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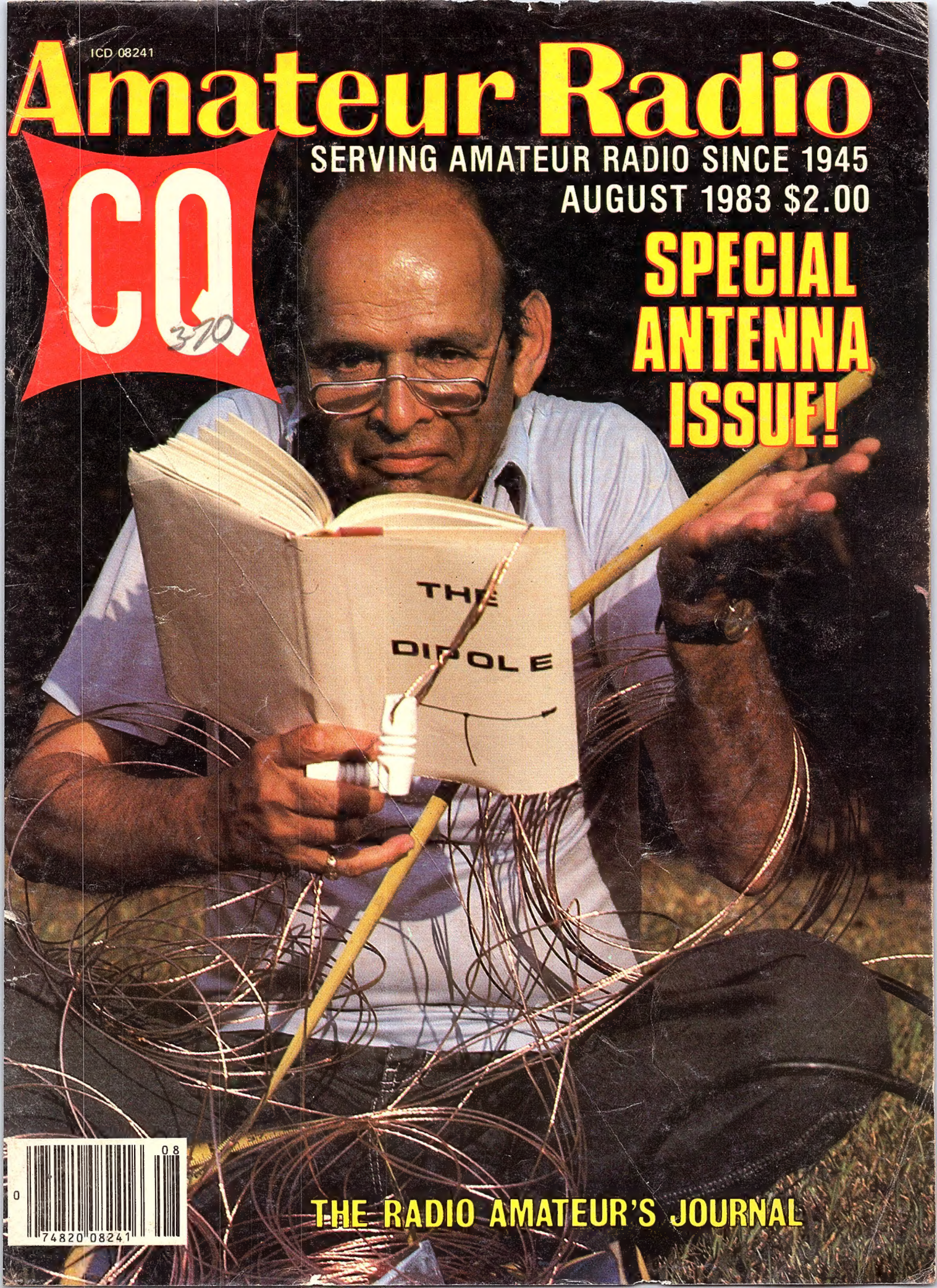
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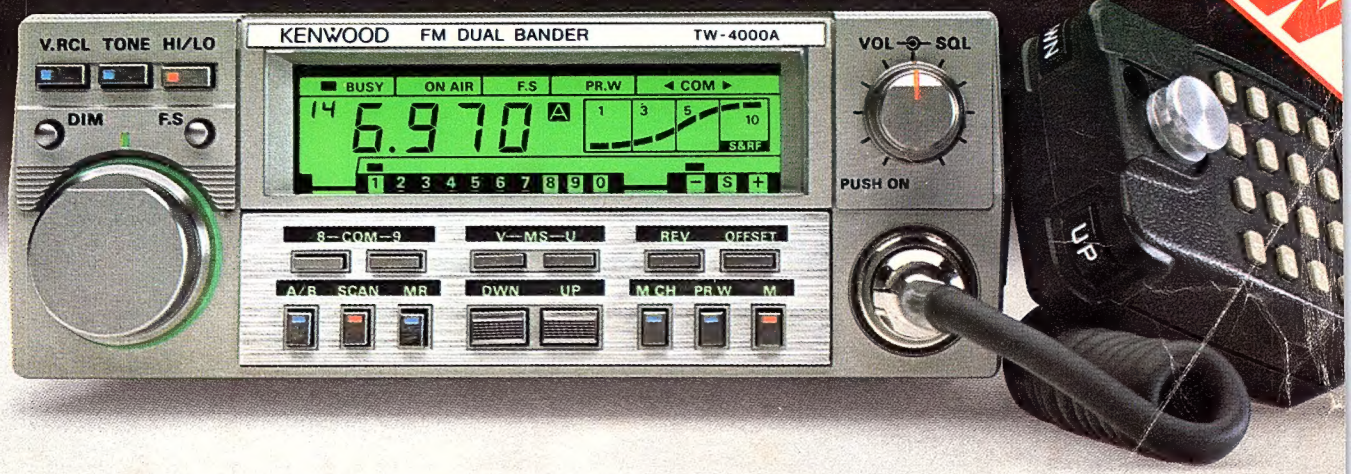


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THE RADIO AMATEUR'S JOURNAL

FM "Dual-Bander."

NEW



2 m & 70 cm in single compact package, LCD, 25 W, optional voice synthesizer.

TW-4000A

KENWOOD's TW-4000A FM "Dual-Bander" provides new versatility in VHF and UHF operations, uniquely combining 2 m and 70 cm FM functions in a single compact package.

TW-4000A FEATURES:

- **2 m and 70 cm FM in a Compact Package** Covers the 2 m band (142.000-148.995 MHz), including certain MARS and CAP frequencies, plus the 70 cm FM band (440.000-449.995 MHz), all in a single compact package. Only 6-3/8 (161)W x 2-3/8 (60)H x 8-9/16 (217)D inches (mm), and 4.4 lbs. (2.0 kg.).
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- **25 Watts RF Power on 2 m/70 cm.** Hi/Lo power switch.
- **Optional "Voice Synthesizer Unit"** Installs inside the TW-4000A. Voice announces frequency, band, VFO A or B, repeater offset, and memory channel number.
- **Front Panel Illumination**
- **10 Memories with Offset Recall and Lithium Battery Backup** Stores frequency, band, and repeater offset. Memory 0 stores receive and transmit frequencies independently for odd repeater offsets, or cross-band operation.
- **Programmable Memory Scan** Programmable to scan all memories, or only 2 m or 70 cm memories. Also may be programmed to skip channels.
- **Band Scan in Selected 1-MHz Segments** Scans within the chosen 1-MHz segment (ie., 144.000-144.995 or 440.000-440.995. etc.). The scanning direction may be reversed by pressing either the "UP" or "DOWN" buttons on the microphone.
- **Priority Watch Function** Unit switches to memory 1 for 1 second each 10 seconds, to monitor the activity on the priority channel.
- **Common Channel Scan** Memory 8 and 9 are alternately scanned every 5 seconds. Either channel may be recalled instantly.
- **Dual Digital VFO's** Selectable 5-kHz or 10-kHz for 2 m, and 5-kHz or 25-kHz for 70 cm. Depress "UP" or "DOWN" key on the front panel for band change in 1-MHz steps.
- **16-Key Autopatch UP/DOWN Microphone (Supplied)**
- **Repeater Reverse Switch**
- **High Performance Receiver/Transmitter** GaAs FET RF amplifiers on both 2 m and 70 cm, high performance MCF's in the 1st IF section, provide high receive sensitivity and excellent dynamic range. The high reliability RF power modules assure clean and dependable transmissions on either band.
- **Rugged Die-cast Chassis**
- **Optional Two-Frequency CTCSS Encoder** Easily mounted inside the radio, allows DIP switch programming of two different tone frequencies, for 2 m and 70 cm.
- **"BEEPER" sounds through speaker.**
- **Easy-to-Install mobile mount**

TW-4000A accessories:

- **VS-1 Voice Synthesizer**
- **TU-4C Two-Frequency Programmable CTCSS Encoder**
- **KPS-7A Fixed station power supply**
- **SP-40 Compact mobile speaker**

More information on the TW-4000A and TS-780 is available from all authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

KENWOOD

...pacesetter in amateur radio

All mode "Dual-Bander"

TS-780

2 m & 70 cm all mode, dual digital VFO's, 10 memories, scan, IF shift...

TS-780 FEATURES:

- USB, LSB, CW, FM all mode, covering the 2 m band (144.000-148.000 MHz) and the middle 70 cm band (430.000-440.000 MHz). UP/DOWN band switch.
- Dual digital VFO's with normal/tight drag switch. VFO steps in 20-Hz, 200-Hz, 5-kHz, or 12.5-kHz, plus "FM CH" channelized tuning. Split (cross) frequency operation possible. F. LOCK switch provided.
- 10 memories include band and frequency data, backed up by internal batteries (not supplied). Battery life exceeds one year. Memories 9 and 10 for priority instant recall.
- Band scan, with selectable 0.5, 1, 3, 5, and 10-MHz scan bandwidth.
- Memory scan selectable for all memories, or 2 m or 70 cm only.
- IF shift circuit rejects adjacent interference.
- High sensitivity and wide dynamic range • 7-digit fluorescent tube digital display • 10 watt RF output • 2 m ±600-kHz TX offset switch with reverse switch • Tone switch for optional TU-4C two frequency tone encoder unit • VOX and semi break-in CW built-in • FM center tune meter • Noise blanker for SSB, CW.

Subject to FCC approval





R-600

"Now hear this"...digital display, easy tuning

The R-600 is an affordably priced, high performance general coverage communications receiver covering 150 kHz to 30 MHz in 30 bands. Use of PLL synthesized circuitry provides maximum ease of operation.

R-600 FEATURES:

- 150 kHz to 30 MHz continuous coverage, AM, SSB, or CW.
- 30 bands, each 1 MHz wide, for easier tuning.
- Five digit frequency display, with 1 kHz resolution.
- 6 kHz IF filter for AM (wide), and 2.7 kHz filter for SSB, CW and AM (narrow).
- Up-conversion PLL circuit, for improved sensitivity, selectivity, and stability.
- Communications type noise blanker eliminates "pulse-type" noise.
- RF Attenuator allows 20 dB attenuation of strong signals.
- Tone control. • Front mounted speaker.
- "S" meter, with 1 to 5 SINPO "S" scale, plus standard scale.
- Coaxial and wire antenna terminals.
- 100, 120, 220, and 240 VAC, 50/60 Hz. Selector switch on rear panel.
- Optional 13.8 VDC operation, using DCK-1 cable kit.
- Other features include carrying handle, headphone jack, and record jack.

Optional accessories for R-600 and R-1000:

- DCK-1 DC Cable kit. • SP-100 External Speaker.
- HS-6, HS-5, HS-4 Headphones.
- HC-10 Digital World Clock.



R-1000

High performance, easy tuning, digital display

The R-1000 high performance communications receiver covers 200 kHz to 30 MHz in 30 bands. An up-conversion PLL synthesized circuit provides improved sensitivity, selectivity, and stability.

R-1000 FEATURES:

- Covers 200 kHz to 30 MHz.
- 30 bands, each 1 MHz wide.
- Five-digit frequency display with 1-kHz resolution and analog dial with precise gear dial mechanism.
- Built-in 12-hour quartz digital clock/timer.
- RF step attenuator.
- Three IF filters for optimum AM, SSB, CW.
- Effective noise blanker. • Tone control.
- Built-in 4-inch speaker. • Dimmer switch.
- Wire and coax antenna terminals.
- Voltage selector for 100, 120, 220, and 240 VAC. Operates on 13.8 VDC with optional DCK-1 kit.





Optional DFC-230 Digital Frequency Controller
Frequency control in 20-Hz steps with UP/DOWN microphone (supplied with DFC-230). Four memories and digital display. (Also operates with TS-120S, TS530S, and TS-830S.)

TS-130SE

"Small talk"...IF shift, Processor, N/W switch, affordable.

A compact, all solid-state HF SSB/CW transceiver for mobile or fixed base station, covering 3.5 to 29.7 MHz.

TS-130SE FEATURES:

- 80-10 meters including the new 10, 18, and 24 MHz bands. Receives WWV on 10 MHz.
- TS-130SE runs 200 W PEP/160 W DC input on 80-15 meters, 160 W PEP/140 W DC on 12 and 10 meters. TS-130V version at 25 W PEP/20 W DC, all bands, also available.
- Digital display, built-in.
- IF shift circuit.
- Speech Processor, built in.
- Narrow/wide filter selection on CW and SSB with optional filters.
- Automatic SSB mode selection (LSB on 40 meters and below, USB on 30 meters and up). SSB reverse switch provided.
- RF attenuator, built-in.
- Effective noise blanker.
- Final amplifier protection circuit assures maximum reliability. Output power is reduced if abnormal operating conditions occur. For very severe operations, optional cooling fan, FA-4, is available.
- Dimensions: 3-3/4 H x 9-1/2 W x 11-9/16 D (inches). Weight: 12.3 lbs.
- Other features: VOX, CW semi break-in with sidetone, one fixed channel, and 25 kHz marker.

Optional accessories:

- PS-30 matching power supply (TS-130SE).
- KPS-21 power supply (TS-130SE).
- PS-20 power supply (TS-130V).
- SP-120 external speaker.
- VFO-120 remote VFO.
- FA-4 fan unit (TS-130SE).
- YK-88C (500 Hz) and YK-88CN (270 Hz) CW filters.
- YK-88SN (1.8 kHz) narrow SSB filter.
- AT-130 antenna tuner.
- MB-100 mobile mounting bracket.

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You've got to get a Santec to get it right!

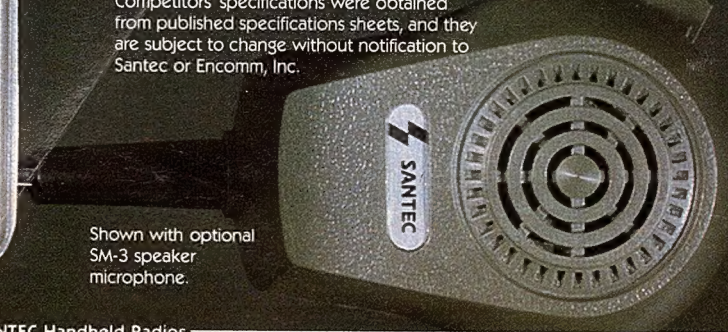
Compare Santec to anything you like, and you'll see — you've got to get a Santec to get: ■ memory channels which store standard repeater offsets for instant recall ■ less than 10 ma drain in receive to conserve power while you're monitoring ■ extremely wide power options of 0.1 W, 1.0 W or even 3.5 W for varying conditions ■ an accurate 24 hour clock for instant reference ■ and a full two year extended service plan which no one else will match.

When you get a Santec, you also get: ■ the widest frequency range of any handheld ■ odd offsets other than ±600 kHz ■ variable step sizes in bandscan ■ a 500 ma battery with charger ■ a full six digit back-lighted LCD display for full frequency readout plus the memory channel number ■ the easiest keyboard entry of any handheld ■ eight modes of scan, search, manual control and open scan ■ the ability to change batteries without losing memory data ■ easily programmable bandscan ■ a frequency lock switch on the keyboard ■ an automatic low battery indicator ■ and much more.

FEATURE	SANTEC ST-144	YAESU FT-208	KENWOOD TR-2500
Size (mm)	68 x 170 x 47	61 x 168 x 49	66 x 168 x 40
Weight with Batt.	600 gm	720 gm	540 gm
Readout	LCD (full 6 digits)	LCD (4 digits)	LCD (4 digits)
Memory Channels	10	10	10
Memory of Offsets	YES	NO	NO
Memory Backup	YES, Capacitance	Yes, Lithium Batt.	Yes, Lithium Batt.
Scan (mem. & band)	YES	Yes	Yes
Search Mode	YES	NO	NO
Step Size	5-100 kHz	5 or 10 kHz only	Any 5kHz multiple
Battery	Quick Change Pack 500 ma-hr, 9.6 V	Quick Change Pack 450 ma-hr, 10.8 V	Slide-on Pack 400 ma-hr, 8.4 V
Frequency Coverage	142-148.995 Tx (149.995 optional) 142-149.995 Rx	143.5-148.495 Tx/Rx	143.9-148.995 Tx/Rx
Power (max)	3.5 W High 1.0 W. Med. 0.1 W Low	2.5 W High 0.2 W Low	2.5 W High .3 W Low (approx.)
Priority	YES (in Mem/Scan)	Yes (Priority Ch.)	NO
Clock	YES	NO	NO
Computer Current Saver	YES (<10 ma)	NO (20 ma)	NO (27 ma)
Display	6 Digits + Mem. #	4 Digits + Mem. #	4 Digits + Mem. #

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Shown with optional SM-3 speaker microphone.



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clockwise from upper left:
- Leather Case (ST-LC)
- Base Charger & Power Supply (ST-5BC)
- Remote Speaker (MS-505)
- Mobile Charger (ST-MC)
- Speaker Microphone (SM-3)

The ST-144 μP is approved under FCC Part 15.

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CQ The Radio Amateur's Journal



ON THE COVER: Len Waldman, KA4MGH, of Miami, Florida, is shown puzzling over the construction of a wire dipole antenna. Photo by Larry Mulvehill, WB2ZPI.

AUGUST 1983 **VOL. 39, NO. 8**

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Zero Bias AN EDITORIAL

It looks as though the ARRL is going out of its way to prove that the old adage is true; you know, the one that says "if you don't learn from history, you're bound to repeat it." During the CB growth and boom, CBers became the official pariahs, and Newington's evangelical approach to converting them to amateur radio was far less than inviting. Alienation and damnation do nothing to win friends and influence people. We lost a "handle" (pardon the pun) on quite a number of prospective new amateurs. It truly became a case of "Us against Them" and "Us" didn't come out looking any too good.

At the last board meeting, the ARRL "proposed that no applicant be afforded Full ARRL Membership unless their license class shall have required Morse Code as a requirement." I guess that this is a preparatory admission that the code-free license is probably going to go through, and that if it does, "We'll show them." I'm sure that this potential second generation of "Second Class Citizens" will rush out to join the League, too.

While I don't think that anyone really expects the same numbers of people to flock to this new license, *if* and/or *when* the license class goes into effect, the net result will be that the ARRL will then represent a smaller and smaller percentage of all *licensed* amateur radio operators. Now they represent about 20% of all licensed amateurs, and it is foreseeable that that number can drop to 5 to 10%. The shrinking coterie that now exists could create an opening for a competing national organization a year or so down the road.

The wagons have truly been drawn in a circle. However, it appears that only the Indians are winning the battles. It seems foolish to create another "Little Big Horn" that in no way will help either amateur radio or the ARRL.

I hope that the ARRL sees fit to mellow their attitude this time, while there is time. The proposal is in committee at this writing. Hopefully they will decide to shelve this idea.

Travels With CQ

Compared to Dayton, the Birming-Hamfest is quiet . . . almost anything else is. While the economy is not exactly thriving in the Birmingham area, the spirit is high and the folks are just as enthusiastic. We did get the usual weekend rain, but the fleamarket for this one was indoors and air conditioned, so there was no inconvenience or discomfort in perusing the wares. As usual, there were plenty of bargains to be had. Dave Ingram was there, and I did get a chance to see Karl Thurber, too. *CQ* was well represented at this one.

The following Friday Dick and I were supposed to leave for the Rochester Hamfest. I say supposed to because in the typical last-minute rush we arrived at LaGuardia Airport only to realize that our plane was to leave from Kennedy. After a wild cab ride to Kennedy (right out of a movie chase scene) we found out that we could get on the plane, but our luggage and cartons couldn't; they wouldn't get there until the next afternoon, way too late for the one-day event. I'm sorry that we didn't make it, as I understand from the folks who got there that it was a very good show. We'll make better plans for next year and allow more time. That Sunday Dick and I were at the LIMARC fleamarket out on Long Island. This fleamarket has grown steadily over the years and now attracts quite a few commercial exhibitors.

Somewhere between the LIMARC fleamarket and the Dallas HamCom came the news that Wayne had sold out. A California-based publisher of computer magazines reportedly bought Wayne Green Enterprises for between 16 and 60 million dollars, depending on who you talk to. Either way it's a lot of money. What will happen to *73*, which has not been as popular or profitable lately, is anybody's guess.

The Dallas HamCom was bigger than ever. I did get to spend an extra day in Dallas, as I arrived on the Thursday before the show. I know that Texas likes to do everything big, but it's hard to reconcile that Dallas has bigger highways and far more traffic problems than we do in New York. On that Thursday I went to visit the home of Encomm, Inc. They market the Santec HTs, the Welz line, and now the KDK amateur transceivers. I had lunch with Encomm's President, Tom Gentry, K5VOU. He's also one of the guiding forces behind HamCom and its growth over the last six years. Later that afternoon I went over to Texas Towers. Gerald Williamson, K5GW, has built up a nice business over the past few years. He's as pleasant and easy going in person as he was to the customers who were calling in while I was there. We had dinner later that evening and talked about homebrewing and the upcoming show.

The next morning I went over to see the gang at AGL Electronics. I saw Gordon Fogg, N5AU. His antenna farm was on our cover a year or so ago—the cover with the great sunset and all of those towers. I also talked with Bob Alexander, W5AH, who works at AGL. Bob has an article coming up next month on a neat 30 meter update for the FT-901.

I then had a quick hour in the sun at the hotel pool before I went to pick up Dick and Jack at the airport. With Dallas traffic that meant a 4½ hour round-trip ride. We had a good time as usual that weekend at HamCom. There were more commercial exhibitors this year, and the fleamarket appeared to be twice the size of last year's. It was a very busy show for all.

Sunday Jack left for New York and Dick and I flew to Chicago for the Consumer Electronics Show (CES). If you can picture a show that is about five times the size of Dayton that has exhibits which run into the hundreds of thousands of dollars, then you might have an idea of CES. It was a mind-boggling day of seeing what will be available to the public next year.

Next week I'll be off to Washington, D.C. for the amateur radio luncheon at AFCEA. Then on the 17th we leave for the Atlanta Hamfest. I'll report on both of these events next month. I can say, though, that after six months of traveling this year I have noticed a definite upward trend in the economy and in the spirit of those who attend shows. I'd like to be able to say that the whole country is thriving, but obviously I can't. However, I think that the worst is over and that the rebuilding efforts will take a little while to filter throughout the land. All of the signs and the will and determination for a recovery are there.

Errata

The first promotional issues of our Spanish edition, *CQ Radio Amateur,* arrived, and they look great. Many of our authors and columnists can now see what their articles look like in Spanish, and they can also amaze their friends by telling them that they are bilingual (a hidden talent). Although the focus for this magazine will be Spain and South and Central America, copies will also be available here in the U.S.

All in all it's been a very busy month for *CQ* and for amateur radio in general. By next month we should know whether there will be four amateur radio magazines or three, so you're all free to speculate on that one. These certainly are exciting times. I'd also like to leave you with the reminder that Dr. Owen Garriott, W5LFL, is set to operate from the mobile as STS-9 Spacelab lifts off on September 30th. Don't ask me what countries or counties this will count for, but it is conceivable that Owen could work WAZ, DXCC, and USA-CA all on 2 meters. There should be complete details in most of the magazines in September.

As summer begins to draw to a close, be good to yourself and amateur radio by getting out there to support your local radio club and hamfest. Your participation does make a difference.

73, Alan, K2EEK

Say You Saw It In CQ

Introducing the hy-gain® EXPLORER 14

Remarkably Compact, High Performance Broadband Tribander with Quad-Band Option

New Para-Sleeve Design

The Explorer 14 is a new antenna design we call PARA-SLEEVE which uses an "open-sleeve" dipole optimized for maximum bandwidth and directivity. Here is the concept. A central dipole, driven directly by the transmission line, has a ½ wave resonance on the lowest operating frequency. Two shorter sleeve elements, tightly coupled to the central dipole, modify its impedance to create a ½ wave resonance to the highest operating frequency. This para-sleeve system is expanded by the addition of 15 meter traps and 20 meter element tips. A revolutionary new concept for HF tribanders. *So unique, we've applied for a patent.*

Broadband Performance

The Explorer 14 will load solid state tranceivers to maximum output with VSWR below 2:1, eliminating the need for an antenna tuner. You'll have edge to edge broadband performance on 20, 15 and 10 meters with gain and front-to-back ratio competitive to giant tribanders that cost twice as much or more. You'll be able to work stations you cannot even hear with a dipole antenna. And, the Explorer 14 handles maximum continuous legal power with a respectable safety margin.

Short Boom Save Space and Money

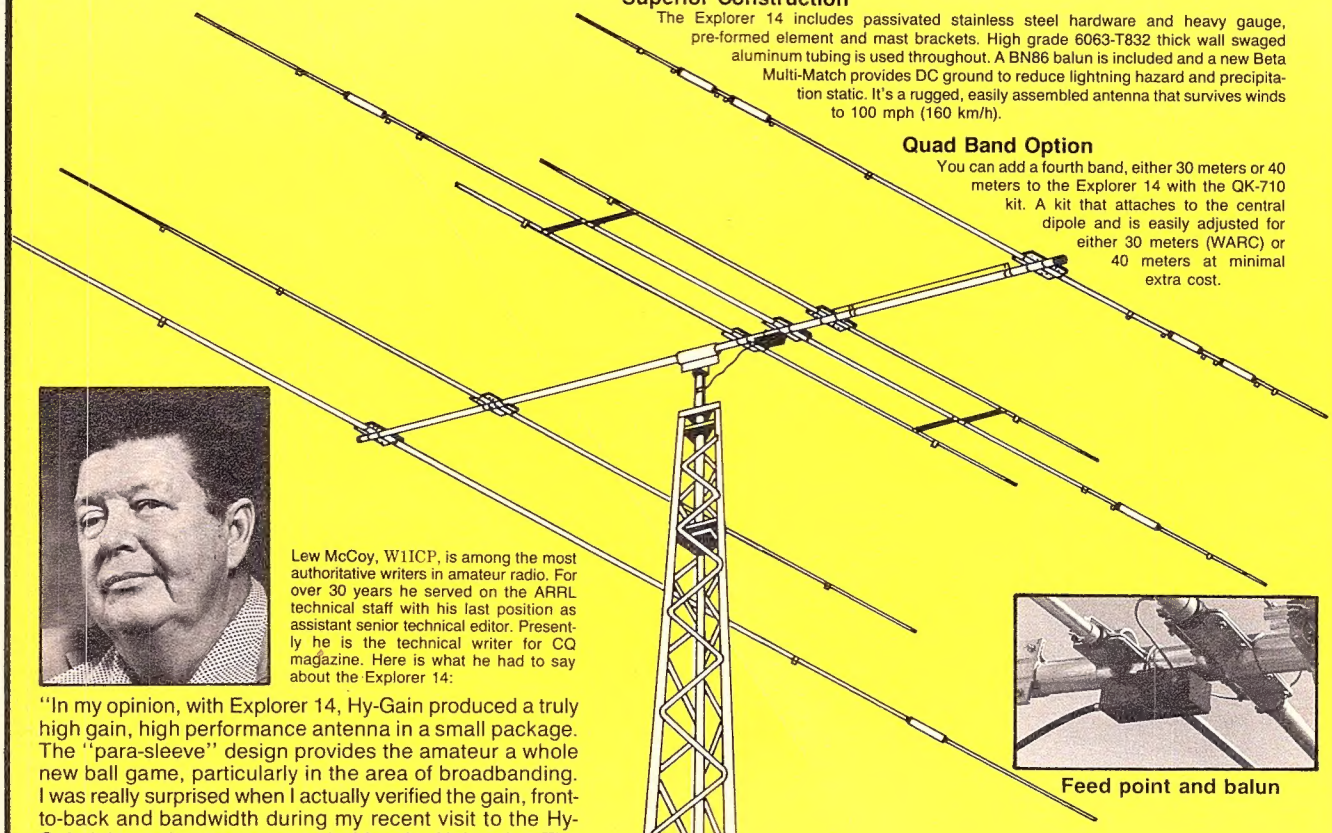
If your space or budget was too limited for a long boom tribander, chances are the Explorer 14 will fit both. The boom is only 14' (4.3 m) long and the turning radius requires only 17'3" (5.3 m). The compactness of the Explorer 14 reduces its overall weight and windload surface so you can mount it on a roof tripod, a mast or a tower. For Example, the Hy-Gain CD-45II rotator and HG52 tower are a perfect match for the Explorer 14. This saves you the cost of an extra heavy duty rotator and tower.

Superior Construction

The Explorer 14 includes passivated stainless steel hardware and heavy gauge, pre-formed element and mast brackets. High grade 6063-T832 thick wall swaged aluminum tubing is used throughout. A BN86 balun is included and a new Beta Multi-Match provides DC ground to reduce lightning hazard and precipitation static. It's a rugged, easily assembled antenna that survives winds to 100 mph (160 km/h).

Quad Band Option

You can add a fourth band, either 30 meters or 40 meters to the Explorer 14 with the QK-710 kit. A kit that attaches to the central dipole and is easily adjusted for either 30 meters (WARC) or 40 meters at minimal extra cost.



Lew McCoy, W1ICP, is among the most authoritative writers in amateur radio. For over 30 years he served on the ARRL technical staff with his last position as assistant senior technical editor. Presently he is the technical writer for CQ magazine. Here is what he had to say about the Explorer 14:

"In my opinion, with Explorer 14, Hy-Gain produced a truly high gain, high performance antenna in a small package. The "para-sleeve" design provides the amateur a whole new ball game, particularly in the area of broadbanding. I was really surprised when I actually verified the gain, front-to-back and bandwidth during my recent visit to the Hy-Gain labs and antenna range in Lincoln, Nebraska. The Explorer 14 is a winner."

Feed point and balun

Specifications:

Electrical

Frequencies of operation:	20M	15M	10M
Under 2:1 VSWR (MHz)	14.0-14.35	21.0-21.45	28.0-29.7
Maximum F/B Radio (dB)	27	27	21
Maximum Gain (dB)	7.5	8.0	8.0
Maximum Power		Maximum Legal DC Ground	

Mechanical

Boom Length	14'1½" (4.3 m)
Turning Radius	17'3" (5.3 m)
Net Weight	43 lbs. (19.5 kg)
Wind Surface Area	7.5 sq. ft. (.69m²)

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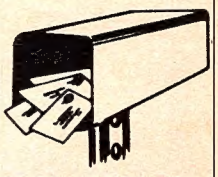


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CIRCLE 81 ON READER SERVICE CARD

Our Readers Say



An Answer To The Ultimate Question

Editor, *CQ:*

Since you ask, "What has happened to the thrill of communicating with another person across the miles, oceans, or continents?" (DX Column, *CQ*, June 1983), I thought I would take a few moments and attempt an answer. It's my answer—personal for me—and I am sure that I probably only represent a small minority of "hamdom."

Let me see. . . . I remember well the first time I drove an automobile. What a thrill! Now boring. I remember well the first time I opened a mike professionally as a disc jockey! That stage of my career has long since passed. I remember the first time I broke 80 on the golf course. I was 16 years old. A great thrill. And it still would be today if I could do it, but I can't. However, the challenger is still there. I guess it is likely that it is the challenge that maintains my interest rather than past accomplishments. I remain proud of the accomplishments, but they are relegated to mementos for the scrapbooks.

I don't exactly remember the first QSO. It took months to get the old surplus gear to "put out." Finally, someone a few miles away answered to report my foghorn note. The first DX contact was Canada on 80 meters. I still have the logs, and still enjoy pouring back through them from time to time. Since 1954 I've been off the air (ham bands) more than on due to career, family, etc. But that old DX bug was never far from thought. And now a few years down the road at 317 countries I'm just as addicted as ever.

Now to take a shot at answering your question—for me. Sorry, but the thrill of communicating with another *person* (your italics) across the miles is long gone. I've done it thousands of times. They're doing it now with half a watt. The kids have grown up with all the things we considered marvels. They are no longer thrilled with it, nor am I. Granted, many enjoy a good ole ragchew. Frankly, most are boring. But I'll also admit that many are interesting. I hear them often, but 99% of the time I feel no compulsion to join; I just enjoy listening. There have been many hundreds of days when the rig was on for an hour or two, or three, with nothing in the log to show for it. Just listening. I've always enjoyed listening more than talking. I've enjoyed code more than phone. Personal tastes.

I really wrote this letter to express my opinion that I wish the ARRL would add some countries instead of deleting at every opportunity. I don't want my lifelong (almost) goals to be accomplished. I want to keep chasing (DX) just like I did when I was 17. I don't think an ARRL DX Advisory Committee member should be allowed to vote on a deletion if he already has that country confirmed. Let's go back to the 200 mile shore rule. Let's add some incentive to maintain the interest of thousands of DXers.

It's only a game. It's only a hobby. It's not my career. It's not my family. It's not my only hobby. I would miss it, but I sure could give it up (as many do, from boredom).

C'mon guys. The reason I got into ham radio was to have fun. I didn't get into it to build and tinker (although that appeals to many). I didn't get into it to ragchew (as that appeals to many). I got into ham radio because I had a burning desire to *operate.* I became, in the early days, a DJ rather than an engineer (although I had a first phone at 16) for the same reason. I could tinker to my heart's content without a license. The license was required only to *operate.* The kids (and adults) did not pick up on CB to tinker; they wanted to operate, to ragchew, to work DX. Let's get some fun back in. Let's get some challenge back in.

But so much for the soapbox. So much for my one and only letter to the editor—ever. For my personal taste, *CQ* is by far the best magazine. It has many more features about *operating,* and the best DX column by far. WA6AUD is one of the finest writers ever to grace a periodical.

Ron Brandon, N4AH (ex-W4DUQ)
Spartanburg, SC

P.S.: What about the ultimate award for band-countries starting at 1000? I could never hope to ever "get them all." And for goodness sake, make it retroactive. Don't deny the old timers what they worked so hard for.

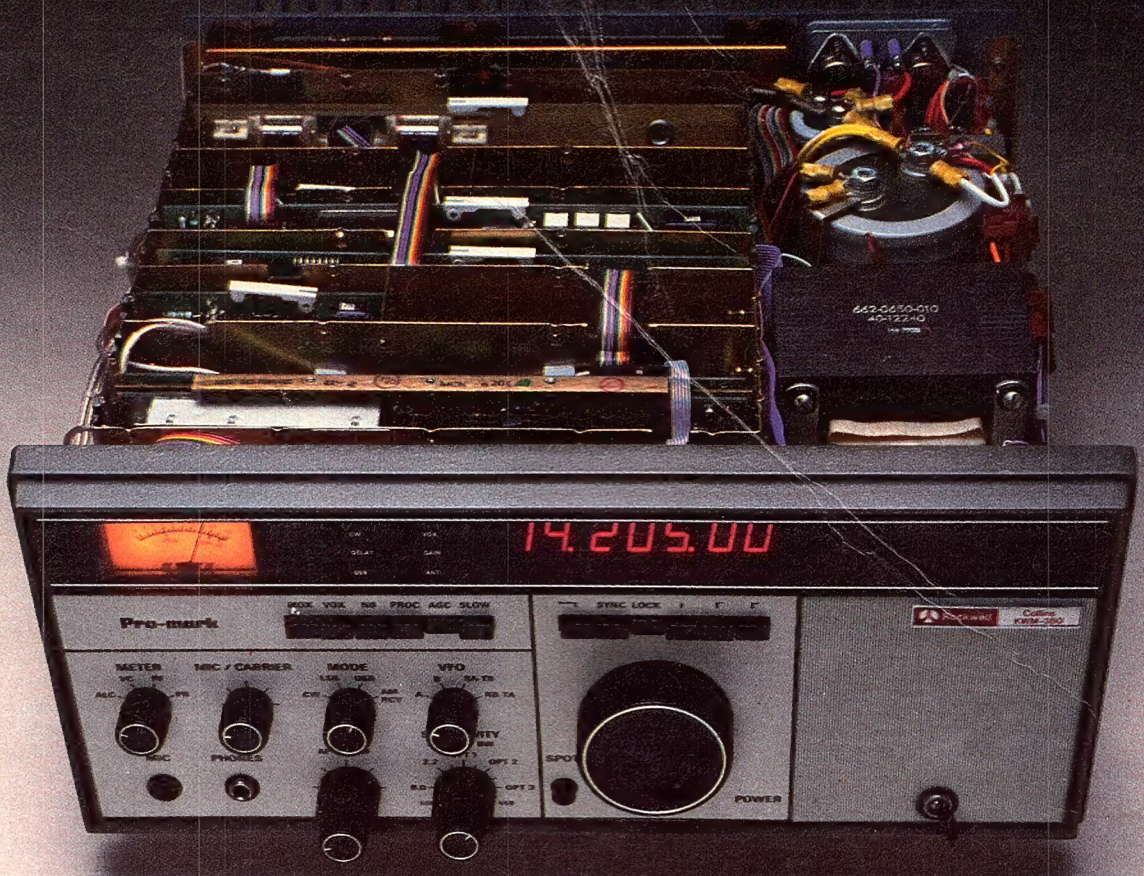
QRP Brings Them In

Editor, *CQ:*

I just wanted to drop you a line to tell you how much I enjoyed your magazine the past two months (May and June 1983 issues) with the QRP articles. I enjoyed them so much that at the Dayton Hamvention I signed up for a subscription. Keep up the good work.

Charles W. Eglhaut, KA3DFK
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Announcing

● **Elmer of the Year Award** - The Northern New Jersey QCWA Chapter is accepting nominations for this year's Elmer Award. The award is given to the amateur in northern New Jersey who has done the most to pass on his or her knowledge to the next generation of amateurs. Nominations may be made by any licensed amateur who resides in northern NJ. Each nomination must be accompanied by a 500 or less word statement about the nominee, and nominations must be received on or before Sept. 1, 1983. Send nominations to Gordon S. Gregory, N2IN, 8 Winding Way, Denville, NJ 07834 (phone 201-627-4426.).

● **VHF Conference Call for Papers** - Papers are invited for the 29th Annual VHF Conference sponsored by the Electrical Engineering Dept. of Western Michigan University. Paper synopses are due for selection by August 15th and final papers are due October 1st. Reports may cover the design, construction, and testing of VHF equipment, plus related areas such as propagation, RTTY, satellites, and more. Papers should be sent to Dr. Cassius Hesselberth, W8FLH, Chairman, Dept. of Electrical Engineering, Western Michigan University, Kalamazoo, MI 49008.

● **VE3VM from the Welland Canal** - The Niagara Peninsula Radio Club will be on the air from the Welland Canal using the call VE3VM weekends in July and August on 7.050–7.095 and 7.225–7.295 s.s.b. Send QSL (with s.a.s.e.) to Box 692, St. Catherines, Ontario, Canada L2R 6Y3.

● **KF2T from Oyster Creek, NJ** - The Jersey Shore ARS will operate KF2T from the Oyster Creek (NJ) Nuclear Generating Station August 6–7 from 1800–1800Z. Phone: 3930, 7230, 14260, 21260, and 28560 kHz. CW/Novice: 30 kHz up from lower band edges. VHF: 146.58. RTTY: 3640, 7085, 14085. QSL to JSARS, 619 17th Ave., South Belmar, NJ 07719 (s.a.s.e. for commemorative QSL).

● **Special Event from Mackinac Island, MI** - From 1500–2300Z August 13th the Tri-County Wireless Group will operate N8COY from the Grand Hotel's "Longest Porch in the World" s.s.b. on 7.280, 14.280, 21.380, 28.580, and f.m. 147.480. QSL with s.a.s.e. to N8COY (DXers via Bureau).

● **K2JD Special Event** - The Rochester ARA will operate using the call K2JD from Camp Good Days and Special Times, Camp Onanda, NY, on August 27–28 between 11 a.m. and 5 p.m. Phone: 80 meters 3900–3925 MHz, 40 meters 7230–7250, 15 meters 21350–21375. CW: 80 meters 3525–3550, 40 meters 7025–7050, 15 meters 21025–21075. Also 2 meter FM. For certificate send s.a.s.e. and QSL to RARA, P.O. Box 1388, Rochester, NY 14603.

● **Little House on the Prairie Commemorative** - This Special Event station will be on the air from August 27th to September 4th using the calls WA@CED and WA@AUU on 10–80 meters on the low end of the General and Novice bands. Certificate for a QSL and $2.00 to above calls.

● **The following hamfests, etc., are slated for August:**

July 23–24, **Charleston Hamfest,** Charleston, SC. Phone 803-747-2324.

Aug. 5–7, **ARRL Rocky Mountain Div. Convention and WIMU Hamfest,** Jackson, WY. Phone WB7AMP at 307-382-9032, or N7COA at 307-875-5324.

Aug. 7, **South Hills Brasspounders and Modulators Hamfest,** Pittsburgh, PA. Contact Andrew L. Pato, 1433 Schauffler Dr., W. Homestead, PA 15120.

Aug. 12–14, **Austin Summerfest '83,** Austin, TX. Contact Austin Summerfest '83, P.O. Box 13473, Austin, TX 78711.

Aug. 13, **Lake Erie International Hamfest,** Dunkirk, NY. Contact Lake Erie Hamfest, P.O. Box 455, Dunkirk, NY 14048.

Aug. 13–14, **Radio Club of Tacoma Hamfair,** Tacoma, WA. Contact Grace Teitzel, AD7S, 701 S. 120th, Tacoma, WA 98444, or phone 206-564-8347.

Aug. 14, **Hamfesters Radio Club Hamfest,** Willow Springs, IL. Contact N9AMY, 10220 S. 86th Ct., Palos Hills, IL 60465.

Aug. 14, **Central Kentucky ARRL Hamfest,** Georgetown, KY. Contact Bluegrass Radio Club, Inc., P.O. Box 4411, Lexington, KY 40504.

Aug. 19–21, **ARRL Pacific Div. Convention,** Reno, NV. Contact Wide Area Data Group, Inc., P.O. Box 3132, Sparks, NV 89432-3132, phone 702-358-6303.

Aug. 20, **Tioga County (PA) ARC Hamfest,** Blossburg, PA. Contact Tioga County ARC, P.O. Box 56, Mansfield, PA 16933.

Aug. 20–21, **Huntsville Hamfest,** Huntsville, AL. Contact Huntsville Hamfest, 2804 S. Memorial Parkway, Huntsville, AL 35801.

Aug. 21, **Chicago Area Computer Hobbyists Exchange and Chicago ARC Swapfest,** River Grove, IL. Call CARC at 312-545-3622.

Aug. 21, **Warren Hamfest,** Warren, OH. Contact KA8GGD, WARA, P.O. Box 809, Warren, OH 44482.

Aug. 21, **New Delmarva Hamfest,** Gloryland Park, south of Wilmington, DE. Contact Stephen J. Momot, K3HBP, 14 Balsam Rd., Wilmington, DE 19804 (s.a.s.e.).

Aug. 21, **Tippecanoe ARA Hamfest,** Lafayette, IN. Contact Lafayette Hamfest, Route 1, Box 63, West Point, IN 47992.

Aug. 21, **Finger Lakes Hamfest,** Trumansburg Fairgrounds, NW of Ithaca, NY. Contact W2CFP, 866 Ridge Rd., Lansing, NY 14882.

Aug. 27–28, **Montgomery (AL) Hamfest,** Montgomery, AL. Contact Hamfest Committee, 2141 Edinburgh Dr., Montgomery, AL 36116.

Aug. 28, **Five County Swap-n-Shop,** Flint, MI. Contact KU8H, 1204 Overland Dr., Lennon, MI 48449.

