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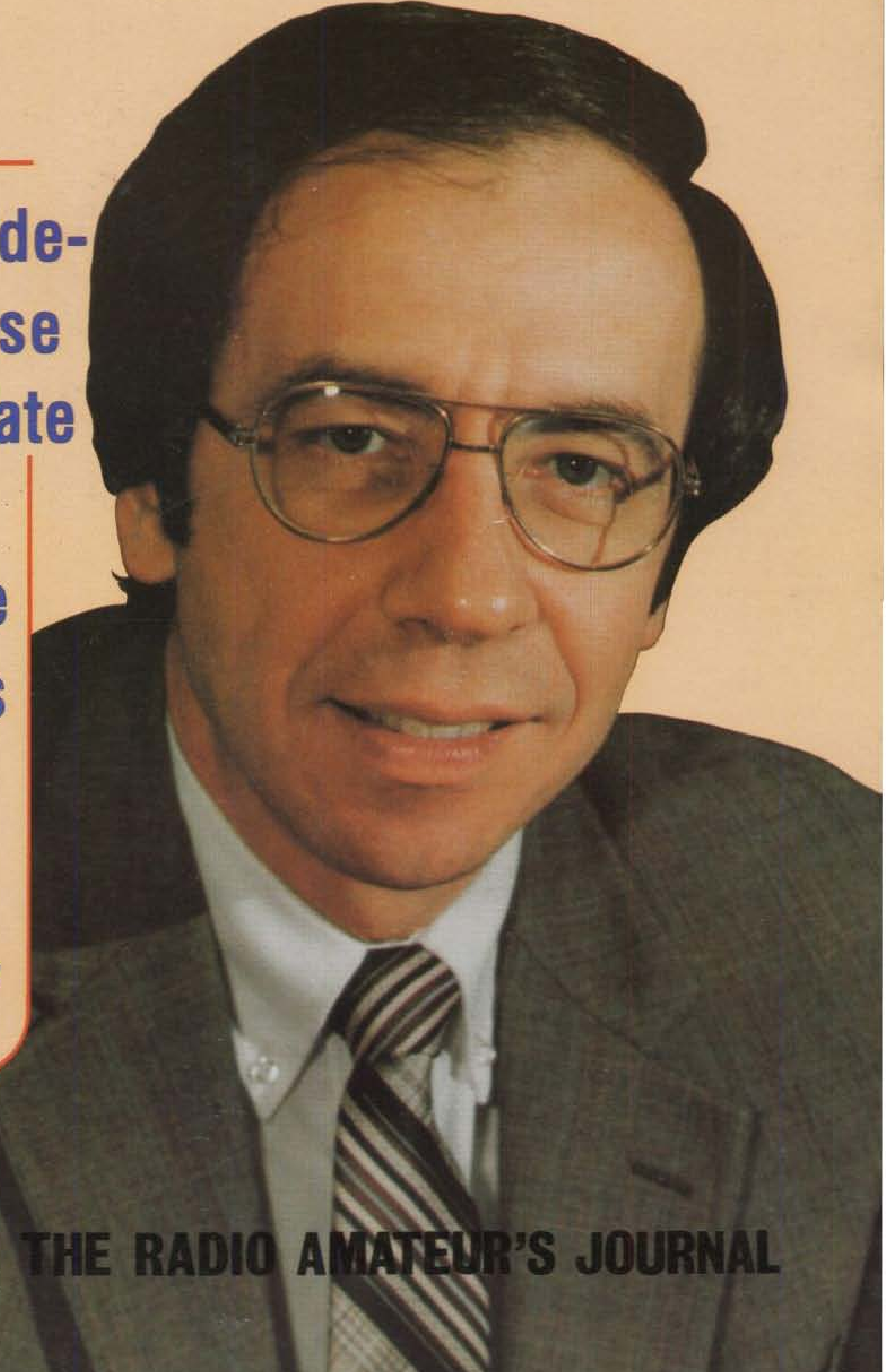
CQ Amateur Radio

SERVING AMATEUR RADIO SINCE 1945
MARCH 1982 $2.00

An Exclusive Interview With
FCC Chairman Mark Fowler . . . p. 18



"'I do believe a code-free amateur license might be appropriate at the higher frequencies where propagation keeps communications 'local.'"

Chairman Fowler

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THE RADIO AMATEUR'S JOURNAL

Watt's new...on 2 meters?

All mode (FM/SSB/CW) 25 watts, plus...!!!

TR-9130

The TR-9130 is a powerful, yet compact, 25 watt FM/USB/LSB/CW transceiver providing increased versatility of operation on the two meter band. It features six memories, memory scan, memory back-up capability, automatic band scan, all-mode squelch, CW semi break-in, and incorporates microprocessor technology. It is available with a 16-key autopatch UP/DOWN microphone (MC-46), or a basic UP/DOWN microphone.

TR-9130 FEATURES:

- **25 Watts RF output**
  All modes, (FM/SSB/CW), utilize a new high power linear module, for more reliable FM operation and increased DX on SSB or CW.
- **FM/USB/LSB/CW all mode operation**
  For added convenience in all modes of operation, the mode switch, in combination with the digital step (DS) switch, determines the size (100 Hz, 1 kHz, 5 kHz, 10 kHz) of the tuning step, and the number of digits displayed.
- **Six memories**
  On FM, memories 1 through 5 for simplex or ±600 kHz offset, with the OFFSET switch. Memory 6 for non-standard offset. All six memories may be operated simplex, any mode.
- **Memory scan**
  Scans memories in which data is stored. Stops on busy channels.
- **Internal battery memory back-up**
  With 9 volt Ni-Cd battery installed, (not KENWOOD supplied), memories will be retained approximately 24 hours, adequate for the typical move from base to mobile. A terminal is provided on the rear panel for connecting an external back-up supply.
- **Automatic band scan**
  Scans within whole 1 MHz segments (ie., 144.0-144.999 MHz), for improved scanning efficiency.
- **Dual digital VFO's**
  Incorporates two built-in digital VFO's, selected through use of the A/B switch, and individually tuned.
- **Transmit frequency tuning for OSCAR operations**
  On SSB or CW, the tuning knob or UP/DOWN buttons on the microphone may be used to adjust the transmit frequency during transmission.
- **16-key autopatch UP/DOWN microphone version**
  The TR-9130 is available with the MC-46 16-key autopatch UP/DOWN microphone, or with the basic UP/DOWN microphone. Manual UP/DOWN scan of entire band possible using either microphone.
- **Squelch circuit on all modes (FM/SSB/CW)**
  The squelch circuit is effective on SSB, CW, and FM.
- **Repeater reverse switch**
  For checking signals on the repeater input, on FM.
- **Tone switch**
  For activating a tone device, (not KENWOOD supplied).
- **CW semi break-in circuit with sidetone**
  Built-in, for convenience in CW operations.
- **Digital display with green LED's**
- **High performance receive-transmit design**
  The use of a low-noise dual-gate MOSFET plus two monolithic crystal filters in the receiver front-end results in excellent two signal characteristics. Care in transmitter design assures clean signals in all modes.
- **Compact size and light weight**
  170 (6-11/16) W x 68 (2-11/16) H x 241 (9-1/2) D mm (inch), 2.4 kg (5.3 lbs.) weight.
- **Extended frequency range**
  Covers 143.9 to 148.9999 MHz, which includes certain MARS and CAP frequencies.
- **Transmit offset switch**
- **High performance noise blanker**
  Suppresses pulse-type noise on SSB and CW.
- **RF gain control**
  For all modes of operation.
- **RIT (Receiver Incremental Tuning) circuit**
  Useful during SSB/CW operations.
- **Amplified AGC**
  Enhances SSB and CW operation. The AGC time constant is automatically optimized for each mode of operation.
- **HI/LOW power switch**
  Selects 25 or 5 watts RF output on FM or CW.
- **Accessory terminal**
  A four pin accessory terminal is provided for use with a linear amplifier or other accessory.
- **Quick release mounting bracket** (Supplied)

More information on the TR-9130 is available from all authorized dealers of Trio-Kenwood Communications
1111 West Walnut Street, Compton, California 90220.

KENWOOD
...pacesetter in amateur radio

Accessories:

- KPS-7 Fixed station power supply.
- TK-1 AC adapter for memory back-up.

Subject to FCC Approval.
Specifications and prices are subject to change without notice or obligation.

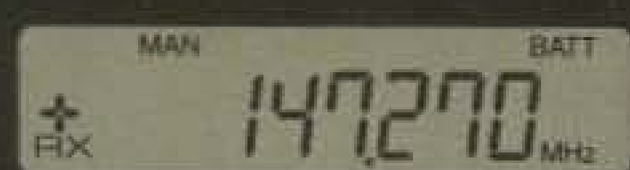
ST-144/µP, 2 Meter FM

It's Time!

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

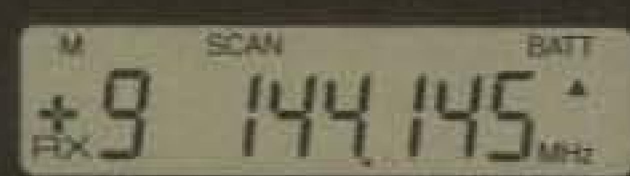
■ The 24 hour format digital clock on the LCD display is uniquely SANTEC, and it typifies the thoughtful operator-oriented design incorporated throughout the ST-144/µP. ■ Not only does it give you accurate time checks whenever you want, but also it can display the time instead of the frequency, while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

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

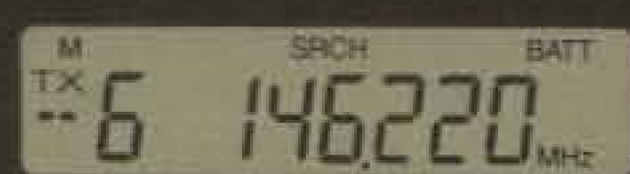


Full Frequency Display showing offset selected, battery condition and current scan mode. At turnon, the contents of M-1 are loaded into the operating register, and the display looks like this.

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



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



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

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

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

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

Accessories for SANTEC Handheld Radios
clockwise from upper left:
- **Leather Case (ST-LC)**
- **Base Charger & Power Supply (ST-5BC)**
- **Remote Speaker (MS-50S)**
- **Mobile Charger (ST-MC)**
- **Speaker Microphone (SM-1)**

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

SANTEC

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

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

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

NAME ______ CALL ______
ADDRESS ______
CITY ______ STATE ______ ZIP ______ CQ

YOU MAY SEND A DUPLICATE OF THIS FORM.

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CQ
The Radio Amateur's Journal

ON THE COVER: FCC Chairman Mark S. Fowler. Read his exciting and insightful interview with CQ's Ted Cohen, this month on page 18.

MARCH 1982 **VOL. 38, NO. 3**

FEATURES

DEPARTMENTS

Zero Bias

AN EDITORIAL

In some circles Frank Sinatra is, or was, known as "The Chairman of the Board," but as far as amateur radio is concerned, our "Chairman of the Board" is Mark Fowler. I am delighted to be able to present another *CQ* Exclusive Interview, especially with Mr. Fowler, the new Chairman of the FCC. I would like to thank him for taking the time for this interview and for sharing his views on amateur radio with us. I would also like to thank the FCC for taping into an already beleaguered budget to provide a new color photograph of Mr. Fowler for our cover.

As with the interview with Chairman Fowler, we hope to present to you an overview of the people within the FCC who work towards shaping amateur radio. It is hoped that through these interviews, the average amateur (if there is one) and reader will become familiar with the political process which governs our service. You will see that a simple request sometimes is not that simple, and perhaps you will experience the thinking that goes into creating legislation and the rationale for killing legislation.

I can recall one of the first interviews we did some time ago in response to which a reader sent in a vehement letter pointing out the "errors" and audacity of the statements made. These particular statements ran contrary to the letter-writer's vested interests and "beliefs" with relation to the FCC and amateur radio, and as such couldn't possibly be true. Fortunately, most of us have a better grasp of reality, and most issues are not that fraught with what can be mistaken as "personal attacks." What is needed and what we are trying to supply is simply exposure. Over the years we have introduced you to several members of the Commission and have given them the chance to let you know what is going on in Washington. I must say that it seems to be working, as more of you are getting involved in the process and are taking an interest in our government on a personal level. The number of comments received on the "Plain Language" rewrite highlights this statement.

Recently, we broadened the scope of our interviews to include people from industry. These may or may not be names you are familiar with—probably not. Certainly, most of the people we have interviewed and plan to interview are not the typical five or six people who are mentioned in relation to amateur radio and world recognition. No kings, entertainers, or sports figures are in the immediate offing. Those we interview are successful people from everyday life, some hopefully role models for tomorrow. Amateur radio has played an important part in their lives, helping them to get where they are, sparking the interest, and providing the motivation. The stereotypical "American Dream" is still possible even today. While I truly admire and appreciate what King Hussein has done for amateur radio via his participation and publicity, that has been done for amateur radio *per se* and not for the individual. By being an amateur radio operator and studying and working hard in school, one can't expect to grow up to be the King of Jordan, let alone a sports figure or entertainer.

Amateur radio can be a vehicle to a career in any of the technical fields, many of which will need people in the next several years. I am sure that through King Hussein's involvement in amateur radio many young people in Jordan are taking up technical careers, sparked by the novelty of amateur radio and the demands for people in a burgeoning industrial society. In that situation, the King is indeed a powerful role model for his people. In our society, a king is more of a novelty than a role model, and not a personage to be emulated.

We have the technology, the industry, and the dream of things being possible. We have, to a great extent, a mobile society in which it is possible to achieve one's aspirations through hard work, perseverance, and a lot of luck. What is hard to instill in our young people is the direction and the desire for the things we choose to judge as the criteria for success.

While we are not trying to create a host of Horatio Alger stories, we *are* trying to say that anything is possible. There is a need for engineers and technically oriented people that will grow in the years to come. This will create a need for all ranges of management and will even create the needs that future entrepreneurs should be there to satisfy. To most of us, amateur radio as a service can be satisfying in and of itself, but it still can be a very powerful springboard to a career. For the youngster starting out, or for the amateur looking for a change in direction, we offer in our interviews these personal glimpses as source material in a world of possibilities. It is seeing the needs and perhaps acting on them.

January Editorial

I have received a lot of mail in response to my January Editorial, which discussed the definition of what is a real country with regard to amateur radio. We are preparing some further material along these lines for the future. All of the mail (with one exception) carried the discussion further with a great number of other examples cited. The one exception (so far) said that I had no business discussing the subject, and that I should let the folks up in Newington handle it. I'm glad, however, that a lot of you responded demonstrating your concern and giving your thoughts on the matter. Being involved does take some effort, but it sure is worth it.

The Ides of March

The Ides of March should be upon Newington this month as a new General Manager is selected. By March I would expect to see 15 or 20 names in the hat all actively looking to get a job that promises a lot of work, aggrevation, and unappreciated achievement. Besides being a membership organization, one cannot lose sight of the ARRL being a multi-million-dollar publishing empire with over one-hundred employees. With this in mind, I would hope that the new General Manager will have some foundation in business (at that dollar level) and publishing. Barring the emergence of the super-qualified, super-educated, and multi-experienced individual (who altruistically is willing to forego six or seven times the income from private industry and is ideally suited in every possible way for the job), we have to look elsewhere for a suitable candidate.

In the January issue of *73*, I read the hatchet job that Wayne did on Harry Dannals, W2HD. I've known Harry longer than both of us would probably like to admit, and if Wayne was trying to say that Harry isn't perfect, I would have to agree with him. Everyone I know of who is officially running for the job at this writing is not perfect. Maybe Wayne feels that he is the ideal candidate for the job of running the ARRL. Maybe he is, but he's not running for the job; Harry and a few others are. Let's assume that they are all pretty honorable and that they all have various talents which make them (and others) think that they can handle the job. We also have to assume that anyone selected will have to spend some time learning the business end and the publishing end of the League's operation, in addition to the organizational machinations. What makes any one of them stand out?

All things being equal, Harry stands out as having more "real world" experience in business, and after paying his dues by eating those chicken dinners and making speeches in all 50 states, he probably has a greater feel for the politics and people involved in amateur radio on a national basis as opposed to perhaps regional experience of another candidate. He's had world-wide political experience in his dealings for WARC and in representing the League here and abroad. In the last two years, he's the only one I can think of who has logged more airport time than I have on behalf of amateur radio.

So all things considered, Harry has certainly been more visible on the scene and more outgoing and has more current organizational experience than the other candidates at this time. While the other candidates may be good and do a good job, I think that Harry's versatile background gives him that needed edge.

In rereading Wayne's comments and suggestions concerning the League and Harry, I must say that there is an element of truth in what he says, but nothing is ideal or perfect. I think he gave Harry a boost when he compared him with Lyndon Johnson, for whatever your feelings were about LBJ, you have to admit that he generally got what he wanted in the way of social legislation. He exercised power. If Harry can exercise power and leadership, then I think that he just may be the man for the job.

73, Alan, K2EEK

A) NEW 2 kW Antenna Tuner/SWR Bridge/Power Meter, $249. Reversible "L" circuit, silver-plated roller inductor, high-voltage variable capacitor and switch-selectable fixed capacitors for precision matching. Automatically provides low Q, minimum-loss path. Rated 2 kW PEP, 1 kW cw. Matches 50-ohm unbalanced output to balanced or unbalanced loads (dipoles, inverted "V"s, long wires, windoms, beams, rhombics, whips, Zepps, Hertz and similar) from 1.8-30MHz. Built-in balun. SWR bridge indicates 1:1 to 5:1; 2-range power meter reads 10 to 2000 watts. Front panel by-pass switch and 4-position antenna selector switch. Coax and screw-type connectors. Requires 12V dc for dial lighting. Styled in black and bronze. Front panel with black-out lighting. 5⅞h x 12¾w x 13½d; 9 lbs. **Model 229.**

B) Deluxe 20 Amp. Power Supply/Speaker Combination, $199. Dual primary (115/230V ac, 50-60 Hz) supply plus 3" x 5" front-facing speaker. 13.5V dc (+0.5V) output, regulated to better than 1%, no-load to full-load, at 117V ac, with output current of 18A, full load, 20A max., and less than 60 mV pk-pk ripple. Over-voltage and over-current protection (16V and 20A), 25A panel meter, power switch, and phone jack. 5⅞h x 8¼w x 12d; 11 lbs. Black and bronze finish. **Model 255.**

C) Dual 20 Amp. Primary Power Supply—$169. Same power supply specifications as Model 255 but less speaker. 5½h x 7w x 12d; 15 lbs. **Model 280.**

D) Dual 10 Amp. Primary Power Supply—$129. Similar to Model 255 except output current 9A full load, 10A max., and ripple less than 50 mV. 4h x 4⅜w x 10½d; 9 lbs. **Model 225.**

E) 200 Watt Antenna Tuner/SWR Bridge—$95. Unique design features a 47-tap silver plated 18-gauge toroid used in a wide-range "T" network with variable capacitors for accurate vernier tuning. Rated 200 watts intermittant, 100 watts continuous. Matches 50-75 unbalanced output of transceivers to balanced or unbalanced loads (dipoles, inverted "V"s, long wires, windoms, beams, rhombics, whips, Zepps, Hertz and similar) from 1.8-30 MHz. Built-in balun. SWR bridge indicates 1:1 to 5:1 ratios. Front panel switch has by-pass and dummy load positions plus selection of 3 antennas. Coax and screw-type connectors. 3⅝h x 10½w x 7¾d; 4¼ lbs. **Model 228.**

F) 200 Watt Antenna Tuner—$79. Same as Model 228 but less SWR bridge. 3½h x 8¼w x 7¾d; 3.5 lbs. **Model 227.**

G) DC Circuit Breakers—from $10. Protects transceivers from over-current demand with battery supply. Model 1140, for 200 watt transceivers, has 18A operating and 24A trip rating, $10. Model 1125 for 100 watt input transceiver includes cable, has 8.5A operating and 12A trip rating, $15.

H) Single Paddle Electronic Keyer—$39. Low cost keyer features self-completing dits and dahs, preset weighting for optimum articulation in the most-used speed range, and a speed control with a range from 6 to 50 words per minute. Uses positive low voltage transistor switching circuit (not for use with cathode or grid block keying) with 1 IC, 5 transistors, 9 diodes. Single paddle of molded plastic has adjustable contact spacing for individual preference. Requires 10-14V dc. 2h x 4w x 6d; 1½ lbs. Black and bronze finish. **Model 670.**

I) Dual Paddle Electronic Keyer—$85. Deluxe iambic keyer features self-completing dits and dahs with automatic adjustable weighting ratio of 50-150% of classical dit length, dit and dah memories with defeat switches, adjustable magnetic paddle return, force 5-50 gms., and a speed of 6-50 wpm. Smoothly pivoting paddles have 4 ball-bearing points. Uses positive low voltage transistor switching circuit (not for use with cathode or grid block keying) has 5 ICs, 5 transistors, 4 diodes. Requires 10-14V dc. 2½h x 5½w x 8¼d; 2 lbs. Black and bronze finish. **Model 645.**

J) RF Speech Processor—$139. Give your rig more punch to improve its operating range under adverse and low propagation conditions. A true Rf processor, this unit converts the audio signal to SSB, clips and processes it through a 4-pole monolithic filter for greater average envelope power, and then converts the processed signal back into audio. Can be used without derating TEN-TEC transceiver power limits. Has adjustable processing levels and output plus disable switch and passband adjustment. Requires 12V dc @ 75 mA. Circuitry uses 2 ICs, 10 transistors, 5 diodes, two 4-pole monolithic filters. Black and bronze finish. **Model 234.**

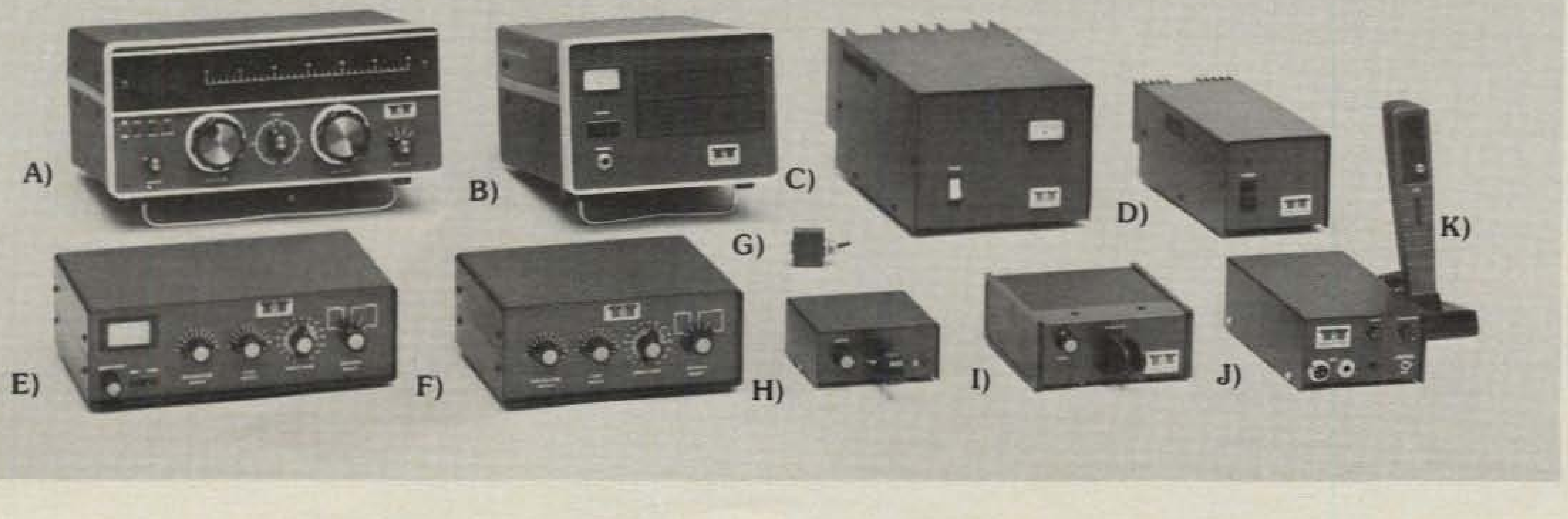
K) Electret Microphone—$39. Designed specifically for use with the Model 234 Processor, this trim light-weight, easy to use microphone features an electret condenser element, coiled cord with 4-terminal connector, and a SPDT PTT switch built into the zinc die-cast and Cycolac case. Matching die-cast base. 8½"h; 11 oz. (base 13 oz.) Black and bronze finish. **Model 214.**

Ceramic Microphone—$34.50 Flat, peak-free response. For clean, articulate pleasant speech. Built in TEN-TEC plant. Comfortable to hold, convenient as a desk mike. Similar in appearance to Model 214. **Model 215PC.**

See your TEN-TEC dealer or write for full information.

TEN-TEC, INC.
SEVIERVILLE, TENNESSEE 37862
EXPORT: 5715 LINCOLN AVE., CHICAGO, ILL. 60646

The best thing next to a TEN-TEC transceiver (or any other) is a TEN-TEC accessory.



The ultimate team...the new Drake "Twins"

The TR7A and R7A offer performance and versatility for those who demand the ultimate!

TR7A Transceiver

• **CONTINUOUS FREQUENCY COVERAGE** — 1.5 to 30 MHz full receive coverage. The optional AUX7 provides 0 to 1.5 MHz receive plus transmit coverage of 1.8 to 30 MHz, for future Amateur bands, MARS, Embassy, Government or Commercial frequencies (proper authorization required).

• **Full Passband Tuning (PBT)** enhances use of high rejection 8-pole crystal filters.

New! **Both 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity are standard,** plus provisions for two additional filters. These 8-pole crystal filters in conjunction with careful mechanical / electrical design result in realizable ultimate rejection in excess of 100 dB.

New! **The very effective NB7 Noise Blanker is now standard.**

New! **Built in lightning protection** avoids damage to solid-state components from lightning induced transients.

New! **Mic audio available** on rear panel to facilitate phone patch connection.

• **State-of-the-art design** combining solid-state PA, up-conversion, high-level double balanced 1st mixer and frequency synthesis provided a no tune-up, broadband, high dynamic range transceiver.

R7A Receiver

• **CONTINUOUS NO COMPROMISE 0 to 30 MHz frequency coverage.**

• **Full passband tuning (PBT).**

New! **NB7A Noise Blanker supplied as standard.**

• **State-of-the-Art features** of the TR7A, plus added flexibility with a low noise 10 dB rf amplifier.

New! **Standard ultimate selectivity choices** include the supplied 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity. Capability for three accessory crystal filters plus the two supplied, including 300 Hz, 1.8 kHz, 4 kHz, and 6 kHz. The 4 kHz filter, when used with the R7A's Synchro-Phase a-m detector, provides a-m reception with greater frequency response within a narrower bandwidth than conventional a-m detection, and sideband selection to minimize interference potential.

• **Front panel pushbutton control** of rf preamp, a-m / ssb detector, speaker ON / OFF switch, i-f notch filter, reference-derived calibrator signal, three agc release times (plus AGC OFF), integral 150 MHz frequency counter / digital readout for external use, and Receiver Incremental Tuning (RIT).

The "Twins" System

• **FREQUENCY FLEXIBILITY.** The TR7A / R7A combination offers the operator, particularly the DX'er or Contester, frequency control agility not available in any other system. The "Twins" offer the only system capable of no-compromise DSR (Dual Simultaneous Receive). Most transceivers allow some external receiver control, but the "Twins" provide instant transfer of transmit frequency control to the R7A VFO. The operator can listen to either or both receiver's audio, and instantly determine his transmitting frequency by appropriate use of the TR7A's RCT control (Receiver Controlled Transmit). DSR is implemented by mixing the two audio signals in the R7A

• **ALTERNATE ANTENNA CAPABILITY.** The R7A's Antenna Power Splitter enhances the DSR feature by allowing the use of an additional antenna (ALTERNATE) besides the MAIN antenna connected to the TR7A (the transmitting antenna). All possible splits between the two antennas and the two system receivers are possible.

Specifications, availability and prices subject to change without notice or obligation.

DRAKE

See your Drake dealer or write for additional information.

COMING SOON: New RV75 Synthesized VFO Compatible with TR5 and 7-Line Xcvrs / Rcvrs

• Frequency Synthesized for crystal-controlled stability • VRTO (Variable Rate Tuning Oscillator*) adjusts tuning rate as function of tuning speed. • Resolution to 10 Hz • Three programmable fixed frequencies for MARS, etc. • Split or Transceive operation with main transceiver PTO or RV75

R. L. DRAKE COMPANY • 540 Richard Street, Miamisburg, Ohio 45342 • Phone (513) 866-2421 • Telex 288-017

* Patent pending

CIRCLE 19 ON READER SERVICE CARD

New Drake TR5 Transceiver

far above average!

COMING SOON:
RV75 Synthesized VFO featuring the Drake "VRTO"

• **Frequency Synthesized** for crystal-controlled stability • **VRTO (Variable Rate Tuning Oscillator*)** adjusts tuning rate as function of tuning speed. • **Resolution to 10 Hz** • **Three programmable fixed frequencies** for MARS, etc. • **Split or Transceive operation** with main transceiver PTO or RV75

* Patent pending

With the new TR5
versatility and value are spelled D-R-A-K-E . . .

DYNAMIC RANGE

The dynamic range of the TR5 is unexcelled by any transceiver in its class. The TR5's greater than 0 dBm third order intercept point (85 dB two-tone dynamic range) at 20 kHz spacing can be achieved only by the use of a passive diode-ring double balanced mixer. Drake was the first to bring this technology to the Amateur market with a high-level mixer in the TR7.

RELIABLE SERVICE

When you purchase a TR5, or any Drake product, you acquire a product of the latest production techniques, which provide reliable performance.

Yet with a product as sophisticated as one of today's transceivers, after-sales service is a must. Ask any Drake owner. Our Customer Service Department has a reputation second to none.

ACCESSORIES

Drake is the only Amateur Radio manufacturer who offers a full complement of accessories to satisfy almost every desire the HF Amateur may have. This wide selection allows any operator to assemble a station which meets his needs, and assures compatible interfacing and styling instead of a desk full of equipment with a variety of styling and poor operation as a system.

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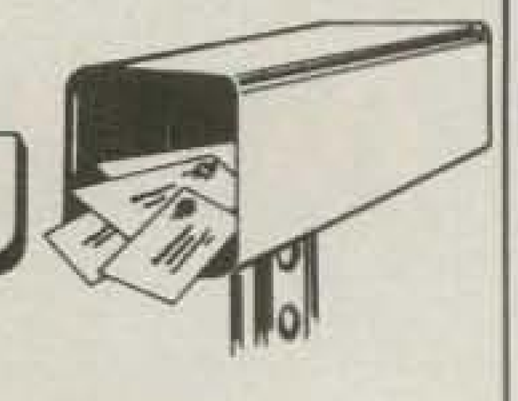

5 Band WAZ Achieved

Editor, *CQ:*

Enclosed is the application and remaining QSL to complete 5 Band WAZ *(all 200 zones—ed.).* Really enjoyed the thrill (and even long nights) of chasing the most difficult award in DXing. Zone 36 on 80 was my last zone to work, but it took forever to get some of those Russian cards. Thanks, *CQ*, for a great challenge!

Ron Blake, N4KE
Green Cove Springs, FL

Sign Me Up!

Editor, *CQ:*

Your direct-mail advertising letter arrived at the right time! Enclosed please find my subscription check.

It was back in the mid-1950s as I entered high school that we anxiously awaited the arrival of *CQ* magazine. It was the further adventures of Danny Weil that had us hooked! It wasn't so much Danny, but the trips he took on YASME and the "adventure" of it all—the fantasizing of what it must have been like in those far away places and what the DX must have sounded like!

I still think back over the years to listening to such far away places as VR6TC and knowing the heritage of Pitcairn, of listening to 9N1MM and then actually meeting the good Father Moran here in the states. He is an unforgettable character with a myriad of stores we could all listen to for days.

CQ motivated me to get a ticket. It offered more than *QST* did at that time in my area of interest. I'll be interested in the respectable contributions of Lou McCoy, W1ICP. I think *CQ* will accentuate the positive aspects of our hobby. I haven't been a subscriber for a long time. New or not, I wish you continued success with *CQ* and look forward to receiving it direct rather than off the newsstand!

Ben D. Kiningham III
Springfield, IL

Commends January Editorial

Editor, *CQ:*

I got a Christmas present in the mail yesterday—my first issue of CQ magazine. This is my first good look at *CQ* and I like what I have seen in a quick review. I'm already glad that I joined your reader group and look forward to more good issues.

More specifically, I want to commend you on your editorial in this January 1982 issue. I am not a crazy DX chaser, but I do enjoy working a distant station when possible. Someday soon DXCC will be possible. As I have read various articles and other comments on DX, I have always been disturbed by the recognition of a hunk of rock, a special building, or some other non-national entity as a country. I have just received information for the World Radio News W-100-N Award, which defines the DX country in the most sensible and simple manner I have yet seen. It eliminates things like the SMOM building in Rome and the strange pieces of rock or reef that the ARRL has recognized for some reason. I would strongly endorse any move to define a DX country in a more reasonable manner. Good luck!

John L. Biester, KB9YY
Beloit, WI

A Real Shortage?

Editor, *CQ:*

Ted Cohen's interview with Kenneth Miller made for interesting reading *(CQ, January 1982).* I would, however, like to take issue with Miller's assertion that there is about to be a shortage of engineers. This is the same old story which is trotted out periodically by corporation executives to ensure a low-cost supply of young engineers and by college professors to ensure a continuing supply of students for their classrooms.

The *Wall Street Journal* (November 17, 1981, page 1) reports, "Since March, employment of engineers among 164 employers fell 8 percent, the first drop since 1978, says a poll by D. Dietrich Associates, Phoenixville, PA, consultants." This is an annual decrease of about 14 percent.

Young people considering a career in engineering would do well to talk to a few over-40 engineers. Age discrimination is still a fact despite the new legislation. Engineering is still not a field where one can count on a lifetime career of interesting work. Thousands of engineers were canned during the 1974–75 recession and many of them took up more promising lines of work.

Thomas W. Webb, EE, PE, W4YOK
Henderson, KY

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Build A 2 Meter Bilateral Transverter

BY FRED BROWN*, W6HPH

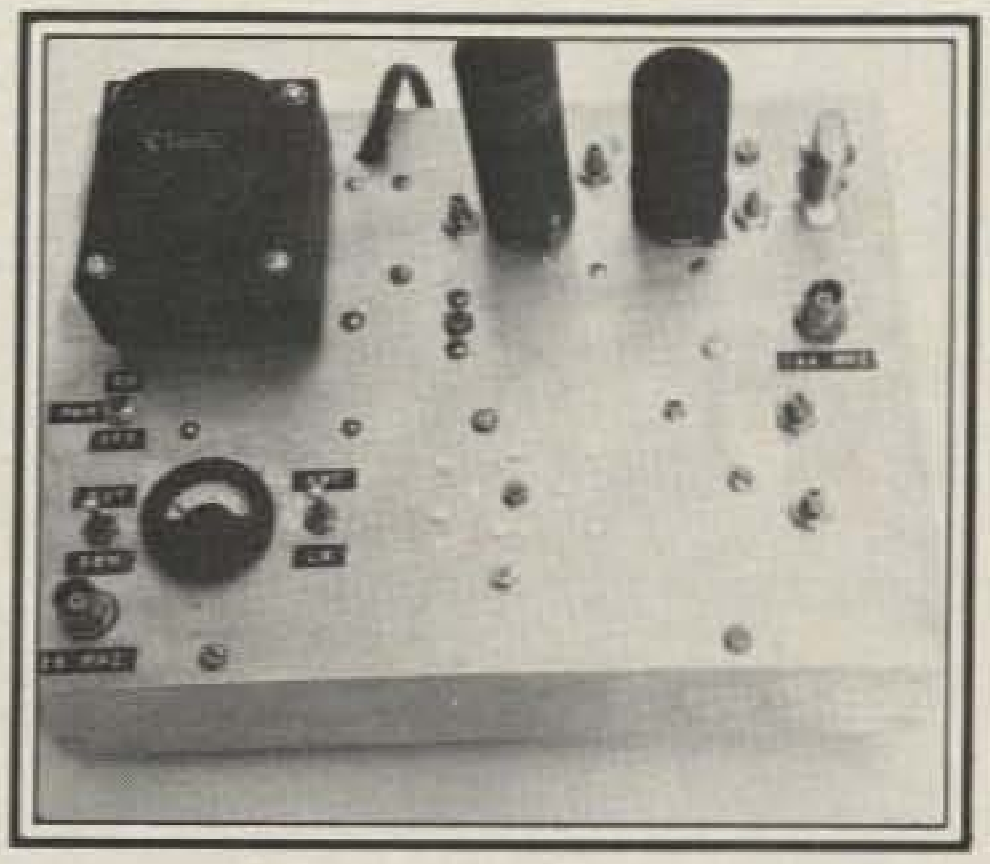
A previous article covered basic principles of the bilateral transverter (BT) and gave construction details of 50 and 220 MHz models.[1] Briefly, the BT amounts to a "bare essentials" transverter, as it consists of nothing more than a local oscillator and bilateral mixer followed by a bandpass filter. Since the same mixer functions on both transmit and receive, switching and change-over relays are avoided. In terms of power output and receiver sensitivity, the BT will not fulfill the performance requirements of a demanding v.h.f. DXer, but nevertheless, it will be entirely adequate for local s.s.b. contacts.

One of the design objectives for this 144 MHz BT was greater power output, and this called for a higher local oscillator power level. For good envelope linearity, LO injection should be at least two or three times the peak h.f. input level. Where unlimited LO power is available, the ultimate limitation on power output will be the reverse breakdown voltage and heat dissipation of the diodes in the doubly balanced mixer (DBM). In this model a LO level of about 1½ watts permits the DBM to deliver as much as ¼ watt of p.e.p. output, or 400 mW of c.w. It is doubtful that this output represents any kind of upper limit to what could be developed by a reverse-biased ring modulator.[2] However, since one objective was simplicity, it appeared that a reasonable trade-off between power output and circuit complexity had been achieved.

This transverter could have been made all solid-state, as were the earlier models, but it was of interest to see just how the "old-fashioned" vacuum tube would measure up against the transistor with regard to ease of construction, debugging problems, and overall performance. The comparison puts the obsolete (?) thermionic valve in a rather good light.

Lee deForest's invention still has some advantages over the transistor. Probably chief among these, from an amateur's viewpoint, is the immunity to abuse.

*1169 Los Corderos, Lake San Marcos, CA 92069



The transverter is built on a 7 by 9 inch plate of 12 gauge (.08 inch) aluminum. A completely shielded rig results when the plate is fastened to an inverted 7 by 9 by 2 inch aluminum chassis. The 1 inch microammeter can be switched to indicate either DBM current or r.f. output voltage.

Tubes are tough. A voltage transient that will destroy an expensive transistor in a millisecond has no effect on a tube. In fact, tubes withstand minutes or even hours of severe overload (even to the degree of red-hot elements!) and survive unscathed. After wrestling with the intransigence of temperature-sensitive, parasitic-prone, and self-destructing transistors for the past two decades, the author found the return to tube design to be downright refreshing.

Not only does this receiving tube BT produce more power than the solid-state versions, but it will probably cost less to build, especially as the tubes are of a common type that can often be gleaned from discarded TV sets.

The 2½ Meter LO

For the local oscillator, one or two watts of crystal-controlled r.f. was needed at 116 MHz, a frequency that lies in what was, prior to Pearl Harbor, our old 2½ meter band. This frequency will put 144 MHz at 28 MHz on the transceiver dial, and if the transceiver range is 28 to 30 MHz, coverage of the entire lower half of the two meter band will be possible.

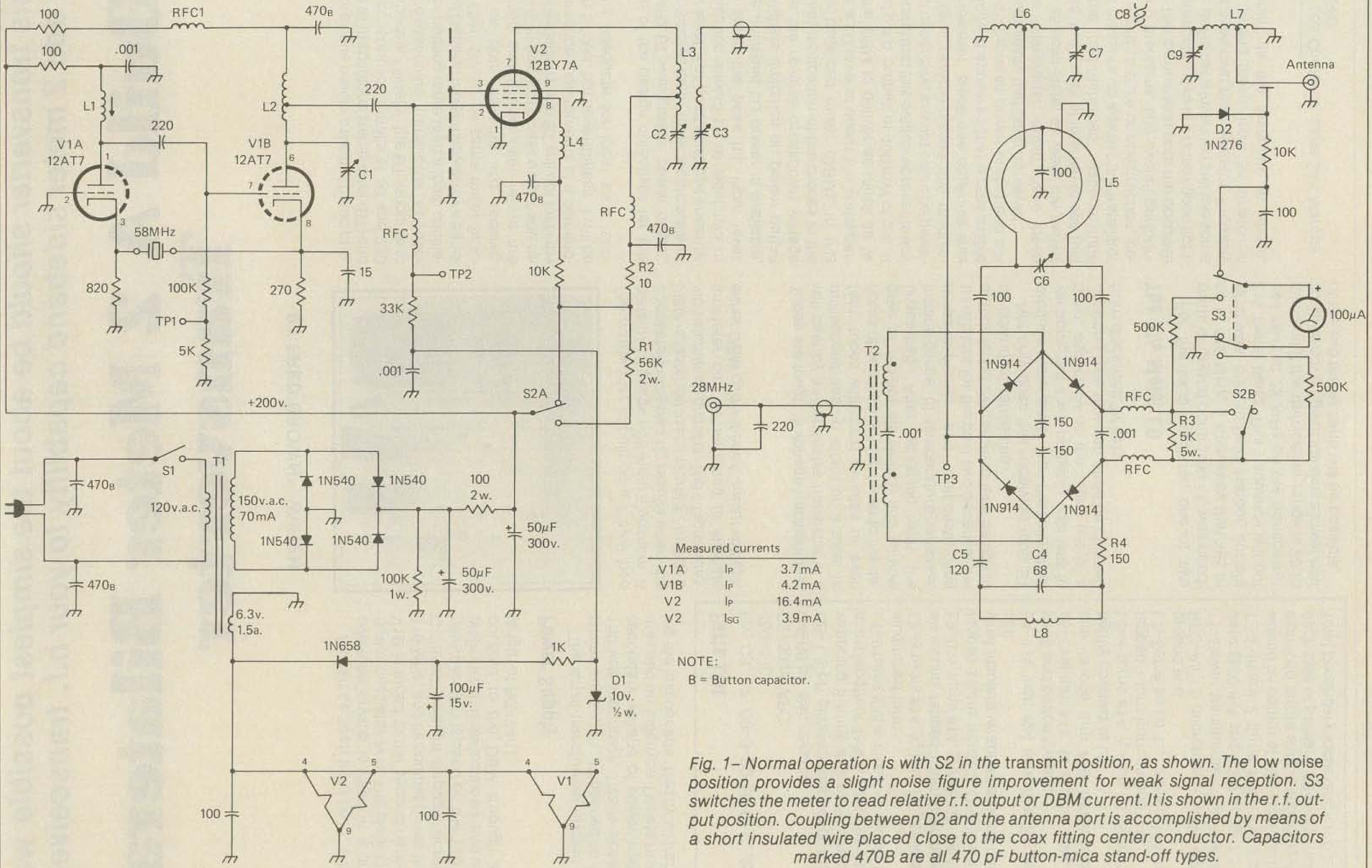
As can be seen from fig. 1, a 58 MHz overtone crystal is used in a standard Butler oscillator (V1). The plate circuit of V1B is tuned to the second harmonic at 116 MHz, and this output drives the class C "final" straight through. Screen grid neutralization is used on the 12BY7.[3] Its plate circuit is series tuned, and output is coupled to the DBM through a short length of RG174/U.

Power Supply

The small transformer chosen for the power supply, T1, happened to have a 150 volt secondary. This is close to the secondary voltage of power transformers used on tube-type TV sets made during the last decade. Nearly all transform-

Parts List

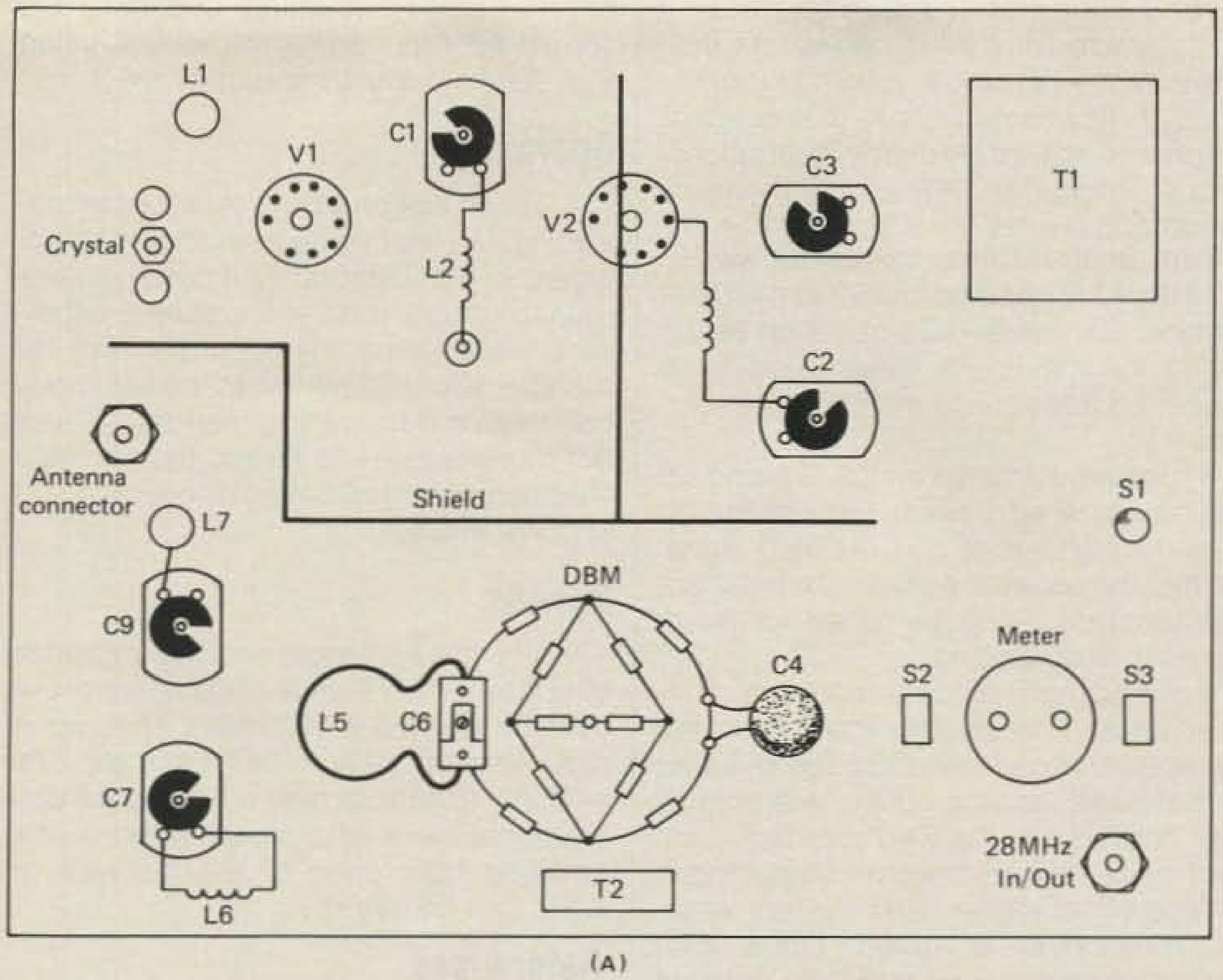
C1, C3, C7, C9–3–20 pF E. F. Johnson 160–110.
C2–50 pF APC.
C4–68 pF disc ceramic.
C8–1.3 pF gimmick capacitor made by wrapping 5 turns #22 bare wire around short length of Teflon insulated #18.
L1–9 turns #28 e. close wound on ¼ inch slug-tuned form.
L2–3 turns #14, ⁷⁄₁₆ inch i.d., ½ inch long, air wound, tapped 1 turn from plate end.
L3–8½ turns #14, ⅜ inch i.d. 1 inch long, tapped 3 turns from C2. One turn link #18 vinyl insulate wrapped around center of coil.
L4–1¼ inch #24 wire running between pin 8 and button bypass.
L5–One turn #14, ¾ inch i.d. (See fig. 2.) Link is one turn #18 Teflon insulated, tightly coupled to L5.
L6–4 turns #14, ⅜ inch i.d., ⅜ inch long, tapped 1 turn from ground end.
L7–Same as L6, but tapped ½ turn from ground end.
RFC–All 1.5 microhenry. Miller #4604.
T1–Power transformer. 150 V ac secondary @70 mA and 6.3 V ac @ 1.5 A.
T2–Primary 2 turns #24 vinyl insulated wound on center of .285 inch dia. by .615 inch long ferrite slug. Secondary 4 turns each side of primary, #24 vinyl insulated. Total secondary inductance is 0.2 μH.



Measured currents

V1A	I_P	3.7 mA
V1B	I_P	4.2 mA
V2	I_P	16.4 mA
V2	I_{SG}	3.9 mA

Fig. 1– Normal operation is with S2 in the transmit position, as shown. The low noise position provides a slight noise figure improvement for weak signal reception. S3 switches the meter to read relative r.f. output or DBM current. It is shown in the r.f. output position. Coupling between D2 and the antenna port is accomplished by means of a short insulated wire placed close to the coax fitting center conductor. Capacitors marked 470B are all 470 pF button-mica stand-off types.



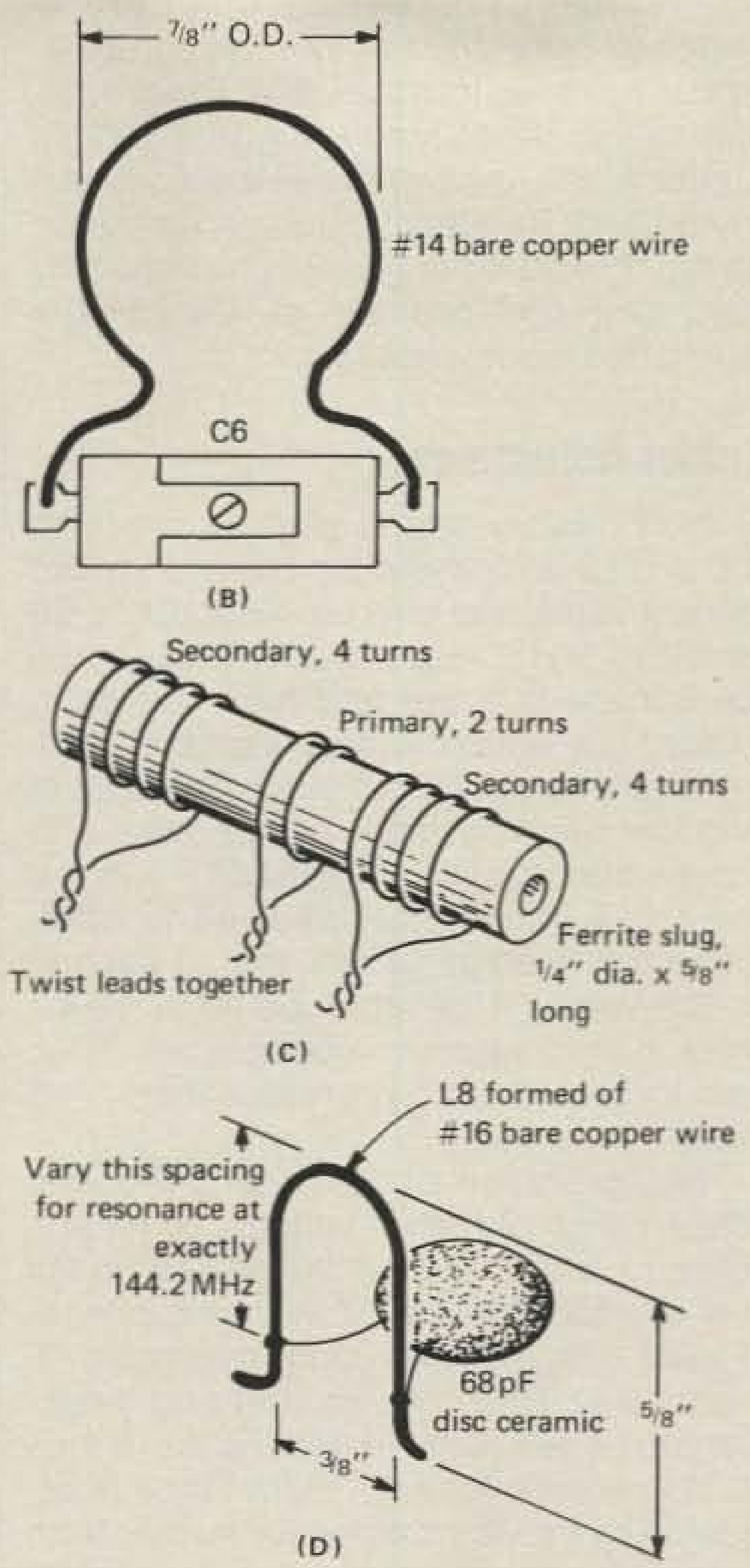


Fig. 2– At (A) is a one-half-scale drawing of the suggested parts arrangement, bottom view. Only larger components are shown. The shield partitions should be 1⅞ inches high. Detail of L5 is shown at (B). The link is the same diameter as L5 and tightly coupled to it. Spacing between L5 and the chassis is ½ inch. Construction detail of T2 is shown at (C). All windings are #24 vinyl insulated solid copper wire. Dimensions of L8-C4 are shown at (D).

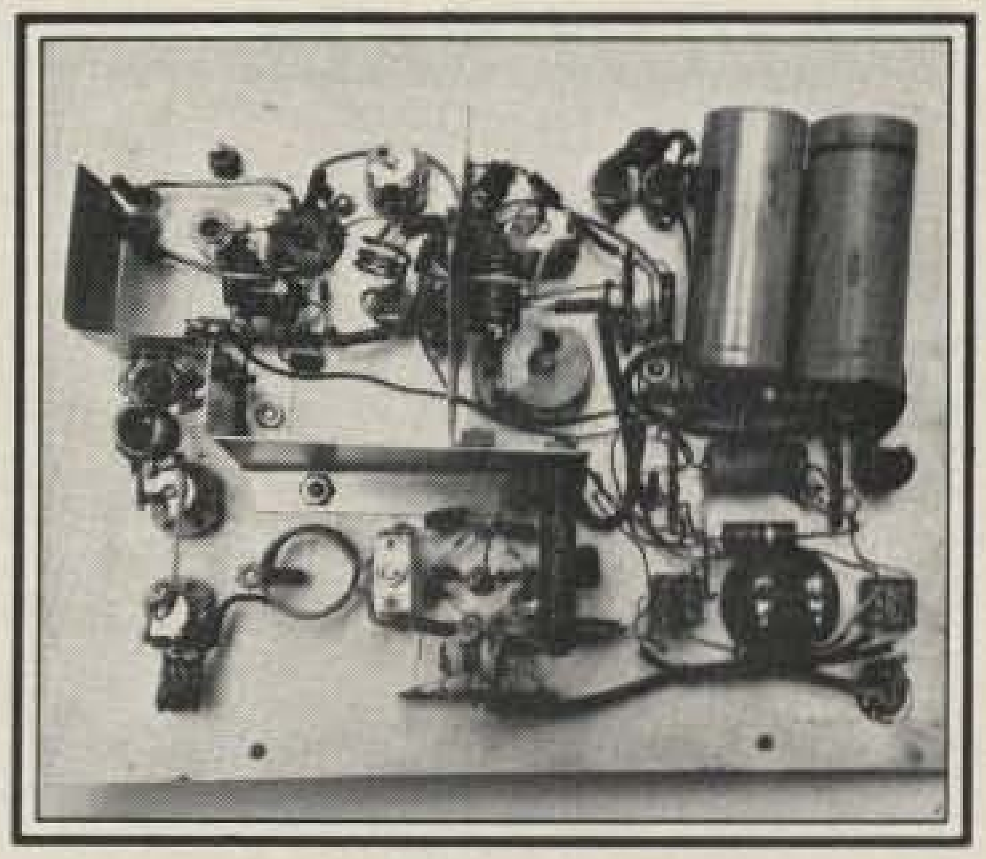
er powered TV sets of the 1970's used full-wave voltage-doubler rectifier circuits to deliver +350 to +380 volts under full load. Such a TV transformer can be used for this transverter if the extra weight and bulk are not objectionable.

Because the plate supply voltage ended up a bit on the low side, the additional voltage drop of a cathode bias resistor was unwelcome. Accordingly, protective bias is applied to the 12BY7 grid. This negative bias is produced by rectifying the 6.3 v.a.c. heater voltage; grid current is carried by the 10 volt zener diode, D1.

DBM

The doubly balanced mixer is similar to the ones used in the 50 and 220 MHz models, but one new feature has been added. It was found that the noise figure could be improved a few dB if the LO level was reduced and the reverse bias resistor shorted. A d.p.d.t. switch, S2, has been added to provide this low-noise option. In the *low noise* position S2B shorts the DBM reverse bias resistor, R3, and S2A switches a 56K dropping resistor, R1, in series with the plate supply to V2. In the *transmit* position S2A restores full plate and screen voltage, and S2B removes the short from R3.

The switching could have been handled automatically by a change-over relay, but this would have added complexity, which would negate one of the main



This underneath view shows the 12AT7 socket at the upper left and to its right the 12BY7 socket with the shield running across it. Power supply components are at the upper right and the microammeter at lower right. At the lower center is the doubly balanced mixer and to its left is the two-pole filter network.

attractions of the BT. With only ¼ watt of output, you will normally hear more than you can work, even with S2 in the transmit position. However, the low-noise position is sometimes nice to have for hearing weak signals, although the stations so heard will often not be workable.

The stabilizing network consisting of C4, L8, C5, and R4 is needed to prevent parasitics in the DBM. C4-L8 is a very high C-to-L ratio tuned circuit, parallel resonant at 144 MHz; it prevents power loss into R4 at this frequency. At all other frequencies R4 loads the DBM output and thereby prevents parasitic oscillations.

Construction

This particular rig was built on a flat 7" × 9" plate of 12 gauge (.08 inch) aluminum. The plate is used as the top cover of an inverted 7" × 9" × 2" chassis, and this combination forms a totally shielded rig. Complete shielding is necessary to prevent i.f. leakthrough of 10 meter signals. As a further measure to prevent i.f. leakthrough, both sides of the a.c. line are bypassed with 470 pF button capacitors at the point where the line cord enters the chassis.

Fig. 2 shows the parts arrangement as seen from the bottom side of the chassis-plate. Tie-point construction is used, and components should be arranged so as to ensure short r.f. leads. Also shown in fig. 2 is the shielding needed to prevent stray coupling between the various coils. As the chassis is 2 inches deep, these shields are all 1⅞ inches in height. The shield across the 12BY7 socket is notched out to clear the socket and is grounded on both sides of it. This shield should be made of a solderable metal such as brass or tin-can metal. The socket center post and pin number 9 are soldered directly to the shield.

The tuned circuit C4-L8 should be resonated to 144.2 MHz before the combination is soldered into the DBM. Exact resonance can be determined with a grid-dip meter which has been checked against a receiver or frequency counter. As shown in fig. 2, adjustment is accomplished by changing the position of C4 on the U-shaped inductance, L8.

Initial Adjustment

It's probably best to start by checking L1 and L2 with a grid-dip meter to make sure these tuned circuits resonate to 58 and 116 MHz, respectively. This should be done with tubes and tube shields in place, but without power applied. If the resonances check out okay, place S2 in the *low noise* position, apply power, and check the negative voltage at TP-1 with a v.t.v.m. L1 should be adjusted to maximize this voltage, which should exceed −3.5 volts. C1 can then be adjusted for maximum negative voltage at TP-2, which should end up greater than −35 volts.

Neutralization of the 12BY7 requires observation of the r.f. voltage, by means of an r.f. probe, at TP-3. With S2 still in the LN position, ground R2 with a clip lead. Peak L1, C1, C2, and C3 for maximum r.f. voltage at TP-3. The neutralizing inductance, L4, amounts to nothing more than a long screen lead. Its inductance is adjusted by moving it closer or farther from the shield partition. It should be adjusted for minimum fed-through power as indicated by the r.f. probe. If no minimum is found, it may be necessary to shorten or lengthen this wire. Properly neutralized, the r.f. voltage at TP-3 should measure less than 0.2 volts.

With neutralization complete, switch S2 to the *XMT* position and S3 to the *DBM* position. C1, C2, and C3 can then be adjusted for maximum meter reading; it should be possible to exceed 60 microamperes.

Rough adjustments on C6, C7, and C9 can be made with a receiver connected to the i.f. port and strong 144 MHz signal run into the antenna port. These three adjustments can then be tuned for maximum S-meter reading.

It should then be possible to tune up into an antenna or dummy load. First, the transceiver drive level should be reduced so that 28 MHz c.w. output is less than ½ watt. With S2 in the *XMT* position, connect the 28 MHz transceiver output to the BT and observe the DBM current when the transceiver is keyed. Drive level should be adjusted so that DBM current rises no more than 20 percent, key down. S3 can then be switched to the *r.f. out* position, and C6, C7, and C9 tuned for maximum meter reading. Coupling to D2 may have to be reduced to avoid over-deflection of the meter. Because there is some interaction between C7 and C9, these two adjustments will need repeaking several times. Coupling capacitor C8 should be reduced to the lowest value that does not impair output.

Operating

Keep an eye on DBM current when operating. Drive or voice level should be adjusted so that DBM current rises no more than 20 percent on voice peaks. Otherwise, flat-topping will occur. Always remember to put S2 back into the *XMT* position before transmitting. Normally it will not be necessary to retune the two-pole filter unless large QSY's of more than 500 kHz are made.

Results

Using the 2 element quad described in the October 1979 issue of *QST*,[4] so far the best DX worked is 162 miles. This was a mountain-top station, but many stations at lesser distances over difficult obstructed paths have also been worked. It's amazing how often a quarter watt of s.s.b. can be heard.

References

[1] "An Introduction to the Bilateral Transverter," *QST*, Dec. 1981, p. 34.

[2] *Ibid, p. 35.*

[3] Orr, W.I. "Transmitting Tubes—How To Use and Abuse Them," Part II, *CQ*, Dec. 1961, p. 32.

[4] "Hints and Kinks," *QST*, Oct. 1979, p. 51.

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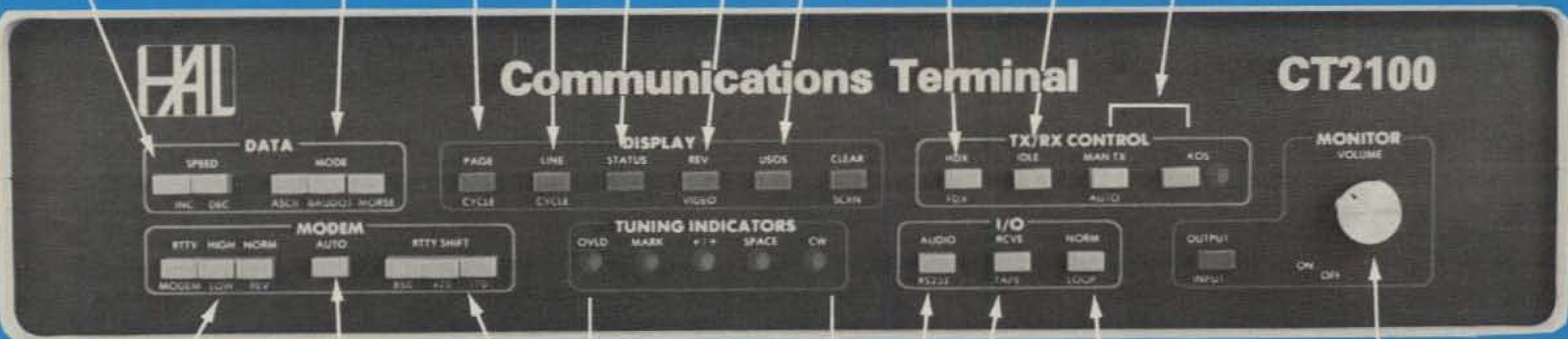

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CIRCLE 10 ON READER SERVICE CARD

A CQ EXCLUSIVE

CQ INTERVIEWS:

MARK S. FOWLER CHAIRMAN, FCC

BY DR. THEODORE J. COHEN*, N4XX

Mark S. Fowler, Chairman of the Federal Communications Commission, got his first introduction to radio at age 17. At that time, he became a part-time radio announcer for station WABR in Winter Park, Florida. Mr. Fowler continued to work in broadcasting throughout his school years, and even worked as a program director and sales representative for WDVH while he attended law school at the University of Florida. Following receipt of his law degree in 1969, he joined the Washington, D.C. communications law firm of Smith & Pepper, with whom he stayed until 1975. In that year he formed the Washington firm of Fowler & Meyers, which represents broadcast and private radio licensees before the Commission. In 1975–76, and again in 1979–80, Mr. Fowler represented then Governor Reagan as communications counsel.

Mr. Fowler, his wife, Jane, and their two children, Mark and Claire, reside in Arlington, Virginia.

CQ: Mr. Fowler, you coined a new word—"unregulate"—to describe what you are striving to accomplish with the Commission. What did you mean in using this term?

Fowler: Previous Chairmen have used the words "reregulate" and "deregulate" to characterize their philosophical approach to the regulation of telecommunications. I use the stronger word "unregulate" to describe my personal commitment to create, to the maximum extent possible, an unregulated, competitive environment for the development of telecommunications. My belief is that consumer choice and entrepreneurial initiative should be emphasized over government control and direction. There is an unbearable arrogance, I think, when any agency acts as if it knows all about how individual technologies ought to operate and how they should all be made to fit into one predesigned regulatory scheme.

"I use the word 'unregulate' to describe my personal commitment to create an unregulated, competitive environment for the development of telecommunications."

CQ: Could you give us some examples of your position on regulation ("unregulation") as it might affect the amateur service?

Fowler: At the FCC, we have as a major objective the elimination of all unnecessary regulations and policies. One example is the recent unregulation of your amateur radio station identification rules *(Docket 80-136, ed)*. We now have a program underway to systematically review each and every one of the Commission's rules and policies. The continued enforcement of pointless rules and policies presently in effect imposes costs on business, discourages individual initiative, and weighs down the government. The old rules required you to give your station call sign at the beginning and end of every communication. You also had to give the call sign of the station you were in contact with at the end of every communication. Several hams pointed out to us that so much station identification was unnecessary. After looking into the matter, we had to agree with them. The old rules did not stand up against the cold light of present day realities.

CQ: What are your initial perceptions of the amateur service?

"I am fascinated by the strong dedication hams have for their service."

