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Issue #319

73® Amateur Radio

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CAN $3.95
A WGE Publication

SPECIAL ANTENNA ISSUE

Kenwood TS-711A

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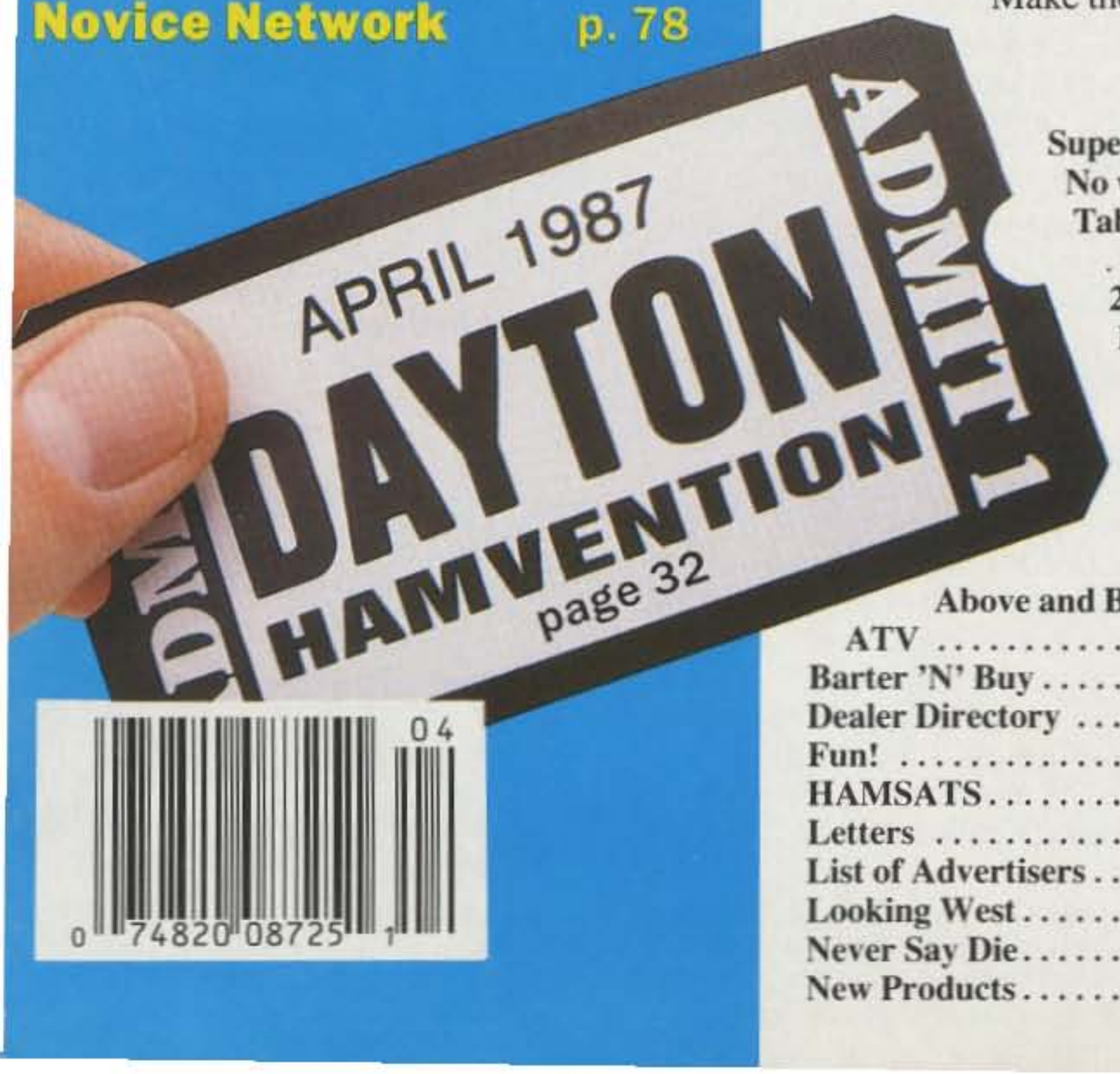

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Departments

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ICOM IC-761

A NEW ERA DAWNS

- **Built-in AC Power Supply**
- **Built-in Automatic Antenna Tuner**
- **SSB, CW, FM, AM, RTTY**
- **Direct Keyboard Entry**
- **160-10m/General Coverage Receiver**
- **Passband Tuning plus IF Shift**
- **QSK up to 60 WPM**

The IC-761 ushers in an exciting new era of amateur radio communications; an era filled with all the DX'ing, contesting, and multi-mode operating pleasures of a fresh new sunspot cycle. The innovative IC-761 includes all of today's most desired features in a single full-size cabinet. This is ham radio at its absolute best!

Work the World. The IC-761 gives you the competitive edge with standard features including a built-in AC power supply, automatic antenna tuner, 32 fully tunable memories, self-referencing SWR bridge, continuously variable RF output power to 100 watts in most modes, plus much, much more!

Superb Design, Uncompromised Quality. A 105dB dynamic range receiver features high RF sensitivity and steep skirted IF selectivity that cuts QRM like a knife. A 100% duty cycle transmitter includes a large heatsink and internal blower. The IC-761 transceiver is backed with a full one-year warranty and ICOM's dedicated customer service with four regional factory service centers. Your operating enjoyment is guaranteed!

All Bands, All Modes Included. Operates all HF bands, plus it includes general coverage reception from 100kHz to 30MHz. A top SSB, CW, FM, AM, and RTTY performer!

Passband Tuning and IF Shift plus tunable IF notch provide maximum operating flexibility on SSB, CW, and RTTY modes. Additional features include multiple front panel filter selection, RF speech processor, dual width and adjustable-level noise blanker, panel selectable low-noise RF preamp, programmable scanning, and all-mode squelch. The IC-761 is today's most advanced and elaborate transceiver!

Direct Frequency Entry Via Front Keyboard or enjoy the velvet-smooth tuning knob with its professional feel and rubberized grip.

Special CW Attractions include a built-in electronic keyer, semi or full break-in operation rated up to 60 WPM, CW narrow filters and adjustable sidetone.

Automatic Antenna Tuner covers 160-10 meters, matches 16-150 ohms and uses high speed circuits to follow rapid band shifts.

Complementing Accessories include the CI-V computer interface adapter, SM-10 graphic equalized mic, and an EX-310 voice synthesizer.

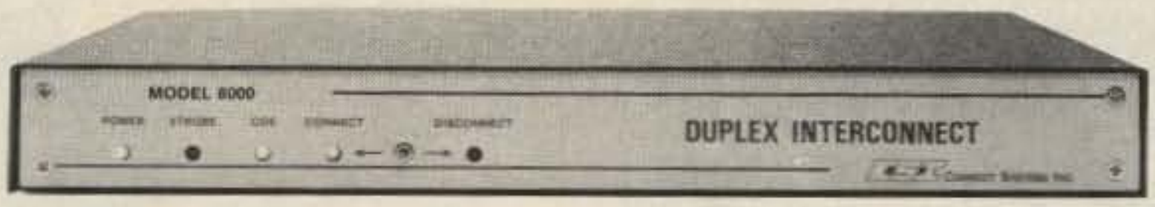
You're The Winner with the new era IC-761. See the biggest and best HF at your local ICOM dealer.

ICOM

First in Communications

ICOM America, Inc., 2380-116th Ave. N.E., Bellevue, WA 98004 **Customer Service Hotline (206) 454-7619**
3150 Premier Drive, Suite 126, Irving, TX 75063 / 1777 Phoenix Parkway, Suite 201, Atlanta, GA 30349
ICOM CANADA, A Division of ICOM America, Inc., 3071 - #5 Road, Unit 9, Richmond, B.C. V6X 2T4 Canada

MODEL 8000 DUPLEX



- Desk top or rack mounted versions
- Pulse or fully regenerated tone dialing
- Full and half duplex operation
- Half duplex privacy mode
- Internally squelched audio
- Powerful toll call protection
- Secret toll override code
- ✱ up # down or multi-digit access
- Ringout
- End to end signalling (DTMF standard)
- Auto answer on 1st, 2nd, 4th or 8th incoming ring
- Mobile to mobile signalling
- Telephone initiated control mode
- Dip switch selectable hybrid compensation capacitance.
- Programmable timout and mobile activity timers with unique beeps
- Disconnect beep
- Separate repeat level control
- Lightning protection
- Connectors for options
- 10-16VDC powered

28 dip switches make all features user programmable and selectable.

OPTIONS

8001 ANI code validator (up to 1024 access codes)
8002 1000 call two tone signalling
8003 32 call CTCSS signalling
8004 FCC registered coupler
8005 Centralized computer billing system

NOW ANYONE CAN ENJOY FULL DUPLEX!

Merely connect a CSI Model 8000 to any duplex base (such as the Yaesu FT-2700RH) and presto. . . you have an instant full duplex mobile telephone system!

Or, the 8000 can be connected to any repeater for shared use. A landline caller can selectively call any mobile on the system with (end to end) regenerated DTMF (standard), CTCSS (optional) or two tone sequential (optional). Mobiles can even selectively call **each other**!

Knowing the correct code, a caller can **take control** of the 8000 from any touch phone and **voice communicate** with mobiles that are not equipped with touch dialers.

No other duplex patch offers so much for so little.

FIRST CLASS FEATURES and PERFORMANCE . . . COACH FARE!

MAKE YOUR MOBILE TELEPHONE SYSTEM FLY WITH A PATCH FROM CSI

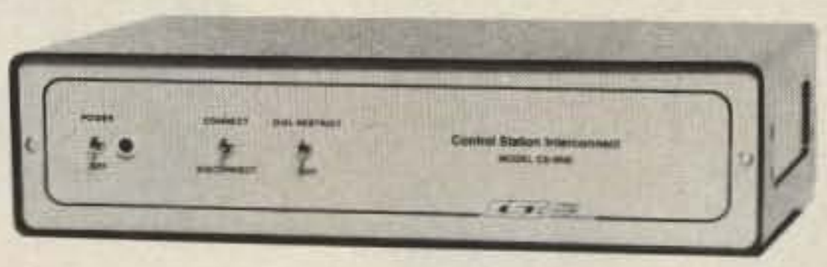
PRIVATE PATCH III

A high performance VOX based patch for simplex systems and for operation through remotely located repeaters.

Thousands of Private Patch III's are in both amateur and commercial use worldwide. Private Patch III enjoys a reputation that is second to none.

CW ID and other powerful features make Private Patch III the best deal going in Vox Simplex phone patches!

MODEL CS-9500



For exemplary simplex performance, the CS-9500 control station interconnect incorporates a full ½ second of landline to mobile electronic voice delay. Voice delay assures compatibility with the slowest CTCSS or trunked repeater systems.

Attractively styled to complement any decor.

STANDARD FEATURES (Both models)

- Three simple connections to base radio
- Simplex operation (VOX, of course)
- Digital "fast VOX"
- Toll restrict
- Secret toll disable code
- Selectable tone or pulse dialing
- Automatic busy signal disconnect
- Control interrupt timer (maintains positive control in simplex mode)
- Three digit access code (eg. ✱ 73)
- Ringout (reverse patch)
- Ringout inhibit if channel is in use
- Lightning protectors
- Spare relay position
- 110VAC supply
- And much more

OPTIONS: 12 VDC or 230 VAC power
FCC registered coupler

CONNECT SYSTEMS INC.
23731 Madison St.
Torrance CA 90505
Phone: (213) 373-6803

DEALERS

AMATEUR ELECTRONIC SUPPLY
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EGE, INC.
Woodbridge, VA

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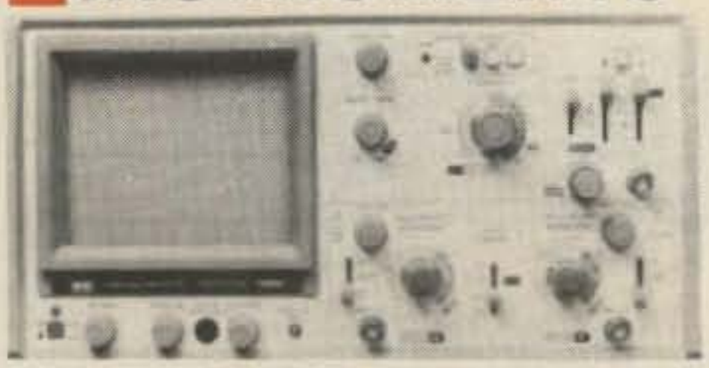
INSTRUMENTS

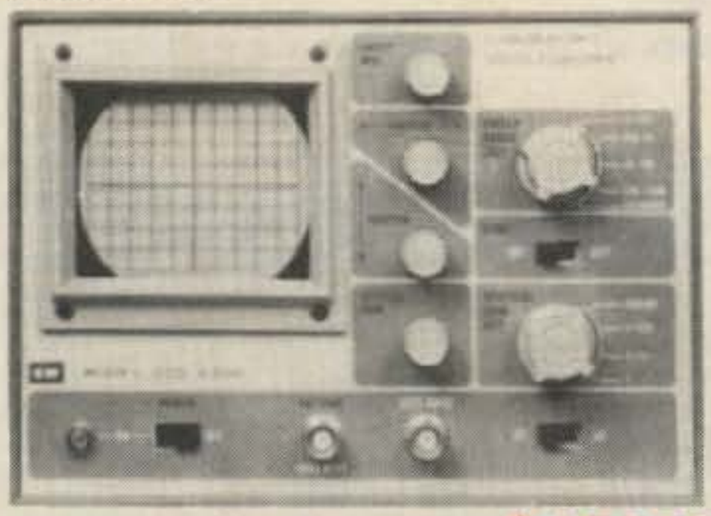


20 MHZ Dual Trace Oscilloscope $379.95

Vert. Sensitivity:5mv-20V/div standard in 12 steps **Bandwidth:**DC:DC-20MHZ; AC:10HZ-20MHZ **Rise Time:**less than 17 ns **Input Impedance:**1 Megohm,20 pF **Max Input Voltage:**600 VAC P-P **Operating Modes:** CH-A,CH-B,Add,Dual **Horiz:**0.2us/div to 0.5 s/div **Magnification:**5 X **Triggering:**auto,normal **X-Y** operation with Z input **Max Voltage:**50 VAC **CRT:**8 X 10 div (1 div = 1 cm) **Acceleration Voltage:**2 KV **Size:**295mm X 165mm X 355mm **Weight:**7 kg. Also includes 2 10:1 direct probes, instruction manual.
Part No. **3T1-200**

10 MHZ Triggering Oscilloscope $219.75

Vert. Sensitivity:5mv-5V/div standard in 4 steps **Bandwidth:** DC:DC-10MHZ;AC:10HZ-10MHZ **Input Impedance:**1 Megohm,35 pF **Max Input Voltage:**600 VAC P-P **Horiz:**0.5 ns/div to 0.5 s/div **Triggering:**auto,norm,ext. X-Y operation with Z input. **Max Voltage:**50 VAC **CRT:**8 X 10 div, 3" round **Acceleration Voltage:**2 KV **Size:**7¾" X 6¼" X 12" **Weight:**9½ lbs. Also includes 1:1 direct probe, instruction manual.
Part No. **3T1-200**



6.5 MHZ Oscilloscope $159.75

Vert. Sensitivity:10mV/div standard in 4 steps **Bandwidth:** DC:DC-6.5MHZ;AC:20HZ-6.5MHZ **Input Impedance:**1 Megohm,35 pF **Max Input Voltage:**600 VAC P-P **CRT:**8 X 10 div, 3" round **Acceleration Voltage:**2 KV **Size:**8¼" X 6½" X 12¼" **Weight:**8½ lbs. Also includes instruction manual, 1:1 direct probe.
Part No. **3T1-100**

FLUKE. Touch-Hold DMM

DCV:320mv,3.2v,32v,320v,1000V **ACV:**3.2v,32v,320v,750v **DC Current:**32mA,320mA,10A **AC Current:**32mA,320mA,10A **Resistance:**320,3.2K,32M. **DC Input Impedance:**10 Meg ohms. Also built in continuity beeper. Fuse protected. Includes test leads, instruction manual **Size:**6.55" X 2.95" X 1.12" **Weight:**10 oz.
Fluke number:77
Order Part No. **3T2-977** $139.95

DMM w/HFE Tester

DCV:200mV,2V,20V,200V,1000V **ACV:**200V,1000V **DC Current:**200uA,2mA,20mA,200mA,10A **Resistance:**2K,20K,200K,2M **AC/DC Input Impedance:**10M ohm. Diode check. Transistor hFe measurement. Includes test leads, spare fuse, instruction manual.
Size:17.5x8.5x3.6cm **Weight:**270g
Part No. **3T2-261** $39.95

TOOLS

$74.95

Controlled Output Soldering Station Weller

60 Watt soldering station capable of handling 3 temperature ranges: 600ºF, 700ºF, and 800ºF automatically. Safe for IC soldering. Furnished with 1/16" tip PTA-7 (3S6-570A)
Weller No. WTCPR
Order Part No. **3S5-570**

$48.95

Regulated Soldering Station

☐ Multiple regulated temperature soldering iron with 3/16" tip. ☐ Line voltage 110V, 50-60 HZ ☐ 48 Watts, 24 VDC, 100ºC-500ºC ☐ 5% temperature variances ☐ Low tip voltage leakage ☐ Continuous temperature adjustable ☐ 4 3/8"W x 6"D x 3"H, 4 lbs.
Part No. **3S5-300**

Portable Butane Soldering Iron

☐ Safe, no open flame ☐ Only 7 inches long, ½" Dia., 3 oz. ☐ Adjustable, with 10-60 W power ☐ No cords or batteries ☐ Averages 60 minutes on one refill ☐ Heats and cools in seconds
Part No. **3S5-700**

$29.95

$89.95

23 Pc. Tool Kit w/Digital DMM

Includes: ☐ 1 Digital DMM Meter ☐ Tool Case. 14 3/8 x 10 x 2 3/4" ☐ 1 Pocket Screwdriver ☐ 1 Pocket Phillips Screwdriver ☐ Jewelers Screwdriver Kit ☐ 5 Miniature Nut Drivers ☐ 4" Tweezers ☐ 1 roll Electrical Tape ☐ 1 Precision Oiler ☐ 1 Long Nose Pliers ☐ 6" Slip Joint Pliers ☐ 5" Parts Picker Upper ☐ 3 Phillips Screwdrivers
Part No. **3F6-206**
REG. PRICE $109.44

SUPPLIES

Cleanse Action®

Part No. **3A1-100** 24 oz. $3.95 1-11 $3.75 12-UP

Lube-on Action®

Part No. **3A2-100** 16 oz. $3.25 1-11 $2.90 12-UP

Compressed Air Action®

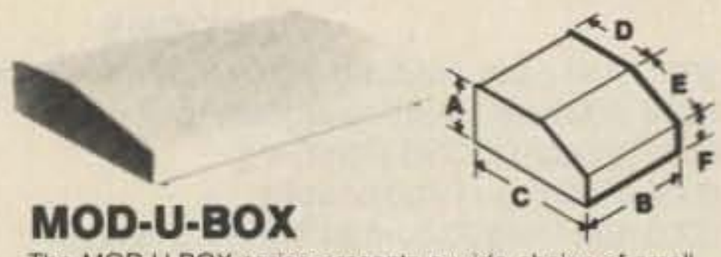
Part No. **3A6-100** 10 oz. $2.95 1-11 $2.70 12-UP

Flux Remover Action®

Part No. **3A1-200** 16 oz. $3.75 1-11 $3.25 12-UP

Freez Action®

Part No. **3C1-100** 15 oz. $3.35 1-11 $2.85 12-UP



MOD-U-BOX

The MOD-U-BOX series presents a wide choice of small electronic cabinets. Distinctively styled. MOD-U-BOX offers rugged high quality construction at an exceptionally low price. Made from aluminum. Simple two piece design. Oven-baked finish. BLUE and OFF-WHITE cabinets in stock for immediate delivery. Modifications: In-plant modifications made to your specifications include silkscreening, venting, cut-outs, etc.

OUTSIDE DIMENSIONS, INCHES

CEI No.	A	B	C	D	E	F	PRICE
2G3-4610	3 12/16	5 13/16	9 13/16	NA	NA	NA	$17.15
2G3-346	2 3/8	4 1/4	6 13/16	NA	6 3/8	1 1/4	$12.69
2G3-376	3 1/8	6 3/4	5 3/8	NA	5 9/16	1 5/8	$14.55
2G3-41010	3 1/2	10	10	8	3 3/16	1 1/16	$27.10
2G3-41211	3 13/16	11 13/16	10 13/16	9 3/4	3 15/16	NA	$28.85
2G3-566	4 13/16	5 13/16	5 13/16	4 1/2	4 15/16	NA	$15.00
2G3-255	1 13/16	4 13/16	4 13/16	2 1/8	2 15/16	1 1/16	$13.20
2G3-276	2 5/16	6 1/2	5 13/16	2 15/16	3 1/4	3/8	$13.85
2G3-31011	2 13/16	9 13/16	10 13/16	5	5 15/16	1 1/2	$26.80
2G3-31311	2 13/16	12 13/16	10 13/16	5	5 15/16	1 1/2	$26.65
2G3-51010	4 13/16	9 13/16	9 13/16	1 15/16	8 7/16	1 3/4	$27.60
2G3-61210	5 3/4	11 13/16	9 15/16	3	7 1/3	2 13/16	$33.25

CTS ENCLOSURES

A complete and compatible family of value engineered cabinets and vertical rack enclosures which meet the highest standards of quality, versatility and ease of use are also available at a surprisingly modest price.

☐ **See Us At The '87 Hamvention In Dayton**
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270

CONSOLIDATED ELECTRONICS

705 Watervliet Ave., Dayton, Ohio 45420-2599 (513) 252-5662 Telex 288-229 Fax No. 513-252-4066

New MFJ-1274 lets you work VHF and HF packet with built-in tuning indicator for $169.95 . . .

. . . you get MFJ's latest clone of TAPR's TNC-2, TAPR's VHF/HF modem and built-in tuning indicator that features 20 LEDs for easy precise tuning

MFJ-1274
$169.95

MFJ-1270
$139.95

Now you can join the exciting world of packet radio on both VHF and HF bands with a precision tuning indicator . . . for an incredible $169.95!

You get MFJ's top quality clone of the highly acclaimed industry standard TAPR TNC-2. We've made TAPR's modem selectable for both VHF and HF operation, added their precision 20 segment LED tuning indicator, a TTL serial port, an easily replaceable lithium battery for memory back-up and put it all in a new cabinet.

If you don't need the tuning indicator or the convenience of a switchable VHF/HF modem, choose the affordable MFJ-1270 for $139.95.

All you need to operate packet radio is a MFJ-1274 or MFJ-1270, your rig, and any home computer with a RS-232 serial port and terminal program.

If you have a Commodore 64, 128, or VIC 20 you can use MFJ's optional Starter Pack to get on the air immediately. The Starter Pack includes interfacing cable, terminal software on disk or tape and complete instructions . . .everything you need to get on packet radio. Order MFJ-1282 (disk) or MFJ-1283 (tape), $19.95.

Unlike machine specific TNCs you never have to worry about your MFJ-1274 or MFJ-1270 becoming obsolete because you change computers or because packet radio standards change. You can use any computer with an RS-232 serial port with an apropriate terminal program. If packet radio standards change, software updates will be made available as TAPR releases them.

Also speeds in excess of 56K bauds are possible with a suitable external modem! Try that with a machine specific TNC or one without hardware HDLC as higher speeds come into widespread use.

You can also use the MFJ-1274 or MFJ-1270 as an excellent but inexpensive digipeater to link other packet stations.

Both feature AX.25 Level 2 Version 2 software, hardware HDLC for full duplex, true Data Carrier Detect for HF, multiple connects, 256K EPROM, 16K RAM (expandable to 32K with optional EPROM), simple operation, socketed ICs plus much more.

You get an easy-to-read manual, a cable to connect your transceiver (you have to add a connector for your particular radio), a connector for the TTL serial port and a power supply for 110 VAC operation (you can use 12 VDC for portable, remote or mobile operation).

Help make history! Join the packet radio revolution now and help spread this exciting network throughout the world. Order the top quality and affordable MFJ-1274 or MFJ-1270 today.

MFJ-1273, $49.95

Now you can tune in HF, OSCAR and other non-FM packet stations fast! This MFJ clone of the TAPR tuning indicator makes tuning natural and easy - - it shows you which direction to tune. All you have to do is to center a single LED and you're precisely tuned in to within 10 Hz. 20 LEDs give high resolution and wide frequency coverage.

The MFJ-1273 tuning indicator plugs into the MFJ-1270 and all TNC-1s, TNC-2s and clones that have the TAPR tuning indicator connector.

↙24

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 • Add $5.00 each shipping/handling • Call or write for free catalog, over 100 products.

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NEVER SAY DIE

BEWARE!

Readers have been concerned over a rather clever new business (scam?). Letters have been going out to hams who haven't renewed their tickets offering to renew them for a measly $35.

The letters are from Federal Licensing, J.V., Amateur Radio Service Division—and Lordy, they're from Gettysburg—with an alternate address in McLean, Virginia, the home of the CIA! Here's my $35, fellas.

Of course, the alternative is to be a cheapskate and spend 22¢ to do the same thing, but without the professional help of FLJV/ARSD. Have you ever heard anyone even suggest that hams are cheapskates? Well...yes...come to think of it, I've heard that calumny a whole lot.

After I got through chuckling at the audacity of the approach, I remembered a lovely old scam. There was this clipping service that sent out letters to hams informing them that their name had recently appeared in a national radio publication. Now, for only $5 (or some such), this outfit would send you a copy of the clipping. Wow! They must have mentioned me in a ham magazine! $5 later you'd get a snip from the *Callbook* with your name and address. Now I call that creative sales! And a lot easier than going to some silly remote island and shaking down Honor Rollers for a hundred bucks a head for a new DXCC country.

Let's see, I wonder how much an "office" in Gettysburg would cost? All I'd need would be a simple mail drop—then I could open the Federal Communications Licensing Authority—charge a discount $25 for renewing licenses—and use the money to finance an episode on *Lifestyles of the Rich and Famous*.

There being no intelligence test given as part of the amateur radio exam, I'll bet I'd clean up. Say, I'll bet most CBers don't know there aren't any CB licenses any more...another even more promising vein to mine. I could start issuing operating permits from my Federal Communications Licensing Authority—complete with the sale of special callsigns. For $25 extra, I'd authorize the use of cartop flashing lights and an emergency communications decal for the car door.

Small business is the life blood of America—right? So let's be creative in thinking up new small businesses. Now, I wonder if I can get Federal Licensing, J.V. to advertise their marvelous service in *73*?

Metro Washington, D.C.
P.O. Box 776
McLean, VA 22101

FEDERAL LICENSING, J.V.
AMATEUR RADIO SERVICE DIVISION

Gettysburg, PA
P.O. Box 610
Gettysburg, PA 17325

Dear Licensee;

Our review of FCC records has revealed that the radio station authorization – LICENSE – which you were granted within the AMATEUR RADIO SERVICE has EXPIRED. As you are aware, it is a violation of FCC Rules to operate a radio system without proper authorization.

If you wish to renew your license, we can assist you in the preparation and filing of the documentation required to obtain a current license. To facilitate this, simply follow exactly the steps below:

1. Review and correct if necessary the information contained on the address label below.

2. Print the name and telephone number of the person to contact where indicated.

3. Attach completed form to your service and preparation fee payment of $35.00. Please make your check payable to Federal Licensing, J.V.

4. Mail all items noted in "3" using the envelope provided.

Expired licensees presently have a grace period of 2 years to renew and retain their call sign. If the license expires for a period of 5 years, the applicant is then required to re-test. All new amateur licenses are now granted for a period of 10 years.

Federal Licensing is the only licensing organization located adjacent to the FCC Amateur Branch in Gettysburg, PA. Additional assistance regarding your licensing needs is always available by calling us at (717) 334-9262 between 9:00 AM and 4:00 PM.

Sincerely,

John A. Hertrick
Federal Licensing

If you receive a letter like this from "Federal Licensing, J.V.," pitch it. You can save $34.78 by ignoring the letter and renewing your license yourself.

OUR 50-YEAR-OLD TRAFFIC SYSTEM

A message sent via the ARRL National Traffic System arrived this morning. It had to do with a coming visit from a Kansas ham. Well, that was nice—except the message was delivered three days short of a month after it was sent and the chap had visited a couple weeks ago.

How about it, you fanatic ARRL members, is constructive criticism uncalled for—out of line—blasphemy? Am I a candidate for the lunatic fringe if I even suggest that we're close to the 90s—and not the 1890s—that perhaps it's getting time to get the delivery time down to two weeks on messages? One would think that our advances in technology should somehow be usable to get traffic through within seconds anywhere

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QRM

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KENWOOD

...pacesetter in Amateur radio

YES! 220 MHz

220: Kenwood Style!

TM-3530A

The first comprehensive 220 MHz FM transceiver

TM-3530A—25 watts of 220 MHz FM—Kenwood style! Features include built-in 7-digit telephone number memory, auto dialer, direct frequency entry and big LCD. All this makes the TM-3530A the most sophisticated rig on 220 MHz!

- **First** mobile transceiver with telephone number memory and auto-dialer (up to 15 seven-digit telephone numbers)
- Frequency range 220-225 MHz
- Automatic repeater offset selection—**a Kenwood exclusive!**
- Direct keyboard entry of frequency
- 23-channel memory for offset, frequency and sub-tone
- Big multi-color LCD and back-lit controls for excellent visibility
- Optional front panel programmable 38-tone CTCSS encoder **includes 97.4 Hz**
- Frequency lock switch
- Digital Channel Link (DCL) option
- High performance GaAs FET front end receiver

- 16-key DTMF pad, with audible monitor
- Center-stop tuning—**another Kenwood exclusive!**
- **New** 5-way adjustable mounting system
- **Unique** offset microphone connector—relieves stress on microphone cord
- HI/LOW power switch (adjustable LOW power)

TH-31BT/31A

Kenwood's advanced technology brings you a new standard in pocket/handheld transceivers!

- 1 watt high, 150 mW low
- Super compact and lightweight (about 8 oz. with PB-21!)
- Frequency range 220-224.995 MHz in 5-kHz steps
- BT Series has built-in tone
- Repeater offset:—1.6 MHz, reverse, simplex
- **Supplied accessories:** rubber flex antenna, earphone, wall charger, 180 mAH NiCd battery and wrist strap
- Quick change, locking battery case

TH-31BT/31A 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 with belt hook
- **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-9A** StubbyDuk antenna
- **BH-3** belt hook

TH-31BT with DTMF pad shown. Optional RA-9A attached.

TM-3530A optional accessories:

- **TU-7** 38-tone CTCSS encoder
- **MU-1** DCL modem unit
- **VS-1** voice synthesizer
- **PG-2N** extra DC cable
- **PG-3B** DC line noise filter
- **MB-10** extra mobile bracket
- **CD-10** call sign display
- **PS-430** DC power supply
- **MC-60A/MC-80/MC-85** desk mics.
- **MC-48B** extra DTMF mic. with UP/DOWN switch
- **MC-43S** UP/DOWN mic.
- **MC-55** (8 pin) mobile mic. with time-out timer
- **SP-40** compact mobile speaker
- **SP-50B** mobile speaker
- **SW-200B** SWR/power meter
- **SW-100B** compact SWR/power meter

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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ALL NEW FM mobile!

Here's One for You!

TM-221A/421A

2 m and 70 cm FM compact mobile transceivers

The all-new TM-221A and TM-421A FM transceivers represent the "New Generation" in Amateur radio equipment. The superior Kenwood GaAs FET front end receiver; reliable and clean RF amplifier circuits, and new features all add up to an outstanding value for mobile FM stations! The optional RC-10 handset/control unit is an exciting new accessory that will increase your mobile operating enjoyment!

- **TM-221A provides 45 W. TM-421A is the first 35 W 70 cm mobile!** Both models have adjustable 5 W low power.
- **Selectable frequency steps** for quick and easy QSY.
- **TM-221A receives from 138-173.995 MHz. This includes the weather channels!** Transmit range is 144-148 MHz. Modifiable for MARS and CAP operation. (MARS or CAP permit required.)
- **The TM-421A covers 438-449.995 MHz.** *(Specifications guaranteed for Amateur band use only.)*
- **Built-in front panel selection of 38 CTCSS tones.** TSU-5 programmable decoder optional.
- **Simplified front panel controls** – makes operating a snap!
- **16 key DTMF hand mic., mic. hook, mounting bracket, and DC power cable included.**
- **Packet radio compatible!**
- **Kenwood non-volatile operating system.** All functions remain intact even when lithium battery back-up fails. (Lithium cell memory back-up—est. life 5 yrs.)
- **14 full-function memory** channels store frequency, repeater offset, sub-tone frequencies, and repeater reverse information. **Repeater offset on 2 m is automatically selected.** There are **two channels** for "odd split" operation.
- **Programmable band scanning.**
- **Memory scan with memory channel lock-out.**
- **Super compact:** approx. 1-1/2"Hx5-1/2"Wx7"D.
- **New amber LCD display.**
- **Microphone test function on low power.**
- **High quality, top-mounted speaker.**
- **Rugged die-cast chassis and heat sink.**

RC-10 Remote Controller

Optional telephone-style handset remote controller RC-10 is specially designed for mobile convenience and safety. All front panel controls (except DC power and RF output selection) are controllable from the RC-10. One RC-10 can be attached to **either or both** TM-221A and TM-421A with the optional PG-4G cable. When both transceivers are connected to the RC-10, **cross band, full duplex repeater** operation is possible. (A control operator is needed for repeater operation.)

Optional Accessories:

• **RC-10** Multi-function handset remote controller • **PG-4G** Extra control cable, allows TM-221A/TM-421A full duplex operation • **PS-50/PS-430** DC power supplies • **TSU-5** Programmable CTCSS decoder • **SW-100A** Compact SWR/power/volt meter (1.8-150 MHz) • **SW-100B** Compact SWR/power/volt meter (140-450 MHz) • **SW-200A** SWR/power meter (1.8-150 MHz) • **SW-200B** SWR/power meter (140-450 MHz) • **SWT-1** Compact 2 m antenna tuner (200 W PEP) • **SWT-2** Compact 70 cm antenna tuner (200 W PEP) • **SP-40** Compact mobile speaker • **SP-50B** Mobile speaker • **PG-2N** Extra DC cable • **PG-3B** DC line noise filter • **MC-60A, MC-80, MC-85** Base station mics. • **MC-55** (8-pin) Mobile mic. with gooseneck and time-out timer • **MA-4000** Dual band antenna with duplexer (mount not supplied) • **MB-201** Extra mobile mount

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

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QRX . . .

EDITED BY PERRY DONHAM KW1O

Novice Enhancement Is Here!

AFTER NEARLY A YEAR of anticipation, the Federal Communications Commission has announced the approval of PR Docket 86-161, ushering in a system of new and exciting privileges for Novice operators. Effective March 21, 1987, at 0001 UTC, Novices will be able to use all amateur modes on three bands in the HF, VHF, and UHF ranges. (Note that, although we are talking specifically about Novices here, due to the structure of the present license system, Technician-class operators also gain the new privileges.)

On 10 meters, Novices can operate CW and digital modes from 28.1–28.3 MHz, and CW and SSB from 28.3–28.5 MHz. Novices and Technicians are limited to 200 Watts output in this subband; all other licenses may use the full legal limit.

On 1.25 meters, all modes may be used from 222.10–223.91 MHz, with a power output not greater than 25 Watts.

On 0.23 meters, the subband runs from 1270–1295 MHz, with a power restriction of 5 Watts.

In every case, Novice stations may not be set up as a repeater or auxiliary station, and a Novice cannot be the trustee of a repeater, even if the repeater's input and output frequencies fall within a Novice subband. I'm certain that this does not imply that digipeating is forbidden when using packet.

The commission specifically prohibits the use of AM by Novices in the new 10-meter subband.

The test for the Novice license will be expanded by adding 10 questions (for a total of 30) covering the new privileges. It's clearly understood, though, that the test should be no more difficult than the current Novice test. Another change requires two examiners to administer the test; the Novice testing program will *not*, however, be run under the present Volunteer Examiner system.

The present examination for Technician and General class is being split into two pieces. Each piece will deal more exclusively with the privileges that come with the license being tested for. That way, a Novice going for Technician will not have to deal with modes and techniques that apply only to General-class operation.

The complete text of the FCC's Report and Order is on page 48.

The Wisdom of Solomon

THE GOVERNMENT GIVETH and the government taketh away. it looks as if a pyrrhic victory of sorts has been achieved with the adoption of PR Docket 86-161, giving Novices 220 voice privileges for the first time! For on February 12, the FCC released **General Docket 87-14**, a Notice of Proposed Rule Making that would delete 220–222 MHz from the amateur service and reallocate it to land mobile services on an exclusive basis. 222–225 MHz would now become an exclusive amateur allocation if this NPRM became law.

It would appear that the FCC has finally tired of the long dispute over 220 and has tried to appease both sides by cutting the "baby" in half! While firm action on their part to give exclusive status to an amateur allocation on 220 is admirable, the plain truth is that a substantial number of weak-signal enthusiasts, EME operators, simplex links, and packet stations will, in effect, be forced off the air. Why? For the simple reason that the frequency segment from 222–225 MHz is already filled with repeaters and simplex operations in many parts of the country.

It wouldn't be fair or reasonable to ask those stations to vacate enough of the remaining 220-MHz allocation to make up for this displacement. Not only that, it would be very difficult, if not impossible, to consider such a redesign of subbands, especially in areas such as New York City, Chicago, and Los Angeles! There is no doubt that we all stand to lose from this proposal. The 220-MHz band is fast becoming an alternative to the congestion on 2 meters, and its unique characteristics make it well suited for such specialized modes as packet and moonbounce.

Every active ham has a stake in this NPRM —from manufacturers of 220 equipment to casual operators who rarely venture beyond the HF bands. Remember—once it's gone, it's gone for good. In the past few years, we've lost a good deal of our amateur satellite allocations through WARC, a large chunk of the 13-cm band, and from 1215 to 1240 MHz to non-amateur interests. . . largely because we weren't using those allocations and didn't present a unified front of opposition. But the technology to operate on 220 is as close as your wallet—literally speaking. FM transceivers and hand-helds abound, linear transverters can be easily had, and at least one manufacturer has spent a great deal of time developing what would be the first 220-MHz multimode transceiver on the U.S. market.

It is imperative that you write to the FCC and state your feelings about this docket. At the very least, the issue is too complex to wrap up in the short time period allocated (initial comments due April 6, reply comments due April 21). Consideration must be given to those operators and modes that will be left out in the cold by this juggling of frequencies. A strong voice now to save 220 might just save 70 cm and higher frequencies from a similar fate. Put your thoughts on paper. Be concise and avoid unnecessary diatribes. Make 12 copies of your comments and mail them to: Federal Communications Commission, 1919 M Street NW, Washington DC 20554. Make sure you clearly state the docket number (87-14) at the top of each copy. Most importantly: Do it today!—KT2B.

This is Andy Broome KB4VRU from Chattanooga, Tennessee. Andy is 9 years old and recently got his license from classes held by the John Ross ARC. Look for Andy on 40 meters, but do it fast because he's trying to upgrade so he can get on packet.

Mega-Winner

THE BIG WINNER of ***73*'s Megaband Sweepstakes** is **Stanley P. Hill N9FXU** of Oak Park, Illinois. By the time you read this he'll be firing up his grand prize: Yaesu's FT-767GX all-band, all-mode transceiver. Stan picked up the winning entry in a newsstand copy of *73* at Spectronics in Oak Park. He has been a ham for a year and is currently a Technician class. Stan became a ham so he could use a two-meter rig at work—he's a truck driver for Yellow Freight Systems. Plans for license and equipment upgrades were already in the works *before* he got the good news, but the incentive to upgrade has just gone through the roof. *73* extends our congratulations to the lucky winner and our thanks to Yaesu USA for making the Megaband Sweepstakes possible.

Call Again

THE FCC has decided to make a move on the callsign assignment system. PRB-3, released recently by the commission, states that the FCC would like to hand special call assignments over to a private organization. This way, hams could request any call that they like (remember the good old days when you could do that sort of thing?). The FCC would still issue an official license with a 2-by-3 call from the NA–NZ block, and the special call coordinator would keep a data base with a cross-index available to the commission for monitoring purposes. Written comments on PRB-3 are due to the FCC by April 23, 1987.

School Support

THE RESPONSE OF READERS to Wayne's call for people to give a special $15 subscription to *73* to the school of their choice has been heartwarming. If you missed it the first time around, the offer is still open. If you want to help the hobby grow but don't have the time to start a Novice class, please give this offer some thought. The following is a representative sample of the many generous folks who've helped contribute to the future of their hobby: George R. Susterick, Larry D. Shaunce WDØAKX, Mid-Michigan ARC, Kenneth Cody KA1BRB, Ozark ARS, James D. Garls W9SKO, William E. Newkirk WB9IVR/4, Stanley M. Grady WB4ZTF, Frank E. Kavenik WA9QJR, Robert P. Felton K7WLX, Matt Kolb NM9H, Bob May K4SE, and D. Bruce Caster WD4CSE. If you'd like to participate, send $15 and the complete address of the school to *73* Magazine, Circulation Department, WGE Center, Peterborough NH 03458, Attn: School Sub.

Hams On Wheels

WE RECENTLY received a request from Steven Rich WA1DFL, the Director of Handicapped Affairs for the town of Revere, Massachusetts, asking us to include wheelchair accessibility in our reporting of ham events. Steven writes: "Amateur radio has always had a strong tradition of brotherhood and sisterhood regardless of physical ability. In keeping with this tradition, I would respectfully request that clubs when advertising classes, exams, meetings, flea markets, and hamfests let it be known if the event is wheelchair accessible." The vast majority of Special Event listings that we receive do NOT mention wheelchair accessibility. How 'bout it, publicity chairmen?

Feedback

YOU MAY HAVE NOTICED that the Feedback card is missing from this issue. We've got mountains of them still to process. Feedback will return on an occasional basis. Thanks to all who participated.

KENWOOD

...pacesetter in Amateur radio

NEW! Computer Interface!

"DX-cellence!"

TS-940S

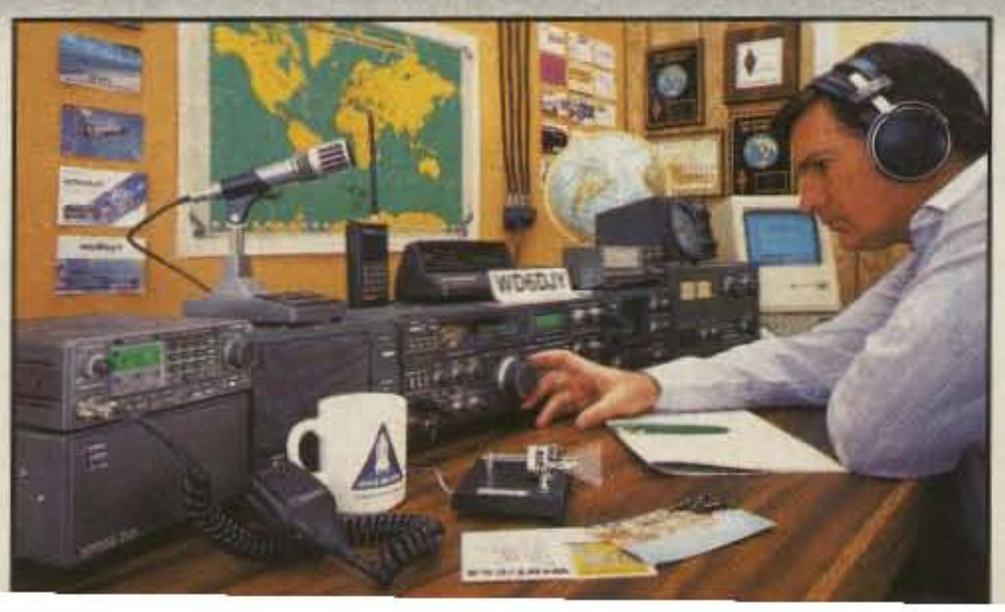
The new TS-940S is a serious radio for the serious operator. Superb interference reduction circuits and high dynamic range receiver combine with superior transmitter design to give you no-nonsense, no compromise performance that gets your signals through! The exclusive multi-function LCD sub display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

Interface IF-232C/IF-10B

Optional accessories:

• AT-940 full range (160-10m) automatic antenna tuner • SP-940 external speaker with audio filtering • YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filters; YK-88A-1 (6 kHz) AM filter • VS-1 voice synthesizer • SO-1 temperature compensated crystal oscillator • MC-43S UP/DOWN hand mic. • MC-60A, MC-80, MC-85 deluxe base station mics. • PC-1A phone patch • TL- 922A linear amplifier • SM-220 station monitor • BS-8 pan display • SW-200A and SW-2000 SWR and power meters.



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

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Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.
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NEVER SAY DIE

from page 4

in the country—minutes around the world.

I'm sure there is still a need for a message handling system that takes a month to deliver the messages. Let's see now, what would we use that for? What a wonderful system to have in place for use in times of emergency, right? And that's supposed to be one of the reasons for the National Traffic System, I believe. Yes, I'm being sarcastic.

When I got involved with RTTY back in 1948, I was impressed by the speed and accuracy of digital communications. We had to build our own converters at first, but as commercial equipment came on the market I expected the traffic handlers to go for it. In 1950 we had a RTTY repeater and network set up so any RTTY op in the Greater New York area could leave a message at an unattended station—complete with an acknowledgement of receipt. It seemed like an ideal system for emergencies and traffic handling.

So here we are, almost 40 years later, and we're still banging out messages with hand keys and taking near a month to get 'em halfway across the country—from Kansas to New Hampshire. Wow! Is it any wonder we have a shortage of youngsters interested in "enjoying" our hobby? Oh, we've made a little progress. Vfo's replaced crystals in the 40s. Sideband replaced AM in the 60s. Repeaters replaced simplex in the 70s. Nothing has yet replaced the dull QSO, the traffic handling, or the DX pileups of the 30s.

One thing modern business has recently relearned from the past—the customer is right. If you've read the business success and the excellence books, you know the most successful businesses are those that provide the products and services their customers want. They keep asking what's wanted—and provide it. Amateur radio has been particularly resistant to this philosophy, with the same results we've seen in business—imminent bankruptcy.

Even the most insular of amateurs is aware by now that all is not well with amateur radio. I'm not the only one pointing to our lack of growth—our geriatric membership—our lack of technical progress in the last twenty years. Indeed, you don't hear anything else these days—even from the ARRL.

Perhaps it's time to look at amateur radio as if it were a business—a nonprofit business, but still a business. Thus, if we're going to keep our business going we're going to need new customers to replace those who lose interest or die—or both. If we're not holding the interest of customers—and not attracting new customers in adequate numbers to stay in business, it's time to ask the customers and potential customers what they want that we're not providing.

One has to be deaf not to hear the chorus asking us, "Why Morse code?" Yes, there sure are a lot of deaf hams—at least as far as this emotional subject is concerned. They don't want to even hear about it—and there's no way you can get them to actually think about it.

The closest thing we have in amateur radio to a corporate organization is our only national society, the ARRL. This puts the onus on the League to provide us with guidance and leadership. The League got to be the one and only by killing off every upstart group that threatened their power. With that power is responsibility—and one of the major responsibilities of any corporation is to make sure the firm survives.

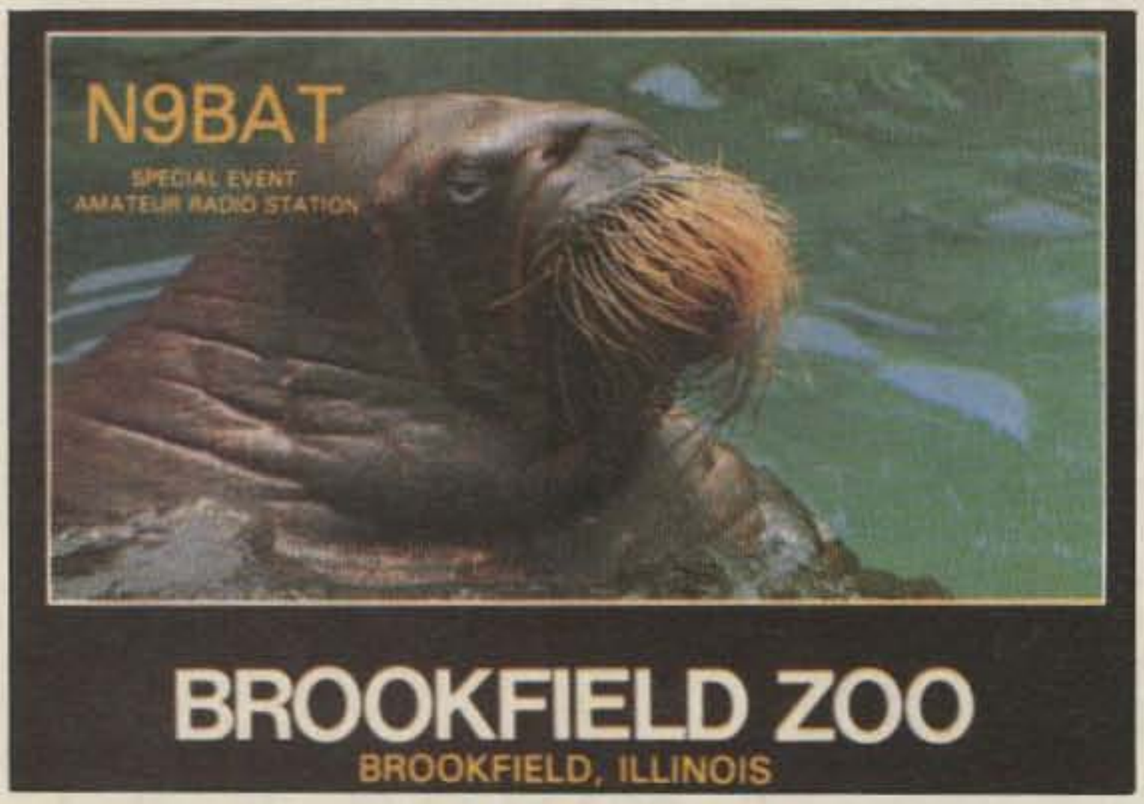
Corporate executives who turn a blind eye and ear to the firm's prospective customers would normally be ousted by the board of directors. In turn, directors who ignore the needs of customers, even over the advice of their executives, would quickly be replaced by the shareholders.

In the amateur radio hobby, the corporation is the ARRL, the executives are the HQ gang, and the directors are those you elect every two years in your division. You, as an ARRL member, are the shareholders.

I've talked with most of the HQ gang and I think they're by far the best bunch I've seen at HQ in 50 years. I wish I could say the same about the directors. Alas! Darn, there I go again, attacking the League. Or am I? From my viewpoint I see a serious problem—and I have what looks to me like a simple proposed solution—one with which I think you'll agree, if you're able to think about it.

Let's go back to the analogy of our hobby and a business. If we want to keep it going, we have to provide services which in some way pay for our license to use public property: our frequencies. We've let our customer base grow old and feeble and have resisted attracting new customers. Am I being unfair to suggest there's an element of responsibility for the League to solve this problem?

The League is an $8 million a year business these days. That's about the same order of magnitude as my *Digital Audio* magazine, so I have a fair grasp of what it takes to run that size business. Businesses of any size have boards of directors (like the



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

Editorial Offices
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Peterborough, NH 03458-1194
603-525-4201

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DAYTON **Hamvention**®

April 24, 25, 26, 1987

Early Reservation Information

• General Chairman, Jim Simpson, WB8QZZ

• Asst. General Chairman, Bill McNabb, WD8SAY

Grand banquet tickets are limited, please place your reservations early.

- **Giant 3 day flea market • Exhibits**
- **Door prizes • License exams**
- **CW proficiency test**

Flea Market Tickets

We increased Flea Market area by nearly 400 spaces this year and all were sold out by January 10.

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.

License Exam

Novice thru extra exams scheduled Saturday & Sunday by appointment only. Send current FCC form 610, copy of present license and check for $4.35 (payable to ARRL/VEC) to: Exam Registration, 8830 Windbluff Point, Dayton Oh 45459

Slide Show

35 mm slide/tape presentation about the HAMVENTION is available for loan. Contact Dick Miller 2853 La Cresta, Beavercreek, OH 45324

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 will be available on DARA's 146.34/.94 repeater.

Free Bus Service

Free Bus Service will be provided between many Motels and Hara Arena. See the schedules at the motel registration desks. Avoid parking problems at the Arena by taking the HAMVENTION buses.

Campers & Trailers

Campers and Trailers may be parked at Montgomery County Joint Vocational School. A HAMVENTION bus will provide transportation between the camper parking area and the Arena. No campers or travel trailers will be permitted to park in the Arena lot or Flea Market area.

Wheelchairs

Wheelchairs will be available. Send S.A.S.E. for details to "Wheelchair" P.O. Box 44, Dayton, OH 45401.

Alternate Activities

HAMVENTION is for everyone. We have planned activities for the YL or your non-ham family members.

Deadlines

Award Nominations: April 4
Lodging: April 4
License Exams: March 28
Advance Registration and banquet: USA - April 11
Canada - April 4

Information

General Information: (513) 433-7720
or DARA Box 44 Dayton, OH 45401
Flea Market Information: (513) 223-0923
Lodging Information: (513) 223-2612
(No Reservations By Phone)

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!

HAMVENTION is sponsored by the Dayton Amateur Radio Association Inc.

League). Since I'm on the board of several corporations, including one projected to reach $1 billion in sales in a couple more years, I'm quite familiar with the responsibilities of directors.

Boards of directors are normally made up of experienced and successful business executives. They're experts in marketing, technology, financial management, and so on. And here's where I see the basic weakness of the League—a weakness that has kept the ARRL from providing our hobby (its business) with the leadership to keep it strong and healthy.

When you get your ballots to vote for your next director, what do you see on each one? You know what you see—a list of the ARRL appointments he's held. In many cases he's come up through the traffic system, so we know he's probably a true believer in Morse code for everyone. How many bios have you seen citing business experience—business success—including marketing, sales, financial, and other experience which is fundamentally a part of a director's responsibility? We seem all too often to elect teachers, who haven't a clue as to how to run an $8 million business.

A business-savvy ARRL board would, I'm convinced, have started working years ago on getting school radio clubs going so we'd have the infrastructure to bring the League new customers. And they'd have kept current with customer needs through surveys—making the needed changes to keep the hobby growing—even including a no-code license.

In the ham field, the responsibility comes right down to you. It's the unwillingness of most hams to be involved with ham politics that has allowed so many hopelessly incompetent hams—good solid Morse men, to be sure—to become ARRL directors—the biggest ego trip our hobby has to offer. Neither you nor your club has ever written to the candidates to find out if they have been successful in business—perhaps even with some experience as a director of other corporations.

"I did the same as you with the last ballot—I looked over the candidates—noted their years of ARRL service and myriad of appointments—sighed, shrugged, and tossed a coin."

The boards of corporations that ignore the customers find their corporations under attack by raiders. Indeed, with virtually no exceptions, recent corporate raids have been brought on by boards of directors that have let their corporations weaken to the point where the directors should be replaced.

No, despite my tone of attack, I'm really not blaming you. But I will blame you if you let this situation continue. No, I have to say flat out that it's my fault. I should have made this an issue long ago. Oh, yes, I did write about it a few years ago—but I didn't keep after you. And you're like me, if someone doesn't hassle you, you forget. I did the same as you with the last ballot—I looked over the candidates—noted their years of ARRL service and myriad of appointments—sighed, shrugged, and tossed a coin.

The board elections are geared so there really isn't time to get the business background (or lack of it) into print in *73* between the time we know who's running and the mailing of the ballots. One of these days we may get amateur radio set up so we're able to actually communicate in less than three months, but I hesitate to even guess when that'll be.