Aug. 28, **Marshall County ARC Hamfest,** Argos, IN. Contact Marshall County ARC, Box 151, Plymouth, IN 46563.

Aug. 28, **Lebanon Hamfest,** Lebanon, TN. Contact Morris Duke, W4WXQ, 210 Disspayne Dr., Donelson, TN 37214.

Aug. 28, **St. Charles ARC Hamfest,** Wentzville, MO. Contact SCARC Hamfest, P.O. Box 1429, St. Charles, MO 63301.

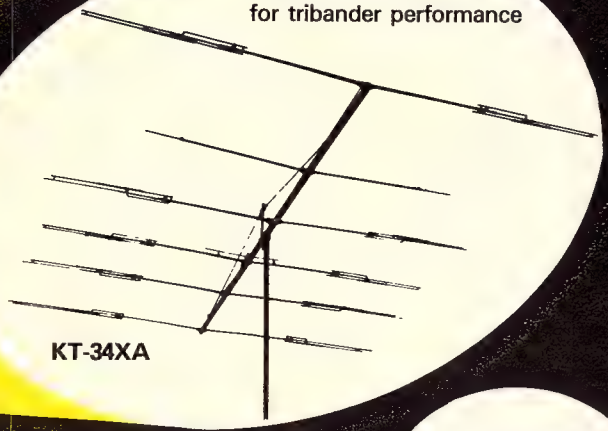
Aug. 28, **Central PA Repeater Assoc. Hamfest/Computerfest,** Hershey Park, PA. Contact WB3DNA, 6140 Chambers Hill Rd., Harrisburg, PA 17111.

Aug. 28, **Bluefield Hamfest '83,** Brush Fork Armory, north of Bluefield, WV. Contact Don Williams, WA4K, 412 Ridgeway Dr., Bluefield, WV 24605.

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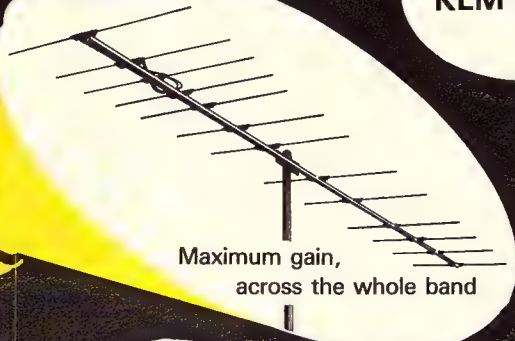


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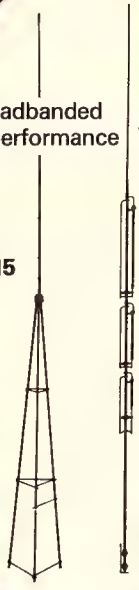
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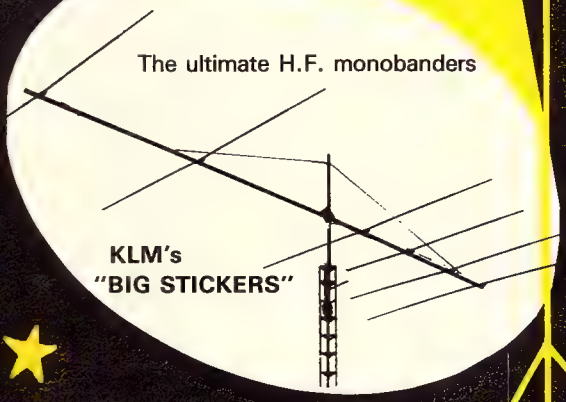
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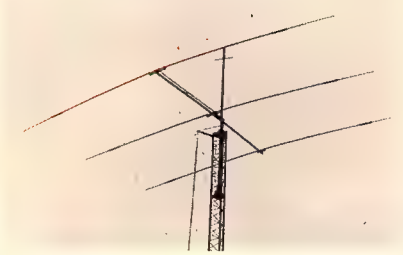
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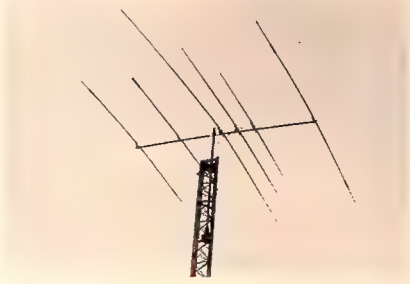


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SQ-22

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HB-35T

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Element	10x2	14x2	4/5/5	3	4	9x2	1	2x2	2x2	2
Gain	14.6dB	22.5dB	10/13/12.5dB	8.5/8.5/10dB	10/10/11dB	16.5dB	—	16dB	16dB	12dB
F/B Ratio	26dB	24dB	23dB	20dB	22dB	22.5dB	—	20dB	20dB	20dB
V.S.W.R.	1.5	1.3	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Power R	500Wpep	1KWpep	2KWpep	2KWpep	2KWpep	1KWpep	250Wpep	250Wpep	250Wpep	250Wpep
Impedance	50ohm	50ohm	50ohm	50ohm	50ohm	50ohm	50ohm	50ohm	50ohm	50ohm
Element L	1.07m	1.02m	8.4m	8.0m	8.0m	1.02m	1.8mx4	0.17m	0.57m	1.8/1.5m
Boom L	3.5m	5.7/2m	7.5m	4.0m	6.0m	3.5m	2.9m	0.54m	2.0m	1.8m
Turning Radius	1.79m	2..79m	5.56m	4.59m	5.08m	2.02m	—	0.43m	1.00m	0.90m
Wind Surface Area	0.23m²	0.60m²	0.75m²	0.46m²	0.62m²	0.32m²	0.05m²	0.03m²	0.15m²	0.22m²
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When an idea germinates, it's still theory until you actually get to try it out. WB0DGF took the idea and went with it through research, modeling, and testing.

The Open-Sleeve Antenna

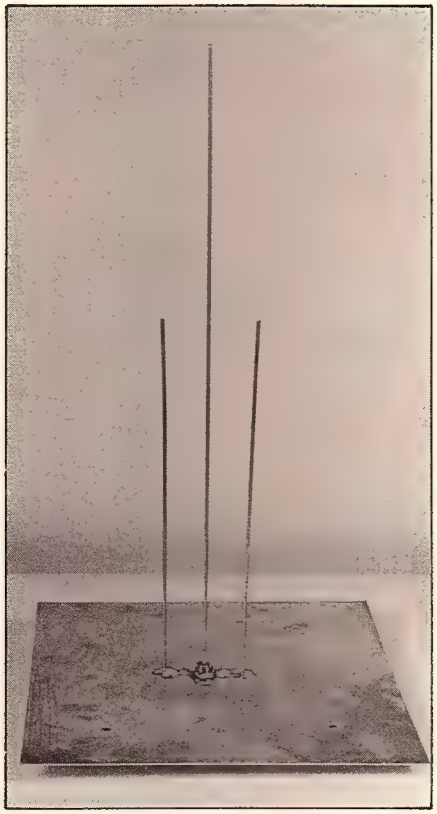
Development of the Open-Sleeve Dipole and Open-Sleeve Monopole for H.F. and V.H.F. Amateur Applications

BY ROGER A. COX*, WB0DGF

A broadband antenna for 80 meters tugged at my curiosity after the 1982 Dayton Hamvention. It was a dipole antenna sold by Snyder Antenna Corp. that exhibited a v.s.w.r. curve with two dips—a double resonance within the same band. Upon returning home and leafing through the pages of the just-arrived April '82 IEEE *Antennas and Propagation Newsletter,* I spotted a familiar v.s.w.r. curve. An antenna for military satellite communications had the same double-resonance v.s.w.r. curve as the 80 meter dipole. After closer examination of the article,[1] which explained various types of v.h.f. and u.h.f. antennas developed by the Aerospace Corporation, I told myself that the antenna with the double resonance may not use the same method in obtaining its broadband performance, but it was certainly worth further investigation. The v.h.f. antenna was an open-sleeve dipole in front of a plane reflector.

I sent for the report listed as a reference in the article. Interestingly, this report was dated January 15, 1973. That would mean that this antenna had been around for awhile, yet I had never read anything about an open-sleeve dipole.

The first thing that came to my mind when I saw the term *open-sleeve dipole* was the conventional sleeve dipole where you strip the insulation off the end of a length of coaxial cable. Then you fold a ¼ wavelength of braid back upon the cable to form a center-fed ½-wavelength dipole. I knew that this antenna doesn't work well unless the ratio between the folded-back shield and the coaxial shield is increased. This is the basis for the sleeve decoupling system used on many v.h.f. antennas. I thought that this was probably not the same as the open-sleeve dipole.



Modeling antennas need not be all that complicated. Here is a version of the open-sleeve antenna as modeled by the author, WB0DGF.

Upon inquiry, I was told that a sleeve antenna can take another form. I was also told to go look in a book entitled *VHF Techniques.*[2] This was a fairly old book, being published in 1947. Consequently, it was not in my collection of antenna books. Luckily I was able to borrow it from a colleague so that I could find out what a sleeve antenna was.

The book's definition of a sleeve antenna is as follows:

> "An electromagnetic radiator is termed a sleeve antenna when it incorporates a tubular conductor, i.e., sleeve, of which the exterior is used as a radiating element and the interior as the outer conductor of the coaxial transmission line that feeds the antenna."

So far this sounds like the familiar sleeve decoupler. Reading on: "The length of the sleeve may be any portion of the total length of the antenna." This seemed totally different from the ¼-wavelength sleeve decoupler. The book went on to describe various forms of the sleeve monopole as shown in figs. 1 and 2.

Continuing from the book:

> "It will be noticed that each of these has been shown to possess a sleeve with the inner diameter substantially less than the outer. In each case a crosshatched region between the walls of the sleeve is shown. It is evident, from consideration of the structures, that the performance of the antennas will in no way depend upon whether the crosshatched regions are empty or are filled with metal, since they are separated from all fields by continuous metal surfaces. This matter has been brought out to distinguish the sleeve antenna as defined here from the type of antenna shown in figure 3, which also involves a "sleeve" element but which differs in that the sleeve is used as a choke and the space corresponding to the crosshatched regions of figure 2 must be empty in order that the choking effect take place. Antennas of this latter type are usually forms of center-fed cylindrical dipoles, and the purpose of the sleeve is merely to permit feeding them with coaxial transmission line."

Now I knew the difference between the two types of sleeve antennas. The book also went on to describe how the sleeve dipole evolved from the sleeve monopole. Some of these are shown in fig. 4.

The impedance of the sleeve dipole (or

*3451 Dudley, Lincoln, NE 68503

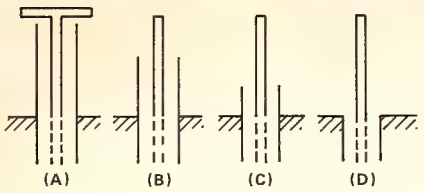


Fig. 1– Sleeve-stub antennas with uniform cross section.

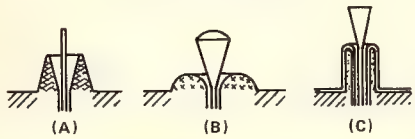


Fig. 2– Sleeve-stub antennas with non-uniform cross section.

sleeve monopole) can be optimized with the use of tapered elements, as shown in fig. 4 (C), (D), and (E). Also, the radiation pattern can be controlled by the maximum length of the dipole. As shown in fig. 5, I could not allow the maximum length (2L) to exceed 1.0 wavelength at a given frequency without introducing major sidelobes into the radiation pattern.

Although the book made a very good argument for an antenna that exhibits rugged mechanical construction and favorable broadband characteristics, I could not justify to myself using this type of antenna in anything other than certain v.h.f. or u.h.f. antennas. It would be a very bulky antenna on any frequency less than 100 MHz, and tuning the antenna by changing the sleeve taper or diameter ratio would be a very time-consuming process.

The Open-Sleeve Antenna

Luckily the Aerospace Corporation report[3] arrived before I lost interest in the design; and upon reading it, I was amazed at the simplicity and flexibility of the construction.

The basic design of an open-sleeve dipole consists of a conventional center-fed dipole with two shorter parasitic sleeve elements *closely* spaced on both sides and parallel to the center-fed dipole. The length of the center-fed dipole corresponds to a half wavelength at a frequency f1, and the lengths of the sleeves correspond to half wavelengths at a higher frequency, f2. As shown before in the conventional coaxial sleeve dipole, the ratio of f2 to f1 cannot exceed 2:1 without creating significant sidelobes. Typical spacing between the sleeve elements and the central dipole is on the order of 4–12 times the diameter of the elements. A comparison of the v.s.w.r. response of a typical open-sleeve dipole with that of a conventional cylindrical dipole of the same dimension is given in fig. 6.

I could easily see the noticeable increase in bandwidth obtained by this design. The report states that an open-sleeve dipole can be operated over a bandwidth of *1.8:1* as compared with an operating

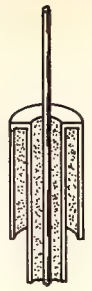


Fig. 3– Center-fed coaxial dipole.

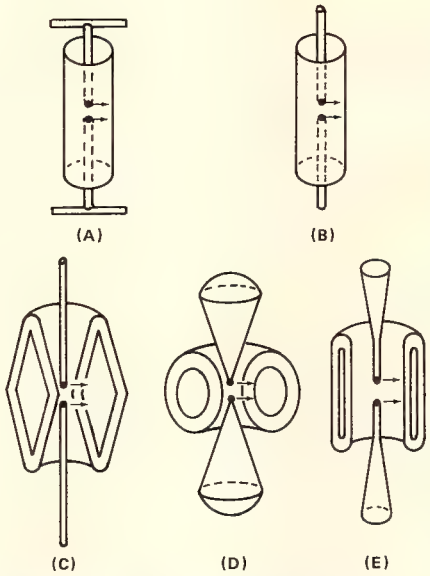


Fig. 4– Evolution of sleeve-dipole antennas from sleeve-monopole antennas.

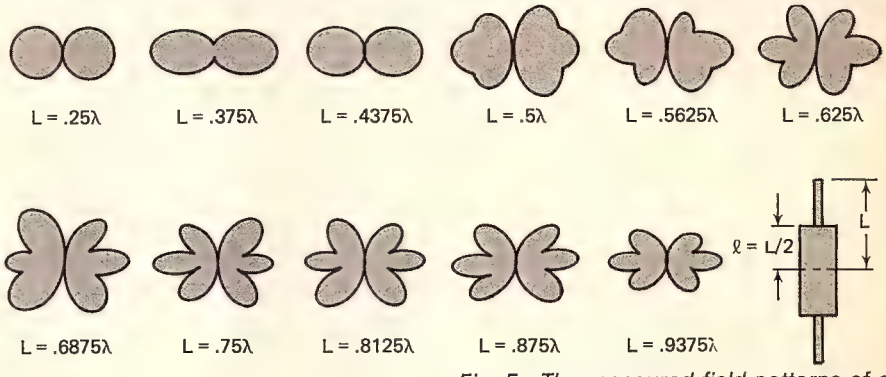


Fig. 5– The measured field patterns of a sleeve dipole. (Note: 1 = 0.5L, D = 0.25L, d = 0.5D.)

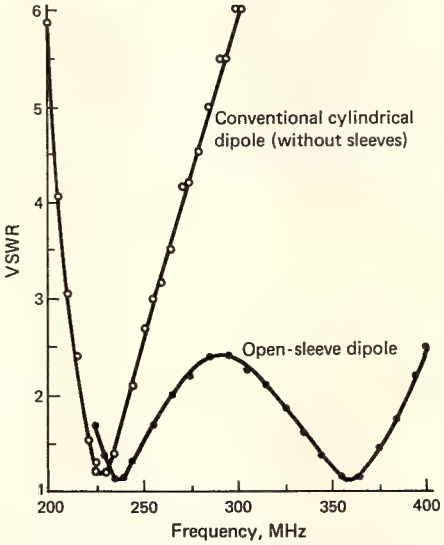


Fig. 6– V.s.w.r. response of an open-sleeve dipole and a conventional dipole.

bandwidth of 1.25:1 for a conventional cylindrical dipole.

What this means is that a cylindrical dipole that was constructed to cover 100 to 125 MHz could, with the addition of the appropriate sleeve elements, be made to cover 100 to 180 MHz instead. Pattern, gain, and impedance variations would be similar to those of the cylindrical dipole alone, but only over a much wider frequency range.

The possibilities of various broadband v.h.f. and u.h.f. antennas were tremendous. I could now cover 88–158 MHz, 138–248 MHz, 225–405 MHz, and 450–810 MHz, each as a separate broadband antenna. But these incredible bandwidths could also be achieved by very large diameter cylindrical monopoles and structures such as discones. What I needed to do was to take a look at the physical size of the antenna structures and compare them.

Size vs Bandwidth

Various open-sleeve dipole arrangements have been described by H.E. King and J.L. Wong.[4] From the information presented in their article, I could see that I would need dipole element diameters of at least 1.125 inches in order to cover 225–400 MHz under 2.5:1 v.s.w.r. Overall dimensions of the antenna would be 5.125 inches wide, 1.125 inches thick, and 20.375 inches long. Scaling this an-

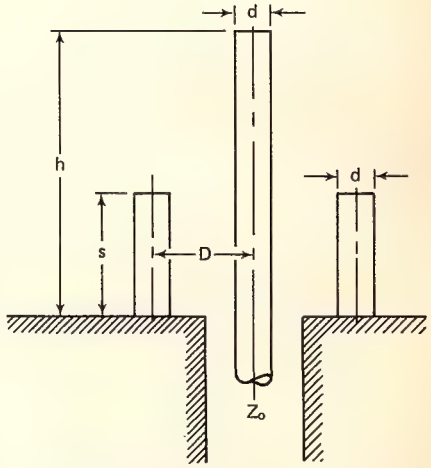
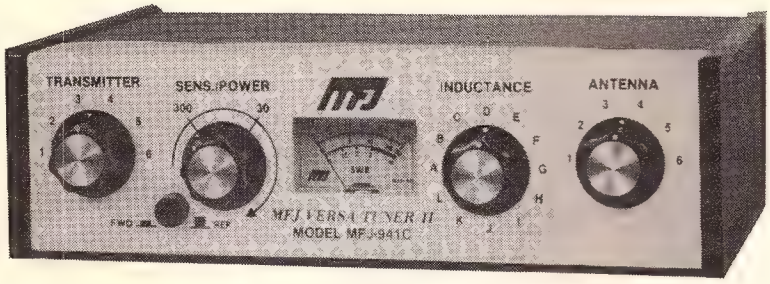


Fig. 7– An open-sleeve monopole.

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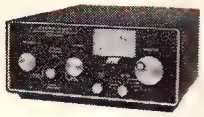
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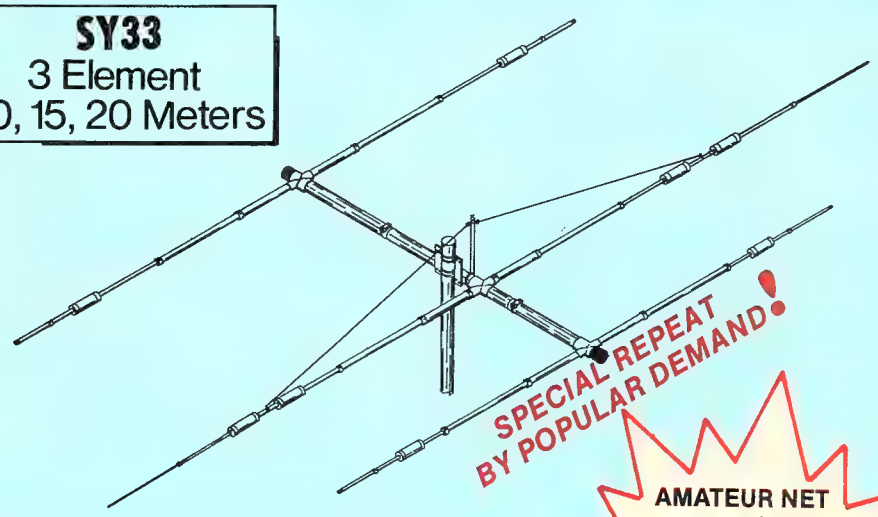
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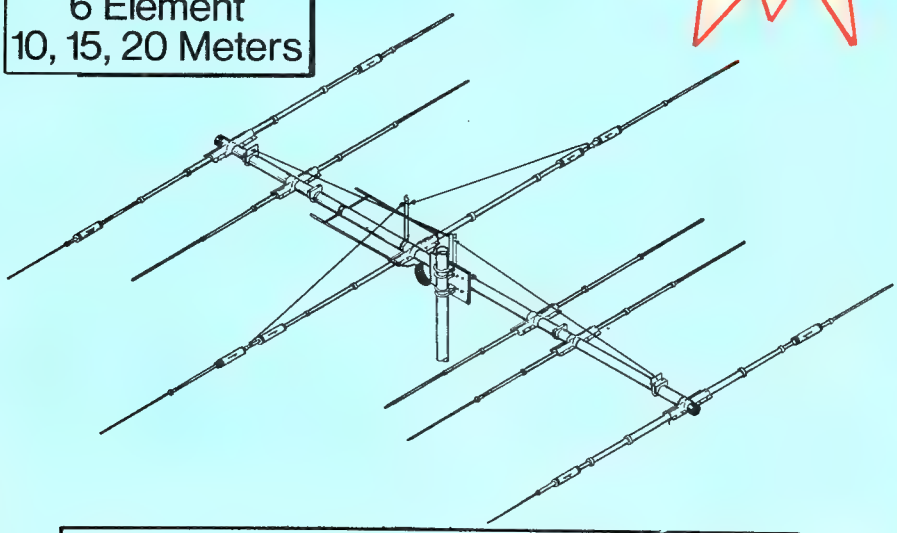


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VSWR at resonance	1.1:1	Surface area	8.6 sq. ft.
Impedance	50 ohms	Wind loading at 80 mph	215 lbs.
F/B ratio	up to 20 dB	Assembled weight (approx.)	53 lbs.
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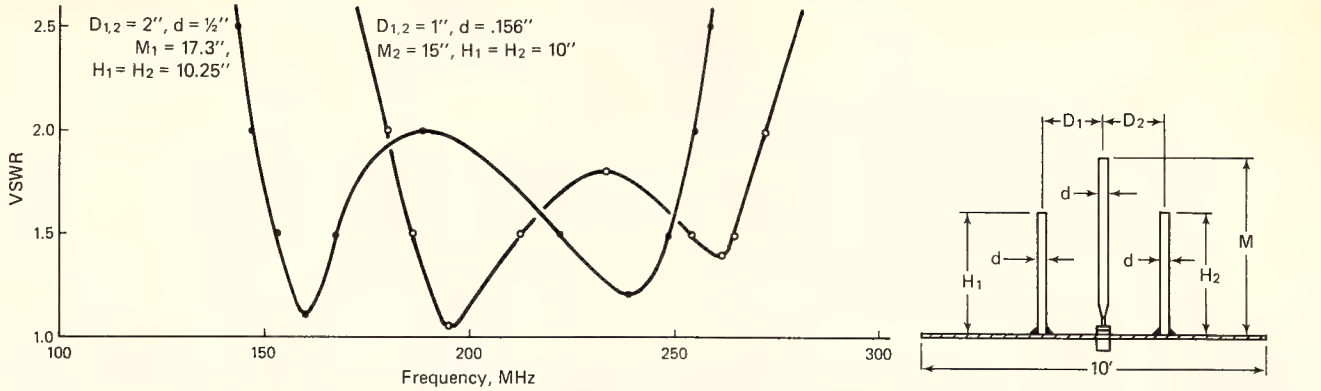


Fig. 8– V.s.w.r. curve of the 195 and 260 MHz modeled antenna. A variation in construction using ½ inch O.D. tubing and 2 inch separation is also shown.

tenna structure by 1.6 so that the lowest frequency is 140 MHz gives overall dimensions of 8.2 inches wide, 1.8 inches thick, and 32.6 inches long. This would permit coverage from 140 MHz to 249 MHz under 2.5:1 v.s.w.r.

A broadband antenna presented by Dave Geiser, WA2ANU, in December 1978 *QST* and the ARRL *Antenna Book*[5] is the discone for 144, 220, and 420 MHz. Although it has a higher cutoff frequency, the lowest frequency, which determines the maximum dimensions, is 140 MHz. For comparison, its overall dimensions are 22.563 inches in diameter by 20 inches tall. Although the discone covers a much broader frequency range, the open-sleeve dipole, because of its long, slender geometry, should lend itself more readily as a driven element in more complex antenna structures such as Yagis and corner reflectors. In fact, Telex Communications, Inc. has applied for a patent on the use of open-sleeve dipole elements in Yagi-Uda arrays. They also have a product called the Explorer 14, which utilizes this application in a triband Yagi beam.

The Open-Sleeve Monopole

Although the studies of the open-sleeve antenna by King and Wong concentrated on applications of the open-sleeve dipole at v.h.f. and u.h.f., the earliest studies of the open sleeve by H.B. Barkley in June 1955 dealt with the open-sleeve monopole.[6] Barkley's MSEE thesis for the U.S. Naval Postgraduate School contains the results of an investigation into the properties of the open-sleeve monopole.

The open-sleeve monopole had previously been patented by Dr. J.T. Bolljahn of Stanford Research Institute and was issued patent no. 2,505,751 in May of 1950. During the fall of 1954 it was suggested to Mr. Barkley that the open-sleeve antenna would be a possible subject of investigation for an 11-week industrial tour with Stanford Research Institute from January through March 1955. Barkley's paper contains the results of this investigation.

The basic principles of the open-sleeve monopole are the same as those of the open-sleeve dipole. The form of the open-sleeve monopole is shown in fig. 7.

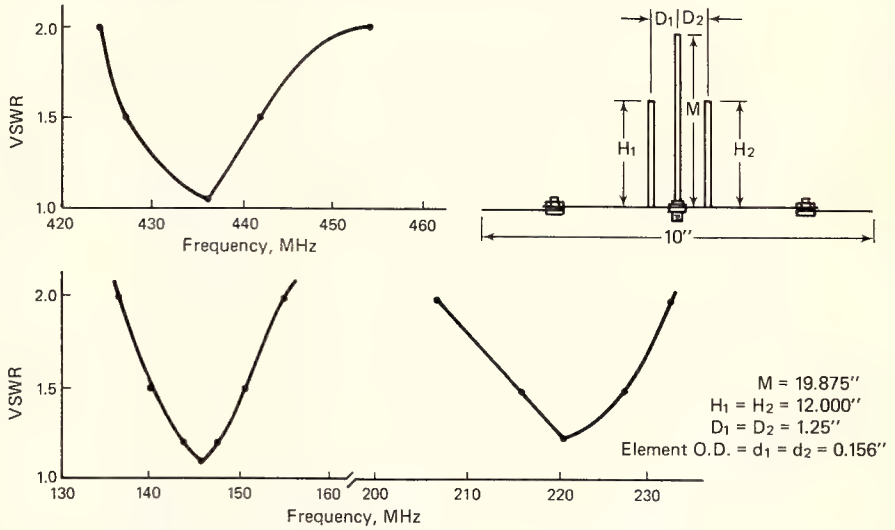


Fig. 9– A third variation of the test antenna. This version tunes 2, 1¼, and ¾ meters.

The longer central driven element controls the low-frequency resonance, and the shorter sleeve elements control the high-frequency resonance. The diameter of the elements controls the maximum v.s.w.r. between the two resonances. In all cases sleeve elements are grounded.

Tests on the V.H.F. Open-Sleeve Monopole

I constructed three v.h.f. models of the

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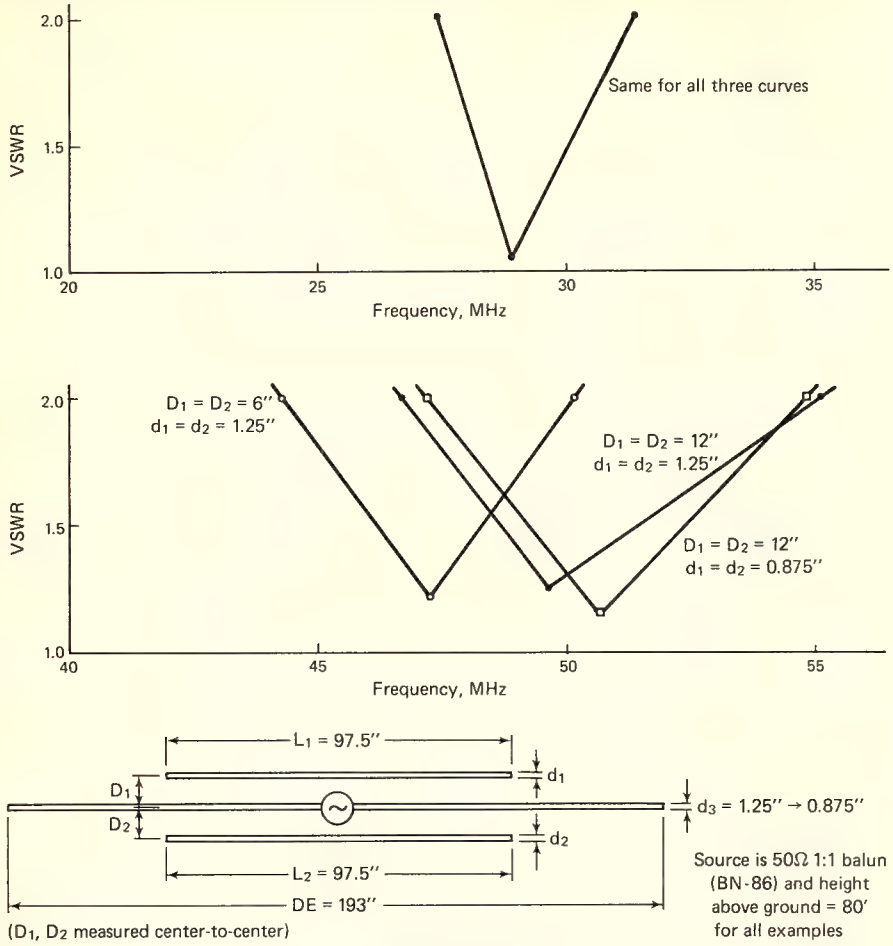


Fig. 10– The v.s.w.r. curves for three different configurations using the same sleeve length of 97.5 inches.

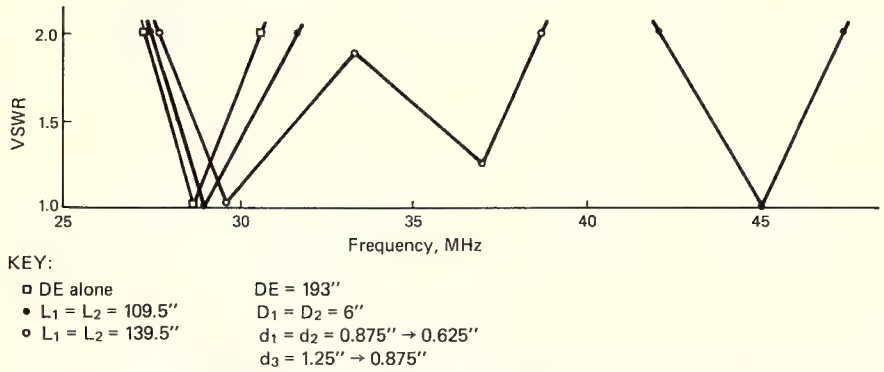


Fig. 11– The effect of lengthening the sleeve elements while maintaining a constant spacing and relatively constant element diameter.

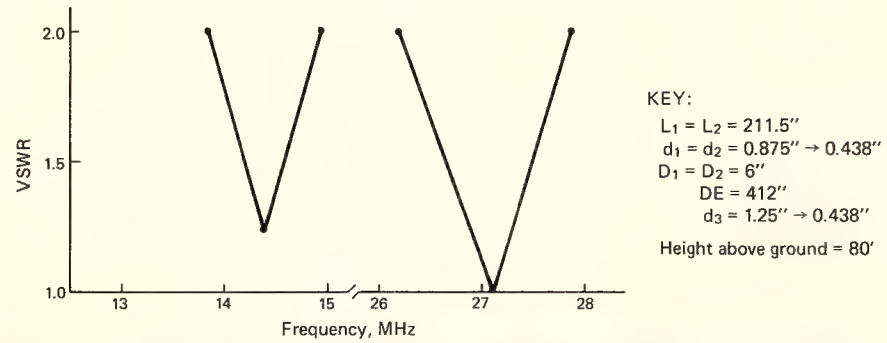


Fig. 12– The results of a model using a central dipole resonant near 14.3 MHz.

open-sleeve monopole to test. The first model consisted of a 15 inch length of 5/32 inch O.D. brass tubing soldered to the pin of a type "N" chassis connector. The connector was attached to a flat copper sheet that measured 10 feet square. Its ¼-wave resonance occurred at 195 MHz. Two 10 inch lengths of the same tubing were soldered to the copper sheet at a separation of 1 inch from the central element. The resultant antenna showed resonances at 195 and at 260 MHz with v.s.w.r. less than 2:1 from 180 to 272 MHz. The v.s.w.r. is shown in fig. 8. Another model using ½ inch O.D. tubing and 2 inch separation is also shown in fig. 8. A third model tuned for the 2, 1¼, and ¾ meter amateur bands is shown in fig. 9. The antenna behaves as a quarter-wave with low-angle radiation on 2 and 1¼ meters. However, the ¾-wave resonance is used at 436 MHz with resulting high-angle radiation. If the central monopole is tuned higher in the 2 meter band, the ¾ meter v.s.w.r. will be better within the 440–450 MHz region.

H.F. Open-Sleeve Applications

The broadband potentials of the v.h.f. or u.h.f. open-sleeve antenna are obvious. Not so obvious is its potential for broadband or multiband use at h.f. (3–30 MHz).

In the investigation by King and Wong it was found that larger diameter elements enhanced the broadband characteristics of the open sleeve by lowering the maximum v.s.w.r. between the resonance of the longer driven element and the resonance of the shorter sleeve elements. With a ratio of the element diameter to the maximum length of the dipole (d/l) at 0.055, the maximum v.s.w.r. between resonances was 2.5:1. With a ratio of d/l at 0.017, the maximum v.s.w.r. between resonances was 4:1. I assumed that even smaller ratios would give even higher values of midband v.s.w.r. I also assumed that the two separate resonances would remain intact, each with a bandwidth typical of the element diameter used.

My first h.f. models of the open-sleeve antenna were open-sleeve dipoles in the transition region between h.f. and v.h.f. My central dipole was a center-fed dipole element mounted on a metallic boom, fed with a BN-86 balun, and resonant near 29 MHz. The sleeve elements were chosen so that the 2:1 frequency range would not be exceeded.

Fig. 10 shows curves of three different configurations using the same sleeve length of 97.5 inches. The sleeve elements were of a constant diameter, whereas the driven central element used tubing which tapered from 1.25 inches at the center to 0.875 inches at the tips. The different configurations of the sleeves did not have a noticeable effect on the v.s.w.r. at 29 MHz.

Fig. 11 shows the effect of lengthening

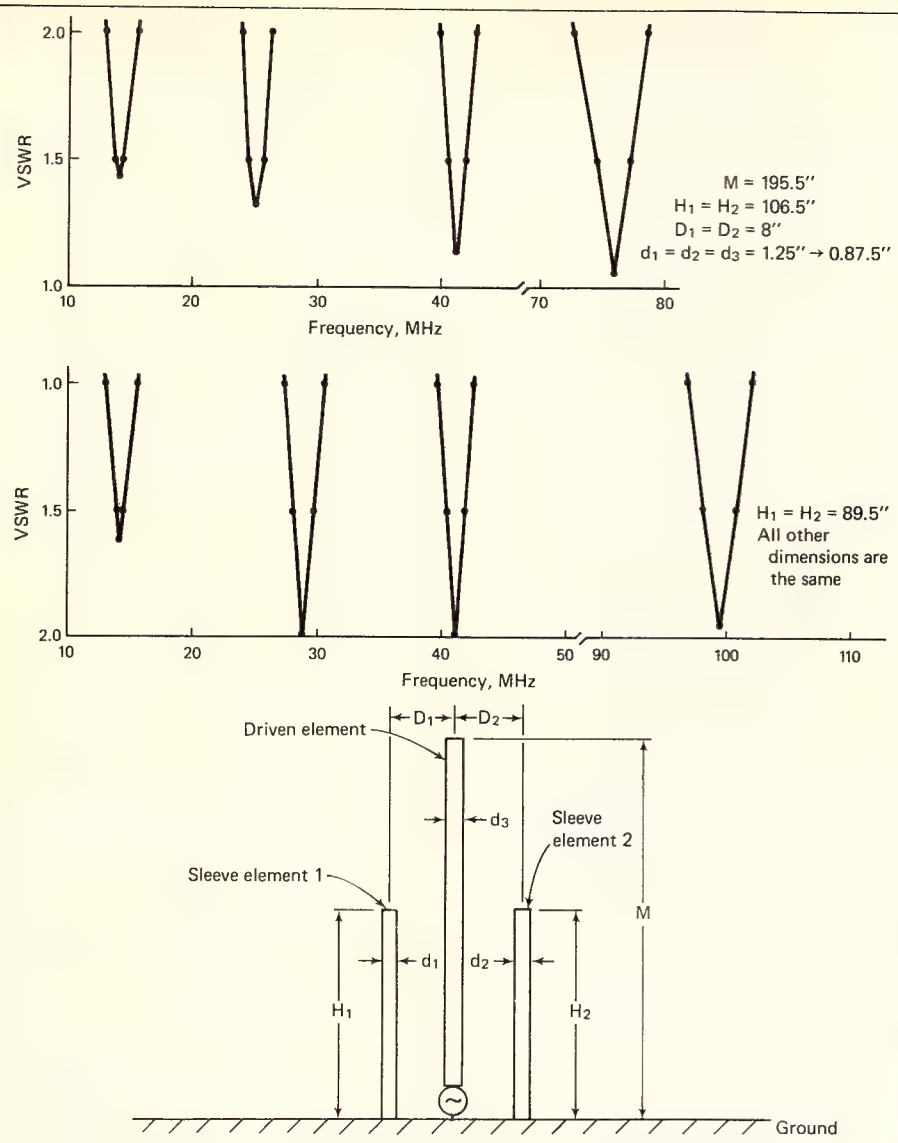


Fig. 13– Diagram of an open-sleeve monopole. The plot shows the v.s.w.r. of two configurations using a central monopole resonant near 14 MHz.

the sleeve elements while maintaining a constant spacing and relatively constant sleeve-element diameter. As one can easily see, the v.s.w.r. curves merge together as the sleeve lengths approach that of the central element. This could allow multibanding of frequencies too closely spaced for conventional traps. This could also be used to broadband h.f. antennas where low v.s.w.r. is required over a frequency range too broad for conventional dipole elements.

Fig. 12 shows the results of a model using a central dipole resonant near 14.3 MHz. The sleeve lengths were chosen at random using the 2:1 criteria established earlier. A slightly shorter sleeve length should make a perfect 20 and 10 meter antenna, whereas longer sleeve elements could make 20/12, 20/15, or 20/17 meter multiband antennas.

Although I have not tried lower frequencies, it should be possible to make open-sleeve antennas for the 40/20, 40/30, 30/20, 30/15, 30/17, 80/40, and 160/80 meter bands. Unique triband configurations should work on 40/30/15, 40/20/15, or 40/17/15 using the central dipole as 3 half waves on 15 meters.

The open-sleeve monopole was also modeled on h.f. Fig. 13 shows the v.s.w.r. of 2 configurations using a central monopole resonant near 14 MHz. One configuration used sleeve elements resonant at 25 MHz (12 meters). It also had ¼-wave resonances near 41 and 76 MHz. The other model used sleeve elements resonant at 29 MHz, with corresponding ¼-wave resonances near 41 and 100 MHz. The h.f. open-sleeve monopoles were ground mounted with 8 radials, each 12 feet long, buried slightly below ground level.

Summary

Even though the open-sleeve antenna has been in existence since the early 50s, I feel as though I have discovered an entirely new and exciting antenna. In a way it is new to the amateur community. Why, in over 30 years of existence, no amateur has put its simplicity and broadband capabilities to work, I do not know. But I do know that with the current popularity of broadband no-tune transceivers, a new broadband antenna will not be overlooked for long.

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Parallel Verticals

A Broadband Antenna Covering Six Bands Without Traps

BY ROBERT H. JOHNS*, W3JIP

In fig. 1, a 25 foot vertical made up of three separate elements is shown. The antenna is resonant on 80, 40, 30, 20, 15, and 10 meters with low s.w.r., and does not have any traps in it, only one loading coil. The bandwidth is unusually broad on all bands from 7 MHz on up.

Parallel dipoles have been successfully used in the past to get multiband operation without traps, but parallel verticals have not been widely used by amateurs. They make a very effective antenna. By clustering three vertical elements into a triangle, a sturdy, tower-like structure is produced. The antenna in fig. 1 is built from ½ inch steel electrical tubing, EMT, held in place by insulator rings cut from PVC pipe. Both of these are readily available and not expensive. The absence of any traps in the antenna makes it easy to build and tune.

Operation

Each of the three elements is resonant on two bands. The 40 meter quarter wave is top-loaded by three capacity loops which shorten its length down to 25 feet. It is also a ¾-wavelength radiator on 15 meters. The 30 meter element also works on its third harmonic, 10 meters. The 80 meter element has a large loading coil located at the top of a quarter wave for 20 meters. This coil acts as a high-impedance choke on 14 MHz, cutting it off from the rest of the antenna on 20 meters. This gives the same result that a trap would do, but no capacitor is used with the coil, and the inductive reactance of the coil, 3000 ohms, is high enough to effectively separate the quarter-wave base section from the rest of the antenna. This coil is also enough to inductively load the 25 foot element so that it resonates in the 75–80 meter band. Top capacity is used on this element also, giving it a fairly wide bandwidth—about 75 kHz at the 2:1 s.w.r. points—considering its restricted height.

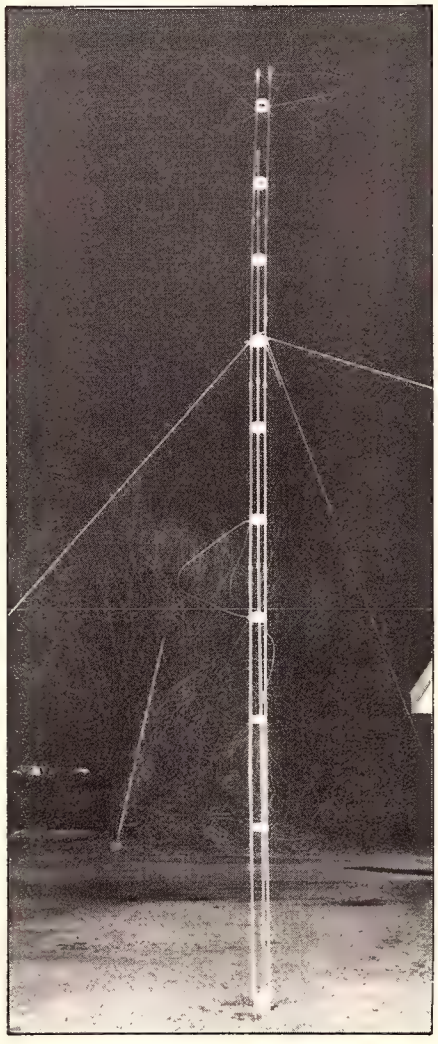


Fig. 1– The six-band vertical uses no traps. Instead there are three separate elements, each resonant on two bands. The capacity "hats" keep the height to 25 feet.

The harmonic operation of an antenna is not a routine matter if a low s.w.r. is desired. If a half-wave dipole is cut for 7.1 MHz, the third harmonic resonance will *not* occur at 21.3 MHz; it rather will be well above the 15 meter band. This is because the end of the antenna has capacity-to-free space, which makes the antenna electrically longer than its physical length. The antenna is really shorter than a half wavelength. On its third harmonic, the end quarter waves are shortened by the end capacity, but the inner wavelength is not. You have to raise the frequency to get three shorter half waves to resonate on this antenna.

In order to get 15 meters to resonate on this vertical, where the end capacity effect is greater, some extra side capacity is added one third of the way up the antenna. This lengthens the part of the antenna where the inner two quarter waves have a voltage loop, and lowers the resonant frequency down into the 15 meter band. Two side capacity loops are used on the 40 and 15 meter elements and only one on the 30 and 10 meter elements.