Fowler: I am fascinated by the strong dedication hams have for their service. For persons in practically every country in the world to be drawn together by their common interest in radio technique alone staggers the imagination. Former Chairman Bob Lee spoke highly of the amateur service at the final meeting he participated in. He developed great respect and fondness for the Service during his distinguished career with the FCC. He told of your proud traditions of self-enforcement and willingness to serve the public in times of need, without any form of compensation. I look forward to learning more about ham radio.

CQ: The Commission is, at all times, buffeted by competing interests within the telecommunications community. Given this competitive environment, would you say that representatives of the amateur service adequately represent our positions before the Commission?

Fowler: Yes. I only regret that I have not been able to schedule as much time as I would like to meet with the representatives of the amateur service more often. I am pleased to announce that we have reinstituted the policy of holding periodic, open, *en banc* meetings like those held when Dick Wiley was Chairman. These meetings provide an excellent opportunity for interested parties to express their views on a variety of telecommunications policy issues directly to the full Commission and, thereby, to contribute to its decision-making process. I know that representatives from the amateur community participated in these meetings in the past, and I encourage them to do so again.

"I look forward to learning more about ham radio."

CQ: Do you see a role for amateur radio in experimentation?

Fowler: Yes, I certainly do. Technological developments are proceeding at a rapid pace, and I want to unregulate in any and all areas where the FCC is standing in the way of amateur radio operators making their contributions. That is why we asked for your comments regarding the use of spread spectrum techniques *(Docket 81-414, ed)* and additional digital codes *(Docket 81-699, ed)* in the amateur service. The challenge we face—both the FCC and the amateur radio community—is to strike the proper balance between two incompatible objectives. On one side, we want to provide rules which have the flexibility to promote experimentation. On the other side, we want to provide sufficient technical standards in your rules so that monitors—especially your own—can do their job effectively and can discourage unauthorized users of amateur frequencies. We are anxious to learn from your comments to our proposals the ideas hams have concerning this important issue.

CQ: How about emergency communications . . . what role can we play in this area, given the sophisticated communication links available today to the public and the government?

Fowler: We are indeed fortunate to have the active support and participation of several knowledgeable amateur radio operators and organizations on the Amateur Radio Subcommittee of our National Industry Advisory Committee; they are all working on some specific answers to your question. But let me say that the very presence of amateur radio operators in practically every inhabited area of the globe, who are ready, willing, and—most important of all—able to communicate when a disaster knocks out normal means of communications, means that information will still flow from the stricken area. Help will be on the way quickly. It is during those first critical hours immediately following a disaster that we often learn through the efforts of hams what has happened and what assistance is needed to relieve human suffering.

CQ: There has been some thought given to recognizing formally, within the FCC's Rules, the hobby aspects of amateur radio. How do you feel about this?

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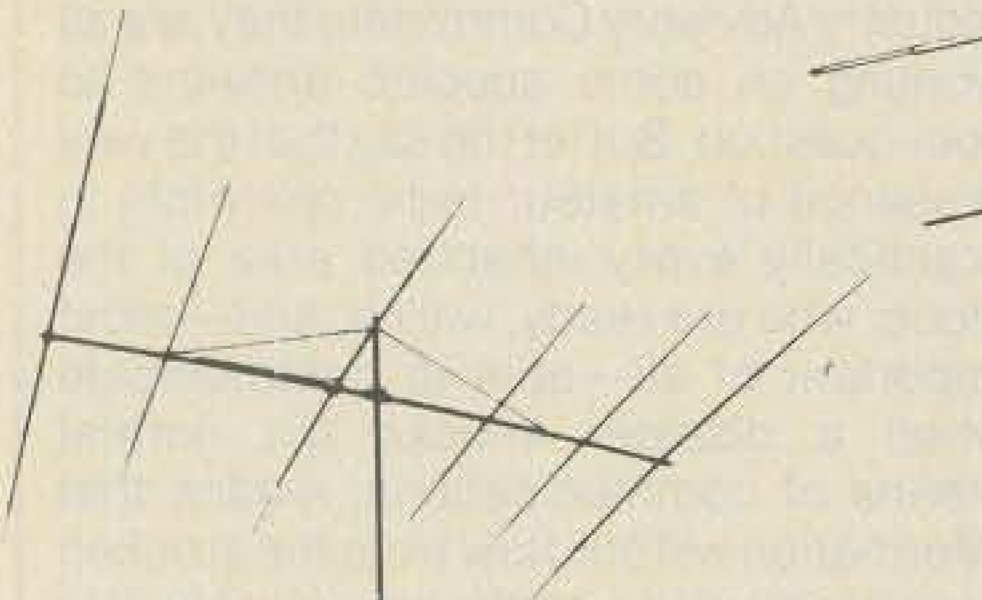

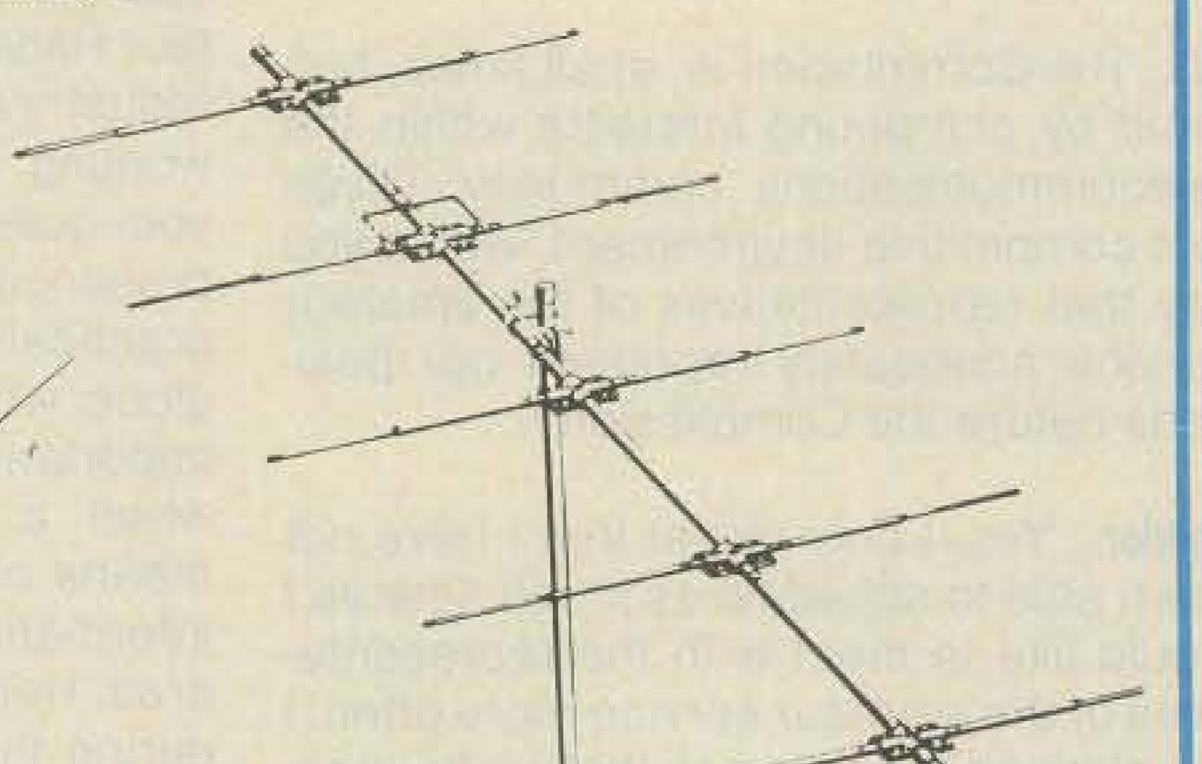

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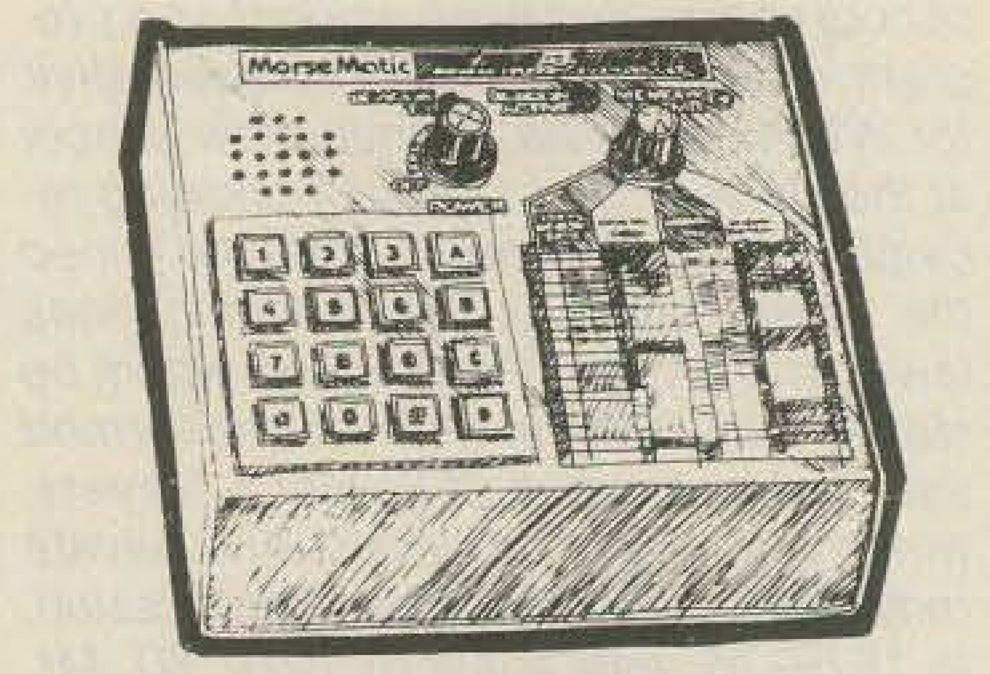

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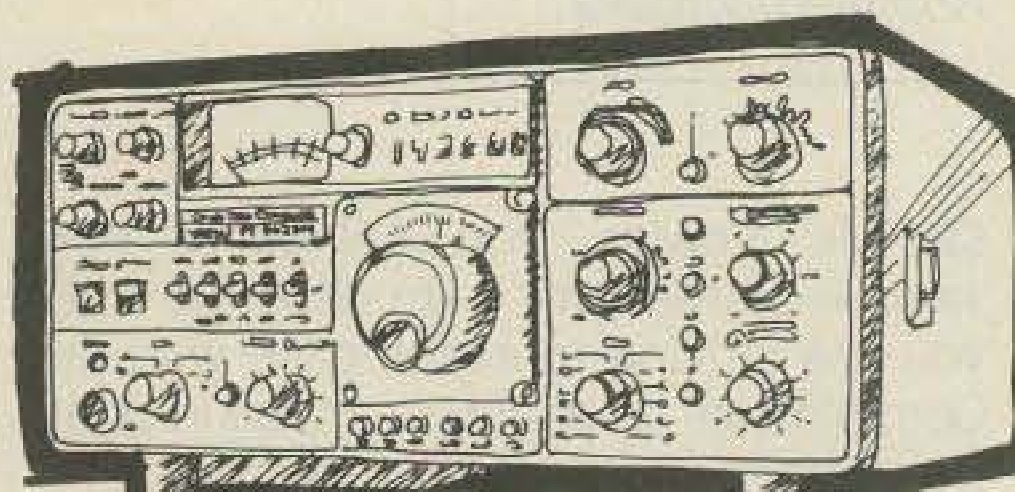

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Fowler: Our Office of Plans and Policy recently published a working paper in which the authors claim amateur radio is entirely a hobby or recreational service since no business communications are permitted. They advocate giving this fact official recognition. While such a non-obligatory statement might be appropriate in the rules, it seems to me that the main thrust should be in removing any obstacles in the rules that unnecessarily impede amateur radio operators from the pursuit of their hobby. Clearly, many hams pursue radio communications and technology with a zeal far surpassing what one would normally expect from an occasional hobbyist. To them, radio may be both a vocation and an avocation; it is not an occasional activity. Those hams who are working on computer/communications linkages are indeed on the leading edge of technology. They are, in fact, extending networking technology. I would not want to indicate to them that the Commission views their activities as mere recreation.

"I would not want to indicate . . . to hams who are working on the leading edge of technology . . . that the Commission views their activities as mere recreation."

CQ: Where does the code-free license issue stand at this point?

Fowler: I am told that the possible creation of a code-free amateur operator license—that is, one which does not require any telegraphy skills—is a most controversial issue among hams. A recent survey by Florida State University for the American Radio Relay League reports that amateurs overwhelmingly supported retention of the Morse code requirement. Although the international Radio Regulations, as a result of WARC 1979, will allow governments to waive the telegraphy requirement for operation on six meters and above, an easy-to-get ham license could bring a host of new problems. The administrative resources required could be tremendous, no matter whether the amateur community or the FCC had to bear the workload. It could be costly in terms of license processing, recordkeeping, enforcement, and testing. We should approach this matter very cautiously and thoughtfully. However, I do believe a code-free amateur license might be appropriate at the higher amateur frequencies where propagation keeps communications "local." We'll certainly be looking into that, especially if we determine that amateurs interested in pursuing digital techniques and computer networking are being kept out of the service by the Morse code requirements. Many of these people simply have no desire to talk over great distances on the high frequencies.

"The Commission shares your concern with the growth of the r.f.i. problem in the United States."

CQ: Given that total r.f.i. complaints currently exceed 80,000 per year and that the number is increasing with time, and given that the majority of such complaints involve a television receiver as the victim device, is r.f.i. a matter of major concern to the Commission?

Fowler: The Commission shares your concern with the growth of the r.f.i. problem in the United States. As you know, after a lull in r.f.i. complaints following the peak in CB activity in 1976–77, the number of complaints has risen steadily. In fact, in FY 1980, over 65,000 r.f.i. complaints of interference to home electronic equipment were received by the FCC. A large percentage of these were complaints about CB and amateur interference with television reception. Licensees and owners of TV sets share a substantial burden of dealing with such interference.

The Commission adopted a "Further Notice of Inquiry in the Matter of Radio Frequency Interference to Electronic Equipment" which was in response to the large number of complaints about r.f.i., especially home electronic entertainment equipment. While the Inquiry is broad and deals with several specific policy alternatives that might be employed in an effort to reduce r.f.i., one undoubtedly of interest to you is the publication by the Electronics Industries Association (EIA) of performance guidelines for TV receivers. This publication gives hope that significant improvement is possible.

Comments on the Inquiry are now being received, and I would hope that amateurs will participate fully in this proceeding. They have had much experience in finding solutions to interference problems, and their contribution will be given full consideration.

CQ: What are your feelings about r.f.i. legislation such as the so-called "Goldwater Bill" (S929)? This bill would allow the FCC to require that r.f.i. suppression techniques be incorporated into electronic home entertainment equipment by manufacturers.

Fowler: We are pursuing the difficult tasks of finding solutions to r.f.i., and believe that passage of legislation in and of itself may provide incentives to the private sector to intensify efforts to resolve the most pressing r.f.i. problems.

I believe the legislation under consideration, and the accompanying legislative history, should make it clear that Congress' intent is to provide the Commission with a number of available options for dealing with r.f.i., including the option of not regulating. Further, the intent is that the Commission should choose those options best calculated to correct the problems perceived while avoiding overly broad federal intervention. In that way, the Commission would be able to choose methods necessary to deal with various interference situations while averting the imposition of unnecessary costs on the industries involved, on consumers, and on the agency.

CQ: At this time, the outcome of the Administration's budget review is not known. We do know, however, that cuts will be made. Do you have any general comments that can be made now as to the impact these cuts might have on the operations of the Commission?

Fowler: The Commission has provided the Congress and the Office of Management and Budget with an initial analysis of the impact on the FCC's program of the 12% cut in fiscal year 1982 and 1983. We fully support the "battle of the budget," yet somehow the agency must be able to deal with the complex question of communications in this decade of mushrooming high electronic technology. I might add that amateurs have clearly expressed their interest in being the vanguard of experimentation and implementation, a familiar role for them.

We are now analyzing all programs within the agency and their relationship to our major objectives under our Management-by-Objectives operating system. I expect the Commission to review the staff report shortly and to make decisions which will refine our initial statement.

"I believe that the amateur service provides an ideal subject for legislation directed at encouraging self-regulation."

CQ: Given the anticipated impact of the budget cuts and the atmosphere of "unregulation" which exists today in Washington, can it be assumed that you support the use of amateur volunteers to assist FCC engineers in monitoring our bands for unlicensed or improper operations?

Fowler: Certainly! We are quite aware of the long-standing tradition of self-regulation among organized radio amateurs. Indeed, it was against the backdrop of this legacy of concern for the integrity of the amateur services shared by most amateur licensees that my initial impression favoring the proposed legislation was formed.

I recognize that the amateur service is neither the largest service regulated by the FCC nor the one plagued by the most severe violation problems. For several reasons, however, I believe that the amateur service provides an ideal subject for legislation directed at encouraging self-regulation. First, we believe that violations could be reduced by volunteer monitoring. Second, the amateur service has several organized clubs and operator groups which can assist in the development of volunteer training and which can aid in the structuring of monitoring formats. Third, radio amateurs and amateur organizations have a long-standing and well-documented dedication to the larger and more effective use of radio. Amateur organizations have, in the past, worked closely with FCC enforcement staff in the identification of violators, and they have actively encouraged the proper use of radio under the provisions of FCC Rules. Organized licensee groups and individuals with well-established commitments to the proper use of their license privilege are the natural core of any volunteer adjunct to the FCC's formal enforcement activity.

CQ: What form of amateur participation do you envision relative to these enforcement activities?

Fowler: Such volunteer activity would not involve the imposition of sanctions; rather, as your introductory statement noted, it would provide the basis for the assertion of peer pressure against violators. This could often obviate the need for a complaint to the FCC and could resolve problems without the expenditure of valuable Federal resources. Indeed, it would be our intent to rely on volunteer prescreening as a first-line response to violations. Where peer pressure proves ineffective, volunteer monitoring could assist the FCC's investigative staff by minimizing the hours of field monitoring needed to identify the location and source of a violation.

CQ: How do you feel about using amateur volunteers as examiners for "entry level" amateur licenses?

Fowler: I fully support legislation allowing higher class amateurs to administer amateur entry-level examinations. This would authorize what has essentially been an FCC practice regarding amateur examinations since 1938. Specifically, I welcome the grant of such authority to continue the use of volunteers to administer the Novice class examination. In fact, the concept of ultilizing experienced licensees in all services to administer the lower classes of examinations has been the subject of recent staff discussions. We believe that the language could be expanded to authorize the FCC to permit, by rule, the administration of any lower class of license examinations by a higher-class licensee.

In these days of tight budgets, this may be the only viable method to bring "examination service" to the amateur applicants in their communities. We expect to have to make substantial cutbacks in examination service at locations away from field offices. We closed offices last year and will close more this year. It may also be necessary to reduce the number of examination days provided at the remaining offices.

"We expect to have to make substantial cutbacks in examination service at locations away from field offices."

CQ: Mr. Fowler, from what your staff has briefed you on, what do you consider to be the major rulemaking items before the Commission which affect the amateur service?

Fowler: I have already mentioned our regulatory review program, and the spread spectrum and digital communication items. There is a hopper full of open Dockets and petitions the staff is working on: repeater ERP *(Docket 81-697, ed)*, slow-scan and facsimile *(Docket 80-252, ed)* and the task of incorporating the results of WARC 1979 into your rules. Then there are petitions for beacon operation, moonbounce, 20 and 40 meter telephony expansion, to mention but a few.

CQ: What are the major problems which you believe face the amateur service today?

Fowler: I believe the problems the service faces stem in part from the steady growth of the service in recent years. In the United States alone, we have almost 400,000 licensees. With reference again to the League survey, I note that malicious interference is regarded as a serious problem by the amateur community in this country. I also note that the survey found that the average amateur has a somewhat negative feeling about the FCC and is reluctant to share his or her thoughts directly with us. I consider both of these findings to be major problems that must be addressed. In this regard, I would hope that the amateur community would come to understand that just because we initiate a Notice of Inquiry or a Notice of Proposed Rule Making does not necessarily mean that we intend to go in a certain direction. These are administrative procedures to allow us to obtain your views. If the comments are a resounding "NO!", we often simply say "Thank you," and stop the procedure. This is what we recently did with the so-called "Plain language" rules *(Docket 80-729, ed)*. Amateurs should not react negatively to our proposals. They give you an opportunity to voice your concerns.

CQ: What can amateurs and the Commission do, working together, to solve these problems?

Fowler: I believe the solutions are to be found in self-regulation under appropriate guidelines, of course. The amateur service is ideal for encouraging self-regulation. Amateur radio operators can and should take on the full responsibility for managing the amateur radio frequencies. The existing band plans developed entirely by amateurs themselves stand as proof that you can be more effective than we ever could be in determining which class of operator may transmit which emission in which part of each band.

CQ: Would you like to comment on any other issue?

Fowler: Yes, although I suppose this isn't an "issue" comment as much as it is a general observation and summary.

It strikes me that the amateur community typifies the spirit of proud self-reliance and creative innovation that our elected officials are now attempting to revive in American society generally. Hams can proudly point to themselves as innovators and experimenters in the field of radio communications. Ham radio isn't simply a challenging and rewarding endeavor to be enjoyed by licensees; it also affords the Commission a practical means of encouraging the development of new uses for radio and enables the public generally to have access to sources of needed information in times of emergency. Amateur radio licensees thus combine the best elements of individual enterprise and public spiritedness.

"Hams can proudly point to themselves as innovators and experimenters in the field of radio communications."

CQ: Thank you, Mr. Fowler. We appreciate having your views.

Fowler: I appreciate having had this opportunity to respond directly to some of the current concerns of the amateur community. I look forward to the valuable input hams can provide on the issues of spectrum efficiency, interference, and technological development in which hams share a common interest with the Commission.

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CQ Reviews:

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BY LEW MCCOY*, W1ICP

The Spider Antenna, a product of Multi-Band Antennas, is a very unusual mobile, or limited space, antenna as the photos will attest. It is a four-band antenna covering 40 through 10 meters. The antenna consists of the vertical supporting mast which is made of ½ inch diameter polished aluminum. The mast supports four resonators each wound on fiberglass. Three resonators—20, 15, and 10—are installed at a slight upward angle from the mast via a special fitting. The 40 meter resonator rises directly above the mast and is 20 inches long. The overall height of the antenna is 5 feet and total weight is only 1¼ pounds.

Adjusting the antenna for a 50 ohm match is a piece of cake. Each of the resonators has a unique tuning sleeve. With an s.w.r. or noise bridge in the line, the sleeves are moved up and down the resonator until a match is achieved. This is done on each band. On the antenna we tested, this whole adjustment operation took less than 30 minutes. No other matching is required.

The Spider Antenna is shown in two installations. On the left it is mounted on the rear of the author's RV, and on the right it is bumper-mounted to his car.

How well does the antenna work? Well, we ran 50 watts to it for our tests, although the antenna is rated for 200 watts. From here in New Mexico we easily worked both Europe and Japan on 20, 15, and 10 with excellent reports. Forty meter work was equally as satisfying. We checked the antenna on the car at 55 m.p.h. into a 20 mile m.p.h. headwind and experienced no appreciable sway in the antenna.

The s.w.r. bandwidth with the antenna mounted on the car was excellent—less than 2 to 1 across the entire 20 meter band, 1.7 to 1 across 15, and 1.5 to 1 for 500 to 600 kHz on 10. On 40, the antenna was less than 2 to 1 across 100 kHz. In all cases we had a match of 1 to 1 at the desired frequency. However, the beauty of the antenna is that you can get out of the car and make a slight adjustment of the resonator sleeve to any premarked setting for a perfect 1 to 1 match. As mounted on our RV, the tuning was much sharper because of the proximity of the trailer body to the resonators. But again, it worked. We plan on mounting the antenna on the roof of the trailer when parked, and then we'll have the excellent ground of the trailer roof. It will be easy to mount the antenna via one of the ceiling vents in the trailer.

There are three outstanding points of this antenna: it uses top loading (which is best for any short vertical), it is easy to adjust for a match, and it can be quickly and easily assembled or disassembled. On the con side, it is unusual looking, but so are towers and beams if you are not an amateur. As far as amateur radio is concerned, beauty has to be in the eye of the beholder!

The antenna is manufactured by Multi-Band Antennas, 7131 Owensmouth Ave., Suite 63C, Canoga Park, CA 91303 and is priced at $110.00.

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Bands: 30-50, 118-136 AM, 144-174, 421-512 MHz.
The new *Bearcat* 350 introduces an incredible breakthrough in synthesized scanning: Alpha-Numeric Display. Push a button—and the Vacuum Fluorescent Display switches from "numeric" to word descriptions of what's being monitored. 50 channels in 5 banks. Plus, Auto & Manual Search, Search Direction, Limit & Count. Direct Channel Access. Selective Scan Delay. Dual Scan Speeds. Automatic Lockout. Automatic Squelch. Non-Volatile Memory. Order your *Bearcat* 350 today!

Bearcat® 300

List price $549.95/**CE price $349.00/$50.00 rebate**
Your final cost is a low $299.00
7-Band, 50 Channel • Service Search • No-crystal scanner • AM Aircraft and Public Service bands. • Priority Channel • AC/DC
Bands: 32-50, 118-136 AM, 144-174, 421-512 MHz.
The *Bearcat* 300 is the most advanced automatic scanning radio that has ever been offered to the public. The *Bearcat* 300 uses a bright green fluorescent digital display, so it's ideal for mobile applications. The *Bearcat* 300 now has these added features: Service Search, Display Intensity Control, Hold Search and Resume Search keys, Separate Band keys to permit lock-in/lock-out of any band for more efficient service search.

NEW! Bearcat® 350

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Get a coupon good for a $50 rebate when you purchase a *Bearcat* 350 or 300; $25 rebate on model 250 or 20/20; $15 rebate on model 210XL; $10 rebate on model 160 or 4-6 Thin Scan. To get your rebate, mail rebate coupon with your original dated sales receipt and the *Bearcat* model number from the carton to Electra. You'll receive your rebate in four to six weeks. Offer valid only on purchases made betwen February 1, 1982 and March 15, 1982. All requests must be postmarked by March 31, 1982. Limit of one rebate per household. Coupon must accompany all rebate requests and may not be reproduced. Offer good only in the U.S.A. Void where taxed or prohibited by law. Resellers, companies, clubs and organizations–both profit and non-profit–are not eligible for rebates. Employees of Electra Company, their advertising agencies, distributors and retailers of *Bearcat* Scanners are also not eligible for rebates. Please be sure to send in the correct amount for your scanner. Pay the listed **CE** price in this ad. *Do not* deduct the rebate amount since your rebate will be sent directly to you from Electra. Orders received with insufficient payments will not be processed and will be returned. Offer subject to change without notice.

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List price $429.95/**CE price $279.00/$25.00 rebate**
Your final cost is a low $254.00
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Frequency range 32-50, 146-174, 420-512 MHz.
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List price $449.95/**CE price $289.00/$25.00 rebate**
Your final cost is a low $264.00
7-Band, 40 Channel • Crystalless • Searches AM Aircraft and Public Service bands • AC/DC Priority Channel • Direct Channel Access • Delay
Frequency range 32-50, 118-136 AM, 144-174, 420-512 MHz.
The *Bearcat* 20/20 automatic scanning radio replaces the *Bearcat* 220 and monitors 40 frequencies from 7 bands, including aircraft. A two-position switch, located on the front panel, allows monitoring of 20 channels at a time.

Bearcat® 210XL

List price $349.95/**CE price $229.00/$15.00 rebate**
Your final cost is a low $214.00
6-Band, 18 Channel • Crystalless • AC/DC
Frequency range: 32-50, 144-174, 421-512 MHz.
The *Bearcat* 210XL scanning radio is the second generation scanner that replaces the popular *Bearcat* 210 and 211. It has almost twice the scanning capacity of the *Bearcat* 210 with 18 channels plus dual scanning speeds and a bright green fluorescent display. Automatic search finds new frequencies. Features scan delay, single antenna, patented track tuning and more!

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Your final cost is a low $184.00
5-Band, 16 Channel • AC only • Priority Dual Scan Speeds • Direct Channel Access
Frequency range: 32-50, 144-174, 440-512 MHz.
The *Bearcat* 160 is the least expensive *Bearcat* crystalless scanner. Smooth keyboard. No buttons to punch. No knobs to turn. Instead, finger-tip pads provide control of *all* scanning operations.

NEW! Bearcat® 100

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Allow 30-120 days for delivery after receipt of order due to the high demand for this product.
List price $449.95/**CE price $299.00**
8-Band, 16 Channel • Liquid Crystal Display Search • Limit • Hold • Lockout • AC/DC
Frequency range: 30-50, 138-174, 406-512 MHz.
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CIRCLE 62 ON READER SERVICE CARD

RESULTS OF THE 1981 CQ WORLD WIDE WPX SSB CONTEST

BY BERNIE WELCH*, W8IMZ

This Silver Anniversary event was another super contest weekend of WPX and DX fun. The many congratulatory remarks were greatly appreciated, and the comments by Jurgen Weigl, OE5CWL, "Congrats on 25th Anniversary—hope to participate in the next 25 years" is a good summation. "The most fun contest of all," says Jim Morse, AF5K. Bob Gregory, KD7H, believes that "This has to be one of the all-time greatest contests." Comments such as these suggest that during the contest's 25 years of growth, it has matured to an above-average activity, appealing to the majority of contesters.

The FCC continues to issue more new prefixes and unintentionally has become a major U.S.A. contributing factor to the contest. As a result, a record 778—yes, 778—different world prefixes were worked at station YT0R. An achievement such as this would have been impossible a few years ago.

Congratulations to Randy Sobol and his six-man multi-xmtr crew who can now boast of being the highest scoring station ever in the history of WPX contesting—19.3-plus million. The AI6V multi-multi group's 12.5-plus million is a U.S.A. record that probably will remain unbroken for many years. Their 728 prefix multiplier is also a U.S.A. record and is second world high. Up Alaska way, KL7RA's 701 is third around the globe.

A total of 26 new calls/scores are now listed in the up-dated All Time Records. For the first time, this honor roll includes an entry for Single Op., Asia, 1.8 MHz. A small but qualifying score by Riki, 4X4NJ, made this possible. We still need "firsts" on 160 meters for Africa, Oceania, and South America. VE3MFT has the record for the top band. After several frustrating years of coming close, Gene, N2AA, did it. He is the new kingpin of the QRP'ers. Very FB. . . .

The Multi-Multi World Champions at station KH6XX are (L to R) back: KH6ND, AH6BK, KH6XX, KH6NO. Front: K7TI/KH6, WH6ABM, KH6LW. They achieved a new All Time Record score.

Stations from all the continents provided the traditional DX pileup action. Expeditions were also in abundance and continue to be an important part of this contest.

Multi-op single transmitter stations that were not aware of the change in the '81 rules, which says, "only one transmitter and one band permitted during the same time period, defined as 10 minutes, no exception" have been listed as multi-multi, the category for which they were qualified.

New donated Trophy Awards, which we were unable to announce in the '81 rules and which are effective with this contest, include: U.S.A. 7 MHz by William Diggins, WA8LXJ (he has also donated a World 7 MHz Trophy beginning with the '82 S.S.B.); U.S.A. 21 MHz by Ted Pauck, Jr., K8NA; Multi-Op Multi-Xmtr U.S.A. by Bert Cerwen, KL7IRT; Club (S.S.B. and C.W.) U.S.A. by Northern Ohio Amateur Radio Society. We also have several new ones for the C.W. part, and we will announce them with the C.W. results. We need more trophy donors, especially for the C.W. part. If you are interested, please contact me.

The general consensus of opinion regarding the maximum length of operating time for the single operator category dictates that we continue the current 30 hours. I enjoyed talking contests with many of you at the hamfests I was fortunate to attend this past year. If we didn't have an eyeball at Dayton, Wilmington, Findlay, Bellefontaine, Cincinnati ARRL, Lima, Cincinnati Stag in Ohio or Jacksonville, Florida, I'm sorry I missed you.

I've agreed to moderate another Contest Forum at the big '82 Dayton Hamvention, scheduled 23, 24, 25 April at the Hara Arena. A change from previous years is that the **Contest Forum** will be held **Saturday afternoon, 24 April** from **1300 to 1630 hours.** Hope to see you in attendance, as I'm sure you will enjoy the program.

Now is the time to send for your '82 contest sample cover sheet and log forms. They are available from the *CQ* magazine office. U.S.A. send s.a.s.e; all others send self-addressed envelope with sufficient IRC's.

My Chief Assistant, Steve Bolia, N8BJQ, was a definite asset in the compiling of these results. I certainly appreciate the time and effort he devoted to this endeavor. May the contest gods smile upon him! Thanks also to my other helpers: Ron Moorefield, W8ILC; Duane Engel, W8LKG; my daughter, Irene; and XYL, Eleanor. Watch for the C.W. results in the May '82 *CQ* magazine.

Hope to work ya in the next one, 27th and 28th March. Good luck!

73, Bernie, W8IMZ

*7735 Redbank Lane, Dayton, OH 45424

Random Contest Comments

"Better multiplier than last year but not as many QSO's (QRPp) . . . *N2AA*. Many asked about the boa. FCC sure helping this contest. U.S. prefixes galore (QRPp) . . . *OA8V*. I had much fun in this contest—a good one this year (QRPp) . . . *DL8QS*. QRPp contesting is 98% boredom with 2% exhilaration, which seems to make it all worthwhile . . . *VE3KKB*. 10 meters was poor the second day from zeroland (QRPp) . . . *ABØX*. Now have 92 countries QRP thanks to contest . . . *AJ7S*. 12 new countries for total of 110 via QRP. Great fun . . . *KA3BSM*. Ears blasted by constant CQ's by USA big guns drowning out DX (QRPp) . . . *W9PNE*.

"Nice having a QRP section . . . *KH6CP*. Last year was great; this year was better. QRP ops should never miss this one. TNX agn CQ . . . *WA3FNK*. Here's my big effort to set the new world record for 10 monoband (QRPp) . . . *WB2VYA*. I got tired operating with 5 watts, QRPp . . . *JH4UTP*. C31, EA6, VP1Ø new QRPp countries . . . *W6YVK*. I worked more DX in 2 days than in the past 7 years (QRPp) . . . *WB8UQB*. Heavy QRM and many people working the best contest (QRPp) . . . *HK4AHX*. QRN level high on 75 (QRPp) . . . *W8ILC*. Lots of fun—I overslept for 2 hours and lost the amplifier for about 4 hours . . . *AK1A*.

"Strange being called by 9K2DR and HS1AMM instead of the other way around . . . *KA1CVM*. Great to work so many on 40 meter S.S.B. . . . *WB1EAZ*. Have found that contests are the only good means of upping my DXCC . . . *N2BIN*. All QSO's made by answering CQ's. I never called CQ as the band was full of stations . . . *W2KZE*. Nice to see you in Dayton, Bernie. This contest is really getting big! . . . *N2WT*. Operate 30 hours, 60 hours to complete paper work! . . . *K3HPG*. This contest really rallies the troops . . . *K3ZJ*. Was thrilled when TYA11 called me . . . *KA3BLP*. Great conditions . . . *AI2C/4*. Have not decided whether all the crazy U.S. prefixes made the contest better or worse . . . *N4UH*.

"Bernie—Thanks for the nice 1980 certificate . . . *WB4BBH*. Many stations on 75 meters; 3A8EE came to my CQ . . . *N4BAA*. Condx were super, especially on 10 meters . . . *K5RC (op: K5ZD)*. Amp blew in 16 hrs. Boo!! . . . *K5FUV*. Murphy really hit—a blown amp and a power outage. I'm only 15 years old and will be in many more WPX contests . . . *KM5R*. Absolutely outstanding! I'm ready to do it again next week. 40 meters was fantastic here . . . *KB5FU*. Bernie's right—a lot of us get in for the fun and to better last year's score . . . *AC6V*. Called by JT1AN during a JA run . . . *W6TPC*. Propagation to Europe from the (USA) west coast was excellent . . . *N6HK*.

"JA operators still the best in pileups . . . *W7CB*. My new call certainly helped—CU next year . . . *KD7H*. 9X5AB called me . . . *WB7FDQ*. Worked KH6XX on 75 with my attic dipole . . . *KF8K*. Good contest and much DX as usual . . . *AA8S*. I was really surprised the way I was getting out with my mobile setup . . . *WD8ALG*. Worked UAØFCL on 40 . . . *WA8LXJ*. Sure wish the DX would listen in the American phone band a little more (40 meters) . . . *W8SQ*. My congrats to the QRP guys, the champions of patience! . . . *WD9DCL*. Really appreciate the effort of stateside stations worked on backscatter even when they didn't need my prefix . . . *KB9AW*.

"Calling CQ and 9N1MM came back . . . *N9BX*. Sure wish I had one of those fancy stateside calls . . . *W9LT*. So much ice on my antenna, I couldn't have gotten out without my

The AI6V ops (above) have a very good reason to smile. Their 12.5 million is the highest U.S.A. score ever in the history of the contest. An excellent Silver Anniversary achievement.

homebrew tuner . . . *KAØFPJ*. I loved being a multiplier for nearly everyone I worked . . . *KFØZ*. Worked 13 new countries . . . *NØAVT*. Got excited thinking what my score would be if I used suffixes instead of prefixes for multipliers. Hi! . . . *KØIHG*. 20 over S9 pileup into Europe Mar 29 for couple hours . . . *NL7K*. OE3ALW, Ulf made contact from Austria on Sat. On Monday he contacted me in Barbados for his QSL card . . . *8P6PF (op: VE3IUE)*. Ice detuned both razor beams and the coax came off the 20M antenna. When the finals quit, so did I . . . *VE3IY*.

"Finally worked Market Reef—OJØ . . . *VE7ZB*. FH8OM calling really woke me up at 6:33 a.m. . . . *VE1BNN*. If I had a point for every station that got me confused with VE7ZZZ, I might have won . . . *VE7ZZ*. When 8Q7AV called for the second time, I had to tell him we had already worked . . . *VE3ICR*. Three new 80 meter countries . . . *VE2ZP*. QSL manager for 4V2BM is KA4MRE . . . *HH2BM*. The biggest thrill was the number of pileups for 6E1 prefix and the number who asked where it was after they worked me . . . *6E1MV (op: XE1MV)*. Worked WB9GGD, KA3GGP, and W2GGB in succession on 28 MHz . . . *VP2MGQ (op: N4MO)*. Where were WD6's and WAØ's on 80 meters? . . . *HP1XRK*. I broke the 21 MHz North America record . . . *KP4O*.

"Looked for prefixes almost all the time—now if they all would QSL . . . *EA8TY*. My favorite contest! . . . *EL2AV*. Working XE and ZL on 80 M was exciting . . . *CN8CO*. Despite the declining sunspot activity 28 MHz remained open around the clock . . . *9X5AB (op: ON8RA)*. A really enjoyable contest . . . *JR1RCR*. Very QRM from high-power station located within 200M of my QTH . . . *JF1SEK*. Tired! Tired! Tired! . . . *JK1RJQ*. Wish I had a QSO for every time I called CX7BY and CE6EZ . . . *HL9DX*. I never worked so many W7 - W6 in a contest . . . *OE3NPW*. I hope to do it again next year . . . *EA6GP*. Biggest thrill is meeting old friends . . . *SVØAW/9*. Fantastic—WB1SQB/CEØA answered my first call . . . *OZ1FTE*. I realized after the contest that I had failed to work a good number of the easier European prefixes, but there was some compensation in the large number of U.S. prefixes worked . . . *G3VBL*.

"Many new prefixes . . . *OY1A*. Licensed since 1954, but first contest just for fun . . . *OH1SZ*. Six new countries and some new prefixes for WPX award . . . *F6FNA*. I like this contest because of the 30 hours rule . . . *DK5AD*. Where were those Canadian special prefixes? Sure miss them . . . *DF2RG*. Enjoyed contest, good signals from W land . . . *GU3YIZ*. Biggest thrills—working VK9CCT/VK9Y, KH6XX, KC4USN, TF3DC/OX, VK9ZD, 8R1RBF, and H44CF. One of the best contests . . . *HAØDU*. Condx were good on 14 MHz . . . *HA5JI*. Very little short skip to Europe (28 MHz) . . . *EI1DH*. Had I had a second station, I would have overcome all the equipment failure . . . *I6NOA*. Lack of a linear and a beam were compensated for by being on the highest point in Sliema, Malta . . . *9H3AM (op: G3VLX)*.

"Activity in this contest is very high from U.S.A. Thanks boys for the points . . . *PAØIJM*. My favorite contest . . . *PAØLIE*. It was fun . . . *LA1RN*. If you can't beat them, join them! . . . *LA4TG*. Noise level was 59 + + (40 meters) . . . LA5QK. The SO prefix is now being given only to foreigners . . . *SO5DW (op: CT1DW)*. FB Contest . . . *SP9BRP*. QSL information is WA3HUP . . . *CSØBY*. The first day gave a return of 59% of total score . . . *CSØOF (op: CT1OF)*. *Nice to hear U.S. prefixes* . . . *YO4AYE*. Very nice to work so many familiar friends . . . *GM4GPN*. My first DX Contest. TNX for availability . . . *EA7AZJ*. Thanks, thanks again for a most pleasant Contest. CU next year and look forward to C.W. part . . . *SM5CMP*. JA's open at any time . . . *4N3EY (op: YU3EY)*. Enjoyed as always in such a great contest . . . *4N3ZV (op: YU3ZV)*. Cdx's were poorer than last year . . . *UA6LLT*.

"Thank you very much for the good contest . . . *UZ3TG*. Wkd many interesting prefixes—thanks . . . *UQ2GDQ*. Just waiting for solar cycle minimum—suppose will be much more DX on low bands . . . *UP2PAQ*. Surprised by call from Father Moran (9N1MM) . . . *VK6NE*. Number of disasters cut operating time, but good conditions made it well worthwhile . . . *VK5OU*. Novice on Wednesday, Advanced on Thursday, S.S.B. on Friday, Begin WPX on Saturday, Finish WPX on Sunday—what a week! . . . *WH6AMR*. A great contest again, with conditions first rate to the U.S.A. and Japan . . . *ZL4BO*.

"Will have 5 el monobanders for single band competition soon . . . *KP4KK/DU2*. Worked 5 new countries on 40 Meters that I needed to complete the 100 countries that I never thought I would ever finish . . . *PT7TP*. I enjoyed log-checking with the help of TRS-80 microcomputer . . . *CE6EZ*. Many asked me to QSY to 80. I wated for them on 80 for 24 hours. Where did they QSY to? . . . *OA4AWD*. Great problem to select the rest periods . . . *4M2AMM*."

ZF2EO, op Steve, KØCS (right), is the new North America S/O 3.5 MHz All Time Record holder. Clark, W8TN, as ZF2EK won a certificate award for 28 MHz.

Number groups after call letters denote Band, Score, QSO's and Prefixes. Bold listings are certificate winners.

QRPp —SECTION— WORLDWIDE

N2AA	A	705,726	733	378
OA8V	A	509,780	601	284
DL8QS	A	436,475	604	325
UA3PAZ	A	421,056	559	288
VE3KKB	A	419,176	503	302
ON6NL	A	370,461	571	273
KT6V	A	263,796	504	228
DLØON	"	259,000	511	259
		(Opr: DH3NAD)		
N2US	"	155,540	320	220
G3FTQ	A	150,228	407	214
ABØX	A	133,488	285	216
AJ7S	A	106,536	262	184
KA3BSM	A	100,033	239	167
W9PNE	A	95,226	231	177
KB9JJ	"	93,808	232	164
KH6CP	A	92,106	258	129
WA6KFX	"	87,575	290	155
JA1KFX	A	54,384	196	103
AH6J	"	47,264	185	112
WA3FNK	"	38,745	148	105
K3VY	"	28,704	132	104
VK2VRJ	A	27,522	141	66
YO2BKG/3	A	15,436	118	68
OH6DO	A	15,300	145	85
K2RF	"	14,578	91	74
N4ASU	A	12,160	86	76
Y26HG	A	5,891	137	43
UC2AAX	A	1,792	37	32
OE1SBA	"	954	20	18
WB2VYA	28	359,205	471	311
JH4UTP	28	172,235	342	185
W6YVK	28	124,938	314	198
K3SWZ	28	124,025	274	205
I5JHW	28	123,214	254	182
UB5MNO	28	109,186	300	154
UY5XE	"	88,641	213	147
UT5DK	"	51,507	191	97
WB8UOB	28	40,599	138	117
WB3EKV	28	37,950	145	115
IØOAY	"	19,320	144	105
UA9OIS	28	15,987	123	73
UA9FBV	"	9,027	82	59
UA9SHD	"	9,016	67	56
I1RBJ	"	7,425	85	45
OH2BLU	"	2,144	32	32
WA8BIN	"	644	26	23
AC8C	21	81,675	208	165
JA2QBA	21	72,215	195	143
UV9WF	14	112,095	252	159
K3ZR	14	75,036	194	148
JA2JSF	14	47,686	155	113
HK4AHX	14	36,570	128	106
PAØNRD	14	8,322	108	73
HA5BA	"	486	27	18
W8ILC	3.5	92,984	403	197
OK1AIJ	3.5	27,448	156	94
UB5DAG	3.5	2,480	41	31
UA3XBB	"	510	21	15
EZ5IFD	1.8	1,320	34	22
UK6HDK	"	364	15	13

SINGLE OPERATOR NORTH AMERICA

UNITED STATES

KC1F	A	3,112,524	2187	558
AK1A	A	2,338,271	1744	533
KA1R	A	2,064,924	1665	492
WA1UZH	"	1,938,432	1521	512
WB1FVO	"	399,728	601	301
WB1FPF	"	270,256	430	266
W1DYH	"	179,790	312	202
AD1Z	"	94,302	241	169
W1CNU	"	62,624	171	152
N1ABX	"	45,084	158	102
W1PLJ	"	12,996	76	58
KA1FCL	"	10,324	65	58
K1SF	28	169,722	330	189
KA1CVM	"	150,021	285	211
KB1U	21	335,016	508	297
KB1Q	"	144,632	294	202
N1ATO	"	80,597	273	187
WA1FRC	"	33,925	147	115
W1WY	14	3,230	40	38
WB1EAZ	7	28,536	94	82
K1RB	"	14,910	79	71
W1BB	1.8	120	6	6
K2SS	A	3,245,793	2197	527
N2SS	A	276,828	422	236
N2ATX	"	265,366	440	277
K2FL	"	152,712	283	189
N2BIN	"	143,451	284	189
AC2J	"	125,609	326	209
K2TD	"	113,004	257	172
W2FGY	"	102,410	229	154
W2FUI	"	94,237	223	143
N2LT	"	61,053	179	141
WB2PXA	"	48,396	170	111
KA2CDJ	"	8,673	66	59
K2HPV	"	5,250	50	42
KA2GLX	"	3,705	42	39
W2GFF	"	1,900	29	25
KC2X	28	980,535	1011	393
W2KZE	"	105,703	241	173
KA2HTH	"	56,695	170	145
WB2TKD	"	50,840	153	124
N2WT	21	2,107,710	1650	495
WA2PHA	"	118,008	269	198
W2UL	"	1,408	23	22
KF2O	7	43,848	136	116
W2XQ	"	16,830	147	99
WA2IFS	"	6,764	41	38
WB2FZO	3.5	233,770	398	241
K2BQ	1.8	3,420	54	38
WA3VUQ	A	1,277,350	1141	433
K3HPG	A	1,243,056	1072	456
WB3JRU	"	772,269	823	411
W3ARK	"	523,798	620	319
K3ZJ	"	311,395	461	245
W3ICM	"	303,336	503	264
W3BGN	"	274,590	324	226
K3ZUF	"	251,165	388	263
W3RJ	"	117,810	261	170
N3AW	"	48,450	158	114
W3FQE	"	35,868	134	98
N3RL	"	17,176	86	76
WB3KIL	"	12,936	76	66
WA3UXP	"	1,368	27	24
AG3S	"	108	7	6
K3FN	28	103,224	216	184
K3ND	"	32,828	138	116
KA3BTG	21	11,316	80	69
KA3BLP	14	238,869	421	243
WB3CFD	"	91,390	266	185
KB3FZ	"	14,615	87	79
K3GYD	7	91,656	331	171
WB3GCG	1.8	8,100	184	75
KC4VA	A	2,172,276	1885	498
K4KZZ	A	1,265,850	1215	435
AI2C/4	A	1,073,406	1035	398
KC4UQ	"	1,045,272	934	449
AA4S	"	684,870	705	370
KG4W	"	494,648	627	308
KI4M	"	265,540	500	284
		(Opr: K4ZGB)		
W4UYC	"	206,116	387	227
W4WJJ	"	201,072	361	213
N4IB	"	141,431	270	233
W4KMS	"	98,384	213	176
VE3BTQ/W4	"	95,018	213	154
W4BV	"	42,840	157	126
W4KO	"	41,148	127	108
K4OD	"	39,964	151	103
N4UH	"	25,500	104	102
W4OGG	"	23,828	100	92
KA4MCM	"	5,490	61	61
WB4BBH	"	243	9	9
N4ZC	28	1,930,946	1465	526
		(Opr: N5TR)		
N4YF	28	475,571	571	307
WA4YNP	"	213,161	350	247
WB4VQO	"	145,754	260	203
WA4DRU	"	107,163	228	189
W4PTT	"	101,460	231	178
K4UTE	"	23,490	98	81
W4ORT	"	15,884	101	76
W4ZTW	21	400,266	578	333
W4FDA	"	11,180	69	65
N4KE	14	1,476,848	1295	482
WB4EYX	"	13,650	77	70
KC4OV	7	19,400	154	100
W4LCL	"	18,170	89	79
N4BAA	3.5	213,428	424	229
AJ2E/4	"	120,582	330	203
K8UNP/4	"	11,218	75	71
K5RC	A	3,055,250	2138	550
		(Opr: K5ZD)		
AF5K	A	2,043,900	1651	540
KN5H	A	1,509,046	1460	451
K5FUV	"	747,400	810	370
W9PL/5	"	629,728	774	352
WA5IYX	"	165,126	342	219
W5QXK	"	117,793	264	221
KB5VF	"	85,646	229	187
K5DEC	"	80,560	215	152
W5OB	"	75,048	209	159
W5GVP	"	7,744	75	64
WB5QPH	"	3,876	39	38
W5EIJ	"	3,783	41	39
W5QOU	"	240	10	10
KM5K	28	1,689,975	1626	435
W5JW	28	1,167,156	1249	404
KO5C	"	710,418	980	334
N5UD	"	171,380	317	220
WN5MBS	"	115,342	324	202
KM5R	21	1,857,065	1785	485
K5TM	"	600,840	862	360
		(Opr: WB5VZL)		
K1DWQ/5	"	112,514	254	202
KM5X	7	214,800	407	200
KB5FU	"	107,672	288	172
K5UR	3.5	154,700	486	238
N6CW	A	3,414,786	2635	498
K6HNZ	A	2,186,331	1957	417
WA6KMW	A	1,270,047	1349	331
AC6V	"	477,750	758	375
WA6TKT	"	347,657	582	223
WD6FLB	"	283,250	463	250
WB6JMS	"	276,736	510	256
N6AV	"	255,730	416	239
W6TPC	"	214,060	391	220
WA6UFY	"	155,172	348	193
W6OKK	"	154,200	389	150
N6HK	"	70,070	172	143
W6GBM	"	63,414	188	117
K6XP	"	14,475	91	75
N6DWW	"	8,208	97	76
AA6EE	"	1,716	26	26
KN6M	28	1,597,150	1773	455
WA6DBC	28	1,226,352	1322	348
K6SVL	28	1,026,720	1271	360
WA6VNR	"	195,444	473	183
W6YMH	"	166,000	400	200
N6UW	"	60,684	211	156
W6OVD	"	15,200	104	95
N6RO	21	2,886,864	2405	439
		(Opr: N9NC)		
KA6DXN	"	126,714	351	147
W6CN	14	88,400	236	170
K6XO	3.5	17,538	138	111
K6SE	1.8	1,888	70	47
N7DF	A	3,013,729	2367	443
W7CB	A	1,797,615	1685	387
WB7FDQ	A	1,331,564	1520	377
W7JYW	"	738,900	967	300
N7RO	"	665,310	817	335
KG5W/7	"	407,420	678	260
WA6NHB/7	"	318,423	626	257
W7EKM	"	278,194	501	217
W7GUR	"	180,011	351	227
W7ISX	"	168,411	341	219
WB7RYC	"	71,585	225	139
KD7H	"	39,128	177	134
KB7HG	"	37,694	169	94
K7CHT	"	31,155	126	93
K7LAY	"	21,945	101	77
K7LYT	"	4,784	55	52
K7RS	"	3,995	50	47
AK7F	"	2,160	31	30
AK7J	"	1,537	63	53
AG7M	28	1,204,602	1666	322
N7AYF	28	793,305	1131	289
W7FP	"	480,180	763	302
KB7G	"	261,048	626	219
N7ABJ	"	189,810	417	185
W7AYY	"	167,983	373	173
AI7B	21	3,058,563	2607	437
KA7AUH	21	1,474,530	1629	345
WB7QFH	21	1,010,739	1219	309
W7LXR	"	391,658	632	226
K7LZJ	"	344,981	601	223
W7EYR	"	70	7	7
W7RIR	14	602	15	14
K7IDX	1.8	500	39	25
KB8EC	A	1,225,162	1212	446
K8CW	A	727,296	830	384
KF8K	A	318,570	468	287
W8IMZ	"	211,167	401	243
AA8S	"	203,232	387	232
N8TN	"	173,056	342	208
KD8V	"	160,056	368	234
K8PUJ	"	139,258	309	203
K8IQQ	"	124,485	259	193
WD8KXN	"	116,735	281	185
N8BRQ	"	116,372	244	188
N8BLB	"	106,140	240	174
WA8NDE	"	59,500	178	125
WB8SIQ	"	58,032	161	144
N8BTT	"	57,963	175	139
WD8ECA	"	49,446	175	123
W8UPH	"	48,831	168	123
AC8W	"	43,306	144	118
W8LKG	"	42,069	113	111
WB8CSH	"	38,759	148	113
WD8IJN	"	38,025	147	117
KK8L	"	30,720	144	128
WB8RBU	"	29,376	120	102
N8AXA	"	27,645	107	97
AI8W	"	25,400	122	100
W8BTD	"	22,989	101	97
W8GV	"	21,280	103	78
N8BKX	"	20,196	111	99
AB8L	"	16,360	75	64
W8DDB	"	13,680	88	60
W8HU	"	12,288	72	64
WB8CKL	"	12,264	83	73
K8LJG	"	11,041	65	61
WD8MOV	"	10,759	55	53
K8TUY	"	7,007	54	49
KC8A	"	5,074	45	43
KB8DB	"	2,121	21	21
WA8WMC	"	1,856	30	29
W9SWM/8	"	1,425	32	25
K8ES	"	1,100	20	20
W8CAR	"	945	21	21
KB8PK	28	228,888	363	264
WD8ALG/M	28	138,838	303	211
WD8PAQ	"	22,220	113	110
WD8MRF	"	19,980	103	74
WB8VPQ	"	3,848	39	37
K8DHK	"	1,704	24	24
KI8J	21	426,048	583	336
K8NA	14	1,740,024	1300	507
WD8KKF	"	216,891	399	261
WA8LXJ	7	100,920	246	174
N8BJQ	7	86,052	284	174
W8UVZ	"	85,608	353	164
W8SQ	"	36,400	118	104
W8JXM	"	1,496	17	17
KB8WB	3.5	22,188	202	172
W8LRL	1.8	15,652	243	91
AI9J	A	2,432,665	1818	551
AG9E	A	410,263	668	329
WD9DCL	A	349,812	527	316
WD9DBC	"	136,325	281	205
AK9N	"	77,184	201	144
WB9TDR	"	55,322	162	139
KB9C	"	24,973	140	113
N9BUZ	"	21,483	122	99
N9BXU	"	11,408	131	124
WB9HRO	"	2,156	32	28
K9GDF	"	1,632	35	32
WB9GGD	28	587,039	709	353
W9UP	"	185,409	357	243
KB9AW	"	123,165	265	207
K9RX	21	1,095,252	1073	428
N9BX	21	1,046,040	997	460
KB9UG	"	129,291	274	213
W9YCV	"	1,007	20	19

W9LT	14	720,792	836	376
AG9S	7	90,916	435	191
WB9TIY	3.5	80,036	387	187
ABØI	A	2,819,285	2184	545
		(Opr: WA6DGX)		
WBØISW	A	484,753	621	307
KBØPR	A	303,376	544	268
KAØFPJ	"	95,400	298	159
WØDEL	"	91,205	253	185
WØPPF	"	75,636	237	132
AKØG	"	66,432	227	173
KØRWL	"	41,418	161	118
KFØZ	"	39,996	175	132
WB8ZRL/Ø	"	35,148	123	101
NØBZE	"	20,826	112	78
WAØDCB	"	15,680	87	80
NØADJ	"	14,688	80	72
NØARI	"	7,440	54	48
KØGU	28	1,260,441	1314	399
KAØHDB	28	59,700	173	150
NØAVT	"	25,160	101	85
KBØC	21	556,739	741	365
KBØUE	"	10,944	81	76
KØIHG	14	60,214	196	161
	ALASKA			
AL7X	A	1,394,190	1669	315
KL7AF	A	521,324	837	236
KL7JAF	"	295,608	522	218
KL7CQ	"	288,583	698	148
KL7IB	28	1,122,805	1517	265
NL7K	21	2,261,880	2226	360
	BARBADOS			
8P6PF	28	2,427,039	4923	493
		(Opr: VE3IUE)		
	BELIZE			
VP1RY	21	70,143	335	103
		(Opr: KØBJ)		
	CANADA			
VE7BTV	A	3,328,654	2481	511
VE3GCO	A	2,295,510	1510	510
VE1CCC	A	949,424	912	392
VE3IY	"	713,700	781	305
VE5GF	A	410,726	524	274
VY1CM	A	246,820	537	176
VE7ZB	"	206,640	365	210
VE4AIV	A	144,180	328	180
VE7BSM	"	130,162	323	151
VE3FEA	"	74,823	194	147
VE3EZU	"	52,700	160	124
VE3GWM	"	52,500	153	140
VE7AJ	"	25,810	118	89
VE7DXC	28	1,223,365	1744	295
		(Opr: W7ZR)		
VE1BNN	28	530,060	589	340
VE7CYT	"	116,090	360	130
VE2FMH	28	17,176	84	76
VE3MCL	"	5,421	48	39
VE2FWE	"	1,836	27	27
VE7ZZ	21	3,463,185	2690	453
VE7CML	21	3,437,625	2786	445
VE3BMV	21	2,821,522	2019	554
VE7IN	"	2,753,752	2322	428
VE6UD/3	"	2,021,820	1613	465
VE6MP	21	976,800	978	400
VE6CJR	"	6,048	57	48
VE3ICR	14	1,277,991	1193	429
VE7WJ	14	813,694	881	361
VE3EEW	"	663,324	863	334
VY1DV	"	1,540	28	22
VE3KZ	7	560,976	572	232
VE3UOT	"	258,136	385	164
		(Opr: VE1BCZ)		
VE3MAC	"	50,572	137	94
		(Opr: VE3JTQ)		
VE2ZP	3.5	405,144	506	204
VE3MFT	1.8	84,906	252	89
	CAYMAN IS.			
ZF2EK	28	518,922	1068	227
		(Opr: W8TN)		
ZF2EO	3.5	668,736	657	243
		(Opr: KØCS)		
	COSTA RICA			
TI2WX/TI5	A	59,187	265	109
	DOMINICAN REPUBLIC			
HI3XRM	A	1,149,960	1354	370
HI8GB	21	224,878	427	229
HI8LC	3.5	26,800	92	67
	EL SALVADOR			
HU1SA	A	194,775	527	175
	GUATEMALA			
TG9GI	28	3,166,764	2698	489
	HAITI			
4V2BM	28	3,126,598	2599	478
	MEXICO			
6E1MV	28	1,087,290	1916	270
4A9LCH	21	2,147,420	2015	454
XE1J	3.5	108,240	204	120
	MONTSERRAT			
VP2MGQ	A	4,111,388	3325	529
		(Opr: N4MO)		
	PANAMA			
HP1XAT	28	2,421,510	2239	
HP2VX	"	89,100	320	
HP1XRK	3.5	632,400	573	[illegible]
	PUERTO RICO			
NP4A	A	5,489,042	3905	596
WP4API	A	1,163,488	1457	353
KP4O	21	3,653,796	2655	582
	UNITED NATIONS			
4U1UN	A	100,386	290	143
		(Opr: HB9RS)		
	VIRGIN IS. (U.S.)			
KV4AA	14	24,080	127	86

AFRICA

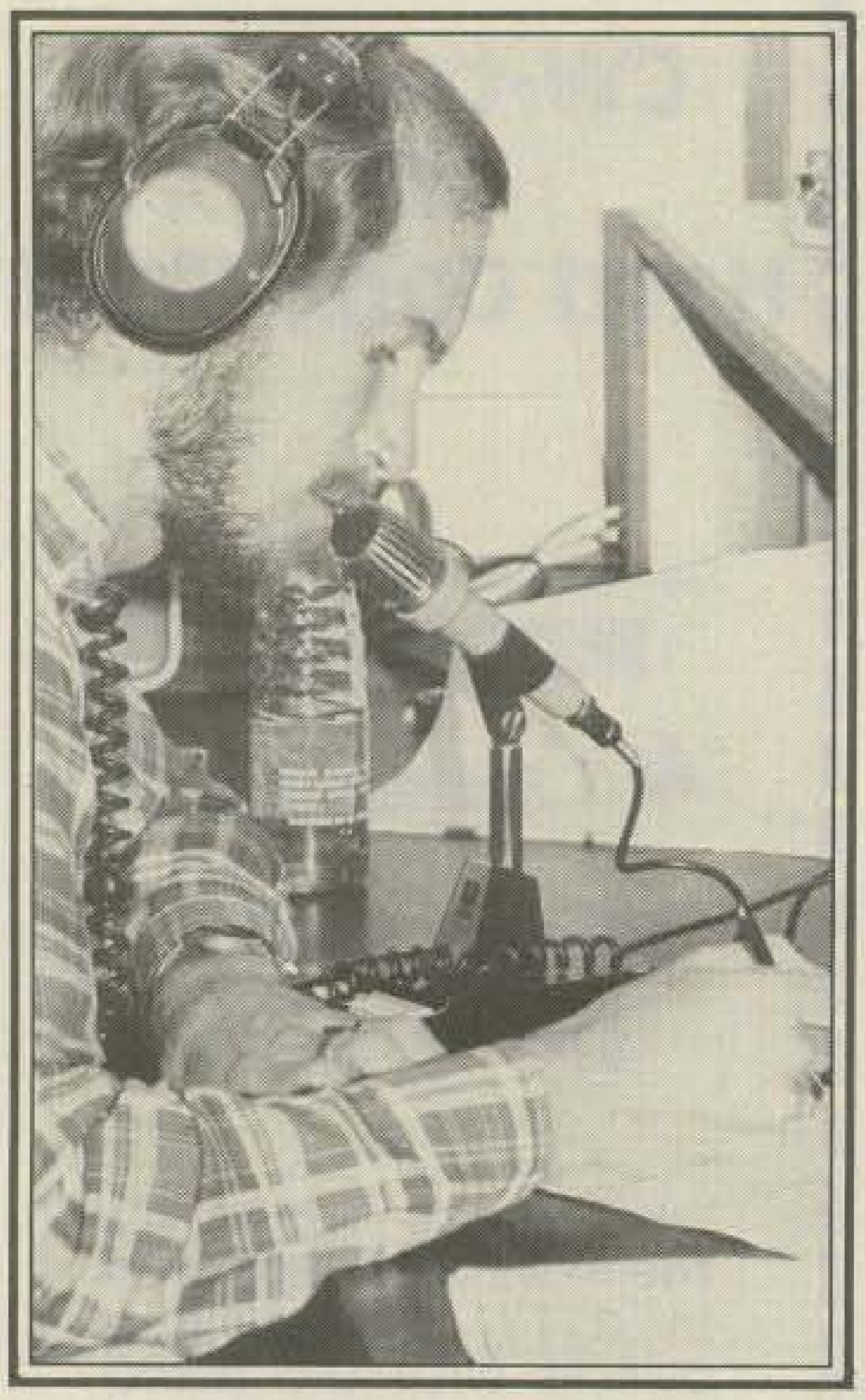
	ASCENSION IS.			
ZD8RH	28	880,380	916	324
	CANARY IS.			
EA8TY	A	1,117,138	999	374
	IVORY COAST			
TU4BA	A	1,291,212	1210	356
		(Opr: K4YT)		
	LIBERIA			
EL2AV	21	4,617,530	2766	557
	MOROCCO			
CN8CO	A	2,247,759	1595	411
		(Opr: W3EMH)		
CN8AN	21	593,655	695	285
CN8ED	14	17,812	82	73
		(Opr: N9BSD)		
	RWANDA			
9X5AB	28	892,892	974	308
		(Opr: ON8RA)		
	SOUTH AFRICA			
ZS2GL	28	136,950	277	166
	TRANSKEI			
S83W	A	48,735	171	95

ASIA

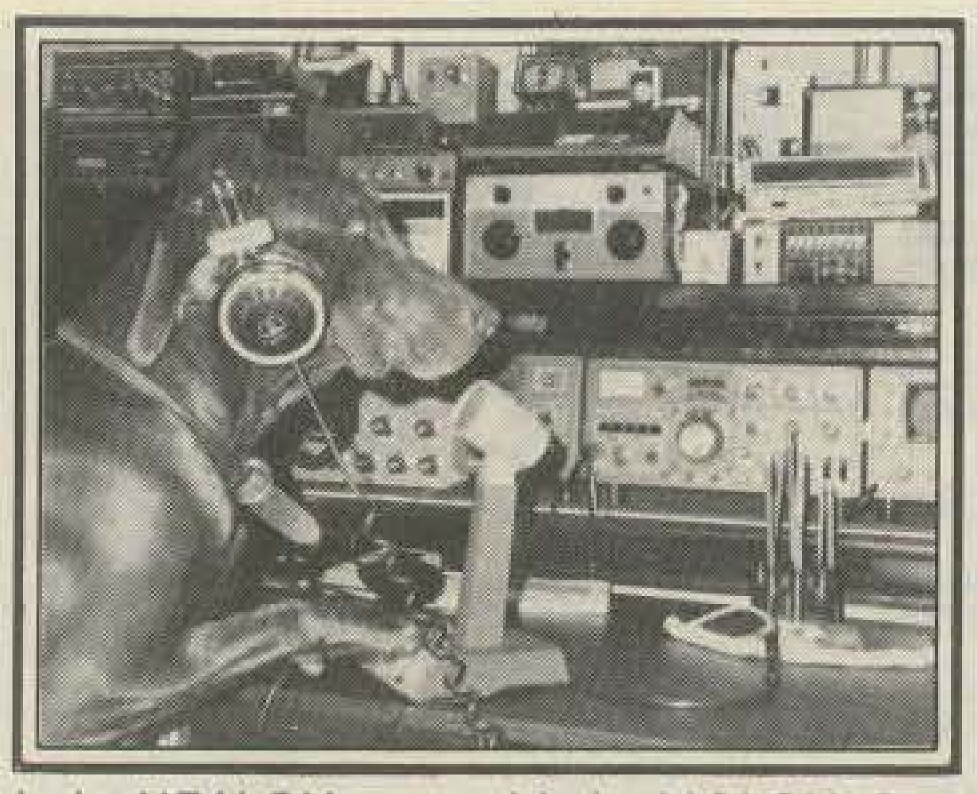
	ISRAEL			
4Z4TR	A	492,888	617	264
4Z4KK	28	11,256	72	56
4XØU	21	2,823,916	2029	514
		(Opr: 4X4UH)		
4X4NJ	1.8	150	5	5
	JAPAN			
JG1GGU	A	1,894,617	1529	423
JAØJHA	A	1,568,784	1336	406
JR1RCR	A	1,228,894	1134	382
JI1QPU	A	864,552	965	326
JE3SEN	"	769,242	829	318
JF1SEK	"	687,488	757	328
JA6CNL	"	583,578	663	321
JA3HTT	"	414,195	615	265
JA6BIF	"	334,390	534	238
JA1AOD	"	290,336	488	211
JA8SW	"	171,600	338	176
JE6PWW	"	165,968	329	176
JH1UUT	"	159,632	325	176
JA6LYV	"	140,201	324	157
JA2QVQ	"	138,777	287	167
JA8DIY	"	123,272	299	152
JK1RJQ	"	123,065	289	151
JA6PL	"	110,110	266	143
JA6CM	"	99,774	241	138
JF3CCN	"	91,105	239	133
JA4JKD	"	89,080	234	131
JA6AKV	"	82,276	209	134
JA1EF	"	77,560	217	140
JH7HWR	"	77,552	206	131
JA4HCK	"	53,445	192	105
JA9JKL	"	33,480	145	90
JK1NSR	"	29,584	124	86
JR7HNF	"	26,789	110	89
JH1MTR	"	23,606	111	74
JA4UIT	"	18,176	92	71
JF2PKI	"	17,739	107	73
JN1AJU	"	15,120	81	72
JH2XTV	"	12,084	76	57
JG3ABR	"	9,282	77	51
JA6EZF	"	6,072	53	44
JA1AJA	"	5,920	50	40
JE3EPK	"	5,031	45	39
JA4PA	"	3,302	45	26
JH6GHZ	"	1,536	27	24
JG3WND	"	1,298	30	22
JE7AFM	"	1,092	29	21
JH8RHI	"	300	12	10
JF3PHY	"	18	3	2
JJ1NUB	28	1,262,978	1201	373
JE2PKD	28	546,561	716	279
JJ1WPU	28	441,298	561	286
JF3KNQ	"	319,920	481	248
JL1BLW	"	292,572	454	243
JL1NRR	"	289,907	473	239
JA4VZX	"	157,728	313	186
JA4KWU	"	107,870	252	161
JA1JGP	"	71,168	201	128
JHØALB	"	64,116	206	117
JE2ABK	"	54,656	176	112
JE1PJR	"	49,800	167	100
JA4AQR	"	49,288	154	122
JF2IPU	"	46,710	222	90
JR4BVD	"	19,950	100	75
JR1OYL	"	12,485	79	55
JH8HUG	"	10,752	70	56
JH4KED	"	7,020	64	45
JA7GVL	"	5,863	55	41
JH4QJT	"	5,547	45	43
JA3BBG	"	2,688	36	28
JA1AAT	"	2,106	35	26
JH1JGX	21	1,179,799	1131	373
JA1DCO	21	343,398	529	242
JAØCIY	"	285,855	409	255
JM1FHL	"	272,664	418	252
JK1KNB	"	226,010	345	233
JG3KAB	"	182,400	354	190
JAØRYN	"	167,800	306	200
JA8UJY	"	166,060	302	190
JI1QLB	"	140,686	273	182
JF2IWL	"	134,154	282	174
JI1LLD	"	125,944	247	182
JJ1AEB	"	84,525	228	147
JM1CPA	"	84,140	214	140
JAØTEA	"	72,020	204	130
JH5IRT	"	56,050	174	118
JH7RVD	"	43,857	162	99
JR4MQB	"	43,155	153	105
JR3CVJ	"	23,436	100	84
JA1IT	"	21,175	97	77
JF1FTU	"	19,596	110	71
JH8TDZ	"	12,644	79	58
JA6QDU	"	10,696	67	56
JAØBQB	"	9,310	70	49
JA7KCD/1	"	8,640	60	48
JH4PPQ	"	7,380	60	45
JH7PWS	"	6,165	47	45
JH9AQI	"	5,661	56	37
JR7XKN	"	5,624	52	38
JE7AFN	"	1,875	31	25
JH1BKA	"	1,206	23	18
JA2TKO	14	7,400	54	50
JA3MFE	"	1,968	31	24
JH1FJK	"	1,610	26	23
JA2BAY	7	469,368	611	212
JF3ELY	"	55,348	163	101
JR7NFW	"	4,816	52	43
JR6LDI/6	"	420	14	14
JA2AAQ	3.5	22,436	89	79
JH7LVK	"	10,088	63	52
	KOREA			
HL9DX	28	260,727	428	233
HL9KW	28	56,112	199	112
	MONGOLIA			
JTØYFU	28	20,384	151	98
	OGASAWARA IS.			
JA7RPC/JD1	14	13,568	128	64
	W. MALAYSIA			
9M2KG	A	129,038	496	182
9M2GZ	28	543,750	1711	290

U.S.S.R.

