July 10-12, 1987—Atlanta, Georgia
August 19-21, 1988—Portland, Oregon

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.]

Canada (Vancouver)—Mar 8: The Pacific North West Radio Amateurs is sponsoring their second annual banquet buffet at the Town County Inn, Delta, British Columbia, Highway 5/99. Activities include live entertainment. For more information and tickets, call either Janis at 604-738-5642, Dennis at 604-671-6261, Patricia at 604-987-2613 or Walter at 604-676-8128.

Connecticut (West Hartford)—Mar 16: The Insurance City Repeater Club will hold its annual Amateur Radio/Computer Flea market at the American School for the Deaf. Talk-in will be on 28/88. Tables $10, call early to reserve in advance. Contact Chuck Motes, K1DFS, 22 Woodside La, Plainville, CT 06062, or call 203-747-6377 evenings.

†**Florida (Ft Walton Beach)**—Mar 15-16: The Playground ARC hamfest will be held at the Ft Walton Beach Fairgrounds. Admission $3. ARRL/VEC exams Sat. For furthur information, contact Hud Huddleston, KF4BU, 925 Forest Ave, Ft Walton Beach, FL 32548, tel 904-862-2566.

†**Georgia (Columbus)—Mar 22-23:** The Columbus Georgia ARC will sponsor a hamfest on Sat, 9 AM-5 PM, Sun, 9 AM-3:30 PM, at the Columbus Municipal Auditorium. There will be an open-air flea market, free coffee, and free parking for self-contained RVs (no hookups). Women's and children's activities. Indoor tables are $6.50 per day. Contact Joe Mills at 404-687-3050 for table rentals. Plan to attend the buffet dinner on Sat night at the Colonial Inn. Details on the buffet will be available at the hamfest site. ARES meeting to be held Sunday at 11 AM at the Civic Center. The GSN will have their annual breakfast meeting Sunday at 8:30 AM at the Colonial Inn. Contact Billy Bedgood at 404-323-5579 for exam information. Talk-in on 01/61. Tickets at the hamfest are $1 each, six for $5, and 13 for $10. Reduced-rate motel rooms are available at the Colonial Inn, Phenix City, AL: $25 single, $29 double. Call 205-298-9361 for reservations. Be sure to specify "HAMFEST" rates when calling. For more information, call Billy Bedgood at 404-323-5579 or Bill Haycock at 404-327-7345, or write to CARC, PO Box 6336, Columbus, GA 31906.

Georgia (Dalton)—Mar 8: The Dalton ARC hamfest will be at the North Georgia Fairgrounds 9 AM-4 PM. Talk-in on 145.23. We offer plenty of parking, indoor tables, heated building and VE exams. More information: Write to Tom Smith KI4IG, 1700 Vann Way NW, Dalton, GA 30720, or call 404-259-5200.

†**Illinois (Grayslake)—Mar 23:** The Libertyville and Mundelein ARS is sponsoring their 1986 Lamarsfest at the Lake County Fairgrounds. Doors open 8 AM-2 PM; setup at 6 AM. Admission: $2 in advance, $3 at the door. Swapfest tables: $5 each; commercial tables $10 each. Activities include large indoor electronic and radio swapfest, commercial exhibitors and code-speed testing. Services include rest area, free parking and public cafeteria. Talk-in on 63/03 and 52. For information, write to Marc Abramson, PO Box 633D, Wheeling, IL 60090 or call 312-255-0642 after 8 PM CST M-F.

†**Illinois (Salem)—Mar 16:** The Centralia Wireless Association is sponsoring their 9th Annual Hamfest at the Salem Community Center, featuring flea market (flea-market tables free—first come, first serve), food and refreshments, inside displays and plenty of parking. Admission $1 at door. Doors open 7 AM-3 PM. Talk-in on 147.870/270 and 146.520. For more information, write to Centralia Wireless Assn, PO Box 1166, Centralia, IL 62801, or David Conder, 213 S Cherry, Centralia, IL 62801, or call 618-532-2772.

Illinois (Sterling)—Mar 9: The Sterling-Rock Falls ARS 26th Annual Hamfest will be held at the Sterling High School fieldhouse, 1608 4th Ave. There will be commercial distributors, dealers, a large flea market and space to accommodate self-contained campers overnight. Doors will open at 7:30 AM and a concession stand will be available. Tickets $3 advance, $4 at the door. All commercial tables and tables requiring electricity are $5. All others $3. Talk-in W9MEP 146.25/85. For information, tables or tickets, contact Sue Peters, PO Box 521, Sterling, Il 61081, or call 815-625-9262.

Indiana (Indianapolis)—Mar 9: The Morgan County ARA is sponsoring an Indiana Hamfest at the Indiana State Fairgrounds pavilion building. Admission $5 at door. Flea-market tables $8, space without table $3. All tables must be reserved in advance. Setup for reserved tables will be available Sat, Mar 8, 3 PM-9 PM. Space setup will be Sun, Mar 9, at 6 AM-8 AM. No cars inside after 8 AM. Free talk-in on 145.25. For table reservations or information, send SASE before Mar 1 to Aileen Scales, KC9YA, 3142 Market Pl, Bloomington, IN 47401, or call 812-339-4446.

†**Maryland (Timonium)—Apr 6:** The Baltimore ARC will present their 1986 Greater Baltimore Hamboree and Computerfest at the Maryland State Fairgrounds Exhibition complex. The indoor flea market and large dealer's display area will be in two modern exhibit halls. Amateur Radio, personal computer and small, business computer dealers will be featured. Food and free parking also available. The fairgrounds are located east of I-83 exit 17, three miles north of I-695 (just north of Baltimore). Gates open 8 AM. Admission $4; children under 12 free. Overnight accommodations are available in the immediate area. For additional information and table reservations, contact GBHC, PO Box 95, Timonium, MD 21093-0095, or call 301-561-1282. For recorded announcement, dial 301-HAM-TALK.

Michigan (Marshall)—Mar 22: The Southern Michigan ARS and Marshall High Photo-Electronics Club is having its 25th annual Michigan Crossroads Hamfest at Marshall High School. Free parking, free carry-in help, food service in the cafeteria. Doors open 8 AM-3 PM; set up at 6:30 AM. Tickets $2 at door, $1.50 in advance. Table space 50 cents/ft, min 4 ft (reserved until 8 AM). Talk-in on 146.52 and 07/67. Amateur Radio license exams (Novice through Extra) will be given, preregistration requested. For reservations, send SASE to SMARS, PO Box 934, Battle Creek, MI 49016, or call Wes Chaney at 616-979-3433.

Missouri (St Louis)—Mar 14: The Jefferson Barracks ARC is sponsoring their 26th Annual Auction Hamfest at Concordia Turners Hall, 6432 Gravois St. Doors open 7:30 PM. Free admission. Talk-in on 52, 36/94 and 5.21. For more information, contact Orda Gibbs, 6407 Inlet Ct, St Louis, MO 63123.

New Hampshire (Hudson)—Mar 15: The Annual Interstate Repeater society Flea Market will be held Sat at the Hudson Lions Club, Lions Ave, 9 AM-4 PM. Doors open 8 AM. Admission $1; tables $8. Food and drink available. Talk-in on 25/85 and 52. Ample free parking. for further information or advance table reservations, contact Richard Everhart, 25 Briand Dr, Nashua, NH 03063, or call 603-889-3479.

New Jersey (Egg Harbor City)—Mar 22: Shore Points ARC is sponsoring their Springfest '86 9 AM-2 PM at the Atlantic County 4-H Center, approx 15 miles west of Atlantic City. 8000 sq ft of heated indoor selling space; covered tailgating also available, weather permitting. Limited ac in indoor space. Sellers $5 per space (bring own table); buyers $2.50 in advance, $3 day of hamfest. Talk-in on 146.985 and 52. Info: SPARC, PO Box 142, Absecon, NJ 08201.

New Jersey (Upper Saddle River)—Mar 22: The 9th Annual Ham Radio Flea Market sponsored by the Chestnut Ridge Radio Club is to be held at the Education Building, Saddle River Reformed Church, East Saddle River Rd and Weiss Rd. Tables are $10 for the first one, $5 for each additional table. Tailgating $5. Food and drink available. For more information, contact Jack Meagher, W2EHD, at 201-768-8360.

†**New Jersey (Trenton)—Mar 23:** The Delaware Valley Radio Association will hold its 14th annual flea market of Amateur Radio and computer equipment, 8 AM-2 PM, at the National Guard 112th Field Artillery Armory, Eggerts Crossing Rd, Lawrence Township. Advance registration $3 (Mar 10 deadline) or $4 at door. Indoor and outdoor flea market area ($5 per space or $7 for wall spaces; seller setup at 6 AM); commercial dealers and refreshments. Sellers must provide their own tables. Talk-in on 07/67 repeater. For advanced registration and/or spaces, write to KB2ZY, Box 441B, RD 1, Stockton, NJ 08559 (SASE, please).

New Jersey (Morris Plains)—Mar 14: The Splitrock ARA is sponsoring their First Annual Evening hamfest at the VFW Post 3401, Tabor Rd (Rte 53). Doors open 7 PM. Admission $1; sellers' tables $7 (suggest advance booking). Lots of free parking. Talk-in on 385/985. For further information, write to SARA, PO Box 3, Whippany, NJ 07981.

†ARRL Hamfest

†**New York (Auburn)—Mar 15:** The Auburn ARA is sponsoring the AARA Winter-Fest at the farm/home 4th Center Grant Ave, Rte 5. Doors open 9 AM-5 PM. Admission $3. Indoor tables $5. Food available, ARRL display, 50/50 forums. VE testing (ARRL); preregistration required! For information, send SASE to Sal Verdibello, W2NVQ, 34 Wegman St, Auburn, NY 13021, tel 315-253-8830.

†**New York (Valhalla)—Mar 16:** The Westchester Emergency Communications Association's second annual hamfest and electronics fair, WECAFEST '86, will be held at Westchester Community College, Valhalla, NY (near White Plains). Features include electronics flea market, ham radio equipment testing, FCC license exams and more. Space will be available for more than 100 dealers. Refreshments and plenty of free parking will also be available. Location is in the WCC Student Center cafeteria. The event will be jointly sponsored by WECA and the WCC student radio station, WARY-FM. Doors open 9 AM-3 PM. Dealer booths are $10 and must be reserved in advance. General admission is $2; under 16 free. For booth registration or more information, write to WECAFEST '86, PO Box 348, Millwood, NY 10546.

†**North Carolina (Charlotte)—Mar 22-23:** The 1986 Charlotte Hamfest and Computerfair, sponsored by the Mecklenburg ARS, will be held at the Convention Center downtown. Hours: 9 AM-5 PM Sat and 9 AM-3 PM Sun. Admission: $5 in advance with SASE until Mar 14; $6 at the door or after Mar 14. Forums both days including packet radio and DX, women's activities, code contest for amateur operators, VEC exams, over 150 dealer-manufacturer booths. Preregistration for VEC exams. Send completed Form 610, photocopy of present license, $4 fee to Charlotte VEC, 227 Bennett La, Charlotte, NC 28213, or contact Clyde Weddle, KF4WY, Hamfest Chairman, 704-596-2168.

Ohio (Dayton)—Apr 25: The All New 17th Annual BASH will be held in the Conference Center at the HARA arena and Exhibition Center, starting at 7 PM. Free admission and free entertainment. Food and drink available. For more information contact the Miami Valley FM Association, PO Box 263, Dayton, OH 45401.

†**Ohio (Madison)—Mar 23:** The Lake County ARA is sponsoring their Eighth Annual Lake County Hamfest/Computerfest. Doors open 8 AM. Exhibitor setup at 5:30 AM. Location is Madison High School, Burns Rd at Middle Ridge Rd (40 miles East of Cleveland). Admission: $3 in advance, $4 at the door. $5 for 6-ft tables, $6.50 for 8-ft tables. Features include large indoor first floor location, easy access, plenty of free parking, food, VEC upgrade exams, equipment test bench. Talk-in on 81/21. Information: Send SASE to LCARA Hamfest, 5261 Harmony La, Willoughby, OH 44094, or call 216-953-9784.

†**Ohio (Manmee)—Mar 16:** The Toledo Mobile Radio Association, Inc is sponsoring their 31st annual Hamfest and Computer Show, to be held at the Lucas County Recreation Center on Key St. Hours: 8 AM-5 PM. Plenty of free parking. Tickets are $2.50 in advance, $3 at door. Tables available and displays limited to electronic, amateur and computer equipment. FCC license examinations for Technician through Extra, by appointment only. Women's activities will be held in the 4H room, starting at 11 AM. Talk-in on 87/27, 447.850/442.850 and 224.140/222.540. Refreshments and other activities available. For further information and examination appointments, write to Joseph Nyitray, W8LNV, 3950 Drummond Rd, Toledo, OH 43613, tel 419-472-7935.

Pennsylvania (Hermitage)—Mar 22: The Mercer County ARC will welcome amateurs to socialize and exchange views at its "How to" seminar 9 AM-4:30 PM. Topics will be presented on development of ham-shack skills. License examinations (Novice through Extra Class) will be given. Free admission for examinees and those under 18; all others $2. Talk-in on 75/15. Location is Hermitage Middle School, Rte 18. For more information, send SASE to MCARC, Box 996, Sharon, PA 16146.

Pennsylvania (McKeesport)—Mar 9: Two Rivers ARC is having a Swap 'n' Shop at the Green Valley Volunteer Fire Department near Eastland shopping Center, off Rte 30. Talk-in on 22/82. Free admission, free parking, food and drinks available. $5 for tables. For more information, write to Andrew Salitros, W3OFM, 2901 Stewart St, McKeesport, PA 15132, or call 412-673-9225.

Texas (Midland)—Mar 15-16: The Midland ARC will hold its annual St Patrick's Swapfest at 10 AM-5 PM Sat and 8 AM-2:30 PM Sun. Location is the Midland County Exhibit Building, east of Midland on the north side of Hwy 80. Preregistration is $5; $6 at the door. Tables $6 each. Refreshments and drinks available. Volunteer examineer tests for all license classes given. For more information and reservations, contact Midland ARC, PO Box 4401, Midland, TX 79704.

Washington (Puyallup)—Mar 8: The Mike and Key ARC will hold its fifth annual Electronics Flea market in the Expo Hall of the Western Washington Fairgrounds 9 AM-6 PM. Admission $2. Table requests postmarked after Feb 15 will be $18. Table setup 4 PM-9 PM Fri and 6 AM-9 AM Sat. Commercial space $50. The Country Store will be available for consignment sales; limit 10 items. Plenty of free parking, snack bar and club information. Free overnight space for self-contained RVs. Talk-in on 146.58 and 224.12. Further information or reservations, write to M&K Flea Market, 20903 NE 77th, Redmond, WA 98053, or call 206-868-0457.

Wisconsin (Jefferson)—Mar 16: The TRI-County ARC, W9MQB, will hold its annual hamfest 8 AM-3 PM at the Jefferson County Fairgrounds. Tickets $2.50 in advance, $3 at door. Tables are $3 in advance, $4 at door. Food and parking available. Amateur Radio exams by the Milwaukee Volunteer Core Group; walk-ins welcome. Doors open 7 AM for sellers only. Talk-in on 144.89/145.49, 52 and other area repeaters. For more information, advance tickets and tables, send a large SASE to Bob Barker, K9RIJ, 724 Burdick, Milton, WI 53563.

†**Wisconsin (Madison)—Apr 6:** The Madison Area Repeater Association, Inc is sponsoring its 14th annual Madison Swapfest at the Dane County Exposition Center Forum Building. Doors open 7:30 AM for flea-market sellers, 8 AM for general public. Special arrangements for early setup are available for commercial exhibitors and purchasers of 6 or more flea-market tables. The Forum Building has over 20,000 sq ft of space for commercial exhibitors and the flea market, as well as plenty of space for parking in the adjacent paved lot. Hotel accommodations are within walking distance of the Swapfest. An all-you-can-eat pancake breakfast and various luncheon sandwiches will be available at the Swapfest. Talk-in on 16/76. The Four Lakes ARC will conduct Amateur Radio upgrade examination during the Swapfest. Preregistration is encouraged, but walk-ins will be accepted. For information on examinations, contact Garrison Lincoln, W9UDY, 6215 Winnequah Rd, Madison, WI 53716. Admission is $2.50 in advance, $3 at the door. Children 12 and under free. Flea-market tables are $5 in advance, $6 at the door plus admission. Be sure to reserve early, as tables were sold out last year. Deadline for mail orders of admission tickets and table reservations is Mar 31. For admission tickets, table reservations or information on commercial exhibit space, write to MARA, PO Box 3403, Madison, WI 53704, or call 608-222-4744 day or night.

[*Note:* Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance.]

Happenings

(continued from page 68)

Section 97.415 is revised in its entirety to read as follows:

§ 97.415 **Frequencies available.**

(a) The frequency bands in the following table are available for space operation, Earth operation and telecommand operation. Unless otherwise specified in this Subpart the rules for authorized emission modes (§§ 97.61 and 97.65) and authorized transmitting power (§ 97.67) are applicable for each of the listed frequency bands.

Frequency band	Limitations (see para [b])	Frequency band	Limitations (see para [b])
kilohertz		*gigahertz*	
7000-7100		3.40-3.41	1, 2
14000-14250		5.65-5.67	1, 4
21000-21450		5.83-5.85	1, 3
24890-24990		10.45-10.50	5
28000-29700		24.00-24.05	
		47.0-47.2	
megahertz		75.5-81.0	
		142-149	
144-146		241-250	
435-438	1		
1260-1270	1,4		
2400-2450	1		

(b) Limitations:

(1) Stations in the Amateur-Satellite Service must not cause harmful interference to other authorized stations operating in accordance with the Table of Frequency Allocations in this band, except radiolocation systems authorized in accordance with Footnote US217.

(2) This frequency band is not available in ITU Region 1.

(3) Stations in the Amateur-Satellite Service in this band are limited to Earth-to-Space transmissions and are not protected from interference caused by fixed-satellite stations in Region 1, radiolocation stations, or industrial, scientific and medical equipment operating in this band.

(4) Stations in the Amateur-Satellite Service in this band are limited to Earth-to-space transmissions.

(5) Stations in the Amateur-Satellite Service in this band must not cause harmful interference to and are not protected from interference caused by stations in the Government radiolocation service.

HAROLD R. RICHMAN, W4CIZ

We are saddened to report the death of Harold R. Richman, W4CIZ, of Annandale, Virginia. Hal, licensed in 1931, was an Extra Class operator for whom radio was both a career and a hobby: Until his retirement in 1974, he served as Engineer-in-Charge of the 24th District office of the FCC. His enthusiasm for radio didn't miss a beat: Hal's special expertise in RFI/TVI matters landed him a spot in ARRL's RFI Task Group, as well as making him a principal in the successful compilation of ARRL's RFI Assistance List. Hal was honored with the ARRL Roanoke Division Service Award in 1981. The proud Richman radio tradition is carried on by daughter Barbara, WB4MHX.

SECTION MANAGER ELECTION RESULTS

Section Manager Arthur R. Smith, W6INI, of the San Diego Section, will begin a two-year term of office April 1, 1986. This election was uncontested.

SECTION MANAGER APPOINTMENT

In the West Indies Section, Alberto L. Valldejuli, WP4CSG, has been appointed to complete the term (until September 30, 1986) of Carlos Flores, WP4J (resigned).—*Arline Bender, WA1VMC*

Affiliated Clubs in Action

Conducted By Leo D. Kluger, WB2TRN
Club Program Manager, ARRL

MORE GREAT IDEAS FROM KB9UM

Details on Stanley W. Henson's booklet, *14 Ideas for More Radio Club Fun,* were given in the December 1985 column. Here's the fifth idea from the Meetings and Members heading.

Help from Elmer

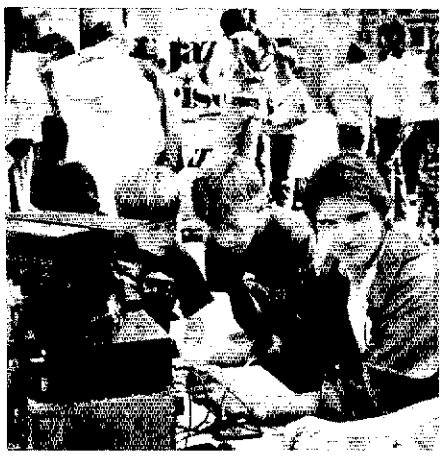
Who's Elmer? Elmer is the friendly, helpful spirit of all amateurs willing to help other amateurs and would-be amateurs learn and develop the skills pertaining to our hobby. Almost all of us have had one or even several Elmers along our Amateur Radio pathways, and they can only be repaid for their generosity by our being generous in turn to those who follow us into the world of Amateur Radio.

At one club meeting a newly licensed amateur was mentioning some of the problems he had with various aspects of our hobby. In reply to our general comment that almost any club member would be glad to help, he asked, "Who do I call?" Upon reflection, it's obvious that newcomers in a club will not know the various club experts who can be consulted when problems arise, and so, the Elmer List was born. Making such a list available at meetings or via a newsletter helps new members easily find out who to call for help, and the club officers won't catch all the questions!

Elmer List

It's composed of club members willing to help other amateurs and would-be amateurs with questions and problems related to radio equipment and general topics. Club members willing to be club Elmers should let the Elmer List Editor know so they can be included in future versions of this list.

The "Equipment" subheading is a list of various popular equipment brand names, each one followed by the call sign of the club's expert on that particular piece of gear. The "General Topics" subheading includes the following items: OSCAR satellite communication, RTTY, packet radio, vintage equipment, license upgrading, club repeater, club dues and club newsletter.



Last fall the Oregon Tualatin Valley ARC participated in Beaverton, Oregon's "Beaverton Good Neighbor Days," an outdoor fair with vendor and general-interest booths. The weekend event drew nearly 30,000 people. Occurring just a few days after the Mexico City earthquake, the club's booth drew large numbers of people interested in hearing firsthand how the rescue efforts were going. *(WB7SIC 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 each of these special groups, their city, state and number of members:

Baton Rouge ARC, Baton Rouge, LA (225)
Gabilan ARC, Gilroy, CA (45)
Vicksburg ARC, Vicksburg, MS (62)

Renewing Special Service Clubs

After completing a year of Special Service, SSCs go through a review process with their respective Affiliated Club Coordinators. With successful programs behind them, they plan their next 12 months of activities. Recently renewing SSCs are presented here, each club name followed by the city, state and number of members:

Bergen ARA, Lodi, NJ (136)
Cherryville Repeater Assn, Inc, Quakertown, NJ (100)
Granite State ARA, Bedford, NH (42)
Key Beepers of Sedro Woolley High School, Sedro Woolley, WA (29)
Knickerbocker ARC, Port Washington, NY (18)
Larkfield ARC, Commack, NY (225)
Lower Columbia ARA, Longview, WA (62)
St. Paul Radio Club, Inc, St. Paul, MN (306)
Stamford ARA, Ridgefield, CT (148)
Wantagh ARC, Seaford, NY (72)
Yellowstone RC, Billings, MT (57)

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 some other VECs.

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." 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. 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. 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. 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.

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 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.

How to Become an ARRL-Accredited Volunteer Examiner: Qualified Advanced or Extra Class licensees (see Section 97.31 of the FCC Rules) are invited to notify the ARRL/VEC of their interest in becoming an accredited VE. Send us your name, call sign, license class and full mailing address. Information will be sent via *Third Class Mail,* which may take about three weeks to arrive.

Registering an Upcoming Test Session with the ARRL/VEC: Complete a Test Session Registration Form and submit it to the ARRL/VEC office *at least 30 days in advance of your session. We need four weeks or more advance notice of a session* to serve you in a cost-effective and accurate way.

Amateur Satellite Communications

Conducted By
Vern "Rip" Riportella, WA2LQQ
PO Box 177, Warwick, NY 10990

The Future Is Up There

We now recognize the need for a broader perspective in designing future satellite systems. The critical design elements must include not just the spacecraft itself but the whole system, including the user interface and environment. Present and future users will require that next-generation satellites be more convenient and accessible.

Future systems will need to be easier to use. They should provide a reasonable performance payback for the users' investment in time (to learn techniques) and equipment. The most satisfactory solution to realizing these and other important objectives is, simply, "up." Up in altitude, up in frequency and, consequently, up in cost.

Why up? The accompanying figures illustrate the advantages of higher altitude.

AMSAT has under consideration two major options for the next-generation high-altitude satellites. One would be the so-called Phase 4 plan for geosynchronous satellites. Phase 4 would have perhaps two geosynchronous satellites operational by decade's end. The other major option is a further refinement of the current Phase 3 program with some fascinating features. A Phase 3D option using two or more satellites in a true Molniya orbit inclined 63 degrees is being closely scrutinized.

Let's look at the latter advanced Phase 3D concept first. It would have two or more true Molniya orbit satellites phased in such a way as to provide nearly continuous coverage for the Northern Hemisphere. The orbital period would be 12 hours. This is important to reduce tracking complexity. The satellites would appear in the same part of the sky on a regular, easily predicted basis. As one satellite passed apogee, its partner would be on the rise. Later, the second one would appear in the same sky location as its partner earlier was located. They would continue in this bola-like arrangement indefinitely. The prime objective of nearly continuous coverage would be realized, since at least one bird would always be in view and "on line." And minimal tracking and antenna steering would be required.

Satellites of a Phase 3D option would build on existing technology. Although some stationkeeping would be required, current techniques using magnetic torquing might suffice.[1] Despun bearings and other very expensive components would then be unnecessary, and costs would be reduced substantially.

What about Phase 4? The view from a single geosynchronous satellite such as AMSAT might consider was pictured last month. The engineering challenges involved in a Phase 4 system are formidable. In the end, however, the deciding factor may be economic. The key technologies would have to be purchased rather than fabricated by in-house AMSAT.[2] This would certainly drive the cost of even a single Phase 4 bird over the one-megabuck threshold.

Whether in a Phase 4 geosynchronous orbit or a clever adaptation of a Phase 3 Molniya-type orbit, future satellites will surely embody our premise: The future is up.

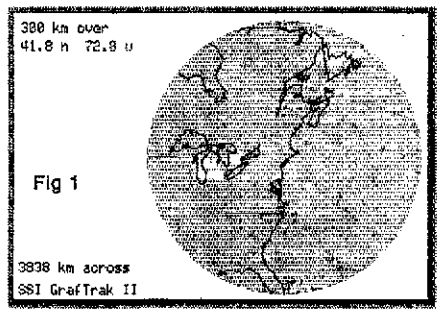


Fig 1

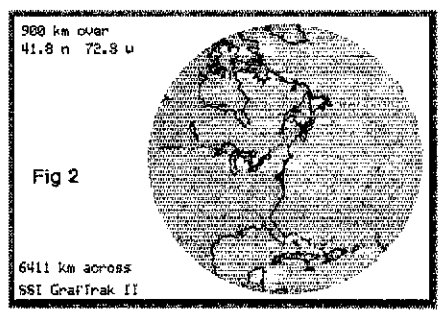


Fig 2

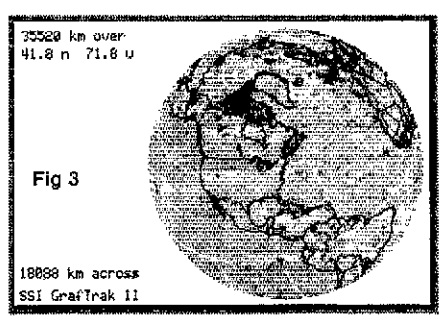


Fig 3

One of the reasons for going "up" in altitude is coverage area. Fig 1 shows the view from a typical Space Shuttle mission if it were directly over Newington at its nominal flight altitude of about 300 km (186 statute miles). Coverage area extends north to Newfoundland, west to the Missouri River and south to Miami. Compare this to the coverage afforded by a typical low earth orbiter such as AMSAT-OSCAR 8, as shown in Fig 2, again positioned over Newington. Coverage is seen to extend north to central Greenland, west to the Rockies and south to Central America. Finally, compare with Fig 3 the view from a typical Phase 3-type elliptical orbit with apogee above Newington. Coverage now extends north over the pole to Asia, east to all of Europe and some of the Middle East and Western Africa, south to Argentina and Chile and west to Hawaii. Compare these three figures with the coverage from a typical geosynchronous satellite, as shown in the January 1986 edition of this column.

But with increased coverage area comes the need for more transponder bandwidth. Clearly the 2-meter and 70-cm bands that now support AO-10 traffic in a bit over 150 kHz cannot support the spectral requirements warranted by the coverage area of the next-generation satellites. The only answer is again "up." At the higher frequencies, 23 cm and up, lie the spectral resources needed for tomorrow's highly capable satellites.

Getting on the higher bands has never been easier, thanks to advances in key, gating technologies. Commercial manufacturers are about to unleash a torrent of equipment, making access to 23 cm and above easier than ever. The new ICOM 1271A all-mode 23-cm transceiver, I'm convinced, serves as harbinger of legions of UHF and even SHF equipment just around the corner. It will soon be possible to bolt together a complete 23-cm station. Soon, 13 cm will yield to the same market pressures that now have brought 23 cm to the brink of popularity.

The challenge of shaping the future of Amateur Radio satellites and, to an increasing degree, the course of the overall hobby is now engaged. Whether it be Phase 4A or Phase 3D, the outcome of current planning will determine the space-communications resources available to hams for at least the first half of the next decade.

Next month, we'll look at a few functions future satellites might provide, such as bulletin delivery to users through gateway repeaters.[3] Meanwhile, there's no time like the present to get your own station on OSCAR. Why wait for the future? Meet it halfway![4-6]

Notes

[1]By contrast, magnetic torquing as a means of stationkeeping is not possible at geosynchronous altitudes because the geomagnetic field is too weak at 22,300 miles.

[2]The key technologies involve either three-axis stabilization or despun bearings. AMSAT can expect little help on either account from donations in kind and has very little likelihood of being able to develop this hardware internally.

[3]Project Linkup will demonstrate bulletin delivery to repeaters using AO-10 Mode L and FM for high-quality audio. Regular AMSAT and space-interest-oriented bulletins will be available to all who interface their stations and/or repeaters. Free info is available from the author (at the address at the top of this column) for interested individuals and groups. An SASE is required, please. First on-the-air tests are scheduled for first-quarter 1986.

Project NATCOM will provide nationwide AMSAT net connectivity for local interest groups as well as AMSAT-affiliated clubs and repeaters using a telephone bridge provided by the Darome Connection, a commercial telephone conference service in Minneapolis. Free NATCOM information is also available for an SASE to this column conductor.

[4]Help in getting started can be obtained from AMSAT Area Coordinators. The name and address of one in your state or province can be obtained for an SASE to this column conductor.

[5]Information on the GRAFTRAK II software, used to produce the figures as well as other software in the AMSAT Software Exchange, is available in the new ASE 1986 catalog, free for an SASE to this column conductor.

[6]Users of the ARRL OSCARLOCATOR can obtain current AO-10 ground-track templates for an SASE to this column conductor.

Public Service

Conducted By Michael R Riley, KX1B
Public Service Manager, ARRL

Let's Communicate!

. . .on the Public Service column! We'd like to know how you feel about the editorial contents of your public service forum in *QST*. What would you like to see more of? Less of? We want the opinions of all readers of *QST*: ARRL members, clubs, Section Managers, Station Appointees, ARES registrants, everybody! With a healthy supply of feedback from you, we can evaluate every aspect of the column and make changes that will make this column more meaningful. In addition, your input will help us determine the present effectiveness of the League's public service program, and again, make changes if we can improve on this level of performance.

Won't you please help us by taking a minute to jot down your answers to the following questions and send this page (or photocopy) to the Public Service Branch at ARRL HQ by April 15? You'll have the good feeling of knowing that you made a meaningful contribution to the future of ARRL's public service commitment and this column. We'll publish the results of this survey in a future issue. Thanks!

NOTE: We ask that you simply write your call sign on the line in the upper-left corner of the survey, answer the questions, then mail the survey to the Public Service Branch at ARRL Headquarters by April 15. Although each issue of *QST* is protected by copyright, a special exception has been made to allow you to photocopy this survey.

1986 PUBLIC SERVICE COLUMN SURVEY

_____
(your callsign)

1) Do you read the Public Service column every month?
☐ Yes ☐ No

2) After receiving *QST*, when do you read the Public Service column?
☐ First
☐ Last
☐ Other (explain) _____

3) As compared to the other columns in *QST*, the Public Service column is (check one response):
☐ Much better ☐ Better
☐ About the same ☐ Worse
☐ Much worse

4) Please rate your interest in the various components of the Public Service column by placing one number in each blank.
1—Very interesting 2—Interesting
3—No opinion 4—Not interesting
5—Never read

___Lead Article
___In Service
___Your Conductor's Caboose
___Section Emergency Coodinator Reports
___Transcontinental Corps Reports
___National Traffic System Reports
___Section Traffic Manager Reports
___Public Service Honor Roll
___Brass Pounders League
___Independent Nets

5) What topic(s) would you like to see covered *more* often in the Public Service column?

_____

6) What topic(s) would you like to see covered *less* often in the Public Service column?

_____

7) If only one thing could be done to improve the Public Service column, what would it be?

_____

_____

8) Would increased use of relevant photographs improve the Public Service column?
☐ Yes ☐ No

9) The present three-page format of the Public Service column is
☐ Fine ☐ Too lengthy ☐ Too short

10) Do you receive the ARRL Section Leader or ARRL Field Forum newsletters?
☐ Yes ☐ No

11) Are you a member of the Amateur Radio Emergency Service?
☐ ☐ No

12) If one thing could be done to improve your ARES program, what would it be?

_____

13) Are you an active member of the Radio Amateur Civil Emergency Service (RACES)?
☐ Yes ☐ No

14) Please list the agencies/organizations you have worked with during the past 12 months:

_____

_____

15) Are you familiar with the National Voluntary Organizations Active in Disaster (NVOAD)?
☐ Yes ☐ No

16) Are you active in the ARRL National Traffic System (NTS)?
☐ Yes ☐ No

17) If you answered "yes" to question 16, how often per month do you check into a net?
_____ times.

18) How many ARRL Radiogram messages did you handle last month? _____ messages

19) How many ARRL Radiogram messages did you originate from, or deliver to, a nonamateur last month? _____ messages

20) If one thing could be done to improve your NTS-affiliated net, what would it be?

_____

21) Are you a member of an Amateur Radio club?
☐ Yes ☐ No

22) If you answered "yes" to question 21, is the club ARRL affiliated?
☐ Yes ☐ No ☐ Don't know

23) If you answered "yes" to question 22, is your ARRL affiliated club a Special Service Club?
☐ Yes ☐ No ☐ Don't know

24) I am _____ years old

25) I have been involved with public-service-related Amateur Radio for _____ year(s).

26) My license class is:_____

27) I have been licensed for _____ years.

28) If the League could do one thing to assist you in serving the public more efficiently, what would it be?_____

_____

29) I own equipment that operates in the following modes (list modes):_____

_____

30) I own equipment that operates on:
☐ HF ☐ VHF ☐ UHF

31) Do you hold an appointment within the ARRL Field Organization?
☐ Yes ☐ No

SPOTLIGHT ON SERVICE

The West Virginia Flood

We have all read about hams providing emergency communications during disasters. I have always wondered what it would be like in the midst of one of these situations. In November, it happened. Heavy rains on November 5 caused the most-damaging flood ever recorded in many counties in the eastern part of West Virginia and some areas in Virginia. Pocahontas County, where Green Bank is located, was one of the affected counties. The flood severely damaged parts of the county, although the Green Bank Observatory, which is on higher ground, was spared. Telephone and power services were lost everywhere.

I was on my way to Boston and learned about the severity of the flood when I called back to my office in Charlottesville, Virginia. K2AOE and WB4ZJO told me that the only way they could communicate with Green Bank was via ham radio (80 meters) with WB3DZD, who works for the National Radio Astronomy Observatory in Green Bank. I also learned that a disaster net was established on 3.865 MHz. I checked into the net and realized that the situation was very serious indeed, with 33 counties without any form of normal communications. Requests for medical supplies, food, clothing and bodybags were communicated by hams who already were in some of the areas, and I heard names of places like Green Bank, Cass, Marlinton and Circleville discussed.

At this point, I decided to turn around and head for Green Bank. I had some problems getting into the area; the roads were in bad shape, and one bridge was completely washed away. Fortunately, I know the area quite well (Pocahontas County was my home for seven years) and was able to detour on a few back roads. In Green Bank, I found a tired Rich, WB3DZD, and took over the operations there as he left for some well-deserved sleep. In the afternoon, I went to Marlinton (about 26 miles south of Green Bank), where the damage was most severe, with four people dead, many houses destroyed and most of the downtown stores totally damaged by the flood. On the second floor of the firehouse, I found WB8YJJ, who had moved in from Richwood (about 40 miles west of Marlinton) as soon as the water receded. He was sleeping on the operating table while two recent arrivals, KA8QCC and WD8SAO, manned the station. The station consisted of an FT-757GX with an inverted V on the roof of the firehouse and a 2-meter rig for local work and the Covington repeater (146.805). Everything was powered by car batteries.

After a few hours in Marlinton, it was decided that the Pocahontas County High School would be the distribution center for food, clothing and medical supplies, and I was dispatched to set up a station there. Since I had equipment for both HF and 2 meters installed in my car, I just drove up to the entrance door of the school and started operating from there. I stayed at the high school for about 24 hours (with some sleep during the night when traffic was low). Four hams from Weston, West Virginia, showed up the second day. Two of them, KD8OG and N8FIP, took over the operation at the high school,and two, KA8GSB and WD8EOM, continued north towards Circleville and Franklin where help was sorely needed. I then went back to Marlinton to relieve WB8YJJ and his friends, who wanted to go home to Richwood for a few hours of rest. During all this, a second station had been established in Marlinton by WA3RRG, who handled health-and-welfare messages while WB8YJJ concentrated on emergency traffic. Operations continued along these lines for a couple of days more. When telephone service was reestablished in Pocahontas County, we closed down most of the operations. All HF operations were directed by W8NR in Charleston, West Virginia, who acted untiringly and very skillfully as net control for the whole period. The Covington repeater was used a lot for semi-local work, and 2-meter simplex came in handy.

So, what did I learn from all this? First of all, I was impressed with the efficiency of the 80-meter operation. In many cases when I needed to get in touch with any of the dozen or so disaster locations anywhere in the area, it took no more than 5 to 10 seconds to establish contact on 80 meters. Secondly, I discovered things that probably would never have occurred to me had I not been involved in an "actual" disaster. I learned a few guidelines from other hams who apparently had been through similar situations before: (1) Get in to the area as fast as possible; you are needed most in the beginning when the situation is chaotic. (2) Be transparent and act as a "telephone" only. Don't get involved in the decision-making process. The local authorities, Red Cross, Salvation Army, etc, know much more about disaster management than you do. (3) As soon as "normal" communications are reestablished, consider closing down ham operations. There is a fine line between being the essential communication link and being "in the way." I am not sure I fully appreciate this last point, but it was what the veteran operators felt.

After the Amateur Radio operations closed down, I spent two more days in Marlinton helping a friend dig out and clean his store. I spent a little less than a week in the area and left quite tired. Seeing so many of my old friends who lost and suffered so much became an emotional experience I hope I never have to repeat. However, I also left with a sense of satisfaction that I had been able to provide some help by using Amateur Radio as well as shoveling dirt.—*Hein Hvatum, N4FWA*

IN SERVICE ...

Ashurst Lake, AZ—November 12. KA7PZL, WB7NFX and N7CEE assisted the Coconino County Sheriff's Department during a rescue of two lost hunters during the first severe winter storm of the season. During the search, the sheriff's radios failed, and all communication during the rescue was handled via the KA7TWW repeater on 147.08. (Bruce Grubbs, N7CEE, EC, Coconino County)

Staunton, VA—November 12-19. Many radio amateurs from Virginia were called to assist West Virginia amateurs in handling emergency communications during the heavy floods. On November 12, a link between WD8PBG (Franklin, WV) and WA4E (Bridgewater, VA), who was in contact with the University of Virginia Hospital, arranged for the hospital's emergency helicopter to pick up an injured girl in Franklin and transport her to the hospital in Charlottesville, Virginia.

During the next several days, members of the Valley Amateur Radio Association were among many volunteers who set up HF and 2-meter stations in hard-hit communities such as Franklin, Sugar Grove and Brandywine. Emergency, priority and health-and-welfare traffic originated from these stations and sent throughout the emergency networks in the region and NTS. (William F. Bowman, KA4UFI)

North Adams, MA—November 28. A twin-engine Piper Aztek airplane crashed the evening of November 27 in the Mt Greylock State Reservation, setting off its emergency locating transmitter (ELT). The pilot was found incoherent and wandering around Wednesday evening within the state park and was taken to the hospital.

Civil Air Patrol officials contacted members of the Northern Berkshire ARC early Thanksgiving morning to assist in the search for the plane. WA1ZFK, KS1N, WB1EYL and WB1HIH were assigned to search teams equipped with direction-finding receivers. The search teams maintained contact with W1YBT at CAP headquarters. WA1ZFK and his team located the plane at 10:45 AM and found no persons aboard. The search teams stayed on the scene until the CAP and North Adams Police Department secured the area. (Warner Smith, W1YBT, and Dick Goodman, WB1HIH, SEC WMA)

San Martin, CA—December 11. While driving home from work, Kevin Levonius, NJ6L, saw a house fire. He contacted the fire department using a local ARES repeater and proceeded to the fire scene. Once there, he began a search inside the residence and rescued a 10-year old boy. NJ6L reentered the home on a second search for occupants. Finding no one, he contacted the fire department again to advise them of the boy's condition. (Dave Larton, N6JQJ, EC, City of Gilroy, CA)

ARRL Section Emergency Coordinator Reports December 1985

Thirty-eight SEC reports were received, denoting a total ARES membership of 21,214. Sections reporting were: AB, EMA, ENY, EPA, GA, IA, KS, MDC, ME, MI, MN, MO, NFL, NH, NLI, NNJ, NTX, NV, OH, OK, ONT, ORG, PAC, SC, SCV, SD, SDG, SFL, SK, SJV, SNJ, UT, VA, WI, WMA, WPA, WNY, WV.

Transcontinental Corps December 1985

Area	Successful Functions	% Successful	TCC Function Traffic	Total Traffic
Cycle Two				
TCC Eastern	123	84.2	1112	2301
TCC Central	81	87.0	567	1278
TCC Pacific	109	87.9	1120	2002
Summary	313	86.4	2799	5581
Cycle Four				
TCC Eastern	—	—	—	—
TCC Central	65	90.3	590	1202
TCC Pacific	119	96.0	1270	2540
Summary	184	93.1	1860	3742

TCC Roster

KA1AE N1BHH K1EIC WA1FCD KN1K KT1Q W1QYY KW1U N2IC WA2FJJ N2XJ VE3CDX N3COY KK3F WB3GZU KB3UD AA4AT N4EXQ N4GHI WD4FTK W4JL WA4JTE WB4PNY K4WJR N5AMK N5BB N5BT WB5CIC W5CTZ N5DT W5GHP K5GM W5JOV W5KLV KD5KQ K5OAF K5OU WB5OXE N5TC K5TL K5UPN ND5T W5TFB W5TNT KD5RC W5VMP KB5W KV5X WB5YDD VE6CHK KU6D W6EOT W6INH K6LL K6UYK W6VZT KN7B KA7CPT VE7EIL W7EP KD7EY KB7FE W7GHT NN7H K7HLR KR7L W7LG, W7LYA K7OVK W7TGU KF7R W7VSE WB7WOW KA8CPS K8OZ W8PMJ W8QHB AF8V WB8YDZ W9FC KA9FEZ KW9J WB9UYU AD0A NJ0B KC0D K0EZ KA0EPY W0HI N0IA KJ0G WA0OYI

National Traffic System December 1985

Net	Sess	Tfc	Avg	Rate	% Rep	% Rep to Area
Cycle Two						
Area Nets						
EAN	31	1880	67.30	1.03	96.8	
CAN	31	1878	60.50	1.06	100.0	
PAN*						
Region Nets						
1RN	62	1104	17.80	.595	97.0	100.0

2RN	46	575	12.50	.481	66.8	100.0
3RN	31	545	17.60	.500	97.0	100.0
4RN	62	1421	22.91	.624	82.0	100.0
RN5	62	1410	22.74	.611	92.0	100.0
RN6	53	493	9.30	.420	100.0	
RN7	60	1287	21.50	.583	93.1	
8RN	62	708	11.42	.390	98.4	100.0
9RN	62	974	16.00	.647	96.0	100.0
ECN	—	—	—	—	—	100.0
TEN	62	3363	54.20	1.941	86.6	100.0
TWN	62	787	12.69	.561	84.5	
TCC						
TCC Eastern	123	2301				
TCC Central	81	1278				
TCC Pacific	109	2002				

Cycle Three

Area Net

EAN	31	989	31.90	.920	96.2	

Region Nets

1RN	30	123	4.10	.290	77.0	100.0
2RN	61	387	6.30	.396	69.2	96.6
3RN	30	94	3.13	.299	86.7	73.3
4RN	26	130	5.00	.310	55.0	100.0
8RN						87.0
ECN						93.5

Cycle Four

Area Nets

EAN	31	2287	73.77	1.47	93.0	
CAN	31	1626	52.50	1.35	99.5	
PAN	31	1418	45.70	0.96	97.8	

Region Nets

1RN						83.4
2RN	58	332	5.70	.416	72.1	87.0
3RN	57	277	4.86	.343	90.1	90.3
4RN	62	1104	17.90	.610	100.0	100.0
RN5	62	1087	17.50	.719	87.3	100.0
RN6	62	635	10.20	.720	98.0	100.0
RN7	62	699	11.30	.705	91.7	100.0
8RN	52	510	9.81	.383	80.0	100.0
9RN	62	907	14.63	.665	88.7	100.0
TEN	62	500	8.10	.455	78.4	98.4
ECN	56	409	7.30	.578	86.6	96.8
TWN	61	497	8.14	.442	90.0	100.0
TCC						
TCC Eastern						
TCC Central	65	1202				
TCC Pacific	119	2540				

*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, EPA, GA, IL, IN, KS, LAX, MDC, ME, MI, MN, MO, NC, ND, NE, NFL, NH, NLI, NTX, OH, OK, ONT, OR, ORG, RI, SB, SC, SDG, SFL, SJV, SNJ, STX, TN, UT, VA, VT, WA, WMA, WNY, WPA.

Public Service Honor Roll
December 1985

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 points or more. 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.