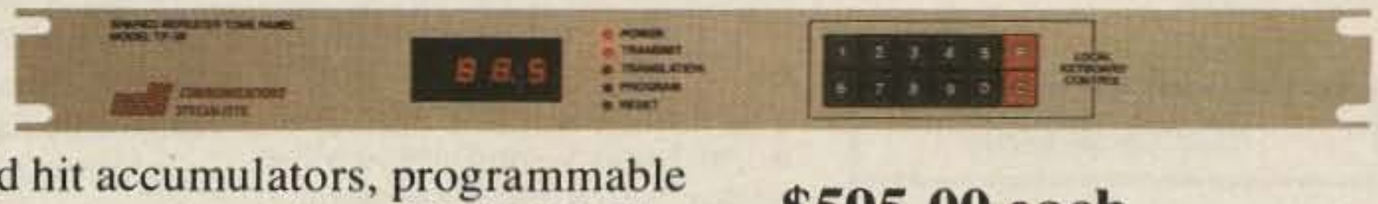
Tell me, if you were an ARRL director, would you think it important to update the National Traffic System by about 50 years?

If you agree and have some constructive ideas, I'd like to hear from you. If you disagree and can express your ideas in other than blind, emotional hate terms, please write. I've tried to get across my ideas on where we are and how to make things better—now I'd like your ideas. I reserve

Continued on page 50

Catch of the day!

Have you been trawling the bounding main for a new product? We have just netted it—the TP-38 microprocessor controlled community repeater panel which provides the complete interface between the repeater receiver and transmitter. Scuttle individual tone cards, all 38 EIA standard CTCSS tones are included as well as time and hit accumulators, programmable timers, tone translation, and AC power supply at one low price of $595.00. The TP-38 is packed like a can of sardines with features, as a matter of fact the only additional option is a DTMF module for $59.95. This module allows complete offsite remote control of all TP-38 functions, including adding new customers or deleting poor paying ones, over the repeater receiver channel.



$595.00 each
$59.95 DTMF module

Other features include CMOS circuitry for low power consumption, non-volatile memory to retain programming if power loss occurs, immunity to falsing, programmable security code and much more. The TP-38 is backed by our legendary 1 year warranty and is shipped fresh daily. Why not set passage for the abundant waters of Communications Specialists and cast your nets for a TP-38 or other fine catch.

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LETTERS

TICKET SALES

For seven years I have had zero luck getting my wife interested in studying for her license. February's Never Say Die regarding the selling of Extra-class licenses did the trick. There are a few modifications we would like to see, however. A regional center for license sales should be set up in each zone to give everyone equal access (Puerto Rico is just too far from 6-land). Mail order would also be a good idea, but it might let in too many people and overwhelm the repeaters. An Extra-class license is just not necessary—a General for $50 would be adequate. In order to maintain the integrity of the traditional licenses, a special prefix would be assigned to purchased licenses. This would allow the real hams to ignore the new pseudo-hams if they want to talk about technical things such as the weather and their latest medical operation.

John R. Fielder N6DAO
Los Osos CA

Ever since the news broke about licenses being sold, 73 has been deluged with calls and letters from people begging us to tell them who to get in touch with in Puerto Rico or New York. We won't say. We don't feel bad for those who can't be bothered with learning code and theory, but when folks who have been earnestly trying to become hams for years call, it's tough to tell them to wait for "no-code."—Eds.

NOVICE NEEDS

I just got my Novice ticket and a subscription to *73*. I guess I got taken in by the eclectic rambling of your magazine's salesman, Wayne. Now, please look over your table of contents and tell me what's in it for me. How about a Novice corner—basics about how an antenna tuner works, the difference between a vertical and a dipole—you get the point. Take a look at other hobby mags. They realize that the newcomer to the craft must also be addressed.

Morris Bleckman KA9WIA
Lincolnwood IL

Take a look at page 78. 73's long search for a Novice columnist has finally ended.—Eds.

PULL TOGETHER

I believe every ham who hides his hobby and doesn't even try to train a new Novice every year should either shape up or turn in his license. When I pass my Novice exam some time in 1987, each year thereafter there will be a new Novice or student on his way to a license or you get to rip up my license. I may be a non-ham upstart to some, but either we all pull together or lose amateur radio. Either live your creed or roll over and die.

Keith Martin
Lewiston ME

"A regional center for license sales should be set up in each zone to give everyone equal access."

MORSE FOR MOPPETS

Thought you'd be interested in the ham radio presentation Ken Fisher W0MJD and I made to eight kids at our local grammar school. We were part of the Gold Dust program of the West Side school, in which volunteers expose first-to-fifth graders to music, arts, crafts, hobbies, etc. We presented Morse code to the kids and taught them the first six letters—a, e, i, m, t, and n—and closed with a packet radio demonstration. I made up Certificates of Completion on my computer (got the idea from "Future Hams of America" (*73*, July, 1986), and the kids were really impressed with them. Most picked up code quickly, and some very intelligent questions were asked, like "Why is shortwave called shortwave?"

One mistake I made was not to notice that one lad was hard of hearing. The teacher noticed the special attention I was trying to give him and told me of his condition. We obtained a hearing aid for him which did help, but it was too late: He already was embarrassed in front of his friends.

For the demo, we made up personal messages for the kids from information we got from the school secretary beforehand, and Ken installed them on a local packet bulletin board. Then he allowed each kid to call up his own message! This went over really big.

Feedback has been positive from both kids and teachers. Check your local schools for similar programs or consider championing such a program yourself. The enthusiasm of the kids can be contagious.

Ron Kyles KJ4NA
Elizabethton TN

A super idea!—Eds.

"NRA TYPES" I

I did not appreciate KW1O's remark about "NRA types" in the February Letters column. That is no different than calling all hams "lids." Many hams are NRA members and I am sure they did not like your derogatory statement.

Karl Burket KC7JU
Payette ID

"NRA TYPES" II

Being a life member of the NRA, I object to the negative connotation that KW1O seems to give to the NRA and its members. If amateur radio had as effective an organization as the NRA does working on its behalf, ham radio wouldn't be in the mess that it's in. I think that hams, and especially the ARRL, could stand to take a few lessons from us "NRA types."

John Aultman KA5UBL
Hattiesburg MS

"NRA TYPES" III

I was shocked after reading KW1O's reply to KH6GPI referring to: "NRA types who haven't really thought much about what they're saying—they just mimic words that they have heard from other 'activists.' " Perhaps KW1O felt safe in unburdening himself in *73* since the implication would be that NRA members are too stupid to pass a ham radio exam and consequently not read *73*. This "NRA type" passed both elements of the Extra-class exam 100% correct at age 65. I will not lower myself to KW1O's level and attempt to typecast him. He did it himself through the above-quoted slur.

Evert Skough N7HID
Kingman AZ

The Letters column of 73 is not an appropriate place for the expression of non-ham-related personal opinions. 73 apologizes to those who were offended by the analogy.—Eds.

SAY DIE

Your Never Say Die column is becoming very repetitive. Please spare us the time reading about how great you are. We all know how great you are. After all, you have been telling us how great you are in every column since you came back. Give the space to the Letters column—it is much more interesting.

Arnold D. Samuels KH6COY
Ocean Shores WA

NEVER SAY DIE

Your editorials are completely outrageous. How do you get away with it? I have only one thing to say—welcome back! I'm a born-again subscriber since you've returned. I'd buy your magazine for the editorials alone—the rest is gravy.

Jerome Prismantas N0HFC
Organ NM

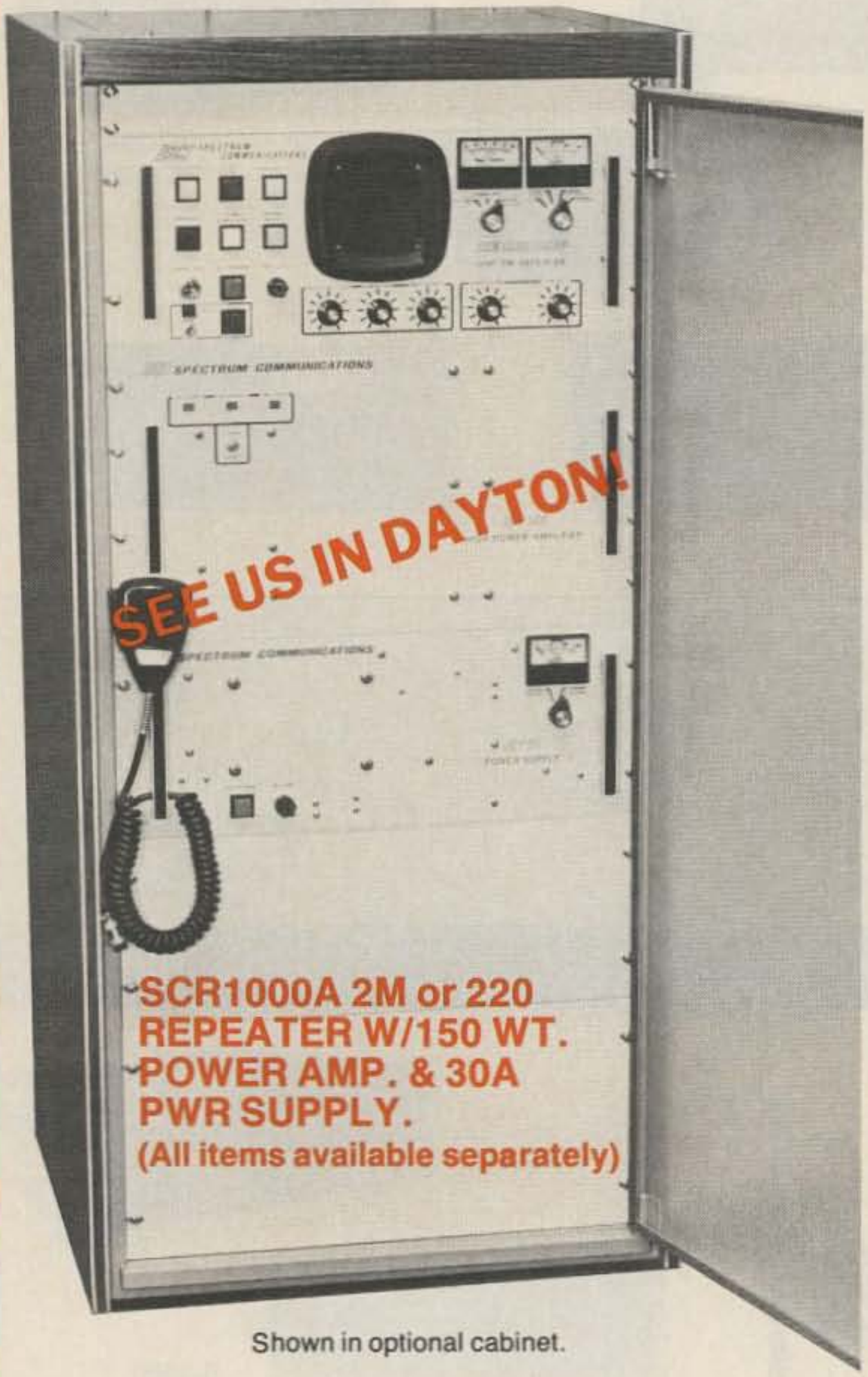
COSMIC COMPARISONS

Concerning the story "Cosmic QRN" (February, 1987), W6HDM evidently thinks like Carl Sagan. Sagan's book *Contact* details the fictional story of the reception of our first extraterrestrial communication. Parallels between the two stories include frequencies and multiple coding methods in a single signal. The two stories make great comparison pieces.

Charlie Cotterman KA8OQF
Dayton OH

For the Finest in Repeaters, Go with the Leader—

SPECTRUM



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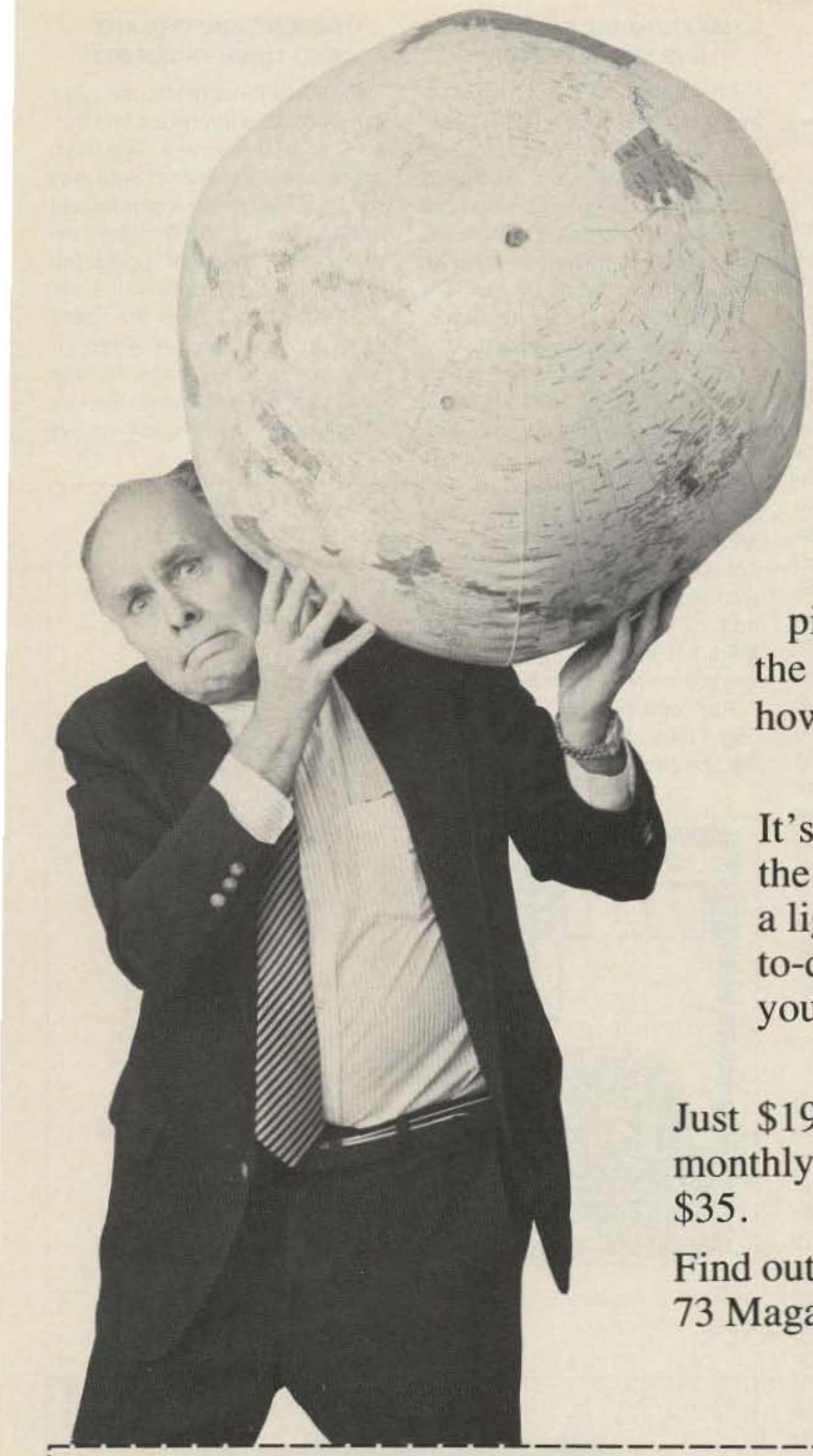

HEAVY STUFF

Face it, the world

of ham radio is a lot more complex than it used to be. We have new modes popping up every day, satellites racing around the globe, computers, spread-spectrum . . . how can you keep up with it all?

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NEW PRODUCTS

YAESU FT-109RH AND FL-7000

Yaesu U.S.A. announces the FT-109RH, a 5-Watt, 220-MHz hand-held transceiver as a follow-up product to the FT-209RH and FT-709R hand-helds. Covering 220 to 224.995 MHz in 5-kHz or 10-kHz steps, it includes battery-saver, 10 memories, standard 1.6-MHz or nonstandard offset, and memory and priority scanning. It is equipped with a DTMF tone generator, front-panel multimeter indicating battery condition, transmitter power output, or received signal strength, and a VOX system. Optional accessories are interchangeable with other units in the 109, 209, and 709 series.

Yaesu's FT-109RH 220-MHz hand-held.

Yaesu has also introduced the FL-7000 solid-state linear amplifier for 160 through 15 meters. It features an automatic antenna tuner with automatic bandswitching when used with a Yaesu FT-757GX, FT-767GX, or FT-980 transceiver. Antenna switching also is automatic with the FAS-1-4R remote antenna selector. Power input is 1200 Watts for approximately 70 Watts; a protection circuit prohibits operation with high swr until the antenna tuner completes the matching process. Thermostatically controlled dual fans run even when the amplifier is turned off if they are still needed for the dissipation of heat.

Further information on these Yaesu products may be obtained by checking Reader Service number 206.

MERCER POCKET DMM

Mercer Electronics is offering a new low-cost digital multimeter, the model 9345. A single rotary disk allows selection of the quantity to be measured and provides automatic measurement on all functions. It measures volts and Ohms, has a high-contrast LCD display, and has audible continuity indications. It comes with carrying case and batteries for $34.95.

For more information, please circle Reader Service number 209.

MFJ COMPACT SPEAKER AND NEW ANTENNAS

MFJ Enterprises, Inc., is releasing its new compact mobile speaker with magnetic base and tilt bracket, the MFJ-280. Equipped with a 3-1/2-mm phone plug on a long cord, it works well with all 8- and 4-Ohm impedances and can handle up to 3 Watts of audio. At $18.95, it is backed with a one-year unconditional warranty.

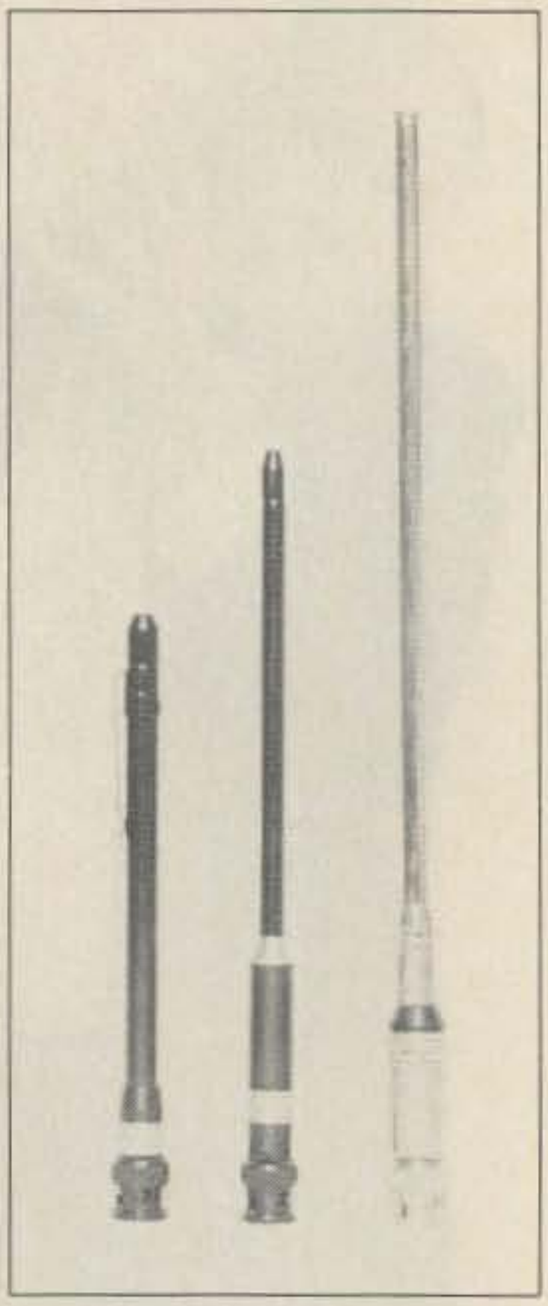
MFJ is also offering three new antennas. The MFJ-1710 is a 3/8-wave, 2-meter, telescopic with BNC. It comes with a pocket clip and is 5-3/4" collapsed and 24-1/2" extended ($9.95). The MFJ-1712 is a 1/4-wave, 2-meter; 5/8-wave, 440-MHz, telescopic with BNC that is 7-1/4" collapsed and 19" extended ($14.95). The MFJ-1714 is an end-fed, half-wave, 2-meter telescoping dipole.

For additional information about these MFJ products, check Reader Service number 207.

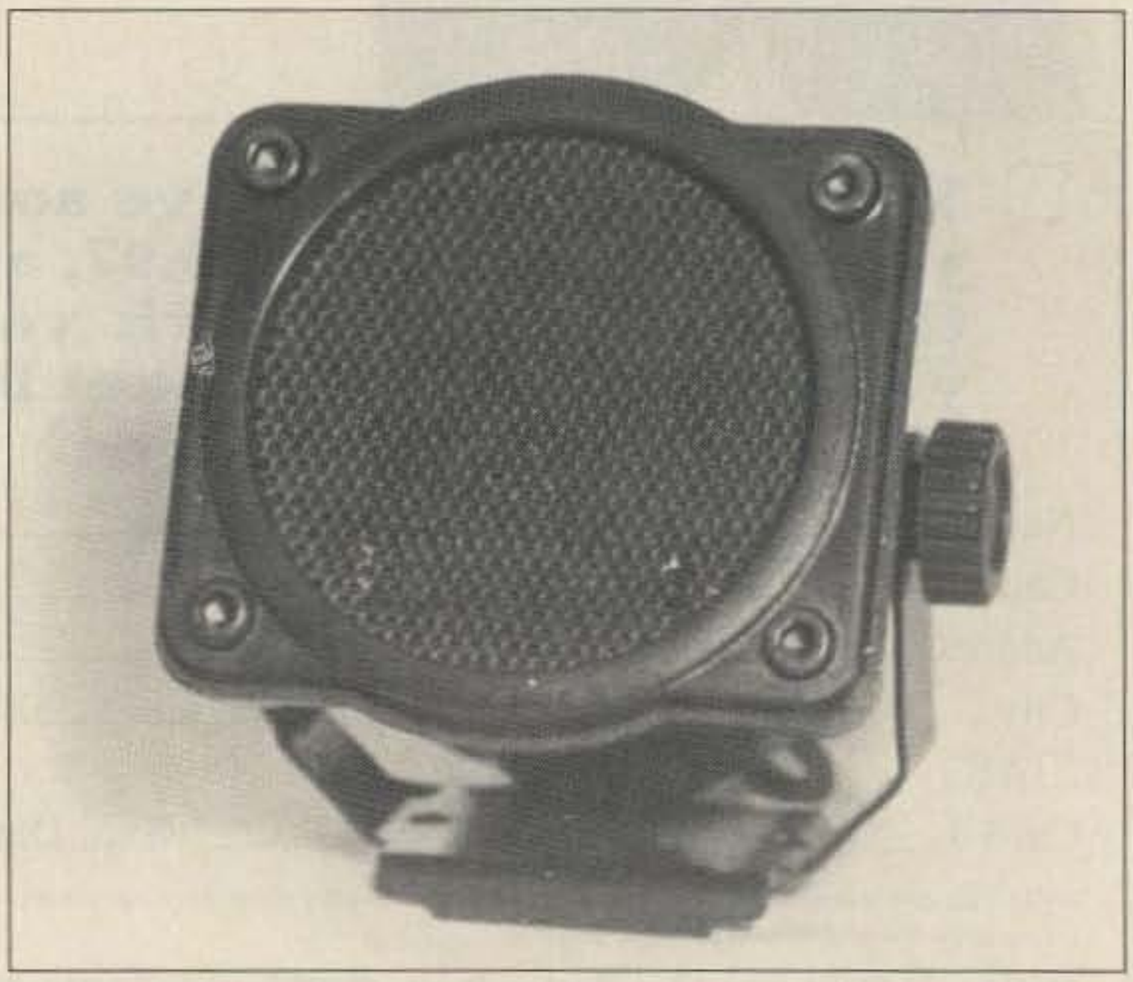
Mercer's model 9345 pocket DMM.

REGENCY INFORMANT AND TUBBO-SCAN 800

Regency Electronics, Inc., has introduced the Informant and Turbo-Scan 800 scanners. The Informant, preprogrammed with key state and local law enforcement frequencies for all 50 states, will search VHF and UHF police frequencies for any state with a single touch at four times the speed of most scanners. A weather-search function scans for the nearest National Weather Service frequency. The display shows



New antennas from MFJ.



MFJ's compact mobile speaker.

Yaesu's FL-7000 solid-state linear amplifier.

state and type of transmission (state or county police); there is a highway/city switch for choice of monitoring local or statewide frequencies, and a hold switch to keep the receiver on a single frequency. The radio comes with a multi-position mounting bracket/clip to fit any vehicle. It includes a telescoping antenna. Wiring can be direct to dc or through a cigarette lighter adapter. The suggested retail price is $369.95.

The Turbo-Scan 800 "scans nearly five times faster than any competitive model" and provides wide coverage of 12 of the most popular 800-MHz public-service frequencies. It has a translucent, rubber keypad, backlit for night use, and dual-level vacuum-fluorescent display. Frequencies may be entered into any of the scanner's 75 channels or grouped into any of the six scan banks. Channels may be retrieved instantly, without having to manually step through all other channels. This rig also has the weather-search function. Designed for home or mobile use, it has a suggested retail price of $499.95. Model TS-2 comes with two telescoping antennas (for standard VHF and UHF as well as 800-MHz reception), ac power supply, dc power cord, and mobile mounting bracket.

To obtain more information about these Regency scanners, circle Reader Service number 208.

The Regency Informant public information radio.

NEW CATALOGS AND BOOKS

Contact East. Comprehensive product guide for 1987 featuring a full line of tools and instruments for electronic specialists, engineers, technicians, involved in assembling, testing, and repairing. Free, including one year of technical supplements. Circle Reader Service number 210.

Jensen Tools, Inc. Catalog of service and maintenance kits, hard-to-find tools. VCR alignment, communications adaptor kits, AT&T handsets, digital test equipment, lighting/optical aids, soldering stations, computer accessories, more. Free. Circle Reader Service number 211.

QSKY Publishing. A primer on data communication written for the beginner level: *The Digital Novice*, by Jim Grubbs K9EI, with cartoonist Tad Barney, 128 pages. Twelve chapters, on everything from Morse code to packet radio and future uses for digital communications. ($12.45 ppd.) For more information, circle Reader Service number 212.

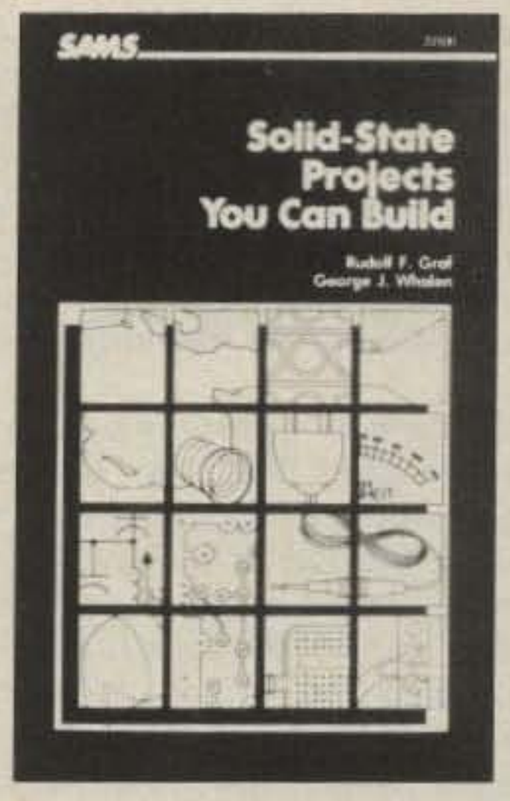
Howard W. Sams & Company. Publications: *Audio IC Op-Amp Applications*, 3rd Ed., by Walter G. Jung; 336 pages. Completely revised; includes devices such as very-high-slew-rate and dynamic-range FET-input units, and new applications circuitry. #22452, $17.95.

First Book of Modern Electronics Fun Projects and also *Second Book . . .*, both by Art Salsberg, both designed for the electronics hobbyist to expand his knowledge through practical fun learning; 20 hands-on projects in each, from the pages of *Modern Electronics* magazine, each is 256 pages. #22503 (#22504 for the second one), $12.95 each.

Forrest Mims' Circuit Scrapbook II, 272 pages. Some 70 projects from *Modern Electronics'* columns, the "Electronic Notebook." Transistor, MOSFET, analog, digital circuits, LEDs, laser diodes, optoelectronics, sensors, assembly tips. #22552, $19.95.

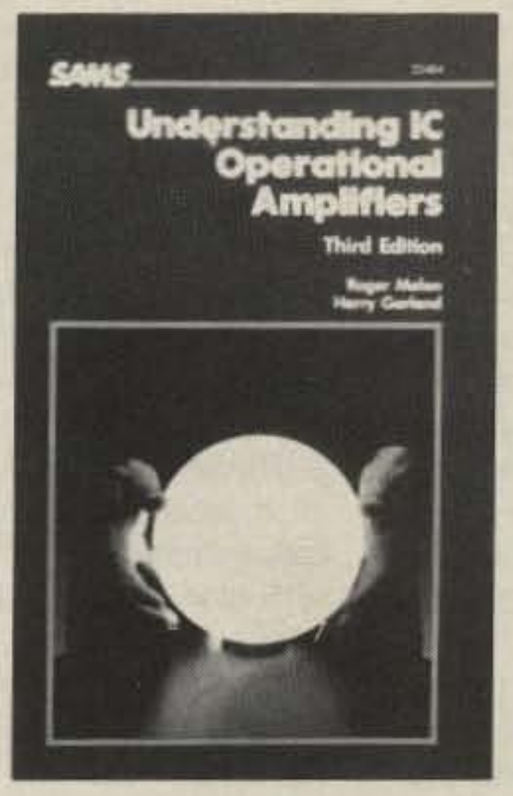
Radio Handbook, by William I. Orr—23rd Edition, 640 pages, hardbound. Completely revised. #22424, $29.95.

Shortwave Radio Listening with the Experts, by Gerry L. Dexter, 528 pages. Features 25 contributors who are shortwave listening researchers, pioneers, and specialists, as well as veteran listeners. #22519, $22.95.



Solid-State Projects You Can Build, by Rudolf F. Graf and George J. Whalen, 176 pages. Complete step-by-step construction procedures, illustrated, with background theory, parts lists, tips on where to get hard-to-find components. Projects include: electronic dice, computing thermometer, proximity or touch alarm, TV remote-sound system, sing-along light controller. #22500, $10.95.

Understanding Electricity and Electronics Principles, 256 pages; *Understanding Electricity and Electronics Circuits*, 328 pages, written by Training & Retraining, Inc., revised by David L. Heiserman. # 27061 (*Principles*) and #27062 (*Circuits*), each $14.95.



Understanding IC Operational Amplifiers, 3rd Ed., by Roger Melen and Harry Garland, 224 pages. New, expanded, and updated applications include material on computer-aided design techniques and IC op amps in microprocessors. #22484, $12.95.

For more information about these Howard Sams Books, circle Reader Service number 213.

73 Review

DJ2UT XP706 Multiband Beam

Sommer GmbH
Distributed by:
H. J. Theiler Corp.
PO Box 5369
Spartanburg SC 29304
Price class: Semi-assembled $778
Unassembled $662

by Jim Godron N1EJF

More than 10 years ago, a German amateur named Walfried Sommer DJ2UT decided that there must be a way to overcome the trap losses induced when a yagi was tribanded for 10, 15, and 20 meters. He also wanted to develop the high gain (7 dB or more) and the excellent front-to-back ratio that can be achieved on a monoband antenna by close (0.1λ) element spacing on a multiband beam. This presented him with the monumental task of overcoming the very narrow bandwidth and extremely low resistance (10 Ohms or less) of those closely spaced designs. After reviewing the work of Rucker, Buchanin, and others and after spending many years in development, Sommer refined his design to that which is available today.

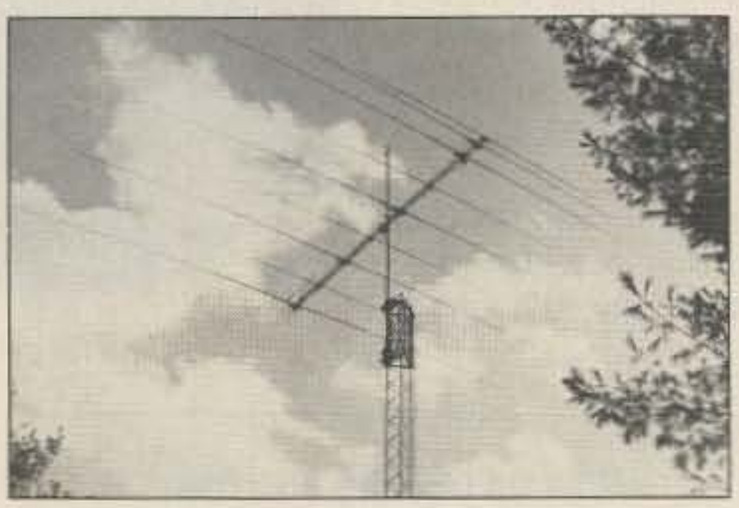


Photo A. The DJ2UT XP706 multiband beam.

Design

The operating principle of the DJ2UT antenna is quite remarkable. On 20 meters, the system is a full-size beam using 1/2λ elements without traps. The main difference between this system and others is that all elements are driven with a phasing line. In effect, you have a 4-element log cell that develops an impressive 9 dB of gain and an excellent front-to-back ratio.

On 15 and 17 meters, the 20-meter elements are about 5/8λ long. This results in a high feedpoint impedance that must be reduced. Instead of using the LC traps commonly found on multiband antennas, Sommer uses the capacitance found in the phasing line, in conjunction with the three or four elements (depending on the model) clustered around the feedpoint. It is this combination of driven and parasitic elements that lowers the system's impedance and provides more than 8 dB of gain on 15 meters.

On 10 and 12 meters, the 20-meter elements are about 1λ long and are fed by the phasing line as split 1/2λ elements in a collinear fashion. Gain on 10 meters is more than 10 dB.

On 30 and 40 meters, the system ignores all but the longest elements. In this configuration, it can be considered a dipole with a transmission line attached. These elements are too short to be resonant on 30 or 40 meters and present a capacitive reactance that must be eliminated. On 30 meters, this is done with an LC match; on 40 meters, a coil and/or a coaxial capacitor is used.

It is extremely important to note that these networks are NOT connected in SERIES with the antenna and that they cancel only the "blind" reactive components. They ARE NOT traps. There is some gain on 30 and 40 meters as compared to a conventional 1/2λ dipole. Because the bandwidth is narrow on 40 meters, the resonant frequency can be easily adjusted.

All the gain figures presented for this antenna are as compared to a 1/2λ dipole, NOT to some mythical reference (the figures presented are the manufacturer's claim, but my experience is that his claims are *conservative*). Sommer goes to some effort to test the performance of his antennas. The figures become really impressive when you consider that this kind of performance is accomplished on a 20' boom!

Antenna Assembly

Construction of an antenna system this complex requires some effort. Having said this, I'm pleased to report that I experienced no real problems putting this antenna together.

When this series of antennas was introduced to the U.S., the instruction package left something to be desired. Pete Theiler has spent considerable time translating and rewriting the instructions. While some improvement can and will be made, I think Pete has done a terrific job.

My antenna arrived on a Thursday. I spent the first day reading through the instructions, and began construction on Friday evening. Fortunately, I was able to assemble most of the antenna (element holders, phasing line, etc.) in my basement, as I was working just after a 1-1/2' snowfall. I concluded the inside phase on Saturday, and on Sunday I verified all measurements and the tightness of all connections.

Putting the elements on the antenna was very straightforward. Each element is color-coded and the measurements on the chart are easy to follow, although they are metric. This wasn't a problem for me, but, if you're worried about cm, mm, and stuff like that, the considerate folks at Sommer even include a metric ruler for your convenience.

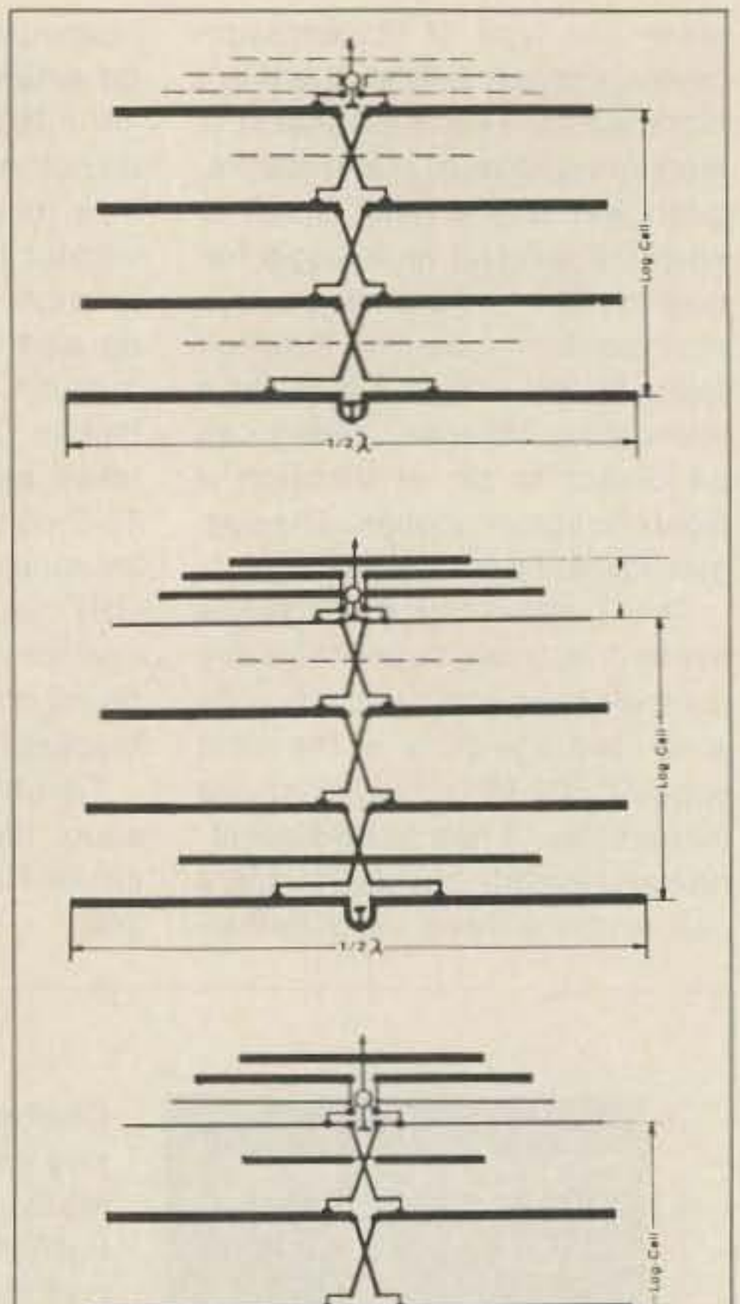


Fig. 1. The Sommer multibander's active elements are shown as bold; the inactive elements are shown as a broken line. From the top down, these configurations are for: 20 meters; 15/17 meters; 10/12 meters; 30/40 meters.

The nuts and bolts are also metric, so a metric wrench is also supplied with the antenna. While it is possible to assemble the antenna using only this wrench and common hand tools, I found that my collection of metric tools was most helpful.

As I was assembling this antenna, the one thing that became clearer and clearer was the quality of the materials and engineering. The wall thickness of the element tubing is greater than that on U.S.-made beams that I've examined. The element holder castings are massive, weighing several pounds each. Every piece of this antenna is first-rate and designed to last a lifetime. All connecting pieces, U-bolts, nuts, and bolts are stainless steel.

I installed the antenna on a Glen Martin Engineering tower and Hazer unit. (If you're

not familiar with the Hazer, please see my review below.) The rotor and thrust bearing mount on the Hazer unit, which travels up and down the tower. By bringing the Hazer to its lowest position (about 2′ above the ground), you can mount the antenna at a very convenient height. It's possible to attach or work on the antenna by using only stepladders. With a beam of this size, that was a distinct advantage.

Performance

In use, this antenna performs better than I expected. My first contact was with a station in California. I was running only 100 Watts, but my signal was three S-units better than his and he was running a kW into a conventional beam. Regardless of distance, single hop or long path, my signal was one to three S-units better with 100 Watts than stations running linears into conventional antennas.

The antenna is absolutely flat across 20 meters, and on all other bands the swr is below 1.7:1. While not very broadbanded on 40 meters, the antenna's performance is quite good. Pete tells me that a modification will soon be out that will make the bandwidth broader, and I'm looking forward to trying it out.

Conclusion

This beam performs as well as monobanders. While its cost may at first seem high, it is actually very reasonable when compared with what you would have to spend to get comparable performance with other antennas. It makes a good investment when you make the transition from wire antennas, as this antenna will provide gain on receive (while a linear works only one way). Don't think I'm knocking linear amplifiers; I'm not. It's just that if you optimize your antennas, any subsequent increase in output power works better.

If you're serious about DX, appreciate quality, or want an antenna that you can leave to your children, you should give serious consideration to this system. Quality is never cheap, but the value represented by your investment will remain through the years. If you would like more information on this antenna, please circle Reader Service number 204.■

Glen Martin M185A Tower

by Jim Godron N1EJF

Glen Martin Engineering
PO Box 7253
Boonville MO 65233
Price class: $1,275

It's not every day that a ham gets to install a new tower. And when he does, it's usually a difficult project and just plain hard work. When I was presented with the opportunity to set up and review a 40′ Glen Martin Engineering tower complete with Hazer unit, I decided to make the job as easy as possible. In my book, that means planning everything so that there are no surprises.

The tower I installed was a 40-foot M185A. It has an 18″ face, is triangular, and is of bolted aluminum construction. Besides being very strong, the tower is also very light; the shipping weight of the complete tower and Hazer unit is only 140 lbs.

Choosing the Site

The first step in a major project like this is planning the foundation. Because this tower is free-standing, it requires quite a substantial foundation—a finished size of 40″ x 40″ x 6′. This represents about 2.5 cubic yards of concrete, far more than could be mixed by hand and more than most people would want to mix on site.

Therefore, you should be able to get a cement truck within 10–16 feet of the location. If you cannot, the choices are to move the site or to bring the cement to the site in wheelbarrows. By the way, moving cement in wheelbarrows is NOT FUN and it takes a LONG time.

I chose the area directly behind the garage for my tower, mostly because that's where my wife said I could put it. Our garage is connected to the house by an enclosed breezeway. With the use of two cement chutes, we could pour cement through the breezeway and into the form.

Preparing the Site

Now that the site was chosen, the next step was to dig a hole. I briefly considered using a shovel, but reason prevailed and I decided to use a backhoe. But, due to a major sewer construction project in our small town, there was only one available at noon on an especially rainy day. When the operator had dug a hole about 6′ wide by 10′ long by 6′ deep, he got the machine stuck in the backyard. It is incredible what carnage a large machine like that can cause to a newly seeded lawn.

A structure this large should really be poured into a form. It's not absolutely necessary, but in the long run it's easier. If you're not an experienced woodworker, you should plan to spend about eight hours building the form.

I constructed two stud walls 6′ tall and 40″ wide, and covered with 1/2″ CDX plywood. I then cut another two pieces of 1/2″ CDX 4′ x 6′ and "banded" these together in five places (see Photo A). I assembled the four pieces of the form in the hole and connected each joint with nails and screws. It is also a good idea to screw the overlapping plywood to the stud walls. After you pour the concrete, you may elect to strip the form or simply backfill around it.

The pouring of the concrete was almost anticlimactic. We pounded a ground rod into the undisturbed ground under the bottom of the form and connected it to the steel base support. The base was held above the form with a two-by-four and a piece of furring so that the bolts would stick out of the concrete the proper distance.

You will notice in Photo B that I didn't completely backfill around the form. This allowed me to strip only the top of the form. I had ordered 2.5 cubic yards of 3,000-lb. concrete and had virtually none left over. After the concrete set, I removed the base assembly, stripped the top of the form, and applied silicone grease to the bolts to keep them from rusting.

The Hazer Unit

The Hazer unit itself appears to have quite a few parts, but assembly took only about two hours. The completed unit stands 4′ tall with the thrust bearing mounted on the top plate and the rotor mounting plate on the bottom. When the unit slides up and down the tower, it rides on nylon studs. There are two studs at each corner (a total of 12) and extras are provided.

In Photo C, you will notice the safety mechanism. The arm must be held away from

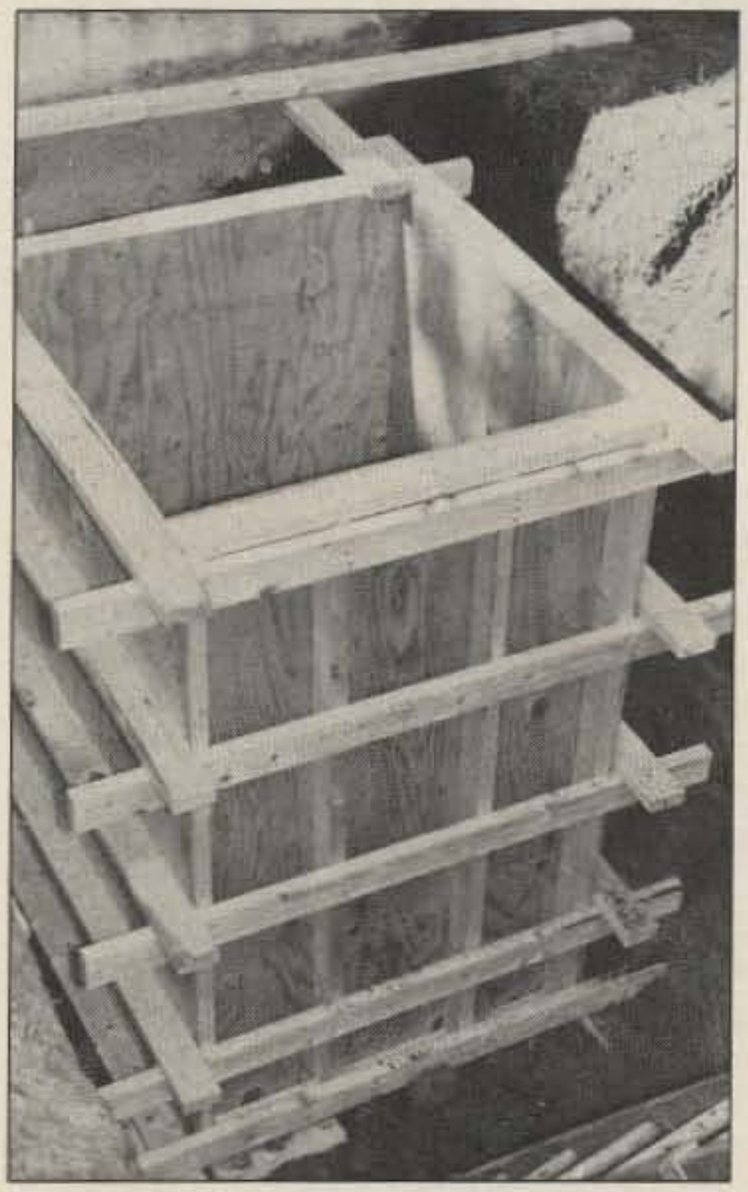


Photo A. The form "banded" together.

Photo B. The area around the form is partially backfilled after the concrete has been poured.

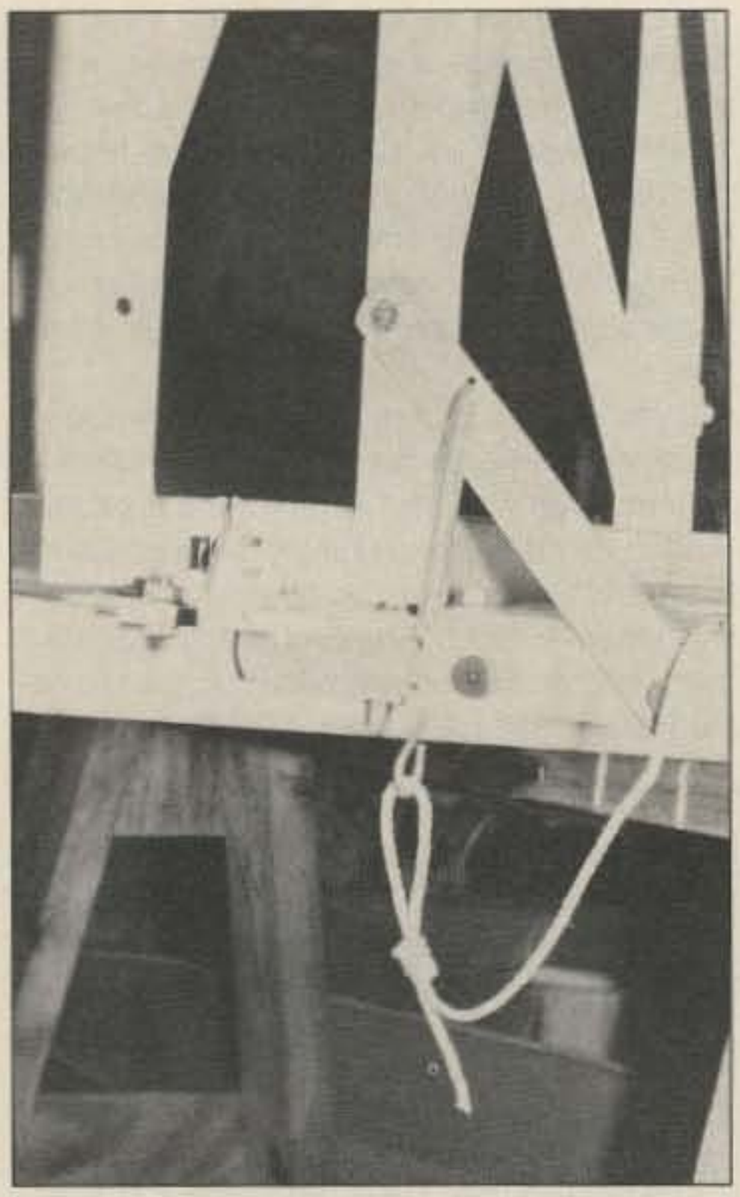


Photo C. Close-up of the Hazer unit, showing the safety mechanism.

the tower while you are lowering the antenna or the Hazer will stop at the next crossbar. The spring that holds the safety bar up is stainless steel. The safety action of this device is "deadman"; if you let go of everything, the downward motion of the antenna stops.

From Photo D, you will notice that there is a lug with a hole mounted in each corner. On taller towers, you can attach the top set of guys to these lugs, or you could use them to hold one end or the middle of a wire antenna. I brought my coax and rotor cable to the bottom right lug and then ran the coax up past the thrust bearing and attached it to the lugs on the right side and upper right corner.

The stainless-steel winch cable passes through the bottom and top plates and then over a pulley mounted at the top of the tower. The cable then goes down the inside of the tower and connects to the winch. The centerline of the mast and rotor pass off the side of the tower; this way, the antenna boom will miss the tower and the entire platform can travel up and down the tower.

The antenna must be pointed in one certain direction as it's raised or lowered. As a matter of convenience, I aligned the tower so that this position would be north. It doesn't make any difference what direction you use, but I think it's easier to use north, south, east, or west.

One thing to consider when using a system like this is that because it's so easy to move the antenna up and down, you're probably going to move it frequently. Because the coax isn't connected to the tower, it needs to be strong and flexible.

I discussed these problems with Joel Knoblock of The RF Connection and he made

Photo D. The Hazer unit.

what I think were the perfect suggestions. We ran International 9086 from the shack to the base of the tower and terminated it with an in-line N splice to International 9095 (called Ultra-Flex), which is a 50-Ohm cable with a .405" o.d. (the same as RG-8).

The center conductor is 11 gauge (made up of 24 strands of 19-gauge copper wire). The shield is 98% and made of copper. The result is a very strong cable that stays flexible to temperatures near 0° F. It is rated to 1,500 Watts and costs only pennies a foot more than RG-8. The International company is located in Arlington Heights, Illinois. More information can be obtained from The RF Connection (213 North Frederick Avenue #11, Gaithersburg MD 20877; 301-840-5477).

The Tower

The tower itself consists of 10-foot sections made up of angled legs and tubular cross braces. The braces are bolted to the legs with stainless-steel carriage bolts and self-locking nuts. The tower sections are attached with a plate bolted to the inside of the leg. By using this method of joining the sections, you will not disturb the centerline of the leg. If the tower is damaged, the bad area can be cut out and the tower reconnected anywhere along its length. The legs are punched with square holes to catch the carriage bolts, and the tubular braces have their ends flattened and drilled.

So that I could fully experience the variations in construction, the factory shipped me two assembled and two unassembled sections. The only tool required is a nut driver or wrench to tighten the nuts. To make things easier, I put the nutdriver bit in my variable-speed drill.

It took me about 1-1/2 hours to assemble one of the sections, an hour to assemble the other. I found that the punched holes and drillings were extremely accurate and I had no trouble with the assembly. You can order sections assembled at the factory

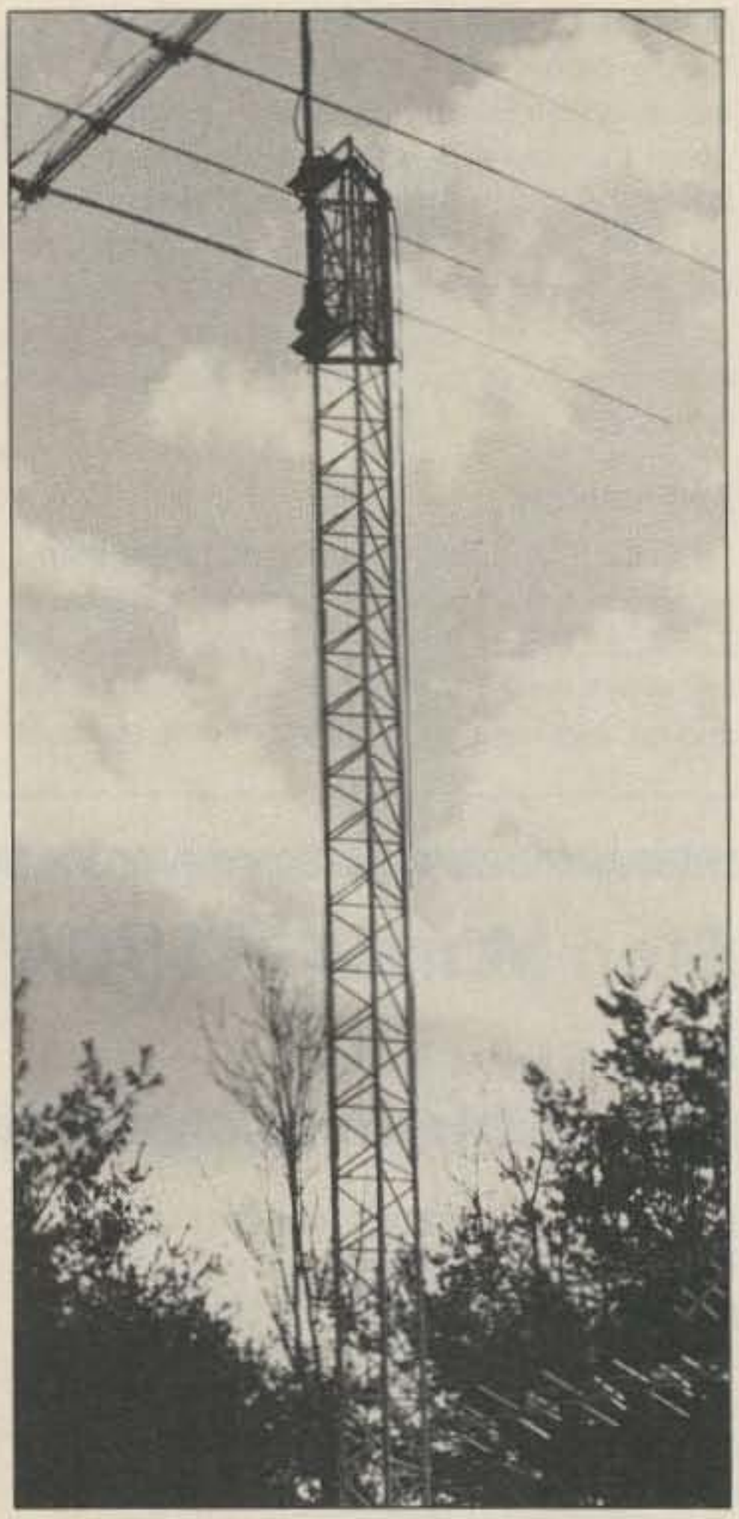


Photo E. The Glen Martin Engineering M185A tower with antenna attached.

for an additional $25. If you're short on time, spend the extra money; if not, I think you'll enjoy the experience of putting the sections together. One thing that I hadn't thought about before my tower was delivered is that because aluminum is so light, the freight charges are much less than those of steel towers.