	ASIATIC			
UA9MR	A	478,256	713	284
UA9YCO	A	280,092	998	204
UV9PP	"	152,520	320	186
UA9OO	"	30,248	112	76
UW9SG	"	19,710	88	73
UW9FD	"	18,796	100	74
UA9MBK	"	7,905	81	51
UA9OS	"	2,240	28	28
UA9UAR	28	348,899	917	227
UA9UFJ	28	193,257	550	197
UA9WDM	"	184,851	351	207
UA9YEJ	"	153,048	556	168
UA9OGF	"	143,500	450	164
UA9YEI	"	70,484	308	134
RA9YIJ	"	48,060	198	108
UA9UTF	"	43,780	160	110
UA9CRR	"	20,619	93	79
UA9WFJ	"	15,048	102	76
UA9NS	"	6,272	78	49
UA9BQ	"	5,250	50	35
UA9CMS	"	1,702	26	23
UA9AFG	21	207,900	388	220
UA9UOF	"	32,655	160	105
UA9CFC	"	23,572	98	83
UV9DO	14	191,092	338	202
UA9FBJ	3.5	50,646	129	69
UAØWAY	A	2,047,563	2047	441
UAØSGL	A	778,872	1160	332
UAØKBO	"	361,800	913	225
UAØCCW	"	6,336	48	44
RAØCCM	28	57,330	162	130
UAØSKL	"	34,600	152	100
UAØLFK	"	3,168	33	32
UAØKBC	"	1,650	32	25
UVØEX	"	924	22	21
UAØSAU	21	1,252,184	1737	386
UAØQWB	14	243	9	9
UAØFCL	7	127,070	513	97
	ARMENIA			
UG6LQ	14	468	13	12
	AZERBAIJAN			
UD6DER	21	14,832	84	72
	GEORGIA			
UF6FER	A	26,940	88	60
UF6FFH	28	176,472	390	171
	KAZAKH			
UL7QF	A	739,600	853	344
UL7EAF	28	458,436	860	276
RL7PFW	"	102,712	321	148
UL7GAA	21	84,084	239	156
	KIRGHIZ			
UM8MAO	A	7,020	60	39
UM8MAN	28	112,566	351	146
UM8MDZ	"	300	10	10
UM8MAZ	21	1,317,200	1633	370



HC9A with Dr. Rick Dorsch, HC1MD, at the controls is the World S/O S/B Trophy winner.



Luis, XE1LCH, says this is 4A9LCH, Dog X-Ray, calling CQ during the contest. How about that?

Market Reef by (L to R) Olli, OH2BBM; Jouni; Jari, OH2BU; Henry, OH3JR; Jorma, OH2KI, was special. OHØXX/OJØ was new DX for many. (The pilot is the sixth person in the photo.)

The VK2DDQ group must have found the WC a bit congested for their multi-multi operation. Hi! Hi!

	TADJIK			
UJ8JGJ	21	942,456	1101	367
	UZBEK			
UI8ACU	28	62,678	231	121
	EUROPE			
	ANDORRA			
C31IU	28	847,645	1263	235
		(Opr: FØAXP)		
	AUSTRIA			
OE5CWL	A	354,200	644	200
OE1WWL	"	110,386	265	194
OE1WO	28	10,908	71	54
OE3NPW	21	732,918	818	339
OE1LPW	"	51,534	172	126
OE1DH	14	605,604	901	327
	AZORES IS.			
CT2DQ	A	49,657	202	127
	BALEARIC IS.			
EA6GP	A	285,580	588	262
	BELGIUM			
ON5FV	21	30,820	100	67
	BULGARIA			
LZ2VU	A	520,519	781	313
LZ1RN	"	54,144	300	141
LZ2CC	"	18,816	105	84
LZ2KKZ	"	3,510	47	45
LZ2DB	14	20,493	133	99
	CRETE IS.			
SVØAW/9	A	60,865	171	165
		(Opr: KB2YB)		
SVØAP	28	1,833,728	1805	464
	CZECHOSLOVAKIA			
OK1MSN	A	1,098,556	1129	386
OK3LZ	A	664,092	822	351
OK1KZ	"	333,560	618	269
OK1AFN	"	291,975	488	255
OK1DLA	"	237,626	422	241
OK2BSA	"	124,200	281	184
OK3EA	"	69,384	197	147
OK1EP	"	54,944	165	136
OK2KVI	"	28,302	160	106
OK2EC	"	26,574	116	86
OK2PDE	"	12,528	70	58
OK1XG	"	8,316	76	63
OK1AMS	"	6,336	50	44
OK3CEG	"	5,502	49	42
OK2PBG	"	4,116	50	42
OK2BJR	"	2,300	33	25

OK2KNJ	"	2,232	34	31
		(Opr: OK2BVD)		
OK1KRQ	"	322	14	14
		(Opr: OK1AYQ)		
OK2SWD	"	264	13	12
OK1FAR	28	2,016,420	1715	420
OK3CFA	28	632,244	837	282
OK3KFO	28	249,878	430	206
		(Opr: OK3CMZ)		
OK1AZI	"	151,740	305	180
OK1KYS	"	2,759	32	31
		(Opr: OK1FRF)		
OK1AJN	"	1,950	27	26
OK1AVD	"	1,518	25	22
OK1AGN	21	780,836	954	316
OK1ARI	21	541,304	751	284
OK2BQL	"	75,933	192	143
OK1ASQ	"	8,721	60	51
OK3KII	14	329,334	587	262
		(Opr: OK3CEI)		
OK1FV	14	295,974	565	261
OK3RXA	"	132,225	351	205
		(Opr: OK3ZMD)		
OK1ATE	"	56,624	200	136
OK3YK	"	49,192	223	143
OK3TCK	"	13,125	121	75
OK1DVK	"	5,445	55	55
OK1KTW	"	900	21	18
		(Opr: OK1AAE)		
OK2BBJ	"	308	16	14
OK2ABU	7	117,920	313	176
OK3ZWA	3.5	221,364	451	198
OK3YCL	3.5	110,864	337	169
OK2HI	"	55,118	229	127
OK3KXR	"	25,110	137	93
OK1MIZ	"	4,950	58	45
OK2BRV	"	2,952	44	36
OK3KFF	1.8	17,424	130	66
		(Opr: OK3CQW)		
OK3TOA	"	840	22	20
	DENMARK			
OZ5EV	A	1,644,687	1495	407
OZ3SK	A	1,132,465	1054	395
OZ1FRR	"	178,235	352	215
OZ6EI	"	167,076	369	204
OZ7JZ	"	137,116	300	166
OZ1CAH	"	80,550	230	150
OZ1BUR	"	26,311	110	83
OZ4MD	"	26,208	120	96
OZ9OI	"	3,706	38	34
OZ1DYC	"	528	17	16
OZ1BWF	"	504	19	18
OZ1FTE	28	95,760	247	140
OZ6XR	28	24,168	107	76
OZ1CCB	"	9,450	65	54
OZ7DX	"	2,716	33	28
OZ9HN	"	532	16	14
OZ5VT	7	138,646	334	181

	ENGLAND			
G3VBL	A	3,161,304	2380	498
G3YWI	"	196,819	476	217
		(Opr: G4LNF)		
G2AJB	"	67,392	239	156
G3NT	21	89,999	250	161
G3TKR	7	22,250	112	89
G4JQK	3.5	74,060	175	115
G4IUF	"	32,724	131	101
	FAROE IS.			
OY1A	A	17,170	154	101
	FINLAND			
OH3YI	A	2,738,512	2207	499
OH1CQ	A	233,287	503	263
OH2LP	"	135,801	266	237
OH7NW	"	79,518	243	174
OH1PS	"	51,000	172	102
OH1SZ	"	38,376	173	123
OH6UM	"	34,404	135	94
OH2AU	"	23,994	103	86
		(Opr: OH2BOI)		
OH2VZ	"	16,279	91	73
OH5LU	"	15,732	108	69
OH1BV/2	"	8,960	90	64
OH1FM	"	5,456	46	44
OH4TQ	"	4,982	50	42
OH1PY	"	3,360	36	32
OH5XB	"	1,920	35	30
OH2DN	"	1,323	26	21
OH2CZ	"	690	16	15
OH2BMH	"	455	13	13
OH3BX/2	"	408	12	12
OH2BCV	28	356,402	573	226
OH4PW	28	13,237	92	61
OH5PA	"	1,081	23	23
OH6ZH/1	"	864	21	18
OH1EB	"	731	17	17
OH2BBF	"	18	3	2
OH6DX	21	1,702,736	1645	368
OH4SD	21	300,800	631	188
OH1CX	"	136,348	296	178
OH6PA	"	16,950	86	75
OH1SV	"	15,300	108	75
OH4MM	"	5,461	53	43
OH7XU	"	2,275	37	35
OH2BCD	"	2,268	30	27
OH3TQ	14	45,500	199	140
OH3LA	"	18,424	139	98
OH1HS	3.5	75,456	288	144
OH6CS	"	25,728	149	96
OH2BVI	"	23,496	140	89
	FRANCE			
F6DZU	A	1,052,800	975	400
F6GCP	A	588,455	857	301
F6FHA	"	37,407	156	111
F6FNA	"	20,768	100	88

F6ENT	"	16,104	100	88
F6DRP	"	15,444	106	78
F3IM	"	1,932	31	28
F6CCI	"	520	14	13
	GERMANY (FRG)			
DK5AD	A	1,558,342	1326	437
DLØRL	A	494,270	746	322
		(Opr: DL5AP)		
DLØSA	"	352,638	513	286
		(Opr: DK3QJ)		
DK5DS	"	261,516	455	222
DJ3EJ	"	216,918	393	234
DK9MC	"	210,090	375	235
DF2RG	"	165,690	367	210
DJ2YE	"	93,806	369	178
DF2AO	"	58,947	182	147
DK6BT	"	48,240	160	134
DF6QI	"	28,875	134	105
DF9ZP	"	27,508	133	92
DK8AX	"	15,042	85	69
DF8AN	"	10,362	99	66
DL2YAK	"	6,726	60	57
DK3SN	28	913,008	1151	276
DK5EF	28	405,990	636	234
DF1DR/p	"	194,480	414	170
DL3ME	"	9,798	88	71
DF9YY	21	1,652,440	1547	379
DF3AX	"	39,240	165	109
DK5GX	"	33,810	145	105
DL8PC	14	1,610,648	1459	442
DJØBA	14	300,539	543	271
DL3YAS	"	9,272	101	76
DJ4PT	3.5	745,216	841	328
	GERMANY (GDR)			
Y45RN	A	431,886	636	294
Y24NO/A	A	407,745	575	255
Y38YK	A	327,467	548	287
Y59UN	"	323,259	547	277
Y37UF	"	306,085	603	277
Y53TA	"	279,616	526	272
Y47XF	"	163,618	328	203
Y47VN	"	147,333	337	201
Y48TJ	"	113,844	432	179
Y22RK/p	"	102,765	364	155
Y32ZF	"	101,352	266	164
Y38TI	"	88,872	276	168
Y43XL	"	67,570	233	145
Y36YC	"	48,863	200	131
Y41YN	"	44,109	173	117
Y24RN	"	36,725	155	113
Y33TA	"	36,400	135	112
Y34XF	"	36,084	160	97
Y66ZN	"	32,790	157	110
Y38WI	"	28,356	166	102
Y25TO	"	26,832	120	78
Y48ZN	"	26,663	133	91
Y39PA	"	26,038	126	94

Y57WJ	"	23,226	101	79
Y54ZI	"	20,930	112	91
Y24IF/p	"	20,025	109	89
Y41ZH	"	18,834	105	73
Y25QN/A	"	18,592	122	83
Y32WH	"	17,460	118	90
Y31SK	"	16,974	113	82
Y23MF/A	"	13,446	66	54
Y37XJ	"	10,730	81	58
Y25BL	"	10,419	82	69
Y39XO	"	8,800	60	50
Y27NN/A	"	5,439	65	37
Y34RI	"	5,300	51	50
Y32UG	"	5,292	57	42
Y42VE	"	5,166	43	41
Y23IB	"	4,888	68	57
Y34YF	"	3,690	50	41
Y26GN	"	2,760	32	30
Y26HO	"	2,520	32	30
Y38YG	"	1,824	35	32
Y57YL	"	1,690	29	26
Y62ZH	"	1,426	31	23
Y21HI/A	"	1,166	23	22
Y44WA	"	1,161	29	27
Y56ZF	"	1,122	27	22
Y62ZM	"	660	16	15
Y62XG	"	600	15	15
Y23ZF	"	420	15	14
Y41ZM	"	330	12	10
Y45SA	"	319	11	11
Y43XO	"	280	10	10
Y48ZF	"	225	9	9
Y27FN	28	693,514	963	262
Y79ZL	28	562,020	761	285
Y78XL	28	526,256	800	248
Y2400/A	"	171,159	333	177
Y22TO	"	117,480	312	132
Y31ZE	"	97,482	240	154
Y49RU	"	62,496	185	124
Y54UA	"	54,400	174	128
Y38ZA	"	45,368	150	107
Y53WL	"	27,880	121	85
Y52YG	"	27,579	112	87
Y67ZG	"	16,685	85	71
Y51YM	"	8,281	63	49
Y35XA	"	6,068	53	41
Y53UA	"	377	14	13
Y56WG	"	370	15	10
Y32UC	21	308,580	540	222
Y21JH	21	12,285	83	65
Y37ZE	"	11,648	80	64
Y32VJ	"	10,044	73	62
Y22TD	"	341	11	11
Y51ZE	14	9,490	101	65
Y21XC	3.5	12,784	100	68
Y24LA	"	8,760	81	60
Y32WC	"	6,392	74	47
Y23RB	"	2,508	40	33

	GREECE			
SV0AU	28	955,438	1330	317
	GUERNSEY (C.I.)			
GU3YIZ	7	111,600	206	124
	HUNGARY			
HA5NP	A	1,899,060	1610	465
HA1ZD	"	70,119	220	147
HA0DU	"	61,476	165	141
HG0MM	28	371,229	531	251
HG9KPU/p	28	125,388	286	162
		(Opr: B. Mihaly)		
HA5KD	"	81,871	219	139
HA8VB	21	1,495,116	1552	349
HA9KSD/p	"	15,984	102	72
		(Opr: Szabo Sandor)		
HA4XH	14	1,016,469	1052	423
HA5JI	14	757,112	957	323
HA3MN	"	35,400	207	120
HA3KHC	3.5	59,400	250	132
		(Opr: F. Borstoldi)		
	IRELAND			
EI1DH	28	270,242	519	199
EI7CC	28	217,992	453	186
	ITALY			
IV3PRK	A	3,814,294	2473	562
I0GPP	A	1,603,680	1601	416
I2AT	28	325,374	491	254
I0PSB	21	168,714	390	206
I5FCK	14	1,403,963	1471	451
I6NOA	7	544,744	608	296
I4EML	3.5	270,972	477	234
	LUXEMBOURG			
PA3AIR/LX	A	9,028	78	61
PA0INE/LX	"	6,278	57	43
	MALTA			
9H3AM	A	708,120	1288	360
		(Opr: G3VLX)		
	MONACO			
F6EXG/3A	A	7,740	84	69
	NETHERLANDS			
PA0IJM	A	1,072,473	1168	389
PA0XPQ	A	59,643	189	141
PA0LIE	"	55,096	176	142
PA3ADR	"	23,300	112	100
PA0YN	"	13,115	83	61
PA3ASC	"	6,439	49	47
PA0MIR	28	222,578	386	218
PA0RRS	28	122,764	252	188
PI1PT	"	12,025	69	65
W5SYN/PA	"	1,260	25	20
PA0BDO	"	300	10	10
	NORWAY			
LA3JAA	A	160,696	330	212
LA5HAA	A	52,122	236	146
LA2BBA	"	16,284	106	92
LA9FY	"	8,280	86	45
LA1RN	"	7,616	77	68
LA6UL	"	1,794	32	26
LA4HH	"	1,134	22	21
LA9LO	"	189	9	9
LA7JO	28	1,068,940	1054	388
LA2TO	28	42,834	153	118
LA5YV	21	2,072	28	28
LA6LX	"	1,104	30	23
LA2ZN	14	95,067	370	189
LA7FY	"	6,105	117	55
LA4TG	"	836	22	22
LA1PBA	"	330	15	15
LA8QW	7	106,590	283	165
LA5QK	"	23,660	128	91
LA5YJ	3.5	106,080	305	170
	POLAND			
SP9HWN	A	602,031	830	339
SP8EMO	A	313,876	551	262
SO5DW	A	240,000	511	250
		(Opr: CT1DW)		
SP7KTE	"	230,092	422	244
		(Opr: SP7IFM)		
SP6IHE	"	202,818	469	231
SP9CTW	"	161,229	335	223
SP9FLY	"	156,212	328	196
SP5BSG	"	74,798	216	149
SP6CZ	"	46,706	159	121
SP7AWA	"	46,464	155	132
SP9JPA	"	32,200	127	115
SP3XR	"	30,846	118	97
SP5GTG	"	30,090	192	118
SP3IOE	"	25,728	140	96
SP9AKD	"	24,849	135	99
SP6DYD	"	16,219	86	67
SP6BZ	"	15,810	87	62
SP3CB	"	9,720	61	60
SP5BHY	"	8,344	70	56
SP7FP	"	6,171	61	51
SP6DVP	"	2,856	36	34
SP6FRQ	"	2,117	31	29
SP5GMM	"	1,113	21	21
SP3KEY	28	1,952,416	1838	388
SP6HRK	"	14,190	79	66
SP3FYX	"	9,308	66	52
SP5AD	"	4,640	42	40
SP9FIH	"	3,783	41	39
SP4HKN	"	225	9	9
SP6DNS	21	43,434	138	114
SP2JUU	"	13,370	76	70
SP7DZA	"	8,792	67	56
SP2FAP	"	300	10	10
SP8GQU	14	333,190	600	286
SP6JLL	14	109,292	345	178
SP9FSH	14	88,963	260	179
SP6HTQ	"	56,592	234	144
SP9BRP	"	34,572	203	129
SP6JIR	"	30,058	197	113
SP3IEZ	"	19,292	132	91
SP2AYC	"	18,450	151	90
SP9AVZ	"	18,090	139	90
SP7ETG	"	12,403	109	79
SP5INZ	"	6,776	64	56
SP6GPJ	"	5,782	78	49
SP9CLO	"	4,312	60	49
SP1LJO	"	2,829	55	41
SP8HXN	"	918	28	27
SP5EAQ	"	510	15	15
SP3DOI	7	148,248	238	142
SP9EMI	7	37,400	170	110
SP9CXM	"	13,600	100	68
SP9HZF	3.5	44,840	209	118
SP9LLE	3.5	33,496	179	106
SP9LDI	"	20,584	127	83
SP1DTG	"	15,352	106	76
SP7PBC	"	15,244	114	74
SP9DST	"	12,740	99	70
SP5IVC	"	12,012	96	66
SP5INQ	1.8	7,872	83	48
SP9DH	"	2,480	40	31
SP5AGT	"	390	17	15
	PORTUGAL			
CS0BY	A	209,664	382	224
		(Opr: CT1BY)		
CT4MS	"	11,456	75	64
CS0OF	28	1,505,602	1660	427
		(Opr: CT1OF)		
CT1AHU	"	22,064	143	112
CS0UA	14	1,233,412	1320	404
		(Opr: CT1UA)		
	ROMANIA			
YO6KEI	A	1,286,194	1077	481
		(Opr: YO6AWR)		
YO6AFP	A	127,627	283	179
YO6BEH	"	127,038	401	186
YO7APA	"	100,464	256	184
YO3CR	"	46,604	180	122
YO8BDA	"	12,120	101	60
YO1K	28	1,876,925	1726	389
		(Opr: YO3JW)		
YO6KNI	28	10,800	68	60
		(Opr: YO6AZL)		
YO3AWT	"	2,222	40	22
YO4AYE	21	42,291	169	127
YO9HT	14	77,958	282	183
YO8BSE	"	34,375	218	125
YO3KSC	7	208,552	390	199
		(Opr: YO8BDB)		
YO4BXX	3.5	10,830	96	57
YO5CMU	"	6,600	68	50
YO6LV	"	6,360	61	53
YO6BTY	"	1,890	35	27
YO2CNY	"	1,792	34	28
	SARDINIA IS.			
IS0WON	28	671,944	937	284
	SCOTLAND			
GM3RAO	A	613,677	839	337
	SHETLAND IS.			
GM4GPN	A	392,472	691	316
	SPAIN			
ED1ABT	A	3,172,260	2441	490
ED7ATE	A	336,654	770	317
EG4CN	A	42,826	186	133
EA2CR	"	16,954	125	98
EA1JO	"	13,932	93	81
EA2ZE	"	8,308	90	62
EA1DM	"	2,847	42	39
EA3RCI	"	2,600	46	40
EA7VE	"	2,263	32	31
EA2XX	"	2,109	46	37
EA2OJ	"	1,584	27	24
EA7BWY	"	364	14	13
EA7AZJ	28	663,520	820	377
EA2AEA	"	23,800	122	85
EA2QU	21	346,880	537	256
EA7BDL	21	107,520	353	210
ED1PJ	14	809,100	1237	372
EA5AMR	"	32,226	172	123
EA3CSS	"	29,869	170	119
EA2ABJ	"	26,442	158	113
EA7ALG	7	11,608	81	68
EA5ANR	3.5	11,122	88	67
	SWEDEN			
SM0BDS	A	106,575	252	175
SM7AIO	A	92,565	236	165
SM0JOQ	A	86,996	243	182
SM7IWN	"	61,008	190	124
SM5BDV	"	21,588	105	84
SM6JY	"	17,112	118	92
SM4JEL	"	15,770	104	83
SM0CHA	"	14,042	80	59
SM0MC	"	2,028	26	26
SM5IMJ	28	35,568	135	104
SM5ARG	28	28,244	120	92
SM7IMK	28	25,830	124	82
SM5ALD	"	17,316	87	78
SM7KCG	"	16,296	114	56
SM6IBF	"	11,160	73	62
SM2BUW	"	10,047	83	51
SM0LPO	"	6,946	75	46
SM6LIF	"	4,056	42	39
SM7KVZ	"	3,520	38	32
SM6FGP	"	2,970	33	30
SM0FM	"	2,407	31	29
SM2KEN	"	416	16	16
SM0LEA	"	225	9	9
SM2LKW/0	"	65	5	5
SM0TW	21	33,136	131	109
SM7TV	"	19,090	107	83
SM5CMP	14	251,056	553	272
SM6BGG	14	216,648	418	216
	YUGOSLAVIA			
YT2D	A	1,121,549	1115	403
		(Opr: YU2RA)		
YU1NZW	A	175,275	360	225
YU7NWJ	"	172,568	370	212
YU5XAF	"	18,525	100	95
YU4VWO	"	7,854	56	51
YU3EW	28	3,191,181	2369	483
YZ3BO	28	2,812,293	2247	459
		(Opr: YU3BO)		
YU2BOP	28	1,787,940	1614	387
YU2CFH	"	524,385	673	271
		(Opr: Nenad Bunoza)		
YU7SF/M	"	28,830	115	82
YU7ORQ	"	2,296	32	28
YU2CB	"	319	12	11
YU7NZR	"	176	8	8
4N3EY	21	3,634,755	2671	501
		(Opr: YU3EY)		
YU7ECD	21	1,691,328	1716	383
		(Opr: YU7QDA)		
YU2CZA	21	1,462,473	1441	387
		(Opr: YU2OB)		
YU2OG	"	1,345,617	1366	371
4N3ZV	14	3,586,240	2553	560
		(Opr: YU3ZV)		
YU1NUF	"	792,981	975	369
4N3APR	3.5	729,736	795	332
		(Opr: YU3DM)		
YU3DBC	3.5	283,584	473	224
YZ9HDE	"	231,340	525	215
		(Opr: M. Levanic)		
YU4VML	"	4,312	58	44
4N3EF	1.8	43,740	207	90
		(Opr: YU3EF)		

U.S.S.R.

	EUROPEAN			
UA6LLT	A	1,077,967	1021	473
UA3QDW	A	652,800	973	320
UA6ALL	A	411,026	651	314
UV3DN	"	405,416	702	271
UW6LC	"	316,774	653	298
UW4CI	"	292,521	576	281
UA3TN	"	250,299	464	261
UW3ZU	"	148,740	370	268
UA6UDB	"	109,980	354	195
UV3MM	"	82,425	219	157
UA3AAH	"	46,287	175	139
UA1AET	"	43,608	183	138
UA3DQS	"	43,296	165	123
UA3VFI	"	41,272	159	134
UA4FCZ	"	40,716	167	116
UA6WS	"	37,252	173	134
UA4NAA	"	22,795	123	97
UA4CO	"	22,724	107	76
UA4CDC	"	20,240	116	88
UA3DJS	"	14,301	80	63
UA3TAG	"	13,311	107	87
UA3TAM	"	12,549	111	89
UA3HE	"	9,702	77	63
UA4CM	"	6,360	58	53
UV3CS	"	6,300	80	63
UA4PWW	"	4,972	51	44
UA6HAC	"	2,821	33	31
UA4ACP	"	1,482	33	26
RA3DKE	28	202,122	400	197
UZ3TG	28	137,618	380	158
UA3QAQ	28	112,640	282	160
UA6LDJ	"	93,233	251	133
UA6PCJ	"	72,980	224	178
UA3TEP	"	72,062	209	137
UW3RR	"	71,672	217	136
RA3PDT	"	64,080	233	120
UA6HFG	"	60,450	214	130
RA3DPD	"	41,405	163	91
UA3ACJ	"	22,428	99	84
UA3DNU	"	19,734	95	78
UA3TBK	"	16,320	96	80
UA3DAT	"	10,324	69	58
UA3AKC	"	8,944	76	43
RA6YBV	"	3,465	43	33
RA3DDU	"	2,912	36	28
UA3RFW	"	912	20	19
UA3ACD	"	465	15	15
UA3DLD	"	448	14	14
UA3TDK	"	325	13	13
UW3HV	21	686,725	901	325
UA6LBC	21	619,760	839	305
UA6BV	"	65,335	221	179
UA1MU	"	43,956	150	111
UA3PAV	"	5,452	60	58
UA3PAU	"	99	9	9
UW1AE	14	211,905	442	255
UA6AKB	14	92,640	300	193
UA3DKT	"	56,376	247	162
UA1CAI	"	34,611	199	139
UA4UAR	"	19,400	137	97
UK1AAA	"	1,850	40	37
		(Opr: UA1-169900)		
UA4UBC	3.5	43,600	210	100
	BYELORUSSIA			
UC2OAZ	28	73,923	219	123
UC2WBJ	3.5	52,644	232	107
	ESTONIA			
UR2DU	A	55,998	218	153
UR2RKS	"	1,564	24	23
UR2OV	"	444	13	12
UR2QD	28	331,968	539	228
UR2RAM	28	189,399	351	203
UR2RSA	"	133	7	7
UR2FU	14	22,374	140	113
UR2RHK	3.5	62,068	258	118
UR2RKV	"	4,704	73	48

The VP1ØA crew had a great time. Standing (L to R): KBØU, WAØTKJ, W6FN, KØBJ. Kneeling: NØBNY, KØTLM. We appreciate their special effort.

ZZ5EG, a special call by PY5EG, was the world high on 28 MHz.

The JARL special prefix station 8J3XPO was a multi-multi operation by the JA3YKC Club group.

A first contest by Eric, VE3IUE, at Barbados as 8P6PF on 28 MHz was a 2-million-plus score success. He's also known as GM4JJA. Vy FB.

TROPHY WINNERS

SINGLE OPERATOR - ALL BAND

WORLD - North Florida DX Assn. Trophy. Won by: **Pedro Piza, Jr., NP4A.**
U.S.A. - Bob Epstein, K8IA Trophy. Won by: **Terry Baxter, N6CW.**
CANADA - Garth Hamilton, VE2VY Trophy. Won by: **Hal D. Hickey, VE7BTV.**
CARIB./C.A. - Ray Alea, KC4OV Trophy. Won by: **Station VP2MGQ. Opr. Ronald Uthus, N4MO.**
EUROPE - Bernie Welch, W8IMZ Trophy. Won by: **Pierluig "Luis" Mansutti, IV3PRK.**
JAPAN - Palm Garden Radio Club Trophy. Won by: **Masuaki Ohshima, JG1GGU.**
S. AMERICA - Ron Moorefield, W8ILC Trophy. Won by: **Station 4M2AMM. Opr: Sergio G. Pontoni Bulfoni, YV2AMM.**
WORLD-QRPp - Dayton Amateur Radio Assn. Trophy. Won by : **Gene Walsh, N2AA.**

SINGLE OPERATOR-SINGLE BAND

WORLD - John N. Reichert, N4RV Trophy. Won by: **Dr. Rick Dorch, HC9A.** (21 MHz)
U.S.A. - Richardson Wireless Klub Trophy. Joe Johnson, W5QBM Memorial. Won by: **Bob Wruble, AI7B.** (21 MHz)
U.S.A. - 7 MHz-William Diggins, WA8LXJ Trophy. Won by: **Gary Pence, KM5X.**
U.S.A. - 21 MHz-Ted Pauck, Jr., K8NA Trophy. Won by: **Station N6RO. Opr. Tom Poland, N9NC.**
CANADA - Gene Krehbiel, VE7KB Trophy. Won by: **Stewart G. Hoar, VE7ZZ.** (21 MHz)
EUROPE - Myron E. Crofoot, WB4VQO Trophy. Won by: **Tine Brajnik, 4N3EY.** (21 MHz)
JAPAN - Ken Ruddock, K6HNZ Trophy. Won by: **Yoshihiro Unno, JJ1NUB.** (28 MHz)
WORLD - 21 MHz-Lee Wical, KH6BZF Trophy. Won by: **Thomas L. Viselli, Jr., EL2AV.**

MULTI-OPERATOR, SINGLE XMTR.

WORLD - Mike Badolato, W5MYA Trophy. Won by: **Station VP5RFS. Oprs. Gordon Fogg, N5AU** and **Ray Sawtelle, KC5EA.**

MULTI-OPERATOR, MULTI-XMTR.

WORLD - Henry Thel, VE7WJ Trophy. Won by: **Station KH6XX, Randy Sobol** and **Oprs. AH6BK, KH6LW, KH6ND, KH6NO, WH6ABM, K7TI/KH6.**
U.S.A. - Bert Curwen, KL7IRT Trophy. Won by: **Station AI6V, Carl Cook,** and **Oprs. AA4KB, N6KT, N6RO, N6RZ, WA6OCV, WA6VEF, WB6SHD.**

CONTEST EXPEDITION

WORLD - Northern Ohio DX Assn. Trophy. Won by: **Station ZF2EO. Opr. Steve Gecewicz, KØCS.** (3.5 MHz)
SPECIAL CQ AWARD: Station VP1ØA.

(**NOTE:** The **WORLD-Club Competition** Trophy & the **U.S.A. Club Competition** Trophy will be announced with the C.W. results as each is a combined S.S.B. & C.W. award.)

CSØUA operated by CT1UA made many prefix hunters happy. New, rare, and special prefixes are always in big demand in the WPX Contest.

		KALININGRAD		
UA2EC	28	29,388	112	93
		LATVIA		
UQ2GDQ	A	2,430,268	2023	467
UK2GAB	"	17,384	102	82
		(Opr: UQ2-037100)		
UQ2DZ	28	261,051	508	217
UQ2GCP	"	15,544	89	67
UQ2GAG	3.6	197,784	436	201
		LITHUANIA		
UP2BAO	A	592,712	843	344
UP2BOX	A	86,548	346	154
UP2BDO	"	60,384	186	136
UP2NO	"	28,560	175	112
UP2DM	28	329,200	583	200
UP2BEX	28	90,280	232	148
UP2BHI	"	33,835	135	101
UP2OQ	"	27,984	114	88
UP2PAW	21	90,200	240	164
UP2AV	"	58,426	215	131
UP2ND	"	42,680	163	110
UP2PCB	14	181,420	519	235
UP2BAS	"	34,810	190	118
UP2NL	"	6,612	92	57
UP2PAQ	7	47,760	191	120
UP2OU	3.6	226,032	492	204
UP2BAW	1.8	51,474	376	69
		MOLDAVIA		
UO5OEK	28	41,580	167	99
UO5GR	3.6	3,008	40	32
		UKRAINE		
UB5LCV	A	2,329,216	1822	496
UB5VAZ	A	673,218	810	351

UB5ECH	A	281,728	551	248
UY5TE	"	186,048	366	204
UY5OO	"	34,944	131	104
UB5UCH	"	9,238	67	62
UB5MFU	"	5,106	68	46
UB5FDF	"	4,928	53	44
UB5UBU	"	2,916	37	36
UB5AAF	"	969	19	19
UB5LAN	28	296,832	556	192
UB5KAN	28	161,655	292	195
RB5MHY	28	120,840	272	190
UB5UKO	"	95,995	232	161
UB5DBV	"	92,612	210	169
UB5UGD	"	81,375	191	155
UB5VAA	"	60,759	186	129
UB5IPN	"	39,375	156	105
UB5ICS	"	36,733	148	109
UB5MLP	"	27,755	133	91
RB5IOV	"	25,756	117	94
RB5ADF	"	22,572	113	76
RB5GCJ	"	14,570	95	62
UB5VDA	"	10,712	81	52
UB5GEI	"	6,298	56	47
UB5ZDK	"	2,349	33	29
UB5QFC	"	1,794	31	26
UB5VCD	"	90	6	5
UB5MDL	21	1,623,232	1556	416
UB5ABK	21	480,872	697	277
UB5ABJ	"	15,096	80	68
UB5HCW	"	12,950	91	74
UY5YY	"	4,284	60	51
UB5LAE	"	2,844	43	36
UB5UCJ	14	109,568	276	214
UB5HCW	"	39,501	210	133
UT5HP	"	17,658	135	109
UB5PBA	3.6	139,664	380	172
UB5WCW	3.6	106,020	317	155

OCEANIA

		AUSTRALIA		
VK6IH	A	1,251,220	1183	365
VK6YL	A	363,308	507	253
VK1RJ	A	273,531	434	219
VK3SM	A	229,827	371	213
VK2PJJ	A	133,860	343	138
VK2BQS	"	71,724	197	129
VK3PU	"	39,087	128	101
VK6AJW	28	1,164,660	1218	329
VK6NE	28	377,504	516	251
VK6FS	"	324,346	464	253
VK6NLV	"	78,848	350	77
VK3VOE	28	43,035	161	95
VK6JS	"	7,399	55	49
VK8BE	"	7,260	55	44
VK5NGC	28	6,118	48	46
VK5OU	14	392,224	499	272
		HAWAII		
WH6AMR	28	857,061	1192	243
KH6B	"	260	10	10
KH6IJ	21	6,900	50	46
		INDONESIA		
YB2SV	A	492,030	794	213
YC7UE	21	37,177	113	60
YC0BJH	"	7,800	57	52
		MARSHALL IS.		
N6HR/KX6	A	3,394,440	2784	420

		NEW ZEALAND		
ZL4BO	28	2,014,320	1837	385
ZL2BED	28	304,261	607	181
		PHILIPPINE IS.		
DU1CPL	28	334,435	871	211
KP4KK/DU2	21	1,789,912	2032	296

SOUTH AMERICA

		ARGENTINA		
LU8FEU	28	2,315,250	1760	441
LU2KAK	28	148,860	283	180
LU1ABT	"	25,080	114	76
LU5FGG	21	1,274,844	1154	372
		BRAZIL		
PP2ZDD	A	1,857,044	1533	406
ZZ4DD	A	354,584	474	254
PY8HP	A	201,912	364	188
ZZ5CA	"	199,600	347	200
PY2FOS	"	85,550	207	145
ZY1NEZ	"	62,444	166	134
PY6FH	"	61,952	163	128
PY6AAZ	"	39,501	133	99
PT7TP	"	30,051	97	81
PY2BSW	"	18,904	98	68
PY2LT	"	13,280	90	80
PY5LK	"	4,068	40	36
PY6ABZ	"	2,520	30	30
PY5VM	"	330	11	11

ZZ5EG	28	4,868,780	2830	581
PQ4SA	28	803,725	834	325
PT7AEE	7	486	9	9
PY4XVP	3.5	11,004	50	42
PY2RHL	"	6,864	44	33
PY2TTV	"	2,058	22	21
PY5XFR	"	342	11	9
		CHILE		
CE6EZ	28	3,756,480	2783	455
		EASTER IS.		
WA1SQB/ CE0	A	2,278,584	2012	378
		ECUADOR		
HC9A	21	6,025,770	3300	615
		(Opr: HC1MD)		
		NETH. ANTILLES		
W1BIH/PJ2	21	617,232	790	264
		PERU		
OA4AWD	3.5	68,748	143	102
		TRINIDAD & TOBAGO		
9Y4VU	21	3,685,248	2456	504
		URUGUAY		
CX7BY	28	2,957,511	2120	467
		VENEZUELA		
4M2AMM	A	4,516,045	2416	565
YV3ANG	"	5,964	50	42
YV4BOU	28	156,450	511	105
YV2IF	14	706,680	837	302
4M3AZC	7	1,371,214	797	299

STATION OPERATORS

MULTI-OPERATOR SINGLE-TRANSMITTER

K7RI & K7UR, W7WA. **N4WW** & N4EF, N4SA, WB4YFF. **KK5I** & K5JZN, N5CG. **N4MM** & N8II. **AJ6O** & N5FA, N6BUW. **KN5A** & KD4M, K5GN, K5KG. **KD8B** & AC8Y, N8AW, N8BNE, K8LF, KA8AEE, WB8RXN, WD8MBB. **AA4VK** & K4NYV, WA4JJW, WA4TLI. **W9ZRX** & KC9C, N9MM, W9OBF. **KD6PY** & K6RTC, N6MG. **KC9U** & KA9DON, WA9EKA, WD9IIX. **AK0A** & K0RWL, K0VBU, KA0AQZ, KA0DGR, W0VWW, WA0ZHY, WB0LFY, WD0HTC. **KC4B** & AA4M. **WB5DDI** & KA5KCQ, KA5KFM. **KI2S** & KA2DLK, KA2HMN, KB2MG, WA2LBB, WB2KEV, WA2PVV, WB2KEX, WB2VYB. **KB9BR** & N9LE. **WB7CLU** & WB7WQE. **W7DG:** KA7CIY, KA7CRN, KA7CRO, KA7HWE, KB7QC, KB7QD, KB7QM, KB7QN, KF7D, WA7ILC. **N5JJ** & N5CDO. **WA0CGV:** AJ0S, K0MYD, KA0GRH, KA0GWN, KB0HL, KB0TU, N0BRO, N0BZE, N0CEK, N0CER, N0CCO, WA0YVB, WB0OEE, WD0FSJ, WD0GML, WD0HBN, WB5CLW, N8AFD, AI9G, W9NQU. **WA5SOG** & WA5VWH. **W3YFV** & WB3IXG. **KA1AAD** & K1JYM, K1ZZJ, KA1BVN, KA1FEG, KA1GMX, KA1MO, KA1NJ, N1AEQ, N1AWO, N1BHU. **AE8W** & K8CQF, K8MK, K8OT, KA8IOX, N8BZT, WD8RIN. **WV2ZOW** & WA2NDV, SM6ARV. **WD6BZS:** WD5JMC, KB7FX. **VP5RFS:** KC5EA, N5AU. **VP2MCL:** K1ZZ, KA1EKY. **VE1DXA:** VE1FH, VE1AIH, VE1AVX. **VE6OU** & VE6KW, VE6WQ. **VP1GA:** K0BJ, K0TLM, KB0U, N0BNY, WA0TKJ, W6FN. **TF3DC/OX:** OX3CS, OX3ZM, TF3DC, TF3YH. **VE7UBC:** VE7BGK, VE7CKK, VE7CKU, VE7CMK, VE7CMN, VE7CNY, VE7COR, VE7CPT, VE7CXC, VE7CXN, VE7DES, VE7FFI. **VE7ZZZ:** VE7EMX, VE7ENF, VE7ENI, VE7SK, VE7VX, VE2EUB, VY1DD. **HP1XOG** & KA0HYH/HP1, N3BLS/HP2. **KL7IF** & KL7KV. **JH7YJF:** 5 Ops. **JA4YFH:** JH4BXA, JH4DIT, JH4FMI, JH4MVB, JH4SQJ, JR4TKR, JG3IIO. **JA7YAA:** JG1UJD, JA7WBW, JH7AEF, JH7CUO, JH7GFO, JH7RVD, JH7UJN, JH7WTC, JR7OMD, JR7SEI, JR7UVL, JH8BME. **JH3YJM:** JA3BAG, JA3HVC, JA3IXL, JA3MMQ, JA3XGF, JE3CJZ, JH3FJG, JH3QKV, JR3EOI. **JA8YXI:** JA8ERG, JA8JCR, JA8OYC. **JG1YFF:** 3 Ops. **Y24UK** & Y21YK, Y23EK, Y24TK. **IN3DYG** & I3EVK, I3FIY, I3MAU, I3ON, I1DFS. **4N4Y:** YU4FRS Ops. **HG1W:** HA1YA & 5 Ops. **SM5GMG** & SM0GNU. **HG6V:** 6 Ops. **G6UW:** G3ZAY, G3ZHL, G4BAH, G4BUO, G4FAM, BRS32525. **IY4FGM:** I1YUM, I4JMY, I4OUT, I4YNO, I4YSS, I4ZNU. **LG5LG:** SM0AJU, SM0DJZ. **PA2TMS** & PE1DTU, PA2161. **OK6OK:** OK1AEZ, OK1JCW, OK1JKT, OK1JWA, OK1SF, OK1WT. **SL2ZZU:** SM2CEW, SM2EKM, SM2EUO & Computer Crew. **OH0XX/OJ0:** OH2BBM, OH2BU, OH2KI, OH3JR. **G3RRS:** G3SJK, G3UKS, G3VPW, G4CEB, G5CMX. **HB9BLQ** & HB9AIB, HB9BAL, HB9ZE. **HB9AOO** & HB9AMK, HB9BEI, HB9BMR, HB9SM. **SM0AQD/OH0** & SM0DRB, SM0GMZ, G4JVG. **Y44ZI** & Y24RK, Y26DI, Y31WI, Y44VI, Y44XI. **HG5A:** HA5FM & 8 Ops. **GW4BRS:** GW4DZE, GW4JOG, GW4KHQ, GW4LFV. **DL0WW:** DA1FM, DA1GI, DA1HV, DA1UY, DA2DE, DA2TN, DF1ZE, DF7ZP, DK8WD, DL3ZA, DL8EZ, DD9FB. **I2PHN** & I2ACC, I2PJA, I2SGE, I2XAV, I2ZZZ. **LZ1KDP:** 3 Ops. **HA6KNB:** HA6NP & 6 Ops. **SK6AW:** SM6CVE, SM6CVT, SM6DER, SM6EHY, SM6FJB, SM6FMB, SM6HCX, SM6LGW. **DL0UE:** DF2OK, DF3AV, DJ5FT, DL3LU, DL7BI, DL8RL, DD3OE. **OH8MA** & OH8MV, OH8PF. **GB3WRR:** G3DSM, G3ZGA, G4GDL, G4DXA, G4GYL, G4IDJ. **G8JC:** G3TQD, G3TQZ, G4FWR, G4GAA, G4KTW, G8ASO, G8NSL, G8XAQ, G8XRF. **SK7HW:** SM7BUR, SM7DBD, SM7EKU, SM7MO, SM0IFK. **DK5XN/OH0** & DK6XR. **OK3VSZ:** OK3EK, OK3ZAF. **HB9BUN** & HB9CGN. **HA5KDB:** HA7UX, HA7VM & 4 Ops. **HA7KPL:** HA7PL, HA7PQ, HA7PR, HA7SH, HA7SQ, HA7UG. **HA4KYH:** HA4XG, HA4XX, HA4YO, HA4YQ, HA4-001. **HA1KZZ:** 6 Ops. **OH3AA:** OH3IQ, OH3KS, OH3WS. **HA5KFN:** HA5PA, HA7SU & 4 Ops. **F8WE** & F6CUH. **OE3ALW** & OE2VEL. **IT9WPO** & IT9RYJ, IT9UJV, WB7RHT. **G4JJE** & G4CVZ. **Y31ZA:** Y31OA, Y31PA. **DF0BV:** DL1MAY, DL5MAE, DL7MAE. **HA3KNA:** HA3NS, HA3NU & 3 Ops. **SK7GC:** Club Gp. **DH8AAB** & DK8KW, DL6PE. **LA4O:** LA6WW, LA9HW, LA0BS. **SP9PRO:** SP9LJD, SP9-3021, SP9-3110, SP9-3367, SP9-3405. **YU5FBE:** 6 Ops. **OK3KAP:** OK2CGI & Club. **HA6KNX:** HA6NO, HA6NW, HA6OD. **HA8KAX:** 5 Ops. **EA5RCG:** EA5ACN & Club Gp. **OK1KUR:** OK1AYE & Club. **OK2KWU:** OK2JK, OK2PJK. **Y42ZJ** & Y42VJ, Y42WJ, Y42YJ. **Y55ZG** & Y55XG, Y55YG. **HA5KMB:** HA5CQ & 1 Op. **Y46ZF:** Y46RF, Y46TF, Y46WF. **HA9BVK:** 2 Ops. **SP7KTF:** Club Gp. **DK0LO:** DH9SAF, DK1HZ, DK6SH, DL2SAE, DL2UH, DL9SAD. **4N7TT:** 4 Ops. **SP3KBJ:** SP3LPG & Gp. **Y33ZO:** Y33CO, Y33FO. **SP9KAD:** SP8HRA, SP9BOR, SP9BPJ, SP9LWC. **PI1ARS:** Club Gp. **SP5ZBL:** SP5ITD & Boy Scouts. **Y32ZE:** 3 Ops. **OZ7BG** & Logkeeper. **OK1KIR:** OK1DAI & Club. **OK2KYC:** Club Gp. **SP6KGN:** 2 Ops. **YU3DEM:** 3 Ops. **OK2KMR:** OK2BQZ & Club. **OK1KZE:** 2 Ops. **SP9PZF:** 3 Ops. **HA1KSA:** Club. **LA7V:** LA1RN, LA1SN. **AH2E** & KB7IJ/AH2, KG6DX, N4ADJ/KH2. **ZL2AH** & ZL2IR, ZL2QA, ZL2TYA & Peter. **KA1AA:** KA2AA, KA2AK. **ZL3BK** & ZL3GI. **HK3AFD** & HK3AXT, HK3TF, K3ZO/HK3. **PP5CIT:** PP5AJ, PP5CAX, PP5DT, PP5HF, PP5MQ, PP5WAQ. **UK0QAA:** UA0QAS, UA0QBB, UA0QCA, UA0-09874. **UK7PAL:** UL7PAE, UL7PAO, UL7PBI, UL7PBY, UL7PCZ. **UK9AAA:** UA9AFV, UA9AGQ, UA9AKJ, UA9AKO, UA9-165631. **UK9FER:** UA9FAL, UA9FAR, UA9FDL, UA9FDW, UV9FN. **UK9CCC:** UA9CRF, UV9CI, UA9-154309, UA9-154310, UA9-154816, UA9-1541057. **UK9JAJ:** RA9JAQ, UA9JAF, UA9JAZ, UA9WO. **UK9SAD:** 4 Ops. **UK9XAN:** UA9-090426, UA9-090445, UA9-090484. **UK8MAF:** Club Gp. **UK0AMM:** UA0-103235, UA0-103267. **UK9OAE:** Club Gp. **UK0CBA:** 3 Ops. **UK9WBY:** 2 Ops. **UK7NAQ:** UL7NAC, UL7NBN. **UK0CAA:** 3 Ops. **UK6APA:** UA6APA, UA6APW, UA6ARA, UA3PCW. **UK6APA:** UA6APA, UA6APW, UA6ARA, UA3PCW. **UK6LAZ:** UA6LHK, UA6LIG, UA6-150262, UA6-1501060. **UK2GKW:** UQ2GKM, UQ2OI, UQ2-037831, UQ2-0371037. **UK2PCR:** UP2BBT, UP2BCR, UP2BCT, UP2BDF, UP2BFL, UP2BFN, UP2BIO, UP2BJO, UP2PAV, UP2PCI. **UK5MAF:** RB5MUV, UB5MDC, UB5MNM, UB5MNX, UB5MOA, UY5LK. **UK2RDX:** UR2RCN, UR2RRJ, UR2-083159, UR2-083160, UR2-083161, UR2-083462. **UK2BBB:** UP2BBB, UP2BIJ, UQ2GFN. **UK4FAV:** UA4FBL, UA4FCM, UA4FCR, UA4FDS, UA4-148273. **UK2PAP:** UP2BIC, UP2OX, UP2-0381617. **UK2RBA:** UR2EJ, UR2MG, UR2QI, UR2RDP, UR2REN, UR2RKB. **UK2PRC:** UP2BIL, UP2-038469. **UK3SAB:** UA3SAQ, UA3-15125, UA3-15128, UA3-151311. **UK4PNZ:** Club Gp. **UK6LAI:** UA6-150820, UA6-150852, UA6-150888, UA6-150994. **EN3D:** UA3DJN, UA3DKA, UA3DKF, UA3DKU, UA3DRB, UV3HD. **UK3R:** UA3AKR, UA3FG, UA3HK, UV3EA, UA3-170239, UA3-170320. **UK4WAB:** 4 Ops. **UK3XAA:** UA3XCH, UA3XM. **UK4ABZ:** UA4AKL, UA4-15672, UA4-156732. **UK5QBE:** UB5QBG, UB5-064900, UB5-0641361, UB5-0641362, UB5-0641441. **UK2GBL:** UQ2-037218, UQ2-037219. **UK3DBG:** 5 ops. **UK3WAA:** UA3-135237, UA3-135263, UA3-135305. **UK2RAC:** 3 Ops. **UK6LWA:** UA6HKG, UA6LYJ, UA6-150643. **UK3WAF:** 9 Ops. **UK4CAO:** 3 Ops. **UK2WAR:** 3 Ops. **UK5ICD:** 3 Ops. **UK6ACG:** UA6-101630, UA6-101632, UA6-1011651. **UK5ICX:** 3 Ops. **UK2BAG:** UP2BAA, UP2BZ. **UK3MAX:** UA3MDE, UA3-1687, UA3-168112. **UK4CBB:** 3 Ops. **UK2AAX:** UC2-008119, UC2-009523, UC2-009613. **UK5ZBW:** 3 Ops. **UK2RAQ:** 3 Ops. **UK4LAZ:** 2 Ops. **UK5HAB:** UB5HEW, UB5-07173. **UK6ACR:** 3 Ops. **UK4CAC:** Club Gp. **UK1ZBB:** 3 Ops. **UK6HBK:** UA6-1081574, UA6-1081588, UA6-1081593. **UK6XAA:** 2 Ops. **UK4PAA:** UA4PDT, RA9FFR. **UK2RAH:** 2 Ops. **UK3DBV:** 3 Ops. **UK5FAB:** UB5FDP, UB5-070427, UB5-070436. **UK5JDF:** 3 Ops.

MULTI-OPERATOR MULTI-TRANSMITTER

KH6XX & AH6BK, KH6LW, KH6ND, KH6NO, WH6ABM, K7TI/KH6. **YT0R:** YU1EW, YU1UU, YU2RYU, YU7ODO, YU7ODS, YU7OQZ, YU7PEJ, YU7QBC, YU7QDW, YU7QOI. **AI6V** & AA4KB, N6KT, N6RO, N6RZ, WA6OCV, WA6VEF, WB6SHD. **KL7RA** & AL7AF, AL7CG, KL7IVX, KL7Y, NL7V. **GB4ANT:** G3GWI, G3JOC, G3IOR, G3MPN, G3NXQ, G3VZT, G3XLL, G4BTY, G4BWP, G4DRS. **KL7IRT** & AL7Z, KG7V, KL7AY, KL7AZJ, KL7ENY, KL7GL, KL7JIZ, KL7LF, NL7L, NL7P, WL7AKS. **OH1AA:** OH1IG, OH1LW, OH1NH, OH1SW, OH1SY, OH1ZE, OH3ZE, OH6JW. **UK5IAZ:** UB5IHO, UB5-073342, UB5-0731151, UB5-0731249, UB5-0731277, UB5-0731619, UB5-0733137, UB5-0732077, UA6-150737. **KF2U** & KB2XZ, N2ME, N2MM, N2RM. **VK2DDQ** & VK2BLC, VK2BVS, VK2BXQ, VK2DGX, VK2PDW, VK2PGV, VK2VAG, VK2YWO. **AD8R** & AJ8K, KB8YN, KG8B, KI8Y, N8BSI, N8BXQ, N8CEC, WA8TBQ, WA8TZP, WA8YVR, WD9COA. **W3GM** & K3GM, K3ND, K3OA, K3RL, K3VW, W3FV, W3RJ. **K3WW** & WA2SFB, K3WJV, KB3AG, KB3GJ, N3EC, W3BGN, WA3VLB, WA4ARV. **WB8JBM:** K8DB, K8US, KA8JCI, KA8LFP, N8ATR, N8CHJ, N8DH, WB8DQP, WB8LSN, WB8VPA, WB8YQJ, WD8IJP. **KG2Y** & AK2F, KA2CDE, KA2JFT, KA2KJQ, KF2X, KG2Z, N2BCX, N2BLX, N2CIC, N2DE, N2HR, WA2PHD, WB2DDE, WB2FDN, N6IN, DK9PO. **8J3XPO:** JA2VUP, JH3KWQ, JH3PKS, JI3OPH, JR3FRR, JR3LOO, JR3RIU, JA5GZB. **ZZ3ZZ:** PP5JD, PY2SOB, PY3ZZ. **UK3DAH:** UA3-1421228, UA3-1421253, UA3-1421254. **AL7O/VY1** & AL7BO, KL7IYN, WD5HKI. **OZ5DD:** OZ1CWM, OZ1FKP, OZ1FMB, OZ6OV. **UK6LEZ:** 5 Ops. **JA2YKA:** JA9NFO, JH2QXG, JH4VBQ, JJ1BTA, JR2GMC. **ON6RM:** ON5CC, ON6XN, ON7MJ. **AB1U** & K1WJ. **JH1YDT:** JA0VSH, JK1DLO, JK1FLU. **LA2Y:** LA1HZ, LA3GX, LA3HX, LA3IX, LA4MY.

MULTI-OPERATOR SINGLE TRANSMITTER

UNITED STATES

K7RI	5,010,501	3442	501
N4WW	4,740,978	2932	638
KK5I	3,765,636	2820	586
N4MM	3,373,821	2173	583
AJ6O	3,087,000	2546	490
KN5A	2,793,606	2223	563
KD8B	2,761,515	2145	563
AA4VK	2,625,623	1823	559
W9ZRX	2,591,446	1910	533
KD6PY	2,114,310	1978	447
KC9U	1,768,200	1799	525
AKØA	1,754,964	1650	492
KC4B	1,532,886	1346	449
WB5DDI	1,443,150	1558	450
KI2S	1,175,656	1116	446
KB9BR	970,405	950	421
WB7CLU	920,220	1063	313
W7DG	601,392	881	264
N5JJ	592,983	808	369
WAØCGV	407,925	598	315
WA5SOG	397,065	546	309
W3YFV	260,454	404	249
KA1AAD	256,951	415	263
AE8W	250,635	518	245
WV2ZOW	200,143	460	263
WD6BZS	169,884	402	198

NORTH AMERICA

VP5RFS	9,304,650	5655	667
VP2MCL	6,546,148	4294	602
VE1DXA	5,671,485	3044	645
VE6OU	5,618,314	3560	562
VP1ØA	5,579,868	4244	543
TF3DC/OX	4,983,300	3672	565
VE7UBC	4,662,930	3180	510
VE7ZZZ	3,796,348	3328	454
HP1XOG	1,197,524	1469	332
KL7IF	731,640	1029	268

ASIA

JH7YJF	3,765,696	2615	528
JA4YFH	2,123,308	1769	451
JA7YAA	1,895,592	1534	456
JH3YJM	942,550	919	350
JA8YXI	293,267	480	221
JG1YFF	92,750	276	125

EUROPE

Y24UK	9,046,800	5140	630
IN3DYG	8,216,340	4732	633
4N4Y	6,752,963	4248	581
HG1W	5,858,510	3550	635
SM5GMG	5,719,584	3427	624
HG6V	5,706,240	3314	640
G6UW	5,674,515	3340	595
IY4FGM	5,316,599	3486	551
LG5LG	5,191,116	3236	609
PA2TMS	4,917,130	2770	670
OK6OK	4,587,689	3032	547
SL2ZZU	4,442,667	3007	578
OHØXX/OJØ	4,381,171	3164	523
G3RRS	4,187,907	2545	579
HB9BLQ	4,004,529	2485	593
HB9AOO	3,737,925	2846	449
SMØAQD/OHØ	3,510,584	2561	574
Y44ZI/p	3,500,766	2521	538
HG5A	3,288,064	2504	512
GW4BRS	2,916,432	2267	516
DLØWW	2,852,322	2053	506
I2PHN	2,836,280	2443	430
LZ1KDP	2,815,364	2103	541
HA6KNB	2,623,428	2060	486
SK6AW	2,559,000	2091	500
DLØUE	2,552,958	2052	486
OH8MA	2,449,724	1978	514
GB3WRR	2,177,303	1899	461
G8JC	1,928,412	1636	414
SK7HW	1,700,497	1549	457
DK5XN/OHØ	1,655,903	1471	479
OK3VSZ	1,652,640	1502	440
HB9BUN	1,640,308	1573	382
HA5KDB	1,466,010	1484	455
HA7KPL	1,347,291	1330	439
HA4KYH	1,107,456	1201	384
HA1KZZ	1,044,510	1181	370
OH3AA	991,051	954	479
HA5KFN	963,724	1073	394
F8WE	956,277	1129	387
OE3ALW	942,480	944	374
IT9WPO	899,625	1326	375
G4JJE	810,920	1008	388
Y31ZA	794,880	992	368
DFØBV	773,916	877	363
HA3KNA	689,187	890	339
SK7GC	650,349	873	334
DH8AAB/A	629,096	852	263
LA4O	609,840	853	360
SP9PRO	569,097	811	333
YU5FBE	520,975	852	325
OK3KAP	446,188	650	337
HA6KNX	437,175	821	335
HA8KAX	428,400	675	306
EA5RCG	422,808	796	316
OK1KUR	342,465	595	255
OK2KWU	327,456	651	288
Y42ZJ	311,129	732	263
Y55ZG	277,386	701	249
HA5KMB	237,405	484	255
Y46ZF	236,000	456	250
HA9BVK	229,628	421	236
SP7KTF	202,261	469	223
DKØLO	186,180	379	214
4N7TT	158,224	357	232
SP3KBJ	151,524	377	207
Y33ZO	135,024	397	194
SP9KAD	121,730	320	185
PI1ARS	113,825	291	145
SP5ZBL	67,425	254	155
Y32ZE	60,606	201	117
OZ7BG	50,978	198	142
OK1KIR	46,374	170	131
OK2KYC	39,483	153	107
SP6KGN	30,508	156	116
YU3DEM	21,870	142	90
OK2KMR/p	14,200	106	71
OK1KZE/p	9,240	78	66
SP9PZF	6,006	79	42
HA1KSA	5,160	54	43
LA7V	3,564	63	44

OCEANIA

AH2E	8,021,376	5138	528
ZL2AH	3,015,783	2568	391
KA1AA	1,266,375	1631	275
ZL3BK	1,018,045	1244	295

SOUTH AMERICA

HK3AFD	6,064,292	3475	556
PP5CIT	656,782	742	301

U.S.S.R.
CLUB STATIONS
ASIA

UKØQAA	4,689,300	3286	580
UK7PAL	3,849,274	2817	559
UK9AAA	3,254,710	2292	542
UK9FER	2,627,152	1907	472
UK9CCC	1,094,610	1206	330
UK9JAJ	438,736	615	272
UK9SAD	410,805	591	255
UK9XAN	203,775	344	209
UK8MAF	202,264	401	193
UKØAMM	110,980	257	155
UK9OAE	37,620	151	99
UKØCBA	6,909	75	47
UK9WBY	3,712	40	32
UK7NAQ	2,418	31	26
UKØCAA	425	21	17

EUROPE

UK6APA	5,500,434	3671	619
UK6LAZ	4,933,992	3271	602
UK2GKW	4,690,270	3225	545
UK2PCR	4,444,177	2809	587
UK5MAF	4,042,010	2730	565
UK2RDX	3,568,053	2499	543
UK2BBB	3,542,880	2592	528
UK4FAV	3,207,960	2539	504
UK2PAP	2,672,880	2009	518
UK2RBA	2,647,512	2211	476
UK2PRC	1,910,080	1629	508
UK3SAB	1,845,480	1703	455
UK4PNZ	1,749,888	1920	441
UK6LAI	1,705,592	1607	458
EN3D	1,655,356	1835	437
UK3R	1,634,360	1700	449
UK4WAB	1,628,699	1672	437
UK3XAA	1,619,151	1357	457
UK4ABZ	1,032,856	1232	388
UK5QBE	1,012,510	1262	365
UK2GBL	732,000	1073	366
UK3DBG	687,035	960	313
UK3WAA	558,780	779	335
UK2RAC	416,646	768	293
UK6LWA	347,100	1157	300
UK3WAF	335,692	725	266
UK4CAO	331,500	739	255
UK2WAR	297,016	560	274
UK5ICD	255,780	549	245
UK6ACG	252,472	521	302
UK5ICX	246,480	467	208
UK2BAG	191,808	382	222
UK3MAX	145,905	335	213
UK4CBB	120,050	311	175
UK2AAX	119,190	382	174
UK5ZBW	100,947	260	161
UK2RAQ	97,197	261	179
UK4LAZ	83,776	344	154
UK5HAB	72,695	207	155
UK6ACR	62,916	252	147
UK6CAC	38,936	200	157
UK1ZBB	34,632	187	117
UK6HBK	33,408	190	116
UK6XAA	19,089	153	101
UK4PAA	17,200	121	80
UK2RAH	14,469	103	91
UK3DBV	10,800	90	75
UK5FAB	7,992	62	54
UK5JDF	4,732	49	43

MULTI-OPERATOR MULTI-TRANSMITTER WORLDWIDE

KH6XX	19,345,473	8850	669
YTØR	14,378,996	7465	778
AI6V	12,529,608	6390	728
KL7RA	12,428,730	6663	701
GB4ANT	11,334,124	5897	698
KL7IRT	9,921,468	5687	642
OH1AA	7,609,268	4715	634
UK5IAZ	7,293,888	4439	648
KF2U	6,594,258	3879	682
VK2DDQ	6,416,627	4081	511
AD8R	5,818,330	3489	730
W3GM	5,711,172	3209	677
K3WW	5,283,300	3129	660
WB8JBM	4,410,871	2291	667
KG2Y	2,790,658	2312	593
8J3XPO	2,586,330	2838	465
ZZ3ZZ	2,378,838	1766	462
UK3DAH	1,645,968	1606	424
AL7O/VY1	1,209,590	1743	290
OZ5DD	1,093,662	1253	387
UK6LEZ	1,058,995	1324	383
JA2YKA	634,785	763	303
ON6RM	544,544	794	308
AB1U	381,969	533	301
JH1YDT	221,840	397	188
LA2Y	149,513	525	217

CHECK LOGS: The following logs were used for cross-checking. Check logs & SWL logs are appreciated. Thank you.
K6FM, KA7BFW, LA2YT, LA3IF, LJ2Z, N8FU, OX3JUL, PAØTV, PT2CRR, SK4DE, SM4AWG, SP7AW, SP9PPP, UA3SBW, UA4PAB, UA6AJG, UA6LXZ, UA9UPS, UA9XWU, UAØSBO, UK3ACW, UK3QAE, UK6LTG, UK9HAC, UK9UAA, UR2RCU, UV3NB, W1PM, Y22WF, Y23RO, Y34SE, Y35UB, Y35YE, Y64YG, Y78XL, and SWL Stations: Germany (FRG) - DE1YAK; Switzerland - HE9FQG; Belgium -ONL5807; Germany (GDR) - Y2-17506/C; Romania -YO7-15815/OT.