206
K7VW
203
KK3F
189
KAØEPY
186
K4SCL
168
N4GHI
163
KB4WT
162
KD8KY
160
NØGCC
154
KA3DLY
152
NG4J
151
KBØZ
143
NJØB
142
W7LRB
141
W9YCV
140
WB2IDS
WF6O
138
K4NLK
137
WB5EPA
134
KB7FE
129
N1AKS
W9CBE
WA2ERT
KA8CPS
128
K2YQK
127
WB4WYG
N4EXQ
125
K6UYK
KA9FFO
KDØCL
W4PIM
124
KA2MYJ
123
WB2EAG
122
AA4HT
KD7ME
121
N1CPX
N4KFU
120
VE3KK
119
AA4AT
KW1U
WB2OWO
WB8RFB
118
W6INH
117
WB1CMQ
AE5I
KA2UBX
116
WA4QXT
WØOYH
WA4JDH
115
K4ZK
W4TAH
KAØARP
KK1A

K5CXP
114
KCØAF
112
WX4H
AF8V
WØIKT
111
WA4PFK
WD8KQC
WB2VUK
WB1GXZ
110
W9JUJ
NK8B
WD8LDY
109
N5AMK
N5DFO
KA8GJV
N3AZW
WA2FJJ
NC9T
108
KJ9J
N1DMU
W4ANK
KT1Q
107
W3YVQ
W7VSE
K2GCE
106
WA4EIC
KT5Y
WA2JBO
105
KB1AF
N8EFB
WB7WOW
W2MTA
104
KF4U
KA8VOZ
103
AG9G
WB4WQL
KC3Y
VE3BDM
NN2H
102
KC4VK
N4KSO
WB8JGW
101
W3FA
K4JST
WBØTED
N1DDC
WD8RHU
W8JMD
K2ZVI
100
WA1FCD
KA1GWE
99
KA4GUS
VE4AJE
98
WD5GKH
KA5SPT
KB5UL
N7FXJ
97
N9BDL
K5UPN
96
VE4RO
VE3DPO
KS5V
KE5YG
95
NI8R
KA1KTH
94
WA4RUE
N6AWH
KA4ERP
WØKK
93
KB9LT
N7BHL
W7GHT
VE3WM
WA4CCK
KØGP
92
KI4YV
K6UXO
KJ3E
NOØA
W5KLV
KA8KHS
KF8J
91
WA6ZUD
WB4ADL
N3COY
KC2TF
KA1KPS
W4CKS
90
WD8PAF
KA4RSC
WB1HIH
89
WB4WII
N4PL
WF4X
VE3GT
WA1YNZ
K3JL
W5CTZ
88
AK1E
WD4KBW
W9DM
87
KA4TLC
NG2T
K5OAF
N1BGW
W5VMP
W9FZW
N8GJO
WB2MCO
86
W2PKY
85
W1PEX
K3NNI
WD8OUO
KA8TNT/T
KG2D
N7BGW
KV5X
84
WB4HRR
KB4OGR
KØSI
W1RWG
WA2KOJ
N8AEH
ND2S
83
ABØY
K2YAI
WA8DHB
82
KK1E
K4JUM
WB6QBZ
W6PW
81
WB8SYA
KB5EK
80
K4MOG
79
N3EGF
VE2EDO
KB4BZA
78
WB4TZR
N6HYM
77
KD4KK
N1BJW
N1CVE
76
KB4LB
KA9RII
NØCLS
WAØTFC
KQ3T
K4VWK
NW4O
WD4ALY
WB5YDD
NE8X
75
WA4EYU
W1TN
VE3KCZ
W9NXG
74
VE4IX
NDØN
WDØBOX
NZ5U
AC5Z
KB1PA
73
KD8RD
WØFRC
WD4NYL
72
WA6WJZ
KA4YHS
WDØGUF
KE6LL
W3DKX
KN1K
KD8IC
WD8KBW
WA6QCA
KA4YEA
WA4RNP
71
NØDZA
70
K9ZBM
WBØWNJ
VE2FMQ
K7OVK
WDØAIT
W9HBI
69
W6PHT
NN4I
68
KA4FZI
W7JMH
NZ5J
W4FMZ
KF7R
67
WA1TBY
NG5O
66
W4HON
KAØBCB
KB3FW
65
K6YD
AIØO
KA7KAI
NT4S
K8JDI
KDØYL
K4ZN
64
KB4IVV
N4JOA
NØBKE
WD8KWC
63
N4JEO
WB9PFZ
NØEBI
KAØODQ
K3RKX
K8ND
WØMZI
KAØKPY
KA8HJK
62
WA4MNR
WD6BZQ
KØPCK
WD8EIB
KA7AID
AE1T
61
KD8WH
W4TYU
N2ABA
W2GJ
AL7W
WB7WVD
ND9V
60
KC3AV
WØOUD
VE3GSQ
VE3FAS
KAØFSM
WA4TVS
KU2N
WA7VTD
57
KA9RNY/T
N2FQP/T
54
N9EQP/T
52
N2EVG/T
W1YOL/T
48
WB4HXS/T
47
KA1HPO/T
46
WD9CVX/T
42
WB1CBP/N
41
N9EJO/T

ND5T 5 545 505 14 1089
WX4H 1 583 493 4 1061
KA8CPS — — — — 1018
N5AMK 1 545 451 3 1000
KA9FEZ 0 487 508 0 995
N4PL 119 356 478 35 988
K4EUK 103 370 483 31 987
W3EKG 2 480 465 18 945
WA4QXT 73 338 465 20 896
WB2IDS 92 351 369 81 893
N4EXQ 18 420 371 68 877
W4NFK 18 402 396 24 840
W1PEX — — — — 876
WBØWNJ 0 384 422 11 817
N3AZW 45 352 368 50 813
K4JST 0 424 387 0 811
WF6O 5 405 355 39 804
WA2HSB 20 392 380 7 799
W8BO 0 376 412 1 789
KT1Q 2 396 376 7 781
WB4ADL 51 358 328 32 769
VE3KK 244 133 325 65 767
N1CPX — — — — 763
W6INH 23 359 347 23 752
VE7BNI 28 248 399 73 748
VE3FAS 1 389 356 1 747
KW1U 4 410 306 18 738
AF8V — — — — 733
KD7ME 10 342 335 21 708
AA4AT 37 327 330 13 707
KN1K 1 389 297 13 701
WA4PFK 44 340 299 15 698
K4ZK 11 332 338 14 695
W7VSE 0 379 309 6 694
NC9T 9 333 332 12 686
N1BGW 33 306 314 28 681
KB9LT 14 348 287 29 678
KØRXK 0 318 13 331 662
NG4J 61 333 224 39 657
N1NH — — — — 652
KB7FE — — — — 649
AA4FG 273 59 292 22 646
NØGCC 5 312 229 95 641
WB2EAG 7 311 282 22 622
K5UPN 44 250 301 33 628
W7AMM 46 267 306 8 627
W1ZHC 15 305 297 6 623
KJ9J 18 387 211 24 620
WØBMA 76 233 283 25 618
AA4HT 141 168 271 28 608
KU6D 10 298 289 9 606
WB4PNY 0 314 290 0 604
VE3GSQ 100 191 296 6 593
WAØAUX 43 151 394 0 588
WB7WOW 2 327 251 4 584
WC4D 191 98 246 37 572
W5KLV 0 273 264 28 565
WB2OWO 53 213 267 30 563
W9HLX — — — — 556
KY1T 116 165 245 1 527
K4SCL 2 245 216 60 523
WA2FJJ 1 266 240 13 520
WB8RFB 2 230 268 18 518
WD8KQC — — — — 517
WB5YDD 2 275 221 17 515
W6PHT 26 255 215 15 511
KF4JA 97 188 206 16 507
N3COY 0 258 246 1 503
K8JDI 0 234 260 6 500

BPL for 100 or more originations plus deliveries:

WØFIR	255
NØBQP	176
KAØEPY	147
WA2YBM	135
VE5BAF	133
KØAJN	129
WA4TGF	288
KK1A	132
KA4UFI	120
WB4TOP	115
WB5OAK	105
WØQBK	103

Brass Pounders League
December 1985

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*
KK3F	13	2440	2318	96	4867
W3CUL	654	1227	1401	133	3415
WAØHJZ	0	1680	31	1016	2727
WD4IIO	764	304	979	60	2107
NZ5U	854	88	942	5	1889
KA4AMC	795	140	1401	18	1788
W3VR	201	429	939	34	1603
NX5V	711	22	721	0	1454
W9JUJ	1	702	717	9	1429
WA4JDH	2	707	624	15	1345
WAØOYI	0	634	672	2	1308
K6UYK	64	557	599	24	1244
WB9YPY	2	709	52	464	1227
N4GHI	47	584	513	67	1211

Independent Nets
December 1985

Net Name	*Sess*	*Tfc*	*Check-ins*
Amateur Radio Telegraph Society	62	876	496
Central Gulf Coast Hurricane Net	31	1442	4072
Clearing House Net	31	530	426
Early Bird Net	31	691	300
Empire Slow Speed Net	31	63	371
Golden Bear Amateur Radio Net	31	216	2069
IMRA	26	1171	1821
Midwest RTTY Net	33	54	257
Mission Trail Net	31	262	937
New England Novice Net	30	32	108
North American Single Sideband	36	252	150
NYSPTEN	30	72	508
Southwest Traffic Net	31	457	1395
West Coast Slow Speed Net	29	75	397
20ISSBN	27	1469	330
75 Meter Interstate SB Net	31	841	1269
7290 Traffic Net	48	2666	1834

Contest Corral

Conducted By Billy Lunt, KR1R
Assistant Contest Manager, ARRL

MARCH

1-2

ARRL International DX Contest, phone, Dec *QST*, page 93.

5

West Coast Qualifying Run, 10-35 WPM, at 0500Z Mar 6 (9 PM PST Mar 5). W6OWP prime, W6ZRJ alternate. Frequencies are approximately 3.590/7.090 MHz. Underline one minute of the highest speed you copied, certify that your copy was made without aid and send to ARRL for grading. Please enclose your full name, call (if any) and complete mailing address. A large SASE will help expedite your award or endorsement.

8

W1AW Qualifying Run, 10-35 WPM at 0300Z Mar 9 (10 PM EST Mar 8). Transmitted simultaneously on 1.818 3.58 7.08 14.07 21.08 28.08 50.08 147.555 MHz. See Mar 5 listing for more details.

8-10

Virginia State QSO Party, Feb *QST*, page 90.

9-10

Wisconsin QSO Party, Feb *QST*, page 90.

15-16

YL ISSB QSO Party, CW, Jan *QST*, page 96.

Bermuda Contest, sponsored by the Radio Society of Bermuda, from 0001Z Mar 15 until 2400Z Mar 16. Operate 36 hours maximum. Off times must be clearly indicated and must be at least 3 hours each. Single operator only. All stations must operate from their own private residence or property. It is recommended that all stations operate barefoot which is in keeping with the spirt of the contest. 80-10 meters, phone and CW. No cross-band or cross-mode QSOs. Exchange signal report and QTH (W stations send state; VE stations send province; UK stations send county; West German stations send DOK number; Bermuda stations send parish). W/VE stations work W. German, UK and Bermuda stations only. A phone contact and a CW contact with the same station on the same band counts for score if the contacts are made at least 30 minutes apart. A multiplier counts only once per band. Count 5 points per QSO and multiply by the number of VP9 stations worked per band. Separate logs for each band and mode. Logs must be received by May 31. Include a dupe sheet if more than 200 contacts were made. Mail to RSB Contest Committee, Box HM275, Hamilton, Bermuda.

Iowa QSO Party, sponsored by the Iowa Section, from 1600Z Mar 15 until 0600Z Mar 16. Work stations once per band and mode. No repeater QSOs. Exchange signal report and county for Iowa stations; Section or country for others. Suggested frequencies are: CW—1.810 3.550 7.050 14.060 21.050 28.050 MHz; phone— 3.875 7.225 14.275 21.325 28.600 50.150 144.200 146.520 MHz. Novice—10 kHz from low ends. Count 1 point for each phone contact; 1.5 points for each CW contact; 3 points for each OSCAR contact. Novices and Techs count 5 points for each QSO. Iowa stations multiply totals by total Sections and total Iowa counties. Others multiply totals by Iowa counties (max 99) worked. Bonus multiplier for each ARRL Iowa Section Official worked (max 8). Awards. Mail logs by Apr 1 to Bob McCaffrey, KØCY, 3913 29th, Des Moines, IA 50310.

20

W1AW Qualifying Run, 10-35 WPM, at 1400Z (9 AM EST) Mar 20. See Mar 5 and 8 listings for more details.

22-23

Tennessee QSO Party, sponsored by the Tennessee Council of ARCs, from 2100Z Mar 22 until 0500Z Mar 23 and 1400Z-2200Z Mar 23. Work stations once per band and mode. Work portables and mobiles again as they change county. No repeater or list QSOs. CW QSOs in CW subbands only. Stations must remain on a band or mode for 10 minutes after making a QSO. Exchange signal report and QTH (county for TN stations; state, province or country for others). Suggested frequencies: CW—1.815 and 50 kHz up from lower band edges; phone—1.860 3.980 7.280 14.280 21.380 28.580; Novice— 3.725 7.125 21.125 28.125. Count 1.5 points per CW QSO and 1 point per phone QSO. TN stations multiply by total states, VE call areas and TN counties (max 95) worked. Others multiply by total TN counties worked. Portables and mobiles add 500 bonus points to total score of each county operated from, excluding home county (min 10 QSOs from each county). Mail logs by May 1 (include a large SASE for results, return of log and/or certificate earned) to Oak Ridge ARC, Mel Wardell, K4PJ, PO Box 489, Oak Ridge, TN 37831.

Spring RTTY Contest, sponsored by the British Amateur Radio Teleprinter Group, from 0200Z Mar 22 until 0200Z Mar 24. Operate 30 hours maximum. Off-times must be no less than three hours each and must be indicated on log. Single operator, multioperator and SWL categories. Work stations once per band, 80-10 meters. Exchange UTC time, signal report and message number starting with 001. Count two points for RTTY QSOs with stations in your country, 10 points for others. Count 200 bonus points for each country worked per band. For final score, add QSO points × (total different DXCC countries + W/VE/VK call areas per band) plus (band countries × 200 × continents). Use a separate log sheet for each band. Mail logs to be received by May 31 to Peter Adams, G6LZB, 464 Whippendell Rd, Watford, Herts, WD1 7PT, England.

29-30

CQ World Wide Prefix Contest, phone, sponsored by *CQ Magazine*, from 0000Z Mar 29 until 2400Z Mar 30 (CW contest, May 24-25). Single ops are allowed a maximum 30 hours operating time; off times must be taken in no more than five periods and must be clearly indicated in the log. Multioperator stations may operate entire 48 hours. Phone only, 160-10 meters (excluding the WARC bands). Categories: single op, all band and single band; QRP (5W output maximum); multiop (multiband only) multi and single transmitter. Multi-singles must remain on a band for at least 10 minutes after making a QSO; multi-multis are allowed only one signal per band. All transmitters must be located within a 500-meter diameter circle or limits of property; no remote stations. Work stations once per band for QSO point credit, but prefix credit may be counted only once. Exchange signal report plus serial number starting with 001. Multi-multis use separate numbers on each band. QSO points: Contacts between stations on different continents count three points on 28, 21 and 14 MHz and six points on 7, 3.5 and 1.8 MHz. For North American stations, contacts between stations in different countries on the NA continent count two points on 28, 21 and 14 MHz and four points on 7, 3.5 and 1.8 MHz. For non-NA stations, contacts with stations in other countries but on the same continent count one point on 28, 21 and 14 MHz and two points on 7, 3.5 and 1.8 MHz. QSOs between stations in the same country count zero points but are permitted for prefix multiplier credit. Multipliers are prefixes, to be counted only once. A prefix is the two or three letter/number combination that forms the first part of an amateur call sign, as in W1, G4, DF3, 8P6, etc. Stations operating outside the call area indicated by their call signs must sign portable. The portable prefix counts as the multiplier; for example, AA1K/3 in Delaware counts as an AA3 multiplier. Final score is total QSO points times sum of prefixes worked. Awards and club competition. Mail logs by May 10 (Jul 10 for CW) to CQ Magazine, WPX Contest, 76 North Broadway, Hicksville, NY 11801.

APRIL

1

West Coast Qualifying Run, 10-35 WPM at 0500Z Apr 2 (9 PM PST Apr 1). See Mar 5 listing for more details.

5-6

GARTG SSTV Contest, Part 1, sponsored by the German AR Teleprinter Group, 0000Z-0800Z Apr 5, 1600Z-2400Z Apr 5 and 0800Z-1600Z Apr 6 (Part 2 will be held Oct 11-12). 3.5, 7, 14, 21 and 28 MHz only. Work stations once per band. Exchange call signs, signal report and serial number. GARTG members also send membership number. Count 10 points per QSO. Multipliers: countries as defined by the WAE and DXCC lists and W/K, VE/VO, JA, PY, VK call areas. Final score = QSO points × multipliers worked per band × continents worked per band. Add 50 bonus points per GARTG member worked. Mail logs to be received within 2 months to Wolfgang Punjer, DL8VX, PO Box 90 11 30, D-2100 Hamburg 90, Fed Rep of Germany.

Connecticut QSO Party, sponsored by the Candlewood ARA, from 2000Z Apr 5 until 0200Z Apr 7, with a rest period from 0500Z to 1200Z. Phone and CW. Exchange signal report, serial number and ARRL Section (county for CT stations). CT stations work DX for QSO points (only one multiplier). Club station W1QI counts 5 points per band/mode. Novice QSOs count 2 points; OSCAR QSOs 3 points. CT stations multiply QSOs by ARRL Sections worked, others multiply by CT counties worked. Suggested frequencies: phone—3.927 7.250 14.296 21.370 28.540 MHz; CW—40 kHz from low end; Novice—3.725 7.125 21.125 28.125 MHz. Certificate to highest scorer in each state, and CT Certificate for working all CT counties. Mail by Apr 30 to CARA, c/o R. Dillon, N2EFA, RFD 7, Noel Ct, Brewster, NY 10509.

12-13

GARTG RTTY Contest, Part 2, sponsored by the German AR Teleprinter Group. VHF, 1200Z-1600Z Apr 12; HF, 0700Z-1100Z Apr 13. VHF and HF are separate contests. Classifications: A—HF over 200-W input, B—HF under 200-W input, C—SWL, D—VHF. Exchange RST, QSO number, name, QTH, QTH locator (for VHF only). After each QSO the station, who called CQ must QSY. HF—3.5 and 7 MHz. Count 1 point per QSO. VHF—144, 432 and 1296 MHz. Count 1 point per 144-MHz QSO, 2 points per 432-MHz QSO, 3 points per 1296-MHz QSO. Final score is total QSO points. Mail logs to be received no later than 20 days after the end of the contest to Wolfgang Punjer, DL8VX, PO Box 90 11 30, D-2100 Hamburg 90, Fed Rep of Germany.

13

W1AW Qualifying Run, 10-35 WPM at 0300Z Apr 14 (10 PM EST Apr 13). See Mar 8 listing for more details.

14

ARRL VHF/UHF Spring Sprints, 144 MHz, from 7 PM until 11 PM local time. (Note: Other Spring Sprint dates are: 220 MHz on Tues, Apr 22; 432 MHz on Wed, Apr 30; 1296 MHz on Thur, May 8; and 50 MHz on Sat, May 17.) Single-operator only. Exchange grid-square locators (see Jan 1983 *QST*, page 49). Signal reports are optional. Count one point per valid QSO. Multiply QSO points by number of different grid squares worked for final score. Contests are separate; there is no accumulation of scores. FM restrictions: Retransmitting either or both stations, or use of repeater frequencies is not permitted. Only these recognized simplex frequencies may be used: 144.90 to 145.10; 146.49, .55 and .58; and 147.42, .45, .48, .51, .54 and .57 MHz. This restriction prohibits use of all repeater frequencies, including 146.76 and .94. Contest entrants may not transmit on repeaters or repeater frequencies on 2 meters for the purpose of soliciting contacts. Use of the national calling frequency, 146.52 MHz, is prohibited. Contestants may not transmit on 146.52 MHz for the purpose of making or soliciting contest QSOs. The intent of this rule is to protect the national calling frequency from contest monopolization. For a valid QSO to occur, call signs and grid-square locators must be exchanged and acknowledged. A station may be worked for credit only once per band, regardless of mode. Crossband QSOs do not count. Stations are allowed only one transmitted signal at any given time. A transmitter used to contact one or more stations may not be used subsequently under any other call sign during the contest (except for family stations for which more than one call sign is assigned to one location by FCC/DOC—and then for family members only). Entries for each contest must be postmarked by June 20. Contests are separate. Mail contest entries in separate envelopes. Submit separate log and summary sheets for each contest entered. Logs must indicate time, call sign and complete exchange for each valid QSO. Multipliers must be clearly marked in the log. Include dupe (cross check) sheets with entries of more than 100 QSOs. Use the official entry forms, available from ARRL HQ for an SASE. Each entrant agrees to be bound by the provisions as well as the intent of this announcement, the regulations of his or her licensing authority and the decisions of the ARRL

Awards Committee. Disqualifications: for excessive duplicate QSOs, call-sign errors or exchange errors. See Jan 1986 *QST*, page 94, for disqualification details.

19-20
QRP ARCI Spring CW Contest

22
ARRL Spring Sprints, 220 MHz.

26-27
Helvetia Contest

27
W1AW Qualifying Run

30
ARRL Spring Sprints, 432 MHz.

Special Events

Conducted By Billy Lunt, KR1R
Assistant Contest Manager, ARRL

Wrightwood, California: WB6FNI will operate from the Jet Propulsion Laboratory's Table Mountain Observatory during **Feb** and **Mar** to commemorate astronomical observations of Halley's Comet. Frequencies and times: CW—7.120 at 0400Z-0500Z; phone—7.228 and 7.249 at 0400Z-1000Z. Certificate and Halley's Comet photo for no. 10 SASE or 5 IRCs via PO Box 576, Wrightwood, CA 92397.

Wales: The Saint David's Day special-event station, GB2SDD, will operate 0000Z-2400Z **Mar 1** to celebrate the National Day of Wales. Operation will be on all bands. QSL via R. R. Jones, GW4HOQ, Bryn-Ynys, 13 Strawberry Pl, Morriston, Swansea, West Glam SA6 7AG, Wales.

San Antonio, Texas: To commemorate the Battle of the Alamo and the Texas Sesquicentennial, a special-event station will operate from the Alamo **Mar 1-2.** Operation will be on 7.235 and 14.280. QSL via Barry Brewer, WA5DTK, PO Box 65, Randolph AFB, TX 78148.

San Antonio, Texas: From Alamo Plaza, next to the Alamo, W5SC will operate 0600Z-0600Z **Mar 2** in celebration of Texas Independence Day. Operation will be in the lower portions of the 10, 15 and 20 General CW and phone bands. Send QSL and no. 10 SASE to W5SC, 90 Brees Blvd, San Antonio, TX 78209.

Fulton, Missouri: The Callaway ARL will operate KSØM 1400Z-2200Z **Mar 9** from the Sir Winston Churchill Memorial to commemorate the Iron Curtain speech "Sinews of Peace," which was delivered at Westminster College in 1946 by Sir Winston Churchill. Frequencies: phone—7.235 14.235 21.310; CW—14.050. Special QSL for SASE to CARL, PO Box 241, Fulton, MO 65251.

Wisconsin: The Greater Rice Lake Contest Club will activate all 72 WI counties during the Wisconsin QSO Party, 1800Z **Mar 9** until 0100Z **Mar 10.** For further information, contact Steve Dubberstein, NA9D, 812 Larsen Ave, Streamwood, IL 60103.

Marysville, California: The Yuba-Sutter ARC will operate K6HDE 1600Z-2400Z **Mar 15** to commemorate the 106th annual Chinese Water God Festival and parade in honor of Bok Kai, the Chinese water god and god of the dark north. Operation will be in the low end of 40 and 20 General phone bands and 147.54-MHz simplex. For certificate, send QSL and SASE to K6HDE, c/o YSARC, PO Box 1169, Yuba City, CA 95992.

Green Center, Indiana: The Fort Wayne RC will operate W9TE 1500Z-2300Z **Mar 15** at the Green Township Community Center to commemorate St Patrick's Day. Frequencies: phone—3.910 7.280 14.285 21.385 28.525; CW—7.105. Certificate via PO Box 15127, Fort Wayne, IN 46885.

Clinton, Ohio: The Buckeye Belle QSO Party will be celebrating their 25th anniversary from 1200Z **Mar 15** until 2200Z **Mar 16.** For a certificate, send an SASE to KA8MPH, 1241 Comet Rd, Clinton, OH 44216.

Munising, Michigan: In celebration of the Alger County Centennial, WD8PAF/KA8VOZ will operate CW 1500Z-1930Z **Mar 15** and SSB 1500Z-1930Z **Mar 16.** Suggested frequencies: CW—3.710 7.110; SSB—3.870 7.280. For a commemorative QSL, send a QSL and an SASE to Alger Centennial Event, WD8PAF/KA8VOZ, Box 274, Munising, MI 49862.

Seattle, Washington: Volunteers from several local ARCs will operate KD7WS to commemorate the 9th annual Northwest Science Fiction Convention (NORWESCON) from 1800Z until 0200Z each day **Mar 20-23.** There will be a speaker and demonstrations to introduce young people to ham radio. Give us a call! Frequencies: phone—bottom 25 kHz of General band; CW—bottom 30 kHz General and Novice bands; RTTY—7.085 14.090 21.090; FM—146.96. Certificate for QSL and SASE to John Hedtke, KD7WS, 8729 Palatine N, Seattle, WA 98103.

Macon, Georgia: The Macon ARC will operate W4BKM from 1500Z until 2200Z **Mar 22** to commemorate the Cherry Blossom Festival. Operation will be phone—14.237 and CW—7.137. For a Cherry Blossom Certificate, send a large SASE to Mona Witherington, N4MPR, 2898 Williamson Dr, Lizella, GA 31052.

Berwick, Pennsylvania: The Columbia-Montour ARC will operate KC3TX 1700Z-2400Z **Mar 22** to commemorate the bicentennial of the city of Berwick. Operation will be in the 40 and 20 General phone bands. Send QSL for nice certificate to CMARC, PO Box 930, Berwick, PA 18603.

Radnor, Pennsylvania: The 25-plus employee/hams of Sun Co, Inc will hold a special Suntennial Amateur Radio Contest on **Mar 22-23.** All bands and modes will be activated. Certificates will be awarded for a contact. For certificate, send QSL to PO Box 326, Radnor, PA 19087.

Cleveland, Tennessee: The Cleveland ARC will operate W4GZX on **Mar 29,** starting at 2300Z to commemorate the first anniversary of their club house. Frequencies: CW—3.700-3.750, 7.125-7.150, 21.100-21.150; SSB—3.825-3.875, 7.225-7.275, 21.300-21.350. Special QSL via Ken Browder, WW4X, c/o Cleveland ARC, PO Box 2692, Cleveland, TN 37311.

New Deadline: The deadline for receipt of items for this column, beginning with the April issue, is the 1st of the second month preceding the publication date. For example, your information would have to reach HQ by Mar 1 to make the May 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.

Strays

REAL-HAM ALERT

☐ How can you spot a real ham? Denton Bromwell, K7OWJ, of Minden, Nevada, gives the telltale signs:

- A real ham is incapable of throwing away a working meter movement, whether he'll ever use it or not.
- A real ham will take his absolutely mint-condition HT-32B to a hamfest and try to sell it for "$249 firm." He will then sell this same transmitter for $18.75 to the 12-year-old neighbor who just got his Novice license because that is all the kid can afford. He will also throw in an expensive coaxial relay at no charge.
- A real ham is slowly collecting parts for at least four projects, one of which has already appeared in the "25 Years Ago" column in *QST*.
- A real ham can pick out a BY prefix that is S1 from underneath six stateside signals running S9 + 20 dB.
- A real ham knows that antennas erected on calm days and during daylight hours will never perform as well as those erected in the dark and during a blizzard.
- A real ham wishes that his tower was at least 10 feet taller.
- Given a choice between Heard Island and Waikiki Beach for a vacation, the real ham will choose Heard Island. He will not understand why other people think this is peculiar.

QST congratulates...

☐ Michael Henderson, N6JFD, of Camarillo, California, on being appointed US National Sales Manager for Amateur Radio Products at Yaesu Electronics Corporation.

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	Sep 1985, p 60
Affiliated-Club Coordinators	May 1985, p 71
Club Contest Rules	Jan 1986, p 94
DX Contest Awards Program	Feb 1986, p 83
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Major ARRL Operating Events and Conventions—1986	Jan 1986, p 61
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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: Roy Ellis, VE6XC. OO: VE6TY. STM/NM/DEC: VE6ABC. Again band condx terrible. Calgary Amateur Radio Emergency Net (CAREN) began 2 meter emergency training on a weekly basis in Calgary under the care of VE6AFO. Bantam A Hockey went well at the end of Dec. Thanks to Ed VE6BOK for setting all up well. Also thanks to the hams in Edmonton for assisting—VE6BKW, VE6AIT, VE6AFF, VE6FB, VE6OG, VE6BBU, VE6BBO, VE6BUR, VE6BEQ, VE6BRO, VE6BOS, VE6BEE, VE6BBS, VE6BTM, VE6BOY, VE6BIA, VE6BJT, VE6BMD, VE6BKE, VE6BOA, VE6BOE, VE6BGJ, VE6BRU, and VE6ABC. Net reports not all in yet. Traffic: VE6BLY 346, VE6CHK 335, VE6CPE 62, VE6CPP 42, VE6AMM 18, VE6ABC 15, VE6EB 6.

BRITISH COLUMBIA: SM, H. Ernie Savage, VE7FB—B.C. Public Service Corps Net. NM VE7DDF Ford. Check-ins, High 176 Low 73 Total 4060. B.C. Emergency Net, no reports; NM went skiing. Burnaby A.R.C. Elections: President, Kirk VE7FKN; Vice, Bob VE7CFK; Secretary Walter VE7FRC. Thanks to Victoria S.W. Club and their FB Zero Beat Magazine. Bill & Doris VE7VR apartment building had a fire and smoked them out. 73. Traffic: VE7BNI 748, VE7CDF 373, VE7FB 145, VE7CGJ 97, VE7EJW 89, VE7XA 63, VE7EDN 51, VE7BNH 38, VE7FME 35, VE7EJU 25, VE7EGM 15, VE7EIR 9, VE7BZI 4.

MANITOBA: SM, Jack Adams, VE4AJE—1985 is now history with many changes in our section leadership. We look forward to an exciting 1986 with CRRL becoming independent of ARRL. Lets all work together to make this league proud. Plan for an exciting weekend at the International Peace Gardens July 12 and 13. This is the date for the International Hamfest. 1986 committee members for Manitoba are Terry, VE4ANR, Kelly, VE4ALO, and the King pin of many years, Dave, VE4XN. Bring your family and prospective ham friends, and enjoy the beautiful campground setting and the generous US of A hosts. Net reports: MEPN:QNI 943, 30 sessions, QTC 16. MWXN:QNI 875, 31 sessions, QTC 71. WPIN: 3 sessions, QNI 170. Only those stations with 25 or more traffic will be reported. Traffic: VE4RO 127, VE4BI 96, VE4AJE 93, VE4AFO 49, VE4TE 34, VE4IX 34, VE4FK 31.

MARITIME-NEWFOUNDLAND: ASM, Aaron Solomon, VE1OC— *Congratulations* to VO1CU & VO1NP on handling Emergency Traffic to FAA Washington and Transport Canada, Ottawa during recent Air Crash at Gander. *Congrats* to VE1CJW on winning Gold Medal at Bulgarian World Exhibition, for Computer Satellite tracking Program. NSVHF Assoc'n. disbanded and NSARA has plans for revitalization including *new VE-1 Call Book*. Changes of Call and QTH, also holders of calls VE1CYA on should contact VE1FQ, Halifax. Applications for NSARA VE-1 *Call Letter Plates* due by 28th. Feb./86. Cape Breton VHF Net now active. VE1BNN, VE1OU and other VE-1 active in ARRL Annual 10 M. Contest. *Hospital*-VE1GG, VE1ABM. *Silent Key*-VE1BZZ. Annual Hfx.-Dartmouth Flea Market/Dinner Dance 30th-31st. May/86. Make reservations now. Tnx es 73.

ONTARIO: SM, Larry Thivierge, VE3GT—BM: VE3LST. PGL: VE3AR. SEC: VE3GV. STM: VE3BDM. TC: VE3EGO. In what is normally our busiest month, December provided some pretty frustrating moments for the Section's traffic handlers as band conditions seemed to deteriorate every evening at sundown. Despite this thourgh BPLs were earned by VE3KK VE3FAS VE3GSQ. After a number of years on the job, net Managers VE3GFN (OLN) and VE3FGU (OQND) are stepping down. Thanks to both for their efforts and hard work. New managers will be named shortly. VE3ICV and VE3MJU are new members of the Ottawa ARC's EMI Committee. VE3HCS is glad to be back on the air with a new IC-745. The Sarnia gang have updated repeater VE3SAR, located just outside of Sarnia, which has resulted in a tremendously expanded coverage. The auotpatch will soon be open to all so take a listen next time you're headed through Sarnia or Lambton County. Not to be outdone, the Chatham-Kent ARC are planning to replace the current VE3KCR machine on 147.12 with a new Micro Control Spec. Mark 4. Many other plans are in the works on behalf of this fine, public service oriented Club. KWARC digipeater VE3KSR/O at Baden is providing a vital link in the path from Windsor-London west to Toronto-eastern Ontario and on. VE3DYE has moved into a new location and is back on the air with a new rig. Regional Municipality of Halton now has the 911 emergency assistance telephone number for services such as fire, police or ambulance. Other 911 systems in the Province are Metro Toronto Hamilton-Wentworth, London, Kapuskasing, Windsor ARC, trying for a Club membership of 100 is up to 83. VE3IHB took first place for Ontario in the 73 Magazine World SSB 160 meter contest. Congratulations to RSO's ONTARS net on their 14th year of operation providing a great service to all on 3.755 MHz. VE3NXG has upgraded to advanced and welcome to new amateur VE3PKK. Traffic: VE3KK 767, VE3FAS 747, VE3GSQ 539, VE3DCX 401, VE3GT 244, VE3FGU 195, VE3KCZ 185, VE3BCZ 164, VE3DPO 144, VE3BDM 107, VE3AWE 97, VE3KXB 61, VE3WM 59, VE3EAM 58, VE3JSM 58, VE3BUO 57, VE3BAJ 30, VE3OER 13, VE3EWD 12, VE3WG 10, VE3WV 7. (Nov.) VE3BCZ 42, VE3BDM 40, VE3KXB 15.

QUEBEC: SM, Harold Moreau, VE2BP—STM: VE2EDO. BM: VE2ALE. PIO: VE2YW. TC: VE2ED. A/TC: VE2CP. NM: VE2EDO. January 1st was the switch over from ARRL to CRRL in Canada, Nov. 1985 issue of *QST* outlined all the important changes. With regret I have to report VE2HDN a Silent Key. Environs 50 stations ont participees au reseau de VE2TA, anime par VE2BIN, au traditionel reseau du jour de l'an. Prompt retablissement a VE2OO. Traffic: VE2EDO 210, VE2BP 62, VE2JN 56, VE2EKC 50, VE2EC 44.

SASKATCHEWAN: SM, W. C. Munday, VE5WM—SEC: VE5CU. EC: VE5AQ, VE5FF, VE5HG, VE5WM. STM: VE5HG. NM: VE5EX, VE5HG, VE5AEJ, VE5AEM, VE5BAF. TC: VE5GF. ATC: VE5XZ. BM: VE5WM. OBS: VE5JA, VE5CU. Congratulations to VE5BAF in handling 237 pieces of traffic which earned him BPL for the month of December. ARES membership is over the 200 mark with the goal of 500 members by April 1986. Remember the new time for the ARES net—1500 UTC Sunday 3780 kHz. Comments to DOC re the proposed restructuring of the Canadian Amateur Radio Service are required by May 1986. Your input is important and required now. Support your local club, SARL and CRRL and help keep amateur radio alive. Traffic: VE5BAF 237.

ATLANTIC DIVISION

DELAWARE: SM, Harold K. Low, WA3WIY—STM: W3DKX. SEC: K3PFW. EC: KC3TI, KC3JM. PIO: WB3DPJ. PSHR: K3JL, W3DKX. Nanticoke ARC is now affiliated. Welcome. The club was involved in Xmas parade, Milford Santa net and Seaford Santa net. Thanks to First State ARC for the very informative newsletter, they will be having third VE Exam in Feb. SARA had Dir. Hugh Turnbull as speaker in Dec. He presented a plaque to W3FKT for 50 years membership. Congrats to KA3OIQ on upgrade to Adv. There will be a Delmarva hamfest Aug. 17, please support it. Please keep me informed. DTN QNI 390 QTC 49 in 23 sessions. DEPN QNI 57 QTC 11 in 4 sessions. SEN QNI 74 QTC 5 in 5 sessions. Traffic: W3QQ 214, W3DKX 55, WB3DUG 44, WA3WIY 28, K3JL 21, K3ZXP 10, KC3JM 10, N3AXH 8, KC3FW 7, KA3IXV 6.

MARYLAND-D.C.: SM, John A. Barolet, KJ3E—We've reported the National Disaster Medical System exercise held here in September as a big ham radio success. STAND BY! A larger simulated disaster centered on Washington, D.C. is scheduled for June 7. ARES, RACES, and NTS types get ready! K3NNI has been appointed Section Traffic manager (STM) for MDC; he is into traffic handling with CW, voice, and digital modes. His task is to integrate and coordinate the various traffic and emergency nets in the section. Speaking of traffic nets and traffic handling: the Maryland slow Net (MSN) sponsored by the Anne Arundel Radio Club has become famous throughout half the country, training taffic handlers even in W0 land and the Dominican Republic. KC3Y, present manager, and KC3AV, the previous manager, successfully steered MSN through outstanding 1984 and 1985 years. The net meets daily at 7:30 PM local time on 3717 kHz and operates near 10 wpm. A complete on-the-air training course is provided. Join them! Other appointments: N3AJJ, EC for Cecil County; WA3VPL, ORS and OES. The Baltimore Radio Amateur Television Society (BRATS) has become an ARRL-affiliated Club. The Baltimore ARC (BARC) was active in December with mali traffic and marathon-supporting communcations, reported by W3YVQ. N3EGE has been using KJ3E's printer to print packet files; net result, KJ3E got the packet bug. The Four State Net, based in Hagerstown, meets at 7:00PM local time, Thursday, on the 147.09 MHz repeater. K3UMV is the manager. The Bowie ARC is administratively supporting their seriously-ill member WA3EUI. The Baltimore ARC and the Columbia ARA have scholarships for Maryland-resident amateur radio operators, W3ABC reports. Also, W3ABC has a number of amateur radio-related films and video tapes suitable for club programs. Write him for details on scholarships and films. N3RO continually sends excellent OBS reports. WB3KJT had a rough month—his HF transceiver and 2-meter handheld quit. I regret to report that W3OU of Edgewater died in a boating accident on December 18. With the Nets: Net/Manager sessions/manager/average checkins: MDD/W3FA 62/418/10. MEPN/WA2ERT 30/218/29, MSN/KC3Y 31/78/14, WRPON/WB3BFK 22/28/14, FREDCARES/K3RXD 5/11/14, MDCPON/W3OYY 4/7/20, WC2MN/KC3DW 4/0/20. PSHR: KK3F 192, WA2ERT 129, W3YVQ 107, KC3Y 103, W3FA 101, KJ3E 92, K3NNI 85, N3EGF 79, K3RXD 63, KC3AV 60. Traffic: KK3F 4867, KC3DW 383, KC3Y 279, KJ3E 248, W3YVQ 183, WA2ERT 172, K3NNI 141, W3FA 100, N3EGF 94, K3MR 66, W3LDD 64, WB3BFK 53, KX3U 51, W3DQI 46, KC3AV 39, W3ZNW 35, K3RXK 33, WA2WOT 31, N3DE 28, WA3VPL 24, W3FZV 21, KC3NS 15, KC3TS 14, KA3IID 8, WB3FUE 6.

SOUTHERN NEW JERSEY: SM, Richard Baier, WA2HEB—SEC: K2QIJ. STM: WB2UVB. ACC: K2IXE. TC: VACANT. PIO: VACANT. SGL: KA2KMU. BM: WB2UVB. OOC: WA2HEB. ATCs: N2BQT and K2JF. Per minute 36 of the July, 1985 ARRL board meeting, "Individuals so designated by Special Service Clubs be permitted to certify and issue" the Worked All States (WAS), 5 Band Worked All States and the VHF/UHF Century Club awards. Today I am very pleased to announce that the Gloucester County ARC has taken the plunge and WILL process your cards for verification of these awards. For these awards SPECIFICALLY, you will not have to send your valuable cards to Newington anymore—only to Pitman, NJ. Further, I understand that GCARC is planning to set up an area at their very popular hamfest in August for verifying cards for these awards, so you won't have to trust the mail with your cards, if you can wait until August. If you wish further information about this new program, contact GCARC at P.O. Box 370, Pitman, NJ 08071. 73 CU next month. Traffic: W2IML 116, NG2T 116, WA4JRP 14, WA2HEB 8, W2IU 1. (Nov.) WB2UVB 148, K2SB 55, KA2COX 19, WA2MGV 14, WA4JRP 10.

WESTERN NEW YORK: SM, William W. Thompson, W2MTA—December was an active month in WNY. BPL to WA2FJJ WA2HSB WB2IDS WB2OWO with near miss by VE2FMQ! 1986 will start off with KB2KW as new Section Emergency Coordinator for A.R.E.S. (Chuck will also be host for the LO meeting on April 5). PSHR: N2ABA KG2D N2EVG WA2FJJ VE2FMQ N2FQP W2GJ NN2H WB2IDS WA2KOJ W2MTA KU2N WB2OWO ND2S KA2UBX K2YAI. Appointments: (ATC) W2AWB KK2B; (OES) W2BCH; (SEC) KB2KW. Club Officers: ARATS-W2VCI KA2JHO K2UD K2QB: BARA-N2BLX WA3WKA NE2W WB2SGS; BRVARC-W2AWB WA2OEP N2CKT; Fulton-KA2RRY WA2LBG N2AWS KC2QV WB2WMB; LARC-WA2MQM W2GLN KA2DVV WB2YGN NA2C WA2KFV; Rome-N2FAO K2GVI KA2TSC KC2RN KA2JXA NI2U; SVARA-WA2ZSC KB2KW N2BLX WA2KUT; Tompkins-KD2IM AF2A N2FSD W2CFP; Utica-WA2AZA NA2A KK2B WB2JNV. OBS reports: WB2DSR WA2ZPE.

NYS/M*3677	358-326-31	NYS/E*3677	362-305-31
WDN/M*04/84	401-156-31	JCARCN 10/70	402-006-30
Mike Farad	228-115-31	Lewis ARES	055-000-05
NYPON*3913	716-558-31	OARCN 25/85	047-001-04
NYSPTEN 3925	508-072-30	BRVSN .655	359-005-31
ESS CW 3590	372-063-31	CNYTN*90/30	266-098-30
OCTEN/E*.94	631-126-31	OCTEN/L*.88	267-038-31
Q Net 31/91	330-005-31	Mohawk VTN	034-040-08
STAR* 13/73	STARTS JAN	STAR* 99/39	006-001-05
WDN/E*57/17	547-266-31	WDN/L*04/64	522-197-31
Blue Line.33	249-041-27	NYS/L*3677	251-176-31
CVARCSEN.15	109-003-05 (Nov)	CVARCSEN	073-002-04

*NTS Net. Packet going strong on 145.01-02-03, should prove valuable for ARES and Pipelines in future . . . Southern Tier SET exercise showed the way, get in on the fun . . . you don't have to be a "hacker"! Contact W2DUC K2GVI KB2KW W2GJ NE2W or others in PACKET to learn more. Send along your accomplishments for this column! HAMFEST CALENDAR Owego STARC 3 May; Rochester 17-18 May; Rome 1 June. Hoping for new club affiliates around East Aurora, Homer, Java Center, Rochester and Roxbury and others! WNY well represented at '85 Scout Jamboree . . . MNI TNX to WA2FQA WB2JWD KA2MLG! CONGRATS: Rochester ARA "Excellent" rating for RARA RAG by the A.R.N.S.! Five counties have Assistant TC's now, does your county/club have one? Nine counties have Public Information Assistants now, does yours? TC K2QR and PIO WA2PUU are looking for "a few good" ham leaders. Next Atlantic Division Cabinet meeting in mid-April, send your suggestions, gripes and praise to W2MTA. Have a green Spring! It's time for the antenna overhaul! Traffic: WB2IDS 893, WA2HSB 799, WB2OWO 563, WA2FJJ 520, VE2FMQ 471, W2MTA 426, KA2UBX 292, ND2S 252, KU2N 187, NN2H 177, KG2D 162, WA2KOJ 151, N2EVG 141, KA2DBD 136, WB2QIX 129, K2YAI 105, N2ABA 90, W2UYE 84, AF2K 68, N2FQP 64, W2GJ 59, WA2SMZ 51, W2PPS 38, W2FR 35, W2HYM 28, W2PHQ 10, WA2RXO 10, K2IUT 7, WB2NAO 4, WA2OEP 4, KC2SJ 3. (Nov.) K2VR 23, W2PHQ 4.

WESTERN PENNSYLVANIA: SM, Otto L. Schuler, K3SMB—STM & ASM: WN3VAW. SEC: WA3UFN. OO Coor: KJ3Q. PIO: WB3IZJ. SGL: K3HWL. TC: K3LR. BM: KR3P. ACC: AK3J.

Net	QNI	QTC	Sess.	kHz	T/D	Man.
WPACW	248	159	31	3585	7:00P	WA3UNX
WPAPTN	515	207	31	3983	9:00P	WA3HLN
WPA2MTN	477	161	31	146.28/88	8:00P	KA3BGC
NWPA2MTN	566	9	31	145.13/53	1499Z	KC3NY
PFN	247	254	31	3958	5:00P	WA3THT

I want to congratulate W3EGK for her time spent handling traffic she is usually on top of the list in the WPA Section, again with 945 pieces handled. She is and has been BPL several times. This month our tfc stations handled very much tfc. We need more to help. Perhaps we can get stations with Packet radio equipment to establish a net over the section this would be an ideal way to get traffic to various areas and then put it on local repeaters. The problems on 75 and 80 have been very bad and not too good for our nets. The Steel City ARC has a new Digipeater. N3AES, N3CZW and others are set up for Packet, if you are please let me know. The WPA section is quite large and it would be very good to have this info. Steel City Officers for 1986 are Pres. W3IOH, V.P. KA3ITM, Treas. AK3J, Rec. Sec. KA3KSD, Cor. Sec. W3UUH, Fort Armstrong WA Pres. KN3ZAN, V.P. W3ZCS, Treas. K3JVJ, Indiana ARC Pres. KA3IYT, V.P. N3EHO, Sec/Treas. W3FVU. Board KA3HJA, KA3MBC, W5UA, K3TOM, WB3EUQ and KA3JGN. I have a list of Pittsburgh area VEC examination points as sent by KT3L. It has dates until Oct. 1986. I'll be glad to send a copy for an SASE. Traffic: W3EGK 945, KQ3T 383, W3OKN 252, N3EMD 235, WA3UNX 113, N3FM 102, W3NGO 98, KA3ETC 96, W3KMZ 95, WN3VAW 84, WA3DBW 67, KQ3M 63, W3RUL 59, W3KUN 55, K3NPW 52, WA3QNT 48, K3SMB 48, WB3GUK 33, N3COX 21, N3EKJ 17, K3LTV 15, KC3JQ 12, KB3NV 5, N3CZW 5. (Nov.) KA3ETC 64, WB3GUK 2.

CENTRAL DIVISION

ILLINOIS: SM, David E. Lattan, WD9EBQ—SEC: W9QBH. STM: KB9X. OOC: W9TT. BM: K9ZDN. SGL: W9KPT. PIO: K9IDQ. ACC: WB9SFT. TC: N9RF. ASM: K9ORP. CONGRATS to KA9FEZ, NC9T, W9HLX, and WB8RFB all of whom made BPL this month. Do it together . . . W9LNQ and his YL N9ALC have been very active in the VE program through the training classes held by HAMFESTERS RC in Chicago. The future of Amateur Radio as we know it is in the hands of those who are willing to take the time to help others get started in our hobby. Each of us can no doubt point to one individual, without whose help we might not have gotten the ticket. Goal for 86 and beyond . . . each one bring in a new one each year. Surely each of us can think of one nonham we know who is a 'prospect.' OOC W9TT and TC N9RF got together to discuss those parts of their areas that overlap. One result may be a computer program from RF that will be a database tool for OO monitoring. N9RF also gave a presentation on TVI in December, this time to the Elgin RC. As of this month, ISN and early ILN are still both one half hour earlier than scheduled times due to poor band condx. If you can't find the nets, try looking a half hour early. By the time this prints, we may be back to normal. December saw further efforts on the SEC relocation front, with much work being done over the Christmas holidays. The end of next month should bring the return of 'normalcy' to W9QBH's office. PIAs and club officers . . . please be sure to send reports and copies of any media coverage of your local events and emergency operations to PIO K9IDQ as well as QBH and HQ. Traffic: KA9FEZ 995, NC9T 686, W9HLX 556, WB8RFB 518, K9BVE 387, W9LWH 204, W9HBI 203, W9NXG 155, KD9K 100, KA9BBV 95, W9HOT 92, W9EHS 74, W9KR 69, ND9V 58, W9DBO 35, W9KPI 25, K9DQU 24, W9LNQ 18, W9RTD 16, WA9RUM 16, W9LDU 15, N9EWT 14, W9VEY/M 13, WB9TVD 13, K9WMP 12, N9ELU 12, KW9X 8, WA9SID 8, KA9UFU 2.