The bottom section of the tower bolts to a hinged assembly, which in turn attaches to the three studs protruding from the concrete foundation. The hinged plate sits on nuts so that leveling can be easily accomplished. When the plate is level, lockwashers and nuts go on top. I set the first section and made sure the whole thing was level and plumb. Then I hinged it over and attached the other sections.

With the complete tower lying on the ground, I positioned the Hazer unit on the middle of the top section and attached a rope to the Hazer to help lift the tower. My kind XYL, Donna, our two children, and I lifted the tower. We got the tower as high as we could (about 45 degrees) and supported it with a ladder. We lifted it the rest of the way by using the rope and the car. All in all, the whole thing went very smoothly and took only an hour or so.

After the tower was up and secure, it was a simple matter to lower the Hazer and disconnect the rope. The Hazer comes drilled for Kenpro rotors, and my Kenpro KR-2000 fit exactly. If you need the unit drilled for another

type of rotor, all you have to do is let the factory know.

If you've ever had to install a large beam on a tower of any height, you'll be amazed how easy it is to do with the Hazer. You simply lower the Hazer, and then two people can attach the LARGEST antenna by using only stepladders. My 20-year-old daughter, Andrea, and I installed a Sommer XP706 (which weighs 110 lbs., and its longest element is 32 feet) by ourselves in only two hours!

Conclusion

In use, the tower and Hazer unit work extremely well. At 40', the tower is free-standing even with an antenna as large as the XP706. During a recent severe winter storm, I became concerned because winds were forecast to be quite strong. I simply lowered the antenna and didn't give it another thought all night.

I must admit that before this experience I was a dyed-in-the-wool steel-tower user. However, the many advantages in maintenance, ease of erection, and strength vs. weight have convinced me that aluminum towers deserve serious consideration.

Even if you have a steel tower, you can still enjoy the freedom from climbing that the Hazer offers. There are models available for Rohn towers. For the ham who can't or doesn't like to climb, the Hazer provides a way to perform the annual maintenance that your beam deserves. Circle Reader Service number 205 to receive additional information about this tower.■

Kenwood TS-711A 144-MHz Multimode Transceiver

by Peter H. Putman KT2B

Trio-Kenwood Communications
1111 West Walnut Street
Compton CA 90220
Price class: $900

For those readers who've been wondering if they perhaps missed a product review of the Kenwood TS-711A 2-meter multimode transceiver in some past issue of *73* . . . relax. You didn't miss it. The TS-711A has been on the market for a few years, but somehow got overlooked in the accumulation of items that are selected for review each year by the *73* staff. Why, we even managed to take a look at the companion 70-cm unit, the TS-811A, last June! Finally, at long last, a TS-711A showed up at the offices of WGE a few weeks ago, courtesy of Kenwood, so I seized the opportunity to put it through its paces.

The TS-711A comes in a package about the size of Kenwood's popular TS-430/440 series HF transceivers, ostensibly to create a matched layout along with the TS-811A for a complete HF/VHF/UHF station. The final is rated at 25 Watts output (adjustable), and band coverage is from 142–148 MHz to allow MARS and CAP operations. The usual bells and whistles are included, such as programmable memories and scanning, as well as some useful controls such as i-f shift and RIT.

If you read the TS-811A write-up, you'll notice a close resemblance to the TS-711A in layout, performance, and size. Both radios are equipped with Kenwood's Digital Code Squelch (DCS) system, which I did not get a chance to tinker with. This system will not permit the squelch to open on any signal unless the proper "code" is present, functioning in the same manner as Private Line™ (PL), but on a more sophisticated level. In addition, the system can be set up to locate an unused channel and then send another TS-711A equipped with the correct code to that channel—automatically.

The modes of operation included are CW, USB, LSB, and FM, which are switch-selectable from the front panel. An audible CW character signals when the desired mode is selected. Also present is a button marked AUTO, which preselects the mode according to a band plan. You may recall that I found this control somewhat useless on the TS-811A due to the different 70-cm band plan employed in Japan. However, the Japanese 2m band plan is very similiar to that of the U.S., with CW switched in from 144.000–144.099 MHz, USB from 144.100–144.499 MHz, FM from 144.500–145.799 MHz, USB from 145.800–145.999 MHz, and FM again for the remainder of the band.

The rest of the left side controls are AL for priority channel function; SCAN, M.IN for loading memories; LOCK and REV, which lock the main dial and select reverse of any offset present, respectively; and CH.S, which scans memory channels. Tone frequencies for PL can be selected from a switch and the front tuning dial. A 20-dB attenuator is provided for strong signals, and a speech processor (nonadjustable) can also be switched in. In addition to the i-f shift and RIT functions, the right side includes controls for squelch, microphone gain, rf power out, af/rf gain, 1-MHz up/down, and noise blanker (nonadjustable).

Specification	Measured	Claimed
Minimum Discernible Signal	Less than −140 dBm	N/A
Sensitivity (SSB), 10-dB S/N	.20 uV	Less than .16 uV
Sensitivity (FM), 10-dB S/N	.17 uV	Less than .22 uV
Selectivity, SSB		
−6 dB	Greater than 3 kHz	Greater than 2.2 kHz
−60 dB	Less than 7 kHz	Less than 4.8 kHz
Selectivity, FM		
−6 dB	Greater than 5 kHz	Greater than 12 kHz
−60 dB	Less than 20 kHz	Less than 24 kHz
Conversion Gain		
(Rf Amp/Mixer)	19 dB	N/A
1-dB Compression	−1 dB	N/A
Dynamic Range, dBm	122 dBm	N/A
Transmitted Power		
Output @ 50 Ohms	26 Watts	25 Watts
Low Power Output	2.7 Watts	2 Watts
Frequency Accuracy	146.0002 meas.	146.0000 disp.

Table 1. Performance data—TS-711A.

The TS-711A is equipped with two vfo's and a memory bank that can hold up to 40 memories with offsets, subtones, and mode for each channel. Main dial tuning occurs in a range of steps, depending on mode. For example, in FM mode you can either select 10-Hz or 5-kHz steps, while in SSB or CW the choice is—surprise!—10 Hz or 5 kHz. The difference is the button marked CH.Q. When it is engaged, you'll hear a loud "kerchunk" as a solenoid kicks in and the tuning knob "click-steps" in 5-kHz increments, very useful on FM. When it isn't engaged, the tuning is silky smooth. And if 10 Hz isn't fast enough, engage the STEP button and cruise along at 100 kHz per revolution.

As noted before, microphone gain is adjustable from the front panel. Following past Kenwood practice, this applies only in SSB mode. Mike gain is preset on FM and is adjustable only by removing the cover. On other multimode transceivers, such as the IC-275A reviewed last month, the mike gain works in every mode, which I find handy when accessing repeaters with different audio frequency response curves. You know the types—everyone says your audio is too hot, or too low, etc.

The PROC (processor) control is of questionable value on 144 MHz, and I could do without it, especially since the level of compression is not adjustable. On the other hand, RIT is very useful as I have pointed out in the past, especially when you're trying to copy weak CW signals through the noise. And the i-f shift pulls its weight during contests! Its function is very similar to a passband tuning control, shifting the passband of the i-f filter to either side of the desired signal.

Let's now take a look at the schematic. The front end employs a 3SK129 GaAsFET driving a 3SK122 MOSFET mixer, and the combination works reasonably well, as the performance data in Table 1 shows. Selectivitiy is accomplished by the use of two helical preselectors—a two-pole unit ahead of the GaAsFET and a three-pole unit following. This scheme does improve selectivity as shown in the performance data and is the right way to go at VHF and UHF frequencies, especially with broadbanded rf receive amplifier stages. On transmit, an M57727 power module is employed with both temperature and swr protection. ALC control is also afforded, and the ALC level can be displayed via the front-panel meter.

The TS-711A has its own self-contained power supply, and it gets fairly warm with use but never hot. A cooling fan will engage after lengthy transmissions—usually on FM—and disengage when the temperature drops below a certain point. Provision has been made to connect an external supply if you wish to go portable. Other connections can be made for your CW key, headphones, external speaker, and an external standby switch—presumably for a footswitch when in CW mode. There is no front-panel TX/RX switch; I find this a bit of a nuisance, especially when doing performance tests or tuning up amplifiers.

Kenwood has provided one accessory jack for interfacing with RTTY for AFSK operation

(ACC1), and the connections are quite clearly spelled out in the manual. Kenwood also identifies an ACC2 jack in the owner's manual which is intended for a computer interface. However, the knockout on my unit where ACC2 would go was filled by a plastic insert, leading me to conclude that you must buy the optional interface to obtain and use this connection. Either that, or the interface isn't available yet in the U.S. (A third possibility is that this particular unit just didn't have the jack installed!)

In actual use, the TS-711A is quite easy to figure out after you remove it from the box. The human engineering is quite good, although some of the less frequently used bells and whistles could have been pushed off to the side. As in all Kenwood transceivers, provision has been made for dial torque adjustment, but the factory setting was comfortable from the start.

I used the TS-711A with my Microwave Modules MML-220S power amplifier and a Cushcraft 32-19 Boomer, and right away noticed one BIG problem: no external amplifier keying jack. ICOM has been offering these for years on their 2-meter multimodes—so, how about it, Kenwood? I personally can't abide by rf VOX keying and prefer a hard-switched setup. It was no problem switching the Kenwood into transmit through its standby terminal, but I had to use an external sequencer to key both devices.

Receiver sensitivity is adequate, although not on par with many state-of-the-art transverters and the aforementioned IC-275A. On more than one occasion, I had to switch in an external GaAsFET preamp to pull out a weak SSB signal, especially during rapid fading. An outboard preamp would probably be a good idea for very-weak-signal work, but I couldn't recommend anything with more than about 10–12 dB of gain. A preamp exceeding that number will cause the 711A's front end to crunch up on strong signals (as will be shown in the test results).

Selectivity is very good, and I can't imagine too many situations on SSB/CW where you won't be able to pull out some signal from the QRM by using the RIT and i-f shift controls. Incidentally, there are no filter options for the TS-711A—what you buy is what you get. It would have been nice to have some sort of CW filter option at least.

Received audio reports were good, although I noticed a similarity with the TS-430S series HF radios, and that was that most operators preferred the audio of the MC-42 hand-held microphone over the MC-50/MC-60 base-station mikes. Reports ranged from "too much bass" to "mushy sounding." The MC-42 was clearly the winner here.

I really wish Kenwood would supply a microphone with their transceivers. Can you imagine how someone feels when they rip into the box, pull out a brand new TS-711A, and discover there's no microphone included? For Pete's sake, mark up the price a few dollars if you have to, but at least include the hand-held microphone!

Performance Review

Now take a look at Table 1. The receiver in the TS-711A got a pretty thorough going-over, as I was looking for dynamic range, compression data, and MDS. The transmitter was checked for power output, output adjustment, and displayed frequency versus measured frequency. The figures are about what I expected, and the 1-dB compression point of −1 dBm is about average for a GaAsFET.

Using an external preamp with the TS-711A might result in IMD products and spurious signals when strong local signals are present, making it very difficult to work weaker signals on nearby frequencies. The dynamic range is acceptable, again considering the use of a GaAsFET in the front end. Selectivity is fairly good. The output power level is sufficient to drive all of the 2-meter amplifiers currently on the market, and the low-power setting is handy for those amateurs using tetrode-type grid-driven power tubes, such as the 4CX250B. I should also mention that operation of the power output control is fairly linear.

Conclusion

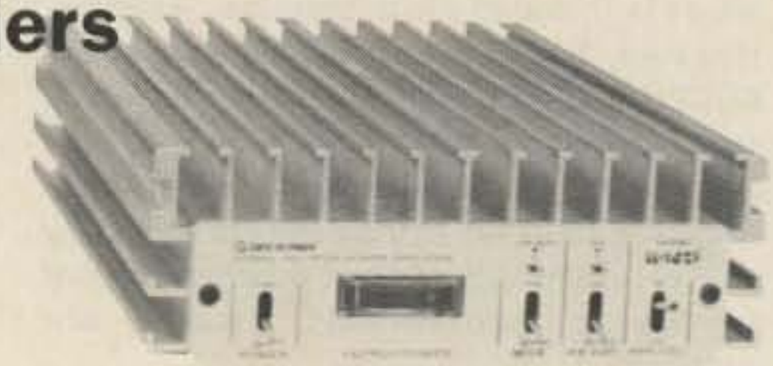
If you would like to add 2 meters to your present station with an all-in-one transceiver, you should consider the TS-711A. In general, it performs as well as any other 2-meter multimode on the market (with few exceptions), is easy to set up and use, and does offer some nice features in addition to the usual complement of bells and whistles.■

Tokyo Hy-Power Labs HL-22V and HL-102V 220-MHz Power Amplifiers

by Peter H. Putman KT2B

Encomm, Inc.
1506 Capital
Plano TX 75074

Price class: HL-22V $100
HL-102V $300



HL-22V *HL-102V*

With all of the increased interest in 220 MHz nowadays, it's nice to see that more and more of the major Japanese manufacturers are coming out with a wide range of products for the band, including handhelds, mobile radios, and rf amplifiers. This is somewhat unusual when you consider that 220 MHz is strictly a North American allocation. However, Kenwood, ICOM, and Azden recently had their investment in 220 MHz pay off when Novice 220 privileges were approved.

Now we have a new player. Tokyo Hy-Power Labs, a subsidiary of Encomm, Inc., has introduced two rf power amplifiers with built-in receive preamplifiers for 220–225 MHz. The HL-22V is designed to be used solely as a handie-talkie "booster" amplifier in the home or while mobile. It features a GaAsFET preamp and about 20 Watts output for a maximum of 2 Watts drive. The HL-102V can function in a base-station or mobile mode and will provide about 100 Watts output with a maximum of 25 Watts drive.

Out of the Box

The HL-22V housing uses the same extruded polished heat-sink design that THL has become known for. Controls are simple: a power switch and a preamp switch. Three LEDs provide indication of dc power, preamp on, and TX. Rear-panel connections consist of SO-239 connectors for your hand-held and an antenna, plus dc power leads. No provision is made for hard-keying of this amplifier. The unit is extremely small—3-7/8" x 1-3/8" x 5-7/8"—and can be slipped into a glovebox, under your seat, or wherever you want in your car.

The HL-102V housing also has an extruded aluminum heat-sink casing. This amplifier is considerably larger and measures 6-3/4" x 2-3/8" x 10-3/8", which is still small enough to fit under a car seat and of course a home station setup. Front-panel controls include a main power switch, a mode switch (FM/SSB) which sets the dropout delay on rf VOX keying, a preamplifier switch, and a power-level switch which in this particular review model served no apparent useful purpose, as I'll mention later. LEDs display power on, RX preamp on, and TX. In addition, a meter is provided to show power output, but the scale is not very precise other than at the 60-Watt position.

The rear panel of the HL-102V features SO-239 input and output connectors, dc leads, and a four-pin connection for hard-keying on either a PTT ground line or "+" voltage. This is the same connector that Kenwood used to use for touchtone™ pad connections on their old TR-7400A series radios. On both of these amplifiers, the SO-239 connectors are of the single-hole type with a threaded barrel as opposed to the flange-type mounting (such as that used on Mirage amplifiers). I'd also prefer a Teflon™ dielectric in these connectors at this power level and frequency.

Inside

Now, let's look at the lineup of devices. The HL-22V employs one gain stage—a 2SC1946A running at about 10 dB. The RX preamplifier device is a 3SK121 GaAsFET (disk type) and the manufacturer claims about 20 dB gain from this device. The HL-102V employs a pair of 2SC2360 devices with a substantial internal resistive pad that dissipates 12 Watts (otherwise the devices would be overdriven). The RX preamplifier is a 2SK241 MOSFET, and again THL claims about 20 dB of gain in this stage.

On The Air

The HL-102V caused some problems for one of my driving sources, a Microwave Modules MMT 220/28 transverter which really likes to look into a 50-Ohm load most of the time. During on-air use, the transverter would actually go into oscillation even with the keying removed. Even after retuning the transverter, the condition cropped up from time to time, so I suspect that rf leaking back through the dc leads may also have caused some of the problem.

The HL-102V was connected from the MMT 220/28 to a KLM 220-14 yagi using conventional 9913 cable. The power source was an Astron RS-35A, which is more than adequate since the amplifier needs 16 Amperes maximum to work. Current draw on the HL-22V is much lighter at 3.5 Amperes maximum, and it was connected to a 7-element vertically polarized KLM yagi and driven by an ICOM 3AT with standard battery pack.

On-air reports about the HL-102V were satisfactory. No distortion of the SSB signal was reported by any listeners. Since I use hard PTT keying exclusively on VHF, I selected the FM mode for instant dropout to RX. (Note that this switch has nothing at all to do with linearity of the amplifier—just the dropout delay time constant!) I chose also to use the HL-102V as my 220 contest amplifier during the January VHF Sweepstakes and worked a number of interesting grid squares, with contacts as far away as Quebec and upstate New York giving good reports. Fortunately, the rf feedback problem didn't appear this time!

The HL-22V found use as a booster amp

HL-102V

Specification	Measured	Claimed
Preamplifier Gain	10 dB	20 dB
Preamplifier 1-dB Comp.	−6 dB	N/A
Preamplifier 1-dB Gain BW	210–230 MHz	N/A
Max. Transmit Power (Output / Input)	100 W / 25 W	110 W / 25 W
Current Draw	16 Amperes	16 Amperes
Input Vswr	Less than 1.1:1	N/A

Table 1. Performance data for the HL-102V amplifier.

HL-22V

Specification	Measured	Claimed
Preamplifier Gain	14 dB	20 dB
Preamplifier 1-dB Comp.	+5 dB	N/A
Preamplifier 1-dB Gain BW	215–235 MHz	N/A
Max. Transmit Power (Output / Input)	20 W / 2.5 W	20 W / 2 W
Current Draw	3 Amperes	3.5 Amperes
Input Vswr	Less than 1.1:1	N/A

Table 2. Performance data for the HL-22V amplifier.

from the shack for my occasional forays onto local 220 repeaters and 223.50 MHz, and other than reports of increased signal strength, no unusual comments were made by listeners. It's been my observation that most of these small HT booster amplifiers are very reliable and tend to sit quietly in the corner doing what they are told, day in and day out, without a fuss. The HL-22V was no exception as it is truly a set-it-and-forget-it unit to be buried in the car someplace.

Come Here, Igor

Off to the laboratory! The test lab setup was an H-P 608F generator, Boonton 92 millivoltmeter, and Bird 43 wattmeters with 5C, 10C, and 100C slugs. The power source was a Sorensen 20-Amp rack-mount supply, and I used a Bird 600-Watt dry dummy load for transmit tests.

Take a close look at some of the numbers in Tables 1, 2, and 3. First of all, the 1-dB compression point of −6 dB on the HL-102V is terrible. I'm pretty surprised at this, considering the design, and must conclude that the particular device used in this amplifier must have been a fallout! A well-designed preamp ought to have a compression point close to 0 dB or better. Happily, the numbers are much better on the HL-22V with a +5-dB compression point, and this preamp offers good performance with 14 dB of clean gain.

Both units are reasonably broadbanded on receive and on transmit. The HL-22V runs somewhere between 9 and 10 dB of gain on transmit, while the HL-102V is cooking along at about 7 to 8 dB, and the variance in the latter amplifier is no doubt due to the nonlinearity of the input resistive pad at different power levels. I was able to get about 25 Watts out of the HL-22V, but it took over 3 Watts to do it, so consider it saturated at 2.5 Watts drive. Under no circumstances could I get more than 100 Watts out of the HL-102V, even with 30 Watts of drive, so it definitely saturates at about the 25-Watt input level.

Now, to get to that HI/LO power-level switch. According to the owner's manual, this switch drops the output to about half in normal service. In actual service, however, with 20 Watts of drive applied, flipping this switch to LO resulted in the power output dropping from 90 Watts to 32 Watts. With 15 Watts of drive, the output fell from about 75 Watts to 22 Watts. This, in effect, cuts the gain to about 1.5 dB and essentially takes the amp out of the line! I suspect that the resistive pad that is switched in here is too large, and a value should be recalculated to drop the output by perhaps 3 dB instead of almost 6 dB.

With the proper size pad, you would then be able to run, say, 100 or 50 Watts out for 25 Watts of drive, and 60 or 30 Watts out for 10 Watts of drive. This might be useful if you intend to employ a grounded-grid amplifier such as the 8874 or 8877 type, as these would result in output level variations from 400 to 1,000 Watts with such an amplifier. This, of course, would result in less overall dc power consumption from your outboard supply, which could be handy at times.

The heat sinks in both amplifiers are adequate; the HL-22V more so. Sustained contest operation on CW and SSB resulted in the case of the HL-102V getting quite warm but not unbearably hot to the touch. It does not appear from the schematic that either amplifier incorporates any form of overtemperature protection, so be sure to allow sufficient ventilation wherever you install them—a good idea anyway. I'd like to mention also that THL has used a high-quality 50-Ohm Tohtsu coaxial relay in the HL-102V, unlike some manufacturers who insist on using dc-type relays to save a few bucks. It's worth the extra money at 220 MHz and above—believe me.

HL-22V	HL-102V
0.3 / 1	1 / 6
0.5 / 3	3 / 20
1 / 9	5 / 36
1.5 / 15	10 / 60
2 / 18	15 / 76
2.5 / 20	25 / 100

Table 3. Transmit linearity (Input / Output) measured at 223.50 MHz.

Conclusion

If you are looking for an alternative to the limited supply of 220-MHz amplifiers, the HL-22V or HL-102V might be for you. Both are rugged units that fill the 20-Watt and 100-Watt gaps nicely. The preamplifier in the HL-22V works exceptionally well and is ideal for a high-density rf environment. The HL-102V preamplifier didn't make the grade, but I have to believe the unit I tested was just plain defective. (It's something you may wish to follow up on with Encomm if you are considering the purchase of this amplifier.) For more information on Tokyo Hy-Power amplifiers, circle number 201 on your Reader Service card. ■

OPTOelectronics 1300 H Frequency Counter
Wenzel Associates Counter-Mate Frequency Standard

by Peter H. Putman KT2B

OPTOelectronics, Inc.
5821 N.E. 14th Avenue
Ft. Lauderdale FL 33334
Price class: $150

Wenzel Associates, Inc.
11124 Jollyville Road
Austin TX 78759
Price class: $350

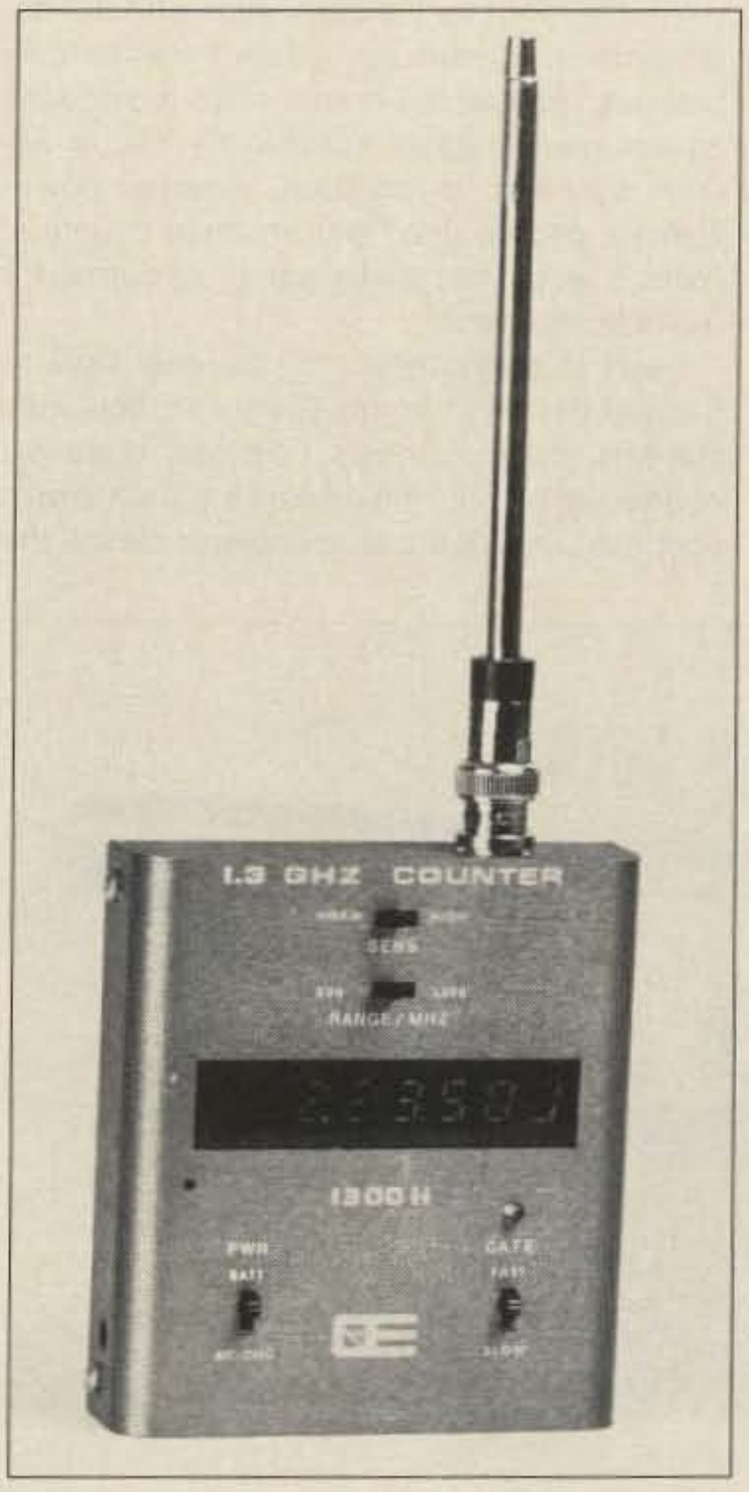


Photo A. OPTOelectronics' 1300 H hand-held frequency counter.

Here are a couple of interesting products you may find of use around your shack. The first, OPTOelectronics' 1300 H hand-held frequency counter, would be of interest to the VHF/UHF enthusiast, as it covers up to 1300 MHz with two sensitivity ranges and a whip antenna. The second, Wenzel Associates' Counter-Mate Frequency Standard, is an oven-regulated, crystal-controlled source of rf at 1 and 10 MHz with external dc supply.

1300 H

The 1300 H counter is small. With dimensions of 4" x 3.5" x 1", this unit was intended to be used in the field to make quick frequency checks, but it also serves well in the laboratory. (An accessory carrying case is available, but there's no hole for the accessory whip antenna should you wish to use the counter in inclement weather.) The 1300 H is actually the top-of-the-line product in a range of portable counter models, including the 1200 HKC (1200 MHz, kit form) and 1200 HC (1200 MHz, wired), and runs off rechargeable NiCds or the included ac power supply/charger.

The whip antenna is an option, as is a 50-Ohm terminated probe. Both sell for less than $20 each, so if you plan to do a lot of measurements in the lab, I'd spring for the pair. OPTOelectronics claims "excellent sensitivity" for these units, with levels of 3–50 mV from 10–1000 MHz being typical. I decided to check for myself using a signal generator and came up with the numbers in Table 1.

It's apparent that the greatest use of the 1300 H is from about 50 MHz to 400 MHz, for

Measured Frequency	LO Sensitivity	HI Sensitivity
10 MHz	−23 dBm	−23 dBm
30 MHz	−28 dBm	−29 dBm
50 MHz	−32 dBm	−37 dBm
100 MHz	−36 dBm	−39 dBm
150 MHz	−34 dBm	−40 dBm
200 MHz	−31 dBm	−44 dBm
250 MHz	−28 dBm	−40 dBm
300 MHz	−26 dBm	−41 dBm
350 MHz	−24 dBm	−38 dBm
400 MHz	−21 dBm	−31 dBm
450 MHz	−17 dBm	−25 dBm
902 MHz*	−6 dBm	−6 dBm
1296 MHz*	+6 dBm	+2 dBm

*These measurements were made using an HP-608F generator and a Boonton 92 rf millivoltmeter—except at 902 and 1296 MHz, where precision QRP wattmeters and attenuators were used.

Table 1. OPTOelectronics 1300 H counter measured sensitivity.

after this point the sensitivity drops off rapidly. For reference, a level of −25 dBm is 9 millivolts and −40 dBm is 2 millivolts. Sensitivity at 902 and 1296 MHz falls off so much that you will have to use a source of rf at better than 100 millivolts to get a reading to lock up. This still would allow measurement of low-level mixer and oscillator stages running in the high microwatt range, and, of course, hand-held radios and transverters can also be tested with ease.

There are two selectable gate times—.25 seconds and 2.5 seconds—that allow resolution to 1 kHz and 100 Hz, respectively. OPTOelectronics claims accuracy to be about ±1 ppm (±.00001%). As I couldn't verify this claim without a very accurate VHF frequency standard, I'll have to take their word for it. The display is an eight-digit, red LED-type with decimal-point indication at the MHz mark.

Counter-Mate

The Wenzel Associates Counter-Mate Standard is claimed to be very accurate, but I couldn't use it with the 1300 H since it generates a 5-V-rms square wave at 1 and 10 MHz. The 1300 H read this 10-MHz signal at either 20 or 30 MHz depending on the mood it was in, and this isn't surprising considering that a square-wave signal of this nature will be rich in harmonics. It does make the Counter-Mate a very strong 1-MHz marker generator!

The Counter-Mate contains a sophisticated scheme using a third-overtone, 10-MHz crystal in an insulated copper oven. This oven in turn is maintained at a high temperature to minimize ambient temperature effects, and a precision 50-turn trimmer can be accessed for recalibration. (Wenzel strongly suggests that you have them do the calibration and the determination of your aging rate between calibrations.) Frequency-divider chips provide the square-wave outputs suitable for TTL or 50-Ohm systems. In addition, external power splitters can be used with multiple counters. (With 5 volts rms, that's plenty of output for multiple counters!)

I was able to connect the Counter-Mate to the 10-MHz input on my Ramsey Electronics 600-MHz counter. In fact, I'd probably leave it connected most of the time as a standard on a scope as well. Wenzel Associates claims the aging to be less than .03 ppm/month after one week of operation, so it is certainly more stable than, say, the 1300 H counter, which ages at the rate of .1 ppm/month. You'd expect that kind of stability with a proportional oven, however. Retrace (the ability to come up to the same displayed output again and again after power-up cycles) is rated within .01 ppm of the previous frequency after 60 minutes, based on a 24-hour downtime.

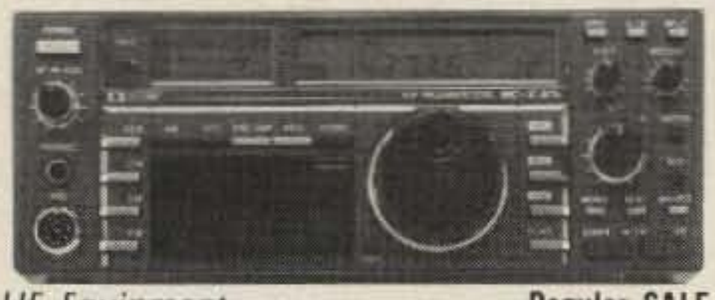
This means that if you plan some very precise measurements, turn the unit on about an hour before you plan to start. Indicators on the front panel display power ON and READY (when the oven has reached its correct operating temperature—not when the crystal has stabilized). If you plan to use the 1-MHz output as a calibration source for HF radios, use a large attenuator, say, 10 dB; otherwise, you may overload the front end. The harmonics are strong enough right up through 50 MHz for precise calibration work.

Conclusion

Both the 1300 H and the Counter-Mate are useful additions to the shack, especially the former unit, which lends itself nicely to field-testing of all kinds of VHF radio equipment. The latter unit would find more use with those engaged in precision measurements, but it's kind of nice to have such a standard if you use frequency counters or oscilloscopes in your station.

Reader Service numbers: OPTOelectronics, 202; Wenzel Associates, 203. ■

Photo B. Wenzel Associates Counter-Mate frequency standard (top) hooked up to a Ramsey frequency counter.



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Heath HW-99 Transceiver

by Errol Naimon KA9HCC and Patty Naimon KN2F

Heath Company
Dept. 011-442
Benton Harbor MI 49022
Price class: $300

Enter Heath's latest Novice transceiver, the HW-99, complete with an integral power supply and a solid 50 Watts on 10, 15, 40, and 80 meters. The rig is solid state and ruggedly designed, and should see years of trouble-free service. The minimal controls will simplify life for the Novice, but will utterly frustrate just about anyone else.

The front-panel controls consist of a power on/off rocker switch, a four-position rotary band switch, a large tuning dial, a volume adjust for output to speaker/phones, and a level adjust which varies the drive to the transmit amplifier chain. The level control is functional only up to the nominal 50-W output limit, provided that output vswr is low; otherwise, an automatic-level-control (ALC) circuit derived from a directional coupler at the output of the transmitter overrides the front-panel level control and cuts back the transmit drive.

A 10-segment LED bar graph is used to display receive signal strength relative to a no-antenna (all segments off) condition. In the receive mode, the display source is the agc detector tapped off the i-f amp. In transmit, the display is driven by a relative power amp which obtains a voltage from the ALC pickup, the directional coupler. No tuning controls are provided since the PA is a broadbanded linear and no tuning is necessary.

The forward and reflected components are summed at the output of the coupler. If either forward or reflected power (or both) increases, so does the display indication; hence, a greater number of lights on the display does not necessarily mean more power out. Operating into a high vswr load can easily light up the whole bar graph, giving the illusion of higher power output even though little or none is actually getting out.

The transceiver is executed on three single-sided boards: an oscillator board, a transmit/receive (T-R) board, and a power-amplifier (PA) board. Single-sided boards for rf kits have characteristics worthy of note for the uninitiated. On the plus side, they are less costly. The components are usually more spread out (i.e., less dense) than double-sided or multilayered boards to make room for more routes, since almost all of the tracks must be crammed into a single layer.

This allows for simpler kit building and troubleshooting. Most of the components are easily accessible, and the chances of shorting something while poking about are reduced since those pesky traces and pads are hidden on the less-accessible underside of the board.

On the other hand, since the traces are all on one side, they necessarily are arranged more densely even though the components are more spread out. Inevitably this means that many traces and pads at substantially different dc levels will end up adjacent to each other, increasing the probability of a catastrophic solder bridge during construction. Equally detrimental is the loss of a ground plane which would improve amplifier stability and harmonic suppression by providing an ultra-low impedance/inductance return for supply current as well as an effective shield.

Building the Kit

Construction of the kit is straightforward although not necessarily simple. Take the time to familiarize yourself with the instructions. No fewer than 10 (count 'em . . . 10!) double-sided pages of instruction-manual changes are included. To avert disaster, read over the changes carefully and enter them all in the manual. Don't delude yourself into thinking that just by having the errata handy you will catch all of the goofs . . . you won't! And do this *before* beginning construction, not as you go along.

The time estimate for completion of the kit as given by Heath is 16 hours. It took me about twice that to complete the job, and a good deal more time to track down the ouches.

Oscillator Board

This is the largest board and the simplest to construct. I recommend that L218 be installed before capacitors C269 and C271–C274 to make it easier to push L218 lugs into the board.

T-R Board

This is somewhat smaller than the oscillator board, but it is more densely arranged and contains a number of hand-wound transformers and inductors which no doubt will prove challenging to the novice kit builder. Carefully note the position of the color dots and notches on rotary switch SW101 in the instruction manual *changes* or you will be lost in space later. Expect a battle from D123 and D124 as the leads are just barely small enough to be inserted into their designated circuit-board holes.

Before building this board, check for a foil-to-foil short to ground at the junction of C134 and C137 (about the middle of the board). My board *was* shorted there after construction. I thought it was a solder bridge, but after removing all of the components in that section and meticulously cleaning all the solder off that part of the board, it still showed a dead short. A trusty X-acto® knife made "short" work of the problem.

PA Board

The power amp board is the smallest but not the least challenging. Several hand-wound transformers make construction interesting. A special word of caution concerning the broadband output transformer T304: Bare wires are soldered to printed-circuit-board (PCB) pieces to serve as leads to connect the transformer to the PA board. Make sure that no part of these wires protrudes over the top of transformer PCB ends, since there is almost no clearance between the transformer and the PA shield. A sharp edge of a wire will easily penetrate the paper insulator on the PA shield and potentially short the 30-V supply to ground. You may wish to check up on that situation with an ohmmeter following installation of the PA board.

The Chassis

The ac wiring, 12-V supply, controls, and input/output jacks are all chassis mounted. Exclusive of the 12-V regulator (U1), the entire 12-V supply is mounted on a 7-lug terminal strip. With board-to-board interconnects here as well, this lug strip gets to be pretty busy, and, if difficulty arises, it is not easy to repair. Circuit-board mounting of this section would simplify life greatly.

A word of caution: Configured as it is, U1 is not blow-out proof. Output capacitor C12 (100 uF) has ample energy storage to destroy U1 should the *input* to U1 become shorted to ground. The schematic is somewhat deceptive at the 12-V supply. Circuit board ground and chassis ground are shown as isolated. In fact, they are made common in at least two places here: first at the center tap of T1's secondary (the red/yellow wire) and the tab of 3-terminal regulator U1.

The board-to-board interconnects are molex® terminals and are time-consuming to crimp without the proper tool.

Finally, the headphone jack is a mono jack. If you have stereo phones (who doesn't?) and don't fancy listening with just one ear, you either will need a mono/stereo adapter or you will need to replace J1 with a stereo phone jack and tie P206-1 (center conductor) to both left and right channel phone lugs.

Alignment

Following repair of all the boo-boos, alignment was a snap. Goofs: two diodes incorrectly inserted; three board shorts (two ours, one theirs); SW101 installed correctly, but shaft notch 180° reversed (see previous comments concerning instruction manual changes); bad

C246; L210 up in a glorious puff of smoke; and J1 soldered incorrectly (don't rely on the pictorial, 4-8, as it does not clearly show the lug hook-ups; you must rely on the schematic).

However, the manual calls for equipment that the average Novice probably doesn't have: a 10-MHz frequency counter and an rf wattmeter capable of measuring 75 Watts. Finding C246 bad would have been difficult without a scope, since rf voltages at the hfo are pretty low and would scarcely show up on the built-in rf detector. A 50-MHz scope came in handy here showing a beautiful low-level sine wave (on all bands) at the hfo side of C246, but only dc present at the hfo buffer side.

It may be of interest to note that resistance readings given in the manual were obtained using a Heath IM-5218 VTVM. The manual notes that readings taken with other ohmmeters (because of different measuring voltages and currents) may be considerably different. We found this to be true.

Don't rely on your Heathkit® store for replacement parts. I promptly ordered (paid up front) a list of all necessary replacement parts as none were in stock. I was told that a two-week lead time was typical. I then ordered the same (equivalent) replacement parts from the will-call desk of a local electronics wholesaler and subsequently picked up the parts three days later. It has been two months, and I haven't heard from Heathkit yet.

One disquieting feature I noted during alignment of the vfo and in subsequent operation thereafter was the lack of a positive end stop on the tuning vernier. The mechanical end stop is supposed to be created by the end of a semi-circular groove on the tuning dial within which ride two screw heads contained in the vernier assembly. It is difficult to tighten the vernier assembly sufficiently on the tuning dial to prevent the dial from slipping as pressure is exerted against the stop. This knocks the vfo out of calibration and puts you off frequency. Because you are on the easy end of a gear reduction, you may not even notice that an end stop has been encountered, and you will be merrily knocking your rig out of calibration repeatedly.

Operation

For a Novice sitting down to use a transceiver for the first time, the HW-99 would be one of the least intimidating radios to operate. With such a simple and uncomplicated front panel, there isn't much to adjust or misadjust. Heathkit understood the obvious inexperience and jitters that go along with those early QSOs. This basic rig will help the Novice to gain confidence as s/he enjoys those first contacts.

However, as the new ham gains experience, the realization will come that there are some features that Heath could have included that wouldn't have complicated the front panel too much. We've already discussed how easy it is to change the vfo alignment by dialing the tuning vernier past the end stop. A crystal calibrator would come in handy to help the operator maintain correct alignment or at least know how far off the dial is. It's always better to be sure of your frequency rather than to guess if your dial reading is accurate. As you gain new operating privileges by upgrading to a General-class license or higher, it will become more apparent that the dial may be 10–15 kHz off at one band edge—and the FCC frowns upon people who operate where they don't have privileges.

Another complaint is the lack of a meaningful meter. The 10-segment LED bar graph looks impressive (all those tiny red lights), but can be giving you misleading information. The manual cautions you to never turn the level control past a point where more than eight segments are lit. It explains that if you do, rf power output will not increase because the ALC circuit will automatically reduce the carrier level from the transmitter.

We checked this with a Bird 4410A wattmeter. The ALC worked as it should, but not at the indicated number of LED segments lit. For example, on 80 meters with seven segments lit, we measured 42 Watts output. We increased to 10 segments lit and obtained a peak power output reading of 58 Watts. As we continued to turn the level control, 10 segments remained lit and the power did cut back as it was designed to do.

On 15m, 40m, and 80m, the power peaked at 10 LED segments lit. On 10m, four segments lit was the maximum that would light and was the maximum power output. The maximum forward power we measured on each band was: 10m, 42 W; 15m, 71 W; 40m, 62 W; and 80m, 58 W. We also found the level control to be very touchy. It didn't take much of a turn to dramatically increase/decrease power output.

The tuning dial is marked in 5-kHz increments and numbers indicating frequencies are every 50 kHz. Markings every 1 kHz and numbers every 10 kHz would have been nice.

One problem that I've encountered has to do with the volume control. For most QSOs, it's fine. But when you're listening to a strong signal, it doesn't turn down far enough. More than once, I've been blasted out of my headphones because of this. (Or, if you're using the speaker, the sleeping kids could get blasted out of their beds.)

Being a radio designed for the Novice, it doesn't have 20m, nor does it have the WARC bands. Adding the capability of having those bands would have necessitated extra circuitry (obviously) and may have meant using double-sided circuit boards. Since the object of this radio was to give the Novice a good start in amateur radio, to keep the kit building as easy as it could be, and to keep the price down, it probably isn't reasonable to expect it to include the other amateur HF bands. Nor is it reasonable to expect lots of other features that are found on more expensive HF rigs. This is a good, basic HF transceiver.

Conclusion

Using the HW-99 was fun. The receiver was clean sounding and sensitive. Most of the comments I received about the transmitter were good. Some of them were "Rig sounds great," "Doing a good job," "You can be proud of it," "Sounds FB to me," and "Very good."

On the whole, the rig is a well-conceived, straightforward piece of work. An experienced builder will not be at all intimidated by it. The first-time builder probably will be. In use, with a good antenna, the rig performs admirably with minimal fiddling, no doubt much as the designers at Heathkit had imagined. The lack of adjustment and meaningful information about power output or state of tune given by the rig are its biggest flaws.

For more information about the Heath HW-99 transceiver, circle number 206 on your Reader Service card.■

John Wood WA4BPI
1101 Little Elton Lane
West Memphis AR 72301

Dayton Digest

Put over 20,000 hams in one place at one time and what do you have? Come on along and find out.

There's just no getting around the fact that the Dayton, Ohio, Hamvention is a people event—for the people, with a crowd of more than 22,000 anticipated for the April 24–26 event, and by the people, with more than 300 volunteers on 31 standing committees to organize the event.

If you'd like to learn more about the 36th annual Hamvention—and perhaps be a part of the event amateurs around the world call "the center of the ham radio universe"—then take a few minutes to read this article. I'll show you how to turn your dream of attending the 1987 Hamvention into a reality!

"If you see a forum that you'd like to attend, give it priority because the forums come only once, while the buying and selling will be going on all weekend."

The Old and the New

Each year, I find the Dayton Hamvention to be a more interesting mixture of what's old and new in amateur radio and in consumer and commercial electronics. With some exceptions, the old can be found by browsing through the Hamvention flea market (which for 1987 is expected to hold more than 1,500 spaces), while the new will be residing inside the host structure, Dayton's Hara Arena. Here, 200 to 250 spaces are set aside for major exhibitors and their state-of-the-art products.

Whether you like the old or the new or a mixture of both, you'll get your chance to see and touch it all during 2-1/2-day run of the Hamvention.

Of course, there's more to the Dayton affair than just buying and exchanging equipment. Each year, the Hamvention offers a variety of activities including the banquet, forums on most ham radio topics (more than 40 in 1986), talks by the world's most famous and knowledgeable hams, FCC examinations, prizes, alternative activities, CW proficiency tests, and much more during the Hamvention weekend. You can see why hams who make only one hamfest a year travel to Dayton, the granddaddy of them all!

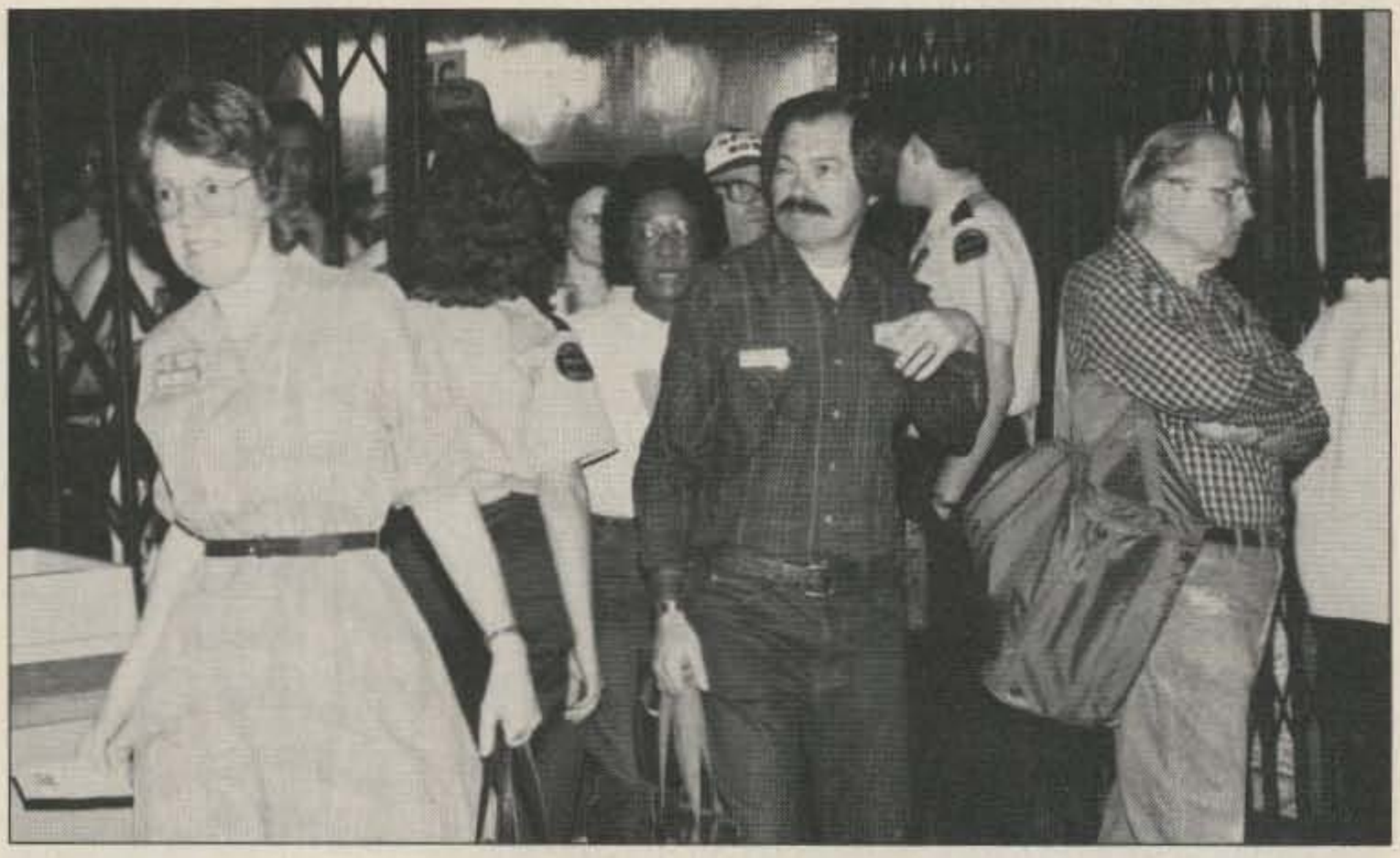

Photo A. The gates open and the crowd comes flooding in.

Planning Your Trip

I guess the first step on the road to Dayton is obvious—get with the gang and see who wants to go. To help them make up their minds, let them read this article and have someone who has attended a recent Hamvention come and talk about the experience. The ones who favor making the trip probably will have to arrange for time off from work if travel days are needed.

To help you stay within a budget, plan early and order your room reservations through Hamvention Housing, 1980 Kettering Tower, Dayton OH 45401-1980. Most area hotels and motels offer a special rate for guests during the Hamvention. Although no reservations are taken by telephone, you can get information about room rates and locations by calling Hamvention Housing at (513)-223-2612.

Covering Expenses

The average ham has most of his extra cash invested in his station, so here's a suggestion that could help defray the cost of your sojourn to Dayton.

The best way to raise funds at the Hamvention is to order a flea market space and sell some of your extra equipment. There are other advantages to having a flea market space. Having a piece of real estate at Dayton gives you a selling point as you gather your group together for the trip—they can sell their surplus also, and the space provides a focal point at which members of your group can gather between market raids and other events.

The charge for a flea market space has increased from $20 to $23; by dividing the cost among the members of your group, it is an expense easy to bear.

If the time required to man the booth is divided among the group members, each person gets the time to see the entire Hamvention.

Persons holding flea market permits and registration tickets can enter the flea market beginning at 8 a.m., Thursday, April 23, to set up in their numbered, assigned space(s). Selling officially begins with the opening of the flea market at noon, Friday, April 24.

Unfortunately, by this time of year all flea market spaces have been sold out for months–they're usually snapped up in the first couple weeks of availability. No secondary selling of flea market permits is allowed, so if you want to go this route, start working on some major advance planning for Hamvention '88.

If you have any other questions about the flea market, you can call the special Flea Market Hotline at (513)-223-0923. This phone is in the home of Flea Market Chairman John Grody WB8TEK and his wife, Cathy, so make your calls before 10 p.m. Eastern Time.

Photo B. You can't tell the players without a program.

Photo C. The big manufacturers strut their stuff.

What You'll See

Now that you've bought your tickets, it's only fair that I tell you a little about what you'll see at Dayton.

The first thing you'll notice is the crowd. Don't worry—the Hamvention organizers have prepared for this turnout, and it shouldn't inconvenience you unless you try to buy lunch precisely at noon or opt to get a free cap given away by one of the generous dealers. Here, the obvious tip is to eat lunch before or after the lunch hour to avoid wasting time standing in a long line.

And it is important to save time at Dayton if you are going to see all of the new amateur gear and take mental notes on the incredibly low prices.

For the last few years, I've been able to watch the price of 5-1/4" floppy disks fall to the bargain level, in 1986, of $6 for 10. This special was available on the first day, but after the dealers ran out, the bargain was gone. So keep in mind that bargains at Dayton don't stay around too long and when the price is low and the expected demand is high, the opportunity will be as limited as the available stock.

Keep in mind that handie-talkies are one of the hottest items sold at Dayton. If you see the one you've been yearning for at an acceptable price, ask the dealer how many he brought to the Hamvention and respond accordingly. Simply put, if he brought two and you want one, you'd best buy it now.

Other items can be handled differently. Say you're looking for a new low-band rig and you want to get the best price possible. Well, this is a big-ticket item and how new it is can affect how many the dealer brought with him. As a rule, the more expensive the item, the better chance you have of it being around on Sunday—the last day of the Hamvention.

So Sunday is the best day for getting a dealer's best price. Buy then (or try to get the dealer's Sunday price on Friday or Saturday), but don't forget to shop that price around the various dealers and see how they respond. After all, this is business and your goal is to get the best product for the best price. That's what they advertise, so make sure that's what they deliver to you.

Along with the dealers inside the arena, you'll also find a large selection of manufacturers who make use of the Hamvention to market their products and visit their dealers. They also are there to answer any questions you might have about their products, so if you are genuinely interested in purchasing, feel free to pick their brains.

This brings up another unique opportunity that presents itself only at Dayton. The chances are good that the person you're questioning about a product is a person who invented or developed it, not just a trained marketing representative. Brother, that's the best source for product information you'll ever have, and Dayton is where you'll find it!

The Weather

For the last three years, the Hamvention has enjoyed some of the best weather imaginable. Clear skies and warm temperatures have blessed the Hamvention and have lulled some attendees into a false sense of security, thinking that rain on Hamvention weekend is an impossibility.

Unfortunately, that's not the way the cold front crumbles. I've enjoyed the beautiful weather, but I've also kept a heavy coat handy for the cold temps and precipitation I've seen that can empty the flea market and

Photo D. Chet Lambert W4WDR personally makes over 10,000 friends at each Hamvention.

Photo E. Ahhh, the flea market. Four people look on as one man decides if he can afford to spend $1.25.

Photo F. "Yes, ladies and gentlemen, these are absolutely the latest in technology, just off the boat from Japan."

GENERAL INFORMATION

Hamvention Information—(513)-443-7720.
Flea Market Hotline—(513)-223-0923.
Housing Information—(513)-223-2612.
Flea Market Setup Day—April 23. Registration tickets and flea market permits must be shown together to gain admission to the flea market prior to opening.
Prices—Registration tickets are $8 in advance, $10 at the door; flea market spaces are $23; banquet tickets are $15 in advance, $17 at the door (*if available*).

CHECKLIST

☐Get the group together, see who wants to go, then figure on how many vehicles you'll need to make the trip.
☐Talk to the boss to arrange for the appropriate days off from work.
☐Secure room reservations for necessary nights.
☐Order registration tickets and flea market permits.
☐Save your money and gather the items you plan to sell at your flea market space(s). Bring twice as much money as you think you'll need. Be sure to convert cash to traveller's checks for your safety and convenience. Don't expect sellers to accept personal checks.
☐Make and carry a list of things you want to buy at the Hamvention.
☐Hit the road.

turn the inside of Hara Arena into an elbow-flattening crowd.

In a word, the weather at Dayton is changeable. So check your forecasts before departure, pack for the unexpected, and dress in layers like the outdoorsman so you can take off or put on clothing as the weather changes. Top off the layers with a waterproof jacket in case of rain or snow. (Yes, it does occasionally snow in Dayton in April; I've seen it.)

Arrival Time

You've done all of the planning and finally the big day is here and you are in the city of the Wright Brothers, Dayton, Ohio. What should you do first? A little orientation trip might be useful, so head for Hara Arena. Don't know how? Motor down I-75 to Needmore Road and exit west; turn right on North Main, then left on Shiloh Springs Road, and watch for Hara Arena to be on your right. Look around, locate the gates to the parking area and to the flea market, and go see where your flea market space is located.