WORLD TOP SCORES SINGLE OPERATOR

ALL BAND

NP4A	5,489,042	K2SS	3,245,793
4M2AMM	4,516,045	ED1ABT	3,172,260
VP2MGQ	4,111,388	G3VBL	3,161,304
IV3PRK	3,814,294	KC1F	3,112,524
N6CW	3,414,786	K5RC	3,055,250
N6HR/KX6	3,394,440	N7DF	3,013,729
VE7BTV	3,328,654	ABØI	2,819,285

SINGLE BAND

28 MHz		21 MHz	
ZZ5EG	4,868,780	HC9A	6,025,770
CE6EZ	3,756,480	EL2AV	4,617,530
YU3EW	3,191,181	9Y4VU	3,685,248
TG9GI	3,166,764	KP4O	3,653,796
4V2BM	3,126,598	4N3EY	3,634,755
CX7BY	2,957,511	VE7ZZ	3,463,185
8P6PF	2,427,039	VE7CML	3,437,625

14 MHz		7 MHz	
4N3ZV	3,586,240	4M3AZC	1,371,214
K8NA	1,740,024	VE3KZ	560,976
DL8PC	1,610,648	I6NOA	544,744
N4KE	1,476,848	JA2BAY	469,368
I5FCK	1,403,963	KM5X	214,800
VE3ICR	1,277,991	YO3KSC	208,552
CSØUA	1,233,412	SP3DOI	148,248

3.5 MHz		1.8 MHz	
DJ4PT	745,216	VE3MFT	84,906
4N3APR	729,736	UP2BAW	51,474
ZF2EO	668,736	4N3EF	43,740
HP1XRK	632,400	OK3KFF	17,424
VE2ZP	405,144	W8LRL	15,652
YU3DBC	283,585	WB3GCG	8,100
I4EML	270,972	SP5INQ	7,872

QRPp

N2AA	A/B	705,726	UV9WF	14	112,095
WB2VYA	28	359,205	W8ILC	3.5	92,984
AC8C	21	81,675	EZ5IFD	1.8	1,320

MULTI-OPERATOR

SINGLE TRANSMITTER

VP5RFS	9,304,650	HG1W	5,858,510
Y24UK	9,046,800	SM5GMG	5,719,584
IN3DYG	8,216,340	HG6V	5,706,240
AH2E	8,021,376	G6UW	5,674,515
4N4Y	6,752,963	VE1DXA	5,671,485
VP2MCL	6,546,148	VE6OU	5,618,314
HK3AFD	6,064,292	VP1ØA	5,579,868

MULTI-TRANSMITTER

KH6XX	19,345,473	GB4ANT	11,334,124
YTØR	14,378,996	KL7IRT	9,921,468
AI6V	12,529,608	OH1AA	7,609,268
KL7RA	12,428,730	UK5IAZ	7,293,888

U.S.A. TOP SCORES SINGLE OPERATOR

ALL BAND

N6CW	**3,414,786**	AB0I	2,819,285
K2SS	3,245,793	AI9J	2,432,665
KC1F	3,112,524	AK1A	2,338,271
K5RC	3,055,250	K6HNZ	2,186,331
N7DF	3,013,729	KC4VA	2,172,276

SINGLE BAND

28 MHz		21 MHz	
N4ZC	1,930,946	**AI7B**	**3,058,563**
KN6M	1,697,150	**N6RO**	**2,886,864**
KM5K	1,689,975	N2WT	2,107,710
K0GU	1,260,441	KM5R	1,857,065
WA6DBC	1,226,352	KA7AUH	1,474,530
W5JW	1,167,156	K9RX	1,095,252

14 MHz		7 MHz	
K8NA	1,740,024	**KM5X**	**214,800**
N4KE	1,476,848	KB5FU	107,672
W9LT	720,792	WA8LXJ	100,920
KA3BLP	238,869	K3GYD	91,656
WB3CFD	91,390	AG9S	90,916
W6CN	88,400	N8BJQ	86,052

3.8 MHz		1.8 MHz	
WB2FZO	233,770	W8LRL	15,652
N4BAA	213,428	WB3GCG	8,100
K5UR	154,700	K2BQ	3,420
AJ2E/4	120,582	K6SE	1,888
WB9TIY	80,036	K7IDX	500
KB8WB	22,188	W1BB	120

QRPp

N2AA	**A/B**	**705,726**	AC8C	21	81,675
KT6V	"	263,796	K3ZR	14	75,036
WB2VYA	28	359,205	W8ILC	3.8	92,984

MULTI-OPERATOR SINGLE TRANSMITTER

K7RI	5,010,501	N4MM	3,373,821
N4WW	4,740,978	AJ6O	3,087,000
KK5I	3,765,636	KN5A	2,793,606

MULTI-TRANSMITTER

AI6V	**12,529,608**	W3GM	5,711,172
KF2U	6,594,258	K2WW	5,283,300
AD8R	5,818,330	WB8JBM	4,410,871

The QRPp World Record holder, Germano, TG9GI, went full power this year. He is the top North American on 28 MHz.

CQ Reviews:

The TenTec Argonaut 515 Transceiver

BY ADRIAN WEISS*, K8EEG

Many of us who have been around since the appearance of the Argonaut 505 back in 1971 scanned the initial ads for the new 515 with a mixture of horror and amazement, somewhat like one feels when a tradition is violated. We sort of gasped, "Oh my gosh, it's black! What do those guys at TenTec think they're doing fooling around with my precious QRP rig?" The 505 and 509 were both woodgrain side-panels and that distinctive TenTec cream color front panel that seemed so odd when the 505 hit the market. But the Argonaut proved itself time and time again, and that gave TenTec the right to give us a "first" s.s.b./c.w. QRP transceiver that looked like no other commercial transceiver ever looked. It *was* in its own class! And it still is! The new 515 isn't just a cosmetic style change in paint color; the guts have gone through yet another stage of evolution in the saga of the Argonaut. I'm sure newcomers to QRP will be quite interested to learn the source of the whole "Argonaut mystique," and I told about that in the review of the 509 in *CQ*'s July 1978 issue.

The Argonaut 515 and Model 208-A CW/Notch filter. The 208-A interfaces with the 515 via a 4-wire cable which provides power and audio signal and a very worthwhile degree of additional selectivity. The black finish of the 515 separates it from the earlier 505 and 509 and gives it an attractive but mysterious air. The front extension legs raise the front panel to a plane perpendicular to line-of-sight. The 208-A provides four selectivities, including the "OUT" position. At the left edge of the 515's front panel the new band-switch for 10 meters can be seen dividing the band into four segments. Crystals for the lower two segments are provided with the unit. The large knob is clearly apparent. The dial-marker "slit" just between the 10–5 kHz marker is lighted to aid readout. The "RF" red LED to the right of the dial began glowing with the test unit output of about 1 watt. Full brilliance was achieved at about 2.4 watts. The "OT" LED indicates the on-off states of the R.I.T. circuit. At the upper left of the front panel can be seen the small diameter R.I.T. tuning knob; replacement with a larger knob is desirable.

Frequency Generator System

The major circuit modification appearing in the 515 is the incorporation of a conventional heterodyne frequency generating system in place of the unique system used in the 505 and 509. In the earlier models, a single heterodyne crystal was used in combination with the v.f.o. consisting of five separate pairs of oscillator inductances. The 509 stability was excellent, and the only drawback with that system related to alignment. Juggling the slugs in the pair of inductances in order to hit band edges and achieve a degree of tuning linearity was a tiresome task at best. The system was a monument of TenTec engineering ingenuity nonetheless.

In the 515, the permeability-tuned v.f.o. operates across the 5.0–5.5 MHz range only, producing the proper output for heterodyning to 500 kHz segments of the 80–10 meter bands. In addition to crystals for other bands, two crystals are included with the unit for operation on 28.0–29.0 MHz; additional crystals are available for 29.0–30.0 MHz. Due to the heterodyne scheme, strong bandedge birdies appear approximately 20 kHz below 21 MHz and 28 MHz, and a weaker birdie appears at about 21320 kHz (about 10 dB above the noise floor). V.f.o. frequency stability is excellent.

Warmup drift (30-minute period)

*83 Suburban Estates, Vermillion, SD 57069

amounts to 50 Hz average. Drift following 30-minute warmup amounts to 20 Hz per hour average. TenTec claims an average 20 Hz per degree F averaged over a 40° range (70–110°F), but means of accurately verifying this figure were not available. Ballpark temperature stability tests indicate that the claimed figure is probably conservative. With respect to mechanical stability, the 515 is virtually immune to frequency jumps from knocking and dropping.

Dial readout accuracy is very good, with the dial markings at 5.0, 5.2, and 5.3 MHz (v.f.o. frequency) corresponding exactly to frequency, and 5.1 MHz showing a difference of + 1.5 kHz, and 5.4 and 5.5 MHz showing a difference of +2 kHz. One of the very noticeable improvements in the 515 with regard to actually operating the rig is the tuning vernier arrangement. The standard ⅝" × 1½" 505 and 509 knob has been replaced by the larger, bulkier 515 knob measuring ¾" × 2". This may not seem to be much of a difference, but the larger knob gives a feel of greater control and precision in tuning. Further, the slide-rule dial pointer, whose purpose is to indicate the approximate 100 kHz points across the band in combination with the circular dial plate which indicates the 1 kHz points, can be set exactly at any 100 kHz point by means of a knob which protrudes from the bottom of the front panel. The entire dial transport is improved.

In regard to finer points, frequency readout from the 1 kHz round dial is rendered easier through the addition of a lighted LED marker positioned directly behind the dial plate. Overall, improvements in the tuning mechanism give the 515 a "big rig" feel compared to the 505 and 509. The tuning ratio is about 20 kHz per revolution of the tuning knob, a slight improvement over the 505 and 509. Because the shaft mounting the slug which tunes the v.f.o. oscillator frequency-determining inductance is left floating with respect to ground, a slight "body capacitance" effect (when the operator's hand touches the dial, a slight shift in frequency can be detected) is noticeable; however, it amounts to only around 40 Hz at the most.

With respect to the v.f.o. circuit, the master oscillator uses a pair of bipolar devices, with frequency determining circuitry comprised of the "T" three inductance system typical of permeability-tuned oscillators. Output from the buffer stage is filtered by a low-pass pi-net on its way to the MC1496P double balanced mixer stage. An FET serves as a heterodyne crystal oscillator, and output is taken through a potentiometer which permits feeding the balanced mixer the optimum level of injection signal for minimum mixing products. Likewise, the balanced mixer stage includes a potentiometer for adjusting for minimum heterodyne oscillator signal feedthrough.

After ten months of fairly intensive use of the test 515, it was necessary to slightly readjust the mixer potentiometer and double-tuned transformer and associated capacitors for cleanest mixer output. Mixer output is delivered to the receive/transmit mixer stages via an FET/bipolar Darlington pair emitter follower stage. Output from the v.f.o. is straight-through for 14 MHz operation in conjunction with the 9 MHz i.f., and is heterodyned to the other bands.

S.S.B. Generator

The circuit of the 515 is the same as in the 505 and 509 with respect to the s.s.b. generator, and includes the microphone amplifier, b.f.o./carrier oscillator, balanced modulator, and 4-pole crystal filter. A single 9 MHz crystal serves the dual function of b.f.o. for the receiver chain, and carrier generator for the transmitter chain. Three trimmer capacitors placed in series with the 9 MHz crystal are switched electronically to position the oscillator frequency either in the center of the filter passband for c.w. operation, or at the 15 dB points of the filter passband for s.s.b. operation (u.s.b./l.s.b.). In the typical manner, the balanced modulator is unbalanced for c.w. operation by the application of a d.c. voltage. The 9 MHz output from the balanced modulator is coupled to the 9 MHz crystal filter through a single tuned transformer.

The crystal filter reflects the design concept of the Argonaut as a dual-mode s.s.b./c.w. transceiver in that a single wideband filter is incorporated to permit operation on s.s.b., which requires a bandwidth of about 2.4 kHz. Naturally, the filter leaves much to be desired for c.w. operations in a crowded contest situation. For general operating, though, it is adequate. The lack of selectivity because of the 4-pole filter is much more noticeable with the 515 than with either the 509 or 505 because the 515 receiver is really hot. The receiver section sensitivity and noise figure compares with the best of them, and as a result, the ultimate unwanted sideband rejection of the 4-pole filter is such that a signal after filtering is usually still very noticeable with respect to receiver noise floor.

Two options are open to the c.w. contest operator. First, addition of the Ten-Tec 208-A Notch/CW Filter, which plugs into the 515, provides just about all the added selectivity that contest situations require. Or, an MFJ Enterprises CWF-2 4-pole active filter can be added to the 515 prior to the a.g.c. pick-off point on the i.f. board (see "Improving C.W. Selectivity in the Argonaut," *CQ*, Jan. 1977, for details). I personally prefer this approach because of the fantastic skirts of the

CWF-2 and the additional gain which the filter exhibits. One other possibility exists—namely, adapting to the Argonaut another of the TenTec crystal filters that are available as accessories for their "big rigs."

Transmitter Circuit

Outputs from the v.f.o. and s.s.b. generator are fed to the transmit mixer, which shares the p.c. board with the receive mixer. The circuit is the same as in the 509, using an MC1496P in a double balanced mixer configuration. Output from the transmit mixer is coupled to the driver stage via a two-section pi-net filter on 80 meters and double-tuned widebandpass transformers on the remaining bands. The two-stage broadband driver is the same as in the 509. The broadband final amplifier circuit is the same as in the 509, but new Motorola MRF476 transistors have replaced the TRW PT3647's used in the 509. These devices are easily capable of loafing along at rated 515 input. Two-section pi-net lowpass filters are switched in for 80–20 meters, while 15–10 meters share a single filter.

In the 515 tested, a bit of a "problem" was encountered with respect to operation on 10 meters, *but only with reduced output. It must be stressed that the 515 performs correctly when operated at the full output power for which it is designed.* When the operator chooses to use the 515 on 10 meters at reduced power output, the unit's design parameters are violated, resulting in the phenomenon noted here. In normal operation with the 515 connected to an antenna, the "problem" can be detected by a marked jump in the reflected power indicated by the s.w.r. meter while decreasing drive so that power output moves downward from about 4.4 watts through a threshold level at around 2 watts output. This non-linearity in decreasing reflected power will not be detectable when the 515 is hooked to a dummy load.

The genesis of the problem seems twofold. First, the drive signal delivered to the final amplifier on 10 meters shows spurious frequencies about 30–35 dB down from the 10 meter signal. Second, the pi-net filter shared by 10–15 meters is a compromise design and apparently will not tolerate the shift in collector load impedance which results from reducing output power on 10 meters. Hence, at full output power, the collector-to-filter match is sufficiently close to reject the unwanted drive signals in excess of 40 dB, but as the match deteriorates, the rejection does also. The signal purity at reduced output levels can be restored to acceptable limits by inserting an antenna tuner between the 515 and the antenna. At full output, it is not needed. Or, a symmetrical resistive attenuator can be inserted between the 515 and the antenna and power reduced by means of the attenuator.

Quite a few Argonaut operators use their units at reduced output levels without any thought of the inefficiency and possible signal impurities that can result, as noted above. Both arise because the lowpass filters respond identically to all signal levels at a fixed input and output impedance, while the collector load impedance of the final amplifier depends upon the relationship between d.c. supply voltage (Vcc) and output power, where $ZC = Vcc^2/2Po$. In the Argonaut and similar broadband units, a broadband transformer steps up the collector impedance to the input impedance of the filter for matching to the filter input impedance. The filter's rejection factor is fully realized only under matched conditions. Hence, when power output is reduced, that match is disrupted, resulting in decreased efficiency and signal impurities.

Table I shows final amplifier ZC *vs* Vcc *vs* IC *vs* Efficiency for full output, reduced output at full Vcc, and reduced output at reduced Vcc. A glance at the figures will serve to convince operators that reduced Vcc for reduced output levels is the appropriate approach. Splitting the final amplifier collectors from the 12–13.6 supply voltage is a simple matter. L1 (toroid wound with red hookup wire) connects the final B+ terminal to the **+12 Volts In** phono jack on the rear panel. L1 is disconnected and then reconnected to the center terminal of the **AUX** phono jack (after first disconnecting the **AUX** from the **IN** jack). A second B+ supply capable of providing the desired Vcc is then hooked to the **AUX** phono jack and the unit operated at reduced Vcc, reduced output with original efficiency and signal purity. Measured r.f. outputs from the test unit can be seen in Table I.

The 515's s.w.r. meter is the same Breune-type circuit that appeared in the 505 and 509 and its sensitivity is non-adjustable. This is a bit of an inconvenience if the full flexibility of the meter circuit is to be utilized, since the needle achieves full-scale deflection at about 1.5 watts r.f. output. In conjunction with the 10 meter peculiarity noted above, the s.w.r. meter is not usable on that band for taking an actual measurement of feedline s.w.r., since lowering output to the level which produces full-scale forward deflection is accompanied by the false reflected power reading which can result. R14 controls s.w.r. meter sensitivity, and can be replaced with a rear-panel potentiometer or a fixed resistor suitable for the operator's purposes.

Receiver

The receiver section of the 515 is essentially the same as that found in the 509, with one improvement in the receiver first mixer. As in the 509, the r.f. amplifier employs a low-noise MOSFET with tuned input and output tank circuits for each band and includes a 9 MHz trap in the input lead to prevent feedthrough of

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KDK FM-2025
FT-101ZD MARK III, FT-480R, FT-707, FT-720RU, FT-720RVH, FT-902DM, YR-901-CW/RTTY
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i.f. frequency signals. The input and output tank circuits consist of switched fixed and adjustable mica trimmers across permeability-tuned transformers, which are peaked by means of the ingenious rack mechanisn used in the earlier units. The receiver input peaking control does not affect transmitter operation. R.f. amplifier gain can be controlled manually from the front panel **r.f. GAIN** control which overrides the a.g.c. control voltage at about mid-range setting. The a.g.c. figure is 6 dB output per 100 dB input signal variation. The attack-decay time constant of the a.g.c. voltage follows the typical s.s.b. "fast attack-slow decay" pattern.

Actually, the slow decay is too slow for some c.w. situations, such as contest exchanges or high-speed c.w. ragchews involving break-in. This represents another design trade-off where c.w. operation is subordinated to the demands of s.s.b. operation. However, if the **r.f. GAIN** control is backed off to the mid-range point and the a.g.c. is neutralized, the full break-in capability of the 515 can be utilized to its fullest extent.

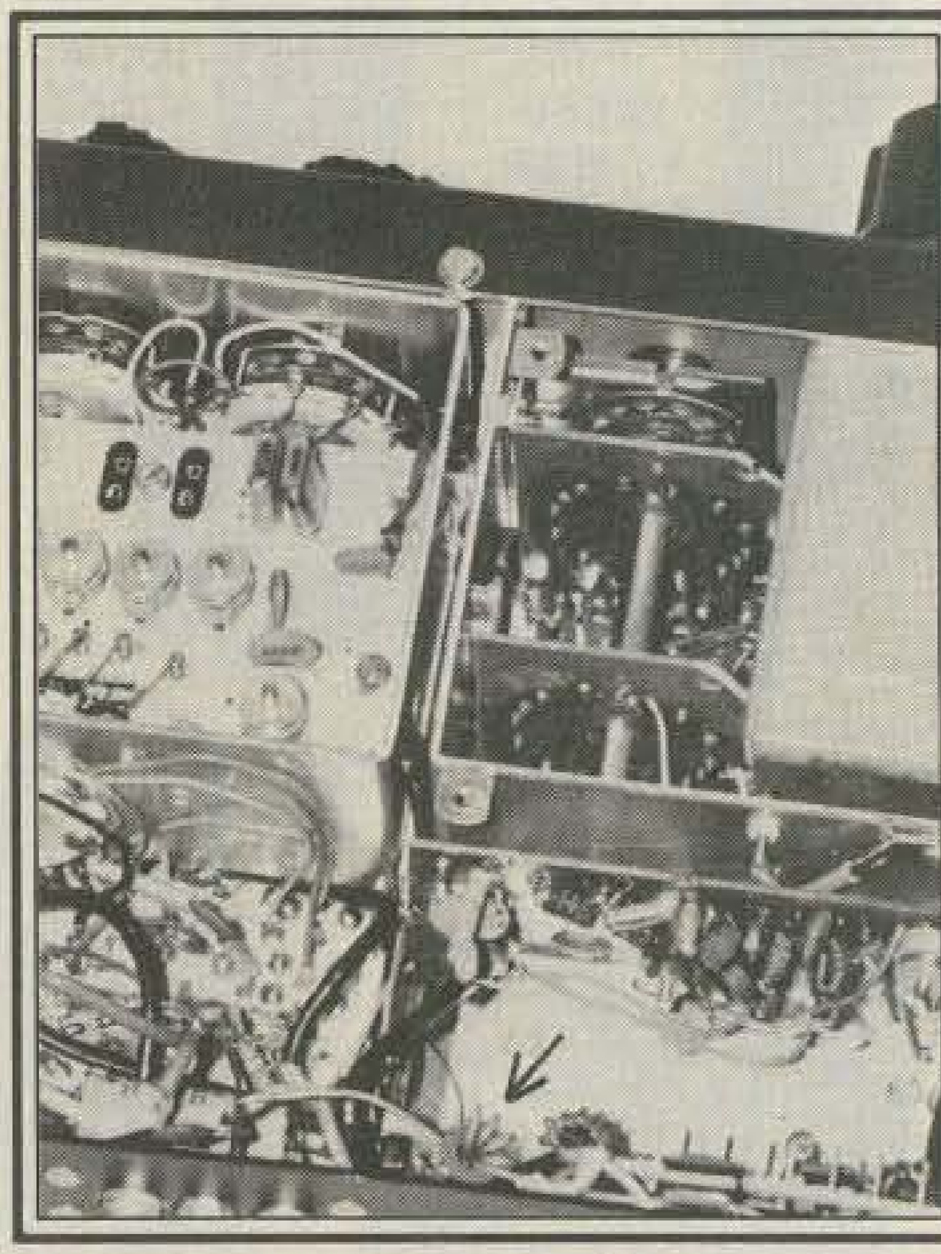
The receiver mixer circuit has been improved with the substitution of the double-balanced MC1494P IC mixer for the MPF132 employed ihe 505 and 509. Output is coupled to the 4-pole crystal filter through a single-tuned transformer. A single stage of i.f. amplification delivers the signal to a MOSFET product detector, and audio output is processed by the three-stage audio preamplifier chain before being passed on to the audio amplifier, which consists of the LM380N circuit found in previous models. Output into 8 ohms at 2% distortion is about 1 watt. As in the 509, audio quality in the 515 is one of the unit's outstanding features—sharp, non-distorted, and no noise. Ten-Tec is ready for the hi-fi preamp market!

The 515 includes a six-prong accessory plug on the rear panel which provides access to the preamplifier chain between the first and second preamp stages. This is the appropriate point for insertion of an external c.w. filter so that receiver passband response and a.g.c. control voltage are determined by the external filter passband, and not by the 4-pole crystal filter. The TenTec 208-A Notch/C.W. Filter includes a 2-foot cable terminated in a matching plug. The filter greatly improves performance of the 515 in the c.w. mode. Finally, the volume and tone of the sidetone oscillator for c.w. keying are controlled by two trimmer potentiometers, which are accessible through a hole in the bottom panel.

One additional feature which makes operation of the 515 more convenient is the new LED R.I.T. in-out indicator mounted on the front panel. When operating the 505 and 509 in a dark setting, it was necessary to feel the R.I.T. tuning knob to determine whether it was on or off, and that process typically changed the receive frequency because of fumbling fingers. The 515 LED indicator remains glowing as long as the R.I.T. circuit is activated. R.I.T. operation is controlled by the push-pull on-off R.I.T. tuning potentiometer switch, or switched automatically during operation whenever the key or mike is activated. As with earlier models, the R.I.T. tuning range is as much as ±5 kHz on some bands, and precise tuning is very difficult with the small knob provided. Substitution of a larger knob improves precision of tuning and is worth the effort.

Mechanical

Incorporation of the crystal-heterodyne frequency generator system has required internal revamping of an area of the chassis. Otherwise, layout is the same as with the 509. The 515 no longer includes the rear panel **Receive/Transceive** switch intended to make the 509 compat-



Only internal change in the 515 can be seen at the upper left corner where a p.c. board has been installed for mounting the four 10-meter crystals as well as the receiver front-end trimmer capacitors. At bottom center, an arrow marks L1, which connects the final amplifier to the B+ supply (phono jack at left end of wire). The connection is broken at the phone jack and a low-voltage supply connected to the free end of L1 if reduced output at reduced Vcc operation is desired (see text).

Vcc = 13.62 v.d.c., Po = Max						Vcc = 13.62 v.d.c., Po = 1 watt				Vcc = 9v, Po = 1 watt				Vcc = 5v, Po = 1 watt			
Band	Po	Ice	Pin	Po/Pin	Zc	Ice	Pin	Po/Pin	Zc	Ice	Pin	Po/Pin	Zc	Ice	Pin	Po/Pin	Zc
3.5	6.26	1.1	14.98	41.8	14.8	.345	4.69	21.2	92.7	.34	3.06	32.6	40.5	.50	2.5	40.0	12.5
7	6.16	1.04	14.16	43.5	15Ω	.36	6.54	15.2	92.7	.35	3.15	31.7	40.5	.48	2.4	41.6	12.5
14	4.1	.76	10.35	39.6	22.6	.335	4.56	21.9	92.7	.343	3.09	32.3	40.5	.54*	2.86	34.9	14.1
21	5.97	1.12	15.25	39.1	15.6	.417	5.68	17.6**	92.7	.45	4.05	24.7	40.5	.49*	2.59	38.5	14.1
28	4.39	.945	12.87	34.1	21.1	.43	5.86	17.0**	92.7	.388	3.49	28.6	40.5	.55*	2.91	34.3	14.1

(1) Pin = Ice × Vcc
(2) Efficiency η = Po/Pin
(3) Zc = $Vcc^2/2$ Po

Ice - Amps
Pin, Po - Watts
Zc - Ω
Po/Pin - %

*Vcc = 5.3 v.d.c.
**Spurious signals less than 40 dB below fundamental.

Table I– Argonaut 515 Efficiency vs. Vcc vs. Po.

ible with the TenTec 405 linear. No great loss. The 515 includes the clip-out front feet which raise the front of the unit about 1.5 inches so that the front panel is perpendicular to the operator's line of sight. The unit is mechanically solid and takes a considerable amount of pounding and dropping without effect upon frequency stability.

Test Results

Transmitter. (1) V.f.o. frequency stability measured over several 6–14 hr. test periods amounts typically to 20 Hz per hour. The internal voltage regulator circuit supplying power to the v.f.o. circuit holds frequency to within ± 2 Hz with external supply variations from 10–15 v.d.c.; at 9 v.d.c., frequency has shifted about −700 Hz. Temperature stability is excellent. Dial calibration vs. frequency measured at 100 kHz markers with these correlations: 5.0 MHz = 0, 5.1 MHz = +1.5 kHz, 5.2 MHz = 0, 5.3 MHz = 0, 5.4 MHz = +2 kHz, 5.5 MHz = +2 kHz.

(2) Final amplifier output powers obtainable for each band are shown in Table I. Final amplifier efficiency is typically around 40%. Operating the 515 with full Vcc at reduced Po = 1 watt predictably lowers efficiency to the 20% range, while Po = 1w at 5v = Vcc brings efficiency back up to the 40% range. Spurious signals are in excess of 40 dB below fundamental at full power output on all bands, with the only exception occurring at less than 2.5w on 15 and 10 meters (see Table I). For Po = 1w on 20–10 meters, Vcc = 5.3v was required. Final amplifier well-stabilized, tolerating considerably more than a 2:1 mismatch without undesired effects.

(3) Keying waveform shows equal rise/decay times for symmetrical, excellent waveform.

(4) Audio quality in s.s.b. mode is clear and crisp. Two-tone IMD tests not performed.

Receiver. Receiver tests were performed with the a.g.c. circuit disconnected and the standard 4-pole crystal filter (no optional filter available) showing a 2.4 kHz bandwidth and shape factor of 1.7 at 6/50 dB points. The Ten-Tec 208-A CW/Notch Filter unit was inserted and the filter selectivity position noted (CW-1, CW-3, etc.) where applicable; otherwise, unless specifically noted, the 208-A was completely removed from the circuit (i.e., unplugged).

(1) Minimum Discernible Signal (MDS) measured as follows: 3.5 MHz = −125 dBm; 7 MHz = −127.5 dBm; 14 MHz = −132 dBm; 21 MHz = −134 dBm; 28 MHz = −136 dBm. In addition, 14 MHz MDS measured at −140 dBm with 208-A inserted, CW-2 position, notch at high frequency setting (full clockwise).

(2) Gain Compression (single-tone blocking) performed on 14 MHz with desired signal separated from interfering signal by 20 kHz. Cross-modulation (see below) due to filter curve prevented establishing blocking level, since cross-modulation level was −38 dBm. Insertion of 208-A filter, CW-3 (notch at high-frequency end), permitted obtaining blocking at −30.5 dBm, for a single-tone Dynamic Range of 110 dB (MDS_{dBm} − Gain $Comp_{dBm}$ = DR, where MDS = −140 dBm). The failure to arrive at blocking without additional filtering is typical for the type of filter in the 515.

(3) Cross Modulation performed with unmodulated interfering signal separated 20 kHz from desired signal on 14 MHz. Without 208-A removed from circuit, an interfering signal of −38 dBm produced a 3 dB increase in audio output at the desired signal frequency. With the 208-A inserted, cross-modulation effects eliminated.

(4) Two-tone **Intermodulation Distortion** tests performed on 3.5 and 14 MHz with 20 kHz signal separation, desired signal at −110 dB, (208-A removed). On 3.5 MHz, an interfering signal of −53 dBm produced a distortion signal equal to the MDS; on 14 MHz, an interfering signal of −59 dBm produced an MDS level distortion signal. Two-tone IMD range for 3.5 MHz is about 73 dB, with the same range for 14 mHz (MDS_{dBm} − Signal B_{dBm} = IMD).

(5) Input intercept for 3.5 MHz = −14.4 dBm, for 14 MHz = −21.4 dBm. (P_{in} = (DR/.66) + MDS).

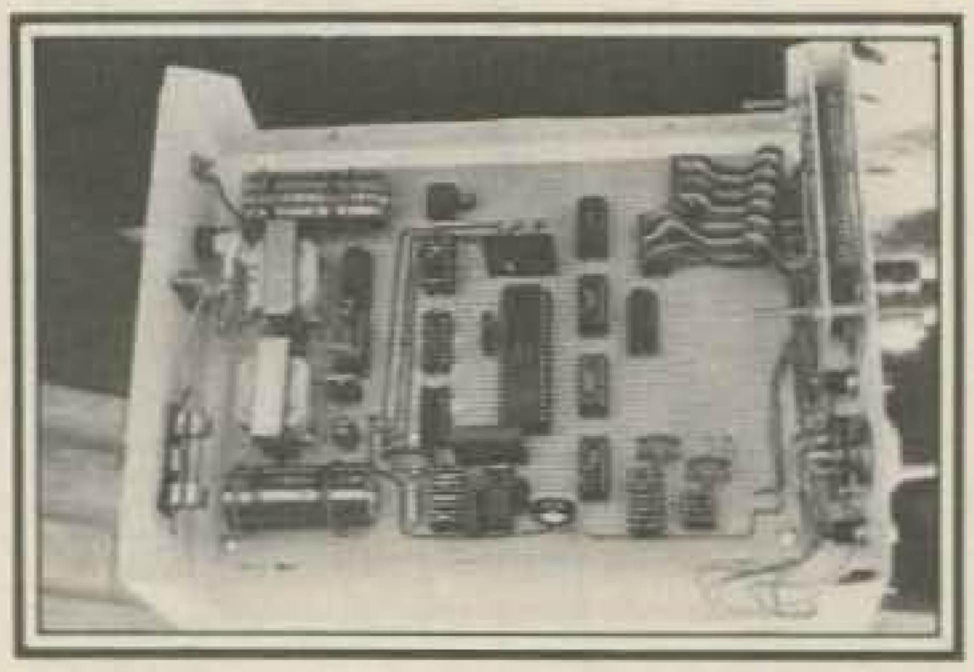
Comments. Receiver performance, overall, is excellent in terms of the usual trade-offs between front-end sensitivity and vulnerability to overloading effects caused by extremely strong signals. The tests were performed with full 515 r.f. gain, maximizing its sensitivity to overload. In practical situations, the low MDS ("noise floor") permits sacrificing up to about 20 dB r.f. gain on 10 meters and still having room to spare in copying a 1 uv signal. This approach will not improve the dynamic range of the receiver, but it will raise the blocking level and IMD level a corresponding amount, permitting toleration of much stronger input signals without undesired effects. The receiver is so quiet that it was possible to copy weak signals on 10 and 15 meters that were not detectable on another modern receiver. This writer was thoroughly impressed with the 515 receiver's performance on the air.

Vaughn Martin has come through with another very interesting teaching and building project that also is quite useful and an accurate piece of test equipment.

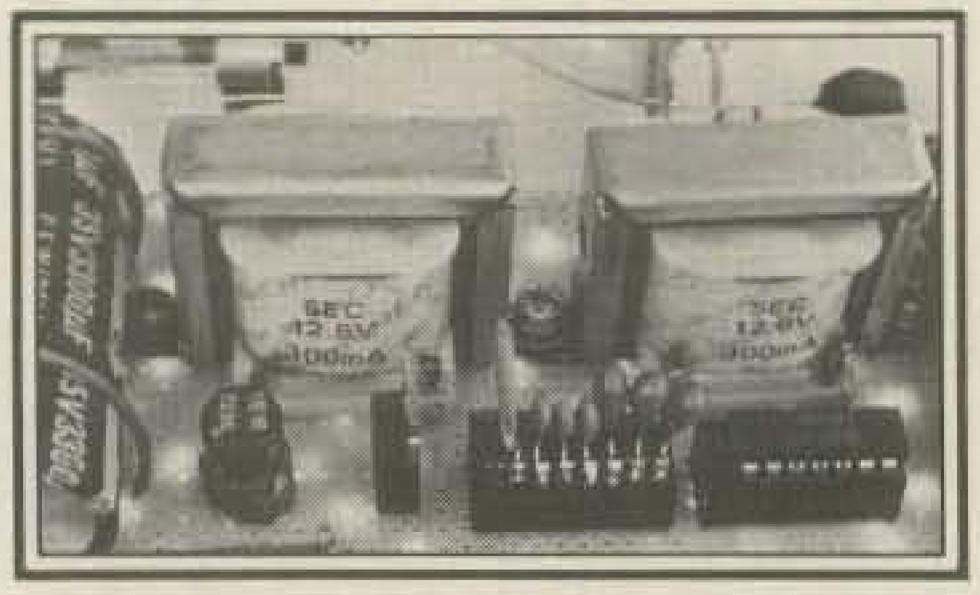
HOW TO BUILD A 3½ DIGIT DIGITAL VOLTMETER (DVM) (AND UNDERSTAND HOW IT WORKS)

BY VAUGHN D. MARTIN* AND JIM McCULLIN

This project is a highly accurate 3½ digit digital voltmeter that will make a handy addition to any workbench. This 3½ digit DVM measures both positive and negative input voltages from 200 mV to 200 v full scale, has overvoltage protection and indicators, and has circuitry for resetting the A/D (analog-to-digital) converter after an overload has occurred. The 3½ digit capability means that three full digits are displayed with a fourth leftmost digit being either a "1" or a "0"; therefore, they refer to this as "½" a digit. The basis of the project is an A/D converter, and as such, a thorough explanation of A/D converters is included herein so that the full capabilities of this project can be most fully appreciated. The tutorial nature of this article might very well also serve to initiate the reader to the vast capabilities of the data converters in general . . . both A/D and D/A's.



View of the 3½ digit DVM hardware.



Power supply section.

*114 Lost Meadows, Cibolo, Texas 78108

An analog-to-digital converter accepts an analog input from continuously varying data representing some physical quantity; this is expressed in the form of voltage, but sometimes also in the form of current, and it then compares the data to a reference voltage. If the input is some proportion of this reference, say three eighths, the digital output code is a binary number that is three eighths of the possible maximum total. As an example, our converter has a full scale (depending on the switch setting) of 1.999 volts; say 2.000 volts for the sake of this discussion. If one quarter of this is applied (½ volt), then a binary number one quarter of the total is generated.

Okay, I can understand a voltage that is varying, but what are these binary ones and zeros, and how can they possibly ex-

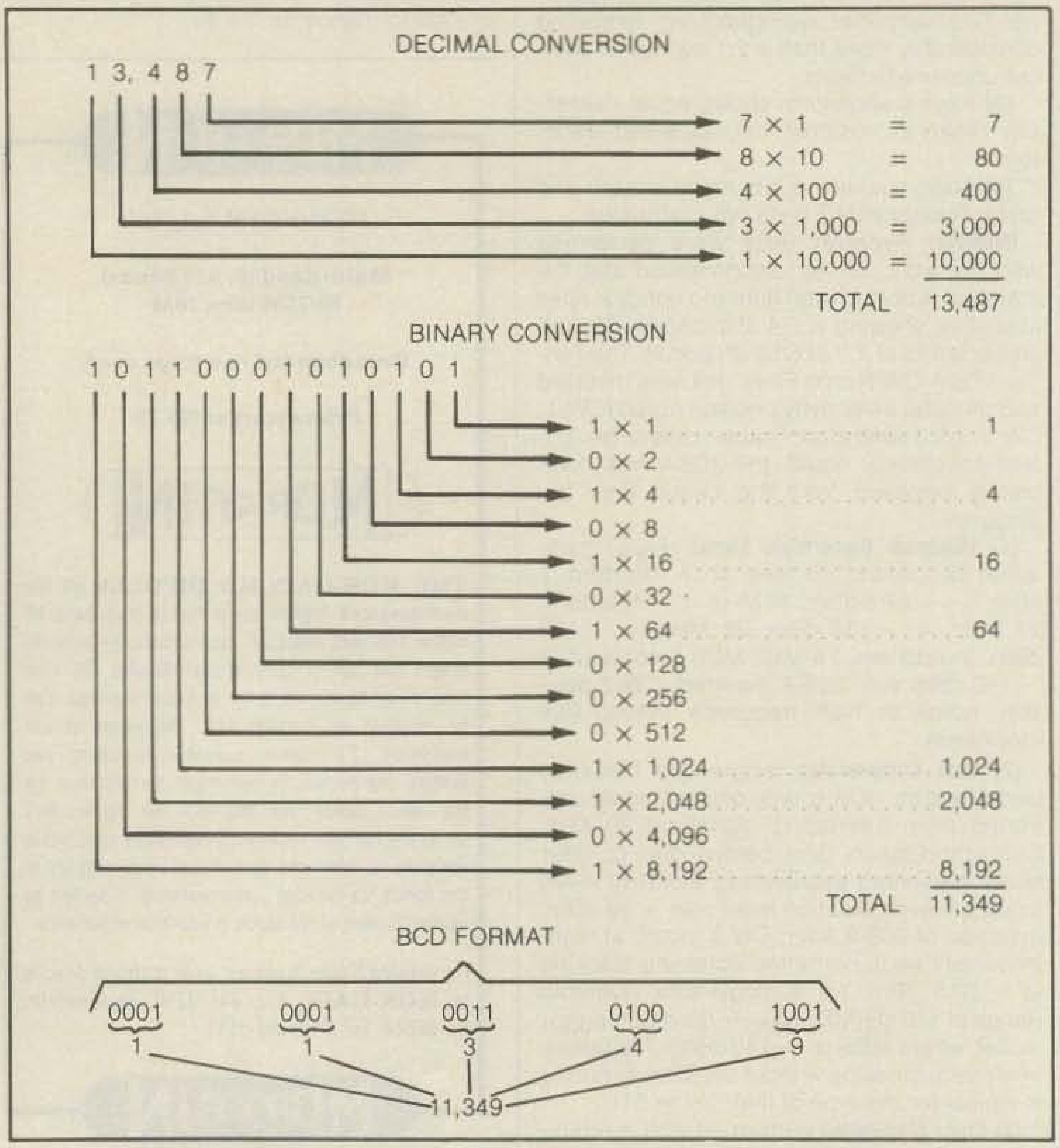


Fig. 1– Standard numbering conventions

press a certain voltage? Well, refer to fig. 1 and note how the number 13,487 was derived. First, this number is a decimal number or a number to the base 10. This means that there are 10 possible numbers which can be expressed in this base; these are naturally 0 through 9. It also means that the highest number "9" expressed as a single digit is one less than the number base itself. Armed with these rules, let us now examine how we get 13,487. Let us define the rightmost digit as the **L**east **S**ignificant **D**igit (LSD) and the left most digit as the **M**ost **S**ignificant **D**igit (MSD). When we deal with binary numbers, we'll see that there is an MSB (**M**ost **S**ignificant **B**it) and an LSB (**L**east **S**ignificant **B**it). Now take 7 × 1 (the right most digit) and add it to 8 × 10, the next digit, and add this to 4 × 100, then 3 × 1,000 followed by 1 × 10,000. We merely multiplied the number occurring within a digit's space by its "weight," which begins as 1 and progresses upward, being multiplied by 10 for each space we go to the left. This sum is added to produce the final number. The sum of these particular successive additions is our original number of 13,487. Now let us venture into the unknown by examining a new number base, the binary or base 2 numbering system. Again examine fig. 1 and look at the number 10110001010101. This figure is the same as 11,349 in the decimal numbering system, *honest!* First, the highest number possible expressed by a single digit is one less than the number base itself, or two minus one for one in this case. We multiplied the least significant digit by one times the decimal number and then by ten by the decimal number in that place and then 100, followed by 1,000 and then 10,000. This is to say that we increased by *ten* as we went from right to left. In the binary numbering system we increase by *two* each time we go across from the right to the left. So we begin at one then go to two followed by four, eight, 16, 32, 64, 128, 256 . . . etc. If a one appears in a digit's slot, then add its "weight" to the total; if a zero appears there, add nothing. Using our example as it appears in fig. 1, add 1 to 4, note that two was skipped because a zero appeared there. Take this and add it to 16, then 64, then 1,024, then 2,048, and finally 8,192. This total is 11,349 in decimal. This is binary arithmetic and it is the basis of digital logic, an awesomely large sector of the electronics industry. There are variations of binary numbers such as **B**inary **C**oded **D**ecimal numbers, also referred to as BCD numbers. These are binary numbers expressed in groups of four binary digits each with decimal "9" being the largest number possibly expressible. This convention was developed mainly to drive displays, because each digit has to be addressed for a display to work properly. Note in fig. 1 how a BCD number is expressed, the same number that we had previously expressed in binary. The A/D

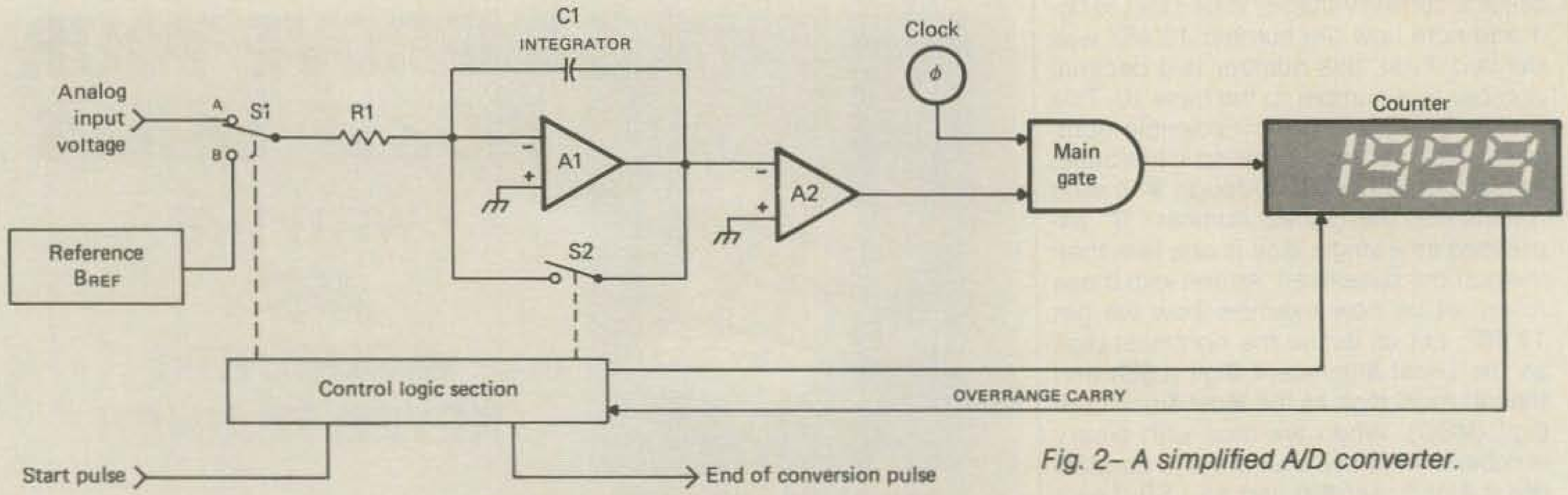
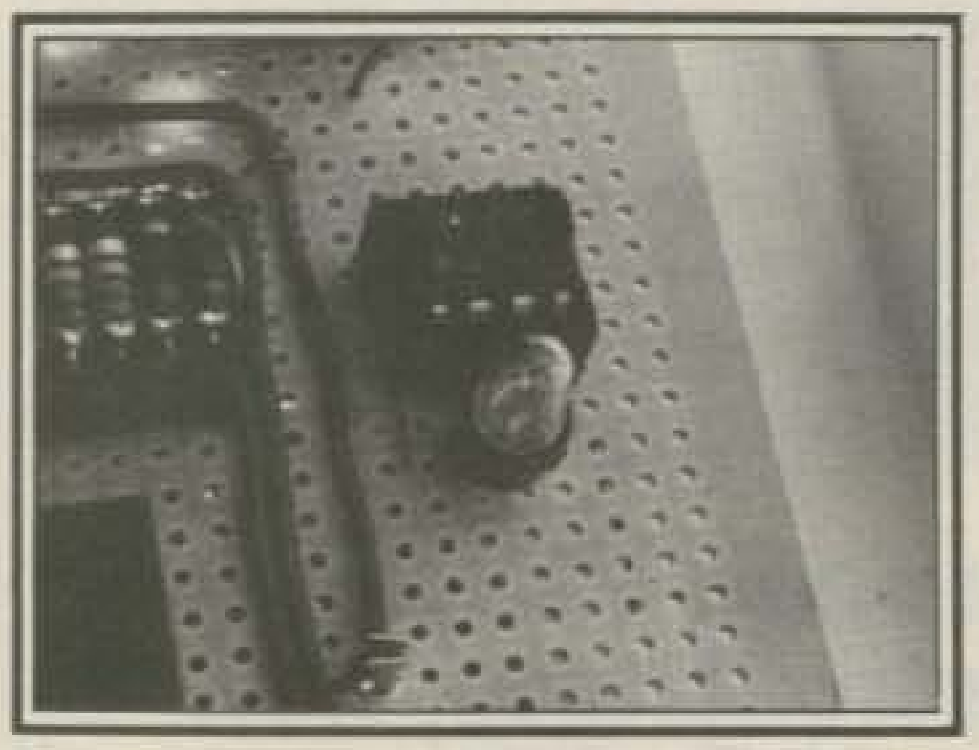


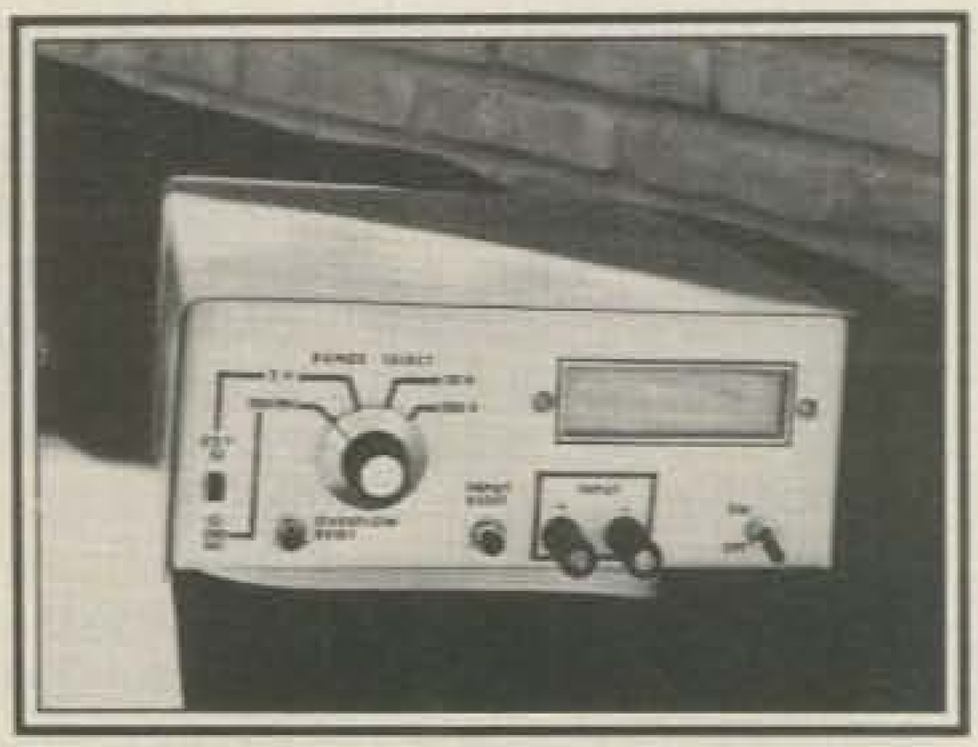
Fig. 2– A simplified A/D converter.



Wein bridge oscillator.

converter we use here has BCD outputs; that is, the digital output code is expressly designed to drive a display or group of either seven-segment LED or liquid crystal displays.

The circuitry that accomplishes all of this conversion is neatly tucked inside the confines of a 40-pin DIP IC package. The basis of this or any A/D is a *voltage comparator*, a circuit that compares two voltages and produces a voltage output that corresponds to the supply voltage, or very nearly to it, and is numerically equated to a binary one. Note how this is done in the simplified drawing in fig. 2. An Analog Devices book on data converters best explains this process when the authors say that it is like a pharmacist who is using a balance scale. He puts one weight on, and if it is too little, he adds another one; if it is too great, he removes it and places a smaller weight on, etc., until both sides of the scale balance. This is precisely what occurs during this voltage comparison process as is illustrated in fig. 2. The particular A/D we are using is a dual slope integrating converter, and it works by an indirect method whereby an unknown voltage (the input) is converted into a time period by an integrator and reference and then measured by a clock (square-wave generator) and counter. The result is a slow one, but it yields great accuracy. Note fig. 3, the internal "schematic" of this A/D converter, and see how it is done. Switch SW2 enables use of two scale factors—2.000 V and 200.0 mV. The ICL7101 A/D converter uses an ICL8052 *Analog Signal Conditioner*. This latter IC provides the internal reference, integrator, and comparator for conditioning the analog signal before it is digitized by the ICL7101. The dual slope method uses ramp generators, but if they were composed of a mere RC network, one would get the traditional exponential charging and discharging curves which are not linear, and only slightly approach being linear over a very small portion of their overall curve. The slope is actually the current (I) divided by the capacitance (C). When the reference is a true constant current source, then the charge/discharge curve becomes very linear with a ramp determined by the value of the integrating capacitor. This ramp is integrated by the integrator shown from pins 11 to 14 within the ICL8052. The integrating capacitor is a 0.22 uF capacitor and deserves some explanation. Generally, this capacitor should be one of exceptionally high quality with very low dielectric absorption, etc. In fact, using a polycarbonate capacitor resulted in an error of approximately 0.8 digit, a polystyrene capacitor yielded 0.3 digit error, whereas a polypropylene capacitor was the best tested and resulted in a mere 0.05 digit error. It should be noted, though, that this attention to low dielectric absorption is only important at power-on or when the circuit is recovering from an overload. Therefore, smaller and cheaper capacitors could be used if the readings are not required to be extremely accurate for the first few seconds of recovery. The capacitor from pins 25 to 28 of the ICL7101 is a *clock capacitor*, which simply means that its value determines the frequency of a square-wave generator. The graph in fig. 3 shows this. When selecting this capacitor, keep in mind that the maximum conversation rate of an A/D converter is usually limited to the frequency response of the comparator. This holds true here, because our integrator's open loop gain-bandwidth product is typically 300 MHz, and the comparator's output follows the integrator's ramp with a 3 μS delay. As an example, at a clock frequency of 160 kHz (6 μS period), half of the first reference integrate period is lost in delay. This means that the meter reading will change from 0



The completed unit.

to 1 with a 50 uV input, 1 to 2 with a 150 uV input, etc. Some circuits use positive feedback or a *latch* (a circuit that holds a fast occurring digital value) to solve this problem. These methods can cause "anticipation" errors that greatly exceed this 3 μS delay error. Another approach to this problem, which also is much less susceptible to noise spikes, is to place a small resistor in the integrator feedback loop. This has the effect of making the comparator respond more quickly by feeding it a small pulse which overcomes the delayed response normally associated with any RC time constant.

The dual-slope A/D converter basically consists of an integrator (note the op amp in fig. 4 with capacitor C11 or C int), voltage comparator (A3 within the ICL8052), gate (control logic block within the ICL7101), and the gate generator (the external clock capacitor from pins 25 and 28 of the ICL7101). There are three phases of operation: 1) auto zero, 2) integrate input, and 3) integrate reference. First, the term *integrate* in calculus means a determination of the area under a curve. In our case, it means the area under a slope. The *auto zero* phase is characterized by a positive pulse on the start-reset line. This generates a clear pulse which resets all internal logic (counters and gates) and sets the clock enable which allows the conversion sequence to begin. Next, the *integrated reference* phase (refer to fig. 3) finds switch S4 closed and all others open.

The internal voltage reference is obviously a very stable reference and has to

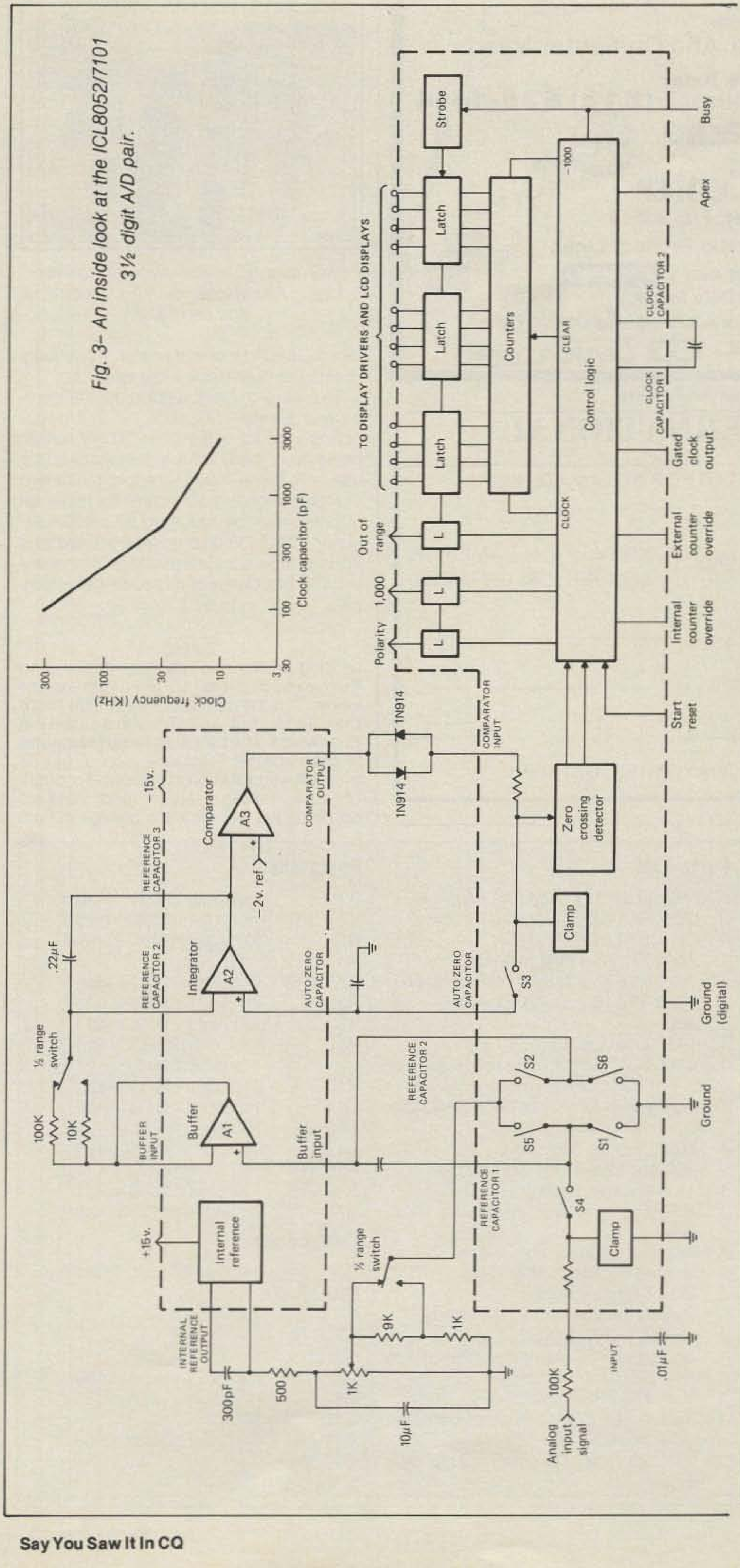
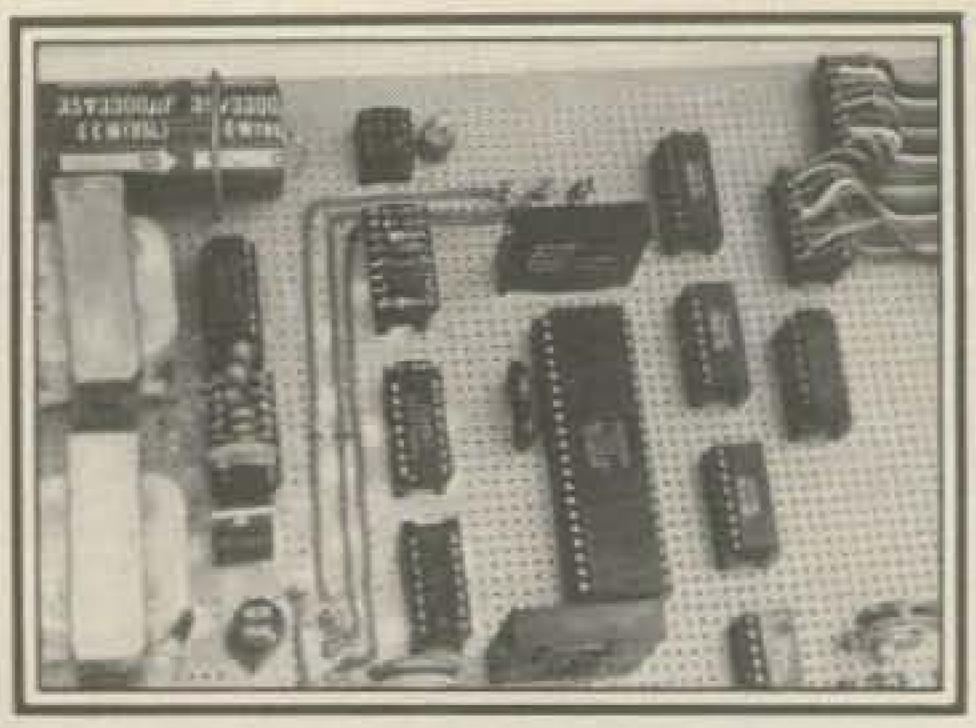


Fig. 3– An inside look at the ICL8052/7101 3½ digit A/D pair.



Power supply section showing full wave bridges, A/D display driver, LCD drivers, and oscillator.

remain constant. Scale selection then is merely accomplished by switching in more or less resistance in a voltage divider which attenuates the input. The amount of voltage applied to the input of the A/D converter is either 200 mV or 2.000 V maximum, and therefore, in order to measure 200 V full scale, we naturally attenuate the incoming signal by a factor of 100:1. Note the resistors on the input scale selection switch.

The input voltage is integrated for exactly 1,000 counts. At the end of these 1,000 counts, S4 opens and S5 and S6 are closed. This causes the integrator to ramp towards its auto-zero point with a slope proportional to the reference voltage. When the integrator crosses the auto-zero point, the comparator changes states and causes the zero-crossing detector to generate a conversion complete signal. This makes the latches latch in their data and it awaits the next initiate conversion signal. However, if 2,000 counts are received prior to the zero-crossing, an out-of-range signal is generated which sets the "out-of-range" output. This causes the *greater than* symbol on the LCD (liquid crystal display) to actuate and the *overflow/reset* has to be reset by SW3. The SW4 switch, also a front panel switch, is pushed to allow the system to stabilize and this also effectively resets the dual-slope integrator.