INDIANA: SM, Bruce Woodward, W9UMH—SEC: WB9ZQE. STM: W9JUJ. SACC: K9TUS. STC: K9PS. SGLC: WA9VQO. SOBC: KC9TA. SPIO: K9DIY. SRC: N9WB. SOOC: KJ9G. Net managers: ITN KD9DU, QIN KJ9J, ICN KW9D, IRN N9ASR, VHF W9PMT, IWN KA9ERC. December Net Reports:

Net	Freq.	Time Daily UCT	QNI	QTC	QTR	Sess.
ITN	3910	1330/2130/2300	3793	861	3481	93
QIN	3656	1430/0000/0300	525	802	2389	93
ICN	3705	2315	81	20	515	24


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2210 Livingston St.,
(415) 534-5757: Don, Mgr. N6IPE
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5375 Kearny Villa Rd.
(619) 560-4900: Glenn, Mgr. K6NA
Hwy. 163 & Claremont Mesa Blvd.
PHOENIX, AZ 85015
1702 W. Camelback Rd.
(602) 242-3515: Bob, K7RDH
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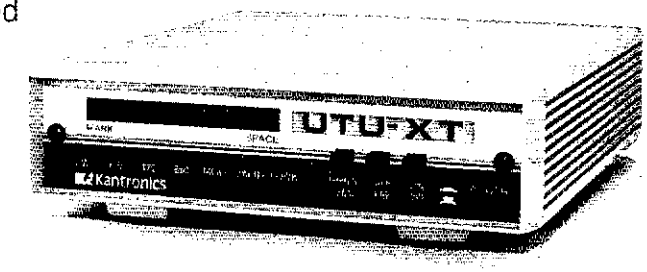

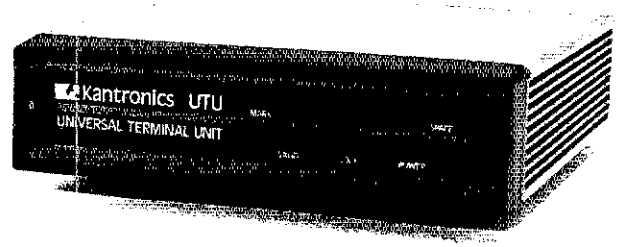

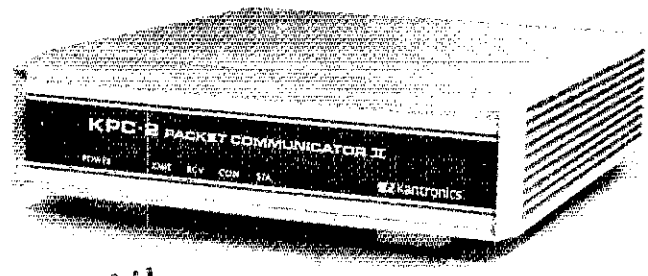

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IWN	VNF	Bloomington	1023	0	310	31
IWN	NHF	Kokomo	1172	0	226	31

Hoosier VHF Nets for December QNI 6329, QTC 218, Bulletins 82, QTR 6211 in 228 sessions for 23 nets. D9RN 974 messages in 1505 minutes. IN 94% Stns. K9CGS W9JUJ N9DWU KA9EIV KB9NR WD9HII KC8XE. CAND 1878 messages in 31 sessions. D9RN 100%. Stns. N9DWU, W9JUJ, K9CGS. 9RN Cycle 4 Report for November QNI 352, QTC 449, PTR 1139 in 58 sessions. IN 100% Stns. W9FC, N9HZ, KJ9J, W9JUJ, WB9OFG, WA9OCF, WB9UYU, K9WWJ. Silent Keys: W9CLX Angola, K9KPC Danville, K9GDB South Bend, and KB9EZ Parker City. The Indiana RTTY Net has a new manager N9ASR and a time change to 00:30Z. Due to a conflict with the Ohio Novice Net, the ICN has moved to 3705 at 23:15. After about 7 trips to the dentist and 3 trips to the plastic surgeon my wife has recovered. She wishes to thank those who sent cards and words of encourgement. Congratulations to the Hancock ARC for their first Christmas Hamfest. It was enjoyable and looked like a success. Congratulations to the Clark County ARC on their annual Special Events Station from Bethleham Indiana, and to Fort Wayne amateurs for Santa's annual visit to the Fort Wayne Hospitals. Our best wishes for a speedy recovery to KA9PSA XYL of K9IIE. Congratulations to WA9LDE OPARC Ham of the Year and KA9KRE Tri-State ARC Ham of the Year. Traffic: W9JUJ 1429, KJ9J 820, W9JZV 210, N9AEI 206, K9WWJ 205, W9CNE 185, W9FC 154, WD9DWD 140, KA9EFO 133, WA9QCF 133, WB9UYU 121, KB9HH 116, WA9YIF 98, KC8XE 89, WD9HII 71, N9DYC 68, WB9OZZ 63, N9HZ 56, KA9EIV 55, KW9C 54, KB9NR 53, WB9AWI 47, W9UMH 45, KD9ER 40, WB9MDS 40, WB9PFZ 38, W9PMT 38, K9TKE 37, W9BTZ 37, K9DFK 35, WB9IHR 34, KA9RNY 31, WA9OKK 30, KW9D 28, K9KTB 24, K9FHQ 23, WB9OFG 23, W9ZGC 22, WA9JNC 21, N9DHX 18, K9PS 17, K9GBR 17, K9BRF 15, KJ9G 14, K9ZBM 14, W9OZJ 13, KA9KRE 10, KD9CC 8, K9DIY 6, KK9N 6, K9OUP 5, W9RTH 5, W9XD 4, K9SBW 4, KA9LAU 4, WD9CIV 4, W9KMY 3, K9JDF 3, W9BDP 3, W9EI 2, W9EHY 2, KB9DE 1.

WISCONSIN: SM, Richard R. Regent, K9GDF—SEC: W9OAK. STM: K9UTQ. ACC: KA9FOZ. BM: WB9JSW. OOC: NC9G. PIO: K9ZZ. SGL: AG9V. TC: K9GDF. Did you just skip reading the list of eight Leadership Appointees? These trained Wisconsin specialists are eager to help you to benefit from your ARRL membership or to insure you have fun in Ham Radio; ask me about the duties behind their titles in case you forgot. New ATCs are W9RYA, K9EVH and WB9EQA; all willing to help with your technical questions or RFI problems. Greetings to new NM of the North Woods Traffic Net, KA9SKU, who has replaced Carl, W9JSF. Carl increased traffic and checkins during his year as NM, thanks for the hard work. Wisconsin Slow Speed Net Manager, N9BDL, will send a beautiful computer-generated certificate for checking into the net, try any evening at 6:30 PM on 3645 kHz. Careful monitoring heard WA9ZTY on WIN/E. Packet radio adds WB9NNJ and WB9SMM to the list of Wisconsin packeteers. For packet information and newsletter contact Wisconsin Amateur Packet Radio Association, POB 1215, Fond du Lac, WI 54935. Clubs: as you schedule your hamfest and events for 1986-87, please send me a note so that I can include the correct date in this column and can tell others that ask for that information. Volunteer Examination sponsors are reminded to promptly let the *Badger State Smoke Signals* know of your exam schedule. The *BSSS* newsletter does all of us a service by publishing a current exam list; contact K9ZZ or K9EN for the details. New officers Mancorad RC: Rod Pajula, Pres.; WB9RJB, V.P.; W9BZV, Treas.; WB9OBX, Sec. North American Teleconference Radio Net on Milwaukee 145.13 repeater had 77 checkins and many more were listening. March 8th, Milwaukee School of Engineering RG Swapfest at 1121 N. Milwaukee St.; March 9th, Wisconsin QSO Party starts at noon; and March 16th, Tri-County ARC Hamfest at Jefferson County Fairgrounds. *Be grateful for luck, but don't count on it.* Traffic: WB9YPY 1227, KA9RII 384, N9BGE 364, W9CBE 303, WA9WYS 299, WD9IID 298, W9YCV 292, K9GDF 186, N9AUG 161, KA9BHL 136, W9UCI 130, WB9ICH 101, W9ODV 98, W9DND 90, W9JSF 86, N9BDL 85, N9DHT 81, N9EJO 76, N9BCX 67, AG9G 67, K9UTQ 59, WB9ESM 57, WD9DNQ 50, N9EQP/T 35, KA9JJY/T 33, KA9BHK/T 3. (Nov.) WB9YPY 1402, WD9FRI 141, W9DND 81, W9JSF 79, N9DHT 68.

DAKOTA DIVISION

MINNESOTA: SM, George Frederickson Jr., KCØT—SEC: KAØARP. STM: KDØCI. TECHNICAL COORD: KØLSE. PUBLIC INFO OFFICER: NØBEI. OO/RFI: ADØS. STATE GOV'T LIAISON: WØWDW. AFFILIATED CLUB COORD: KBØRZ. BULLETINS MGR: KBØMB. Hello again. Please take note of the section leadership positions above as they will be listed in their entirety every six months. Updates will be made in this column as changes occur. Our club salute for this month goes to the Paul Bunyan Wireless Assn. This group of amateurs is a very diversities organization. ADØS is Coordinator and founder of PBWA which now has 27 active members. It is a special Service Club and participates in a wide range of activities. Club President is Rick Payne, KCØYG. Club historian is KXØV who was very conspicuous by his absence at the annual Christmas Party and owns the club record for awards... just don't ask him what kind of awards! Keep up the fine work! Our "Amateur of the Month" award for December went to Arthur Putt, KDØCL. Our heartiest congrats to Lucy Lackore, NØCLS for being named 1985 Minnesota Amateur of the year. She's a very deserving recipient who works hard all year in the public service, and does so entusiastically. NET NEWS: 75 Meter nets are really battling against terrible conditions from early evening on. Relays are often counted on to get messages through. I hope everyone will be patient during this period. KØOGI is the new EC for Mille Lacs County. WØEHI has been ill and we wish him a speedy recovery. He has been missed on the WC nets where he has been a workhorse for many years. The 147.03 rptr in Brainerd now carries the call KØQIH. We regret the passing of Robert Power, formerly of Backus ex-WØTUS, most recently W6MRT. Bob was very active on the old Minnesota phone Net back in the AM days. "Amateur of the Month" to either KCØT, KAØARP or myself for consideration. Refer to March 1985 *QST* for details on this program. 73 de KDØCI.

NET	FREQ	TIME	QNI/QTC/SESS	MGR
MSN/1	3685	6:30	300/132/31	KAØEPY
MSN/2	3685	10:00P	28/49/31	NCØE
MSSN	3710	6:00P	193/14/30	KAØODQ
MSN/RTTY	3620	7:00P	39/2/10	WAØLUT
MSPN/N	3929	12:00P	530/262/31	WBØWNJ
MSPN/E	929	5:30P	1070/252/31	WDØBGS
MNAMWXNT	3929	6:15P	256/151/25	KAØIZA

PICONET 925 9:00A 4589/418/165 WDØBAC MINN EMERGENCY FREQ: 3929. BULLETINS: 3685 & 3929 MN/MSO: 3620 Tues & Thur 5-7 PM, Sat & Sun 8-12 AM. TRAFFIC: WBØWNJ 817, KAØEPY 472, WAØTFC 431, KDØCL 256, WØUCE 138, NØBEI 111, NØCLS 110, WDØHDD 99, W9DM 95, KØHJC 80, KAØARP 72, KAØPQW 61, KAØODQ 50, NIØX 47, WAØONE 46, KCØT 46, WDØBGS 43, KDØCI 42, WØGRW 40, KØCVD 32, KAØAJF 31, WDØGUF 31, NØEWA 30, WØHZU 29, NØJP 27, KTØR 27, KØOGI 25, WØZSW 25, KBØCD 19, WAØCEL 19, NEØD 17, KAØBFP 13, KAØP 13, KAØCDC 9, WAØONJ 7, KBØWV 7, WAØMJF 4, NØFKU 2.

NORTH DAKOTA: SM, Michael Mankey, WBØTEE—Success in Devil's Lake best describes the recent testing session. Upgrades: KAØVNN-advanced; KAØVHW-tech.; KAØUMV-general; KAØSLH-tech.; KAØFIN-gen. KAØVOJ-tech. and KAØLIL-advanced. Congratulations to all and good luck. With five new techs, I am sure that the repeater activity will pick up in the future in the Carrington area. Thanks to the efforts of WDØATI & WDØEUV and many rotating instructors classes have again begun in the Bismarck area. It is time once again to start thinking about SKYWARN. Please contact NWS office in your area for scheduling your groups training. Remember it is on a first come bases. Remember DATA Net 6:30 PM CST, 3883 KHz. 73's Mike. Net Summary for December.

Net	Freq	Mgr	Sess.	QNI	QTC
GOOSE RIVER	1990	WØCDO	5	152	115
ND WX NET	3883	WAØRWM	28	192	100
DATA	3883	KAØFSM	25	331	16
NORTH FORTY	04/64	NØGHA	5	46	0

Traffic: KAØFSM 48.

SOUTH DAKOTA: SM, Roland Cory, WØYMB—Ole Johnson, NØABE, STM & Bob Olson WAØFPR, ASST SM. All amateur radio clubs are urged to send me copies of their newletters. It's the best way I can keep informed about your activities. My sincere thanks to those whose suggestions and comments have greatly helped me concerning the column. WØPUF, AAØF, NØCPY, and WB4QHM using packet in the Black Hills area. Like to hear from anyone else using packet around the state. Which club is going to sponsor the state ham picnic this summer? KCØAF 110, NØABE 14, KØZBJ 50, KDØYL 7, WØYMB 14, KAØKPY 14, WBØOMF 33, WØMZI 39, WØHOJ 7, WAØVRE 76, KØERM 52, WAØUEN 61.

DELTA DIVISION

ARKANSAS: SM, Joel M. Harrison, WB5IGF—STM: W9OK. SEC: N5BPU. ACC: NI5D. TC: W5FD. BM: W5HYW. ASM: K5UR. SGL: W5LCI. REPEATER COORDINATOR: WB5FDP. 1986 Officers for the Northwest Arkansas Amateur Radio Club: Pres WA5NRT, V.P. N5HAP Sec KA5RFC, Treas KA5BML, Repeater Chairman W4RHD. Congratulations to the Faulkner County Amateur Radio Club on becoming an affiliate with ARRL. The Arkansas Hamfest and ARRL State Convention will be April 12 and 13 in Little Rock. Contact Dale Temple, W5RXU, in Little Rock for more information. We want your club active in the Arkansas Sesquicentennial. NI5D is coordinating the planned activities and wants to hear from you. Arkansas Weather Net: 146.34/94 and 3995 kHz when needed. Traffic: W5QFU 102, W5RIT 58, W5UAU 28, W9OK 24, WB5IGF 12, AC5W 10, K5MEA 8.

LOUISIANA: SM, John "Wondy" Wondergem, K5KR—Congratulations to the Baton Rouge Amateur Radio Club for being officially designated as an ARRL Special Service Club. Through the work of its members, this club was recognized by ARRL for its extended efforts on behalf of Amateur Radio and service to the community. West La. ARC election of officers: Pres: WB5JZQ. V.P.: N5HRO. Tres: N5GSK. Sec: N5CAH. The club, now 1 yr. old has grown to 40 members. The Baton Rouge QCWA Chapter 109 recently honored the following three lifetime members with certificates and pins: Vince-W5KC for 65 yrs. of licensing. "Doc"-W5DQ for 65 yrs. of licensing. Shirley-W5AXG for 60 yrs. of licensing. Congrats to these real "Old Timers" for their long participation in Amateur Radio. Their election of officers for a 2 yr term: Pres: El-W5MD, V.P. Bill-W5URR. Sec/Treas: Warren-K5DVQ. Directors: Kirk-W5KYC & Al-W5OVV. Historian: George-W5LUX. The Louisiana Council of Amateur Radio Clubs (LCARC) 1985 membership of 33 organizations was an all time record. The next official meeting will be at the Lafayette Hamfest in March 86. All are invited to the meeting. See you there. Traffic: DRN-5 1410 msg. 62 sessions. La. 95% with W5GHP, WA5LHL, K5WOD, WA5WBZ, WA5V, WD5NCM, WA5DEV & N5HJE.

MISSISSIPPI: SM, Paul Kemp, KW5T—ASM: K5QNE. SEC: AL7GQ. VHF Coord: N5DWU. ACC: KC5VD. STM: KB5W. PIO: KA5VBE. BM: AJØX. TC: WB5SXK. OOC: W5VMC. Make plans NOW for Jackson Hamfest April 19-20. Hattiesburg's 145.37 repeater now fully operational, complete with emergency power and autopatch. Hattiesburg ARCs 147.36 machine back at 250-ft. site following repair of lightning damage. Congrats to whole slew of new club officers: Laurel ARC—W5VKR, pres.; KF5AU, vp; N5IKA, secy-treas. Neshoba ARC—WC5V, pres.; WA5VFP, vp; KA5PEN, secy.; N5EPP, treas. Vicksburg ARC—WB5SXK, pres.; N5IEN and WC5J, vps; N5EZX, secy-treas.; NZ5Z prop offcr. Regretfully announce K5DA is now Silent Key. Congratulations to Vicksburg ARC on certification as Special Services Club (has YOUR club looked at this worthwhile program?). Hattiesburg ARC hosted joint dinner meeting with Laurel ARC for annual report from Delta Division Director W5CH. New appointment: KA5PEN, PIA for Neshoba ARC. CLUB OFFICERS: Your organization's activities deserve recognition; please keep the ASM or PIO informed! Reminder: bad weather soon will be upon us . . . get your emergency gear and procedures ready for quick response if you're needed. Laurel ARC has new solid state repeater on 146.61. VHF/UHF activity growing rapidly with second 6 meter repeater in works at Laurel and reports of at least two new 440 machines imminent in South Mississippi. CAND (W5KLV) sess 31 QTC 1878. DRN5 (WB5YDD) sess 31 QTC 62. MSBN (W5HKW) sess 31 QNI 2165 QTC 85. MTN (K5OAF) sess 31 QNI 131 QTC 61. MMN (KF5GK) sess 31 QNI 576 QTC 8. MSN (N5AMK) sess 31 QNI 93 QTC 7. MLEN (WO5O) sess 5 QNI 134 QTC 0. CAEN (NF5Q) sess 5 QNI 136 QTC 3. HAEN (KA5HOA) sess 5 QNI 60 QTC 0. Traffic: N5AMK 1000, KB5W 453, K5OAF 347, KT5Z 187, W5WZ 55.

TENNESSEE: SM, John C. Brown, NO4Q—ASM/ACC: WA4GLS, OO/AA: W9FZW. PIO: N7EJI. SEC: WA4GZQ. SGL: WA4GZZ. STM: NG4J. TC: W4HHK. Word has just arrived stating that your PIO has upgraded to the advanced class from technician. Congrats to him and now we will be expecting him on the phone bands and nets so that items of information can be passed or noted. Word is starting to come in on the swap and hamfests. A new one

is scheduled for April 13, Clarksville. Please note that on the activity schedule for the year. The packet-radio activity is starting to roll in the section. It appears that we need to get it together for the whole section under one control manager(s). Need to get some word as to how it should go and be managed. What do you say? Your section manager has made several contacts with our Delta Division Director about getting more appointments from the section. I have made some nominations to this end and as soon as the results are known, it will be made public. Those nominated are considered to be well qualified for the positions. There are several positions open in the section like net controls, official observer, assistant technical coordinator and emergency coordinator. How about getting in contact with one of the section staff and volunteering for one of the positions. Don't leave all the work and coordination to a few. We would like to hear from you and have you join the team. KA4UVR has been made the assistant net manager for the evening section of the Tenn phone net. He is doing one fine job and welcome aboard John. The band has been going out and it takes the added effort of many to get the job done. This has also caused a big drop in the activity for the evening net. Stay in there, it will get better soon. Hope all you people out there will try to gear your activity to add to the data now available about meteor-scatter communications. The section traffic for the period is as follows: LF nets Sessions 73, QNI 3691, QTC 107 (some reports missing); VHF Sessions 51, QNI 1126, QTC 453; CW Sessions 40, QNI 190, QTC 56. Traffic: NG4J 657, NG4J (last month) 536, K4WWQ 245, KA4RSC 162, W9FZW 133, WA4FMR 131, NN4S 38, KE4LS 30, KA5KDB 26, W4PFP 23, KA4UVR 22, W3HET 16, W4TYV 13, W4EWR 12, KB4UQ 7, N4KQX 6, W4PSN 5. Keep up the good work.

GREAT LAKES DIVISION

KENTUCKY: SM, Dale Bennett, WA4JTE—Looks like a bunch of congrats are in order. Several upgrades and change of calls. First congrats to Russ Chinn, KA4GBZ on becoming manager of KTN. Thanks Russ. Know you will do a fine job. Upgrades KA4PUG; KA4PUF to General, KB4MYG to Tech. KI4UI, WB4IEA, K4AUX to Extra. KA4YBO/KJ4NN to Advanced. Fine business fellows keep up the good work. Frankfort has five YLs on their roster. Jessamine Amateur Wireless Society five new members in the club challenge. Western KY DX Association now 100 percent club. Still need help on liaison to D9RN/9RN. Club review: Bluegrass Amateur Radio Society, Inc (BARS). Lexington Ky. First Monday of each month at 7:30 PM EST at the Red Cross building. Use 146.16/76 for directions to the meeting. President: Frank Brumett, WB4CIZ. 1st Vice President: Bill DeVore, N4DIT. Second Vice President: Jim Hughes, K4ZPL. Secretary: Nan Muth, KB4OCQ. Treasurer: Ed Bono, WA4ONE. Director(s) at Large: Terry Fugate, WN4ISX and Mike Maynard, KJ4FZ. Look for your club review in later editions.

MICHIGAN: SM, James R. Seeley, WB8MTD—Departing STM WD8RHU has "left his house in order" in the same way he typically handled the assignment throughout his four years of service. Endorsements for all presently active ORS and NM appointees are current. If you know you have not been reporting any activity, then you know why you have been dropped from the rolls. Anyone who has not gotten an ORS endorsement in the last two years and who feels he or she has been missed by oversight should contact me. I have all the records and will be able to make a recommendation to the new STM (not appointed as of this writing). Alas, there are no awards we can make to traffic nets for outstanding performance. I feel that each of our nets is outstanding in its own way, with valuable service to the public and to the amateur community being performed by all, so it is just as a note of interest that I hereby make these highly unofficial and imaginary "awards" based on the very interesting statistical summary that Larry compiled for MI nets for 1985: for Best Attended Net, UPN, total QNI 13, 381; for Most Traffic Handled, MITN, total 3101, with QMN so close, at 3045, that I have to give them an Honorable Mention; and for Most Useful Service Under Strained Circumstances, the 160-meter Traffic Net-no whopping stats, but they've been there when everything else has closed down. (Yes, we *do* need to work to do everything possible to preserve our 160 privileges.) Now for an award in a different activity: Longest Suffering Editor of a Club Newsletter. I quote form the Jan. *Tuned Circuit*, L'Anse Creuse ARC: "Over 10 years ago I took the editorship of this bulletin on a TEMPORARY basis until we could find someone to take it." It goes to Art, W8PBO, and well deserved! Thanks to John Diefenbaker, N8FPN, for sending me info on amateur activity in the Michigan Emergency Patrol, the highly regarded road-reporting service so well known to motorists in the SE MI area. I shared the popular misconception that MEP is strictly a CB activity. Not so. I will be meeting with John in the near future and hope to have further to report soon. Welcome to newly affiliated clubs: Utica Shelby Emergency Communications Assn., and Spare Time Amateur Radio Society (Grand Rapids). K8OCP has been appointed NM for MACS. Dec. net summary: (QNI, tfc) QMN 1138, 456; MACS 507, 278; MITN526, 231; UPN 1424, 208; MNN 240, 45; 160-M 291, 58; GLETN 563, 36; WSSBN 820, 26; VHF, 14 rpts, 730, 10. Traffic: KA8CPS 1018 (BPL), AFF8V 733 (BPL), WD8KQC 517, (BPL), KA8VOZ 351, W8QHB 273, WD8RHU 248, WD8MJB 208, NJ8R 145, WA8DHB 132, WD8OUO 131, WB8YDZ 127, NJ8S 85, K8GXV 82, K8EQO W8SCW 69, W8ACW 57 (GCRC), WD8PAF 53, W8EOI 48, WB8MTD 47, N8EXS K6HAP 44, N8CNY 42, K8UPE 41, WB8SYA 37, K8OCP 33, W8YIQ 27, WB8WJV 26, WD8EIB 25, W8URM 24, W8CUP 18, W8IHX 17, KI8Q W8VIZ 15, WB8TPM 10, WB8SIW 9, KB8ZJU 8, K8MJK WA8MVH NM8Z 7, N8CQA 6, KZ8V 3.

OHIO: SM, Jeffrey A. Maass, K8ND—ASM: N8AUH. SEC: WD8MPV. STM: KF8J. BM: W8ZM. TC: KB8MU. OOC: AD8I. PIO & SGL: N8CVK.

Net	QNI	QTC	Sess.	Time (Local)	Freq.	Mgr.
BN(E)	241	164	31	1845	3.577	W8JMD
BN(L)	176	91	31	2200	3.577	W8BO
BNR	285	173	31	1800	3.605	W8EK
BSSN	417	393	59	0945,1830	3.885	N8AKS
ONN	102	22	29	1830	3.708	WD8KBW
OSN	329	160	31	1810	3.577	N8AEH
OSSBN	2102	1426	93	1030,1615, & 1845	3.9725	WB8MZZ
OSSN	156	123	31	0646	3.577	KA8GJV
O6MN	269	21	30	2100	50.16	WD8CTX
OH ARES NET				1500 Sun.	3.875	WD8MPV

I missed two events in last month's column: hope these reach you in time! The Cuyahoga Falls Hamfest is February 23, and the ARRL Great Lakes Division Convention will be held in Cincinnati February 21-23. Sorry folks! March hamfests: Circleville March 2, Toledo/Maumee

March 16; Madison March 23. The Second Annual Lucas County ARES Benefit Banquet will be held March 15 in Toledo: contact WD8DYW for details. New OH-KY-IN Officers for 1985: Pres WA6EZV; VP KJ8K; Treas K8THT; Recording Sec KI4QJ; Corresponding Sec WD8NMV. (OH-KY-IN lists 8 upgrades and 16 new licensees in December!) New Portage ARC Offices: Pres WD8MPV; VP KD8JM; Sec/Treas KJ3O; Radio Officer N8KW; Trustee NB8Y. PARC will be sponsoring a new event this year, the Portage Hamfair, on May 18. Contact KX8V for details! At the NOARS Christmas Banquet, this ARRL Special Service Club issued it's annual awards: Ham of the Year WA8CAE; DXer of the Year KZ8Y; Public Service NB8W. Congratulations! During December, we received three applications from organizations seeking to become ARRL Special Service Clubs: has your club reviewed this valuable program? I'll be glad to send you details on request. Mike Bokulich, K8US, has stepped down as Affiliated Club Coordinator (ACC) to pursue other interests. Thanks for your efforts, Mike! The ACC position will be filled shortly and will be announced in next month's column. W8TK has donated a Drake TR-7 to the Central Ohio Chapter of the American Red Cross for use at the COARES station (K8DDG) at ARC Headquarters! The Triple States Radio Amateur Club (TSRAC) ARES net was put on "standby" during the December prisoner takeover of the Moundsville (WVA) Prison. Although their services were not required, they were there as a possible backup communications service, since the police and Prison administration were concerned that the prisoners might have access to radios receiving police frequencies. DAYTON HAMVENTION 1986: APRIL 24-26! The one and only hamfest in Ohio during April, this single event brings more Amateurs to our State than all others! As always, I know that they will find Ohio's repeaters open to them and holding a few special surprises! I will send a copy of the WB8YUS Ohio Repeater Map, listing each 2 meter repeater in the State, to any Dayton-bound amateur sending me an SASE prior to April 17! I have also updated for the New Year the now-famous Ohio Section Hamfests List, which identifies over 30 hamfests in Ohio during 1986. It includes their dates and the callsign of a person to contact for details. I will be distributing this sheet at each of the hamfests that I attend this year, and a copy will be included in the Ohio Section Newsletter sent to clubs and Field Organization appointees! See you all at the hamfests or on the air! Traffic: W8BO 789, KBJDI 500, KD8KU 485, NJ8P 378, WB8JGW 336, NE8X 289, WD8KFN 280, W8JMD 277, KD8IC 242, KD8KY 233, WB8MEK 222, K8TVG 221, WA8SSI 217, WB8DMF 214, WD8RAO 206, W8QZK 183, KV8Q 179, W8SKP 170, KA8KHS 158, WD8RIB 158, KF8J 154, N8EFB 142, N8AKS 136, WA8HED 134, KA8CGF 133, W8ZOL 128, WD8KBW 123, K8CMR 121, WB8KWC 110, KA8GJV 106, NK8B 101, WA8DYS 98, K8EF 95, N8AEH 94, KE8BE 94, WA8HGH 94, W8EK 92, WD8JAW 90, N8HAZ 87, WB8KWD 85, W8WEG 84, N8FWA 75, WB8HHZ 75, N8FAZ 70, KD8XI. 70, K8ND 69, KC8UZ 64, WB8BWY 63, KA8MFH 63, K3RC 62, N8FPH 57, KA8TNT 56, W8FPA 55, N8GOB 54, WD8IKC 51, KA8OOF 51, WD8JYE 49, N8CW 44, NC8Q 43, KA8RIX 43, K8CKY 39, WD8MIO 38, KA8MFG 37, W8RG 37, KD8WH 37, WD8CKK 36, N8FBE 33, K8AN 32, KC8JV 26, N8CJS 25, KC8YV 25, WD8CSP 24, W8IQ 24, KD8ZE 24, NF8B 23, W8SWM 21, W8HVK 20, KA8ICB 19, N8EEK 18, KA8LAY 18, K8LQM 18, KD8WI 18, N8FNP 17, K8VOY 17, K8DXZ 16, KA8RBQ 16, WD8EKI 15, KA8THO 15, WB8GDM 14, K8NJQ 14, WD8OYK 14, KA8UYM 13, N8AJU 12, NK8C 12, N8GIY 12, KC8NM 10, WB8OFR 10, NI8Q 10, W8BHL 9, W8FUP 9, WB8YFD 9, KC8WH 8, W8ZM 8, KA8UPR 6, KC8D 5, W8XT 5, N8CDN 4, WB8NHV 4, WB8TRK 3, WD8CTX 2, WB8MRL 2, WD8NED 2, WB8SMC 2, N8GST 1. (Nov.) K8AN 37, KA8THO 35, W8IQ 18, N8GST 1.

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	TIME/DAY	FREQ.	NET MANAGER
ESS	2300Z	3.590	W2WSS
NTS/E/L	0000/0300Z	3.677	WB2MCO
NYS/M	1500Z	3.677	WB2EAG
NYPON	2200Z	3.913	WA2KOJ
CDN	2330Z	146.34/94	WB2ZCM
HVN	2330Z	144.535/135	KA2MYJ
SCRN	0100Z	147.735/135	KV2U
SDN	0230Z	14766/06	K2ZVI

NET LISTINGS (QNI/QTC): AESN 54/2 ATEN 17/6 Col/GRN 51/2 ESS 371/63 HVN 248/62 NYPON 716/558 NYSE 362/305 NYSL 251/176 NYSM 358/326 Sch. 2 meter 67/5 SDN 282/154. CLUB NEWS: Albany ARA elections K2QF-Pres, WB2BEJ-VP, KN2Q-SEC, K2XA-treas, N2AIF-dir. Homebrew night at Jan. meeting. CCNR elections K2LV-Pres, KA2ZEW-VP, KA2RHO-Sec. WB2MOG-Treas, SGT at arms-N2AXS, Trustee-W2DPV, Dirs-KA2NDD KA2RHO WB2MOG W2DPV. WARA had talk in Jan. on medical effects of RF by W2JAJ. Saratoga RACES had program on weather. SARA had WA2SPE talk about amateur involvement in space mission-telescope in space. WECA had program on traffic and packet. Orange Cty ARC elections KA2MSL-Pres, KC2HV-VP, WA1WTG-Sec, WA1LHW-Treas, Act-KA2USL. New Col. Cty EC-KA2MYJ TNX to WB2LKZ for fine job. Putnam Info. and TNG Net in full swing on PEARL. Contact me thru WA2SNA-1 or WB2RKN-2 BBS-leave msg. DEC, SPL: WB2EAG, WA2YBM. DEC, PSHR: KA2MYJ WB2EAG WB2VUK WA2JBO K2ZVI KC2TF WB2MCO W2PKY. Traffic: WB2EAG 622, WB2MCO 467, KC2TF 421, WB2VUK 258, W2PKY 251, KA2MYJ 182. WA2YBM 173, WA2JBO 95, K2ZVI 62, K2HNW 45.

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: W2IYX. The following are traffic nets in and around the section:

*NLI	3630 kHz	1900/2200	WB2EUF mgr
NCVHF	6.745 rpt	1930 M-F	K2MT mgr
BAVHF	6.67 rpt	2000 M-F	K2YOK mgr
SCVHF	5.37 rpt	2030 M-F	W2GZD mgr
ESS	3590 kHz	1800	W2WSS mgr
NYS/M	3677 kHz	1000	WB2EAG mgr
NYS	3677 kHz	1900/2200	WB2EAG mgr

*Denotes section net, all times are local, please try and help out by checking in whenever possible. Please note the appointment of Joe Kolb, W2NL as Assistant Section Manager for the V.E. program. LIMARC will continue to sponsor examination sessions on the second Saturday of the month at N.Y. Inst. of Technology, Rt. 25A, Old Westbury, in Salten Hall, Rm 2. Applicants are reminded to bring 2 forms of I.D., original and a copy of your F.C.C. license, check for $4.00 made payable to ARRL/VEC, 2

DAYTON **Hamvention**® April 25, 26, 27, 1986

• **Technical Forums**	Personal Computer, Packet Radio, ARRL, AMSAT, Antennas, RTTY, SSTV/ATV FCC, Electrical Safety and many, many others.
• **New Products**	See, touch and feel the latest in high-tech equipment.
• **Giant Flea Market**	Starting at noon Friday, all day Saturday and Sunday. All spaces are **SOLD OUT.**
• **License Exams**	Novice through Extra, by reservation only. Send a completed form 610, a copy of your present license and a check or money order for $4.25 payable to ARRL/VEC. Indicate the desired time. Send to: License Exam, Attn. Tom Holmes, 8830 Windbluff Pt., Dayton, OH 45459. **Deadline: March 29.**
• **Alternate Activities**	HAMVENTION is for everyone. We have planned activities for the YL or your non-ham family members.
• **Special Awards**	Nominations are requested for "Radio Amateur of the Year," "Special Achievement" and "Technical Achievement" Awards. Contact: Awards Chairman, Box 44, Dayton, OH 45401. **Deadline: April 1.**
• **CW Awards**	See how fast you can copy the International Morse Code (World record is 72.5 WPM). All participants receive an award indicating their maximum speed.
• **Admission**	Registration: $8.00 in advance, $10.00 at the door. Banquet (Roy Neal, K6DUE, Speaker): $14 in advance, $16.00 at the door, **if available.** Ladies Luncheon: $6.75. Last Day for advance tickets: April 5 (Canada), April 12 (U.S.).
• **Housing**	Most motel rooms in the Dayton area have been set aside for the HAMVENTION. Write: Dayton HAMVENTION Housing, 1980 Kettering Tower, Dayton, OH 45423-1980. **NO RESERVATIONS WILL BE ACCEPTED BY TELEPHONE.**
• **Parking**	Free parking is available at Hara Arena. In addition, there will be free shuttle bus service from all major motels and designated parking lots. Parking and road information is available on DARA's 146.34/.94 repeater.
• **Other Information**	Special air fares are available on Piedmont and USAir. A free slide show about the HAMVENTION is available for club meetings. Wheelchairs and handicap parking are available. For more information . . . Write: Box 44, Dayton, OH 45401 or call (513) 433-7720.

This is the year for you to attend the internationally famous Dayton HAMVENTION. Come with your friends to hear enlightening forums, see the latest equipment, and visit a flea market that has everything! No matter what you are looking for, you can find it in Dayton!

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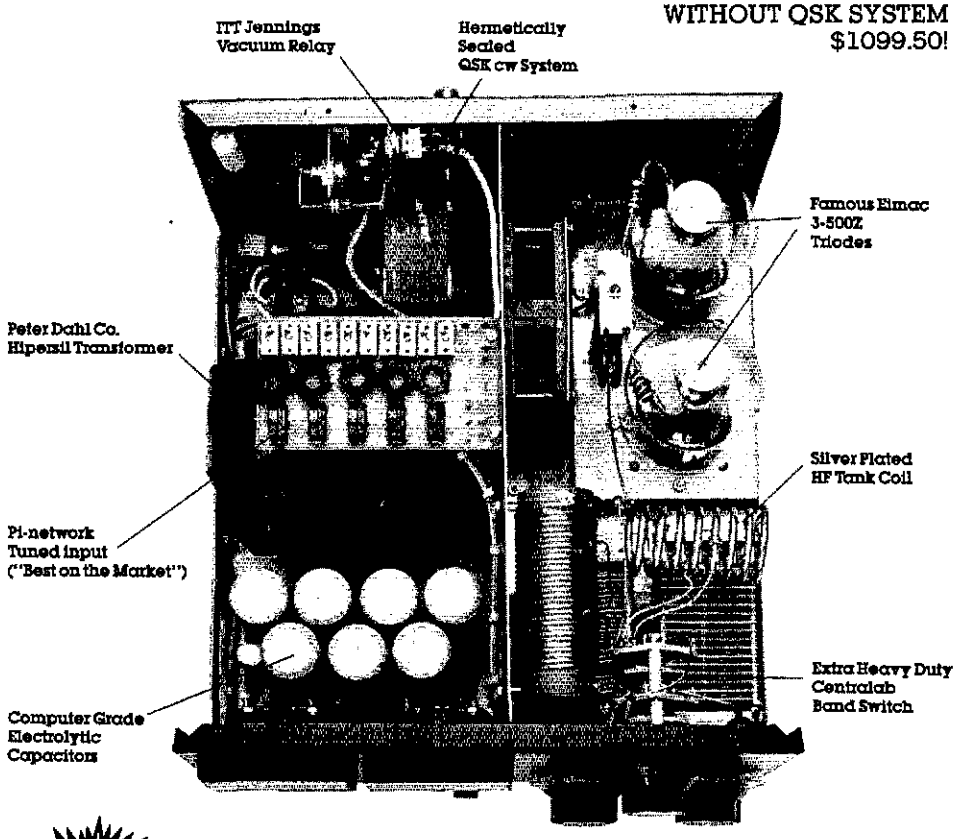

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pens/pensils and a calculator for the math questions, for further info contact Woody Gerstner, WB2IAP, 42 Mohawk Ave., East Atlantic Beach, NY 11561. Got antenna zoning problems in your town? Contact Vice Dir. Steve Mendelsohn, WA2DHF, for lots of info. Officers for the Nassau County Wireless Assn. are NK2T Pres., N2FTF VP, N2FLI Sec., NK2W Treas. and trustee. Their Charter was presented by Steve Mendelsohn, WA2DHF, Vice Dir., also in attendance were K2IZ SM NYC LI and WB2IAP, ASM, Kings County RC runs a net on 144.97 simplex, 2100 local. Officers for the Kings County RC are: KA2VBL Pres., KD2IN VP/Trustee, KA2KDO Sec., K2OWH Treas., W2LWB reports he is checking into the EAN mailbox on 40 mtrs every morning at 1130 local, the freq is around 7089 kHz and the SYSOP is K8OZ (Jerry). Officers for the Tu-Boro Radio Club are WB2EXI Pres., KA2WIJ VP, WA2WLQ Sec., NB2Z Treas. It is with deep regret that we list W2NCL as a Silent Key. Officers for LIDXA are K2ON, Pres., KB2CB VP, K2ENT Sec., WB2OHD Treas., W2QL, W2JGR, K2BS Directors. Traffic: K2YQK 368, K2GCE 116, W2GKZ 91.

NORTHERN NEW JERSEY: SM, Robert R. Anderson K2BJG—ASM (VE liaison): N2XJ, SEC: KB2ZM, STM: KA2HNQ, OO/AAC: N2WM, ACC: K2BJG, PIO: WB2NQV SGL: W2KB, TC: K2BLA, and BM: N2CXX. December 1985 appointments are: DEC (Warren) WA2VUY, EC W2MYA, OES's WA2JSB, WA2VUY, and W2MYA, ORS W2XD,and PIA N2DUP. If you are interested in a NNJ ARRL field appointment, please contact the applicable leadership official listed above. The Tri-State Amateur repeater Council has formed a new sub-committee concerning area packet digipeater and bulletin board operations. This committee headed by W2JUP of the NLI section includes members N2DSY and WA2BAU of the NNJ section. Packeteers planning new digipeater or PBBS operations are requested to coordinate with TSARC. NNJ point of contact is WA2BAU at 227-6953. Congratulations to: The Sourland Mountain ARC now a new ARRL affiliated club. ASM (VE liaison) Carl Felt N2XJ now has a current listing of NNJ VE test session schedules. This is available for an S.A.S.E. form Carl at 8 Charles Pl. Chatham NJ 07928, or may be downloaded form the WA2SNA-1 PBBS file name NNJVE.SCH. Please coordinate with Carl when scheduling new VE test sessions. Phone 635-7686. Congratulations to the following who were newly licensed or upgraded during December sessions at Bayonne EM, Cherryville Rptr Asso, NNJ VE Board, and Old Bridge RA: Novice: KA2WEN. Technician: KA2YMY, KA2YXV, KA2YXZ, KA2ZDY, and D Housel. General: KA2IWS, N2EJQ, KA2YXU, and KA2UWC. Advanced: N2CVD, N2EAG, N2FVW, W2EPU, WB9VZB, KA2YLS, KA2VFQ, KA2YJT, and W2IKI. Extra: N2DCD, W2YM, N2FYP, and WB2NIE. Look again and please note. Our NNJ VE activity is producing lots of upgrades but too few new licensees! Our affiliated clubs must address this situation and take positive steps to increase efforts to recruit new amateurs. To accomplish this is not easy. It takes individual involvement in support of club efforts. Get involved! Sorry to have to report Silent Key, WA2HCI. December Data:

Net	Freq	Time	Sess	QNI	QSP
NJM	3695	1000 DY	31	186	232
NJPN	3950	1800 Dy	Not	Available	
		0900 Su	Not	Available	
NJSN	3735	1830 Dy	31	51	165
NJN/E	3695	1900 Dy	Not	Available	
NJN/L	3695	2200 Dy	Not	Available	
NJVN	49/49	2230 Dy	31	199	245
OBTTN	147.12	2000 Dy	31	265	361
TCETN	146.685	1930 Dy	31	32	80
NJRTTY	147.51	Autostart	Not	Available	
NJPTN	145.01	WA2SNA-1 PBBS			

UPLINK Amateur Radio News call 201-735-8550 SAR/PSHR: AG2R 316/130, N2XJ 291/103, WB2QMP 255/92, KA2SPH 210/115, W2RRX 132/83, N2BNB 78/81, N2DXP 62/0, K2VX 58/64.

MIDWEST DIVISION

IOWA: SM, Rollin J. Sievers, WBØAVW—SEC: KDØBG, BM: KØIIR, ACC: WBØQAM, PIO: NØEBA, OCC: KDØRT, TC: KØDAS, SGL: AKØQ. Many thanks to KØCY for the job he has done in the past as SM. Bob resigned to spend more time at his job. The new SM is now (Rollie) WBØAVW of Storm Lake, IA. He resigned as NM to accept this position. Congrats to the following upgrades, KAØVPC, KAØVBP, KAØVMZ, KAØVIB, WBØEGA, WØCON and WAØUZI. Des Moines operation Santa Claus benefitted 1700 families/7000 people during Christmas. WDØDOK and KAØJZF awarded WIN MAGER, Remember Hamboree #8 at the Marina Inn at So. Sioux City, April 18 WBØJFF is the new noon NM and NØAEF is the evening NM. Nathan Morland (KDØTH) Ham of the Year of the N.E. IA Amateur Radio Assoc. S.E.I.D.X.A. repeater to be activated again soon. Can use more support for the ICN. Iowa represented well on DTRN (100%) by KAØADF, NØCWW, KØGP, NØSM, WØSS, and WØYLS-500 messages in 62 sessions.

Net	Freq.	UTC	Dy	QNI	QTC	Sess.	Mgr.
75 mtr	3970	1830-2330	M-$	2133	323	62	WBØAVW
TLCN	3860	0030-0400	Dy	268	184	62	WØYLS
ICN	3705	0200	M-W-F	19	0	10	NCØR

Traffic: WAØAUX 588, WØSS 254, KAØADF 166, KØGP 166, W4JL 118, KØCY 112, WDØFWB 91, WØHTP 86, WØYLS 86, KCØXL 78, WBØAVW 70, KØBRE 61, KAØGSA 47, WBØJFF 28, KDØBG 27, KØKQJ 26, NØCKD 22, KØEVC 20, WØBW 18, KCØSC 10, AI9D 8, KDØRT 4, (Nov.) KØKQJ 16.

KANSAS: SM, Robert M. Summers, KØBXF—SEC: NØBLD, STM: WØOYH. Net reports for Nov. are as follows: KSBN QNI 1143 QTC 129, KPN QNI 461 QTC 42, KWN 863/719, KMWN 747/682, CSTN 2418 and 46 QTC, QKS 234/50, QKS-SS 38/11, KS RTTY QNI 66/7. For the month of December KSBN 1121 QNI and 110 QTC, KPN 481/47, KWN 705/546 KMWN 576/615, CSTN 2419/152, QKS 203/58, QKS-SS 56/22, KS RTTY 67/4. Clay County ARC officers for 1986 are KAØRZO, Pres.; NØFFN V. Pres.; NØBMX Sec/Tr. Jayhawk ARS elected KAØKGO Pres., NØGAB V. Pres.; KAØMIQ Sec/Tr. and KØBXF also KAØRZO to the Board of Directors. CKRC officers are KAØSZO Pres. WDØEQZ V. Pres. KAØNOO Sec/Tr. The Pilot Knob ARC elected KAØDJR Pres. WBØIEL V. Pres. KTØW Tr. and WAØRNR Sec. The new newsletter of the Douglas County ARS is 'THE HAM STRING REVIEW,' received this month from editor KAØTKJ. Johnson County ARS officers are NØFMO Pres, KØROS V. Pres. KAØKKV, Sec, and WDØDCS Tr. By the time this report hits the press, you no doubt will be beginning to repair antenna etc. getting ready for the storm to hit. Make sure your local area is also ready to act if an emergency should arise. WHO is your EC? What freq. does the local group meet when the need arises. ARE YOU PREPARED??? Traffic: NØGCC 641, WØQBK 364, WØFIR 255, WØFRC 217, KSØU 135, WØOYH 105, WØHI 87, WØFDJ 77, WBØZEN 55, WAØHOZ 50, KØBXF 49, NBØZ 22, WØMYM 12, WØQMT 9, WØPB 8.

MISSOURI: SM, Ben Smith, KØPCK—The Lebanon ARC

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Specifications Subject to Change

provided communications for Lebanon Shriners Christmas Parade. Members helping were: WBØSSB, KAØPTS, KAØQVJ, WAØQEW and KØDEW. W3OU died from the result of a boating accident. He was the Father of KMØL, KUØW and the Father-In-Law of WDØCGJ. Our sympathy to the family. The Jefferson Barracks ARC will hold their annual auction March 14 in South St. Louis at 6432 Gravois. Contact WBØBZP for more information. Club officers elected for 1986 for the following clubs were: Kansas City DX Club, Pres. KØRWL, VP. RØUAA, Treas. KBØ and Sec. KØCS. The Heart of America ARC; Pres. WBØEJJ, VP. NØCLV, Sec. WDØEIG and Treas. KBØUH. OARS officers 1986; Pres. KYØB. VP. WBØGFJ and Sec-Treas. WBØSQY. I hope all clubs will report their activities to me this year.

Nets reporting:

					PM	MHz	
MON	62	347	238	Dly	7:00/8:45	3.585	KØSI
MOSSB	31	608	118	Dly	6:00	3.963	KT5Y
MEOW	31	596	101	Dly	6:30	3.963	KØDSQ
HBN	22	335	37	Mon-Fri	12:05	7.280	KØDSQ
ZAEN	5	87	37	Tue	8:00	147.84/.24	NOØE
PHD	6	171	19	Mon	9:00	146.43	WAØKUH
RRABN	29	425	10	Dly	8:00	146.39/.79	KAØLLN
MOFON	3	30	8	Wed	8:15	222.42/4.02	AIØO
MCARES	4	36	3	Thu	8:30	146.52	WBØELJ
LARES	5	40	2	Wed	8:00	146.10/.70	WBØRHC
LOZFM	4	87	0	Sun	9:00	146.13/.73	WØRTL
SARN	4	55	0	Thu	9:00	145.43/7.03	WØENW
TCN	4	54	0	Thu	9:00	147.09/.69	KAØILO
GMEN	4	49	0	Wed	9:00	146.16/.76	KØPGK
JCCCN	3	41	0	Wed	8:00	146.40/7.00	WBØDZX
IFN	4	35	0	Wed	7:30	147.84/.24	WBØSZI
LOZCW	4	17	0	Sat	9:00	3.707	WØRTL

Traffic: WØBMA 618, NØAIM 278, KØSI 221, NDØN 125, KT5Y 116, NØSS 109, AIØO 106, KØPCK 86, K9OCU 71, KØORB 67, NOØE 62, KBØZL 52, NØBKE 47, WØOUD 45, KØDSQ 18, NIØR 14, WBØCJB 7, WAØKUH 2.