Next, it might be a good idea to check into your motel room and, depending on the time, grab a meal or tour one of Dayton's two leading attractions—the Air Force Museum at Wright-Patterson Field (10 minutes from downtown Dayton) or the Dayton Museum of Natural History (home of the Dayton Amateur Radio Association Club station, W8BI).

Whatever you do on Thursday night, try to get a good night's sleep; you'll need all the rest you can get to survive the first day of the Hamvention! Opening time is noon, but you'll need to be there early to set up your flea market wares and maybe check out what your fellow flea-marketeers have brought to sell. Buying and selling is prohibited until the flea market opens, but it's great to spot the bargains so that you can come back and buy them later.

Once the Hamvention opens, enter the inside exhibits through the main doors of the Silver Arena and you'll receive a free copy of the Hamvention program which contains a complete listing of activities, including forums. Take a few minutes to look over the schedule, and if you see a forum that you'd like to attend, give it priority because the forums come only once, while the buying and selling will be going on all weekend. Closing time on Friday is 6 p.m.

On Saturday, the flea market opens at 6 a.m., while the inside exhibits open at 8 a.m. Both close at 5 p.m. to give all persons who plan to attend the banquet time to change and drive downtown to the Dayton Convention Center.

Speaking of the banquet, if you miss it you're missing a big part of the Hamvention. In 1986, Roy Neal K6DUE was presented the Amateur of the Year Award—just one of the awards presented at the annual event. We not only enjoyed watching the award presentations, listening to featured speaker Roy Neal, and eating a great meal, we also had a chance to get Senator John Glenn's autograph when he stopped by to congratulate his friend, Roy. That was an unexpected pleasure—but it was one of those lucky things that happen at Dayton.

On Sunday, the flea market opens as on Saturday, at 6 a.m., and the inside exhibits at 8 a.m., but the level of activity slows as the time nears for the drawing for unclaimed hourly prizes at 2 p.m. and the drawing for major prizes at 3 p.m. In 1986, the major prizes included a complete Kenwood TS-940S station, and ICOM IC-751A HF transceiver, a Yaesu FT-1 HF transceiver, and a Shackmaster 100 Station Controller—so if you feel as if you're due to win a prize, stick around!

Additional Activities

If I tried to write about all of the activities held in association with the Dayton Hamvention, I'd need all of the space in the magazine. But be aware that there are many alternative activities planned in a variety of interest areas.

Now that you know how to do it, let me give you a formal invitation to join me at the 36th annual Dayton Hamvention, April 24, 25, and 26, 1987. Get the gang together and come on along. You should have a most enjoyable time at "the center of the amateur radio universe." See you there!■

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QRP Antenna Farming

Your antenna can be the single most important factor in QRP success—W0VM plants the seeds for more efficient operation.

Nearly everything that has been written about QRP operation points out the need for having excellent antennas. For best results, a QRP "antenna farm" should have two or more antenna systems, and the operator should be able to switch from one antenna to any one of the others instantly. It is rather useless to dream about farms up on high hills with long-wire antennas supported by poles 100 feet tall and a rotating beam on top of a 100-foot-tall tower. Most amateurs have to make do with the space they have.

My friend Harry once lived in a small house on a very small lot. When asked about his antenna farm at that location, Harry wrote, "Over the years, I wore out the roof putting up and changing antennas. But the main antenna that got me WAC (Worked All Continents) was the vertical J on 20 meters—with 100 Watts maximum power. The antenna didn't 'do' much until I added the extra height so that the bottom of the 33-foot radiating portion was above the power lines going down the alley. Incidentally, those power lines were just 1/2 wavelength away from the 20-meter antenna. That last bit of height cleared the way for some good results. Press the key and they came back quite well."

Harry had to go up quite high to get good results. "There is no substitute for height" is one of his favorite and most repeated sayings. In front of Harry's house is a large tree. A wire 99 feet long runs from the shack up into the tree and out to the pole on the back of the house on which the vertical J antenna is mounted. The top of the pole is 52 feet above the ground. Another wire, 33 feet long, runs from the shack horizontally along the side of the house.

The transmitter's output is inductively coupled to a coil. One end of this coil is connected to the end of the 99-foot wire, and the other end is connected to one side of a large variable capacitor. The other side of the capacitor is connected to the shack end of the 33-foot wire that runs along the side of the house. With this arrangement, the antenna system can be tuned to resonance at any frequency in either the 40- or 80-meter band. Harry wrote, "This antenna was good for all U.S. coverage and all of Canada. Again, 100 Watts maximum dc input to the final stage."

Harry's small antenna farm proves several things: (1) It is important for an antenna to be up high and in the clear; (2) an antenna system should be tuned to resonance on the exact frequency being used; (3) good results can be obtained even if the area available for antenna construction is small; (4) the low angles of radiation provided by a vertical half-wavelength antenna help in working DX stations; and (5) it is a good idea to experiment with many different antenna systems until you have one that performs well.

"Antennas for QRP operation should have gain as compared to a half-wavelength dipole for the frequency in use."

Making Do With Space

If you have little space for antennas except straight up, you will be interested in designing good multiband vertical antenna systems and mounting them way up in the air, as high as possible. With more space, you could plan and build a better antenna farm, possibly using a multiband antenna that would work on 80, 40, and 30 meters and on the higher-frequency bands as well. You could also have a rotating beam antenna for 20, 15, and possibly 10 meters. (Someday, 10 meters will again be usable. Hi!) A tuned-doublet or center-fed-zepp antenna system would be ideal for use on 80, 40, and 30 meters.[3] For best results on 80 meters, the wires should be at least 66 feet each side of the tuned feeders.

If you don't have the space for 66 feet of wire each side of center, shorter lengths will work quite well so long as the length each side of the center is exactly the same. Also, in some cases, the ends of the 66-foot-long wires could be bent around and strung up at an angle to the rest of the wire.

So that the antenna system will work well on 80 meters, it is a good idea to make the wire lengths at least 35 feet each side of the center. In most parts of the United States, antenna wires running north and south are desirable so you can send best east and west. This north/south-running 80-meter tuned doublet, when used on the 20- and 15-meter bands, would have strong lobes extending northeast, northwest, southeast, and southwest.

With this kind of antenna located in St. Louis County, Missouri, I have made good contacts in Europe and eastern Asia on 20- and 15-meter CW. I have also made 40- and 15-meter CW contacts with European stations with the 1-Watt output of a Heathkit HW-8 transceiver.

If possible, a QRP antenna farm should have a rotating beam antenna for 20 and 15 meters (and 10 meters someday). At easily attainable heights of 25 and 30 feet (or less), a vertically polarized cubical-quad antenna will outperform a three-element horizontal beam.[4, 5] I worked YU5FAM in Yugoslavia with my vertically polarized quad with the 2-Watt output of a Heathkit HW-8 transceiver. This quad was fed with tuned feeders, and it loaded up and worked well on 15 meters also. For QRP operation, using tuned feeders is the best way to get the rf from the transmitter into the antenna.

Where space is limited, you could use a combination of vertical and horizontal elements or a vertical-slanter. If you have lots of space, you could try vee-beam or rhombic antennas aimed in favored directions. Low-frequency triangle or quad loops are other possibilities.[6, 7] The "Loop Skywire" antenna described in the November, 1985, issue of *QST* should be an excellent performer for QRP operation. All of these antennas should

be fed with tuned feeders for best performance in QRP operation.

Tuned feeders will also provide full-frequency, all-band coverage with fewer antennas than if coax feed is used. To obtain similar but less effective results with coax-fed antennas, four different antennas would be required: one for 80-meter CW, one for 75-meter phone, one for 40-meter CW, and one for 40-meter phone.

Even with four coax-fed antennas, the results would not be as good as those obtained with the one tuned-doublet antenna system because the tuned doublet can be tuned to *resonance* on *any* frequency on *any* of its bands. On 40 meters, the tuned doublet would have a gain of 1.8 dB as compared to either 40-meter coax-fed antenna. Furthermore, unless these four antennas could be located quite far from each other, they would interfere with each other.

Special Considerations

Antennas for QRP operation should have *gain* as compared to a half-wavelength dipole for the frequency in use. An 80-meter tuned doublet (center-fed zepp) has gain as compared to a dipole on all of the higher frequency bands. On 80 meters, it has some gain as compared to an 80-meter coax-fed dipole, both because it can be tuned to resonance at the *exact* frequency being used and because the feedline (open-wire or twinlead) has less loss than coaxial cable.

The old adage "If you can't hear 'em, you can't work 'em" is as true today as when the statement was first used. Having the ability to switch instantly from one antenna to another often makes it possible to hear a station after it fades out on the first antenna. To make use of antenna switching during reception, all of the antennas must be tuned to the frequency being used. When the station to which the operator is listening starts to fade, he can quickly switch to the other antennas and listen. He will use the antenna that brings in the station the loudest. This switching of antennas has saved many QSOs.

Incoming signals often change polarization, and this causes fading (QSB). Having one antenna with vertical polarization and another with horizontal polarization is useful for reception purposes. Having three antennas to which the operator can switch provides even more chances for good reception.

"If they can't hear you, they can't work you" is also true. Generally speaking, when operating QRP, it is a good idea to transmit using the antenna that has the most gain in the desired direction. A quick on-the-air check with the station at the other end can sometimes be used to determine which antenna should be used in transmitting.

For amateurs living in apartments or condominiums where no (outside) antennas are allowed, systems with gain as compared to a dipole are possible. NFØR has had antenna systems in the attic of his condominium. One of these consisted of two equal lengths of aluminum foil fed with tuned feeders made out of a good grade of twinlead. Another of his antennas was a tuned doublet with the ends of the wires bent around to fit the available space. NFØR has worked into Australia with 5 Watts of rf output using one of his attic antennas.

You should try out many different antenna systems until you find ones that will work well in your particular location. Get them up in the air as high as possible! I hope that this article will help you design, build, and use the best QRP antenna farm that your space will permit. ■

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The Cellular Phony Antenna

Okay, okay, it's a little bit vain to want a two-meter mobile antenna that looks like it's hooked up to a cellular phone—but this way you save $1200.

If you live in a U.S. metropolitan area, you've probably heard of "cellular telephone." Most cars that have cellular telephones sport a small black antenna with a "curly Q" phasing coil in the center. Mobile phones have been around for years, but this funny little antenna has become a status symbol. "Yuppie phone" is its nickname around these parts.

Well, no need to fret. No need to spend $1,200 for a cellular telephone. Your trusty 2-meter rig has been autopatching you for years. At the local 2-way shop, I found out that a couple of antennas have been sold to people who have no intentions of having a cellular phone, but simply want the antenna as a status symbol. Let's combine the two and create the ham radio "cellular phony" antenna that you can use on 2 meters.

Advantages

First, there is nothing like pulling up alongside a cellular-equipped Mercedes 280SL with your pickup truck sporting the same cellular antenna. It's almost like beepers. Remember when only doctors had them? Now the janitorial services carry them.

The second reason for sporting one of these antennas is that, if stolen, a cellular phone is difficult to get rid of since each one transmits a unique serial-number identification. As soon as the owner reports it stolen, the ID is locked out of the system and the phone is useless. Ham gear and CB rigs, however, can easily be used by someone else, so thieves will go after them. Also, some, if not most, of the cellular phones are locked into the mounting bracket very securely. Consequently, thieves will pass up the car with the cellular antenna. This makes the "cellular phony" antenna attractive to the 2-meter FM mobile user.

Finally, this particular antenna detaches at its base, so going through the car wash doesn't damage it. And it is black, which makes it almost impossible to see at night. You should consider this antenna as your next 2-meter FM mobile antenna.

Disadvantages

Yes, there are a few minor ones, which I will discuss. I want the neophyte ham to be able to learn from this article as well as have fun, too. For you antenna purists, you'll claim less than unity gain.

First, the antenna, being less than a quarter wave in length, actually becomes a loaded quarter wave. I do not have complex measuring gear to confirm my claim, but the surface area is virtually identical to a quarter-wave vertical. Its height is 16", which is a very good percentage of an 18-1/2" "full-length" quarter wave. After all, hams get good results with 8-foot mobile antennas on the low bands and with stubby ducks on VHF and UHF.

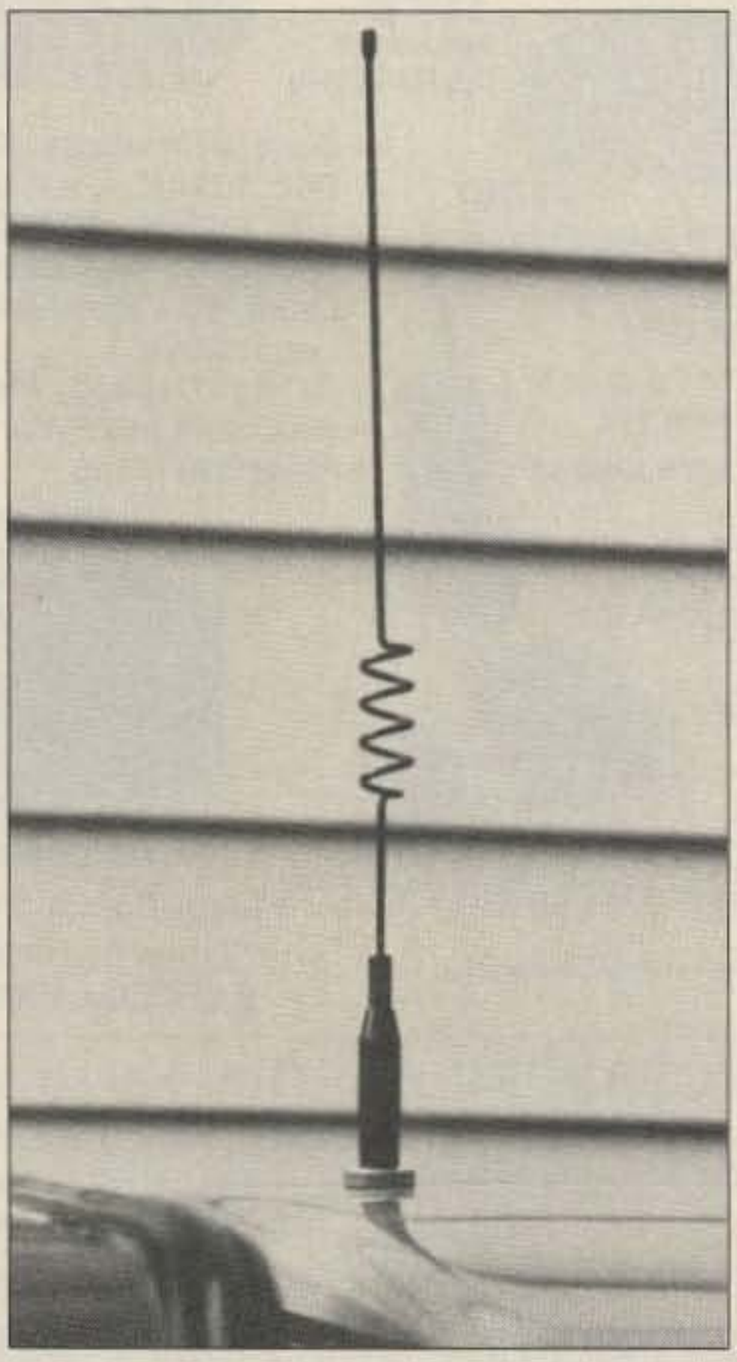

Photo A. The cellular phony antenna. Total length is 16 inches from tip to end of base.

Think of it in terms of an 80-meter vertical, which should be about 66 feet high. The "cellular phony" antenna is the same percentage of a quarter wave that a 55-1/2-foot vertical is of the 66-foot vertical. Many hams use antennas shorter than that on 80 meters and have excellent results.

Having a 16" high antenna on a minivan still gives you garage-door clearance. I have field-tested the antenna on distant repeaters, dead spots, and fringe areas and found no difference from a quarter-wave antenna.

The second problem is swr bandwidth. I found 1.4:1 swr at 144.00 and 148.00 MHz, with 1.2:1 at center band. Again, for you antenna purists, it isn't perfect, but it is totally acceptable.

Other antennas I have used are flatter and have greater bandwidth. The reason for this is that a loaded shortened antenna will exhibit narrower bandwith than a full quarter wave. The antenna did not exhibit a 1:1 "perfect" match because shortened antennas exhibit a lower feedpoint impedance; when fed with 50-Ohm coax they cause standing waves at the transmitter. With 1.4 on the band edges and 1.2 at center frequency, building a matching device is just not worth the trouble.

Finally, for a couple of dollars, you can buy a BNC adapter, which allows use of the antenna on most HTs. There also are adapters available for Antenna Specialists and Motorola bases if you currently are using one of those but wish to "upgrade" to a cellular phony antenna.

Mounting the Antenna

As you can see from the picture, this antenna is roof-mounted. A 3/4" hole must be drilled into the roof using a circular hole saw, which can be purchased at the local hardware store for about $6. ORA Electronics (20120 Plummer Street, PO Box 4029, Chatsworth CA 91313; 800-423-5336) also offers a

trunk-lip mount and an interesting new window mount that clips onto the top of a rolled-down window and is rolled into place when the window is closed.

The antenna has a TNC connector at its base. To adjust the antenna rod, loosen the Allen setscrew (located at the top of the connector) to remove the antenna, and then shorten the antenna to the required frequency. I had to remove about an inch from the antenna. This may vary in your application, due to such variables as type of mount or mounting position on the vehicle.

Pruning the Antenna

The out-of-the-box starting point showed the lowest swr at 142 MHz. That means that virtually whatever variation you choose, you should be able to prune the antenna to frequency. Like other quarter-wave antennas, a 1/4" cut resulted in moving the lowest swr *higher* by 1 MHz. After mounting the antenna, simply tune it by pruning it to obtain the lowest swr at 146.00 MHz. By using a synthesized rig, you can make plots of frequency versus swr and watch the antenna fall into place.

The best way to prune the antenna is to carefully scrape the black plastic coating off the antenna rod with a knife so that the Allen screw makes good connection with the rod. Use a triangular file to make a groove around the bare antenna rod, then snap the excess rod off with a pair of pliers. Reinstall the antenna rod on the TNC connector and tighten the Allen setscrew. Now check your swr and repeat the process if necessary.

My finished antenna measured exactly 16 inches from the tip to the bottom of the TNC connector after pruning, and the lowest swr occurred at 145.75 MHz. I also tried the antenna on the 440-MHz band: The swr was about 1.3:1 across 440 to 450 MHz—not as good a performance as I would have liked. I suspect a high angle of radiation, but nevertheless the antenna can be used on 440 for local or emergency communications.

Parts List

Item	Description	Part Number	Price
High-end cellular antenna mast	Black polynoxo finish, for use with any CMR series mounts or adapters	CMR-488	$19.00
Cellular antenna mount	Standard 3/4" hole mount with 16 feet of RG-58 coax, low-profile black finish. Accepts all CMR-type antennas	CMR-MT-311	10.75
Cellular trunk-lip mount	Adjustable angle design, made of stainless steel in black polynoxo finish. Comes with 16 feet of RG-58 cable. Accepts all CMR-type antennas	CMR-MT-540	18.00
Cellular window mount	Comes with 16 feet of RG-58 cable. Accepts all CMR-type antennas	CMR-MT-688	23.60
Antenna adapter	Antenna Specialist mount to CMR antenna	ASA85	5.00
Antenna adapter	Motorola mount to CMR antenna	MTA94	5.50
Adapter BNC to TNC	For mounting antenna on HTs	TNC98	1.80
Conventional PL-259 connector		PL259	1.10
Reducer for RG-58 coax		UG175	.40

Parts

I bought the antenna (called the "high-end cellular antenna mast") from ORA Electronics. Other cellular antennas may not work because different manufacturers vary their designs. In addition to the antenna, you'll need a base or an adapter. The three types of bases mentioned earlier are listed in the parts list along with the three adapters available. Finally, you'll need a PL-259 connector and a UG-174 reducer for the RG-58 cable, if you don't all ready have them in your junk box. ■

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Carencro LA 70520

Weatherproofed Antennas

KD5UJ shows you how to keep the elements out of your elements.

Most amateurs experience recurring problems with their antenna systems. Every summer most of us are pulling our antennas down because they're not working properly. By following the procedure which follows, you can eliminate this yearly ritual.

Where I work, technicians provide communications for the oil industry both on- and offshore. It's not unusual for an antenna system that we put out on an offshore platform to operate successfully for more than three years without requiring *any* maintenance.

These repair/installation instructions assume that you're working on an aluminum antenna that requires assembly, such as a beam or a vertical. (Some of these suggestions will be helpful when working with wire antennas also.) If you're dealing with a new installation, the first thing you need to do is install the connector on the feedline. Since most amateur antennas require UHF connectors and most amateurs use coaxial cable, your installation will make use of PL-259 connectors.

Strip 1-1/8" of outer insulation off the cable (see Fig. 1), being careful not to nick the braid. Tin the braid, but don't overheat it. Overheating will make the insulation bubble out, making soldering to the connector difficult. After it is cool to the touch, use a sharp knife and strip the braid and inner insulation off, leaving approximately 3/8" of braid exposed. Be careful not to nick the center conductor. Tin the center conductor and slide the coupling ring onto the cable. Screw the connector body onto the cable, being careful not to damage the outer insulation.

At this point, trim the center conductor even with the end of the connector body. If your connector body is chrome-plated, use a knife to scrape around each hole to get a smooth solder flow. If it's silver-plated (dull silver), scraping isn't necessary.

Solder the braid to the connector body through the holes on the connector body. (Be sure solder drops through the holes.) After the connector cools, solder the center conductor to the connector body. Use an ohmmeter on its highest scale (R x 10,000 or higher) to ensure that no continuity exists between the center conductor and the shield.

If you are repairing an existing installation, perform the resistance check on your feedline to determine if replacement is necessary. Make sure both ends of the feedline are disconnected prior to performing the check.

If you're rebuilding an antenna, you will need some 200-grit wet/dry sandpaper to clean off the corrosion. For a good electrical connection take extra care where sections of the antenna connect. Soak all hardware in WD40 and clean it with a wire brush. Replace any pieces that show excessive corrosion.

After cleaning the old antenna, or prior to putting the new one together, you will need to protect it from corrosion (and from icing over, for those living in the winter wonderlands). To do this, saturate the antenna with CRC 2-26 or another similar product and allow it to dry for about an hour prior to assembly. After assembling the antenna, respray it liberally with the CRC 2-26.

The next step is by far the most important. This is where most antenna failures occur—connecting the feedline to the antenna. If you are using UHF connectors (PL-259, SO-239), then you need to get a tube of clear (*not white*) silicone heat-sink compound (Z5 compound). Fill the hole in the female side of the connector with this compound.

Screw on the male side of the connector until it's hand tight. Then use a pair of channel-lock pliers to turn the connector an extra 1/4 turn. Be careful, since you can damage the connector by over-torquing. If you are using N-style connectors, *do not* put silicone in them! They have no free space inside them, so using silicone can cause damage or distortion. Clean any excess silicone off the cable and connector.

After connecting the feedline to the antenna, you will need to waterproof it. Start with a good-quality electrical tape such as Scotch 88T. Tape the connector, overlapping the layers at least 50 percent of the tape thickness, and continue taping down the cable approximately 4–6 inches past the connector.

Next, liberally coat the taped connector with Scotch Kote™—don't use commercial antenna wrap, as it is messy and hard to apply and you can't be sure there are no cracks or air bubbles in it. Allow the Scotch Kote to dry about 10–15 minutes, then retape the connector and again coat it with the Scotch Kote. This substance won't come off, and the better you tape and Scotch Kote your antenna, the longer it will last.

If you're building wire antennas, you should tape and Scotch Kote the point where your feedline connects to the legs of the dipole, vee, or sloper.

After mounting or remounting your antenna, you should be able to sit back and enjoy your antenna system. The only maintenance I would suggest, for those whose installations permit, would be to liberally spray the antenna with CRC 2-26 approximately every six months. This will ensure protection from corrosion and help maintain electrical continuity between the sections. ■

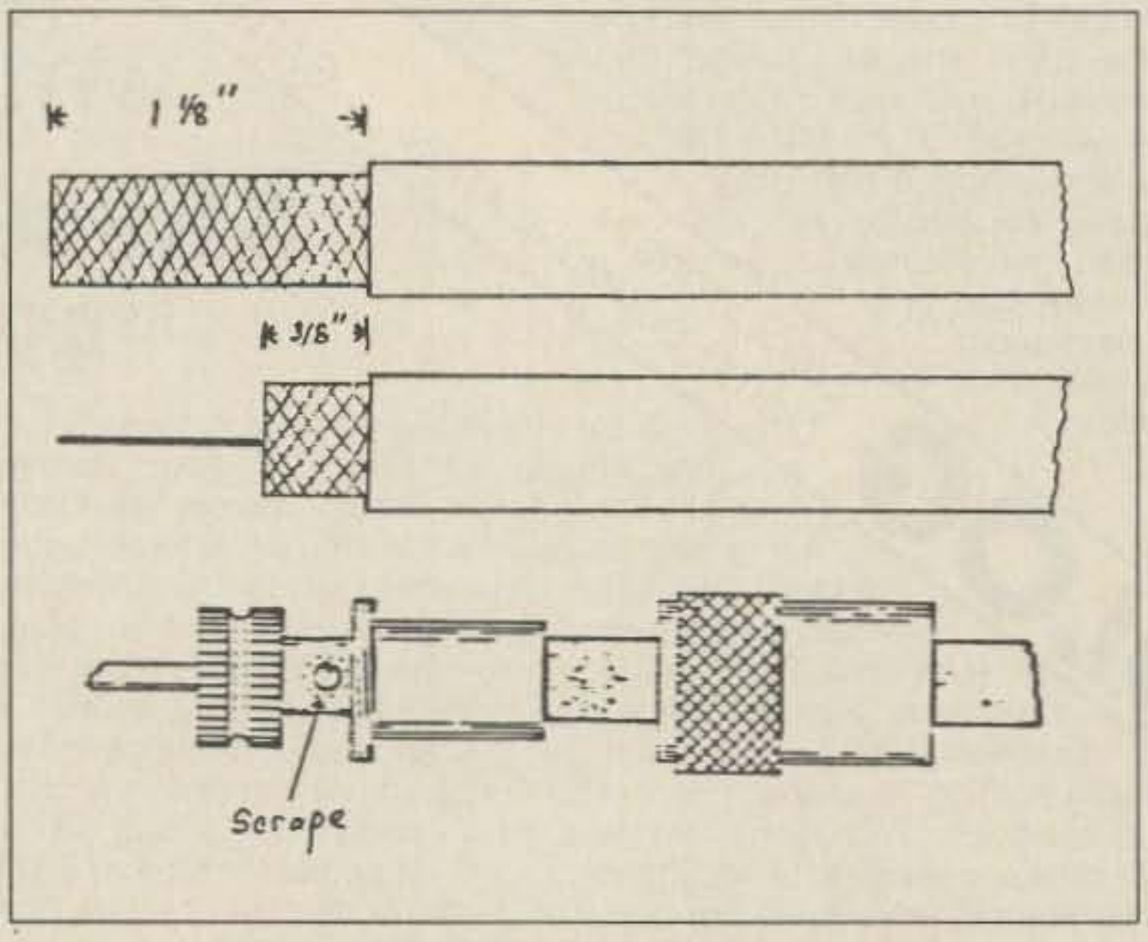

Fig. 1. Installation of a PL-259 connector.

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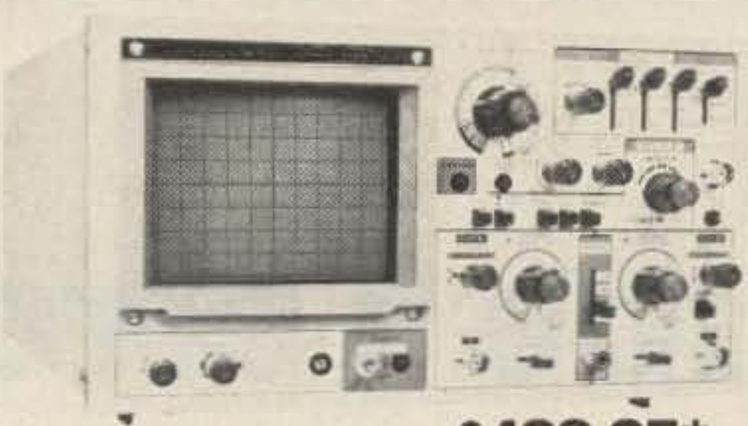

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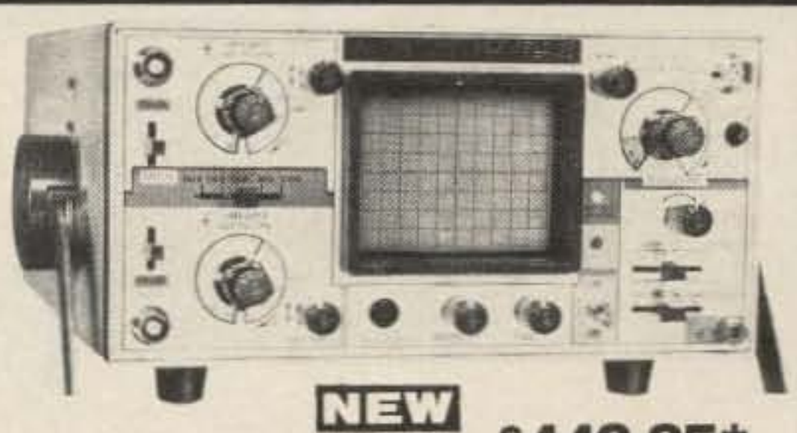

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CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	<25mv @ 50 MHz <15mv @ 500 MHz <100 mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
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Tube Terror

Will the vacuum tube thermionic generator change the world as we know it? Probably not.

The chill of the gritty concrete floor against the side of my face roused me to consciousness. I was lying, I gradually realized, on my side in a dimly lit place.

My knuckles brushed against metal as I sat up. An arm's reach away, a steel beam protruded vertically from the floor. A dust-coated cardboard carton sat next to the beam.

I looked around. I was in a warehouse, I discovered, the largest warehouse I had ever seen. The aisle I was in vanished in the dimly lit distance, bounded on either side by row after row of cartons resting on steel shelving.

I looked up. The nearby steel beam went up and up, disappearing into a smoky haze. I couldn't see the ceiling, the source of the dim light, or the tops of the stacks of cartons.

There was writing on the cartons, I noticed. The closest one read "1B3-GT"; across the aisle, another carton read "1D5-GT." Vacuum tubes? What was I doing in a warehouse full of vacuum tubes?

I became aware of a shadowy, robed figure standing a few yards away. "Who are you?" I muttered. "And what am I doing here?"

The figure lifted an arm and a bony hand protruded from the sleeve of the robe. "I am the Spirit Of Radio and you are in the Warehouse Of Tubes Past. Before you can leave, you must find an application for every tube in the warehouse."

A rising tide of panic gripped me. "You can't be serious—nobody designs with tubes these days!"

"You must or you will never leave," the spectral figure whispered. The hood fell away and, instead of a face, I saw the screen of a cathode-ray tube bearing the image of Lee DeForest, inventor of the triode.

"Before you can leave, you must find an application for every tube in the warehouse."

I gasped and ran—down the aisle past the 2CY5s, the 3V4s, the 5U4-GBs, the 6A7s—chased by the shadowy figure. A protruding carton of 6L6s tripped me and I fell headlong . . . the floor melted beneath me . . . .

I woke up on the sofa, an opened copy of the 1957 *RCA Tube Manual* resting on my chest. It was just a bad dream.

* * * * *

What follows is probably the last conceivable application of the vacuum tube. Certainly, all the obvious uses for tubes have been exploited. Why, once upon a time, clever people built transmitters and receivers and even computers using vacuum tubes!

But it occurred to me that a tube is more than just an amplifier, an oscillator, or a rectifier. It's also a power source.

A number of years ago, a device called the "thermionic converter" was invented. It consisted of a source of electrons and a collector. The electron source was made of an element that "boiled off" electrons when heat was applied. The collector gathered the electrons and delivered them to the circuit to be powered.

The heat source, as I recall, could be anything from a solar collector to waste heat from an industrial engine as long as the source's temperature was 800 degrees Kelvin (or greater) for reasons of efficiency.

Okay, so what's a vacuum tube but a source of electrons and a collector, all neatly packaged in an easy-to-use form—with a built-in pilot light, even?

I dragged out a carton of tubes and rummaged through them until I found a 6W4-GT, a television damper diode. The transformer junk box yielded a 117-to-6.3-volt filament transformer and, with the aid of some clip leads, I breadboarded the circuit of Fig. 1.

I waited impatiently for the 6W4 to warm up, and attached a digital voltmeter. The open-circuit voltage delivered by the tube measured 3.35 volts polarized as shown (plate negative, cathode positive). Remember, the tube's plate is acting as an elec-

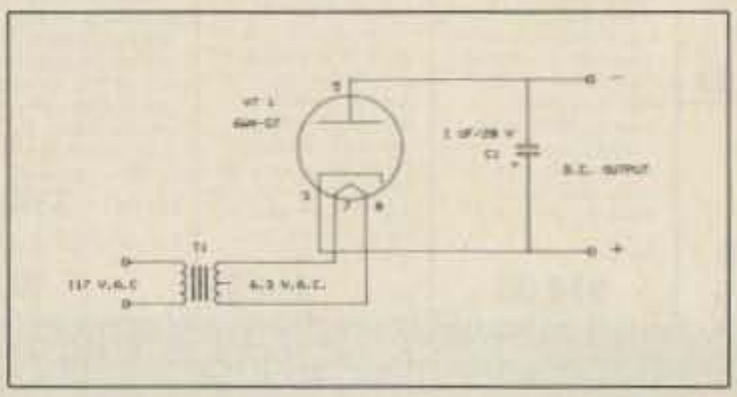

Fig. 1. The first circuit.

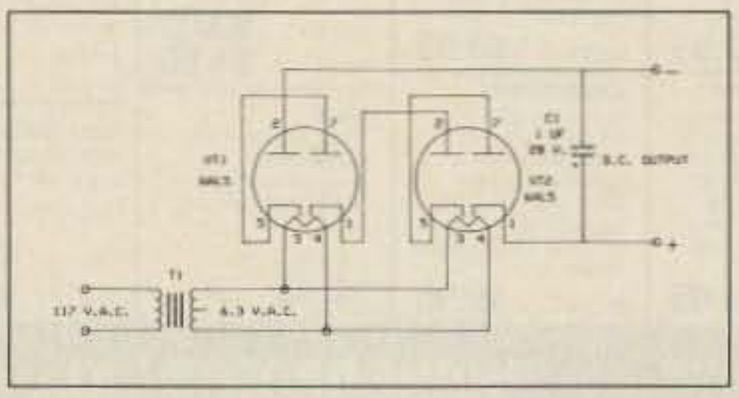

Fig. 2. The second circuit—.0023% efficient.

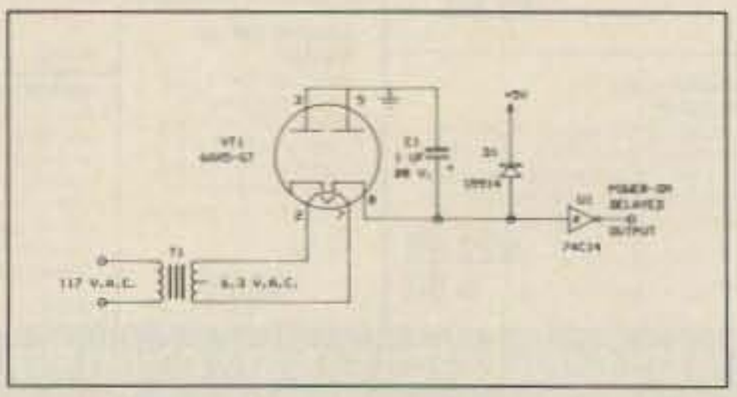

Fig. 3. The ac power-on delay circuit.

tron "collector" and hence has a negative charge.

Under a 4.7k-Ohm load, the output voltage sagged to 0.47 volts, which corresponds to an output current of a smashing 100 microamperes. Clearly, we're not going to put Boston Edison out of business!

While the output from the 6W4 was pure direct current, the tube's internal impedance is quite high relative to a more conventional source, and 60-Hertz noise pickup occurred with my clip-lead lashup. Capacitor C1 acts as a noise bypass and reservoir capacitor.

For my next experiment, I selected a pair of 6AL5 duodiodes and connected the diode sections in series to obtain 3.2 volts open-circuit (0.8 volts from each diode section) and 190 microamperes short-circuit current. Under a 19.2k-Ohm load, the circuit's output voltages dropped to a measly 1.3 volts. See Fig. 2 for the circuit schematic.

No analysis of any power source would be complete without a look at the circuit's efficiency. One 6AL5 draws 0.3 Amperes of heater current at 6.3 volts or 1.89 Watts. Two 6AL5s consume 3.78 Watts and deliver 88 microwatts for an efficiency of...0.0023 percent!

"Two 6AL5s consume 3.78 Watts and deliver 88 microwatts for an efficiency of... 0.0023 percent!"

Is there any practical use for such a miniscule power source? Fig. 3 shows one idea. The 6AX5-GT full-wave rectifier duodiode is powered from a switched ac power line. As the 6AX5 warms up, its output voltage climbs until it exceeds the trigger voltage threshold (3.6 volts typical, 4.3 volts maximum) of one section of a 74C14 CMOS hex Schmitt trigger IC.

The 74C14's output is thus time-delayed from the initial application of ac to the 6AX5's heater circuit. Under no-load conditions, the 6AX5 delivers approximately 5 volts, and diode D1 is incorporated to prevent overstressing U1 in case a figuratively "hot" 6AX5 is plugged in. If the reverse leakage current of D1 is excessive, you may wish to add a 1-megohm resistor from the junction of D1 and C1 to ground.

If you'd like to experiment further, try using gridded tubes as thermionic power sources by tying all grids to the plate for maximum electron collection. See what happens when a grid is connected to the tube's cathode instead of the plate (excuse me, the collector).

There you have it. Arguably, the "vacuum tube thermionic power source" is the world's least efficient generator. Keep it in mind, though, just in case you ever find yourself locked in a warehouse full of tubes with a shadowy robed figure. ■

"When You Buy, Say 73"

Rich Stiebel W6APZ
840 Talisman Drive
Palo Alto CA 94303

The Ducky Doctor

Heat-shrink tubing gives you a flexible fix for your cracked rubber ducky.

With 144-, 220-, and 440-MHz handie-talkies enjoying high popularity, the rubber-ducky antenna is much in demand. At a recent local ham flea market, at least half the hams there had an HT—either clipped to the belt, hanging out of a back pocket, tucked into a shirt pocket, or grasped in the hand. In all but the last position, the rubber ducky takes a lot of abuse as the wearer moves about.

Now we all know that rubber duckies are flexible. One rubber-ducky vendor at the flea market put a 90° bend in one ducky to demonstrate its flexibility and ability to snap back to a vertical position. This is fine and good for new rubber duckies, but after several years the covering becomes brittle and can crack.

My wife's (W6ANT) rubber ducky developed such a crack, and its ever-increasing size eventually caused some concern. By the time the crack had extended about one-half inch, I could see the innards of the ducky—a coil of wire wrapped on a foam plastic core. I was concerned about: 1) the rubber-ducky wire breaking with continued flexing, 2) moisture getting inside and causing a mismatch, and 3) the wire corroding because of exposure to salt air.

To prevent these things from happening, I had to repair the crack in a way that would: 1) add strength to the rubber ducky, 2) keep moisture out, 3) protect the wire, 4) retain the flexibility of the rubber ducky, and 5) be a permanent fix. I knew from experience that electrical tape would not add enough strength—it wouldn't withstand the abuse a rubber ducky gets. Epoxy would seem to fit most of the requirements, but it's not flexible and might crack and fall off with use.

The solution was to use a permanent sleeve made of shrink tubing, a type of plastic tubing that shrinks when heat is applied to it. It is available at many electronics stores, such as Radio Shack (# 278-1627) or Dick Smith Electronics.

W6ANT's rubber ducky with shrink tubing in place is shown in Photo A. The shrink tubing is seen as the extra covering on the lower part of the rubber ducky. It really blends in well with the original cover of the antenna.

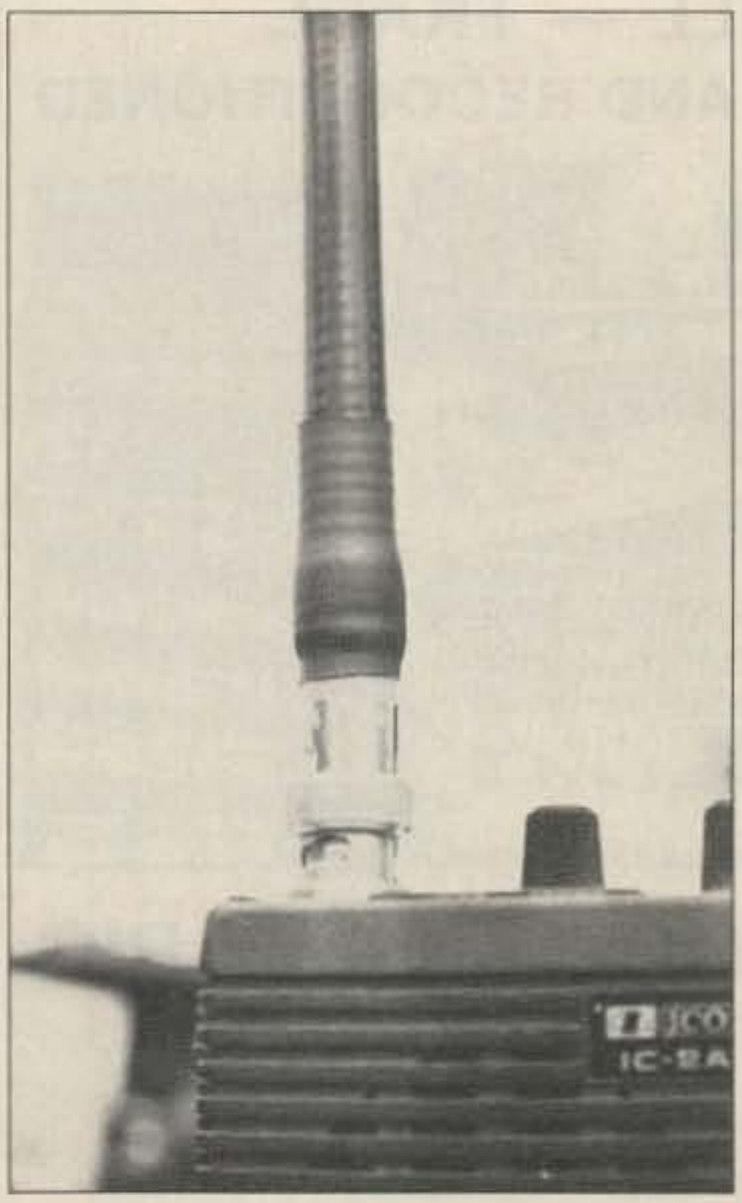

Photo A. The shrink-tubing fix is on the lower portion of the rubber ducky.

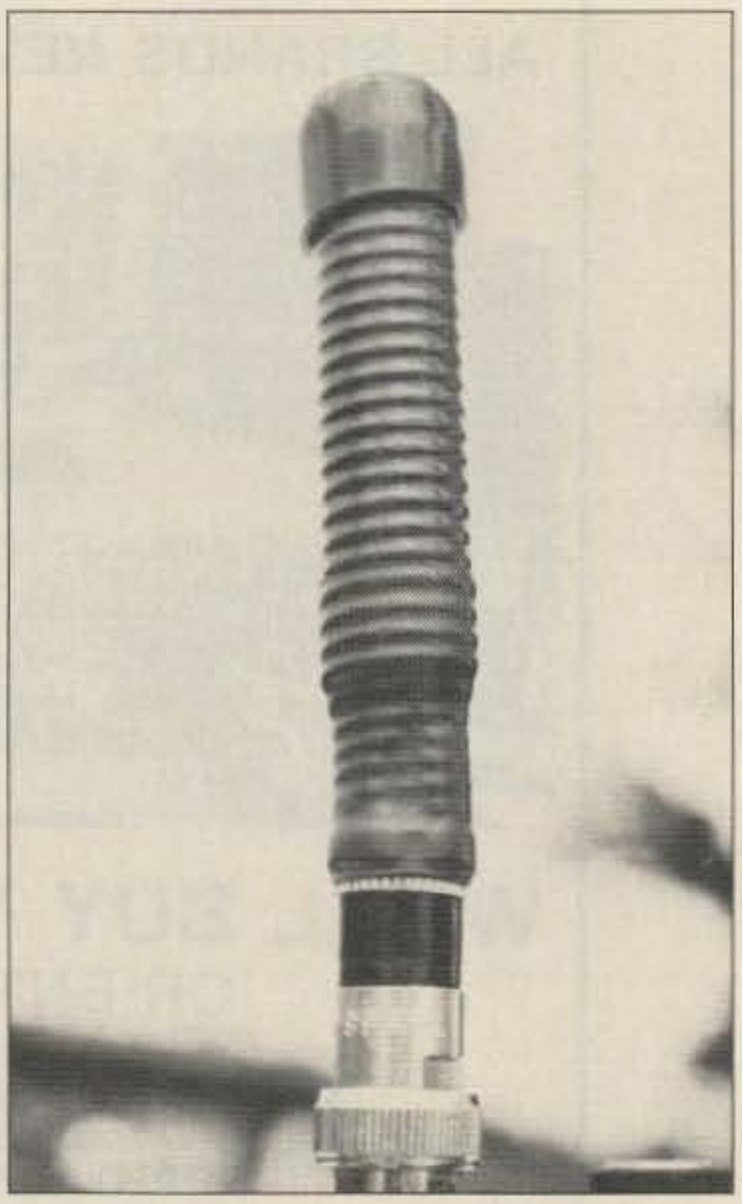

Photo B. A stubby ducky with a shrink-tubing fix.

Making the Repair

1) Measure the largest diameter of the rubber ducky over which the tube must slide. On my wife's rubber ducky, I slipped the tubing over the top, since that is smaller than the BNC connector.

2) Buy a piece of shrink tubing just barely large enough to slip over this diameter. The tubing can shrink to approximately 50% of its original diameter.

3) Cut a piece of the tubing about one inch longer than is necessary to cover the crack (about one-half inch in each direction).

4) Slip the tubing on the rubber ducky and center it over the crack.

5) Apply heat to the shrink tubing.

6) When cool, verify the tight fit and the added strength with flexibility.

Applying heat is the tricky part. Years ago, when I worked in a lab as a design engineer, I used a heat gun to shrink the tubing. A heat gun looks a hair dryer. When you "pull the trigger," the element heats up and a small but powerful fan blows hot air out the front.

What did I have at home that would serve the same purpose? Why the XYL's hair dryer, of course. Forget it! After 15 minutes with the dryer on high, the tubing had not shrunk even one millimeter! The air was just not hot enough.

I thought about using a match, which might work, but an open flame would be too uncontrollable. One slip and the tubing and rubber ducky might start to burn.

Finally, from my junk box I pulled an old heating element from an oven that I salvaged many moons ago. It was rated for 120 volts, so I attached a line cord and mounted the heater on a couple of metal shelf brackets to keep it from burning the workbench. As the element began to glow, I held the end of the rubber ducky with the shrink tubing about an inch from the glowing coil and rotated the ducky continuously.

Rotation is very important—it allows you to shrink the tubing evenly while not overheating the rubber ducky. Within minutes, the shrink tubing fit snugly against the ducky. I unplugged the heating coil and let the ducky cool about ten minutes.

Lacking an old oven heating element, you could shrink the tubing over an element on an electric stove or hot plate. Be careful not to overheat the rest of the rubber ducky. The end near the connector gets the most bending, so most repairs will probably be at that end of the rubber ducky.

Other Fixes and Uses

The stubby ducky on my HT also developed a crack. I used the same technique to fix it. The repaired stubby ducky is shown in Photo B. The shrink tubing half covers the knurled metal band, which is above the black plastic tube directly above the BNC connector. The BNC connector, as well as the short black tube, unscrews to mount the 5/8-wave antenna that came with the stubby ducky. This made slipping the shrink tubing on easier than on the full-size rubber ducky. Even with this shrink tubing in place, the extent of the original rip is evident.

5/8-wave and 1/2-wave HT antennas have a flexible matching coil at the bottom. The technique described here could be used to repair the covering on the matching coil, if needed. For those who like to build their own antennas, covering the matching coil with heat-shrink tubing will provide protection and make the job look professional.

Shrink tubing is available in different colors. You might even decide to color-code your rubber duckies—say, black for 2 meters, yellow for 1-1/4 meters, and red for 3/4 meters. There would be no mistaking an extended 440-MHz ducky for a 2-meter rubber ducky if it had a color band of shrink tubing around the base or at the tip.

The two repaired duckies have been in use for about a year with no noticeable difference in radiation characteristics or any mechanical problems. If you have an injured rubber ducky, this fix will have your antenna up and about in no time flat. ■

Peter Ferrand
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Tuner Transformation

Make your Heath SA-2500 antenna tuner truly automatic.

While I haven't heard of any fingers getting worn out from adjusting the dials of an antenna tuner, the three-handed balancing act it takes to get on the air is not something I look forward to. The Heath SA-2500 automatic antenna tuner looked like the answer to more than 20 years of trying to use one none-too-optimized antenna for all HF bands. Just put a little power into it and let it find its own match.

Almost!

Probably to limit the already very complex circuitry, the SA-2500, although equipped with a motor to drive the rotary inductor, requires you to set up to 18 different preset points on that coil, nominally two for each band. Unlike some other designs, the tuner does not use these presets as a starting point to find the optimum amount of inductance; the designers have relied on turning only the capacitors to find a match.

Although theoretically capable of matching nearly anything with its high-pass-filter type circuit, the SA-2500 has a tuning range that is quite limited once a preset has been set. And for absolutely no reason I can think of, Heath has chosen to mount the 18 preset-control potentiometers on the main circuit board. You have to remove eight little screws from the top cabinet cover to get to them.

Also, I can't understand why the circuit won't let you set the inductor manually and find the best match from there. If you go into automatic, the roller coil just spins back to the preset point.

In the case of my wire antennas, I found that daily variations (hot and cold, ice on the trees) were affecting the system so that the tuner could not get an adequate match. This was a real disappointment. Running a tuner without its top cover is poor practice, and fiddling with those printed circuit controls makes a mockery of the automation electronics I spent a week assembling.

There are two obvious answers—cutting a trap-door in the top cover or outboarding the potentiometer array. The first is pretty crude. While the second could actually be worked via the 9-pin connection on the back, the thought of a little box with nine pots to turn was a bit much to take. Then, too, there was the problem of how to watch D359, the LED that lights when you've matched the electronics with the roller inductor position.

> ***"Daily variations were affecting the system so that the tuner could not get an adequate match."***

Several hours of staring at the schematic and the manual's none-too-clear explanation of the relevant circuit yielded an answer. By replacing a single fixed resistor with a remote potentiometer, I could vary the range of *all* the pots up or down, quickly and accurately, just like a vernier. This, of course, voids the warranty, but the unit can be restored to its original condition easily.

Say the original setting for doing 40 meters on the rollers was 12. As modified, the remote potentiometer's value would be set to the same value as the original resistor, so the setting remains at 12.

One fine day (probably the next day) you won't be able to get a match at that setting. A small adjustment of the remote pot will vary the setting up or down until things come into resonance. Now the first try will, of course, have to be experimental, but once you've done it a few times, it will be nearly as automatic as the tuner should have been.

Another nice feature is that after you move the range of all the settings, setting things up on one band (at least in my case) brought all the other settings very close. I was using the same antenna (a small vee) on all bands, so you may not notice this with your setup.

I would highly recommend using a 10-turn precision pot in this application for ease of adjustment and reproducible settings. Using the type with a shaft for a knob instead of the screwdriver-adjust type makes things *much* easier—and it's designed for heavier use. The one that I used (Bourns BP3540S-1-1K) costs about $14, but flea markets and junk boxes are good sources since most people have little use for such pots. A 1k pot should be used.

Similarly, the use of a turns-counting dial makes things much more convenient. This device is made to match the pots, and generally can be found at flea markets attached to some incomprehensible piece of junked test equipment.

Remove resistor R452—it's the 220-Ohm resistor on the left edge of the main circuit board of the SA-2500, when looking at the unit from the front. Now set your 10-turn pot to 220 Ohms, using an ohmmeter. Attach a pair of shielded wires to the points where R452 used to be and run the wires out of the cabinet to your 10-turn pot—one wire to the wiper connection, the other to the pin 1 end. This would be pins 1 and 2 of the Bourns control mentioned before.

Of course, you should ground the braid of the shielded wire near its end. If you don't have two-conductor shielded wire, use two pieces of RG-174/U and ground both shields. The length doesn't seem especially critical, but since you're apt to have a lot of rf floating around, try to keep it short. You might be able to figure out how to mount the pot on the front panel, but I couldn't—unless you want to sacrifice use of the antenna switch.

I found there is plenty of room between the

multiple-pin connectors and the chassis for slipping wires. You may have to use normal RFI measures on the wire (ferrite beads and capacitors), but I noticed no changes running the full legal limit. You also might want to put the potentiometer in some kind of box to make it look nice.

Setting the dial to something appropriate, such as 5 if it's a 1-to-10 scale, will give you a reasonable frame of reference. To match the resistance value, 2.2 also would be a good choice.

And that's it. If you don't change anything, your settings will stay the same. You can override the preset when you need to and still preserve the automatic feature. When you do, remember to turn the dial slowly and keep an eye on the readout, since you don't—under any circumstances—want to let the inductor run against the stops.

A Few Notes

While the manual doesn't specify it, communication with Heath indicates that the gray multi-conductor cable coming from the sensor assembly should be dressed away from the variable capacitors and placed flat against the rear panel. Otherwise, due to the very high voltages encountered, an arc can develop from the capacitor to the cable, with disastrous results.

"Using a coaxially fed antenna is not what I call a solution!"

Heath also suggests that turning the antenna-selector switch be done with a sharp, snapping motion, due to the flexing in the 16″ shaft. Using a gradual motion may leave the selector switch set in some in-between position.

Finally, high-power rf and solid-state electronics don't always mix too well. In my case, I noticed that the tuner easily found a match at low power, but as soon as I switched to high power, the motors ran continuously. The Heath service consultant said he had heard about this before but could offer no solution. "Use a coaxially fed antenna" is not what I call a solution!

The easiest answer is to let the tuner find the match at low power and then switch into manual mode. I was able to improve the grounding (by using a resonant ground), so the problem went away. I also improved the shielding by scraping away the paint around the cabinet screws wherever the two halves of the cabinet came into contact with the chassis.

With these provisos in mind, if you're going to be chasing DX up and down the frequencies, or even if you prefer just getting on the air to fiddling with knobs, the SA-2500 is a useful accessory at a price not much higher than a manual tuner. ■

THE COMPLETE TEXT OF DOCKET 86-161, THE FCC'S FINAL RULING ON NOVICE ENHANCEMENT

1. On April 18, 1986 in response to several petitions for rule making we adopted a Notice of Proposed Rule Making (51 FR 17074 May 8, 1986)(Novice) proposing to enhance the privileges authorized by the Novice amateur operator license. The enhanced privileges would be in the HF 10 meter, VHF 1.25 meter and UHF 0.23 meter bands with transmitter peak envelope power maximums of 200 watts, 25 watts and 5 watts respectively. We proposed all authorized emission modes for the VHF and UHF bands and emissions A1A, F1B and J3E for the HF subband. We also requested information on related issues including the number of questions appropriate for the Novice operator written examination, the number of volunteer examiners (VEs) required to properly administer a Novice operator examination and whether a better balance between the requirements and privileges of the Technician operator license would be helpful. More than 350 comments were filed, including four reply comments.