The back-to-back diodes on the comparator's output (ICL8052 pin 2) are recommended for use in the 200 mV range; however, if the DVM is to be designed for use only in the 2.000 V range, these two diodes, which are only there for noise reduction, may be replaced by a 100K resistor. The 1458 dual op amp is used as a Wein bridge oscillator/voltage comparator. The frequency of this oscillator is simply:

$$\frac{1}{2\pi RC}$$

as long as the two resistors (330 k) and the two capacitors (.01 μF) are the same value. This figures out to be a little more than 48 Hz, but was 55 Hz in actuality in this design. The tungsten lamp filament is in the negative feedback loop of the op amp for stabilization purposes. A couple of guys named Hewlett and Packard came up wit this idea in a garage in Palo

Parts List

	ICL7101/8052 3½ Digit A/D Pair
3	CD4055 LCD Driver IC's
1	CD4054 LCD Driver IC
1	7404 TTL IC – Hex Inverter
1	7420 TTL IC – Dual 4 – Input NAND
1	7486 TTL IC – Quad Exclusive – OR Gate
1	1458 Dual Op Amp
1	LM325 ± 15V Out Voltage Regulator IC
1	LM7805 + 5V Out Voltage Regulator IC
1	LCD Display, 3½ Digit
2	300 mA 12.6 V rms Transformers
1	¼ A Fuse with Holder
1	A.C. line cord and necessary hardware
4	Rectifier Diodes or a Bridge
4	IN4148 Signal Diodes
2	IN914 Signal Diodes
1	Switch – 4 position 2 pole rotary
1	Switch – DPDT slide
1	Switch – SPST Momentary Push (Normally Off)
1	Switch – SPST (ON/OFF)
1	Switch – SPST Momentary Push (Normally Closed)
1	12V 25 mA Tungsten Lamp and Holder

Resistors

R1	1 Megohmn 1% ¼ watt
R2	11.1 Kilohm 1% ¼ watt
R3	10.1 Kilohm 1% ¼ watt
R4, R7, R13, R19	10 Kilohm 5% ¼ watt
R5, R6	4.7 Kilohm 5% ¼ watt
R8	300 ohm 5% ¼ watt
R9	1 Kilohm pot (trimmer) PCB mountable
R10	9 Kilohm 1% ¼ watt
R11	1 Kilohm 1% ¼ watt
R12, R14	100 Kilohm 5% ¼ watt
R15	330 ohms 5% ¼ watt
R16, R17	330 Kilohms 5% ¼ watt
R18, R21	1 Kilohm 5% ¼ watt
R20	22 Kilohm 5% ¼ watt

Capacitors

C1, C5	3300 μF 35 VDC Electrolytic
C2, C3, C4	2.2 μF 35 VDC
C6, C7, C9, C14, C16, C17	0.01 μF Ceramic Discs
C8	.1 μF
C10	300 pF
C11	0.22 μF Polypropylene
C12, C13	1 μF
C15	1500 pF

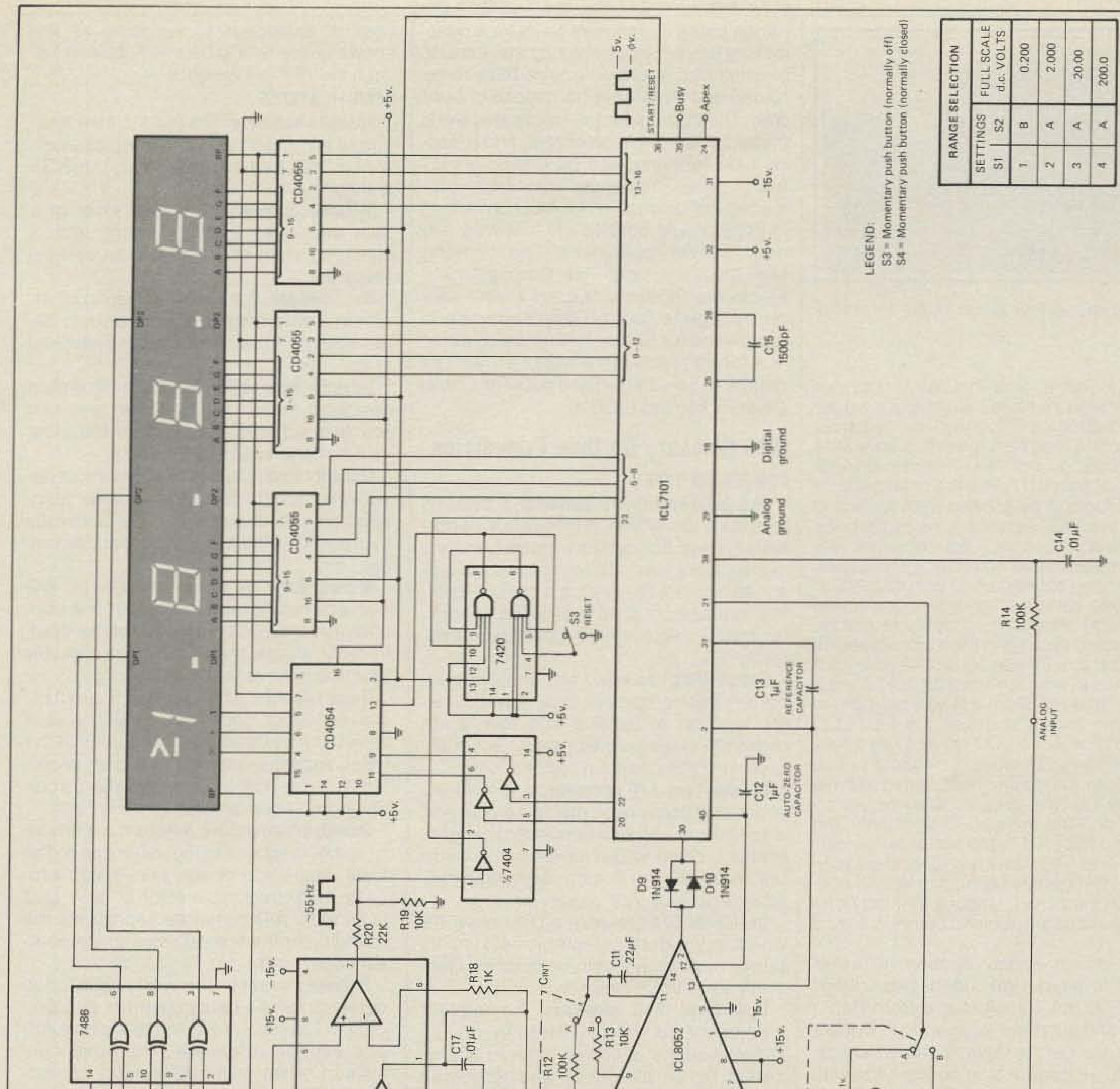
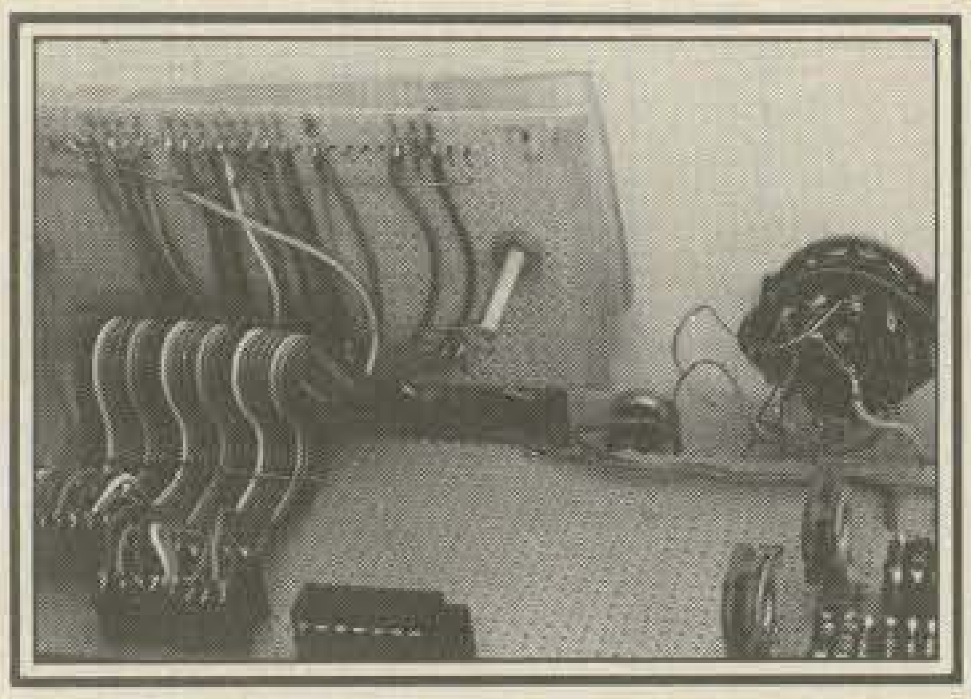


Fig. 4– The actual 3½ digit DVM schematic.



Display mounting/ribbon cable interconnect.

Alto, California, and the result was not only a stable audio oscillator, but a worldwide electronics firm. Anyhow, at power turn-on, the tungsten lamp has very little resistance, so not much negative feedback is apparent. This lets the amplifier's gain at turn-on be greater than unity and allows oscillations to start. As oscillations build up at resonant frequency, the filament heats and its resistance increases. This varying of resistance with oscillation amplitude variance has a self-correcting effect and keeps the amplitude stable. The second op amp in the pack serves as a comparator whose squarewave output is voltage divided by the 22K-10K combination. This resultant 4.8 volt output is a TTL logic high and drives the four LCD drivers. The 4055 LCD drivers have fully decoded outputs, while the 4054 only has three output lines and is designed to drive the one (1), the greater than or out-of-range, and the minus (−) signs only. Pin 23 of the ICL7101 is the out-of-range indicator. The 7404 inverter and the exclusive − OR gates (7486), working in conjunction with SW1, ensure that only one of the switchable decimal points is on at a time.

The power supply section is rather straightforward. We used two rather small 300 mA transformers from Radio Shack and put them in series to provide a means for center-tapping the windings. The 300 μF capacitor in conjunction with the 2.2 μF capacitor provide excellent filtering of the rectified a.c. The LM325 IC is a dual voltage regulator providing positive and negative 15 volts out. The only requirement is that the input voltages be at least 3 volts greater than the output or, that is, 18 volts. The 12.6 volts times 1.41 provides this nicely. The LM7805 IC is a positive 5 volt regulator and is good for 100 mA, which is more than enough for the three TTL gates and the ICL7101. The range selection is shown in the small box within the schematic. Diodes D1 through D4 are 1N4148 or the equivalent and provide input protection for overrange. The 1K pot on the input (pin 6 of the ICL8052) provides improved accuracy by allowing the internal reference output to be trimmed.

This project was constructed on a perf board, and we used component "headers" or DIP sockets with specially designed component attachments that allow easy soldering. This was coupled with flat ribbon cable connectors to make a neat-looking project by minimizing the number of wires that would otherwise have to be routed and eventually harnessed or bundled. The cutouts for the front panel were made by use of a nibbler tool, and press-on type lettering was burnished on for front panel nomenclature. This concludes the discussion of A/D converters in general and specifically how they are used in DVM applications. The following Mini-Glossary from the October 1978 *Electronic Products Magazine* was written by Eugene Zuch of Datel Systems and is provided for further reference or study.

A future article in the works at this time details a complete discussion of Liquid Crystal Displays (LCD's).

Mini Glossary On Data Conversion

CONVERTER TYPES

Charge balancing A/D converter: A conversion method which employs an operational integrator within a pulse-generating feedback loop. Current pulses are balanced against the analog input by the integrator and counted to produce the digital output. Also called *quantized feedback.*

Companding converter: A/D and D/A converter which employs a logarithmic transfer function to expand and then compress the analog signal range. Generally used in voice communications.

Counter-type A/D converter: A simple, inexpensive conversion method employing a counter driven A/D converter that generates a ramp which increases in value until it equals the analog input. Also called a *servo type A/D converter.*

Deglitched D/A converter: A D/A converter which incorporates a sample hold into its output to virtually eliminate glitches. Generally used in CRT displays.

Dual slope A/D converter: An indirect method of conversion whereby an unknown voltage is converted into a time period by an integrator and reference and then measured by a clock and counter. The method is slow but capable of high accuracy.

Flash type A/D converter: An ultra-fast conversion technique employing $2^n - 1$ comparators to quantize an analog input to n bits. Also known as *parallel* or *simultaneous method.*

Multiplying D/A converter: A D/A converter in which the reference input can be varied over a wide range, thus producing an output that is a product of the reference voltage and the digital input word.

Ratiometric A/D converter: An A/D converter in which the reference input can be varied over a wide range to produce an output that is the ratio of the analog input and reference input.

Successive approximation A/D converter: A conversion method that compares a series of binary weighted values against an analog input in sequence to produce an output digital word in just n steps, where n is the number of bits. The process is analogous to weighing an unknown quantity on a balance scale by using a set of fixed weights.

SPECIFICATIONS

Absolute accuracy: The worst case input-output error of a data converter, as a percent of full scale, referred to the *NBS standard volt.*

Dynamic accuracy: The total error of a data converter when operating with a changing input at the maximum conversion rate.

Error budget: A systematic listing of errors in a data converter or system to determine the total maximum or statistical error.

Linearity error, differential: The maximum deviation in the analog value between any two adjacent codes from the ideal value of one least significant bit.

Linearity error, integral: The maximum deviation of a data converter transfer function from the ideal straight line. Generally expressed in *percent* or in *least significant bits.*

Monotonicity: A characteristic of A/D converters whereby the output is a continuously increasing function of the input. In other words, the slope of the transfer function is never negative.

Noise rejection: The amount of suppression of normal mode analog input noise of an A/D converter due to integration of the input, expressed in *dB*. This is an important feature of dual slope and charge balancing A/D converters.

Quantizing error: The inherent uncertainty in digitizing an analog value due to the finite resolution of the conversion process. This irreducible error of ± ½ LSB in an ideal A/D converter represents the rounding of the analog value to the nearest code word.

Relative accuracy: The worst case input-output error of a data converter, as a percent of full scale, referred to the converter's voltage reference. The error consists of offset gain and linearity components.

Resolution: The smallest change that can be distinguished by an A/D converter or produced by a D/A converter. Resolution may be stated in percent of full scale, but is most commonly stated as the *number of bits, n, of a converter, where the number of possible output states is 2^n.*

Settling time: The time from the application of a full scale input code change to the point when the output of a D/A converter has changed to its new value and made final entry into a specified error band around the final value.

Static accuracy: The total error of a data converter under near ideal input conditions.

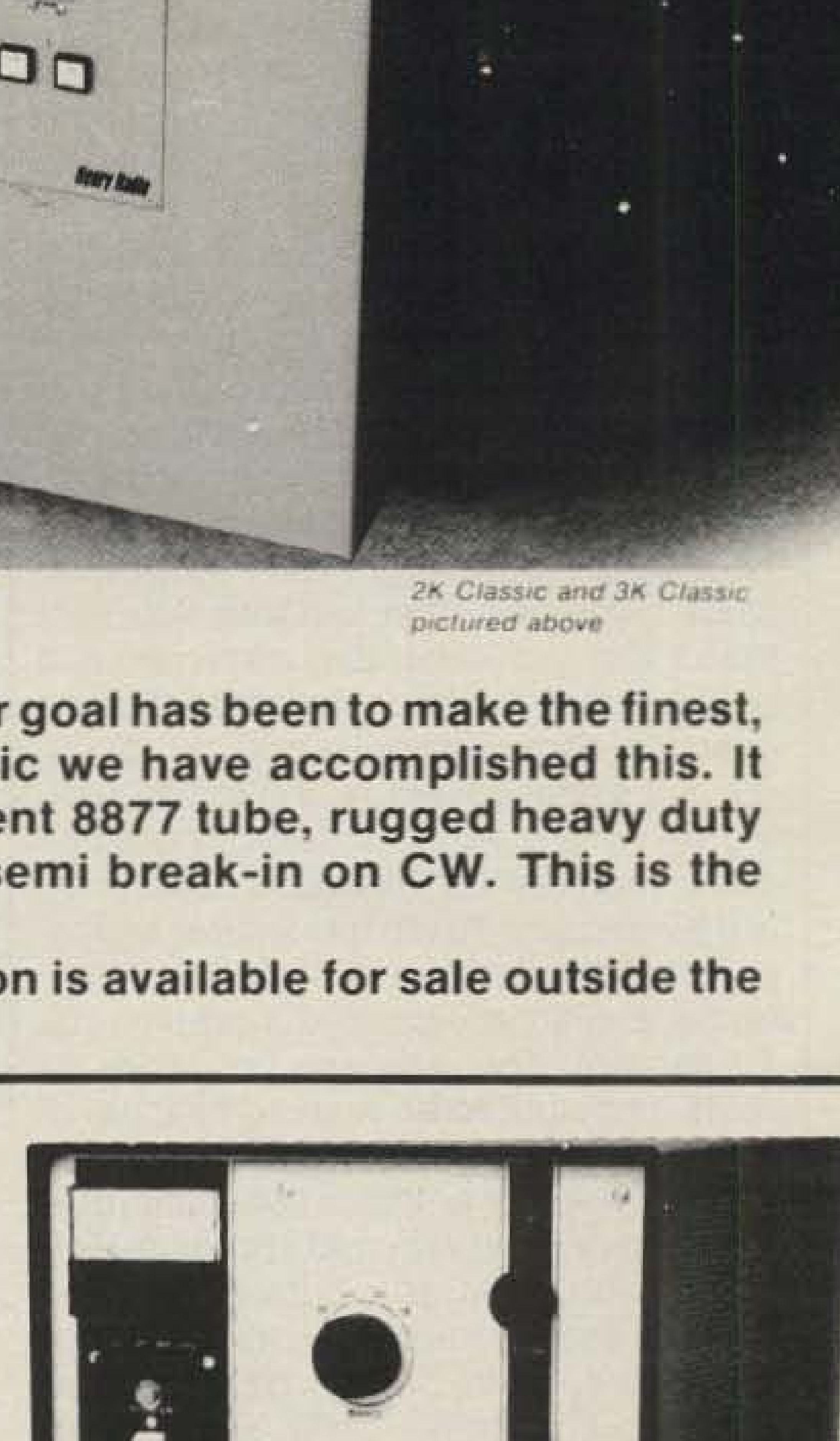
Throughput rate: The maximum rate at which a data conversion system can operate. It is determined by adding the various times required for multiplexer settling, sample-hold acquisition, A/D conversion, etc., and then taking the inverse of the total time required.

We think it is...and we think you'll agree with us.

2K Classic and 3K Classic pictured above

Ever since we made our first Amateur amplifier almost 20 years ago, our goal has been to make the finest, most rugged and reliable amplifier possible. Now with the 3K Classic we have accomplished this. It contains all of the famous Henry amplifier features plus the magnificent 8877 tube, rugged heavy duty power supply components and advanced antenna switch relay for semi break-in on CW. This is the amplifier of every Amateur's dreams!

The 3K Classic/X with heavy duty power supply and 10 meter operation is available for sale outside the USA where FCC type acceptance is not required.



The 2K Classic The 2K Classic represents the culmination of years of experience in developing, manufacturing and improving the 2K series. It remains as always a "workhorse", engineered and built to loaf along at full legal power for days or weeks without rest. A look inside shows why! It is truly a "Classic" amateur amplifier. Heavy duty, top quality components along with its rugged construction assures you trouble free operation. It will put your signal on the air with greater strength and clarity than you ever dreamed possible. The 2K Classic operates on all Amateur bands, 80 through 15 meters (export models include 10 meters). Price $1295.00

The 1KD-5 ...Another fine member of the famous Henry Radio family of superior amplifiers. And we're still convinced that it's the world's finest linear in its class. The 1KD-5 was designed for the amateur who wants the quality and dependability of the 2KD-5 and 2K-4, who may prefer the smaller size, lighter weight and lower price and who will settle for a little less power. But make no mistake, the 1KD-5 is no slouch. Its 1200 watt PEP input (700 watt PEP nominal output) along with its superb operating characteristics will still punch out clean powerful signals...signals you'll be proud of. Compare its specifications, its features and its fine components and we're sure you will agree that the 1KD-5 is a superb value at only $695.

The 2KD-5 We have been suggesting that you look inside any amplifier before you buy it. We hope that you will. If you "lift the lid" on a 2KD-5 you will see only the highest quality, heavy duty components and careful workmanship...attributes that promise a long life of continous operation in any mode at full legal power. The 2KD-5 is a 2000 watt PEP input (1200 watt PEP nominal output) RF linear amplifier, covering the 80, 40, 20, and 15 meter amateur bands. It operates with two Eimac 3-500Z glass envelope triodes and a Pi-L plate circuit with a rotary silver plated tank coil. Price $945.

Henry amateur amplifiers are available from select dealers throughout the U.S. And don't forget the rest of the Henry family of amateur amplifiers...the Tempo 2002 high power VHF amplifier and the broad line of top quality solid state amplifiers. Henry Radio also offers the 4K-Ultra and 3K Classic/X superb high power H.F. amplifiers and a broad line of commercial FCC type accepted amplifiers for two way FM communications covering the range to 500MHz.

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a monthly feature by
DAVE INGRAM, K4TWJ

The World of Video

A LOOK AT THE WORLD AROUND US

Two of our most commonly asked questions are, what are the basic differences between Fast Scan and Slow Scan TV, and how can an amateur living in a remote or isolated area join either of these exciting video activities.

Amateur Fast Scan TV is similar to regular television except it's operated in the 435, 1290, and 2300 MHz amateur bands. Conventional scanning rates of 15,750 Hz horizontal, 60 Hz vertical, and 480 *active* scanning lines are employed. The signal's wide bandwidth necessitates u.h.f. operations which usually restrict communication distances to less than 100 miles (depending on terrain and propagation). Fast Scan repeaters, however, are becoming quite popular for improving signal coverage and for escalating an area's FSTV activity. The basic items required for Fast Scan operation are a wideband 70 cm transmitter and receiving converter, a high-gain 70 cm antenna, and an inexpensive closed-circuit TV camera. The receiving converter directs its output to an unused channel of an ordinary TV set for viewing.

Slow Scan TV employs scanning rates which have been reduced approximately a thousand times, plus a lower total line count in each picture. As a result of these reductions, signal bandwidth is decreased to approximately 1100 Hz and may thus be transmitted using one's existing h.f. (s.s.b.) equipment. Unlike Fast Scan TV, which employs amplitude modulation (a.m.) for conveying video intelligence, SSTV employs frequency modulation (f.m.): 2300 Hz equals white, 1500 Hz equals black, and 1200 Hz equals sync pulses. Each SSTV picture requires eight seconds for transmission; thus, some form of extended readout is necessary for their display (the SSTV monitor). The first SSTV monitors used P-7 radar display tubes for this function. However, recent systems employ digital scan converters. Described in the simplest of terms, the scan converter stores an SSTV picture and accelerates it a thousand times to create Fast Scan compatible rates (and vice versa). The resultant Fast Scan signals are displayed on a conventional TV set or monitor.

*Eastwood Village No. 1201 So., Rt. 11 Box 499, Birmingham, AL 35210

The N7AON SSTV keyboard/titling system which loads an Apple II via disc provides several unique functions, including "canned" messages with "fill-in" blanks. A two-punch keyboard action brings up those programs.

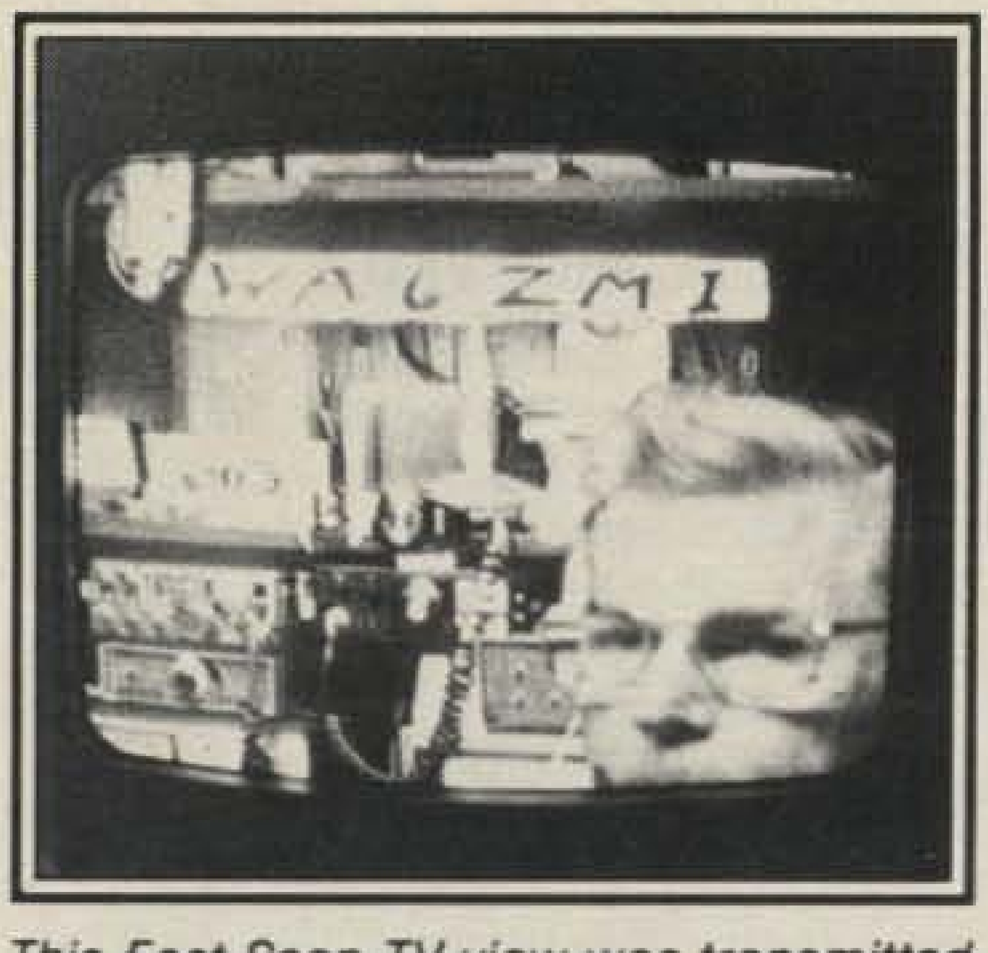
Anyone can join the excitement of video communications, regardless of his or her location. Isolated amateurs can enjoy the benefits of SSTV, while metropolitan-located amateurs can enjoy both FSTV and SSTV activities. Some rural areas are not as signal isolated as they may originally seem; check with area amateurs and clubs. Fast Scan repeaters are gaining widespread popularity, and signal propagation on the 435 MHz band often spans surprising distances. Bear in mind, also, that a strategically located TV relay setup can link remote locations with metropolitan area repeaters. If you really feel gusto, maybe you would like to join our plans to meet late some night on the Westar TV satellite. The pioneering opportunities and capabilities of visual communications are, indeed, limited only by one's imagination.

Home Computers and SSTV

An increasing number of amateurs are adapting their home computers to provide various SSTV functions, and the results are quite encouraging. The most popular units at this time are the Apple II and the TRS-80C color computers. Although these units do not produce results comparable to full-blown scan converters, their multiple in-house applications make them quite attractive.

In order for any computer to function as a scan converter, an analog to digital converter (input line) and a digital to analog converter (output line) must be utilized. In addition to this television signal voltage to computer binary level interface, an audio discriminator is necessary to convert SSTV tones into analog signals. Since the Apple II computer includes both of these items (an a.f. converter and an analog to digital converter), it can be programmed to provide standalone Slow to Fast Scan conversion. The TRS-80C computer features an analog to digital converter which can be accessed through its joystick input. However, the SSTV enthusiast must rig his or her own "front end" for driving this unit. (These SSTV tones-to-analog converters are easily constructed on perfboard. Several suitable circuits are included in Chapters 5 and 6 of my *Complete Handbook of Slow Scan TV*, TAB Books #859, available from *CQ* Book Shop, $9.95 plus $2.00 shipping and handling.) In case you're wondering, the TRS-80 model 1 and model 2 units can't be used with any degree of success for SSTV reception or transmission. These units do not include (among other things) an analog to digital converter or sufficient memory to function as a scan converter.

Chris Galfo, WB4JMD/6, has developed a software package to permit using the Apple II for Slow to Fast Scan conversion with relatively good results. The program loads via cassette tape to provide SSTV receiving capabilities (a separate Fast to Slow Scan converter setup or SSTV source, however, is required for transmitting Slow Scan Television). Using WB4JMD/6's program, Slow Scan signals from the receiver's audio output are directed to the computer's cassette input port. Following a frequency to voltage



This Fast Scan TV view was transmitted from Lee, WA6ZMI, to Tom, W6ORG, via the W6ORG 434 MHz to 1265 MHz Fast Scan repeater. WA6ZMI was 35 miles from the repeater and running 10 watts. W6ORG was 12 miles from the repeater. The views are in color, but the photograph is black and white. Next month's column will feature a comparison of Fast Scan and Slow Scan resolution using this photo.

conversion, the Apple II's game section performs analog to digital conversion for loading the main memory. A digital to analog converter in the computer's output section transforms accelerated data into video voltages which can be applied to a modulated TV oscillator or TV monitor. The program will function with only 16K or memory; however, 48K of memory will provide substantially better results. SSTV pictures are reproduced with the Apple II in only four shades of gray, whereas a Robot 400 Scan Converter reproduces sixteen shades of gray.

Clay Abrams, K6AEP, has developed several interesting "packages" for the TRS-80C computer. One package features an SSTV "front end" and software for using the unit as a Slow to Fast Scan converter. Incoming Slow Scan signals are "outboard" voltage discriminated and fed to the joystick input on the unit's RS232 port. Following scan conversion, output signals from the RS232 port are directed to a TV monitor. The program requires at least 16K of memory, with 32K being preferred. Output picture resolution is quite acceptable: 128 lines by 128 pixels, with sixteen shades of gray.

Another "K6AEP package" sets up the TRS-80C for limited resolution reception of color SSTV. Incoming pictures are reproduced in a format of 64 lines by 64 pixels and four colors: red, green, blue, and yellow (the four colors used in TRS-80C computers). Secondary colors such as magenta, orange, etc., can't be defined by this system, and picture resolution isn't equal to the conventional 128 by 128 format. This arrangement, however, is an inexpensive way to get rolling in SSTV, particularly if you already own a TRS-80C computer. K6AEP also has some elaborate RTTY programs for the Radio Shack

Nio -58-54

computer, and we will discuss them at a later date.

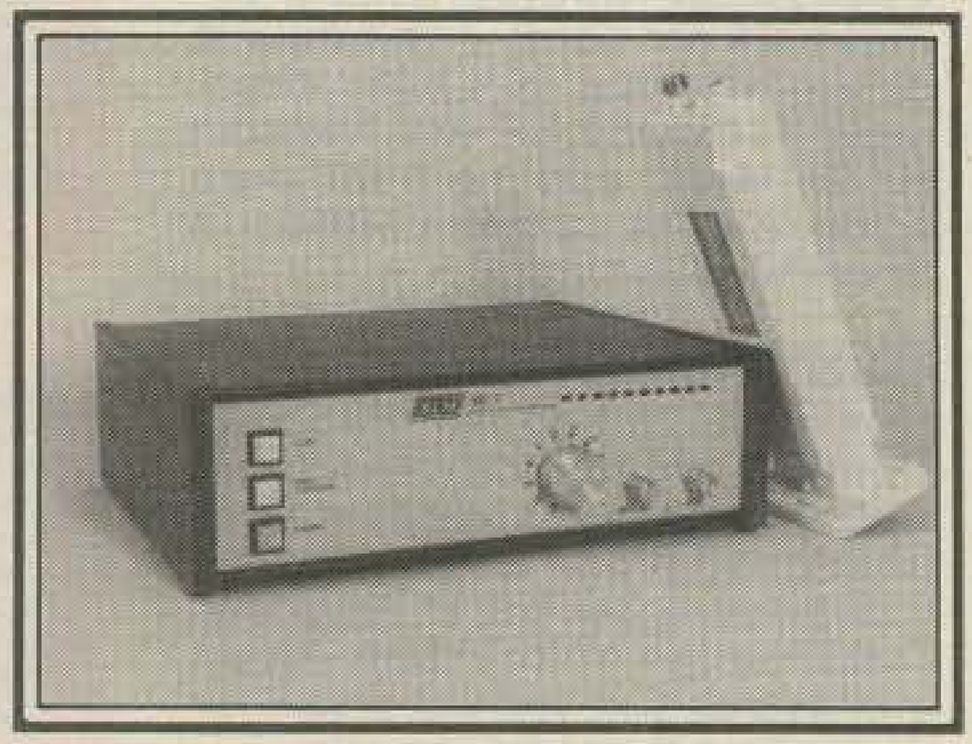
Tom Murray, N7AON, has developed a floppy-disc-available program for using the Apple II in conjunction with a Robot 400 for SSTV titling and keyboard functions. The program runs in 48K of memory and features several "log keeping functions" and "canned messages." Tapping various numbers on the computer's keyboard, for example, brings up preprogrammed CQ's, station ID's, description of station gear, etc. The Apple's output is connected to the Robot's Fast Scan input, either independently (straight letters on screen) or parallel with the station camera (superimposed letters on screen).

The consideration of using a computer or a full scan converter for SSTV operations depends on one's devotion to video activities. Commercial scan converters provide both Slow to Fast Scan *and* Fast to Slow Scan operations, and they can be modified for superb color SSTV (see last month's column). Home computers afford less overall capabilities, but they can be used for numerous other functions ranging from home bookkeeping and temperature control to word processing and RTTY operating. Bear these considerations in mind while studying your needs and desires, then make your own best decision.

Satellite TV and TVRO's

As you are surely aware, satellite TV reception is one of the hottest and fastest growing trends in the video world. Large parabolic dishes and their associated receiving equipment are appearing in locations on almost every continent, providing their proud owners with almost unlimited television receiving capabilities. Being the "first kid on the block" with a TV Receive Only setup can have its pitfalls: living rooms may become village gathering spots and popcorn expenditures can rise significantly! Some of the South American folks, however, interestingly have turned tables in their favor: they retransmit programs to neighbors in an MDS fashion on a specially allocated range near 440 MHz. Inconvenience becomes income, offsetting initial TVRO cost and reflecting shades of our own microwave TV broadcasting craze. The technology associated with satellite TV reception is quite sophisticated, but such challenges have proven inspirational to

New Products In Video



The new KLM SR-3 TVRO system features a dish-mounted downconverter/LNA (ampliverter) and optional microprocessor for automatic tuning/dish orientation.

KLM Communications, P.O. Box 816, Morgan Hill, California 95037, recently introduced their new TVRO system which promises some very cost-effective results. The system features a combination 120 degree, 52 dB gain LNA and 4 GHz downconverter which is mounted at the parabolic dish focal point. This ampliverter arrangement improves overall system signal to noise ratio, increases signal thresholds, reduces local oscillator "spurs," and eliminates the need for hardline cables and connectors. Since ampliverter output connects to the indoor unit via RG58, dish placement can become more convenient and secure. Power for the ampliverter is fed via the RG58 cable, with blocking capacitors used at each end to pass signals. An optional concentric feedhorn which increases efficiency and gain while reducing noise is available for the LNA input.

Universal Communications, P.O. Box 339, Arlington, Texas 76010, also recently introduced their self-designed, ampliverter-equipped TVRO system. This setup includes a 120 degree, 50 db gain LNA and hybrid downconverter which eliminates "spurs" and feeds the indoor unit via RG59 cable. The system features scan capabilities, video sampling, and probably some other features we've overlooked. Both the KLM and the U.C. systems are trend setters which are destined for a bright future.

The Universal Communications TVRO system features a dish-mounted downconverter which is a separate unit capable of operation with many commercially available LNA's. The indoor tuning unit features a LED bar indicator and scan modes.

radio amateurs for many decades. Satellite TV signals are "cloaked" from general public reception in three particular ways: frequency, signal strength, and video format. The 3.7 to 4.2 GHz satellite TV band is a remote area one simply doesn't stumble upon with conventional gear. Additionally, satellite relayed signals are critically weak and seemingly buried under inherent noises. Uncovering these signals by a carrier to noise factor of 10 dB (minimum) requires both large parabolic dishes and high-gain low-noise preamplifiers. Finally, the use of f.m. rather than a.m. for conveying video intelligence is difficult for laymen to handle in an efficient and effective manner.

All large receiving dishes are not created equal. They should be made flatter for higher gain, but deeper for more narrow bandwidth and greater signal to noise ratio. A second metallic structure, grounded and situated close behind the "front dish," also reduces extraneous noise pickup (this concept is often employed in fiberglass-type dishes). As a suggestion when studying dish parameters, consider those exhibiting focal length to diameter ratios between 0.5 and 0.7. The high cost of commercial dishes has inspired many amateurs to "roll their own" fashioned from designs of EME dishes. One of the prime keys to success in this endeavor involves maintaining overall parabola accuracies within one percent; otherwise, LNA requirements rise significantly.

One of the more recent innovations in TVRO designs involves combining the LNA and the 4 GHz to i.f. downconverter into a single dish-mounted unit (an in-depth look at this concept was presented in my article "Satellite TV Receivers—Is There a Better Way?" which appeared in November 1981 *73* magazine). This arrangement reduces stringent LNA requirements while lowering system costs and decreasing undesirable self-generated interferences. At least two TVRO manufacturers are presently using this "ampliverter concept," and their units provide good results at a fair price. Other manufacturers will probably follow this technique in their subsequent designs.

Indoor tuning units are also undergoing improvements, particularly in the area of video processing. The use of f.m. for conveying video intelligence has a tendency to produce unrelated frequencies and scatter them in a random manner. Video sampling, which starts a sawtooth ramp at the beginning of each video cycle and is coincidentally stopped at the end of each cycle, eliminates such interferences and ensures that only true video creates output voltages *(shades of SSTV sampling techniques, eh?).*

Some would-be satellite TV enthusiasts have been "holding back" on involvement, waiting to see how Japanese technology will affect the field. The Japanese satellite TV band is 12 GHz, so they haven't a reason to construct 4 GHz units. We will probably continue *status quo* until the days of direct home satellite TV broadcasts. Those planned 12 GHz units could create a frenzy of imported terminals. Meanwhile, homebrew TVRO designs are logical considerations, with the exception of the LNA. Dish-mounted downconverters and 120 degree LNA's are suggested.

An Untapped Resource?

As you are probably aware, technological expansions in SSTV have outpaced its applications by a noticeable degree. A change of tactics is in order, lest we stalemate exchanging full-color pixel averaged and computer enhanced views of ourselves, our rigs, magazine pictures, etc. Let's get cracking with some interesting on-the-air views!

Everyone has something worth sharing, be it a stamp collection, a travelogue, a step-by-step viewing of a recent jacuzzi installation, views of a city's attractions, or merely technical notes similar to those innovative ideas scratched on restaurant napkins during each year's Dayton Convention. SSTV views can surely outpace "napkin notes," and that beats delaying ideas until personal meetings. Maybe we should instigate a "Best Views of the Month" contest. Opinions and ideas are solicited. Let's hear/see your thoughts, and soon. Here's looking at you!

73, Dave, K4TWJ

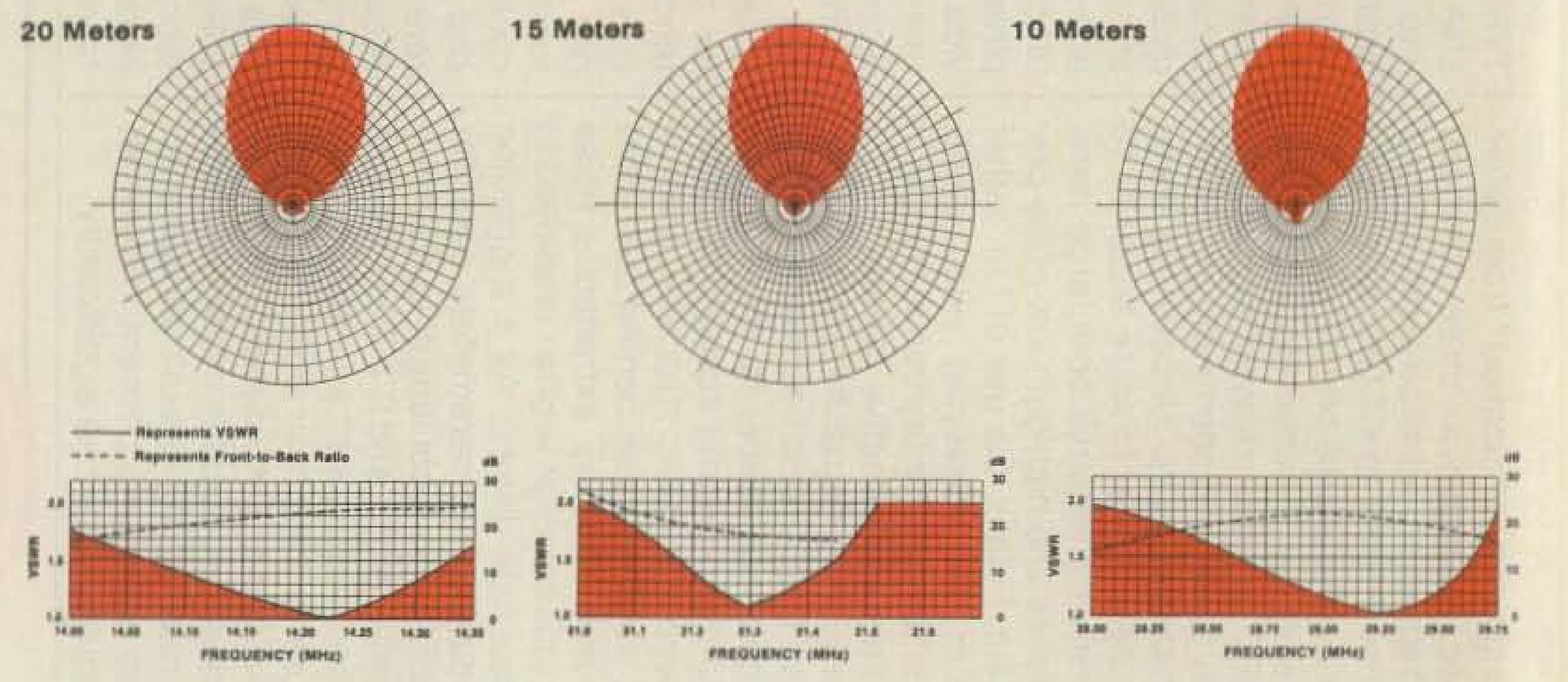
ANNOUNCING

A new standard of comparison for HIGH PERFORMANCE TRIBANDERS

the all NEW hy-gain® TH7DX

BROADBAND WITHOUT COMPROMISE

For years now, whenever hams got together and talked about the performance of any triband antenna, they would invariably compare it to the famous Hy-Gain TH6DXX. Now, there's a new standard of comparison—the NEW Hy-Gain TH7DX. This amazing new tribander, using a dual driven element system, maintains a VSWR of less than 2:1 on all bands, including ALL of ten meters. Hy-Gain didn't compromise on performance to achieve this efficiency either. The TH7DX utilizes a combination of trapped and monoband parasitic elements for more efficient broadband performance. This unique combination produces an *average* front-to-back ratio of 22dB on 20 and 15 meters, and 17dB on 10 meters. The TH7DX, with its great broadband characteristics, is the ideal choice for "all mode" operation.



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The broadband TH7DX has high performance specifications that meet or exceed the monster antennas that seem to take up most of your real estate and part of your neighbor's. However, with its short 20 ft. (6.1 m) turning radius and 31 ft. (9.4 m) longest element, it's no more imposing than a TH6DXX. It's easy to assemble and weighs only 75 lbs. (34 kg). The wind loading is 240 lbs. (109 kg) at 80 mph (129 kph) with only a 9.4 sq. ft. (0.9 sq. m) wind surface area, so the TH7DX is one of the safest and most manageable high performance tribanders you can buy. And, you don't have to spend a fortune on special towers and rotators either.

MECHANICALLY SUPERIOR

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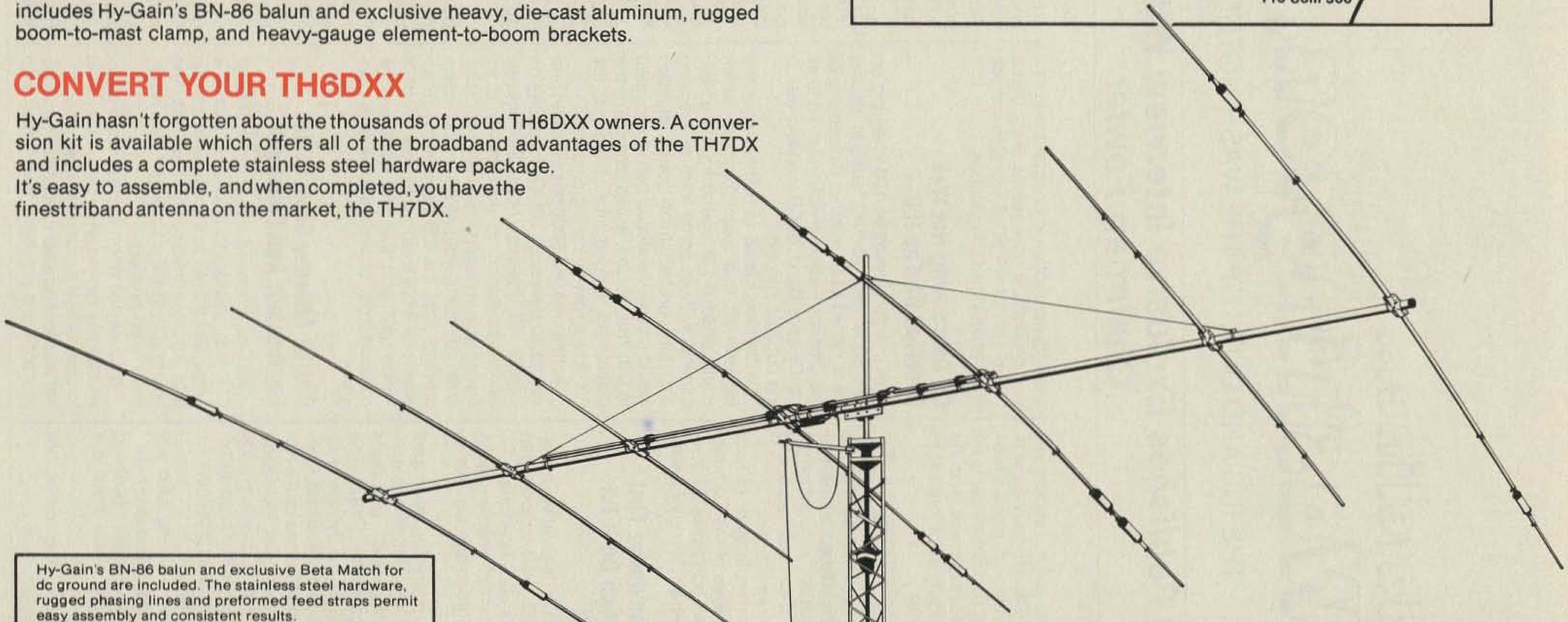
This is an ultralight, single-sided, aviation-style headset with powerful electret microphone. The dual impedance microphone has a 100 to 8000 Hz frequency response specifically tailored to the human voice. And, it equals or exceeds the on-the-air performance of any desk mic, regardless of its size or weight. Leaves your hands completely free for maximum flexibility. Once you've tried it, you may never clutter up your operating area with a desk mic again.



Hy-Gain's BN-86 balun and exclusive Beta Match for dc ground are included. The stainless steel hardware, rugged phasing lines and preformed feed straps permit easy assembly and consistent results.

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CIRCLE 65 ON READER SERVICE CARD

a regular feature by
THEODORE J. COHEN, N4XX

dateline... Washington, D.C.

THE INS AND OUTS OF THE WASHINGTON SCENE

CQ Publishes Exclusive Interview With New FCC Chairman Fowler

Elsewhere in this issue, readers will find a far-reaching in-depth interview with Mr. Mark S. Fowler, the FCC's new Chairman. This is the first such interview to be published in the amateur press, and the material covered should be of interest to amateurs everywhere.

Included in the interview are exchanges on subjects such as "unregulation," the Chairman's perceptions of the amateur service, the role amateurs can play in experimentation, recognition of the hobby aspects of amateur radio, and creation of a code-free license.

For an up-to-the-minute view of how we stack up in the eyes of the Commission's new Chairman, don't miss *CQ*'s exclusive interview with Mr. Mark S. Fowler.

Congressman Convinced That Enabling Legislation On R.F.I. May Be Required

Discussions with a legislative assistant to Rep. Swift (D., WA) indicate that the congressman is convinced that r.f.i. is a real problem and that enabling legislation may be required to address this issue.

This view was apparently developed during hearings on HR 5008, which contains the "noncontroversial" proposals in the FCC's program for FY82. (The hearings were held in the House Subcommittee on Telecommunications, Consumer Protection and Finance on 19 November 1981.) Unlike similar legislation in the Senate (S. 1731), however, the House bill currently contains no provisions for addressing the growing r.f.i. problem in this country.

The 19 November hearing also addressed the so-called "Goldwater Bill" (S. 929). Since this bill contains enabling legislation on r.f.i., and since there is a growing perception in Congress that r.f.i. is a problem, it now seems likely that a "mark-up" of HR 5008 will also include such enabling r.f.i. legislation.

8603 Conover Place, Alexandria, VA 22308

CB Delicensing Not Well Received On The Hill

In the 19 November 1981 hearing on HR 5008 (see above), several doubts were raised as to whether delicensing of the Citizens Radio service (referred to as the Citizens Band, or CB, service) was in the public's interest.

Witnesses called to testify frequently focused on one major problem which could arise if CB operators were delicensed: without some form of licensing structure, an "anything goes" situation would rapidly develop in bands allocated to CB. This, in turn, would jeopardize the usefulness, among other things, of the Ch. 9 emergency calling channel.

At this time, HR 5008 does contain provisions to delicense CB. Our sources on Capitol Hill, however, note that Congressional resistance to delicensing is increasing as a result of mail from constituents. As such, your Washington editor predicts that the CB delicensing provisions of HR 5008 will *not* survive this bill's "mark-up," and that the issue will be dropped from consideration in this Congress.

District Attorney Goes To Bat For Amateur And Consumer

At first, it looked like another case of r.f.i. that was going to end up before a judge. But thanks to the efforts of the district attorney involved in the case, the amateur and the consumer may never have to go to court.

It all started when a cititzen complained that she had no alternative other than to commence a criminal prosecution for harassment against a neighbor because of continued problems and annoyance created by (alleged) r.f.i. caused by the neighbor's amateur transmitter. On investigation, however, it was learned that the devices experiencing the interference were tape recorders, both produced by a well-known Japanese manufacturer.

The amateur, armed with the ARRL's RFI Packet, persuaded the district attorney that the problem was a result of the tape recorders' designs. Further, he convinced the DA that there was nothing he could do to his transmitter that would stop an audio device from behaving like a radio.

As a result of the amateur's efforts, the DA wrote a letter to the manufacturer requesting assistance in eliminating the problem.

We can only hope that the manufacturer involved will resolve what is rightly his problem. But it would have been much better if the tape recorders had originally been designed and built to reject r.f. energy. It would have saved everyone involved time and trouble!

Radio Club Of America Citations Awarded

As if to attest to the fact that an involvement with amateur radio can lead to a rewarding career in communications and electronics, the Radio Club of America, in late 1981, announced that amateurs received two of the Clubs most coveted citations.

The 1981 recipient of the Sarnoff Citation is Jerry S. Stover, W5AE. Jerry is currently on the staff of the SMU School of Engineering and Applied Science, and has assisted in the development of the School's Graduate Program in Telecommunications Management. As Special Assistant to the Dean, he also provides liason between the school and several high-technology firms in the Dallas-Fort Worth area.

The 1981 DuMont Citation was awarded to Horace Atwood, Jr., W2SXW. Among other things, Horace was appointed Chief Television Receiver Engineer by DuMont in 1945, and he was responsible for DuMont's first post-war TV receiver product line. These sets featured 20-inch picture tubes manufacturer by DuMont . . . tubes that were years ahead of the competition. Horace has been an amateur and commercial radio operator for over 40 years, and he holds seven patents for electronic circuit inventions.

Also honored by the RCA was James J. Lamb, who received the Pioneer Award for 1981. Many will recall that Jim joined the technical staff of the ARRL in 1928, and from 1929 to 1940, he was Technical Editor of *QST*. While in that position, he pioneered a number of developments, most famous of which is the Lamb Noise Silencer. Besides his early achievements in radio circuitry, Jim also did important work in atmospheric refractivity gradient and tropospheric radio propagation measurement. In all, he holds nine patents.

Finally, the RCA awarded citations to the following new Fellows:

Mr. James C. McKinney, Chief, Private Radio Bureau, FCC, for contributions in vital FCC and international conferences, and

Mr. Carlos V. Roberts, Director, Land Mobile Radio Development, M/A-COM Corp., for former service as Chief, Private Radio Bureau, FCC.

The staff of *CQ* joins your Washington editor in extending congratulations to these and other recipients of Radio Club of America awards.

AMRAD Requests Amendment To STA For Expanded Spread-Spectrum Experiments

In late 1981, the Amateur Research and Development Corporation (AMRAD) requested that the FCC amend the Special Temporary Authority for spread-spectrum experiments to include a fifth experiment. Specifically, the new experiment (#5 in the series) was to be performed in the 2-meter amateur band (144–148 MHz), with sub-bands designated for weak-signal and satellite activities to be avoided.

Initial tests will be conducted using American Radio President 240 v.h.f. transceivers which have been modified for frequency-hop applications. Hopping rates of between 10 and 80 hops per second will be used, with up to 16 channels to be occupied (the units are capable of hopping to any one of 46 channels). The tests will be conducted in the Washington, DC, and Annapolis, MD, areas, with power levels in the range of 25 to 150 watts. Ship-to-shore and ship-to-ship tests are also contemplated using ships operating within the waters of the United States.

Commission Amends Rules To Allow Facsimile And TV Transmissions On Additional Frequencies

The FCC has amended its rules to allow FAX and TV transmissions on additional frequencies in the amateur service. The rules change will permit amateur operators to transmit FAX and TV signals anywhere in the h.f. spectrum (3 to 30 MHz) where voice transmissions are currently allowed. The effect of the change will be to expand the authority for these transmission modes to almost all of the amateur telephony bands.

The FCC has allowed the transmission of "slow-scan" TV (SSTV) in certain bands since 1968. It has yet to find any adverse impact or increased interference to amateur operations as a results of these transmissions. As a result, the Commission does not anticipate that serious interference problems will result by opening up other frequency bands for FAX and TV transmissions.

In its announcement of the rules change, the Commission stated that relaxation of Part 97 of the rules affecting TV and facsimile operation will permit experimentation and operation of those modes by more amateur operators, thus contributing to the advancement of their technical skills.

Commission Proposes Automatic Control For Amateur Beacons

The Commission has proposed authorizing unattended automatic control for amateur stations transmitting one-way "beacon transmissions" to detect unusual propagation conditions, and to check out and adjust radio equipment. Also proposed was a requirement whereby an amateur engaging in such operations would have to terminate transmissions if he or she caused undue interference.

In announcing its proposal, the FCC also indicated that it would seek to limit beacon operations to certain frequencies so as to prevent beacon transmissions from being used to harass other operations. The use of such frequency limitations would also make it easier for amateur operators to locate beacon transmissions.

Given the nature of the FCC's proposal, the details of which are beyond the scope of this column, interested amateurs should address their inquiries to: Mr. Steve Lett, FCC, Washington, DC 20554 (telephone: 202-632-7597).

Job Opportunities For Engineers To Increase Significantly Over Next Four Years

As reported in *Electronic Engineering Times*, a recent survey by the American Electronics Association (AEA) showed that job openings for electronics and

computer-science engineers will exceed the number of graduates able to fill these jobs by three to one over the next four years. Specifically, while American colleges will graduate only 69,315 electronics and computer-science engineers between now and 1985, the US electronics industry will have positions for 198,191 such individuals. With industry demand for qualified engineers expected to be high, competition on the campuses for new engineering graduates will be intense. This does not bode well for the military, which is already faced with a shortage of the personnel needed to maintain our sophisticated weapons systems.

Foreign Engineers Stir Controversy In US

With a domestic shortage for electronics and computer-science engineers apparently in the making, a major manufacturer of industrial controls recently hired 17 foreign electronics engineers for work in this country. Their arrival here will surely stir up bitter feelings, since many engineers believe that there is no shortage of trained engineering personnel. Said Darrell Vines, a member of the IEEE United States Activities Board (USAB), "There is no shortage of engineers. It's just difficult to get them to take jobs at the salaries being offered."

Of the 17 foreign engineers to work in the US, 10 are from the Philippines. This nation's unemployment is currently running at 36%, and so, the flight of skilled Filipino labor to the US could accelerate in the months ahead. This is especially true of those in the engineering profession, for the five major engineering schools in the Philippines continue to graduate over 2000 BSEEs each year.

The IEEE's USAB is expected to draft a position paper on alien engineers, and to submit this paper at an early date to the Secretary of Labor. Among other things, the paper will include a detailed salary chart (based on a recent survey of US engineers) and a recommendation that before an alien be allowed to fill a job, that the job be advertised in the US at the appropriate salary range.

Citizen's Band Legalized In Britain

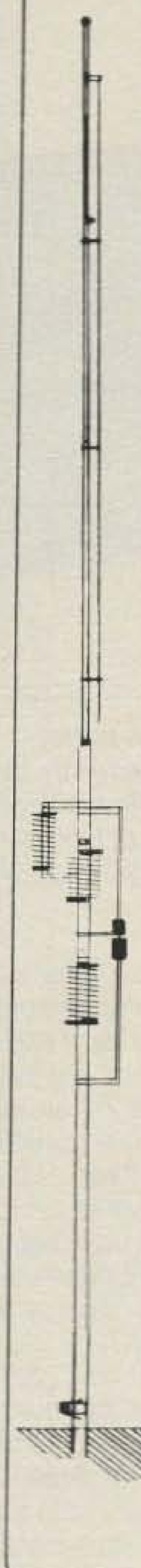
For years, the British government hoped that the CB craze which hit the US in the 1970's would not hit their island nation. But with the number of illegal, 27 MHz transmitters operating in England estimated at 250,000 at the beginning of 1981, the authorities finally relented. Known as "Open Channel," the new service is authorized 40 f.m. (!) channels between 27.6 and 28 MHz; maximum transmitted power is limited to 4 watts. A license costs the equivalent of $18, and it permits the use of up to three sets.

Still on the drawing board in Britain is an "Open Channel" service around 928 MHz.

Commission Acts To Relax Rules On Low-Power Transmitting Devices

Responding to the complaints of security system manufacturers, the FCC recently removed the time limit for radio transmissions from home security systems. Before this action, the operating time of low-powered transmitting devices used in security systems was limited to one second out of 30. The time limit was also removed on emergency medical alert devices and on radio-controlled camera shutters. In all cases, however, these devices may not transmit continuously, and must shut off automatically.

The old time-limit rule still applies to radio-controlled toys.



CQ Reviews:

The Sony ICF-2001 Receiver And The MFJ 1020 Active Antenna

BY JOHN J. SCHULTZ*, W4FA

The Sony ICF-2001 was introduced in the U.S. this past year and is befitting of a product that is bound to be a forerunner in what will probably be a decade of advances in general-coverage receiver design. On the surface, the ICF-2001 would appear as just a general-coverage a.m./f.m./s.w. portable receiver with digital readout selling in the medium price range. There is nothing new about such receivers, and there are a number of good ones on the market already. However, such receivers to date have used what might be termed "conventional" design with manual bandswitching and tuning, but with the convenience of a digital readout. The Sony ICF-2001 is a drastic departure from such designs. It brings frequency synthesis and microcomputer technology to a medium-priced but high-performance general-coverage receiver.

The ICF-2001 is billed as a portable receiver, and it fits this classification since it is about 12 × 7 × 2 inches in size and weighs about 4 lbs. The frequency coverage is from 150 kHz to 30 MHz in *one* continuous range in the a.m. or c.w./s.s.b. modes and from 76 to 108 MHz in the f.m. mode. The liquid-crystal frequency display provides a readout to 1 kHz on the LW/MW/SW bands and to 100 kHz on the f.m. band.

The Sony ICF-2001 "push-button" receiver has about more features than any portable, general-coverage receiver yet available. However, contrary to the frequency readout shown here, it doesn't cover up to 144.000 MHz. Apparently a touch-up artist got carried away and meant to illustrate some frequency in the 150 to 30,000 kHz or 76 to 108 MHz range which the receiver actually covers.

One might notice from the photograph of the unit that there are no tuning or bandswitching knobs, and this is where the fun starts. Once the set is turned on, to receive any frequency in the 150 kHz to the 30 MHz range, one simply enters the frequency into the keyboard *a la* hand calculator fashion and presses the **execute** key. The receiver almost instantly displays the frequency entered and is set on it. If there is any station to be heard on the frequency, the receiver is ready. For most frequencies, one enters the frequency into the keyboard in straight-forward fashion. For instance, to receive 209 kHz or 22.181 MHz, one simply enters the numbers 2-0-9 or 2-2-1-8-1 followed in each case by a depression of the **execute** key. There is a slight shortcut possible in the case of even numbered MHz frequencies. For instance, if one wanted to receive 10.000 MHz, one need only enter 1 and 0 followed by a depression of the **execute** key. The display will indicate 10,000 kHz. This feature of almost instantly being able to set the receiver on any frequency can alone keep one fascinated for hours. If one makes an invalid entry, such as trying to set up a frequency of 50.000 MHz, a sign will appear in the lower portion of the LCD display which politely flashes "Try Again."

Once the receiver is set on a given frequency, one can tune it up or down from that frequency in 1 kHz steps by pressing either the key marked **up** or **down**. Every depression of either key will step the frequency 1 kHz. If, however, one continues to hold either key down for 1 or 2 seconds, the receiver will start to scan frequencies in 1 kHz steps in the direction chosen. It takes about 1¾ minutes to scan 1 MHz. Or, if one depresses either the **up** or **down** key and simultaneously the **fast** key, the scanning rate is increased and 1 MHz is covered in 25 seconds.

The 1 kHz steps are perfectly satisfactory for most a.m. mode reception purposes, but what about c.w. and s.s.b. reception? Perhaps I should backtrack a second and mention that there is a switch on the receiver labeled **Band**. The Sony people must have had a hard time finding a label for this switch since it is not quite a band switch and not fully a mode switch. It is not a band switch when one considers the 150 kHz to 30 MHz range. However, it does switch the receiver from that range to the 76 to 108 MHz range and sets the internal circuitry for f.m. demodulation when it is placed in the **FM** position. Its two other positions—**AM** and **SSB/CW**—choose the mode of reception in the 150 kHz to 30 MHz range. In the **SSB/CW** mode a product detector and b.f.o. are used for demodulation, and also a fine tuning control marked **SSB/CW Compensator** is activated.

*c/o CQ Magazine

The fine-tuning control varies an oscillator frequency ± 6 kHz so the incoming signal can be placed on either slope of the i.f. passband for either u.s.b. or l.s.b. reception. Using this control and manually stepping the received frequency in 1 kHz steps, one can easily tune in c.w. or s.s.b. signals on any frequency. The frequency display does not change as one varies the compensator control.

Another control that might be mentioned is the **AM Antenna Adjustment**. Actually, this control has nothing particularly to do with a.m., but it is an antenna peaking control active over the 150 kHz to 30 MHz range. When using the built-in telescoping whip antenna, this control only significantly affects reception above about 20 MHz where it does have to be carefully adjusted for optimum reception sensitivity.

Besides the manual scanning feature mentioned, the receiver also has automatic scanning and memory features. The automatic scanning feature is unique in that one can enter from the keyboard the lower and upper frequency limits over which scanning is to be conducted. The range can be any desired one and in any portion of the ranges covered by the receiver. Scanning is done in 1 kHz steps in the 150 kHz to 30 MHz range and in 100 kHz steps in the 76 to 108 MHz range. The scanning rate is the same as for manual scanning. For instance, one could set up the receiver to scan 21.000 to 21.100 MHz, and it will take about 10 seconds to scan this range. Or, if one has nothing to do for about 70 minutes (!) one could set the receiver to scan from 150 kHz to 30 MHz. The receiver will dutifully sit there and scan the entire range. As each 1 kHz is stepped, the receiver audio makes a slight sound like a squelch tail. As scanning proceeds, the overall background sound is almost like that of an old steam locomotive chugging along. Scanning is continuously repeated unless it is manually stopped or the receiver set to automatically stop scanning when an "S9" signal is encountered. If scanning is manually stopped by the **Scan Start-Stop** button, depressing the button once will stop the scanning and pressing it again will resume the scanning. If the receiver is set to automatically stop scanning and one wishes to advance the scanning after it has stopped, the same button has only to be depressed once.

The receiver has six memory presets which can be used in any frequency range. That is, one can use all six in the 150 kHz to 30 MHz range or in the 76 to 108 MHz range or split them as desired. One enters frequencies into memory directly from the keyboard. Or, if one is receiving a frequency that is to be stored, one simply depresses two keys (**enter** and any of the the **1** to **6** memory keys) and the frequency is stored! To recall frequencies, one simply depresses the memory number key. The only exception is if one has stored some f.m. frequencies, the **Mode** switch must be set to f.m. when those frequencies are recalled. The LCD display indicates which memories have frequencies stored in the 150 kHz to 30 MHz range or f.m. range by means of a separate number readout on the bottom of the display. For instance, if one has f.m. frequencies stored in memories 5 and 6, when the **Band** switch is placed on f.m., a tiny "5" and "6" will appear in the display. In reality, one can gain two more memories if the automatic scanning feature is not being used. The upper and lower scanning frequency limits which are entered from the keyboard are just another form of memory controlled by keys marked **L1** and **L2**. These frequencies can be recalled just like one of the preset memories by depressing the appropriate key.

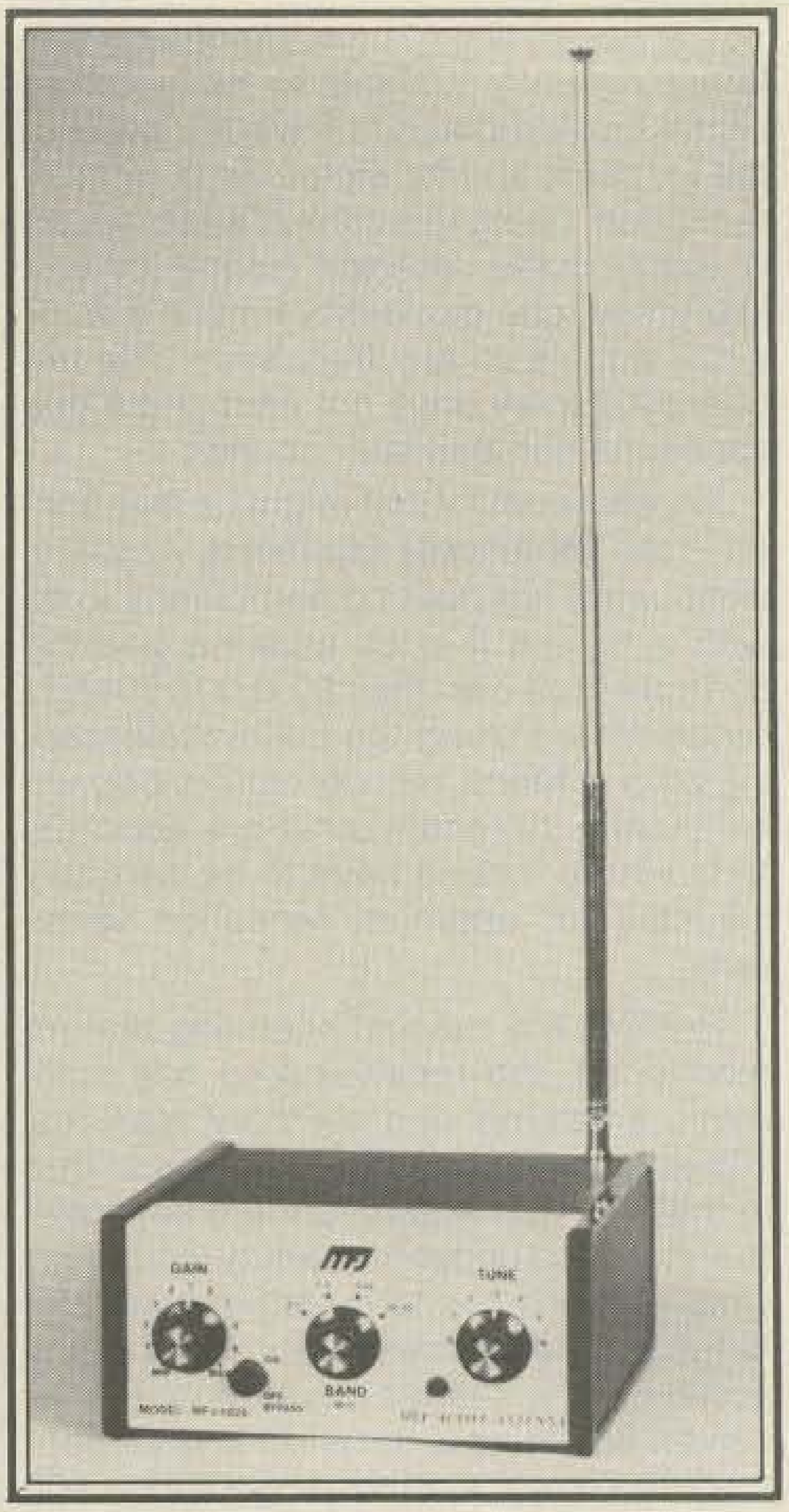
There are probably some features concerning frequency call-up, scanning, and memory which I haven't discovered, but at least the foregoing will give you some idea of the tremendous versatility of the receiver. Other features include separate tone controls, input terminals for an external antenna, access jacks for recording, headphones, timer and external power, LED bar graph S meter, and a shut-off timer. The shut-off timer can be set to automatically shut-off the receiver during any time period from 10 to 90 minutes, in increments of 10 minutes, after it is activated. The receiver is powered by two sets of batteries. Three D cells are used to power the receiver, as such, and last for about 9 hours continuous usage. Two AA cells are used for memory backup and last for about a year. By the way, the receiver will return to whatever frequency it was set up for after power has been shut off and then reapplied.