NEBRASKA: Vern Wirka, WBØGQM—Packet Radio enthusiasts have formed the "Tri-State Amateur Packet Association" (TRISAP) with members from parts of Nebraska, Iowa and South Dakota. TRISAP president, Mike Nickolaus, NFØN, says there are no actual membership dues but donations are accepted by the elected treasurer and all funds are allocated for meeting and related expenses. TRISAP does not own any packet equipment. All packet related equipment, including digital repeaters is owned and maintained by individual amateur radio operators. The TRISAP club envisions a major role in network planning as packet activity increases. Information on TRISAP can be obtained by contacting any club officer at their callbook address. TRISAP officers are: President, Mike Nickolaus, NFØN; Vice President, Larry Workman, KAØJRC; Secretary, Loren Barbee, WBØYOW. Treasurer, Fred Groce, WBØBLR; information officer, Dean Lonning, WBØTKC. Cornhusker Net Manager Kenneth Albright, WBØGMQ reports a QNI gain of 16% for 1985 when compared to 1984 figures. Cornhusker Net meets daily at 1830 UTC on 3980 kHz. Hall county 2 meter ARES Net Manager, Emery Rodabaugh, WØEXK reports he could use additional net control stations for the net which meets nightly at 7:00 PM local time on the Grand Island 146.34-94 MHz repeater. Traffic: KØDKM 300, WØKK 158, WBØTED 58, WAØBOK 31, KØIXY 24, NOØA 21, KAØBCB 13, WDØBOX 11.

NEW ENGLAND DIVISION

CONNECTICUT: SM, Robert J. Koczur, K1WGQ; 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	176	254	K1EIR
CPN	396	1800 M-S	114	279	KA1BHT
NVTN	22/88	2130	110	216	N1BOW
WCN	78/18	2030	275	543	WB1GXZ
RTN	13/73	2100	61	255	KA1JAN

Spring is just around the corner! It's time to get out there and fix all the damages done by Old Man Winter. I know that's what I'm going to do. It has been another busy and productive month for traffic handlers. From Mary, WB1GXZ-in spite of difficult HF bands WESCONS traffic count improves. Messages were sent ranging from forest fires to floods in West Virginia. The net continued even after the repeater in Naugatauk received a direct hit by lightning. Apologies are in order to Al Jaras, NA1I, whose call has been listed as NA1L. In the past couple of columns. Al has been busy this past month helping 5 new hams get licensed. Good work. Our Southington club has been busy as well. Milt Chattee W1EFW, tells us that they have a new repeater on the air located on the town hall. They are operating on 144.57 down 600. Congrats to the newly elected officers at ECARA. President-KB1H, Vice President-K1UQE, Secretary-N1BBI, Treasurer KB1VM, Trustee-KA1LMN. It has come to our attention that PRB-1 is helping to show some good results for hams in court actions across the country. Because of PRB-1, the courts seem to be more sympathetic towards the position of hams perhaps because they see the FCC supporting us. Remember, any inquiries concerning repeaters should be relayed to John Ronan, K3ZJJ,. Congrats to Arline Bender, WA1VMC, for 25 years of outstanding service to our field organization. 73s. Traffic: W1EFW 347, WB1GXZ 318, K1EIR 213, KA1KTH 141, KY1F 118, N1BOW 111, KA1GWE 111, W1YOL 102, N1DMV 85, KA1KPS 78, KA1BHT 61, W1BDN 52, W1DPR 46, W1WP 45, WA1EKC 43, WA1NLD 29, K1AQE 18, WB1CRH 18, NA1O 13, W1CUH 8, W1QV 2.

EASTERN MASSACHUSETTS: SM, Luck Hurder, KY1T—ASM: K9HI, OO/AA: KA1KF, SEC: KB1PA, STM: KW1U, ACC: K1AZE, TC: KA1IU, PIO: K1HLZ.

Net	Mgr.	Freq.	Time(Loc)/Dy	QTC	QNI
EMRI	N1AJJ	3658	1900/2200 Dy	153	214
EMRIPN	N1BGW	3880	1730 Dy	316	176
EM2MN	KA1AMR	145.23	2000 Dy	311	371
NEEPN	K1BZD	3945	0830 Sn	18	63
HHTN	WB1CMQ	04/64	2230 Dy	239	433
EMRISS	N1CVE	3715	1600/2030 Dy	125	218
CITN	N1BYS	145/045	1930 Dy	141	275

Thanks to all clubs who have been sending me their newsletters—they're certainly a fine way to get an accurate "pulse" of Amateur activity within the EMASS Section. I get a lot of inquiries as to where to go for Amateur Radio classes and examinations—services that the larger clubs like Billerica ARS, Acton-Boxboro ARC, Cape Ann ARA and others are providing with a great deal of expertise. FCC/ARRL Amateur Auxiliary Coordinator KA1KF reports that ECARS and the New England Spectrum Management Council are both making progress in becoming members of the Auxiliary. Ass't SM K9HI is presently making plans to coordinate CATVI problems in the Section. If you're interested, Phil would very much appreciate your assistance, either in regard to providing or obtaining information on CATVI difficulties. STM KW1U

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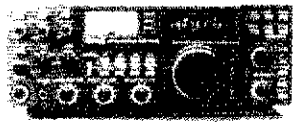

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Accessories
Everything an amateur needs by Kenpro, Alliance, Ameritron, TE Systems, Mirage, Tokyo Hy-Power, Daiwa, MFJ, Ten-Tec, Santec, Bencher, Amphenol, Astron, B+K Precision, Welz and more.

Computer Stuff
Packet Radio; RTTY/Morse hardware and software by Hal, Kantronics, AEA, Microlog, MFJ; Amateur software by Ham Data.

Books
On every topic. Call and ask about the book or subject you need.

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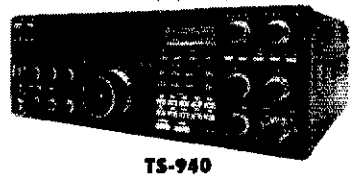

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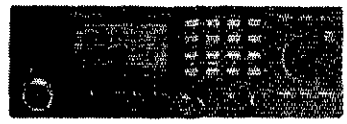

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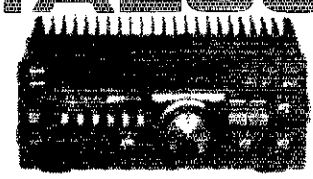

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reports that in spite of severe propagation difficulties on HF, many of our public service communicators did their usual outstanding jobs. Congrats to W1ZHC N1BGW KN1K N1DDC and KW1U for their efforts that earned them the COVETED BPL award this month, as well as to KB1AF WB1CMQ and KW1U for their high Public Service Honor Roll totals. Have you expressed your opinions to your Division Director or Section Manager lately? Traffic: KW1U 738, KN1K 701, N1BGW 681, W1ZHC 623, KY1T 527, WA1FCD 444, KB1AF 310, N1BHH 285, KA1AMR 251, WA1TBY 250, N1DDC 200, K1GRP 172, N1CVE 171, WB1CMQ 167, W1CE 160, N1AJJ 119, K1ABO 108, N1BZD 73, KA1EID 65, N1BYS 60, KB1PA 56, WA1FNM 50, KA1KCU 46, WA1SNH 45, KA1ON 34, KA1LIH 20, KY1B 11, KA1DKV 9.

MAINE: SM, Cliff Laverty, W1RWG—SEC: KL7IJG/1, STM: AK1W, ACC: KY1C, BM: W1JTH, OOC: W1KX, PIO: KY1E, SGL: K1NIT, TC: K1PV, PSHR: WA1YNZ 89, W1RWG 84, N1BJW 77. Welcome to Mid-Coast as an ARRL affiliated club; Pres Frank Weaver KX1I has done super job in publicizing ham activities in several newspapers. If the public doesn't recognize a ham, it won't be Frank's fault. At Southwest Harbor 30 preschoolers tuned in for chat w/Santa on Elf Radio KA1LJZ. Elf stations statewide operated by hams participated in schools and hospitals from Caribou, Presque Isle, Ellsworth, Waldoboro and listened to K1HHC provide "ho-ho-hos." Robert Kendall, member of Portland AWA, received VIP carrier award from Portland Press Herald. KL7IJG has asked to be relieved due to need to put time on University studies. Interested hams for SEC please contact Section Manager.

Net	Sess.	QNS	QTC	Mgr.
SeaGull	26	910	257	KTGUP
PineTree	31	272	129	K1MZB
LatePTN	19	73	14	WA1YNZ
MePubSvc	5	84	19	KL7IJG
AroostookEm	5	98	2	WA1YNZ
RACES	5	68	8	W1RWG

Traffic: KA1JOJ 148, AK1W 147, W1ISO 125, N1BLZ 107, K1MZB 93, N1BJW 86, WB1CBP 62, KA1AVU 56, W1BMX 48, W1RWG 48, WA1YNZ 45, N1BIR 34, W1JTH 27, W1OTQ 23, W1GCB 21, KL7IJG 17, W1KX 17, W1VEH 16, KA1FTL 9, KA1ENL 9.

NEW HAMPSHIRE: SM, Bill Burdan, WB1BRE—OO: N1NH. PIO: WA2MBQ. The Nashua Area Radio Club completed 1985 with 10 more new licensees in December. Several have already taken advantage of the VE and upgraded. New officers for NARC for 1986 are KA1LDF-Treasurer, K1CII-Membership, WB1BRE-Programs. Incoming board chairman Pauline, KA1LDF, reports that the Christmas and New Years parties were great successes. The club is currently installing antennas and stations at both the local police station and Red Cross to result in permanent emergencies stations in both locations thans to the efforts of KA1GOZ, N1BAO and WA1UXA. More Novice license classes, participation in the Novice roundup and NHQSO party and another raffle at the spring Deerfield fleamarket are in the 1986 plans. Looks like a busy 10th anniversary year for the club! Butch WB1GXM, reports a very successful 2M simplex test in the central NH area. 26 Hams participated including WA1SIR of the NHCD staff who operated the CD station in Concord. Two test messages were passed to NHCD as part of the test. Congats to W1TN on becoming a new grandpa! NH NETS: GRANITE STATE PHONE NET 5:30 PM Daily 3870. NH TFC MAILBOX (MSOVTP) 6PM-6AM Daily 147.330. NEW HAMPSHIRE NET 7PM Daily 3547. GRANITE STATE FM NET 8:30PM Daily 146.94, 146.655. As a result of the many new licensees in 1985 and many new hams moving into the state, we are hearing more new calls on the air. Many are looking for ways to make contact with groups, clubs, etc. Some need technical or operating help, some are trying to get on the air for the first time. Please stay sensitive to the opportunities to help other members of the fraternity to enjoy the hobby. And don't miss the opportunity to get them active in local clubs or other groups. Above all, make sure thay feel welcome in Amateur Radio. Traffic: GSFM 317, NHN 285, GSPN 115, MSOVTP 32, W1PEX 876, N1CPX 783, N1NH 652, K6UXO 286, N1AKS 175, WB1DSW/P 162, W1TN 161, KK1E 140, KI1M 134, K1POV 87, W1ALE 81, KV1S 78, KA1LBW 76, K1OIQ 55, WB1GXM 52, W1FYR 27, KA1GOZ 26, K1TQY 20, KB1MK 16, KA1HPO 15, WA1YZN 12, W1MHX 9, W1LQG 8, N1ALM 6, KB1NS 4, K1ACL 4. (Nov) W1QYY 220.

RHODE ISLAND: SM, John (Bob) Vota, WB1FDY—New officers of the N.C.R.C. Pres K1PTV, VP, KB1RE Treas, WA1OSL, Sec, W1IIC. Silent Keys WA1SGX WA1ZOZ. The Amateur Auxiliary in full swing in our section, if you are interested pse call S.M. Amateur Auxiliary Coordinator KA1NDY Gary Lewis. Tnx Gary for taking on the job as Coordinator. Northern Area Coordinator Dick N1DRL. Tnx Dick for helping out here. Did not receive any newsletters from any clubs this month. Come on I know you're out there. Traffic: KA1JXH 314, PSHR 129; W1EOF 264. 73s CUL.

VERMONT: SM, Ralph T. Stetson, KD1R—Well so far I have received one nomination for the youngest HAM in VERMONT, from CVARC. He is 11 year old Jacob Nevin, KA1NOM, who hails from the Radio Active family of KK1U Don, KA1NOQ Sara Jacobs mom and dad, plus his brothers Joel KA1NON, Peter KA1NOO, David KA1NOP. Should I receive no other nominations by April 30, then I will present a suitable award to be announced to Young Mr. Nevin. A special thanks to WB1AJG for bringing this to my attention via Packet Radio. Welcome to the Burr & Burton ARC to the ranks of ARRL affiliated clubs. Club Secretaries don't forget to get your club's Annual Report Form filled out and returned to ARRL, so that your clubs can maintain their affiliated status. The BARC group in Burlington is celebrating their 50th year by looking for memorabilia from the early days if anyone out there can help please write to Barb N1DLE, P.O. Box 312, Burlington, VT 05402. So let's give Barb a hand so that she can put together a good presentation for all of us newcomers to enjoy. I am slowly getting reports on Novice classes finishing up so far: Mitch WB2JSJ reports that 14 folks have completed their Novice class and several will be upgraded to Tech by the time you read this. Also Don KK1U reports 10 people including those mentioned above have successfully completed their Novice work and are starting on the path to Tech/Gen and beyond, as are Mitch's students as well. The Silicon Junction ARC has been busy in areas of Technical Experimenting they are now part of the New England 220 MHz Network on a call up basis from the 146.85 K1VT Repeater Good Work Gang. While on the subject of technical things, NOW is the time to get your club's Field Day 86 plans started. During FD 85 I had the pleasure of visiting several FD sites here in VT, and hope to do so again. NET Reports VTN 31/149/89, CAR 26/679/30, VTPN 5/98/7, GMN 26/443/41, CVFM

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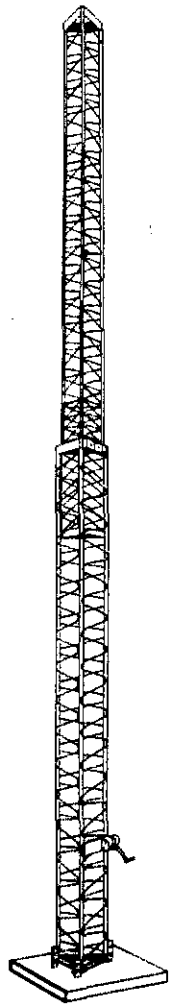

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5/119/10 Station Reports only totaled 4 this month but for a total traffic volume of 1,012 pieces passed. Please remember that your station activity report is often the only way I get to know what you're doing so don't feel your numbers are too small. Traffic: KT1Q 781, W1KRV 124, AE1T 89, W1OAK 18.

WESTERN MASSACHUSETTS: SM, Don Haney, KA1T—OO/RFI: N1CM. PIO/ACC: K1BE. SEC/SGL: WB1HIH. TC: KA1JJM. STM: W1UD. N.E. Spectrum Management Council was officially formed with K1JHC as WMA Director and KA1JJM as Vice Director. And on the subject of repeaters, CMARA could still use some donations toward the new .97 machine. Those who use this Worcester repeater can help support it by a donation sent to KS1B. Planned March HCRA program on HF propagation seems very timely as it continues to be a challenge to work that good DX and keep those schedules with friends. Starting to get into the outdoor activity season as NOBAHC plans to support the Bay State Games again. And their annual auction is March 30. Acton-Boxboro club has published their Novice classes to the local chapter of US Power Squadron. With the number of boaters who have VHF or SSB, think about this as a good source of new amateurs. PSHR: N1DMU, WB1HIH. Traffic: N1DMU 369, KA1T 274, W1SJV 186, W1UD 128, W1KK 87, WB1HIH 61, KA1EKO 33, W1ZPB 30, WA1OPN 24, WB1FSV 20.

NORTHWESTERN DIVISION

ALASKA: SM, Jim Moody, Jr., NL7C—February commenced the amateur support to Sled-dog racing in Alaska. The Arctic ARC provided support to the Yukon Quest, a race from Fairbanks to Whitehorse in the Yukon Territory. The Anchorage ARC provided communications for the World Championship Sled-dog Races during "Rondy" in Anchorage. Preparations are nearly complete for the Iditarod, the race of the year from Anchorage to Nome, a distance of 1049 miles and about three weeks of running. Hams from all over the state will assist on HF and VHF. I need input from all clubs and groups for this column on your activities for this column on your activities for this year. The lead time required makes it imperative that I have the information at least three months in advance. Traffic: KL7VL 70.

IDAHO: SM, Lem Allen, W7JMH—ASM: KA7T. STM: W7GHT. SEC: N7BI. OO: KU7T. PIO: WB7PFQ. TC: W7ZRC:. RFI: K7QQP. CLUB NEWS: The Boise, Payette, Twin Falls, Pocatello Clubs all had Xmas Dinner Parties. (There may be others not reported). Most Clubs are planning Upgrade classes to start in the near future. Contact your nearest Club and upgrade! *ARRL MATTERS:* WD6CDD is new EC Bonner County. N7BHL is ARES Training Officer. We still need a volunteer for EC Canyon County. The VEC fee for all grades of VE Tests except Novice (Free) is now raised to $4.25 per person. *PEOPLE AND THINGS:* KE7HO has new FT 101 ZD and 440 Rig. N7BI has Packet and Fast Scan Color TV but needs viewers! North Idaho has a Digipeater on Idaho Mica N7BI-4 on 145.01. NET REPORTS:

Net	Freq	Time	Sess	QNI	QTC
FARM	3937Lsb	7P Da	31	1796	113
ID CD	3990Lsb	810A M-F	22	832	96
IMN	3635w	8P Da	24	239	80
NW TFC	146.38/98FM	730P Da	31	826	23

GENERAL: When you get a 40 over 9 report, reduce transmitter power, to conserve power, equipment, and the nerves of other Hams trying to have a QSO near your frequency. FCC requires it. W7GHT 412, N7BHL 212, KA7KAI 203, W7JMH 109, KE7LL 72, KA7IHO 72.

MONTANA: SM, Les Belyea, N7AIK—SEC: W7LR. STM: KF7R. PIO: N7HAZ. ACC: WB7TWG. SGL: W7JMX. BM: K7KCR. 1986 club officers - Great Falls Area ARC - KD7VH pres, WB7ETT sec'y, N7CTS treas. Capitol City ARC KA7MAH pres, NE7K vp, N7FFM sec'y, KA7PFK pia. Gallatin ARC - KE7LH pres, WB7USV vp, W7OZH sec'y/treas. Congrats and good luck to all. Fourteen ARES members from Bozeman responded to a call early Sat. morning, Dec. 14th, when a Burlington Northern train derailed, spilling hazardous material (acetone) into the Missouri River. KB7Q and N7HAZ were at the right place at the right time, (Flat Top Mountain north of West Yellowstone), when a lady snowmobiler had an accident and had to be taken out via helicopter, KE7X also assisted. If you need information on HAM license plates, WA7FLG of Butte is the one to contact. Try to remember the N.W. Div net on 3893 kHz at 10:00 PM the first Monday of each month. PSHR: KF7R, WB7WVD.

Net	Sess.	QNI	QTC	Mgr.
MTN	31	1810	248	KF7R
IMN	24	249	80	WA7GQO
IMNS	6	13	3	KA7QVN
MSN	5	94	0	KØPP

Traffic: KF7R 158, WB7WVD 87, N7AIK 21.

OREGON: SM, William R. Shrader, W7QMU—STM: W7VSE. SEC: N7CPA. PIO: KC7YN. SGL: KA7KSK. STC: N7ENI. ACC: KB7CC. OO: N7SC. RFI: AK7T. Upgrades: KA7QPS (Advanced); KA7AHK, KA7TES, KA7SEI, KA7WGW, N7HIQ (General); KA7TIX, KA7NXH, KA7VOI (Tech); KA7WNM (Novice). KA7AHK is 80 years young so let that be an example to all. Congratulations! Some calls missed in the Mexican Earthquake operation were W7LRB, WB7BRG, WA7VTD, WA7AWJ, N7HMV, KA7SIK, N7HMB, N7NYG, N7GFB and W7NI. Without them things would not have happened. KX7Y, WA7VTD, AL7W, and K7RUN worked to get Amateur exemption from Portland antenna height ordinance. KX7Y and WA7VTD are working in the ARRL volunteer legal council program that is offering legal help to foster Amateur Radio. Rogue Valley ARC officers: Pres. K7JBU, V.P. WB7BPI, Sec./Treas. KA7OFM. OTVARC officers: Pres. W7AGQ, V.P. N7DZR, Sec. K7JF, Treas. KZ7T. Interesting statistics from OTVARC show that the members of the club worked 1235 hours and drove 7,235 miles in 29 Public Service projects in 1985. Portland ARC did a fine job with their HELP project with USCGC Glacier. Help support SEA-PAC convention in Seaside 6, 7, 8 June. Traffic: W7VSE 694, N7ELF 348, W7ZB 220, K7OVK 217, N7DRP 182, N7FXJ 120, KA7AID 71, N7BGW 56, W7FBP 51, WA7VTD 32, W7HLF 24. (Nov.) N7ELF 247, N7DRP 69, W7FBP 47.

WASHINGTON: SM, Gene Sprague, KD7G—OOC: N7IL. PIO/SGL: W7CKZ. STM: KD7ME. TC: W7BUN. SEC: N7DRT. ASM: KR7L. ACC: KC7PH. Refer to Jan *QST* for NTS Traffic Net times and freq's—to the ARRL Net Directory for other registered Washington Nets. Congratulations to the WARTS Net and Eye Emergency Net Officers for the cooperative manner in which they adjusted the starting times of both nets to allow both nets to function well. Well done Gentlemen! Working together benefits all of us. A letter from the STM & SM was sent to the nets for their commendable action. The Mike & Key ARC will hold its Electronics Flea Market at the Western

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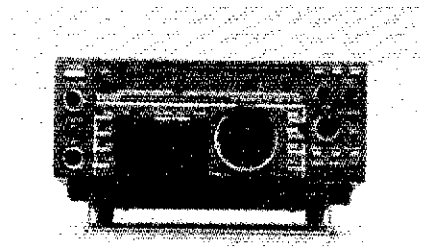

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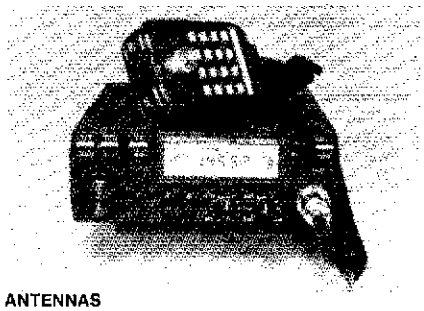

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3/16" Guy Cable 3700 #7 x 7 strand, import	12c/ft
3/8 x 6 E&I Turnbuckle	7.95
3/16" Wire Rope Clips	.40
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K5bO is January's Winner.

DON'S CORNER

Winter is just about at its end and pre-Dayton Spring rumors are starting to fly!

One has it that a major Japanese manufacturer is just completing engineering and is gearing up to produce a hand-held that covers 144 and 440 MHz. The technology is disarmingly simple and will amount to a major step forward in radio design.

Another concerns the current lack of activity on 900 MHz. Who'll be the first to have a radio for sale? Will they be in compliance with the JA personal radio band plan or will they conform to the ARRL version? It's too soon to tell. This band has a tremendous amount of potential for digital and other forms of specialized communication as well as for voice.

Spread spectrum has also now been authorized above 420 MHz. Ham Radio, December 85 has a complete primer by N9NB. Who will be the first in this exciting new field of Amateur Communication?

For those of you looking for a smaller radio, check out the Kenwood TS-430, ICOM IC-735 and Yaesu FT-757. These radios are fully featured and offer state-of-the-art performance at close to the same price. Call today to get all the details and place your order.

73 and Good DX!

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Washington Fairgrounds, Puyallup, WA on March 8. Talk-in on 146.58 (Simplex) and 224.12-16 (Repeater). W7BUN, the Tech Coordinator is busy teaching Amateur Classes and assisting fellow Hams with technical matters, RFI problems, etc. Is your part of the Section covered? If not, would you like to assist the TC? If so, contact Jerry. Congrats to the Radio Club of Tacoma, Lower Columbia ARA, Key Beepers of Sedro Woolley, Lower Yakima ARC on your Special Service Club renewals and to the Radio Club of Tacoma, North Seattle ARC and others (will list when known) who have received the ARRL Booster Certificates; thanks to all! Our Section is fortunate to have so many fine clubs, including the GTE Amateur Radio Repeater Group, Inc., Hewlett-Packard Lake Stevens ARC, and Mason County ARC who have become affiliated with the ARRL. Greetings and welcome aboard. Can KC7PH, the ACC help your club? Let Tom know, W7CKZ, Section PIO is very active in promoting Amateur Radio to the Public; would you like to assist? Contact John to inquire about the Public Information Assistant (PIA) appointment. Thank you field appointees who report regularly, it really helps in getting the job done. Congrats to all new Amateurs and those who up-graded. I have been attending as many club and other meetings as possible to offer you the opportunity to ask questions, express your views, etc. This is your Section, your opinions and input are very much appreciated and are needed to serve you better. If you cannot make meetings, please contact the Staff or me, on the nets, by letter etc. This is the reported December '85 traffic. Many people received holiday traffic due to the efforts of these people (and many others). An excellent way to demonstrate to the public what we can do as a service. 73. Traffic: KD7ME 708, WB7WOW 584, KR7L 334, KR7F 263, K7GUX 253, W7LG 244, K7GXZ 218, W7GB 160, W7IEU 50, KD7G 49, KD7TJ 46, N7GDW 45, K7AJT 26, WA7BDD 22, N7FXM 15, WA7CTS 8, KA7AEF 8. (Nov.) W7APS 9.

PACIFIC DIVISION

NEVADA: SM, Joe Lambert, W8IXD—A sad note: Ex-SCM, Carroll Short, W7CV who has been a ham for more than 50 years has recently passed away. TARA VE Test Schedule: 2/22, 4/19, 6/21, 8/23, 10/18. Contact K7HRW. Trying to affiliate more clubs in Nevada. Clubs interested, contact SM. Nets as follows:

RACES	Mon.	1900 PST	3.996.5
ARES	Thurs.	1900 PST	146.01/61
WX Net	M-Sa	0600 PST	3.993

16 year old Chris, N7FZG has built a new repeater in Boulder City which is now operational on 145.35. W8IXD attended a Pacific Division Staff meeting. Major topics were staff organization and PRB-1. We would like to have more clubs affiliated. K7HRW coordinated communications for an American Red Cross Drill held 1/22. NV WX Net had 323 checkins. If you enjoy reading Nevada news, please contribute info to W8IXD, SM by 1st of month.

PACIFIC: SM, Army Curtis, AH6P—This report being made by AH6CO and section information is divided between Army and myself. From me mahalo for all cooperation of all of you over the past two years. I know you will all be helpful to him and if you want your area covered in this report, get the info to your new SM. From Big Island the report of sixteen new Novices from their last class. A real challenge for the other islands. Oahu reports HARC Annual Dinner had 115 in attendance. From Kauai Packet Radio is very active with KH6S and KH6FMT checking into the inter-island coverage offered by AH6P on BI; KH6GPI, AH6CP, and KH6JPL on Oahu; and KH6H on Maui. Packet Radio bulletin board is active on 145.05. KH6GPI digipeater is on 147.00. N5HRN has nets active on 28.125 (novice), 14.094 (RTTY) and 28.505 (fone). Local info on nets (Oahu) is 146.97d repeater. Aloha and gud luk to all.

SACRAMENTO VALLEY: SM, Bob Watson, W6IEW—A first Section Meeting brought together section appointees and club representatives for a "get acquainted" session. Purpose of the meeting was to gather input to pass along to the Division Director at his Cabinet meeting. We had the great pleasure of having the new Director, Rod Stafford, KB6ZV with us. Club representation from the outlying areas was surprisingly good although that from the Sacramento area was disappointing. Those present voted to recommend the making available to ALL field appointees of a distinctive ARRL badge to make the presence of the League more apparent. Congratulations to the newly elected officers of several clubs. There is only space to mention the new presidents-Eric, W6PZJ, Sierra Foothills ARC; Ron, KJ6R, Sacramento ARC; Sterling, KB6AFF, Amador County ARC; Brad, KA6TUK, El Dorado ARC; Walt, KE6EP, Golden Empire ARS. Sorry if I missed anyone-I just didn't know about them. FCC exams will be given March 15, July 19, Nov. 8 in Jackson. Contact KE6NS of Amador County ARS for info. Any others having exam sessions scheduled please let me know far enough ahead to get the info out. Traffic: WB6CLD 395, N6LUY 351, WA6WJZ 196, WD6BZQ 130, K6SRF 49, WD6EEZ 42, WB6SRQ 24, W6RFF 34, WA6ZUD 13, KB6CFX 7, WA6ERZ 4.

SAN FRANCISCO: SM, Bob Smith, NA6T—SEC: Pete Spruance, KB6LF. STM: Bob Franklin, K6TP. Congratulations to Betty Bravin, AG6C. She was chosen as *Amateur of the Year* in Sonoma County. She has trained 38 YL Novices and is the Only Certified VE for Handicapped Amateurs in The North Bay. VOMARC is including a few Breakfast Meeting this year, no you have no excuse for missing a club meeting in Sonoma on the 3rd Sat. VOMARC was also recognized for 600 hrs. of public service to the City of Sonoma. ACS will try an open autopatch later this year. Don't abuse it or you will lose it. WA6JRB is the newest DXCC member in REXDA. Hope to see a good Turnout at SCRA in March for my visit—ARRL info and the 'Midway 1985' Slide Show. Let me know if your Club would be interested in a VK6GC slide show or mine. VE HOTLINE: 408-984-8353 FOR TEST INFORMATION. Traffic: KK1A 270, N6FWG 109, W6PW 97, K6TWJ 59, K6TP 37.

SAN JOAQUIN VALLEY: SM, Charles McConnell, W6DPD—SEC: WA6YAB. STM: N6AWH. TC: WA6EXV. ACC: N6ECH. Asst. SMs W6TRP and K6YK. The Lodi ARC is a new club in the SJV. Officers are Pres N7AOT, VP WB6AYE, S/T NR6Q. Editor K6URI. The club meets the 1st Wednesday in Lodi. Officers of the Kern County ARC are Pres N6DTB, VP KB6CMB, Sec KB6BVV, Treas KB6JXF. Officers for QCWA Chapter 99 for 1986-1988 are Pres W6MEL, 1st VP W6VMB, 2nd VP W6YO, S/T W6TRP. Officers of the Central Cal DX Club are Pres WA6UOR, 1st VP W6YO, 2nd VP K6PKO, S/T W6DPD. WA6SZC and WK6S are Extra. WB6FYU and KB6FSS are General. W6JPU has a TS 940. Fresno Hamfest is May 2-4, 1986 in Fresno. The ARRL Pacific Division Convention is October 3-5, 1986 in San Jose. Traffic: N6AWH 226, W6DPD 41, WA6YAB 28, (Nov.) KB6HGW 10.

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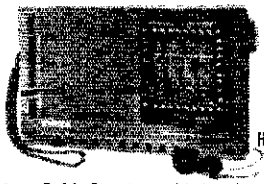

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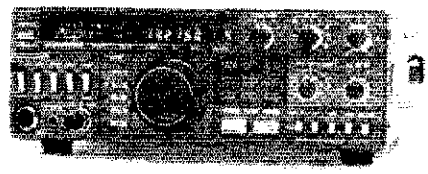

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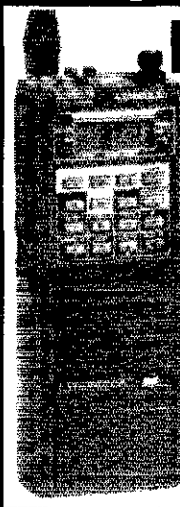

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SANTA CLARA VALLEY: SM, Glenn Thomas, WB6W—BM: W6BCY. PIO: (vacant). TC: WA6PWW. SEC: K6ITL. ACC: W6MKM. ASM: NS6N. STM: W6PHT. The Peninsula, South Bay, and East Bay areas now have an OSCAR AMSAT-VHF Net on W6EDE/R, 146.61- at 8:00 PM on Wednesday evenings. If you are interested in OSCAR, why not check in and join the gang? Congratulations to our newest Special Service Club, the Gabilan Amateur Radio Club. The South Peninsula Communications System had their quarterly breakfast on January 18 . . . the FARS/EMARC annual banquet was held at Vahls in Alviso, and a goooood time was had by all. Also, congratulations to our new technical coordinator, Kit Blanke WA6PWW. It's not too early to start thinking about Field Day in June. This IS next year, so go get 'em! The SJSU Amateur Radio Club is entering the Engineering Depts engineering contest with an OSCAR/packet setup, good luck guys. Congratulations to Sharon N6MWD on her recent upgrade. The Pacific Packet Radio Society meeting with a talk on packet operating do's and don'ts for the beginner by Walt AJ6T. Let's see those Club newsletters; how else can I publicize your coming attractions if I don't know about them? My address is somewhere near page 8 of this QST. QQ reports from K6AYB, W6OKK. Traffic: W6YBV 266, W6KZJ 173, KA6CVM 138, W6PHT 137, KB6ZV 47, KA6SXW 36, W6PRI 26.

ROANOKE DIVISION

NORTH CAROLINA: SM, Rae Everhart, K4SWN—This month marks the end of our term as your SM. It's been an exciting and fast two years. Thanks for your support in the re-election process for another term. Hope to see everyone at the Charlotte Hamfest March 22-23. Exams will be given the first Saturday of each month at Kernersville Public Library—contact W9TZ. Attention all clubs. Field Day is only 3 months away so make your plans NOW to participate. Are YOU ready for the emergency? December was a busy month for traffic and showed a steady 10% increase over 1984. PSHR reports have doubled. Do you the membership think changes need to be made in counting PSHR points? Let me hear your ideas. Congrats to our TC, K4ITL on being honored by APCO for his work in Amateur Radio Public Service. To NJ4L and WB4TOP for making BPL (BPL) in 85. New appointments: N4MCT EC Lincoln County. Should the president invoke the Presidential Warpowers Act what would amateur radio as we know it do? Shut down our stations? Very possible. Do you want to operate your station under such conditions? Then join ARES/RACES. State government recognizes the joint association. Check with your county EC to make sure you have an approved RACES plan on file with Emergency Management Office and be sure that you are listed on file with that agency approved for such an emergency. No ARES/RACES plan? Start one and get approved today. Needed: Public Information Assistants and Official Observers. Contact WA4OBR and K1PLR. Make your plans NOW to attend the ARRL State Convention at Raleigh on April 13. W4CQ Newsletter has a NEW look. Very impressive. HQ will give away 3 transceivers in 1986 to 3 top clubs in USA getting most new members. Get new interest in your club by recruiting new ARRL members. Silent Key: W4JZA. Traffic totals for Oct, Nov, Dec, 85.

NET	QNI	QTC	TFC	QND	SESS.	MGR	FREQ.
NCEN	2162	763	651	2560	89	WB4WII	3823
NCMN	1248	609	446	1793	90	WB4HRR	3927
CN	1704	1086	1003	4734	184	NJ4L	3573
CSN	873	200	196	2744	91	N4EST	3715
CNCTN	2583	491	429	1620	92	WA4MNR	6.22/82
PCTN	1588	601	380	1620	91	NF4J	6.28/88
RARS	566	78	74	977	91	K4ABJ	6.04/84
CFARS	1118	55	54	1472	91	KE4HW	6.31/91
M2MEN	2584	149	147	1947	92	KD4JC	6.35.23
THEN	1499	175	139	1355	87	W4YBQ	3923
PETN	293	87	79	580	62	WB4HRR	6.75.17

Traffic: K4NLK 461, NJ4L 409, AB0Y 336, KA4TLC 331, AK1E 244, KB4IVV 240, WB4TOP 220, WB4N 182, WD4HTE 174, KB4FWL 164, WB4HRR 147, WB4WII 144, K4IWW 127, AA4MP 105, N4MQU 93, KI4YV 81, WA4MNR 65, N4JEO 62, KA4YMY 62, KB4OGH 60, K4SWN 57, K4DDY 56, N4LST 49, N4LUO 47, WD4MRD 43, WD8BOQ 42, WD4RMQ 42, N4BYV 37, WD4EQK 36, NE4J 35, WB4CYN 34, K4GI 32, K4YJB 30, KA4EYF 28, K4QXA 26, N4CJJ 21, K4FOY 16, KU4W 16, K1PLR 13, WK4S 12, W4EHF 8, N4KYD 7, N4UE 7, W2JDB 5. Totals: SAR 44, TFC 4407.

SOUTH CAROLINA: SM, Jimmy Walker, WD4HLZ—ASM: WB4UDK. ACC: WA3WIP. BM: W0IKT. OOC: W4NTO. PIO: KJ4DT. SEC: K4SUG. SGL: WD4HLZ. STM: W4ANK. TC: NE4G. AIRS: W4DRF. Did you notice this article missing last month? Took over three weeks for HQs to receive my reports! Several weeks ago I was approached by a CO-OP student at work and asked to inquire on the H&W or his parents in Beirut, Lebanon. His parents' apartment was the scene of severe street fighting and he had been unable to contact them for over two weeks. What would have been your answer to this individual? He did not understand my answer and asked why I could not talk to an amateur in Beirut and inquire about his parents. I was troubled by the conversation and determined to find out what could be done. Here are the results of my investigation. The Red Cross can help anyone regardless of nationality and the following information is required. Name and address of two (2) individuals to contact in the disaster area, what happened (flood, fighting, etc.), date and time of occurrence, telephone number and name of person requesting information. Then contact the ARC - Dick Sanders (803-254-8274) Columbia. Nov/Dec Traffic: K4ZN 506, W4ANK 228, W0IKT 205, W4FMZ 193, KB4BZA 182, KA4LRM 87, WB4UDK 82, KA4YEA 76, K4ZB 74, WJ4P 57, N4LST 49, K4FRX 35, W4DRF 13, WA4JWS 8, WD4FJP 4.

VIRGINIA: SM, Claude Feigley, W3ATQ—STM: KB4WT. SEC: WB4UHC. OOC: W4HD. ACC: NT4S. BM: AB4U. TC: WB5MAE. SGL: W4THV.

VTN	1 PM	3097	AA4T
VSBN	6 PM	3947	K4VWK
VSN	6:30 PM	3680	NN4I
VN (EARLY)	7 PM	3880	K4AXF
VN (LATE)	10 PM	3680	N4GHI
VLN	10:15 PM	3047	N4KSO

I am sorry to report W4LXB as a Silent Key. John was very active on all Va. nets both phone and CW. He will be missed. Welcome to the Bedford Amateur Radio Club as an ARRL affiliated club. If any other clubs are interested in affiliation contact Club Coordinator, N14S or the SM. By this time all affiliated clubs should have received the 1986 annual report form and sent the forms back to League Hdqs. If your club has not received a form contact me. Forms must be filed to keep your club on mailing lists. New ORS appointees are: N4KSO, K4BGZ and KB4NGO. Congrats to the Virginia DX Century Club as the only ARRL affiliated club in the Section with 100% ARRL

NEW! Lower Price Scanners

Communications Electronics,™ the world's largest distributor of radio scanners, introduces new lower prices to celebrate our 15th anniversary.

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List price $699.95/**CE price $394.95/SPECIAL**
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Frequency range: 25-550 MHz. continuous coverage and 800 MHz. to 1.3 GHz. continuous coverage
The *Regency* MX7000 scanner lets you monitor military, F.B.I., Space Satellites, Police and Fire Departments, Drug Enforcement Agencies, Defense Department, Aeronautical AM band, Aero Navigation Band, Fish & Game, Immigration, Paramedics, Amateur Radio, Justice Department, State Department, plus thousands of other radio frequencies most scanners can't pick up. The *Regency* MX7000 is the perfect scanner for intelligence agencies that need to monitor the new 800 MHz. cellular telephone band. The MX7000, now at a special price from CE.

Regency® Z60-DA

List price $379.95/**CE price $179.95/SPECIAL**
8-Band, 60 Channel • No-crystal scanner
Bands: 30-50, 88-108, 118-136, 144-174, 440-512 MHz.
Hear Police, Aircraft and the FM Broadcast Bands.
The *Regency* Z60 covers all the public service bands plus aircraft and FM music for a total of eight bands. The Z60 also features an alarm clock and priority control as well as AC/DC operation. Order today.

Regency® Z45-DA

List price $329.95/**CE price $159.95/SPECIAL**
7-Band, 45 Channel • No-crystal scanner
Bands: 30-50, 118-136, 144-174, 440-512 MHz.
The *Regency* Z45 is very similar to the Z60 model listed above however it does not have the commercial FM broadcast band. The Z45, now at a special price from Communications Electronics Inc.

Regency® RH250B-DA

List price $613.00/**CE price $329.95/SPECIAL**
10 Channel • 25 Watt Transceiver • Priority
The *Regency* RH250B is a ten-channel VHF land mobile transceiver designed to cover any frequency between 150 to 162 MHz. Since this radio is synthesized, no expensive crystals are needed to store up to ten frequencies without battery backup. All radios come with CTCSS tone and scanning capabilities. A monitor and night/day switch is also standard. This transceiver even has a priority function. The RH250 makes an ideal radio for any police or fire department volunteer because of its low cost and high performance. A UHF version of the same radio called the RU150B covers 450-482 MHz. but the cost is $449.00. To get technician programming instructions, order a service manual from CE with your radio system.

NEW! Bearcat® 50XL-DA

List price $199.95/**CE price $114.95/SPECIAL**
10-Band, 10 Channel • Handheld scanner
Bands: 29.7-54, 136-174, 406-512 MHz.
The Uniden Bearcat 50XL is an economical, hand-held scanner with 10 channels covering ten frequency bands. It features a keyboard lock switch to prevent accidental entry and more. Also order part # **BP50** which is a rechargeable battery pack for $14.95, a plug-in wall charger, part # **AD100** for $14.95 and also order optional cigarette lighter cable part # **PS001** for $14.95.

NEW! JIL SX-400-DA

List price $799.95/**CE price $399.95/SPECIAL**
Multi-Band, 20 Channel • No-crystal Scanner Search • Lockout • Priority • AC/DC
Frequency range 26-520 MHz continuous coverage
With optionally equipped RF converters 150KHz-3.7 GHz
To celebrate our 15th anniversary, when you order the *JIL* SX-400 synthesized scanner before March 31, 1986, from CE, you'll get your choice of the RF-8014-DA or RF-5080-DA converter **free**. Or if you prefer, you can get the RF-1030-DA converter for only $50.00 more with your SX-400 order. The *JIL* SX-400 is designed for commercial and professional monitor users that demand features not found in ordinary scanners. The SX-400 will cover from 150 KHz to 3.7 GHz with RF converters. You may also order the following RF converters for your SX-400 scanners separately at these prices. **RF-1030-DA** at $234.95 each for frequency range 150 KHz - 30 MHz, USB, LSB, CW and AM. (CW filter required for CW signal reception); **RF-5080-DA** at $194.95 each for 500-800 MHz.; **RF-8014-DA** at $194.95 each for 800 MHz.-1.4 GHz. Be sure to also order **ACB-300-DA** at $99.95 each which is an antenna control box for connection of the RF converters. The **RC-4000-DA** data interface at $259.95 each gives you control of the SX-400 scanner and RF converters through a computer. Add $3.00 shipping for each RF converter, data interface or antenna control box. Add $10.00 for shipping both the scanner and free converters. If you need further information on the JIL scanners, contact JIL directly at 213-926-6727 or write JIL at 17120 Edwards Road, Cerritos, California 90701.

SPECIAL! JIL SX-200-DA

List price $499.95/**CE price $157.95/SPECIAL**
Multi-Band - 16 Channel • No-Crystal Scanner
Frequency range 26-88, 108-180, 380-514 MHz.
The JIL SX-200 has selectable AM/FM receiver circuits, tri-switch squelch settings -signal, audio and signal & audio, outboard AC power supply - DC at 12 volts built-in, quartz clock - bright vacuum fluorescent blue readouts and dimmer, dual level search speeds, tri-level scan delay switches, 16 memory channels in two channels banks, receive fine tune (RIT) ± 2KHz., dual level RF gain settings – 20 db pad, AGC test points for optional signal strength meters all for this special price.

NEW! Regency® HX1200-DA

List price $369.95/**CE price $219.95/SPECIAL**
8-Band, 45 Channel • No Crystal scanner Search • Lockout • Priority • Scan delay Sidelit liquid crystal display • EAROM Memory New Direct Channel Access Feature
Bands: 30-50, 118-136, 144-174, 406-420, 440-512 MHz.
The new handheld *Regency* HX1200 scanner is fully keyboard programmable for the ultimate in versatility. You can scan up to 45 channels at the same time including the AM aircraft band. The LCD display is even sidelit for night use. Order **MA-256-DA** rapid charge drop-in battery charger for $68.95 plus $3.00 shipping/handling. Includes wall charger, carrying case, belt clip, flexible antenna and nicad battery.

NEW! Bearcat® 100XL-DA

List price $349.95/**CE price $209.95/SPECIAL**
9-Band, 16 Channel • Priority • Scan Delay Search • Limit • Hold • Lockout • AC/DC
Frequency range: 30-50, 118-174, 406-512 MHz.
The world's first no-crystal handheld scanner now has a LCD channel display with backlight for low light use and aircraft band coverage at the same low price. Size is 1⅜" x 7½" x 2¾". The *Bearcat* 100XL has wide frequency coverage that includes all public service bands (Low, High, UHF and "T" bands), the AM aircraft band, the 2-meter and 70 cm. amateur bands, *plus* military and federal government frequencies. Wow...what a scanner!
Included in our low CE price is a sturdy carrying case, earphone, battery charger/AC adapter, six AA ni-cad batteries and flexible antenna. Order your scanner now.

Bearcat® 210XW-DA

List price $339.95/**CE price $209.95/SPECIAL**
8-Band, 20 Channel • No-crystal scanner Automatic Weather • Search/Scan • AC/DC
Frequency range: 30-50, 136-174, 406-512 MHz.
The new Bearcat 210XW is an advanced third generation scanner with great performance at a low CE price.

NEW! Bearcat® 145XL-DA

List price $179.95/**CE price $102.95/SPECIAL**
10 Band, 16 channel • AC/DC • Instant Weather
Frequency range: 29-54, 136-174, 420-512 MHz.
The *Bearcat* 145XL makes a great first scanner. Its low cost and high performance lets you hear all the action with the touch of a key. Order your scanner from CE today.

NEW! Bearcat® 800XLT-DA

List price $499.95/**CE price $317.95**
12-Band, 40 Channel • No-crystal scanner Priority control • Search/Scan • AC/DC
Bands: 29-54, 118-174, 406-512, 806-912 MHz.
The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4¼" x 12½".

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SMMX3000-DA Service man for *Regency* MX3000. ..... $19.95
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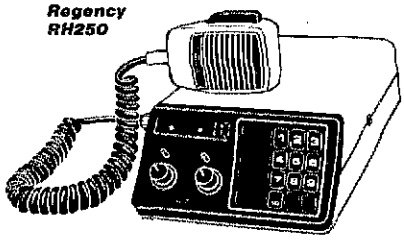
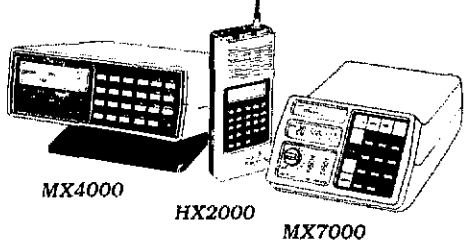




membership. In spite of poor conditions December was an outstanding traffic month with a section traffic count of 9860 by 45 stations reporting. N4GHI, N4EXQ, K4JST, KB4WT, AA4AT, WB4PNY and Mail message stations WA4TGF and KA4UFI made BPL. K4JST handled 75% of his traffic via HF and VHF Packet and AMTOR. WB4PNY says the CYCLE ONE TRAFFICBOX using 100 WPM RTTY is up and running on 7091 kHz. VE Exams are scheduled for Mar. 1 in Chesapeake, Apr. 5 in Williamsburg and May 3 in Hampton. Contact the SM for details. Mark your calendars, the Roanoke Division Convention will be held in Virginia Beach, August 23 and 24. The Division League Planning Meeting will be in Greenville, SC, in May. I want to thank all the Clubs that send me copies of their newsletters. They are very helpful in keeping abreast of Section activities. Since no other candidate filed for the election of Section Manager I have been declared reelected for another term as your SM. I appreciate your support for the past 2 years and will look forward to serving you again. The appointment of Section Public Information Officer (PIO) is open. If interested in being our "PR" person contact me. Does your club have a RFI committee, if so, at least one member of that committee should be an "ATC" appointee. It was good talking to many of you at the Frostfest and Winterfest. See you at Manassas in June. OOC, W4HU reports OO's KE4EQ, W8IRT, K4JDJ, KB4WT and AA4EL were active scanning the bands for operating discrepancies. Plan to participate in the Virginia QSO Party from 1800Z Mar. 6 to 0200Z Mar. 10. Traffic: N4GHI 1211, N4EXQ 877, K4JST 811, KB4WT 776, AA4AT 707, WB4PNY 604, WA4TGF 488, AA4GL 427, WA4CCK 397, W3ATQ 371, WD4ALY 273, WD4OCW 271, KA4UFI 243, K4MTX 219, WA4QGI 174, K4AXF 156, KA4ERP 156, K4JUM 143, WA4LJI 142, K4JM 128, N4KSO 109, WB4KSG 108, WD4MIS 106, K3RZR 100, WB4FLT 99, KB4NGO 96, WB4KIT 81, K4BGZ 76, NW4O 72, NT4S 66, NN4I 60, K4MLC 51, W4JLS 44, K4GR 33, W4TZC 31, K4VWK 31, KA4IUM 25, WB4UHC 20, N4DWO 19, N4FNT 18, WA4TVS 14, WB4ZNB 9, WB4DQZ 8, N3RC 6, W4YE 4.