2. The proposed enhanced Novice class privileges were intended to create a greater desire in new entrants into amateur radio to stay with the hobby and advance through its five tier licensing structure. In this way, the licensing structure would become more responsive to the needs and desires of the amateur community. The other proposals and questions were generally related to the increase in Novice privileges or to the basic licensing procedures.

Comments

3. More than 80% of the commenters supported the proposal. They believed that enhanced Novice operator privileges would attract and retain more persons in the service. In addition, manufacturers and distributors of amateur radio equipment said they hoped it would curb the loss of operators and consequent declining sales of equipment. The major concern in the comments was that excessive privileges could diminish the incentive for Novice operators to upgrade to a higher operator license. Also objected to was authorizing present Novice and Technician operators licensees any additional privileges without requiring them to qualify by further examination.

4. The comments favored expanding Novice operator HF 10 meter privileges to 28.1–28.5 MHz. The International Beacon Project, the International Amateur Radio Union and other commenters were concerned that such an expansion could jeopardize the usefulness of the amateur beacon system. They believed that amateur stations in other countries would be driven to transmit on beacon system frequencies in order to avoid congestion caused by an influx of stations with Novice and Technician control operators. The American Radio Relay League, Inc. (ARRL) stated, however, that amateur operators traditionally observe voluntary operating restrictions when necessary for the protection of universally beneficial operations like the beacon system.

5. The Notice of Proposed Rule Making in this proceeding proposed that Novice control operators be authorized privileges in the entire VHF 1.25 meter band. The comments generally supported this proposal because it would provide a common meeting ground for new amateur operators to meet experienced operators. In commenting on our statement that we will not finalize this aspect until certain related allocation matters for the 216–225 MHz band are resolved, ARRL said that this proceeding has no connection with frequency allocation decisions. It stated that the inclusion of Novice operator privileges on a band already available to the Amateur service would not affect future allocation revisions.

6. Richard S. Mosseson and other commenters pointed out that the proposed UHF 0.23 meter Novice operator privileges were not in keeping with the ARRL voluntary band plan. In its reply comments, ARRL acknowledged the discrepancy and requested the subband be at 1270–1295 MHz where repeater operation is conducted. Also mentioned in the comments was a potential biological hazard to the operator of a station transmitting in this frequency range.

7. The comments favored all emission modes in the VHF and UHF bands so Novice operators could communicate using modern technology. Dissatisfaction with the telegraphy only privileges was blamed as a major cause of Novice operators dropping out of the Amateur service. Although most commenters favored limiting Novice operators to emissions A1A, F1B and J3E in the 10 meter subband, a few commenters urged authorization of emission A3E. Still other commenters considered any HF emission privileges for Novice operators beyond A1A as a disincentive to upgrading. In its reply comments, ARRL said that enhanced privileges in the limited frequency bands proposed would operate as an incentive for Novice operators to upgrade. About 5% of the commenters were apprehensive that Novice operator telephony privileges in the 10 meter band could attract unlawful operators from the nearby 11 meter band.

8. Novice operators were asked to comment on the proposal to limit their stations to low transmitter power while higher class operators could transmit on the same frequencies with high power. The comments stated that this would place Novice operated low power stations at a distinct disadvantage. It was also suggested that all stations transmitting on the Novice subbands be restricted to low power. It was noted that higher class operators would lose existing privileges if this approach were taken.

9. The comments generally concurred that the topics on the Novice operator written examination should correspond to the privileges authorized. They favored increasing examination Element 2 to 30 questions or even to 50 questions. The repeated concern was that Element 2 should not be so difficult as to discourage newcomers.

10. Twenty-one percent of the comments discussed ARRL's request for two administering volunteer examiners (VEs). Some 9% of the comments stated that the one VE requirement should be continued because it is more convenient and less stressful for beginners. About 5% of the comments including the ARRL's disagreed and said that enhanced privileges for Novice operators necessitated a second administering VE to minimize the likelihood of examination fraud. Another 7% of the comments recommended that the examinations be prepared and administered under the volunteer examiner coordinator (VEC) system. ARRL opposed this approach because it would increase the burden on the VEC System and reduce the availability of examinations.

11. Comments were requested on confining the written examination for the Technician operator license to the privileges authorized by that license. Gordon West, an amateur operator instructor, stated that such a change would allow instructors to train students preparing for the Technician operator license more thoroughly in relevant VHF and UHF topics. Another viewpoint expressed in the comments was that another examination element would complicate the examination process.

Discussion

12. The prospect of enhanced privileges for Novice operators has already stimulated growth in the service. In FY 1986, nearly 21,000 new persons entered the Amateur service, an increase of 20.75% over FY 1985. More than 19,000 became Novice operators. Furthermore, the number of licenses dropping out of the Amateur service decreased by 15.13% during the same period. We believe these are clear indicators that changes in the entry level license are appropriate.

13. In its proposal regarding the 1.25 meter band (VHF), the ARRL requested that Novices be permitted use of the band 220–225 MHz with all voice and data modes, including radiotelegraphy with a power limit of 25 watts output. However, it asked that repeater operation by stations licensed or controlled by Novices not be permitted, i.e. a Novice signal could be retransmitted by a repeater, but a Novice operator could not sponsor or be the trustee of one. The comments reflected an interest in VHF privileges for Novice operators. In our view, VHF privileges for Novices would create the kind of interest that is needed for amateurs to continue in the hobby and at the same time motivate them to advance to the higher license classes. To this end we will authorize frequencies 222.10–223.91 MHz for use by Novice operators. This action in conjunction with voluntary band plans will allow operation on repeater input and simplex channels. Novices may not be licensees, control operators or trustees of the repeaters. This would permit Novice operators to operate with those modes most appropriate to their level of license and to communicate with more experienced amateurs. For example, frequencies below 222 MHz are typically used for moonbounce, propagation beacons and control signals, activities generally engaged in by amateurs with more experience.

14. We agree with the commenters that the UHF 0.23 meter subband should be at 1270–1295 MHz to allow Novice operators to gain experience with repeater operation. Low transmitter power and incorporation of suitable safety precaution information in the amateur radio practices examination topics should assure that Novice operators will not endanger themselves. Thus, we will authorize the subband at 1270–1295 MHz as requested.

15. The prospect of interference to the 10 meter beacon system expressed in the comments is speculative and may never become a concern, given the record of amateur operators in adhering to voluntary arrangements. Moreover, the low power limit proposed for stations with Novice control operators should satisfy this concern. Thus, it does not afford a reason not to go forward.

16. It is evident from the comments that more emission modes will attract more Novice operators to the Amateur service. However, the frequency ranges in which to use them should provide the proper degree of enhancement so that Novice operators would still have an incentive to upgrade to higher operator licenses. Thus, digital and limited telephony privileges in the 10 meter band appear appropriate and will be authorized.

17. We continue to believe in power restrictions for Novice sections in the new bands. The restrictions will add a further incentive to upgrade the class of license. Also, because of the lesser experience level, Novice operators are more likely unintentionally to cause interference. Reduced power levels will help limit the extent of any interference.

18. When the privileges of any operator license class are modified, the qualification requirements should be revised accordingly. The Novice operator license written examination Element 2 is based upon telegraphy station operation. We believe the examination should be broadened in scope commensurate with enhanced Novice operator privileges. We shall therefore require an additional 10 questions for a total of 30 to make the scope of Element 2 appropriate to the new privileges, without creating a significant deterrent to potential Novice operator examinees.

19. We will adopt rules so that two VEs will prepare and administer Novice operator examinations. Although there may be isolated areas where locating two VEs may be difficult, the added safeguard would be justified. There are legal and practical problems which prevent placing Novice operator examinations under the VEC System. Additionally, to incorporate this work into the VEC system would nearly double the workload and expense for the volunteers operating that system. We will accordingly adopt the two VE procedure and reflect that requirement in a revised Form 610, Application for Amateur Radio Station and/or Operator License.

20. In a related issue, Novice operators may not be upgrading to Technician operator because the content of Element 3 requires them to also be knowledgeable about General class operator privileges. This is the only instance in the operator license progression where the applicant must not only know the material for the operator privileges that will be authorized as the next step (Technician), but also must know the material for the next higher step (General). To require any applicant to be knowledgeable about privileges which the license does not authorize is inconsistent and a burden upon applicants, administering VEs and instructors. To resolve this problem, we will separate Element 3 into two parts. Technician operator questions will be placed into an Element 3(A) VEC question pool and General class questions will be placed into an Element 3(B) VEC question pool. It would be timely to take this action at this juncture for two reasons. First the VEC's will have to revise Element 3 as a result of this action in order to move certain of its questions to Element 2 in conjunction with enhanced Novice operator privileges. Therefore, they could concurrently divide the remaining Element 3 questions into an Element 3(A) and an Element 3(B) as appropriate. Second, the application form is being revised in order to incorporate provisions for Novice operator examination certification by two administering VEs. It could be concurrently revised to include marking boxes for Element 3(A) and for Element 3(B).

Other Issues

21. All present Novice and Technician operators will be authorized the new privileges without additional qualification. However, we strongly recommend that present Novice operator licensees become knowledgeable in the new requirements before using their new privileges. For example, they should study the material in new Element 2 that relates to the enhanced Novice operator privileges even though we will not require that they be examined on it. As to present Technician operators, any examinee holding such a license issued before the effective date of these rule amendments will be given examination credit for Elements 1(A), 2, 3(A) and 3(B).

22. FCC Form 610 is currently being revised in connection with rule amendments pertaining to allowing credit to examinees for certain previously passed written examinations. Those revisions and the revisions required by the action taken in this proceeding are being simultaneously incorporated into the form. Upon receipt of Office of Management and Budget (OMB) approval of FCC Form 610, we will issue a Public Notice with a draft sample of the form attached. The modified FCC Form 610 will provide for certification by two administering VEs for the Novice VE System and for a revised Administering VEs Report.

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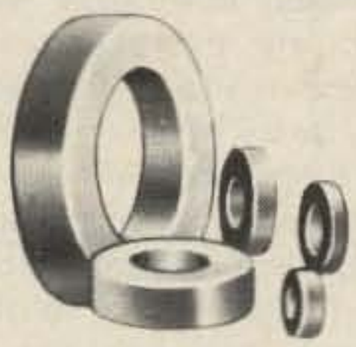

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NEVER SAY DIE

from page 12

the right to change my mind completely if something better comes along.

FREELOADING?

In my February editorial I pointed out—perhaps much too subtly—that we amateurs have been given the almost exclusive use of billions—perhaps trillions—of dollars in radio spectrum. What I didn't yet mention was what, if anything, we're doing to be worth this enormous investment by our government. And it's just that—an investment. The FCC could start leasing out radio frequencies to the highest bidders. They might even be able to balance the federal budget that way.

Let's see. Let's take just a little bit, say our 160-meter band. 160m used to run from 1715–2050 kHz before WWII. If they extended the broadcast band by just 500 kHz, that would be fifty more 10-kHz channels—room for at least 2,500 more stations to operate. Have you any idea what the rights to use 2,500 radio channels are worth? Billions.

Okay—so we're each sitting on millions of dollars of valuable spectrum—how are we supposed to make this investment pay off for the country? Let's get out our rules and look at our franchise—it's right there in 97.1. That's where the FCC spells out what we have to do to warrant this enormous investment per user.

You should remember that the rules were written in 1935. Is it going to be a surprise to you that these rules are just a tad out of date? Hey, please don't mention this to the FCC—the last thing we need right now is to have them taking a look at our franchise in the light of 1987 realities. As long as the Commission is wrapped up in "more important" problems and forgets we're around, we're sailing free.

First—keep in mind the 1935 rules were written back when ten meters was still a VHF experimental band. Look back in your 1935 issues of *QST* and you'll see that ham pioneers were working to develop 10m communications technology. I well remember Fred Stevenson W1CUN, up in Bethlehem, New Hampshire, the first ham I ever met, as one of those ten-meter pioneers.

The microwaves weren't even imagined then. As I recall, the regulatory imagination stopped around 400 MHz. Beyond that was "up." Today our microwave bands are almost beyond calculation in value for satellite communications—and with so few exceptions they prove the rule, we're flat out not using 'em for anything. Worse, we don't even have any serious prospects for using 'em in mind.

There are five elements to our franchise—our responsibilities. Let's look at what we signed up for when we got our ham tickets and see how well we are measuring up to our agreement.

One—the amateur radio "service" is to provide a source of trained operators in time of war. Hmmm. Let's just think about that. When el biggo came along in 1941 we had about 50,000 licensed amateurs. I think you'll agree we lived up to our bargain when 40,000 joined the armed forces—80%. That obviously involved every available able-bodied ham who wasn't too young or too old.

"These days I see a whole new life at HQ—an enthusiasm I never used to see. If you give HQ a live board, I think they'll blossom and we'll get amateur radio growing again."

Those were simpler days, so our Morse-code skills were still of value. I even ran into an occasion when my ability to copy the code saved me and my submarine from being sunk. And I found my amateur radio technical knowledge of enormous value in learning how to use and repair Navy radio, sonar, radar, and test equipment.

I'm sure I was like many other hams in the armed forces, using my ham ingenuity at every opportunity. I rifled spare parts supplies on my submarine to build a radar alerting system to make sure I didn't miss any sudden targets. You see, sitting and watching a radar monitor for hours will stupefy anyone, and it takes only a couple minutes for a low-flying black-cat bomber to sneak in and blooie! So, just in case, it seemed to me worthwhile to have an alerting system in case an operator missed seeing a blip. Such a target indicator is common with radars these days, but was unknown then.

Also, I wanted to be able to keep track of what was going on, so I set up a monitor in my bunk in the After Battery so I could check the radar from there as well as when I was on duty in the conning tower.

We won that war with technology—by having better electronic scientists and engineers and enough technicians to operate and service all that gear. We're just now reading about some of the communications coups accomplished back then—breaking secret codes. As I've mentioned before, our radar superiority over the Japanese was of critical importance. My submarine was able to travel on the surface right down through the middle of well-protected Japanese troop convoys in the middle of the night, torpedoing ships left and right, with me keeping track of the course and speed of every escort warship, while they were unable to spot us.

Our electronic technology was so far ahead of the Japanese's during the war that the captain of my submarine had instructions not to let me be captured alive. That was a sobering reality of war which the other crew members took delight in reminding me of during our many depth-charge attacks.

Considering the enormous advances in electronic technology in Japan these days, we'd better make absolutely sure they are on our side from now on. They're leaving us hopelessly behind in many high-tech electronic development areas.

But let's just say that somehow the U.S. manages to get involved in a war. How valuable would we hams be to our military today as compared with 1941? Frankly, from what military equipment I've seen, 99% of us wouldn't have a clue. The few of us who can use the code would get the big laugh. Communications are all computerized now—most of it complete with automatic encoding and decoding for secrecy.

The few of us who have been fighting the miserable Loran pulses on 160m may not realize this system is hopelessly out of date. With satellites it's now possible for a car to find its way around city streets, located and guided with an accuracy of a few feet by computers.

I know of no interest on the part of the military to acquaint radio amateurs with their electronics and communications technology of today. So we haven't a clue as to what, if anything, we might do should there be a sudden need for technicians and operators. Frankly, I think we'd be ignored as useless—not just because such a high percentage of us are too old to be of use any more, but because most of us are hopelessly ignorant about modern technology.

In short, I don't believe we're even remotely honoring this part of our franchise as expressed in our rules.

Okay, there are four more responsibilities we're supposed to fulfill in order to be worthy of the trillions of dollars in frequencies we're hogging. Let's move on.

Number two—we're supposed to be a self-generating group. We're supposed to maintain and increase our ranks so we will be able to provide the operators and technicians for emergency military use. We're not doing that either.

Number three—we're supposed to keep on top of communications technology, and use our creative technological skills to invent and pioneer new modes of communications. Up until about twenty years ago we were doing very well with this. For instance, hams developed the sideband circuits which made SSB a practical possibility. We invented and pioneered narrowband FM, slow-scan television, invented most of the RTTY circuits, pioneered repeaters, and so on.

It was hams who built the SSB gear and demonstrated it to the Air Force and got them to accept this weird new communications mode. I remember well the antics of K2AAA, Art Collins W0CXX, General Curtis LeMay, General Butch Griswald, and Bill Grenfell

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W4GF of the FCC back then. That's a great story and should be told before everyone involved dies.

To be told, too, should be the way Collins outfoxed General Electric and John Costas K2EN with his superior DSB system—great political maneuvering which cost GE hundreds of millions.

But, alas, what have we hams done in the last twenty years to pioneer new communications technologies? Packet is about it. When you consider the incredible number of potential new communications systems we could develop, obviously we're asleep. Between computers and microwaves, we have the technology right now to develop a communications system using satellites and repeaters which would enable us to deliver messages at 25,000 words per minute anywhere in the world in seconds—complete with automatic translation of the messages into any language.

The sad fact is that it takes younger technicians to build and pioneer these things and we haven't got 'em. Strike three.

Let's see—what else. Oh yes, we're supposed to provide a source of international goodwill. We're sure working hard on this one, with our DX pileups, harrassing DX stations for contacts and QSLs for DXCC, driving 'em off the air with endless contests, and so on. Tell me about international friendship. There is no way to have an uninterrupted contact with someone in a rare spot.

Now, last and least, we're supposed to help out in cases of emergency. We do this, but the communication we provide is so incredibly far from the state of the art that it's pitiful. We congratulate the hell out of ourselves for the magnificent work we do to help with earthquakes, storms, volcanos, and so on. And we do help. But compared to what we technically could do if our communications system wasn't about thirty years out of date, it's embarrassing.

The emergency communications networks we set up these days all use voice for message handling, thereby slowing down the throughput and introducing errors. Some 12% of the communications time is wasted with station and operator identification. 14% involves correcting errors or misunderstood communications. The increasing age of our operators has made it more difficult to find enough operators for serious emergencies—and those we do find are often not able to cope with hardship conditions. They tire quickly.

An objective look at our charter and our fulfillment of our responsibilities under that charter shows us woefully lacking. Mea culpa. Can we get ourselves straightened out before the FCC notices how badly we've dropped the ball? You bet we can—and it isn't all that difficult either.

The prime move for us is to bend our every effort at getting youngsters back into amateur radio. Raid the schools—get school clubs going no matter how difficult "educators" make it. Get your own youngsters to come to your local club meetings. If the meetings are dull and boring (which they are, and you know it), make sure they're made exciting. That means making big changes.

Now—technology. If you keep accepting the pap you've been putting up with in your ham magazines, that's just what you'll continue to get. Push the ham magazines to help you learn more about today's technology. Electronics is a ball—the more you know, the more opportunities will open for you to take advantage of your knowledge. And the opportunities are unlimited. We're going to see communications expanding by a factor of a thousand or more in the next few years—with or without us.

Are you on packet radio yet? What in the heck do you need, an enema? Get out your August *73* and read it this time. It's all there. Then get busy. Put together a packet unit and stop sitting around like a mental amputee. Some old fogies treat amateur radio as if it were golf—which is defined in some circles as a way to needlessly extend useless lives.

We're sitting on top of a gold mine—not just as a key to making money as communications systems expand—but in the sense that if we are true to our duty as outlined in our rules, we'll be getting youngsters into amateur radio. This will, in turn, launch them into high-tech careers, providing our country with the scientists, inventors, engineers, and technicians we desperately need to compete with Japan.

Now, are you going to spend the few remaining years of your ham life tying up a local repeater, saying almost nothing over and over, jamming up our more crowded bands during contests, making life miserable for your fellow DXers by adding to the pileups—or are we going to see you Elmering newcomers? Will I be hearing you making amateur radio a bit more fun for a Novice? Will you be working to get a school radio club going? Will you endow a *73* subscription for a local school library? Or will I be hearing you jamming the 40-meter service nets and stomping all over 80-meter DX stations trying to get through? Are you one of the hopelessly frustrated, doing everything you can to mess up the fun others are having, or are you working with kids and keeping up with the state of the art?

"Keep in mind the 1935 rules were written back when ten meters was still a VHF experimental band."

Well, damn! There goes that confounded Wayne Green spreading doom and gloom—and making you feel guilty about our hobby. Maybe—but is it me making you feel guilty or yourself? I'm only telling you things you really know already, but have been trying to ignore.

Oh yes, if you try to make any effort at all towards getting amateur radio growing, one thing you're going to find straight out is that I haven't been exaggerating one whit about the resistance you're going to find to the code. I warn you, if you don't have any honest answers for the kids on this, they're going to see through your baloney if you try and convince them the code has any validity these days. Don't you hate a smart kid? Well, they're smart and they don't buy baloney the way we did.

A no-code license? No problem here at all, as I've mentioned before. It's simple—as soon as the ARRL demands a no-code license from the FCC we'll have one. How do we do that? Simple again—you're the people who vote in the ARRL directors. If you want a no-code license—say for 220 MHz—just stop voting in directors who are opposed to it. What could be simpler? You vote in these blokes every two years, so if you really want a change it'll take you two years to do it. Period.

As long as you continue to vote in directors who would rather see amateur radio die than bend on no-code, even for 220 MHz, we're in deep do-do. Now—I don't think I've attacked the League or even said anything nasty. That certainly isn't my intention. I just want to mention again what was brought out so clearly at the Dayton ham industry meeting last year. One more thing—I'll bet you won't find anyone at ARRL HQ fighting you once you clean up the director mess you've made. I'm very impressed by the new HQ gang.

The League used to be run by a bunch of arrogant alcoholics who were very cynical about amateur radio. None were really hams at all—just bureaucrats keeping their jobs by having ham calls. These days I see a whole new life at HQ—an enthusiasm I never used to see—and I've known 'em all personally for over 35 years now. If you give HQ a live board, I think they'll blossom and we'll get amateur radio growing again.

The strength of the League, like the strength of amateur radio itself, lies in your interest—your strength. If you ignore director elections, you'll get just what you ask for—bureaucrats looking for power. If you ignore your duty as a ham, you'll see us continue to lose our hobby. Your personal involvement is needed—as an individual—as an active ham club member. The prize? I guarantee you'll find it frustrating beyond description—and rewarding beyond anything else you've ever undertaken. What a glorious sense of satisfaction there is in helping others get their ham tickets and then go on to become successful engineers and technicians.

EMP REVISITED

Six years ago the FCC's Defense Commissioner Mimi Dawson, with the support of Chairman Mark Fowler and Senator Goldwater, formed the Long Range Planning Committee (LRPC), with four National Industry Advisory Committees (NIAC) to assist it. The LRPC was made up of top executives in the communications industry, brought together to formulate an overall plan for emergency communications for our country.

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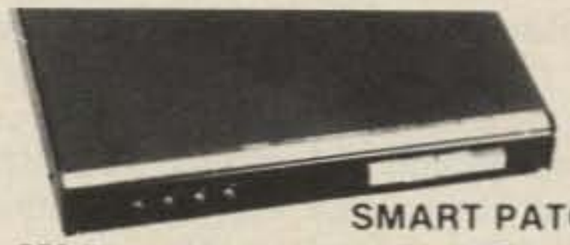

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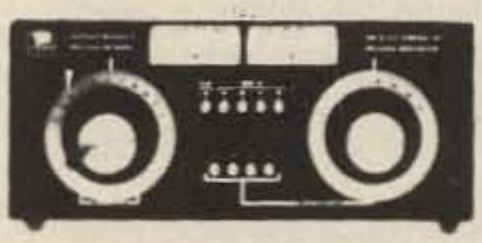

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had been done in the past to cope with emergencies—what systems were available and how they had worked. The next step was to look closely at all communications systems and their role in helping us cope with future emergencies. Emergencies encompassed everything from local problems due to accidents, fires, and floods—to regional emergencies due to earthquakes—right on up to the ultimate emergency: an atomic attack.

The LRPC soon had to face one fundamental fact: Only the amateur radio service had the potential for providing the needed communications. The military depended almost entirely on commercial telephone lines for their communications (95%)—and the first thing that seems to go out in any emergency is the telephone. Indeed, it was this which put the Alaskan military bases out of communications with the Pentagon for almost a week following the Alaskan earthquake. Their only communications were via hastily set up amateur radio networks.

The LRPC and the FCC then faced an extremely serious problem. If the only dependable emergency communications system that could tie together police, fire, towns, road crews; two-way services such as trucks, taxis, doctors; television remote units, CB, CAP, MARS, broadcast radio and TV, and so on was amateur radio, then we were going to need a substantial growth and modernization of this service. The traffic volumes estimated were several orders of magnitude beyond the capability of our present voice or CW communications systems. These volumes could only be handled by high-speed automated digital communications such as packet radio.

The LRPC and the Commission then tried to tackle the need for vastly more hams. The only ham system in the world that seemed to be working these days was the one adopted by the Japanese—a no-code license. Efforts to implement this here were completely stopped by the ARRL directors. In frustration, the FCC disbanded the LRPC and its NIAC committees last year—giving up on the whole emergency communications situation.

All this is the background—and, my apologies since I've covered it all before—but I find many ham memories seem to be incredibly short when it comes to the no-code debacle. A couple of hams have been pushing the FCC to deal with the problem of electromagnetic pulses (EMP) so the few amateurs we have left will be in a better position to provide emergency communications should an atomic bomb be used.

Little has been published on how we can cope with this problem. Indeed, we have little information on how much of a problem this really is! Some reports indicate that a high-altitude bomb might wipe out most solid-state equipment for a thousand miles around. Pffft would go all our HTs and mobile VHF gear—plus our low-band rigs—leaving us nothing with which to communicate. The Department of Defense (DOD) has been fighting to keep the FCC out of the EMP arena—saying there's plenty of information available on how to guard against EMP. The hams replied that the key information on this is classified—or, at best, apparently only available to large corporations.

Can ham gear be protected against EMP so we would have a chance to do our thing in case of an atomic bomb? Unless data is made available to help us shield and protect our ham stations—unless data is available to help manufacturers build in bypassing and shielding—the only backup communications our country has in case of such an emergency will be completely out of business.

Well, you say, the likelihood of an atomic attack is remote enough so all that is just the usual gloom and doom baloney. That's nothing I have to worry about anymore. Okay, let me repeat a bit of another recent editorial—backed up by the *Connections* program I saw last night on PBS. You have to be terribly out of touch not to know that atomic bombs are now portable enough to fit in a suitcase—per the illustration on *Connections*. So all that's necessary is for one terrorist group to grab enough nuclear material and guess where they're going to head, suitcase in hand?

Nuclear material comes from atomic power plants—where several recent reports have shown security often is pitiful. Plus we have nuclear sources now in more and more Third World countries. How much trouble would Kaddafi have getting enough for a bomb? The French seem eager to sell atomic energy equipment to virtually any country interested.

So it's more a question of when we're going to be faced with a nuclear terrorist than if. As I asked in my editorial—how ready is your club? If you're around New York or Washington, you'd better be very ready, with as hardened protection against EMP as possible—with as high-speed automated communications as the state of the art will allow. Depending on Morse code for communications, where we'll be the only service capable of replacing the telephone, is about as effective as planning to use smoke signals.

Not only are the military almost totally dependent upon telephones, so are virtually all other disaster groups. Civil Defense officials have almost universally given up even trying to use amateur radio links—too slow compared to picking up the telephone. Ham communication is slow, seriously prone to errors, and too dependent upon older men without the stamina needed.

I think you'll find the latest filing by the hams trying to get the FCC to face this situation of interest. Talk about fighting city hall!

Now, lest I be put down (now, *who* would do that?) for doom and gloom without solutions, the way to resolve this is to first get the FCC to help us find out how to cope with EMP—despite the unreasonable resistance of the DOD. Second, it's getting on to time to recognize our need for a million or so hams instead of more like the 250,000 we have today. Third, we need to urge the few technically competent hams we have—those who didn't Bash or bribe their way to Extra class—to start work on high-speed automatic digital communications systems—like packet, only much faster. We need to be able to provide million-message throughputs, not dozens—and our gear should be capable of being operated by anyone around who is still alive.

We have the technology to do all this—all we lack is the technicians and the guts to face the biggest challenge of our lives. Lacking this, my suggestion is to move as far away from New York or Washington as you can—and soon! Living near those death traps could be more harmful than smoking—or even Southern California and its coming humdinger earthquake.■

"Unless data is made available to help us shield and protect our ham stations . . . the only backup communications our country has in case of such an emergency will be completely out of business."

JANUARY 28 REPLY COMMENTS OF DONALD J. SCHELLHARDT AND NICKOLAUS E. LEGGETT TO COMMENTS FILED BY THE DEPARTMENT OF DEFENSE

We, the undersigned, hereby file Reply Comments in response to the January 21, 1987 Comments of the Department of Defense (DOD), which were filed in opposition to our January 5, 1987 Petition for Reconsideration in Docket No. RM-5528. In filing these Reply Comments to DOD, we expressly reserve our right to file further Reply Comments in response to possible future filings in this Docket by other interested parties besides DOD.

Overall Assessment of DOD's Comments

In general, the DOD filing fits into the classic pattern of debate in this Docket so far. One side of the debate says, in essence: "We've started to look into the EMP issue. We have a plan of action, even though virtually nothing about it is available to the general public, and at some point down the road you will see some results. Trust us." We continue to ask: "If action is on the way, then who is going to do what by what date? Who is going to review the work product with an eye to the public interest? And, if DOD and the telecommunications companies are really committed to action, why are they hiding behind a wall of secrecy? Why won't they let the general public look at the NSTAC study and other details of the plan of action that supposedly exists? Why do they resist public input? If there's really action underway, why are they stonewalling?"

Because this ground of debate is well trodden by now, our overall assessment is that DOD's filing says very little which has not already been said in GTE's September 11, 1986 Comments, or in the December 12, 1986 decision by the Federal Communications Commission staff, or in both documents. Due to this reiteration of key points made in other documents, most of DOD's contentions have already been addressed by us, either in our September 24, 1986 Reply Comments to GTE, or in our Petition for Reconsideration. A few of the points were even addressed in our initial July 30, 1986 Petition for Notice of Inquiry.

We will not burden the Commission with a lengthy reiteration of points we have already made in previous filings. Instead, we will focus upon those points raised by DOD which add something new to the established record.

Responses To New Points Raised By DOD

1. On page 2 of its filing, DOD states that "While there is no dearth of information regarding EMP, as the petitioners state (Petition for Reconsideration, pp. 3–4), there is also much contention regarding the impact of EMP."

To the best of our knowledge, this is not the case. In our review of the technical literature on EMP, there appears to be two solid points of consensus: 1) that shielding and bypassing, and other protective measures, can be dramatically effective in reducing or eliminating vulnerability to EMP; and 2) that unprotected solid state equipment is extremely vulnerable to EMP.

While it is true that one can find differing technical opinions on the exact *degree* of vulnerability to EMP, the technical literature displays little—if any—disagreement over the *fact* of high vulnerability to EMP.

In short, we seem to have a disagreement with DOD over what the facts are. To buttress our own assessment in this factual dispute, we have submitted to the Commission the abstracts of literally hundreds of government-sponsored studies on EMP. We will let these studies "speak for themselves" as the Commission reviews them. DOD, however, has simply made the flat statement we quoted and then implied that classified material *might* support its assertion. If DOD has evidence to support its contention, then DOD has a duty to bring that evidence forth—in a form that would not jeopardize national security. Indeed, the Notice of Inquiry that we have requested would be a perfect national forum for putting all of the evidence before the Commission—our evidence, DOD's evidence, GTE's evidence, everyone's evidence—and then letting the Commission decide what the facts are, with the benefit of review and participation by *all* interested parties.

2. Speaking of the need to make evidence publicly available, we note that DOD mentions—as one of the "core" constructive actions on EMP protection—preparation of a study on EMP by the President's National Security Telecommunications Advisory Committee (NSTAC). According to the previously referenced GTE Comments, which quoted from this study, it was this NSTAC document which triggered ongoing efforts to develop EMP equipment protection standards through the American National Standards Institute (ANSI).

Strangely, this NSTAC study—which plainly plays a crucial role in guiding current EMP protection efforts—is not available to the general public. Instead, Louis Slessin, Editor of *Microwave News* in New York City, has had to file a Freedom of Information Act request in his pursuit of a copy, and at present his request (dated September 28, 1986) is still "under consideration."

Actually, it is not precisely correct to say that the NSTAC study is publicly unavailable; it would be more accurate to say that the document is *selectively* unavailable. After all, GTE was able to quote from the NSTAC study in its Comments. Thus, attorneys for large telecommunications companies can apparently obtain a copy—but members of the press cannot.

In short, when it comes to the development of EMP protection measures, DOD and GTE seem to want a game where everyone can play except the general public.

Playing the game in this manner produces results that the architects of our Republic can hardly have intended. Here we are as private citizens, exercising our Constitutional and statutory rights to petition our government for a "redress of grievances," and we are told that the action we request is unnecessary due to plans set forth in a NSTAC document that we are not even allowed to see because we are merely members of the general public. Why must we private citizens "debate in the dark" and find ourselves excluded from the decision-making process?

Now DOD and GTE are asking the Commission to perpetuate a public policy development process that is hermetically sealed against the public it is supposed to serve. If the Commission agrees, it will be departing from the democratic spirit that is America's heritage. It will also be departing from its own statutory obligations.

3. On page 3 of its filing, DOD maintains that "To address EMP issues in a formal regulatory proceeding will only slow down, and could hamper, ongoing EMP mitigation efforts."

We can imagine situations where this might be the case. For example, let us assume that the NSTAC/ANSI participants were *committed* to developing a definite work product, by a *date certain* in the reasonable future, with at least some Commission review of the work product to assure that the public interest has been protected. Under such circumstances, injection of regulatory proceedings could conceivably interrupt ongoing progress (although we would still face the problem that the NSTAC/ANSI group's narrow focus on telephones excludes action on such vital communications equipment as radios, television sets, and communications satellites).

Such a set of circumstances remains hypothetical—at least at this time. Instead of a firm commitment to action, tangibly reflected in *deadlines* for specific accomplishments, we have a vague promise of possible results, of an unspecified nature, at an unspecified time. Indeed, of the DOD filing's four cited examples of ongoing action, one example involves equipment testing, one involves the NSTAC study, and two involve equipment protection standards that are still under development. None of the examples has yielded as yet a tangible, measurable change in the vulnerability of working equipment in the real world. Under such conditions, regulatory proceedings would not be interrupting action; they would be serving the cause of effective action by alerting key parties that vague promises are not enough.

4. On page 2 of its filing, DOD makes the following statement: "Moreover, because the Department of Defense relies upon commercial telecommunications suppliers (i.e., civilian communication systems) for over 95% of its telecommunications services within the United States, significant effort has been made in the EMP area."

DOD makes this point in an attempt to rebut our concern that efforts to protect military communications equipment have tended to overlook the need to protect civilian communications equipment. If we understand DOD correctly, it is saying that the two are largely inseparable—that DOD has an incentive to protect civilian communications systems, as well as purely military systems, because purely military systems carry only a tiny fraction of the military's actual communications traffic.

This point cuts both ways, however. If the military relies on civilian communications systems for 95% of its traffic, then the nation's *military* operations—not "just" its economic activities—would be placed in grave jeopardy if an EMP strike occurred under current conditions.

In this regard, it is interesting to see that the DOD filing is made on behalf of the Secretary of Defense "in his capacity as Executive Agent for the National Communications System." This same National Communications System has issued a detailed report on EMP. The report, entitled "Electromagnetic Pulse/Transient Threat Testing of Protection Devices for Amateur/Military Affiliate Radio System Equipment" (NCS TIB 85-10), is fortunately available to the public. It mentions, among many other conclusions, that older civilian telephone equipment is relatively resistant to EMP—but is generally being replaced by solid state equipment that is highly vulnerable to EMP. A condensed version of part of this report was published in the August 1986 edition of *QST* magazine, and was formally submitted to this Commission as Exhibit II of the GTE Comments. On page 20 of the magazine, the article states that "The commercial telephone system consists, in large part, of unshielded telephone switches and cable systems . . . In recent years, the telephone companies have started using solid-state switching systems that could be highly sensitive to EMP."

In short, it appears that the military has in large part tied itself to the civilian communications system. In the words of an agency for which the Secretary of Defense is "Executive Agent," this civilian communications system "could be highly sensitive to EMP."

By clear implication, our nation's military must be in the same boat.

On balance, then, the information supplied by DOD strengthens the case for actions on civilian communications systems. Because military communications and civilian communications are so intermingled, it now appears that an EMP strike might devastate more than "just" the nation's economy.

This point should not be lost on a Commission whose statutory charter explicitly mentions protection of the national defense as one of the Commission's duties.

Conclusion

For the reasons set forth in this filing and in our previous filings, we urge the Commission to grant our Petition for Reconsideration and to proceed expeditiously with a Notice of Inquiry on the crucial subject of Electromagnetic Pulse.

Donald J. Schellhardt
Nickolaus E. Leggett

Tech Talk from ICOM

ICOM

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While attractive front panels and impressive magazine advertisements may initially glamorize any amateur radio item, they can also reflect the classic proverb of beauty being only skin deep. The favorable returns from any unit and the success of its manufacturer, however, are directly influenced by **after-purchase reliability and factory-backed service.** Knowledge of such performance records and readily available customer support encourage the peace of mind to use and enjoy a new unit to its maximum potential.

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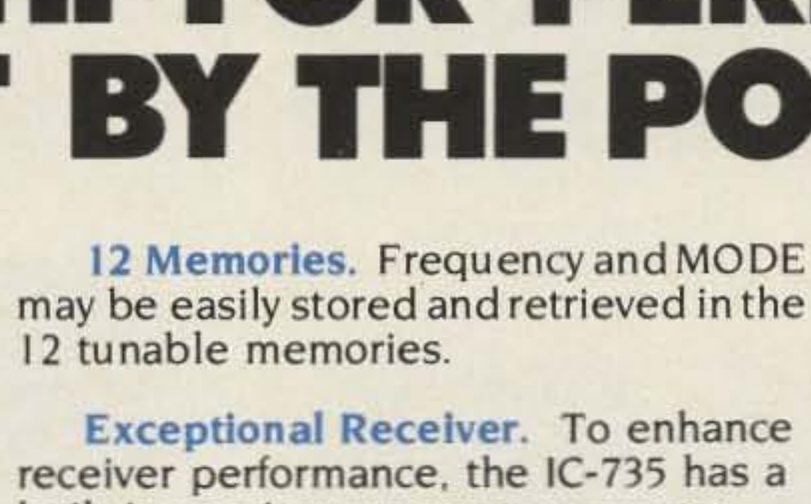

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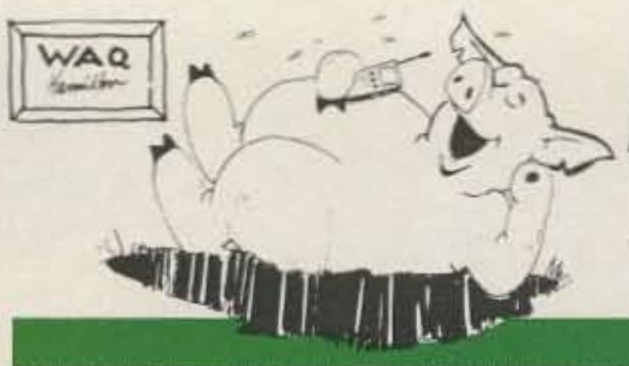

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AP-10 5-band Apartment Antenna	39.95
370-15 All-band Dipole Antenna	129.95

—Other antennas in stock—

DAIWA

CN-520/CN-540 Meters	59.95/69.95
NS-660A SWR/Watt Meter	134.95
CN-630 Meter	126.00
CN-720B 2kW HF Watt Meter	120.00
CNW-419 Antenna Tuner 500 W	174.95
CNW-518 Antenna Tuner 2.5 kW	279.95
CN410M SWR/wt mtr 3.5-150 MHz	64.95
CS201 2-position Switch	21.95
CS401 4-position Switch	64.95

ANTENNAS & TOWERS

CUSHCRAFT

A3 3-element 10-15-20m	217.95
A4 4-element 10-15-20m	292.95
R3 10-15-20m Vertical	268.95
215WB SSB/FM 2m Boomer	82.95
ARX-2B 2m Ringo Ranger	36.50
4218XL 2m Boomer	103.95
10-4CD 4-element 10m	111.95
15-4CD 4-element 15m	125.95
40-2CD 2-element 40m	296.95
Other Cushcraft models available	CALL

KLM

KT34A 4-element 10-15-20m	Call
KT34XA 6-element 10-15-20m	Call
2m-11X 11-element 2m	Call
2m-16LBX 16-element 2m	Call
432-30LBX 30-ele 440 MHz	Call
Fiberglass mast 5'	Call
Fiberglass mast 7'	Call

MOSLEY

CL-33 3-element Triband Beam	265.95
TA-33 3-element 10-15-20m	239.95
Pro 37 7-element 10-15-20m	465.95
Pro 57 10-12-15-17-20m	465.95
Pro 67 10-12-15-17-20-40m	579.95

HUSTLER

6-BTV 10-80m Vertical with 30m		128.95
5-BTV 10-80m Vertical		108.95
4-BTV 10-40m Vertical		87.95
G6-440 440 MHz Base Vertical		99.95
G7-144 2-meter Base Vertical		115.95
G6-144B 2m Base Vertical		87.95
MO-1/MO-2 Masts		21.50
BM-1 Bumper Mount		14.95
MOBILE RESONATORS	Standard	Super
10 and 15 meter	11.95	17.95
20 meters	15.50	21.85
30 and 40 meters	17.95	25.95
75 meters	19.95	36.95

HY-GAIN ANTENNAS

391S TH7DX 7-ele 10-15-20m	CALL
393S TH5DX 5-ele 10-15-20m	CALL
395S Explorer 14 10-15-20m	CALL
203S 3-element 2-meter Beam	CALL
208S 8-element 2-meter Beam	CALL
214S 14-element 2-meter Beam	CALL
BN86 Beam Balun	CALL
V2S 2-meter Vertical	CALL
V4S 440 MHz Vertical	CALL

MORE ANTENNAS

AVANTI HM 151.3G 2m On-glass	32.50
LARSEN LM-150 5/8 Mag Mount	39.95
BUTTERNUT HF6V 10-80m Vert	119.95
BUTTERNUT HF4B 2-ele Beam	189.95
BUTTERNUT 2MCV5 2m	42.75
VOCOM 5/8-wave 2m Handheld	15.95

ANTENNAS FOR OSCAR

Cushcraft 416TB Twist	59.95
Cushcraft A14410T 10-ele	53.30
Cushcraft A14420T 20-ele	76.95
Cushcraft AOP1 Package	149.95
KLM 2m-14C 2m 14-ele Circular	88.95
KLM 435-18C 18-ele Circ Polar	111.19
KLM 2m-22C 22-ele Circ 2m	109.00

Unarco-Rohn

Limited Quantities

Self-supporting towers:

HBX40 40-feet with Base	209.95
HBX48 48-feet with Base	279.95
HBX56 56-feet with Base	349.95
HDBX40 Higher load with Base	259.95
HDBX48 Higher load with Base	339.95

Other BX, HBX, HDBX in stock

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FK2558 58-feet, 25G	940.00
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Other sizes at similar savings.
Foldovers shipped freight paid, 10% higher west of the Rockies.

Straight Sections:

20G Straight Section	39.95
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Complete Tower Packages:

	25G	45G
40'	Call	Call
50'	Call	Call
60'	Call	Call

Each package includes top section, mid section, base, rotor shelf, guy brackets, guy wire, turnbuckles, equilizer plates, guy anchors, cable clamps, thimbles. Ask about substitutions and custom designs. Tower packages are shipped freight collect FOB our warehouse.

HY-GAIN TOWERS

HG37SS 37-feet tall	CALL
HG52SS 52-feet tall	CALL
HG54HD 54-feet/higher load	CALL
HG70HD 60-feet/higher load	CALL

Order Hy-Gain tower, Hy-Gain antenna, and Hy-Gain rotor and receive free shipping on all.

Tri-Ex

W36 36-feet tall	549.00
WT51 51-feet tall	929.00
LM354 54-feet/higher load	1575.00

Shipping not included. Shipped direct from factory to save you money

PHILLYSTRAN — CALL

CABLE BY SAXTON

RB213 Mil Spec	29¢/ft
RG8/U Foam 95% Shield	25¢/ft
8-wire Rotator 2 #18, 6 #22	17¢/ft
Mini-8 95% Shield	13¢/ft

Cablewave Hardline — CALL

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Diawa Rotators available	CALL
Alliance HD73	109.95
Hy-Gain Ham IV	CALL
Hy-Gain Tailtwister T²X	CALL
Hy-Gain Heavy-duty 300	CALL
Kenpro KR500 Elevation Rotator	199.95
Kenpro KR5400 azmth/elevat	329.95

TELEX HEADPHONES

Procom 350 ultra light set	58.95
Procom 250 soft phone/mike	72.90
Procom 450 padded phones	35.50
Procom 400 desk mike	49.95
Procom 460 padded phones	37.20
SWL-610 light headphone	8.75
C-610 light headphone	7.95
Others in stock	Please Call

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962 1.5 kW Tuner switch/meter	189.95
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941D 300-watt Tuner swch/meter	89.95
1020A Active Antenna	69.95
202B Noise Bridge	48.95
752B Dual Tunable SSB/CW Filter	79.95
Keyers—407, 422, 484	CALL
Other MFJ products in stock	CALL

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INTERNAL POWER SUPPLY

All 500 Series amplifiers have a Peter Dahl Hipersil plate transformer and a separate filament transformer. The fullwave bridge rectifier system—unlike other systems that utilize weak voltage doublers—uses computer grade electrolytic capacitors.

COMPATIBILITY GUARANTEED

Customer feedback in 1986 insisted on system compatibility. Responding to this challenge, a special Plug and Play Harness to hook your favorite radio to the LK500 is offered as an accessory. Of course, all Amp Supply amplifiers have our famous ATI-6 tuned input systems, assuring a perfect 50 ohm load to your transceiver.

AUTOMATIC LOCK OUT "NEW"

All the new LK-500ZC Series amplifiers are equipped with the ALO which stops amplifier operation when it senses an unacceptable SWR, improper tuning, or overcurrent on the tubes..

2-SPEED FANS

Most manufacturers have had to compromise on fan speed, one of the noisiest and objectionable aspects of amateur radio operation. But, our 500 Series amplifiers are different; they are the result of our perfected system of customer communication and engineer response.

THE LK-500ZC WITHOUT QSK

A version of the 500ZC is available without the Jennings vacuum antenna changeover relay and a companion sealed relay QSK system. A super buy at $1199.00!

THE LK-500NTC NO-TUNE

Our no-tune amplifier is the same dependable amplifier as the LK-500ZC with the new ALO system and full QSK, and completes our popular 500 Series. This desirable version allows you to merely switch to your favorite amateur band and transmit at full power. We have preset internal capacitors and coils for each of the traditional six amateur bands. The LK-500NTC is also available for special MARS and commercial channelized frequencies.

SPECIFICATIONS LK-500ZC

Frequency Range: 160 Meters 1.8-2.2 MHz, 80 meters 3.5-4.5 MHz, 40 meters 7.0-7.5 MHz, 30 meters 10.1 to 10.15 MHz, 20 meters 14.0-14.9 MHz, 17 meters 18.0-19.2 MHz, 15 meters 21.0-21.5 MHz, Export models: 12 meters 24.8-24.9 MHz, 10 meters 28.0-29.7 MHz.
Drive Power: 100W Nominal for 1500 Watt SSB PEP output, 125W Nominal for 1500 Watt CW output.
RF Output SSB 1.5 KW PEP continuous, CW 1.2 KW Average continuous, RTTY, SSTV 1 KW Average 1.5 KW PEP.
Plate Voltage: RTTY/AM/SSTV/CW/SSB 3.2 KV DC
Harmonic Suppression: -50 dB minimum.
Intermodulation Distortion Products: -33 dB down minimum.
Circuit Type: Class AB_2 grounded grid. Type of Emission: SSB, CW, RTTY, AM, SSTV
Duty Cycle: Amateur continuous duty in all modes at specified output.
Output Circuit: Pi-network (silver plated tubing HF coil).
Power Requirements: 115/230 VAC, 30/15 amps (230 VAC factory wired and recommended).
Dimensions: 8" H x 14" W x 16" D (including knobs).
UPS Shippable: 59 lbs.
Warranty: Two years on amplifier.

LK-500ZC Full QSK	**$1395.00**
LK-500ZC Without QSK	**$1199.00**
LK-500NTC No-Tune Version	**$1695.00**
Plug & Play Harness (Specify your radio)	**$ 9.95**
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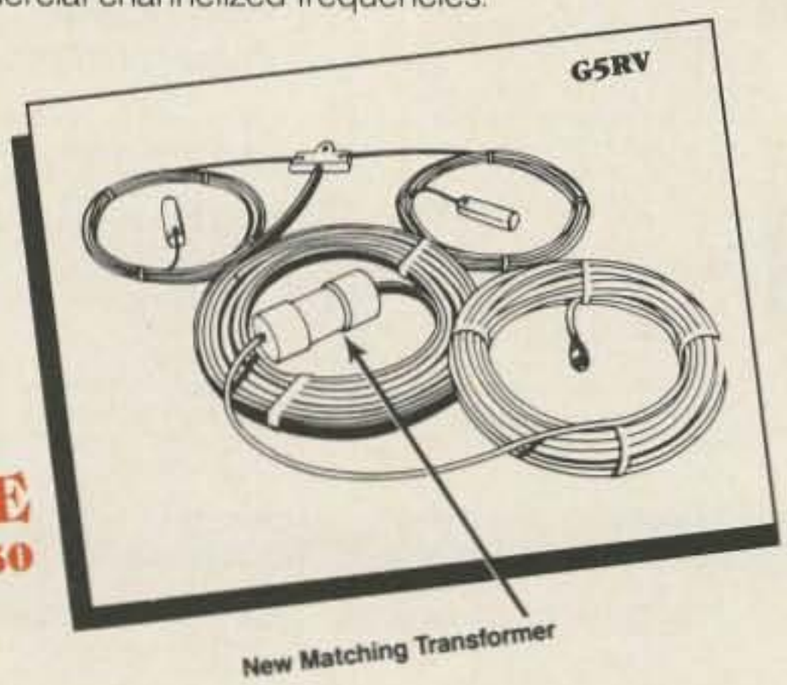

THE G5RV ANTENNA **Reg. $60.00 SALE $49.50**

The G5RV Signal Injector™ antenna is an excellent all band (3.5-30 MHz) 102 ft. dipole. On 1.8 MHz the center and shield of the coax at the transmitter end may be joined together and the antenna may be used as a Marconi with a tuner and a good earth ground. The proper combination of a 102 ft. flat-top and 31 ft. of 300 ohm tranmission line achieves resonance on all the amateur bands from 80 to 10 meters with only one antenna. There is no loss in traps and coils. The impedance present at the end of the 300 ohm line is about 50-60 ohms, a good match to the new RG8X mini foam coax.

- 2 KW PEP
- Completely assembled
- Use as horizontal or "V" configuration
- Consists of: 102 ft. copper antenna wire, 31 ft. 300 ohm transmisison line, 70 ft. RG-8X coax, 2 end insulators, 1 center insulator, 1 PL-259 and sleeve, connector and the **new transformer coupler.**

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MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

MARINE RADIO: Marconi Canada CH-125 synthesized AM/SSB transceiver, 22 channels on 4, 8, and 12 MHz, 125 Watts, 12 V dc. Never used, list $1,995, asking $1,495. Stu Norwood, 70 Rte. 202 North, Peterborough NH 03458. BNB047

QSLs to order. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

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CITIZEN BAND OPERATORS! Join the newest club around. Club benefits include power and modulation mods, a CB trader sheet, official number, CBs and accessories at discounted prices. Send $2 for information and postage to CB Operators of America, Attn: W. Thomas, 11 Collin Avenue, Uniontown PA 15401. BNB503

WANTED: EQUIPMENT AND RELATED ITEMS. The Radio Club of Junior High School 22 NYC, Inc., is a nonprofit organization, granted 501(c) (3) status by the IRS, incorporated under the laws of the state of New York with the goal of using the theme of ham radio to further and enhance the education of young people. Your property donation would be greatly appreciated and acknowledged with a receipt for your tax deductible donation. Please contact WB2JKJ through the *Callbook* or telephone (516)-674-4072, 24 hours, seven days a week. Thank you! BNB506

APPLE II+/c/e MORSE CODE PROGRAM. Menus, 31 modes, lesson plans, graphics, word processor, 1–100 wpm, etc. Write LARESCO, PO Box 2018, 1200 Ring Road, Calumet City IL 60409; (312)-891-3279. BNB507

HOME-BREW PROJECTS LIST. SASE WB2EUF, PO Box 708, East Hampton NY 11937. BNB509

SATELLITE SYSTEMS DISCOUNT CATALOG—$2 (refundable). Orion Descrambling Manual—$19.95. LSASE—brochure. Microtronics, PO Box 2517-BB, Covina CA 91722. BNB513

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ROTATING TOWER SYSTEMS, INC—Offers complete hardware systems to rotate 45 and 55 tower. Write or call for further details and prices. Box 44, Prosper TX 75078; (214)-347-2560. BNB520

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DX AWARDS. Need info on any DX awards, especially lesser known ones. Check incoming cards for stickers or award notices. Directory planned for mid-1987. Ted Melinosky K2BV, 525 Foster Street, South Windsor CT 06074. BNB526

TRS-80 4P/KANTRONICS UTU RTTY. Split-screen, 10 user keys, file transfer. Runs in Mod 4 (80 char.) mode. $30 to COMMPRO RTTY, c/o KB6IC, 3711 Gayle Avenue, Omaha NE 68123. BNB527

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REAL-TIME HF WEFAX MAPS on a dot-matrix printer. Available for Commodore, IBM, Apple, Atari, and CoCo. See March 86 *QST* Magazine for circuit details. Kit $28.15. Assembled $39.95. Software—Apple, Atari, and Commodore $10. IBM—$15 plus $2.50 shipping. For info, send large SASE. A & A Engineering, 2521 W. La Palma #K, Anaheim CA 92801; (714)-952-2114. BNB531

QSLs, QSLs, RUSPRINT QSLs. Quantities of 100, 200, 300, or more. Full color Old Glory and Liberty. Also Parchment, Golden Eagle, and others. SASE appreciated. Rte. 1, Box 363-73, Spring Hill KS 66083. BNB532

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COLOR SSTV—For sale, Robot 400C slow-scan color transceiver and Robot 800C multi-mode keyboard. Both mint condition, like new. Asking $650 for both. Call after 5 p.m. to (601)-843-6405 or write to Don Durel N5ICQ, 700 Farmer Street, Cleveland MS 38732. BNB539

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WANTED: Yaesu YO-901 band scope adapter. Pete Haas, PO Box 702, Kent OH 44240. BNB543

KENWOOD 430S OWNERS: Stop Scan automatically resumes the scan *after* the channel clears! No mods! No cut traces! Reviewed in *QST* 6/85 and *73* 2/85. $29.95 (kit $19.95). Jabco Electronics, R1 Box 386, Alexandria IN 46001. BNB544

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NEED FIVE-DAY CRASH COURSE to pass 13-wpm code test. Test must be given and passed at end of course. Name fee. Prefer east of Mississippi, but will go anywhere. Respond to Bob Herron, 3312 Jude Cr., Murrysville PA 15668. BNB550

FOR SALE: Brand new Ten-Tec 2510 satellite station, $400. Jim N1EJF, PO Box 1101, Hillsboro NH 03244; (603)-478-3262. BNB551

WANTED: Azden PCS-3000 2-meter FM transceiver, any condition. Adlai Breger, 8006 Dove Flight, San Antonio TX 78250; (512)-523-5438. BNB552

WANTED: Service manual for Yaesu FTX-650. Will pay for copying and postage. Jim Lisle WA4WQK, 3227 Park Avenue, Columbus GA 31904. BNB553

THE COMMUNICATION POST: Buy, sell, trade—ham, shortwave, and other electronic gear. Technical articles, projects. Send large SASE for sample copy. 24 issues, $9.95 per year. Box 1771 Grand Forks ND 58206-1771. BNB554

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"COMMODORE C-128" specific ham programs. SATRAK128 tracks up to 8 satellites simultaneously in real-time. C128RTTY RTTY program for user port RTTY (example, MFJ-1228) devices. Send SASE for additional information on above to: Reid Bristor WA4UPD, 14303 177th Avenue SE, Renton WA 98056. Phone (206)-235-0676. BNB556

FACTORY FRESH NiCds. Save this ad. AA/$1.45 each, AAA/$1.45 each, 2N 270AA (replaces 2N 250AA used in ICOM 2AT/4AT BP3 packs) $1.85 each, BP3 pack of 7 wired for your case $14.95 each, 2N 450A (used in ICOM BP2/BP5, Tempo S4, Yaesu FT-207R/208R) $2.40 each. Add $2 S&H/order. Cunard Associates, R.D. 6, Box 104, Bedford PA 15522. BNB557

HAM RADIO REPAIR, all makes, all models. Robert Hall Electronics, PO Box 8363, San Francisco CA 94128; (408)-729-8200. BNB558

SPECIAL EVENTS

HOLIDAY-IN-DIXIE QSO PARTY APR 4

The Holiday-in-Dixie QSO Party will operate on April 4 from 1800–2300 UTC during the Holiday-in-Dixie Celebration, an annual 10-day event commemorating the Louisiana Purchase, which is held in Shreveport and Bossier City, Louisiana. Exchange: Name, QTH, and RS(T). Frequencies: SSB—7.235 and 14.245; CW—7.115 and 21.115 (listen for CQ HID). For an 8-1/2 x 11 certificate, send an SASE and QSL to Holiday-in-Dixie QSO Party, c/o WA5ARJ, PO Box 4842, Shreveport LA 71134.