Capacity loading to shorten an antenna has a big advantage over inductive loading: it doesn't reduce the bandwidth. In this antenna, the three parallel elements together with the loops at the sides and top make a very thick effective radiator, and the resulting bandwidths are very broad.

*3379 Papermill Rd., Huntingdon Valley, PA 19006

Say You Saw It In CQ

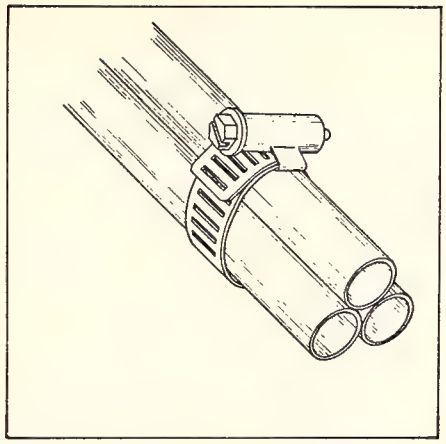


Fig. 2– Hose clamps are used to hold three lengths of steel EMT tubing together so that holes for attaching them to the insulating rings can be drilled in the proper places. The holes need to be in the same plane in a single tube and at the same height on all three tubes.

Tuning

The 75 meter antenna can be tuned by spreading the two capacity loops at the top. With the two together, resonance is near 4 MHz, and when they are spread apart, the antenna tunes just below 3.8 MHz. For 80 meter operation, add some wire straight up. With two more feet to the height of the element it tunes to about 3.6 MHz.

With the dimensions given in fig. 8, the 20 meter element is tuned to the top of the band. It can be lowered in frequency by adding a few inches to the wire between the coax connector and the element, or with a small capacity rod about a foot long attached to the top of the 20 meter section at the insulating ring just below the coil. This is visible in fig 1. Bending this rod outward lowers the frequency on 20. Thirty meters can be tuned similarly.

Forty, fifteen, and ten meters are so broad that you won't need to adjust for different ground conditions or your favorite part of a band. The side loops can be pushed together on 15 meters or the single one folded in on 10, if you do want a tuning adjustment.

Construction

The ½ inch EMT is available from hardware and discount stores, but an electrical distributor will have it at a better price. Nine 10 foot lengths are needed. With some care match up three lengths that will be side-by-side in the antenna so that the antenna will be straight when assembled. If the differences in length are more than an eighth of an inch, equalize them with a hacksaw. The lengths needed are shown in fig. 8, as well as the location of the holes to be drilled in the tubing. All the holes are 3/16 inch in diameter. The insulating rings are 30 inches apart and 15 inches from the ends of the EMT tubes, except at the base.

Fig. 3– The lengths of EMT are bolted to the insulating rings with 3/16 inch (#10-24) bolts. The loading coil for 80 meters is wound on a thick-walled PVC pipe which is a good fit over the ½ inch EMT. Notice that the coil connections are not made to the antenna by the through bolts that bolt the form to the tubing, but rather are made by separate self-tapping screws into the steel for a positive electrical contact.

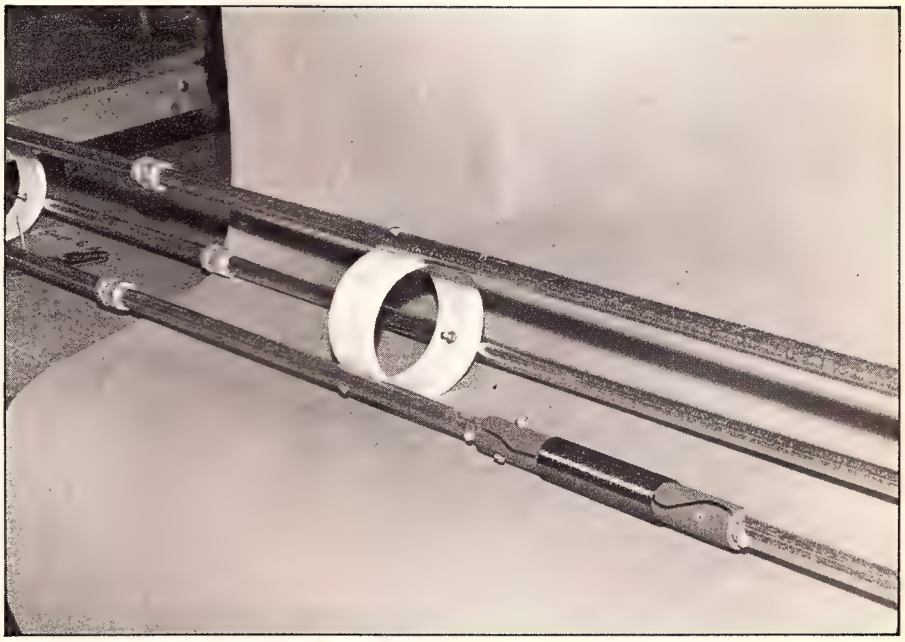




Fig. 4– The base insulator with the SO-239 coax connector mounted on it and wires connecting to the elements. The bolt below is for a ground connection and the radials. A shallow hole can be dug for the base to sit in, or the base can sit on level ground.

The holes in the EMT must be parallel to one another in each length of tubing. To help in laying them out correctly, strap three lengths together with two 1½ inch hose clamps, as shown in fig. 2. This will hold them in place and prevent them from rotating while you measure, mark, and center punch for the holes to be drilled. A rubber band wrapped around the tubes will help locate holes in the same place on all three tubes.

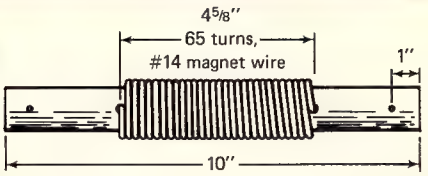


Fig. 5– Dimensions and hole locations for the 80 meter coil and form. The coil is ¾ inch PVC pipe, schedule 80.

The insulating rings, 2 inches long, are cut from 4 inch PVC pipe, schedule 40. This is available from plumbing and swimming-pool suppliers. The base insulator is 4 inches long. Three 3/16 inch holes are spaced equally around each ring. Measure and lay out these with some care so that the elements will be straight after they are bolted to the rings. See figs. 3 and 4.

Details of the coil for the 20 and 80 meter element are given in fig. 5. The thick-walled schedule 80 PVC pipe for the coil form is harder to find than schedule 40 pipe, but it is worth phoning around for since it is a good fit around ½ inch EMT. The ¾ inch schedule 40 pipe can be used if necessary.

The base insulator in fig. 4 has a 5/8 inch hole drilled in it for the SO-239 coax connector. File a flat on the outside of the insulator so that the connector will lie flat against it. Solder three wires to the inside of the connector to run to the base of the elements. The connector will also need weatherproofing.

The 10 foot lengths of antenna can be built anywhere, but the final joining of the sections will need a smooth, level surface. I suggest assembling everything

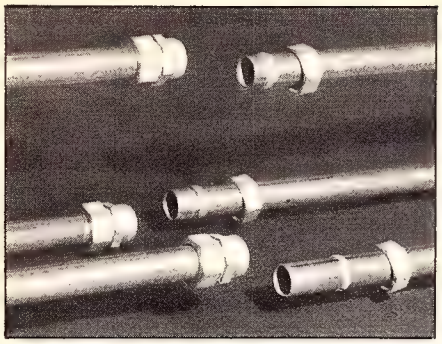


Fig. 6– The EMT compression couplings in place ready to join two sections of the antenna together. A split ring will be trapped between the sleeve and the large nut and forced into the EMT, actually cutting grooves into it. A very strong joint results.

loosely at first, both the couplings and the nuts and bolts. This will permit some twisting and adjusting of the elements to get them straight.

The compression couplings are easy to use if they are disassembled and the nuts and split inner rings put onto the two EMT pipes to be joined, as in fig. 6. The pipe ends then slide easily into the coupling sleeve. Remove any cutting burr first. For final tightening of the joints, use large wrenches or arc joint pliers and tighten with a lot of force. The compression couplings are very strong. They are subject to compression and tension in the antenna and do not have to resist much bending. Such short sleeves could not provide much stiffness.

With the top of the assembled antenna on a chair or stepladder, the top loops can be installed (see fig. 7). The top insulators are made from a ½ inch PVC slip-cap and a 4 inch length of ½ inch PVC SDR pipe. This type (SDR) has thinner walls than the schedule 40 pipe and is used because it makes a good fit over ½ inch EMT. Place the cap over the pipe and drill a 3/16 inch hole near the edge of the cap. When the bolt that holds the top loops in place is tightened, the cap and pipe flatten to make a tight grip on the element. Make sure the bolt isn't touching the element; it should be an inch or so above it.

The capacity loops are all the same size, each made from a 6 foot length of #9 galvanized steel wire. This is a hardware item that is sold in 50 foot rolls for clothesline and dog runs. It is difficult to cut. If your pliers won't cut through, make as deep a notch as you can and then bend the wire sharply at the notch and it will break there. The loops are held to the antenna elements by the 3/16 inch bolts that hold the EMT to the insulator rings. Bend eyes (small rings) into the ends of the loops that will fit around the 3/16 inch bolts. The longer 2 inch bolts and washers are used where the loops attach.

The EMT and the #9 wire have a good galvanized coating and should last for many years. Places where that coating

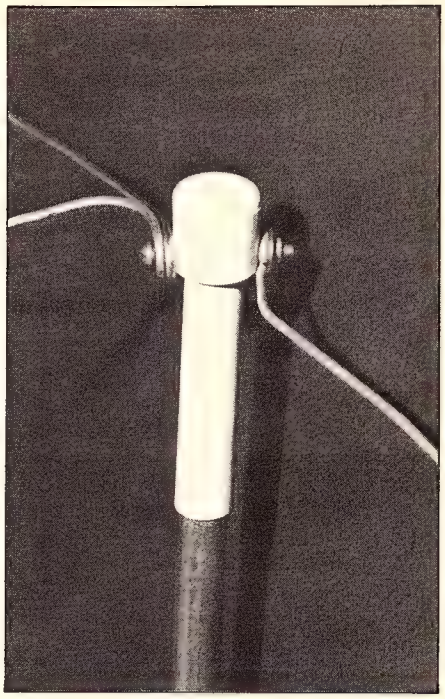
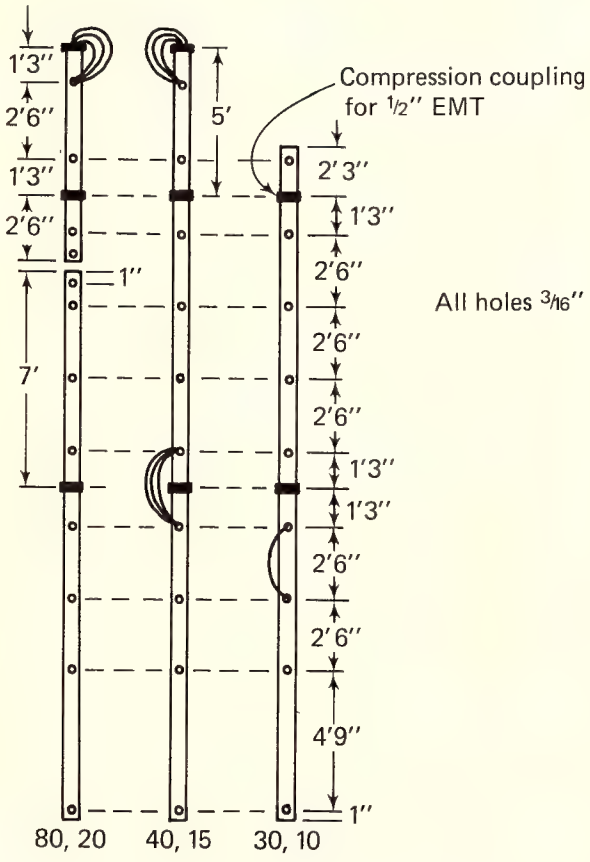


Fig. 7– An insulator cap that supports the capacity loops at the top of the antenna. This one, with three loops bolted to it, is on the 40 meter element. The ½ inch PVC pipe is a good fit over the EMT, provided it is the thin-walled type, SDR. The ends of the #9 wire loops have been bent into small circles to fit over the 3/16 inch bolts, and washers have been used under the bolt head and the nut.



Quantity	Material
90 ft.	½" EMT, electrical tubing in 10 ft. lengths
6	Compression couplings for ½ EMT
26	1½" long, #10-24 bolts, with nuts and lockwashers
8	2" long, #10-24 bolts, with nuts and lockwashers
2 ft.	4" PVC pipe, Schedule 40
10 in.	¾" PVC pipe, Schedule 80
10 in.	½" PVC pipe, SDR
2	½" PVC slip caps
1	SO-239 coaxial cable connector
40 ft.	#14 copper magnet wire
560 ft.	wire for radials, any
16	washers, 3/16"
2	1½" hose clamps
5	solder lugs, for #14 wire, 3/16" hole
50 ft.	#9 galvanized steel wire
1 qt.	plastic roof coating

Table I– Parts for the six-band vertical.

Fig. 8– Location of the holes to be drilled in the EMT. All of the holes are 3/16 inch and pass through both walls of the tubing. The drilling will go better if you have a new, sharp, good-quality, high-speed drill bit.

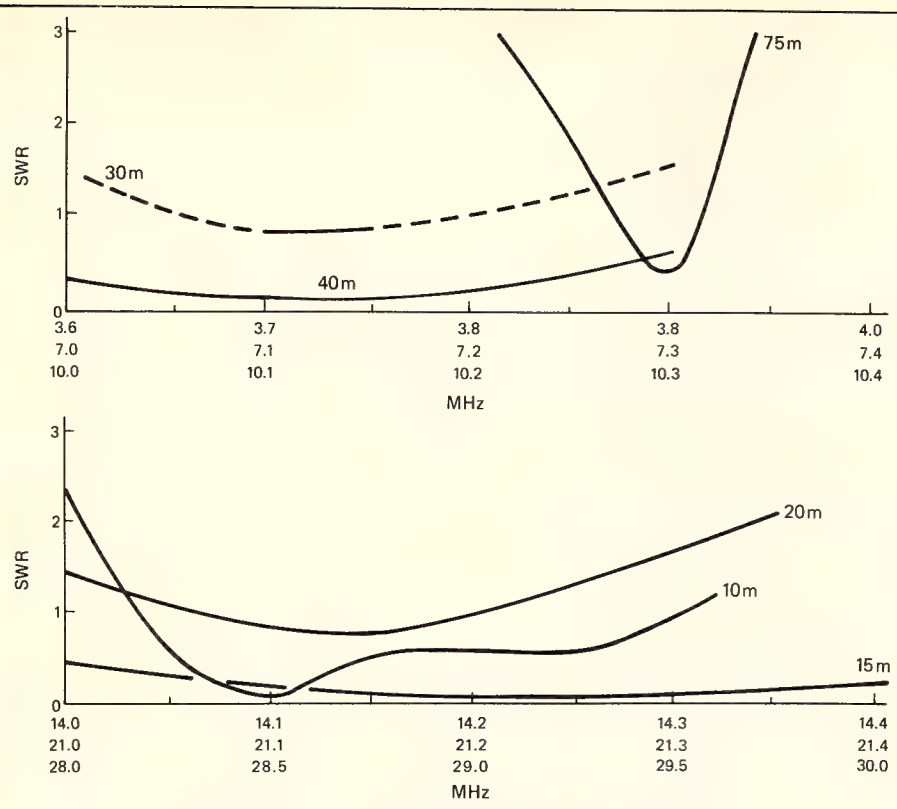


Fig. 9– S.w.r. curves for the six-band vertical.

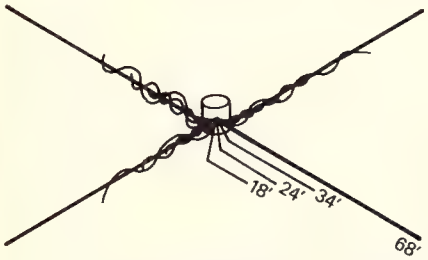


Fig. 10– A set of radials for the six-band vertical. The radials for 30 and 40 meters are also resonant on 10 and 15, so only four wires are needed in each "leg" of the radials. If you don't have the room to run them out straight, bend them and wind them around your property. Any type of wire may be used for the radials, and they can be buried or laid on top of the ground. If insulated wire is used, the four-in-one leg can be twisted together as shown above. The ones shown straight are just to indicate the lengths to use.

has been lost, such as holes or cuts, will need protection. I recommend coating each nut and bolt and coupling with an undercoating or a roof-patching compound. These adhere to metal and stay somewhat flexible and waterproof. Coax-Seal® is also a good choice for a sealant.

Radials

A vertical antenna fed at a current loop must have a good ground system to work against. Four radials, each with four wires, as shown in fig. 10, will do an adequate job, but a larger radial system will do even better. Aim for a good system, with 50 to 100 wires, and put out a good low-angle signal that will work DX. Consult an antenna handbook for a discussion of radials. Fig. 9 shows the s.w.r. curves for the six-band vertical when used with a proper radial system.

Guys

The antenna may be supported by a tree or the side of a house with good results. The best installation, however, will be in the clear away from interfering objects. It will need guying, just below the coil, as shown in fig. 1. Quarter inch or larger nylon or polypropylene rope is good and will not require insulators. Watch out for nylon stretching, especially in wet weather. Phillystran guy cable, of course, would be ideal. If you must use wire guys, install insulators every few feet, especially near the antenna.

The complete antenna weighs about 40 pounds and can readily be put up by a large person. By butting the base against a tree or building, you can simply walk it up to a vertical position and carry it upright to the installation point. If a helper isn't available to tie the guys, you can secure two guys and raise it against them by lifting and pulling the base in under the rest of the antenna. Once all the guys are tied, the vertical can be raised and lowered for adjustments quite easily this way without loosening the guy ropes.

Several of the features shown in this antenna are the subject of a patent application. Amateurs are welcome to build the vertical for their own use, but manufacturers are cautioned that all rights under the Patent Code will be strictly enforced. A complete antenna is available from Barker & Williamson, 10 Canal St., Bristol, PA 19007. See their ad in this issue.

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CIRCLE 54 ON READER SERVICE CARD

CQ REVIEWS:

The Flesher TU-170A RTTY Terminal Unit

BY LEW MCCOY*, W1ICP

Many years ago when I was working at the ARRL, I was assigned the job of building a terminal for transmitting and receiving RTTY. The unit I built was a tube job, and it was very cumbersome to say the least. What with computers and solid-state devices, amateur radio RTTY has come a long way since then. The Flesher TU-170A RTTY terminal unit described in this review is an outstanding example of these advances. Compared to that early tube version of mine, the TU-170A is about one-quarter the size and does about ten times as much. The TU-170A is available in either kit or wired form. I elected to wire the kit version.

Among the amateurs who use computers in conjunction with their amateur stations, particularly for RTTY work, the Flesher name is quite popular and their units are in wide use. This is not to imply that the unit described here cannot be used with any TTY unit. It can. It is just that this reviewer became familiar with the Flesher products through other amateurs using computers—particularly TRS-80's®. (And, incidentally, my testing of the TU-170A involved the use of a TRS-80® Model I.)



This is a front-panel view of the TU-170A. At bottom left is the power switch, followed by the standby/operate, the send/receive, the reverse send, and reverse receive switches. At the upper right are the LED indicators described in the text.

Constructing the Kit

The TU-170A kit that I wired consisted of the main board and chassis, two plug-in filter units, a plug-in demodulator board, and an AFSK board. There are separate manuals for the different boards, five in all. That may sound like a lot, but it isn't. There is a manual for the main board and cabinet, another for each of the filters, one for the demodulator, and the other for the AFSK board. All the construction books are extremely clear and use the conventional, step-by-step, check-off wiring procedure. Nothing is left to guesswork, and a neophyte can easily wire the project correctly. I must admit that as clear as the manual is, I goofed. I wired in one diode backwards, and it took about an hour of troubleshooting to find it!

Wiring time for the complete unit, main board and others, was about five or six hours. Board and component quality is excellent and I have nothing but praise for the kit—with the possible exception of the circuit diagram. It takes a little studying to follow the diagram simply because the unit is in sections (main board and plug-in units). It would be nice to have one complete diagram rather than to trace the multi-terminal connectors. However, I suppose this is a technical writer's criticism more than anything else. As I said, it is an excellent kit, and the construction manuals are very clear.

Circuit Description

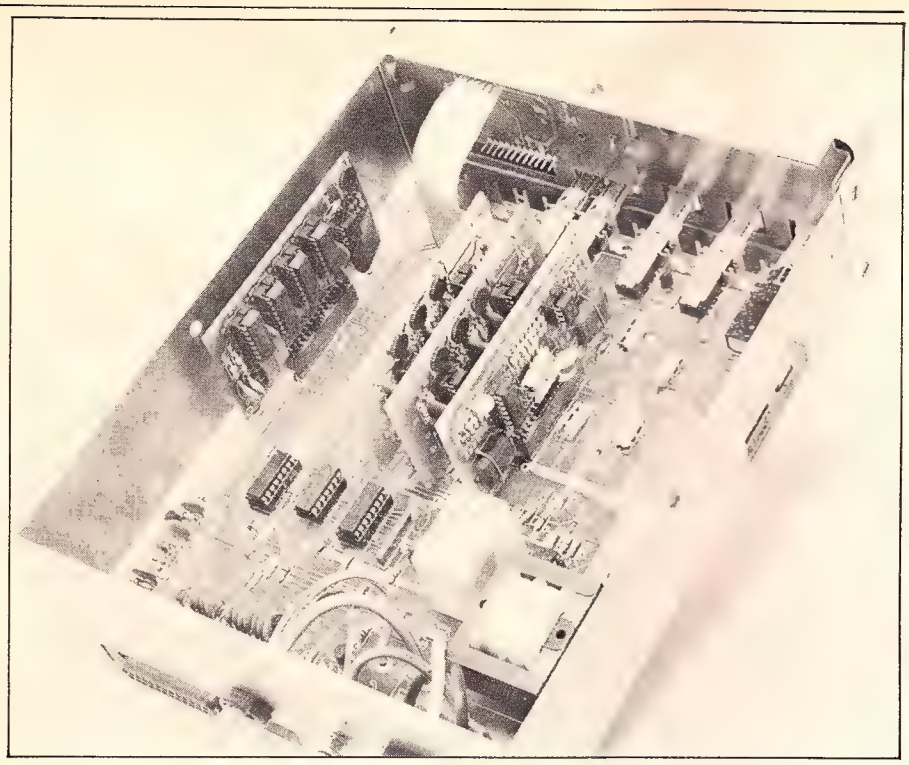
The TU-170A is set up so that several active filters can be used, depending on the keying shift desired. This kit was provided with two filters: one was wired for 2125 Hz and the other for 2295 Hz, which are the commonly used amateur mark/space frequencies. However, the filter boards can be set up when wired for other frequency shifts. The frequencies include 2125, 2295, 2550, and 2975 Hz. Each of the active filters consists of three stages of two-pole, active bandpass filters. Each stage is a low-gain low-Q stage, which wnen cascaded with the other two stages results in a very highly stable, high-Q filter.

The first filter stage consists of one half a dual op amp, the second filter using the second half of the op amp. Another half of a dual op amp is used for the third filter stage. Each filter stage is peaked independently by a potentiometer.

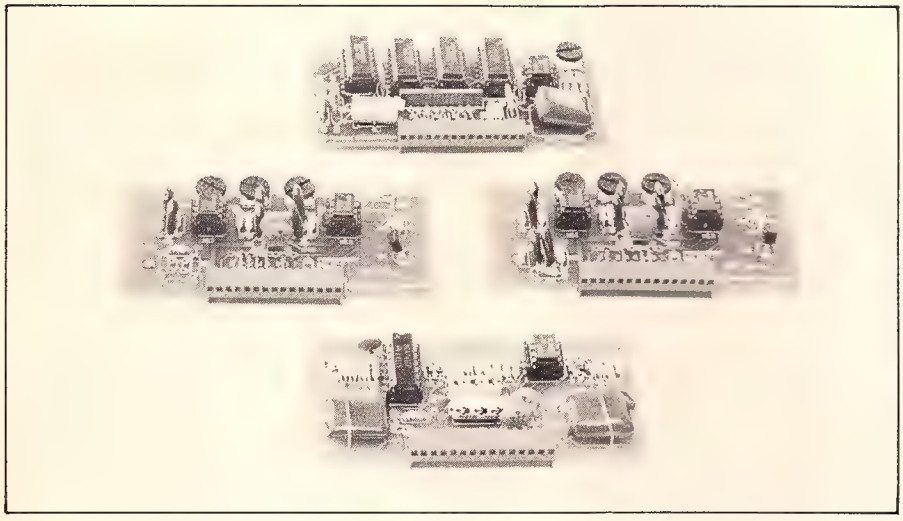
On the filter board tuned to 2295 or 1445 Hz, an additional phase shift network is formed by an RC network. This network provides additional delay of the signal passing through the filter to pro-

*Technical Consultant, CQ, 200 Idaho St., Silver City, NM 88061

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The interior view of the TU unit clearly shows the plug-in boards. At right is the demodulator board, next at the left are the filter boards, and near the far wall is the AFSK board. At the lower right is the power transformer; next to it is the auto-start relay.



Shown here at the bottom is the demodulator board, above it are the two filter boards, and at the top are the AFSK boards.

vide proper phase relationship between the mark and space signals to give a proper plus-shaped oscilloscope pattern which may be used for tuning.

The Demodulator Board

The TU-170A Demodulator consists of a discriminator stage, low-pass filter section, signal-balance restorer circuit, slicer and mark hold circuit. The output of the discriminator circuit is a pulsating d.c. voltage of a polarity determined by the dominant filter signals (mark or space). Output from the discriminator is fed to an active low-pass filter, one using an op amp. Filter output is then fed to the signal balance restorer. This circuit essentially corrects for any signal level differences between the mark and space filter outputs. The output of the signal balance restorer provides a bias voltage which will center the output levels of the low-pass filter at the input of the slicer. The slicer stage, utilizing an op amp, is a positive feedback- or hysteresis-type slicer. As such, it has a dead band which is determined by the ratio of two resistors and will only change state when the input voltage exceeds the hysteresis level. This circuit prevents low-level signal fluctuation from generating erroneous output signals. Also, a mark/hold circuit returns the TU output to the mark state any time a space

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signal is longer than the normal space pulse width should be.

Audio Frequency Shift Keyer Board (AFSK)

The TU-170A AFSK board utilizes a crystal-controlled oscillator, a programmable frequency divider, and a bandpass filter which provides a sinusoidal audio frequency output in the range from 2000–3000 Hz (Hi-Tones). For a time base, a 5.508 MHz crystal oscillator is used. The oscillator is connected to the input of programmable dividers—three 40193's. The output of the last divider is a symmetrical square wave which is connected to a low-pass filter designed to have a flat response in the range of 2000–3000 Hz (Hi-Tones).

Main Circuit-Board Details

The main circuit-board logic consists of the input and output circuits necessary to interface the various plug-in circuit boards just described to the front-panel controls and peripheral equipment.

There are various inputs to the main board. The KEY-IN input switches the AFSK to the downshift CW ID frequency when the TU is in the transmit mode. This is a TTL compatible input.

AFSKIN-TTL input signal causes the AFSK to switch between mark and space frequencies when the TU is in transmit. AFSKIN-TTL is TTL compatible.

AFSKIN-RS input also provides the determination of the mark or space output frequencies when the TU is in the transmit mode. This signal is connected through an IC and is wired OR'ed with the AFSKIN-TTL signal.

SEND-N controls the operating mode of the TU. The SEND-N line is left open or held at +5 volts when the TU is in the receive mode. When SEND-N is pulled down or at a low TTL level, the TU is switched to the send mode.

RECEIVE AUDIO input signal is the signal from the receiver audio output circuit which contains the audio-frequency-shifted TTY signal. Minimum audio input level must be 100 millivolts.

RDA (Receive Data Available) output indicates the presence of an output signal from the mark filter.

DMOUT-TTL output is derived from the demodulator circuit-board output.

DMODOUT—RS is a demodulator output that is a bi-polar signal.

SCOPE MARK and SCOPE SPACE are also available outputs.

Front-Panel Displays

As with any TU, one of the primary concerns of the RTTY operator is "How easy is it to tune-in a TTY signal?" With the tuning indicators on the TU-170A I found it extremely simple to tune-in signals correctly. First, there is a 10-segment LED bar-graph signal indicator which displays the output level of the filters. Also, there are two LEDs for the mark and space signal. (In the SEND mode, these LEDs indicate the presence of mark and space signals on the AFSK input.) It is easy to tune-in signals with these indicators.

There is a power indicator to show when the unit is turned on or off. Additionally, there is a SEND LED that shows when the TU is in the send mode, and last, there is an RDA LED which indicates when a signal is present and the autostart relay is on.

Additional Details

The TU-170A is packaged in a gray metal case 7½″ × 3″ × 10″. It has its own a.c. supply, 120 v.a.c. at 5 watts. The main connector on the back of the case is a chassis-mount DB25 (female). And (I consider it a nice touch) Flesher includes a DB25 male connector in the kit so one doesn't have to go berserk trying to find the suitable connector.

In my setup I used the TU-170A in conjunction with the Crown ROM-116 and the TRS-80®. My exciter (transceiver) is a Drake TR4CW. The Drake drives a 1 kw amplifier. The combination worked very well and the TU-170A was faultless. Used in conjunction with the ROM-116, the system was everything I could ask for.

The TU-170A is made by Flesher Corp., 507 Jackson, Topeka, Kansas 66603. The price is $189.95 kit, $289.95 wired.



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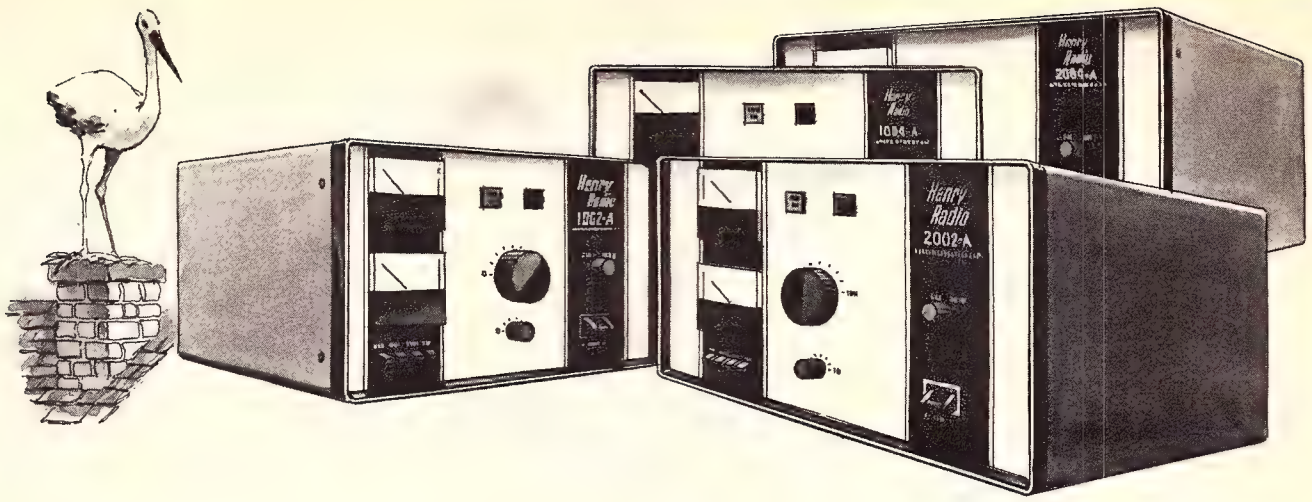
NEW Model 2MCV-5 "Super-Trombone"™ — Same advanced features as the basic 2MCV but a full wavelength taller with additional "Trombone"™ phasing section for additional gain. Height: 15.75 ft/4.8 meters.

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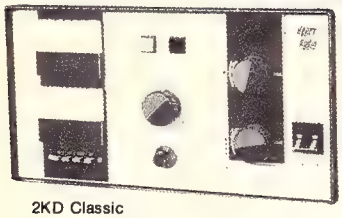
2. the 2004-A is identical to the 2002A except that it is set up for the 430 to 450 MHz band. This amplifier will use a ½ wave strip line and offer all of the same specifications as the 2002A. This will replace our limited production 2004. The 2004-A . . . $1295.00

3. the 1002-A is a 2 meter amplifier with the same design as the 2002A, except using one 8874 tube for ½ power specifications. The 1002A is rated at 600 watts PEP output and 300 watts continuous carrier output. It employs the same strip line design as the 2002A. The 1002-A . . . $795.00

4. the 1004-A . . . a half power version of the 2004A – using again the 8874. The 1004A will cover the 430 to 450 MHz band using a ½ wave strip line design. The 1004-A . . . $895.00.

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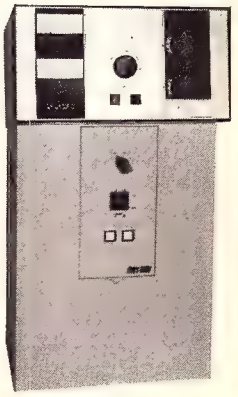
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K4JZB reports on his "V" beam experiments and shows us how to roll our own.

Development and Construction of "V" Beam Antennas

BY ROBERT F. ZIMMER*, K4JZB

The antennas to be described here are often mistaken to be log-periodic antennas. They are not. They are "V" antennas, ½-wavelength "V's" both parasitic and driven. I have been using them for over 10 years. I also have a three-element tribander, plus four-element monobanders for 14 and 21 MHz.

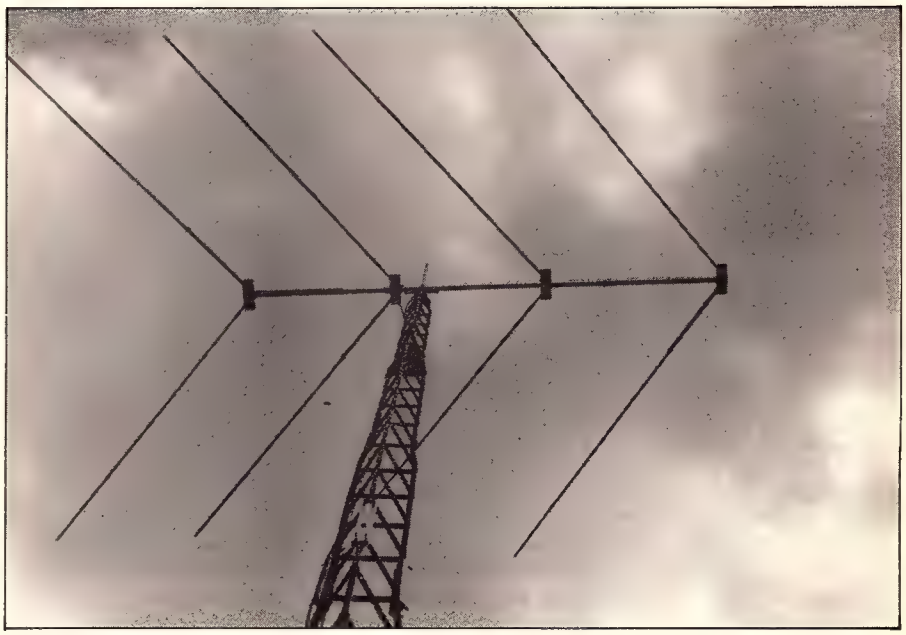
I started off first by bending the antenna elements forward 40° to determine if the reported 3 to 5 dB additional gain actually could be realized. The first antenna was a two-element antenna with both elements of equal length (fig. 1). This proved two things: (1) that front-to-back ratio could be obtained, and (2) that good forward gain could be achieved. They both were justified in this design.

Next I lengthened one element by 5% (fig. 2). This proved to be very beneficial and will out-perform three-element Yagi beams. These antennas were used on 21 MHz s.s.b. and were evaluated on short haul (1,000 miles), medium haul (3,000 miles), and long haul (10,000 miles plus). They were tested at heights from 5 to 50 feet and with output powers from 60 to 600 watts p.e.p.

I then built a three-element broadband antenna for 28 MHz (fig. 3). It was installed 24 feet up and aimed due west. With only 60 watts p.e.p. output, I was able to work VK's when they were only hearing west coast stations.

On January 27, 1982 I got caught with my antennas down when Martha, 3C0AC, came on. With the aid of my wife, the antenna shown in fig. 2 was hauled up on the roof and installed on the tower 24 feet up. I pointed it toward Africa and got 3C0AC on the first call through a terrific pile-up. This all took place in a half-hour period.

The next antenna to be described in this series is a four-element one. It has three driven elements plus a reflector on 21 MHz. It has been up since February at a height of 50 feet and has done a terrific job. I have had many inquiries about it from stations I've worked all over the



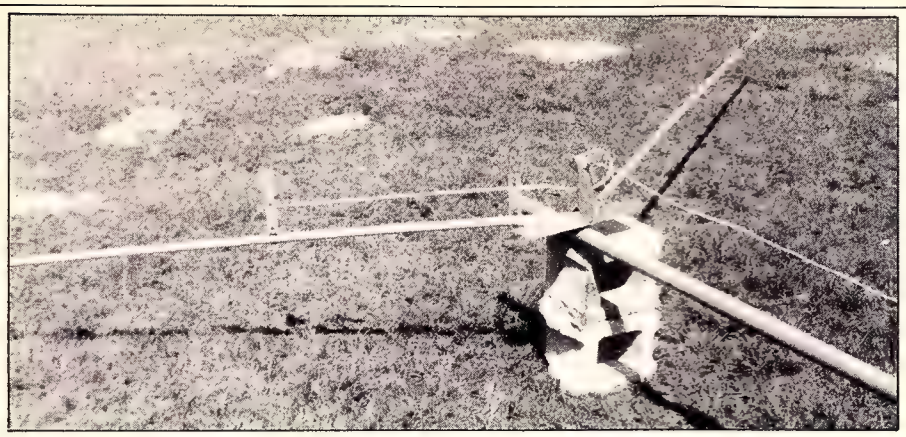
The 4-element version with 4 foot spacing between DE1, DE2, and DE3, 12 dB gain.

The 10 meter antenna ready to be put up on the tower.



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Note that the inner part of RG-8U is slid into the ⅜ inch Gamma rod to adjust s.w.r.

BAND	REFL	DE_3	DE_2	DE_1	DIR
20	424″	404″	400″	346″	376″
15	284″	270″	267″	264″	252″
10	210″	200″	196″	192″	182″

Table I– Element lengths.

ELEMENT SPACING	REFL TO DE_3	DE_3 TO DE_2	DE_2 TO DE_1	DE_1 TO DIR
20	8′	2′	2′	8′
15	5½′	2′	2′	5½′
10	4′	2′	2′	4′

Table II– Element spacing.

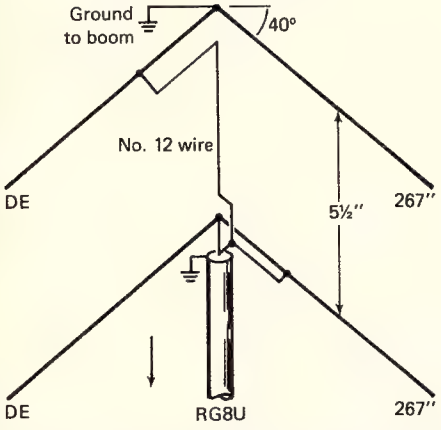


Fig. 1– This was constructed to test the theory of "V" beam operation. It proved forward gain and front-to-back ratio.

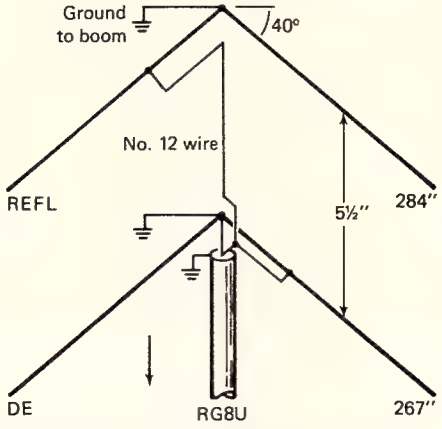


Fig. 2– This is a very good beam with 6.64 dBi gain. The front-to-back ratio is about 25 dB on 21 MHz.

world. I get reports of S-9 plus 10-20, to even pegging the "S" meter, to being the only "W" coming through.

When the elements are formed into a "V" there are two problems to be solved: the element mounting plates and the joining of the two halves of the tubing. The photographs show the method used to mount the elements to the boom. The automotive muffler clamps used to mount the plates to the boom are painted to retard rust, so it is necessary to use an aluminum strap to ground the plates to the boom.

I have never been able to bend tubing with ordinary tools found in a home workshop, so I just put the tubing in a vise and flatten the center. This also makes it very easy to drill and fasten at the center to the bracket. The elements can be made from almost any size aluminum tubing available at a local hardware store. They all seem to stock from ½ to 1¼ inch sizes in lengths of 6 and 8 feet and are of the thickness necessary for telescoping.

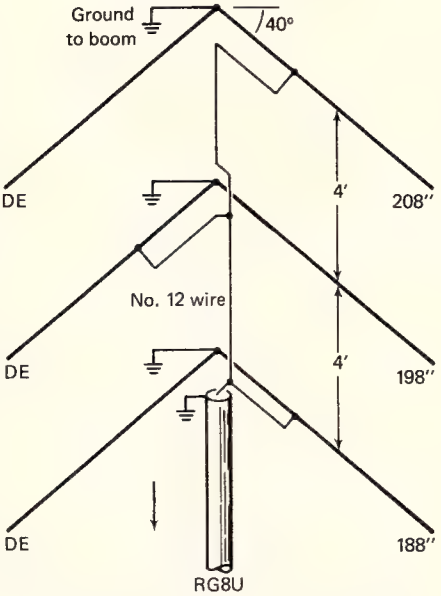


Fig. 3– The design shown in this diagram was used on 10 meters with 7.92 dB over the entire phone band.

BAND	GAMMA LENGTH	SPACING TO ELEMENT	CAPACITY
20	40–48″	6″	140pF
15	30–36″	4″	70pF
10	20–24″	4″	45pF

Table III– Dimensions of Gamma matches.

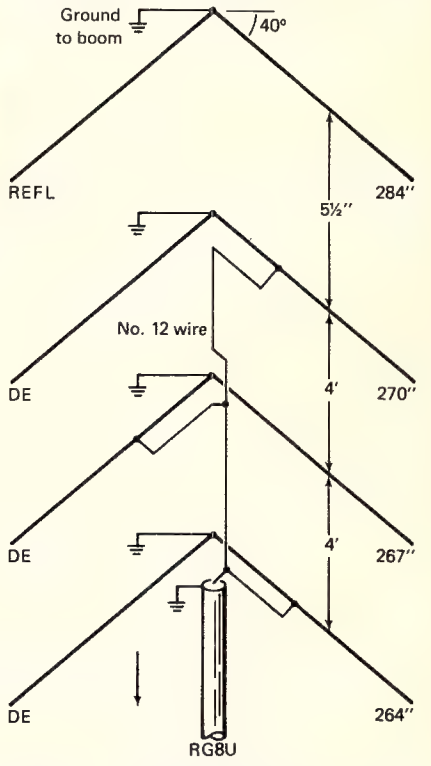


Fig. 4– This configuration is in use at present at K4JZB. It has a gain of 12 dB.