WEST VIRGINIA: SM, Karl S. Thompson, K8KT—SEC: K8QEW. STM: KD8G. TC: K8CG. ACC: WA8CTO. BGL: K8BS. New Novice Net Freq. and time is 3730 at 5:30 EST. Fall Meeting of State Radio Council will be March 8, at Jackson's Mill. Pls attend. Participation is needed on all section nets. See times and freqs below. WVRN continues to grow, good work Mark.

Net	Time	QNI	QTC	Sess.	NM	Freq.
WVFN	6:00	893	230	31	W8YP	3985
WVMD	11:45	853	106	31	W8FZP	7235
WVN	7:00	289	117	31	KZ8Q	3567
WVNN	5:30	58	12	30	WD8LDY	3730
WVRN	6:30	278	51	31	KD8RD	3640

Traffic: N8GJO 534, WD8LDY 403, W8YP 272, WA3NUI 124, W8FZP 106, WA8KCJ 70, KD8RD 65, W8JWX 43, K8QEW 40, N8EMQ 36, K8UQY 34, K8KT 33, KA8OGF 30, NC8G 28, N8FXH 18, WA8YCA 15, WD8DHC 15, WD8MJE 9.

ROCKY MOUNTAIN DIVISION

COLORADO: SM, Bill Sheffield, KØØJ—SEC: WBØFOB. STM: WDØAIT. ASM: WØRSG, KAØMQA. ACC: WBØDUV. OOC: NMØX. PIO: NØFOE. SGL: WDØGQL. TC: NCØF. BM: KDØRX. The League reports that 1985 showed the largest increase in ARRL membership since 1977. Colorado has recently gained many new amateurs thru upgrades, and many new ARRL members . . . so I will touch on the fact that there are many station appt's available in the Section. ORS, if you enjoy traffic the STM can use your talents. OES and some EC positions are needed by the SEC. PIA's are needed from every area of the state to keep the PIO and myself informed of the activities happening in amateur radio locally. OBS to help disseminate ARRL bulletins and local events to the many nets and repeater groups around the state. OO is a most important program of the league and the FCC. The TC can use some ATCs in certain areas of the State. If your club is not ARRL Affiliated, let the ACC know there are many advantages including insurance. Drop me a note if you are interested. Congrats to the PPRAA ARES-program & their installation of antennas on many of Colorado Springs Hospitals. 73, KØØJ. NETS: Col: QNI 761, QTC 81-inf 84. CWN: QNI 101, QTC 47 CWXN: QNI 2753, QTC 2227. HNN: QNI 2014, QTC 155 inf 461. NCTN: QNI 1304, QTC 220. SCTN: QNI 92, QTC 29. Traffic: WAØHJZ 2727, KØRXK 662, WAØOYI 1308, NØBQP 465, KØJAN 433, WØACH 416, KBØZ 302, WDØBSZ 161, WBØFFV 135, NØDZA 115, WDØAIT 57, AIØW 37, KØCI 14, WØNFW 12.

NEW MEXICO: SM, Joe T. Knight, W5PDY—ASM: W5HD. DEC: KB5XD. STM: ND5T. NMs: WA5UNO K6LL W5VFQ. TC: W8GY. ACC: W5HD. Southwest Net (SWN) meets daily on 3583/7083 at 0230 UTC and handled 229 msgs with 200 stations in. New Mexico Roadrunner Net meets daily on 3939 at 0100 UTC and handled 56 msgs with 1056 stations in. New Mexico Breakfast Club meets daily on 3939 at 1330 UTC and handled 95 msgs with 917 stations in. Yucca 2-mtr Net 7/18 handled 23 msgs with 355 checkins. Caravan Club 2-mtr Net 66/06 handled 42 msgs with 147 checkins. SCAT 2-mtr Net 66/06 handled 30 msgs with 613 checkins. Sorry to report the passing of KE5UB, W2OV, K5PPC, K5ORF & W5QKA. W5ERJ in hospital but doing better. W5UR and about twenty others packeteering. KV7B gave a good packet talk in ABQ. Traffic: ND5T 1069, W6SX 28.

UTAH: SM, Jim Brown, NA7G—SEC: WA7JJL. STM: W7OCX, Herb Summers, KA7GYW received a Certificate of Merit for his hard work in promoting amateur radio with the Shriner's Hospital. Packet radio activity is steadily increasing, with over 50 stations on, a long range digipeater up, and several bulletin boards operating. Club presidents: WB6BKM, DARC; N7EZC, OARC; KA7SFL, TCARS; KA7SQQ, UARC; K7JL, VHF Society. 73 de NA7G. Traffic: K7HLR 437, WA7KHE 214, WA7MEL 135, N7ASY 50, WA7JJL 25, W7OCX 18, NA7G 14.

WYOMING: SM, Dick Wunder, WA7WFC—ASM: KA7AWS, SEC: W7TVK. STM: KAØX. KA7FDL is Net Manager for "Albany County ARES Net". W7VEW and K7MM are on Packet Radio in the Riverton-Lander area. KA7WQI is new Novice, & upgrades include N7HBX to ADV and KC7KC to Extra. Cheyenne's new repeater is up and running with autopatch on 146.175/.775 and welcomes visitors. New officers in WARS (146.22/.82 Rptr. on Sherman Hill are: W7NE-Pres, KA7FDL-Vice Pres, & KD7CF-Sec/Treas. KC7AR reports the Wyoming Cowboy Net held 22 sessions with 684 QNI and 20 QTC. Traffic: NN7H 560, KC7AR 20, W7SQT 14, and K7SLM 14.

SOUTHEASTERN DIVISION

ALABAMA: SM, Joseph Smith, Jr., WA4RNP—STM: N4JAW. SGL: KA4WVU. BM: KF4VV. OO/A AUX: AA4BL. TC: N4AU. ATC: WB4BYQ. ACC: WA4RNP. From Mobile comes this list of new club officers: President WU4K, Jim; Vice President W4YXO, Cal; Secretary N4FRU, Cecil; and Treasurer WA4AVC, David. Also Mobile now sports a digipeater for packet and a new 440 machine. The Samford University ARC is the newest club in our section with

ICOM

The Excitement of Satellite Communications

An ever increasing number of radio amateurs are joining the excitement of Phase III-type satellite communications, and there are some good reasons. This new medium combines the communications range of the 20 and 80 meter bands with the line of sight reliability of 2 meters in a completely perfected manner. It's equivalent to a totally new band, it's unaffected by sunspot variations, and a vast technical background isn't necessary for enjoying the action.

ICOM America stands ready to help you enjoy the fascinating new capabilities of OSCAR 10 and future amateur satellites, and it has a full line of equipment to back that statement. Its all mode 2 meter and 70 cm base transceivers bring the operating conveniences of low band units to the VHF and UHF amateur bands. They can be used for local FM operations via repeaters or for SSB/CW communications via any Phase III OSCAR satellite. The new IC-1271 all mode 23 cm transceiver is in a class of its own, providing mode L satellite uplink capability (mode L is 23 cm uplink, 70 cm downlink) and optional fast scan amateur TV operations using home video equipment.

The overwhelming preference of mode B equipment (435MHz band transmit, 145MHz band receive), among OSCAR groups and users, is ICOM's IC-271H and IC-471H transceivers. Why? Satellite relayed signals are somewhat weak in nature, and the IC-271H's low noise/high sensitivity receiver gives the highest possible performance for hearing everyone regardless of their uplink performance. The IC-271H's noise blanker also prevents pulse-type electrical interference from masking some highly desired DX signals, and its selectable AGC can follow fast fades associated with spin modulation. There are also 32 all mode memories which can be used for intermixed FM repeater and SSB/CW operations. When the IC-271H is equipped with the optional mast-mounted AG-25 GaAsFET preamp, it becomes a satellite operator's dream come true.

ICOM's IC-471A (25 watts output) or IC-471H (75 watt output) 70 cm transceivers boast an output signal that's recognized on the satellite by its crystal clear audio. Power output of either unit IC-471A/IC-471H is continuously front panel adjustable to adjust to daily signal variations. This sidesteps the taboo practice of overloading a satellite's on-board receiver. The IC-471A/IC-471H also includes 32 all-mode memories for the ultimate in operating flexibility.

ICOM's IC-PS30 system DC power supply is an ideal single cabinet unit for simultaneously powering both satellite transceivers, or the IC-271A and IC-471A can be equipped with an optional PS-25 internal DC power supply for "stand alone" operation. A pair of small 16 element antennas, one for 435MHz operation and one for 145MHz operation, connect to their respecti transceivers to complete the spac age setup. No complex interwirin are necessary in the previously described setup.

Operating OSCAR 10's popul mode B is almost as easy as operati an HF band. The satellite's ba centers are 435.100MHz upli (receive from ground operators) a 145.900MHz downlink (transm back to ground operators), with band edges roughly 50KHz abo and below those frequencies Assuming both transceivers a tuned to band centers, ones ov satellite-relayed signals can be ceived while transmitting and us for "tweaking" antenna positio and offset-tuning doppler shift OSCAR 10's inverting passband then tracked as follows: for each K the IC-271H's receiver is tuned abo 145.900MHz, the IC-471A/471H transmitter should be tuned an equ number of KHz below 435.100M to "zero beat" others. The accura readout of ICOM's digital displa even eliminate the need to "talk or self onto frequency."

If you're interested in joinin today's most exciting era of amate communications, OSCAR 10 a future Phase III satellites are t medium to use. If you appreciate to performance equipment for tho activities, ICOM is the logical choic It's simply the best, and it's backed an uncompromised policy of t service. Isn't it time you enjoy these exciting pleasures?

ICOM America, Inc., 2380-116th Ave NE, Bellevue, WA 98004 / 3331 Towerwood Drive, Suite 307, Dallas, TX 7

Star Performers!

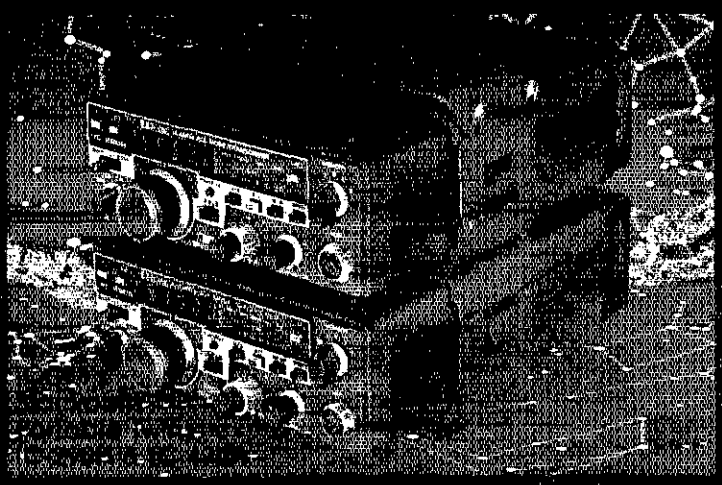
ICOM's VHF/UHF Pairs for Satellite Communications

Oscar 10...Are you ready? in the future of amateur tellite communications with OM VHF and UHF transceivers. ad why ICOM is ...*Simply e Best* for satellite mmunications.

C-271A/471A Twins

This new series of VHF/UHF se stations offers a mbination of features and ibility found in no other nsceivers anywhere. For celving MODE J down-link, the 471A features a less than 0.5 crovolt for 10dB quieting SSB ceiver plus an optional mast unted GaAs FET preamplifier h a 15dB gain.

Thirty-two tunable memories ep the IC-471A ready to go on quency and to monitor the acon frequencies. A good se blanker plus all mode uelch make listening a real asure. 10Hz variable speed ning, which automatically fts to 100Hz when needed, d a low-noise PLL that locks to Hz makes the frequency olution of the ICOM Twins



second to none. For MODE B use, the IC-471A features a 10W SSB transmitter with variable power control.

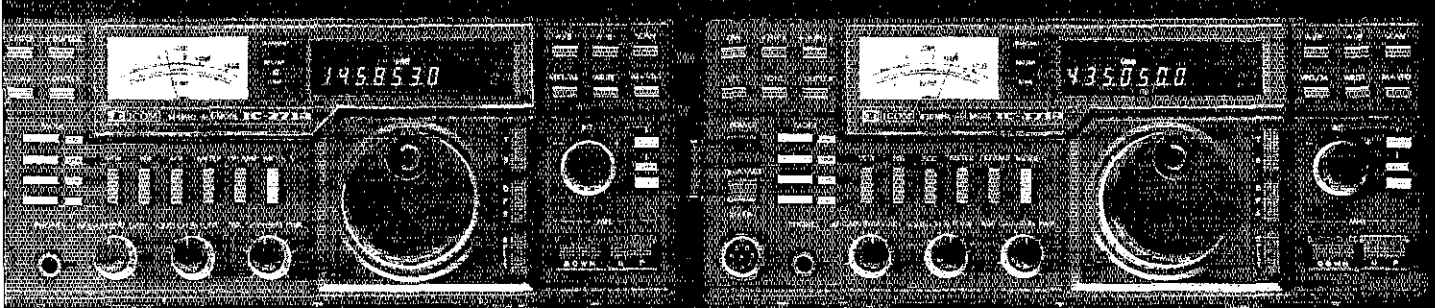
The same basic features of the IC-471A apply to the IC-271A and an optional internal pre amplifier with front panel switch is available. The IC-271A transmitter features 25W of transmitter power.

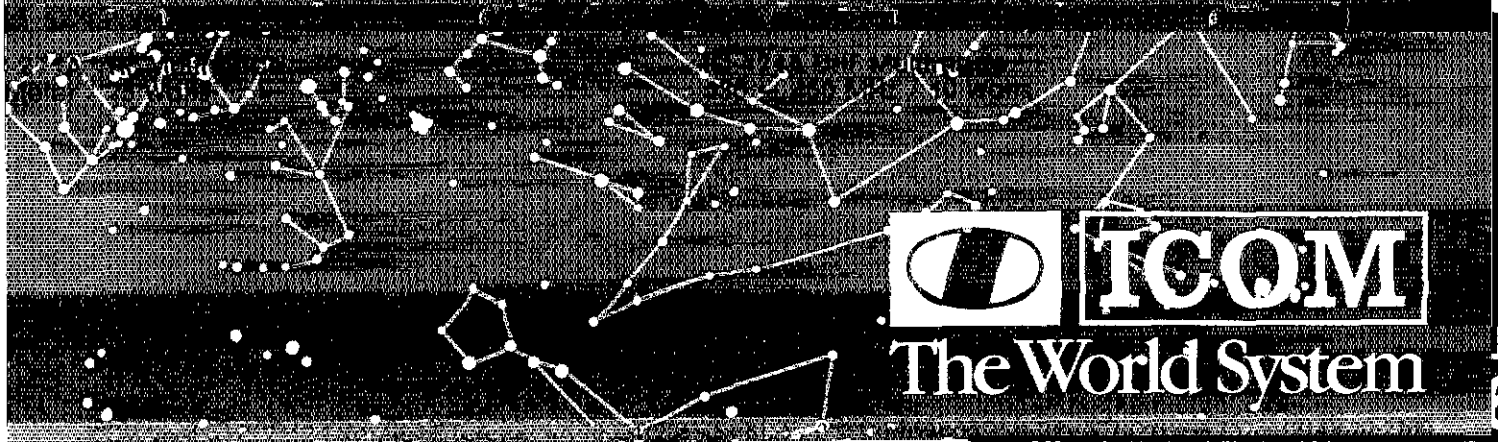
The IC-471A and the IC-271A both have options for computer interfacing. The ICOM BUS is brought out through an optional interface to the back of the radio. From this point, it may be routed to the ICOM computer interface terminal, mounted in a matching box, that will convert the ICOM BUS to RS232C standard. Allowing computer control of both transceiver units, this capability, plus the antenna-tracking programs available for Oscar 10, will make the IC-271A and 471A Twins the ultimate for computer control of your satellite operations.

IC-290H/IC-490A Twins

ICOM's IC-290H and IC-490A mount together as a stackable, mountable pair that offers versatility, portability and satellite capability in an incredibly small size. These units are easily hung from your ham shack bench, taken on portable operations or used mobile.

Each features multiple tuning rates, memories, FM/SSB/CW, programmable scan and priority function, and an all mode squelch. The IC-290H has a 25W transmitter, the IC-490A, 10W. Both of these transceivers are high quality designs by ICOM and offer all the flexibility needed for satellite operations.





ICOM

The World System

these club officers: President KB4PJM, Tim; Vice President KB4PJF, Son; and Secretary/Treasurer N4ECZ, Liz. It's the season for hamfests and tornadoes and I wonder which one will get the most attention. I hope to see most of you at the "fests" this season and I will pray that the twisters pass us by. I have two Silent Keys to report this month: W4FGR, Lois V. McKistry of Wetumpka, Ala. and W4OGT, Tom Jones of Lincoln, Ala. They will be missed. Traffic: CAND reports 1878 messages in 31 sessions with AL rep 100% by W4CKS and NW4X. DRN5 reports 1410 messages in 62 sessions with AL rep by WA4JDH, W4CKS, NW4X, and KC4GS. The AEND reports 99 messages in 31 sessions. The AEND reports 76 messages in 31 sessions. BPL: WA4JDH. PSHR: WA4JDH, W4CKS, WD4NYL and WA4RNP. 73 all, Joe. Traffic: WA4JDH 1346, NW4X 268, W4CKS 218, K4AOZ 74, WD4NLY 59, WA4RNP 55, AA4KE 18, W4DGH 15, KC4GS 13, WB4TVY 4.

GEORGIA: SM, Eddy Kosobucki, K4JNL—ASM & BM: K4VHC. SEC: NC4E. STM: W4PIM. ACC: WA4ABY. OOC: NA4I. PIO: WA4PNY. AGL: W4BTZ. TC: K4UDR. This month it's the annual Columbus Hamfest on the 22nd & 23rd & in April on the 19th it's the Kennehoochee at Marietta. Pse support our section affairs. Congrats to all who were elected to the leadership to your clubs & groups & to the new SSC clubs. Conyers ARG & the Gwinnett ARS are the latest Special Service Clubs in the Georgia section. I know that many more can qualify for this honor so let's give it that good American try. The benfits alone are worth the effort. West Georgia elected WA4BWZ Pres., VP: N4JDM, Tng & Contest: N4UZ, VP prog: WB4ZOJ, Sec/Treas: KB4GH. Congrats to the Chehaw Club who placed first in #3A in the 1985 FD. Macon ARC elected Pres: KA4UQC, VP: KA4FUB, Sec/Treas: KB4PKJ, Dir: WA4IYC & Rpt Trustee: W4VZY. CGARC at Warner Robins elected WL7ACY Pres., VP: W4HON who also won the AMATEUR of the YEAR AWARD, Sec/Treas: KC4WU, Prog Dir: WD4ENO. Albany ARC new 3 yr Directors are, WA4DDA, W4EVG & KC4WL. The ladies at MALARC continuing to tape YL HARMONICS for the YLRL. Gud job & ur helping the sightless. Dixie DXer's new 1986 officers are: Pres: W8ZF, VP: K4JPD, Sec/Treas: WD4IKI, Pub Edit: WB4GWA Act: NQ4I & KB4IUC. Tech: N4UZ. They meet 3rd Thurs at Morrison's near Atlanta Airport at 6 PM Net meets Sun nites on 3805 at 8:05 PM. BGMRC at Newnan elected WD4PAH Pres, VP: K4ERE, Sec/Treas: KB4GGX, Act: W4IGE & Finance: N4DSG. We lost 3 more section hams during the past month. W4FOE, K4AEC & AA4TT. May God have mercy on them & let their families suffer no pain. Traffic: W4PIM 415,W4WXA 221, WB4WQL 126, K4MOG 99, KF4FG 61, KI4IG 44, W4HON 44, WB4SPB 35, K4BAI 33, K4NM 28, KC4WL 26, W9NXC 26, WB4DBO 22.

NORTHERN FLORIDA: SM, Phil O'Dwyer, WF4X—ASM, ACC: N4ADI. STM: WB4GHU. SEC: WA4PUP. PIO: WA4PUO. SGL: KC4N. BM: KB4LB. OO: K4JJE. TC: N4KF. Well, the past year has surely been an unusual one: We saw forest fires rage from one end of the state to the other and were encouraged and enthused by the unselfish performance of all of you and of our Emergency Corp especially. While I was off the air for a little while we had hurricanes Elena, Juan and Kate dub our area as "Hurricane Alley" and you all came through again in the same great way. While all this was going on we increased the number of DEC's and EC's so that only a few counties are not currently represented. When Mexico was devastated by earthquakes it was a different group that gave so unselfishly but with the same devotion to helping those in need. The propagation on all frequencies has remained a problem but our net members and managers have managed to keep the traffic moving despite a few extra grey hairs die to the frustrating conditions. By the time this column gets into print I hope to see and thank each of you at the Orlando Fest; until then, I salute and thank you on behalf of our Section and those fine volunteers who are listed at the beginning of this column and serve as our League Officials on my staff. Traffic: WD4IIO 2107, WX4H 1061, N4PL 988, WA4QXT 896, WB4ADL 769, KB9LT 678, AA4FG 646, AA4HT 608, WC4D 572, WD4IUI 358, KC4VK 264, KD4KK 252, WB4GHU 248, WB4TZR 220, WA4EYU 171, KF4U 151, WD4MLO 130, N4DY 117, W4KIX 107, KB4LB 102, W4MGO 101, W4GUJ 97, N4JAQ 82, WD4EQB 82, ND4O 67, N4GMU 48, W4LDY 46, WA4SXW 42, NA4F 38, W8IM 37, N4JHI 36, KB4MHH 35, N4EDH 34, KI4CQ 25, NS4C 23, NQ4P 21, WB4FJY 19, WD4HBP 19, N4ADI 18, WA4PUO 17, KA4KAH 16, WA4PUP 16, N4ENL 12, KF4GY 11, WB4AWG 9, WD4HUZ 5, KV4HI 4.

SOUTHERN FLORIDA: SM, Richard D. Hill, WA4PFK—SEC: W4SS. STM: K4ZK. TC: KI4T. BM: W4KBW. PIO: W4WYR. SGL: KC4N. OO: W4SS. ACC: WA4NBE. WD3KBW reports a total of 205 bulletins received and transmitted this month. OBS stations reporting were: AA4BN 10, W4ESH 4, WT4F 7, KA4GUS 28, K4IEK 27, WD4KBW 27, WA4EIC 56, and W4DL 46. AA4WJ proudly reports that his daughter, KB4AEV has now obtained her general class license. KW1K wrote that his first RTTY contact was a QSO with an HP1! Elsie, KF3JA, conducted a traffic forum in early January for the Lee County amateurs. It was an excellent forum presented by KF4JA, who is manager of both the Southwest Florida Traffic Net and the Tropical Phone Traffic net. Also speaking were Blaine WA4EIC, a well known CW and phone traffic handler as well as Miss Phil, KA4FZI, the manager of the All Florida Slow CW Traffic Net. It was an enthusiastic group and they were never at a loss for questions! Both N4KB and K4ZK were sick form Christmas through New Year's Day—but OK now. WA4PFK received a note from an elderly lady for whom he had originated a number of Christmas messages. A portion of her note follows—"...Just had a note form a 90 year old lady who has just had an eye implant. She said, you don't know how very much your message meant to me. I was alone and answered the phone myself. Thank you and the kind one who sent the message for you. It couldn't have been sent at a more appropriate time...". In the midst of a heavy Christmas traffic season it is nice to know and not lose sight of what our efforts do for others—WA4PFK says thank you to all those traffic handlers who helped relay those messages. 73 de WA4PFK. Traffic: W3CUL 3415, KA4AMC 1768, W3VR 1603, K4EUK 987, W4NFK 840, WA4PFK 698, K4ZK 695, K4SCL 523, KF4JA 507, N4KFU 406, K4IA 382, AA4BN 377, W4TAH 351, KY9T 346, WD4KBW 334, KA4FZI 325, WB4WYG 302, WA4EIC 280, KA4NXF 249, KA4GUS 239, W4RUE 217, WD4CHO 151, W1NJM 145, WD9AEP 135, N4KB 131, W4DL 123, N4JOA 120, WA4HXU 117, W4LX 116, KI4ZW 102, KA4YHS 92, KF4RL 73, KB4MON 71, WT4F 70, KB4KAW 55, W4SS 54, N4MML 49, WA4NBE 48, W3IJR 46, K4JI 45, KY8Y 43, W4DVO 41, K4BLM 40, K5IHH 35, WA9VND 35, N4ET 34, N4ILN 32, KA9AKY 31, WB4AID 30, WA4HDH 28, KB4LKT 28, KB3LPL 28, KA4SIH 28, W3TLV 27, WD4NXK 25.

IC-1271A

OM 1.2GHz transceiver

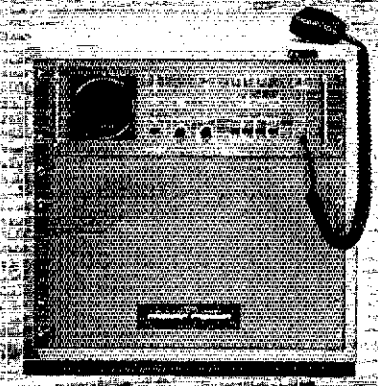
Explore the World of 1.2GHz!

Explore the world of 1.2GHz with ICOM's new IC-1271A base station transceiver. ICOM has a complete line of 1.2GHz gear to meet your operating requirements...the IC-1271A base station, IC-120 mobile and IC-1210 repeater.

IC-1271A. ICOM introduces the first full-featured 1200 to 1300MHz base station transceiver, the IC-1271A with 10 watts of RF output power, 32 memories, scanning and multi-mode operation including ATV (amateur TV). The IC-1271A is a pioneer in 1.2GHz technology. Whether your interest is in mobile, DX, repeater, satellite or moonbounce operation, the IC-1271A has exceptional receiver sensitivity because of front end GaAs FETs.

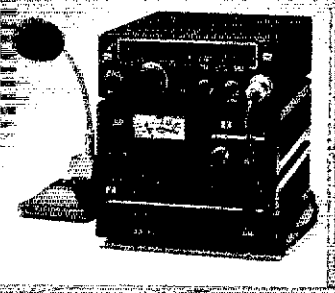
A variety of options are available for the IC-1271A including the IC-EX310 voice synthesizer, UT-155 CTCSS encoder/decoder, IC-PS25 internal AC power supply and the TV-1200 interface unit.

TV-1200. The interface unit allows amateur television (ATV) operation when used in conjunction with a video recorder or a video camera for transmission, and a television monitor for reception. Explore the new facet of amateur radio, "video hamming."



RP-1210. Complete your 1.2GHz system with the RP-1210 repeater. The RP-1210 features PLL frequency selection (198 channel, DIP switch), high stability PLL, repeater access to CTCSS, three digit DTMF decoder for control of special functions, 10 watts, selectable hang time and ID'er.

IC-120. The 1.2GHz mobile transceiver features six memory channels, scanning, an HM-14 up/down scanning mic, RIT, LED readout and three tuning rates. Accessories include the ML-12 10 watt amplifier and the PS-45 slimline power supply.



See ICOM's full line of 1.2GHz gear at your local ICOM dealer.

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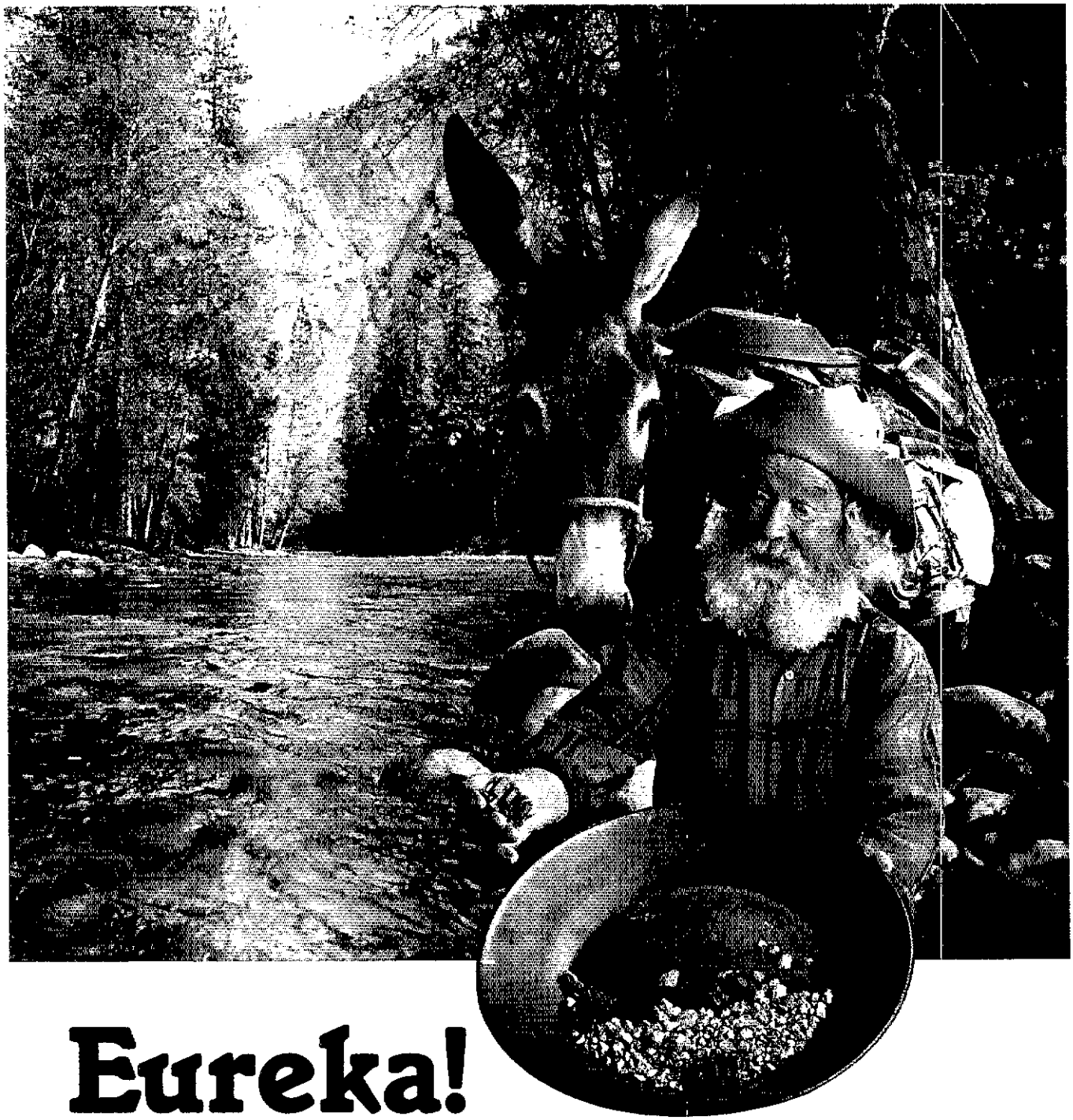
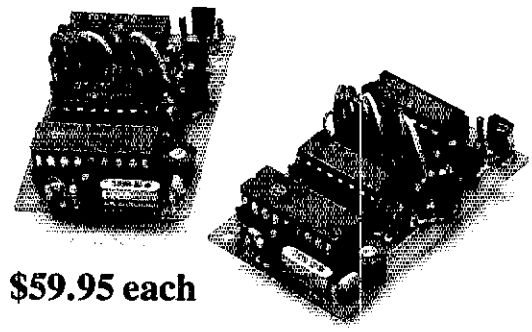


Eureka!

We just struck gold with a miniature, high quality and very reliable DTMF decoder at a rock bottom price of $59.95. Our DTD-1 will decode 5040, 4 digit codes with the security of wrong digit reset. It contains a crystal controlled, single chip DTMF decoder that works great in bad signal to noise environments and provides latched and momentary outputs. Why carry that heavy gear when its size is only 1.25 x 2.0 x .4 inches and it comes with our etched in stone, legendary, one year warranty.

Instead of sifting through the field...searching, use our super quick one day delivery and cash in on a rare find.



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COM Dual Bander

IC-3200A

The Most Compact Dual Bander at the Smallest Price

Finally there's a compact ull featured 25 watt FM ual bander that's simple in esign, and operation, plus ery affordable...the -3200A.

Dual Bands. The IC-3200A overs both the 2-meter 40.000–150.000MHz) and 0cm (440.000–450.000MHz) ands. The IC-3200A also fea- ures fully programmable off- ets in 5KHz steps for MARS nd CAP repeater operation.

25 Watts. The IC-3200A elivers 25 watts of output on oth bands. Or the low power an be adjusted to one to ten watts.

Compact. The IC-3200A is only 5½"W x 2"H x 8½"D.

Simple to Operate. With only 14 front panel controls, the IC-3200A is by far the easiest dual bander to use.

Memory Lockout. For scanning only certain memory channels, ICOM utilizes a memory skip (M.SKIP) function.

10 Tunable Memories. To store your favorite frequencies, 10 memories are provided. Each memory will store the receive frequency, transmit offset, offset direction and PL tone. Each memory can be tuned up or down when selected, yet automatically returns to the original frequency when reselected. All memories are backed up with a lithium battery.

Scanning. The IC-3200A has four scanning systems... memory scan, band scan, program scan and priority scan.

Other Outstanding Standard Features:

- New LCD display, easy to read in bright sunlight
- Tone encoder (all PL/subaudible tones built-in)
- IC-HM14 mic with up/down scan and DTMF
- One antenna connector (Duplexer already installed)
- Variable tuning increments 5 and 15KHz (2-meters) 5 and 25KHz (70cm)
- Frequency dial lock
- Dual VFO's
- Mounting bracket

Optional Accessories. An optional IC-PS30 system power supply, voice synthesizer and IC-SP10 speaker are available.

See the IC-3200A at your local ICOM dealer for the best buy on a full featured dual bander.

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New *New*

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Definitely Superior!

AZDEN PCS-5000

COMMERCIAL — GRADE

UNPRECEDENTED WIDE FREQUENCY RANGE: Covers 140.000-153.000 MHz in steps that can be set to ***any*** multiple of 5 kHz up to 50 kHz.

CAP/MARS/NAVY MARS, BUILT IN: The wide frequency range facilitates use of CAP and ALL MARS FREQUENCIES including NAVY MARS. ***COMPARE!***

TINY SIZE: Only 2 inches high, 5½ inches wide and 7⅝ inches deep!

MICROCOMPUTER CONTROL: Gives you the most advanced operating features available.

UP TO 11 NONSTANDARD SPLITS: ***COMPARE*** this with other units!

20 CHANNELS OF MEMORY IN TWO SEPARATE BANKS: Retains frequency, offset information, PL tone frequency.

DUAL MEMORY SCAN: Scan memory banks separately or together. ***ALL*** memory channels are tunable independently. ***COMPARE!***

MEMORY SCAN LOCKOUT: Allows you to skip over channels you don't want to scan.

TWO RANGES OF PROGRAMMABLE BAND SCANNING: Limits are quickly reset. Scan ranges separately or together with independently selective steps in each range. ***COMPARE!***

BUSY SCAN AND DELAY SCAN: Busy scan stops on an occupied channel. Delay scan provides automatic auto-resume.

DISCRIMINATOR CENTERING (AZDEN EXCLUSIVE PATENT): Always stops on frequency desired when scanning.

PRIORITY MEMORY AND ALERT: Unit constantly monitors one memory channel for signals, alerting you when channel is occupied.

LITHIUM BATTERY BACKUP: Memory information can be stored for up to 5 years even if power is removed.

FREQUENCY REVERSE: Allows you to listen to repeater input frequency.

ILLUMINATED KEYBOARD WITH ACQUISITION TONE: Keys are easily seen in the dark, and actuation is positively verified audibly.

CRISP, BACKLIGHTED LCD DISPLAY: Easily read no matter what the lighting conditions!

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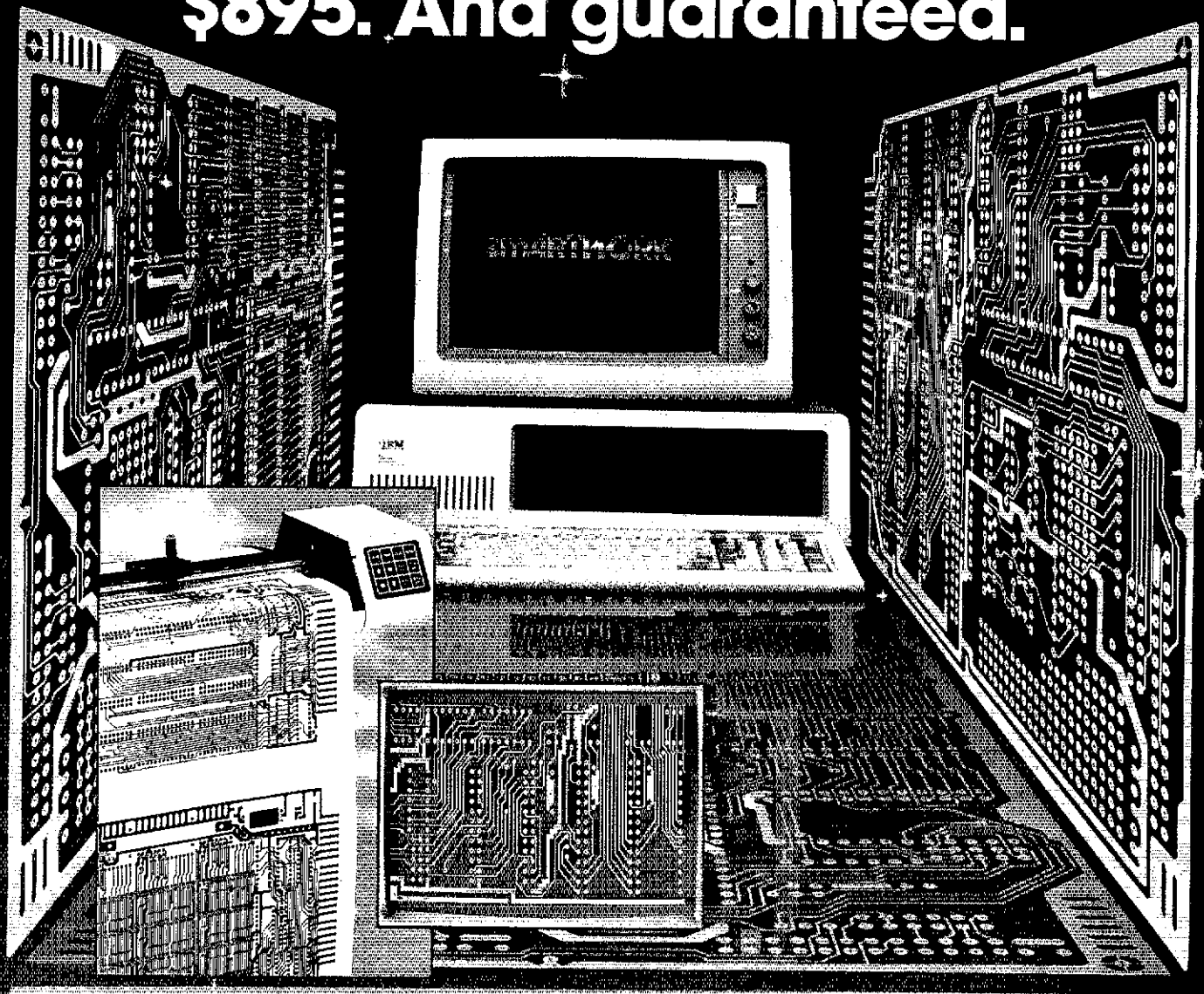

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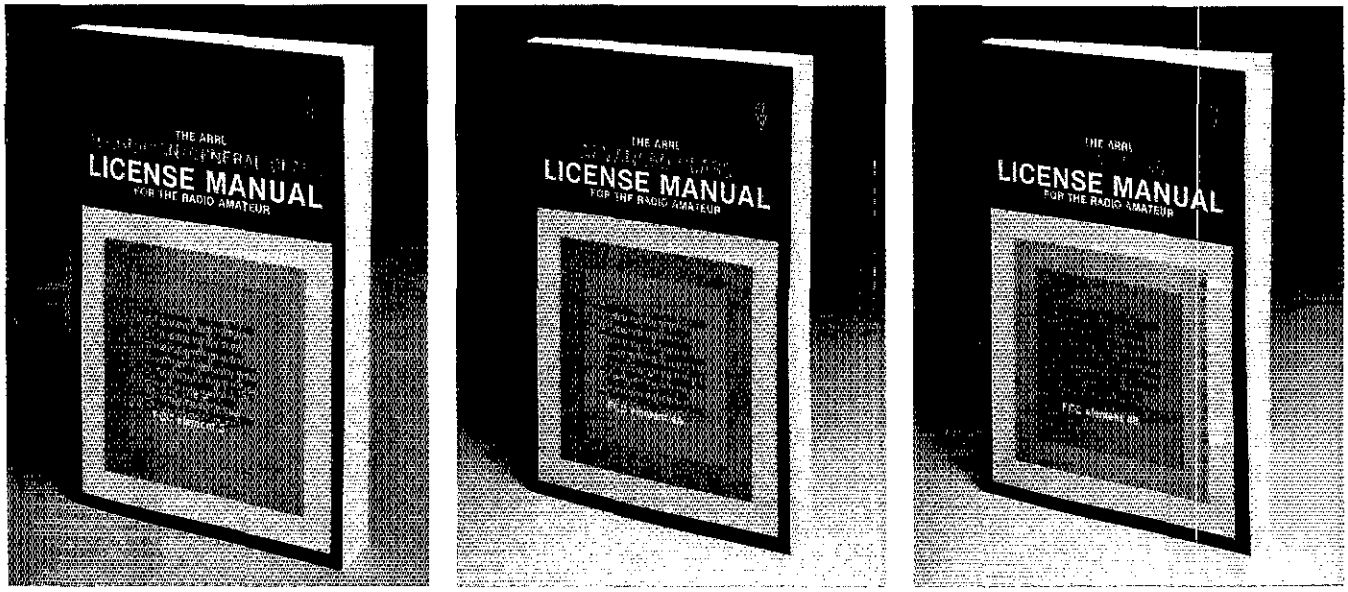

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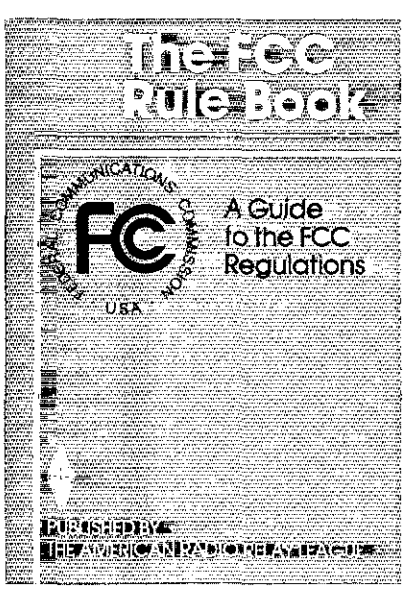

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RF Output Power	5.0 Watts (H), nominal at 12V 3.5 Watts (H), nominal at 10.5V 0.5 Watts (L), nominal at 10.5V	3.0 Watts (H), nominal at 10.5V 0.5 Watts (L), nominal at 10.5V
Modulation	Frequency modulation	Frequency modulation
Maximum Deviation	± 5 KHz	± 5 KHz
Transmit Spurious	– 60 dB	– 60 dB
Microphone	Electret Condenser Microphone	Electret Condenser Microphone
Receiver		
Receiving Methods	Double superheterodyne	Double superheterodyne
I.F.	1st 16.9MHz 2nd 455KHz	1st 21.4MHz 2nd 455KHz
Sensitivity	Less than – 0.25uV at 12dB SINAD	Less than – 0.25uV at 12 dB SINAD
Band Width	± 7.5 KHz at 6dB down	± 7.5 KHz at 6dB down
Selectivity	± 15 KHz at 60dB down	± 15 KHz at 60dB down
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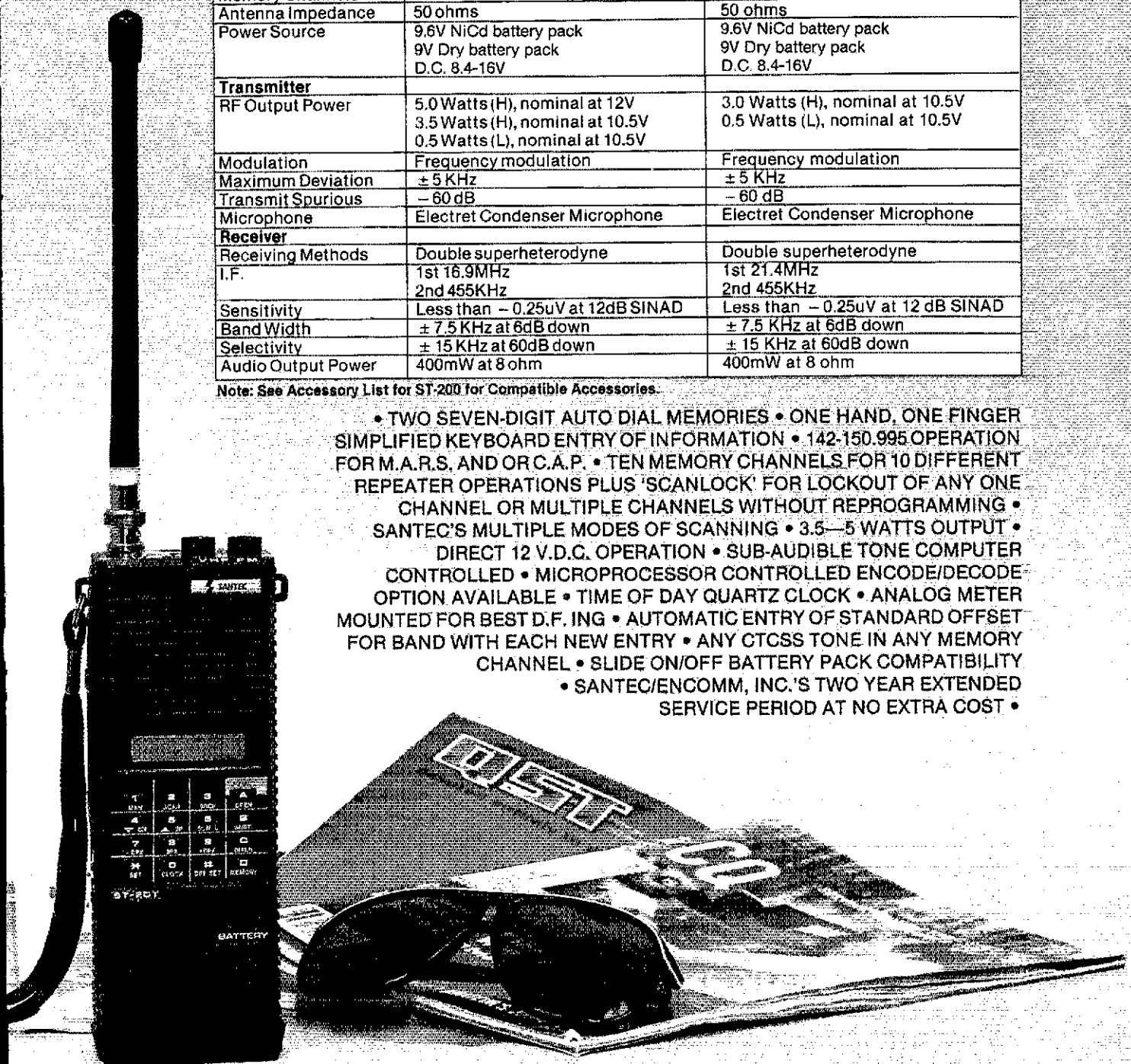

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SOUTHWESTERN DIVISION

ARIZONA: SM, Jim Swafford, W7FF—STM: W7EP. NMs: K6LL. KA7HEV, WB7CAG.