ROCHESTER MN APR 4

The Rochester ARC will sponsor the 10th annual Rochester Area Hamfest on April 4, beginning at 8:30 a.m., at John Adams Junior High School, 1525 NW 31st Street, Rochester, Minnesota. Talk-in on 146.22/.82. For further information, write to RARC, c/o WBØYEE, 2253 Nordic Center NW, Rochester MN 55901.

COLUMBUS IN APR 4

The Columbus ARC will hold its Swapfest '87 on April 4, from 8 a.m. to 5 p.m., at the 4-H Fairgrounds, in Columbus, Indiana. Admission is $3. 8-foot table, $4; 6-foot table, $3. Talk-in on 146.790 and 444.950. FCC testing held at Knights Inn Motel. Send Form 610 and copy of license ten days in advance to Til Kinser KI9R, 6651 N. Road 110 W., Columbus IN 47203; (812)-372-5006. For tables or information, contact Dave Mann KA9UUP, 458 N. Country Club Road, Columbus IN 47201; (812)-342-6302.

ARCADE TRADE FAIR APR 4–5

The Pioneer Radio Operators Society (PROS) will operate KC2JY on April 4–5, from 1400–2200 UTC, for the 4th annual Arcade Trade Fair. Operation will be on SSB with suggested frequencies 3.890, 7.240, and 14.250. For a QSL, send a QSL and an SASE to PROS—KC2JY, Box 296, Arcade NY 14009.

WILLINGBORO NJ APR 5

The Willingboro Repeater Group will hold its annual hamfest on April 5, from 8 a.m. to 2 p.m., at Holiday Lakes, Rte. 130 and Creek Road, Willingboro, New Jersey. Admission is $3 at the door or $2.50 in advance, XYLs and children under 16 free. Table space: $5 per 8-foot table. Tailgaters must purchase an admission ticket, outdoor selling only. Talk-in on 146.925 or 146.52. For further information, write to Willingboro Area Repeater Group, PO Box 472, Willingboro NJ 08046, or call Jack K2KLM at (609)-877-5249 after 6 p.m.

GROSSE POINTE WOODS MI APR 5

The South Eastern Michigan ARA will hold its 29th annual Hamfest Swap and Shop on April 5, from 8 a.m. until 3 p.m., at the Grosse Pointe North High School, 707 Vernier Road, Grosse Pointe Woods, Michigan. Advance tickets $1, $3 at the door. Advance tables $8, $10 at the door. Talk-in on 147.70/.10 and 146.52. For more information, write to SEMARA Hamfest, PO Box 646, St. Clair Shores MI 48080, or phone Fred Lewis NK8M at (313)-881-0187.

FRAMINGHAM MA APR 5

The Framingham ARA will hold its annual spring flea market and exams on April 5, beginning at 10 a.m., at the Framingham Civic League Bldg., 214 Concord Street (Rte. 126), in downtown Framingham, Massachusetts. Admission is $2 and tables are $10 (includes one free admission). Pre-registration is required for tables and exams. Talk-in on .75/.15. To reserve tables, contact Jon Weiner K1VVC, 52 Overlook Drive, Framingham MA 01701; (617)-877-7166. To register for license exams, send completed Form 610, copy of ham license, and check for $4.25 payable to ARRL/VEC to FARA, PO Box 3005, Framingham MA 01701. Walk-in exams given on a space-available basis.

MADISON WI APR 5

The Madison Area Repeater Association, Inc., will hold its 15th annual Madison Swapfest on April 5, beginning at 8 a.m., at the Dane County Exposition Center Forum Building in Madison, Wisconsin. Admission is $2.50 in advance and $3 at the door. Children 12 and under are admitted free. Tables are $5 each in advance and $6 at the door, plus admission. Reserve by March 31. Talk-in on 146.16/.76. For admission tickets, table reservations, or information on commercial exhibit space, contact MARA, PO Box 3403, Madison WI 53704; (608)-274-5153.

CHARLESTON WV APR 5

The Charleston WV Area Hamfest & Computer Show will be held on April 5, from 8 a.m. to 5 p.m., at the Civic Center in Charleston, West Virginia (follow I-64, I-77, and I-79 to exits marked "To Civic Center"). Admission is $4. Talk-in on 6.28/6.88. For more information, contact Ollie Rinehart KA8TIK, 1256 Ridge Drive, South Charleston WV 25303; (304)-768-9534 (days) or (304)-768-9534 (nights).

LANCASTER PA APR 5

The 14th Lancaster Hamfest, sponsored by Sercom, Inc., will be held on April 5, from 8 a.m. to 2 p.m. at the Overlook Roller Rink (on Rte. 501 just one mile north of the Rte. 30/501 intersection, two miles north of Lancaster, Pennsylvania). $4 admission, XYLs free. $5 per space for tailgating. Tables $10, perimeter or with electricity $12. Talk-in on 146.01/.61 or 147.015/.615. SASE to Hamfest Committee, PO Box 6082, Lancaster PA 17603 for info.

CLARKSVILLE TN APR 5

The Clarksville Amateur Transmitting Society will sponsor its annual

Swapfest at the National Guard Armory on Hwy. 41A (Ft. Campbell Blvd.) in Clarksville, Tennessee, on April 5. The armory is off I-24, three miles south of Gate 1 to Fort Campbell. Admission is free. Tables are $5 each. Talk-in on 146.52, 146.805/.205, or packet 145.03. To reserve tables or to get more information, call Larry WD4DBJ at (615)-232-6141.

OMAHA NE
APR 5

The Ak-Sar-Ben ARC will present its annual auction on April 5 at The Radial Social Hall, 1516 N.W. Radial Highway, Omaha, Nebraska. Check-in starts at 8 a.m., auction at 9:15. No admission fee. Talk-in on 146.34/.94. For rules or more info, write Ak-Sar-Ben ARC, PO Box 291, Omaha NE 68101, Attn: Auction Chairman.

MOORELAND OK
APR 5

The Great Plains ARC 6th annual Northwest Oklahoma Eyeball and Swapmeet will be held in Mooreland on April 5, starting at 9 a.m. $2 admission at the door. Dealer and swap tables available at no charge. Talk-in on 147.72/.12, 146.13/.73, and 146.52. VE tests given on April 4. Directions: North on Main or Elm Street, across the tracks and west. For further information, call (405)-994-5600 or write to Gerald Bowman WG5Z, Box 356, Mooreland OK 73852.

APPALACHIAN TRAIL
APR 10–12

The Lanierland ARC will operate W4IKW from 1400 UTC on April 10 until 0200 UTC on April 11, and also from 1400 UTC on April 11 until 0200 UTC on April 12 at Amicalola Falls State Park to honor the 50th anniversary of the completing of the Appalacian Trail, a 2,000-mile hiking trail from Springer Mt. in Georgia to Mt. Katahdin in Maine. The suggested operating frequencies ±QRM are 14.270, 7.270, and 3.870 on the General phone bands, and 7.140 and 3.740 on the Novice bands. Listen for CQ ATC on all bands. For a commemorative certificate, send QSL and a 9 x 12 SASE to Lanierland ARC, PO Box 2182, Gainesville GA 30503.

ST. CHARLES MO
APR 11

The St. Charles ARC will operate WBØHSI from 1400–2200 UTC on April 11 to celebrate its fifteenth anniversary near its original meeting place. This special-event station will transmit on 7.250, 14.325, 21.350, 28.510, and 146.67 as propagation and QRM permit. For a certificate, send a large SASE to the St. Charles ARC, PO Box 1429, St. Charles MO 63302-1429.

SUBMARINE SERVICE ANNIVERSARY
APR 11–12

The Olympia RAC will celebrate the anniversary of the United States Submarine Service by operating station WA3BAT from the *U.S.S. Becuna*, a World War II submarine and the *U.S.S. Olympia*, flagship of Admiral Dewey in 1898. Transmissions can be heard beginning at 1300 UTC on April 11 until 2000 UTC on April 12. CW frequencies will be 3.590, 7.050, 14.050, 21.090, and 28.150. Phone frequencies will be 3.890, 7.240, 21.360, and 28.600 (all frequencies within 10 kHz). Two-meter operation is planned as well as Novice bands. For a certificate and additional information, send a business-sized SASE (U.S.) or one IRC (foreign) to Olympia Radio Amateur Club, PO Box 928, Philadelphia PA 19105.

PA MAPLE FESTIVAL 40TH
APR 11–12

The Somerset County, Pennsylvania, ARC will operate KA3IUS on the lower 25 kHz of the General section of 75 and 40 meters on April 11 and 12 to commemorate the 40th anniversary of the Pennsylvania Maple Festival. On April 11 from 1700–2200 UTC on 40 meters, then from 2200 to ? on 75 meters. On April 12, from 1700–2200 UTC on 40 meters. Please send an SASE for a certificate to KA3IUS, R.D. #1, Box 394-B, Meyersdale PA 15552.

BRAINTREE MA
APR 12

The South Shore ARC will hold its annual indoor flea market on April 12, from 11 a.m. to 4 p.m., at the Viking Club, 410 Quincy Avenue, Braintree, Massachusetts. Admission is $1. 8-foot tables available for $10 each (includes one free admission per table) in advance. Send payment (made out to South Shore Amateur Radio Club) to Ed Doherty W1MPT, 236 Wildwood Avenue, Braintree MA 02184 before April 9. Tables will cost $12 on the day of the sale. If you have questions, call Ed at (617)-843-4431 during the evenings.

AUSTIN TX
APR 18

The Austin ARC will sponsor its Spring Swapfest on April 18, beginning at 7 a.m., at the Manchaca fire station on FM1626, south of Austin, Texas. Free admission. Tables, $2. Talk-in on 146.18/.78. For info, contact Dave Harper WD5N, 109 West 38 Street, Austin TX 78705; (512)-454-9205 (evenings).

ARBOR DAY
APR 20–26

Special-event stations will be operating from 2400 UTC April 20 to 0600 UTC April 26 from Nebraska City, Nebraska, the home of Mr. J. Sterling Morton, the founder of Arbor Day. Stations will be operating in the General portion of the phone and CW bands on 80 through 10 meters. SWLs can participate also. Please send a business-size SASE and your QSL to Nebraska City ARC, PO Box 278, Nebraska City NE 68410.

DAYTON OH
APR 24–26

The Dayton ARA will sponsor the Dayton Hamvention on April 24–26. Tickets for all three days will be sold in advance only; no spaces sold at the gate. For further information, contact DARA, Box 44, Dayton OH 45401; call (513)-433-7720 for general information, (513)-223-0923 for flea market information, and (513)-223-2612 for lodging information (no reservations by phone). See display ad on page 11 for further details.

FITCHBURG MA
APR 25

The Montachusset ARA will hold a flea market at the Knights of Columbus Hall on Electric Avenue in Fitchburg, Massachusetts, on April 25 from 9:30 a.m. to 3 p.m. Admission is $1, tables are $8. Talk-in on 144.85/145.45 and .52. For reservations, send check payable to MARA, c/o James Beauregard, 7 Mountain Avenue, Fitchburg MA 01420.

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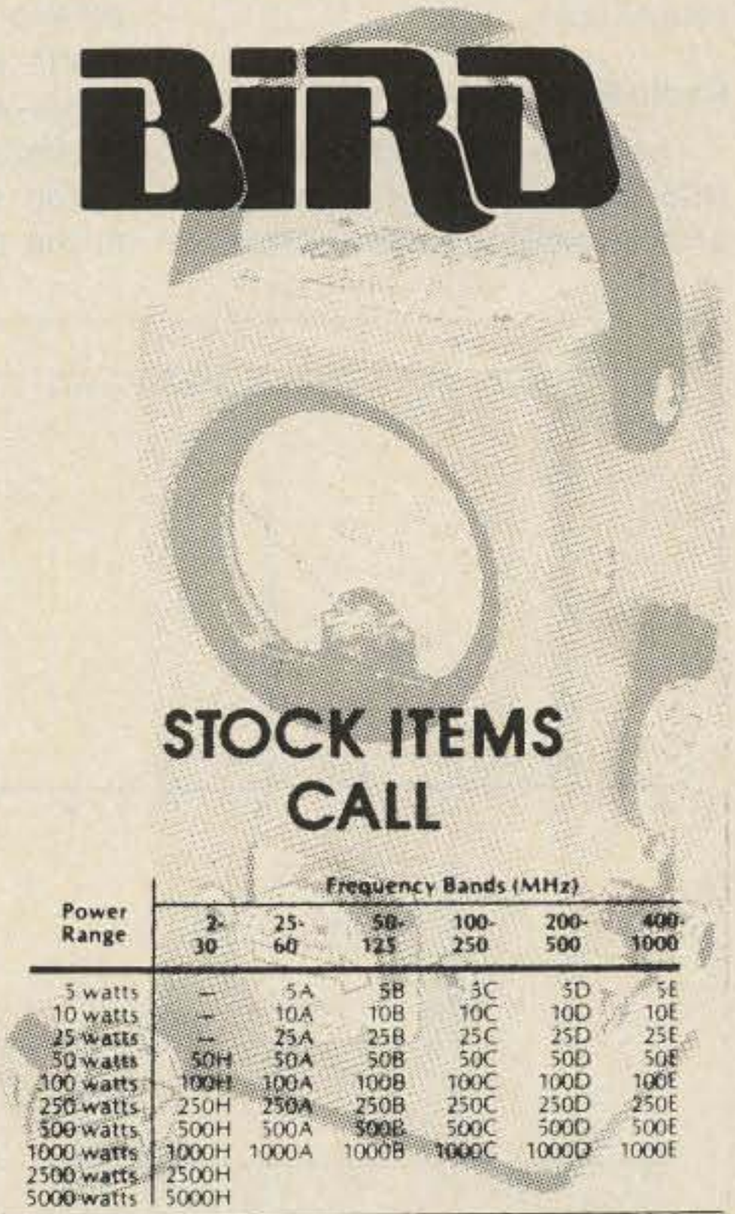

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100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
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STATUS REPORTS

Another exciting month of excellent satellite activity has passed, and our "repeaters in the sky" are constantly changing due to eclipsing and other factors. This month, I will begin with complete status reports on all of the hamsats, and then I'll round things out with some hints on antennas for successful OSCAR operation.

I will not get into product reviews on the various antennas, but will describe their characteristics briefly. I will bypass many of the equations and physics involved and will simply look at systems that get results. For those of you who are just now joining this on-going hamsat conversation, beg, borrow, or steal the last three issues of *73* and get caught up!

Radio Satellites

The Soviet Radio satellites, RS5 and RS7, have once again entered eclipse season. This is when portions of certain orbits pass through the shadow of the Earth, meaning drastically reduced operating time for us. RS5, whose batteries are virtually gone, will yield almost zero activity. Although sources in Europe have reported that both satellites will be off till mid-March (about the time you read this), I have found RS7 to be active for at least half the passes I have monitored.

RS5 will not be heard very often, if at all, while in eclipse. Due to the battery problems, solar power is its only source of energy. When the satellite is overloaded with too many high-powered uplink signals, it will turn off. A command station must send the coded signals up to the satellite to turn it back on again. This doesn't happen over the western hemisphere. All I can suggest is that you monitor the CW beacon on 29.451 MHz when RS5 is expected and use QRP—less than 100 Watts effective radiated power (erp)—when attempting to access the transponder.

The same power rules apply to the two-meter uplink of RS7. Although its batteries are in somewhat better condition, heavy overload has occasionally turned off this satellite. The downlink signals from RS7 have not been very strong lately, but the DX has been available to those stations with the better antennas for the ten-meter downlink signals. Watch for the beacon on 29.501 MHz.

As of this writing, RS9 and RS10 are still earthbound. The extreme cold in the Soviet Union at the Plesetsk launch site has delayed activities there. I hope to be reporting on new hamsats in orbit next month.

In the meantime, I have included a frequency-planning chart for the new RS birds by WA5RON (see Fig. 1). Note that the RS10 ROBOT uplink frequency is in the 15-meter Novice band. This certainly has possibilities. Refer to last month's column for more details on RS9 and RS10.

UoSATs

The UoSAT series of scientific hamsats continues in good health. Several of you have reported success hearing the two-meter beacon signals on 145.825 MHz with HTs and simple rubber-ducky antennas. Several attitude changes have been under way on UoSAT-OSCAR 11 to invert the spacecraft. Typically, UO-11 is oriented in a stable gravity-gradient-locked position with the camera end always facing the Earth. If you cannot find the satellite's beacon on, it is due to the many experiments that the folks at the University of Surrey implement from time to time.

AMSAT-OSCAR 10

AMSAT-OSCAR 10 has provided some surprisingly good activity lately. Stations from Kuwait to Borneo have been heard and worked by stateside hams. Unfortunately, we will have little or no use of the satellite until May. Since the ground control stations cannot change the satellite's orientation in space, its behavior due to things like precession and nodal regression can be predicted as is shown in Table 1.

These calculations were provided by Ross WB6GFJ, using a computer program developed by Jim G3RUH. The most important items in this chart are sun angle and percent illumination. Sun angle refers to the orientation of the satellite with respect to the sun's radiation. Zero sun angle occurs when the sun's rays are perpendicular to the plane of the solar arrays on the spacecraft, giving 100 percent illumination. When the angle hits 90 degrees, we have virtually no illumination of the solar cells.

The other numbers on the chart, the Bahn coordinates, tell us when the satellite's antennas are pointed at the Earth. When the longitude is 180 degrees and the latitude is zero, AO-10 is aimed at the middle of the Earth when at its highest point or apogee. During the year, the latitude will move only slightly, but the longitude shows a continuous trend to smaller values. For us, this means that signals will be best early in each orbit. Later in each pass, the antennas will be aimed away from the Earth and communications will be very difficult or impossible.

I am assuming that the satellite will survive the period in late March and early April when the sun angle will be so bad that all active systems on the satellite most likely will power down and the batteries will be discharged. AO-10 has done well in this type of situation before, but there are no guarantees that things will be easy again. If you find the satellite active, keep your erp down to 100 Watts or less on the 70-cm uplink, avoid operation around perigee (possible eclipse peri-

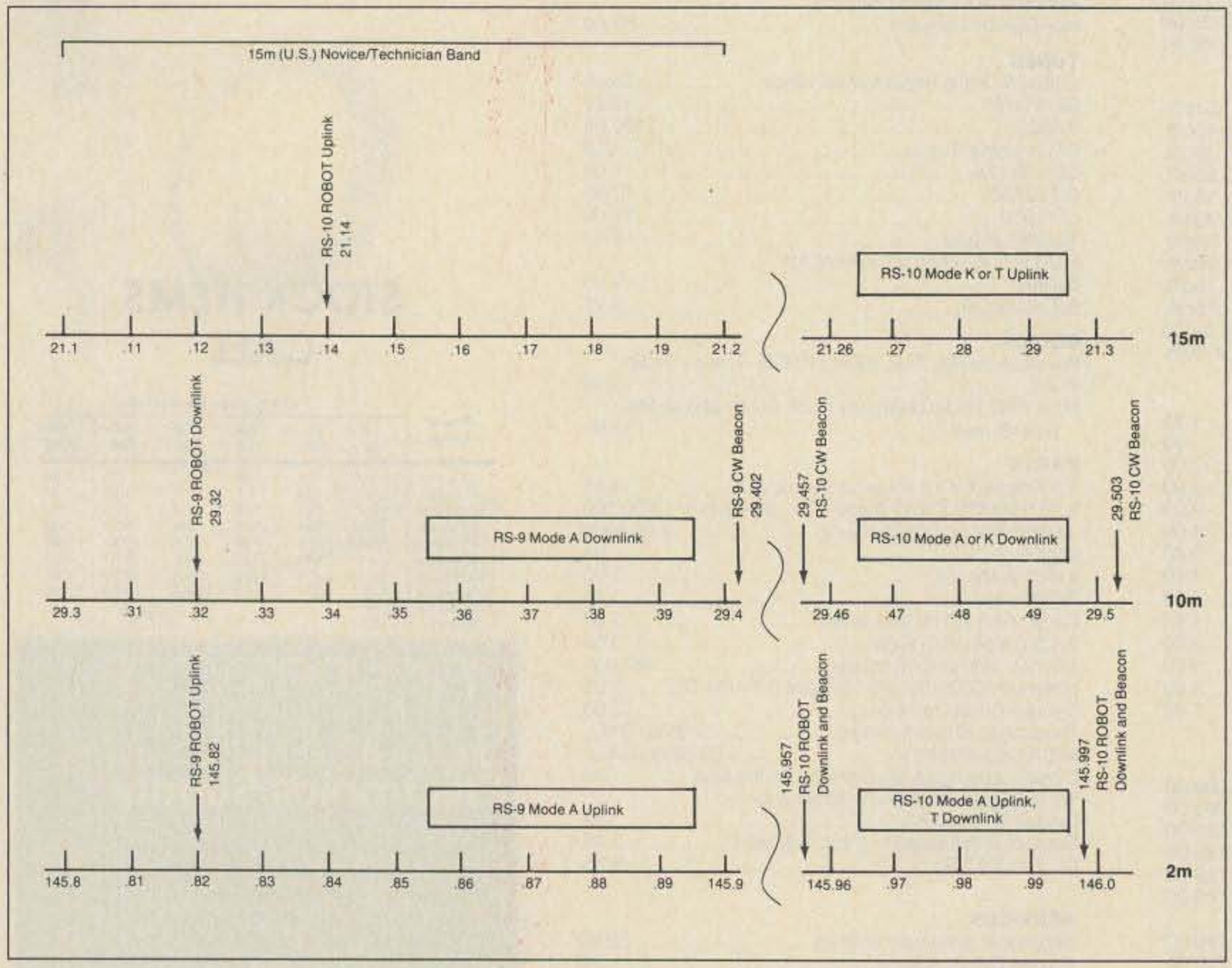

Fig. 1. Frequency-planning chart for the new RS birds.

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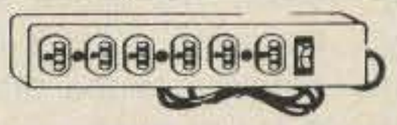

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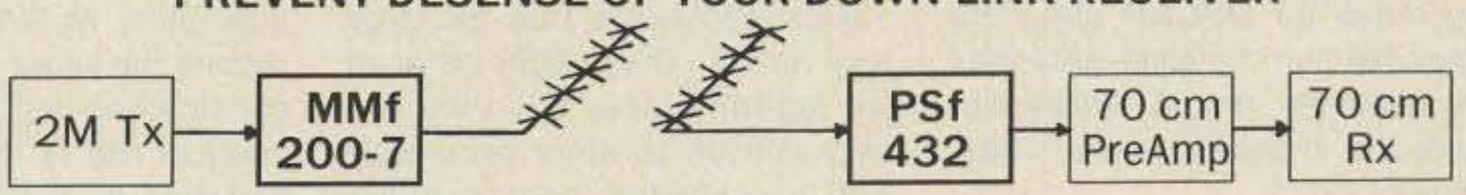

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ods), and listen to the AMSAT nets for the latest news on operating conditions.

Fuji-OSCAR 12

Fuji-OSCAR 12 continues to provide us with excellent SSB and CW QSOs. The satellite does not have enough power available for continuous mode JD operation, but we are hoping that some digital operation can be scheduled on a regular basis soon.

In the meantime, we have had five days of mode JA with two days of recharge (no operation) per week. It is not easy to adjust rotators every two minutes and keep up with the rapidly changing frequencies due to Doppler shift, so many of those now on FO-12 have added or are thinking about adding some sort of computer interface to their rotor systems. Accessories like this are helpful, but are not necessary for enjoyable FO-12 contacts. Address your basic system needs first before worrying about the bells and whistles.

DATE	SUN ANGLE	PERCENT ILLUMINATION	BAHN COORDINATES LONGITUDE	LATITUDE
Mar 5	65.1	42.1	148.4	11.5
Mar 12	72.0	30.9	147.5	11.1
Mar 19	78.8	19.4	146.7	10.6
Mar 26	85.1	8.5	145.8	10.1
Apr 2	85.6	7.7	145.0	9.7
Apr 9	79.5	18.2	144.1	9.2
Apr 16	72.8	29.6	143.3	8.7
Apr 23	66.1	40.5	142.4	8.3
Apr 30	59.3	51.0	141.5	7.8
May 7	52.6	60.7	140.7	7.3
May 14	45.8	69.7	139.8	6.8
May 21	39.1	77.6	138.9	6.4
May 28	32.4	84.4	138.1	5.9
Jun 4	25.7	90.1	137.2	5.4
Jun 11	19.0	94.6	136.3	4.9
Jun 18	12.3	97.7	135.4	4.4
Jun 25	5.7	99.9	134.6	3.9
Jul 2	-1.0	100.0	133.7	3.5
Jul 9	-7.7	99.1	132.8	3.0
Jul 16	-14.3	96.9	131.9	2.5
Jul 23	-21.0	93.4	131.0	2.0
Jul 30	-27.7	88.5	130.2	1.5
Aug 6	-34.4	82.5	129.3	1.0
Aug 13	-41.1	75.4	128.4	0.5
Aug 20	-47.8	67.2	127.5	0
Aug 27	-54.5	58.1	126.6	-0.5
Sep 3	-61.2	48.2	125.7	-1.0
Sep 10	-68.0	37.5	124.9	-1.4
Sep 17	-74.7	26.4	124.0	-1.9
Sep 24	-81.3	15.1	123.1	-2.4
Oct 1	-86.6	5.9	122.2	-2.9
Oct 8	-83.6	11.1	121.3	-3.4
Oct 15	-77.1	22.3	120.5	-3.9
Oct 22	-70.3	33.7	119.6	-4.4
Oct 29	-63.4	44.8	118.7	-4.8
Nov 5	-56.4	55.3	117.8	-5.3
Nov 12	-49.4	65.1	117.0	-5.8
Nov 19	-42.4	73.8	116.1	-6.3
Nov 26	-35.4	81.5	115.2	-6.8
Dec 3	-28.3	88.0	114.4	-7.2
Dec 10	-21.2	93.2	113.5	-7.7

Table 1. 1987 AMSAT-OSCAR 10 attitude predictions.

ANTENNAS

To build or to buy—the choice is yours. Today, we have several manufacturers involved in satellite antenna design and production. Dishes are not common for amateur-radio satellite operation, but if someone offers you a forty footer with free installation, let me know if you don't want it! The most common antenna system for the serious satellite chaser includes a pair of crossed yagis, one for two meters and another for 70 centimeters. A ten-meter dipole, vertical, or three-element yagi will provide mode A downlink capability.

Some manufacturers and distributors include KLM, Cushcraft, Telex/Hy-Gain, and Spectrum International. Of their antennas, the most common ones heard on the air are from KLM and Cushcraft. This is likely due to their established positions as makers of a large variety of antennas, including those for OSCAR use. The Telex/Hy-Gain satellite antennas are relatively new. A review can be found in the February, 1987, issue of *73*.

Since most amateur satellites are configured for circular polarization, so too are most of the antennas manufactured for the earth station. The "sense" of circular polarization is right- or left-handed. This circular polarization can be created using the crossed-yagi design by feeding one of the yagis 90 degrees out of phase with the other. The sense is selected by switching a delay line from one antenna to the other. Some of these antennas also use element staggering to achieve the circular pattern.

When purchasing a satellite antenna, you must consider several things. These include performance, price, and reliability. In most circumstances, you would consider more gain to be a deciding factor, but for satellite chasing, more is not always better. A forty-foot dish has a lot of gain at 70 centimeters, but it would be quite a chore to keep up with a low-orbit satellite like Fuji-OSCAR 12 as it goes from horizon to horizon during a 20-minute pass.

This also holds true for large yagi arrays. They might be good for moonbounce, but they are very difficult to steer accurately and quickly for most satellite work. Although the inclusion of stainless-steel hardware increases the price, it does improve reliability.

Polarization-switching relays also add to the antenna cost, but provide more versatility for operation through satellites with different circular sense. I would suggest a two-meter crossed yagi with 14 to 22 elements and a 70-cm crossed yagi with 16 to 30 elements. Larger arrays with stacked antennas may be appropriate after you gain some experience.

For the antenna builder, there are many antenna types from which to choose. Several cross-yagi designs have been described in publications like the ARRL *Handbook* and the *VHF-UHF Manual* from the Radio Society of Great Britain.

A favorite home-brew antenna is the helix. It looks like a corkscrew with a reflector plate in the back. Building one for two meters is quite a chore, but for 70 cm it is a fine performer and not unwieldy. Due to excellent broadband characteristics, its dimensions do not require the same precision during construction as a yagi. Its only shortcoming is that it cannot be switched from one sense to the other. It is either wound for right- or left-hand polarization.

Other useful satellite antennas not typically found in catalogs include VHF and UHF quads and turnstiles. For two meters, the quad is not large and won't exhibit quite the signal-fading symptoms experienced by linear yagis pressed into satellite service. The turnstile is simply a crossed dipole suspended above a reflector to give a nearly omnidirectional horizontal pattern. More detailed information on home-project satellite antennas can be found in Martin Davidoff's *The Satellite Experimenter's Handbook*.

Some Satellite-Station Setups

From the sound of it, amateur satellite chasing requires significant antenna arrays. Fortunately, this is not always the case. Although the newcomer to space communications may find minimal systems unsatisfying, the activities of some stations are very thought-provoking. Doug WB5IRI has been monitoring FO-12 using a whip antenna in the garage with a Hamtronics preamp and downconverter to a Kenwood TS-120S. Jody N5HQM has made several FO-12 QSOs using a Diamond XL-200 dual-band base-station antenna, a single run of 9913 coax, a Yaesu AD-2 duplexer, and a Yaesu FT-726R transceiver with a two-meter power amplifier.

Scott WA5LHM has been able to monitor AO-10 using a two-meter mobile antenna in the shack with a Kenwood TS-711A. Courtney N5BF has monitored his own signals through FO-12 using a quarter-wave "mag-mount" antenna in the attic for transmit on two meters and a rubber ducky on 70 cm for receive. The rigs were ICOM with a duck-mounted preamp.

Perhaps the most intriguing activities are those of Chris N5JHM, who has made mobile-in-motion QSOs via AO-10 from his pickup truck using a Kenwood TR-751A with 5/8-wave whip for receive and an ICOM IC-471H with whip antenna for transmit. These contacts were possible due to the antenna orientation of AO-10 in recent weeks.

The challenge of satellite operation with simple setups can provide a very enjoyable pursuit similar to long-haul DX on the shortwave bands using milliwatt transmitters. Come on up and join the fun!

A FINAL NOTE

The Tuesday-night, 75-meter AMSAT nets have moved from 3.855 MHz to 3.840 MHz, plus or minus 10 kHz. This was due to the crowded conditions in the General-class portion of the band. Nets start at 9 p.m. local time.■

RTTY LOOP

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

APRIL

I want you to check around this issue carefully. After all, any magazine that prints a "contract" at the end of the Postal Statement (February, "What kind of dummy wastes time reading the fine print of the postal statement? . . . What further proof is needed that hams are crazy? Case closed."), or has me as a columnist, for that matter, has got to be suspect of publishing an "April Fool" article. So, those of you, and from your letters there are a lot of you, who turn right to this column first thing are excused for a bit to go looking. You won't find it here. Don't worry, I'll wait right here for you.

C-64 RFI

Back so soon? Hmmm, can't wait to take a look myself! Anyway, let's start out with a quick question posed by Bill Fletcher AF9B of Madison, Wisconsin. Bill writes, "How does one get rid of the awful rf from a C-64 when attempting to use it with a Kenwood TS-520S? The noise just plain wipes out most reception on the 520S."

One of the most common sources of RFI to the C-64 computer that I have heard about has been the type of interface, or demodulator, used. Several of them have been named as rather potent RFI sources. You might see old columns for details on this one. Lacking that source, you come down to the computer itself and the interconnecting cables. Of course, anything that should or could be grounded should be, and any extra shielding you can put between interferers and interferees (another point for the neologists among you) may be significant. Let me know your results. I am sure there are others in the same situation that may well benefit.

Amiga RTTY, Anyone?

George B. Miler, currently a computer science major at North Carolina State University, Raleigh, North Carolina, was attracted to *73* because of the RTTY coverage here, as he is interested in using an Amiga computer on RTTY. Well, George, I have zipparino in the way of information on the Amiga. Either no one out there is using one on RTTY (highly improbable) or no one has let me know what they *are* doing (on the nose!). Wish I could help you, but it will have to wait until more information is available at this end. In the meantime, if you have any success in your efforts, please pass it along so that others may benefit.

Talking RTTY Remembered

Wonder how many of you noticed the article in *73* two months ago, the RTTY issue, on "The Talking Teletype." I don't want to toot my own horn, but if I don't who will? Such a concept was presented here in RTTY Loop several years ago, using a 6800 microcomputer to receive the RTTY and channel it to a Votrax Type 'N' Talk speech synthesizer. The effect was remarkable and a blind ham I knew was suitably impressed. No doubt that some of the newer systems could do far more with less work. It does show how far we have come.

CoCo RTTY Questions

That inevitable march of progress has hit one of our gang, John R. Cooley KD9YK of Morrison, Illinois. John writes that he is an old-timer who is getting back into ham radio. He jumped from no ticket to N9FVK to KD9YK in six-week steps!

John has "leanings" toward the CoCo (Tandy Color Computer) as the machine to get for RTTY, especially with the observation that the CoCo 2 can be had for less than $100 and the CoCo 3 for $220. (I have seen the CoCo 2 for less than $70 and the CoCo 3 for less than $200 in local sales—and less than that by mail order . . . mil.) Given that he wants to operate several modes, including Murray RTTY, ASCII, AMTOR, and CW, he poses several questions. I shall cover them as he asked them.

His first question wonders as to the state-of-the-art software available for the CoCo, be it the Crowston/Grosvenor described here a few months back or other. Well, the Grosvenor software does appear to be the latest for the CoCo. I don't know what else may be in someone's beta test ready to be released, but the above-cited software is very good. I will be publishing a simple machine-language/Basic loader CoCo RTTY program as soon as I receive an update from the author, hopefully within the next two months. This will not be a fully stacked bells-and-whistles program. but the price will be right.

Question two is a simple one, whether or not the commercial software will be compatible with the CoCo 3. I don't know. Most of the CoCo 1/2 programs are compatible with the newer CoCo 3, unless they use a certain area at the high end of the first 64K, which Tandy "reserved" for future use. I just don't know whether or not these programs will run and I won't until I get a CoCo 3 or someone tells me about it. Given the newness of the CoCo 3, I'm not even sure that the manufacturer will know the answer yet.

The third question is one I shudder at, and am forced to break up into three parts. First off, "Is the Pakratt, Heath, or Kantronics the preferred unit?" Come on! They are all clearly fine units, and which one you buy may well determine which one you like best, or vice versa. After all, Chrysler, GM, and Ford each have large numbers of folks who swear by, and at, each of them. But when push comes to shove, they really are all fine cars, right folks? So, ask around, see if you can play with one or all of them, compare features and what you need, and make an informed decision.

"Buy the computer you like, then the programming."

Part two of this compound question is that John is interested in the RS-232 port of the CoCo 3. Well, so am I. The serial port of the CoCo 2 was driven by a software UART in what is commonly called a "bit-banger" technique. This has the disadvantage of tying up the CPU for rather large chunks of time, and severely limits the ability of the program to do anything else. By contrast, the new CoCo 3 still uses one bit of a PIA driven by a "bit banger," but somehow allows it to be interrupt-driven, so that the CPU is not, itself, always tied up. Should be a bit more useful. Unfortunately, the solution that Tandy might have considered, that many of us have done, was to use a true serial port, an ACIA chip, for RS-232 interfacing. This option will still be available for the CoCo 3 with an outboard board, just as with previous incarnations.

And the third part, now you see why I broke this one up, is the question of IBM compatibility for the CoCo 3. It's not.

Question four is not exactly RTTY, but it is cogent. John wonders about the CoCo 3 as a video generator for ATV. Don't see why not, John, and the graphics available, up to 640 by 192, for the cost can't be beat. In fact, a little later in this column I will tell you about one way to use those graphics.

The fifth question is not about the CoCo at all, but another computer. John poses the classic question, and I paraphrase: What good is the thus-and-such program if I don't have a whoosie-bob computer? I have said before, and I will say again, buy the computer you like, then the programming. My own preferences do tend towards economy in computers, though.

John poses a lot of good questions, questions that I am sure have occurred to all of us at one time or another. I, for one, thank him for his interest, and look forward to hearing of his progress.

A New RTTYer

Another beginner in our midst is located right here in Baltimore! Craig Renier KB3KK is interested in RTTY but does not know if he has the right equipment. He says that he has a Heath HW-101 transceiver and a C-64 computer. Well, Craig, you have an excellent start. About all you need is a program and interface, both of which have been covered well here in the pages of *73*, and you should be on. Good luck, and keep us posted, too.

CoCo 3 Graphics and Other Goodies

Now, what was that I said about graphics for the CoCo 3? Our good friend Bob Rosen of Spectrum Projects, Inc., has come out with the first graphics program designed for the CoCo 3, C III Graphics. Requiring a CoCo 3 with 128K

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of RAM and a disk drive, this is a 320 by 192, 16-color graphics program. With ten sets of palettes, each with 16 colors, box, circle, cut-and-paste, paint, and all kinds of other nifty features, including loading and saving a high-resolution screen to disk. Written in Basic, thus able to be modified by the user a tad, this program represents an excellent entry-level graphics program for what is sure to become a popular graphics machine. And at $19.95, it's quite a bargain to boot.

Bob has quite a few other goodies for the CoCo 3. A memory upgrade to the full 512K can be had for $139.95—I know folks who paid more for their 4K computers than that. And a book, *CoCo III Secrets Revealed*, exposes the inner mysteries of this new powerful machine for the hacker in all of us.

Need I go on? Bob has all the bases covered, it seems, for those of us who are "into" Tandy CoCos. Drop Bob a line at PO Box 264, Howard Beach NY 11414, for a full rundown on CoCo products. Don't forget to mention *73*'s RTTY Loop as where you read it.

To Come

In the coming months, stay tuned for the above-mentioned program for the CoCo, as well as a look at some other innovations in RTTY that have, shall we say, changed our hobby significantly. As always, the fabled reprint list remains available for a little old self-addressed, stamped envelope. I fancy a change in the list within the next month or so, so those of you who have requested one before might drop me another SASE, and be sure to note your request for the "new" list. That way, I will hold the envelope a bit if the new list is not yet ready.

Your questions continue to be appreciated, of course. As you can tell from this month's column, they help provide a feel for what is going on in *your* minds. Send them to me at the above address, enclosing an SASE if you desire a personal reply, or via CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR).

As a parting note, do your duty and fill in that Feedback Bingo card somewhere near here. You'll help the staff of *73* tell what you're reading, and stand to win a year's extension to your *73* subscription! Notice I said "extension." You do already subscribe, don't you? YOU DON'T? (Not you. . . I was talking to the guy next to you.) Then use the card above the Feedback card to subscribe. That way, you will be sure to see what's new in RTTY Loop.■

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

MICROPHONES

Hello, hello. Test one, two.

Oh, hello there. Just testing my microphone. Wheeeee. Whoooo. Boy, this thing looks terrible. It's amazing the amount of effluvia (for want of a better word) a mike can pick up. Wow! Ever notice how a heavily used mike looks worse than the handset in the average public telephone booth—all that brown crud and stuff and everything. Yucch! Get out the Janitor in the Drum, right?

Anyway, where was I? Oh yes, microphones. Over the years I've been strangely attracted toward microphones. I don't think I'm suffering from a fetish, but I don't believe it's a natural attraction, either. Perhaps it's caused by an unhealthy fear of Morse-code tests or something.

Over the years, I guess I've owned something like three or four dozen mikes. Most of them have been absolute junk. You know, little 99-cent button jobs from Radio Shack that make you sound like you're transmitting from a Roman bath, or CB-type mikes with preamplifiers that drive your rig to something like two zillion percent modulation. They should give 'em away in Cracker Jack boxes.

The best-looking mike I ever owned was this big chrome-plated lollipop job that made me feel like H. V. Kaltenborn. Back when I was about 14 or 15, a childhood chum sold it to me for five dollars. I thought I had cut a real shrewd deal until WB2ZFF told me that I sounded as if I were transmitting from a Roman bath. When I unscrewed the top of the mike, it turned out that my buddy had swapped the original element for a 99-cent Radio Shack button job. Caveat emptor, right?

Shortly thereafter, I journeyed into Manhattan (or "The City," in the vernacular of Queens residents) to visit the Lafayette store on Union Square. At that time, around 1969, Lafayette was selling a sharp-looking crystal mike for $2.99. This bullet-shaped beauty looked like something out of a World War II spy movie. Like the 99-cent Radio Shack product, it only contained a cheap crystal element. But, damn, it looked good, with a sleek Art Deco-type styling and a business-like olive enamel paint job.

My plan was to spend the $2.99 for that mike, and then blow another $19.95 for a mike stand and boom attachment. That way, my shack was going to look like one of those super-duper operating positions they were always showing in *QST*.

So I headed for the subway with my pal Jon WA2MJK. I get to the store, go inside, point to the catalog, and tell the clerk what I want. About five minutes later the guy comes back, puts the mike on the counter and says, "Yer in luck. It was the last one left." I paid for the mike and the rest of the equipment, and with Jon in tow rushed back to the subway.

God, that stand and boom kit was heavy. The thing used a 10-pound counterweight and had a 20-pound base. Jon, seeing me struggling, offered to help me with the load. He took the quarter-pound mike out of my arms and asked, "Is that better?" I was too winded to reply.

Finally, we arrived at the subway. We paid our fares and headed downstairs. After about a five-minute wait, Jon says, "Let me see if the train is coming." So he leans out over the edge of the platform, yells, "I see two lights," and promptly drops my Art Deco beauty onto the tracks. In a flash, the Broadway local turns that microphone, the microphone of my dreams, into microphone scrap.

"In a flash, the Broadway local turns the microphone of my dreams into microphone scrap."

I spent most of the next two weeks calling Lafayette stores for a replacement. As it turned out, the Japanese company that made the mike was no longer in business, and you can guess the rest. Sigh.

Currently, I'm using a Kenwood MC-50. It's a nice mike, but it's been through the wars. During the past 10 years, I've used it to work all states, about 105 countries, and endless rag-chews on 15 meters. Friends tell me it still sounds good, but it sure ain't much to look at.

So I'm now looking for another mike to grace my shack. One of the old RCA jobs would be nice. You know the type I'm talking about. It's the one that David Letterman has on his desk. It looks sort of like an overgrown aspirin capsule, with a wire mesh on top, an RCA logo near the middle, and some solid metal trim on the bottom. I'm sure this mike has an official name, and I know all of you mike experts out there know it. But I don't, and I don't really care if you do. So don't bother writing to tell me.

Anyway, I want to put this mike in my shack for display purposes. You know, something to show company when I take them on the KI2U grand tour. Somehow, it doesn't quite befit Mr. Fun! to have a junky, disgusting, spit-riddled relic exhibited at his operating position. I want that beautiful RCA mike sitting there. As my brother recently said, "It'll be for showin', not for blowin'."

If someone out there in my radio family has one of these mikes and wouldn't mind parting with it for a fair price, I'd sure like to hear about it. But, please, don't send me one with a 99-cent Radio Shack button element installed. I'm wise to that trick.■

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Q & A

This month, I'll answer some questions from readers. That's my way of saying I've really been stacked up with work this month and haven't had time to prepare a lengthy dissertation on any one subject. I'll be going to the Tucson Amateur Packet Radio meeting in a few days, where I expect to hear all about several new networking projects, and that will probably be the topic of next month's column. I'll touch on that a bit in this column, too.

Comments on the Packet Survey

I received several comments on the type of questions that were included in the Packet Poll. Gregory Lefebvre K5LTW wrote:

"I have a few complaints about the quality of the survey. It seems that the questions greatly favor positive responses to the acceptance of packet radio. I know that there are questions allowing for negative answers, but certainly not in comparison with the positive questions. Also there appears to be an exclusion of other modes, or at least treating the other modes in the past tense.

"I would be interested to see if someone in the polling business might respond with some ideas for a future survey that might be somewhat better written to allow a more accurate description of opinions, whether they are positive or negative. I certainly felt that the questions did not allow me to express my feelings about packet or how packet fits into my operating time."

I'd be happy to get suggestions for questions for the next packet poll. Notice I didn't say "next year's" packet poll; one was more work than I thought it would be.

On the subject of beacons, Jay Underdown W0OGS writes:

"I have been hearing and seeing in the print what appears to be a diatribe against packet beacons. I agree for the most part, but beacons do still have a place in packet activity and supply useful information. In my opinion, the time and space spent condemning beacons could be better used to educate new and existing packet radio users on proper beacon use and on methods of improving the network by such items as better external modems, GaAsFET preamps on receivers, etc."

Jay makes a point in his letter that while beacons are usually bad in urban areas, they have their uses in less densely populated areas. I agree that sometimes the beacon bashing gets out of hand, but that's largely a regional slant.

Watchdog Timers

I was sent a copy of a letter to the editor of the *Chatter Bug*, the newsletter of the Triple A Amateur Radio Association in Beaver County, Pennsylvania. KB3L wrote about a bad experience he had with his TNC "locking up." TNCs sometimes stop running correctly. This is referred to technically as being "wedged," or OTL (out to lunch). Sometimes nothing bad happens, but sometimes the TNC will turn on the PTT line to your transmitter in its death throes.

KB3L points out that not all TNCs have a watchdog timer. This is a device that watches the PTT line and cuts it off if it is asserted for too long. Some TNCs have a built-in watchdog and some don't. If you leave your TNC on when you aren't around, do yourself a favor and check to see if your unit has one. For those that don't have one, the manufacturer will usually have a recommended design for one you can add on. Give them a call and see. I'll try to get KB3L's design for a future column.

Morality Through Software

I got a letter from one ham which said, "Can you suggest any way I can selectively prevent other stations from digipeating through my packet station? I would like to prevent beacons and connections to a BBS from running though my station."

Way back in 1983, when a second-generation command set for TNCs was being discussed, the concept of lockout came up. At that time, we thought that this option would cause more trouble than it would solve. Since there aren't any bits in the protocol that gets set for packets that originate at a BBS, and since beacons don't necessarily have the text "BEACON" in them, you are limited to locking out packets based on the origination station call or the destination station call.

Our feelings on the matter were that if other users were not willing to voluntarily avoid using your digipeater in ways you disagree with, locking them out personally by call would just propagate hard feelings. Going with "out of sight, out of mind," the BUDLIST/LCALLS were originally oriented toward keeping the "bad guys" off of your screen by locking them out of your local monitor mode. They would still be repeated.

Attempts to mandate morality through software are seldom successful at reasonable cost. My suggestion to this reader is to take some deep breaths or get a dog (it's been proven pets lower your blood pressure). Alternatively, some new software may have this feature; check around. A hardware box to monitor the incoming bit stream is doable, but it wouldn't be much less complex than the TNC itself.

"Yes, Virginia, there will be packet forums at the Dayton Hamvention this year. They'll be on Friday, so get there early."

Auto-forwarding

John Skubick K8JS wrote to remind me that many readers are running low-end computers with their packet equipment, and that many authors are writing columns for the high-end machines. The Packet Poll certainly shows that there are a large number of low-end users out there, and I'll keep that in mind.

John also asked for a short lesson on sending mail to distant stations using the auto-forwarding system. Many BBSs can forward mail. To find out if your local system can, ask the local sysop. Of the systems that can forward mail, most do so with the following command: S call @ bbs (for example, S WA2KDL @ NK6K).

The spaces are important. The command shown will send a message to WA2KDL at the NK6K BBS. You'll have to make sure that your local BBS knows how to get to the BBS call you placed after the @. Again, ask your sysop to make sure.

New Hams

Christian V. Moreau N3FDP writes: "I not only worked to get my license as a result of packet radio, it is the only mode that I have ever used." He goes on to say that he doesn't expect that this will always be true. He wants to try ATV and the microwave bands.

That's what I'd like to see more of, packet getting a different segment of the population "hooked" on amateur radio. Once they're here, who knows what else they'll find that they'll like. It's sure that we need to keep new blood coming in.

As I write this, an FCC notice of proposed rule-making has come in which proposes to take away part of 220. I haven't seen the text and won't comment further this month, but the comment period will close before I get to speak again. The procedure for commenting to the FCC has been discussed in a previous column. *(Also see the QRX story on this subject.—Eds.)* This is particularly disturbing since Skip WB6YMH has just gotten 9600-baud packet activity stirred up on 220.95 here in the Los Angeles area.

How Soon We Forget

Remember back in the dim distant past when the new packet mode had to fight for space in the crowded two-meter band? Back when you had to petition the local frequency coordinating councils, go to meetings, write papers, or just squat on the channel and make nasty "braap, braap" noises to build a home for packet?

In the still fast-growing mode of digital radio, a new type of packet is starting to be heard, and some of the old-timers are starting to kick up a fuss about getting that new stuff on the traditional "packet" channels. The funny thing is, of course, that a packet "old-timer" is anyone who's been on for a year, and the really ancient

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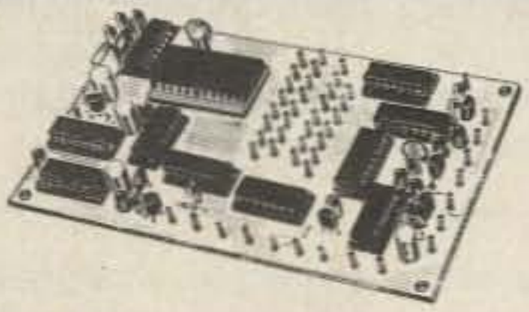

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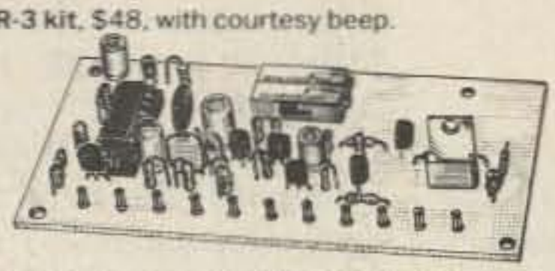

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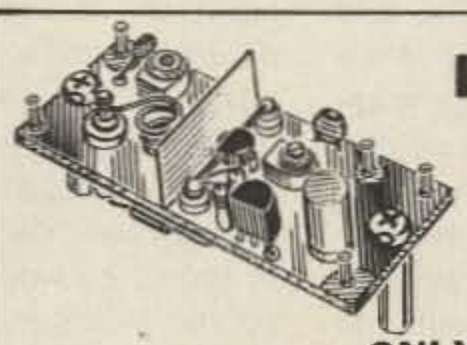

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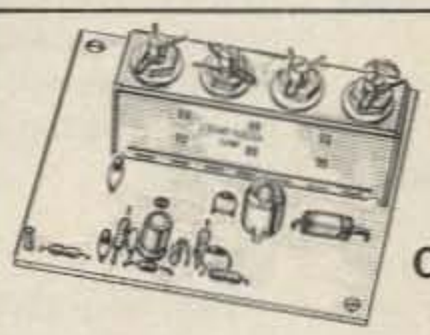

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patriarchs are those who have been around for two years. The ink on the band plan defining the "traditional" packet channels is barely dry.

The new kid on the block is actually any of several new systems based on higher-layer protocols. Back in the analog vs. digital turf wars, the complaint was nasty noises in the ears. In new-digital vs. old-digital fracas, the complaint is nasty characters on the screen.

Most of the new protocols (like those discussed in KA9Q's net-working article in the August, 1986, packet issue of *73*) use the data portion of an AX.25 frame to carry the information from their higher-level packet. Some of that data is control information and some is clear text. Depending on what kind of computer or terminal you have, this control information will print as Greek, lines and arrows, smiley faces, or if you have an old OSI computer, even pieces of the *USS Enterprise*.

The control information is an integral part of the new protocols, just as is the control information in the part of the AX.25 packet that isn't usually displayed in monitored frames. As development on these new systems continues, more and more of the packets you see on the air will contain "garbage." These systems have names like Gator, TexNet, TCP/IP, and NetRom.

Building the amateur packet radio network is like building a high-rise. We started to build the first floor, and while building the second floor, because it was cold and rainy outside, we all moved into the first floor. Because it was a lot more fun furnishing the first floor than it was standing in the cold building the second, most of the time has been spent in (or magazine articles written about) that first floor. But now there are a bunch of nuts walking on the temporary roof, pounding away at all hours, and walking though the first floor carrying bricks and leaving a trail of mud.

What am I saying here? The packet network is still under construction. You'll be seeing some funny characters in monitored packets, especially this summer. Once that second story is built, there will be new software, new terminal programs, and new options to avoid seeing garbage on the screen.

Until then, explore the ways that the current TNCs offer to avoid seeing trash. Most TNCs have a way to restrict monitored packets to a list of stations you want to see, or a list of stations you don't want to see. Many can filter out particularly annoying characters such as the bell and clear-screen characters.

On the other hand, we must keep in mind the basic requirement of "monitorability." The third-party traffic rules as amended by the FCC to allow unattended packet operation are based on the following thought: While the traffic may not be easily monitored while in transit between network relay points, it IS monitorable at the entry point to the network.

Another point made by the amateur community during the 85-105 rule-making proceeding is that there are a large number of folks "reading the mail" and carrying on the tradition of self-policing the ham bands. We've got to make sure that this continues to be true, even at the expense of a few extra bits.

Dayton

Yes, Virginia, there will be packet forums at the Dayton Hamvention this year. They will be on Friday, so get there early. The current schedule, subject to change, includes Bob Neben K9BL, Dave Pederson N7BNC, and the infamous Dr. Dave Toth VE3GYQ for the Fundamentals and Tutorial session from 1300–1445. The 1500–1700 session includes Lyle Johnson WA7GXD and me on packet technical developments.

I'll also be wandering the displays at Dayton, but you probably won't see much of me at the *73* booth; there is usually a sign posted prohibiting verbal dart throwing. Speaking of which, a friend of mine called the *73* subscription number to ask for a *73* subscription because of the great digital column. What he got was a year's worth of *Digital Audio*. See you next month.■

NOVICE NETWORK

Perry Donham KW1O
73 Staff

WHAT IS A NOVICE?