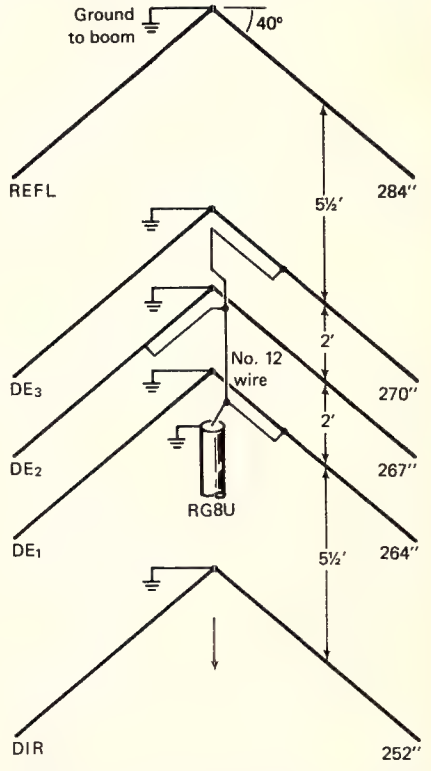
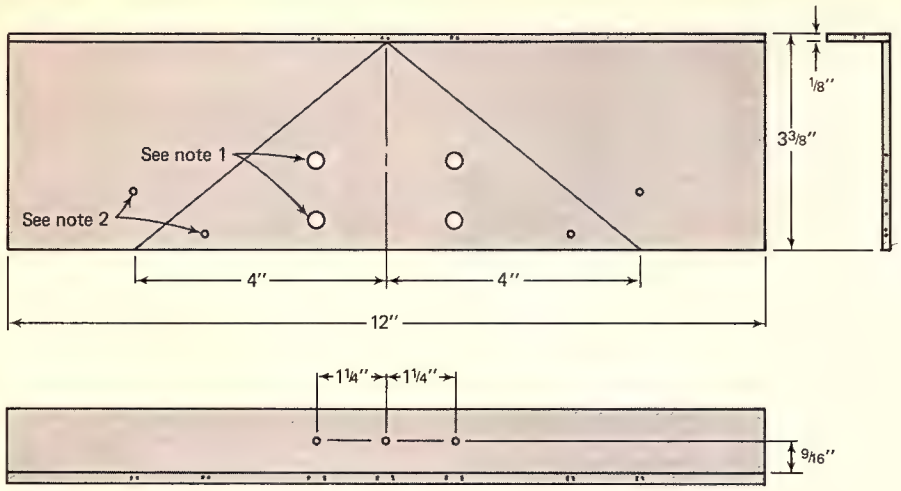


Fig. 5– Revised spacing results in 16 dB gain and sharper horizontal beam width.



NOTES:
1. These holes depend on boom size and size of clamps.
2. These holes, diameter and spacing depend on element size and clamps.

Fig. 6– Element-to-boom plate for 10 and 15 meters. Use two angle plates back to back as per the photos. For 20 meters use the stronger method as per the photos.

I have used 1 to 7/8 to 3/4 inch tubing for 10 and 15 meter beams, as well as 7/8 to 3/4 to 5/8 inch, and also 3/4 to 5/8 to 1/2 inch, all with equal success. For 20 meter beams one or two sizes larger are recommended. To fasten one size into another, I use stainless steel automotive hose clamps and slit the tubing end 1 inch long with two cuts at 90° to each other.

The booms used here are aluminum tubing 1 1/2 and 1 5/8 inches in diameter. I picked up the tubing as surplus after World War II, and they have been used and reused since that time. For the shorter booms TV masting can be used very effectively.

One nice thing about these antennas is that they take a shorter boom. The antennas shown in figs. 3 and 4 were also used with spacing between driven elements (DE) of 2 feet as shown in fig. 5. These would have a boom length in fig. 3 of 4 feet and in fig. 4 of 9 1/2 feet. This would make a very compact beam for 10 and 15 meters.

I could not ascertain any great difference between the 2 foot or 4 foot spacing. The main thing to watch for is to have each adjoining element out of phase to the other. This is necessary to have the gain additive. I recommend the 4 foot reflector spacing for 10 meters, 5 1/2 foot spacing for 15 meters, and 8 foot spacing for 20 meters.

The element mounting plates (use two together) are used and inverted as per the photographs. The feedline between elements is No. 12 copper wire. This is preferred over coax cable. The only precaution is to be sure that the center of each element is well grounded to the boom.

The antenna in fig. 6 has an added di-

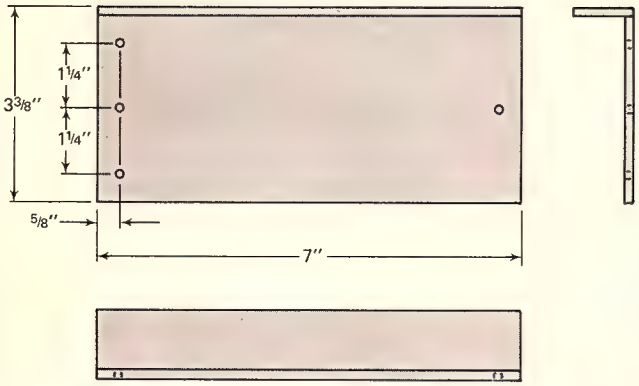


Fig. 7– Use the same angle plate for feedline support. It mounts at a right angle to the element plate.

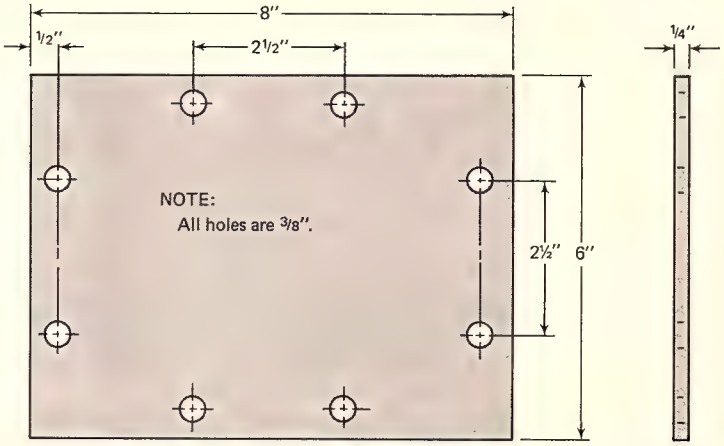
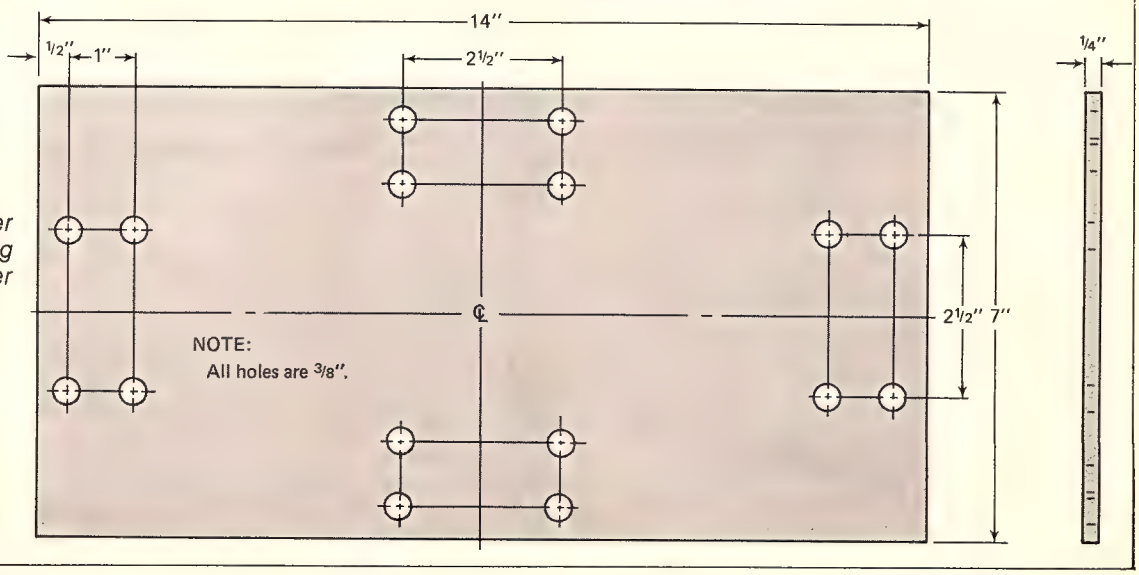


Fig. 8– The 10 and 15 meter boom-to-mast mounting plate for 2 inch boom diameter and 2 inch mast diameter.

Fig. 9– The 20 meter boom-to-mast mounting plate for 2 inch diameter boom and mast.

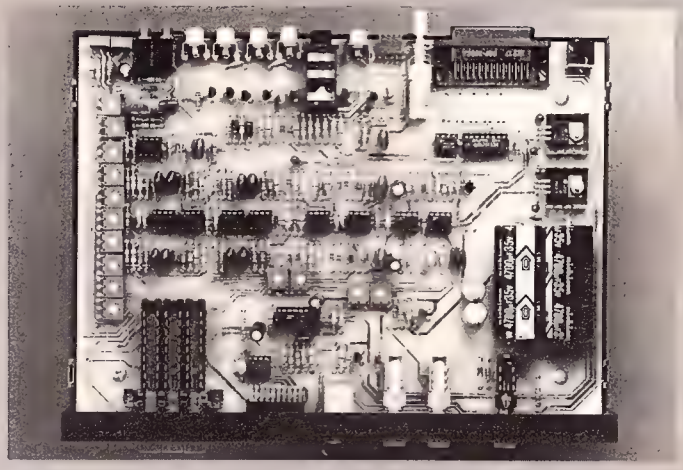


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The CP-1 offers variable shift capability in addition to fixed 170 Hz dual channel filtering. Auto threshold plus pre and post limiter filters allow for good copy under fading and weak signal conditions.

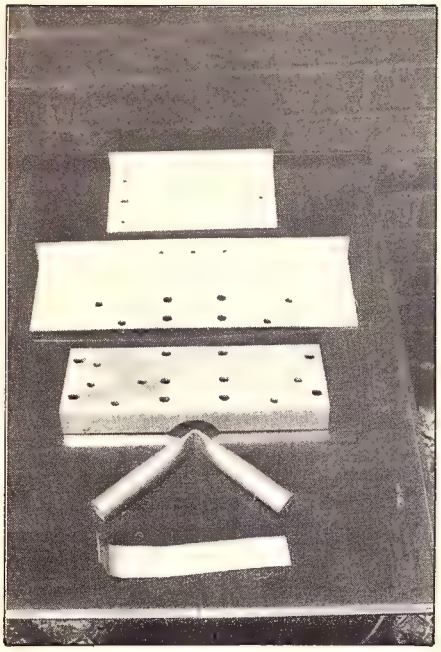
Transmitter AFSK tones are generated by a clean, stable function generator. Plus (+) and minus (-) output jacks are also provided for CW keying of your transmitter. An optional low cost RS-232 port is also available. The CP-1 is powered with 16 VAC which is supplied by a 117 VAC wall adaptor included with the CP-1.



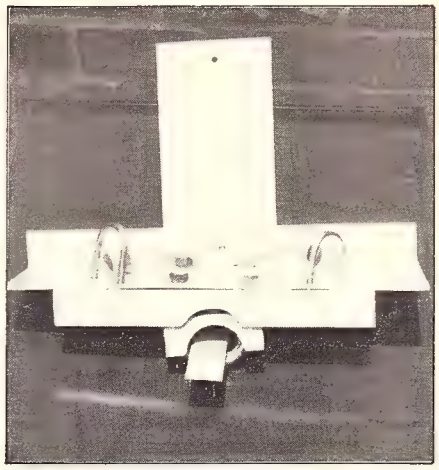


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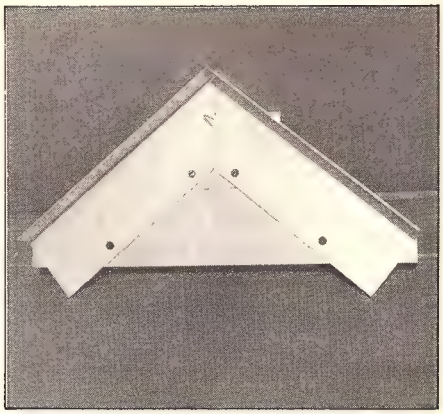
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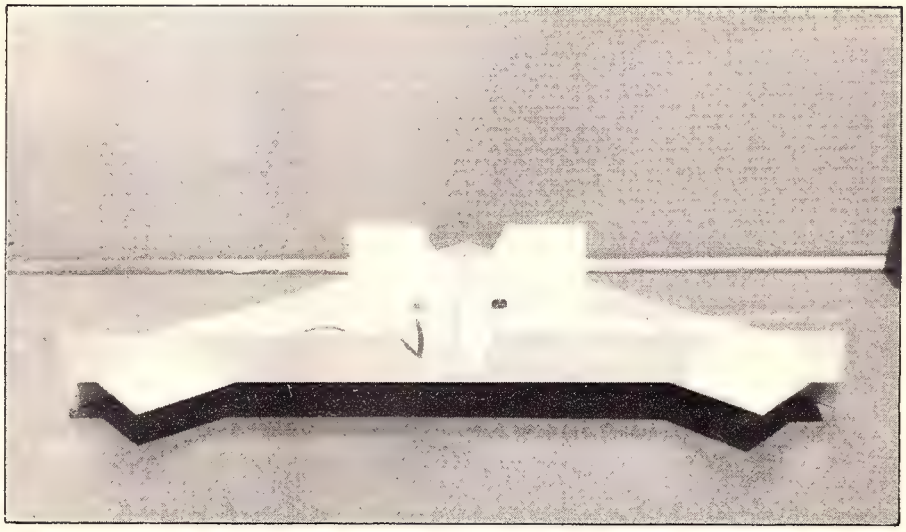
Element mounting brackets used on 10 and 15 meter beams.



Here the bracket is assembled and ready to go on a boom.



Brackets used on 20 meters are much heavier due to larger and longer elements. They are each 12 inches long.



Note the double construction. This is the bottom view.

rector which sharpens the beam width and greatly increases the gain. With the antenna pointed at VK land, the ZL stations cannot be heard. The direction must be changed 8° south of west to bring them in, and the VK's are lost at that time.

The mail I received from my first article in the January 1983 issue of *CQ* indicates that more information is needed about the construction and adjustment of Gamma matches. I trust the following information will be helpful.

I have used many different Gamma matches over the years. The one used now is made from ⅜ inch aluminum tubing, spaced 4 inches from element, shorted at far end to the driven element. Into the center is slid RG-8U coax which has the outer covering and shield braid removed. This makes a fine capacitor which seems to hold up very well in all climates.

To adjust the Gamma, I vary the shorting bar first to get the lowest s.w.r., and then vary the coax capacitor to lower the s.w.r. even further. When it has reached 1.5 to 1 or lower, I stop, as more time spent here does not seem to pay. When multiple driven elements are used, Gamma matches must be adjusted as a group—i.e., each one must be the same.

Each antenna has a critical angle of radiation, and at that angle the gain is maximum. At other angles the antenna will not exhibit its full gain.

I have found from use that multiple driven elements have a lower angle of radiation than parasitic beams. This is evident in the "W8JK" and "ZL Special" beams. The driven beams show their higher gain over longer paths. Also, the driven beams work more effectively at low heights. I have never found a Yagi that would work very well at heights of less than 40 feet, while the driven "V" antennas have proved to work well at 12 and 14 feet above ground. This is a bonus for those who do not have a 50 to 70 foot tower, as a lower-priced structure will work.

From on-the-air use I have concluded that tilting the elements forward 40° results in a 1 db additional gain per element. Adding more driven elements adds 2.64 db per element. I have figured the gain of each antenna many times over a long period of time and at various distances, and I have included this information in the drawings. CQ



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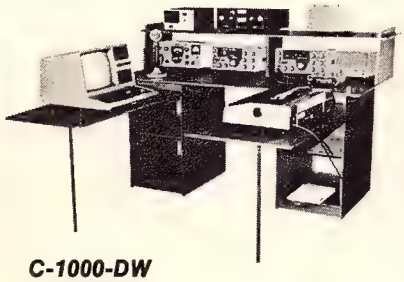
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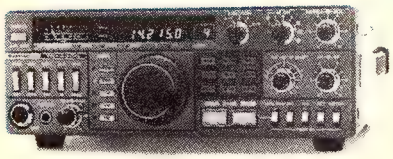
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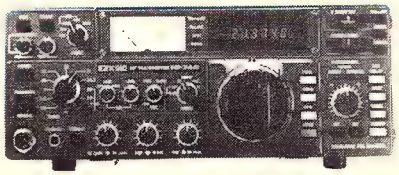
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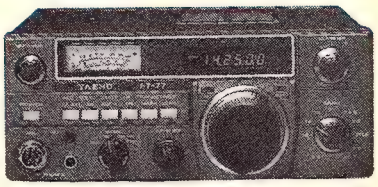
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AI6V	1,863,708
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KQ8M	1,807,542
K4CG	1,420,826
KQ9L	1,190,624
WI4R	1,029,216
WA0TKJ	1,001,784
KF2O	938,950

28 MHz

K6SVL	308,460
NN6U	303,739
N3DAY	287,946
WD0ASM	166,413
W0GOR	163,030

21 MHz

NO4J	866,866
KU8V	690,897
WB6FCR	653,184
KV0K	535,952
K1KJT	491,904

14 MHz

AI7B	1,162,458
W8LU	1,039,280
KC0MB	325,254
WB7WQE	302,510
K3ND	126,800

7 MHz

K9MWM/0	296,468
KR2Q	292,608
K7UR	237,896
AG9S	221,844
K8NA	212,544

3.8 MHz

KJ9D	158,098
KU8E	97,500
N4OH	97,364
KB5FU	92,448
KE9U	60,048

1.8 MHz

WA2SPL	29,524
AA4MM	11,800
K1KNQ	6,466
WA9EYY	5,238
KG7D	928

MULTI-SINGLE

KB1H	1,845,633
AK6A	1,771,740
N3GB	1,461,200
KK5I	1,149,057
KR9A	750,750

MULTI-MULTI

AB0I	5,635,860
K5LZO	2,741,640

QRPp

W8ILC	AB	204,120
W6CN	21	88,624
KH6CP/3	14	84,667
W9PNE	AB	60,006
AD2Y	AB	41,416

DX SINGLE OPERATOR ALL BAND

4M3AZC	5,549,634
H44R	4,303,760
I6FLD	4,052,862
SV1JG	3,627,615
9Y4VU	3,264,338
IO6NOA	2,794,469
XO7IN	2,543,550
WL7E	2,318,189
PP2ZDD	2,275,280
PY8ZWM	2,156,875

28 MHz

P42J	1,575,712
PY5BAB	1,291,209
EA8ZI	1,241,080
LU1ABT	1,117,611
CP6EL	1,115,604

21 MHz

OH0BH	3,983,972
SM2EKM	2,721,114
KP4EQF	2,635,512
LU2X	921,690
F6BEE	637,518

14 MHz

JH3DPB	1,053,812
PP8ZAT	550,020
EA3DFA	304,722
4C5AZ	242,592
GM4RFE	137,088

7 MHz

FM7CD	2,361,240
CQ4NH	1,207,338
EA7EL	853,512
VE5DX	814,657
HI8GB/6	489,984

3.8 MHz

HC1HC	504,678
NP4CC	406,386
CT4KQ	147,223
OH3WS	145,920
DF2IS	81,900

1.8 MHz

T32AF	16,872
VP2MO	8,190

MULTI-SINGLE

VE1DXA	7,417,257
VE6OU	6,267,891
JG1ZUY	6,226,493
XF0MDX	4,660,802
SL0ZG	3,370,200

MULTI-MULTI

VK2WU	7,058,808
VE2UN	1,987,980

QRPp

JK1QLH	21	101,703
JA9XBW	AB	67,727
JA9CRI	21	33,966
EA2SN	AB	30,240
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Note: Queries pertaining to the WPX Contest should be sent to Steve Bolia, N8BJQ.

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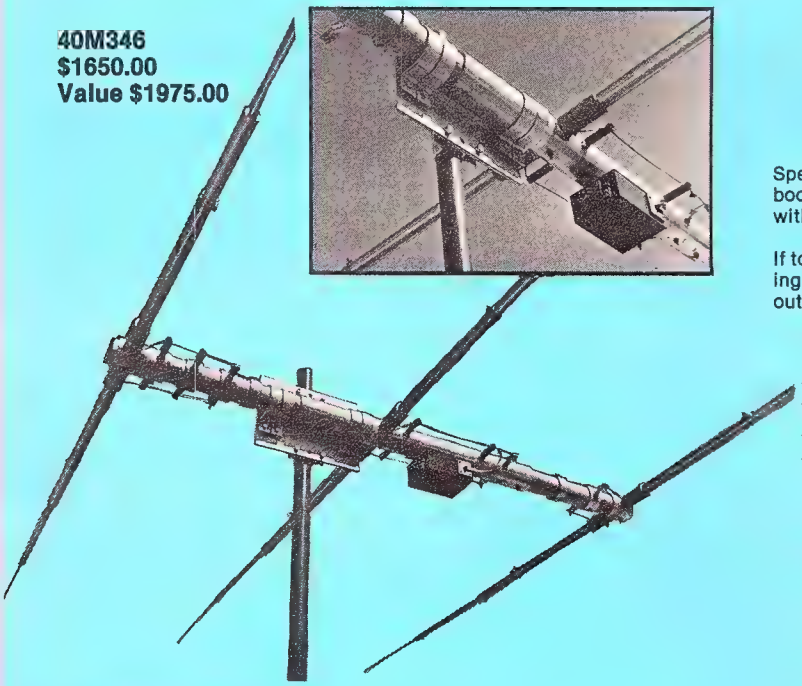
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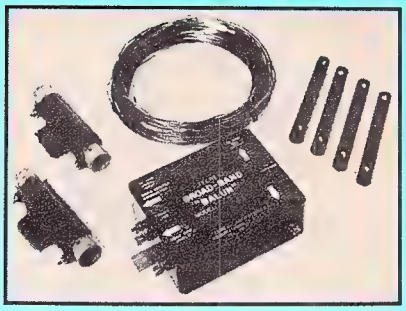
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Better than optimum full sized Dipole performance in an antenna which can be set up within the hour, needing a minimal support structure (existing tower, house, tree, etc.). The "Inverted-Vee" produces a low-angle "Balanced" Omni-Directional pattern, which increases the signal to noise, and signal to interference ratios. Complete simplified instructions are provided. NO TUNERS NEEDED!



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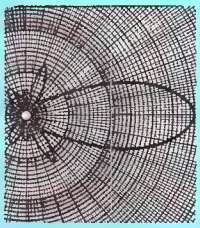
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Ingenuity and economical necessity make design engineers of us all. KA0MSI shows us how to make a gain antenna for 2 meters for under $4.00. It's also a good practical exercise for making simple plumbing repairs around the house.

Build A 2 Meter J-Pole Antenna For $3.98

BY JEROME T. MAGEE*, KA0MSI

I recently found myself in the position of being laid off and newly upgraded, so I had to watch my pennies. I have only one 2 meter rig—an old rock-bound Standard HT. From the shack I could hit the Denver area repeaters nicely, but on simplex I was limited to the immediate area.

Some of the locals had built 300 ohm twin-lead J-pole antennas which worked out fairly well in portable use, and that gave me the idea for building a sturdier version. An ideal (cheap) and widely available material for v.h.f. antenna construction can be found in your local hardware store—copper do-it-yourself plumbing hardware. A quick exercise with my calculator gave me the dimensions for this antenna using ½ inch ID (⅝ inch OD) copper tubing.

Copper tubing and all of the assorted fittings can be joined together simply by using a small torch. A few tips are in order before we proceed to the actual construction. Clean all surfaces to be soldered (both inside and out) to a high shine with emery cloth prior to any soldering. Use a dab of soldering paste on the surfaces to be joined, again both inside and out. Use solid solder, not acid or resin core. Heat the tubing and fitting with the torch until the solder *flows* into the joint, and then wipe the joint with a dry cloth (or fine steel wool). This makes a clean, nice, shiny connection, just like the pros.

Construction

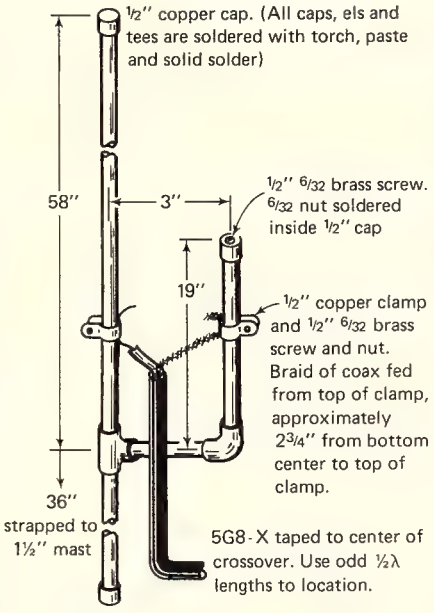
Fig. 1 shows how the antenna should look upon completion. Measure the driven element from the center of the Tee fitting to the top, including the cap. This dimension should be 58 inches. Tuning and adjusting of the antenna will be done with the 19 inch ¼λ section. Again, this dimension includes the cap.

The matching section is constructed of both brass and copper hardware. Partially this is done to keep down electrolysis and for the practical reason of availability. Drill a hole in the cap used for the ¼λ matching section large enough to pass a 6-32 screw. Solder one of the 6-32 nuts to the inside of the cap. The 6-32 screw then will "fine tune" the element.

First solder all of the caps on, followed by the Tee and Elbow fittings as separate units. Use a long table or planks with C-clamps to align the tubing. Make sure the elements are parallel and exactly 3 inches apart (center of one tubing to center of the other) before soldering the connecting nipple into the Tee.

The remaining 3 feet of tubing is then soldered into the bottom of the Tee as a mount. This bottom section can be hose-clamped to a standard 1¼ inch mast.

Strip one end of the coax. Leave about 1 inch of the foam insulation on the center conductor. Tin the ends of the braid and center conductor. Assemble the clamps (made from hangers). The coax is connected to the elements by the clamps in a pressure fit. The center conductor goes to the driven element and the braid to the matching section. From a center line at the midpoint of the Tee and Elbow, the top of the clamp measures 2¾ inches up. Tape the coax to the nipple (the small connecting piece of tubing) for support.



Parts List	Price
1 Elbow	$0.18
1 Tee	.35
3 Caps	.60
1 Pipe 10 feet	2.19
2 Hangers	.18
2 Brass screws ½ 6-32	.24
3 Brass nuts 6-32	.24
Total	$3.98

All hardware is copper-plumbing fixtures. The pipe is ½" ID stock (⅝" OD).

Fig. 1– The plumbing-school delight. This is a simple one-evening project that you can build for a few bucks and will put more punch in your signal.

Tuning

The antenna is tuned with a field-strength meter and an s.w.r. meter. Slide the clamps slightly up and down until the lowest s.w.r. and highest field-strength reading is achieved. This may take several tries. The 6-32 adjusting screw should be sticking up about ⅛ inch at this point. After you've reached a happy balance, adjust the tuning screw for minimum s.w.r. If this is done at ground level, you may have to adjust the antenna again once it is at operating height.

How Does It Work?

In actual practice, the s.w.r. over a 1.75 MHz range was essentially flat. The "action test" took place in my dining room where I compared a reference ¼λ antenna on my HT to the J pole. I called a station on the other side of town on simplex first with the little whip. He reported my signal as S-6. Switching to the indoor J pole, his aural S meter registered a 40 dB over S-9. My field-strength meter also confirmed a stronger signal with the J pole.

If I can abstract the apparent investment of $.88 per dB increase, it did make quite a difference and was certainly well worth the effort. CQ

*1391 South Holly St., Denver, CO 80222

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CIRCLE 147 ON READER SERVICE CARD

Here's another neat little idea that will help you out with those building projects. It's a simple piece of test equipment for finding the resonance of tuned circuits and quarter-wave stubs.

Build A Resonance Detector

BY RUDOLPH E. SIX*, KA8OBL

Finding resonance with a grid-dip oscillator has always been complicated due to the limitations of the instrument. The dials tend to be small, and a wide frequency range is packed on a small scale. There are usually several dips; the confusing part is trying to find out which is the right one. I started looking around for something simple and accurate to measure tuned circuits and quarter-wave stubs. My Hewlett-Packard TS-510 r.f. generator covered 10–400 MHz and had just enough output to drive a diode detector with a 50 microamp meter as the indicator (fig. 1).

This simple arrangement worked rather well, but something was needed for resonances below 10 MHz. The Heath IG-102 r.f. signal generator on the bench had a large dial and covered fundamentals up to 100 MHz. This unit is typical of these signal generators, but their output is limited to approximately 100 mv, not enough to drive a microamp meter directly. Since the detected signal is d.c., a simple op-amp arrangement was used to boost the signal enough to drive a meter. The diode works in the square-law region. In other words, twice the r.f. voltage across the diode results in a four-times increase across the meter; this makes resonance-dips nicely sharp.

The calibration on these signal generators is close enough for most purposes—tuned circuits with variable caps or tuning slugs—but for accurate work a frequency counter is needed.

Quarter-wave stubs presented a different problem. An open twin-lead stub picked up enough low-frequency noise to prevent sharp dips at resonance. The r.f. coupling cap was moved to the diode side to block the noise, and the low ends of the stubs were grounded. With coax the shield is connected to the r.f. source and the center wire to the detector, a self-shielding arrangement. This works extremely well even with large lengths of coax. Twin-lead does not have the self-shielding feature of coax, and large lengths (50 inches or longer) pick up increasingly more noise. Resonance is also influenced by nearby objects, thus making measurements on open-wire stubs more difficult and not as accurate as on coax.

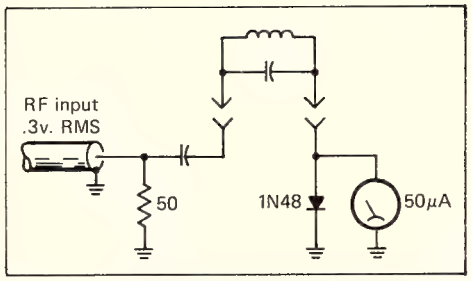


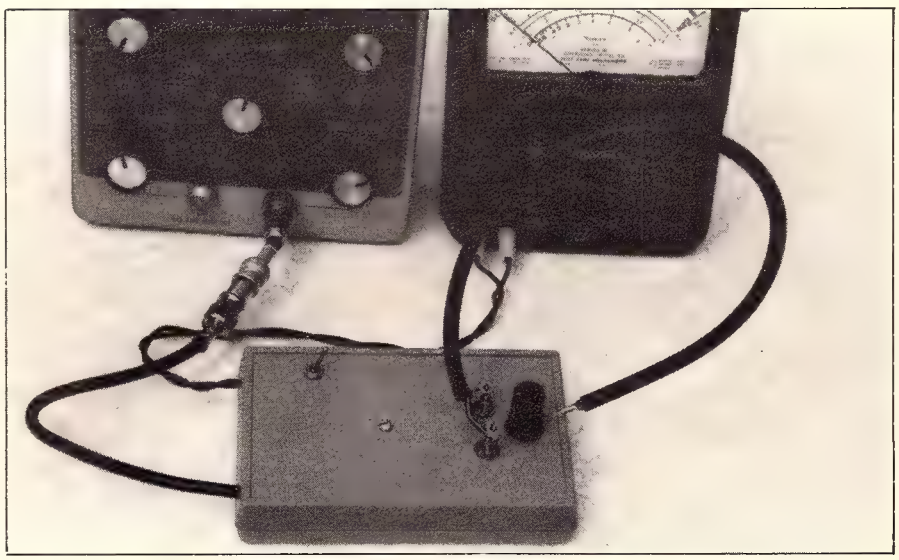
Fig. 1–A simple diode detector using a 50 microamp meter as the detector.

Construction

Fig. 2 shows the circuit assembled in a shielded enclosure made from a piece of copper-clad board and a bathtub capacitor shell. The existing capacitor holes, plus 2 extra holes that were drilled, were enlarged to fit three 500 pF feed-through caps which were soldered in. The coax r.f. feed comes through the fourth. Vector spring clips (Vector T-32A-1dp) were installed on the copper-clad board. The copper shield was removed from around the clips with a sheet-metal drill and an Exacto® blade. The op-amp was built on a small vector board with spacers. The whole assembly was mounted in a plastic case with two 9 volt batteries and power switch. A lot of unnecessary plugs were avoided by direct r.f. feed, and the output is a twisted pair of wires with banana plugs. Rather than mount an individual meter, I used my Simpson v.o.m. on the 2.5 volt scale. For accurate dipping plenty of hash marks are needed, and a v.o.m. has a lot; not only that, but it saves the expense of an extra meter. Tuning up is simple; with no signal applied, turn the 5K null pot for zero volts. Assemble the shield and you are ready to go.

Tuned circuits are dipped in the conventional manner. The value of the capacitor has to be known to calculate the inductance of the coil. Tuned tank circuits up to 2 meters are easily measured. Above 2 meters, quarter-wave stubs should be used. Coax stubs below 250 MHz present no problems; accurate length above 250 MHz does. With the vector spring-clip arrangement, approximately 0.2 inches should be added to the coax-length calculation. For u.h.f. work, a coax connector should be mounted in place of the spring clips. Quarter-wave antenna stubs

The resonance detector. It detects resonance of tuned circuits and transmission lines from 1–250 MHz.



*30725 Tennessee, Roseville, MI 48066

Say You Saw It In CQ

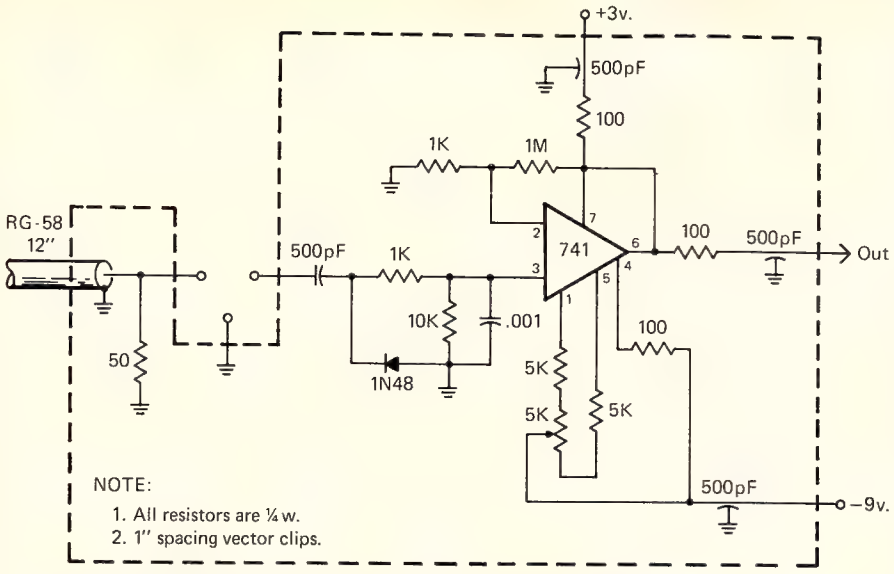
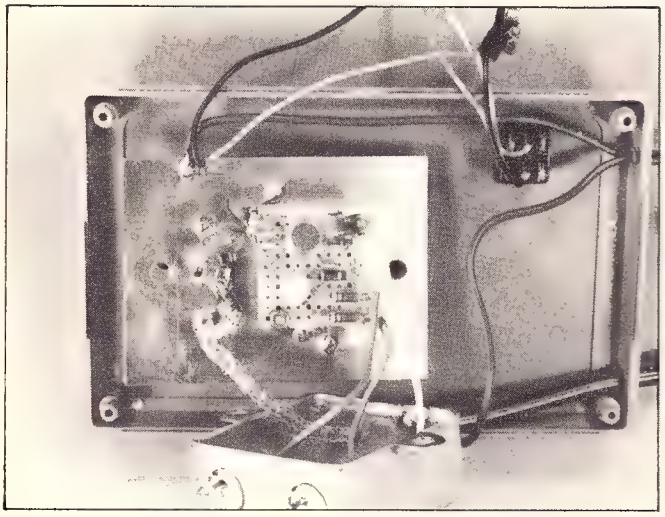


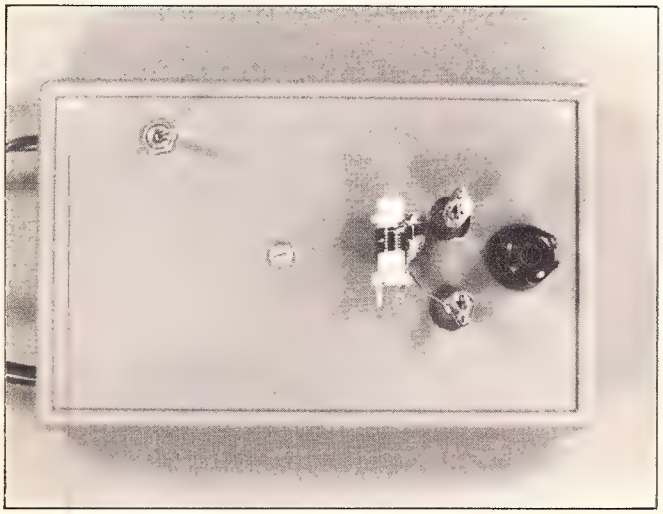
Fig. 2– Schematic diagram of the resonance detector described in the text.

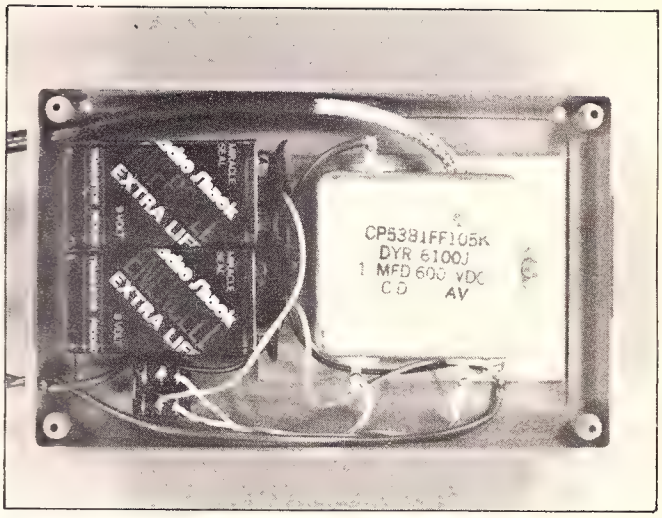
could then be checked more accurate. with their connector. An alternative meth od for finding the length of a stub at the higher frequencies is to measure the resonant frequency at a longer length. For instance, a coax stub for 220 MHz can be made by cutting one-quarter of the length of a stub adjusted for 55 MHz. A more accurate method would be to plot several lengths and find the resonant frequency and velocity factor. The velocity of a magnetic wave is slower through a transmission line with a dielectric other than air. The wavelength of coax or twin-lead is always shorter than in free space. The ratio of the wavelength in air versus wavelength in the transmission line is the velocity factor. This velocity factor is different for various types of lines, and the measured value can be substantially different from the published value. A plot of different lengths versus frequency can give an accurate correlation at any frequency. CQ

Construction details. The detector diode and coupling cap are mounted as close as possible to the Vector pins. The enclosure is a bathtub capacitor shell.

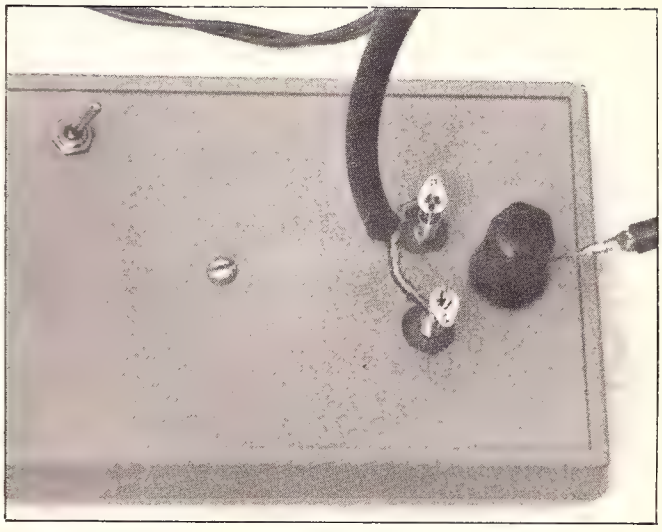


Mounting tuned circuits for testing.





The batteries are held in place with a dab of silicone rubber. All the parts are available from Radio Shack.



Quarter-wave stubs. One-half inch is peeled back, the center wire and shield are abruptly turned 90° and inserted. The low end is peeled back, the center soldered to the shield and grounded. The line length is the part in the vinyl sheet plus 0.2 inch added for the instrument.

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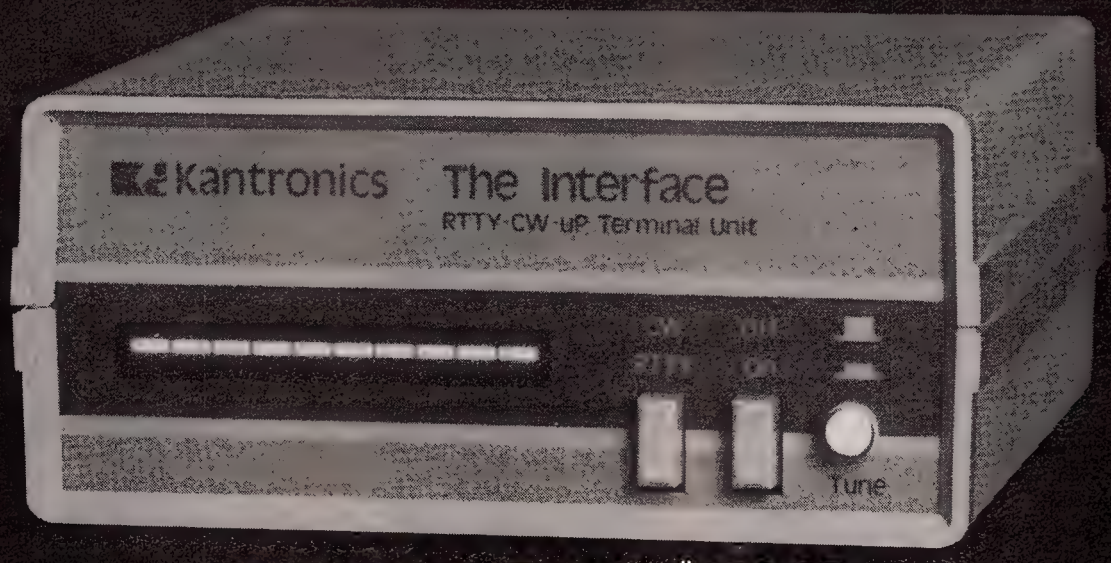
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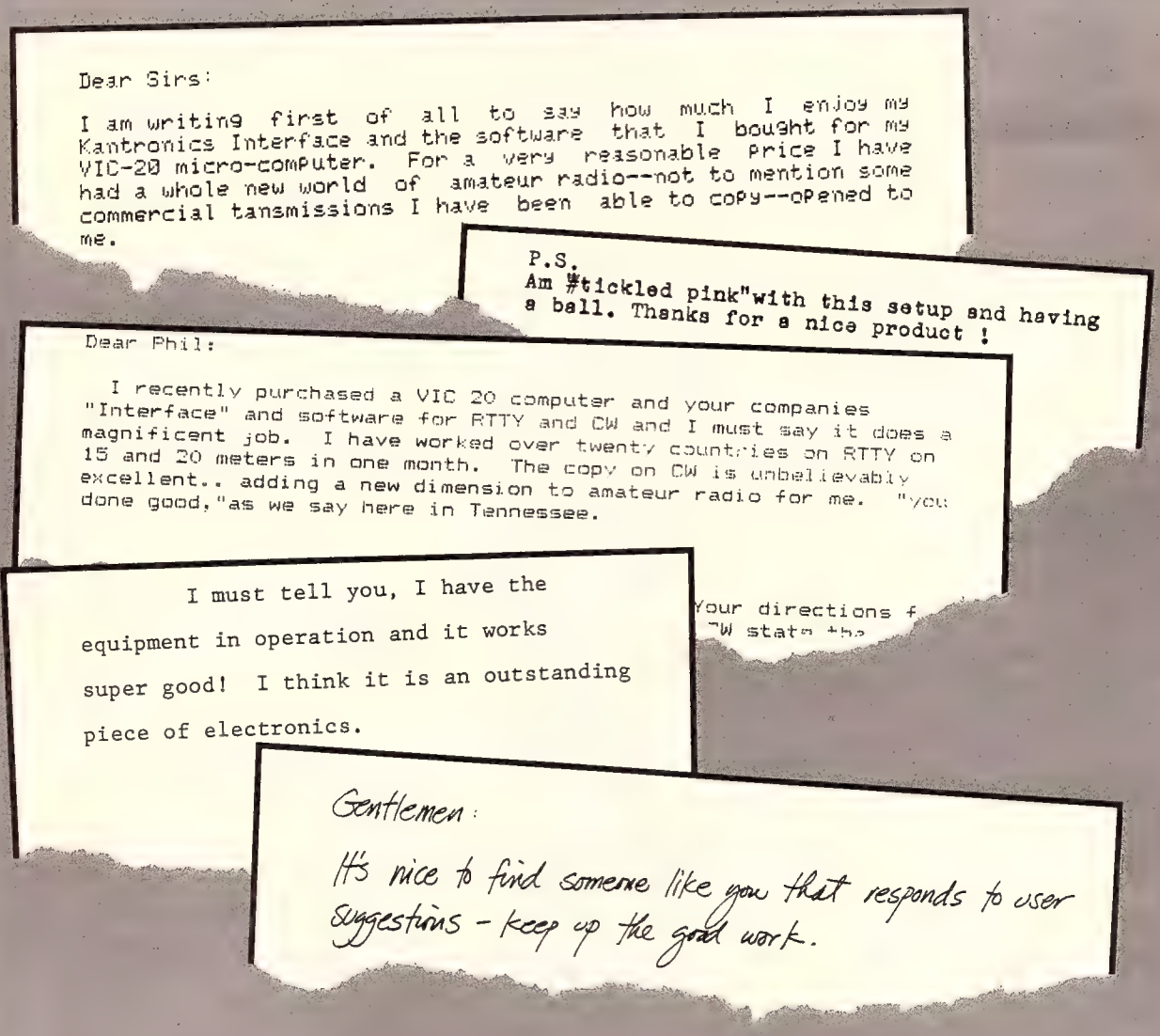
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Here's another little task—besides beam headings, logging, latitude, and longitude—that your PC can do. You can actually use it to design an antenna.