Current Net Schedules are:
Daily: 1800 Cactus Net 3.915
(local) 1830 Cactus Net 147.86/26
1930 AZ TFC & EMERG. 3.992
1930 Southwest Net 3.583

Last month's mention of the convention in San Diego next Sept. 5-7, should have said "ARRL NATIONAL" rather than "SW DIVN." Pima County Bd. of Supervisors recently passed an antenna ordinance restricting heights and locations of communications towers. Tucson hams met with the Planning & Zoning staff as well as members of the Commission and succeeded in getting amateur structures less than one hundred feet height exempted from the ordinance. Considered a major victory for the ham community. Thanks to K7KI, W7HT, KD7WM, W7SA, WB7RJV, K7KNP, K7DXD, K7CET, W7YXE, K7OMR, KB7KZ and others who worked on this. FB show. Green Valley R.C. new officers are: W9ROD, Pres.; W6EVL, V.P.; and K8TXT, Sec-Treas. Their club station has full OSCAR satellite capability. ARCA has decided their first choice of dates for Ft. Tuthill hamfest is Aug. 1-2-3, with July 25-26-27 as second choice. The first choice dates will allow ARRL officials from HQ and Divn to attend. Dates to be firmed up in January. CADXA reports new officers: KY7M, Pres.; KC7CE, V.P.; N7US, Sec.; and W8AKH, Treas. Long skip shortly after sunset affecting some 80 meter traffic nets. Low sun spot numbers mean lower MUF's and as a result 80 and 40 meters become excellent DX bands. W7YS reports his current major activity is DX, DX, and DX! SARC again supported the 15th annual Fiesta Marathon run. K7PYK made packet radio history by QSO'ing from his Janus 2 glider while soaring at 4000 ft! He is also promoting the use of packet radio for emergency operations. Sounds like a good idea. 73, JIM.

Net Name/Designation	QNI	QTC	Net Mgr.
Cactus Net (HF/SSB)	651	274	WB7CAG
Cactus Net (VHF/FM)	377	129	WB7CAG
Apache Junction Radiogram Net	217	27	KE7DR
Arizona Tfc & Emergency Net (ATEN)	860	271	KA7HEV
Southwest Net (SWN) HF/CW	200	229	K6LL

LOS ANGELES: SM, Bob Poole, AJ6F—ASM: K5IYK, SEC: AK6Y. STM: W6INH. ACC: KX7Q. OOC: K6BMG. Still not too early to get ready for the National Convention in San Diego; plan ahead for this. AK6Y and the LAX ARES team have made great progress in developing new vitality and leadership. Among the leadership are DECs WB6MKA, K6YMJ, WA6MZV and W6UPN. Contact AK6Y or AJ6F to see how you can help in this important Field organization. WA6HXZ reports that the members of the Palos Verdes Radio Club operate the video equipment to televise the City of Rancho Palos Verdes council meetings. This all volunteer team makes this important service available to the community while promoting amateur radio at the same time. Our congratulations to this club. The W6FNO/R system, as reported by KA6ZDL, handles many emergencies, too numerous to report here; a total of 307 messages were handled in December on 146.82(-) here in the Los Angeles area. Further, their group provided the communications for the city of Covina's Christmas parade. Not only these prior items are worthy of note, but W6FNO-1, -2 and -3 on 223.72 are digipeating packets in a rapidly expanding digital emergency network, according to DEC WB6MKA. Coverage from the desert to the sea is expected from this network. Perhaps the most important building block in the ARRL field organization is the Affiliated Clubs. ACC KX7Q requests that clubs update their affiliation paperwork if they haven't already done so. New applications are also solicited. Holidays are over and things are back to normal. This years traffic was exceptionally heavy, lots of Holidays messages. There is now a new OOTC club in the Los Angeles area It is Chapter #2 President is Stu Wolfe, W6FYV. Meetings will be twice a year. For more information contact W6FYV or Bert W6CL. There are rumors that we will soon have a new SOWP group in our area, lets hope so. Traffic: K6UYK 1244, W6INH 752, N6LHE 122, W6ORF 53, W6NKE 28, W6ORF 25, K6CL 12.

ORANGE: SM, Joe H. Brown, W6UBQ—SEC: Jim, AE6N. STM: Ernie, WA6QCA. OCC: Alex, W6RE. SGL: Loren, N6HIQ. TC: John, KD7XG. PIO: Joe WB5DXT. ACC: KB6FRW. Phil. Karl Pagel, N6BVU has resigned as ASM. With Karl's devotion to the preservation of privileges and interests of all Amateur Operators thru his radio frequency spectrum management activities, it was a little much to ask of Karl. Thanks OM. KA6RON, Marv has resigned from the Emergency Position is the Hemet/St. Jacinto area. During his tour of duty the membership in the ARES/RACES increased, the City Council appointed Amateur Radio Operators to the City Emergency Service Council, a complete Amateur Radio Station was purchased and installed in the city EOC. A Simulated air to ground damage assessment and communications exercise was flown. With Colonel Don Taylor at the controls, Gerhard, AI6I (of VIP fame) at the Mike and Chester, WA6MGU at the EOC the operation was successful. We are going to miss you Marv. Art Douglas, N6GDM will take over the EC slot. Art comes well qualified for the job, he was AEC for the District and presently holds the positions of AD and PIA. Members of the Corona-Norco ARC brought Santa Claus to Corona Community Hospitals Pediatric Ward via the air waves. A good write up appeared in the local press. The Victor Valley ARC reports the 1985 exams are wrapped up for the year, for 1986 the test will be given on the 2nd Saturday of the odd months. The Fullerton ARC Hunter of the Year. The data for 1985 FRC T-hunts indicate WB6ADC, Clark, with average of .830. T-Hunt winners for DEC85, WB6ADC/K6SXD, 10.53. Rehab Radio had another round of successful Santa Claus QSOs. Childrens Hospital of Orange made contact with the North Pole Dec 17 and on the 19 Dec. with a video link. Many thanks to hams: Gary, WB6GCT; Betty, KB6BAI; Joe, KØOV; Bruce, WB6DCC; Karen WB6DCB; Mark Adams (awaiting his Tech license). Many youngsters talked and watched Santa in his work shop. Listen for REHAB RADIO WD6BPT on 2, 10, 15 and 20 meters each Wed morning, and on 1st and 3rd Sat morning of the month. Give them a QSO in 1986. Words of Wisdom from WB6GEI. Not all of us are able to serve as Club Officers of members of the Board, but many of us can find time to help with the smaller jobs that are part of running the club. Right now there's an opportunity for fame (not fortune). Any Volunteers? Nov. PSHR WF6O, WB6QBZ, WA6QCA, KA6HJK. DEC. PSHR WF6O, WB6QBZ, WA6QCA.

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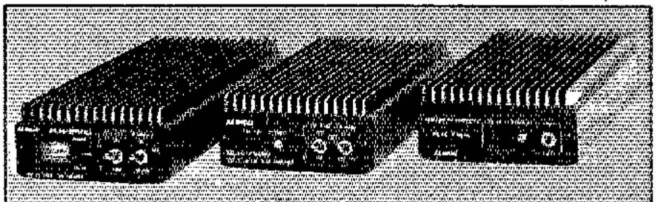

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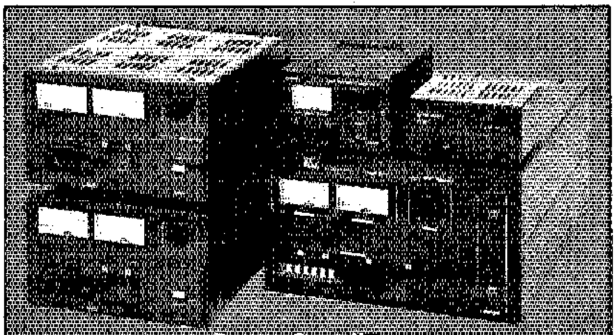

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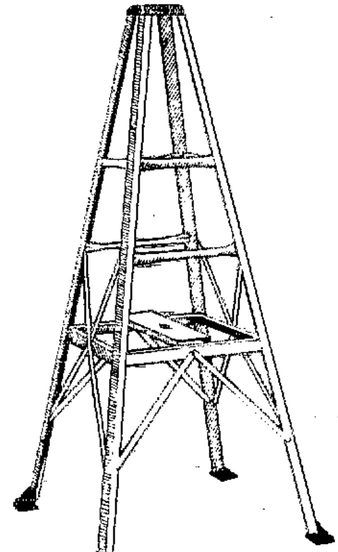

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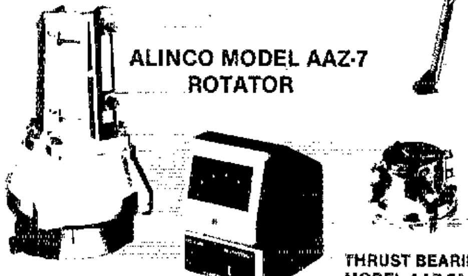

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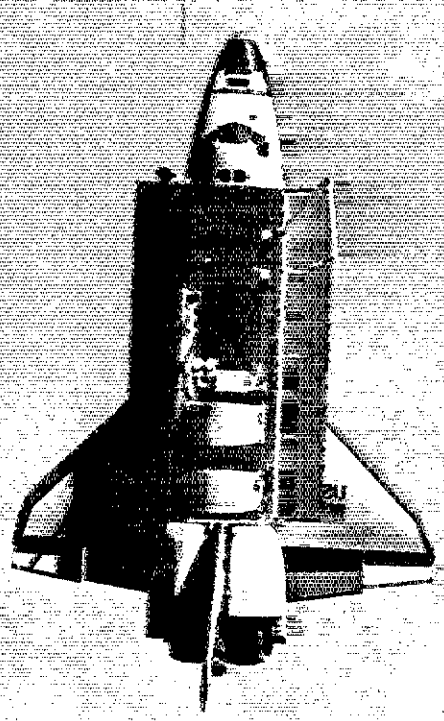

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NET	FREQ	TIME	SES	QNI	TFC	NM
SCN/1	3598	1830	31	265	330	WF6O
SCN/6	3598	2015	27	465	46	WF6O
SCN/V	146.645	2100	31	423	634	WA6QCA
RTTY/V	145.12	0900	62	461	233	KA6HJK

Traffic: WF6O 804, WB6QBZ 423, KA6HJK 308, WA6QCA 237, N6GOT 216, W6CPB 116, K6DD 99, W6TKV 83, AD6A 62, W6NTN 14, W6RE 49, K6VCE 32, (Nov) WF6O 528.

SAN DIEGO: SM, Arthur R. Smith, W6INI—ACC: WA6COE. TC: N6NR. STM: N6GW. SEC: W6INI. PIO: KG6LF. Spend your vacation in San Diego, at the 1986 National Convention, Sep 5-7. This column needs your input. Pls put newsworthy items on postal card to reach me by 5th of month. Addr page 8. 1986 club officers: QCWA Pres K6UV, VP KG6VB, Sec W6OSD. Trs WA6JQM; ARC of El Cajon Pres N6COW, VP KG6VP, Sec NV6E. Trs W6ULU; North Shores ARC Pres WA6EOO, VP N6JZE, Sec KB6FHN, Trs KA6UCD. The ARC of El Cajon gave its Ham of the Year Award to KB6DYM. Congrats, Bob! Upgrade: N6LQF, KG6ZL to Extra. Call sign change: N6LQF to WN6L. New ARES members: N6GBN, NC6J, N6MMP, K6VMI, KG6VX. ARES holds breakfast (0800-0845) & meeting (0900) on second Sat. each month at Normal Heights United Methodist Church, 4650 Mansfield, S.D. All welcome to either or both. Join your local club. The Imperial Valley ARA meets at the Imperial Valley Airport on second Thur each month. NCTN: 30 sessions, 196 msgs handled. ARES CW: (Dec) 5 sessions, 28 ck-ins; (Nov) 4 sessions, 22 ck-ins. Traffic: KU6D 606, N6GW 224.

SANTA BARBARA: SM, Byron Looney, K6FI—Newest EC is K6BWJ, Bill Palmerston, for Northern San Luis Obispo County. Bob, AF6R, is departing the section for a new job. Good luck to both of you. Paso Robles ARC really knows how to put on a great Christmas dinner. The new Santa Ynez Valley ARES group is using 220 MHz for their training sessions. Next drill is a HazMat spill. Most urgently needed appointee is DEC for Santa Barbara County. SBARC reports that the financing for their emergency communications van is "over the top" with construction work 99.9% complete. WB6RVA and KA6KGF, representing amateurs from Ventura and Santa Barbara counties, were presented with resolution from city of Ventura for July, 85 Wheeler fire operations. Plan now to attend the National Convention in San Diego, September 5,6,7. Traffic: N6HYM 63, K6YD 44.

WEST GULF DIVISION

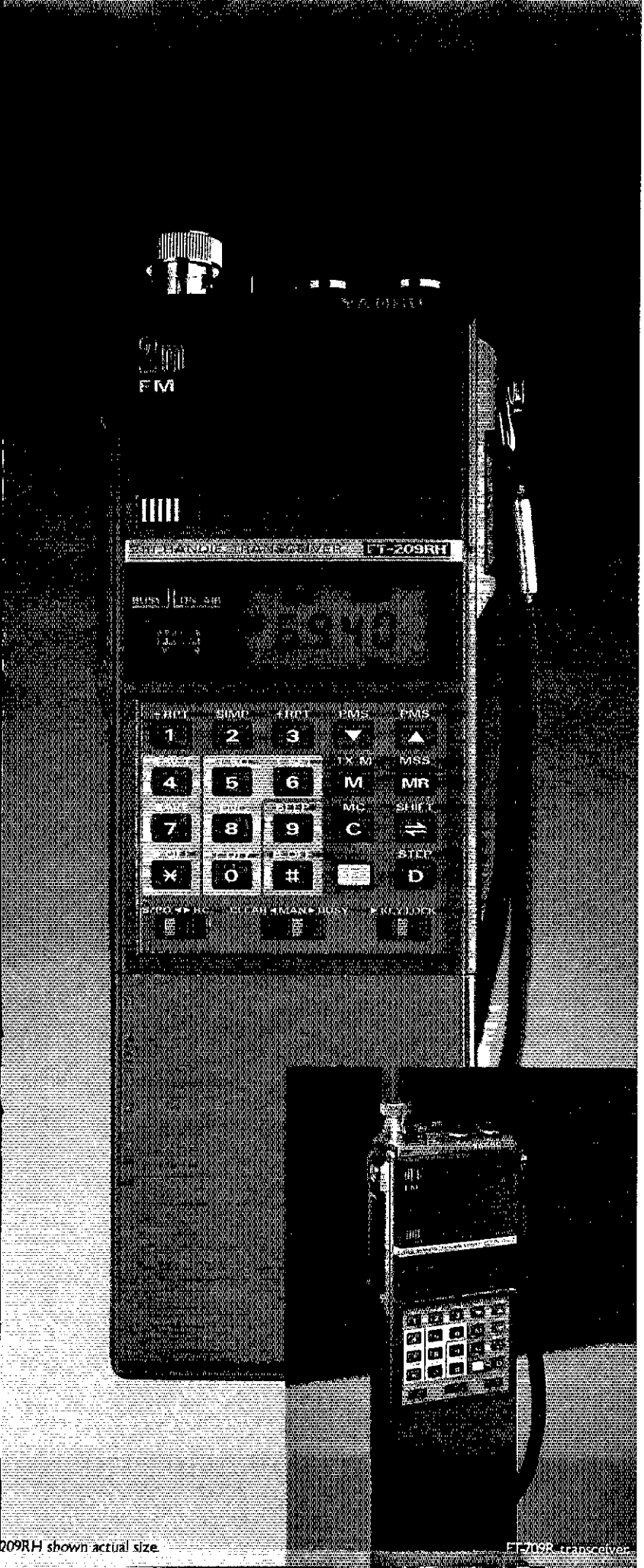
NORTHERN TEXAS: SM, Phil Clements, K5PC—Asst. SM/ACC: NI5V. STM: AE5I. RFI: WB5JBP. PIO: K5HGL. TC: W5LNL. BM: W5QXK. SGL: W5UXP. Congrats to K5EVI, new D/FW Metroplex Tfc. Net Mgr. Also, Dale, KD5RC in Longview takes over the helm on the Texas Tfc. Net for 1986. Tornado season is not far away; it is time to review our Section Emergency plan. Our emergency calling frequencies are: day/7290 night/3873 CW/3697. As always, the local EC is in charge of the disaster, and should initiate the calls for equipment and/or manpower as soon as an initial size-up of the situation has been made. It is better to call for too much-too soon than too little-too late! The first 12 to 24 hours is always the critical time in a communications emergency. A staging area, just outside the disaster site should be set up to assemble the disaster site should be set up to assemble the incoming ARES teams and equipment. We have three fully equipped emergency vans in service at Abilene, Amarillo, and Dallas. Let's make full use of these valuable tools, and get them rolling ASAP. In sparse areas and when no word is received, a standard Response Team will be sent to the site as soon as word is received of a possible communications emergency. Check out your emergency kits and gear, and be ready! PSHR for Dec. KE5YG, K5UPN, KA5SPT W5VMP AE5I and KB5UL. Traffic: K5UPN 628, W5TNT 481, WB5CIC 419, KB5UL 315, W9OYL 289, KD5RC 280, KE5YG 243, N5BT 242, KA5SPT 227, AE5I 213, WB4HML 184, KA5AZK 162, W5VMP 138, N5HEN 105, N5IGR 103, KA5KQF 85, W5ERT 53, KA5QYV 39, K5PC 2.

OKLAHOMA: SM, Dave Cox, NB5N—ASM: K5WG, SEC: W5ZTN. STM: KV5X. ACC: NJ5Y. BM: W5AS. PIO: WD5IFB. OOC: K5WG. SGL: W5NZS. TC: W5QMJ. Congrats to Edmond ARC for their 10th anniversary. Kudos to all volunteer examiners. Exams are now offered almost monthly throughout the Section. CORA sponsored exams are held the 3rd Monday each month in OKC; contact KA5UOS. Tulsa area exams held monthly; contact WB5OSM. Western area hams contact NR5L for details. Other VE contact persons please relay test info to NB5N. Following is a listing of Section net stats for December. Net Managers please relay report of your nets activity to the STM, KV5X, and NB5N.

NET	FREQ.	TIME/DAYS	QTC	QNI	SESS.	NM
OLZ	3682.5	0100Z/Dy	65	156	31	NG5O
ONON	07/67	0430Z/Dy	169	495	31	W5AS
OPEN	3900	1400Z/Sn	5	318	5	W5ZTN
OTWN	3900	2345Z/M-S	406	424	26	WA5OUV
QCWA	3855	1430Z/Sn	24	200	5	W5AS
STN	3850	2300Z/M-S	197	434	26	WD5IFB
TRO	28/88	0100Z/Tu	2	30	2	K5ENA
EATIN	77/37	2300Z/Dy	1	230	31	KD5KV

Traffic (greater than 25): W5REC 259, WB5OHK 208, NR5L 206, KV5X 189, K5CXP 152, W5AS 149, NO5W 146, KB5EK 142, W5RB 139, NX5E 104, NX5I 102, W5VXU 96, WA5OUV 83, NG5O 77, KX5W 71, NB5N 69, N5IKN 67, WD5IFB 65, WA5ZQO 52, K5GBN 49, KA5TTH 47, KC5OU 33, K5CAY 32, N5GTP 31, WA5OGC 27.

SOUTHERN TEXAS: SM, Arthur R. Ross, W5KR—ASM: N5TC. STM: K5QEW. SEC: KA5KRI. STC: NZ5U. STX PIO WA5UZB reports Houston has a new club: Northwest ARS, with 80 members by December; activities scheduled up in to March: club is 100% registered with ARES; newsy club bulletin runs to three pages. OBS W5KLV reports 9 bulletins, 31 satellite bulletins, 4 propagation forecasts, 3 DX bulletins and 3 CRRL bulletins given 182 readings on 9 nets. OOs reporting: WA2VJL, W5BKK, K5VRF. OOC WA2VJL looking for OOs, especially in Corpus Christi and San Antonio areas. ORS NZ5J reports that several GVRAEN members have received rain gauges from San Antonio NWS office; also that first Seguin VE team exams produced 2 Technicans, one being previously unlicensed. ORS WD5GKH is active on 2 meters and Packet Radio since upgrading to Advanced. DRN5 Mgr WB5YDD reports 1410 messages handled in 62 sessions; STX section represented 100% by W5KLV, WB5EPA, WB5FQU, W5CTZ, KD5CB, NX5V (ex-N5GKM), N5DFO, WB5YDD. San Antonio ARC reports WB5NOL received the club's W5FZU award for dedicated and unselfish service to the Amateur Radio community; Director's award for outstanding service went jointly to WA5FSR and WB5LCT for work on the SKYWARN program; KA5VLA upgraded to General; Novice class produced 12 new Amateurs for the club. TTN Mgr for 1985, W5UIH, reports KD5RC has been elected to that post for 1986. CAND Mgr W5KLV reports



209RH shown actual size.

FT-709R 440-MHz transceiver

High power to get you out. Battery saver to keep you there.

Where other HTs don't make it, Yaesu's 2-meter FT-209RH and 440-MHz FT-709R keep going strong. Here's why:

Our 2-meter model offers you 5 watts output. And our 440-MHz model offers 4½ watts.

Yet there's no excessive battery drain, thanks to a unique user-programmable Power Saver. When activated, it puts the rig "to sleep" while monitoring, and "wakes it up" when the squelch breaks. Thus, you can listen for hours while keeping plenty of power in reserve.

And despite the wealth of advanced features, operation is actually simple and intuitive. That's why our radios are so much easier to "learn" than any other advanced HT.

At the push of a button, you can recall the information you've independently stored in each of the ten memories: receive frequency, standard or non-standard offset, even tone encode/decode.

Monitoring your favorite repeaters or simplex frequencies is just as easy. Just touch a button to scan all memory channels, selected ones, or all frequencies between adjacent memories. And use the priority feature to return automatically to a special frequency.

Bring up controlled-access machines with the optional plug-in subaudible tone encoder/decoder, independently programmed from the keyboard for each channel. Then use the decode function to listen for tone-encoded signals on selected channels — without a lot of chatter.

Finally, both HTs cover 10 MHz, and come complete with a 500-mAh battery, charger and soft case. Options include a VOX headset and hard leather case.

So next time you visit your dealer, pick up Yaesu's 2-meter FT-209RH or 440-MHz FT-709R. Because they not only get you out, they keep you there too.

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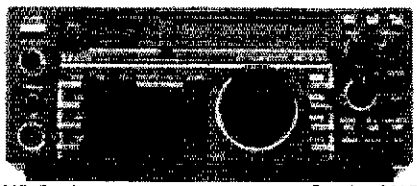
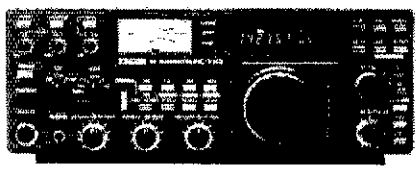


HF Equipment	Regular	SALE
IC-735 HF transceiver/SW rcvr/mic	849.00	729.95
PS-55 External power supply	160.00	144.95
AT-150 Automatic antenna tuner	349.00	314.95
FL-32 500 Hz CW filter	59.50	
EX-243 Electronic keyer unit	50.00	
IC-745 9-band xcvr w/.1-30 MHz rcvr	999.00	769.95
PS-35 Internal power supply	160.00	144.95
EX-241 Marker unit	20.00	
EX-242 FM unit	39.00	
EX-243 Electronic keyer unit	50.00	
FL-45 500 Hz CW filter (1st IF)	59.50	
FL-54 270 Hz CW filter (1st IF)	47.50	
FL-52A 500 Hz CW filter (2nd IF)	96.50	89.95
FL-53A 250 Hz CW filter (2nd IF)	96.50	89.95
FL-44A SSB filter (2nd IF)	159.00	144.95
HM-10 Scanning mobile microphone	39.50	
SM-6 Desk microphone	39.00	
HM-12 Extra hand microphone	39.50	
MB-12 Mobile mount	19.50	



IC-751 9-band xcvr/.1-30 MHz rcvr	1399.00	999.00
PS-35 Internal power supply	160.00	144.95
FL-32 500 Hz CW filter (1st IF)	59.50	
FL-63 250 Hz CW filter (1st IF)	48.50	
FL-52A 500 Hz CW filter (2nd IF)	96.50	89.95
FL-53A 250 Hz CW filter (2nd IF)	96.50	89.95
FL-33 AM filter	31.50	
FL-70 2.8 kHz wide SSB filter	46.50	
HM-12 Extra hand microphone	39.50	
SM-6 Desk microphone	39.00	
RC-10 External frequency controller	35.00	
MB-18 Mobile mount	19.50	
IC-720A 9-band xcvr • (CLOSEOUT) •	1349.00	699.95
PS-15 20A external power supply	149.00	134.95
FL-32 500 Hz CW filter	59.50	
FL-34 5.2 kHz AM filter	49.50	
BC-10A Memory back-up	8.50	
SM-5 8-pin electret desk mic	39.00	
MB-5 Mobile mount	19.50	

Other Accessories:	Regular	SALE
PS-15 20A external power supply	149.00	134.95
CF-1 Cooling fan for PS-15	45.00	
EX-144 Adaptor for CF-1/PS-15	6.50	
PS-30 Systems p/s w/cord, 6-pin plug	259.95	234.95
OPC Opt. cord, specify 2, 4 or 6-pin	5.50	
SP-3 External base station speaker	49.50	
SP-5 Remote speaker for mobiles	25.00	
CR-64 High stab. ref. xtal (745/751)	56.00	
PP-1 Speaker/patch (specify radio)	139.00	129.95
SM-8 Desk mic - two cables, Scan	69.95	
SM-10 Compressor/graph EQ, 8 pin mic	119.00	
AT-100 100W 8-band auto. antenna tuner	349.00	314.95
AT-500 500W 9-band auto. antenna tuner	449.00	399.95
AH-1 5-band mobile antenna w/tuner	289.00	259.95

ICOM

Other Accessories cont.	Regular	SALE
AH-2 8-band tuner w/mount & whip	549.00	
GC-4 World clock • (CLOSEOUT) •	99.95	79.95

HF linear amplifier	Regular	SALE
IC-2KL 160-15m solid state amp w/ps	1795.00	1299

6-meter VHF Portable	Regular	SALE
IC-505 3/10W 6m SSB/CW portable	449.00	399.95
BP-10 Internal Nicad battery pack	79.50	
BP-15 AC charger	12.50	
EX-248 FM unit	49.50	
LC-10 Leather case	34.95	

VHF/UHF base multi-modes	Regular	SALE
IC-551D 80W 6-meter SSB/CW	699.00	599.95
EX-106 FM option	125.00	112.95
BC-10A Memory back-up	8.50	
SM-2 Electret desk microphone	39.00	
IC-271A 25W 2m FM/SSB/CW	699.00	569.95
AG-20 Internal preamplifier*	56.95	
IC-271H 100W 2m FM/SSB/CW	899.00	759.95
AG-25 Mast mounted preamplifier*	84.95	
IC-471A 25W 430-450 SSB/CW/FM xcvr	799.00	699.95
AG-1 Mast mounted preamplifier*	89.00	
IC-471H 75W 430-450 SSB/CW/FM	1099.00	969.95
AG-35 Mast mounted preamplifier*	84.95	

Limiter Offer! • Matching preamp* only **$1.00** extra with purchase of IC-271A/H or IC-471A/H.

Accessories common to 271A/H and 471A/H	Regular	SALE
PS-25 Internal power supply for (A)	99.00	89.95
PS-35 Internal power supply for (H)	160.00	144.95
PS-15 External power supply	149.00	134.95
SM-6 Desk microphone	39.00	
EX-310 Voice synthesizer	39.95	
TS-32 CommSpec encode/decoder	59.95	
UT-15 Encoder/decoder interface	12.50	
UT-15S UT-15S w/TS-32 installed	79.95	

VHF/UHF mobile multi-modes	Regular	SALE
IC-290H 25W 2m SSB/FM, TTP mic	549.00	479.95
IC-490A 10W 430-440 SSB/FM/CW	649.00	579.95

VHF/UHF/1.2 GHz FM	Regular	SALE
IC-27A Compact 25W 2m FM w/TTP mic	369.00	329.95
IC-27H Compact 45W 2m FM w/TTP mic	409.00	359.95
IC-37A Compact 25W 220 FM, TTP mic	449.00	329.95
IC-47A Compact 25W 440 FM, TTP mic	469.00	399.95
PS-45 Compact 8A power supply	112.95	99.95
UT-16/EX-388 Voice synthesizer	29.95	
SP-10 Slim-line external speaker	29.95	
IC-3200A 25W 2m/440 FM w/TTP	549.00	489.95
UT-23 Voice synthesizer	29.95	
AH-32 2m/440 Dual Band antenna	32.95	
Larsen PO-K Roof mount	20.00	
Larsen PO-TLM Trunk-lip mount	20.18	
Larsen PO-MM Magnetic mount	19.63	
IC-1271A 10W 1.2 GHz SSB/CW Base	999.00	889.95
ATV-1200 ATV interface unit	TBA	
PS-25 Internal power supply	99.00	89.95
EX-310 Voice synthesizer	39.95	
UT-15S CTCSS encoder/decoder	79.95	
IC-120 1W 1.2 GHz FM Mobile	499.00	449.95
ML-12 1.2 GHz 10W amplifier	339.00	299.95

Repeaters	Regular	SALE
RP-3010 440 MHz, 10W FM, xtal cont.	999.00	899.95
RP-1210 1.2 GHz, 10W FM, 99 ch. synth	1199.00	1089
Duplexer 1210 1.2 GHz duplexer	1199.00	1089
Cabinet for RP-1210	249.00	

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Hand-held Transceivers Deluxe models	Regular	SALE
IC-02AT for 2m	349.00	289.95
IC-04AT for 440 MHz	379.00	319.95
Standard models	**Regular**	**SALE**
IC-2A for 2m	239.50	189.95
IC-2AT with TTP	269.50	199.95
IC-3AT 220 MHz, TTP	299.95	239.95
IC-4AT 440 MHz, TTP	299.95	239.95

Accessories for Deluxe models	Regular
BP-7 425mah/13.2V Nicad Pak - use BC-35	67.50
BP-8 800mah/8.4V Nicad Pak - use BC-35	62.50
BC-35 Drop in desk charger for all batteries	69.00
BC-60 6-position gang charger, all batts SALE	359.95
BC-16U Wall charger for BP7/BP8	10.00
LC-11 Vinyl case	17.95
LC-14 Vinyl case for Dlx using BP-7/8	17.95
LC-02AT Leather case for Dlx models w/BP-7/8	39.95

Accessories for both models	Regular
BP-2 425mah/7.2V Nicad Pak - use BC35	39.50
BP-3 Extra Std. 250 mah/8.4V Nicad Pak	29.50
BP-4 Alkaline battery case	12.50
BP-5 425mah/10.8V Nicad Pak - use BC35	49.50
CA-2 Telescoping 2m antenna	10.00
CA-5 5/8-wave telescoping 2m antenna	18.95
FA-2 Extra 2m flexible antenna	10.00
CP-1 Cig. lighter plug/cord for BP3 or Dlx	9.50
DC-1 DC operation pak for standard models	17.50
LC-2AT Leather case for standard models	34.95
RB-1 Vinyl waterproof radio bag	30.00
HH-SS Handheld shoulder strap	14.95
HM-9 Speaker microphone	34.50
HS10 Boom microphone/headset	19.50
HS-10SA Vox unit for HS-10 & Deluxe only	19.50
HS-10SB PTT unit for HS-10	19.50
ML-1 2m 2.3w in/10w out amplifier SALE	79.95
SS-32M Commspec 32-tone encoder	29.95

Receivers	Regular	SALE
R-7000 25-2000 MHz, 117V AC	899.00	789.95
RC-12 Infrared remote controller	TBA	
R-71A 100 kHz-30 MHz, 117V AC	$799.00	649.95
RC-11 Infrared remote controller	59.95	49.95
FL-32 500 Hz CW filter	59.50	
FL-63 250 Hz CW filter (1st IF)	48.50	
FL-44A SSB filter (2nd IF)	159.00	144.95
EX-257 FM unit	38.00	
EX-310 Voice synthesizer	39.95	
CR-64 High stability oscillator xtal	56.00	
SP-3 External speaker	49.50	
CK-70 (EX-299) 12V DC option	9.95	
MB-12 Mobile mount	19.50	(4)

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Handy Handful...

TR-2600A/3600A

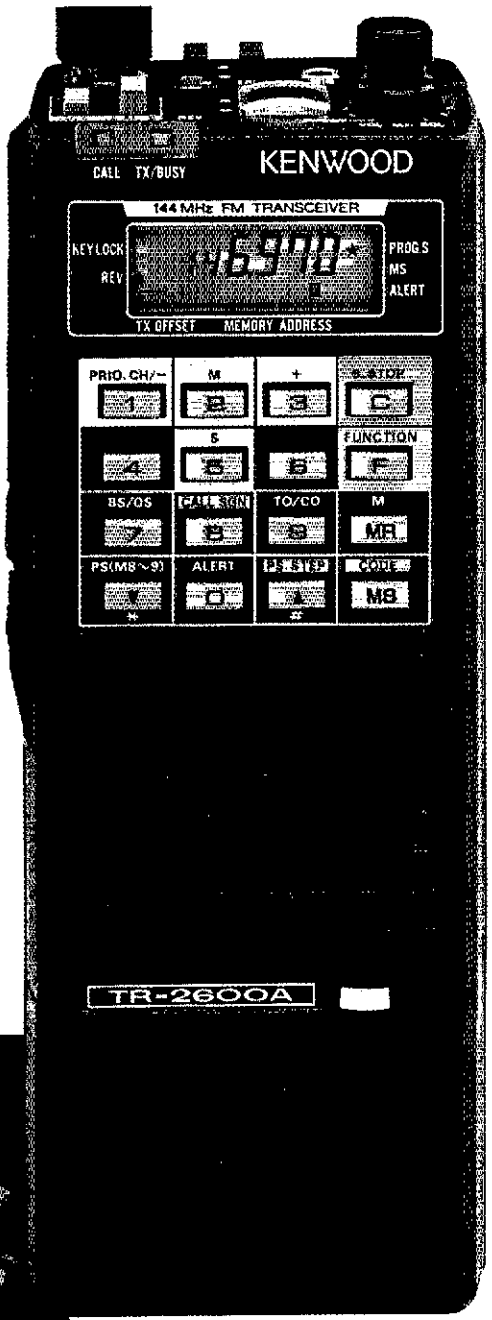
Kenwood's TR-2600A and TR-3600A feature DCS (Digital Code Squelch), a new signalling concept developed by Kenwood. DCS allows each station to have its own "private call" code or to respond to a "group call" or "common call" code. There are 100,000 different DCS combinations possible.

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

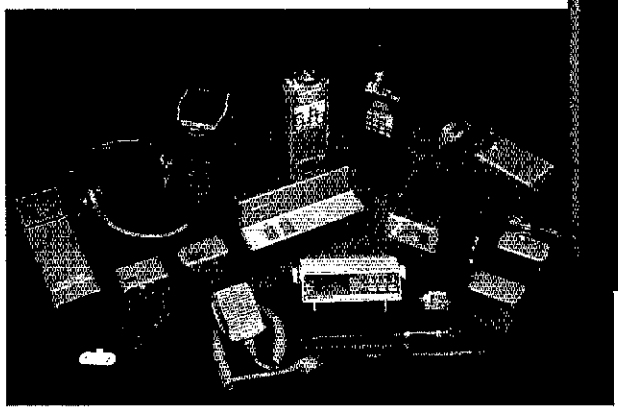
Optional accessories:

- 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.



- **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.



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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.
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Our numbers talk

424B

SUCCESS

BOOMERS WIN
1983 Central States VHF Conference, Antenna Contest

144MHz BOOMER	1st Place
	2nd Place
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432MHz BOOMER	1st Place
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BOOMERS WIN AGAIN
1983 EME CONTEST WA1JXN
1st PLACE 2 METERS
WITH 12 X 32-19
PLUS
1st TO WORK SPACE SHUTTLE

They have talked to winning scores in many important amateur activities including the 1979, 80, 81 June VHF contests, 1981 Central States antenna measuring contest, 1981, 82 EME contests, 1982 Rocky Mountain antenna measuring contest and many more. Now there are three new numbers: the 424B, 24 elements for 432 MHz; the 410B, 12 elements at 432 MHz; and the 416TB, 16 elements at 435 MHz for satellite communications.
The new Boomer models feature insulated elements, stainless steel hardware, N type connector, T match feed and trigon reflectors.

THREE EXCITING NEW BOOMERS

HIGHEST GAIN BOOMER XL

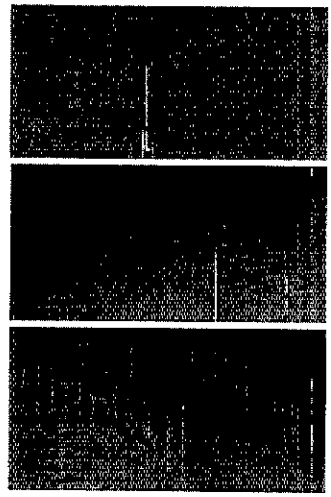
Boomer XL is "the antenna for 2 meter DX" with higher gain and cleaner pattern this antenna is designed to perform and survive in harsh environments. It has 18 elements on a 28.8 ft. 8.8 m tapered boom.
MODEL 4218XL 144-145 MHz

WIDEBAND BOOMER 215WB

Featuring the latest in wideband technology. The 215WB is high performance across the entire 2 meter band, for FM, SSB or CW. It features 15 elements on a 15 ft. 4.57 m boom.
MODEL 215WB 144-148 MHz

FM BOOMER POWER PACK

A combination of 215WB Boomers vertically polarized with support boom, power divider, and interconnect harness. Like all boomers it features all stainless steel hardware. You'll easily work those distant repeaters.
MODEL 230WB 144-148 MHz



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TH-21AT/31AT/41AT

Kenwood's advanced technology brings you a new standard in pocket/handheld transceivers!

- **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-21AT/A).** Covers 141.000-150.995 MHz in 5 kHz steps, includes certain MARS and CAP frequencies. **TH-31AT/A:** 220.000-224.995 MHz in 5 kHz steps. **TH-41AT/A:** 440.000-449.995 MHz in 5 kHz steps.

- **Easy-to-operate, functional design.** Three digit thumbwheel frequency selection and handy top-mounted controls increase operating ease.

- **Repeater offset switch.** **TH-21AT/A:** ±600 kHz, simplex. **TH-31AT/A:** −1.6 MHz, reverse, simplex. **TH-41AT/A:** ±5 MHz, simplex.
- **Standard accessories:** Rubber flex antenna, earphone, wall charger, 180 mAH NiCd battery pack, wrist strap.

NOW! Extended-life battery pack

- **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.

See your authorized Kenwood dealer and take home a pocketful of performance today!

Optional accessories:

- **HMC-1** headset with VOX
- **SMC-30** speaker microphone
- **PB-21** NiCd 180 mAH battery
- **PB-21H** NiCd 500 mAH battery
- **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
- **TU-6** programmable sub-tone unit
- **AJ-3** thread-loc to BNC female adapter
- **BC-6** 2-pack quick charger
- **BC-2** wall charger for PB-21H
- **RA-8A/9A/10A** StubbyDuk antenna
- **BH-3** belt hook

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TH-series transceivers shown with optional StubbyDuk antenna. TH-31AT shown with PB-21H.
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Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.

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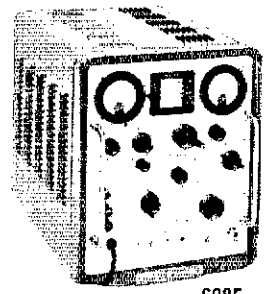
32S-3 Transmitter 299 mfc
32S-3A Xmtr (round) 469 f
312B-4 Station control 189 mf
KWM-2 Xcvr 439 m
KWM-2 (round) 499 f
KWM-2A Xcvr (round) 599 m
312B-5 PTO console 289 mf
516F-2* AC supply 149 mwfc
PM-2* AC supply 119 f
*Not sold separately
CC-1 Carrying case 49 f
DAIWA
CNA-1001 Auto ant tuner $189 m
DENTRON
MT-3000A Tuner $199 f
GLA-1000 Linear 229 fc
Clipperton L Linear 459 w
DRAKE
R-4 Ham Rcvr $129 f
R-4A Ham Rcvr 149 v
R-4B Ham Rcvr 179 mv
R-4C Ham Rcvr 249 c
MS-4* Speaker 19 mwfv
*Not sold separately
FL-500 500 Hz filter 35 m
FL-4000 4 KHz filter 35 m
SC-2 2m rcv conv 49 mw
SC-6 6m rcv conv 49 wf
CPS-1 Conv ps 19 mwf
SCC-1 VHF calib 19 w
CC-1 Conv console 29 wf
TC-6 6m xmit conv 169 f
R-7 Shortwave receiver 699 m
T-4X Transmitter 149 wv
T-4XB Transmitter 169 mfv
T-4XC Transmitter 219 fv
RV-3 Remote VFO 59 f
TR-4 Xcvr 199 mwcv
TR-4C Xcvr 249 mwf
TR-4CW Xcvr 299 m
TR-4CW/RIT Xcvr 349 w
FF-1 Fixed freq adapt 29 w
RV-4 Remote VFO 69 m
RV-4C Remote VFO 89 m
AC-3* AC supply 59 mwf
AC-4* AC supply 79 mwfcv
*Not sold separately
TR-5 Xcvr 349 c
TR-5/500 Hz filter 379 m
TR-7 Xcvr 469 mwfc
TR-7/500/1.8 filters 529 f
TR-7/500/1.8/6 filters 549 v
TR-7/fan/aux/500/1.8/6 649 m
TR-7/nb/aux/5/1.8/6/warc 629 m
PS-7* Power supply 149 mwfve
*Not sold separately
PS-75 Power supply 89 m
MS-7 Speaker 29 m
RV-7 Remote VFO 99 mf
NB-7 Noise blanker 49 m
SP-75 Speech proc 79 mfc
TR-7 service manual 25 mv
SL-500 500 Hz filter 35 mw
SL-1800 1.8 KHz filter 35 m
SL-6000 6 KHz filter 35 m
TR-6/NB 6m Xcvr 349 v
MN-2000 Tuner 149 m
550 Rcv only terminal 169 e
LA-7 Line amp 29 f
WH-7 Wattmeter 69 f
7077 Desk mic 29 f
7073 Hand mic 19 f
ETO
Alpha 76PA Linear 1695 e
HAL
RKB-1 RTTY keyboard $ 39 m
ST-6/AK-1 Demod/keyer 129 v
DS-3000KSR Term vers 2 349 m
DS-3000KSR Term vers 3 399 e
ARQ-1000 Error terminal 569 m
HENRY RADIO
TP-400 DC ps; Drake TR-4 $ 39 v
ICOM
IC-720 Xcvr $489 m
IC-720A Xcvr 549 mfv
IC-720A/cw filt/mem ps 599 m
IC-720A/cw filt/am filt 599 m
IC-730 Xcvr 450 mfc
IC-730/cw filter 479 mf
IC-740 Xcvr 499 m
IC-740/ssb filt/cw filt 599 f
IC-740/int ps/2 CW filts 649 w
IC-740/int ps/kyr/pb/cw 659 m
IC-745 Xcvr w/FM 629 f
IC-751 Xcvr 869 f
PS-15 Power supply 99 mf
PS-20 Power supply 159 m
PS-30 Power supply 99 f
SP-3 Speaker 29 m
EX-2 Relay box 29 m
AT-500 Ant tuner 299 f
Spkr/patch; 745/751 89 f
IC-2KL Amplifier 1069 v
R-71A Rcvr w/remote 549 c
IC-502 6m SSB port 129 mv
IC-551 6m Xcvr/fm/vox 399 m
IC-551D 80w 6m Xcvr 469 m
IC-21A/DV-21 2m Xcvr/vfo 149 f
IC-22A 2m FM Xcvr 69 m
IC-251A 2m Xcvr 369 mf
IC-255A 2m FM Xcvr 149 w
IC-271A 2m Xcvr 469 mw
IC-290H 2m Xcvr 369 v
IC-45A 440 FM Xcvr 189 v
IC-451A 430-440 Xcvr 469 m
IC-451A 440-450 Xcvr 469 f
ML-1 2m 10w amp DEMO 49 v
SM-5 8-pin desk mic 25 mf
KDK
FM-2016A 2m FM Xcvr $139 mc
FM-2030 2m FM Xcvr 169 mc
KENWOOD
R-599 Ham Rcvr $129 v
R-599A Ham Rcvr 149 m
R-599D Ham Rcvr 199 m
T-599 Transmitter 149 v
T-599D Transmitter 199 m
TS-120S Xcvr 329 wc
AT-120 Ant tuner 69 c
TS-130SE Xcvr 429 v
AT-130 Ant tuner 99 mf
SP-180 Speaker 49 v
VFO-180 Remote VFO 99 v
PS-30 Power supply 99 mc
AT-230 Ant tuner 129 f
TS-430S Xcvr w/FM 599 m
TS-520 Xcvr 349 fcv
TS-520/CW filter 379 m
TS-520S Xcvr 369 f
TS-520S/CW filter 399 m
TS-520SE Xcvr 399 mc
TS-520SE/CW filter 429 m
VFO-520 Remote VFO 89 f
VFO-520S Remote VFO 99 w
SP-520 Speaker 19 w
TS-530S Xcvr 469 v
TS-660 15-6m Xcvr 469 m
VOX-4 VOX unit 29 m
TS-820 Xcvr 399 c
TS-820/DG-1 Dig Xcvr 449 mf
VFO-820 Remote VFO 99 m
TS-830S Xcvr 589 w
SP-230 Speaker 49 w
DFC-230 Dig freq control 119 mf
DFC-230 (new close-out) 169.95 mwfv
VFO-230 Dig remote VFO 199 we
VFO-240 Remote VFO 119 v
TS-930S Xcvr w/tuner 989 fce
BS-8 Panadaptor 49 v
TL-922A Linear (air) 869 v
R-600 SW receiver 229 m
R-820 Ham Rcvr 399 f
R-820/2 cw filters 469 f
R-2000 SW receiver 369 w
TV-502S 2m Xvtr 189 m
TS-700A 2m Xcvr 289 fc
TR-7200A 2m FM Xcvr 69 m
TR-7400A 2m FM Xcvr 149 f
TR-7500 2m FM Xcvr 99 m
TR-9130 2m Xcvr 369 c
TR-9130/TTP 2m Xcvr 389 mw
TM-401A 440 FM Xcvr 219 f
TR-8400 440 FM Xcvr 199 mc
TR-8400/TTP mic 229 m
KPS-21 16A ps 79 f
MC-50 Desk mic 29 v
TS-670 Xcvr w/FM 499 f
MICROLOG
ACT-1 Terminal $199 wv
PANASONIC
RF-6300 SW receiver $289 w
ROBOT
800C Terminal $299 v
SONY
ICF-2001 SW receiver $149 f
ICF-2002 SW receiver 169 m
TEMPO
Tempo One Xcvr $189 c
AC One* AC ps 69 mc
*Not sold separately
TEN-TEC
505 Argonaut Xcvr $199 c
509 Argonaut Xcvr 229 v
515 Argonaut Xcvr 269 m
206 Calibrator 19 m
208A Ext CW filter 19 m
210 1A supply 19 m
251 9A supply 49 m
525 Xcvr 349 mf
570 Century/21 Xcvr 189 c
579 Century/22 Xcvr 279 f
979 Power supply 69 f
670 Keyer 19 m
Triton II Xcvr 199 f
240 160m conv 69 f
545 Omni-A Xcvr 299 m
546 Omni-D Xcvr 369 m
546C/1.8 Omni Xcvr 569 m
252M/O Power supply 79 m
262G Power supply 89 c
560 Corsair Xcvr 699 fv
560/500 Hz CW filter 735 m
560/2 cw/1.8 filters 799 m
255 Power supply 119 m
260 Power supply 129 mfv
263 Remote VFO 139 mf
243 Remote VFO 99 m
228 Ant tuner 99 m
229 Ant tuner 169 f
277 Ant tuner/SWR 59 m
444 Hercules Linear 1069 m
2510 Sat conv 369 m
215 Desk mic 25 m
700A Hand mic 19 w
700C Hand mic 19 m
USI
1400C 14" color monitor $189 m
UNIDEN BEARCAT
BC-100 Pocket scan $129 m
YAESU
FR-101S Ham Rcvr $149 m
FR-101S/6/2/fm/cw/am 249 m
FL-101 Transmitter 229 c
FT-101 Xcvr 379 fc
FT-101B Xcvr 389 c
FT-101E Xcvr 449 mc
FT-101EE Xcvr 399 c
FT-101EE/CW filter 429 m
FT-101EX Xcvr 389 mf
FT-101F Xcvr 449 c
FT-101ZD Mk III Xcvr 549 m
FV-101Z Remote VFO 79 wf
FV-101DM Remote VFO 69 m
SP-101PB Spkr/patch 49 m
FT-301S 20w Xcvr 199 f
FT-301 Xcvr 229 f
FP-301 Power supply 99 f
SP-120 Speaker 19 m
FV-301 Remote VFO 99 f
FT-77 Xcvr w/FM 399 m
FV-700DM Remote VFO 89 m
FT-901DM Xcvr 549 fc
FT-902DM Xcvr 729 mv
SP-901 Speaker 19 c
SP-901P Spkr/patch 49 c
FC-902 Ant tuner 149 v
FT-102 Xcvr 589 f
FT-107M Xcvr 389 m
FT-107M/DMS/int ps 499 w
FP-107E External ps 99 m
SP-107P Spkr/patch 49 w
FT-707 Xcvr 369 f
FP-757GX Power supply 119 wf
FC-757AT Tuner 189 c
SP-102 Speaker 49 c
SP-980P Spkr/patch 55 m
FT-ONE/fm/ram/4 filters 1369 mv
FT-ONE/fm/ram/4 filts/kyr 1399 w
FRG-7 SW Rcvr 169 mw
FRG-7700 SW Rcvr 289 c
FRG-7700/mem SW Rcvr 349 m
FRA-7700 Indoor act ant 19 mf
FRT-7700 Ant tuner 39 mc
FRV-7700F VHF conv 79 m
FT-620B 6m Xcvr 289 m
FT-221 2m Xcvr 229 mv
YC-221 Dig display 69 v
FT-225RD 2m Xcvr 449 c
FT-230R 2m FM Xcvr 199 c
FT-720RU 440 FM Xcvr 189 me
FP-80 4.5A ps 39 w
YS-200 Wattmeter 49 v
SATELLITE TV EQUIPMENT
AMPLICA
100° LNA $ 29 m

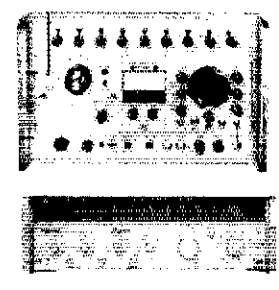
1-23-86

(1) This list was prepared from an inventory taken on the date shown. The letters after the prices indicate in which store the equipment was located at that time. The quantities vary. In some cases there are several of an item; others, only one. Due to the lead and distribution time of this publication, some of the items may have already been sold by the time you see this ad. However, due to the number of trades we are involved in each day, some items are in stock that are not listed. (2) We reserve the right to sell certain power supplies and accessories only with matching transmitters or transceivers, depending on our stock situation. (3) Sometimes used gear is serviced **after** we receive your order. Please allow for a few days delay in shipping your order. (4) No trades on **used** gear. (5) Used gear policies do not apply to New Equipment specials, Closeouts, etc.