Aside from the unique tuning features, the ICF-2001 stands up very well when considered on the conventional grounds of stability, sensitivity, etc. The stability, particularly, is excellent as based on its PLL crystal-referenced frequency control system. One can punch up 10 or 15 MHz and zero-in to a frequency/time standard station and the receiver will just sit there for hours and remain on frequency. For its price class, it must be the most stable general-coverage receiver available on the market. No formal measurements were made on the receiver, since it doesn't present itself as a communications receiver and such comparison would not be fair. However, it was subjectively compared to some other widely known medium-priced general-coverage receivers such as the Barlow-Wadley XCR-30 and the Panasonic RF-2800, at least on grounds other than frequency readout, tuning, and stability, where there is no comparison. The sensitivity of the ICF-2001 is as good as or better than the other receivers except perhaps for the Barlow-Wadley above 15–20 MHz.

The only thing one has to watch on the ICF-2001 is getting the antenna peaking control correctly adjusted on the higher frequencies. There is no great trick to it, but it is facilitated by careful use of what is essentially a three-position r.f. input attenuator switch located on the side of the receiver. The attenuator should be used to reduce the signal input while adjusting the control so a clear peak in signal input or noise can be obtained. There is no r.f. gain control, as such, but the attenuator switch can serve as a quasi gain control. The selectivity is far better than that of the RF-2800, but not as good for s.s.b. as the XCR-30. However, s.s.b. tuning is far easier than with either receiver, since one can step tune the receiver in 1 kHz increments and then just use the **Compensator** control for final tuning. C.w. is just as easy to tune. In fact, if one added a 500 Hz active audio filter to the receiver's audio chain, the receiver would be a fine unit for portable QRP c.w. operation. If one uses the **RF Attenuator** switch properly, there are no problems with intermodulation, and as far as spurious signals or birdies are concerned, the ICF-2001 far outshines the other two receivers. Sony does, in fact, call out the possibility that one may find some seven internal spurious signals present, but they are all low level and only one is inside an amateur band (21.400 MHz).

The circuitry of the ICF-2001, as one might imagine, is complicated and uses a mixture of junction transistors, FET's, IC's, and custom LSI. There is probably the equivalent of several hundred discrete active devices in the receiver. Two PLL loops are used to generate the 1 kHz and 100 kHz frequency steps. On the 150 kHz to 30 MHz range, double conversion is used with the first i.f. at 66 MHz and the second i.f. at 10.7 MHz. On f.m. a conventional single conversion scheme is used with the 10.7 MHz i.f. FET r.f. amplifier stages are used on all ranges. The audio output is a respectable 1600 mw into a built-in 4-inch speaker. However, it should be mentioned that the three D cells which power the receiver will not last long if much audio power is used. An a.c. adapter is highly recommended, not only to allow one to use audio power as desired, but because one will become so fascinated with the operation of the receiver that the batteries will seem to go dead in minutes instead of hours.

The receiver comes complete with a wire antenna, headphones, operating instruction, and a separate booklet on shortwave listening. The booklet is extremely well written and compliments the quality of the receiver. It is a complete text on all the basics of shortwave listening and includes some very detailed listings of international broadcasting station frequencies and broadcast times. It also covers a bit of the basic background of the various services found in the h.f. ranges, how to listen for them, and how to obtain QSL cards. The only boo-boo that one notices is on the page which describes CB. The text is correct enough, but Sony shows two amateur radio QSL cards in the background supposedly to illustrate CB QSL's!



The MFJ-1020 Active Antenna is an interesting device that covers the entire range from 300 kHz to 30 MHz. It will significantly improve the performance of some shortwave receivers.

It seemed only natural to try the ICF-2001 with the MFJ-1020 Active Indoor Antenna, since the latter advertises itself as a compliment to general coverage shortwave receivers. As it turned out, the combination was found to provide a really outstanding s.w.l. setup in a very compact space.

The idea of active antennas is not new, and, in fact, the author discussed some of the principles involved in such antennas many years ago in *CQ*[1]. Basically, a very short antenna can be just as efficient for reception purposes as a long antenna under certain circumstances. One first has to consider that an incoming signal will be a certain value above the prevailing atmospheric noise. One can't change this ratio at the receiving end of a circuit. The receiver used will have an inherent built-in noise floor. So, obviously, to hear a signal, the antenna used has to pick up enough signal (atmospheric noise and the desired signal) so that the atmospher-

[1]*Miniaturized Antennas, Schultz, CQ, Nov. 1967.*

ic noise pickup is at least above that of the receiver noise floor. The signal can then be detected by the receiver. The longer the antenna used, the greater the signal pickup; therefore, one might say that the "noisier" the receiver, the longer the antenna has to be. If one connects a very short antenna to a given receiver, the signal pickup may be insufficient to override the receiver noise floor. However, if one could amplify the signal available at the terminals of even the shortest antenna sufficiently to override the receiver noise, one could theoretically be able to receive even the weakest signals. In the ultimate case, this would require an amplifying device which did not load down the short antenna in any way and which could amplify without generating any noise of its own. Of course, such an amplifier is not practical. However, with the use of a good interface circuit between a short antenna and a receiver, one can realize most of the basic weak signal detection capabilities of a much larger antenna.

The MFJ-1020 Active Antenna consists basically of a short 2 foot telescoping antenna coupled into a low noise FET preamplifier. Tuned input circuits are provided in five ranges to cover from 300 kHz to 30 MHz. The dual FET preamplifier stage drives a bipolar stage used for output coupling. The gain of the FET stages is fixed, but by means of the 1K potentiometer, the drive level to the last stage and hence the output level of the preamplifier can be adjusted. Switching and connection points are provided so one can use the preamplifier in a variety of ways. That is, one can switch it in or bypass the preamplifier while using the telescoping whip as the receiving antenna, or one can do the same while using the external antenna. Thus, one can readily judge the effectiveness of the preamplifier with any antenna being used.

The unit can be a.c. powered by means of the plug transformer supplied or by a regular 9 volt transistor battery mounted inside the enclosure, so it is readily portable. However, one does have to note that the circuitry draws about 30 ma due mainly to the LED "on" indicator. Therefore, although short-term portable operation is no problem using a battery supply, one might consider disabling the LED if long-term portable operation and maximum battery life are desired. Of course, if one wants to have the best of both worlds, one can always invest in an LM3909 blinker for the LED which will result in an average current drain for the LED of less than 1 ma.

As with many MFJ products, it comes housed in a very attractive tan enclosure. The circuitry is mounted on a single PC board and neatly assembled. The variable capacitor used for the input circuit tuning is also noteworthy in that it is a good-quality air-variable rather than an inexpensive BC type. The instruction pamphlet provides a number of hints for the proper use of the unit and its quite complete.

The 1020 Active Antenna was not designed to complement a $1,000 amateur band receiver, and it should not be judged in that light. It can, however, provide a significant boost in performance to many general-purpose or s.w.l. receivers. For instance, when used with the Sony ICF-2001, it definitely allowed some weak signal reception to be achieved which would have been lost using the ICF-2001 alone. This was particularly true in the range above 10–15 MHz. A comparison was also made using the MFJ-1020 alone with the ICF-2001 and a randomly strung 30 foot wire antenna on the ICF-2001. The MFJ-1020/ICF-2001 combination was better in almost every respect, again particularly on the higher frequencies. Although front-end overload problems can occur with the ICF-2001 if one doesn't use its attenuator switch properly, there was no need to worry about this when the MFJ-1020 was used. One does, however, have to take care in setting the gain control on the MFJ-1020. The amplifier in the MFJ-1020 is a high-gain circuit, and one can overdrive a receiver on strong signals. This point is covered in the MFJ-1020 instructions, but unless one pays a bit of attention, one tends to leave the gain control always set at maximum, which can be a mistake.

Images are not a particular problem with the ICF-2001 because of its very high first i.f. However, if the MFJ-1020 is used with a more conventional s.w.r. receiver, the MFJ unit can definitely help when images are a problem. For instance, it was tried with a Sony ICF-7600 receiver. The latter is a particularly compact s.w. receiver which has an FET r.f. amplifier stage using only a single tuned input circuit, and which has a first i.f. at 455 kHz. As one might imagine, images are a severe problem with this receiver, although its performance in other respects is quite good. Using the MFJ-1020 with this receiver definitely allowed easy reception of many s.w. broadcast stations which were severely interfered with by images when the receiver was used alone.

All in all, the MFJ unit can go a long way towards allowing one to achieve the same basic shortwave reception as would be possible with a randomly strung outdoor wire antenna when it is not possible to erect such an antenna. Also, the unit will definitely help alleviate the front-end problems common to many medium-to low-priced s.w.l. or amateur band receivers—namely, a lack of overall sensitivity and selectivity for image rejection. It's a nice little unit that could make for a reasonable investment if one wants to improve the performance of a marginal receiver in the respects mentioned, but yet is not ready or able to make a major investment in a more sophisticated basic receiver.

There are no ends to which contesters will not go for that winning edge. There is very little geography left untouched by amateur radio in the quest of an unusual prefix. Here's the story of one such group who made the great trek for our last CQ WPX S.S.B. Contest.

The welcome sign greets the visiting amateurs to Morokulien.

Typical March weather covers the QTH. The 70 foot tower stands next to the shack, probably one of the few buildings in Morokulien.

Leif, SMØAJU, shown at the operating position during the Contest.

A 1981 CQ WPX S.S.B. DXPEDITION TO MOROKULIEN (WHERE?)

BY JOHN HALLENBERG*, SMØDJZ

In the *CQ* WPX Contest you always try to come up with some special prefix in order to please the contestants and also to be attractive in the pile-ups yourself. Here in Sweden we've not been too successful with these special prefixes (like the EA, PY, and other boys), but we do have one little specialty, namely SJ9WL/LG5LG belonging to ARIM in Morokulien.

If you look at any major world atlas, you can't be certain of finding this QTH. However, right on the border between Norway and Sweden at approximately 60°N, 12°E (about 50 miles due east of Oslo) you should be able to pinpoint this spot.

Back in 1959 during the International Refugee Year, both Sweds and Norwegians started this "country," and shortly after, ARIM (**A**mateur **R**adio **I**n **M**orokulien) was established. ARIM is a group of amateurs from LA and SM who work very closely with foundations for handicapped and disabled radio amateurs in these countries. All the income from the activities in Morokulien is divided equally among these foundations in order to help handicapped people get started in amateur radio. The QTH is an old building situated almost right on the borderline, and it is very well equipped. You can operate as much as you like, plus do your own cooking, relax, and rest between the pile-ups.

The rig is an IC-701 with a newly built 70 foot aluminum tower supporting a TH6DXX and a double dipole for 80 and 40 meters. There are also a 144 MHz rig and antenna.

During the last few *CQ* WPX Contests the station has been operated mainly by SMØGMG and SMØGNU. ARIM has two different callsigns, namely the Swedish SJ9WL (formerly SK9WL) and the Norwegian LG5LG, both dedicated to two famous amateurs, SM5WL and LA5LG. The choice is yours when you operate the station.

This year it was LG5LG's turn, so we decided to get Norwegians out for this one. We, SMØAJU and myself, brought a Drake TR7 and Heathkit SB-220 as our main rig and used the ICOM IC-701 as a multiplier checker. The trip is a 6 hour drive from Stockholm.

We arrived at Morokulien Friday afternoon, and after setting up the rigs and checking that all worked okay, we went to sleep, setting the alarm for 2300Z.

After some coffee and snacks we were ready for the great challenge of beating the 1979 SJ9WL Morokulien record of 5.3 million points. The first night was quite good with a lot of W's on 14 MHz and also a good JA pile-up on 21 and 28 MHz. The first 24 hours gave us about 2000 QSOs, and we were in a good position to make a new record. On the second day the aurora made it more difficult for us to operate. On 21 MHz it was really hard to hear the 20 watt JA stations when they all called at the same time with the same weak signals. They didn't come through, and we

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missed a lot of valuable 3 pointers there. The last 24 hour period gave us just 1300 QSOs, and we ended up with 5,192 million points, leaving the SM0GMG and SM0GNU Morokulien record untouched.

In this contest there were also three other SM groups that we know of competing in the same category—multi-single. We listened for SM5GMG, SL2ZZU, and SM0AQD/OH0 very carefully, and we were satisfied when we realized that we had ended up second among these guys. No other Norwegian groups that we heard of had the same score as we did (we were competing as an LA station), so we feel quite certain of winning the top prize of LA multi-single for this contest.

Finally on Sunday at 2400Z the contest was over, and we just went to bed for a couple of hours before taking the rig down on Monday morning. Two red-eyed amateurs ended a wonderful adventure, and we look forward to meeting you all again in a DXpedition from Morokulien for a *CQ* WPX Contest in the future.

If you managed to work us in 1981, or maybe earlier with SJ9WL, you may have qualified for the Morokulien Award. For rules see *CQ* March 1978 issue page 79, or write to LA2ZN for further details. *Remember:* All income goes to handicapped and disabled people, so one or two extra IRC's are most welcome. Thank you!

a monthly feature by

KARL T. THURBER, JR., W8FX

Antennas

DESIGN, CONSTRUCTION, FACT, AND EVEN SOME FICTION

The H.F. Yagi: Part II

Experience has shown the need for some sort of "signal multiplier" for successful h.f. DX operating: this multiplier usually takes the form of a rotatable Yagi. In this series, author W8FX gives us the plain-vanilla facts about parasitic beams for h.f. work. He continues with Part II in this issue.

Last month we began our technical discussion of the Yagi by going back to the simple dipole, following with a discussion of elementary parasitic element theory and operation. We continued with simple, single-band, two-element configurations and went on to more complex, multiple-element arrays.

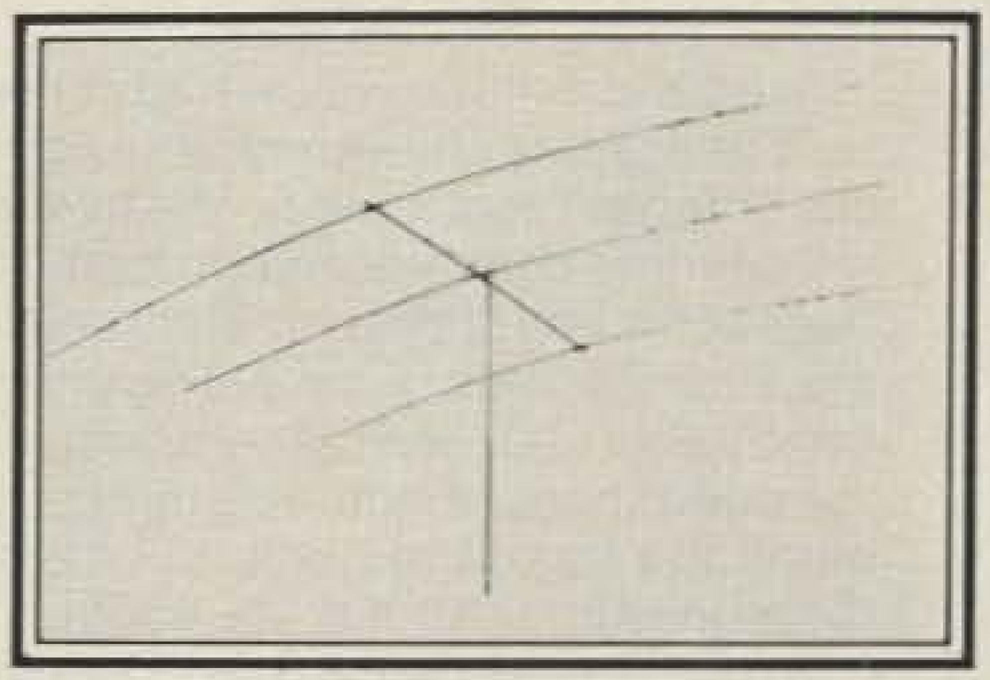
From our discussions, one thing is clear: the array Drs. Yagi and Uda envisioned was a single-frequency affair, with frequency excursions limited in scope. But the Yagi lends itself, like the dipole, to multiband operation using multiple-resonant circuits pioneered by people such as Howard K. Morgan in the early 1940s and Chester Buchanan in the 1950s. Out of their work grew the trap dipole and the trap Yagi, the latter being the subject of this month's column.

Let's first briefly review how traps work, then we'll talk about the multiband trap Yagi. Next month we will take up with a few words on the quad vs. Yagi controversy.

Trap Theory And Operation

It's a good idea at this point to review trap history, theory, and operation as it applies to the simple dipole. From there, it's not hard to relate traps to the multiband Yagi.

Very early trap experimentation and development is credited to an airline engineer who needed a simple multiband antenna that would provide good ground station reception of various h.f. signals. This man was Howard K. Morgan, who came up with what was essentially a centerfed dipole in which the end insulators were replaced with parallel-tuned circuits. These lumped constants, placed at specific points along the antenna, allowed it to simultaneously develop resonances on several discrete frequencies. Morgan published his early research in the August 1940 edition of *Electronics*. There was little amateur interest in traps in the 1940s and 1950s, however.



A logical extension of the basic trap dipole is the multiband trap beam, the most common form being the rotatable tribander covering 20, 15, and 10 meters. This design incorporates the same trap principles and concepts to resonate the director and reflector elements to give the array its directionality, gain figure, and front-to-back (F/B) ratio. Shown here is the Hy-Gain TH3JR three-band array. *(Photo courtesy Hy-Gain Electronics)*

In 1950, Chester Buchanan, W3DZZ, published an article in the old *Radio and Television News* on using tuned circuits in a beam, and later popularized them in a *QST* article. By the late 50s and early 60s, traps came into their own as a practical means of feeding a single dipole antenna (or beam driven element) with coaxial cable on several bands without manual bandswitching in the antenna system.

Today, the trap antenna is almost old-hat. Just about everyone acquires a bandswitching transmitter and receiver, or transceiver, covering from 160 or 80 through 10 meters. This wideband coverage promotes the search for a reasonably efficient, easily matched antenna system that will allow operation on most or all h.f. bands with a minimum of readjustment when changing bands. In the future, the trap will likely become even more important in view of accelerating trends to apartment and condominium living, small home lot size, and restrictive covenants or ordinances on land use that suggest that the minimum number and size of antennas serve one's amateur operating needs.

The trap dipole antenna, if designed and installed properly, can provide hassle-free multiband capability; the system will have essentially the same efficiency, radiation pattern, and characteristics as if erected as separate antennas. There *is* some loss in the traps themselves, although losses are usually minor when compared with overall possible *system* losses, such as from improper grounding, poor matching, feeder radiation, etc., often incurred with other types of multiband antennas.

The traps, in effect high impedance inductor-capacitor combinations, serve as a sort of "transmission line" that prevents r.f. energy from moving along the entire length of the antenna at the higher frequencies. Each lumped-constant trap is used in the antenna to divorce or decouple the remainder of the antenna flattop from the section on the inside of the traps—the portion nearest the feedpoint—as bands are changed. In that the L/C circuit poses a high impedance to r.f. current flow at its resonant frequency, it acts as a trap for r.f. so as to electrically "chop off" the antenna beyond that point. In effect, the trap acts as though it were the end of the antenna at that frequency. At all other frequencies above and below the trap's resonant frequency, the trap is a short circuit so that r.f. passes through it virtually unobstructed—simple, as a look at fig. 1 shows.

As we suggested, trap antenna efficiency is usually good. While the efficiency of the trap dipole may be *slightly* lower than separate dipoles for each of the bands (due to some trap losses and the fact that the traps are not absolutely perfect insulators), losses are not usually significant in a carefully adjusted multiband trap antenna using good quality, high-Q-factor traps. The traps themselves may be homebrewed, although commercial versions are relatively inexpensive and probably boast better mechanical and waterproof construction than the average amateur can manage.

There is little doubt that, as in *any* multiband antenna, traps involve some compromise. After all, six or more antennas may be rolled into one, and there is some price to pay for such convenience. Some

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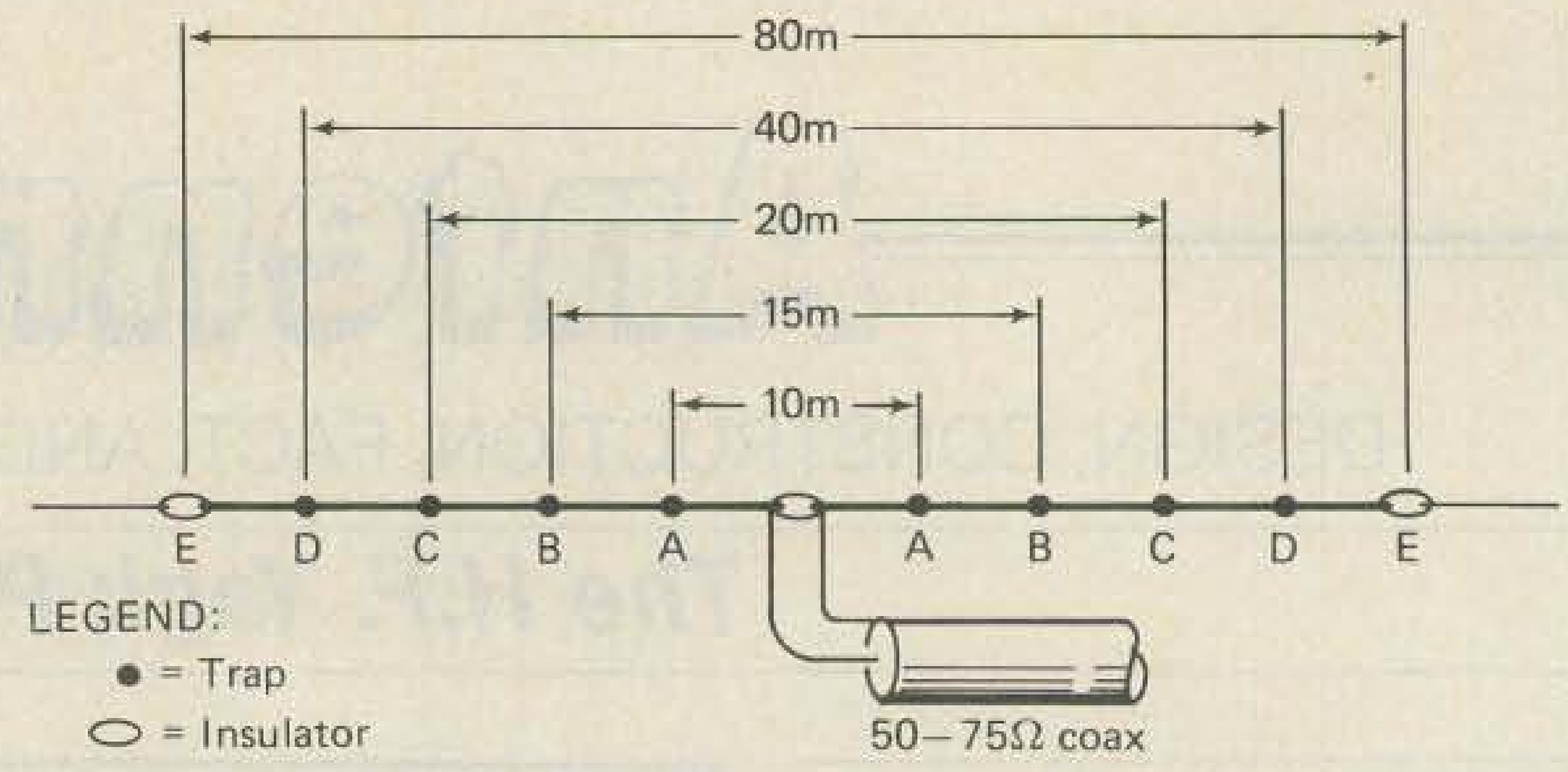


Illustration shows typical trap configuration in a five-band multiple-trap antenna. The antenna shown uses four pairs of traps, for a total of eight, for simultaneous antenna resonance on the five bands.

The innermost antenna section, A:A, makes up the 10-meter antenna. The traps at the end of this dipole section make up a resonant L/C circuit that isolates the outer portions of the antenna when working on 10 meters. The outer sections—B:B, C:C, and D:D—function in similar fashion for the lower bands. On the lowest band, which is 80 meters for this antenna, the full antenna (E:E) resonates as a half-wave dipole, but it is somewhat shorter than formula length due to the loading effects of the traps.

A five-band dipole can be constructed with as few as one pair of traps, but operation on the higher bands (20, 15, and 10 meters) is somewhat sporty, since the traps cause the antenna to operate in a harmonic mode on those bands, with actual resonance and resultant s.w.r. not easily predictable.

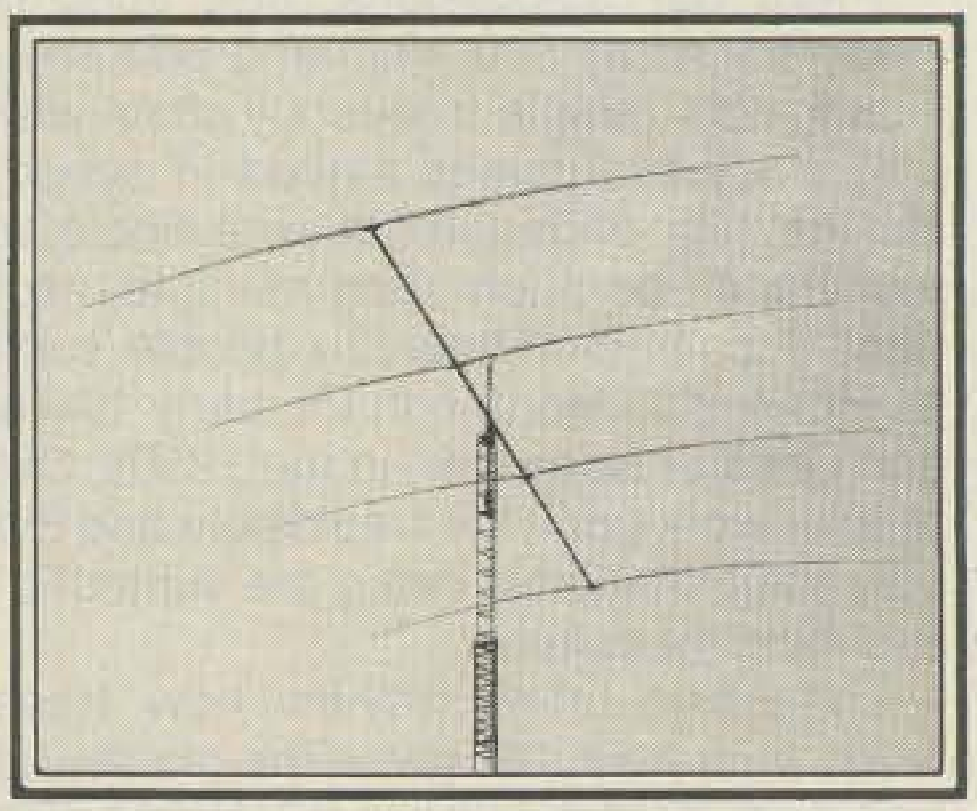
The trap dipole is normally fed with 50- to 75-ohm coaxial cable.

Fig. 1– Basic horizontal trap dipole antenna.

trap advertising literature may lead one to believe that trap feedline match is perfect over all bands that the antenna covers, but this is almost never the case in practice. Generally, it is necessary to carefully adjust the traps, shorten or lengthen sections of the antenna itself, or, as a last resort, even change transmission line lengths to get uniform transmitter loading on all bands. Even then, perfect s.w.r. is a pipe-dream.

Nevertheless, it's important to get a *reasonable* match on all the bands that you wish to use. If the feedline is of the low-loss type and if the run to the hamshack isn't too long, losses won't be excessive and the antenna will function well with s.w.r.'s of up to 4:1 or 5:1, although you may want to use an antenna coupler or transmatch to facilitate sometimes finicky solid-state transmitter loading. The compromises involved are especially noticeable in those trap dipoles which feature a *single* pair of traps for all-band use and which rely on placing the antenna in various harmonic-resonant modes for all-band coverage. With this type of trap antenna, it's virtually impossible to achieve a 1:1 s.w.r. on all bands, since adjusting one band for optimum conditions will throw out another band.

What is especially important is high, clear, and free trap antenna installation. This is even more critical than with simple, single-band dipoles, since trap resonances can easily be upset if the traps are not installed in the clear. Like other horizontal antennas, vertical radiation

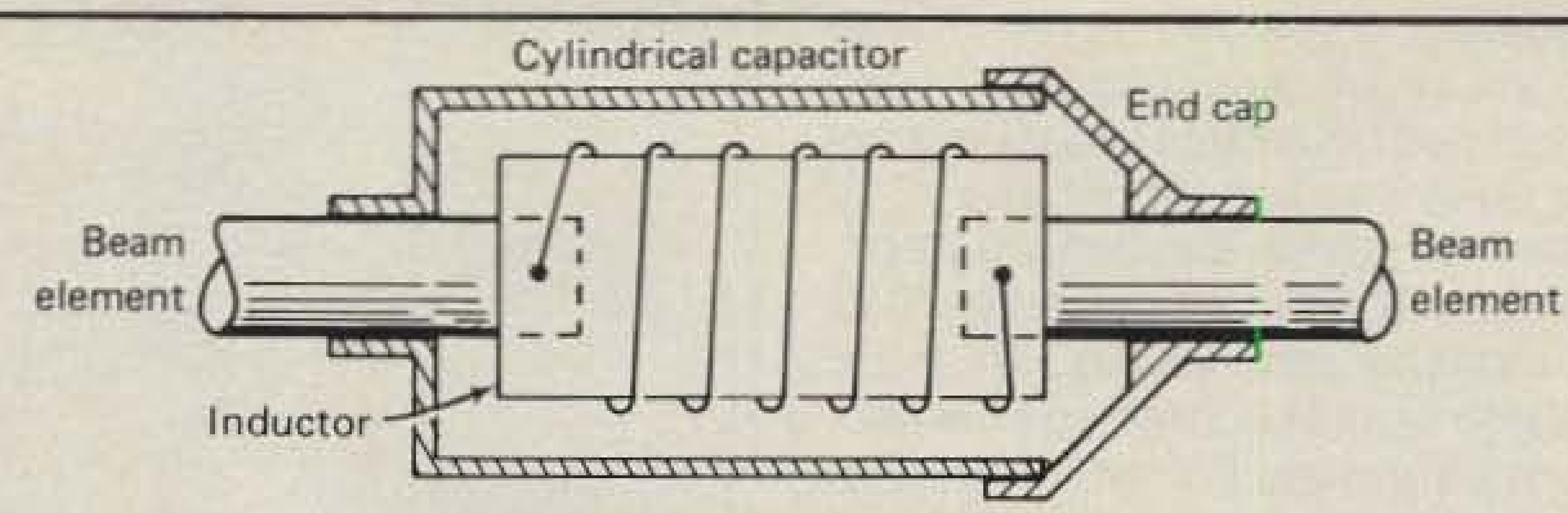


KLM 40-meter "Big Sticker" monoband antenna allows operation on a band where few rotatable arrays are used, for obvious reasons of size and weight. The four elements are shortened by nearly 20 feet (to about 46 feet) by the use of "linear loading" techniques for a boom length of a manageable 42 feet. In this unusual design, two of the four elements are driven to achieve a broadband characteristic and a 7.2 dB gain over a reference dipole. Feedpoint impedance is 200 ohms for matching to 50-ohm coax with a 4:1 balun. Antenna weight is 85 pounds. (Photo courtesy KLM Electronics, Inc.)

angle depends on the antenna height above ground. Generally, the higher the antenna, the lower the angle of radiation will be. For most practical antenna heights, maximum radiation will be at about 30–35 degrees from the horizontal. This figure assumes an antenna height of one-half wavelength. If it's less, which would normally be the case on the lower h.f. bands, then the radiation angle would be higher. If more, the radiation angle would be lower.

Something rarely considered, but something we should point out, is the fact that the trap antenna may efficiently radiate all harmonics presented to it—that's its job. While most modern-day amateur transmitting gear has sufficient harmonic suppression built in, it's still a good idea to use a transmatch in the feedline even if it is not required by conditions of high s.w.r. and/or loading problems. The use of the antenna coupler may provide as much as 10 dB second harmonic suppression and help reduce the possibility of receiving an FCC citation or causing unnecessary interference.

While we're now speaking mainly of the trap *dipole*, it's well known that traps can be used in other multiband antennas in the same way they are used in the basic dipole or doublet. Traps can be combined with loading coils to produce physically short multiband antennas, incorporated in vertical antennas, and—of special interest to us this month—employed in multiband parasitic arrays. Let's now consider this latter kind of specialized trap application.

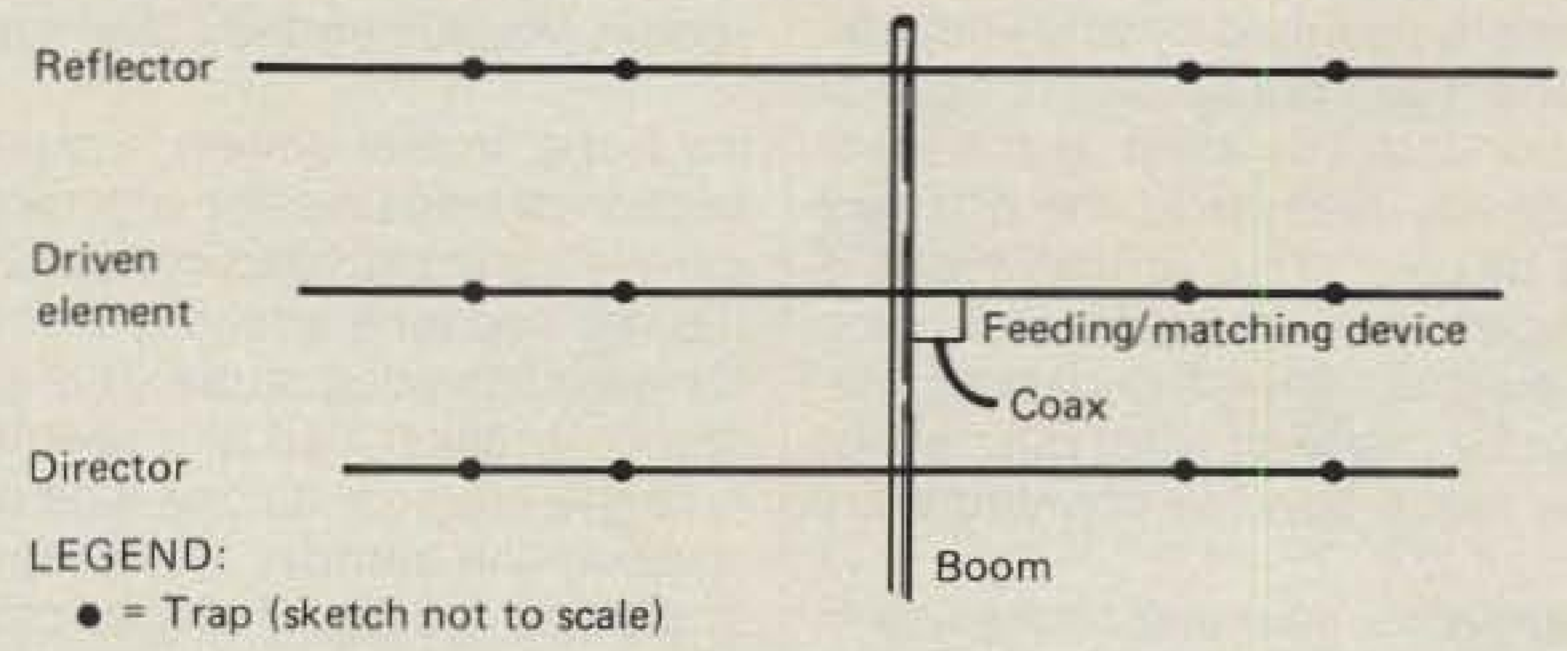


Shown above is an example of a single-band beam trap. In this design, popular with many multiband beam manufacturers, the capacitor serves as an outer shield, with air serving as the dielectric, to provide capacitance between the cylinder and the trap coil. An end-cap seals out weather, and in some designs, the entire assembly is encapsulated in a weatherproof jacket.

Electrical operation is relatively simple, but it is far more complex mechanically because of the required physical support of the antenna elements.

In some beams, two traps are combined in one housing, with two coils being contained within a single cylindrical capacitor.

Fig. 2– Representative beam trap construction.



Shown here is a partial schematic of a three-element tribander for 20, 15, and 10 meters. The driven element is split at the center for direct feed, or is left intact and fed with a Gamma match or other system. In this antenna, a total of 12 traps is required. However, some variations incorporate the two traps in a single assembly, allowing simpler design and slightly shorter element length. Also, a separate, interlaced 10-meter director is often used, allowing the main director to sport a single set of traps (for 15 meters).

Fig. 3– Representative triband trap Yagi antenna.

Multiband Yagi

A logical extension of the trap dipole principle is the multiband trap rotatable beam, which typically takes the form of a tribander covering 20, 15, and 10 meters. The tribander uses the same trap principles as used in the dipole to resonate the driven element, reflector, and director elements of the beam to give the antenna its directionality, gain, and F/B ratio.

The trap Yagi represents an excellent compromise antenna for most operators, since it's tailor-made for those amateurs on a modest budget or who don't have the space or inclination to install multiple, full-size monobanders. While the trap Yagi won't outperform full-size Yagis designed for single-band operation, the trap Yagi can provide reasonable gain and good F/B ratio, and even some reduction in size. The only marginal situations that usually develop are those which occur when the beam is much shorter than a half-wavelength so that the traps take on the aspects of loading coils, with their attendant losses. This is normally a problem only if 40 or 80 meter operation is attempted in a multibander.

As we mentioned, the trap Yagi has its antecedents in Morgan's 1940 multiband dipole and got its real "push" from the W3DZZ 1950s articles. As in the dipole, the traps, or L/C circuits, act as frequency-sensitive switches. In the typical tribander, the inner section and traps are resonant at 15 meters, and the entire antenna is resonant at 20 meters, the story being essentially the same whether we are discussing the driven (dipole) element, the director, or the reflector.

The heart of the multiband Yagi is, of course, the trap. A few amateurs make their own traps for multiband dipoles, using as the L/C circuit an airwound inductance and a transmitting-type ceramic capacitor housed in a waterproof housing. However, traps for triband beams are more sophisticated, having mechanical requirements that are difficult for the average amateur to fill.

Commercial multiband beam manufacturers have taken a number of approaches to physical trap design, one of the most popular being that of using the capacitor as an outer shield with air serving as the dielectric; sometimes, the trap is completely encapsulated in a tough weatherproof jacket (see fig. 2). As with the dipole, the loading effect of the traps is to slightly shorten overall element length; the result is that the multiband beam will usually be slightly smaller than a monobander for the lowest band used.

There is some loss in the tribander, but not so much as to become objectionable. But one area in which degradation is noticeable is with respect to bandwidth. Typically, on 10 meters, usually the top band, bandwidth is not noticeably different from that of a 10-meter monobander. But on 15 and 20, a portion of the element on each band is made up of the trap(s) for the higher band, tending to slightly restrict operational bandwidth. This effect is most pronounced on the lowest band, 20 meters, where boom length is often shorter than optimum, thus aggravating the problem. This is not to say that operating performance will be noticeably degraded, but s.w.r. may rise at or close to the edges of the operating band. This may cause loading problems for solid-state transmitters or transceivers, in which case an antenna coupler may be used to smooth out s.w.r. variations.

To this point, we have used the term "multiband Yagi" as being synonymous with "trap Yagi." Actually, there are oth-

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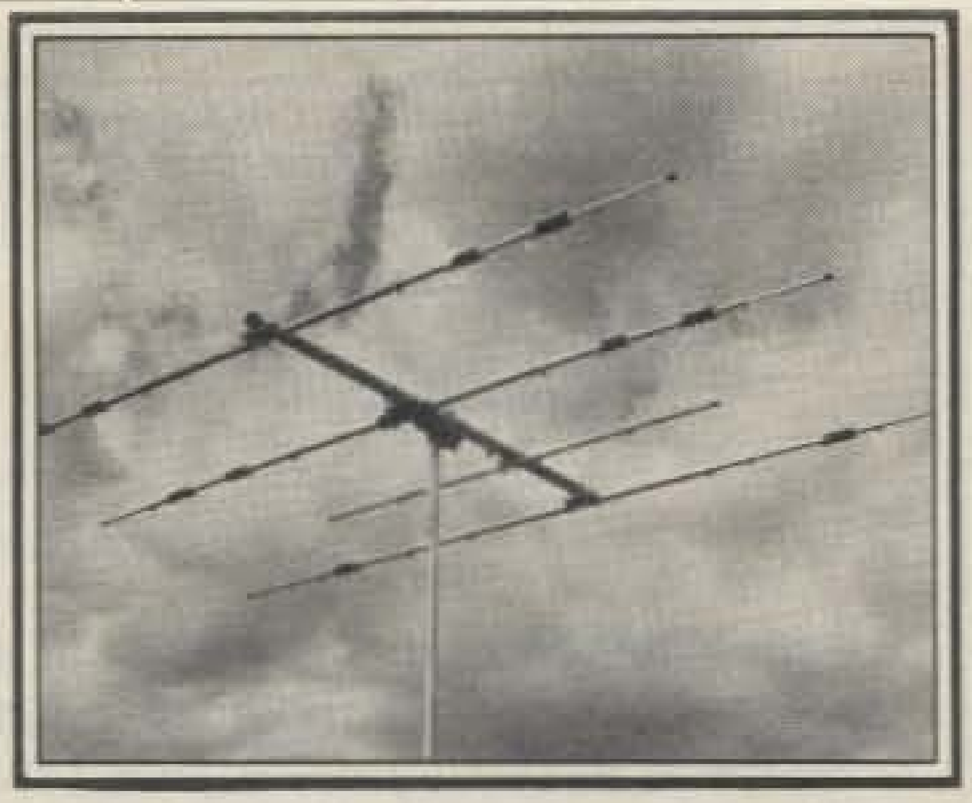
er ways to develop multiband operating characteristics in the Yagi array. These methods are much less frequently used than are lumped constants (traps), but we should at least mention them here.

Besides the familiar decoupling traps, resonant coaxial sections can be used to develop multiple resonances. In a tribander, there would be three coaxial sections used: a short section which is resonant at the highest operating frequency; a longer, center section which is resonant at the next lower operating frequency; and a long inner section which is resonant at the lowest operating frequency. The sections are decoupled from one another because the impedance between the tip of each outer section and the adjacent inner section is very high. One difficulty with this arrangement is that the high "Q" of the system makes adjustment difficult, time-consuming, and critical.

In a variation of this concept, the coaxial sections are replaced by *wire* linear elements. The result is a system of parallel dipoles connected together at the feedpoint in similar fashion to the ordinary "multiple dipole." This arrangement is much simpler and less costly that using coaxial sections, since the parallel elements can be made of wire, but neither method is much used in contemporary designs.

A system some manufacturers use in contemporary designs is linear decoupling traps. In this system, a quarter-wave section of transmission line replaces the parallel-tuned lumped-constant L/C trap; the line sections effectively act as quarter-wave isolating stubs. This system effectively makes use of a segment of the antenna element as one side of a transmission line section. The linear decoupling traps, if cut and placed properly, effectively decouple portions of the antenna from the balance of the antenna for multiband operation, thereby achieving an overall effect equivalent to that achieved by traps, probably with even lower loss.



Contemporary h.f. Yagi design is exemplified by the Cushcraft ATB-34 tribander for operation on the 10-, 15-, and 20-meter bands using low-loss fiberglass-form traps. The antenna shown here boasts a 7.5 dBd gain on all three bands and an F/B ratio of 18–22 dB, depending on band, according to manufacturer's data. Note single pair of traps on the director, with a separate interlaced 10-meter director. (Photo courtesy Cushcraft Corp.)

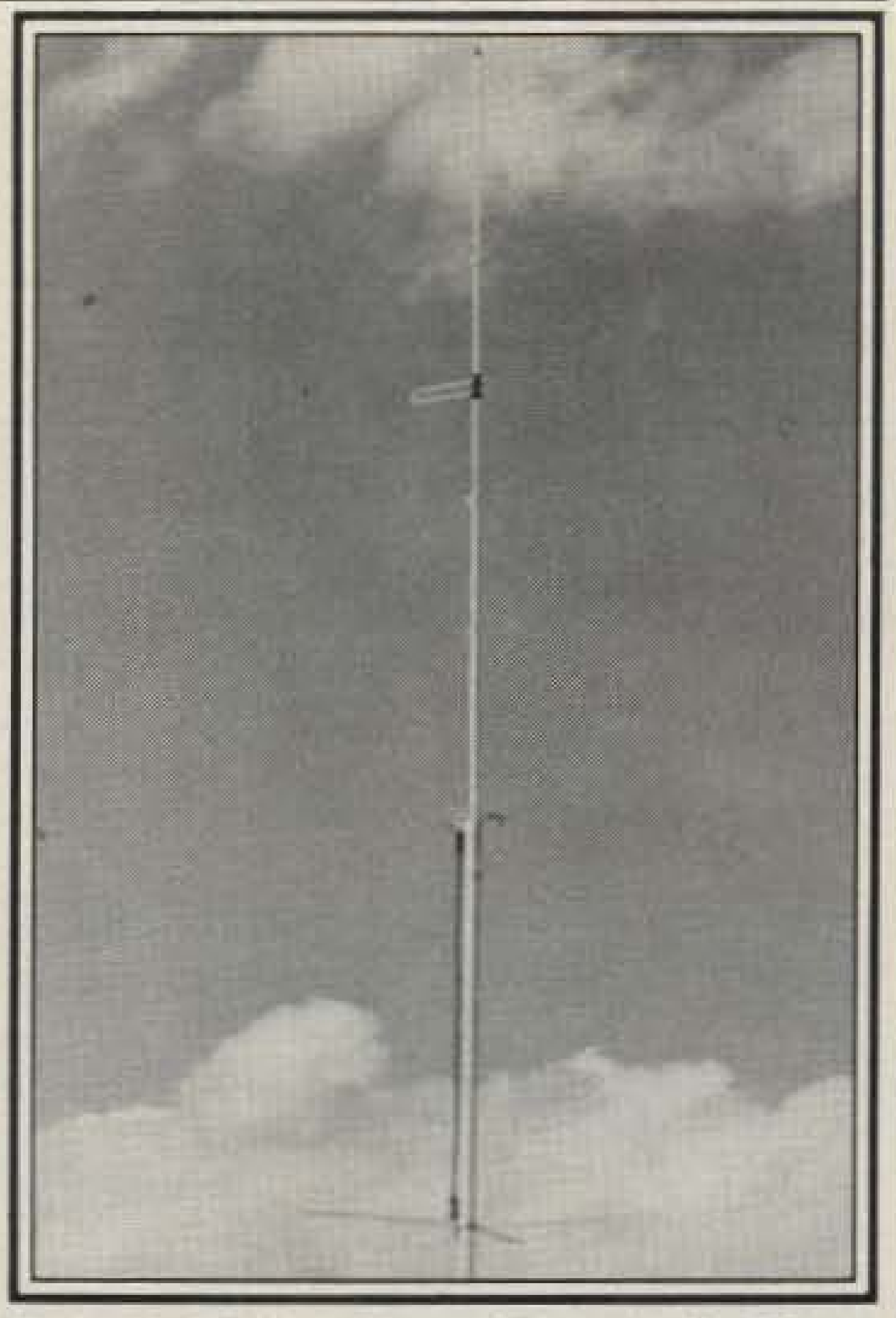
In addition, various *interlaced array* designs can yield multiband operation, but without the use of lumped constant, linear, or coaxial decoupling devices. This array is one in which the elements of two or more antennas are aligned in a single plane and supported by a common structure. Various combinations are possible, but individual two- or three-element monobanders separately fed (usually through a coaxial switching relay to make use of a single transmission line) on the same boom are most used.

Interaction between the interlaced elements isn't prohibitive, if the elements are properly spaced and adjusted, and wind loading is not as great as would be the case if the antennas were stacked Christmas-tree style. Still, working with interlaced arrays entails a great deal of cut and try, and often the system is plagued with spurious resonances and interlocking tuning and adjustments. Some hybrid interlaced designs, in an effort to reduce the weight of "metal in the air," have made good use of ordinary trap-type driven elements. Fig. 3 displays a representative triband trap antenna configuration.

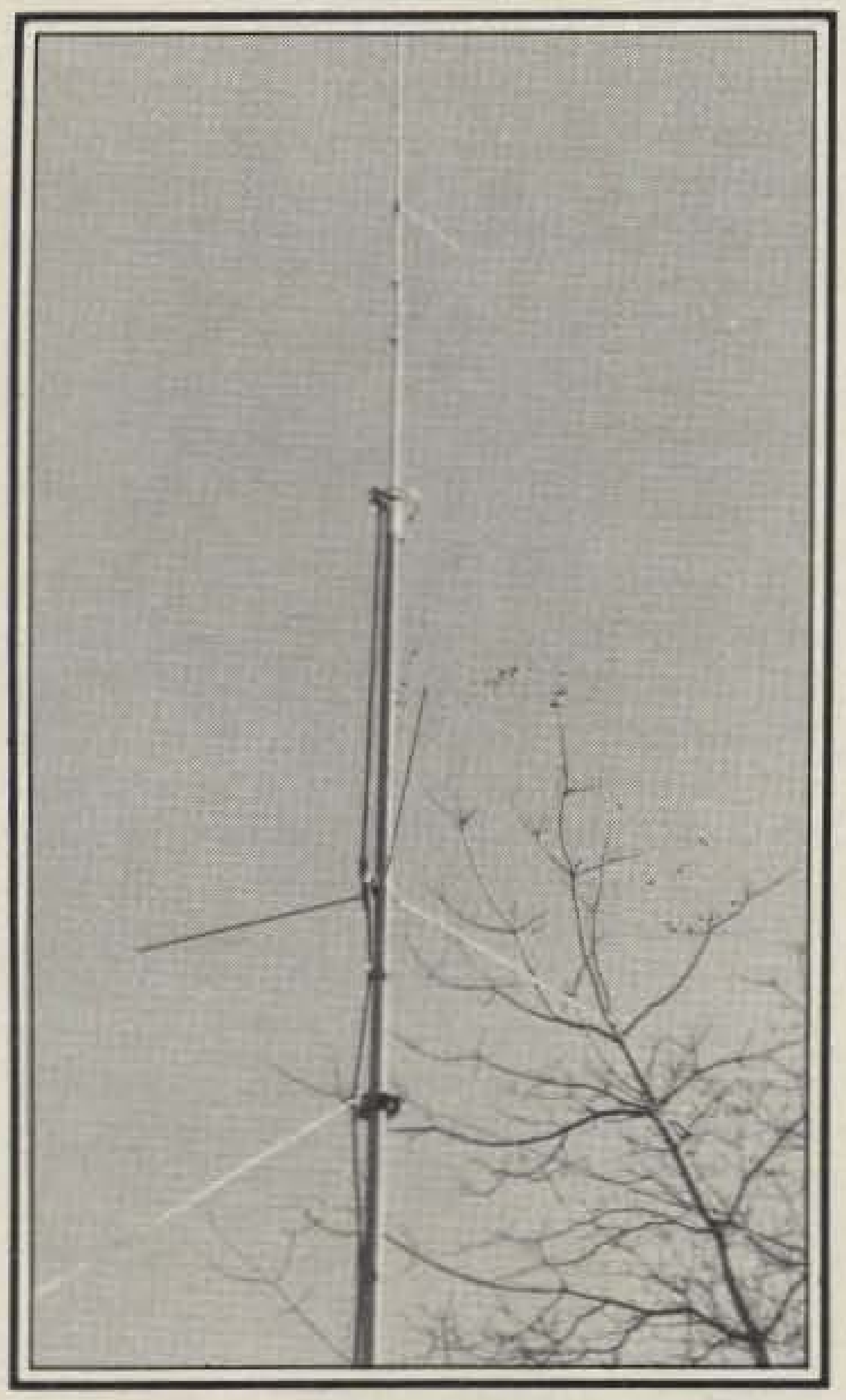
(To Be Continued)

Antenna of the Month: Cushcraft Ringo Ranger II

The 220 MHz Ringo Ranger II is representative of the several new antennas in the "Ranger" series designed for v.h.f./u.h.f. f.m. operation. The antennas, designed for either 146, 220, or 450 MHz operation, feature three 5/8-wave sections for a 5.5 dBd (7 dBi) gain. They feature Ranger-type construction, with the exception of new-design ABS insulator, and 5/8-wavelength decoupling section and radials for enhanced gain and increased feedline isolation. The 220 MHz unit shown in this photo is rated at 500 watts, is 112 inches long, and has a 2:1 v.s.w.r. bandwidth of greater than 5 MHz; weight is 5 pounds. All of the antennas cover the entire band, yet can be optimized for a specific operating frequency and location. Conversion kits are also available to convert older models to the Ranger II type; the kits include decoupling radials, interconnecting harness, coaxial lightning arrestor, and conversion instructions.



The 220 MHz Ringo Ranger II. (Photo courtesy Cushcraft Corp.)

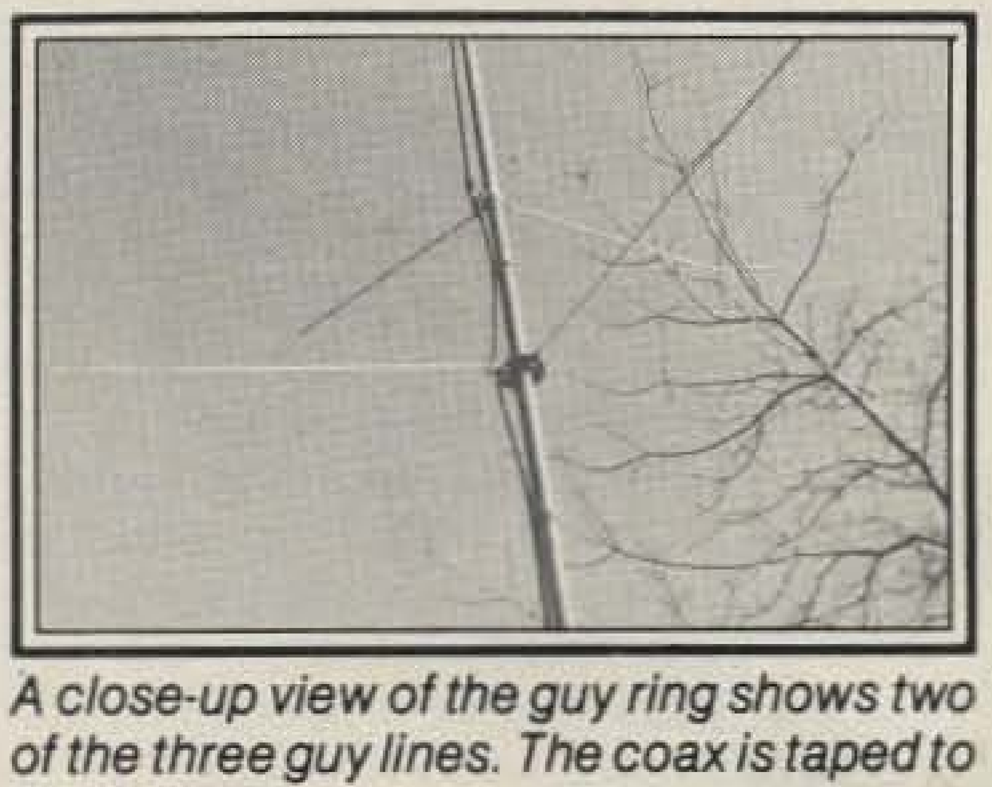


The very top of the Ringo Ranger II is cut off in this view of K2EEK's installation.

A quick and simple installation for the Ringo Ranger II was performed by *CQ*'s Editor, K2EEK. The antenna-erecting hardware was obtained from a local Radio Shack store for under $30.00. Two 10-foot heavy-duty TV masts were swagged together (RS #15-843). A floating guy ring and collar (RS#15-835) was mounted about two-thirds up the mast. Three lengths of nylon guy line were tied to the guy ring. The base for the 20-foot mast is the "tap-in" tapered in-ground mount (RS #15-5069).

The ARX-2B (Ringo Ranger II) and mast-assembly were put together with the help of several saw-horses. The tuning rod was set as per instructions (which later proved to be optimum) for lowest s.w.r. Two of the guy lines were anchored and the entire mast/antenna assembly was walked-up and tied off by the third guy line. Raising and lowering the system can easily be done by one person, although a second set of hands would make the job much easier and safer.

The improvement over the indoor "rubber ducky" was obviously dramatic and necessitated the purchase of a repeater directory to find out where all these new signals were coming from.



A close-up view of the guy ring shows two of the three guy lines. The coax is taped to the mast.

Here the leaves are brushed aside to show the base plate for the "tap-in" tapered in-ground mount.

This month by
ROD LINKOUS, W7OM

DX

NEWS OF COMMUNICATIONS AROUND THE WORLD

The DX contest was quite a show. A real show! Listening to a Caribbean DX station working a pileup is very common, even on 40 meters. Yet, this particular time it was more than just the horde chasing DX. It was entertaining. It was an education. And it was most of all:

His Bat And Ball

The Caribbean station was working by United States call areas. He started with the zeros and then on to the nines. About this time the multitude found him in his sanctuary below 7100 kHz. Breakers, tail-enders, and everyone joined the pileup at 7210.

His remark "everyone is 20 over S9" did more to encourage even the meek to give it a try. That meant his end was even worse. So he explained his technique to a couple of out-of-the-zone lids. It went like this: "When I call for a specific call sign, I want *only* that station to reply. NO ONE ELSE. Then I'll give him a report. He must verify the report and I must get mine in return before the QSO goes in the log. Then I'll go QRZ and all of you may call me. OKAY?"

Simple? Well a few didn't get the word. So he said "N . . . you don't understand." And he repeated the whole spiel. I guess N . . . must have gotten the word, as it went along kinda smooth for awhile.

Then "KA . . . give your call only once. I either hear you the first time or I don't. Repeating your 2 by 3 call ten times only covers up three or four potential contacts." Calmness seemed to prevail for about fifty contacts, then someone came home from a heck of a party and joined the pack. It got real colorful. It would have been funny if it hadn't been so sad. "W . . . I am not going to work you. If you're not willing to go by the zone plan I'm using, forget it. Come back tomorrow. I have you on my no-no list for today. Nines ONLY."

For those of us waiting, the situation seemed to return to a low-order chaos. Then on to the eights and then the sevens. I lucked out and got my contact. It took about a half hour of waiting, but it was worth it, as it was a new country on 40 meters. With a quarter wave sloper (the beam is on the ground for awhile), a new band country on 40 is an event.

Tom Wong, VE7BC, (right) shows a couple of ARRL handbooks to Henry Thel, VE7WJ (left), and Rush Drake, W7RM (center). These are just some of the items provided to the Amateur Radio Association of the People of the Republic of China. VB7JI, VE7ZK, VE3HC, VE3MR, K7JA, W6RJ, W6AVF, WAØOAH, W8QFR, WØLYM, N6FL, K5FUV, and K5OS help put it together.

So off to the sixes for the Caribbean DXer and off to 80 meters I went hoping for another rare catch. About an hour and a half later, I returned to forty. Tuning below 7100 kHz found the Caribbean station still working the sixes. Seemed strange, so I started listening to both ends again.

A big gun in four land let him have it. "Come on, get off the sixes." Considering it was a contest, I guess he needed him for a multiplier. Back came the DX station. "I can work the southeast U.S. anytime, including daylight hours. The west coast is a rare contact for me. I assume I'm rare for them, too. Besides, there aren't as many alligators west of the Mississippi. Sixes ONLY." Thirty minutes later he was in the fives. About forty-five minutes after he finished the sixes the first time, he was back in the sixes again.

There are a lot of points to be made in the events cited. First and foremost is the DX station calls the shots. It is his rule book. It is indeed *His Bat and Ball.*

A couple of weeks later, I heard that same operator again on the high bands. This time someone criticized his operating style. He stopped everything and asked, "I would like to know how I might improve. What do you suggest I do?" Silence. "Come on, there must be a better way." Silence. "No suggestions? Okay. QRZ." He wasn't using the call area or zone scheme. They were working him on his frequency. Then came another complaint. That broke the camel's back. "If you think you can do any better, come down here and try. Here is the mike." It was real quiet as the DX station took his bat and ball and went home. The game was over.

There are many ways of handling a massive pileup. The real-life example here is a technique. It works for him, as most of you have his card on at least one band.

George, FB8WG, on Crozet, had to seek another way to get the pileups down to manageable size. He asked for help on the band and an emcee set the rules. One day George may be able to go at it free style, but that is sometime away, if ever.

Back to the call area scheme of controlling who calls and when. A set number from each call area is really simple, but it is truly lopsided. According to a recent call book, the USA call area distribution of licensed (generals or higher) amateurs is roughly:

W1	15,871	W6	33,813
W2	24,340	W7	21,845
W3	16,300	W8	21,701
W4	40,716	W9	20,134
W5	25,630	WØ	23,041

When one considers these numbers, it is apparent that there are more DXers in California (W6 land) than in all of New England (W1 land) and W3 land combined. And obviously there are more in W4 land than anywhere. So when using the call area scheme, one must give some balance to how many are in each area.

Another trait that drives some right up the band (wall) is a DX station's good intentions by calling for so many from an area that doesn't have propagation. I for one have trouble with "I'm going to stay on the one area until I work five stations,"

*5632 47th Avenue SW, Seattle, WA 98136.

The WPX Program

Mixed

960	AKØG	963	AG9S
961	YU4HA	964	DL7OU
962	DL1AM	965	JR2MWZ

S.S.B.

1452	WD9HAW	1455	I4KYO
1453	K8HF	1456	9G1RT
1454	AI6Z		

C. W.

2113	KB6N	2115	WØJIE
2114	KH6JWK	2116	K2BLA

WPNX

204	VK7NWR	205	KA4ITQ

VPX

500	OE1-109976

Endorsements

Mixed: 450 DL1AM, NI4Y, AG9S. 500 K8HF, DL1AM, AG9S. 550 W6OUL, K8HF, DL1AM, AG9S. 600 W6OUL, AI6Z, DL1AM, AG9S. 650 W6OUL, AI6Z, DL1AM, AG9S. 700 W6OUL, K2QF, DL1AM, AG9S. 750 K2QF. 800 K2QF. 900 I2MQP. 950 I2DMK. 1000 YU1DZ. 1150 SM3EVR. 1800 N4MM. 1900 VE3GCO.

S.S.B: 350 WD9HAW, AI6Z, OE1KJW, VE1ANH, 9G1RT. 400 WD9HAW, WB9TDR, VE1ANH, 9G1RT. 450 WD9HAW, VE1ANH. 500 VE1ANH. 600 I2OMF. 700 DF7QD, I6ICD. 900 I2MQP, ZP5RS. 950 ZP5RS. 1250 WØYDB. 1450 VE7WJ. 1500 VE7WJ. 1550 N4MM. 1750 W4BQY.

C.W.: 350 KH6JWK, WØJIE, WA2CNF, KA8EBG. 400 VE1ACK, KA7AIG, K8HF, WØJIE, AK2H. 450 AK2H. 500 AI6Z. 550 AI6Z, IT9VDQ, VE1ANU. 700 G3HB. 750 G3HB. 800 W1OPJ, OK1KYS. 850 OK1KYS, JA2IU. 900 OK1KYS, KH6HC, N4YB, JAWIU, W1CNU. 950 N4YB. 1050 LZ1XL. 1250 N4MM. 1350 W4BQY. 1400 G2GM. 1550 WA2HZR.

10 meters:	W6OUL, VE2FOU, AI6Z, AG9S.
15 meters:	W6OUL.
20 meters:	W6OUL, K8HF, AG9S, WB4UBD.
80 meters:	VE2FOU, AG9S.

Asia:	W6OUL, OK1KYS, AG9S.
Europe:	W6OUL, K8HF, AI6Z, AK2H, AG9S.
No. America:	DF7QD, K8HF, AI6Z, AG9S.
Oceania:	W6OUL, KA3A.

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if air-mail desired) to CQ WPX Awards, P.O. Box 1351, Torrance, CA 90505-0351 U.S.A.

especially when he can't find but one W1.

At first glance, you would think the USA call area layout is orderly, and to some degree it is. We've lived with it for so long that we accept it and hope the FCC doesn't change it. Yet it gives a DX station funny results when he takes the call areas in sequence. From W1, W2, W3, and W4 it seems to make sense. But the next four (5, 6, 7, and 8) are not aligned in the same manner. Remembering back to a very successful DXpedition which used a variation of the call area technique seems more sensible. The operator considered the USA in three groups: 1, 2, 3, and 4; 5, 8, 9, and Ø; and 6 and 7. He worked one group until propagation became less favorable, and then he went on to the next group. This served two purposes: it was semi-manageable in pileup size and it moved with the propagation.

What started as an item on the DX station's control—his rule book versus the DX chaser's desires—digressed for a moment to call area schemes. It is meant to educate and to motivate some to thinking about a pileup from the DX station's point of view. If one of you has an ideal technique for the DX station, we are always interested in hearing from you.

For those who recognize the DX station in this item, it means you are a DXer, *unless* you were one of those he lectured. I am not sure how to label those few, but I am sure many readers have their private and not-so-private names.

European ZIP Codes

In response to the September item on how European envelopes should be addressed came a beautiful letter from Erik Jacobsen, OZ6KS. It was especially educational, so I've repeated part of it here for all to gain a closer look at getting your QSL cards and letters to European DXers and QSL managers.

For example, for use inside Denmark, the correct way to write Erik's address is:

Erik Jacobsen
Postboks 306
8700 Horsens

Note that the name of the city is underlined and that the postal code number precedes the city. Also significant are the *two* spaces between the number and the city.

A letter sent to Erik from somewhere in Western Europe (and part of Eastern Europe, where the system is used) could be:

Erik Jacobsen
Postboks 306
DK-8700 Horsens

The DK is an abbreviation of Denmark, and is the same as the country identification on a car. Although the "DK-" is sufficient in Europe, you can (and must, if you are writing from outside of Europe) include the name of the country, bringing it up to:

	or	
Erik Jacobsen		Erik Jacobsen
Postboks 306		Postboks 306
DK-8700 Horsens		DK-8700 Horsens
Denmark		Denmark

Erik uses the example where the DK- is moved three spaces to the left to make it easier to read.