Writing Antenna Design Programs For Your Personal Computer

BY PHILIP S. RAND*, W1DBM

Many amateurs have purchased a computer, if not for themselves then for their children. So why not put it to work in the hamshack? Besides sending and receiving c.w. and RTTY, they are well suited to doing mathematics. As a matter of fact, they take all the drudgery out of calculating the lengths of all kinds of antennas. I use my TRS-80 Color Computer® to design those antennas I told you about in *CQ* last August.

If you are a novice at computing, you probably would try to buy an antenna program on tape. However, save your money; it's really very easy to write your own program just the way you want it. All home computers use a program language called BASIC, which was developed at Dartmouth College in the 1960s. BASIC stands for "Beginners All-purpose Symbolic Instruction Code," and it approximates the English language. It varies slightly from one brand of computer to another, but it is generally very easy to use.

A program written in BASIC consists of a bunch of numbered lines each containing a command or statement telling the computer what you want it to do. These go into the computer's memory to be used when you "run" the program, and may be saved on a cassette tape recorder for future use. You could start the program with line 1, continuing with consecutive line numbers to the end of the program. However, it is better to start at, say, line 10 and then go to lines 20, 30, 40, etc., so that you can go back later and add some commands that you forgot earlier.

Writing an Antenna Program in BASIC

The keyboard on the computer works just like that of a typewriter except that it only prints in capital letters. At the end of each line you must hit the carriage **RETURN** or **ENTER** key, the same as on a typewriter. There are, however, several special keys such as **CLEAR**, which clears the TV screen, **BREAK**, which breaks the running of the program, and an arrow pointing to the left, ←, which is used as a back-space and eraser.

Your computer has been programmed at the factory to recognize certain English words as commands and statements such as: NEW, RUN, LIST, PRINT, INPUT, GOTO, IF THEN, FOR NEXT, LOAD, SAVE, and END to name a few that we will use in our antenna program. In general they mean the same thing to the computer as they do to you. Punctuation marks also have special meaning to the computer as you will see.

Let's write a program in BASIC to design a dipole antenna. We will keep it very simple using only six program lines. All programs are written using numbered program lines so that the computer can store them in memory in numerical order and find them when needed. We will write this program with widely spaced line numbers so that we can go back later and add some sophistication to the program.

The first thing to do is to give the program a name. Therefore, type the following into your computer keyboard:

```
30 PRINT"  DESIGNING DIPOLE ANTENNAS"
```

Don't forget to press the enter key after each program line.

Next enter the frequency for which you are designing the antenna like this:

```
50 INPUT"  PLEASE ENTER THE
   FREQUENCY IN MHZ.";F
```

Note the quotation marks following PRINT and INPUT. These tell the computer to print everything on the TV screen that is between them. The semicolon in line 50 tells the computer to assign to the letter F the value that you input for the frequency. The two spaces between the quote and the first word tell the computer to print that word starting two spaces from the left side of the screen.

Antenna Formula

Since the computer only knows what you tell it, you must now tell it how to design a dipole. To do this, look up the formula for designing a half-wave dipole:

$$L = \frac{492 \times .95}{F}$$

where L = feet, and F = MHz. This formula must be changed slightly so your computer will know what you want it to do. The multiplication sign in BASIC is the asterisk (*) and the division sign is the fraction bar (/). So enter the following line into your program:

```
130 L= 492*.95/F
```

The computer now recalls the value that you entered for F and solves the formula for L and stores the length in feet until you request it. The next program line will do just that. Type:

```
160 PRINT F,L
```

Because there is a comma between F and L, the computer will print the F on the left side and the L on the right side of the TV screen. This all will happen so fast that you will not be able to see it unless you stop the program for a moment. We will do this with an **INPUT** statement. Type the following:

```
190 INPUT"  PRESS THE ENTER KEY
    TO CONTINUE";C
```

Again, all between the quotation marks is printed on the TV screen, and the computer waits for you to enter something. After you have read the dipole dimensions, hit the **ENTER** key. The computer will enter a zero as the value for C, but this does no harm to the program, since we do not use the letter C in the program.

The next and last line in our simplified program is to tell the computer to go back to the beginning and run the program again. Therefore, type:

```
200 GOTO 30
```

After entering line 200, "list" the pro-

*P.O. Box 8, Haverhill, NH 03765

gram on the TV screen to see if you have made any typing mistakes. To do this simply type:

LIST

and everything you have typed so far will appear on the TV in numerical order. If you find any errors, just retype that line over again and the computer will replace the old line with the new line when you press the **ENTER** key. Now try "running" the program. Type:

RUN

and instantly your TV screen should look like fig. 1. Next comply with the request and enter a frequency such as 3.900. This will appear following the **"?"** as you type it. Upon hitting the **ENTER** key, fig. 2 will appear on the TV giving you the dimensions for a 75 meter dipole.

That's all there is to writing a program in BASIC to design a dipole antenna. To design other types of antennas, simply put the correct formula into line 130 and change the title in line 30.

Improving the Appearance of the Print-Out

Let's dress up the TV display a little by using some of the unused program lines. Press the "**BREAK**" key to interrupt the program so we can use the keyboard.

BREAK

Type in the following lines:

```
10 CLS
20 PRINT: PRINT: PRINT
40 PRINT: PRINT
```

Line 10 **CL**ears the **S**creen at the start of the program, and lines 20 and 40 add line spaces at the top of the screen and between the program name and the frequency request. Let's put a title over the frequency and length printout, like this:

```
70 CLS: PRINT
80 PRINT" THE LENGTH OF A DIPOLE FOR
   THIS FREQUENCY IS:"
90 PRINT" MHZ","  FEET"
```

Note the comma between the **MHZ** and **FEET**. This will place these titles directly over the figures. Now try running the program again and it will look like fig. 3.

Errors

You will find the computer is very exacting and will not tolerate misspelled commands or statements in program lines or the incorrect use of punctuation marks. The program will halt and **"? SN ERROR IN LINE 200"** will appear on the TV. In case this happens, you type:

LIST 200

Line 200 will now be printed on the screen so that you can compare it with what was supposed to be there. Perhaps you find you forgot to type what line to go to. All you do is retype the line correctly

```
DESIGNING DIPOLE ANTENNAS
PLEASE ENTER THE FREQUENCY IN MHZ, ?
```

Fig. 1– TV display of the six-line antenna design program waiting for the frequency to be entered.

```
DESIGNING DIPOLE ANTENNAS
PLEASE ENTER THE FREQUENCY IN MHZ.  ? 3.9
3.9                    119.846154
PRESS THE ENTER KEY TO CONTINUE  ?
```

Fig. 2– TV display after entering the requested frequency. Note that the printing is all crowded at the top of the screen.

```
THE LENGTH OF A DIPOLE ANTENNA FOR
THIS FREQUENCY IS:
MHZ.                   FEET

3.9                    119.846154
PRESS THE ENTER KEY TO CONTINUE  ?
```

Fig. 3– The display after lines 20 and 40 have been added to the program.

and press **ENTER**. At this point line 200 should be retyped to read:

200 GOTO 10

If you want to completely erase an entire line in the program, simply type the line number and press the **ENTER** key. Now **LIST** the program and you will find that the line has been eliminated.

Decimal Places

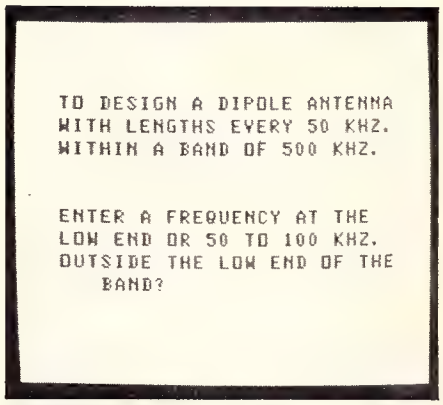
Who needs a frequency or antenna length to 6 or more decimal places? Our computer is only trying to be as accurate as possible, so let's tell it to print the frequency to only two decimal places and the feet to only one decimal place. There are several ways to do this, but the following way is simple. We will use the "integer" function, **INT(X)**. This changes our decimal number into a "whole" number by eliminating everything to the right of the decimal point. Type in the following new program lines:

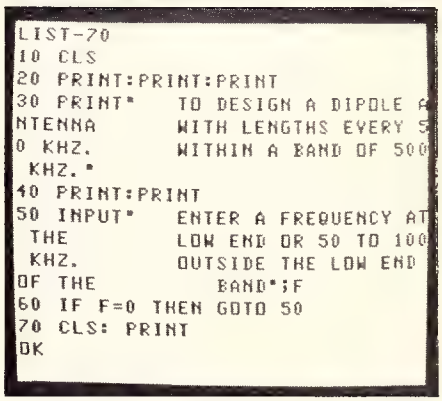
```
110 F=INT(F*100)
120 F=F/100
140 L=INT(L*10)
150 L=L/10
```

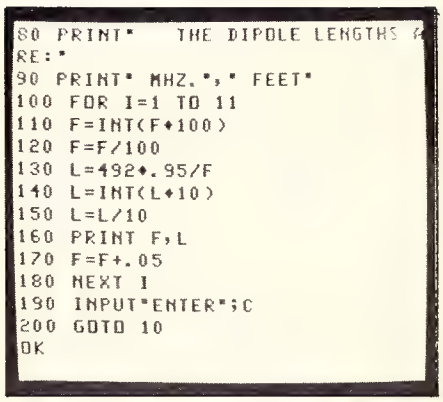
Run the program now and you will see that the frequencies and feet have been reduced to two and one decimals respectively. You can now compare antenna lengths for several frequencies within an amateur band just by entering a series of frequencies, say, 50 kHz apart. But why go to all this bother? Let the computer do it. Tell your computer to go through the length calculation 11 times adding 50 kHz to the frequency each time and to print the results in two columns on your TV screen. Type the following program lines:

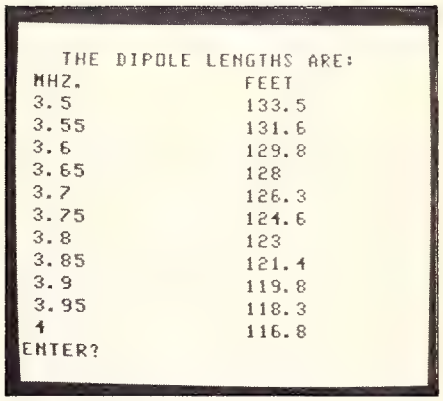
```
100 FOR I = 1 to 11
170 F = F+.05
180 NEXT I
```

Back in line 50, if you fail to enter a fre-









The final printout of the complete program is shown in these photos.

quency before hitting the **ENTER** key, you will be entering a "zero" for the frequency. Since you cannot divide by a zero, the program will abort with a **"?/0 ERROR IN LINE 50"** appearing on the TV screen. To prevent this enter the following line:

60 IF F=0 THEN GOTO 50

Run the program now and see how you like designing dipoles for every 50 kHz in an amateur band. Great, isn't it! Obviously the program name needs to be changed, so try this one:

30 PRINT" TO DESIGN A DIPOLE ANTENNA WITH LENGTHS EVERY 50 KHZ. WITHIN A BAND OF 500 KHZ."

Also let's change line 50 to read:

50 INPUT" ENTER A FREQUENCY AT THE LOW END OR 50 TO 100 KHZ. OUTSIDE OF THE LOW END OF THE BAND";F

Now run the completed program (see Table I), only entering a frequency at the low end of the band, such as 3.5, 6.9, 13.9, etc. Note how easy it is now to compare antenna lengths for different parts of a band. Your TV displays should now look like those in the photos.

If you own a computer that will do trigonometry, such as the TRS-80-C®, with Extended Color BASIC®, you can also write your own program to calculate great circle bearings and distances. Have fun! The first thing you know, your computer will be running your whole station.

In Conclusion

If you own a computer other than a TRS-80 Color, a TRS-80 Model III, or an IBM Personal Computer, you may have to make a few changes in the above program, since all computers do not speak the same "dialect" of BASIC.

Table II is a modified program listing that runs successfully on the Apple II, VIC-20, TI-99/4A, Sinclair/Timex, and other similar computers, including the three mentioned above.

Note that "commands" and "statements" such as **"CLS"**, **"HOME"**, **"STAY CLEAR"**, and **"SHIFT"-"HOME/CLR"** that are only acceptable to certain makes of computers have been left out of the program. Some computers will reject an input statement such as this: **50 INPUT" ENTER THE FREQ. IN MHZ.";F** but almost all will accept the following:

50 PRINT" ENTER THE FREQ. IN MHZ."
55 INPUT F

A few computers require the use of the word **"LET"** when assigning a value to a variable in the program. Others will simply ignore the word. Note that we have added **"LET"** to several program lines; for example: **110 LET F=INT(F*100)**.

Some computers will only accept a single statement per line. Therefore, a line such as **10 PRINT: PRINT** must be put into two lines:

10 PRINT
15 PRINT

When writing your programs for your particular make of computer, keep the above in mind and you should have no problems. CQ

```
10 CLS
20 PRINT: PRINT: PRINT
30 PRINT"  TO DESIGN A DIPOLE ANTENNA
           WITH LENGTHS EVERY 50 KHZ.
           WITHIN A BAND OF 500 KHZ."
40 PRINT: PRINT
50 INPUT"  ENTER A FREQUENCY AT THE
           LOW END OR 50 TO 100 KHZ.
           OUTSIDE THE LOW END OF THE
           BAND";F
60 IF F=0 THEN GOTO 50
70 CLS: PRINT
80 PRINT" THE DIPOLE LENGTHS ARE"
90 PRINT" MHz.","  FEET"
100 FOR I=1 TO 11
110 F=INT(F*100)
120 F=F/100
130 L=492*.95/F
140 L=INT(L*10)
150 L=L/10
160 PRINT F,L
170 F=F+.05
180 NEXT I
190 INPUT" ENTER";C
200 GOTO 10
```

Table I– Listing of the complete program.

```
10 PRINT
20 PRINT
30 PRINT"  TO DESIGN A DIPOLE ANTENNA
           WITH LENGTHS EVERY 50 KHZ.
           WITHIN A BAND OF 500 KHZ."
40 PRINT
50 PRINT"  ENTER A FREQUENCY IN MHZ.
           AT THE LOW END OR 50 TO
           100 KHZ. OUTSIDE THE LOW
           END OF THE BAND."
55 INPUT F
60 IF F=0 THEN 55
70 PRINT
80 PRINT" THE DIPOLE LENGTHS ARE"
90 PRINT" MHZ.","  FEET"
100 FOR I=1TO 22
110 LET F=INT(F*100)
120 LET F=F/100
130 LET L=492*.95/F
140 LET L=INT(L*10)
150 LET L=L/10
160 PRINT F,L
170 LET F=F-.05
180 NEXT I
185 PRINT" TO REPEAT, ENTER 'C' "
190 INPUT C$
200 GOTO 10
```

Table II– This is a modified program listing that will run on almost any make of home computer.

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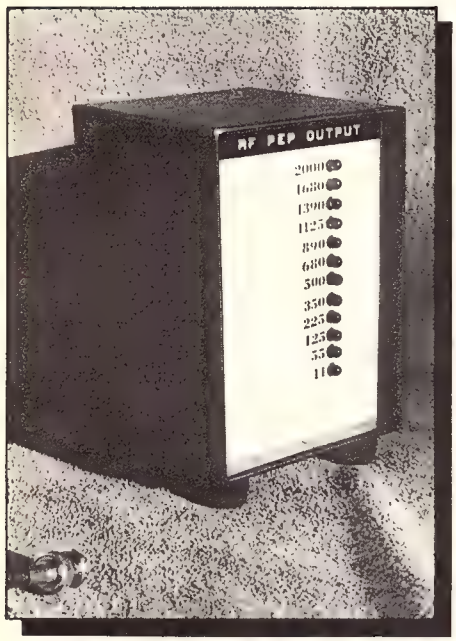
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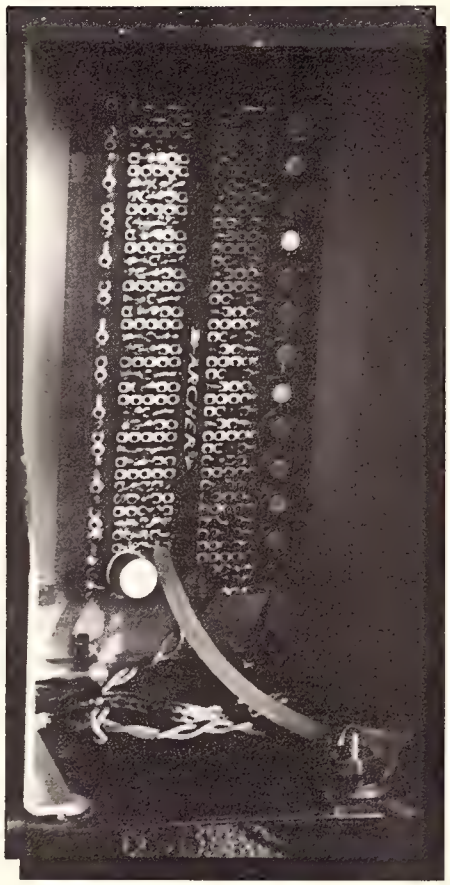
Here's a great little weekend project that will light up your operating. This practical piece of test gear will make a good addition to your shack.

CONSTRUCT A PEAK-READING LED R.F. WATTMETER

BY R. DAVID BEARD*, WA4QGA



Front view of the wattmeter. You can dress up the completed project to suit your own taste.



Interior view. The coax at the bottom goes to the sampler unit, and the twisted pair of wires goes to the d.c. source.

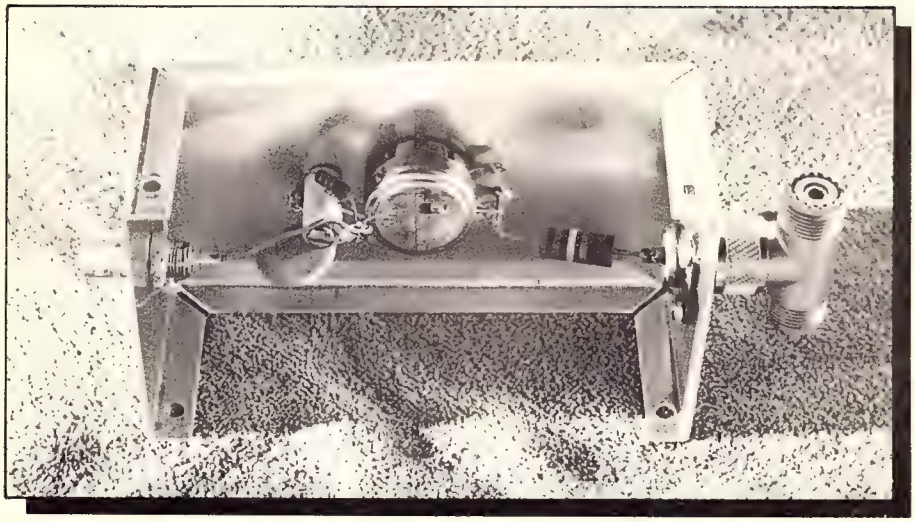
Have you ever wondered just how much power is actually traveling up the coax? The following schematic and circuit description will give you a device that is (1) easy to build, (2) inexpensive to build, (3) simple to calibrate, and (4) will actually tell you how much power you're running. The project should cost between $25 and $30 to build and will satisfy the FCC proposal recently published regarding power output levels.

Circuit Description

The schematic, fig. 1, consists of 12 LEDs. Each LED is driven by a 2N2222 transistor. Practically any small-signal NPN transistor will do. For turning on each LED at a discrete power level 1N914 diodes are used. As the diodes are in series, the LEDs are turned on in sequence as each diode starts to conduct. Resistors R2 and R3 form a simple voltage divider, and resistor R1 limits collector current. Resistor values are not extremely critical as long as all segments contain equal values. The values may be changed somewhat to accommodate on-

*2913 Gaston, El Paso, TX 79935

Interior and exterior views of the sampler. Sampling is done via the T connector. Construction is straightforward and uses normally available components.





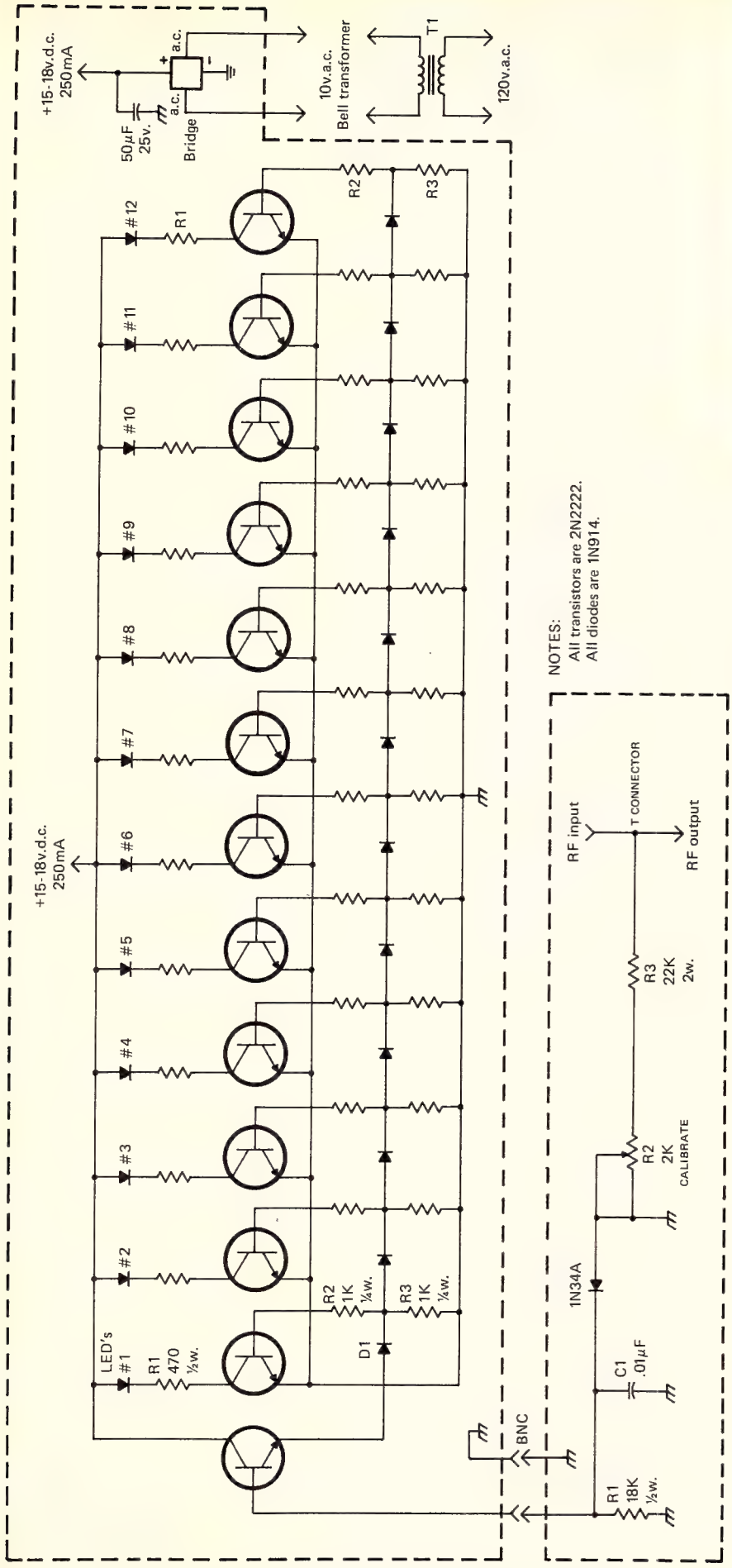


Fig. 1– Schematic of the peak-reading LED r.f. wattmeter.

LED No.*	Power Output
1	14
2	55
3	125
4	225
5	350
6	500
7	680
8	890
9	1125
10	1390
11	1680
12	2000

**LED No. 1 is at the bottom of the display. LED No. 12 is at the top of the display.*

Table I– Relationship between LED numbers in fig. 1 and the peak power output they reflect.

hand junk-box values. Transistor types are also noncritical as long as all transistors are the same number.

The complete power meter is built on two separate chassis. One is the LED pc board and the other is the rectifier unit. Transmission-line voltage is sampled via a "T" connector connected to an SO-239 on a small chassis. The lower schematic enclosed in dotted lines is the unit being described. The time constant of R1C1 is only critical in that if C1 is too large, the true peaks will not be indicated. If R1 is too large, the low-order LEDs will have a tendency to stay lit after the r.f. output has ceased, or the LEDs will have a tendency to glow upward as power increases instead of indicating discrete power levels.

As the unit is actually a voltmeter and we wish to read the output in watts, I have included the approximate power level each LED will indicate (see Table I).

After the unit was built and calibrated, the LED display was compared to an oscilloscope (Tektronix 535) voice display on 20 meters, and true peak values of power were displayed by the meter. For ranges of 0–20 and 0–200 watts, the values of R2 and R3 in the rectifier unit will have to be scaled to provide full-scale readings on the 20 and 200 watt levels.

To calibrate the unit you will need an accurately calibrated r.f. voltmeter or an in-line wattmeter. The single-tone (or two-tone) output level will be the same value displayed by the LEDs as by the RMS value indicated by the two above methods. Calibrate at the highest power level available if a full-scale value cannot be reached.

With no speech "processing" or "compression," the highest order LED should flash only on occasion when the peaks of your voice reach the peak limits of your transmitter. *Never* should an LED flash indicate higher power output than that reached during carrier condition tune-up.

To test the completed display unit to see that all LEDs light, temporarily connect the input lead, through a 1K resistor, to the positive side of the power supply. All LEDs should light to their maximum brightness. Good DX!

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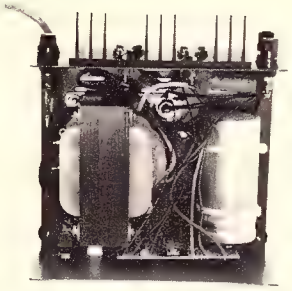
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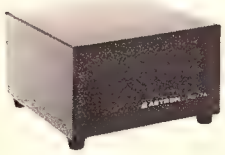


MODEL RS-50M



MODEL VS-50M

RS-A SERIES



MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W X D	Shipping Wt (lbs)
RS-4A	3	4	3¾ x 6½ x 9	5
RS-7A	5	7	3¾ x 6½ x 9	9
RS-10A	7.5	10	4 x 7½ x 10¾	11
RS-12A	9	12	4½ x 8 x 9	13
RS-20A	16	20	5 x 9 x 10½	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13¾ x 11	46

RS-M SERIES



MODEL RS-35M

- Switchable volt and Amp meter

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt (lbs)
RS-12M	9	12	4½ x 8 x 9	13
RS-20M	16	20	5 x 9 x 10½	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13¾ x 11	46

VS-M SERIES



MODEL VS-20M

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- Output Voltage adjustable from 2-15 volts
- Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt (lbs)
VS-20M	16	9	4	20	5 x 9 x 10½	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13¾ x 11	46

RS-S SERIES



MODEL RS-12S

- Built in speaker

MODEL	Continous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt (lbs)
RS-12S	9	12	4½ x 8 x 9	13
RS-20S	16	20	5 x 9 x 10½	18



MODEL RS-7B

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MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt (lbs)
RS-7B	5	7	4 x 7½ x 10¾	9
RS-10A	7.5	10	4 x 7½ x 10¾	11

*ICS—Intermittent Communication Service (50% Duty Cycle 5 min. on 5 min. off)

CIRCLE 80 ON READER SERVICE CARD

a regular feature by
THEODORE J. COHEN, N4XX

THE INS AND OUTS OF THE WASHINGTON SCENE

RFI Complaints To Commission Continue At High Level

According to Jeffrey Young, Enforcement Division, Field Operations Bureau (FOB), FCC, RFI complaints to the Commission in the second quarter of FY83 (January, February, and March 1983) totaled 17,860, down from the 20,943 complaints reported in the same period a year earlier. The drop is attributed to the fact that the public finds it more difficult to file complaints today because of the FCC's closing last year of field offices around the country. Regardless, the number of complaints received in the last quarter suggests that on an annualized basis, *reported* cases of RFI are still running in excess of 71,000 per year!

Of the 17,860 complaints received, 14,060 (79%) involved a television receiver as the victim device. Of these, CB operations were alleged to be involved in 9,784 cases of TVI, while amateurs were cited in 795 cases. The continued high level of TVI complaints, most of which are linked to front-end overload of the TV set, indicates that TV manufacturers still have not corrected the design deficiencies responsible for the alleged "interference."

In all, CBers were alleged to be involved in 10,889 complaints, while amateurs accounted for 1,218. Complaints by amateurs against other amateurs totaled 389, up from the 314 complaints reported during the last quarter.

Finally, one area that the Commission is watching with concern is that involving complaints about Part 15 devices (i.e., devices that are not intended to radiate, but do). Radiation from things such as lamps that can be turned on and off by touch were among the devices cited.

Readers experiencing RFI problems are urged to file complaints with the FCC.

FCC Reinstitutes Survey of Part 15 Devices

As noted above, RFI caused by Part 15 devices is of increasing concern to the Commission. Because of this, the Commission's Field Operations Bureau is now surveying the retail marketplace to determine the level of compliance by manufacturers of these devices with the FCC's labeling requirements.

According to Joe Casey, Enforcement Division, FOB, a similar survey last year found that 30% of the devices examined did not contain the required label indicating that they were FCC approved. Specifically, of 317 items examined by Commission engineers, 114 were not properly labeled. As a result, 38 citations were issued to the appropriate parties.

In the current survey, engineers from four FCC field offices will visit retail stores in their local areas and will sample devices that generate an RF signal for compliance with the labeling law. Emphasis will be placed on devices such as computers, coin-operated games, security transmitters, TV interfaces for games and computers, and cordless telephones. The four geographical areas in which this activity is scheduled to take place will change each month, and the survey will continue for at least a year.

Readers experiencing RFI problems with Part 15 devices are encouraged to file a complaint with the nearest FCC district engineer. Alternatively, complaints may be sent to the FCC in Washington, D.C., for forwarding to the appropriate field office; write to: Federal Communications Commission, Field Operations Bureau, 1919 M St., NW, Washington, D.C. 20554.

Electronic Organ Manufacturer Tells Complainant to Stick Pin in Amateur's Cable

A well-known manufacturer of electronic organs recently advised an organ owner who complained of interference from a nearby amateur station to "put a pin in the ham's coax." The "advice" was brought to the attention of the ARRL, which sent the following comments to the president of the company:

"Had the organ owner taken the advice of your man seriously and damaged the amateur radio station's transmission line, he would have become criminally liable under Federal law for causing damage to a federally-licensed radio station. He could also have caused the radio transmitter to malfunction and possibly injure the operator.

"Not only would your employee be criminally liable as an accessory should someone actually follow such advice, (but) it is very possible that (name of company deleted) could be held liable for personal and property damages under the doctrine of respondeat superior. This doctrine establishes that an employer is responsible for the tortious acts of his employee which occur in the course of the tortfeasor's employment."

It is cases such as this which suggest the time is ripe for the FCC to consider susceptibility standards for electronic home-entertainment equipment . . . standards provided for under Public Law 97-259. The Federal imposition of standards is the only solution to the RFI problem, since the electronics industry has done little, if anything, to ensure that its equipment will operate properly in the presence of strong RF fields.

FCC Issues NPRM on Expansion of 10 Meter Repeater Band

On 12 May 1983, the Commission released an NPRM which seeks the public's comments on a proposed expansion of the 10 meter repeater band. Currently confined to the band 29.5–29.7 MHz, the NPRM proposes opening the band 29.0–29.7 to repeaters.

According to John Johnston, Chief, Personal Radio Branch, Private Radio Bureau, the reasons for the proposed expansion are many. For example, amateurs are exhibiting an ever-increasing interest in the use of 10 meter f.m. and of repeaters in this band. Then, too, the increasing availability of commercial equipment and so-called "10 meter convertibles" (i.e., CB transceivers that have been converted to 10 meter f.m. operation) suggests that it won't be long before the current 200 kHz repeater band is overcrowded.

CATVI Prevents Amateur From Establishing Emergency Communications

A report has reached your Washington Editor of a case in which harmful radiation from a cable television system (so-called cable television interference, or CATVI) prevented an amateur from using his f.m. 2 meter transceiver to report an accident. The incident, which involved an automobile accident in an urban area, was not life threatening, and the amateur was able to call for help by driving away from the scene and using the telephone.

The cable operator in question has frequently been notified that his emissions on cable channel "E" interfere with ama-

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Say You Saw It In CQ

teur communications on the 2 meter band. And while some attempts have been made to clear up the problem, radiation from overhead cables is still responsible for high levels of interference in some areas. In the case noted above, the CATVI was so great that the mobile operator was unable to signal through the repeater in a location where the repeater is normally full quieting.

It is situations such as this which make urgent the early consideration of FCC Docket RM-4040, which if approved would require the CATV industry to vacate channels "E" (144 MHz band) and "K" (220 MHz band). These frequency bands, after all, are assigned to the Amateur Service by the FCC; their use by the CATV industry is only to be on a "closed circuit" basis.

Astronaut Owen Garriott to Operate on Amateur Band From Space

As should now be known, Shuttle astronaut Owen Garriott, W5LFL, will operate an amateur station aboard an upcoming mission. Specifically, *Amateur Satellite Report* (AMSAT's newsletter for the amateur space program) announced that "NASA's Associate Administrator for Manned Space Flight, Gen. James Abrahamson, has designated the STS-9/Spacelab flight, to be flown this fall, as the mission on which the amateur radio equipment will be carried."

The amateur operations, of course, will be carried out on a non-interference basis during Garriott's free time, with the equipment used to be furnished by the ARRL. Operations are planned for the low end of the 2 meter band, and efforts are now underway to establish the communication protocols to be used.

Congratulations to the ARRL and AMSAT for helping Dr. Garriott obtain the necessary permission for this operation, an operation that will place amateur radio in the spotlight worldwide!

For more information on W5LFL's operation from space, contact: Radio Amateur Satellite Corporation (AMSAT), 850 Sligo Avenue, Silver Spring, MD 20910; or American Radio Relay League (ARRL), 225 Main Street, Newington, CT 06111.

Amateur's Station License Revoked Because of Malicious Interference

The Chief of the Private Radio Bureau, Mr. James McKinney, has ordered that the license for amateur radio station N6BII be revoked immediately. Further, the order suspended the General Class amateur operator license of Harold R. Claypoole, operator of N6BBI.

The order resulted from observations by Commission engineers from the San Diego office of Claypoole's malicious interference to communications of other operators. The interference consisted of making transmissions, including unmodulated carriers, directly on top of ongoing transmissions by other operators; of broadcasting recorded material, including music; and of identifying with a false call sign, WB6AAT. Claypoole, in a telephone call to the Federal Bureau of Investigation, also threatened to shoot Commission engineer Grigsby to death if the engineer came to Claypoole's house.

The Commission, according to Ray A. Kowalski, Chief, Special Services Division, PRB, views malicious interference in any radio service as a very serious matter, and will take whatever measures are necessary to enforce the Rules on the books.

Other Issues of Interest Considered by Commission

As we go to press, the Commission is reviewing a number of matters of interest to the Amateur Service. In addition to several minor changes to the Rules and Regulations, the FCC is expected to release a Report and Order on the elimination of logging requirements. Instead of preserving mandatory logging of international third-party traffic, as was requested by the ARRL, the Commission is expected to authorize its district Engineers-in-Charge to order an amateur to maintain a comprehensive log when questionable operations or rule violations are observed.

It is also expected that the FCC will consider the allocation of additional frequencies to the Radio Amateur Civil Emergency Service (RACES).

ARRL Honors Delegates to Communications Technology and Policy Seminar

In May the ARRL sponsored a reception and buffet to honor delegates attending the Seminar on Communications Technology and Policy. The seminar, sponsored by the U.S. Information Agency and the U.S. Telecommunications Training Institute, is for top-level telecommunication managers from countries around the world, and is intended to familiarize these people with communications equipment, operating procedures, and telecommunications policies.

The ARRL reception, which took place in the Dirksen Senate Office Building, provided for one-on-one contact between the visitors and amateurs from the Washington, D.C. area. Members of the Capitol Hill Amateur Radio Society, the Department of State Amateur Radio Club, and the Capital City Amateur Radio Society all took part, as did representatives of the League.

Planning for the reception and buffet was under the able direction of the League's Washington Area Coordinator, Mr. Perry Williams, W1UED. Perry was assisted by Ellen Thrasher, who, among other things, handles appointments for Senator Barry Goldwater.

Commission Invites Amateurs to Submit Exam Questions

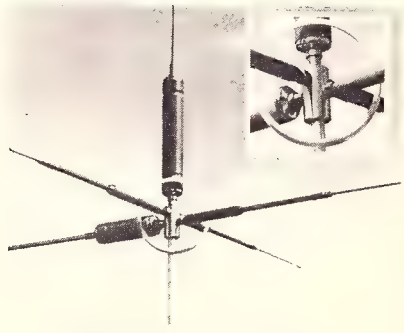
If you are a licensed amateur, the FCC invites you to submit questions for use in its amateur radio operator examinations. These examinations determine whether an individual is qualified for the privileges conveyed by an amateur radio license, and as such, the subjects covered are many and diverse. Included is material on the FCC's Rules and Regulations, operating procedures, radio-wave propagation, amateur radio practice, electrical principles, circuit components, practical circuits, signals and emissions, and antennas and feedlines.

For more information, write to the Private Radio Bureau, FCC, 1919 M St., NW, Washington, D.C. 20554, and request PR Bulletin 1035.

FCC Staff Members Win Awards

Richard Smith, Chief, Field Operations Bureau, and Robert Foosaner, Deputy Chief, Private Radio Bureau, recently won awards as outstanding members of the Government's Senior Executive Service. These annual awards, made annually, reward senior executives for their performance during the previous year. Congratulations, Dick and Bob, from everyone at *CQ!*

Your Washington Editor thanks Mr. Richard I. Vaughan, Regional Director, FCC, San Francisco, CA, for his contributions to this month's column.



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CIRCLE 17 ON READER SERVICE CARD

Awards

a monthly feature by
DOROTHY H. JOHNSON, WB9RCY

NEWS OF CERTIFICATE AND AWARD COLLECTING

The story of the month for August as told by Dave is:

David S. Short, W5PWG
All Counties #393 8-7-82

"Thanks for the memories and the opportunity to ride along with each one of you during my 19 year odyssey which took me through every county in the 50 states of America. I can still recall the faint 40 meter signals of a small, but determined group who had a notion that they would attempt to contact an amateur radio station in every county, and then someone did do just that. Remember? As it turned out, Cliff, K9EAB, was the first, and as I write these very words, the 400th person to have worked them all has long since passed.

"Well, it was rare indeed, back in the early 60's, to find a mobile station who would name each new county as they drove along. The chase was on; fixed stations, mobiles, and portables were searched out as if they were rare DX. Looking back through some of the old log books it still amazes me that the monthly county total back then roughly compares to what is now worked in one day. No complaints from this end. The excitement of being in the initial chase, along with several others, was compensation enough. The chase continued until in 1969 we finally made it over the 3000 mark (#33), and then—Europe. I had mixed emotions about leaving, but then this is a hobby, you know!

"As it turned out, the stay in Europe was longer than I had first expected. You can imagine that the 'whole ball of wax' was mighty big by the time I returned. Something had to be done to whittle that ball back down to size. So, armed with a TS-530S and a vertical, we melded back into the chase with all that could be mustered. At times it seemed to me that the task would be all but impossible, what with being in the fringe area running not quite QRP power.

"For the record, if you were listening on the 30th of June 1982 (my birthday) at 0152Z when I contacted Pete, KC4IF, in Monroe County, Kentucky, you knew that the chase which started many years ago finally came to an end. What a thrill that contact was for me. I'll never forget it. Thanks, Pete!

"That 'ball of wax' is now on the back burner, soon to be melted down into small squares, packaged, and made ready for the next generation. Best wishes to all who are starting! I hope that it won't take you quite as long as it took me. And in memory of Cliff Corne, K9EAB, and a small group of County Hunters who gathered in Jackson, Mississippi, March 1969, I tender my thanks to you one and all."

(Dave, W5PWG, is ex-W4SKI/W2GRH/DL5DA—ed.)

333 South Lincoln Avenue, Mundelein, IL 60060



David Short, W5PWG, All Counties #393.

Special Honor Roll
All Counties

#419 John Hawkins, W5EHY 4-19-83.
#420 Karel Tettelaar, VE7ATH 4-27-83.
#421 Thomas Sundstrom, W2XQ 5-2-83.
#422 James Blackwood, N8AIL 5-3-83.

Awards Issued

John Hawkins, W5EHY, contacted his last county and completed all records to claim All Counties #419, Mixed, dated 4-19-83.

Karel Tettelaar, VE7ATH, in British Columbia, heard and was heard from all counties and has been awarded All Counties #420, all 2× S.S.B., 4-28-83. Margaret Tettelaar, VE7ATI, holds All Counties #133. The story of Karel and Margaret appeared in the May 1980 issue of *CQ*.

With a little help from his computer, Thomas Sundstrom, W2XQ, finished all the paperwork to qualify for All Counties #421, Mixed, 5-2-83.

Busy as he was helping prepare all the details for the 1983 County Hunters Convention, James Blackwood, N8AIL, completed every county to win All Counties #422, Mixed, 5-3-83.

Lew Mulligan, WA4OIB, added USA-CA 2500, all 2× S.S.B., to his collection.

Tom Van Ettiger, WC4K, collected USA-CA 500 through 1000, Mixed.

Lorraine Bachmann, WDX9DCJ, did a lot of listening and sent for USA-CA 500 through 1000, endorsed Mixed. This is the first USA-CA Certificate issue to an s.w.l. in Wisconsin.

USA-CA 500 certificates this time were issued to:

Masao Nakamura, JA1AJA, endorsed Mixed.

Hiroyuki Takeuchi, JA8AYN, endorsed Mixed.

Vladimer Naumenko, UA3GEA, endorsed Mixed.

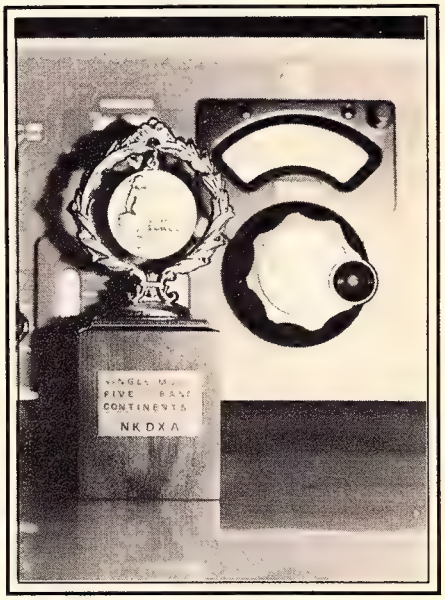
Fumioki Sato, JH8MXH, endorsed all 2× S.S.B.