What can you do with an FCC Novice license? *Communicate*, that's what! You can talk with other ham operators around the world, from Australia to Zanzibar. It doesn't cost a lot of money to do (in fact, the license itself is *free*), and you don't need an engineering degree to understand the electronics required to pass the Novice test.

That's what this column is all about—how to pass that first test on the ladder of amateur radio. In the months to come, you'll learn everything that you need: FCC regulations, a little electronics, and the art of hamming. We'll be going pretty fast, since you're undoubtedly anxious to get your own callsign!

The Novice

In the early sixties, the American Radio Relay League decided that the old system of two classes of ham licenses wasn't promoting growth in the hobby. They sat down and came up with a plan called Incentive Licensing, which divided up the available spectrum into chunks. A ladder of license classes was created, and the higher you could get on the ladder the more privileges you got.

Incentive licensing has evolved into our present five-tier system: Novice, Technician, General, Advanced, and Extra. The amount of electronic theory required to upgrade to the next license increases as you move up, but the privileges increase as well. An Extra-class licensee has all amateur privileges on all bands.

QUIZ

1. What are the five classes of amateur license?
2. What code speed is required for the Novice-class license?
3. What government body regulates ham radio?
4. What is the symbol for current?
5. What does the symbol E stand for?
6. What is the voltage in a circuit with 3 Amps of current and a total resistance of 500 Ohms?
7. What does Ohm's Law look like when solved for resistance?

As a Novice, you'll be able to use Morse code on four bands and voice on three. You can also use your computer to talk over the air. You must pass a five-word-per-minute test on the code, and a very simple exam on electronics theory and amateur practices. The rules governing Novices have just changed, and we haven't seen the full text of the regulations yet; in the future, I'll give you a full rundown on the new spectrum and modes available, as well as a summary of how the testing for Novices has changed.

The Code

Yes, you still have to learn Morse code to get a Novice ticket. Maybe next year we'll finally have a code-free license, but for now you'll just have to do it. I won't give you any song-and-dance about how wonderfully artsy code is (it isn't) or how it will "make it through" in an emergency when all other modes fail (it won't). The law says that hams must pass a Morse test, so just learn it because you have to.

Obviously, I can't teach code in a magazine. Go out and buy one of the code-teaching tapes on the market—*73* happens to sell one that's pretty good. Most of the ones you can get are pretty much equal when it comes to ease of learning, but you should look for a tape that sends characters at 13 words per minute with spacing set at five words per minute. If you learn code that sounds like "daaaaaahhhh diiiih daaaaaaaaaahhhhh," you'll be in for some real trouble when you realize that you have to copy code that really sounds like "dah dih dah."

The other bit of advice I can give you is NOT to learn code by writing down all of the little dots and dashes and staring at the paper for hours. It won't work. You have to actually hear the stuff to learn it right. The absolute best thing that you can do is to get someone who will sit down with you and teach you code. Classes are OK, but one-on-one is the best method. I've been doing code lessons for

years this way, and it seems to take about three weeks of lessons three times a week to get to five words per minute.

Theory and Regs

Apart from the code, you'll be expected to know the barest amount of information about FCC regulations and electronics theory. As I mentioned, the rules have changed to allow Novices to use voice and data communication, so there should be additional technical questions covering the new modes. I don't expect them to be too difficult, though, so not to worry.

Traditionally, FCC reg questions are best answered by relying on your common sense: Questions pop up like, "Is it legal to send unidentified transmissions?" (Hint: It isn't.) The theory section is pretty much the same. You'll need to know a few simple formulas and terms.

ANSWERS

1. Novice, Technician, General, Advanced, Extra
2. 5 wpm
3. The Federal Communications Commission (FCC)
4. I
5. voltage
6. 1,500 volts
7. R = E/I

What I'm trying to say is that getting a Novice license is *easy*. Note: This column will *not* teach you electronics! It *will* give you the information you need to get a Novice license. You won't find many theoretical explanations here.

First Lesson

OK, I've pretty much blown my space with a description of what it is you're getting into, but we'll do a quick lesson before your attention span runs out. One of the primary electronic principles is **Ohm's Law**. You'll run across it in one form or another in just about every field of the hobby. Simply stated, Ohm's Law says that the current in a circuit is equal to the voltage in that circuit divided by the total resistance: I = E/R. The symbol I is for current, measured in Amps; the E is for voltage, measured in volts; and the R is for resistance, measured in Ohms. (I always remember the formula with the phrase, "The Indian looks at the Eagle flying over the Rabbit.") Using a little algebra (did I mention that you need math, too?) you can come up with two other relationships: E = IR and R = E/I. Simple, eh?

Plug in some numbers to try the formula out: What is the current in a circuit with a total resistance of 10 Ohms and an applied voltage of 50 volts? Since I = E/R, I = 50 volts/10 Ohms; I = 5 Amps.

I won't bore you with numbers to plug in *ad nauseum*. You get the idea. Try the quiz on the preceding page and check how you did. See you next time.■

QRP

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QRP CLUBS

Well, it looks as if I'm going to have to skip a month or two before getting that Field Day column ready. I always forget about the difference between when I type in these columns and when the actual issue comes out.

After reading the past few months' worth of mail, I've concluded that everyone wants to know about the different QRP clubs. Some of the letter writers asked if there are in fact QRP clubs to join. Well, this month's column will be about these clubs.

The Michigan QRP Club

I'll start things off with the Michigan QRP Club, which is a member of the World QRP Federation. This club was organized on January 19, 1978, by a small group of ham operators in the Lansing area of central lower Michigan. When the club first started operations, most if not all the members were from the area, hence the name of the club. The Michigan QRP Club has now grown to include members in 20 or more states, several Canadian provinces, and several European countries. The club has designated QRP as 10 Watts input or 5 Watts output or less.

What surprised me the most is the club emblem. Each person receives a club patch when he sends in an application for club membership. The emblem was designed and adopted during the early months of the club's existence, when the founders were not seeing beyond Michigan's boundaries. In fact, the first version didn't even show the Upper Peninsula of Michigan. Since the emblem was made to be used as a patch for display on jackets and hats, it's very colorful.

No matter what type of club you join, that organization needs to have a purpose. The Michigan QRP Club constitution states its intentions as follows:

1) To foster and develop friendship and cooperation among amateur radio operators who have a common interest in the unique pleasure and challenge of operating amateur transmitters at power levels of 5 Watts output or less.

2) To sponsor such actions and activities as may be deemed proper and consistent with the purpose of the organization.

3) To take general interest in all matters affecting or involving amateur radio.

If you're not a real diehard QRP person, the club has no restrictions that you must run low power all the time. If it takes a kW to get the message through, so be it. The member's good judgment rules on such cases.

Any club worth its salt has some kind of award program. So, not to be left behind, the Michigan QRP Club has several to offer. The QRP WAS award and the QRP DX award are the club's two big ones. The WAS is, of course, Worked All States running low power, while the QRP DX award is given for working 25 countries while running QRP. The club also gives out a QNI award for checking into the nets a minimum of 25 times. A special award is the WMA, for working at least 10 members of the club, with endorsements for 15 and 25 members. A good place to start for the QNI and the WMA awards would be the weekly nets. The Michigan QRP Club holds a net on 3.535 MHz on Tuesdays at 9 p.m. EST.

To keep all this together, the club publishes a quarterly newsletter called *The Five Watter*. It contains accounts of club activities, technical articles, and correspondence from club members. Reports of awards, QRP contests, nets, and QRP operating are also included. Tom Root WB8UUJ does a bang-up job as the editor. Having been a member of this QRP club for a while, I can say that *T5W* is packed full of QRP goodies every quarter.

If all this sounds too good to be true, then by all means drop a letter off to the Michigan QRP Club, 5346 W. Frances Road, Clio MI 48420. If you decide to join, you become a member for life. The club dues are only $7. That includes the first year of *T5W* and covers the $2 initiation fee. After that, the yearly dues are $5. That's not bad considering the price of postage these days.

The G-QRP Club

Moving to the other side of the ocean, we have the G-QRP club. The name of the club gives us a clue as to which country I'll be talking about—England.

The G-QRP club was founded in 1975, and it now has more than 4,000 members in 54 countries. The club exists to promote interest and growth in low-power amateur radio communication (5 Watts or less). Membership is open to any licensed amateur or shortwave listener anywhere in the world who has an interest in low-power communication. The annual membership fee is $10.

The G-QRP club publishes a free quarterly journal called *SPRAT* (Small-Powered Radio Amateur Transmitters). It contains circuits, technical hints, and ideas for QRP construction projects. *SPRAT* also contains club news, contest and award information, and other items of interest to QRP operators.

Club members may also receive low-cost Morse-code training tapes. A data sheet service is provided free to club members. These sheets cover articles of QRP interest from different overseas magazines, which may be too long to be printed in *SPRAT*. This list is constantly being updated and new sheets are listed in *SPRAT*.

The G-QRP club also runs its own free QSL service through which cards can be interchanged between members (cards are mailed with *SPRAT*. To top all of this off, the club offers a wide range of awards. Weekly club activity takes place each Sunday between 1100–1230 and 1400–1500 UTC on the International QRP frequencies.

To become a member of the G-QRP club, write to: Membership Secretary, Christopher Page G4BUE, Alamosa, The Paddocks, Upper Beeding, Steyning, West Sussex, BN4 3JW England. The stateside QRP operator should either send a $10 bill or a check made out for the amount of $12. The extra $2 is to cover the conversion at the bank. Don't send IRCs. It will be the best $10 you've spent in a long time.

QRP ARCI

The final QRP club I'll talk about has been around for some 20 years. It is the QRP Amateur Radio Club International, or QRP ARCI for short. This club was founded in 1961 by K6JSS. It's a nonprofit organization dedicated to increasing the worldwide enjoyment of QRP operation and experimentation. QRP, as defined by the club, is 5 Watts output CW and 10 Watts output PEP.

With a membership of more than 6,000, the club sponsors many contests. Among them are two large CW contests, one in April and the second in October. They have proven very popular with the QRP gang. Aside from these, the club has a wide assortment of awards. One of the most treasured of these is the 1,000-mile-per-Watt award. Working 1,000 or more miles per Watt may not appear at first to be a big deal. Have you tried? Try it on 432 MHz with 5 microwatts output over a 10-mile path. It's been done, but it wasn't easy. How about working Australia with 1 Watt output for 12,000 miles per Watt? Does this peak your interest? I hope so.

Besides all the awards, the club publishes a rather slick newsletter four times a year, called the *QRP Quarterly*. Printed in January,

Photo A. Terry N8ATZ, vice-president of the Hate Mike Bryce Club, pounds some brass for the 1985 W8NP Field Day. Note the "hi-tech" CW radio on the same table as the Heath Apache and the Collins 75A4.

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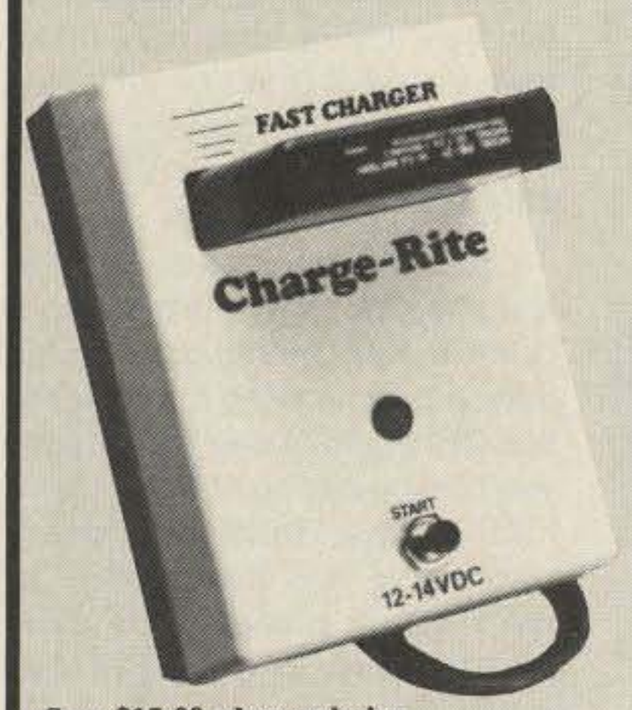

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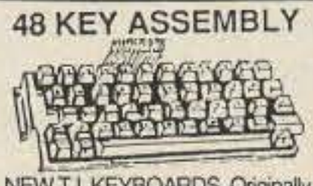

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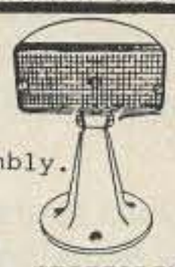

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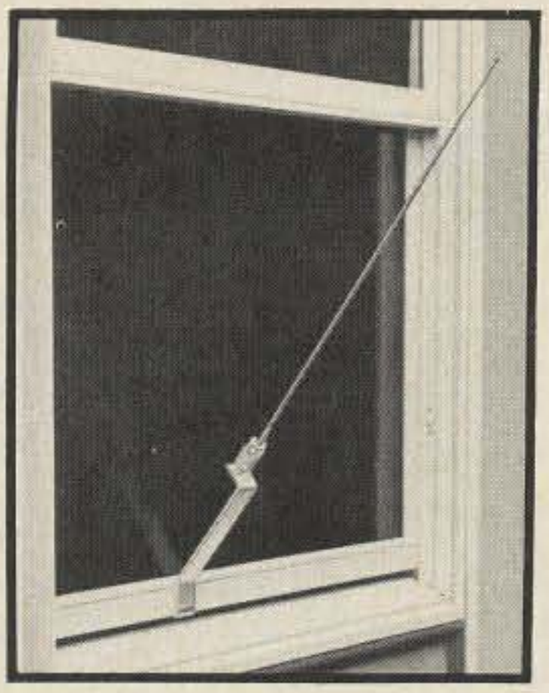

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April, July, and October, it brings all the latest information to the active QRPer. Each issue is packed with some of the best construction projects for the QRPer. Antennas, tuners, and DX-chasing tips can always be found inside the *Quarterly*. There is even an article or two about solar-power QRP operation from yours truly from time to time.

The QRP ARCI also sponsors a first-Sunday informal QSO party, as well as several national QRP nets. The list of the nets was given in this column several months ago.

To become a member, send for the membership guide from the club's publicity manager, Joe Sullivan WA1WLU (267 Sutton Street, North Andover MA 01845). While I have never seen what Joe sends out, I hear it's a bundle. To keep Joe from tapping into his beer money, send along $1 to cover postage costs. Speaking of money, new memberships to the QRP ARCI are $8; renewals are $7.

Doing Your Share

That's about it for the QRP clubs. Yes, there are some smaller ones about, but I hear very little from them. So here is your chance. Write and let me know about your small QRP club.

There is one footnote that must be brought up. Almost every one of these clubs operates on volunteer time. Working to feed the kids, the wife, and the dog sometimes leaves very little for the radio clubs. Don't get mad if it takes a few weeks to get a reply to your questions and letters. Also, be a sport when writing to any of these clubs and send an SASE.

Photo B. A Novice training class at the Massillon Amateur Radio Club (W8NP). A talk about QRP and the lower cost of the gear may win over a few newcomers to ham radio. Photo by WB8OWM.

While we are on the subject of radio clubs, what have you done to spread the word of low-power operation to your local club? Most are just starving for a program at the meetings. QRP is a good start in such endeavors.

Have you been active in your club's Novice training? Your local club DOES run Novice classes doesn't it? The small size and portability of QRP gear is ideal for a hands-on demo at a Novice class.

If you think that I'm leading into something, you're right. To get new people into this hobby we call ham radio, we have to make it fun. Nothing less will do. Take a look at Photo A. This is a W8NP Field Day setup. No, the photo wasn't taken in 1957—it was in 1985. We did it as a dare and to have fun. We even made some contacts with this setup. Most of the new Novices liked the look and feel of the vintage radios. We had a ball.

Get active in the local club. While I don't quite know what came over the crew at W8NP, Steve N0CVZ and I were voted vice-president and president of the club. I sure hope they know what they did! Don't be an invisible QRPer. Get involved.

Till Later

Looks like the old computer is just about done with this month's column. Next month, by popular demand, I'll have the plans for my 6L6 QRP band-buster rig. I'm sure you'll enjoy putting one together.

As always, send your ideas, comments, and suggestions to me. I gather strength from them all. I ask only one thing, if you would like an answer or a circuit schematic, please send an SASE. In fact, I'll write the address down if you send along a stamp.

While you're at the post office, remember to send the Reader Service card back to *73*. Remember in my first column I said I needed the money. Well, I plan to purchase a new bike this summer. What's this? OHMYGOSH, you mean to tell me that the guy who writes this is a biker? A long-haired, pot-smoking, hippy freak? No, really, I'm talking about bicycles, the people-powered kind. I'm going to do a column on very small, lightweight radios for backpacking and cycling. So until next month, use intelligence instead of power. It's a lot more fun.■

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Avenue
Saugus CA 91350

INTERVIEW WITH A LEGEND: PART I

If I were to ask you who was the one person directly responsible for your favorite repeater, you would probably respond by giving due credit to the person whose callsign appears on the system's identifier. Or, you might name the club that supports the machine. Well, you would probably be correct on a tunnelvision-like scale, but in the overall cosmos of amateur relay communications, you would be very far from correct.

If credit is truly given where credit is due, every FMer owes gratitude to a ham most have never heard of—a now-retired Los Angeles broadcast engineer named Arthur M. Gentry W6MEP.

Art has never laid claim to having put up the world's first FM repeater. If I remember correctly, Wayne Green W2NSD says that he and a friend put up a RTTY repeater in New York City in the late 1930s. But, there is a big difference between being the first and being successful on a long-term basis. In the case of W6MEP, his repeater (which was first operated under the callsign K6MYK) went on the air in the late 1950s, and one way or another it has remained in service ever since.

Almost two years ago I visited Art. After the usual amenities, the two of us adjourned to his front yard where we sat down with my cassette recorder between us. What follows in this month's column (and is concluded in next month's column) was garnered from that interview and from updates from subsequent conversations between Art and me. I invite you to sit back and read what I can only call an interview with a man who should be considered a legend in his own time.

73: Art, when did you first put K6MYK on the air?

Gentry: In September of 1956 we started operation. We went to the Mt. Lee site in October of 1958, but there were other sites in between. The original license for K6MYK was issued in 1954 for a location in Burbank, California, but that was never used. The repeater went to remote control in June of 1957 when we finally got on a hilltop, but we were already well-known from our operations here in the San Fernando Valley. . . It's been on the air ever since. *(Note: Since the interview was taped, Art has moved his repeater to the top of Mt. Wilson at an altitude of 5,600'.)*

73: Do you know if you were the first repeater in the country?

Gentry: I can't say that we were the first repeater in the nation because at the 1954 ARRL convention in San Jose, a group of people put up a 2-meter AM repeater in the Berkeley Hills. Later that year, we went on a vacation to Colfax, a city north of Sacramento, and we worked through the repeater for a distance of 300 miles down to Lemmore. That machine was K6GWE, and it stayed on the air for a few months and then reportedly fell by the wayside. It was not what we know of today as an open machine. Rather, it was on the air spasmodically. If you were lucky enough to get in when the guys had it on, that was fine. Otherwise. . .

73: Do you know whatever happened to that repeater?

Gentry: Well, as I remember, it came back on the air several years later in the San Francisco North Bay area. Actually, the machine is probably still around. That is, you may be able to trace the lineage down to the present. It's still in the North Bay area, though I

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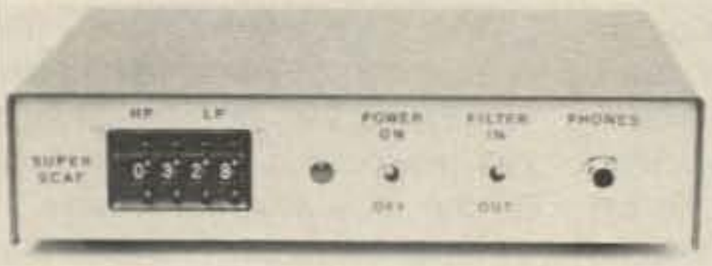

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am not sure of its present call.

73: What was your motivation to put up K6MYK?

Gentry: This was a way of extending the range of VHF. I've operated VHF mobile since 1940 when I went on 112 MHz, and I ran very high power . . . a 35-T modulated oscillator. Receivers were all super-regeneratives.

After World War II, when the 2-meter band was opened up . . . which I remember happening in January of '46, I acquired an ARC-4, which I made into a crystal-controlled, 10-Watt transmitter and a tunable receiver. Many still remember the old ARC-4 I'm sure.

That was a mobile rig, and I can remember going to Mt. Wilson one time. I came on the air and it was like a foreign country showing up. I talked my lungs out going from one station to another as fast as I could for two hours! This pointed out the advantage of a high location, and I began looking for remote-controlled transmitter articles in amateur magazines. But, in the late '40s and early '50s, all you could find was information on how to remotely control a transmitter. Nobody had ever thought in terms of a completely remote-controlled station.

73: So you built one?

Gentry: The marrying of a receiver and a transmitter took a lot of long hard work. It also meant a lot of spectrum separation along with a lot of tinkering and puttering to eliminate interference and desensitization. In fact, one of the biggest problems with early repeaters was if we had our receivers on the low end of the band—as when we were receiving on 145.08 MHz, which was a net frequency—then the transmitter had to be up near 147.70 MHz. Most of the people using the repeater had big beams and good receivers tuned to the low end. When they had to move their receivers up almost 3 MHz to hear the repeater, they got into problems because their antennas were way out of their tuning range. That was as close as we could get in frequency with that era's state of the art.

Later on, we built our own completely new receiver that permitted less separation. Remember, you couldn't buy anything. Nor could you find information on how to do this. So, we were left to use our own ingenuity. We had to find ways of getting rejection of the transmitter on the receiver to eliminate the problems. These things you could never find in print, but you were also too busy that there was not any time to write an article—mainly because so few people were interested. And besides, who would have published it?

73: When you were experimenting and building back then, did you ever think that the interest in repeaters would grow to the proportions they have today?

Gentry: I think I can say "yes" to that question. Yes . . . because my logic told me that this was a good way to get better communications. If you can imagine a 10-Watt AM mobile running all over the greater Los Angeles area and never being out of communications range with someone else, and you do this way back in the early '50s, then you have a pretty good idea of why I say that I had faith. There was something else. I observed the growth of commercial two-way radio at elevated sites . . . and I knew it would eventually happen with amateurs. I also knew that this would become a very widespread idea, and, with the adoption of FM, I knew it had to happen!

As an aside, my personal communications went to FM in the early '60s, and I started full-time FM in my automobile in 1966.

73: But, K6MYK was an AM repeater and it remained AM for quite a long time. Why?

Gentry: It remained AM because it served a great many people then using that mode. It was still "their repeater," if I may use the term. When the activity dropped to where there were no customers, then there was no sense keeping it on AM any longer.

There was also a second factor. At the time, we knew that there would be new repeater rules coming out, and concurrent with that was the channelization of all bands in Southern California. We applied to SCRA and got a repeater pair at that time, with the intention of going to FM. By the way, the repeater's control system has been FM since the beginning, and some of the original control equipment is still in operation.

73: There are now more than 300 repeaters on 2 meters in Southern California. Did you expect this?

Gentry: It's hard to say how far I expected it to go, because you can't really look ahead, but I would like to point out some history for you. I believe it was in 1967 that Howard Sheperd became the ARRL Director in this division. We tried through Howard to get the League to pick up the bit on repeaters and get some rules changed because we had essentially no repeater rules. I wrote to Jon Griggs W6KW when he became Director requesting that he get the League to do something. This was about the time of the Don Miller lawsuit, and before the board of directors was a motion to develop "Advisory Committees." The Board voted for this . . . and this left an opening for Jon to make a motion to create a VHF Repeater Advisory Committee. Jon then asked that I help him outline how the committee should be formed. I was also one of the first members of that committee.

73: In your opinion, why, after forming the VRAC, did it take the ARRL so many years to really get involved in VHF/UHF relay communication?

Gentry: The League has traditionally been conservative, and from the standpoint of . . . let us say . . . the best interest of the League, that is basically a good policy. We want to maintain what our League is, what it has been, what it stands for, and so on. You just cannot go out off the deep end every time something new comes along. I just don't think that back then there were enough people in the ARRL who were exposed to repeaters, who understood the concept, and who knew what to do about it. Even before the days of repeaters, League officials would come out here and could not believe the level of VHF activity. They thought it was a put-on, that everyone got on the air to make a big showing for them. They just didn't realize the use we were putting into VHF.

73: If this is all true, and the early California repeater growth was as you say, then why did it take the rest of the nation over a decade to catch on that so many of these machines existed?

Gentry: Let's put it this way. Take W6MEP . . . the callsign that K6MYK uses these days. It's currently located about 5,600′ above sea level. But even in the early days, there were probably 5 to 7 million people it could reach. Today, that's probably closer to 20 million. I doubt if very many other repeaters serve a larger population group than those out here in the major California cities.

Now, California has a very unusual geography. It has lots of elevated sites. The early people who got into 2-meter repeaters were, for the most part, the people in commercial radio. They got into the business because the concept interested them, not so much at first as repeaters but as remote bases. They'd be controlled over telephone lines. It took only a few sharpies to find out that they could couple a receiver to a transmitter, and this brought on tremendous area growth. Also, there were people . . . hams living at elevated locations and wanting out of the hassle of the lower frequencies. They found that they could ragchew for hours on 2 meters without interference.

Now, you remember that out here we have repeater sites with line-of-sight coverage for several hundred miles. You go back East . . . in the plains or coastal areas, and if you can get to a height of 500′, you are doing well. In New York City, they have places you can get up maybe 1,000′, but look what you have to contend with. The concrete canyons are one of the worst things in the world to try and get signals in and out of. Then, too, the West has always been known for its innovativeness. It was a big, wide open country, and people had many generations out here where it was up to the individual to get out and do something. That same spirit has shown itself in amateur radio. To be innovators. To be pioneers. The pioneer spirit that came west is still here. It's in our basic attitudes. A lot of people like you who came out here from the East have adopted this philosophy because you like that attitude and that spirit. You must remember that early television was spawned out here in parallel with the East, and it developed very rapidly once there was a chance for it to get a start.

I can remember when we used to swear at the Don Lee Broadcasting system because its third harmonic fell right in the middle of the 2-meter band. Ironically, as K6MYK and then WR6ABN, my repeater also operated from the original Don Lee broadcast site. That's also a bit of history.

And it's a bit of history that will have to wait until next month. For now, 73 from those of us who work and write the late shift from Los Angeles.■

"The pioneer spirit that came west is still here. It's in our basic attitudes."

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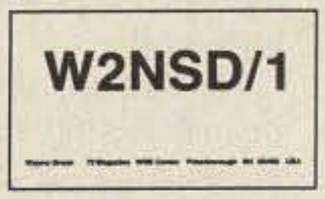

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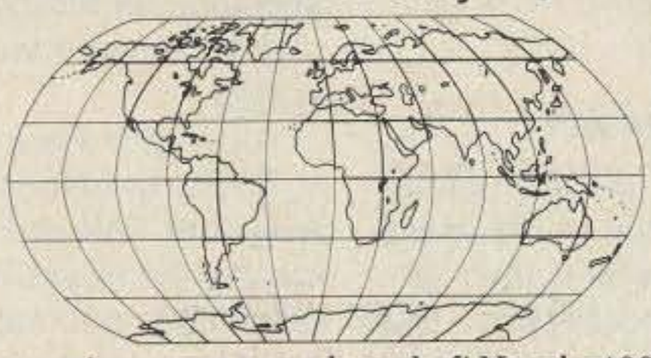

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TIMEBASES

Way back in the December column, I promised to talk about timebase circuits and then proceeded to get sidetracked. This month I will get back to timebases, if only to avoid piling up too many unrealized promises!

All of the direct-broadcast weather satellites that most of us are likely to be interested in transmit video at either 240 lines per minute (lpm) or 120 lpm. The former includes the WEFAX transmissions from the U.S. GOES, European METEOSAT, and Japanese GMS geostationary satellites; single mode (either visible or IR display) from the U.S. TIROS/NOAA polar orbiters; and advanced Soviet METEOR/COSMOS transmissions. The 120-lpm rate is used for display of the "standard" Soviet METEOR imagery and simultaneous display of visible and IR data from the U.S. TIROS/NOAA spacecraft.

If you are going to display the pictures on FAX, you will probably be using a 240-rpm or 120-rpm synchronous drum or helix motor (or some other synchronous speed with suitable gearing to get the same end result). If you want to use a slow-scan-type CRT display, you will want to trigger your horizontal display at either 4 Hz (240/60) or 2 Hz (120/60).

Some approaches to scan conversion also use the equivalent of such line trigger pulses to establish timing for the loading of image lines to the computer or display memory. Other scan converter designs (such as the one in Chapter 10 of the *WSH*) use hardware clocks to pace the loading of individual pixels into memory and as the basis for line delays that are essential to the operation of almost any scan conversion software.

The point is, no matter how you plan to display pictures, it requires some pretty accurate clocks in order to keep your display in synchronization with the incoming satellite video. All the various satellite video sources have their line rates locked to crystal-controlled standards, so proper display of "live" pictures, directly from the receiver, requires similar accuracy on the part of the display timebase if you are to keep in step.

You might have a 240-rpm, 110-V, 60-Hz synchronous motor running your FAX drum for WEFAX display, for example, but it would never do to run that motor off the ac mains. Most of us are aware that the long-term accuracy of 60-Hz ac is pretty good; after all, we do run all those wall clocks from just such a source.

Unfortunately, while long-term accuracy is good, short-term accuracy may be quite variable. Any frequency excursions from *precisely* 60 Hz during the minutes of image display will cause the motor to run slightly faster or slower than the rated 240 rpm, and that will throw off image sync. Similar problems arise with any other timebase for CRT or scan-converter display.

Most operators would also like to be able to tape-record satellite images for later playback and display, but that introduces a whole range of new problems. Even the best stereo tape deck will have some short-term variability in recording and playback speeds. (You can see the magnitude of these in the wow and flutter specifications.) Speed changes during recording or playback result in changes in the rate of the video data, so while crystal-controlled frequency standards will handle "live" display, they can provide no direct help for recorded display.

You can get around this problem rather neatly by using a crystal-referenced source for display and using the same system to generate a clock signal or reference tone. The satellite signal can be recorded on one stereo channel, while the reference tone is recorded on the other. During playback, the reference tone is used in conjunction with a phase-locked loop (PLL) to lock the display timing to the recorded reference tone.

Tape speed will certainly vary during both the recording and playback process, but now the display timing will "track" such variations, giving you a solid display provided your initial reference tone was produced with sufficient accuracy! Let's look at some of the possible approaches for crystal-referenced timebases, including the needed reference tones for recorded display!

Subcarrier Lock

One of the neat aspects of U.S. weather satellites (and the more advanced Soviet METEOR/COSMOS spacecraft) is that the 2,400-Hz audio subcarrier (which is amplitude modulated to produce the video signal) is typically locked to or of comparable accuracy to the timebases used to generate the video timing. This means that the satellite subcarrier itself can be used as the master time reference for image display.

If you digitally divide the 2,400-Hz subcarrier signal by 600 (a divide-by-six stage followed by two divide-by-ten stages), you would have an accurate 4-Hz line pulse. Divide the signal by 1,200 (substitute a divide-by-12 for the divide-by-six stage in the preceding example) to get an equally accurate 2-Hz signal! Need an accurate source of 60 Hz for your drum motor? Simply divide the 2,400-Hz signal by 40 (divide by four and then divide by ten) and you are in business!

Of course, things are never *quite* that simple; you cannot simply feed the AM 2,400-Hz subcarrier into a TTL or CMOS divider chain, but it can be almost that easy with the circuit shown in Fig. 1 (a). This is a PLL tone decoder with a sample of the 2,400-Hz subcarrier applied at the input.

With the proper component values shown in Table 1, this chip will lock to the 2,400-Hz tone and the OUT signal will be a nice square-wave sample of the PLL 2,400-Hz voltage-controlled-oscillator (vco) signal. This square-wave signal can be divided to yield any of your needed display frequencies!

An advantage of this circuit over a PLL such as the 565 is that the 567 has an internal control transistor that will light the LOCK LED when the chip is properly locked to the input signal. With a 2,400-Hz subcarrier at the input, the vco pot is simply adjusted until the LOCK indicator stays on with signal modulation.

A major advantage of the subcarrier lock approach is that the satellite signal itself is your reference tone so you need only a monaural recorder or a single stereo channel for recording. Recorder speed variations will be reflected in changes in the 2,400-Hz subcarrier frequency, but these small shifts will be tracked by the PLL in the 567 and your timing will stay in step.

Subcarrier lock is extremely popular for those just getting into satellite display because it is quite simple, but it is not without its drawbacks. In order to maintain sync, the system must stay locked to the satellite subcarrier signal.

This can become impossible during a deep fade in a polar-orbit pass or during a burst of intermod or other interference, and it also becomes a problem during occasional episodes on GOES where the WEFAX modulation becomes misadjusted, causing the subcarrier to drop to 0% amplitude on black instead of 4%. The technique also doesn't work with most 120-lpm Soviet METEOR space-

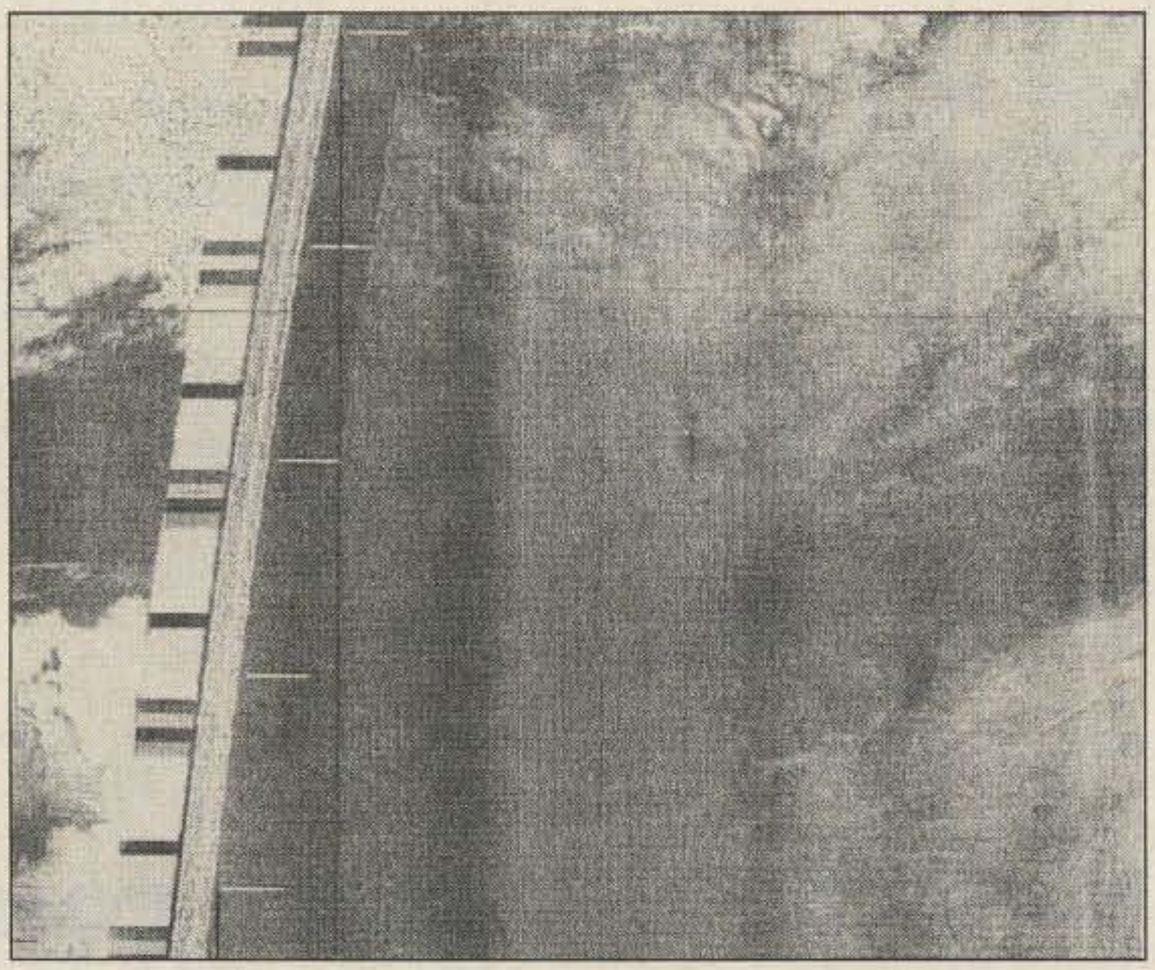

Photo A. An example of a visible light NOAA FAX print with a clock frequency that is off.

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" *only minorities can get small business loan money from the government!*"

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" *don't even try, it's just impossible — all those Business Loans Programs are strictly for the Chryslers, the Lockheeds, the big corporations, not for the little guy or small companies*" etc.

Still there are those who declare:

" *I need money right now and small business government loans take too darn long. It's impossible to qualify. No one ever gets one of those loans.*"

Or you may hear these comments:

" *My accountant's junior assistant says he thinks it might be a waste of my time!*" "*Heck, there's too much worrisome paperwork and red tape to wade through.*"

Frankly — such rantings and ravings are just a lot of "bull" without any real basis — and only serve to clearly show that lack of knowledge, misinformation and not quite fully understanding the UNITED STATES GOVERNMENT'S Small Business Administration's (SBA) Programs have unfortunately caused a lot of people to ignore what is without a doubt — not only the most important and generous source of financing for new business start ups and existing business expansions in this country — but of the entire world!

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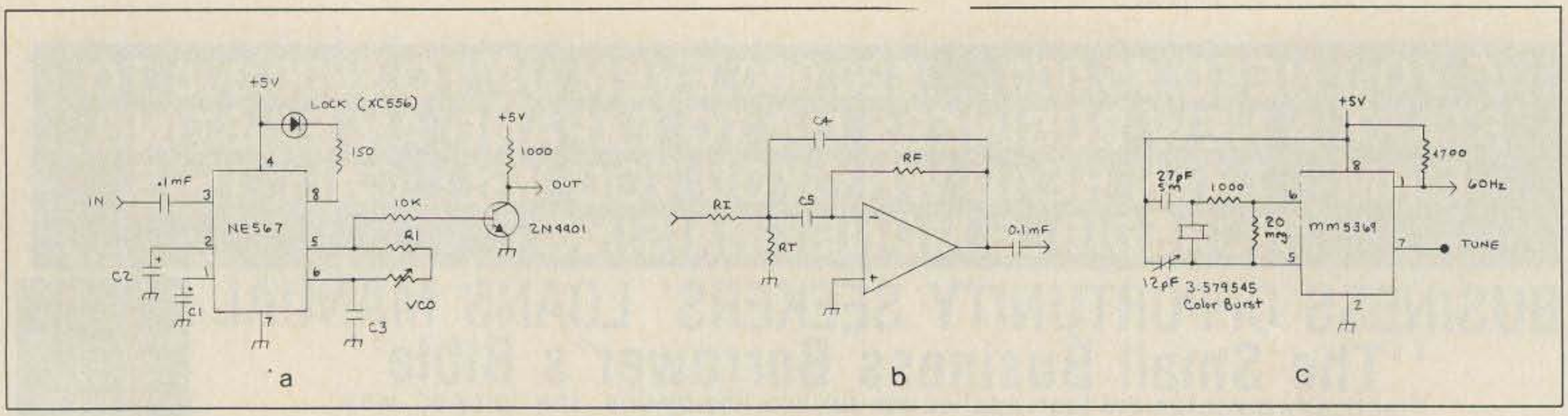

Fig. 1. (a) A PLL tone decoder; (b) the active bandpass filter; (c) precision 60-Hz source.

craft, whose line rate is *not* locked to the subcarrier frequency.

Usually the first upgrade of a subcarrier-locked station is to build a 2.4-MHz crystal oscillator and divide the signal by 1,000 to produce a steady 2,400-Hz tone for locking up the display. This is a major improvement but does require a stereo tape system (video on one channel, 2,400-Hz tone on the other). It is also not terribly convenient since 2.4-MHz crystals are special-order items and three divide-by-ten chips are required.

If you go this route, the 2,400-Hz square wave from the final divider should be routed through a bandpass filter—Fig. 1(b)—to convert it to a sine wave for better recording response. (Use the 2,400-Hz values from Table 1.)

Some cassette recorders may have a problem with this approach due to the fact that the left and right channels are adjacent to one another on the tape and quite close together. The problem is a beating of the two 2,400-Hz signals, as well as possible degradation of the black level on the video channel due to 2,400-Hz reference tone feedthrough.

In summary, I would recommend the direct subcarrier lock only if extreme economy were the object. If you designed around this approach initially, upgrading later to a 2.4-MHz/2,400-Hz system would be highly desirable whenever you could manage it. Given the versatility of today's digital circuits, there are better approaches to use right from the beginning that will actually result in a simpler system in the long run!

FAX Timebases

As noted earlier, the typical FAX system uses a 60-Hz synchronous motor that requires a precision source of 60 Hz ac at 110–120 V. The 110–120-V part is fairly easy, and a reliable power amplifier to run the drum is shown in the *WSH*. What is needed is a precise source for the 60 Hz to feed the amplifier.

You could get it from the subcarrier (see earlier discussion) or you could use a 6-MHz oscillator (crystal-controlled) followed by a division of 100,000 (five decade counters), but either approach is unnecessarily complicated. The circuit in Fig. 1(c) will do the same job with a single chip and a universally available color-burst crystal!

The 60-Hz output of this circuit is a square wave. That is not suitable for either drum motor amplification or recording, so this stage should be followed by the bandpass filter in Fig. 1(c) to produce a 60-Hz sine wave. (Use the 60-Hz component values from Table 1.) RT in Fig. 1(c) should be a pot adjusted for maximum voltage out of this stage with 60 Hz at the input. A similar stage should be used even if you use the subcarrier/crystal 2,400-Hz option.

For recorded operation, the sine-wave output from the bandpass filter can be routed to the reference channel of the tape system, which can be used to drive the drum amplifier on playback. There are several ways that the drum speed can be altered to provide for phasing in a system of this sort. A relay can be used to lower the drum amplifier drive level, dropping the drum out of lock, or a second oscillator can be used with a 4-MHz crystal with digital switching of the two sources for phasing. The latter approach is used in the *WSH* FAX recorder.

CRT/Scan Converter Timing

I have already noted how the direct lock and 2,400-Hz reference tone systems can be used to generate either 4-Hz or 2-Hz line trigger or scan converter timing pulses, but there is a much simpler way to accomplish the same task. A crystal-controlled oscillator can be operated at a frequency of 4.194304 MHz; the crystal is available from most parts houses for microprocessor use.

This frequency can be divided by 2,048 using a single CMOS chip such as the 4020. The result is a 2,048-Hz reference tone using only two ICs (a 74LS00 oscillator and the 4020 divider), compared with four ICs (oscillator plus three decade counters) required for the 2,400-Hz version.

The same bandpass filter and PLL circuit used for 2,400 Hz will work with 2,048 Hz, but this seemingly oddball frequency is far more versatile than the 2,400-Hz version. Assuming you have 2,048-Hz output from the PLL circuit, a single 4020 divider can yield either 4 Hz (divide by 512) or 2 Hz (divide by 1,024). You save a great many chips, the construction is correspondingly simpler, power drain is lower, and the crystal is cheaper by a factor of at least five! This approach is used for the CRT timebase in the *WSH* project for just these reasons.

Any system requiring a 4-Hz or 2-Hz trigger or timing pulse will also require a single shot at the end of the timing chain to produce a relatively short pulse (typically 10–15 ms) for timing or horizontal triggering purposes. The single shot output can also be fed back to a series of control gates to introduce a controlled time delay for either automatic or manual phasing, a subject covered in detail in the *WSH*.

The versatility of the 2,048-Hz timebase also extends to other approaches to scan converter timing. The *WSH* scan converter uses the 2,048-Hz tone directly without the need for additional dividers, single shots, or phase control gates. This clock frequency will toggle 512 times in each 240-lpm line (1,024 times for 120 lpm), making it a simple software task to store 256, 512, or 1,024 pixel samples during each line.

Precision phase delays in the ms range or extended time delays up to 32 seconds using a single 16-bit register are possible by simply counting 2,048-Hz lock transitions, greatly simplifying the scan converter timebase. By cheating unmercifully in the design of the *WSH* scan converter, the same reference crystal and divider

Component	2,048/ 2,400 Hz	60 Hz
Values for Fig. 1(a)		
C1	2.2 mF	20 mF
C2	4.7 mF	10 mF
C3	.1 mF	.22 mF
Vco	5k	25k
R1	1,500	75k
Values for Fig. 1(b)		
C4, 5	.01 mF	.1 mF
RI	10k	150k
RT	2,700	2,500*
RF	20k	330k

* = series variable pot for fine-tuning.
pF caps = silver mica.
Less than 1 mF = mylar.
Greater then 1 mF = tantalum.

Table 1. Component values for Fig. 1.

chain can be used for display timing as well! Such tricks are one of the primary reasons that the entire *WSH* scan converter circuit, including all satellite video, timebase, computer interface, and TV display circuits require only 13 ICs with a total component cost of about $60!

Timebase Adjustment

If a timebase is to do its job, it must be operating at just the right frequency. As you shall see in a moment, close is not good enough. The principal virtue of the direct subcarrier lock approach, aside from simplicity, is that the only adjustment to be made is adjusting the PLL for lock on the subcarrier. All of the other approaches require that a crystal oscillator be trimmed to a precise frequency. There are three ways to do this.

The first and most obvious approach is to use a frequency counter on the oscillator in question and adjust the relevant trimmer capacitor for the proper frequency. Don't bother with this one unless you are sure about the absolute calibration of your counter. If you are a few hundred Hz off in the 2–5-MHz range, you will get unacceptable results!

Your run-of-the-mill counter can be used, however, if you first examine the results of a live printout or display. The geometry of the display can give you all the information you need to get the oscillator on frequency regardless of the calibration of your counter.

Photo A is an example of a visible-light NOAA FAX print I received in the mail with an understandable "What's wrong?" query. What is wrong is that the clock frequency is off; but the question is, by how much?

Date	1 April 1987	
Spacecraft	NOAA-9	NOAA-10
Orbit Number	11844	2778
Eq. Crossing Time (UTC)	0054.19	0102.14
Longitude Asc. Node (Deg. W.)	147.59	82.33
Nodal Period (Min.)	102.0638	101.2979
Frequency (MHz)	137.62	137.50

These orbital parameters are projected two months in advance due to deadline considerations. Accumulated errors due to uncompensated orbital decay and other anomalies result in expectation of errors up to two minutes and possibly as many degrees in terms of the crossing data and possible small changes in the indicated period. Users requiring precision tracking data should rely on more current sources.

Table 2. TIROS/NOAA orbital predict data.

Note that the readout is progressively offset to the left from its initial starting position at the top. This indicates that the clock frequency is LOW. If the tilt had been to the right, the frequency would have been HIGH. Had the image been precisely vertical, the frequency would be right on (see the third option below), but then I never would have gotten the letter! OK, it's low in frequency. Now let's find out how low!

Using the trailing edge of the sync pulse, together with the minute markers (white horizontal lines in the pre-earth space scan), you start by physically measuring the offset over a specific time interval. In this case, the offset totals 14 mm (measured from the original print) over a period of 4 minutes.

Since the print width is 142 mm, the total offset error accumulated over 4 minutes is 9.86%—(14/142) x 100. Each line is 250 ms long, making the accumulated time error 250 x 0.0986, or 24.65 ms, over 4 minutes. Since 4 minutes is 240 seconds, you have an error of 24.65 ms/240 seconds, or 0.102 ms each second. This may not seem like much of an error, but it represents 0.01%—(0.102/1,000) x 100.

This particular recorder was using the circuit in Fig. 1(c) as the timebase, so the 0.01% frequency error represents 368 Hz—0.0001 x 3,679,545. You already knew that the frequency was low, so in this case you want to raise the clock frequency by 368 Hz.

Now comes the reason for all this calculator punching. No matter how well or poorly your counter is calibrated, simply hook it to the TUNE point in the circuit, note whatever reading you get, and then adjust the trimmer until it is higher by 368 Hz! This technique can be used with any display as long as you can measure the offset error over a known time period. All this requires is counter resolution, not precision calibration, since you are making a relative frequency adjustment.

The final approach, to be used if you have no counter but plenty of patience, is to make very *small* adjustments in your trimmer while looking at the results of live printouts or displays with each change. The goal is to get the printout precisely vertical, which means that everything is on frequency!

You must use live transmissions for each run since a recording will always preserve any error that was present when the recording was made and what you really want to do is check each adjustment against a live reference signal. Once properly adjusted, your recordings will also come out correctly since the reference frequency is now on the money!

Well, I have thoroughly run out of space this month, but at least I have made good on an introduction to timebases. Next month, I will look at the many aspects of image resolution, an often misunderstood subject!

Note

References to *WSH* refer to the third edition of the *Weather Satellite Handbook*, available from yours truly for $12.50 plus $1 shipping in the U.S. and $2 elsewhere.■

ABOVE AND BEYOND

Peter H. Putman KT2B
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Morris Plains NJ 07950

JANUARY SWEEPSTAKES

Funny, isn't it. Here I was, all set to tell you about my latest escapade up a snow-covered Catskill peak in a rare grid square during the January VHF Sweepstakes, carrying complete stations for 144, 220, 432, 902, and 1296 MHz to make countless operators happy by giving out contacts from FN22. There would be the usual photos showing the trek up the mountain, setting up, and spectacular vistas in the background, while I was furiously logging contacts at one per minute.

What I am actually going to tell you about is a difficult three-hour trip up a two-mile road into 60-mph winds and a −30° wind chill, the almost total destruction of my F9FT 432 yagi, snow blowing into everything, one lousy contact on 220 MHz FM, and a fast retreat to (of all things) a nearby UHF-TV transmitter site to warm up and then hitch a fast ride down the hill on a Snowcat accompanying one of the crew after a minor accident.

Overlook Mountain (elevation 3,150 ASL) is about 10 miles northwest of Kingston, New York. It is an excellent VHF location and sits right on the southern edge of grid square FN22, with a commanding shot to the north, east, south, and southwest. Only the paths from 270 degrees to 360 degrees are difficult. It is just north of the legendary "activity corridor" that runs from Boston to Washington and lies close to several major population centers with lots of VHF activity.

What better time to put it on the air than during the January Sweepstakes? The mountain's usual occupants, John Lindholm W1XX and crew, had announced their intention to travel west to FN01 in western Pennsylvania instead, and I couldn't resist the temptation. Stations were quickly assembled for 144, 220, 432, and 1296 MHz, using the notorious TR-9000 as both transceiver on 2 meters and transverter exciter for the higher bands. I selected the IC-3AT for 220 FM, and Hans Peters VE3CRU sent along a review model of the new SSB LT33S 902-MHz transverter to take along.

Antennas were the trusty 19-element 432 F9FT, the 23-element 1296 F9FT, and a new 18-element 902 F9FT. In addition, Ivars Lauzums KC2PX provided one of the new 9-element portable 144-MHz F9FT antennas, wherein the elements collapse against the boom for transportation. This made for a neat package. I tried a radical idea with coax feedlines: Everything used RG-8/X "mini-8" to save weight and size. How much loss did I give up? About 3 dB in the 1296 run, 2.5 dB at 902, and 1.5 dB at 432 MHz. These were figures I could easily deal with, since I could negate the loss-

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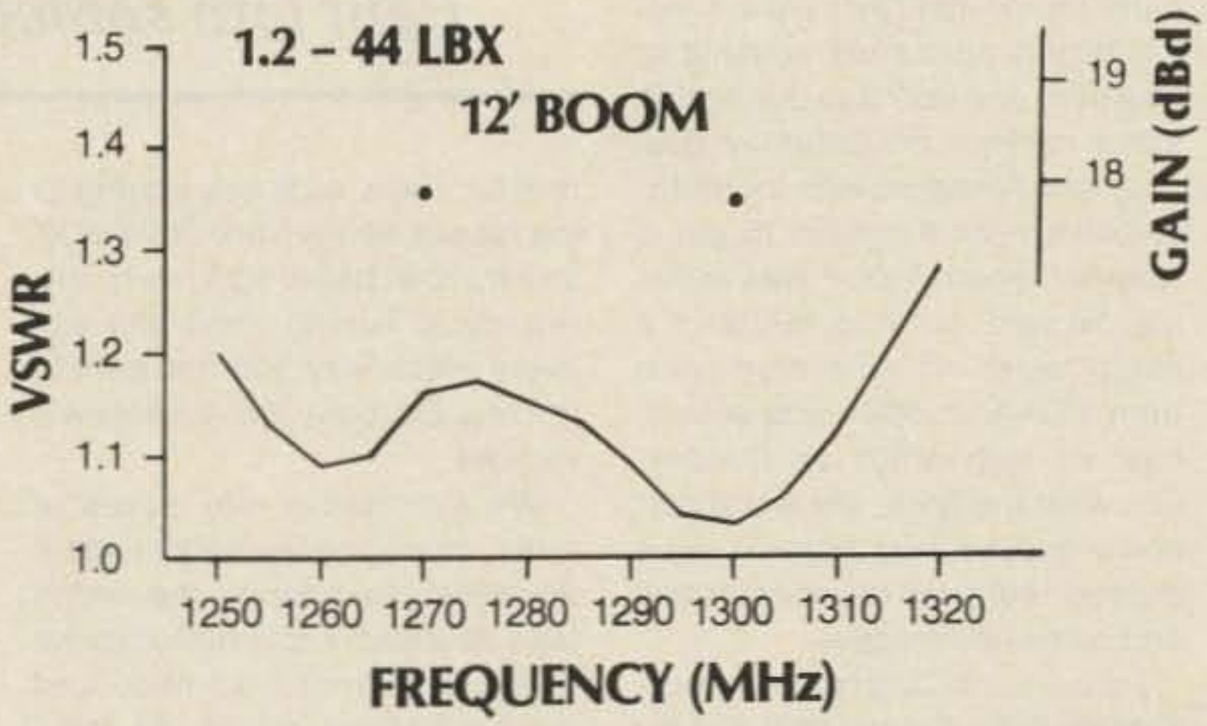

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es just by being at 3,150 feet. Unusual thinking, but it did save weight in the long run.

Once again, the power source was to be the trusty motorcycle battery, with special power cables and harnesses made up for the various rigs. I brought along two batteries for the IC-3AT, as well as a separate whip antenna. No plans were made for 50-MHz operation; otherwise, I could have brought a 220-MHz transverter with 6-meter i-f stage as well. Along with support materiel (clothes, food, hot coffee, tools, log, and pencils), the entire package weighed in at 60 pounds—not bad for a 5-band operation running about 8 to 10 Watts per band. The plan was to access the top between 10 and 11 a.m., operate for about three to four hours, and begin the descent at about 2 p.m., depending on the weather. I dutifully got on the local VHF nets and notified everyone I could think of to look for me on Sunday morning and "work that rare grid."

I should have known I was in trouble when the Microwave Modules MMT 432/144 transverter (which regularly self-destructs right before one of the mountaintop operations) gave me no trouble whatsoever in pre-pack tests, right up until Saturday evening! At one point, I even forgot to put the 15-dB transceive pad in-line and accidentally blasted the input with 10 Watts for a second. No problem—it just kept ticking along at 10 Watts output. Not only that, the synthesizer in the TR-9000, which refuses to lock up from time to time in inclement weather, was as happy as a pig in slop. Not a good omen!

We concluded a grand birthday party for my son Ross (who readers of this space will remember was born one year ago during this same contest) on Saturday evening, and I checked with my brother Miles near Kingston to get a weather report. Yes, it was snowing, he said, but it looked as if it might taper off. The only hitch from NOAA weather was a forecast for high winds on Sunday. Oh, what the heck, the worst that could happen was that I'd drive the two hours and have to call it off and come home again.