USED AES SHOP TEST EQUIPMENT



608E



8640B

HEWLETT-PACKARD
608E 10-480MHz sig gen 1295
8640B .5-1024MHz sig gen w/options 002/003 4995

SINGER-GERTSCH
FM-10CS w/RFM-10A, FIM-3 & ODM-1 3995
OAM-1 AM module/FM-10 195

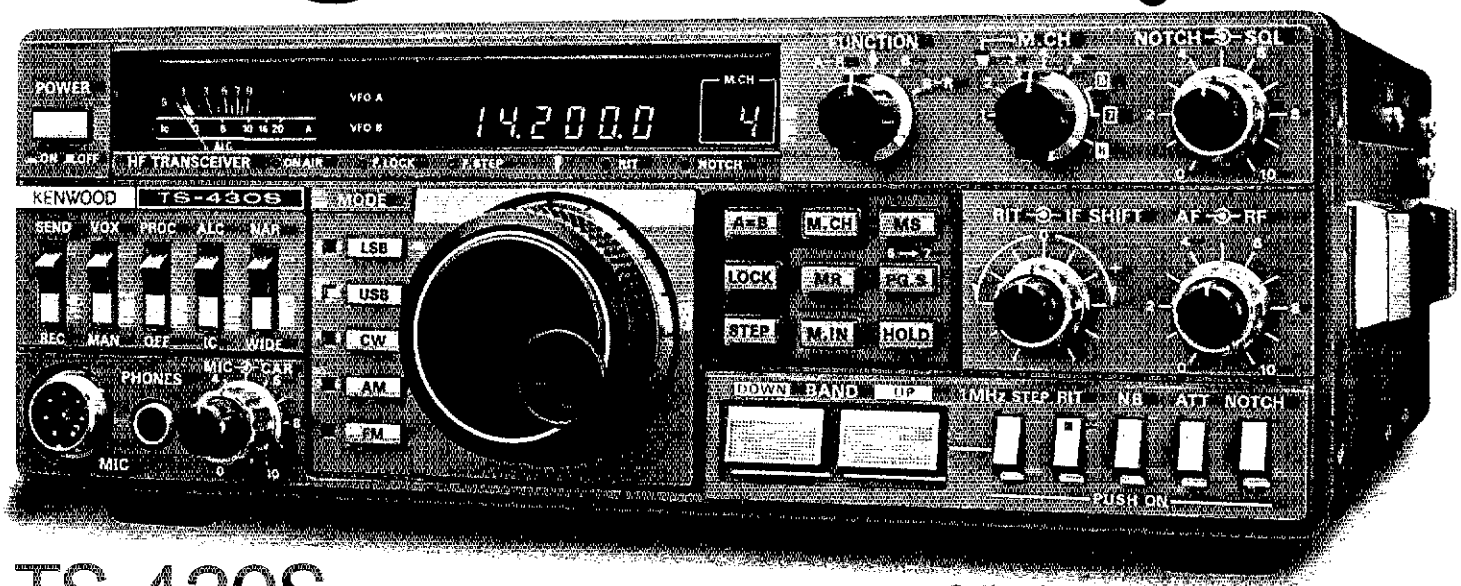
Location	Local Phone	Nationwide	In-State
m = Milwaukee, WI 53216; 4828 W. Fond du Lac Ave	(414) 442-4200	1-800-558-0411	1-800-242-5195
w = Wickliffe, OH 44092; 28940 Euclid Ave	(216) 585-7388	1-800-321-3594	1-800-362-0290
f = Orlando, FL 32803; 621 Commonwealth Ave	(305) 894-3238	1-800-327-1917	1-800-432-9424
c = Clearwater, FL 33515; 1898 Drew Street	(813) 461-4267		
v = Las Vegas, NV 89106; 1072 N. Rancho Drive	(702) 647-3114	1-800-634-6227	
e = Chicago, IL Erickson Communications (Associate)	(312) 631-5181		

MasterCard VISA

KENWOOD

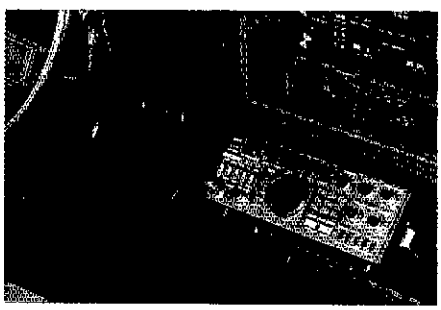
...pacesetter in Amateur radio

"Digital DX-terity!"

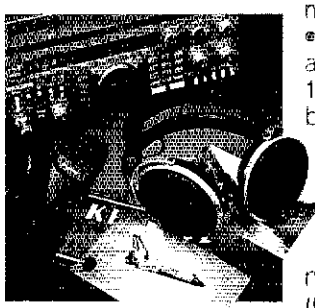


TS-430S

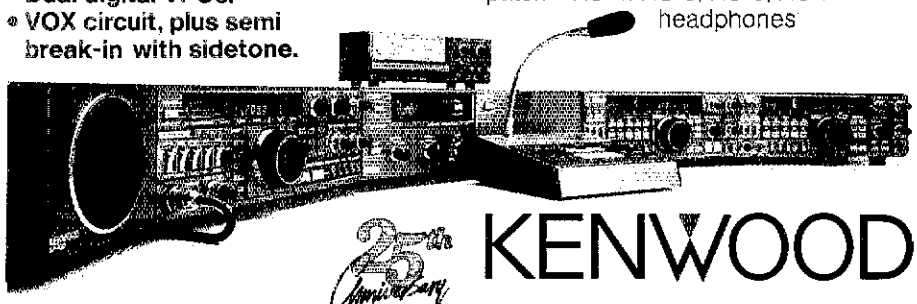
Digital DX-terity—that outstanding attribute built into every Kenwood TS-430S lets you QSY from band to band, frequency to frequency and mode to mode with the speed and ease that will help you earn that dominant DX position from the shack or from the mobile!



- **Covers all Amateur bands** 160 through 10 meters, as well as the new 30, 17, and 12 meter WARC bands. High dynamic range, general coverage receiver tunes from 150 kHz to 30 MHz. Easily modified for HF MARS operation.
- **Superb interference reduction** Eliminate QRM with the IF shift and tuneable notch filter. A noise blanker supresses ignition noise. Squelch, RF attenuator, and RIT are also provided. Optional IF filters may be added for optimum interference reduction.
- **Reliable. all solid state design.** Solid state design permits input power of 250 watts PEP on SSB, 200 watts DC on CW, 120 watts on FM (optional), or 60 watts on AM. Final amplifier protection circuits and a cooling fan are built-in.
- **Memory channels.** Eight memory channels store frequency, mode and band data. Channel 8 may be programmed for split-frequency operation. A front panel switch allows each memory channel to operate as an independent VFO or as a fixed frequency. A lithium battery backs up stored information.
- **Programmable, multi-function scan.**
- **Speech processor built-in.**
- **Dual digital VFOs.**
- **VOX circuit, plus semi break-in with sidetone.**



Optional accessories:
• PS-430 compact AC power supply • SP-430 external speaker • MB-430 mobile mounting bracket • AT-130 compact antenna tuner covers 80-10 meters, incl. WARC bands • AT-250 automatic antenna tuner covers 160-10 meters, incl. WARC bands • TL-922A 2 kW PEP linear amplifier • FM-430 FM unit • YK-88C (500 Hz) or YK-88CN (270 Hz) CW filters • YK-88SN (1.8 kHz) narrow SSB filter • YK-88A (6 kHz) AM filter • MC-42S UP/DOWN hand mic. • MC-60A/80/85 deluxe desk mics. • SW-2000/200A SWR/power meters • SW-100A SWR/power/volt meter • PC-1A phone patch • HS-4, HS-5, HS-6, HS-7 headphones



25th Anniversary

KENWOOD

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

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

1878 messages handled in 31 sessions; DRN5 represented 100% by STX stations N5DFO, WB5EPA, WB5FQU, KD5KQ, W5KLV, NZ5U, NX5V, WB5YDD and WB5BQR. Houston ECHO Society has scheduled 6 VE sessions, bi-monthly, for 1986; contact WA5UZB for details. Traffic: NZ5U 1889, NX5V 1454, W5KLV 565, WB5YDD 515, W5CTZ 353, N5DFO 280, W5TFB 261, WD5Z 219, KF5CL 215, WB5EPA 214, WD5GKH 172, WB5FQU 149, KS5V 144, AC5Z 57, K5QEW 56, WA5VJL 44, W5BGE 38, WA5WCY 28, NZ5J 23, KC5T 9, WA5UZB 8, K5HZR 2. (Nov.) WA5UZB 9.

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 20th of the second month preceding publication date. No cancellations or changes will be accepted after this closing date. Example: Ads received August 21 through September 20 will appear in November *QST*. If the 20th 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. Plauler, 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).

MORSE TELEGRAPH CLUB, established 1942, seeks landline and radio operators interested in telegraphy and Morse history. 46 chapters USA & Canada. For information and sample paper contact W. K. Dunbar, AD9E, 1101 Maplewood Dr., Normal, IL 61761 309-454-2029.

THE FLORIDA Amateur Digital Communications Association (FADCA) publishes a monthly newsletter, the FADCA Beacon, about Packet Radio. Write for a sample copy, FADCA, 812 Childers Loop, Brandon, FL 33511.

FCC EXAMS, Novice-Extra. Sunnyvale VEC ARC. 408-255-9000, 24 hour. 73, Gordon, W6NLG, VEC.

THANK YOU for attending Warren Ohio Hamfest. See you August 17, 1986.

THE ALL NEW 17th Annual B*A*S*H—New location, New entertainment, New food—will be held on Friday Night of the Hamvention, April 25, 1986. The new location is in the Conference Center at the HARA Arena and Exhibition Center (the same location as the Hamvention) starting at 7:00 P.M. There is no admission charge, and free continuous entertainment. Food and beverages are available. Two exciting top awards, and many others. Stay right at HARA when the Hamvention closes on Friday evening and meet your friends and join us for an evening of fun and entertainment. Sponsored by the Miami Valley F.M. Association, P.O. Box 263, Dayton, OH 45401.

LONG ISLAND, NY—Computer and Electronics Flea-market, Saturday April 12—10 AM to 4 PM, 250 vendor tables (advance sale only) priced at $70 each. All indoors at Colonie Hill, 1717 Motor Parkway, Hauppauge, Exit #57 off L.I.E. Admission (with this ad) $5. For vendor reservations call 800-631-0062 or in NJ 201-297-2526. Ken Gordon Productions, Inc.

ANNUAL FLEMINGTON, NJ Hamfest by Cherryville Repeater Association II, Inc. will be held Saturday April 12 at Hunterdon Central High School Field House on Route 31. Doors open at 8:00 AM, with breakfast served on site starting at 6:30 AM. Talk-in: 146.52, 147.975/.375, 147.615/.015, 222.52/224.12 and 449.850/444.850. For table reservations, call 201-788-4080 or write Bill Inkrote, K2NJ, RD-10 Box-294 Quakertown-Croton Road, Flemington, NJ 08822. FCC Exams will be given; send FCC 610 Form, copy of current license and $4.25 (checks to ARRL/VEC) to Cherryville Repeater Association II, Inc., Box-308 Quakertown, NJ 08822.

OLD BRIDGE, NJ, April 6, 1986. The Old Bridge Amateur Radio Association will hold an in/outdoor Amateur Radio and Electronic Flea Market at the Knights of Columbus Hall in Old Bridge. The Hall is located on Pine St. off Route 18 in Old Bridge. Contact Bob Navin (N2DFJ) at 201-251-6449 or Sam Ugliarolo (WB2HAE) 201-583-2158 for sellers information. Talk-in frequencies 147.120 + 600 and 146.520. Admission will be charged. Sellers may register by mail. Send SASE to Bob Navin, 106 Madison Ave., Old Bridge, NJ 08857.

QSL Cards/Rubber Stamps/Engraving

POST CARD QSL Kit - Converts Post Cards, Photos, to QSLs! Stamp brings circular. Labelcraft, P.O. Box 412, West Sand Lake, NY 12196.

DON'T buy QSL cards until you see my free samples — or draw your own design. I specialize in custom cards. Send black and white sketch; wil give quote. Little Print Shop, Box 9848, Austin, TX 78766.

DISTINCTIVE QSL's — Largest selection, lowest prices, top quality photo and completely customized cards. Make your QSL's truly unique at the same cost as a standard card, and get a better return rate! Free samples, catalogue. Stamps appreciated. Stu, K2RPZ, Box 412, Rocky Point, NY 11778.

FREE samples — stamp appreciated. Conner, 522 Notre Dame Ave., Chattanooga, TN 37412.

QSLs & rubber stamps. Top quality. QSL samples and stamp information 50c. Ebbert Graphics D-3, Box 70, Westerville, OH 43081.

EMBROIDERED emblems, custom designed club pins, medallions, trophies, ribbons. Highest quality, fastest delivery, lowest prices anywhere. Free info: NDI, Box 6665 M, Marietta, GA 30065.

QSLs — 1) Famous KØAAB custom collection. 2) Railroad employees and railfan's specials. 3) Front report styles. 4) Multiple callsigns. 5) Ham "business cards." State your sample wants. 39¢ self addressed business size envelope required. Marv Mahre, WØMGI, 2095 Prosperity Ave., St. Paul, MN 55109-3621.

QSLs Samples 40¢ (stamps OK) Fred Leyden, W1NZJ, 454 Proctor Ave., Revere, MA 02151.

INTRODUCING: Beautiful natural full color photo QSL cards, made from your color negative or slide. From $285. for 3,000 cards minimum. Free samples, stamps appreciated. K2RPZ, Box 412, Dept. NC, Rocky Point, NY 11778.

BE SURPRISED - get a variety of cards - 100 for $8 or 200 for $13. Samples $1 refundable. All three colors, fast service, satisfaction guaranteed. Constantine, 1219 Ellington, Myrtle Beach, SC 29577.

FINEST CUSTOM QSLs AND RUBBER STAMPS: Large cut catalog and samples $1 refundable on first order. Ritz Print Shop, P.O. Box 45018, Westlake, OH 44145.

QSL's — since 1956, free samples, Rusprint, Box 7575, Kansas City, MO 64116.

FREE, 100 QSLs with first order. Samples 50¢. Gazebo Press, Rt. 4, Box 4148, LaPlata, MD 20646.

ENGRAVING. CALLSIGN/name badges by WØLQV. SASE for price sheet. Box 4133, Overland Park, KS 66204.

CADILLAC of QSLs — Completely different! Samples $1. (refundable) Mac's Shack, P.O. Box No. 43175, Seven Points, TX 75143.

PICTURE QSL cards of your shack, etc. from your photograph or black ink art work. 500 $24.00; 1000 $36.50. Also unusual non-picture designs. Send stamp for illustrated literature. Generous sample pack $1.00; half pound of samples $2.00. Custom printed cards, send specifications for estimate. Raum's, 4154 Fifth Street, Philadelphia, PA 19140. Phone: 1-215-228-5460.

FIRST CLASS, Full Color QSL from your prints or slides. Confirming report and address printed on back, $199/2,500. Smith Printing, 20420 Calhaven Dr., Saugus, CA 91350. 805-251-7211.

QSLs, QUALITY and Fast Service for 25 Years. Include Call for Decal. Samples 50¢. Ray, K7HLR, Box 331, Clearfield, UT 84015.

BROWNIE QSLs since 1939. Catalog & Samples $1 (refundable with order) 3035 Lehigh Street, Allentown, PA 18103.

QUALITY QSLs, Samples 50¢. Olde Press, WB9MPP, Box 252, Kankakee, IL 60901.

SERVICE . . . a thing of the past? Personal service . . . non-existent? . . . WRONG!! Still skeptical? Call me evenings and I'll give you phone numbers of Hams that will tell you W4MPY is from the "Old School" which believes the customer does us a favor when they order . . . not the other way around. Wayne, W4MPY, 803-279-5986.

RUBBER STAMPS and BUSINESS CARDS. QSL for Free Literature! J. Glass, WB6ZTI, 14316 Cerecita, Whittier, CA 90604.

Your Best Bet—YAESU Quality at an EGE Discount

VHF/UHF

FT 203
2m HT with TTP

FT 103
220 MHz HT / TTP

FT 703
440 MHz HT / TTP

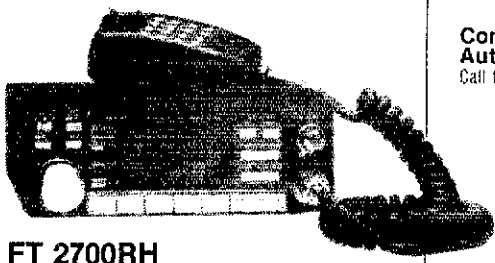
FT 209RH
2m Handheld

FT 709R
440 MHz Handheld

Accessories:
YH-2 Headset
MH-12A2B Speaker/Microphone
FTS-6 Programmable Tone Squelch
PA-3 DC/DC Car Adapter/Trickle Charger
MMB-21 Mobile Hanger Bracket
NC-15 Quick Charger/DC Adapter
FBA-5 Battery Case for 6xAA
FNB-3 10.8V, 425 mAh Ni-Cd pack
FNB-4 12V, 500 mAh Ni-Cd pack

FT 726R
Especially good for Oscar

Accessories:
6m-726 6-meter module
430-726 430-440 unit for Oscar
440-726 440-450 FM unit
HF-726 10-12-15 meter unit
SU-726 Satellite Duplex module
XF 455 MC 600 Hz CW Filter



FT 2700RH
Duo-band 2m/440 Mobile Radio

FT 270RH
Compact 45 Watt 2m FM Mobile

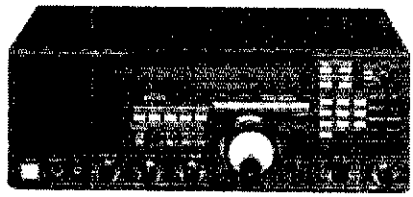
Accessories:
FTS-8 Programmable Tone Squelch Unit
FVS-1 Voice Synthesizer Unit

SHORTWAVE LISTENING

FRG 9600
Scanning Receiver for 60-905 MHz
FM/AM/SSB, 100 memories

Accessories:
PA-4B/PA-4C AC-DC Wall Adapter
SP-55 External Speaker
NTSC Video Unit

Coming soon: Software to extend the range of the 9600. Call for details.



FRG 8800
General Coverage Receiver
All-band, all-mode
AM/SSB/CW/FM, 150kHz-30MHz

Accessories:
FRV-8800 Converter for 118-174 MHz
FRA-7700 Active Ant for 150kHz-30MHz
FRT-7700 Antenna Tuner
DC-8800 12-volt kit
SP-102 Speaker with filters

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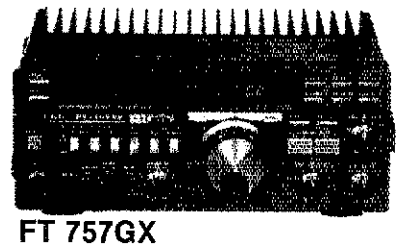
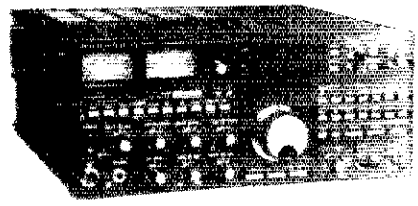


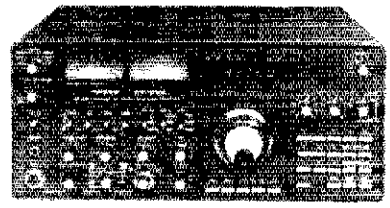
FT 757GX
Mobile Transceiver, SSB/CW/AM/FM
General Coverage Receiver
Receives 500kHz-30MHz

Accessories:
FP-757GX Flatpack Power Supply
FP-757HD Heavy Duty Power Supply
FC-757AT Automatic Antenna Tuner
FAS-1-4R Remote Antenna Selector
SP-102 Speaker
SP-102P Speaker
MMB-20 Mobile Mounting Bracket
FRB-757 Relay Box
MD-1B8 Desk Microphone



FT 980 CAT
Computer Controlled Transceiver

Accessories:
GEN-980 General Coverage Kit
XF 8.9 HC 600 HzCW Filter
XF 455.8 MCN 300 Hz CW Filter
SP-980 Speaker
SP-98P Speaker Patch
MD-1B8 Desk Microphone



FT ONE
General Coverage Transceiver
The all-mode Super Radio

FT 77
Compact Transceiver

Accessories:
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FC-700 Antenna Tuner
FM-77 FM Unit
MK-77 Marker Unit
FV-700DM External VFO
XF 8.9 KC 600 Hz CW Filter

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GENERATOR, Ferris, Microvolter model 10B early 1930s, *$40. Crystal Calibrator* for WW2 no. 19 set, mint, $25. C. A. Fortier, 62 Richlin, Ottawa, Ont., K2B 8K4.

WANTED: Early Hallicrafter "Skyriders" and "Super Skyriders" with "Silver" panels, "Skyrider Commercial," early transmitters — HT-1, HT-2, HT-8, etc., other Hallicrafter gear, parts, accessories, manuals. Chuck Dachis, WD5EOG, The Hallicrafter Collector, 4500 Russell, Austin, TX 78745.

WANTED; old microphones for my mic. museum. Also mic-related items. Write Bob Paquette, 107 E. National Ave., Milw. WI 53204.

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WANTED: radios, magazines, horn speakers, pre 1930. W6THU, 1545 Raymond, Glendale, CA 91201. 818-242-8961.

MICROPHONES and related memorabilia used in radio/TV broadcasting prior to 1960 wanted. Cash paid; trade items available. Write: James Steele, 80 Central Park West, New York, NY 10023-5206.

WANTED: MCINTOSH and Marantz tube-tupe audio equipment, parts, accessories and literature, for personal collection. 100% reply. Marcus Frisch, WA9IXP, Box 385, Elm Grove, WI 53122-0385, 414-475-5356.

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COLLINS WANTED: Pre-WWII transmitters - 45 series, 20R, 202A, 30FXR, 30FXC for personal collection. Also want to find a nice HRO Sr. with all coils and manual, in good condition. Please contact AC1Y c/o ARRL Hq. or call 203-667-2494 days 8-4.

WANTED: QST VOLUME 1. W6ISQ, 82 Belbrook Way, Atherton, CA 94025.

SCHEMATICS: Radio receivers 1920's/60's. Send Brandname, Model No., SASE. Scaramella, Box 1, Woonsocket, R.I. 02895-0001.

WANTED: OLD Crosley 1-3 tube radio. K4NBN, "No Bad News".

OCEAN HOPPER by Knightkit wanted - N4ZO. Call collect 803-237-9212 daytime.

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WANTED, OLD Western Electric, Cunningham, RCA, McIntosh, Marantz, Telefunken, tubes, speakers, amplifiers, 713-728-4343, Maury Corb, 11122 Atwell, Houston, TX 77096.

VINTAGE TUBES, Books, Magazines. Dollar and wants. WA2RUG.

CRYPTOGRAPHY items wanted. WB2EZK. 516-378-0263.

WANTED: MINT condition Hallicrafter SX-115. Larry Green, 100 Mountainbrook Lane, Spartanburg, SC 29301, 803-576-5668.

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WANTED: Hallicrafters HA-5 VFO. Will buy one or more. Condition determines the price. Like new $100. Junk? Call or write WA6PJR, 36308 Panorama Dr., Yucaipa, CA 92399, 714-797-1782.

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HALLICRAFTERS HT-40 Mark I good shape with manual $50 plus UPS WA9REF, 7127 N. Ozark, Chicago, IL 60631.

WANTED JOHNSON Adventurer WA3JJT.

SELL-HAMMARLUND HX50D, National NC303 w/Speaker and Manuals, $125 each. Won't ship but will deliver in Bay Area. W7EDO, 1-415-537-4743.

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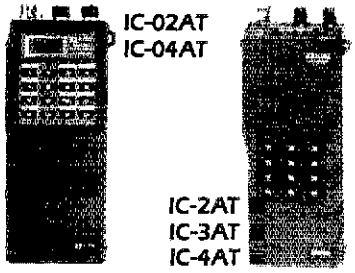

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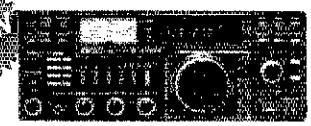

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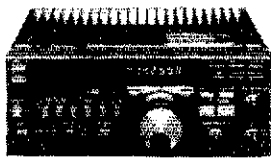

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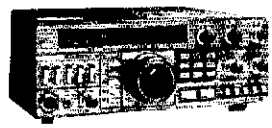

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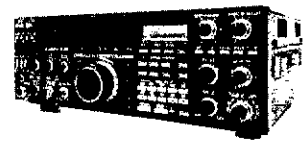

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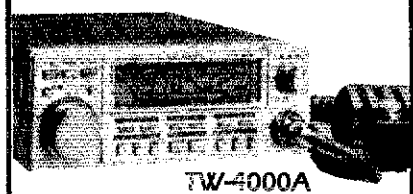

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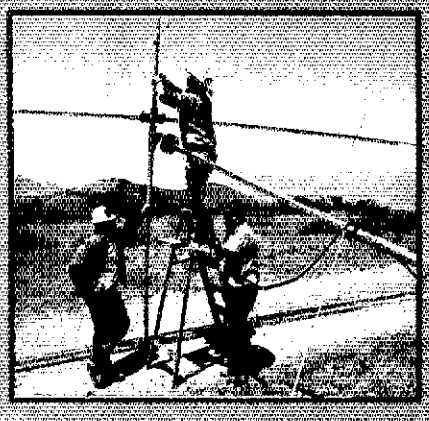

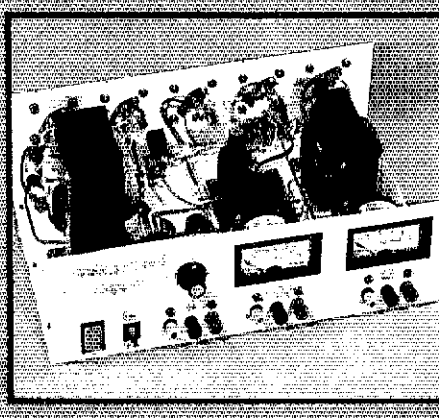

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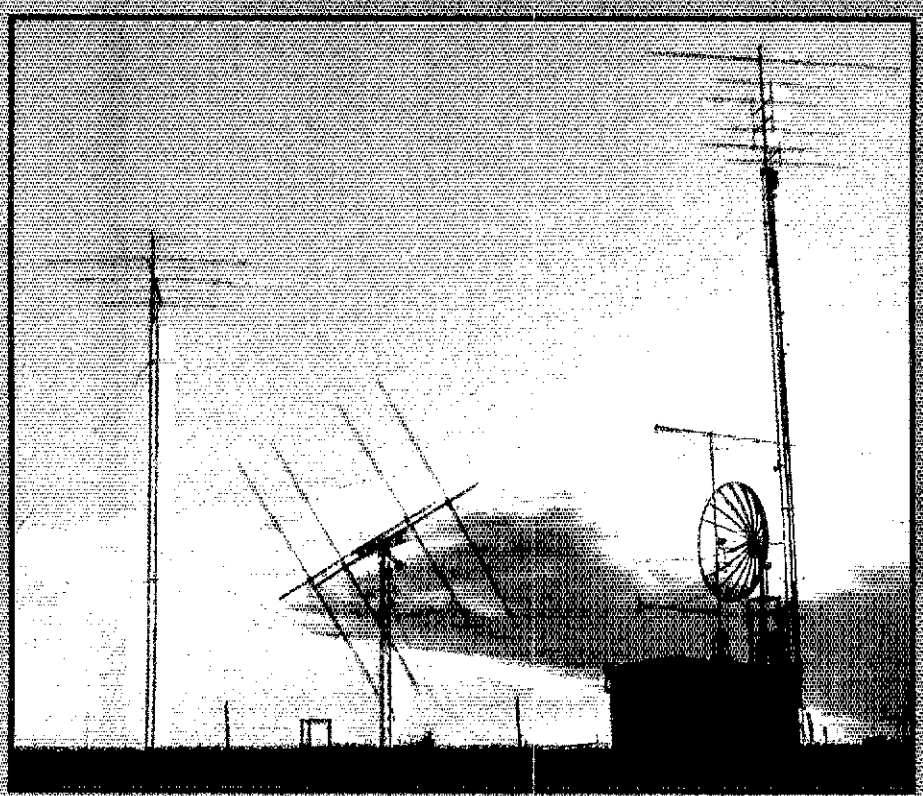
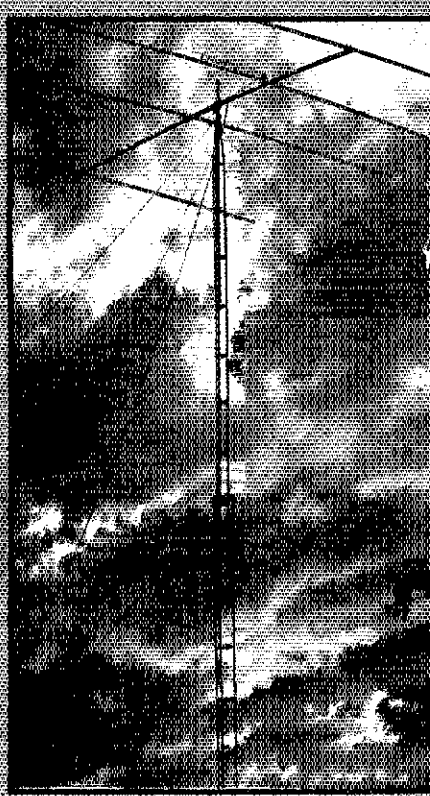
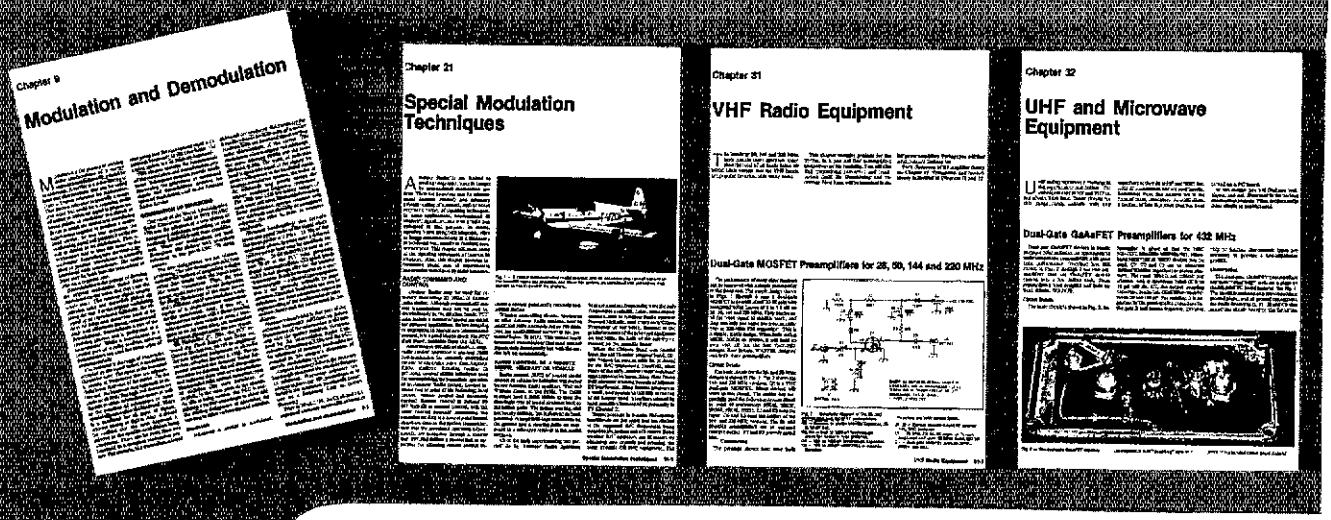
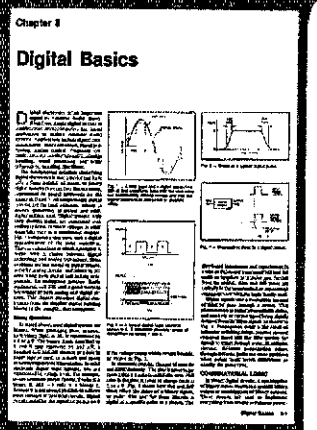
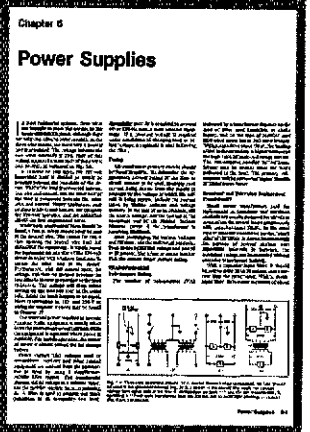
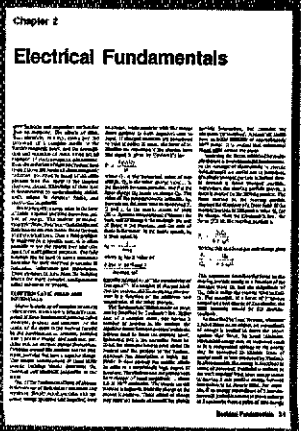












THE PLOT THICKENS!

The ARRL 1986 Handbook for the Radio Amateur takes over where the 1985 Edition left off. Each of the 40 chapters has had some revision, and there are more than 500 new or revised figures. The new edition will contain 1184 pages — way up from last year's count of 1024. Many key chapters with "hot" topics among today's radio amateurs have been completely revised and rewritten. In fact the new material represents 532 text pages.

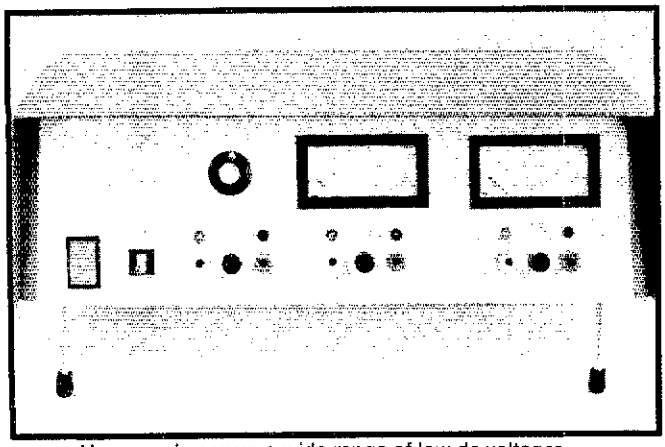
An understanding of digital electronics is a must these days since such circuitry has so many practical applications in station control, frequency synthesis, telemetry, word processing and other information-handling systems. The Digital Basics chapter will help you to understand what is going on in everything from simple keyers to sophisticated microcomputers. Packet-radio enthusiasts will find the most up-to-date information available in the Digital Communications chapter. There are new sections on data interfacing and modems, 50 new and revised figures, plus an expanded bibliography and glossary.

The Special Modulation Techniques chapter has the latest on spread-spectrum. On the fun side, we've added a new section on remote control of model aircraft and vehicles.

On the practical side, you will find many of the 27 new projects described on the next page. There are new power amplifiers for 1.8, 50, 144 and 1296 MHz, plus preamplifiers and transverters for the VHF/UHF enthusiast. The new digital PEP Wattmeter - SWR Calculator will be one of the most popular projects.

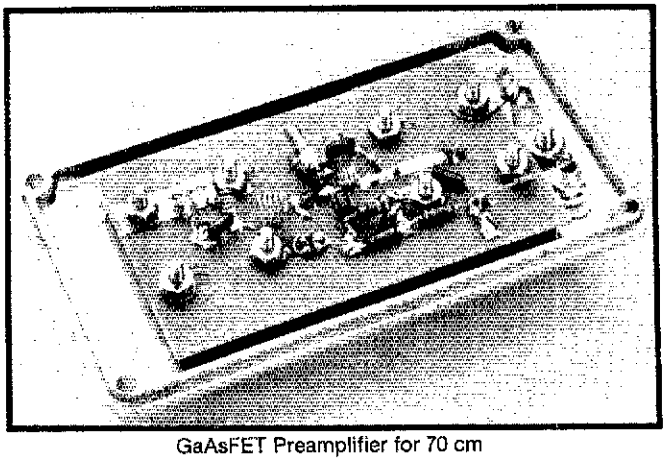
We've only scratched the surface in describing what is in the standard manual of RF communication. Over 5.7 million copies of *The Handbook* have been published in 63 editions since 1926. The new edition will be available in early November. It is must reading for today's radio amateur!

Paperbound prices are $18.00 in the U.S., $19.00 in Canada and elsewhere. Cloth prices are $27.00 in the U.S. and $29.00 elsewhere. Prices in U.S. funds. Foreign remittance should be in the form of an international money order or a check drawn on a bank account in the U.S.

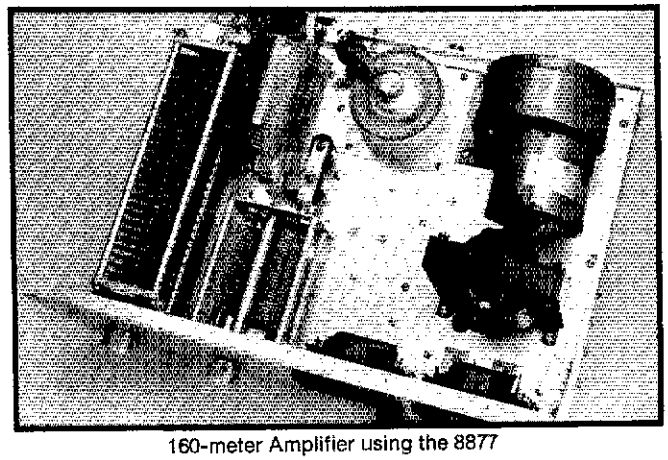


New supply covers a wide range of low dc voltages

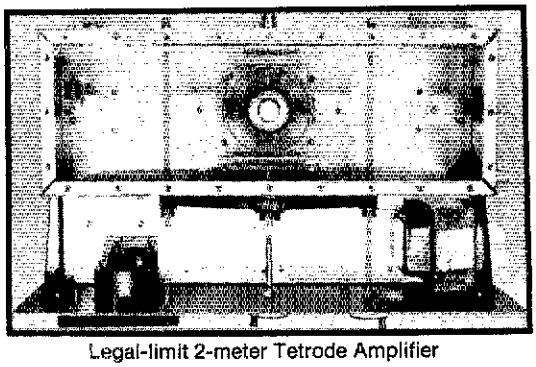
RF-proof regulator board in the new high current power supply



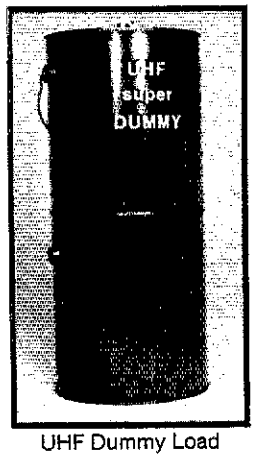
GaAsFET Preamplifier for 70 cm



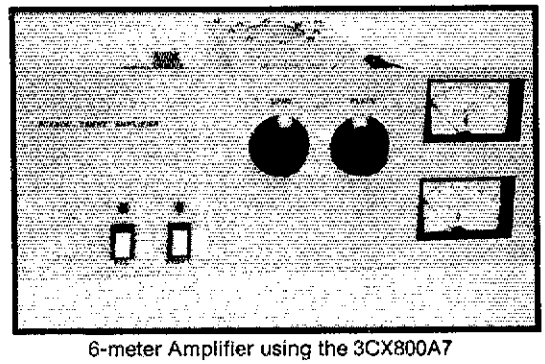
160-meter Amplifier using the 8877



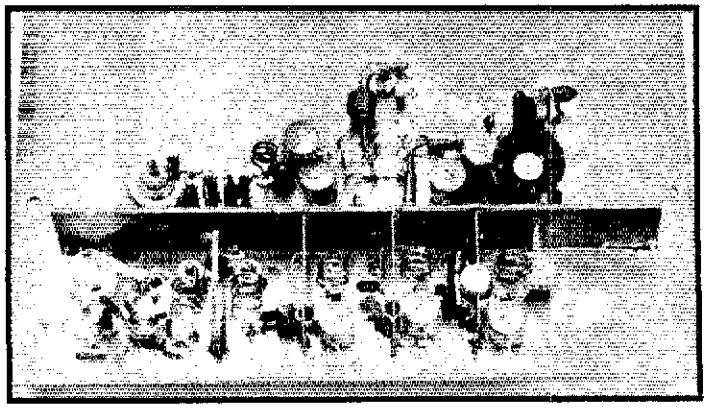
Legal-limit 2-meter Tetrode Amplifier



UHF Dummy Load

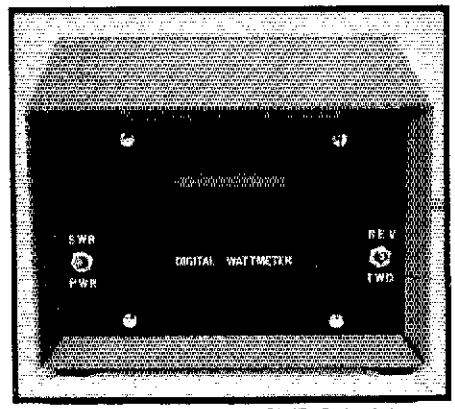


6-meter Amplifier using the 3CX800A7



Transmit converter board: 220 MHz Transverter

New for '86



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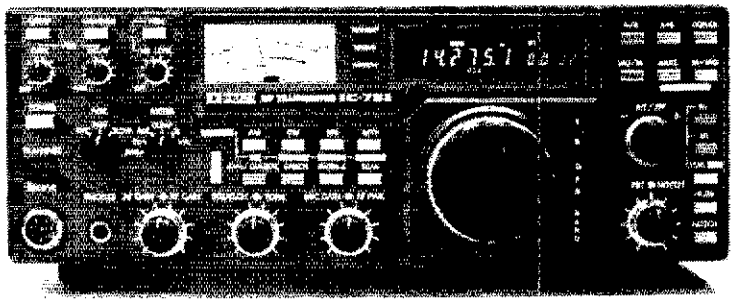

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WANTED-MICROWAVE antennas, waveguide flanges, small coaxial relays, test equipment, what-have you. D. Lusis, 420 King St., Apt. B-8, Bristol, CT 06010.

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ELECTRON TUBES—Radio & TV types 75% off List Price - Huge Inventory! Also industrial types. Send for Free Catalog today or call Toll Free 800-221-5802, Box QC, Transistoronics, Inc., 1365 39th St., Brooklyn, NY 11218.

C-128 LOGGING and QSL Program. 80 Column monitor required, $12.95 W6BSW, WSR Box 9457, Oroville, CA 95966.

QRP TEN-TEC Argonaut 515 with PS, CW/Notch, 25 kHz Cal, MFJ 525B Speech Processor. All mint, $325. Keith Darwin, 11770 Minuteman, Riverside, CA 92503, 714-351-8160.

SHORT DIPOLES for 160/75, 160/40, 160/30 . . . coax-fed, no tuning. $59.50 postpaid. Tom Evans, W1JC, 113 Stratton Brook, Simsbury, CT 06070.

FOR SALE: Drake T4X Transmitter with Power Supply. 2B Receiver with Crystals, 2BQ Multiplier and Speaker. All manuals. Excellent condition. $500. FOB Boston, W1LF, 617-899-2624.

WANTED—IC-502 6-meter portable. Must be in good condition. D. Lusis, 420 King St., Apt. B-8, Bristol, CT 06010.

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C64 SYSTEM: C64, 1541, 1702 Color Monitor, AEA-SOFT MBA-TOR cartridge, Simon's BASIC, Epyx Fast Load, Wico Joystick, Card? + G printer-interface, C2N cassette, Hes Modem 1, two (2) Tech Sketch light pens and software, F-15 Strike Eagle, Beach Head, RF Modulator, manuals: $550. Heath SB610 (modified), $65. You ship. Paul K. Pagel, N1FB, 4 Roberts Rd., Enfield, CT 06082. Days: 203-866-1541, evenings before 9 PM Eastern, 203-745-1029.

HAM GEAR, Shortwave, Scanners, Antennas, MFJ, much more!! Free testing before shipping. Free UPS shipping & insurance to 48 states. 31-Page 1988 Picture Catalog $1 (refundable) Galaxy Electronics, Box 1202, 67 Eber Ave., Akron, OH 44309 216-376-2402 9-5 PM EST.

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KENWOOD TS-530S, excellent with manual and original box. $475. Steve Randall, WA2EHW, 4114 W. Walworth Rd., Macedon, NY 14502.

SELL Drake R7A, SW Receiver, mint, $375 firm. I ship. Write John Griffin, Apt. 111, 701 East High Street, Charlottesville, VA 22901.

HAMSWAP NEWSLETTER—Send us your Free Ad. Include phone. Buy/Sell/Trade. Subscriber equipment discounts. 12 issues $9. Ham Swap, P.O. Box 2222, Vacaville, CA 95696.

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. Be specific. Grand Systems, POB 3377, Blaine, WA 98230.

LABORATORY OSCILLOSCOPE. Hewlett-Packard dual-channel, solid-state, 15 MHz, $395. W2DB/4, 904-344-1041.

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SELL, SIGNAL ONE CX7, good condition, original owner. K8RNE, 216-322-8722 or 216-322-9451.

COLLINS S-LINE, Round Emblem: Receiver, Transmitter, Console, Power Supply, Microphone, Audio Filters, Digital Frequency Display, all original manuals, excellent condition. Ken Beck, 2507 Middle Road, Bettendorf, IA 52722, 319-355-3489.

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SELL TS-403/A, 2-4 GHz Signal Generator $150. Aerotron Lo-Band "Companion" Portamobile 10/50 Watts, solid state with IB $200. GE Radiotelephone with control box and IB $200. Will consider swaps. 1000 feet RG-11/U foam cable (new) $175. RCA Radiola "7" vintage 1923, $300. QST's 1950-1973, some sets complete-some partial, CQ's 1949-1953, call/write for dates/prices. Tubes, 813's, 4-400's, 837's, 5AZP4 Proj. CRT, 803's, TV Type 75/300 Matching Xfmrs, (new) make offer, all prices negotiable. W3QVZ, D. T. Morar, P.O. Box 129, Great Cacapon, WV 304-258-5351.

FOR SALE: Kenwood TH21AT Handheld 2M FM Transceiver, good condition, extra PB-21 Ni-Cad Pack, $160. N. Faulkner, KI7H, 7640-239th Pl. SW, Edmonds, WA 98020, 206-775-6140.

WANTED: RADIOMARINE AR8510, W7MN, 225 So. 17th St., St. Helens, OR 97051.

TS-820S, Filter, MC-50, manuals. Pristine. Delivered 100 miles, or you ship. $525. AE7M, Box 3341, Gresham, OR 97030.