Kazuo Kumanaka, JA8JL, endorsed Mixed.

Awards

Jamaica Amateur Radio Association Award 1983. This award is in commemoration of Jamaica's 21st year of independence, 6th August 1983. It is available to all licensed radio amateurs, and is issued for c.w., phone, or mixed modes. The award will be issued for contacts during the period August to December 1983. Applications should be sent to: Awards Chairman, Gerald Burton, 6Y5AG, Box 214, Kingston 20, Jamaica W.I.

Rules are as follows. Contact must be made with 5 different 6Y5 stations on any band during the period August to December 1983. QSL cards or written proof with time, date, band, mode, and 6Y5 stations worked is required. The fee for this award is U.S. $3.00 or 10 IRCs and an 8″ × 10″ self-addressed envelope.



Northern Kanagawa DX Assoc. Trophy.

Northern Kanagawa DX Association Single Mode 5 Band All Continents Award. Applicants must submit proof of QSOs with stations in six continents on a single mode and five bands. This award is issued to any licensed radio amateur and s.w.l. who submits proof of 2-way radio

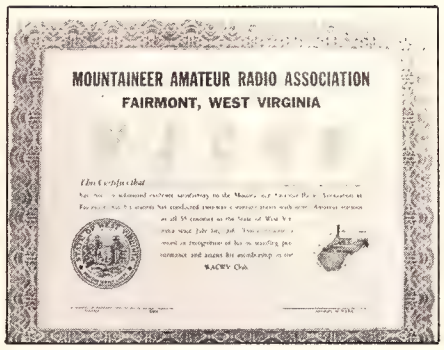
Say You Saw It In CQ

contacts with the above stations. The mode and amateur bands used and the date of contact are not limited at all. The serial number of the award is given separately to each mode. The award may be issued for six or more bands with the special endorsement if all supporting information is included in the application. QSL cards of the same station for different bands and different modes may be used in one application. Cross-band and cross-mode QSOs cannot be counted. This award is given in the form of a trophy with a medal.

Send the log data certified by two licensed radio amateurs with 25 IRCs to: Award Chairman, Northern Kanagawa DX Association, Jeitti, Michinori Jimbo, 2653, Saurashi, Sagamiko-Machi, Tsukui-Gun, Kanagawa-Ken, 199-01, Japan.

Worked All Counties West Virginia Award. The Mountaineer Amateur Radio Association of Fairmont, WV, is sponsoring the WACWV. The award is open to any licensed amateur radio operator. Only contacts made after July 1, 1946 will count toward this award. Attractive certificates will be issued to each amateur who works all 55 West Virginia counties. Contacts may be made on any of the amateur bands and on any mode. *Repeater contacts are not allowed.* Stations working the WV counties may be portable or mobile during the operation. All contacts do not have to be made from one fixed location. Qualification will be determined by presenting a log with the 55 county contacts, in alphabetical order, and should include the following: date, time, WV county, station worked, band, mode, RS(T), and name of county worked.

This log must be signed by two amateurs, other than the applicant, confirming the fact that they have viewed the original QSL cards and find them accurate. Submit the application, along with $2.00 to cover handling and postage, to Mountaineer Amateur Radio Association, c/o Steve Wilson, 1332 Overhill Rd., Fairmont, WV 26554.



Worked All West Virginia Counties Certificate.

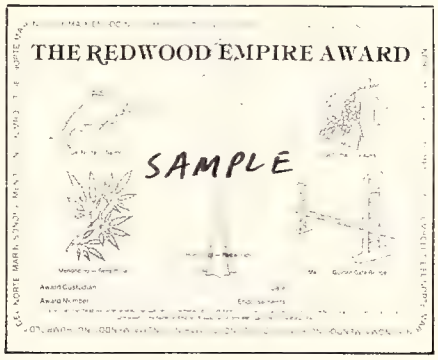
Diploma Taba Poty—PS7 Award. DTP (PS7) is an international diploma granted through the Sectional Directory of LABRE of the State of Rio Grande do Norte, Brazil. It is intended to develop amateur radio activities and give everyone the opportunity to work the PS7 prefix. The award will be granted to any Brazilian, except PS7 stations, and to foreign amateurs contacting different PS7 radio stations as follows.

Foreign radio amateurs—Work 10 different PS7 stations which have different call suffixes (for example, PS7AB, BS, CAM, DFA, EET, FCA, XA, etc.). Stations may be worked in any mode or band, including via v.h.f. repeater.

In both cases, contacts must be made after January 1, 1976. Brazilian stations send 10 single units of postage along with the log sheets; foreign stations send 6 IRCs with log sheets. Enclose your QSL card and address application to Diploma Taba Poty—PS7 Award, LABRE, P.O. Box 251, ZC 59.000, Natal (RN) Brazil.

USA-CA Honor Roll

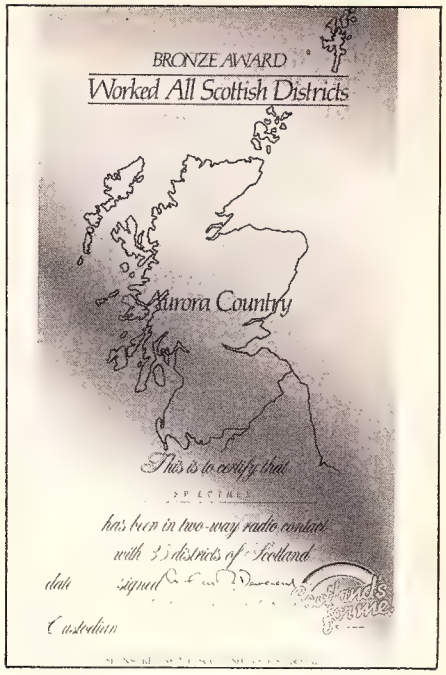
3000				500	
W5EHY	448	W2XQ	509	JA1AJA	1827
VE7ATH	449	2000		JA8AYN	1828
W2XQ	450	WA4OIB	564	WC4K	1829
N8AIL	451	1000		UA3GEA	1830
2500				JH8MXH	1831
WA4OIB	507	WC4K	775	JA8JL	1832
W5EHY	508	WDX9DCJ	776	WDX9DCJ	1833



The Redwood Empire Award.

The Redwood Empire Award. The Redwood Empire DX Association proudly announces the Redwood Empire Award. REDXA will award the unique, handsome certificate for working amateurs in each of the five coastal counties of Northern California: Marin, Sonoma, Mendocino, Humboldt, and Del Norte. Contacts must be made after Jan. 1, 1981, on any h.f. band 10–160 meters. The award is endorsable by band or mode. Send certified log data with U.S. $2.00 or 7 IRCs to: The Redwood Empire DX Association, Box 4881, Santa Rosa, CA 95402.

The certificate is professionally designed and features the best-known symbols of California's north coast. Marin County is represented by the Golden Gate Bridge, Sonoma County by its excellent grapes and wine, Humboldt County by the towering redwood trees, Del Norte County by the Pacific salmon, and Mendocino County by its major cash crop. Behind each drawing is an outline map of each county. The award is printed on heavy, light-blue stock with navy blue and black inks. It is shipped flat and will make a welcome addition to any radio shack.



Worked All Scottish Districts Award. (Details of this award are in the March 1983 Awards column.)

Notes

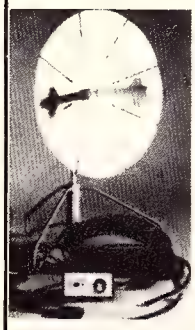
Well, we have made some mistakes! In the March column All Counties #401, John Sebastian, was listed as W8BGF. John's correct call is N8BGF. Sorry, John. Incorrect USA-CA numbers were listed in the June column. Instead of All Counties #116 and #117, they should be as follows: #416 Burwyn W. Thurman, N9TN 2-8-83; and #417 John A. Devoldere, ON4UN 2-17-83. If you are keeping your own records of USA-CA numbers, please make these corrections.

Only one more month left of the summer holidays! I hope everyone is enjoying the outdoors and sunshine.

73, Dorothy, WB9RCY

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CONFIDENTIAL
For Antenna Tuner Users Only

BY JERRY VOLPE*, KB8ZO

Today is literally the "age of the antenna tuner." In fact, there are more antenna tuners advertised in amateur radio magazines or built from construction articles in these magazines than any other station accessory. The intention of this article is not to present another rendition of the perfect antenna tuner. Instead, I hope to show you a better way to use your present antenna tuner no matter what its design.

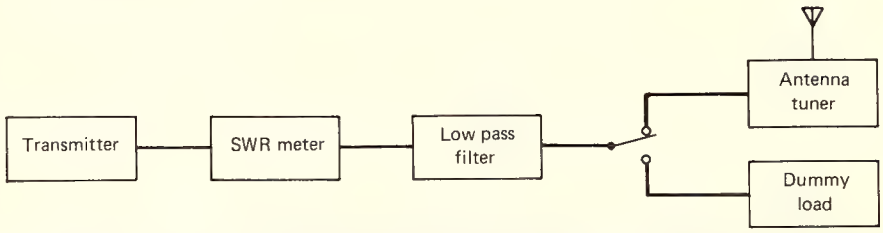


Fig. 1–Block diagram of a typical station showing the various elements which must be adjusted, usually quickly.

Adjusting Your Tuner: A Real Ordeal

Like many of you, I have never liked using an antenna tuner. Oh, I appreciate the results (a proper impedance match for the transmitter and low-pass filter). I'm just not sure that the "means" is justified by the "end." There are already so many steps involved in the station tune-up process! However, I honestly believe that there are enough honest-to-goodness benefits derived from antenna tuners that they are here to stay.

If we take a moment to think about it, there are at least three major drawbacks to using an antenna tuner. First of all, we will need to transmit through our tuner to the antenna while adjustments are being made! This on-the-air tuning is undoubtedly responsible for many of the interfering signals present on our crowded amateur bands. Secondly, our transmitters, low-pass filters, and some types of automatic T/R circuits are susceptible to damage or instability problems during the tune-up process. This, of course, is due to the tremendous mismatches presented to the equipment by the antenna tuner. In fact, many solid state transmitters are so affected by the initial inductive or capacitive reactances presented by a mistuned antenna tuner that they literally oscillate themselves to a quick death! The third drawback involves complexity. Here we must consider the equipment required (an s.w.r. meter, coax switch, and a dummy load) and the number of actual steps involved in the tune-up process.

Let's examine the basic steps involved in tuning a typical station, such as the one illustrated in fig. 1, before I present an alternative approach to antenna tuning. Normally we:

1. Attach an appropriate 50 ohm nonreactive load to the transmitter (omitted for solid state output transmitters).

2. Tune the transmitters for normal output to the dummy load (also omitted for solid state output transmitters).

3. Replace the dummy load with the antenna tuner (and the antenna!).

4. Locate an unused frequency near the proposed frequency of operation.

5. Set the s.w.r. meter for maximum sensitivity.

6. Key the transmitter, identify your station, and increase the power output until the s.w.r. meter deflects sufficiently. **CAUTION:** At this time the transmitters and low-pass filters are not operating into their designed loads. A transmitter's output will be reduced significantly, even though relative power meters may state otherwise. You might be tempted to adjust your transmitter's load and tune controls to compensate. *DON'T do it!* Simply limit the length of your test transmissions. Unfortunately, it is possible to permanently damage both your transmitter and filter at this time, even though you may be using a low-pass filter normally designed for 1 kw operation.

7. Adjust the antenna tuner's controls to obtain an acceptable s.w.r. indication. This probably will take two or more transmissions.

8. Increase the transmitter's output power (which somewhat changes the impedance transformations in the transmitter, tuner, and antenna system), reduce the sensitivity of the s.w.r. meter, and then readjust the tuner controls for the best s.w.r.

9. Identify the last transmission, and then move to the frequency of operation. Hopefully, this will not be far enough from the tune-up frequency to require readjustments.

As you can see, we do an awful lot in this tune-up process, although it can be shortened somewhat by keeping a log of tuner control settings for future starting points.

An Alternative That Works

It is often said that "adversity is the mother of invention." Well, I am not really much of an inventor, although I seem to flourish in the art of re-inventing others' ideas. Unfortunately, I must give the major credit for this idea to those hundreds of electronic marvels who came before me. In fact, it was by reading various dis-

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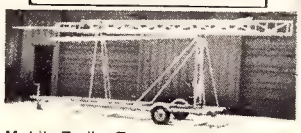
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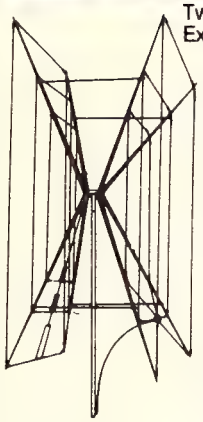


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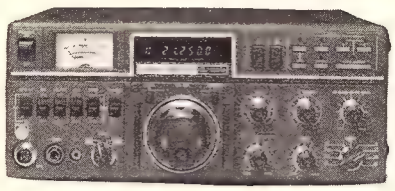
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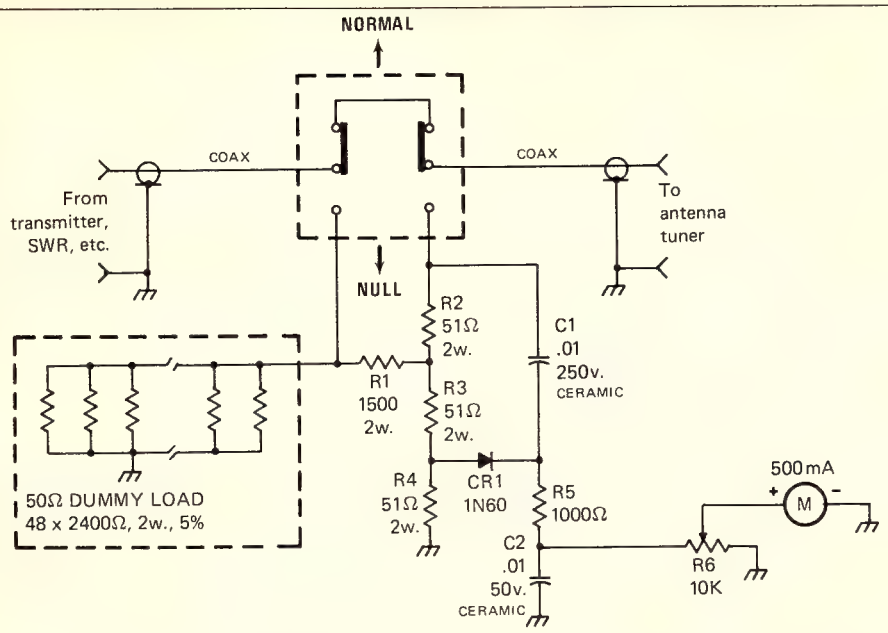


Fig. 2–Schematic diagram of an antenna null meter.

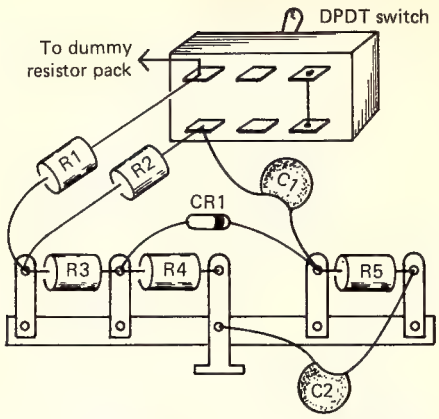


Fig. 3–Partial parts placement detailing the short lead connections of the r.f. bridge components.

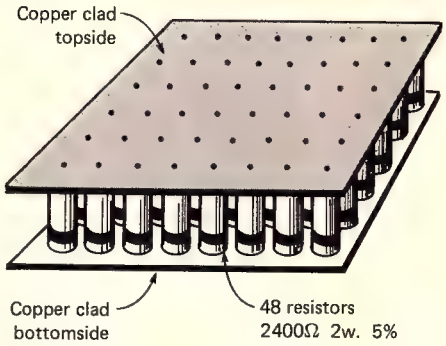


Fig. 4–Construction technique used for the inboard dummy load.

cussions in the *ARRL Solid State Design* book that I came across this idea for "improved" antenna-tuner tuning! I call this little device an Antenna Null Meter.

Fig. 2 shows the diagram for this little wonder box. The heart of the device is a 50 ohm resistive bridge, although it needs a coax switch and a dummy load for our purposes. For convenience sake, I have included the coax switch (a hefty d.p.d.t. toggle switch), the "null bridge," and a 100 watt dummy load in the same enclosure. As I live in an apartment, with the station neatly packed into a drop-front desk, I chose to compact my station as much as possible by combining all these items together. I saved a lot of money, too. However, you may wish to use an external dummy load and coax switch (d.p.d.t. variety) to build your own Antenna Null Meter.

The Antenna Null Meter

The Antenna Null Meter is a simple, highly effective, yet inexpensive device to build. In fact, the entire construction price is only a fraction of the cost of the s.w.r. bridge, coax switch, and dummy load that it replaces. All you need is a simple d.c. meter and a handful of easily obtained parts, which can be scrounged from your junk box or a local radio parts dealer.

The basic purpose of this device is to furnish you with an alternate means of adjusting an antenna tuner—a means that dramatically reduces on-the-air interference problems, protects transmitters and transmitting accessories from mismatch tuner conditions, and reduces the complexity of the tune-up process.

How It Works

Through the Antenna Null Meter's design, the transmitter's output is connected directly to a 50 ohm non-reactive load. Then a very small portion of this r.f. energy is coupled through a 1500 ohm resistor to a resistive bridge circuit made up of three 51 ohm resistors and the antenna tuner's input impedance. When the antenna tuner is adjusted so that it transforms the antenna's feedline impedance to a pure 50 ohm resistance, the bridge circuit becomes "balanced."

The balance of r.f. currents is monitored on a simple volt meter. The action of balancing the bridge eliminates any potential r.f. voltage differences between the two sides of the meter circuit, in which case the meter will read 0 volts (a perfect null). Obviously, as the antenna tuner is adjusted away from the perfect match condition, the bridge's r.f. currents become unbalanced, which results in a forward-scale deflection of the meter. The more unbalanced the bridge, the higher the meter's deflection. In this manner, the bridge portion of this device indicates when an antenna tuner is properly adjusted.

Construction

You can use any meter movement ranging from 50 microamps to 10 milliamps in this circuit, with the larger current meters giving only a slight decrease in bridge sensitivity. Regardless of your final choice of meter, you should include a sensitivity control to protect its movement from damage during the tune-up process.

R1 through R5, C1, C2, and CR1 should be mounted physically close to the d.p.d.t. switch and with the shortest leads possible. This can be accomplished by mounting them on a 5 lug terminal strip at the switch as shown in fig. 3. The coax connectors and the dummy load are connected to the switch through lengths of RG-8X coax. The d.p.d.t. toggle switch can be any type able to hold approximately 10 amps at 110 v.a.c. The dummy load can be internal or external to the unit. However, building one inside the unit eliminates one more coax from the jumble of cables in your shack.

The dummy load for this unit is made up of forty-eight 2400 ohm 2 watt resistors that are sandwiched together, with air spacing of ¼ inch, between two identically drilled circuit boards. The resistor ends are mounted flush with the non-clad side of each circuit board. Then the leads are soldered to the foil side and cut. Finally, the finished "sandwich" is mounted to the bottom panel of the cabinet. This keeps the ground connection short, which eliminates stray reactances at the higher r.f. frequencies.

The finished dummy load, shown in fig. 4, is capable of dissipating at least 98 watts of r.f. power. In practice, one of these dummy loads has worked for a year on my TS-520SE, and has never shown any tendency to heat-up. Of course, other combinations of 2 watt resistors could be used. However, this particular choice seemed best for both cost and performance. In fact, the total cost of the resistors and circuit boards was under $9.00!

Installation and Operation

The Antenna Null Meter (A.N.M.) should be installed directly ahead of the antenna tuner. This particular unit should not be used at power inputs much above 100 watts, although this restriction is primarily a function of the dummy load's size. Once your A.N.M. is installed, you:

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1. Select the band and frequency of operation.

2. Turn the A.N.M. switch to the **TUNE** position.

3. Tune the exciter for normal operating power. Remember that even though 99 percent of your r.f. is going to a dummy load, you still must identify your transmissions!

4. Adjust the antenna-tuner controls for a total "null" on the A.N.M.'s meter. You may need to change the sensitivity control while making these adjustments.

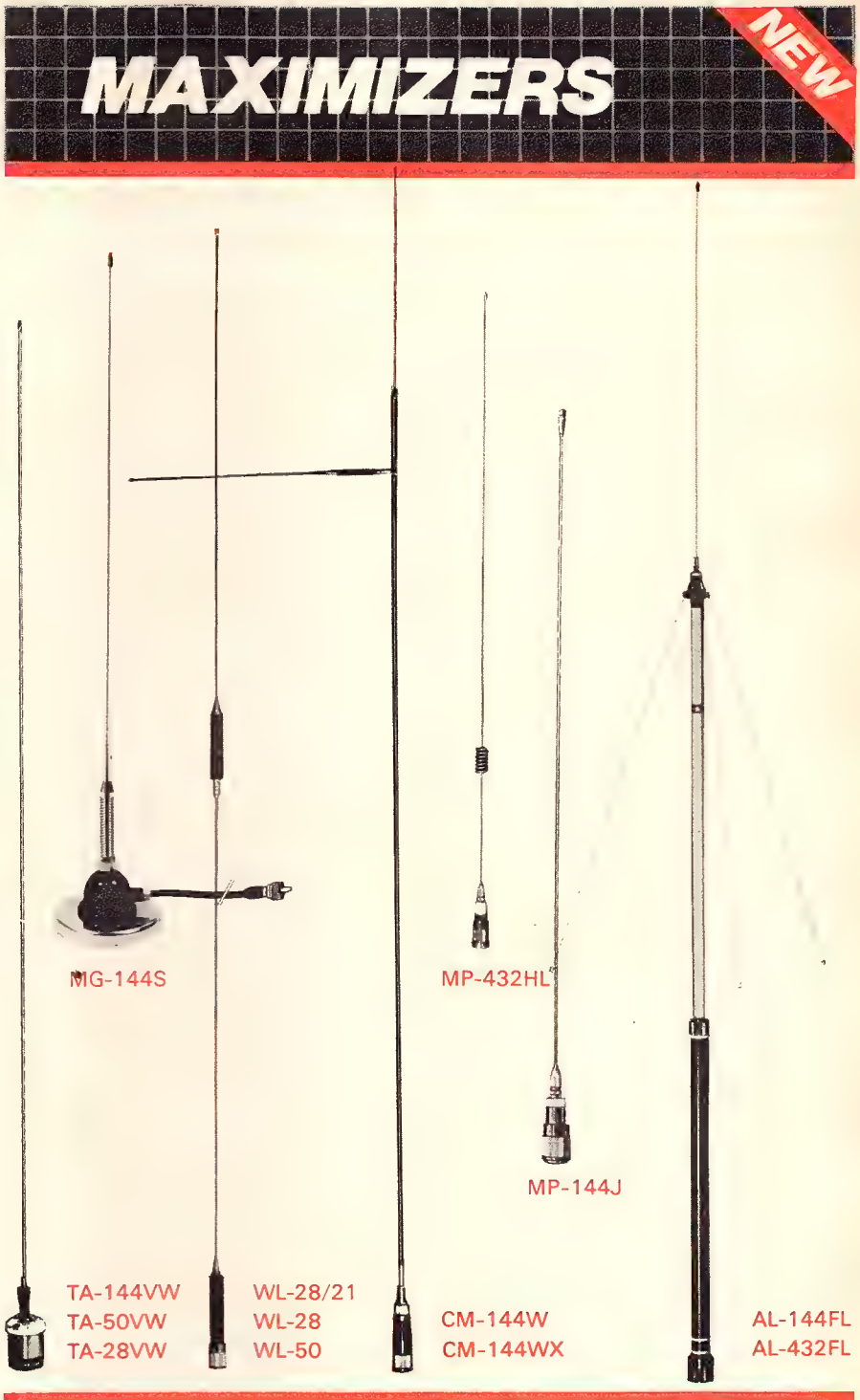
5. Switch the A.N.M.'s switch to **NORMAL** and transmit away!

Final Notes

I don't believe that antenna tuners are cure-alls when it comes to antenna/transmitter matching. To the contrary, I believe, like many of you, that the antenna should be matched to the feedline when at all possible, thus presenting a matched 1.0 to 1 condition to the transmitter. However, even in the best of conditions a perfect antenna/feedline match is a function of frequency. Therefore, as you tune above or below the design frequency of your antenna, there is an increasing mismatch between the antenna system and the transmitter. As long as an antenna system to transmitter mismatch is 2.0 to 1 or less, you will have very little trouble loading a tube-type transmitter for maximum output, although the effectiveness of internal and external low-pass filters (TVI fighters) is reduced. However, this is not true with solid state transmitters.

Antenna to transmitter matching is extremely critical for most solid state transmitters, as they are very s.w.r. sensitive, even to the point of cutting their output power by 25 or more percent with a 2.0 to 1 s.w.r. Add to this the fact that many solid state transmitters either break into immediate high-power oscillations or shut-off altogether when operated into a badly mistuned antenna circuit. Therefore, it is important that the antenna/feedline combination show a good match to this type of transmitter, regardless of how far you have tuned from the antenna's design frequency. Unfortunately, this is a job that can only be accomplished with an antenna tuner.

So, you see, whether you have a tube-type or solid state transmitter, antenna tuners can be extremely useful devices. I've used many different types of tuners over the years, although I had never found them to be particularly convenient—at least not until I built my first Antenna Null Meter. Since then antenna tuning has become a cinch. The null meter makes using the tuner easy, and the tuner keeps my transmitter and low-pass filter happy, in which case they last a long, long time, delivering all that communicating power to the ether. And that, my friends, is the name of the game! So use your antenna tuner in good health, and perhaps the next time you are tuning up, we won't hear you.



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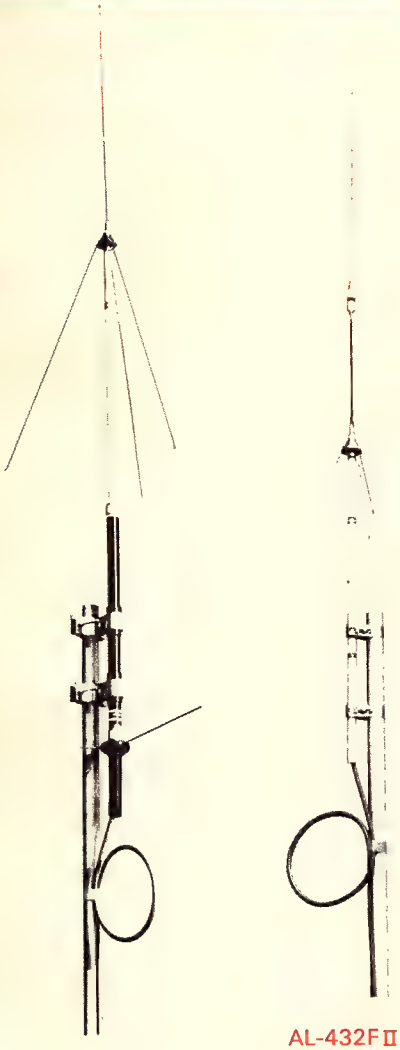
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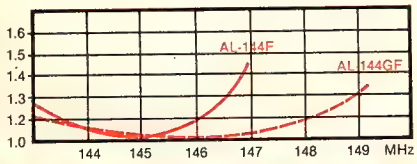
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Many types of antennas have been used by radio experimenters, commercial users, and radio amateurs. Some of these have been adopted for general use and are well known. Others, some with merit, some lacking same, have fallen into disuse and dropped out of sight and memory. Among these is the "condenser antenna." As its name implies, it has the form of a two-plate capacitor with both plates above ground. The lower plate normally is somewhat larger than the upper to compensate for the "fringe effect."

The capacitor antenna, to use more modern terminology, had a flurry of interest in the early 1920s, chiefly as a receiving antenna. It was touted as a competitor of the loop antenna for replacement of outside aerials. A test conducted by the Radio Laboratory, U.S. Bureau of Standards, revealed the loop to be better for lower frequencies (below about one megahertz) and the capacitor type to have advantages on higher frequencies. This information was published in the April 1923 issue of *Radio News* and was made available to the author through the courtesy of Ken Bale, W7VCB, and Ray Long, W5TY.

As these tests were made only for the receiving mode, they left untouched the interesting question of performance as a radiator. There is reason to suspect that the capacitor antenna may have some merit as a radiator.

The Radio Laboratory tests indicated that ohmic resistance and dielectric losses were major limiting factors in its performance. Each of these was easy to reduce to quite small amounts. By making the plates of copper mesh, resistance was dropped to a very low figure. Dielectric losses were kept low by two means. One was to keep material out from between the two plates by supporting the plates from their corners with insulating material (rope, etc.) running out to the supporting posts. The other was to keep the entire structure well above ground to minimize ground losses. It was important, too, to keep the edges of the antenna well removed from buildings, trees, etc.

One description of such an antenna in another magazine (*Popular Radio*) of the same vintage revealed square plates with a lead-in coming down from the middle of the upper plate and through the center of the bottom plate to the radio equipment immediately below. Although polarization was not mentioned, it is probable that it was vertical, with the actual radiation in the transmitting mode taking place from the vertical lead-in. (This premise is suggested by the functioning of the DDRR antenna.)

The Radio Laboratory version, as illustrated in *Radio News*, showed rectangular plates with leads from both the upper and the lower plates coming off an edge and running to radio equipment sitting alongside the antenna. The rectangular plates, which were 310 cm by 90 cm for the upper and 400 cm by 180 cm for the lower, with 80 cm spacing initially and 120 cm later, did not introduce any directional effects, according to the Bureau of Standards report. There was no mention of how radiation would take place when used as a transmitting antenna and no mention of polarization.

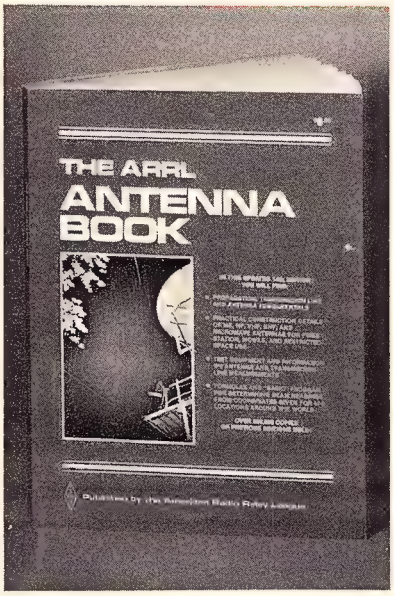
As a general rule, the more interface there is between the conducting surface of a radiator and the surrounding space, the more effective is the radiator. Accepting this premise leads one to believe the capacitor antenna might be an effective radiator. On the other hand, recalling the action of strip-type wave guides would suggest that little energy would extend (be radiated) beyond the dimensions of the (larger) lower plate unless there was great distance between the two plates. Reception experiments indicate that separation of plates has a major bearing on strength of received signals, and it is reasonable to believe that the reciprocal relationship would hold for the transmitting mode.

Although the Bureau of Standards report gave numerical values to matters such as resistance (ohmic plus loss) and capacitance, it did not touch on the matter of feed-point impedance. This, of course, would be of prime interest to the modern radio amateur. It remains for some ambitious amateur, one equipped with the time, the space, and the required apparatus, to investigate and to explore not only feed-point impedance but use capabilities. Who knows? Possibly here may be a limited-space antenna worthy of wide acceptance! ▣

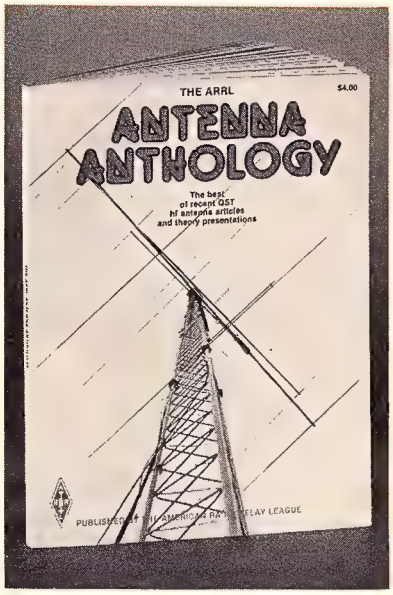
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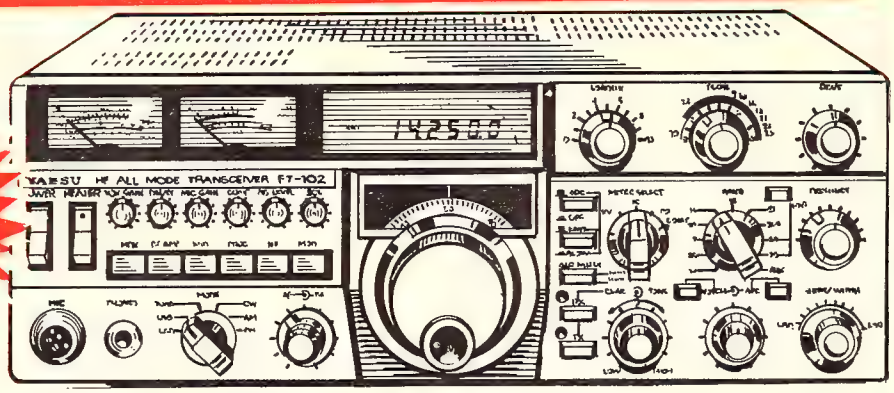
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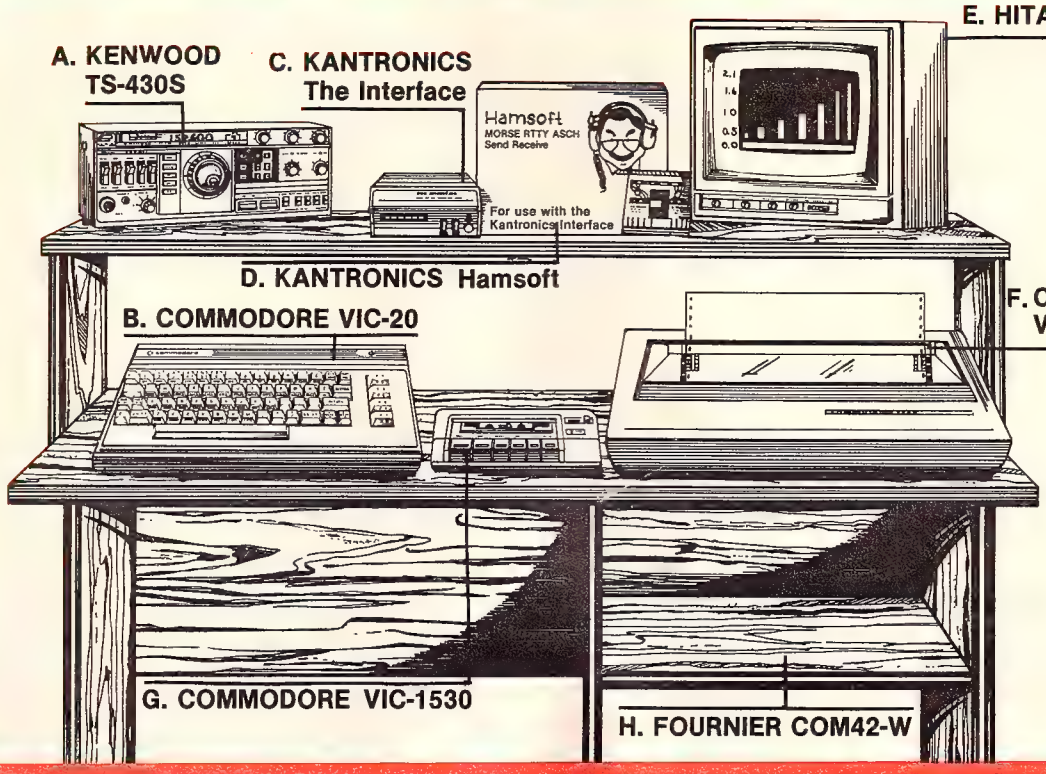


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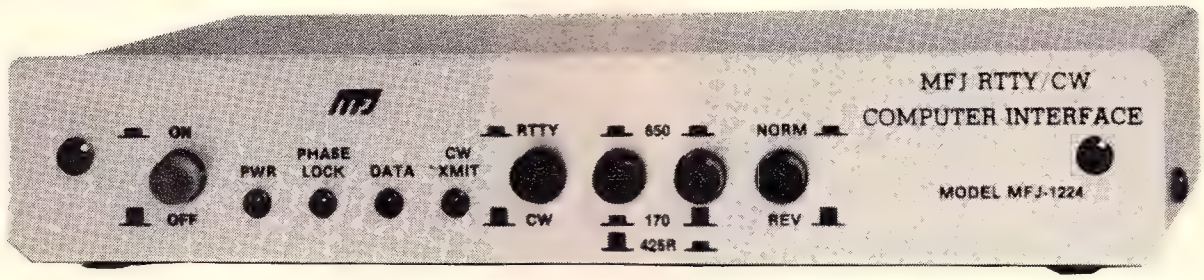
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A 2 LED tuning indicator system makes tuning fast, easy and positive. You can distinguish between RTTY/CW without even hearing it.

Once tuned in, the interface allows you to copy any shift (170, 425, 850 Hz and all shifts between and beyond) and any speed (5 to 100 WPM on RTTY/CW and up to 300 baud on ASCII).

Copies on both mark and space, not mark only or space only. If either the mark or space is lost the MFJ-1224 maintains copy on the remaining tone. This greatly improves copy under adverse conditions.

A sharp 8 pole active filter for 170 Hz shift and CW allows good copy under crowded, fading and weak signal conditions. Uses FET input op-amps.

An automatic noise limiter helps suppress static crashes for better copy.

A Normal/Reverse switch eliminates retuning while stepping thru various RTTY speeds and shifts.

The demodulator will even maintain copy on a slightly drifting signal.

A +250 VDC loop output is available to drive your RTTY machine. Has convenient speaker output jack.

Phase continuous AFSK transmitter tones are generated by a clean, stable Exar 2206 function generator. Standard space tones of 2125 Hz and mark tones of 2295 and 2975 Hz are generated. A set of microphone lines is provided for AFSK out, AFSK ground, PTT out and PTT ground.

FSK keying is provided for transceivers with FSK.

High voltage grid block and direct outputs are provided for CW keying of your transmitter. A CW transmit LED provides visual indication of CW transmission. There is also an external hand key or electronic keyer input jack.

In addition to the Kantronics compatible socket, an exclusive general purpose socket allows interfacing to nearly any personal computer with most appropriate software. The following TTL compatible lines are available: RTTY demod out, CW demod out, CW-ID input, +5 VDC, ground. All signal lines are buffered and can be inverted using an internal DIP switch.

For example, you can use Galfo software with Apple computers, or RAK software with VIC-20's. Some computers with some software may require some external components.

DC voltages are IC regulated to provide stable AFSK tones and RTTY/ASCII/CW reception.

Aluminum cabinet. Brushed aluminum front panel. 8x1¼x6 inches. Uses 12-15 VDC or 110 VAC with optional adapter, MFJ-1312, $9.95.

RTTY/ASCII/CW Receive Only SWL Computer Interface



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Use your personal computer to receive commercial, military and amateur RTTY/ASCII/CW traffic.

The MFJ-1225 automatically copies all shifts (850, 425, 170 Hz shift and all others) and all speeds.

It plugs between your receiver and VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64 and most other personal computers.

It uses Kantronics software which features CW receive 5-99 WPM, RTTY receive 60,67,75,100 WPM, and ASCII receive 110, 300 baud, plus more.

An automatic noise limiter helps suppress static crashes for better copy, while a simple 2 LED tuning indicator system makes tuning fast, easy and positive.

In addition to the Kantronics compatible socket, a general purpose socket provides RTTY out, RTTY inverted out, CW out, CW inverted out, ground and +5VDC for interfacing to nearly any personal computer with most appropriate software.

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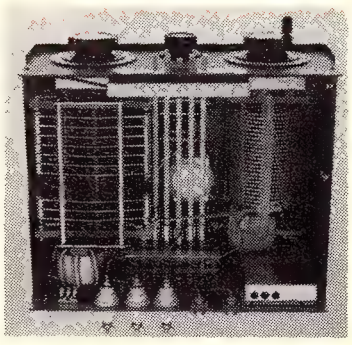
COMPUTERS + RADIO = RTTY/MORSE

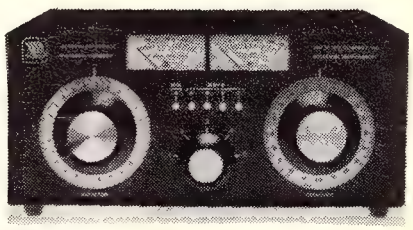
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#2 Above package with HAMTEXT $375.00
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Ground systems are the most frequent culprit. Be sure you're not running parallel to the tx line. No? Check for inductance coupling with fences, rain gutters, etc. Go step by step. Need help? Call our regular number for advice. YOU ARE NOT UNIQUE, and we might help.

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"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Military Radio Frequency Transmission Lines

The transmission line between the station equipment and antenna is very important. This feedline carries the transmitter's radio frequency (r.f.) output to the antenna; it also brings signals from the antenna to the receiver portion of the station. Attenuation (loss) in the feedline causes a reduction in the signal transmitted from the antenna. Of more importance, feedline loss can make it difficult (or impossible) to have a contact with a very weak station. Use good feedline to have optimum results. Using a high-loss feedline at one's station is like running your car on kerosene and mothballs.

The list accompanying this column provides basic technical information on all existing transmission lines identified by RG/U and the newer M17 designations. Most of these cables are coaxial, but there are other types such as triaxial and waveguide. Most of the information in this list is extracted from Military Specification MIL-C-17E (dated 12 July 1974), updated through Amendment 3 of 12 February 1982, General Specification for Flexible and Semirigid Radio Frequency Cables. The explanations in the following paragraphs can help you select proper transmission lines for your applications.

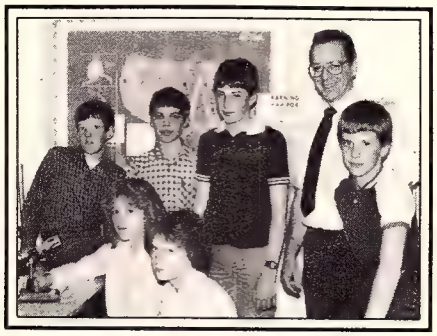
Transmission-line cables are presently being manufactured with 13 types of outer protective jackets, although 3 types are no longer used in new cable designs. They are also made using 24 types of dielectrics, with 6 types no longer used in new cable designs. Type I and IIA jackets are most common to our applications.

Type I low-temperature plasticized polyvinylchloride (PVC) jackets are used on cables of older design. Some Type I jackets are vinyl-acetate copolymer. Type I jackets have a plastisizer (extender) incorporated during their manufacture to improve cable flexibility. Cable flexibility is satisfactorily maintained by this method, but the extender migrates through the shield braid and attacks the insulation surrounding the center conductor. The insulation deteriorates and the radio frequency losses increase. The lifespan of this kind of coax, before losses become high, is only about two years from the date of manufacture, and old coax of this type is no bargain at any price.

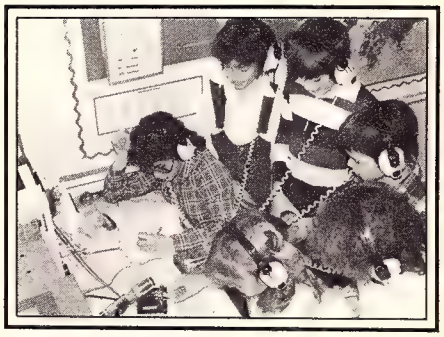
Type IIA non-contaminating medium / low-temperature plasticized synthetic resin protective (black) jackets are used on newer cables such as RG-213/U (RG-8/U replacement). This jacketing has a long service life, is abrasion resistant, and is not damaged by sunlight. These Type IIA jackets do not contain an extender which would contaminate the insulation surrounding the center conductor. Cables with Type IIA jackets can be buried for underground use. These cables have a minimum service life of about 20 years, and they usually cost no more than those with Type I jacketing. Type II jackets were also made from a non-contaminating synthetic resin. Type II jackets are similar to Type IIA jackets but they are gray, not black.