Feed Back

It seems when I get a note about an article I've written for this column that they always seem to point out the error of my ways. The comments by Frank Anzalone, W1WY, and others on "Hired Guns" was great. Frank cleared the air and set the cards straight. If you missed his response, see his Contest Calendar column. One of the locals asked me about Frank's comments and thanked us for the work that went into the articles/columns. Then he asked, "How do I teach the XYL to fix the rig while bringing me sharper pencils. Hi!"

On the DX nets, the mail was delivered in an asbestos envelope. Comments were on both sides of this one. But Jack Bock, K7ZR's editorial in the *Totem Tabloid* was the most interesting. Jack pointed out the greatness of our DXing hobby, as the world was big enough for all, even the little guy. But without the DX nets, it was going to be a world of DXing by the big guns, as we all spread out and compete, while the inexperienced rare DX retreat to the safety of local rag chewing. Another DXer asked, "How can you tell on a QSL card if the contact was made on a net or in a free-for-all pileup?"

Another point from the purist: "Fishing in a fish farm isn't fishing."

One DXer of note wrote to take exception to the DX nets and the list takers. It was not so much the subject in generic terms, but the operating habits of the emcees and list takers—the selective hearing of net controls, favoritism to the few at the disregard of the general populace, and the rude, and yes, destructive, handling of those trying to participate. If there is a way to correct the inequities, we should all join forces to clean up our act and do away with the blight that blemishes DXing. Unfortunately, it is easy to identify the problem, but tough to develop a clean cure. Hopefully, we can find a way to enrich DXing without the on-the-air policemen we have found to be more destructive than helpful. If a DX net is demonstrating any of the ills cited above, we should boycott them, for only then will they go away or correct the manner in which they perform.

Cal, W2PPG, and Alan, KQ2L, from the *Afrikaaner Group* dropped us a line with some of the more comical items from the favorite 15 meter net. These are some of the antics that stretch a three hour net into four or five hours.

"Oh Lordy—here's that Alpha Two checking in . . . I NEED HIM! 'Down ten, Don . . . DOWN TEN! I'LL CALL YOU . . . Down ten Alpha Two . . . DOWN TEN, DON . . . Oh, why don't all you creeps shut up. DOWN TEN!"

"Hey Cal, BREAK. Listen Cal, got an emergency here, Cal . . . going into the hospital in the morning, Cal, for some major-type brain surgery, Cal. Can I work the 7P8, Cal? You know, in case I don't make it through . . . " Oh boy . . . was he in a surly mood. Oh well, give it another try tomorrow."

But some kid with a nickel rig and a runty dipole works a couple of new ones, come sin politely at the end of the show for QSL info, then shyly asks you what a Green Stamp is and where he can get some, and you suddenly realize that IT'S WORTH IT. *(Thanks Cal—ed.)*

VP2E Radioteletype Operation

RTTY DXers will have an opportunity to add Anguilla (VP2E) to their DXCC totals between February 23 and March 3, 1982.

A group of contesters will travel to Anguilla to participate in the ARRL c.w. and s.s.b. DX contests between February 15 and March 10. HAL Communications has agreed to loan two complete RTTY stations to enable the group to put Anguilla on for what may be the first RTTY operation ever.

Tom Wong, VE7BC, shown with the second shipment of equipment sent to China. Approximately $50,000 worth of new equipment was sent to China in the Spring of 1981. It was part of a major long-range effort. Every club station has an FT-107, amplifier, and TH6DXX.

The group also hopes to make side trips to French St. Martin (FS7) and Dutch St. Martin (PJ7) probably around the weekend of February 27 and 28.

Checkpoints And QSL Bureaus

The CQ DX Awards programs include many features not available via other major awards programs. One of the unique features is the use of local DX checkpoints of DXers who can verify your QSL cards and thus save the round-trip shipment of the valuable QSLs. Our current checkpoints include W1DA, W1AM, W1WY, K2FL, W2GT, W2LZX, K2EEK, WB3DNA, AE4Q, N4MM, W4UG, N4NO, AA4FF, W4KA, K4IIF, N4UF, K4SE, W4WJ, KC5FW, K5OA, N5JJ, K5UR, W5YH, K6NA, N6AV, W6RJ, K6ZDL, WB6SHL, N6AR, N7YL, W7OM, W7XN, W8LFO, W8IMZ, K8LJG, W9LT, W9DWQ, WØSFU, KØJSY, WØKU, VE1RY, VE3GMT, VE7AFY, KL7PJ, and many in other countries. When you send for your awards form ask about a local checkpoint. It is more than handy. It provides a chance to meet with another DXer who shares your interest in DX.

Victor C. "Digger" Ulrich, WA2DIG, having just celebrated his 81st birthday, has stepped down from his chores as second call area QSL bureau manager, conducted under the auspices of the North Jersey DX Association. Digger's flawless performance as bureau manager reflected his total dedication to the amateur radio fraternity, which he served well. Joseph Painter, W2BHM, will now serve in this capacity, and the new QTH for all second call area QSL cards routed through the bureau is the North Jersey DX Association, ARRL 2nd District QSL Bureau, P.O. Box 599, Morris Plains, NJ 07950. *(Information via W2LZX.)*

China

A nice note from VE7Big Cookie, Tom Wong, gave some insight into the China situation. Tom has been a regular traveller to China every year since 1972, and he is involved in world trade. Today China has a very large and active Government Amateur Radio Association with hundreds of members. The ARRL, CRRL, and JARL have been taking part in helping the Chinese Amateur Radio Association for many years. Not too much has been in print or said due to the present political situation, and the approval to transmit has not yet been given by their own government people. Although on May 10, 1981 short wave listeners were given permission to put up antennas, no s.w.l. cards have as yet been sent out. However, it won't be long now.

The work that Tom and others have been doing on our behalf is a long road. When China returns to the air, it is most likely that they will have closely supervised radio clubs reminiscent of the UK (USSR) stations of the 1950s. The pictures used in this column give some idea

The WAZ Program

10 Meter Phone

167	KB8DB	171	W8CY
168	KØZZ	172	EA7PW
169	KB3KV	173	WB2PEL
170	WB5RQM		

15 Meter Phone

110	W1TRC	111	W5YH

20 Meter Phone

385	KB8KW	387	IØSSW
386	K1MM		

15 Meter C.W.

56	KØZZ	57	W1WLW

20 Meter C.W.

156	WØSA	159	KB8KW
157	K1MM	160	W9MCJ
158	JA1PS		

40 Meter C.W.

30	K1MM

All Band WAZ

S.S.B.

2320	WB4KTG	2332	KB8KW
2321	JA2ALS	2333	IØJTV
2322	WØQHT	2334	JH7AJY
2323	KB5RF	2335	WA7VMC
2324	WB9VCI	2336	WA9WGJ
2325	KBØVM	2337	K7LTV
2326	EA7BMZ	2338	AI9U
2327	JA9DDM	2339	WØKH
2328	DL8AK	2340	K4URK
2329	VE5QY	2341	KE3A
2330	EA9IB	2342	WB4AGT
2331	WA7YBN		

C.W. and Phone

5262	W8RC	5269	K6VL
5263	PAØEFI	5270	OK1STU
5264	WA4BSN	5271	WØKZV
5265	DK3NU	5272	W6PYV
5266	HB9BPP	5273	W7JKA
5267	G3GHY	5274	I2DMK
5268	K3JGJ		

All Phone

575	I1ZFT

Applications and reprints of the latest rules may be obtained by sending a self addressed stamped envelope (30 cents) size 4½ × 9½ to the W A Z Manager, Leo Haijsman, W4KA, 1044 S.E. 43 Street, Cape Coral, Florida 33904. Applicants forwarding QSL cards either direct to the WAZ manager or to a check point should include sufficient postage for safe return of their QSL cards. The processing fee for all C.Q. awards is $4.00 for subscribers and $10 for non-subscribers. In order to qualify for the subscriber rate, please enclose your latest *CQ* mailing label with your application.

of the tremendous effort undertaken by many and focused through Tom's personal effort. *Be patient,* for progress comes to those who endure.

From The Pileup

Again the stack is down, as the bands have been hotter than the mail. The contributors are given in parentheses.

WD4JNS has declined to act as QSL manager for HHØN due to circumstances of the operation which may not count for DXCC. QSLs will now have to go to the operators: KA4MRE, KD4VU, and HH2CR. *(Long Skip)* I am now back home in old Germany. For those who still need QSL cards for my operation as ZS2LK, please send them to my home call. *(DJ4LK)* The CHC DX nets have added more to their operation. You can now find the nets at 0000Z daily on 21370 kHz; 0200Z daily on 14297 kHz; and 0700Z Fridays and Saturdays on 7230 kHz. There is also an earlier or later meeting on 21370 kHz at 1900Z. *(KØLST)* We could fix the bad conduct on DX nets if the only DXCC that counted was two-way c.w. *(QRM)*

A request for permission to operate from San Felix by N4WF earlier this year was summarily turned down with no explanation given. This sheds further light on recent San Felix antics. *(TDXB)* Fernando, EA8AK, has a letter from the Ministry of Sports and Youth that gives permission for an operation from Albania. However, he says that he has had later communication from the Ministry, and they have asked that the operation be postponed from the 4 December 1981 date mentioned in the letter. Fernando is awaiting a new letter advising him as to when the operation may take place. *(QRZ DX)* A Danish DX group reports that their attempt to apply for a South Yemen 70 license got a reply which said, "At present we are very regret to inform you that Amateur Radio Station in our country is still under study, and not yet established." *(QRZ DX)*

Why isn't North Korea counted as a country, and why isn't anyone trying to put it on the air? *(QRM)* Ron, ZL1AMO, said that his 1981 application for landing permission on Kermadec was denied. He has appealed, but foresees no operation until 1982. *(QRZ DX)* Lloyd and Iris of YASME finished their Barbados operation after 9,000 contacts as 8P6QL in 150 countries. *(TDXB)* Craig, VK9XW, Christmas Island frequents the 20M DX nets between 0600 and 1000 GMT. *(Long Skip)* Don't panic! The station at South Georgia, VP8, isn't likely to be completely automated for many years to come. They will be reducing the staff as they do automate, yet a radio operator will still be required for safety reasons. *(QRM)*

FRØGGL is a new operator on Europa, which still counts the same as Juan de Nova. Some talk has been coming out of France that the two islands may be separated, but nothing definite, and it is not yet known how this might affect DXCC status. FRØGGL/E has been found both on c.w. and several French nets. *(TDXB)* Howard, WB8ODW, operated VP2MFM again. Several reported great cooperation in moving to other bands for skeds both on c.w. and s.s.b. *(Several)* Alan, VK2BNA, is now active as VKØAN on Macquarie Island. He will be there until November. He is on 14120 most days from 1200 to 1230 GMT. Also look on 14200 after 0600Z and 14225 at 1400Z. *(QRZ DX)*

ZK1BM is active from the Northern Cooks, Mannahiki, around 0300Z and again around 1100Z. He is reported to have a big signal for low power on 75 meters. I join him often, giving many a chance to work both North and South Cooks. *(ZK1CG)* VU7DA is a resident of the Andamans and hopes to be QRV soon. He confirms that the VU7AN operation was less than legal. *(Long Skip)* There are over 1200 members of the G-QRP Club. With reports of fantastic results using less than 1 watt, one wonders about all that money in the big rigs. Their journal for the G-QRP Club is great. You've got to read SPRAT to believe it. *(QRM)*

The JY7 prefix was to commemorate JY1's birthday. If you worked seven JY7's, you can apply for a special award. *(TDXB)* 7P8BS is now G4MBP. *(SPRAT)* Chris, ZL4OY, is staying on Campbell Island through November. *(QRZ DX)* South Sandwich, LU3ZY, is active again with list operation around 14239 kHz about 2400 UTC. *(Long Skip)* IAØKM is the newest addition to the DXCC list. Before becoming recognized, the IAØKM crew logged over 12,000 contacts. The station should be back on again regularly after some recent renovation. *(QRM)*

For those who might be confused

Rich Blaney, KB7IJ/KH2, has extended his tour on Guam, thus giving many another chance. He operates all bands. His skill landed third place in the 1980 10 meter contest, so he can handle the pileups. He will be in Saipan for the March WPX Contest as a single band effort on 10M.

5 Band WAZ

Standings as of December 1, 1981

All 200 zones worked:

1. ON4UN, John Devoldere (Belgium)
2. K4MQG, Gary Dixon (U.S.A.)
3. SM4CAN, Kent Svensson (Sweden)
4. AA6AA, Steve Orland (U.S.A.)
5. W8AH, Albert Hix (U.S.A.)
6. W6KUT, E. A. Andress (U.S.A.)
7. EA8AK, Fernando Fernande (Spain)
8. LA7JO, Stig Lindblom (Norway)
9. EA3SF, Fernando Blenert (Spain)
10. OH1XX, Hannu Nieminen (Finland)
11. EA8OZ, Julio Rosello (Spain)
12. WØSD, Edward Gray (U.S.A.)
13. KØZZ, Gary Knutson (U.S.A.)
14. ON6OS, P. Michiels (Belgium)
15. OK3TCA, E. Melcer (Czech.)
16. K6SSS, Fred Capossela (U.S.A.)
17. ZL3GQ, Peter W. Watson (New Zealand)
18. OK3CGP, Stefan Melcer (Czech.)
19. SMØAJU, Leif Lundin (Sweden)

The top 12 contenders for 5 Band WAZ:

1. K5UR, 199
2. CT1FL, 198
3. DL3RK, 198
4. LA5YJ, 197
5. K1MEN, 196
6. 4X4DX, 196
7. W8GT, 195
8. G3MCS, 194
9. N4RR, 192
10. LA9GV, 191
11. N6DX, 191
12. F6DZU, 191

122 Stations have attained the 150 zone level

CQ DX Awards Program

S.S.B.

1067	VE2FOU	1073	W5TZN
1068	KI7I	1074	IØSSW
1069	KD8DB	1075	KW4T
1070	KB5RF	1076	WA6SJX
1071	N3ARK	1077	I8ACB
1072	TG9EP	1078	N2AQH

C.W.

514	KH6JWK

S.S.B. Endorsements

310	K6WR/318	275	TG9EP/284
310	W3GRS/318	275	XE1OX/280
310	VE7WJ/311	275	KD8DB/276
310	W9SS/310	275	IØSSW/275
300	N6AW/309	275	W6MFC/275
300	VK4VC/308	250	KB5RF/270
300	JH1VRQ/300	200	N3ARK/225
275	LA7JO/299	200	DA1MV/201
275	I8ACB/298	150	WA6SJX/151
275	VE3GCO/297	150	GI3ZCK/150
275	W1LQQ/297	28 MHz	KD8DB
275	I8LEL/296		

C.W. Endorsements

310	DL7AA/317	200	KL7AF/201
310	W3GRS/317	150	KH6JWK/150
310	K9MM/310	3.5/7 MHz	VE2FOU
300	W4OEL/305	3.5/7 MHz	KD8DB
275	OK1MP/279		

With the addition of SMOM, the total number of active countries is now 319. The basic award fee for subscribers to CQ is $4. For non-subscribers, it is $10. In order to qualify for the reduced subscriber rate, please enclose your latest CQ mailing label with your application. Endorsement stickers are $1.00. Updates not involving the issuance of a sticker are made free when an s.a.s.e. is enclosed for confirmation of total. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business size, No. 10 envelope, self-addressed and stamped, to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. DX stations must include extra postage for air-mail reply.

Gary Huff, K9AUB, sits at the controls of the 285 net. Gary has filled out a lot of QSL cards as a manager for several DX stations. He is also active on 40 meters where many join forces in giving a new one for those who join in the roundtable.

about the redefinition of prefixes in the Pacific, this might help: T3Ø Western Kiribati was Gilbert and Ocean Islands; T31 Central Kiribati was Phoenix Island including Canton; and T32 Eastern Kiribati was Line Island. The T32s are very active, with several showing on the 20 meter DX nets. *(Long Skip)*

Austrian Pacific DXpedition 1981

Wolf Klier, OE2VEL, and Ed, OE1ETA, spent 27 days in the Pacific logging 32,606 contacts from seven countries. The pair spent over $10,000 to bring this DXpedition about. That doesn't include the QSL cards handled by OE2DYL. The breakdown of the contacts is very interesting, as the not-so-rare and rare countries brought life to the bands. They were especially active on 80/75 and 40, where many got a new band or zone country. These Pacific Islands are on the need list for many European DXers who are currently on the Honor Roll.

From	Contacts	Days
OE1ETA/KH6 and OE2VEL/KH6	742	Few hours
OE1ETA/KH8 and OE2VEL/KH8	4,985	5
5W1DD and 5W1DO	1,266	2
ZK2EL and ZK2TA	10,544	8
C21NI	5,957	4
T3ØBF and T3ØBG	5,003	4
T2ETA and T2VEL	4,109	3

When you get these cards up on the wall, just remember it only cost you a few cents, but it cost them about 33 cents to give you the contact. And best of all, we *all* had a great time doing it.

Photographs

Getting photos for this column takes a lot of cooperation from many of you. My thanks to those who have provided DX photos. We can't use them all at once. They will appear as space permits. Thanks again.

QSL Information

Thanks to K6ZDL, *The DX Bulletin*, *QRZ DX*, and The W6GO/K6HHD List for the following:

A22GM to N4FD
A71AE to DF4NW
AM1A to EA3AOC
C31ON to F2VX
C31WX to DL3ZI
C5AEG to N6BFM
C5AEH to W6JKV
C6ADV to N7YL
C6AES to K4XG
CN8CX to K4CEB
CR9AC to DJØFX
D68AM to WB2OHD
DL1BA/3A to DJ5PX
DL2VK/ST2 to DF2FM
EA6FS to EA6GO
EIØWPO to EI2CZ
EM8T to UK3SAB
FB8YH to F3KH
FMØGA to N6ZV
FM7BX to KA8ANQ
HC7CM to N5BET
HFØPOL to SP5EKZ
HL9EZ to K5DZE
IØØONU to ISØVMB
IZ2RSB to I2RSB
J3AE to J3AAG
JD1BAT to JH4PRU
JY5US to DJ3HJ
LZ13C to LZ1KAB
N5DPH/DU2 to WB3IET
N6TU/KHØ to JA2VUP
OA4ARB to WB5JJD
OA4AWD to VE2AQS
OA4BJ to K7NOS
OA4BR to W1IE
OE1ETA/KH8 to OE2DYL
OE2VEL/KH8 to OE2DYL
OHØBH to OH2BH
OHØDX to OH2BBM
PZ5JR to K3BYV
PZ5RC to WD9DAE
S21GM to N2CW
S79CP to KA2AKE
T2ETA to OE2DYL
T2VE1 to OE2DYL
T3ØBF to OE2DYL
T3ØBG to OE2DYL
T3ØKC to W5RBO
T32AF to JA1NVG
TA2KS to G3SCP
TE1C to TI2CF
UPOL-22 to UA1ABY
V2ADX to W9SWM
V2AJ to WB2TSL
V2AU to OE3ALW
VK9YC to G8MBX
VKØAJ to VK3AWY
VKØAN to VK9NS
VP2EC to N5BET
VP2ED to WB8VPA
VP2EJ to WA8CZS
VP2EM to VE1BHA*
VP2EV to K8ND
VP2MEV to AJ6V
VP2MFM to WB8OBW
VP2MR to W5STI
VP2VHT to WA3YJA
XT2BK to W9GW
YBØPG to KB5AS
YJ8RW to ZL1AMO
ZK2AD to AA6AD
ZK2EL to OE2DYL
ZK2TA to OE2DYL
3B6CF to 3B8CF
4N1R to YU2DX
4X6DX to KA2KWG
5W1DD to OE2DYL
5W1DO to OE2DYL
8P6QL to YASME
9U5WR to SP6FER
9Y4KG to YASME
V2ARS - Box 550, Antigua, Windward Island
***VE1BHA** - Box 583, Fredericton, NB, Canada

73 and best of DX, Rod, W7OM

CQ DX Honor Roll

The CQ DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more ACTIVE countries for the mode indicated. The ARRL DXCC Countries List is used as the country standard. Honor Roll listing is automatic when submitting application or endorsement for 275 or more countries. To remain on the CQ DX Honor Roll, annual updates are required. Honor Roll updates may be made at any time, in any number. Updates indicating "no change" will be accepted to meet the annual requirement. All updates must be accompanied by an SASE for confirmation. The fee for endorsements involving the issuance of a sticker is $1.00. The basic award fee is now $4 for *CQ* subscribers and $10.00 for non-subscribers. Please attach your latest *CQ* mailing label to qualify for the $4.00 rate.

C.W.

W6PT	318	W6ID	315	W1NG	305	N6FX	298	JH1VRQ	281
ON4QX	317	N6AV	314	W4OEL	305	N4MM	298	K9QVB	281
DL7AA	317	K4CEB	311	W2GT	304	WA8DXA	294	OK1MP	279
W3GRS	317	K6JG	311	DL3RK	303	K1MEM	289	WØIZ	278
K6EC	315	K9MM	310	K3FN	301	JA1GTF	285	W1WLW	276
N4PN	315	W4BQY	310	DJ7CX	300	SM3EVR	284	W4BV	275
W9DWQ	315	N6CW	309						

S.S.B.

W6EUF	318	K9LKA	315	K8LJG	310	W7OM	298	W8JXM	282
W4UG	318	DJ9ZB	315	W9SS	310	I8ACB	298	I5BDE	282
K6WR	318	ZL3NS	315	OE3WWB	309	AI8S	297	N3RL	281
K2FL	318	VE3GMT	314	N4KE	309	VE3GCO	297	W2FGY	280
W3GRS	318	SM6CWK	314	N6AV	309	W6DN	297	IV3YRN	280
W3NKM	317	I8YRK	314	DL6KG	309	W1LQQ	297	VE3IUE	280
W9DWQ	317	I4ZSQ	314	N6AW	309	WA4JTI	296	WDØBNC	280
DL9OH	317	F2MO	314	W2SUA	309	K8CMO	296	KB8O	280
K8DYZ	317	OZ3SK	314	YV5DFI	308	I8LEL	296	I8KCI	280
W6REH	317	K4MQG	314	WØYDB	308	I6PLN	295	XE1OX	280
XE1AE	317	SM6CKS	313	VK4VC	308	WA4LOF	295	4Z4DX	280
W4EEE	317	EA4LH	313	XE1J	306	WD8MGQ	293	WD8MOV	279
W2TP	317	N4WF	313	XE1KS	305	IØMBX	293	WB4UBD	279
IØAMU	317	YV1KZ	313	LU1BAR/W3	305	JA5PUL	292	K8HV	278
W9JT	317	K9MM	313	WA4WTG	305	ZL1BIL	291	K3MWV	277
WA2EOQ	317	W4DPS	313	W1NG	304	YU2RTW	288	KC8JH	277
W9QLD	317	OE2EGL	313	OK1MP	304	K9UAA	288	WA6TOO	276
ZS6LW	317	DK2BL	313	N2SS	302	VE3IPR	287	K1WJ	276
VE3MR	316	WØSD	313	K8PYD	302	W4BQY	286	WA4TLI	276
TI2HP	316	W6YMV	312	W6FET	301	WB3HAZ	286	XE1CI	276
VE3MJ	316	I5WT	312	K9SM	301	AE5B	285	KB8KW	276
I8AA	316	W3GG	312	K9BWQ	301	CT1UA	285	KB5FU	276
W9KRU	316	ZL1AGO	312	VE3FJE	301	WA4DAN	285	KKØC	276
I8KDB	316	YV5AIP	311	WØSR	300	N5FG	284	KD8DB	276
W3AZD	316	K5OVC	311	W2CC	300	TG9EP	284	K9QVB	275
W3CWG	316	VE7WJ	311	HP1JC	300	K9HQM	284	W8ILC/QRPp	275
K6EC	316	W6RKP	310	9H4G	300	XE1NI	284	WAØTKJ	275
VE2WY	316	K6XP	310	K1UO	300	SM4CTT	284	VE4AT	275
IØZV	315	W8ILC	310	DJ7CX	300	I3OBO	283	KØGT	275
F9RM	315	N4MM	310	G4CHP	300	W8IMZ	282	K8VFV	275
K6YRA	315	WØSFU	310	K5DUT	300	KA8T	282	IØSSW	275
W4SSU	315	K9RF	310	JH1VRQ	300	WB1DQC	282	W6MFC	275
K6JG	315	I3LLD	310	LA7JO	299	WD9IIX	282	KB9KD	275

a monthly feature by
FRANK ANZALONE, W1WY

Contest Calendar

NEWS/VIEWS OF ON-THE-AIR COMPETITION

The DX Family Foundation has offered to sponsor two new awards for last year's World Wide DX Contest (October and November 1981). They will provide the Trophies for Japanese amateurs only.

The announcement reads as follows:

Single Operator

JAPAN - 21 MHz Phone - DX Family Foundation.

JAPAN - 21 MHz C.W. - DX Family Foundation.

Also note that there are two new additional Trophies for the upcoming WPX Contest:

Single Operator

WORLD - 7 MHz S.S.B. - Bill Diggins, WA8LXJ.

WORLD - 3.5 MHz C.W. - Lance Johnson Engineering.

And speaking of awards, we admit that some of our plaques sometimes take a long time to reach their destinations. We apologize for some of these delays, but it's not always our fault. Some of you fellows periodically pull up stakes but never tell us where you can be located. Deciphering your hieroglyphics is no big help either.

As we have indicated in the rules, all awards go to the licensee of the station, and not to the guest operator. This sometimes also holds up the details. Not to mention that there are sometimes delays by our supplier and a few reluctant sponsors. Drop me a note if after a reasonable wait you still have not received your award.

We sometimes receive bitter complaints that certain stations should be disqualified from contest operation for running excessive power, operating illegally from a visited country, etc. Your complaint may be justified, but it's understandable that we cannot take any action unless we receive official documentation from the proper authorities.

The deadline for getting announcements to me is March 15th for the June issue, and April 15th for July.

73 for now, Frank, W1WY

14 Sherwood Road, Stamford, CT 06905

Calendar of Events

* Mar.	6-7	ARRL DX Phone Contest
* Mar.	13-14	QCWA Phone QSO Party
Mar.	13-14	Commonwealth CW Contest
Mar.	13-15	Virginia QSO Party
Mar.	20-21	Bermuda Contest
Mar.	20-21	Tennessee QSO Party
Mar.	20-21	YL ISSB CW QSO Party
Mar.	20-22	BARTG RTTY Contest
Mar.	21-22	Wisconsin QSO Party
Mar.	**27-28**	**CQ WW WPX SSB Contest**
Apr.	3-4	Polish CW Contest
Apr.	3-4	ARRL Open CD Phone
Apr.	7-8	DX YL to N.A. YL CW
Apr.	14-15	DX YL to N.A. YL Phone
Apr.	17-18	Polish Phone Contest
Apr.	17-18	ARRL Open CD CW Contest
Apr.	17-18	ARCI QRP SSB QSO Party
Apr.	24-25	Swiss "H 26" Contest
Apr.	24-25	YL ISSB Phone QSO Party
Apr.	24-25	King of Spain Contest
May	**29-30**	**CQ WW WPX CW Contest**

* Covered last month.

CQ WW WPX Contest

S.S.B.: March 27–28 C.W.: May 29–30
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

Complete rules were published in last month's issue. Basically, the format is the same as in previous years with the following clarifications.

Par. IV. Definition of a multi-operator, single transmitter station is defined as follows: Only one transmitter and one band may be used during the same 10 minute period. Picking up new multipliers on another band during the same 10 minute period is **not** permitted.

The physical boundaries of a multi-multi station are defined as within a 500 meter diameter area.

Par. XI. The eligibility clause for Trophys and Plaques is *two years*. This does not apply to QRPp, Expedition, Club, or Special awards.

Stations that are World winners will not be considered for a sub-area award, which goes to the runner-up of that area.

Par. XIII. A prefix check list is now a definite requirement and must be included with each log entry.

Everything else—the exchange, the scoring, etc.—remains exactly the same. And keep in mind that a Prefix multiplier is counted *once only*, not once on each band.

Two new Trophies not listed in the rules have been added for this year's contest and are as follows:

S.S.B. 7 MHz - World - Donated by Bill Diggins, WA8LXJ.

C.W. 3.5 MHz - World - Donated by Lance Johnson Engineering.

Logs again may be sent to the Contest Director, Bernie Welch, W8IMZ, 7735 Redbank Lane, Dayton, Ohio 45424, and of course to CQ WPX Contest, 76 N. Broadway, Hicksville, NY 11801. Be sure to indicate S.S.B. or C.W. Contest on the envelope. Deadline for S.S.B. is May 10th and July 10th for C.W.

Commonwealth C.W. Contest

Starts: 1200Z Saturday, March 13
Ends: 1200S Sunday, March 14

Only RSGB members residing in the United Kingdom and radio amateurs licensed to operate within the British Commonwealth and British Mandated Territories are eligible to participate in this one. That, of course, includes our Canadian and Caribbean neighbors, as well as the other world-wide British areas. *(We lost our eligibility in 1776. Hi!)*

Contacts between stations in the same call areas are not permitted. All the British Isles prefixes count as one call area.

Activity will be on c.w. only, and it is requested that operation be confined to the lower 30 kHz of each band, 3.5 through 28 MHz (except for Novice contacts).

Exchange: RST plus a three figure contact number.

Scoring: Each completed contact is worth 5 points. In addition, a bonus of 20 points may be claimed for the 1st, 2nd, and 3rd contact with each Commonwealth call area on each band.

Each band is scored separately and totalled for the final all-band score. There is no multiplier; just add total QSO and Bonus points from each band as indicated.

Multi-band scores cannot also be used for single band awards, but you can request that a single band be judged for competition. Only single operator entries accepted.

There is an s.w.l. section with scoring the same as above. If both stations in contact are heard, they should be reported as separate entries for credit.

Awards: Certificates to the 1st, 2nd, and 3rd place winners in all areas, both multi-band and single band. Three Rose Bowl Trophies for the overall winners.

Logs must be received by May 17th and go to: D.J. Andrews, G3MXJ, 18 Downsview Crescent, Uckfield, East Sussex TN22 1UB, England.

Virginia QSO Party

Starts: 1800Z Saturday, March 13
Ends: 0200Z Monday, March 15

This party is again being sponsored by the Sterling Park A.R.C.

The same station may be worked on each band and each mode, and Virginia stations may contact in-state stations for QSO and multiplier credit.

There are three categories: fixed/portable, single operator and multi-operator, and mobile.

Exchange: QSO no., and QTH. County for Virginia stations; state, province, or country for all others.

Scoring: One point per QSO. VA stations multiply total QSOs by sum of states, provinces, and DX countries and VA counties worked.

Out-of-state stations multiply number of VA contacts by number of VA counties worked (maximum 96).

Frequencies: C.W.—60 kHz from the low end of each band, and Novice bands. Phone—3930, 7230, 14285, 21375, and 28575.

Awards: Certificates to top scorers in each state, province, DX country, and VA county. A Plaque to the top scoring VA station.

Indicate each new multiplier as worked. Include a summary sheet with your log and an s.a.s.e. for a copy of the results.

Mailing deadline is April 15th to: Virginia QSO Party, Att: A. Ray Massie, K3RZR, Rt. 1, Box 115E, Dunnsville, VA 22454.

Bermuda Contest

Starts: 0001Z Saturday, March 20
Ends: 2400Z Sunday, March 21

This has become one of the more popular fixed-area contests, an obvious reason being that guest trip to Bermuda.

Stations in the U.S. and Canada may work the United Kingdom, West Germany, and Bermuda. The U.K. and W. Germany may work the U.S., Canada, and Bermuda.

The same station may be worked once per band, either phone or c.w., not both. Cross band or cross mode also not permitted. On 40 meters phone contacts are not permitted between the U.S. and the U.K. or W. Germany.

You are limited to 36 hours out of the 48-hour contest period. Off times must be no less than 3 consecutive hours.

Participation is for single operator stations only, and operation must be from their own residences.

Exchange: RS(T) and QTH. State for W/K, province for VE, county for the U.K., DOC for DL, and parishes for VP9's.

Scoring: Each completed QSO is worth 5 points, except for contacts with G, GI, GM, and GW, which are now worth 7 points.

Multiply total QSO points by the number of different VP9 stations worked on each band, 3.5 through 28 MHz for your final score. (*Note:* It's each different VP9 on each band, not different parishes.)

Awards: The top station in each U.S. state, VE province, U.K. county, and DL DOK will receive printed awards. The overall winner in each of the above areas, however, will receive something more substantial—a Trophy to be presented at the Society's Annual Dinner in Bermuda in October. Round-trip transportation and hotel accommodations will be provided by the Society. (*Note:* Trophy winners for '78, '79, '80, and '81 are not eligible.)

Use a separate log sheet for each band, and a dupe sheet if 200 or more contacts are logged. A penalty of 3 contacts will be deducted for each duplicate contact for which points are claimed. An excess of claimed duplicates may mean disqualification. A signed declaration that all rules have been observed is also requested.

Entries must be received before May 31st by the Radio Society of Bermuda, P.O. Box 275, Hamilton 5, Bermuda.

Tennessee QSO Party

2100Z Sat. to 0500Z Sun., March 20/21
1400Z to 2200Z Sun., March 21

The Tennessee Council of Amateur Radio Clubs is again sponsoring this activity.

The same station may be worked on each band and each mode, mobiles in each county change. No county line operation, however. Tenn. stations may contact in-state stations for QSO and multiplier credit.

Exchange: Signal report and QTH. County for Tenn.; state, province, or country for others.

Scoring: Contacts on 10 and 15 are worth 1½ points, on all other bands 1 point.

Tenn. stations multiply total QSO points by sum of states + VE provinces + Tenn. counties worked.

Out-of-state stations multiply QSO points by sum of Tenn. counties worked (maximum of 95).

The following bonus points may be added to your final score: A power multiplier of 1.5 for stations using 200 watts or less input, and a 200 point bonus for mobile and portable stations for each county change outside own county (minimum of 10 QSOs per county).

Frequencies: C.W.—50 kHz up from bottom of each band. Phone—3980, 7280, 14280, 21380, 28580. Novice in their authorized bands.

Awards: Certificates to each station submitting a log with 15 or more contacts. Plaques to the top Tenn. and out-of-state scorers, and to the Tenn. mobile and portable winners. Only single operator stations are eligible.

Use a separate log sheet for each band with 50 or more contacts and a check sheet if you make over 200 contacts. Include a large s.a.s.e. with your entry.

Mailing deadline is May 1st to: Dave Goggio, W4OGG, 1419 Favell Drive, Memphis, Tenn. 38116.

YL Int'l SSBers QSO Party

C.W.: March 20–21 S.S.B.: April 24–25
Starts: 0001Z Saturday
Ends: 2359Z Sunday

Rules are designed for membership participation and are rather lengthy and complicated. I would advise you to write to the party co-chairwoman, Minnie Connolly, KAØALX, for more details and log forms.

Essentially the rules are as follows:

All bands may be used, and the same station may be worked on each band for QSO credit but only once for a multiplier. Two meter simplex contacts are also permitted.

You are required to take two 6 hour off periods in each section.

Exchange: Name, RS(T), s.s.b.'er number, country, state, and partner's call if any. Non-members send "no member" and QTH.

Points: On c.w., contacts with members are worth 8 points, with non-members 1 point.

On s.s.b., 5 points with members and 1 point with non-members.

Multiplier: Only contacts with members count as a multiplier. One for each of the following: each state, VE province, country, YL/OM team, DX/WK team, and for DX/WK partners working each other.

Frequencies: C.W.—3665, 7070, 14070, 21070. S.S.B.—3925, 7290, 14332, 21373, 28673. DX on 3765 and 7090, VKs on 3690.

Awards: Certificates to the winners in each category as listed above.

Members desiring to enter as DX/WK teams should send their request to KAØALX as soon as possible.

Non-members can only enter the single operator category.

Again, I strongly advise that you write for more details and log forms. Include a large s.a.s.e. with your request.

Mailing deadline for all entries is May 15th. This year they go to the party co-chairpersons Rick and Minnie Connolly, KØRDJ and KAØALX, Star Rt. #1, Crocker, MO 65452.

Wisconsin QSO Party

Starts: 1800Z Sunday, March 21
Ends: 0200Z Monday, March 22

The West Allis Radio Amateur Club is again sponsoring this one, with a change to a March date this year.

The same station may be worked once on each band and each mode, mobiles in each county change. Wisc. stations can work other in-state stations for QSO and multiplier credit.

Exchange: RS(T) and QTH. County for Wisc.; state, province, or country for others.

Scoring: C.w. contacts are worth 2 points, phone contacts 1 point. The multiplier for Wisc. is countries + states & provinces + Wisc. counties worked. Others will use Wisc. counties (maximum of 72).

There is a 100 point bonus for mobiles for each county change (minimum of 10 QSOs per county). Bonus to be added to final score.

Frequencies: C.W.—3570, 7070, 14070. Phone—3990, 7290, 14290 (three bands only). Lower portion of Novice bands.

Awards: Certificates to the winning stations in each state, province, and DX country. A Trophy to the Wisconsin Club with the highest aggregate score.

Entries must be postmarked no later than May 1st and go to: West Allis A.R.C., P.O. Box 1072, Milwaukee, Wisc. 53201.

B.A.R.T.G. Spring RTTY Contest

Starts: 0200 GMT Sat., March 20
Ends: 0200 GMT Mon., March 22

Sponsored by the British Amateur Radio Teleprinter Group, this contest is open to all amateurs and s.w.l.'s. There are three categories: single operator, multi-operator, and s.w.l.

Use all bands, 3.5 through 28 MHz. Operation is limited to 30 hours out of the 48 hour contest period. The 18 hours off may be taken any time but not in less than 3 hour periods.

Short Wave Listeners are now only required to log the message from the station heard.

Exchange: RST plus a three figure contact number, and time in GMT (full 4 figures).

Points: Contact with stations within own country 2 points. With stations in other countries 10 points. A bonus of 200 points for each country worked on each band including own. The same station may be worked on each band for QSO and multiplier credit.

Multiplier: Total number of countries worked on each band, and number of continents worked (counted once only).

Final Score: (a) Total QSO points × country multiplier. (b) Country multiplier × bonus points × continents worked. Add sum of (a) and (b) for your final score.

Awards: Certificates to the top stations in each of the three classes, in each continent, and each W/K, VE/VO, and VK call area.

Final position will be valid for entry in the World RTTY Championship. There are also awards for working all six continents. (Get additional info from G8CDW.)

Indicate on/off times in your log and include a summary sheet showing the scoring, etc. Log forms are available from G8CDW by sending a large s.a.s.e. and 2 IRCs.

Logs must be received by May 31st and go to: Ted Double, G8CDW, 89 Linden Gardens, Enfield, Middlesex, England EN1 4DX.

Polish "SP" DX Contest

C.W.: April 3–4 S.S.B.: April 17–18
Starts: 1500 GMT Saturday
Ends: 2400 GMT Sunday

The SP DX Contest is now a two week affair, c.w. and phone, each independent of the other.

There are three categories—single operator, single band and all band, and multi-operator, single transmitter, all band only. Also s.w.l.

Exchange: RS(T) plus a 3 figure QSO

number starting with 001 for foreign stations. Polish stations will send RS(T) and their province (Wojewodztwo) i.e., 579KA or 57KA.

Scoring: Each QSO with an SP/SQ/3Z station on each band is worth 3 points.

Multiplier: Each different province (WOJ) worked counted once only (maximum of 49).

Final Score: Total QSO points multiplied by number of provinces. The same station may be worked on each band for QSO points but not for a multiplier.

Awards: Certificates to the top scoring stations in each category and each mode; in each continent, each country, and each call area of Australia, Canada, Japan, USA, and USSR.

S.w.l. entries must report the call of the Polish station as well as the call of the station being worked. Scoring same as above.

Contest contacts may be credited for the PZK awards in lieu of QSL cards, providing an application is made and the contact is logged by the SP station.

A summary sheet is requested showing the scoring, plus a signed declaration, and your name and address in Block Letters.

Entries must be postmarked no later than April 30th for c.w. and May 15th for phone. They go to: PZK Contest Committee, P.O. Box 320, 00-950 Warszawa, Poland.

ARRL Open CD Party

Phone: April 3–4 C.W.: April 17–18
Starts: 1800Z Saturday
Ends: 0600Z Sunday

There are three of these CD (Communications Department) parties held each year: January, April, and October. This one is open to all members of the ARRL membership; the other two are for ARRL appointees only.

It's only a 12 hour affair with operation limited to 10 hours. Times out must be at least 30 minutes long. Only certain portions of the different bands have been designated for operation.

The exchange is very simple—your status or title and your ARRL section. Non-appointees can send "member" for identification.

Phone and c.w. are separate contests. The same station can be worked once on each band.

The scoring is also very simple: multiply your total QSO's by the number of different ARRL sections plus VE8 worked (maximum of 74).

No sense in my going into more details. To be eligible to participate you must be a member of the ARRL, and if you are a member you will be receiving *QST*. The March issue has all the details.

There is a special CD Party form. Address your request with a large s.a.s.e. to ARRL Headquarters, Newington, CT 06111.

a monthly feature by
GEORGE JACOBS, W3ASK

Propagation

THE SCIENCE OF PREDICTING RADIO CONDITIONS

Solar Cycle Stalled!

The solar cycle continues to hold steady at a smoothed sunspot number of approximately 143.

The *Royal Observatory of Belgium*, the world's official keeper of the sunspot cycle index, reports monthly mean sunspot numbers of 161 and 136 respectively for October and November 1981. These result in smoothed sunspot numbers, upon which the sunspot cycle is based, of 143 centered on both April and May 1981.

The present solar cycle began its decline from a maximum intensity of 165 in December 1979. By December 1980 it had dropped to a level of 143. It dropped further during January 1981 to a level of 140, and rose slightly during February to 141. In March 1981 the smoothed sunspot number continued to climb to 143, where it remained throughout April and May.

The cycle will, of course, eventually continue to decline. However, the longer it remains stalled at the 143 level, the higher the average level of solar activity expected during 1982 will be. A smoothed sunspot number of approximately 122 is now forecast for March 1982. This is up four points from the expected level shown in Table I, Progress of Sunspot Cycle 21, which appeared in the January 1982 Propagation column.

March Propagation

The spring and fall equinoctial periods are generally the best months for DX propagation on the h.f. amateur bands. These are the times when the sun is most nearly overhead at the equator, making night and day of almost equal length throughout the world. This occurs exactly on March 21st (spring equinox) and September 22nd (fall equinox) of each year. Favorable propagation conditions associated with equinoctial periods are experienced for several weeks before to several weeks after these dates.

During equinoctial periods, it is always spring in one hemisphere and fall in the other. This tends to have an "equalization" effect on the ionosphere both north and south of the equator, compared to the extremes that exist when it is summer in one hemisphere and winter in the other. It is this similarity in ionospheric conditions over most of the world that is responsible for optimum propagation conditions on the h.f. bands during the equinoctial periods.

The improvement in conditions expected during March should be most noticeable on long circuits between, for example, the United States and Australia, South America, southern Africa, southern Asia, Antarctica, etc. Grey-line DX propagation conditions both at dawn and sunset should peak during March, because of the similar conditions north and south of the equator. Conditions should also be optimum for long-path openings as well. Improvement due to equinoctial conditions should be noticeable on all bands *6* through *160* meters during March.

During March expect good daytime DX conditions on *10*, *15*, and *20* meters, with DX openings on *6* meters also possible on some days. Conditions on these bands follow the sun, first opening towards the east and south shortly after sunrise, peaking towards the south and north during the afternoon hours, and towards the west during the late afternoon and the sunset period.

From sundown to midnight best bands should be *40*, *80*, and *160* meters. These bands will first open towards the east and south, with peak conditions likely around midnight. The *20* meter band should also provide good DX openings during this period, mainly towards the south and west. When conditions are High Normal or better, it is also possible that *15* meters will remain open during this period, peaking towards the south and west. There is also a possibility for some *10* meter openings in the same direction during this period.

Between midnight and sunrise, *40* and *80* meters should be optimum bands for DX propagation, mainly towards the south and west. Good openings to many areas of the world should also be possible on the *160* meter band. Remember, signals are expected to peak on *40*, *80*, and *160* meters when it is *sunrise* on the east-

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for March 1982

Propagation Index	Expected Signal Quality (4)	(3)	(2)	(1)
Above Normal: 5, 21, 27	A	A	B	C
High Normal: 1-2, 4, 6, 20, 22-23, 26, 28-29, 31	A	B	C	C-D
Low Normal: 3, 7, 11-13, 18-19, 24-25, 30	A-B	B-C	C-D	D-E
Below Normal: 8-10, 14, 17	B-C	C-D	D-E	E
Disturbed: 15-16	C-E	D-E	E	E

Where expected signal quality is: A—Excellent opening, exceptionally strong, steady signals greater than S9 + 30 dB.

B—Good opening, moderately strong signals varying between S9 and S9 + 30 dB, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.
2. With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be good (B) on the 1st and 2nd, good-to-fair (B-C) on the 3rd, good again (B) on the 4th, excellent (A) on the 5th, etc.

For updated information, subscribe to bi-weekly MAIL-A-PROP, David D. Meisel, Editor, 54 Westview Crescent, Geneseo, NY 14454.

*11307 Clara Street, Silver Spring, MD 20902

erly leg of a path. Some fairly good *20* meter openings should also be possible towards the south and west during this period.

For more detailed information concerning DX band openings during March, refer to the *DX Propagaton Charts* which appeared in last month's column. This month's column contains *Short-Skip Propagation Charts* which are valid for both March and April 1982. These Charts, which include data for Hawaii and Alaska, contain band opening predictions for predominantly one-hop, or short-skip, paths ranging in distance from 50 to 2300 miles. For day-to-day changes in short-wave propagation conditions expected during March, see the *Last Minute Forecast* which appears at the beginning of this column.

V.H.F. Ionospheric Openings

Unusually good ionospheric propagation conditions can generally be expected on the v.h.f. bands during equinoctial periods.

Optimum trans-equatorial scatter propagation (TE) is expected during March between the southern tier states and countries deep in South America on *6* meters, with the possibility of an occasional *2* meter opening as well. TE openings must cross the magnetic equator at or near a right angle, and signals are usually very weak, often with severe flutter fading. The best time to check for TE openings should be between 8 and 11 p.m. local time.

Solar activity is expected to remain high enough during March to permit some regular *F*-layer DX openings on *6* meters to many areas of the world. While fewer openings are expected towards Europe and the Far East, an increased number of openings between the United States and locations in the southern hemisphere should be possible. Signals arriving in the quadrant between northeast and southeast should peak by mid-morning. Noontime should be best for openings towards the Caribbean, Central America, and the northern countries of South America, although *6* meters may open in this direction as early as an hour or two after sunrise. During the afternoon hours skip should extend deeper into South America and also shift towards the west and northwest. Trans-continental openings on *6* meters can be expected from about noontime through the late afternoon hours. Be sure to check for *6* meter DX openings when daily conditions are expected to be High or Above Normal.

Widespread auroral activity can be expected during March, particularly on days that are expected to be Below Normal or Disturbed. Intense ionization associated with auroras can be responsible for auroral-scatter-type openings on the v.h.f. bands and for sporadic-*E* short-skip

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular Meter band (10 through 160 Meters) as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts the predicted times of openings are found under the appropriate Meter band column (10 through 80 Meters) for a particular geographical region of the continental USA as shown in the left hand column of the Charts. An * indicates the best time to listen for 80 meter openings.

2. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. On the Short-Skip Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. The index indicates the number of *days* during the month on which the opening is expected to take place, as follows:

(4) Opening should occur on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

3). Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. On the Short-Skip Chart appropriate *standard* time is used at the *path midpoint*. For example on a circuit between Maine and Florida, the time shown would be EST, on a circuit between N.Y. and Texas, the time at the midpoint would be CST, etc. Times shown in the Hawaii Chart are in HST. To convert to standard time in other USA time zones *add* 2 hours in the PST zone; 3 hours in the MST zone; 4 hours in the CST zone, and 5 hours in the EST zone. *Add* 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 14 or 2 P.M. in Los Angeles; 17 or 5 P.M. in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to *standard* time in other areas of the USA *subtract* 8 hours in the PST zone; 7 hours in the MST zone; 6 hours in the CST zone and 5 hours in the EST zone. For example, at 20 GMT it is 15 or 3 P.M. in N.Y.C.

4. The Short-Skip Chart is based upon a transmitted power of 75 watts c.w. or 300 watts p.e.p. on sideband; the Alaska and Hawaii Charts are based upon a transmitter power of 250 watts c.w. or 1 kw p.e.p. on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level for each 10dB loss, it will lower by one level.

5. Propagation data contained in the Charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

CQ Short-Skip Propagation Chart
March & April, 1982
Local Standard Time at Path Mid-Point
(24-Hour Time System)

Band (Meters)	Distance From Transmitter (Miles)			
	50-250	250-750	750-1300	1300-2300
10	*Nil*	09-18 (0-1)	07-09 (1) 09-12 (1-2) 12-13 (1-3) 13-16 (1-3) 16-18 (1-2) 18-21 (0-1)	07-08 (1) 08-09 (1-2) 09-12 (2-4) 12-16 (3-4) 16-18 (2-3) 18-20 (1-2) 20-21 (1)
15	*Nil*	07-09 (0-1) 09-13 (0-2) 13-14 (0-3) 14-16 (0-2) 16-20 (0-1)	07-09 (1-2) 09-13 (2-4) 13-14 (3-4) 14-16 (2-4) 16-19 (1-3) 19-20 (1-2) 20-21 (0-2) 21-23 (0-1)	07-08 (2) 08-09 (2-3) 09-16 (4) 16-19 (3) 19-21 (2-3) 21-23 (1-2) 23-01 (0-1)
20	11-13 (0-1) 13-16 (0-2) 16-21 (0-1)	08-09 (0-3) 09-11 (0-4) 11-13 (1-4) 13-16 (2-4) 16-18 (1-4) 18-21 (1-3) 21-02 (0-2) 02-08 (0-1)	06-07 (1-2) 07-08 (3) 08-09 (3-4) 09-18 (4) 18-22 (3-4) 22-00 (2-3) 00-02 (2) 02-06 (1)	06-07 (2) 07-08 (3) 08-10 (4) 10-15 (4-3) 15-22 (4) 22-23 (3-4) 23-00 (3) 00-02 (2) 02-04 (1-2) 04-06 (1)
40	06-07 (1-2) 07-09 (2-3) 09-18 (4) 18-20 (3-4) 20-22 (2-3) 22-00 (1-2) 00-06 (1)	06-07 (2-3) 07-09 (3-4) 09-11 (4-3) 11-13 (4-2) 13-15 (4-3) 15-20 (4) 20-22 (3-4) 22-00 (2-4) 00-03 (1-3) 03-06 (1-2)	06-07 (3-2) 07-08 (4-2) 08-09 (4-1) 09-13 (2-1) 13-15 (3-1) 15-17 (4-2) 17-19 (4-3) 19-00 (4) 00-03 (3-4) 03-06 (2-3)	06-08 (2-1) 08-15 (1-0) 15-16 (2-0) 16-17 (2-1) 17-19 (3-2) 19-03 (4) 03-04 (3-4) 04-06 (3)
80	07-11 (4) 11-18 (4-3) 18-22 (4) 22-00 (3-4) 00-07 (2-3)	07-08 (4-2) 08-11 (4-1) 11-16 (3-0) 16-18 (3-2) 18-20 (4-3) 20-00 (4) 00-05 (3-4) 05-07 (3)	07-08 (2-1) 08-11 (1-0) 11-16 (0) 16-18 (2-1) 18-20 (3-2) 20-03 (4) 03-05 (4-3) 05-07 (3-2)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-2) 22-03 (4-3) 03-05 (3-2) 05-07 (2-1)
160	05-07 (4-2) 07-09 (3-1) 09-17 (2-0) 17-19 (3-1) 19-20 (4-2) 20-05 (4)	05-06 (2-1) 06-07 (2-0) 07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (2) 20-22 (4-3) 22-03 (4) 03-05 (4-3)	05-06 (1) 06-19 (0) 19-20 (2-1) 20-22 (3-2) 22-03 (4-3) 03-05 (3-2)	05-06 (1-0) 06-19 (0) 19-20 (1-0) 20-22 (2) 22-03 (3-2) 03-05 (2-1)

HAWAII
March & April, 1982
Openings Given in Hawaiian Standard Time

TO:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	08-09 (1) 09-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	06-07 (1) 07-08 (2) 08-11 (1) 11-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-20 (2) 20-22 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-21 (4) 21-00 (3) 00-04 (2) 04-06 (3) 06-07 (2) 07-08 (1)	18-20 (1) 20-22 (2) 22-01 (3) 01-02 (2) 02-03 (1) 21-22 (1)* 22-01 (2)* 01-02 (1)*
Central USA	08-09 (1) 09-11 (2) 11-15 (3) 15-17 (4) 17-19 (2) 19-20 (1)	06-07 (1) 07-08 (2) 08-09 (3) 09-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-22 (1)	09-14 (1) 14-16 (2) 16-19 (3) 19-23 (4) 23-03 (3) 03-06 (2) 06-08 (3) 08-09 (2)	19-20 (1) 20-22 (2) 22-02 (3) 02-04 (4) 04-05 (2) 05-06 (1) 22-23 (1)* 23-02 (2)* 02-03 (3)* 03-04 (2)* 04-05 (1)*
Western USA	08-09 (1) 09-11 (2) 11-12 (3) 12-16 (4) 16-17 (3) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (4) 11-15 (3) 15-18 (4) 18-20 (3) 19-22 (2) 22-00 (1)	15-17 (3) 17-21 (4) 21-00 (3) 00-02 (2) 02-04 (1) 04-06 (2) 06-08 (4) 08-10 (3) 10-15 (2)	18-19 (1) 19-21 (2) 21-22 (3) 22-04 (4) 04-05 (3) 05-06 (1)* 21-22 (1)* 22-23 (2)* 23-04 (3)* 04-05 (2)* 05-06 (1)*

ALASKA
March & April, 1982
Openings Given In GMT

TO:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	18-20 (1) 20-00 (2) 00-01)1)	16-18 (1) 18-22 (2) 22-01 (3) 01-02 (2) 02-03 (1)	13-15 (1) 20-22 (1) 22-01 (2) 01-03 (3) 03-05 (2) 05-06 (1)	06-13 (1) 07-12 (1)*
Central USA	19-21 (1) 21-00 (2) 00-02 (1)	17-19 (1) 19-22 (2) 22-00 (3) 00-02 (4) 02-03 (2) 03-04 (1)	14-16 (1) 20-23 (1) 23-02 (2) 02-04 (3) 04-05 (2) 05-07 (1)	07-14 (1) 08-12 (1)*
Western USA	20-23 (1) 23-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	18-20 (1) 20-22 (2) 22-23 (3) 23-02 (4) 02-04 (3) 04-05 (2) 05-06 (1)	16-18 (1) 18-20 (3) 20-00 (2) 00-02 (3) 02-04 (4) 04-05 (3) 05-06 (2) 06-10 (1)	07-09 (1) 09-12 (2) 12-14 (1) 09-10 (1)* 10-12 (2)* 12-13 (1)*

#See explanation in "How To Use Short-Skip Charts" in box at the beginning of this column.

*Indicates best time for 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a propagation index of (2), or higher.

Note: The Alaska and Hawaii Propagation Charts are intended for distances *greater* than 1300 miles. For shorter distances, use the preceding Short-Skip Propagation Chart.

openings for distances up to approximately 1200 miles. Ionospheric openings resulting from auroral conditions are usually marked with a distinctive flutter fading, although at times unusually strong signal levels are possible with little fading.

No significant meteor activity is expected during March, although some brief meteor-scatter-type openings may be possible on both *6* and *2* meters during minor meteor showers expected March 12–13 and 22–23.

31st Anniversary

The March edition of *CQ* always marks an anniversay for this column, since the first Propagation column under my byline appeared in the March 1951 issue!

This, then, is the 31st consecutive year that this column has appeared under my name on the pages of *CQ* continuously month to month. The column has weathered the waxing and waning of sunspot cycles 18, 19, and 20, and has been written from all corners of the earth under conditions varying from the tranquility of seaside resorts to the sounds of nearby wars in Southeast Asia, from the sands of the Sahara to the ice fields of the Arctic, from the high points of the Andes and Alps to the low points of the Dead Sea and Death Valley, without missing a deadline.

Through this column I hope to continue bringing the latest in ionospheric predictions, forecasts, and scientific news for the remainder of Cycle 21 and into Cycle 22 and beyond.

73, George, W3ASK

CQ World-Wide WPX/SSB Contest All-Time Records

By BERNIE WELCH, W8IMZ, Director, CQ WPX Contest

The contest is held each year on the last full weekend of March. The All-Time Records will be up-dated and published annually. The method of computing final scores changed several times since 1957. Data following the calls below are: year of operation, total score, and number of prefix multipliers.

WORLD RECORD HOLDERS

Single Operator

1.8	VE3MFT('81)	84,906	89
3.5	4M3AZC('80)	852,548	262
7.0	I5NPH('80)	1,619,706	363
14	4N3ZV('81)	3,586,240	560
21	HC9A('81)	6,025,770	615
28	ZZ5EG('81)	4,868,780	581
AB	PJ2CC('80)	6,521,098	538

Multi-Operator Single Xmtr.

9A1ONU('80)	13,362,486	723

Multi-Operator Multi-Xmtr.

KH6XX('81)	19,345,473	669

U.S.A. RECORD HOLDERS

Single Operator

1.8	W8LRL('81)	15,652	91
3.5	W1CF('77)	460,908	186
7.0	K6JAN('75)	270,972	117
AB	K1AR('80)	3,703,194	513
14	K8NA('81)	1,740,024	507
21	AI7B('81)	3,058,563	437
28	N2RM('80)	2,311,156	521
QRPp	N2AA('80)	808,080	370

Multi-Op Single Xmtr.

K7RI('81)	5,010,501	501

Multi-Op Multi-Xmtr.

AI6V('81)	12,529,608	728

CLUB RECORD

FRASER VALLEY DX CLUB('80) 38,762,436

WPX (Prefix) RECORD

YTØR('81) 778

QRPp RECORD

TG9GI('80) 855,336

CONTINENTAL RECORD HOLDERS

AFRICA

1.8	No Entrant		
3.5	CT3BD('80)	181,412	133
7.0	ZD8CS('72)	40,230	45
14	CQ6LF('73)	1,138,047	309
21	EL2AV('81)	4,617,530	557
28	EL2AV('79)	1,874,140	415
AB	EL2AV('80)	3,444,666	498

ASIA

1.8	4X4NJ('81)	150	5
3.5	4X4DK('71)	478,950	155
7.0	JA2BAY('81)	469,368	212
14	UK9ABA('71)	1,740,020	361
21	4XØU('81)	2,823,916	514
28	4X4UH('80)	2,718,760	440
AB	UA9ACN('78)	3,319,488	459

EUROPE

1.8	UP2BAW('81)	51,474	69
3.5	DJ4PT('81)	745,216	328
7.0	I5NPH('80)	1,619,706	363
14	4N3ZV('81)	3,586,240	560
21	4N3EY('81)	3,634,755	501
28	YU3MY('80)	3,530,016	412
AB	YT2D('80)	5,291,218	587

Multi-Op Single Xmtr.

AF	CT3/OH2BC('78)	4,377,450	385
AS	UK9AAN('80)	11,152,020	660
EU	9A1ONU('80)	13,362,486	723
NA	VP5RFS('81)	9,304,650	667
O	AH2E('81)	8,021,376	528
SA	HK3AFD('81)	6,064,292	556

NORTH AMERICA

1.8	VE3MFT('81)	84,906	89
3.5	ZF2EO('81)	668,736	243
7.0	W4BRB/C6A('76)	911,302	213
14	KZ5FR('78)	2,039,456	391
21	KP4O('81)	3,653,796	582
28	FGØDYM/FS7('80)	3,304,752	484
AB	NP4A('81)	5,489,042	598

OCEANIA

1.8	No Entrant		
3.5	KH6XX('78)	305,080	115
7.0	KH6JSG/KH2('80)	277,398	99
14	VR3AH('79)	3,526,153	437
21	VK4QK('80)	2,592,216	396
28	KH6XX('79)	4,020,646	343
AB	N6HR/KX6('81)	3,394,440	420

SOUTH AMERICA

1.8	No Entrant		
3.5	4M3AZC('80)	852,548	262
7.0	4M3AZC('81)	1,371,214	299
14	YY2AMM('79)	2,751,776	452
21	HC9A('81)	6,025,770	615
28	ZZ5EG('81)	4,868,780	581
AB	PJ2CC('80)	6,521,098	538

Multi-Op Multi-Xmtr.

AF	9E3USA('69)	2,398,192	296
AS	UK9AAN('78)	10,702,776	532
EU	YTØR('81)	14,378,996	778
NA	CK7WJ('79)	16,545,370	590
O	KH6XX('81)	19,345,473	669
SA	ZZ5CA('80)	12,545,616	664

THE
A.R.O.
UNITY RING

a monthly feature by
A. EDWARD HOPPER, W2GT

Awards

NEWS OF CERTIFICATE AND AWARD COLLECTING

The "Story of The Month" for March as told by Doug is:

Douglas S. Hall, WA4UNS
All Counties #276, 4-11-80

"I guess what would be of some interest is how I got into County Hunting. In 1970, the United States Navy decided I should go to Adak, Alaska, for a year. I tended to agree with them and looked forward to frolicking through the tundra.

"While I was there, I upgraded my license from Technician to General, since there was not a great deal of six meter activity in the Aleutian Islands. I also asked the FCC for an Alaskan call sign and they obliged with KL7HDF.

Life was rough for a new General class license. The only station I had available to me was KL7AIZ, the club station at the Communications Station. It didn't have much in the way of equipment. All that was available was a Collins S-Line transmitter (32S3) and receiver (75S3B), a Henry 2K-3 linear, and a full rhomic antenna pointing towards San Diego.

It was difficult, but I managed to survive the many pileups that resulted from my CQs. During one of my more exciting days, I took a break from running phone patches back stateside and ran across Doc, KR6IX (W5ROP), now a silent key, then on Okinawa. He had just received USA-CA-#30 (All Counties) and was, needless to say, extremely happy. I said to myself, 'USA-CA'?? 'What is he talking about?' He then explained it was for working all the counties in the United States. Here I sat just trying to get WAS from Alaska. All I could think was this guy was crazy! But we still had a very nice, long QSO. Doc turned out to be a very interesting gentleman, and I always enjoyed our subsequent QSOs.

"When I returned to the 'lower 48,' I left my poor equipment situation behind and returned to my well-equipped shack, consisting of a DX-60B, HQ110, AC-VHF, and myriad of twisted wire antennas operating from the bedroom of a ground floor apartment in Virginia Beach. About a year later I finally purchased an HW101 just to see what was happening on sideband.

" I ran across the old CHC-FHC Net on 3934 kHz and Bertha, WA4BMC. Bertha took me off frequency where we had a very nice QSO. She mentioned something about a MARAC, to send her 26¢ and she would tell me all about it. I started checking into 3934, and Bertha sent me the MARAC information package. So there I sat in front of my HW101 listening to these 'fools' working counties while I worked an occasional new state for WAS.

"Then the fateful day arrived. I said, 'What the heck! I might as well do it too.' From that day on I was doomed to 'looking for 3075.' That was in April 1972. What these two people, Doc and Bertha, did for me was to provide many good times and a great deal of hair-graying frustration. Eight years later I received USA-CA#276 (All Counties). The only regret I have is that I didn't listen closer to Doc and start earlier.

"During all this time I was discharged from the service and went back to college for a year and a half. Currently I'm working for the Public Broadcasting Service as a satellite tech/engineer. Have been at this phase of PBS for 2½ years, having been with PBS for 5½ years.

"My professional broadcasting career began in 1973 when I worked as a part-time DJ for WSLC/WSLQ Radio in Roanoke Valley. I then was part of the team that built WQBX (AM) in Blacksburg, VA. Later, I was Assistant Chief Engineer/Air personality for this station. The following year (1975) I went to work for WSLS-TV in Roanoke as a studio engineer/jack-of-all-trades for a year and a half before returning to my native Washington, DC area.

"Amateur radio-wise, I've been licensed since July 1964 when I got my Technician license. Upgraded to General in 1970 and Advanced in 1972, both while in the service. I've held two calls in addition to WA4UNS, WA3NBK, and KL7HDF. Activities in the shack include traffic handling, rag chewing, certificate hunting, RTTY, microcomputer construction and applications, and MARS operation.

"I devote most of my spare time to the art of fire and rescue science by being a member of Franconia Volunteer Fire Department. I've been Rescue Captain for several years. I've been a certified Emergency Medical Technician for 5 years and recently upgraded that training to Cardiac Care Technician, which is almost Paramedic in Fairfax County and the Commonwealth of Virginia. In addition to this, I teach Advanced First Aid and Emergency Care and Cardiopulmonary Resuscitation for the American Red Cross.

"Other leisure activities include bridge, square dancing (which I've been doing for 20 years), bowling, model railroading, first-day-cover and plate-block stamp collecting, and 5-string bluegrass banjo picking.

"In 1976, I married Susan Wheeler from Colts Neck, N.J. Fortunately, or unfortunately (it's all in how you look at it) we have no children.

"One thing I will say about the County Hunting experience: I have made more lasting friendships than I ever thought I could, and have been fortunate enough to see much of our beautiful country as a result of mobile operation. To someone not in County Hunting, I say, 'Try it, you'll like it.' As to whether I will do it again, well . . ."

"Hoppy" Hopkins, WB5UJO, All Counties, #348 11-24-81.

Awards Issued

Les Laabs, N9ATA, added USA-CA-3000 and All Counties endorsed Mixed to his fine collection.

Jim Miller, N8BNI, waited until he had them All and picked up USA-CA-500 through All Counties endorsed All S.S.B.

Ray Stone, W5RBO, also waited until he had them All and requested USA-CA-500 through All Counties endorsed Mixed.

Ken Wosika, KB7QO, acquired USA-CA-500 through USA-CA-2000 endorsed All 14, All Phone, All Mobiles.

Tom Sundstrom, W2XQ, obtained USA-CA-1000, 1500, and 2000 endorsed Mixed.

John Kray, KA2CNG, applied for USA-CA-1500 endorsed Mixed.

Ray Glasscock II, KCØJG (ex-KØOQI), claimed USA-CA-500, 1000, and 1500 endorsed Mixed. (His father is KØDJC, All Counties #261.)

P.O. Box 73, Rochelle Park, NJ 07662

Special Honor Roll
All Counties

#352 Lester Laabs, N9ATA 11-30-81.
#353 James A. Miller, N8BNI 12-2-81.
#354 Ray Stone, W5RBO 12-5-81

John Minke III, N6JM (ex-W6KYA, AC6KYA, KY6ITU, WA6JDJ, K2IKS), qualified for USA-CA-1000 endorsed Mixed.