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WANTED: 30L1 or L4B for cash. K2AK, 718-358-6837.

SALE: COLLINS 312B-3 Speaker. Mint condition. Will ship UPS. $80. Certified check. Gloria McDaniel, W9GHO, 6090 Fall Creek Road, Indianapolis, IN 46220, 317-257-0362.

SALE ICOM 740 Internal PS FL52 filter, FM Automatic Antenna Tuner AT100, EX2 $750. Drake T4X PS, R4 $350. TA33 Ham Rotor $125. 201-569-2576 eves WB2QMU.

SSTV: ROBOT 400 with 3000C Conversion. All manuals included. $375. KI4GP, Ed Carpenter, Rt. 2, Box 621, Troutville, VA 24175, 703-992-3539.

WANTED: DRAKE C4 Console in excellent condition for a minor collection. Please state price and condition if you write me. WA6PJR, 36308 Panorama Dr., Yucaipa, CA 92399, 714-797-1782.

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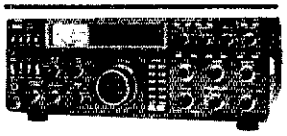

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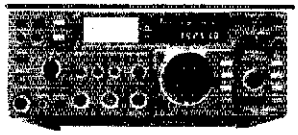

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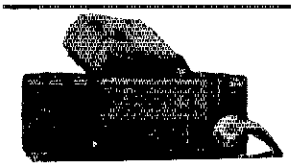

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RS20A	16	20	89
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RS35A	25	35	135
RS35M	25	35	149
RS50A	37	50	199
RS50M	37	50	229

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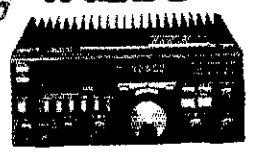

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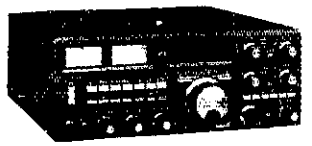

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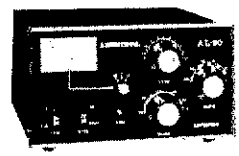

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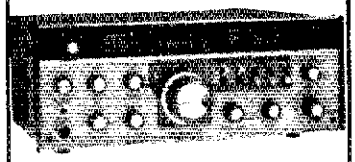

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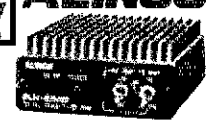

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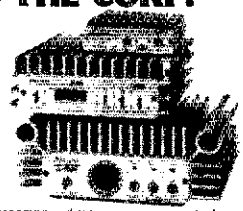

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IC-3AT, HT	299.00	Call $
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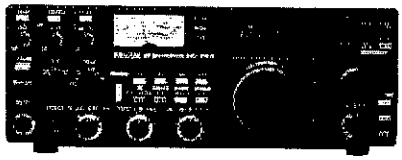

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TM 411A 70 cm	449.95	Call $
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FT-2700H w/FTS-8	599.95	Call $
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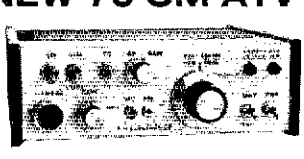

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AMTOR/RTTY/ASCII/CW. Everything you need plus a computer! Includes VIC20, AIR-1 w/Amtor & WRU/Selcals, green screen hi-res monitor. Sacrifice all for only $299. Send postal money order and will add VIC1525 printer! All functioning perfectly. KY1T, PO Box LL, N. Eastham, MA 02651.

HW-101, w/Filters, PS, Spkr, SB-610 Scope, PTT Desk Mic. and SWR Bridge. XCLNT cond. $300 for pkg. Will split shipping cost. K8OXI, 517-856-2738.

RTTY/ASCII/CW. Brand new, never used Heath HD3030. Calibrated and certified by Heath. Optional preselector. Original cost $350. First postal money order for $125 takes it! KY1T, POB LL, N. Eastham, MA 02651.

SELL COLLINS Receiver 75S-3B and Collins Transmitter 32-S3 with power supply $500. Johnson Ranger $100. Henry Anderson, Box 384, Pelican Rapids, MN 56572.

WANTED ICOM 22U. Must be in good working condition. Contact Ron, WB6CVJ, 415-457-5722, Box 612, Fairfax, CA 94930.

DRAKE TR-4 CW/RIT, P.S. AC-4 Remote VFO RV-4C, MN-4C, Ameco Preamp PT-2 $560. Excellent condition. KM3U, 302-762-6309.

WANTED: 430 module for Yaesu FTV-901R Transverter, N8FTR, Joe, 614-262-2250.

CORSAIR, Deluxe Power Supply, CW and extra SSB Filter, Mike, mint. $825. K8CV, 1-313-549-1846.

DX-302 RECEIVER, 10 kHz, 30 MHz, digital readout, AM, SSB, CW, Mint in original carton with manual. $200. KZ1S, 10 Bonnie Brook Dr., Huntington, CT 06484, 203-929-8049.

W5LUT SELLING OUT - mint 750 watt Collins AM xmtr, mint HRO60, $750. RCA CR88 .5-32 MHz Rcvr plus Panadapter, $250. Mint AF67, $150. OSS Spy Radio RA6, $100. TS-120S, 500 Hz CW, Mike, $375. ICOM 2AT, BC-30 charger, extras, $200. Lafayette HA-146, xtals, $100. Kenwood 211A, mint, $300. Yaesu FT102, AM, FM board, all filters, FC102, FAS4RSW, $850. SASE for pictures. Zeke Adair, 612 Newberry Rd., Socorro, NM 87801, Ph 505-835-1425.

GALAXY III TRANSCEIVER with Power Supply in good operating condition. $300. Galaxy Linear with Power Supply in mint condition externally needs minor tuneup internally $300. Both for $450. Includes all manuals. WA7MMM, 2744 NE 37th, Portland, OR 97212.

ROHM FOLDOVER Tower with Ham-M and TA33, Quad - cable & coax - about 60' high - $500, Hammarlund B-S with speaker, Collins 32V2, National NC-300 with pre-amp, $50 each. You move. W1SO, 203-582-5004.

FOR SALE - Swan 250 - Gonset SSB 144 Mc - TS520S - HT-37. Best offers. K2LNS, 201-526-0781.

ESTATE SALE: Drake T4XB, R4B, AC4, MS4, Mike, Manuals, $300 + UPS; Hallicrafters HT32A, Mike, Manual, $100; S-40B, S43, S-108; Clegg-Zuess 331 2-6 meter TX, 332 P.S. Mike, Manual: H.B. (2-811A) Linear w/1500V. P.S.; QST-1923 UP; Eico 465 Scope; Measurements 80; 2-813; SASE 914-769-9331, W2DQC, 229 Sarles Lane, Pleasantville, NY 10570.

ESTATE SALE: Drake TR4CW w/AC4 $345. Swan 500C w/AC $195. Swan T600 Xmtr $175. Hallicrafter HA2 W/P26 $120. Johnson SSB Adaptor w/AC $150. 2 AP1 $10. 3-1000A $185. 4XC3000A7 $285. 826 $15. Panel meters, microamp, milliamp, volts $3 ea. TR7 service manual $20. 70' Tristao Tower w/motor p/u only $1000. 40M 2 el Beam $125. TH6DXX (needs some hardware) $95. Contact John Kakstys, 18 Hillcrest Ter., Linden, NJ 07036, 201-486-6917.

WANTED: CORNELL-DUBILIER AR-40 Control Box, five wire, working. WAØKKC, 7139 Hardy, Overland Park, KS 66204.

KENWOOD T-599D Tx, Drake 2-C RX, w/manuals. Nice novice rig. Will ship UPS USA. KA4ATI, 901-756-6233.

FOR SALE: Kenwood TS430S complete general coverage. Call 201-759-7512, Dick, WA2JHP.

KENWOOD TS-520SE, CW Filter, SP520, $460. Heath HW-8 QRP $85. Larry, WB5ESW, 713-996-0073.

TEN TEC OMNI 545, 6 filter selections & 242M P.S. $475. W1EWD, 236 Briar Lane, San Mateo, CA 94403.

ESTATE OF Deceased Ham. Operator has eqpt. for sale. ICOM Transceiver IC-745. Sony CRF-1 Receiver w/SP102. MFJ Keyer. MFJ Tuner. Stewart Multi-Band Receiver. ICOM P515 Power Supply. Write to D. Simard, 7 Sisson Ave., Hartford, CT 06106.

FOR SALE: New Westinghouse commercial broadcast parts to build Super Linear. Capable of 5kW DC Out continuous. Complete with three 4-1000 tubes. $900/B.O. Pick up only. WA3CXW. 412-929-4630 or S.A.S.E.

WANTED: TEN-TEC, PM1, PM2, PM3, state condition and price. WBØMPG, 536 North Walnut, Wichita, KS 67203.

HAL CWR-6850 Port. Terminal, 5" CRT & Keyboard. Excellent condition, one year old, $450. KA9OAK, 312-631-3753 Eves & Weekends.

NOVICE RADIO OUTLET New and used equipment dealer! Attention beginners! *Used Kenwood 520-S Transceiver, w/manual $400. Large SASE for equipment list! Free shipping U.S.A. 919-286-7927. 1604 Delaware Ave., Durham, NC 27705.

FOR SALE: ICOM 730, like new with hand mike, processor, IF shift, dual VFO's etc. built-in, $485 with ICOM PS, $420 without, negot. Original cartons, KF4JZ, 101 W. Linden St., Alexandria, VA 22301, 703-836-5934.

KENWOOD TS-820S, MC-50 mike, $450. Excellent. Lou Susman, W9FUP/4, 305-972-8766.

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.

MFJ-989 **$329.95**

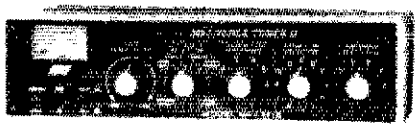
Accurate meter reads SWR plus forward and reflected power in 2 ranges (200 and 2000 watts). Meter light requires 12 VDC. Optional AC adapter, MFJ-1312 is available for $9.95.

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 2.8 to 30 MHz! dipoles, inverted vee, random wires, verticals, mobile whips, beams, balanced and coax lines.

Built-in 4:2 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-962 **$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.

Built-in SWR/Wattmeter has 2000 and 200 watt ranges, forward and reflected power. 2% meter movement. 6 position antenna switch handles 2 coax lines (direct or through tuner), wire and balanced lines. 4:1 balun 250 pf 6 KV variable capacitors. 12 position inductors. Ceramic rotary switch. All metal black cabinet and panel gives RFI protection, rigid construction and sleek styling. Flip stand tilts tuner for easy viewing. 5 x 14 x 14 in.

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.

ORDER ANY PRODUCT FROM MFJ AND TRY IT-NO OBLIGATION. IF NOT SATISFIED, RETURN WITHIN 30 DAYS FOR PROMPT REFUND (less shipping).
• One year **unconditional** guarantee • Made in USA
• Add $5.00 each shipping/handling • Call or write for free catalog, over 100 products.

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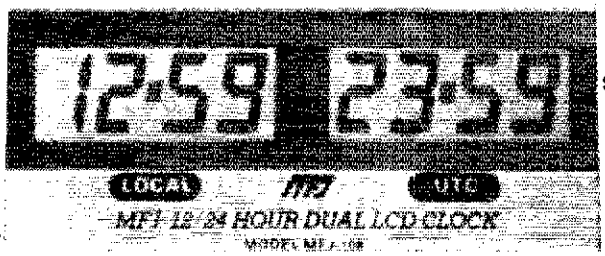
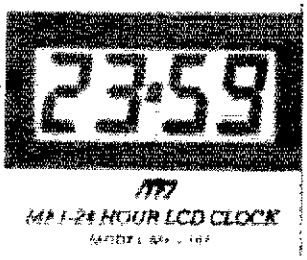
BEST OF MFJ

MFJ 24 HOUR LCD CLOCKS



MFJ-108 **$19.95**



MFJ-107 **$9.95**

These MFJ 24 hour clocks make your DXing, contesting, logging and SKEDing easier, more precise.

Read both UTC and local time at a glance with the MFJ-108, $19.95, dual clock that displays 24 and 12 hour time simultaneously. Or choose the **MFJ-107, $9.95** single clock for 24 hour UTC time.

Both are mounted in a brushed aluminum frame, feature **huge easy-to-see 5/8 inch LCD numerals** and a sloped face that makes reading across-the-shack easy and pleasant.

You can read hour, minute, second, month and day and operate them in an alternating time-date display mode. You can also **synchronize them to WWV** for split-second timing. Both are **quartz controlled** for excellent accuracy.

They are **battery operated** so you don't have to reset them after a power failure, and battery operation makes them suitable for mobile and portable use. Long life battery included.

MFJ-108 is 4½x1x2 in. MFJ-107 is 2¼x1x2 in.

RTTY/ASCII/AMTOR/CW COMPUTER INTERFACE MFJ-1229 $179.95

Everything you need is included for sending and receiving RTTY/ASCII/CW on a Commodore 64 or VIC-20 and your ham rig. You get MFJ's most advanced computer interface, software on tape and all cables. Just plug in and operate.

The MFJ-1229 is a general purpose computer interface that will never be obsolete. An internal DIP switch, TTL and RS-232 ports lets you adapt the MFJ-1229 to nearly any home computer and even operate AMTOR with appropriate software.

A crosshair "scope" LED tuning array makes accurate tuning fast, easy and precise.

You can transmit both narrow (170 Hz) and wide (850 Hz) shift while the variable shift tuning lets you copy any shift (100-1000 Hz) and any speed (5-100 wpm, 0-300 baud ASCII).

Automatic threshold correction and sharp multipole active filters give good copy under severe QRM, weak signal and selective fading.

There's an FM (limiting) mode for easy trouble-free tuning that's best for general use and an AM (non-limiting) mode that gives superior performance under weak signals and heavy QRM.

A handy Normal/Reverse switch eliminates retuning while checking for inverted RTTY.

An extra sharp 800 Hz CW filter really separates the signals for excellent copy.

12½ x 12½ x 6 inches. Uses floating 18 VDC or 110 VAC with MFJ-1312, $9.95.

MFJ PORTABLE ANTENNA

MFJ's Portable Antenna lets you operate 40, 30, 20, 18, 15, 12, 10 meters from apartments, motels, camp sites, vacation spots, any electrically clear location where space for full size antenna is a problem.

A telescoping whip (extends 54 in.) is mounted on self-standing 5½ x 6¾ x 2¼ inch Phenolic case. Built-in antenna tuner, field strenght meter, 50 feet coax. Complete multi-band portable antenna system that you can use nearly anywhere. 300 watts PEP.

MFJ-1621 **$79.95**

MFJ ANTENNA BRIDGE MFJ-204B $79.95

Now you can quickly optimize your antenna for peak performance with this portable, totally self-contained antenna bridge that you can take to your antenna site—no other equipment is needed.

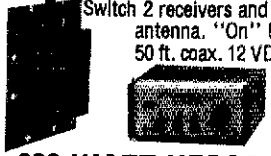
You can determine if your antenna is too long or too short, measure its resonant frequency and antenna resistance to 500 ohms. It's the easiest and most convenient way to determine antenna performance available today to anyone. There's nothing else like it and only MFJ has it. Built-in resistance bridge, null meter and tunable oscillator-driver (1.8-30 MHz). Uses 9 V battery. 4 x 2 x 2 inches.

REMOTE ACTIVE ANTENNA

The authoritative "World Radio TV Handbook" rates the MFJ-1024 as "a first-rate easy-to-operate active antenna ... Quiet, with excellent dynamic range and good gain ... Very low noise factor ... Broad frequency coverage ... the MFJ-1024 is an excellent choice in an active antenna"

54 inch remote active antenna mounts outdoor away from electrical noise for maximum signal and minimum noise pickup. Often outperforms long-wire hundreds of feet long. Mount anywhere-atop houses, buildings, balconies, apartments, ships.

Use with any radio to receive strong clear signals from all over the world. 50 KHz to 30 MHz. High dynamic range eliminates intermodulation. Inside control unit has 20 dB attenuator, gain control. Switch 2 receivers and auxiliary or active antenna. "On" LED. 6 x 2 x 5 in. 50 ft. coax. 12 VDC or 110 VAC with MFJ-1312, $9.95.



MFJ-1024 **$129.95**

200 WATT VERSA TUNER

MFJ-901B **$59.95**

MFJ's smallest 200 watt Versa Tuner matches coax, random wires and balanced lines from 1.8 thru 30 MHz. Works with all solid state and tube rigs. Very popular for use between transceiver and final amplifier. Efficient air-wound inductor gives more watts out. 4:1 balun, 5x2x6 in.

ROLLER INDUCTOR TUNER

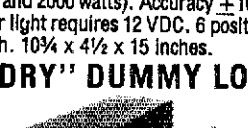
MFJ-989 **$329.95**

Meet the "Versa Tuner V", the compact roller inductor tuner that lets you run up to 3 KW PEP and match everthing from 1.8 to 30 MHz.

Designed to match the new smaller rigs, the MFJ-989 is the best roller inductor tuner produced by MFJ. Our roller inductor tuner features a 3-digit turn counter plus a spinner knob for precise inductance control for maximum SWR reduction. Just take a look at all these other great features! **Built-in 300 watt, 50 ohm dummy load, built-in 4:1 balun and a built-in lighted meter** that reads SWR and forward and reflected power in 2 ranges (200 and 2000 watts). Accuracy ±10% full scale. Meter light requires 12 VDC. 6 position antenna switch. 10¾ x 4½ x 15 inches.

MFJ "DRY" DUMMY LOADS

MFJ-262 **$64.95**

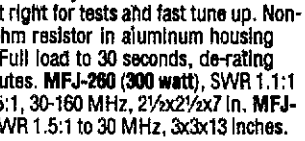


MFJ-260 **$26.95**

MFJ's "Dry" dummy loads are air cooled—no messy oil. Just right for tests and fast tune up. Non-inductive 50 ohm resistor in aluminum housing with SO-239. Full load to 30 seconds, de-rating curve to 5 minutes. **MFJ-260 (300 watt)**, SWR 1.1:1 to 30 MHz, 1.5:1, 30-160 MHz, 2½x2½x7 in. **MFJ-262 (1 KW)**, SWR 1.5:1 to 30 MHz, 3x3x13 inches.

MFJ ELECTRONIC KEYER

MFJ-407 **$69.95**



MFJ-407 Deluxe Electronic Keyer sends iambic, automatic, semi-auto or manual. Use squeeze, single lever or straight key. Plus/minus keying. 8 to 50 WPM. Speed, weight, tone, volume controls. On/Off, Tune, Semi-auto switches. Speaker. RF proof. 7 x 2 x 6 inches. Uses 9 V battery, 6-9 VDC or 110 VAC with AC adapter, MFJ-1305, $9.95.

ORDER ANY PRODUCT FROM MFJ AND TRY IT-NO OBLIGATION. IF NOT SATISFIED, RETURN WITHIN 30 DAYS FOR PROMPT REFUND (less shipping).
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VISA MasterCard

SELL: KENWOOD TS-930S xcvr ser. 5050221 including MC-60A mike and AM filter, $895. Kenwood TL-922A amplifier ser. 4120058, $845. Both units are one year old in new cond. including all manuals and original cartons. Albert Weiss, K6VU, 1700 Forest Lakes Blvd., Naples, FL 33942. Tel. 813-262-6866.

KENWOOD SALE: TS-820S $425. Kenwood R-820 Receiver $295. Both units in mint condition. Robert White, K9LWA, 2501 Birch Drive, Richmond, IN 47374, 317-935-3966.

WANTED: HEWLETT-PACKARD Model 612A UHF Signal Generator in good working condition. Ron, K2RS, 10 Rose Court, Dover, NJ 07801.

WANTED: MOTOROLA VHF PL length HT-220 with 12 channel Spectronics/portable clinic conversion kit. Will also purchase kit separately. Must be complete. Radio must be mint and late model board. No basket cases! Will travel within 100 miles of Northern N.J. to pick up. Contact Rich Fluharty, 201-334-2984 0900-1100 hrs ONLY EST.

KENWOOD STATION: TS830S w filters, SM220 w BS-5 Pan Kit, TL922A 2 kW amp, SP230, VFO 230, MC60 mic, Daiwa CNW518 tuner, 2 new 3-500Z's, HC1 clock, VIC-20, Kantronics interface w. software, phones, all manuals and shop manuals + more. Like new in original boxes $2,250 + freight takes all. Bill, KV0D, 5715 Greenbriar, Yorba Linda, CA 92686, 714-777-8160.

COMPUTER PRINT-OUT of Beam Headings and Distances from your exact location to all Call Sign Prefixes worldwide including over 200 U.S. and Canadian cities. Send $11.95 to: G. Miller, K7GFL, 3715 Brittlewood Ave., Las Vegas, NV 89120. Ph 702-456-9048.

CRYSTALS: FT-243 made to order. Build something, QRP, etc. 160M $3.95, five or more $2.95. 80M $2.95, five $2.50. 40M $2.50, five $1.95. 30M $2.95, five $2.50. Sockets 60¢. Airmail 30¢ per crystal. Stamp or long SASE for Listing. Circuits, 1700 - 60,000 kilocycles. "Crystals Since 1933," W0LPS, C-W Crystals, Marshfield, MO 65706.

820S KENWOOD with MC60 Mike very nice $475. Heathkit Sixer and Twoer $35 each. Hallicrafter S-72 Portable Receiver $40. Want Atwater-Kent Bread Board. Grebe Shortwave. Deforest Crystal Set. K4UJZ, Rt 11, Murfreesboro, TN 37130, 615-893-5344.

COLLINS: RF/AMP 30L-1 with 16 new/extra tubes (811A). Collins 180S-1 Antenna Tuner 1kW w/shockmount (never used). Misc other parts. Manuals. Round emblems. WB2HED, 212-884-7064.

ROSS'$ NEW SPECIALS (March only): Robot 1200C $1199.90. ICOM IC-45A $279.90, IC-04AT $286.90, IC-490A $509.90, IC-751 $1099.90. Kenwood TS-940S/wAT $1689.90, R-1000 $334.90, TR-3500A $249.90, TM-2550A $384.90, TS-430S $688.50, TM-201A $279.90, TR-8400 $349.90, TS-180SDFC $579.90, VFO-120 $139.90, Yaesu FT-209RH & FTS-6 $294.90, FT-757GX $phone, FRG-7700 $369.90, FRG-8800 $499.90, YR-901 $399.90, FT-230R $169.90. Over 7500 ham-related items, all major lines, send Call Letters, name & phone # for personal price quote. Mention ad. Prices cash, FOB Preston. We close at 2:00 on Saturdays & Mondays. Ross Distributing Company, 78 South State, Preston, ID 83263, 208-852-0830.

TR-7 TRANSCEIVER Drake, WH7 Wattmeter, PS7 Power Supply and 7077 Microphone $750. W0AT, P.O. Box 188, Raymore, MO 64083.

TEN-TEC Omni-C with AC Supply. All filters. Beautiful condition. You ship $500. Conrad, KP4EIX, 203-271-0039 after 6 P.M. Cheshire, CT 06410.

WESTERN ELECTRIC, D168479, Mercury Relays, SPDT, pressure-sealed, 4500 Ohm coil, std Octal base, $2.50 plus $1 postage. K4DKJ, 3289 Hallwood Circle, Macon, GA 31204.

HW-100, AC and DC Supplies, good condition, $200 or best offer. W8MIF, 301-266-0061.

DRAKE MN-7, Swan 250, PS and NB, Gonset 6M Communicator. Bob Blaney, W9FRU, 127 Westlawn Dr., Decatur, IN 46733.

WANTED: FT-902DM. Write stating condition. Price N8AFX, 808 Daniel, Ann Arbor, MI 48103.

CENTURY-21 excellent condition $180. KD2MU, 516-878-1918.

EXPECTING JUNIOR OPERATOR or grandchild? Send Amateur Radio-design birth announcements. Free samples. S.A.S.E. Birth-O-Grams, Box 140398, Coral Gables, FL 33114.

IBM-PC RTTY/CW. CompRtty II is the complete RTTY/CW program for the IBM-PC and compatibles. Virtually any speed ASCII, BAUDOT, CW. Text entry via built-in screen editor! 10,000 character transmit/receive buffers! Adjustable split screen display. Instant mode/speed change. Hardcopy, diskcopy, break-in buffer, select calling, text file transfer, customizable full screen logging, 24 programmable 1000 character messages. Now with WRU (simple mailbox). Ideal for MARS and traffic handling. Requires 128k PC, XT, AT, PCjr, PC-DOS, serial port, RS-232C TU. $65. Send call letters (including MARS) with order. David A. Rice, KC2HO, 7373 Jessica Drive, North Syracuse, NY 13212.

ROSS'$ USED March Specials: Kenwood TS-520 $359.90, TS-830S $569.90, TS-180S/WDFC $389.90, AT-230 $144.90, TS-820S $449.90, TS-700SP $365.90. Yaesu FT-301D $299.90, FT-101E $399.90, FR-101S & FL-101 $399.90. ICOM IC-211 $329.90, IC-730/FL30 $469.90, IC-701 $295.90, send SASE, Call Letters, name & phone # for used list. Over 200 used, 7,500 NEW ham-related items in stock. Mention ad. Prices cash, FOB Preston. We close at 2:00 on Saturdays & Mondays. Ross Distributing Company, 78 South State, Preston, ID 83263, 208-852-0830.

QST's FREE. '40-'84 for postage, '25-'39 for trade. Will break up. Need: '14-'24, 10/25, 6/31, 6/35, 11/44, 3/51. K2GBH.

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WANTED - CRANK-UP Tower - 10 ft minimum height to 40 ft plus. K6KS, 3045 Crownview Dr., Palos Verdes, CA 90274, 213-833-9640.

SELLING ENTIRE STATION: TR7A, four filters and manual, MN75, TVI #42, CW-75, SSK-001 Nye Key, 7077 Desk Mic, Astron 35A, CDR TR-44 Rotor, HyGain #388 Triband Beam, 30 ft. Tower, $1,600 takes all. You ship. John Houser, P.O. Box 33, Casanova, VA 22017, 703-788-9529.

SELL: HEATHKIT SB-104 Transceiver w/NB, SB-604 Remote VFO, SB-604 Speaker, HP-1144 PS, HDP-121A mike, SB-614 (kit) station monitor, manuals, $385. W1CRL, 201-327-2706 after 6 PM.

HEATH VL-2280 2-meter all-mode amplifier, 75 watts output. $150 pick-up, $175 shipped. Paul Bock, K4MSG, 204 S. Harrison, Sterling, VA 22170, 703-435-2994.

FOR SALE: Yaesu FT-101E, covers 80m-10m. Includes: DC-DC Converter, 500 Hz CW Filter, Mic, SWR Meter. Asking $300 (best offer), or will trade for good 2m mobile rig. Tom, KA1JQW, 203-649-5862, eves.

QUALITY REPAIRS at very affordable prices. $25/hr. We repair: Kenwood R-600, R-1000, R-2000, TS-120, TS-130, TS-430, TS-520, TS-530, TS-820, TS-830, TS-930. Yaesu FT-101, FT-102, FT-757. ICOM IC-720, IC-730, IC-740, IC-745, IC-751. H.F. Amplifiers including Amp Supply, Ameritron, Dentron, Kenwood, Yaesu. Most any Heathkit equipment at prices less than Heath rates, including T.V. Circuit Boards and High Voltage Supplies. Other equipment includes some Satellite, Computer, and Disk-Drive Alignment. We offer 30 day warranty on parts and labor. Call for an estimate on equipment not shown. Skylab, Inc., 3306 S. 27th Street, Milwaukee, WI 53215, 414-672-6000 (24 hours).

HAMMARLUND WANTED: HQ-215 Receiver, HXL-1 Linear Amplifier. Contact G. Hawrysko, K2AWA, P.O. Box 568, Boro Hall, Jamaica, NY 11424.

SELLING: AMERITRON AL-80, never used, 10 meter kit (not installed) included, $500 plus UPS; KE4XQ, 502-765-6784.

WANTED, JUNKER FT-101 series, $50. Also TS-430 $300. Working or not. I'll pay shipping. Pete Wendt, WB8RFI, 6605 W. Holmes Ave., Greenfield, WI 53220, 414-281-9655.

FOR SALE: HAL CT2200/KB2100 RTTY Equip. Exc. cond. $600. Call John, WB4OBO, 504-837-8422.

ICOM-730 and Astron RS-20A, year old, $500. WB4HDP, 813-646-3876.

CIRCUIT BOARDS, guaranteed lowest quotes and Free twelve hour prototypes. Single and double sided boards. Small through large production quantities. Mail specifications. Hobbyists, any schematic, 6" × 9" maximum, etched on a 3" × 4" board - $1.75. (Larger boards - $2.75). Send remittance and artwork; or, print your own circuit boards. Kits of all sizes. Guaranteed lowest prices. Basic kit $3; materials for two 3" × 4" boards (included), or S.A.S.E. for catalog - T.O.R.C.C.C. Electronics, Box 47148, Chicago, IL 60647, 312-342-9171.

DX STATION Closeout: 40' foldover guyed tower, rotor, mast, elements, $250. Heathkit SB200, $265. Drake R4B, $175. Drake TR4, $265. Drake MS4, keyer, mike, earphones, Micronta 3 range tester. Ballantine 3/24 digital multimeter, Heathkit AC Power Supply, Ballantine 1010A scope, Heathkit HX10, Ballantine 5725B Counter, 2 new 572B/T160L tubes, Simpson 312 VTVM, RCA WV-76A VTVM, Ballantine DC-AC 345 VOM, RG17U transmission wire, QST's 1961-82 incomplete, numerous meters, some vintage, 100's of tubes, some rare, old tube manuals, old Vibroplex keyer, 4 tube Qualitone receiver, Hallicrafter S-36, SX-28A, speakers, more. Joyce Hughes, 5 Coddington Court, East Greenwich, RI 02818, 401-885-1254.

TRADE YOUR Excess Gear through Electronic Barter House, P.O. Box 44, Goshen, IN 46526.

RESISTORS-ANY VALUE/Quantity, ¼ watt @ $.01, ½ watt @ $.015 ($1 minimum). Quantity discounts, 1,000+. Send wattage(s), value(s), quantity(s), and remittance-T.O.R.C.C.C. Electronics, Box 47148, Chicago, IL 60647, 312-342-9171.

YAESU FT-101ZD, excellent condition. $375. N4ESD, Bill, 813-722-4004.

KENWOOD TR8400 440-450 MHz FM Transceiver, 10W, $249. Kenwood TR2500 2 mtr HT with basestand charger and extra battery, $199. Heathkit SB-102 10-80 mtr Transceiver, AM-CW-SSB, 200 W with P.S., needs work, $99. Heathkit SB-614 Station Monitor, $80. Call Jim, WB2REM, 609-771-8070.

WANTED: HW8 or 9 & TS 430S or Yaesu 757GX. Bill Getchell, W4LRD, 1216 N. Jefferson St., Arlington, VA 22205, 703-536-5994.

UHF GEAR: KLM Echo 70, updated w/all factory mods, covers 432 and 435 MHz ranges for OSCAR, 10 W output & excellent rcvr, guaranteed $200; Janel 432PL preamp (uses NE64535), 1 dB NF, guaranteed, $35. KLM 110 W linear power amp, 70 cm, 10 W drive (same as Mirage D1010N), perfect condx, guaranteed, $180. All this makes a great starter package for 432 MHz: $395 complete. WB2WIK, 24 Louis Drive, Budd Lake, NJ 07828, 201-376-2004 days.

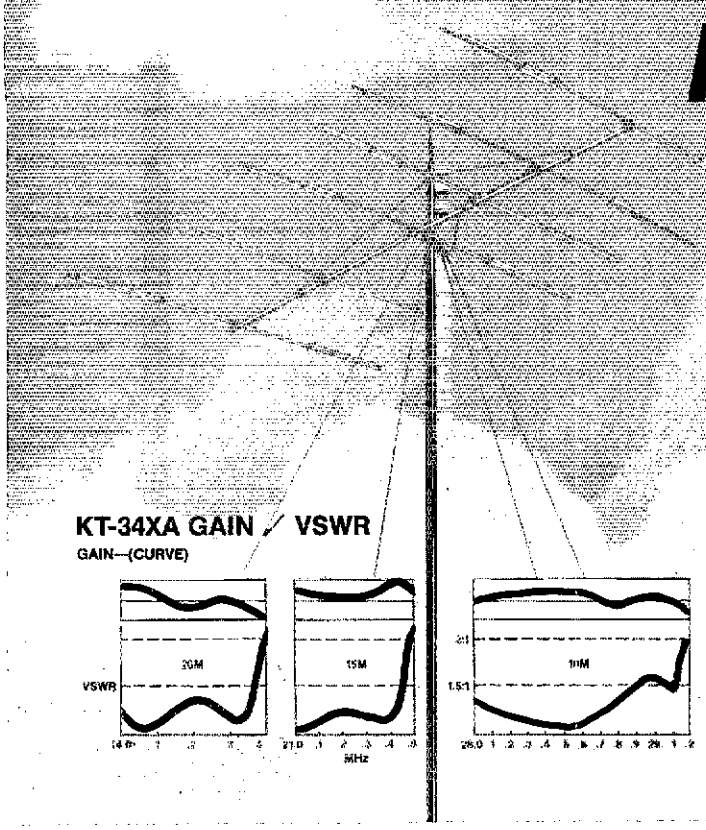
REPLACE RUSTED Antenna Bolts with Stainless Steel. Small quantities, free catalog. Elwick, Dept. 577, 230 Woods Lane, Somerdale, NJ 08083.

KENWOOD 7950, Astron RS12A, Hustler G6-144B, antenna, manual, mint, $450. W3FYW, 215-644-3285.

HEATH HW-100 Transceiver, Power Supply, Speaker, mic complete $175. Hallicrafters HA-1 Keyer with Vibroplex Vibro-Keyer $40. F.O.B. John, W6MQK, 1049 N. Hollston Ave., Pasadena, CA 91104, 818-798-9345.

KENWOOD TS-520S transceiver with CW Filter, mic, original manual and carton, in perfect cond, great Novice rig. $350. N4NDK, 8A Mannsfield Condos, Pittsboro, NC *27312, 919-929-2256, evenings.*

KT-34XA Triband Performance



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Takes you through the sunspot lull with solid QSO's and exciting DX.

The unequalled performance of the KT-34A and KT-34XA Triband Antenna Systems are the result of KLM's uncompromising approach to antenna performance and reliability.

Our unique design utilizes lossless linear loading techniques with High Q Air Capacitors for peak efficiency. Dual driven elements deliver "Monobander" gain and low VSWR to make even barefoot solid state rigs work like kilowatts.

The four element KT-34A is expandable to the latest KT-34XA using the available KT-34XA upgrade kit.

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KENWOOD: TS-530S, CW Filter $475. KDK FM-2033 $175, RS7A $35. All excellent. W2GCW, 518-828-9860.

CENTURY-21 XCVR mint condition, $185. Write to P. Laspina, 33 Gloria Ann Smith Dr., Bricktown, NJ 08723 or call 201-920-0273 WA2ERD.

HILL-TOP QTH in peaceful Central New Jersey. Cozy expanded cape, 4 bed, 2 bath, living, dining, family, kitchen, sun-room, screen-porch. Full basement, finished/bar. Attached garage. Over half acre. Easy bus or train commute NYC. Triex W-51, HyGain-204BA. John Waugh, VK1JW. Call 201-263-8167/8185.

TEST EQUIPMENT, Lab Calibrated Signal Generators, HP8640B AM/FM, 500 kHz thru 1024 MHz, options 002, 003, and 323 portable carrying case, $5,500. HP5245L Frequency Counter with HP5253B plug-in, range 0-500 MHz $375, Marconi TF 1066B/6 Signal Generator 10 MHz thru 470 MHz AM/FM $550. HP606A Signal Generator 50 kHz thru 65 MHz $375. Military TS-510A Signal Generator 10 MHz thru 420 MHz $295, military URM-25D Signal Generator 10 kHz thru 50 MHz $245, HP/Boonton 202H Signal Generator AM/FM 54 MHz thru 216 MHz $295. HP608E Signal Generator 10 MHz thru 480 MHz $495. HP616B Signal Generator 1.8 GHz thru 4.2 GHz $375. VISA, M/C, check. Satisfaction guaranteed. Phone 704-524-7519, Siep Electronics, Highway 441, Otto, NC 28763.

KENWOOD: TS-820, $335; VFO-820, $75. Ten-Tec: Argonaut (509), $160. Linear (405), $70. P/S (251), $50; CW (208) Filter, $15. AA6EE, 619-789-3674.

FOR SALE: QST, CQ, 73, HR, HRH magazines. 15¢ each plus shipping SASE for list. WA8AWU, 3069 Dumont Rd., Allegan, MI 49010.

KENWOOD: TS-520, CW Filter, MC-50 Microphone, Manuals. Like new. Ship original carton. $385. W4MGG, 919-924-0934.

WANTED: YAESU FC-707 Antenna Tuner, FL-2100Z Amplifier. K6KZT, 2255 Alexander, Los Osos, CA 93402.

FLORIDA QTH, 3 Bedrooms, 2 Bath, 24 × 24 Garage with bath, 23 × 23 workshop, pool, 160' + 70' Towers on 1.5 acre lot. Excellent location, 5 minutes from town. $118,000. KU4F, 5013 NW 43rd Street, Gainesville, FL 32606, 904-375-4545.

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COUNSELOR: OPERATOR with General license to teach Ham Radio at Pennsylvania co-ed Camp. Have completely equipped Ham Station. Write Trail's End Camp, 215 Adams Street, Brooklyn, NY 11201.

WANTED for summer of 1986: Instructors in Electronics, Ham Radio, and Computers. Small boys' science camp in Pennsylvania. Apply: Donald Wacker, P.O. Box 356, Paupack, Pennsylvania 18451.

COUNSELOR - Ham Radio; H.S. Grad., College Student, Adult. Children's camp; varied activities; professional atmosphere; 6/24/-8/22 or any part thereof. Northeastern Pennsylvania 2½ hours. NYC. Apply Camp Wayne, 570 Broadway, Lynbrook, NY 11563 516-599-4562.

CAMP COUNSELOR/RADIO INSTRUCTOR, nine summer weeks in New Hampshire. Top facilities for programs in DX, AM and Ham, long established activity, triplebeam tower, new rigs. Winter office c/o Dr. A. J. Stolz, 5 Lockwood Circle, Westport, CT 06880, 203-226-4389.

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Lindy Messmer, Advertising Assistant

203-667-2494 is a direct line, and will be answered only by Advertising Department personnel

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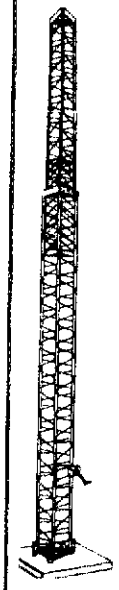

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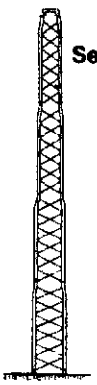
All Models Shipped Factory Direct—Freight Paid*!

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.!



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- 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.**

Tri-Ex®

These rugged crankup towers now available from Texas Towers! All models available On Sale for tremendous savings to you!

To save on freight costs, all towers are shipped directly from the Tri-Ex factory to you!

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- **Hot dip galvanized after fabrication**
- **Complete with base and rotor plate**
- **Totally self-supporting—no guys needed**

Model	Height Up	Down	Wind Load	List	Sale
W36	36.0 ft	20.5 ft	9.0 sq ft	$694	$575
WT51	51.0 ft	20.5 ft	9.0 sq ft	$1154	$899
LM354	54.0 ft	21.0 ft	16 sq ft	$2010	$1595
LM470D (Motorized)	70.0 ft	22.0 ft	16 sq ft	$4195	$3199
DX86 (Motorized)	86.0 ft	23.0 ft	25 sq ft	$7200	Call

US TOWER CORPORATION

Formerly Tristao Tower Co.

MA-40
40' tubular
Regular $745
SALE! $549

MA-550
55' tubular
Will handle 10 sq. ft. antennas at 50 MPH winds.
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IN STOCK FOR IMMEDIATE DELIVERY
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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

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	6.8
RG-58/U	52	1.4	1.9	6.0	12.5
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™ 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.

HARDLINE & HELIAX™ CONNECTORS

Cable Type	UHF F/ML	UHF MALE	N F/ML	N MALE
½" Alum	$19	$19	$19	$25
½" Heliax ™	$25	$25	$25	$25
⅞" Heliax ™	$49	$49	$49	$49

AMPHENOL CONNECTORS
Silver Pl.259 . . . $1.75
UG21B N Male . . . $2.95 UG23D N Female . . . $2.95

Antenna Wire & Accessories
Solid Copperweld 12 ga. $.12/ft 14 ga. $.10/ft
Stranded Copper 14 ga. $.10/ft. 16 ga $.09/ft
Stranded 14 ga. $.10/ft 16 ga $.09/ft
¼ mile 18 ga copper-clad steel wire . . . $30
6 inch heavy-duty end insulator . . . $2.00/ea
Dog-bone insulator . . . $.79 Coax seal . . . $2.50

Van Gorden
1:1 Balun . . . $11 Center Insulator . . . $6
Dipole Kits . . . DB0 $31/DB40 $28
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G5RV . . . $49.00

ALPHA DELTA
DX-A 160-80-40 Sloper . . . $49

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A3 3-el Tribander Beam . . . $209
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AV5 80-10mtr Vertical . . . $99
D40 40mtr Dipole . . . $149
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A50-5 5-el 6mtr Beam . . . $79
215 WB NEW 15-el 2mtr Beam . . . $75
321S 19-el 2mtr Beam . . . $89
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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
18 AVT/WB 80-10mtr Vertical
18HTS 80-10 mtr Hy-Tower Vertical
23BS 3-el 2mtr Beam
25BS 5-el 2mtr Beam
28BS 8-el 2mtr 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

Limited Quantities purchased at old prices. Call for current prices.

HUSTLER
6BTV 80-10 mtr Vert $129 5BTV 80-10 mtr Vert $109
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G6-144B 2-mtr Base $89

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400W Standard	$16	$17	$19	$22	$26
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Free Shipping On Butternut Accessories Also When Purchased With Antenna

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TA-33 3-el Tribander	$239
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Telex HAM 4 (15 sq ft rating)	$Call
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Telex HDR300 Heavy Duty (25 sq ft rating)	$Call
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Kenpro KR400 Azimuth Rotator	$129
Kenpro KR500 Heavy Duty Elevator Rotator	$159
Kenpro KR600 Azimuth Rotator	$199
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Kenpro KR5600 Heavy Duty AZ/EL Rotor Pkg.	$329

ROTOR CABLE Standard 8 cond cable $.19/ft (vinyl jacket 2-#18 & 6-#22 ga)
Heavy Duty 8 Cond cable $.36/ft (vinyl jacket 2-#16 & 6-#18 ga)

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10 ft Stack Sections

20G $39.50 45G $112.50
25G $49.50 55G $134.50

All 20G, 25G, 45G and 55G Accessories In Stock at Discount Prices - CALL!

Foldover Towers	Model	Height	Ant Load*	Price
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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.

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3/16 EHS Guywire (3990 lb rating)	$.15/ft
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6" Diam - 4 ft Long Earth Screw Anchor	$14.95
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PHILLYSTRAN GUY CABLE

HPTG2100 Guy Cable (2100 lb rating)	$.29/ft
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9902LD Cable End (for 6700 cable)	$8.95
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GALVANIZED STEEL MASTS
Heavy Duty Steel Masts 2 in OD - Galvanized Finish

Length	5 FT	10 FT	15 FT	20 FT
.12 in Wall	$29	$49	$59	$79
.18 in Wall	$39	$69	$99	$129
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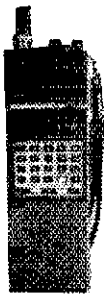

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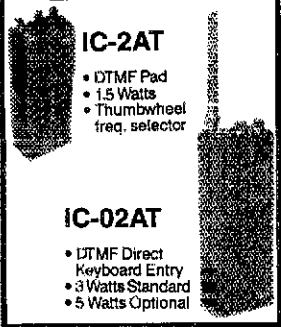

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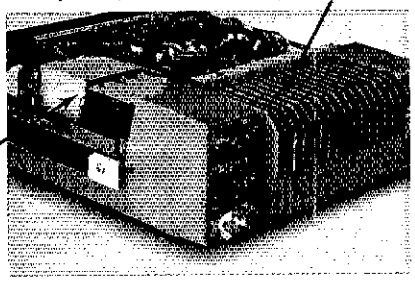

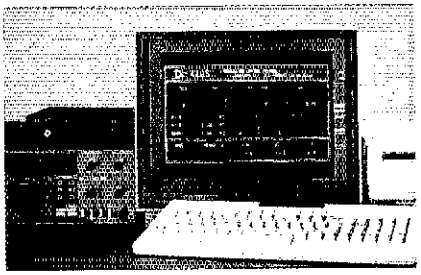

- **100 memory channels**
  Frequency and mode may be stored in 10 groups of 10 channels each. Split frequencies may be stored in 10 channels for repeater operation.
- **TU-8 CTCSS unit (optional)**
  Subtone is memorized when TU-8 is installed.
- **Superb interference reduction**
  IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and optional filters fight QRM in today's crowded bands.
- **MC-42S UP/DOWN mic. included**
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- **5 IF filter functions**
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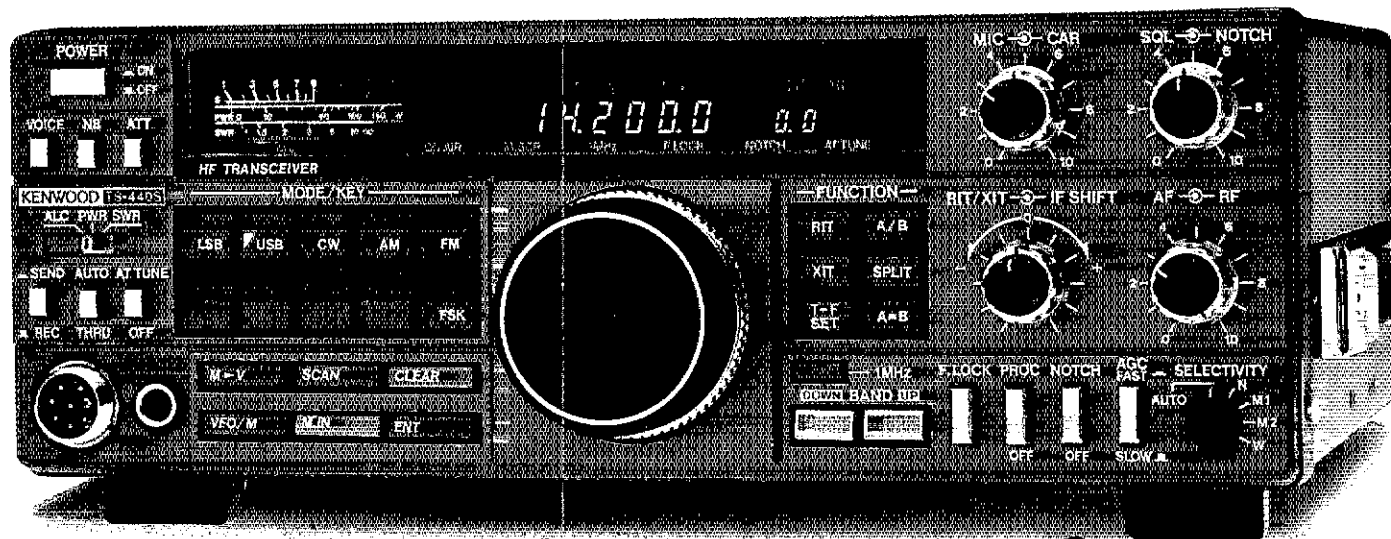
  A built-in SSB filter is standard. When an optional SSB filter (YK-88S or YK-88SN) is installed, **dual** filtering is provided.
- **Full or semi break-in CW; AMTOR compatible.**



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.

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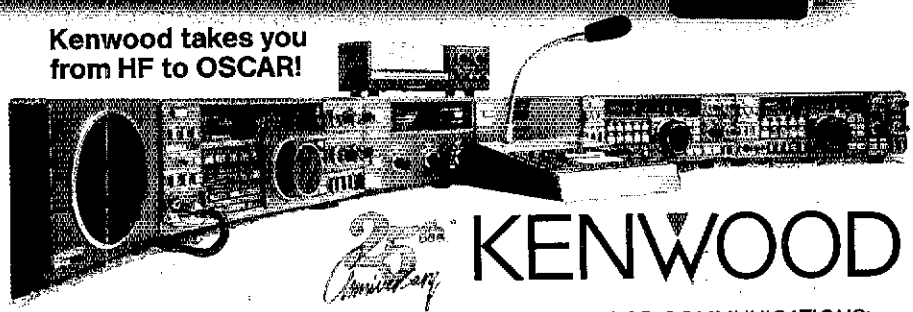

Complete service manuals are available for all Trio-Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

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