RG-8/U has not been manufactured to military specifications since November of 1969, and individual cable manufacturers now produce their own versions of RG-8/U, which are sometimes not a good value. The braided shield on cheapened cables is usually reduced to the point where any bend in the cable causes an undesirable gap to open in the sparse shielding. Inadequate shielding results in unacceptable r.f. leakage, even at relatively low frequencies and power levels.

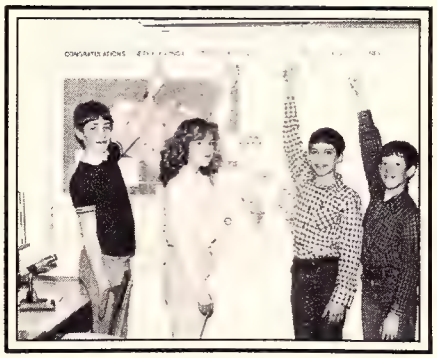
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The 1982–83 Radio Club members. Four of the six are Novices in this new club and are working on their General tickets. Sponsor L.K. Woods is at right.



This shows a typical noontime scene in the classroom. While these students listen in to a c.w. contact, others are practicing code using tape recorders.



These are the four Novice license holders in the club: Gerry Fink, KA7NQX; Tracey Mader, KA7NQW; Joe Kalus, KA7NRG; and Scott Madsen, KA7NRH. Tracey at age 11 is the youngest YL ever to be licensed in Wyoming!

Here are Gerry Fink, KA7NQX; Tracey Mader, KA7NQW; Joe Kalus, KA7NRG; and Scott Madsen, KA7NRH. All four are in the 11 to 13 year age bracket, and they are members of the Clear Creek Middle School Amateur Radio Club in Buffalo, Wyoming. Larry Woods, KC7HL, provides a hands-on introduction to amateur radio for his sixth and seventh grade students. The classroom station includes a Kenwood TS-530S transceiver with an automatic keyer; their antenna is a 5-band vertical. They hope to expand their station to include SSTV (Slow-Scan TV) and RTTY (radioteletype) next year. The students paid for all station equipment and accessories by conducting fund raisers. They have contacted 65 countries and most states. They operate before and after school, plus lunch times. Several new Novices are in process in this club, and the four current Novices are hoping to upgrade to General soon. FCC examinations are just conducted two times per year in their area, and the test site is not in Wyoming. It appears that Larry is doing an excellent job of using amateur radio to increase learning interest on the part of his students; at the same time, he is making it easier for other amateurs to contact Wyoming.

This leakage is worse when one of these cables is used at higher frequencies and power levels. It is not advisable to use cables which are not manufactured to current military specifications, *unless* you specifically know that they meet your requirements. These commercial equivalent cables are sometimes less efficient, but they are just as expensive as their superior counterparts. It has recently become common to see cheap coax with aluminum shielding in lieu of the usual copper braid. This aluminum shielding is usually found on cables sold with connectors already attached. There is no satisfactory way to solder to aluminum, and users of this kind of cable are forced to use crimp-type connectors when these cables are cut.

Manufacturers' specifications would seem to indicate that coax with foamed insulation is better than coax with the usual solid insulation. Foamed coax has a higher velocity of propagation and less loss when comparing specifications. However, these foamed coaxial cables may not be as good as they appear to be at first glance. Many of these foam insulations are not gas impregnated and moisture accumulates in the air bubbles. This moisture accumulation changes the velocity of propagation, alters the characteristic impedance, and increases r.f. attenuation in foamed cables. There is another practical disadvantage to foamed cables: they are physically more susceptible to damage at bend points. When using a cable with foam insulation, one must exercise extreme care to avoid mechanical bending stress.

In summary, use coaxial cables which are manufactured to current military specifications and which have Type II or Type IIA jackets. Do not use coax with (non-gas) foamed insulation and Type I jackets. The better coaxial cables usually cost no more than their less useful counterparts. It is often easier to use RG-58C/U in lieu of RG-213/U for the various short interconnections required in the station. RG-58C/U is smaller, cheaper, and more flexible than RG-213/U. However, RG-58C/U has about twice as much loss as RG-213/U, so it should not be used for long transmission lines, such as between the station and an outside antenna.

The better known "RG" cable designations are listed first in this list followed by the newer "M17" cables. The part number of every "RG" cable has been changed to an "M17" number, and most have been superseded by a new "M17" number following the initial change. The first change resulted in a coaxial cable such as RG-213/U being re-identified as M17/74-RG213. The second change resulted in M17/74-RG213 being superseded by M17/163-00001, and this latter number is the new correct identification of this cable. However, it is realized that the older numbers will be seen and used for several years. In this example (M17/163-00001), M17 refers to the basic specification (MIL-C-17), /163 is the sheet number in that specification (163), and the 00001 is the number of the cable in that group (issued in sequence).

If you need additional information, you can request it from coaxial cable manufacturers such as:

Amphenol Cable Division
2122-T South York Road
Oak Brook, IL 60521

Belden Corporation, Electronic Div.
2000 South Batavia Avenue
Geneva, IL 60134

Cablewave Systems, Inc.
60 Dodge Avenue
North Haven, CT 06473

Champlain Cable Corporation
West Canal Street
Winooski, VT 05404

Columbia Electronic Cables
New Bedford, MA 02744

Dearborn Wire and Cable Company
9299 Evenhouse Avenue
Rosemont, IL 60018

Essex, Telecommunications Products Div.
1601 Wall, Department 2-R
Fort Wayne, IN 46804

ITT Suprenant
172 Sterling Street
Clinton, MA 01510

National Wire and Cable Corporation
136 San Fernando Road
Los Angeles, CA 90031

Phalo Corporation
530 Boston Turnpike
Shrewsbury, MA 01545

Pirelli Cable Corporation
2 Tower Drive
Wallingford, CT 06492

Plastoid Corporation
Gingerbread Castle Road
Hamburg, NJ 07419

Precision Tube Company, Inc.
Wissahickon and Church
North Wales, PA 19454

Standard Wire and Cable Company
2345 Alaska Avenue
El Segundo, CA 90245

Teledyne Thermatics
P.O. Drawer 505
Elm City, NC 27822

Tensolite Division, Carlisle Corporation
Old Post Road, Route 9A
Buchanan, NY 10511

Thermax Wire Corporation
32-02 Linden Place
Flushing, NY 11354

Thermofil, Limited
Industrial Zone
Maalot, Israel

Times Fiber Communications, Inc.
358 Hall Avenue, P.O. Box 384
Wallingford, CT 06492

Uniform Tubes, Incorporated
200 West 7th Avenue
Collegeville, PA 19426

The purpose of each column of the cable list is as follows:

An asterisk **(*)** preceding a cable designation (RG/U) indicates that the cable is known to have the preferred Type II or Type IIA outer protective jacket.

The **RG/U** column shows just the basic transmission-line numbers in sequence. As an example, RG-58C/U is listed as 58C. R, G, and U represent Radio Frequency Transmission Line (R), Government Designation (G), and Universal Application (U).

The **Ohms** column lists the characteristic impedance (if applicable) shown in the associated military specification. Cable

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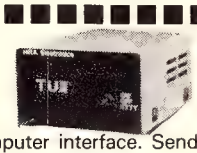
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manufacturers often show a different value and this is okay as long as their stated impedance falls within the specified allowable tolerance. As an example, RG-213/U is listed as 50 ohms with a tolerance of 2 ohms; consequently, a manufacturer can list their RG-213/U as being any characteristic impedance between 48 and 52 ohms.

The **Tol.** column lists the characteristic impedance tolerance allowed, whenever it is known. Unless otherwise stated, each tolerance can be assumed to be plus or minus.

The **Cap./ft.** column lists the typical capacitance between the inner conductor and the outer shield.

The **Velocity Factor** column gives the relationship between a full wavelength in free space and a full wavelength of coaxial cable. For example, in free space a full wavelength at 7.15 MHz is 137.66 feet. A full wavelength of RG-8/U would be 137.66 times the velocity factor (.659), or 90.72 feet. This information is useful in certain applications for phasing antennas.

The **10 MHz** column lists the typical attenuation (in decibels) at 10 megahertz per every 100 feet of transmission line. The number to the right is the power-handling capability (in watts) at 10 MHz. Cable manufacturers may rate their cables at better values than the specification requires.

The **400 MHz** column lists the typical attenuation (in decibels) at 400 megahertz per every 100 feet of transmission line. The number to the right is the rated minimum power-handling capability at 400 MHz. Cable manufacturers may rate their cables at lower loss levels and higher power-handling capabilities than the specification requires. Remember that power is approximately doubled or halved by each 3 dB change; this means that a 100 foot length of cable with an attenuation of 6 dB at 400 MHz cannot be expected to deliver more than 25 watts to the load (antenna) when 100 watts of 400 MHz power is supplied to its input from the transmitter.

The **Comment** column contains amplifying information. *Inactive* in the comment column means the cable is inactive for new design use.

Notes

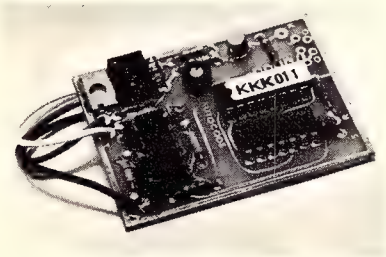
Since the r.f. currents flowing through coaxial cable flow along the outer surface of the inner conductor (the GO line) and the inner surface of the outer conductor (the RETURN line), each coax acts like a waveguide above some critical frequency.

Regardless of which cable you select, remember to avoid sharp bends and to minimize mechanical stress on your cables. Sharp bends can displace the center conductor closer to the shield, and this lowers the characteristic impedance of the cable.

RG/U	Ohms	Tol.	Cap./ft. (in pF)	Velocity Factor	10 MHz dB	10 MHz Watts	400 MHz dB	400 MHz Watts	Comment
1	—	—	—	—	—	—	—	—	Waveguide
2	—	—	—	—	—	—	—	—	Waveguide
3	—	—	—	—	—	—	—	—	Waveguide
4	50	2	—	—	1.40	650	—	—	Superseded by 58B
5	52.5	2	—	—	0.83	1500	6.5	200	Superseded by 5A
*5A	50	2	—	—	0.83	1500	6.5	200	Superseded by 5B
*5B	50	2	29.5	.659	0.83	1500	6.5	200	Superseded by M17/73-RG212
*6	75	3	—	—	0.83	1500	6.5	200	Superseded by 6A
*6A	75	3	20.0	.659	0.83	1500	6.5	200	Superseded by 6B
6B	75	3	—	—	0.83	1500	6.5	200	Superseded by M17/2-RG006
7	97	3	—	—	0.66	3500	6.0	300	—
8	52	2	29.5	.659	0.66	3500	6.0	300	Superseded by 8A
*8A	52	2	29.5	.659	0.66	3500	6.0	300	Superseded by 213
*9	51	2	—	—	0.66	2700	6.1	300	Superseded by 9A
*9A	51	2	29.5	.659	0.66	2700	6.1	300	Superseded by 9B
*9B	50	2	30.0	.659	0.66	2700	6.1	300	Superseded by 214
*10	52	2	—	—	0.66	3500	6.0	300	Superseded by 10A
*10A	52	2	29.5	.659	0.66	3500	6.0	300	Superseded by 215
11	75	3	20.5	.659	0.66	2500	5.2	250	Superseded by 11A
*11A	75	3	20.5	.659	0.66	2500	5.2	250	Superseded by M17/6-RG011
*12	75	3	—	—	0.66	2500	5.2	250	Superseded by 12A
*12A	75	3	20.5	.659	0.66	2500	5.2	250	Superseded by M17/6-RG012
13	74	3	—	—	0.66	2500	5.7	250	Superseded by 13A
*13A	74	3	20.5	.659	0.66	2500	5.7	250	Superseded by 216
*14	52	2.5	—	—	0.41	6000	3.1	480	Superseded by 14A
*14A	52	2.5	29.5	.659	0.41	6000	4.3	480	Superseded by 217
15	75	3	—	—	0.66	2500	—	—	Superseded by 12A/11A
16	52	2	—	—	—	—	—	—	Good to 1 GHz
*17	52	2	—	—	0.24	14000	2.8	1100	Superseded by 17A
*17A	52	2	29.5	—	0.24	14000	2.8	1100	Superseded by 17B
*17B	50	2	—	—	0.24	14000	2.8	1100	Superseded by 177
*18	52	2	—	—	0.24	14000	2.8	1100	Superseded by 18A
*18A	52	2	29.5	659	0.24	14000	2.8	1100	Superseded by 219
*19	52	2	—	—	0.17	25000	2.3	1500	Superseded by 19A
*19A	52	2	29.5	.659	0.17	25000	2.3	1500	Superseded by 220
*20	52	2	—	—	0.17	25000	2.3	1500	Superseded by 20A
*20A	52	2	29.5	.659	0.17	25000	2.3	1500	Superseded by 221
*21	53	2	—	—	4.40	340	33.0	60	Superseded by 21A
*21A	53	2	—	—	4.40	340	33.0	60	Superseded by 222
22	95	5	—	—	1.20	1700	9.5	150	Superseded by 22A
*22A	95	5	—	—	1.20	1700	9.5	150	Superseded by 22B
*22B	95	5	—	—	1.20	1700	6.8	150	Superseded by M17/15-RG022
23	125	5	—	—	0.40	—	5.2	—	Superseded by 23A
*23A	125	5	—	—	0.40	—	5.2	—	Superseded by M17/16-RG023
24	125	5	—	—	0.40	—	5.2	—	Superseded by 24A
*24A	125	5	—	—	0.40	—	5.2	—	Superseded by M17/16-RG024
25	48	4	—	—	—	—	—	—	Superseded by 25A
25A	48	4	—	—	—	—	—	—	HV Pulse Cable
26	48	4	—	—	—	—	—	—	Superseded by 26A
26A	48	4	—	—	—	—	—	—	Armored Pulse Cable
27	48	4	—	—	—	—	—	—	Superseded by 27A
27A	48	4	—	—	—	—	—	—	HV Pulse Cable
28	48	4	—	—	—	—	—	—	Superseded by 28A
28A	50	4	—	—	—	—	—	—	Superseded by 28B
28B	48	4	—	—	—	—	—	—	Pulse Cable
29	53.5	2	—	—	1.35	1150	8.8	160	Superseded by 58C
30	58	2	—	—	1.35	1150	8.8	160	Superseded by 58C
31	51	2	—	—	0.66	3500	5.5	300	Superseded by 213
32	51	2	—	—	0.66	3500	5.5	300	Superseded by 215
33	51	2	—	—	0.66	3500	—	—	—
34	71	3	—	—	0.32	7200	3.8	650	Superseded by 34A
*34A	75	3	—	—	0.32	7200	3.8	650	Superseded by 34B
*34B	75	3	20.0	.659	0.32	7200	3.8	650	Good to 1 GHz
*35	71	3	—	—	0.24	13500	2.8	1500	Superseded by 35A
*35A	75	3	—	—	0.24	13500	2.8	1500	Superseded by 35B
*35B	75	3	20.5	.659	0.24	13500	2.8	1500	Armored 164
36	69	3	—	—	—	—	—	—	Good to 1 GHz
37	52.5	2	—	—	1.25	730	—	—	Superseded by 58C
38	52.5	2	—	—	0.83	1500	—	—	Superseded by 212
39	72.5	3	—	—	0.83	1500	—	—	Superseded by 6B/59B
40	72.5	3	—	—	0.83	1500	—	—	Superseded by 6B
41	67.5	—	—	—	—	—	—	—	—
*42	78	—	—	—	—	—	—	—	Superseded by 222
43	95	—	—	—	—	—	—	—	Superseded by 130
44–47	—	—	—	—	—	—	—	—	Stud-Supported
48–53	—	—	—	—	—	—	—	—	Waveguide
54	58	—	—	—	0.92	1580	7.0	200	Superseded by 54A
54A	58	—	—	—	0.92	1580	7.0	200	Good to 1 GHz
55	53.5	2.5	28.5	.659	1.35	800	11.7	90	Superseded by 55A
*55A	50	2	29.5	.659	1.35	800	11.7	90	Superseded by 55B
*55B	53.5	2.5	28.5	.659	1.35	800	11.7	90	Superseded by 223
56	48	—	—	—	—	—	—	—	Pulse Cable
57	95	5	—	—	0.65	3000	8.8	350	Superseded by 57A
*57A	95	5	—	—	0.65	3000	8.8	350	Superseded by 130
58	53.5	—	28.5	.659	1.25	730	10.0	85	Superseded by 58A
58A	50	2	29.5	.659	1.40	650	14.0	75	Superseded by 58B
*58B	53.5	—	—	—	1.25	730	10.0	85	Superseded by 58C
*58C	50	2	29.5	.659	1.40	650	14.0	75	Superseded by M17/28-RG058
59	73	3	21.0	.659	1.10	1200	9.0	135	Superseded by 59A
*59A	75	3	—	—	1.10	1200	9.0	135	Superseded by 59B

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RG/U	Ohms	Tol.	Cap./ft. (in pF)	Velocity Factor	10 MHz dB	10 MHz Watts	400 MHz dB	400 MHz Watts	Comment
*59B	75	3	20.5	.659	1.10	1200	9.0	135	Superseded by M17/29-RG059
60	50	—	—	—	—	—	—	—	Pulse Cable
61	500	—	—	—	—	—	—	—	—
62	93	5	13.5	.840	0.90	1300	8.0	125	Superseded by 62A
*62A	93	5	—	—	0.90	1300	8.0	125	Solid Conductor
62B	93	5	—	—	0.90	1300	8.0	100	Extra Flexible
62C	93	5	—	—	0.90	1300	8.0	100	Superseded by M17/30-RG062
63	125	6	—	—	0.52	3000	5.5	340	Superseded by 63A
63A	125	6	—	—	0.52	3000	5.5	340	Superseded by 63B
*63B	125	6	10.0	.840	0.52	3000	5.5	340	Superseded by M17/31-RG063
64	48	4	—	—	—	—	—	—	Superseded by 64A
64A	48	4	—	—	—	—	—	—	Superseded by M17/33-RG064
65	950	50	—	—	21.20	—	—	—	Video Delay
*65A	950	50	—	—	21.20	—	—	—	Video Delay
66–69	—	—	—	—	—	—	—	—	Waveguide
70	—	—	—	—	0.66	3500	6.0	300	—
71	93	5	13.5	.840	0.90	1300	8.0	125	Superseded by 71A
71A	93	5	13.5	.840	0.90	1300	8.0	125	Superseded by 71B
71B	93	5	13.5	.840	0.90	1300	8.0	135	Superseded by M17/90-RG071
72	150	—	—	—	0.50	2300	3.6	430	—
73	25	—	—	—	—	—	—	—	—
*74	52	2	—	—	0.41	6000	4.3	48	Superseded by 74A
*74A	52	2	29.5	.659	0.41	6000	4.3	48	Superseded by 224
75	—	—	—	—	—	—	—	—	Waveguide
76	—	—	—	—	—	—	—	—	Stud-Supported
77	48	—	—	—	—	—	—	—	Superseded by 77A
*77A	48	—	—	—	—	—	—	—	Pulse Cable
78	50	—	—	—	—	—	—	—	Superseded by 78A
*78A	50	—	—	—	—	—	—	—	Pulse Cable
79	125	6	—	—	0.52	3000	5.5	340	Superseded by 79A
79A	125	6	—	—	0.52	3000	5.5	340	Superseded by 79B
*79B	125	6	10.0	.840	0.52	3000	5.5	340	Superseded by M17/31-RG079
80	—	—	—	—	—	—	—	—	Bead-Supported
81	50	+4/−2	—	—	—	—	5.5	—	Cancelled
82	50	+4/−2	—	—	—	—	5.5	—	Cancelled
83	35	—	—	—	—	—	—	—	Deleted
84	75	3	—	—	0.24	13500	2.8	—	Superseded by 84A
*84A	75	3	—	—	0.25	13500	2.8	—	Cancelled
85	75	3	—	—	0.24	13500	2.8	—	Superseded by 85A
*85A	75	3	—	—	0.24	13500	2.8	—	Armored 84A/Inactive
86	200	10	—	—	—	—	—	—	Cancelled
87	50	2	—	—	0.60	15000	5.0	2500	Superseded by 87A
87A	50	2	—	—	0.60	15000	5.0	2500	Superseded by 225
88	48	4	—	—	—	—	—	—	Superseded by 88A
*88A	48	4	—	—	—	—	—	—	Superseded by 88B
88B	50	—	—	—	—	—	—	—	HV Pulse Cable/Inactive
89	125	—	—	—	—	—	—	—	Deleted
*90	50	—	—	—	—	—	—	—	Excellent Shielding
91	—	—	—	—	—	—	—	—	Waveguide
92	46	—	—	—	—	—	—	—	Bead-Supported
93	50	—	—	—	—	—	—	—	Superseded by 211
94	50	2	—	—	0.60	15500	3.8	2500	Superseded by 94A
94A	50	2	—	—	0.55	18000	3.0	3500	Superseded by 226
95–97	—	—	—	—	—	—	—	—	Waveguide
98	50	2	—	—	0.66	2700	5.5	300	Superseded by 214
99	—	—	—	—	—	—	—	—	Waveguide
100	35	—	—	—	—	—	—	—	Good to 1 GHz
101	75	—	—	—	—	—	—	—	—
102	140	—	—	—	—	—	—	—	—
103–107	—	—	—	—	—	—	—	—	Waveguide
*108	78	7	—	—	2.30	340	16.0	50	Superseded by 108A
*108A	78	7	—	—	2.30	340	16.0	50	Superseded by M17/45-RG108
109	—	—	—	—	—	—	—	—	Waveguide
110	—	—	—	—	—	—	—	—	Waveguide
*111	95	5	—	—	1.20	1700	6.8	150	Superseded by 111A
*111A	95	5	—	—	1.20	1700	6.8	150	Superseded by M17/15-RG111
112	—	—	—	—	—	—	—	—	Waveguide
113	—	—	—	—	—	—	—	—	Waveguide
114	185	10	—	—	1.34	1150	6.7	160	Superseded by 114A
*114A	185	10	—	—	1.34	1150	6.7	160	—
115	50	2	—	—	0.60	15000	5.6	2500	Superseded by 115A
115A	50	2	—	—	0.60	15000	5.2	2500	Superseded by M17/168-00001
116	50	2	—	—	0.60	15000	5.0	2500	Superseded by 227
117	50	2	—	—	0.25	66000	2.3	10000	Superseded by 117A
117A	50	2	—	—	0.25	66000	2.3	10000	Superseded by 211A
118	50	2	—	—	0.25	66000	2.3	10000	Superseded by 118A
118A	50	2	—	—	0.25	66000	2.3	10000	Superseded by 228A
119	50	2	—	—	0.50	31000	3.8	4000	Superseded by M17/156-00001
120	50	2	—	—	0.50	31000	3.8	4000	Superseded by M17/156-00002
121	—	—	—	—	—	—	—	—	Waveguide
*122	50	2	—	—	1.7	240	18.0	60	Superseded by M17/54-RG122
123	—	—	—	—	—	—	—	—	Unassigned
124	73	—	—	—	—	—	—	—	Superseded by 302
*125	150	—	—	—	0.50	2300	3.6	430	—
126	50	2	—	—	—	—	—	—	Superseded by 301
127	—	—	—	—	—	—	—	—	Waveguide
128	50	—	—	—	—	—	—	—	Bead-Supported
129	—	—	—	—	—	—	—	—	Flexible Waveguide
130	95	5	—	—	0.65	3000	8.8	350	Dual

RG/U	Ohms	Tol.	Cap./ft. (in pF)	Velocity Factor	10 MHz dB	10 MHz Watts	400 MHz dB	400 MHz Watts	Comment
131	95	5	—	—	0.65	3000	8.8	350	Armored 130
132	—	—	—	—	—	—	—	—	Waveguide
133	95	5	—	—	—	—	5.7	64	Superseded by 133A
*133A	95	5	—	—	—	—	5.7	64	Superseded by M17/100-RG133
134	185	—	—	—	—	—	—	—	Bead-Supported
135–139	—	—	—	—	—	—	—	—	Waveguide
140	75	3	—	—	1.2	5700	8.0	1100	Superseded by 302
141	50	2	—	—	1.20	5700	9.0	1100	Superseded by 141A
141A	50	2	—	—	1.20	5700	9.0	1100	Superseded by 303
142	50	2	—	—	1.20	5700	11.7	1100	Like 55
142A	50	2	—	—	1.20	5700	11.7	1100	High Temp 55A
142B	50	2	—	—	1.20	5700	11.7	1100	Superseded by M17/60-RG142
143	50	2	—	—	0.85	8700	6.0	2000	Like 5
143A	50	2	—	—	0.85	8700	6.0	2000	Superseded by 304
144	75	3	—	—	0.60	17000	4.5	2800	Hi Temp 11A
145	75	—	—	—	—	—	—	—	—
146	190	10	—	—	—	—	—	—	Cancelled
147	52	—	—	—	0.17	25000	2.3	1500	Cancelled
148	52	—	—	—	—	—	—	—	Armored 8
*149	75	3	—	—	0.88	1900	10.0	—	Superseded by 391
*150	75	—	—	—	0.88	1900	10.0	—	Superseded by 392
151	50	—	—	—	—	—	—	—	Bead-Supported
152	50	—	—	—	—	—	—	—	Bead-Supported
153	50	—	—	—	—	—	—	—	Bead-Supported
154	50	—	—	—	—	—	—	—	Bead-Supported
155	50	—	—	—	—	—	—	—	Bead-Supported
*156	50	4	—	—	—	—	—	—	Cancelled
*157	50	4	—	—	—	—	—	—	Cancelled
*158	25	2.5	—	—	—	—	—	—	Cancelled
159	50	2	—	—	1.20	5700	9.0	1100	Superseded by 142
160	125	5	—	—	—	—	—	—	Superseded by 160A
160A	125	5	—	—	—	—	—	—	Superseded by 264
161	70	2	—	—	5.30	350	21.0	150	Miniature
162	175	—	—	—	—	—	—	—	Bead-Supported
163	—	—	—	—	—	—	—	—	Waveguide
*164	75	3	20.5	.659	0.24	13500	2.8	1500	Unarmored 35B
165	50	2	—	—	0.60	15000	5.0	2500	Superseded by M17/65-RG165
166	50	2	—	—	0.60	15000	5.0	2500	Armored 165
167–173	—	—	—	—	—	—	—	—	Waveguide
174	50	2	30.0	.659	3.90	170	20.0	25	Miniature
*174A	50	2	—	—	3.90	350	20.0	25	Superseded by M17/119-RG174
175	—	—	—	—	—	—	—	—	Bead-Supported
176	2400	240	—	—	—	—	—	—	Cancelled
*177	50	2	30.0	.659	0.24	14000	2.8	1100	Superseded by M17/160-00001
178	50	2	—	—	5.60	640	29.0	100	Superseded by 178A
178A	50	2	—	—	5.60	640	29.0	100	Superseded by 178B
178B	50	2	—	—	5.60	640	29.0	100	Superseded by M17/93-RG178
179	75	3	—	—	5.30	350	21.0	150	Superseded by 179A
179A	75	3	—	—	5.30	350	21.0	150	Superseded by 179B
179B	75	3	—	—	5.30	350	21.0	150	Superseded by M17/94-RG179
180	93	5	—	—	3.30	2000	17.0	400	Superseded by 180A
180A	95	5	—	—	3.30	2000	17.0	400	Superseded by 180B
180B	95	5	—	—	3.30	2000	17.0	400	Superseded by M17/95-RG180
*181	125	5	—	—	—	—	6.0	—	Cancelled
*182	125	5	—	—	—	—	—	—	Superseded by 160
183	50	—	—	—	0.18	14000	1.2	2100	—
184	—	—	—	—	—	—	—	—	Waveguide
*185	2000	—	—	—	—	—	—	—	Time Delay Cable
*186	1000	—	—	—	—	—	—	—	Time Delay Cable
187	75	3	—	—	5.30	350	21.0	150	Superseded by 187A
187A	75	3	—	—	5.30	350	21.0	150	Superseded by 179B
188	50	2	—	—	6.00	770	20.0	240	Superseded by 188A
188A	50	2	—	—	6.00	770	20.0	240	Superseded by 316
189	50	—	—	—	0.20	20000	1.5	1500	Superseded by 389
190	50	4	—	—	—	—	—	—	Cancelled
191	25	2.5	—	—	—	—	—	—	Cancelled
192	12.5	—	—	—	2.00	—	—	—	Pulse Cable
193	12.5	—	—	—	2.00	—	—	—	Pulse Cable
194	12.5	—	—	—	2.00	—	—	—	Pulse Cable
195	95	3	—	—	3.30	2000	17.0	400	Superseded by 195A
195A	95	3	—	—	3.30	2000	17.0	400	Superseded by 180B
196	50	2	—	—	5.60	640	29.0	100	Superseded by 196A
196A	50	2	—	—	5.60	640	29.0	100	Superseded by 178B
197	50	—	—	—	0.14	18000	0.93	2800	Semi-Rigid
198	70	—	—	—	0.23	6800	1.7	1100	—
199	70	—	—	—	0.17	15000	0.87	2400	—
200	70	—	—	—	0.07	42000	0.51	5800	—
201–208	—	—	—	—	—	—	—	—	Waveguide
209	50	+2/−3	—	—	0.32	47000	2.85	10000	Cancelled
210	93	5	—	—	0.90	1300	8.0	125	—
211	50	2	—	—	0.25	66000	2.3	10000	Superseded by 211A
211A	50	2	—	—	0.25	66000	2.3	10000	Superseded by M17/72-RG211
*212	50	2	29.5	.659	0.83	1500	6.5	—	Superseded by M17/73-RG212
*213	50	2	30.5	.659	0.66	3500	5.5	300	Superseded by M17/74-RG213
*214	50	2	30.5	.659	0.66	2700	5.5	300	Superseded by M17/75-RG214
*215	59	2	30.5	.659	0.66	3500	5.5	300	Superseded by M17/74-RG215
*216	75	3	20.5	.659	0.66	2500	5.2	250	Superseded by M17/77-RG216
*217	50	2	30.0	.659	0.41	6000	4.3	480	Superseded by M17/165-00001
*218	50	2	30.0	.659	0.24	14000	2.75	1200	Superseded by M17/166-00001
*219	50	2	30.0	.659	0.24	14000	2.75	1200	Armored 218

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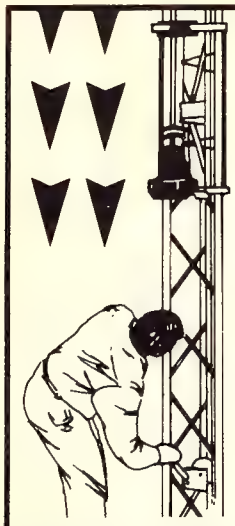
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RG/U	Ohms	Tol.	Cap./ft. (in pF)	Velocity Factor	10 MHz dB	10 MHz Watts	400 MHz dB	400 MHz Watts	Comment
*220	50	2	29.5	—	0.17	25000	2.3	1500	Superseded by M17/81-RG220
*221	50	2	29.5	—	0.17	25000	2.33	1500	Superseded by M17/82-RG221
*222	50	2	—	—	4.40	340	33.0	60	Superseded by M17/83-RG222
*223	50	2	30.0	.659	1.35	800	11.7	90	Superseded by M17/84-RG223
*224	50	2	30.0	.659	0.41	6000	4.3	480	Superseded by M17/85-RG224
*225	50	2	—	—	0.60	15000	5.0	2500	Superseded by M17/86-RG225
*226	50	2	—	—	0.55	18000	3.8	3500	Superseded by M17/87-RG226
*227	50	2	—	—	0.60	15000	5.0	2500	Superseded by M17/88-RG227
*228	50	2	—	—	0.25	66000	2.3	10000	Superseded by 228A
*228A	50	2	—	—	0.25	66000	2.3	10000	Superseded by M17/89-RG228
*229	50	2	—	—	0.60	15000	5.0	2500	Superseded by 116
*230	26	3	—	—	—	—	—	—	Superseded by 158
*231	50	1	—	—	0.23	8500	2.3	1000	Superseded by 231A
*231A	50	1	—	—	0.23	8500	2.3	1000	Cancelled
*232	50	—	—	—	0.14	18000	0.93	2800	Semi-Rigid
*233	50	—	—	—	0.08	48000	0.49	6500	Semi-Rigid
*234	50	—	—	—	0.04	130000	0.28	20000	Semi-Rigid
*235	50	2	—	—	0.60	9900	5.2	2500	Superseded by 115A
*236	50	—	—	—	0.25	7500	1.8	1200	—
*237	50	—	—	—	0.25	7500	1.8	1200	Semi-Rigid
*238	50	—	—	—	0.14	18000	0.93	2800	Superseded by 197
*239	50	—	—	—	0.14	18000	0.93	2800	Superseded by 232
*240	50	—	—	—	0.08	48000	0.49	6500	Semi-Rigid
*241	50	—	—	—	0.08	48000	0.49	6500	Superseded by 233
*242	50	—	—	—	0.04	130000	0.28	20000	Semi-Rigid
*243	50	2	—	—	0.04	130000	0.28	20000	Superseded by 234
*244	75	2	—	—	0.25	6000	1.7	900	Semi-Rigid
*245	75	—	—	—	0.25	6000	1.7	900	Semi-Rigid
*246	75	—	—	—	0.13	13000	0.83	2000	Semi-Rigid
*247	75	—	—	—	0.13	13000	0.83	2000	Semi-Rigid
*248	75	1	—	—	0.07	38000	0.55	5500	Semi-Rigid
*249	75	1	—	—	0.07	38000	0.55	5500	Semi-Rigid
*250	75	—	—	—	0.40	100000	0.28	19000	Semi-Rigid
*251	75	—	—	—	0.40	100000	0.28	19000	Semi-Rigid
*252	75	2	—	—	0.23	8000	1.7	1800	Semi-Rigid
*253	75	2	—	—	0.23	8000	1.7	1800	Semi-Rigid
*254	50	—	—	—	0.13	19000	0.86	2800	Semi-Rigid
*255	50	—	—	—	0.13	19000	0.86	2800	Semi-Rigid
*256	50	—	—	—	0.16	36000	1.0	5400	Semi-Rigid
*257	50	1	—	—	0.07	50000	0.55	7000	Semi-Rigid
*258	50	1	—	—	0.07	50000	0.55	7000	Semi-Rigid
*259	50	—	—	—	0.40	8700	2.75	1300	—
*260	50	—	—	—	—	—	—	—	—
*261	50	—	—	—	—	—	—	—	Cancelled
*262	50	—	—	—	—	—	—	—	Cancelled
*263	50	—	—	—	0.20	6500	1.0	8000	—
*264	40	2	—	—	—	—	—	—	Superseded by 264A
*264A	40	2	—	—	—	—	12.0	—	Dual Twinax
*264B	40	2	—	—	—	—	12.0	—	Superseded by 264C
*264C	40	2	—	—	—	—	12.0	—	Moistureproof
*265	50	—	—	—	0.12	48000	0.44	7000	Superseded by 319
*266	1530	150	—	—	—	—	—	—	Delay Line
*267	50	—	—	—	0.12	48000	0.44	7000	Superseded by 318
*268	50	—	—	—	0.27	7800	1.8	1000	—
*269	50	—	—	—	0.12	22000	0.8	4300	Superseded by 269A
*269A	50	—	—	—	0.12	22000	0.8	4300	—
*270	50	—	—	—	0.12	48000	0.44	7000	Superseded by 270A
*270A	50	—	—	—	0.12	48000	0.44	7000	Superseded by 270B
*270B	50	—	—	—	0.12	48000	0.44	7000	—
*271–278	—	—	—	—	—	—	—	—	Waveguide
*279	75	3	—	—	1.40	4500	11.0	660	Cancelled
*280	50	2	—	—	0.37	46000	3.5	5000	Cancelled
*281	50	2	—	—	0.32	47000	2.85	10000	Cancelled
*282	54.6	—	—	—	1.50	1200	11.0	330	—
*283	46	—	—	—	—	—	—	—	—
*284	75	—	—	—	0.11	16000	0.75	2100	Superseded by 284A
*284A	75	—	—	—	0.11	16000	0.75	2100	—
*285	100	—	—	—	0.09	—	0.69	—	Superseded by 285A
*285A	100	—	—	—	0.09	—	0.69	—	—
*286	75	—	—	—	0.05	3500	0.41	4800	—
*287	100	—	—	—	—	—	—	—	—
*288	50	—	—	—	0.04	90000	0.3	13000	—
*289	75	—	—	—	0.04	63000	0.3	13000	—
*290	—	—	—	—	—	—	—	—	Waveguide
*291	—	—	—	—	—	—	—	—	Waveguide
*292	75	—	—	—	0.05	35000	0.41	4800	—
*293	50	2	—	—	0.41	6000	4.0	480	Superseded by 293A
*293A	50	2	—	—	0.41	6000	4.0	480	Moistureproof
*294	95	5	—	—	0.65	3400	10.0	350	Superseded by 294A
*294A	95	5	—	—	0.65	3400	10.0	350	Twinax
*295	50	2	—	—	0.24	14000	3.0	1100	Moistureproof
*296	50	4	—	—	—	—	11.0	—	Cancelled
*297	50	—	—	—	0.12	22000	0.8	4300	—
*298	—	—	—	—	—	—	—	—	Buoyant Cable
*299	—	—	—	—	—	—	—	—	Waveguide
*300	—	—	—	—	—	—	—	—	Waveguide
*301	50	2	—	—	—	—	70.0	—	Good to 3 GHz/Active
*302	75	3	—	—	1.20	5700	8.0	1100	Superseded by M17/110-RG302
*303	50	2	—	—	1.20	5700	9.0	1100	Superseded by M17/111-RG303
*304	50	2	—	—	0.85	8700	6.0	2000	Superseded by M17/171-00001

RG/U	Ohms	Tol.	Cap./ft. (in pF)	Velocity Factor	10 MHz dB	10 MHz Watts	400 MHz dB	400 MHz Watts	Comment
*305	75	—	—	—	—	—	—	—	Like 298
*306	75	2	—	—	0.15	15000	1.3	1700	Superseded by 306A
*306A	75	2	—	—	0.15	15000	1.3	1700	Cancelled
*307	75	4	—	—	1.20	1300	7.5	130	Superseded by 307A
*307A	75	4	—	—	1.20	1300	7.5	130	Superseded by M17/116-RG307
*308–315	—	—	—	—	—	—	—	—	Unassigned
*316	50	2	—	—	6.00	770	20.0	240	Superseded by M17/113-RG316
*317	95	5	—	—	—	—	8.0	—	—
*318	50	—	—	—	0.12	22000	0.8	4300	—
*319	50	—	—	—	0.12	48000	0.44	7000	Superseded by 319A
*319A	50	—	—	—	0.12	48000	0.44	7000	—
*320	—	—	—	—	—	—	—	—	Waveguide
*321	50	—	—	—	0.04	90000	0.3	13000	—
*322	50	—	—	—	0.04	90000	0.3	13000	—
*323	50	—	—	—	0.15	17000	1.2	2100	—
*324	50	—	—	—	0.15	17000	1.2	2100	—
*325	50	—	—	—	0.36	3800	3.0	340	Flexible
*326	50	—	—	—	0.24	11000	1.8	720	Flexible
*327	50	—	—	—	0.16	23500	1.4	1400	Flexible
*328	25	2.5	—	—	—	—	0.4	—	Good to 3 GHz
*329	50	4	—	—	—	—	0.4	—	Good to 3 GHz/Inactive
*330	50	—	—	—	—	—	—	—	—
*331	50	1	—	—	0.23	8500	2.3	1000	—
*332	50	1	—	—	0.15	17000	1.2	2100	—
*333	50	1	—	—	0.15	17000	1.2	2100	—
*334	75	2	—	—	0.25	6600	1.9	860	—
*335	75	2	—	—	0.25	6600	1.9	860	—
*336	75	2	—	—	0.15	15000	1.3	1700	—
*337–359	—	—	—	—	—	—	—	—	Waveguide
*360	50	1	—	—	0.19	12000	1.5	1600	—
*361	—	—	—	—	—	—	—	—	—
*362	—	—	—	—	—	—	—	—	—
*363	—	—	—	—	—	—	—	—	—
*364	—	—	—	—	—	—	—	—	—
*365	50	2	—	—	0.66	2700	5.5	300	Superseded by M17/164-00002
*366	50	—	—	—	0.27	7800	1.8	1000	—
*367	50	—	—	—	0.35	250000	2.3	35000	—
*368	—	—	—	—	—	—	—	—	—
*369	50	—	—	—	0.34	4300	2.4	35000	—
*370	50	—	—	—	0.34	4300	2.4	35000	—
*371	—	—	—	—	—	—	—	—	Buoyant Cable
*372	—	—	—	—	—	—	—	—	Buoyant Cable
*373	—	—	—	—	—	—	—	—	Buoyant Cable
*374	—	—	—	—	—	—	—	—	Buoyant Antenna
*375	—	—	—	—	—	—	—	—	Waveguide
*376	50	—	—	—	0.15	17000	1.2	2100	—
*377	50	—	—	—	0.28	16000	1.9	2300	—
*378	50	1	—	—	0.07	1800	0.17	—	Semi-Rigid
*379	—	—	—	—	—	—	—	—	Waveguide
*380	—	—	—	—	—	—	—	—	Waveguide
*381	—	—	—	—	—	—	—	—	Waveguide
*382	50	—	—	—	—	—	—	—	Rigid
*383	100	—	—	—	—	—	—	—	Buoyant Twisted Pair
*384	50	—	—	—	—	—	—	—	Buoyant Antenna
*385	50	—	—	—	0.26	70000	21.0	7000	—
*386	—	—	—	—	—	—	—	—	Buoyant Antenna
*387	—	—	—	—	—	—	—	—	—
*388	50	—	—	—	0.41	6000	4.3	480	Moistureproof
*389	50	—	—	—	0.20	20000	1.5	1500	Flexible
*390	—	—	—	—	—	—	—	—	—
*391	72	3	—	—	0.88	1900	15.0	—	Superseded by M17/126-RG391
*392	72	3	—	—	0.88	1900	15.0	—	Superseded by M17/126-RG392
*393	50	2	—	—	0.60	15000	5.0	2500	Superseded by M17/127-RG393
*394	—	—	—	—	—	—	—	—	—
*395	—	—	—	—	—	—	—	—	—
*396	—	—	—	—	—	—	—	—	—
*397	50	—	—	—	0.60	15000	5.0	2500	—
*398	—	—	—	—	—	—	—	—	—
*399	—	—	—	—	—	—	—	—	—
*400	50	2	—	—	1.20	5700	9.6	1100	Superseded by M17/128-RG400
*401	50	0.5	—	—	0.85	8600	6.0	2000	Superseded by M17/129-RG401
*402	50	1	—	—	1.20	5700	8.0	1100	Superseded by M17/130-RG402
*403	50	1	—	—	5.60	640	29.0	100	Superseded by M17/131-RG403
*404	50	2	—	—	5.60	640	29.0	100	Superseded by M17/132-RG404
*405	50	1.5	—	—	5.60	640	14.0	300	Superseded by M17/133-RG405
*M17/2-RG006	75	3	—	—	0.83	1500	6.5	200	Video
*M17/6-RG011	75	3	—	—	0.66	2500	5.2	250	Good to 1 GHz
*M17/6-RG012	75	3	—	—	0.66	2500	5.2	250	Armored
*M17/15-RG022	95	5	—	—	1.2	1700	6.8	150	Twin Axial
*M17/15-RG111	95	5	—	—	1.2	1700	6.8	150	Armored 22B
*M17/16-RG023	125	5	—	—	0.40	—	5.2	—	Twin Axial
*M17/16-RG024	125	5	—	—	0.40	—	5.2	—	Armored 23A
*M17/19-RG025	48	4	—	—	—	—	—	—	HV Pulse Cable
*M17/21-RG026	48	4	—	—	—	—	—	—	Armored Pulse Cable
*M17/22-RG027	48	4	—	—	—	—	—	—	HV Pulse Cable
*M17/22-00001	48	4	—	—	—	—	—	—	Unarmored 27A
*M17/23-RG028	48	4	—	—	—	—	—	—	Pulse Cable

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*Education Technology & Services, see page 81, October 1981 issue of Ham Radio Magazine.