I drove up through mostly freezing rain Saturday evening and arrived about 11 p.m., armed with two sets of dry clothes, a fresh battery, food, and a thermos of red-hot coffee from the party. Little did I know how handy that coffee would come in later! After we exchanged pleasantries, I set the alarm for 6 a.m. and hit the sack.

Back down at the trailhead at the end of the ordeal, the entrepid KT2B contemplates other mountains to climb and a hot bathtub, though not necessarily in that order. (Photo by Miles Putman.)

All too soon it was time to get up. I checked outside the apartment; all was still. The air temperature seemed to have warmed up, and no snow was falling. Miles and I agreed to give it a shot and at least drive to the base of the trail, which proved to be more difficult than I had expected! My Honda Civic has front-wheel drive, but it just gave out halfway up Mead Mountain Road to the trailhead. While contemplating how to attack the grade from the other direction, I was suddenly staring in the face of a New York State DOT snowplow bearing down the mountain, hurling sand and salt every which way and threatening to plow me right into someone's mailbox.

"I was suddenly staring in the face of a New York State DOT snowplow bearing down the mountain, hurling sand and salt every which way and threatening to plow me right into someone's mailbox."

We executed a nifty series of turns, driving backwards at about 25 miles per hour in the wrong lane for about a half mile until we found a secondary road, and quickly backed out of the monster's path. After the plow roared by, I found the road was now quite tractable, and in no time we accessed the top and trailhead. Light snow was falling, but the air temperature was still in the 30s, so we saddled up the equipment and shoved off. Note that by now I had scuttled 902 to save weight, feeling that the few contacts I might make wouldn't be worth the time spent. (Sorry, you 902 fans!)

The trek was quiet. About 1/8 mile up I realized I'd forgotten the keyer, and went back to get it, probably adding another 15 minutes to the climb. About halfway up we started to notice that the power lines along the road were oscillating—a sure sign of wind somewhere near the top. Yet it was as calm as a summer day where Miles and I stood, with light snow fluttering to the ground. We paced ourselves slowly and about a 1/4 mile from the top the wind started to really pick up. At that point, we were passed by a Snowcat carrying about six folks, and my question "How far to the top?" was met by the answer "Follow the telephone poles!" Useful information, indeed.

Shortly thereafter we crossed the saddle of Overlook Mountain at 2,800 feet and checked the map. According to it, we should have been standing by some sort of ruins, but all I could see were trees and the road stretching ahead. I thought it was off to the right, but Miles—a pretty good map reader and geologist in his own way—insisted we continue up the road. He was right, for shortly afterwards the ghostly stone walls of the Overlook Mountain House loomed directly ahead of us. So, too, did the 200' tower of WTZA-TV, and we were greeted by some pretty stiff winds.

After climbing to the hotel ruins, we noticed the large transmitter housing behind it and I knocked on the door to make inquiries as to compass directions (of course, I'd left mine at home!). The chief engineer was a friendly fellow and determined that the rectangular ruins of the hotel ran east-west with a southern exposure. That was a big help. Unfortunately, we couldn't see the fire tower (1/2 mile further) at the very top of the hill, due to the increasing amount of snow being kicked up by the wind.

After determining my purpose for needing compass directions, the chief engineer scoffed at making any serious distances at 1296, let alone 432. "The snow alone will attenuate your signal so badly you'll be lucky to get into Kingston!" Well, we hams are bullheaded at times. I suggested to Miles that we take a look at a rise above the hotel, and lo and behold found the trail to the fire tower. At this point the wind was really gusting, but I thought we could give it a shot and Miles agreed.

After some assembly, I pulled out the IC-3AT and called a quick CQ on 223.50 simplex, immediately working KF6AJ in Connecticut. He asked me to go to 1296, but at that moment the partially assembled 432 yagi and 10 feet of mast stuck in the snow was launched through the air about 20 feet by an amazing blast of freezing cold air. Then I realized we were standing in the middle of some sort of localized blizzard, and couldn't even see the hotel (200 yards away), TV antenna (150 yards), or even our fresh tracks made barely 10 minutes earlier. Miles was trying to construct a windbreak from the sections of the F9FT portable antenna and a poncho I brought along, but had no luck and was starting to really feel the cold in his extremities.

At this point, several thi..gs became very obvious to me: (1) I was going to be very lucky to work anyone on 1296 because of the precipitation attenuation. (2) The 432 antenna coax had actually frozen and broken off from the impact of

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MRF245	80W	136-174	28.00	65.00
MRF247	75W	136-174	27.00	63.00
MRF607	1.75W	136-174	3.00	—
MRF641	15W	407-512	22.00	49.00
MRF644	25W	407-512	24.00	54.00
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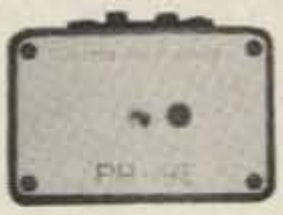

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the wind blast. (3) The TR-9000 would probably refuse to lock up in such cold temperatures. (4) All of the type-N fittings were filling up with snow and water faster than I could dry them out. (5) If we stayed up here much longer, Miles and I would probably wind up in the frozen vegetables section of the local market.

As if I needed a clincher, Miles turned to me and said (in the best tradition of Bob Uecker), "Hey—great seats, buddy! Where's the rest of the gang? They're missing all of the fun!" That did it. He was starting to go insane. "Let's get the ndshndshndshndsh off this mountain!" I shouted. "Good idea!" he replied. We threw everything into a hodgepodge of antennas, masting, cables, guy rope, and equipment, and literally tumbled down the rise to the transmitter shack, where I proceeded to pound on the door vigorously.

The engineer's face greeted me. "Having a nice hike, fellows?" he asked. I inquired as to the possibility that we be allowed to come inside for a minute and warm up enough for the trip down. He obliged us, and I wound up getting a guided tour of the 250-kW transmitter facility. Seems they were also having their problems with the weather, and the crew was trying to repair an air waveguide to 1-5/8" hardline transition at the antenna—just 200 feet above the mountain in what was now a howling blizzard.

What made things worse was that the crewman at the top either lost power to his Motorola handie-talkie or wasn't listening as his friends below tried to call him off the tower and wait out the storm. Next, someone managed to drop a come-along wrench several feet down the tower onto the head of another crew member, who was brought inside with a nice gash in his scalp. I quickly brought out the still red-hot thermos of coffee (which we had been gulping up on the ridge) and offered him a cup, while the engineer brought him out a blanket and a pillow to lie down on.

The decision was made that this poor fellow would have to go to a local hospital for observation, so the engineer gave me the equivalent of the old western movie cliche "There's a train leaving town in half an hour. Be on it." Except that our train was a Snowcat. Miles and I didn't care—we were just happy to have the ride. Soon enough, we were roaring down the same road we had climbed up, except that the blowing snow had now come around to the south face of the mountain and hit us full force. Also, a Snowcat's treads throw up an awful lot of snow, especially if you happen to be riding on the back. We were soaked by the time we reached the bottom around 1:30 p.m., with only one contact to show for it!

After drying off at Miles' place, we caught a late lunch at the pancake house in Kingston and watched the television tower 10 miles away on Overlook disappear and reappear every ten seconds in the snow. The storm front bringing all of this wind and snow was parked right along the ridges in the Catskills! No doubt that poor fellow was still up at 200 feet trying to secure that transition, since no one was able to get his attention by the time we had left the hill. Afterwards, I dropped Miles at his apartment and drove home, arriving at 6 p.m. just in time to watch the end of the Giants playoff game, grab a quick meal, and get on the last three hours of the Sweepstakes.

Well, there you have it. If there's a lesson to be learned, it's that no one can ever underestimate the severity of the weather at the tops of these peaks—even those smaller hills around 3,000 feet. Was I discouraged? Sure. But I'll try it again next winter, except that I'll be better prepared for the weather. At least I had a nice hike on the way up. And it isn't every day that you get a guided tour of a UHF television station!

Letters Dept.

Walter Stringer N8BSG writes to ask how he can attempt to make skeds to work stations on 10 GHz either near his home in southeastern Michigan or from a mountaintop expedition. Walter is using converted TR-6 police radar units, running wideband FM on 10.25 GHz and 10.28 GHz. Walter, I suggest you contact the various specialty newsletters for VHF, and one good choice in your area would be the *Midwest VHF Report*, published by Roger Cox WB0DGF, 3451 Dudley Street, Lincoln NE 68503. A year's subscription costs but $10 and may help you line up those needed skeds.

Kevin Neal (HCR 62-222, Flippin AZ 72634) writes to inquire about a schematic for a Boonton 91-27 probe for a Boonton 92 meter. Kevin, my probe is a 91-12F so I can't help you out, but perhaps one of our readers can? These probes do pop up on the surplus market, and I would suggest trying Brian Kent at Kentronix (PO Box 2444, Allaire Airport, Farmingdale NJ 07727), as he may be able to help you. . . Until next month, see you Above and Beyond!■

ATV

Mike Stone WB0QCD
PO Box H
Lowden IA 52255

THE N9CAI ATV/R SUPER SYSTEM

This month, I'd like to talk about what an organized, cooperative, positive-thinking ATV group of about 10–20 people can accomplish in just a few years. I speak from personal experience on this subject. In the entire state of Iowa and extreme NW Illinois, there was zero FSTV activity in 1979. Today, there are more than 100 active stations.

Our now 30+ member group, called the B.R.A.T.S. ATV Group (Big River Amateur Television System, not to be confused with the Baltimore BRATS ATV Group), does not meet weekly or monthly. We are lucky if we have two or three official meetings a year. On ATV, you see, you don't have to do what other clubs are required to do. We "see" each other all the time!

We do hold a regular ATV net on Sunday evenings at 8 p.m. in conjunction with a long-standing 2-meter FM net. It gives us a regular time and meeting place to catch up on all the week's activities. A regular net also constantly exposes the mode to non-ATVers. Newcomers will come at you right out of the woodwork!

Our ATV group sponsors three amateur repeater systems and one remote transmitter:

1) The N9CAI ATV/R UHF fast-scan TV repeater (mode B) takes inputted video signals on 439.25 MHz and passes them out (without desense) in band at 421.25 MHz. This system accepts standard 3.58 colorburst NTSC video and 4.5 MHz audio FM subcarrier sound.

2) An auxiliary audio feed (not

Photo A. WB0QCD in Iowa as seen at WB0ZJP in St. Louis, Missouri—200 miles away.

link—there is a difference) is fed from 144.340 MHz FM simplex and goes out the TV system at 425.75 MHz.

3) The remote transmitter (mode A) part of the system outputs at 421.25 MHz as well.

4) The N9CAI-1 packet radio digipeater accepts AX.25 protocol at 145.01 MHz FM. We have a videotape feed off this source as well, which can be called up on the main ATV/R system.

Yes, it sounds complicated, but you get used to it in a hurry around here.

Shown in Fig. 1 is a block diagram of the N9CAI ATV repeater, remote transmitter, and packet radio digipeater system located at St. Ambrose College in Davenport, Iowa. This system is unique because it has nine TV video feeds to choose from in mode A. These feeds were brought to us in part by Tracy Monson N9AEP and his diversified home-brew touchtone™ command systems.

•Channel 1—NTSC colorbars or a "live" on-campus television center production feed. We watch basketball games, football replays, stage plays, VCR editing, and other self-programming.

•Channel 2—A Radio Shack (Tandy Corp.) 64K TRS-80C Color Computer with disk-driven Mul-T-Screen (cable-TV type) ATV bulletin board software. I keep it updated every Friday. The troops use it constantly.

•Channel 3—A "live," moving B/W Hitachi "security" and shack camera.

•Channel 4—A FSTV window.

•Channel 5—Our packet radio feed from VHF. Even those mem-

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Just plug in your camera or VCR composite video and audio, 70cm antenna, 12 to 14 vdc, and you are ready to transmit live action color or black and white pictures and sound to other amateurs. Sensitive downconverter tunes whole 420-450 mHz band down to channel 3. Specify 439.25, 434.0, or 426.25 mHz transmit frequency. Extra transmit crystal add $15.

Transmitting equipment sold only to licensed radio amateurs verified in the Callbook for legal purposes. If recently licensed or upgraded, send copy of license. Receiving downconverters available to all starting at $59 (TVC-2G).

WHAT ELSE DOES IT TAKE TO GET ON ATV?

Any Tech class or higher amateur can get on ATV. If you have a camera you used with a VCR or SSTV & a TV set, your cost will just be the TC70 and antenna system. If you are working the AMSAT satellites you can use the same 70cm antennas on ATV.

DX with TC70-1s and KLM 440-27 antennas line of sight and snow free is about 22 miles, 7 miles with the 440-6 normally used for portable uses like parades, races, search & rescue, damage accessment, etc. Get 50 watts p.e.p. with the Mirage D24N or D1010N-ATV amp for greater DX or punching thru obstacles.

The TC70-1 has full bandwidth for color, sound, like broadcast. You can show the shack, home video tapes,computer programs,repeat SSTV, weather radar, or even Space Shuttle video if you have a home satellite receiver. See the *ARRL Handbook* chapt. 20 & 7 for more info & *Repeater Directory* for local ATV repeaters.

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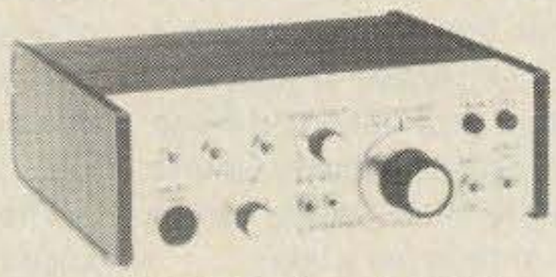

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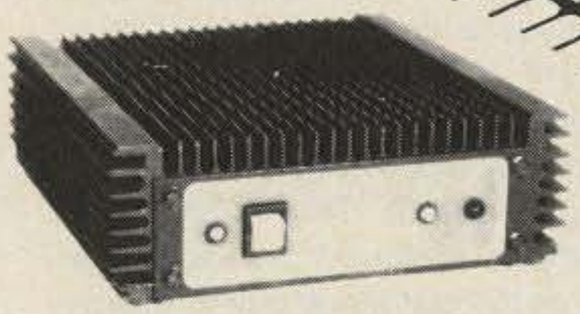

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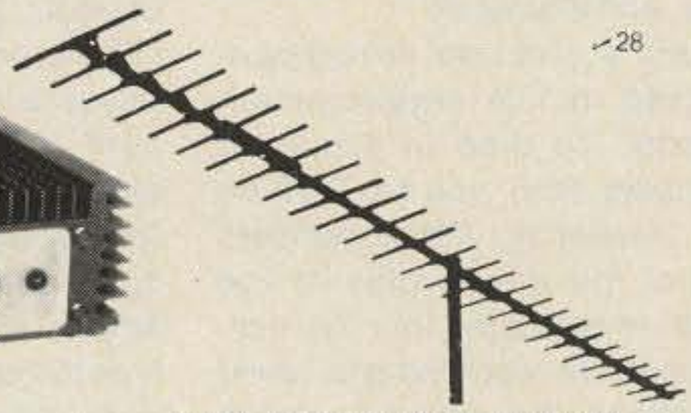

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KLM	440-27	14dbd	$107
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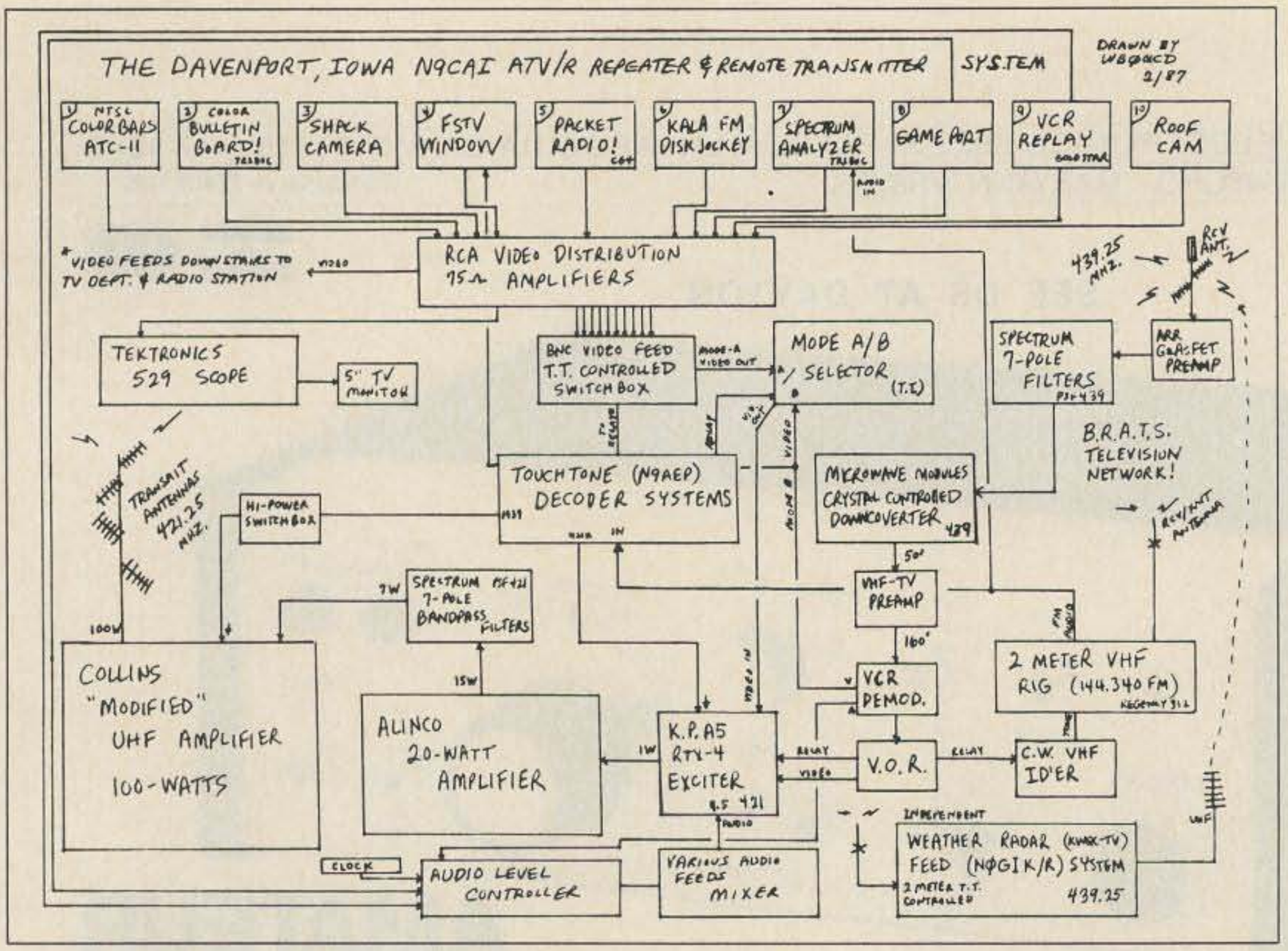

Fig. 1. The Davenport, Iowa, N9CAI/R repeater and remote transmitter system.

bers not involved in packet can watch the fun.

•Channel 6—Another "live" B/W camera watching the college's KALA-FM radio station disk jockeys do their thing. We "tune" 88.1 and listen to the station, as well as "see" the student spinning the wax. One of the Ambrose DJ students is also a club member and a ham (KA0GOA). The other night, we called him on his phone to let him know we were all watching him, and he held up a sign that said QRZ CQ-ATV. It was great!

•Channel 7—Another 64K CoCo using a ROM pack spectrum analyzer program that graphically shows your input on 2 meter FM.

•Channel 8—One of the "hottest" channels! It is our gameport feed. Four (interactive via 2-meter-FM touchtones) games are available to play: Joker Poker, Dice, Horse Race, and Blackjack.

There is, of course, no real money used in this entertainment channel. To drop in a quarter (members only), you hit TT#8 on your 2-meter rig. Other numbers control the actual play of the game. High scores into the multi-billions are recorded and saved in memory along with the callsign of the top seven finishers per game. Competitiveness is high, and each day brings a new leader. We reset all scores about every two months. This, as far as we know, is the only such "interactive" amateur system in the country—perhaps in the world!

•Channel 9—Our latest addition. I took an "on sale" Gold Star VHS VCR player ($160) and had Matt Reed NØGIK (our resident solder junky) modify it for automatic rewind, restart, and play hold. We run all kinds of taped programs—special events, Field Day stuff, ATV DX replays, lectures, bloopers, etc. The audio is also fed so all can hear. Future feeds include an outside camera and a soon-to-come, authorized weather radar feed from nearby KWQC-TV (NBC affiliate).

As mentioned, all nine TV video feeds make up what we call mode A. Mode B is the actual fast-scan TV signal repeater. The system employs a P.C. Electronics RTX-4 transmitter (Kreepy Peepie KPA5 1-Watt exciter), which drives a small Alinco amplifier to an output of about 15 Watts. The 15 Watts (TT-selectable ON/OFF) then drives a larger modified Collins UHF aircraft 4CX250B single-tube, high-power tube amplifier for about 90–100 Watts "average" output. The large Collins amp is preferred over a Mirage-type transistor one due to long periods of keydown time and better color.

The signal passes through about 90 feet of Andrews 7/8-inch, 50-Ohm hardline (with brass connectors) to our split 4-KLM (6-element) beam array. Our group has tested many types of horizontally polarized antennas for the best omni-directional patterns with respectable gain, and the beams have given us the best performance. Each A440-6 KLM beam has a 60-degree beamwidth pattern and 7.6 measured dB of gain.

We cover all areas with absolutely closed-circuit, P5 color TV pictures, out to about 40–50 miles (if you do your homework on the other end, of course). We estimate a genuine 100-mile coverage radius on this system, which is remarkable for UHF, let alone a television repeater.

There are a number of published antenna designs (such as stacked big wheels, slots, etc.) that perform well for those ATV groups now using horizontal polarization and desiring to remain that way. As stated in my previous columns, disrupting polarizations in established areas can mean DEATH to ATV activity. You've heard that lecture before, so I won't go into it again. If you need some further information on these types of antennas, write to Gerald Cromer K4NHN in Cayce, South Carolina, or drop me a line.

On receive, we use a simple W9DNT Alford Slot antenna with a couple of KLM 440-6 beams as kickers to bring in a couple distant and weak-signal areas. An Advanced Receiver Research GaAs-FET preamp is ahead of a 7-pole Spectrum International inter-digital bandpass filter and a Microwave Modules crystal-controlled downconverter, which has a 45-MHz i-f rf output. Another line preamp is used (Channel Master VHF-TV 10-dB model) about 50 feet into the run, which travels over another 160 feet of Belden 9913 to our transmitter room.

Everything is mounted near the antenna in a milkbox-type weatherproofed container at the foot of our second tower tripod/mast arrangement. There is approximately 75 feet of horizontal separation between the transmit antennas and the receive antennas. It took filtering and proper cabling on both ends to keep the extra 85 Watts of "natural desense" out of incoming weak pictures. Contrary to a lot of negative predictions by some, the system works and works well!

A special P.C. Electronics VOR circuit board senses the presence of video TV sync (not radio carriers) and automatically turns on the "repeat" transmitter. Surplus RCA broadcast distribution amplifiers set the proper levels on all feeds on mode A, including the FSTV input on mode B. A Tektronix 529 Waveform Monitor Scope is used on-site to keep everything in line.

Our whole system is housed on a third-floor room, just above the FM radio station, within the college complex. Electricity is provided us at no charge and we can come and go to the system as we please. It is a nifty arrangement for which we owe thanks to our member sponsors, N9CAI and WD0AMA. Stop by our ATV workshop session on Saturday night at Dayton (see below) to see this system on tape in action.

Dayton ATV Workshops

You are invited to join other fellow USATVS members at our special ATV workshop meeting/conferences sponsored jointly by the *Spec-Com Journal* and the Chicago-based Peacock ARC (a club of prominent TV and radio broadcast amateurs) to be held this year during the upcoming Dayton, Ohio, Hamvention.

The location of these informal, social get-togethers has changed from previous years. We will be at a large two-room suite at the Ramada Inn North, 1/2 mile south of I-70 and I-75 in north Dayton (4079 Little York Road, Dayton OH 45414). Ask for Beth if you call (513-890-9500) to make room reservations ($60).

Attend all the doings at the Day-

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ton Hamfest on Friday and Saturday, and then come rest your feet and learn more about amateur radio fast-scan television at our sessions. $1 will be asked at the door both days to cover the expensive "extra" meeting room.

Friday's ATV workshop is from 7 until 11 p.m. It will be an informal get-together rag-chew session, with all the various groups of ATVers from around the country showing off their edited color VCR programs about their local activity, repeaters, remote transmitters, DX, clubs, special events, etc. Bring your latest, uncensored commercial TV bloopers. Keep the XYL and kids at home or back in the motel unless they won't mind a lot of boring technical conversation.

We will try and have an operating FSTV station on the air possibly into the Dayton ATV repeater. Vertical polarization will be used on UHF. The 2-meter ATV input channel there is 147.450 FM. We will be there or on 144.340 MHz. How many ATV mobiles will show up once again? We will award a $19.95 Hamfest Game to every mobile that makes it (must be verified at the Ramada or Dayton Hamvention location).

Henry Ruh KB9FO (former Editor of *A5 ATV*) of the PARC group will present an update and film of the new Chicago 1,350-foot high John Hancock Building KB9FO ATV/R system around 9 p.m. (See "Repeater Update" below.) It should be quite an interesting and relaxing night.

On Saturday, the ATV workshop doors will be open from 3 p.m. on. Formal ATV lecture presentations will begin promptly at 7. At 7:30, I will speak and show a videotape on the fancy Davenport, Iowa, N9CAI ATV repeater system. At 8:30, our special guest speaker will be John Beanland G3BVU/W1 of Spectrum International, Inc. If you haven't had the opportunity to hear John lecture, you are in for a real treat. He will speak on the importance of good inter-digital bandpass filtering in the 80s. Bring your notepad!

Other Dayton ATV events include the annual 7 p.m. W0LMD/W9NTP Saturday night SSTV get-together at the Holiday Inn North and the Saturday afternoon (1300–1445) Dayton ATV Forum meeting held by Tom O'Hara W6ORG. The forum will include a talk on ATV basics, a talk by Gary Heston W6KVC on portable ATV applications, and a talk by Bruce Brown WA9GVK/4 on FM ATV, standards, comparisons, and equipment. Don't forget to stop by and see the P.C. Electronics and Wyman ATV booths as well.

Repeater Update

Last month, I talked about the new PARC Chicago ATV repeater announcement. The latest news is that the transmitter is being located up on the John Hancock building—not just on the top floor or on the roof, but two-thirds up the left side tower, with 1,350 feet of antenna height and three feet of coax. Way to go, guys! Look for it in the Midwest—120 Watts of rf on 421.25 MHz—especially during band openings.

Henry got permission from The Kavouras Company and WMAQ-TV (where he is employed) for a weather radar feed. Chicago ATV is "on the move" again after being dormant for several years. Old timers, watch out for the newcomers. The old, do-nothing days are over. If you live in or near Chicago for about 100–150 miles, you may want to get an ATV downconverter or build an antenna because now there is something more to watch than just postcard IDs, weak attic colorbars, and questionable channel 7 TV feeds.

ATV Directories

Many of you have written wanting to know more information about the *North American USATVS ATV Directory* and the *1987/88 ATV Repeater Directory*. For more information about these directories, write to Spec-Com Communications & Publishing Group, PO Box H, Lowden IA 52255.

Special Offers

73 ATV fans, you can get a special "get started" FSTV incentive deal from P.C. Electronics (2522 S. Paxson Lane, Arcadia CA 91006; 818-447-4565). Their popular TVC-2 420–450-MHz (channel-3 output) ATV downconverter circuit board—built and tested, but minus the cabinet—regularly $49, is now just $39! The finished unit, a TVC-4, comes all ready to operate in an attractive Ten-Tec-style box with 110 V ac supply—regularly $89, it is now just $74! Simply mention this special *73* magazine "ATV Column" offer or purchase this gear at Dayton from booth #359 to get your discount. ■

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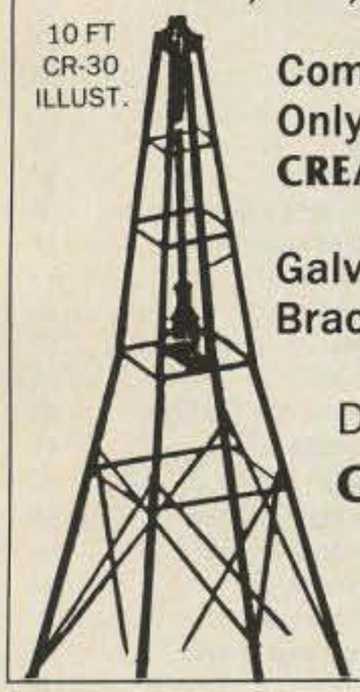

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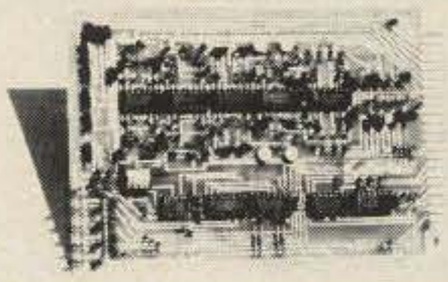

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UG-175	Reducer for RG-58	.20
UG-176	Reducer for RG-59 & MINI 8	.20
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UG-21B/U	N Male RG-8, 213, 214, Kings	3.75
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UG-21D/9913	N Male for RG-8 with 9913 Pin	3.95
UG-21B/9913	N Male for RG-8 with 9913 Pin	4.75
UG-146/U	N Male to SO-239, Teflon USA	5.00
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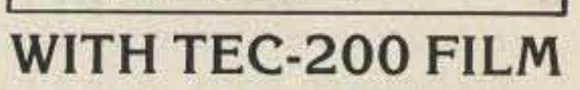

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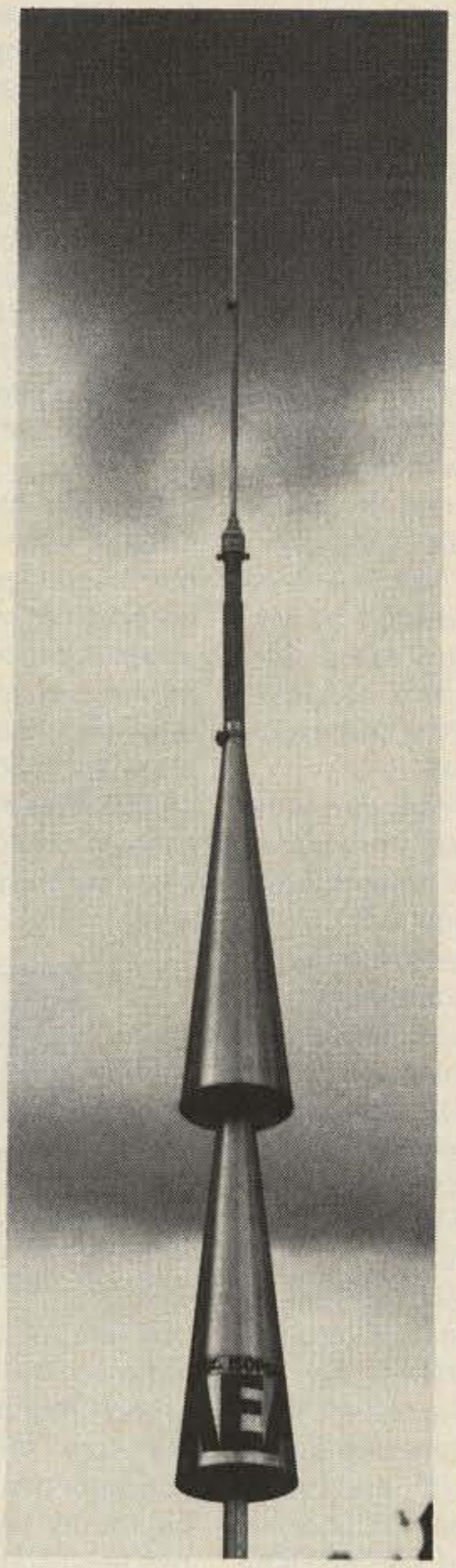

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**dbd — db gain over a dipole in free space

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73 INTERNATIONAL

NOTES FROM FN42

Correction: In Ralf Beyer DJ3NW's report on the beacon robot, IY4M (February, 1987), the bandwidth of the receiver should have read: "about ± 250 Hz," and NOT ± 2590 Hz.

Welcome to Djurica Maletin YU7DR, writing from the Socialist Federal Republic of Yugoslavia, and inviting hams to come work from YU: "...a very nice country [with the] blue sunny Adriatic, high mountains...national food [which] is very tasteful and wine pleasant to drink. Our people are always hospitable." Only a sample of information this month.

This seems to be the month for royal birthdays, including one for the "King of Code," Samuel F.B. Morse (April 27, 1791). In your DX-ing, remember to send birthday congratulations for the Queen of Denmark (16th), the Emperor of Japan (29th), and the King of Sweden (30th). The 30th is also Queen's Day in the Netherlands. It is Independence Day in Senegal on the 4th and in Zimbabwe on the 18th; Republic Day in Sierra Leone is on the 19th and National Day in Chad is on the 13th, which also is New Year's Day in Bangladesh. The 14th is Pan American Day (Dia de las Americas). And XYLs, the 7th is Womens Day in Mozambique. It is World Health Day everywhere on April 7, so wish everyone, everywhere *the best of health in mind and body! After all, one of the four basic reasons radio amateurs are licensed is To Foster International Goodwill!*

ROUNDUP

Japan. We were pleased to receive a letter from Shozo Hara JA1AN, president of the Japan Amateur Radio League (JARL), promising this column amateur radio information from Japan from time to time. An international column in a ham radio publication without any input from Japan is ridiculous! We hope to do a better job than we did a few years ago.

HAMBIT. Billed as the "First International Congress on Amateur Radio and Computers," HAMBIT was held in Florence, Italy, last November. HAMBIT '87 will be on November 22; details are under the Italian flag, below, since the Associazione Radioamatori Italiani (ARI) sponsors it.

Diego Garcia. Bill Poulin KA4WWG/MM writes to encourage hams to bring their equipment "for a DXpedition for 12 months that they will never believe." Well, first you join the Navy... Diego Garcia is a U.S. Navy support and communications facility in the middle of the Indian Ocean (VQ9). Using the club station, an ICOM 745 and a TH7 beam up about fifty feet, "the bands are really fun to work," he writes. He worked Guam, the Malaysian Peninsula, Europe, and a few stateside stations. Full operating privileges are yours "regardless of current stateside license." More info on Diego Garcia is available by writing: Station Manager, Diego Garcia QSL Bureau, Box 15, NAVSUPPFAC, Fleet Post Office, San Francisco CA 96685.

Africa. "By the early part of the next century virtually the whole of mankind should be brought within easy reach of a telephone."

That was an objective set by the Independent Commission for World Wide Telecommunications Development, which led to the "Arusha [Tanzania] Declaration," which led to discussions about African Telecommunications Development by the pan-African telecommunications network (PANAFTEL). A common strategy is to be developed for extensions of current cooperative efforts in the fields of training, research and development, purchasing policy, maintenance, tariffs, and the international development priorities for the continent. (Excerpted from the December *ITU Telecommunications Journal*, the magazine of the International Telecommunications Union). Talk about challenges!

(The ITU—for readers new to this column—is an autonomous organization, with functional relationships with the United Nations, located in Geneva, and with a membership of 159 nations. Its function is to set up international regulations of radio, telegraph, telephone, and space radio-communications, and allocate radio frequencies. The magazine has a history a bit longer than that of the United Nations. The December issue includes this, from the *Journal Telegraphique* for December, 1886: "The Imperial Telegraph Administration of Brazil has recently opened a telegraph office in the quarantine station of Ilha Grande to the South of Rio de Janeiro." (A new DX country?)

A new plan for FM broadcasting in band II, to go into effect July 1, this year, was drawn up in 1984 for the whole of Region 1 (Africa and Europe, including all of the USSR, Turkey, and the Arab countries of the Middle East) and Afghanistan and the Islamic Republic of Iran from Region 3. In Nairobi recently, a new plan was drawn up for television broadcasting in the frequency bands I, III, IV, and V. A report on that will be in this column in the future.

World. Better and faster: That's the word for what will be available by 1990 for communications across the Atlantic and Pacific Oceans with fiber-optics—glass fibers and laser beams in underwater cables. Audio quality will be superior to both the present copper cable system and satellite system—and faster than via satellite since Earth-bound channels are 45,000 miles shorter. The Atlantic cable is scheduled for operation next year and the Pacific, the year after.

FRANCE

Chuck Martin F/AB4Y
American Embassy Paris
APO NY 09777

A veritable explosion of packet radio activity is underway in the French Republic. Remy F6ABJ, the "guru" of packet, said that his company had originally built 200 boards for packet. The demand has been so great that 600 units have been built and the demand is still increasing. He has started the association called ATEPRA; there are about 190 in the Paris area that are active in packet.

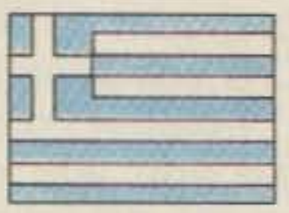
The propagation characteristics on 14 MHz are such that only one 20-minute window opens each day where communications with the USA are possible.

Three frequencies are used for packet communications in Europe: 144.675 (primary), 144.650 (secondary), and 166.625 (tertiary). These frequencies were chosen arbitrarily, and while they have proven adequate in their own right, it is difficult or impossible to co-locate a digipeater with an FM repeater, due to heterodyning and desensitization.

Packet radio is not addressed in the French amateur radio regulations. There is a *modus vivendi* wherein amateurs may operate packet legally. There is no 220-MHz allocation in Europe, so plans are underway to cross-link digipeaters on 430 MHz. In the future, there will be a 50-MHz allocation in France.

Paris has two active digipeaters: F1KAL and F6ABJ-2. They permit a Paris station to work stations within a 125-km radius. I have connected with stations from Rouen to Orleans. There are two active PBBS systems operating: F6ABJ and F5LO. Another digipeater will soon appear: FF6KEV. The future looks very bright for packet in France, with new stations appearing every day.

Reciprocal licenses for foreigners are now made "over the counter" in France. The Republic has reciprocal operating treaties in force with some 30 nations. A 90-day permit can be had for a fee of FF 42 [$0.16 per French Franc as of 1/27/87], and a one-year permit costs FF 150.



GREECE

Manos Darkadakis SV1/W
Box 23051
11210 Athens
Greece

I would like to welcome the return of Wayne Green to the magazine! Since this column is written months before it appears, it may look a little old, but it is necessary to say because, even though I don't know Wayne Green in person, I think this was the best thing happening to the magazine for the last two years. Since I also believe that everybody has to be in proper position, I am glad to see W2NSD back in charge of *73*.

THE *ΑΒΕΡΩΦ*

Last July you may have heard a strange callsign, SX1MBA, on the air for seven days, working the pileups all day and all night long. This call had been given to the Radio Amateur Association of Greece (RAAG) during the celebration of Navy Week. The station was in the radio room of the Memorial Battleship *Αβερωφ*; that is where the MBA suffix came from. Here is the story, from recent Greek history:

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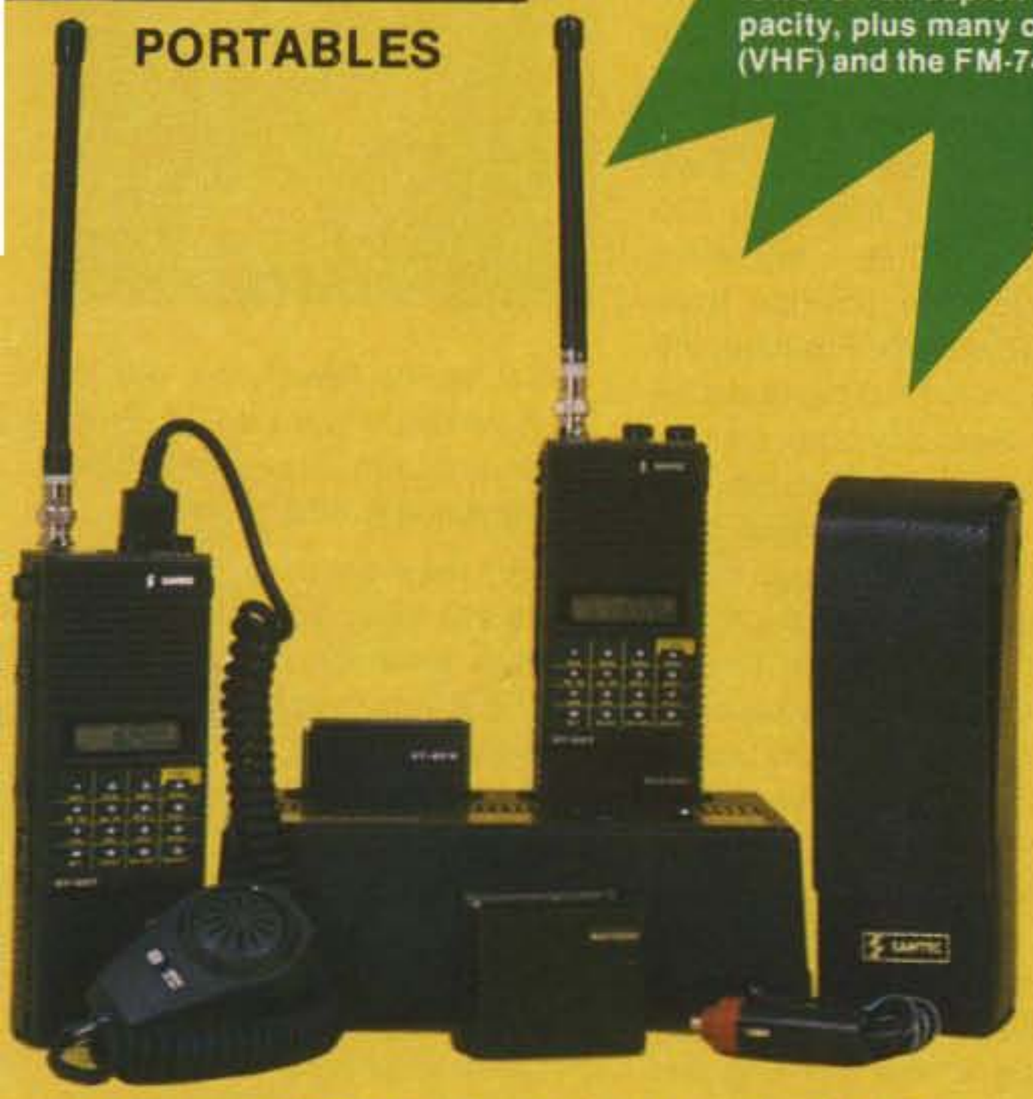

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The 1980 SV1DC/SV1IW/SV1JG operation on the back balcony of the Monastery, with all equipment.

At HAMBIT '86, left to right: Mario I5WBJ, Clelia I5ICY, Mr. Giani, Mr. Spina and Mr. Poli of the Italian Telecommunications Ministry, Carlo I5CLC, Marco I5ZMH, Cesare I5TGC, Mario I5DEX, and Francesco I5IGQ.

ITALY

Further information on HAMBIT may be obtained by sending an SAE and IRCs for an airmail stamp with your request to Carlo Luigi Ciapetti I5CLC, Via Trieste 36, 50139 Florence, Italy.

Florence, Italy, the "Capital of European Culture," played host to 250 representatives of the high-tech world on Sunday, November 23rd last year, thanks to the sponsorship of ARI, the Italian Telecommunications Ministry, EXPOSER (one of Italy's big fairs), and the Florence Savings Bank (Cassa di Risparmio Firenze). Papers were presented by representatives of Germany, the Netherlands, Sweden, Switzerland, and Italy, on subjects ranging from dedicated software through digital modulation and application and data radio transmission, to data security. A general overview of the field was presented, from the latest high-tech developments to current research into the high tech of the future. Carlo I5CLC, president of the Florence branch of ARI, organized and coordinated HAMBIT '86.

Presiding at the opening session was University of Florence Professor Vito Cappellini, director of the Italian Institute for Radio Wave Research; welcome was extended by the President of the Italian Republic, Francesco Cossiga I0FCG.

HAMBIT '87, to be on Sunday, November 22, this year, will focus on PC-compatible hardware and software for amateur radio.

REPUBLIC OF KOREA

Our guest columnist, Byong-joo Cho HL5AP:

Not having heard from our Korean correspondent, HL1AFP, for several months, here is a guest appearance to fill in for him.

You may be surprised to receive this letter from an unknown Korean amateur radio operator, but I got your name and address from the KARL DX News (the official bulletin of the Korean Amateur Radio League) [in which *73* said it would welcome news]. I am a charter and life member of KARL since it was organized way back in 1955.

I wish to be a news supplier for you. I am retired from the EL0AP/MM last June (Sanke Steamship Company, Tokyo) and was ex-HM1AP, HM9AP, HM5AP, EL0P/MM, PA9SR, HM5AP/DL, and YB0ZAA/HL5AP. My amateur class is 1st Class Amateur (same as top class in W), and I am QRV on all bands/modes with 2 meter, and a keen award hunter and DXer.

After the signing of a peace agreement between Greece, Serbia, Bulgary, and Montenegro on November 20, 1912, Turkey was starting to prepare an expedition to the Aegean Sea to defeat the Greek navy and occupy Greek islands.

This was noticed by a Greek squadron, and the fleet began to patrol on the Dardanellia Sea to watch for the Turks. Action began December 3 when the Turkish fleet came along the strait. The *Abepωφ*, with a speed of over 20 mph, left the Greek fleet and circled around and attacked the flank of the Turkish fleet, firing many successful shots. As the rest of the Greek fleet came up under cover of the fire from the guns of the *Abepωφ*, the Turkish fleet retreated. In less than three hours the fight was over: It was a victory by almost just one ship!

SX1MBA ran on this ship, the *Abepωφ*, for seven days on all bands and all modes. There were HF stations as well as VHF for the local people. RAAG equipment was used; lots of other SV1s offered tuners, power supplies, keyers, switches, and even keyboards for RTTY. Simple dipole antennas were used on all bands, and special attention had been paid on CW and the low frequencies. By the end of the week, 9,000 QSOs had been logged.

A nice-looking QSL card with a photo of the ship was developed, as well as a special award for 10 IRCs, from RAAG's Award Manager. Those who have already applied should have them by now [in March].

MT. ATHOS AGAIN

By the time you read this, you should have heard about a new failed attempt to activate Mt. Athos, last August, by an Italian group. I won't go into detail (although I know many details) since it was covered in this column before, and I do not want to bore you. [November, 1986, issue; *but here is a picture we did not use in that issue.*] Also, the circumstances of this attempt were not so different except for one thing: This time, the Italian group made sure to leave very few chances to anyone coming along later for a try. Now for those who still need this rare country, things aren't so easy and only time will tell who is to be blamed about it. DL7FT and the Italian group may have shut the doors of Mt. Athos forever.

In the meanwhile, work anyone you hear claiming to be from there and worry later about its validity.

Medical Administration Radio, station J4MAR, was established recently in Greece in order to give medical help to those who need it. RAAG is providing QSL service for its members completely free of charge.

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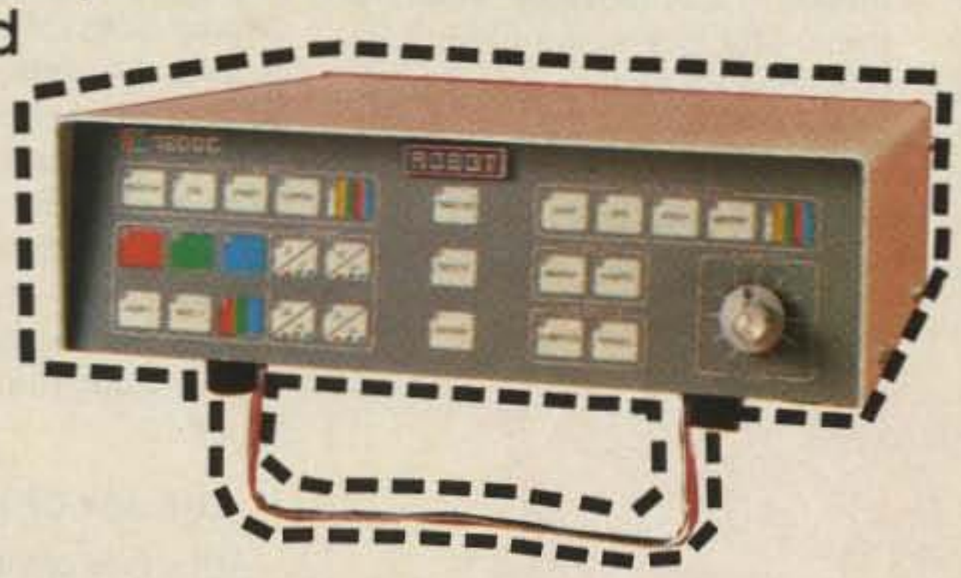

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I am chairman for the Korea DXer Society, established in 1960 with HL9KKB, etc., and we issue the WAK award to hams and SWLs. I am at PO Box 4, Haeundae, Pusan, Korea 607-04.

I am QRV on 14 MHz CW every day around 2300–0200 UTC, and 0600–0800 UTC 14 MHz CW for DXing. I should like to QSO everyone, spread out all over the world. My QSL manager is Hideke Nishida JH4NPP, PO Box 229, Okayama, Japan 700. It is OK via JARL/JH4NPP or my QTH also.

My two sons are also hams: HL5QU and HL5BDE, who is the main engineer on the M/S *Spring Swift* under a Liberian bulk carrier [flag]. He hopes to operate EL0??/MM soon if he can get a license from the Liberian government.

I was chief radio operator for the *Sanke Line*, and once was a flight radio operator and communications manager for an airline, with 5,000 hours of flying time. I was a radio engineer in Saigon during the Vietnam war.

It didn't surprise us to hear from HL5AP—We hear more and more from hams all around the world. But we bet it will surprise HL5AP to see parts of his letter here! When space is available, we enjoy sharing our mail. Write us, and maybe you'll be surprised, too. Maybe we'll start a new small section—International Ham Of The Month—and select one letter from an overseas ham each month.

MEXICO

Mark Toutjian XE1MKT
Apartado Postal 42–048
06470 - Mexico, D.F.

GOOD NEWS FROM MEXICO

More than a year has gone by since the big Mexico City earthquake. Bad memories were brought back once again with the recent El Salvador earthquake, but Mexican hams were quick to respond to the needs of our friends "south of *our* border."

I cooperated with a local cultural group near my home which was able to send, from Mexico City, a 10-ton truck with supplies to friends in San Salvador. The customs officials at both borders (Mexico/Guatemala and Guatemala/El Salvador) were outstandingly organized and helped us through with no red tape. But how was it possible for us to find out the needs of our friends down south—since there was little or no telephone communication into El Salvador for some time?

A new ham flies high! XE1XJX with his wife and daughter. XE1MKT and his wife, XE1RBT, are behind.

You guessed it! If it wasn't for my ham equipment, we wouldn't have known that our friends needed more than a thousand sheets of galvanized roofing, literally tons of food, blankets, medicine, and other necessary items.

After the trucks had arrived, what a pleasure it was to hear Dominic, in San Salvador, all choked up on the air, trying to thank us for all that was done.

Yes, ham radio had done it again!

THE JOY OF HAM RADIO

At the time of this writing, I am in the middle of writing a new book, entitled *The Joy of Ham Radio—A Beginner's Guide*.

When I first began investigating ham radio, I felt that I was lost in a jungle full of tubes, circuits, wires, and strange people who crawled out of bed in the evening for QSOs, QSYs, and QRTs. I sympathize with today's innocent and bewildered beginner who is often on the border of pulling the plug and picking up another hobby.

My book is to *encourage* the real newcomer who has a spark of interest but has no idea of what he's getting into. Learning something new can be joyful. Ham radio is not the exception.

Besides the introduction, there are six basic chapters, two appendices (one with a glossary of ham-radio terminology and one with charts and tables), and a subject index for quick reference. Depending on the agreement between the publisher and me, I hope to have the Spanish edition available not too long after its first U.S. printing in English.

For me, trying to learn on my own was not easy at all. Trying to determine what equipment I should buy, how and where to install my antennas, and all the other juicy details, was like trying to nail jello to a barn door.

Special Note: Congratulations to my father-in-law, Jesus Becerril XE1XJX, who just got his license after many years of interest in ham radio! In fact, he was the one who first got me started!

YUGOSLAVIA

Djurica Maletin YU7DR
PO Box 132
21400 Bačka Palanka
Yugoslavia

I hope the information I will have for *73* International will be interesting because I work each day on all HF bands and participate a lot in HF contests. Also, I am a QRQ CW contester.

The Vojvodina Award. On HF bands 1.8 to 28 MHz (no new bands), six contacts from Europe with YU7 or 4N7, YT7, or YZ7; two contacts DX. On VHF band (144 MHz), three contacts from Europe, one DX.

Send GCR (no QSL cards) with 8 IRCs or U.S. $1 to Savez Radioamatera Vojvodine, Trg Lenjina 10, 21000 Novi Sad, Yugoslavia.

Information about licenses can be had via SRJ, Box 48, 1101 Belgrade, Yugoslavia.

All QSL cards for 4O7WCY, YT0ARG, YZ7Q, YZ7L, YZ7ARG, YT7T, YZ7DR are sure through YU7DR.■

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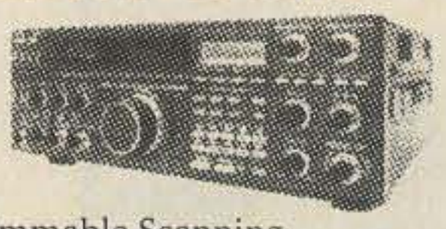

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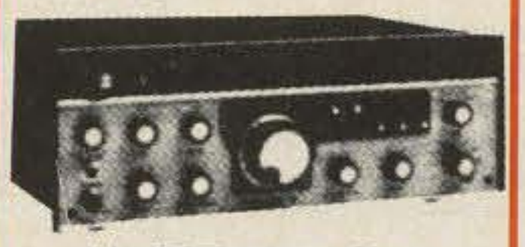

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PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U. S. S. R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U. S. S. R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U. S. S. R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

G=Good, F=Fair, P=Poor.

April will be an excellent month for HF DX. Due to seasonal improvements and increasing sunspot activity, the ionosphere will be capable of providing daylight-to-dark DX openings on 20, 15, and occasionally 10. The poorest propagation will be before the 10th of the month due to an active geomagnetic field. After the 10th, only occasional disturbances will disrupt east-west path propagation.

APRIL

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F	2 F–P	3 P–F	4 F–P
5 P	6 P–F	7 F–G	8 G–F	9 F–P	10 F	11 G
12 G	13 G	14 G	15 G	16 G	17 G	18 G
19 G	20 G	21 G	22 G	23 G	24 G–F	25 F
26 F–G	27 G	28 G	29 G	30 G		

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Tuning via tuning knob, or up/down buttons. PL tone board (optional). PL display.

Independent PL memory per channel. PL encode *and* decode. LCD power output and "S"-meter display. Eight-key control pad. Keypad lock. High/low power switch (low power: 5 watts VHF, 3 watts UHF).

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Optional accessories.

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- IF-232C level translator
- CD-10 call sign display
- SP-430 external speaker
- VS-1 voice synthesizer
- TU-5 CTCSS tone unit
- MB-430 mobile mount
- MC-60A, MC-80, MC-85 deluxe desk top microphones
- MC-48B 16-key DTMF, MC-43S UP/DOWN mobile hand microphones
- SW-200A/B SWR/power meters:
  SW-200A 1.8-150 MHz
  SW-200B 140-450 MHz
- SWT-1 2-m antenna tuner
- SWT-2 70-cm antenna tuner
- PG-2U DC power cable

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