Jerry Goff, WA4LWL, gained USA-CA-500 and 1000 endorsed All S.S.B., All Mobiles, All 14.

Herb Werry, DJ3OE, claimed USA-CA-1000 endorsed All 2XCW.

USA-CA-500 Certificates went to:

Norman Kremen, K9VIQ, endorsed All S.S.B.

Emery Flinn, Jr., N4DX, endorsed Mixed.

Chris Konkle, N9AHL, endorsed All CW.

Cliff Ahrens, KIØW (ex-KAØEZR, NØBQN), endorsed Mixed.

Shoji Igawa, JA7HMZ, endorsed Mixed.

Raj Singh, 3D2ER, endorsed Mixed, #1 to Fiji. (His QSL manager is W5RBO.)

Awards

A1-OP Certificate of Merit: In my November column, data on this certificate which listed a cost of $3.50 was in error. There is no cost for this award, I'm now informed. It is issued without request by sponsors and by request of three licensed amateurs. For more details, send an s.a.s.e. to Scott R. Douglas, Jr., P.O. Box 46032, Los Angeles, California 90046. Also request data on the many other awards he issues.

Bougainvillea Festival Award: Issued by the Darwin Amateur Radio Club coinciding with the Darwin Bougainvillea Festival held in May each year. Requirements: Work ten (10) different amateur radio stations in the greater Darwin area during the period from 0000Z 1st of May to the 31st of May 2400Z in the *same* year. Contact with the club station, VK8DA, counts as two (2) stations. S.w.l.'s need to hear ten (10) different stations, and for them VK8DA and the beacon VK8VF each count double. Any band or mode is okay. Log data certified by two other amateurs and $1.00 or ten IRCs are required. Apply to: Awards Manager, Box 1418, Darwin, N.T. 5794 Australia. Thanks to VK8HA and VP2MM for this data.

USA-CA Honor Roll

3000	
N9ATA	379
N8BNI	380
W5RBO	381
2500	
N8BNI	440
W5RBO	441
2000	
KB7QO	496
N8BNI	497
W2XQ	498
W5RBO	499
1500	
KA2CNG	556
KB7QO	557
KCØJG	558
N8BNI	559
W2XQ	560
W5RBO	561
1000	
N6JM	680A
KB7QO	681A
WA4LWL	682A
KCØJG	683A
DJ3OE	684A
N8BNI	690
W2XQ	691
W5RBO	692
500	
K9VIQ	1667
N4DX	1668
KB7QO	1669
WA4LWL	1670
KCØJG	1671
N9AHL	1672
KIØW	1673
K8BNI	1674
JA7HMZ	1675
W5RBO	1676
3D2ER	1677

Worked 100 Nations Award, Series II: In an effort to encourage personal communications among people around the world via amateur radio, WORLDRADIO offers this Award to those confirming two-way amateur communications with *permanent* stations in 100 distinct countries having a *permanent, native* population. As the rules/explanations are rather lengthy, I suggest you send an s.a.s.e. to: W-100-N Awards Manager, WORLDRADIO, 2120-28th Street, Sacramento, California 95818. The rules also list the Nations acceptable.

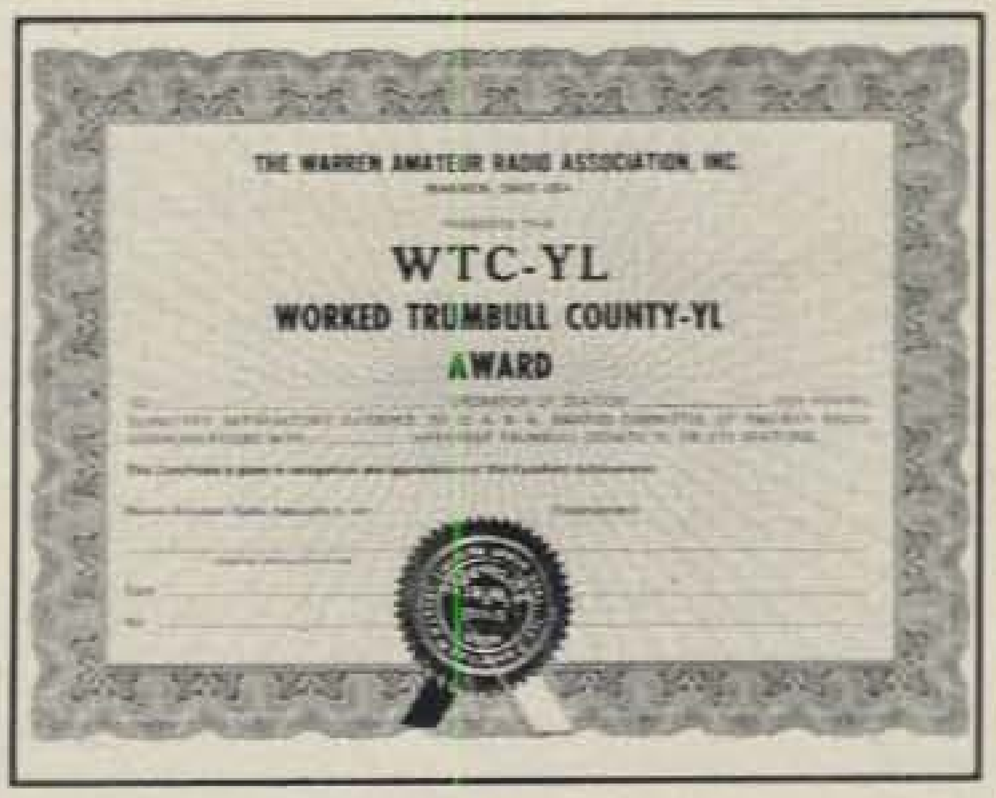
Worked Trumbull County Awards: The Warren (Ohio) Amateur Association, Inc., announces its Worked Trumbull County (WTC), Worked Trumbull County Mobiles (WTC-M), and Worked Trumbull County YL (WTC-YL) Awards.

Application: Send applications and all correspondence to Don Lovett, K8BXT, Awards Chairman, W.A.R.A., P.O. Box 809, Warren, Ohio 44482, USA. One dollar must accompany applications from U.S.A. and Canadian amateurs; all others shall send 3 IRCs with application. Trumbull County applicants, only, must submit QSL cards. All others shall have certification letters from two other amateurs who signify they have seen and checked the applicant's QSLs. Each application must also be accompanied by a list of the calls worked with full log data for each contact.

Requirements:

WTC—For each certificate or endorsement, Trumbull County applicants must have 20 contacts with other Trumbull County amateurs. USA and Canadian stations must contact 10 Trumbull County amateurs, while DX applicants must have 5 contacts.

Worked Trumbull County Mobile Award.



Worked Trumbull County YL Award.

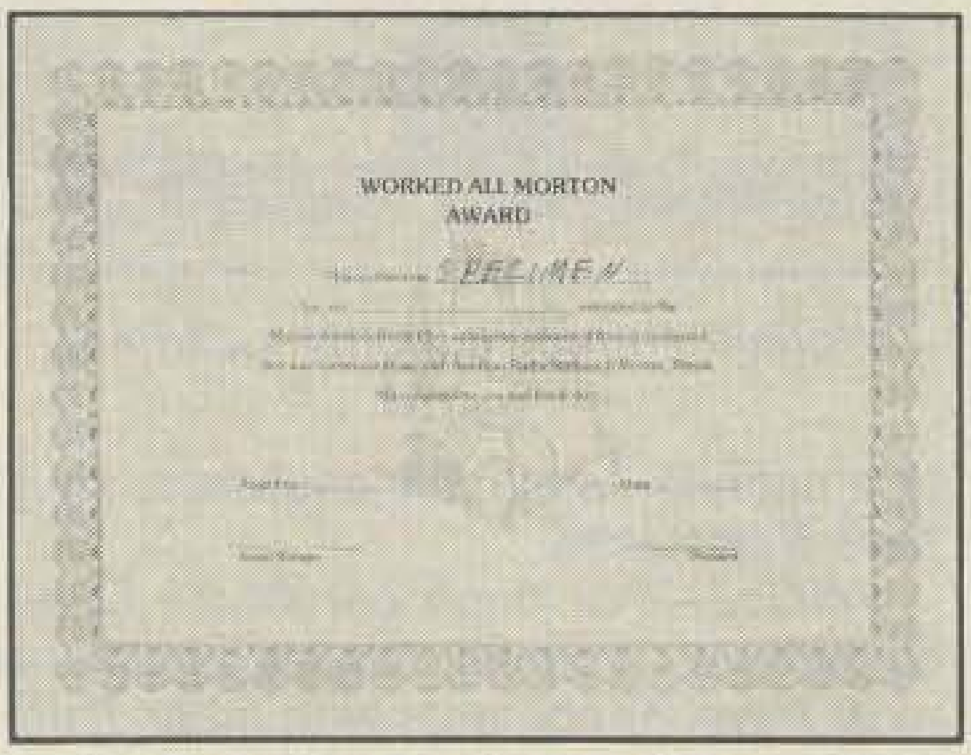
WTC-M—For each certificate or endorsement, Trumbull County applicants must have 20 contacts with other Trumbull County amateurs operating Mobile in Trumbull County. Other USA and Canadian stations must contact 10, and DX applicants must have 5 contacts.

WTC-YL—For each certificate or endorsement, USA and Canadian stations must contact 10 Trumbull County YL or XYL amateurs, while DX applicants need 3 contacts.

Award—A certificate will be issued on each approved application, but in order to appear on the certificate, special endorsements must be filed with the initial application, and each must contain at least 25 percent new contacts. Initial endorsements are free of charge, but endorsements on later dates will take the form of WTC certificates, and applications for these must contain proper filing fees.

Endorsements may be all one mode or all one band or all mobile to mobile or all members of the Warren Amateur Radio Association, Inc.

Net contacts, contacts made through repeaters, and contacts made before 1 January 1959 cannot be counted.



Worked All Morton Award.

Worked All Morton Award: Issued for having QSOs with five (or more) members of the Morton Amateur Radio Club or hams living in Morton, Illinois. Only contacts made January 1, 1981, and after, will count for this award. Send log information, along with a large s.a.s.e. to: Morton Amateur Radio Club, 701 Columbus Avenue, Morton, Illinois 61550.

Australian Ladies Amateur Radio Association Award (A.L.A.R.A.): Here are the new rules effective 1 January 1982. The Award is available to all—YL, OM, SWL.

Rules: VK/ZL contact 10 members and include 5 Australian States; DX contact 5 members and include 4 Australian States. All contacts must be made on or after 30 June 1975. No two-meter repeater contacts allowed.

Applicants must submit a *complete* extract of log entries, which must be certified by two other amateurs. If this is not possible, QSL cards must be submitted. All contacts must be made from the same call area. Official ALARA Net contacts do not qualify. Special endorsements are available. Endorsement stickers are available for each 10 additional members contacted; for DX applicants, 5 additional are needed.

Fee: Applications should be accompanied by the equivalent of 3 *Australian* dollars or 7 IRCs. Fee for additional stickers is 1 Australian dollar.

Apply to: A.L.A.R.A. Awards Custodian, Mavis Stafford, VK3KS, 16 Byron Street, Box Hill South, Vistoria, 3128, Australia.

Notes

The new officers of The Mobile Amateur Radio Awards Club, Inc. are: President, Robert S. Hanson, WØKMH, 9 Hillside Court, Northfield, Minnesota 55057; Vice-President, James A. Whittaker, WBØTVL, 3019 O'Henry Road, Brooklyn Center, Minnesota 55429; Secretary, Jon D. Fogfall, NØAGW, 7120-127 Street Court, Apple Valley, Minnesota 55124 (all dues and Secretary information should be sent to Jon; all money should be sent by check or money order made out to MARAC, Inc.); Treasurer, Wallace W. Karjalahti, KBØXB, 1745 Crystal Avenue, Saint Paul, Minnesota 55112; Editor MARAC Monthly Newsletter, Robert L. Dyson, 8943 South Overhill, De Soto, Kansas 66018; Awards Chairman, Tom Storm, KBØKS, 1157 N. Oliver, Elkhart, Kansas 67208.

73, Ed, W2GT

The Southeastern Mini-Convention, which ICHN and MARAC held November 6 and 7, 1981, at the Holiday Inn, Machester, Tennessee with Director Gene Tyree, N4ANV and Bill Bell, KM4W as chairman, was a complete success! Some 51 were in attendance. Here are some photographs, courtesy of Bill, KM4W.

Awaiting N4ANV's camera are: first row—K4QFK, WA6GQY, XYL N4ANV, XYL N9ATA, W5FS. Second row—K4BZV, XYL W4UVP, WB1ENJ, N9ATA, KT4U, N9BLO. Third row—K4CCW, W4UVP, XYL KM4W, KM4W, W4OWY, XYL W4OWY. Fourth row—WB8SNO, N8BGF, XYL N8BGF, WA3ZMY, WBØTVL, N9CHU. Fifth row—N4EEL, N8BNI, XYL W4IZR, WB9TKS, W4IZR, W4ARH.

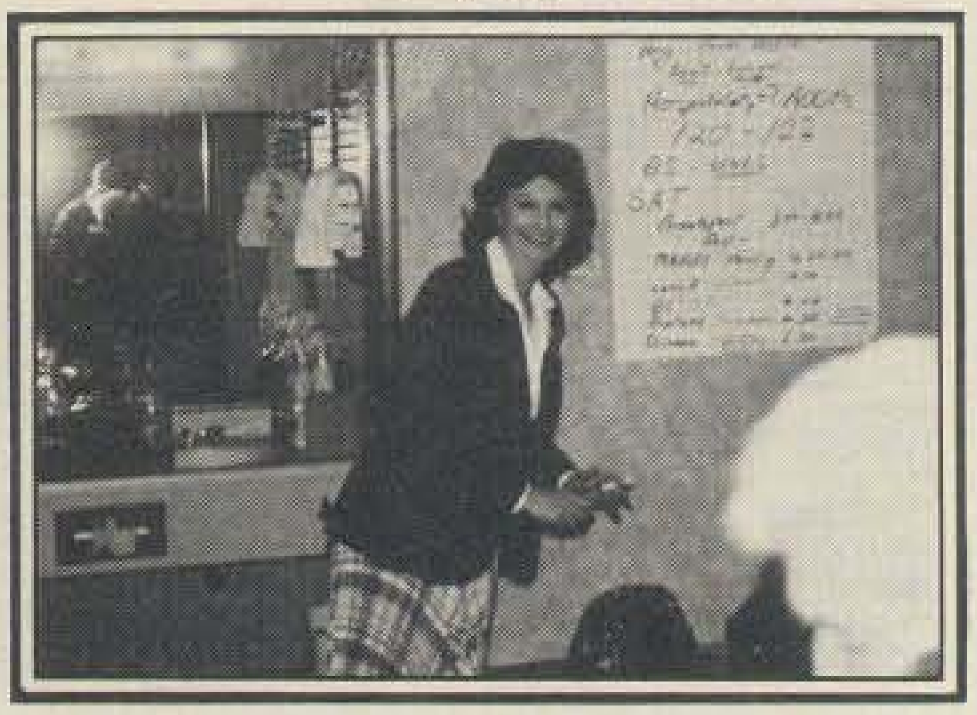
WB9TKS, WB9TKR, W9HQW.

W5FS, N8BGF, XYL N8BGF, XYL N8AIL, N8AIL.

W4UVP, XYL W4UVP, N9CLZ, K9CSL.

WBØGRN, XYL WBØGRN, XYL W4IZR, W4IZR.

KA8MRB, WB8SNO, WB9RCY, N9WA.



Jimmie, XYL KM4W in hospitality room.

Announcing

• **Special Events Station WØDD -** The Winston Churchill Memorial Special Events Station WØDD (Callaway Amateur Radio League) will operate from the Winston Churchill Memorial, Fulton, Missouri, on March 6 and 7 from 1500Z to 2200Z. S.a.s.e. for special QSL via P.O. Box 241, Fulton, MO 65251. The station commemorates the famous "Iron Curtain" speech of Sir Winston Churchill in 1946 and calls attention to the Winston Churchill Memorial located at Westminster College, Fulton, MO.

• **Ramapo Mountain ARC Spring VHF/UHF QSO Party -** This QSO Party will be held from 1800 hours (local) Saturday March 27 until 2400 hours (local) Sunday March 28. For a copy of the rules and log forms send an s.a.s.e. to Ramapo Mountain ARC, P.O. Box 364, Oakland, NJ 07436. Logs must be received no later than May 1. All who submit the required data will receive a copy of the newsletter with results. Certificates will be awarded to the highest scoring stations on each band as well as on a total basis in each ARRL section, division, and overall.

• **Special Events Station WA6BMH -** Operated by the Poinsettia ARC, this Special Events Station is in commemoration of the bicentennial of the San Buenaventura Mission. Operation will be from 2000Z March 27 to 2000Z March 28. Frequencies will be: CW—28.045, 28.145, 21.045, 21.145, 14.045, 7.045, 7.145; Phone—28.545, 21.365, 14.285, 7.245, 3.945. For a certificate, send a QSL and $1.00 to P.A.R.C., P.O. Box 716, Ventura, CA 93002.

• **Quietus Cassette Net -** This net's purpose is to record amateur radio anecdotes for posterity and archives. They are seeking unusual radio recollections. For more information, contact Arnold Timm at 612-874-9561 at 0300Z weekends, or send an s.a.s.e. to 2308 Garfield Ave. So. Apt. 304, Minneapolis, MN 55405.

• **Purple Heart Veterans Organization Being Formed -** The National Headquarters of the Order of the Purple Heart has appointed Clem Harris, KC5MM (ex-WB5VDL), to organize a national chapter of amateur radio operators. If you hold the Order of the Purple Heart from any war, contact Clem Harris, KC5MM, 6110 Pecan Trail Drive, San Antonio, TX 78249; phone 512-699-1420.

• **The following hamfests and fleamarkets are slated for the month of March:**

March 7, **Penn Wireless Assn. Tradefest '82,** Langhorne, PA. Contact Mark J. Pierson, KB3NE, P.O. Box 734, Langhorne, PA 19047.

March 13, **Midland ARC Annual Swapfest,** Midland, TX. Contact Midland ARC, Box 4401, Midland, TX 79704.

March 14, **Randolph ARA Third Annual Hamfest,** Winchester, IN. Contact R.A.R.A., P.O. Box 203, Winchester, IN 47394, or call W9VJX at 317-584-9361.

March 19-20, **Sixth Annual 3900 Club and Sooland Repeater Assoc. Hamboree,** South Sioux City, NE. Contact Dick Pitner, WØFZO, 2931 Pierce St., Sioux City, IA 51104.

March 21, **Toledo Mobile Radio Assn. 27th Annual Auction and Hamfest,** Maumee, OH. Contact J. Honisko, KB8YD, 1733 Parkway Drive N., Maumee, OH 43537.

March 27-28, **Columbus ARC Hamfest,** Columbus, GA. Contact Columbus ARC, Box 6336, Columbus, GA 31904.

March 27-28, **A.R.C.H. '82,** St. Louis, MO. Contact Gateway ARA, P.O. Box 8432, St. Louis, MO 63132, telephone 314-361-4965.

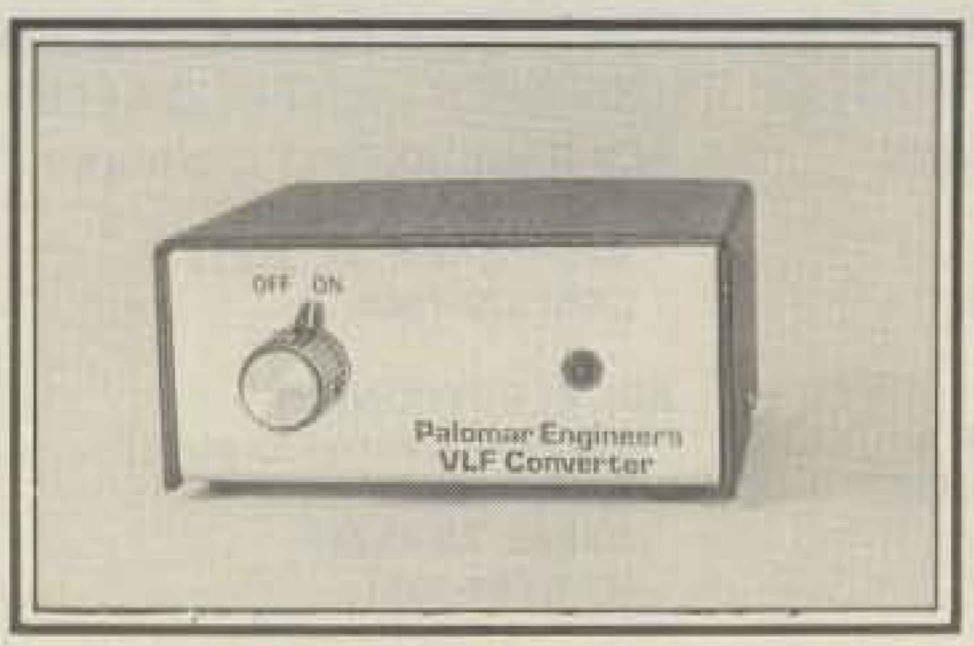
March 28, **Conemaugh Valley ARC Fifth Annual Hamfest,** Seward, PA. Contact Conemaugh Valley ARC, 2829 Bedford St., Johnstown, PA 15904.

March 28, **Delaware Valley Radio Assoc. Annual Fleamarket,** Lawrence Township, New Jersey. Contact D.V.R.A., P.O. Box 7024, West Trenton, NJ 08628.

March 28, **LAMARS Annual Hamfest,** Grayslake, IL. Contact WA9HRN, LAMARS, P.O. Box 751, Libertyville, IL 60048.

March 28, **Fourth Annual Lake County Hamfest,** Madison, OH. Contact Lake County Hamfest Committee, 1326 East 349th St., Eastlake, OH 44094, telephone 216-953-9784.

CQ SHOWCASE



Palomar Engineers VLF Converters

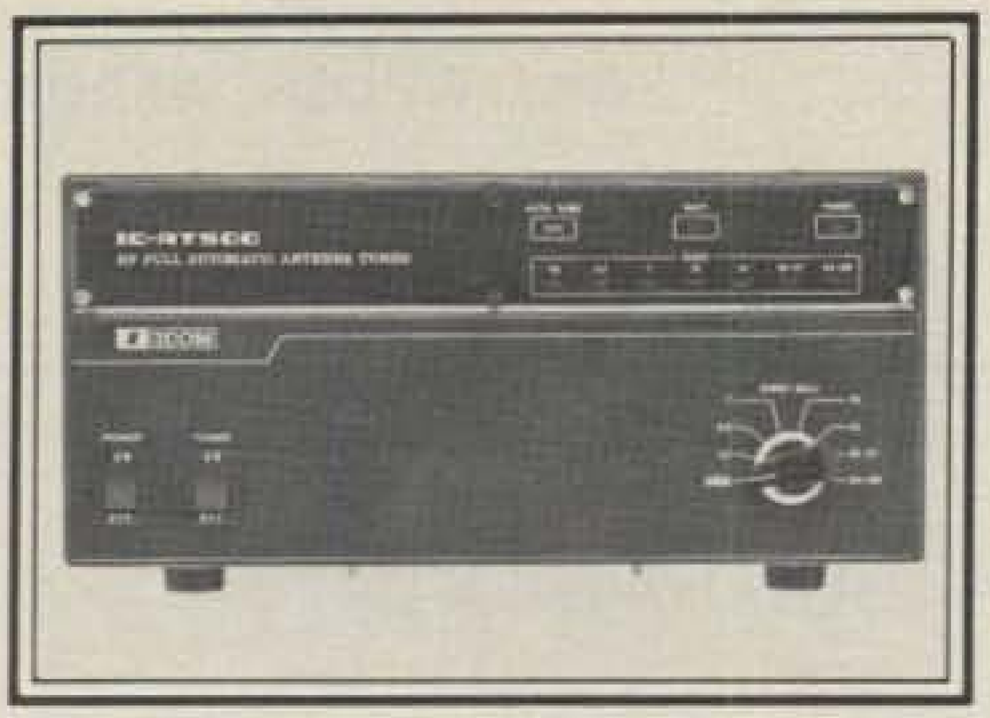
Two converters for the 10–500 kHz band add to the shortwave receivers' reception of weather, ship-to-shore c.w. traffic, RTTY, WWVB, navigation beacons, 1750 meter no-license band, and European low-frequency broadcast stations. The Model VLF-A converts to 3510–4000 kHz for use with ham-band-only receivers and transceivers. The Model VLF-S converts to 4010–4500 kHz for general-coverage shortwave receivers; with digital readout, the last three digits read frequency directly.

The converters feature antenna bypass when turned off, LED power indicator, low-current 9 volt d.c. operation, and are housed in brushed aluminum and black vinyl cabinets. They sell for $79.95. For more information, contact Palomar Engineers, 1924-F W. Mission Rd., Escondido, CA 92025, or circle number 103 on the reader service card.

Trio-Kenwood TS-660 Quad Bander

The TS-660 "Quad Bander" is an all-mode transceiver designed for operation on 6, 10, 12, and 15 meters. The unit features built-in dual v.f.o.'s, a five-channel memory, memory scan, f.m., s.s.b., c.w., and a.m. operation, fluorescent digital frequency display, squelch, up/down pushbutton bandswitch, i.f. shift, c.w. semi break-in with side tone, "S" meter, RIT control, and noise blanker. The r.f. output power is 10 watts on s.s.b., c.w., and f.m., and 4 watts on a.m.

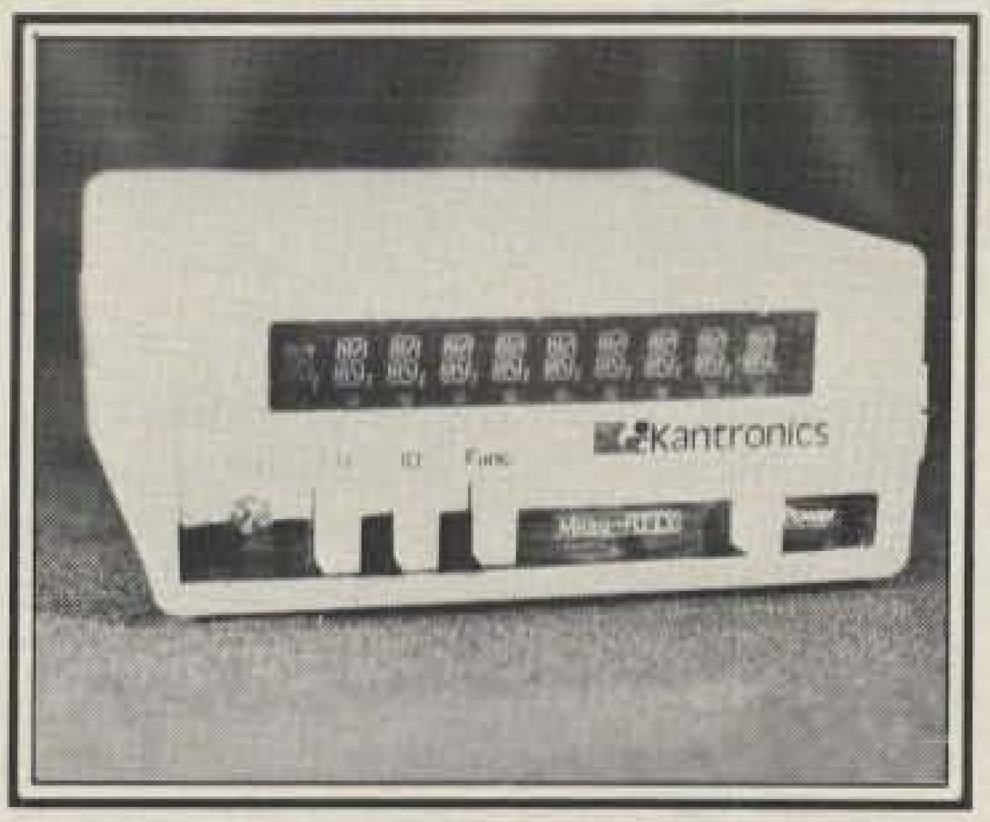
The unit operates on 13.8 v.d.c., drawing one ampere in receive, 4 amperes in transmit. For more information, contact Trio-Kenwood Communications, P.O. Box 7065, Compton, CA 90224, or circle number 101 on the reader service card.



ICOM IC-AT500/AT100 Automatic Antenna Tuner

This new compact 6.4 kg antenna tuner provides quick tune up, usually taking less than 3 seconds, via a detector circuit; auto band switching; pre-set capability; four antenna connectors; matching styling to the ICOM base stations; and two-way power source (can be used with d.c. 13.8 volts or a.c. 117 volts or 230 volts).

The IC-AT500 handles 500 watts, and the IC-AT100 handles 100 watts. The IC-AT500 is priced at $449, while the IC-AT100 is priced at $349. For more information, contact ICOM America, Inc., 2112 116th Ave. N.E., Bellevue, WA 98004, or circle number 102 on the reader service card.



Kantronics Micro-RTTY

The Micro-RTTY converts c.w. from any keyer or keyboard into standard AFSK two-tone RTTY or two-tone c.w. ID. Micro-RTTY sends and receives RTTY at 60, 67, 75, and 100 w.p.m., plus ASCII 110 baud. Special c.w. characters allow for entering Morse ID mode or sending a carriage-return/line-feed character without ever touching the unit. A printer attachment is also provided via a back panel connection. The unit receives any shift of RTTY and displays the message on a 10-character, ⅜" high, vacuum-tube fluorescent display. The package is small, 2½" × 5" × 5½", and the 9 vdc power supply is included. The suggested retail price is $299.95.

For more information, contact Kantronics, 1202 E. 23rd Street, Lawrence, KS 66044, or circle number 105 on the reader service card.

Hy-Gain TH7DX Tribander

The TH7DX is a broadband tribander based on the front-to-back characteristics of the TH6DXX, plus the v.s.w.r. characteristics of a dual driven element system, maintaining a v.s.w.r. of less than 2:1 on all bands. Average front-to-back ratios are 22 dB on 20 and 15 meters, and 17 dB on 10 meters. The average half-power beam width varies from 66 degrees on 20 meters to 63 degrees on 10 meters.

The TH7DX has a turning radius of 20 feet and the longest element is 31 feet. It weighs 75 pounds. Wind loading is 240 pounds at 80 mph. The cost of the TH7DX is $499.95. For more information, contact Hy-Gain, Div. Telex Communications, Inc., 9600 Aldrich Ave. So., Minneapolis, MN 55420, or circle number 107 on the reader service card.

Henry Radio Tempo M1 Marine Portable

The Tempo M1 is a marine v.h.f. portable that operates on every marine channel, both U.S. and international, with all the necessary offsets built it. It also includes all weather channels and a channel 16 override function. Channel selection is made by a thumbwheel switch on the top panel. Other features include a rechargeable ni-cad battery pack, rubber flex antenna, and full marine-band all-channel programming. Standby current is below 25 ma, and the unit includes a high-power 2½ watt position and a low-power 1 watt position.

Accessories to become available include a drop-in charger, a d.c. charger and 25 watt amplifier, leather holster, speaker microphone, and higher capacity batteries. For more information, contact Henry Radio Marine Division, 2050 S. Bundy Drive, Los Angeles, CA 90025, or circle number 106 on the reader service card.

a monthly feature by
BILL WELSH, W6DDB

Novice

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Operating Tidbits

The December 1980 Novice column provides information about telegraph codes based on the alphabets of several languages, including the International Morse Code which is based on the English language alphabet. The October and November 1980 Novice columns list worldwide transmissions that can be used to increase one's code receiving proficiency. The June 1981 Novice column includes information about transmissions of Navy code practice, Ron Martin, W6ZF, West Coast Bulletins, and Army MARS messages that can also be used for code receiving practice. If you want to obtain these prior issues, or reprints, they can usually be purchased from *CQ*, 76 North Broadway, Hicksville, New York 11801 at two dollars each.

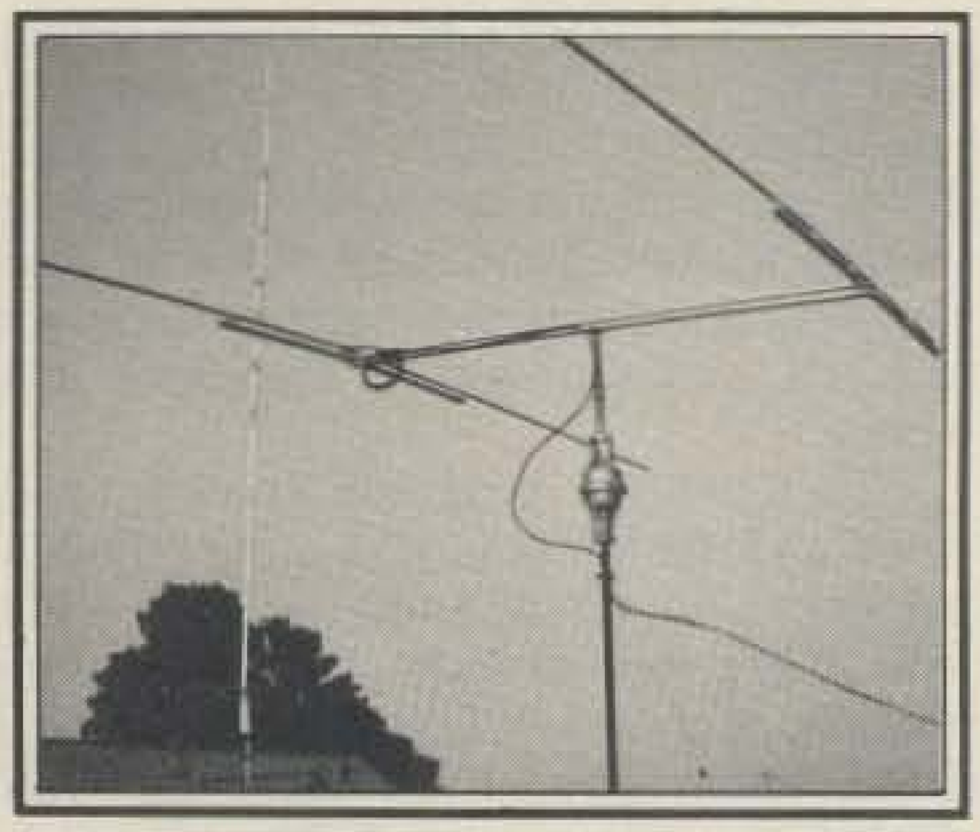
An additional good source of code receiving practice is the U.S. Air Force weekly information bulletin transmitted to U.S.A.F. Military Affiliate Radio System (MARS) members. Two stations transmit the same information about 105 minutes apart. Each station transmits simultaneously on two frequencies.

AFA5NO is located in Ogden, Utah. This station uses manual keying at 10 w.p.m. during this transmission. Tune-in is aided by a series of V's transmitted from 0240 to 0245 UTC Thursdays (Wednesdays, U.S.A. time). The bulletin is sent on 5741.5 and 11,100 kHz starting precisely at 0245 UTC.

AIR is the U.S.A.F. headquarters station in Washington, D.C. and it uses automatic keying at 15 w.p.m. during this transmission. The bulletin transmission starts at 0100 UTC Thursday (Wednesday, U.S.A. time) on 6995.5 and 13,997.5 kHz.

UTC (Universal Time Coordinated) is 4, 5, 6, and 7 hours ahead of EDST, CDST, MDST, and PDST, respectively. UTC is 5, 6, 7, and 8 hours ahead of EST, CST, MST, and PST, respectively. UTC is still commonly known as GMT (Greenwich Mean Time), GCT (Greenwich Civil Time), Zebra time, or Zulu (Z) time. UTC is the correct current term.

2814 Empire Ave., Burbank, CA 91504



Bill Chouinard, KA1ECI, recently enclosed his pictures with his subscription order. Bill has been licensed about 20 months, and his Novice accomplishments so far are 49 states confirmed (he still needs Hawaii), 30 countries, and 15 zones. He normally runs a 520 into an 18AVT, but this summer he added a 2 element 15 meter beam which he says comes from Lew McCoy, W1ICP's article in CQ *this past August and W1FB's article in the August issue of* QST. *On the left Bill is shown at the operating position and on the right is a shot of his hybrid 2 element 15 meter beam.*

Disaster Communications

Most of the current Civil Defense communications handled on amateur radio frequencies is governed by FCC Part 99 (Disaster Communications Service), which specifies that all operations must be performed by FCC licensed commercial and/or amateur radio operators. Existing systems are being allowed to continue in operation, but no new applications are being accepted under Part 99.

The FCC has established a new system that is obviously intended to initially supplement existing emergency communications (Part 99) systems, and to eventually supersede them. This system is called **SECURE**, which is an acronym representing **S**tate **E**mergency **C**apability **U**sing **R**adio **E**ffectively. SECURE rules and regulations are being added to FCC Part 90 (Local Government Radio Service).

The FCC assigns frequencies in the 2 to 10 MHz spectrum and reserves the right to withdraw them to meet future international requirements. If assigned frequencies are withdrawn, the FCC will assign alternate frequencies.

SECURE transmissions are limited to s.s.b. (A3J) and radioteletype (RTTY) (A2/F2/AFSK) emissions. Equipment must be capable of being instantly switched between any frequencies in the 2 to 10 MHz range. Transmitter power output is limited to 1000 watts PEP, and s.s.b. bandwidth is limited to 2.8 kHz in multiband SECURE equipment. Unlike Part 99, SECURE communications do not have to be performed by FCC licensed commercial and/or amateur radio operators.

SECURE frequencies will be assigned to states to enable them to communicate between emergency command centers and disaster sites in real emergencies. As is common to all such operations, the FCC suggests limiting related training and testing on-the-air activities to no more than one hour per week. SECURE frequencies may not be used to handle routine traffic, and each state's SECURE application must specify how minimum usage is to be accomplished, plus their disaster communications plan.

DX Items Bring Responses

The January 1981 *CQ* Novice column included several items about Novice band DX opportunities. Several readers sent letters expressing interest in having more of this type of information printed in future Novice columns. If you know specific details regarding future DX (foreign) operations in Novice bands, please send such information to me. Naturally, it is preferred that the DX operator directly provide this type of data.

Fred Matos, W3ICM, advised that he did some 10 and 15 meter Novice band operating from 4U1ITU while attending an international telecommunications conference at Geneva, Switzerland, during November and December of 1980. 4U1ITU is the callsign of the International Telecommunications Union Amateur Radio Club, and it has separate country status towards the ARRL DXCC award. Fred ran into the same problems that we have all experienced when operating in the Novice bands from a DX location. Novices usually answer stronger American stations instead of the weaker DX ones. The 4U1ITU callsign confused several Novices and they simply went off the air instead of working Fred. Other Novices refused to accept the 4U1ITU callsign and kept trying to change it into some more familiar one. Contacted Novices insisted upon sending complete information about their equipment, antenna, weather, need for a QSL, and address. These unnecessarily long contacts made it impossible for Fred to provide a new country contact for many Novices. However, he was thrilled to operate 4U1ITU and he is happy that he contacted many Novices.

Amateur Radio Operator Examinations

The FCC Field Operations Bureau Report 81-01 (April 1981) of the Radio Operator and Public Service Branch is entitled *Statistical Report on the Amateur Radio Examination Program.* This report shows an approximate drop of 7500 in the amateur radio operator examinations conducted by the FCC during the last two years. Fiscal year totals are as follows:

FY-78/79	66,208	
FY-79/80	58,753	(down 7,455)
FY-80/81	50,913	(down 7,840)

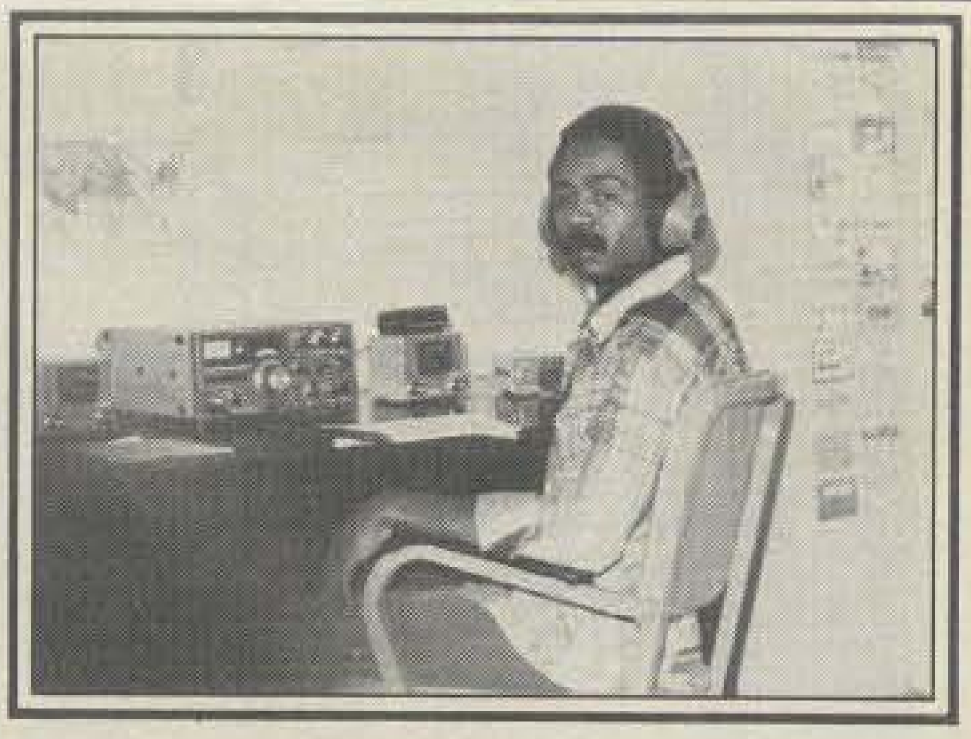
FCC fiscal years start 1 October and end 30 September. The preceding figures do not include Novice (Elements 1A and 2) examinations conducted by volunteer examiners.

Written examinations outnumber code examinations almost two to one each year. This is easy to understand since many applicants already have the required code credit and simply have to pass the written examination to upgrade. If one holds a valid Novice license and is applying for the Technician license, the Element 1(A) 5 words per minute code requirement applies to both of these licenses and the applicant just has to pass the Element 3 Technician/General written examination to upgrade. Similarly, if one holds a General license and is applying for an Advanced license, the Element 1(B) 13 w.p.m. code requirement applies to both of these licenses and the applicant just has to pass the Element 4(A) Advanced written test to upgrade. Another major factor contributing to the high percentage of no-code examinations is that if an applicant passes a required code test, but fails the associated written examination, that code credit is good for one year, permitting an applicant to take as many written tests as are likely to be required without having to pass the code element each time. There is a 30 day minimum interval between attempts to pass the same upgrading element.

The passing rate for each element is as follows:

Code Element	Description	Passing %
1(A)	5 w.p.m.	61
1(B)	13 w.p.m.	47
1(C)	20 w.p.m.	42
Written Element		
⅔	Novice, plus Technician/General	85
3	Technician/General	70
4(A)	Advanced	44
4(B)	Extra	76

It is surprising that many code test papers are turned in blank. If one is going to make a trip to an FCC office to take a test, it seems reasonable that one should be prepared to give it an honest effort. I advise my students to get a good night's rest, leave early to get to the FCC office, take at least two good writing instruments, and just do their best. Passing an amateur radio operator examination is not a life or death situation.



Fletcher J. Long, KA4PQY, a 33-year-old meter tester who works for the Alabama Power Company, is also a registered journeyman electrician in Tuscaloosa. Between testing meters days and doing electrical work evenings and weekends, Fletcher is very busy. He has been licensed about one year and has contacted almost all states plus 7 countries. His station includes a Kenwood TS-520-SE Transceiver, a ground-mounted Hy-Gain all-band vertical antenna, and a customized operating desk featuring excellent electrical connections. Fletcher was interested in amateur radio for several years, but he did not get started in it until after he married and settled down. He used a recording to learn the code, and he operated a friend's station until he installed his own. Fletcher is a member of the Tuscaloosa and the University of Alabama Amateur Radio Clubs. He has probably upgraded to General by now.

Mercury Batteries Danger

The *British Medical Journal* recently carried an article to advise people to keep button-size mercury batteries away from children and pets. Each battery contains almost twice as much mercury oxide as is fatal to a child. Stomach acids can deteriorate the battery case in a few hours. If one of these camera, calculator, wristwatch batteries is swallowed, immediate surgery is required to remove it.

Rag Chewers' Club

The first award you can qualify for is most likely the Rag Chewers' Club Award. All you have to do to earn this nice 8.5 by 11 inch certificate is to have at least a 30 minute two-way contact with any other amateur. You simply send the contact details to the American Radio Relay League, RCC Administrator, 225 Main Street, Newington, Connecticut 06111. Include the date, start time, and end time of the qualifying contact, plus the callsign of the station you worked. Also, furnish your own name, callsign, and complete mailing address, including your postal zip code. If you supply a self-addressed and stamped envelope, you will receive your RCC faster. If a standard number-ten business envelope (about 4 by 9.5 inches) is supplied, your RCC certificate will be folded. If a large envelope (at least 9 by 11.5 inches) accompanies your application, your certificate can be mailed to you without being folded. However, the postage on an oversize envelope is about double. The League will send your RCC certificate whether or not you supply an s.a.s.e.

One does not have to be an ARRL member to apply for this certificate, and no fee is associated with this award. Do not send QSL cards as proof of contact; a letter or note suffices.

ARRL Divisions

One of the questions that appears in received letters is about sections and divisions of the American Radio Relay League. This information appears in each issue of *QST*, a magazine sent to ARRL members. In addition, the ARRL booklet *How to Operate an Amateur Radio Station* shows these boundaries. In most cases, the section name (often an entire state) provides clear identification of an amateur's section. If you live in a central area of a state with more than one section, simply ask an active local amateur to tell you the applicable section. If you do not know a nearby amateur, send your question to ARRL, 225 Main Street, Newington, Connecticut 06111.

Photographs Wanted

Black-and-white photographs of Novices in their shacks are frequently includ-

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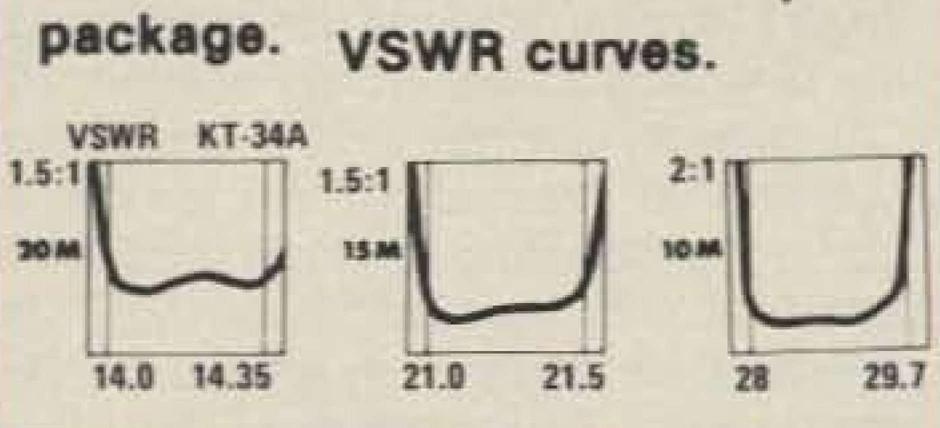
The new concept in triband antenna design. Gain and band width all in one compact package. VSWR curves.



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During February and March these rugged beauties are being offered at Big Discounts and — we are shipping them freight prepaid! Look over the specifications and pick the unit most suited for your needs, then — Call us to place your order with Master card/Visa or write and include your check for quick shipment — Freight Prepaid!

And — Save even more — include antenna and rotor of your choice with the order and we will ship them along freight prepaid also! Hows that for good old fashioned savings?

Tower Model	Tower Ht.	Load Rating	Ship Weight	Tower Base	Tower Price	Base Price	Total Price
HBX40	40 ft	10 sq ft	164	BX86	269	24	293
HBX48	48 ft	10 sq ft	303	BX87	349	26	375
HBX56	56 ft	10 sq ft	385	BX88	419	30	449
HDBX40	40 ft	18 sq ft	281	BX87	313	26	339
HDBX48	48 ft	18 sq ft	363	BX88	399	30	429

BUTTERNUT

HF6V	80-10 mtr. Vertical	$109
TBR160	160-mtr. Coil Kit	$ 33
RM KIT	Roof Mount w/Stub Tuned Radials	$ 33
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2MCV	2 mtr. Trombone Vertical	$ 29

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A3	3-El. Triband Beam	$169
A4	4-El. Triband Beam	$209
A743	40 mtr. Add-on Kit for A3 Antenna	$ 59
A744	40 mtr. Add-on Kit for A4 Antenna	$ 59
R3	New Motor Tuned 20/15/10 mtr. Vertical	$229
AV5	80-10 mtr. Trap Vertical	$ 89
20-3CD	3-El. 20 mtr. Beam	$169
20-4CD	4-El. 20 mtr. Beam	$239
15-3CD	3-El. 15 mtr. Beam	$ 89
15-4CD	4-El. 15 mtr. Beam	$ 99
10-3CD	3-El. 10 mtr. Beam	$ 69
10-4CD	4-El. 10 mtr. Beam	$ 89
A50-5	5-El. 6 mtr. Beam	$ 59
617-6B	6-El. 6 mtr. "Boomer"	$169
214B	14-El. 2 mtr. "Boomer"	$ 66
214FB	14-El. 2 mtr. FM "Boomer"	$ 66
228FB	28-El. 2 mtr. FM "Power Pack"	$189
32-19	19-El. 2 mtr. "Super Boomer"	$ 79
220B	17-El. 220 MHz "Boomer"	$ 69
ARX2B	2 mtr. "Ringo Ranger II"	$ 36
ARX450B	450 Mhz "Ringo Ranger II"	$ 38
A147-20T	2 mtr. Vert. & Horiz. 10-El. Beam	$ 59
A144-10T	10-El. 2 mtr. Satellite Antenna	$ 45
A144-20T	20-El. 2 mtr. Satellite Antenna	$ 66
A432-20T	20-El. 432 MHz. Satellite Antenna	$ 45
A14T-MB	Dual Antenna Mounting Assembly	$ 24

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V2	New 2 mtr. Base Vertical	$ 36
TH5DX	5-El. Triband Beam	$209
TH6DXX	6-El. Triband Beam	$239
TH3MK3	3-El. Triband Beam	$179
TH3JR	3-El. Triband Beam	$139
TH2MK3	2-El. Triband Beam	$119
HY-QUAD	2-El. Triband Quad	$209
402BA	2-El. 40 mtr. Beam	$179
205BA	5-El. 20 mtr. "Long John"	$239
155BA	5-El. 15 mtr. "Long John"	$149
105BA	5-El. 10 mtr. "Long John"	$ 99
204BA	4-El. 20 mtr. Beam	$189
203BA	3-El. 20 mtr. Beam	$119
153BA	3-El. 15 mtr. Beam	$ 69
103BA	3-El. 10 mtr. Beam	$ 59
DB1015A	3-El. 10/15 mtr. Beam	$129
64B	4-El. 6 mtr. Beam	$ 49
66B	6-El. 6 mtr. "Long John"	$ 89
18HT	80-10 mtr. Hy-Tower Vertical	$279
18AVT/WB	80-10 mtr. Trap Vertical	$ 85
214	14-El. 2 mtr. Beam	$ 33
2BDQ	80/40 mtr. Trap Dipole	$ 49
5BDQ	80-10 mtr. Trap Dipole	$ 89
BN86	80-10 mtr. KW Balun	$ 14

HUSTLER

3TBA	New 3-El. Triband Beam	$169
4BTV	40-10 mtr. Vertical	$ 79
5BTV	80-10 mtr. Vertical	$ 99
G6-144B	2 mtr. Base Vertical	$ 69
G7-144	2 mtr. Base Vertical	$ 99

HF Mobile Resonators (STD 400 Watt)		Super 2 KW)
10 & 15 mtrs.	$10	$15
20 mtrs.	$12	$18
40 mtrs.	$15	$21
75 mtrs.	$17	$32

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KT34XA	6-El. Tribander	$479
7.2-1	2-El. 40 mtr. Beam	$299
7.2-2	2-El. 40 mtr. Beam	$299
7.2-3	3-El. 40 mtr. Beam	$449
7.0-7.3-4A	4-El. 40 mtr. Beam	$629
144-148-13LB	13-El. 2 mtr. Long Boomer	$ 79
432-16LB	16-El. 432 Mhz. Long Boomer	$ 69
144-150-16C	16-El. 2 mtr. Circular Pol. Beam	$ 99
420-450-18C	18-El. 435 MHz. Circular Pol. Beam	$ 59

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CDE Tailtwister (30 sq. ft. rating)	$239
HYGAIN HDR-300 (Most H.D. Rotor for BIG Arrays)	$399
KENPRO KR 500 (Heavy Duty Elevation Rotor)	$179
8 COND (2-#22GA./6-#18GA.) Rotor Cable	$0.19/ft.
H.D. 8 COND (2-#16GA./6-#18GA.) Rotor Cable	$0.36/ft.

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RG213/U (95% shield - non-contaminating jacket)	$0.29/ft.
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RG11/U (75 OHM - 95% shield)	$0.35/ft.
½" Aluminum Hardline w/poly jacket	$0.69/ft.
½" Copper Hardline w/poly jacket	$1.10/ft.
½" Alum. H.L. Conn (UHF or N - Male or Female)	$15.00
½" Copper H.L. Conn (UHF or N - Male or Female)	$22.00
Amphenol Silver Plate PL259	$ 1.25
Amphenol Nickel Plate PL259	$ 0.90
Amphenol N Type Male Conn For RG213/U	$ 2.95

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HG37SS	37 ft. Self Supporting	$589
HG52SS	52 ft. Self Supporting	$829
HG54HD	Heavy Duty 54 Ft. Self Supporting	$1379
HG70HD	Heavy Duty 70 Ft. Self Supporting	$2379
HG50MT2	50 ft. Side Supported	$689

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HBX32	32 ft. Free Standing (rated 10 sq. ft.)	$169
HDBX32	32 ft. Free Standing (rated 18 sq. ft.)	$189
HBX40	40 ft. Free Standing (rated 10 sq. ft.)	$229
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VISA

James L. Hensarling, WB5LUU, is a Novice retread who had given up on amateur radio in early 1978. Although he had been active enough to earn a Worked All States (WAS) award by May 1977, his job took so much time that he was forced to give up amateur radio and he sold his equipment. However, he renewed his license just in case he might later decide to again become active. A friend loaned a copy of the July 1980 CQ magazine to him, and it rekindled his interest to the point that he was back on the air within one month using a Kenwood TS-180S with a Hy-Gain 18AVT vertical antenna. He read the Novice Roundup article in the February 1981 CQ Novice column and it encouraged him to enter his first contest. He had 448 contacts, including amateurs in 61 ARRL sections, 3 foreign countries, and W6DDB. He particularly enjoyed working the General, Advanced, and Extra class licensees who livened up the contest. James has earned the 15 and 40 meter endorsements for his WAS award, the Worked All Continents (WAC) award for both 10 and 15 meters, USA-CA 500 (521 counties), and WPNX (163 prefixes). He has had 140 contacts with foreign (DX) amateurs in 29 countries. He has 27 and 48 states confirmed on 10 and 80 meters, respectively, and he plans to upgrade in license after he has obtained his 5-band WAS. James thanks CQ for the help he has received by reading this magazine.

ed in this column. The size of the submitted photograph is unimportant, but it must have reasonably good definition, contrast, and subject matter. Color pictures can be used, but black-and-white photographs are preferred. A brief summary of operating activities and achievements, plus a personal self-introduction, are needed with each picture. Photographs are not returned unless they are accompanied by a request for their return, plus a self-addressed and stamped envelope. A free one-year *CQ* renewal or new subscription (please state which) is awarded to the amateur who sends the picture I select as the winner for the month. One award is made each month, no matter how many photographs are printed.

73, Bill, W6DDB

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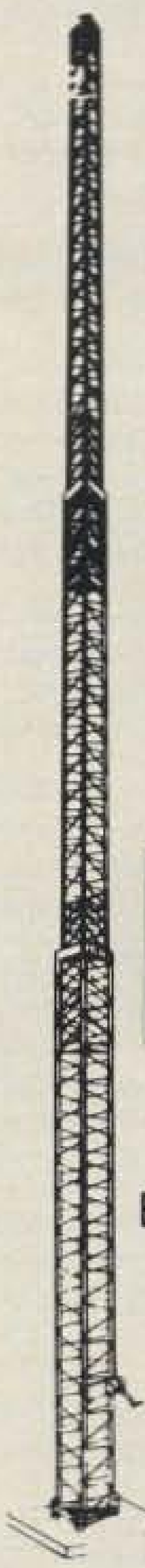

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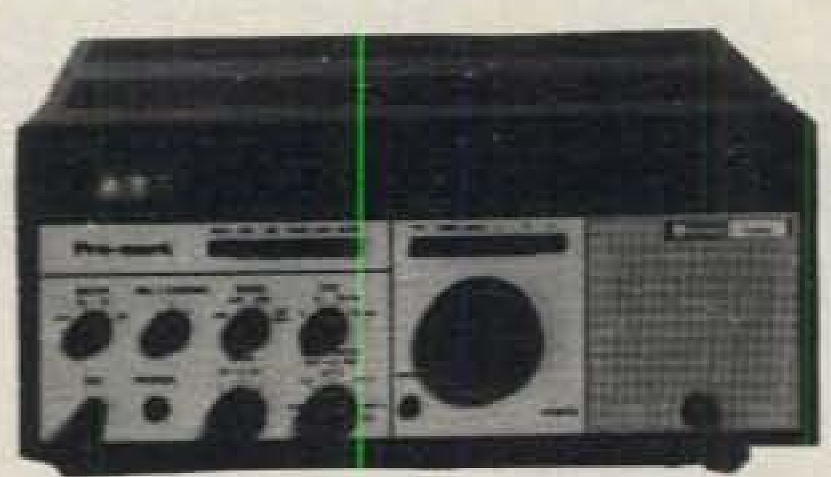

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FOR SALE: B.C.Scanner 250, Tempo I 10-80, 2 meter rig. Send S.A.S.E. to ARS, P.O. Box 518, Whitehouse, FL 32220.

SELL: Heath HX-1681, P/S-23, new $200.00. Joseph Schwartz, 43-34 Union Street, Flushing, NY 11355, (212) 461-5933.

NOVICE ALL-AMERICAN Certificate: Work a Novice in all 10 call areas. Send list and $1. K6ASI, 25 Rudnick, Novato, CA 94947.

WANTED: HW-7 and HW-8 transceivers for new Novices. Please state condition and price. W.C. Spenn, KD5AK, Box 33081, San Antonio, TX 78233-0081.

FOR SALE: YAESU FTV-250, like new and complete, $175.00. P. Lancaster, WA8KUR, 216-369-4021.

IC-211 multimode 2-meter transceiver for sale, with low-noise preamplifier, $400. Stan Horzepa, WA1LOU, 72 Stiles St., Waterbury, CT 06706.

WANTED: SWAN SW-240 Transceiver, even in poor condition. Contact H.E. Ray, WD4GUA, Route #1, Milner, GA 30257.

HEATH SB104A/CW FILT/NB with SB604 speaker/HP1144 supply $500; SB614 Monitor $125; SB644A VFO $75; TenTec Century 21 w/keyer $225. D. Sowers, K4SUE, 522 McGeorge Dr., Vinton, VA 24179.

FOR SALE: New and used radio and TV tubes; new carbon and W.W. resistors; xformers; pots. T. Wojciechowski, 101-45 94th St., Ozone Park, NY 11416.

WANTED: R644/URR 20–237 MHz Receiver as offered/shown by Fair Radio, Dec. 79 CQ, p.97. T.J. LeVell, Box 446, Lakehead, CA 96051.

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NEED HELP for your Novice or General Ticket? Recorded Audio-visual Theory Instruction. No electronic background required. Free information. Amateur License, P.O. Box 6015, Norfolk, Virginia 23508.

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FOR SALE: Alda 105 with mike and mobile mount. Also complete Hustler mobile ant 80–10 meters with mast. All in good shape. $400.00 prepaid. Bill Walker, R.R. #2 Box 219F, Crothersville, IN 47229.

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WANTED: Old microphones, pre 1940, for my mic museum. Also mic related items. Write Bob Paquette, 107 E. National Ave., Milwaukee, WI 53204.

WANTED: Hallicrafter S-1 through S-7, DD-1, 8 HPA, SX-10, SX-12, and other early Hallicrafter gear, parts, manuals, and accessories. Any condition. For my collection, please write, even if in doubt on Model No. Chuck Dachis, WD5EDG, 4500 Russell Dr., Austin, TX 78745.

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WANTED: Low Frequency Converter, Model 2-LF for Drake 2 B. Oslender, am Alten Forsthaus 48, 53 Bonn, West Germany.

FOR SALE: Drake R4C receiver with filter. Mint condition. WA2BLY, Phone 518-399-0755.

FOR SALE: Heath Model IM-28 VTVM. Perfect condition, with manuals and leads. $35.00. You ship. W9MCJ, 19600 Dubois Ave., South Bend, IN 46637.

CALL BOOKS: 1981 Foreign and US, each with 3 supplements, $8 per set. Include SASE to return your check in case sold. Art Johnson, K2POA, 656 Westminster Rd., Baldwin, NY 11510.

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BUILDERS: Electronic parts for sale, list s.a.s.e. W2EZM, 431 Oakland Ave., Maple Shade, NJ 08052.

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SELL: 1981 U.S. and Foreign callbooks with all supplements. Ken Wolfe, KA9EWB, Box 134, Buffalo, IN 47925.

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AZDEN 3000's owners: I can change mic up & down to M-scan & M-adrs. Send head only and $15. Harold, 1217 N.W., Jackson, MS 39202. Phone 948-3229.

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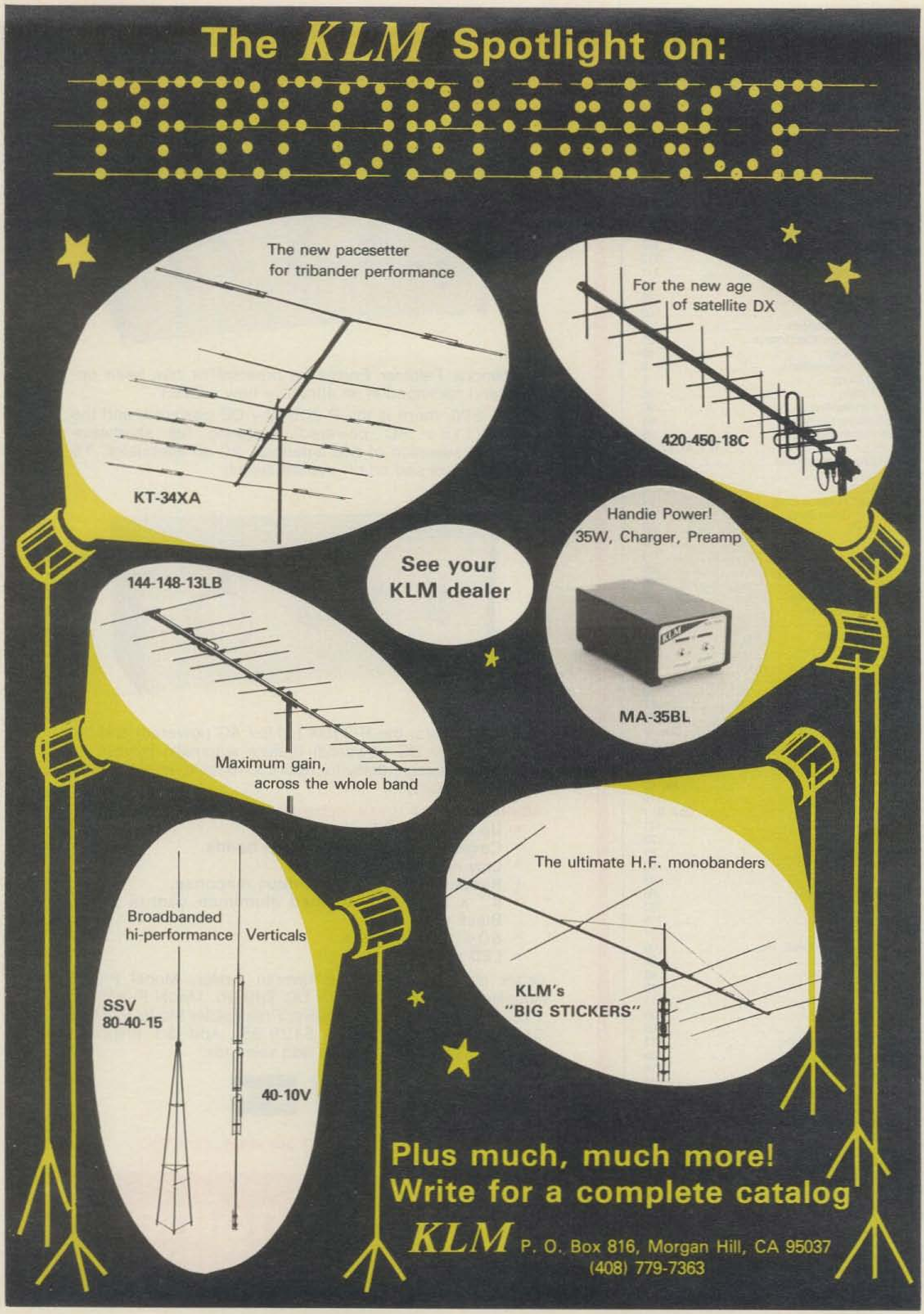

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Automatic scanning of the band or memories (or a segment of the band) with pause and restart feature.

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ICOM's IC-AT500, IC-2KL & IC-720A

Enjoy ICOM's new AT500 Antenna Tuner: The perfect companion for the ICOM HF series. Providing 160-10 meter coverage, including the new WARC bands, the IC-AT500 accepts up to 4 antennas and automatically selects the proper one for the band in use.

Silent automatic bandswitching with the IC-701, IC-720A or IC-730 (w/EX202), the IC-AT500 provides advanced features not found in ordinary antenna tuners: Preset capability allows a "lookahead" tuning to preset each band to a near matched condition without application of RF. This allows the receive function of the transceiver to perform at peak performance without application of RF power (causing RFI).

"Hands off" tuning requires no manual adjustment. Powerful motors quickly drive the capacitors in the "T" network to their optimum value. "Feedthru" control connectors allow channeling of both the IC-2KL linear as well as the AT-500 for a complete no tuning 500 watt output system.

The IC-AT500 is designed to match coax fed antennas with 3:1 or less VSWR, allowing your solidstate transceiver to run at maximum power into the transmission line.

See it at your local ICOM dealer. You will be glad you did. ICOM...simply the best.

CIRCLE 3 ON READER SERVICE CARD

ICOM

The World System

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