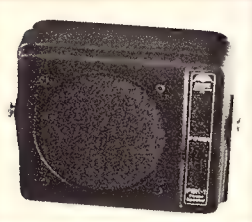
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RG/U	Ohms	Tol.	Cap./ft. (in pF)	Velocity Factor	10 MHz dB	10 MHz Watts	400 MHz dB	400 MHz Watts	Comment
*M17/24-RG034	75	3	—	—	0.32	7200	3.8	650	Good to 1 GHz
*M17/28-RG058	50	2	—	—	1.4	650	14.0	75	Superseded by M17/155-00001
*M17/29-RG059	75	3	—	—	1.10	1200	9.0	135	Good to 1 GHz
*M17/30-RG062	93	5	—	—	0.90	1300	8.0	100	Extra Flexible
*M17/31-RG063	125	6	—	—	0.52	3000	5.5	340	Air Spacing
*M17/31-RG079	125	6	—	—	0.52	3000	5.5	340	Armored 63B
*M17/33-RG064	48	4	—	—	—	—	—	—	Pulse Cable
*M17/34-RG065	950	50	—	—	21.20	—	—	—	Video Delay
*M17/45-RG108	78	7	—	—	2.30	340	16.0	50	Twin Axial
*M17/47-RG114	185	10	—	—	1.34	1150	6.7	160	—
*M17/52-RG119	50	2	—	—	0.50	31000	3.8	4000	Hi Temp
*M17/52-RG120	50	2	—	—	0.50	31000	3.8	4000	Armored 119
*M17/54-RG122	50	2	—	—	1.70	240	18.0	60	Superseded by M17/157-00001
*M17/56-RG130	95	5	—	—	0.65	3000	8.8	350	Twin Axial
*M17/56-RG131	95	5	—	—	0.65	3000	8.8	350	Armored 130
*M17/60-RG142	50	2	—	—	1.2	5700	11.7	1100	Superseded by M17/158-00001
*M17/62-RG144	75	3	—	—	0.60	17000	4.5	2800	Hi Temp 11A
*M17/64-RG035	75	3	—	—	0.24	13500	2.8	1500	Armored 164
*M17/64-RG164	75	3	—	—	0.24	13500	2.8	1500	—
*M17/65-RG165	50	2	—	—	0.60	15000	5.0	2500	Superseded by M17/159-00001
*M17/65-RG166	50	2	—	—	0.60	15000	5.0	2500	Armored 165A
*M17/67-RG177	50	2	—	—	0.24	14000	2.8	1100	Good to 12.4 GHz
*M17/72-RG211	50	2	—	—	0.25	66000	2.3	10000	Superseded by M17/161-00001
*M17/73-RG212	50	2	—	—	0.83	1500	6.5	100	Superseded by M17/162-00001
*M17/74-RG213	50	2	—	—	0.66	3500	5.5	300	Superseded by M17/163-0001
*M17/74-RG215	50	2	—	—	0.66	3500	5.5	300	Armored 213
*M17/75-RG214	50	2	—	—	0.66	2700	5.5	300	Superseded by M17/164-00001
*M17/75-RG365	50	2	—	—	0.66	2700	5.5	300	—
*M17/77-RG216	75	3	—	—	0.66	2500	5.2	250	Good to 1 GHz/Inactive
*M17/78-RG217	50	2	—	—	0.41	6000	4.3	480	Good to 3 GHz
*M17/79-RG218	50	2	—	—	0.24	14000	2.5	1100	Good to 1 GHz
*M17/79-RG219	50	2	—	—	0.24	14000	2.5	1100	Armored 218
*M17/81-RG220	50	2	—	—	0.17	25000	2.3	1500	Good to 2 GHz/Inactive
*M17/82-RG221	50	2	—	—	0.17	25000	2.3	1500	Good to 1 GHz/Inactive
*M17/83-RG222	50	2	—	—	4.40	340	33.0	60	—
*M17/84-RG187	75	3	—	—	5.30	350	21.0	150	Superseded by 179B
*M17/84-RG223	50	2	—	—	1.35	800	11.7	90	Superseded by M17/167-00001
*M17/85-RG224	50	2	—	—	0.41	6000	4.3	480	Good to 3 GHz/Inactive
*M17/86-RG225	50	2	—	—	0.60	15000	5.0	2500	Hi Temp
*M17/87-RG226	50	6	—	—	0.55	18000	3.8	3500	Hi Temp
*M17/88-RG227	50	2	—	—	0.60	15000	5.0	2500	Armored 87A/Inactive
*M17/89-RG228	50	2	—	—	0.25	66000	2.3	10000	Armored 211A/Inactive
*M17/90-RG071	93	5	—	—	0.90	1300	8.0	125	Double Braid
*M17/92-RG115	50	2	—	—	0.60	15000	5.2	2500	Hi Temp
*M17/93-RG178	50	2	—	—	5.60	640	29.0	100	Superseded by M17/169-00001
*M17/93-00001	50	2	—	—	5.60	640	29.0	100	Good to 3 GHz
*M17/94-RG179	75	3	—	—	5.30	350	21.0	150	—
*M17/95-RG180	95	5	—	—	3.30	2000	17.0	400	—
*M17/97-RG210	93	5	—	—	0.90	1300	8.0	125	—
*M17/100-RG133	95	5	—	—	—	—	5.7	64	—
*M17/101B	50	2	—	—	5.60	640	29.0	100	Superseded by M17/93-00001
*M17/102B	—	—	—	—	—	—	—	—	Cancelled
*M17/109-RG301	50	2	—	—	—	—	70.0	—	Hi Attenuation
*M17/110-RG302	75	3	—	—	1.20	5700	8.0	1100	Hi Temp
*M17/111-RG303	50	2	—	—	1.20	5700	9.0	1100	Superseded by M17/170-00001
*M17/112-RG304	50	2	—	—	0.85	8700	6.0	2000	Hi Temp
*M17/113-RG316	50	2	—	—	6.00	720	20.0	240	Superseded by M17/172-00001
*M17/116-RG307	75	4	—	—	1.20	1300	7.5	130	Triax

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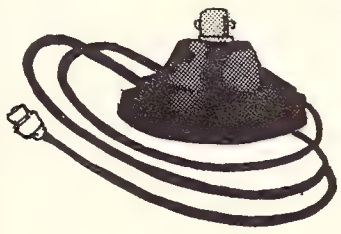
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RG/U	Ohms	Tol.	Cap./ft. (In pF)	Velocity Factor	10 MHz dB	10 MHz Watts	400 MHz dB	400 MHz Watts	Comment
*M17/119-RG174	50	2	—	—	3.90	350	20.0	25	Superseded by M17/173-00001
*M17/120B	—	—	—	—	—	—	—	—	Cancelled
*M17/124-RG328	25	2.5	—	—	—	—	0.4	—	—
*M17/125-RG329	50	4	—	—	—	—	0.4	—	—
*M17/126-RG391	72	3	—	—	0.88	1900	15.0	—	Low Noise
*M17/126-RG392	72	3	—	—	0.88	1900	15.0	—	Armored 391
*M17/127-RG393	50	2	—	—	0.60	15000	5.0	2500	Superseded by M17/174-00001
*M17/128-RG400	50	2	—	—	1.20	5700	9.6	1100	Superseded by M17/175-00001
*M17/129-RG401	50	0.5	—	—	0.85	8700	6.0	2000	Semi-Rigid
*M17/129-00001	50	0.5	—	—	0.85	8700	6.0	2000	Semi-Rigid
*M17/130-RG402	50	1	—	—	1.20	5700	8.0	1100	Semi-Rigid
*M17/130-00001	50	1	—	—	1.20	5700	8.0	1100	Semi-Rigid
*M17/131-RG403	50	2	—	—	5.60	640	29.0	100	Triax
*M17/132-RG404	50	2	—	—	5.60	640	29.0	100	Low Noise
*M17/133-RG405	50	1.5	—	—	5.60	640	14.0	300	—
*M17/133-00001	50	1.5	—	—	5.60	640	14.0	300	—
*M17/133-00002	50	1.5	—	—	5.60	640	14.0	300	—
*M17/133-00003	50	1.5	—	—	5.60	640	14.0	300	—
*M17/134-00001	50	2	—	—	1.2	700	6.0	60	Triax
*M17/134-00002	50	2	—	—	1.2	700	6.0	60	Triax
*M17/135-00001	50	2	—	—	0.8	4000	6.0	330	Triax
*M17/135-00002	50	2	—	—	0.8	4000	6.0	330	Triax
*M17/136-00001	75	3	—	—	—	—	21.0	1400	Good to 3 GHz
*M17/137-00001	95	5	—	—	—	2500	17.0	370	Good to 3 GHz
*M17/138-00001	50	2	—	—	3.3	1300	21.0	220	Good to 3 GHz
*M17/139-00001	95	5	—	—	—	2400	18.0	370	Good to 3 GHz
*M17/140-00001	95	5	—	—	—	2400	18.0	370	Cancelled
*M17/151-00001	50	2.5	—	—	13.0	110	25.0	50	Semi-Rigid
*M17/151-00002	50	2.5	—	—	13.0	110	25.0	50	Semi-Rigid
*M17/152-00001	50	2	—	—	3.3	1400	20.0	220	Good to 12.4 GHz
*M17/153-00001	50	2	—	—	3.3	1400	24.0	210	Good to 12.4 GHz
*M17/154-00001	50	3	—	—	—	—	38.0	22	Semi-Rigid
*M17/154-00002	50	3	—	—	—	—	38.0	22	Semi-Rigid
*M17/155-00001	50	2	—	—	1.4	650	14.0	75	Good to 1 GHz
*M17/156-00001	50	2	—	—	0.5	31000	3.8	4000	Hi Temp
*M17/156-00002	50	2	—	—	0.5	31000	3.8	4000	Armored M17/156-00001
*M17/157-00001	50	2	—	—	1.7	240	18.0	60	Smaller 58
*M17/158-00001	50	2	—	—	1.2	5700	11.7	1100	Good to 12.4 GHz
*M17/159-00001	50	2	—	—	0.6	15000	5.0	2500	Hi Temp
*M17/160-00001	50	2	—	—	0.24	14000	2.8	1100	HF 218
*M17/161-00001	50	2	—	—	0.25	66000	2.3	10000	Hi Temp
*M17/162-00001	50	2	—	—	0.83	1500	6.5	100	Good to 10 GHz
*M17/163-00001	50	2	—	—	0.66	3500	5.5	300	Good to 1 GHz
*M17/164-00001	50	2	—	—	0.66	3500	5.5	300	Good to 10 GHz
*M17/164-00002	50	2	—	—	0.66	2700	5.5	300	—
*M17/165-00001	50	2	—	—	0.41	6000	4.3	480	Good to 1 GHz
*M17/166-00001	50	2	—	—	0.24	14000	2.5	1100	Good to 1 GHz
*M17/167-00001	50	2	—	—	1.35	800	11.7	90	Good to 12.4 GHz/Inactive
*M17/168-00001	50	2	—	—	0.60	15000	5.2	2500	Hi Temp
*M17/169-00001	50	2	—	—	5.60	640	29.0	100	Good to 3 GHz
*M17/170-00001	50	2	—	—	1.20	5700	9.0	1100	Hi Temp
*M17/171-00001	50	2	—	—	0.85	8700	6.0	2000	Hi Temp
*M17/172-00001	50	2	—	—	6.00	770	20.0	240	Hi Temp
*M17/173-00001	50	2	—	—	3.90	350	20.0	25	Miniature
*M17/174-00001	50	2	—	—	0.60	15000	5.0	2500	Moistureproof
*M17/175-00001	50	2	—	—	1.20	5700	9.6	1100	Flexible
*M17/176-00001	77	7	—	—	—	—	—	—	Flexible Twin

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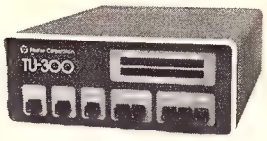
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DESIGN, CONSTRUCTION, FACT, AND EVEN SOME FICTION

More Random Headings: Part IV

Last month CQ *carried Part III of columnist Thurber's current series which reviewed several new antenna products and which also highlighted the author's plunge into computers. This month it's back to some mainline antenna topics.*

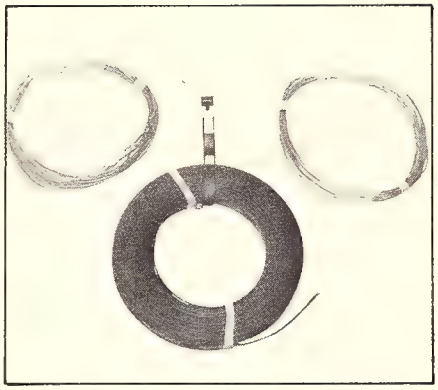
Last month's Antennas column saw your columnist digress from the usual format of the Antennas column to sidetrack into some observations on experiences with a new personal computer. Last month's column, in fact, was the first one which was 100% completed by electronic word-processing means, rather than by using the trusty Smith Corona electric. In that column, we publicly answered some reader mail, focusing primarily on reflected/forward power measurement and standing-wave ratio (s.w.r.), and also discussed the new Palomar Engineers M-827 light-bar s.w.r. meter.

This time it's back to antennas, but we'll cover three items of quite dissimilar nature. First, we'll get into the problem of obtaining acceptable reception between the amateur bands (such as for s.w.l.'ing or RTTY monitoring); discuss specialized antennas for cordless telephones; and take a look at the "big signal" arrays at N7AM. First, some considerations for monitoring.

Monitoring Between the Bands

Most amateur systems are designed with the primary objective of first obtaining good transmitting performance on a given band or bands, and second, securing good reception characteristics on the same band(s). For the most part amateur antennas are designed for discrete frequency performance on the 160, 80/75, 40, 20, 15, and 10 meter bands, or some combination thereof, with some recent expansion to cover the 12, 17, and 30 meter WARC assignments. Although the new WARC bands have caused some readjustment in antenna designs to recognize the fact that transmitting antennas should also cover these frequencies, at least for future use, even multiband antennas will offer but "discrete" performance across the h.f. spectrum, albeit expanded to cover up to nine h.f. bands.

Even nine-band amateur antennas are relatively poor performers on the in-between frequencies. Generally, the narrow bandwidth of quads and Yagis results in significant gain only in the bands(s) for which the antennas were designed; dipoles and verticals offer a similar though less-pronounced drop-off in performance as the operating frequency is removed from the design frequency. In fact, sharply tuned antennas will often perform worse than, say, a simple, casually installed randomwire when used for reception on frequencies far removed from an amateur band, due to the high selectivity of the antenna.

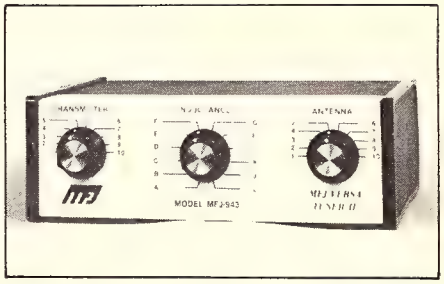


The conventional multiband dipole generally lends itself well to reception anywhere in the h.f. spectrum. This Drake AK75 dipole is designed for 160–10 meters when used with an antenna tuner (and balun, for transmitting). The Drake antenna, as shown here, consists of 100 feet of 470 ohm balanced feedline ("ladderline") connected to a 135 foot dipole with a strain-relief center insulator. (Photo courtesy R.L. Drake Company)

It's possible to adapt most amateur antenna designs to any h.f. frequency, tailoring the antenna for the in-between frequencies of interest. In many cases, however, doing so isn't practical or cost-effective; most amateurs have little interest in replicating an antenna system for off-ham-band operation. If cost is not a limitation, the log periodic antenna represents a good choice for consistent performance and directivity across a wide range of frequencies. The log periodic offers very good forward gain (7–8 dB or more) and a high front-to-back ratio, characteristics akin to standard Yagis. However, the physical size, mechanical complexity, and cost generally restrict these antennas to a lower limit of 7 to 14 MHz, and heavy-duty rotators are a "must" for them. The log periodic designs are covered in the standard antenna texts, and several manufacturers, such as KLM and Hy-Gain, offer log periodics that will do a good job over a very broad frequency range, both for transmitting and receiving purposes.

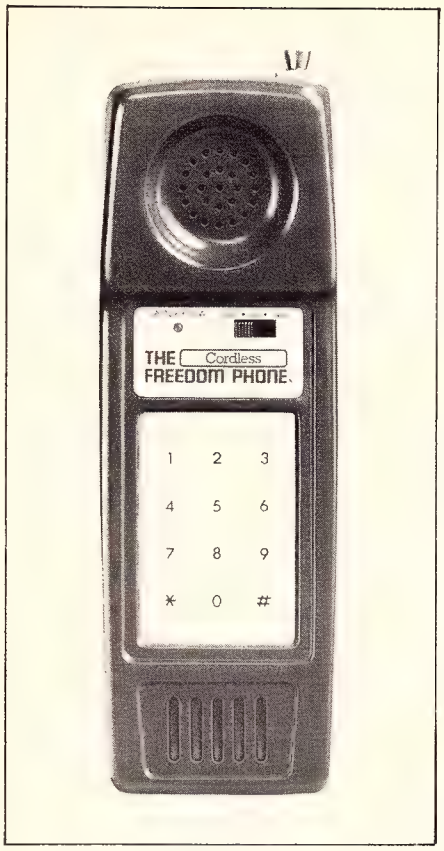
A more conventional broadband transmitting antenna offers another alternative to the between-the-bands reception problem. If you have the space for a full-size dipole for regular transmitting purposes, you may wish to consider one of the antenna designs that boast fairly "flat" performance over a wide range. Naturally, such an antenna will also provide good reception in the popular shortwave bands. One new commercial design having promise is the Barker and Williamson Model 370-15 broadband folded dipole that covers the full 3.5–30 MHz range continuously and with a low s.w.r.; the 90 foot, coax-fed antenna can be used as a flattop dipole or a "sloper." Of course, you should not overlook various single and multi-band amateur antennas that can be adapted to odd-frequency use. For example, the well-known 7/21 MHz odd-harmonic dipole relationship could be used to produce a 6/18 MHz antenna, while there appears to be no reason why the popular Windom antenna design could not be "slipped" to favor non-ham bands, although I haven't tried this approach. Have any of you?

A "no-cost" approach to in-between-bands monitoring is simply to tie the transmitting antenna wires together, whether they lead to a Yagi, quad, dipole, or vertical, in order to operate the entire system as a randomwire. Often this pro-



A simple, wide-range transmatch is a useful accessory in matching a variety of receiving antennas. This inexpensive MFJ unit is designed to match any feedline from 1.8–30 MHz—coaxial cable, balanced line, or singlewire. It includes a 4:1 balun; an SO-239 coax connector is provided, as are binding posts for single-wire or balanced transmission lines. For transmitting, the unit handles 300 watts r.f. output. (Photo courtesy MFJ Enterprises, Inc.)

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Cordless telephones are becoming increasingly popular; most units provide 300–600 foot range. Several range extending techniques may be employed to expand the versatility of these units. The handset should usually be left alone, however, as its performance is fairly well fixed by the 1.7 MHz Ferrite rod receiving antenna and the 49 MHz telescopic whip. (Photo courtesy Bearcat-Electra)

cedure works out acceptably well, since antenna characteristics are not nearly as demanding for receiving as for transmitting. Assuming a wide-range antenna tuner/transmatch is available that can handle a full range of input impedances and that can be tuned continuously over the entire h.f. spectrum of interest, receiver input matching should be taken care of fairly well with little signal loss. However, the result is an antenna system whose overall directivity, polarization, and general performance are unpredictable; the tied-together transmission line also invites r.f.i. from various noise sources, TV receivers, and household appliances.

A better approach is to install a tunable longwire antenna fed using open-wire or TV-type transmission line through an antenna tuner. While offering broadband reception, this type of antenna can offer gain as well; this can vary from about 3 dBd with a four-wavelength antenna, to upwards of about 7 dB with an antenna that is 9 wavelengths long. The longwire is an excellent choice for DX over long paths. Of course, with the proper choice of length and materials, the longwire antenna may also be useful for ham-band transmission, particularly on 160 and 80/75 meters. A close relative of the longwire, the Beverage antenna, is particularly favored by long and medium-wave DXers for transcontinental reception on the lower frequencies. Again, the handbooks have no dearth of material on these antenna types.

Another choice is the tunable vertical antenna, which often gives superior results over horizontally polarized antennas, especially over low-angle DX paths. Obviously, a single-band or even a multiband amateur trap antenna would not be much use, although an antenna such as Mosley's SWV-7, which covers the 11, 13, 16, 19, 25, 31, and 49 meter bands, would give fairly good performance over a wide range, although in discrete "performance windows" as a result of the trap's action, which effectively resonates the antenna on a number of frequencies simultaneously. Better for between-the-band monitoring is a continuously tunable, base-loaded vertical that can be resonated to any desired portion of the h.f. spectrum.

Construction materials for this type of antenna involve little more than the aluminum tubing; ground mounting coil, capacitor, and waterproof box; and transmission line. Gotham Antennas, for example, sells a line of base-loaded verticals that may be used for this purpose, and of course, for transmitting as well, as long as one does not object to the inconvenience of readjustment at the base of the antenna when changing frequencies.

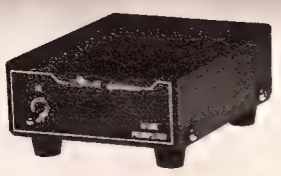
Another approach is to make use of so-called "active" antennas, which are generally short verticals which contain a base-mounted matching network and r.f. preamp to offer good performance over a very wide range of frequencies, often from as low as 50 kHz, through the medium-wave frequencies, to 30 MHz or higher; some even cover v.h.f. frequencies. These antennas are easy to handle and install, and represent a good choice for the apartment dweller and for situations where limited space is available. Although most such antennas are intended for outside installation, several are intended for indoor use in difficult reception areas. Several manufacturers offer these antennas—including McKay Dymek, MFJ, and Datong—while Palomar Engineers offers a loop antenna for low noise reception from v.l.f. to 15 MHz using plug-in loops. (Gilfer Shortwave, Box 239, Park Ridge, NJ 07656, and Grove Enterprises, Inc., Brasstown, NC 28902, sell a wide range of active and other listener-type antennas; write to them for their catalogs.)

Antennas for Cordless Telephones

Many enterprising users of cordless telephones have found that the effective range of their units can be increased by a factor of two or more by adding an outdoor antenna to the base-station unit. Doing so is a fairly easy proposition, although it's useful first to describe the typical cordless telephone system.

The cordless telephone system is made up of two major components: the base-station transponder and the portable cordless (wireless) transponder. The transponder, which is connected directly to the household telephone line, answers incoming telephone calls and processes outgoing telephone calls. Generally, the

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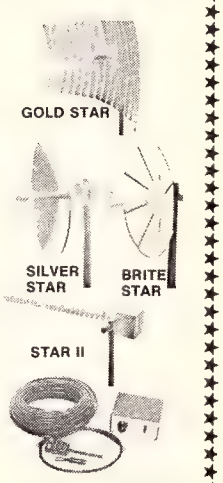


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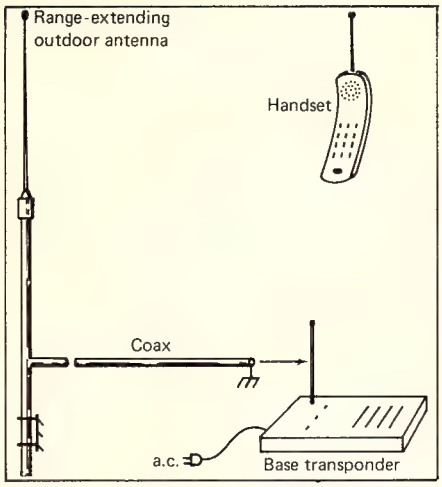
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Shown above is a typical cordless telephone system consisting of the base-station transponder and the portable handset. Most range-extending techniques are applied to the base-station unit, usually taking the form of an outdoor 49 MHz receiving antenna substituting for the small telescopic whip found on most units. A long, elevated a.c. extension cord may help extend the range of the transponder's 1.7 MHz carrier-current-style transmitter.

Fig. 1–Diagram of a typical cordless telephone system.

base-station transponder transmits on one of several frequencies in the 1.7 MHz range by feeding r.f. to the a.c. power line, much in the fashion of carrier current radio systems operated by colleges and universities for their dormitories. The portable handset receives the medium-wave signal through a Ferrite loop or bar antenna which is built into the handset. The handset usually transmits to the base-station transponder on the 49 MHz band using a telescoping whip or "rubber ducky" type antenna. The modulation used both ways is f.m., which provides fairly noise-free reception over the typical 300–600 foot system range. Operation is in the duplex mode; that is, reception and transmission on both units are carried out simultaneously, as on regular wired telephone circuits. The cordless units are becoming increasingly popular for a variety of purposes, such as working in the yard, visiting with a neighbor, dipping in the family swimming pool, etc., when it's desirable to remain in telephone contact. The hamshack applications are many, especially if the shack is in a garage or shed detached from the home. Recent telephone company deregulation will probably further increase cordless telephone sales.

Both units in the system use low power, 100 milliwatts or less, and fall under Part 15 FCC regulations for limited radiation devices. Range is necessarily limited as a result, and most manufacturers guarantee only 300 feet, although sometimes range is stated as being as high as 700 feet. There are a few steps that may be taken to increase range, however.

First, there is little that can be done with the handset to boost range. Most of the telescoping whips are designed to be resonant on 49 MHz (precisely, 49.83 to 49.89 MHz, where five channels are used) and should not be modified. However, if the handset uses a rubber ducky type antenna, additional range may be secured by substituting a telescoping whip for a slight improvement in transmitting and receiving efficiency. Manufacturers are quick to point out, however, that antenna modifications that affect the transmitted signal may be illegal, although this point is not a crystal-clear one. Little can be done to improve the 1.7 MHz reception range, which to some extent depends on the size of the Ferrite antenna, which, of course, must fit within the confines of the handset case.

The base-station transponder's transmitting efficiency in the 1.7 MHz range is fairly low, and it depends largely on the type and layout of house wiring. Metal-shielded house wiring will quickly attenuate the low-power r.f. carried in the electric mains. Also, signals are quickly dissipated by transformers, power meters, and other devices in the a.c. lines. Two things that may be tried to increase transponder transmission range include: (1) simply plugging the unit into a different a.c. outlet to see which yields greater transmitting range; and (2) using a long, well-elevated extension cord between the base station transponder and the wall plug; the extension cord helps get the signal across for greater transmit range. It is also possible to feed the 1.7 MHz r.f. into a randomwire antenna, although to do so almost certainly would be in violation of the FCC requirements for Part 15 device radiation.

The most practical and effective way of increasing cordless telephone range is to install an elevated, outdoor, 49 MHz receiving antenna for the base-station transponder. This antenna would be of the same approximate dimensions as a 6 meter amateur-band antenna, and may be either cut-down slightly from the 6 meter length, fabricated from scratch, or purchased commercially. Most such antennas are mast mounted, vertically polarized, and use coaxial cable to feed the transponder. The only tricky part comes into play in connecting the coax to the base-station unit. A "cheap and dirty" method is simply to clip the coax onto the telescopic whip; a better method is to remove the whip and open up the transponder, connecting the coax center conductor to the same circuit-board point at which the whip was originally attached. The coax braid is attached to the circuit board ground connection or circuit foil at a point as near to the antenna connection point as possible.

There are several other frequency combinations in use on domestic and export models, including 35/49 MHz, 49/70 MHz, and 49/49 MHz. The latter frequency combination is becoming increasingly popular among the more expensive systems, and range is more easily enhanced on this band than with the 1.7/49 MHz band units. The outdoor antenna will, of course, be effective for both transmission and reception on the 49 MHz transponder. However, modifying the transmitting antenna may be of questionable legality, as suggested earlier.

Several manufacturers make antennas specifically designed for cordless telephones; these include Firestick, Valor, and Winn-Tenna. The latter, for example, makes a number of models for both domestic and export (nonstandard frequency) use. These include vertical dipole, vertical ground plane, and vertical center-fed coaxial types. A horizontally polarized model is also available.

A typical "range-extended" system example is shown in fig. 1. Those interested in keeping up with developments in cordless and other telephone technologies may be interested in following the "On the Line" column which appears on a monthly basis in *CQ*'s sister publication, *Popular Communications.* This column reviews new telephone technology and is authored by Gordon West, WB6NOA.

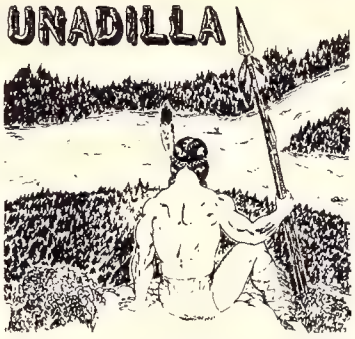
Big Signal from Bremerton

Not long ago Jack Riggs, N7AM, sent us some photos and a description of his 5-element, 80 meter vertical array and his 3-element 40 meter quad which have served to put N7AM and Bremerton, Washington, on the DX map. Both antennas are impressive, to say the least, and the 80 meter one is especially so. We'll share with you some of the details on the latter, thanks to Jack.

Jack used a 3-element, quarter-wavelength vertical parasitic array for 3 years, and was quite pleased with the 80 meter DX performance of the antenna. The quarter-wave, 3-element vertical provided a gain of about 7 dB and a front-to-back (F/B) ratio of about 25 dB. Experiments were later conducted with three elements in a half-wave version, which yielded DX signal reports up to two "S" units better than with the quarter-wave version.

To provide southwest and northeast coverage, Jack erected two additional verticals in a half-wave configuration to provide three reflectors and one director, for a total of five elements with switchable directivity in the four quadrants. The five-element vertical array was first placed on the air in July 1981; field-strength measurements showed that the desired results were attained: a narrowing of the beamwidth using the side reflectors, and an increased forward gain that approached a husky 12.5 dB.

The resultant antenna consists of 5 telescoping elements made of 40 foot alu-



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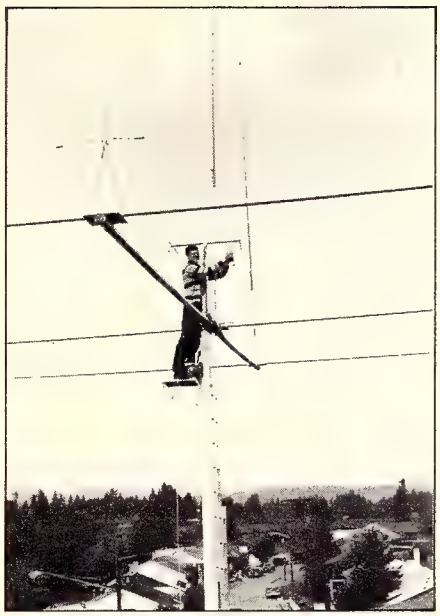
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A complement to N7AM's 80 meter colossus is his equally impressive 40 meter, 3-element, wide-spaced quad. The antenna, shown perched atop a sky-needle-design tilt-over tower, consists of three loops approximately 109 feet around. (Photo courtesy N7AM)

minum irrigation pipe in sizes ranging from 2 to 4 inches in diameter. The driven element has a 14 foot fiberglass pole at the top for a design frequency of 3.7 MHz; guying is done at the 40, 80, and 108 foot levels, using 5/32 inch polyester line, while 1/8" inch aircraft cable is used for winching. Vacuum relays at the base of each outer element allow the array to be changed in direction and tuned by switching wire lengths to make the individual elements act either as a director or as a reflector (the close 0.1 wavelength spacing causes the tuning to be critical). As with any ground-mounted h.f. antenna, the ground system is important. In fact, Jack points out that he put in two summers on his hands and knees installing ground radials covering two city lots. The radials were necessary for the quarter-wave array, but for the half-wave array the radials are still useful to help hold down the angle of radiation and to provide a good "balance" to the system.

Jack's conclusions from his experiences with the half-wave array included the observation that the half-wavelength vertical is about 5 dB better than any 3-element array (horizontal or vertical). The superb performance of the antenna has also enabled him to learn a great deal about 80 meter propagation conditions, especially regarding European "long-path" propagation that would not be readily discernible when using a lesser-performing antenna.

The accompanying photos show Jack's 5-element vertical array and also his 40 meter quad. Hopefully, it will only take a little extra encouragement for Jack to write up his antenna as a construction article for *CQ!*

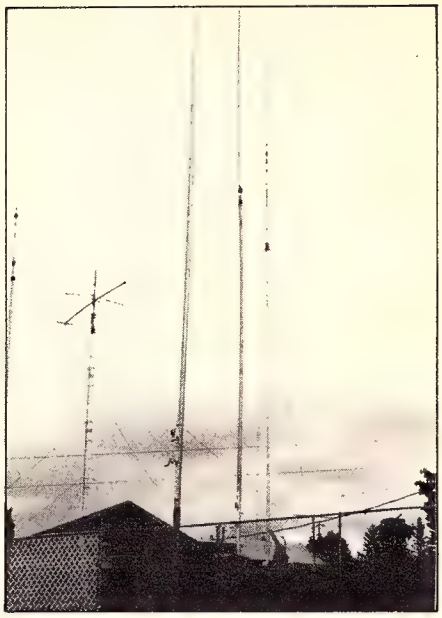
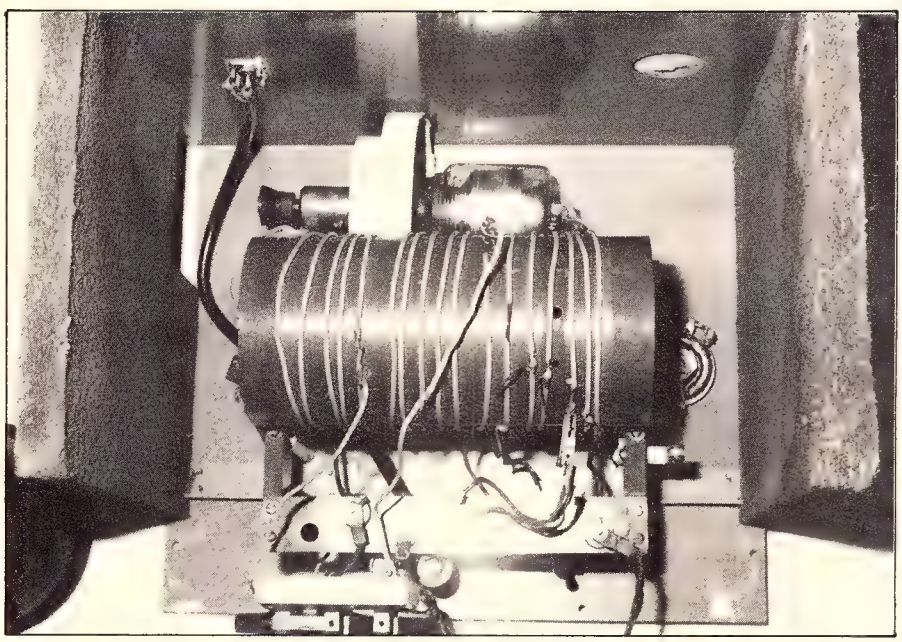


Photo looks to the northeast; the left side of the picture shows the NW element cranked down to the 40 foot level. Vacuum relays are used to switch directivity patterns and between phone and c.w. segments of the 80 meter band. (Photo courtesy N7AM)

Wrapping It

In this month's "Random Headings" Antennas column series we have returned to some more conventional antenna subjects and issues to discuss between-the-bands signal monitoring and specialized antennas for cordless telephones. We have also looked at the interesting antennas making up N7AM's "big signal from Bremerton." Next month we'll continue with several other topics of timely interest. See you then.

73, Karl, W8FX



Parallel-tuned coil and condenser, mounted at the base of the driven element, with taps for best s.w.r. Additional taps are provided for operation on 40 meters. (Photo courtesy N7AM)

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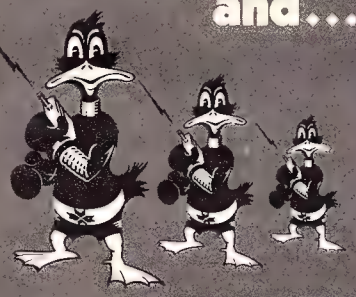
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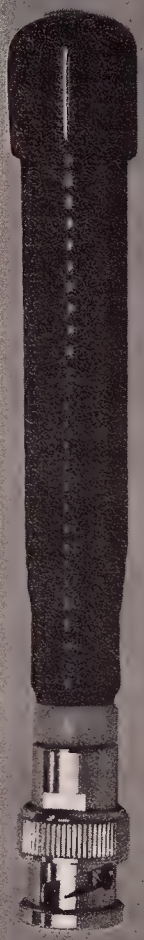
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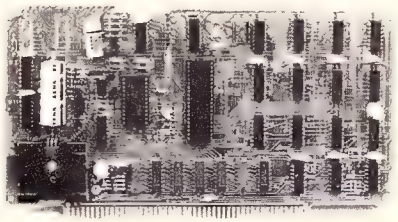
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LATITUDE AND LONGITUDE CALCULATIONS

BY THOMAS R. SUNDSTROM*, W2XQ

Among the variety of tasks the microcomputer has taken on in the home and in the amateur radio shack are calculations involving latitude and longitude. There has been a proliferation of beam-heading charts. Some include return bearings and some include both long- and short-path headings. Still other reports include distances expressed in statute miles, nautical miles, or kilometers. Great-circle and direction-finding programs should be of interest to the amateur who operates the h.f. bands and the v.h.f.-u.h.f. bands. For example, the ARRL has announced VHF/UHF Century Club awards based upon the grid locator system, a system that has been used in Europe for a number of years. Further, direction finding on the repeater sub-bands has become increasingly more important. Some amateurs compile a reference table of compass bearings to known transmitter locations, compare that to their antenna rotor control readout, and use all of that data to triangulate on an unknown jamming source.

For the shortwave listener, great-circle path and propagation prediction programs are interesting to compare broadcasting schedules to band conditions. Billboard Publication's annual *World Radio TV Handbook,* in addition to broadcast schedule information, lists many transmitter locations with latitude and longitude expressed in decimal degrees.

Over the past few years print media have published a number of computer programs using latitude and longitude values. Most of them work well but require the user to enter latitude and longitude as decimal values. In addition, given the design of the program, some values must be entered as positive values and some as negative values, depending upon positional relationships to the Greenwich meridian and the equator. With a microcomputer available for use, there is no reason to do these calculations by hand.

A set of subroutines were developed and used to replace the front end of a number of programs of interest to me. A subroutine is not a complete program unto itself, but may be incorporated into a larger program by using a **GOSUB** statement to enter the subroutine and a **RETURN** statement to get back to the main program.

Although these subroutines have been written for an Apple II Plus™ (trademark of Apple Computer Inc.), it should be relatively easy to convert them for other microcomputers.

How It Works

The subroutines in the listing with this article have been documented with **REM** (remark) statements. The main loop, beginning at line 1000, offers an option to insert your home location values (beginning at line 1600) or two locations (beginning at line 1100). You have the option of entering degrees, minutes and seconds, or decimal degrees, or combinations thereof by looping through the subroutine beginning at line 1300. Format reminders prompt for the input data separated by commas.

The subroutine starting at line 1300 calculates decimal degrees and then runs each calculation through the subroutine beginning at 1500. This subroutine assigns plus or minus values to each latitude and longitude calculated. You may have to adjust the **"if-then"** (lines 1520–1550) statements to route the calculation through the correct value (line 1560 or line 1570). The output of this subroutine drives your program. In your main program, write one additional line using the information in line 1580 to convert C(1) through C(4) to the variables in your main program. The added line should precede the main program and follow the format:

```
xxxx C(1)= :C(2)= :C(3)= :C(4)= :REM CONVERSION
```

Where **"xxxx"** is the line number. Insert values as needed.

The subroutine beginning at line 1600 inserts the standard home location values based on the data in lines 1630 and 1650. You can calculate your decimal values for your location by answering "no" to the question in line 1010 when you run your program for the first time. Use a **PRINT** statement to write the values of C(1) and C(2) to the screen, copy them down, and then change lines 1630 and 1650 for your location.

For your use, two additional subroutines may be called with a **GOSUB** statement whenever you need them. The first is an option to run the program again (beginning at line 1900), and the second is an "enter C to continue." The latter is useful to control the flow of output to the screen, to enable you to look at one screen at a time, rather than have it whiz by at an unreadable speed.

Where practical, all key responses test for an acceptable response to minimize keyboard errors. **"If-then"** statements do the work here.

Conclusion

You can use these subroutines by writing your main program and get the input data (location names and four coordinates) from the subroutines by using a **GOTO** 1000 or **GOSUB** 1000 statement early on in your program. Get back to your main program by inserting the appropriate **GOSUB** statements into lines 1180, 1190, and 1200 as needed.

In conclusion, if you find these line numbers duplicate those of another program, I recommend you type these in as listed and save them on disc or tape.

*Box 175, Vincentown, NJ 08088-0175

Say You Saw It In CQ

```
1000  REM  *** MAIN LOOP ***
1010  HOME : VTAB 10: PRINT "ARE YOU AT YOUR NORMAL HOME LOCATION?"
1020  PRINT : HTAB 25: PRINT "(Y/N)  ";: GET Z$: PRINT Z$
1030  IF Z$ = "Y" GOTO 1600
1040  IF Z$ = "N" GOTO 1710
1050  IF Z$ <     "Y" OR Z$ >     "N" GOTO 1020
1060  FOR X = N TO 4: PRINT
1070  IF X = 1 THEN 1110
1080  IF X = 2 THEN 1120
1090  IF X = 3 THEN 1130
1100  IF X = 4 THEN 1140
1110  HOME : PRINT "ENTER LATITUDE OF HOME LOCATION": GOTO 1150
1120  PRINT "ENTER LONGITUDE OF HOME LOCATION": GOTO 1150
1130  GOSUB 1800: HOME : PRINT "ENTER LATITUDE OF OTHER LOCATION": GOTO 11
      50
1140  PRINT "ENTER LONGITUDE OF OTHER LOCATION": GOTO 1150
1150  GOSUB 1300: REM  DEG-MIN-SEC TO DECIMAL DEGREES
1160  GOSUB 1500: REM  STANDARD VALUES +/-
1170  NEXT X
1180  REM  *** PUT YOUR MAIN PROGRAM STATEMENTS,
1190  REM  *** GOSUB STATEMENTS, OR RETURN
1200  REM  *** STATEMENTS IN THIS SECTION OF THE PROGRAM.
1210  GOSUB 1900: REM  REPEAT JOB?
1220  END
1300  REM  *** CONVERT DEG-MIN-SEC TO DECIMAL DEGREES ***
1310  PRINT : PRINT "DO YOU WANT TO ENTER:": HTAB 5: PRINT "(1) DEGREES-MI
      NUTES-SECONDS: OR": HTAB 5: PRINT "(2) DECIMAL DEGREES?" SPC( 15);: GET
      Q: PRINT Q
1320  IF Q < 1 OR Q > 2 GOTO 1310
1330  ON Q GOTO 1340,1410
1340  PRINT : HTAB 5: PRINT "DEGREES, MINUTES, SECONDS, LAT/LONG"
1350  HTAB 5: PRINT "FORMAT: D,M,S,L"
1360  PRINT : HTAB 6: PRINT "ENTER: ";: INPUT D,M,S,Y$
1370  IF Y$ = "N" OR Y$ = "S" OR Y$ = "E" OR Y$ = "W" THEN 1390
1380  IF Y$ <  > "N" OR Y$ <  > "S" OR Y$ <  > "E" OR Y$ <  > "W" THEN 134
      0
1390 C(X) = D + (M / 60) + ((S / 60) * .001)
1400  GOTO 1450
1410  HTAB 3: PRINT "FORMAT: D.D.L": PRINT
1420 M = 0:S = 0
1430  HTAB 4: PRINT "ENTER: ";: INPUT D,Y$
1440  GOTO 1370
1450  RETURN
1500  REM *** ASSIGN +/- ***
1510  REM  ** CHANGE LINE NUMBERS IN THE FOLLOWING FOUR STATEMENTS TO ADJU
      ST PLUS AND MINUS VALUES FOR N, S, E AND W TO YOUR PROGRAM
1520  IF Y$ = "N" THEN 1560
1530  IF Y$ = "S" THEN 1570
1540  IF Y$ = "E" THEN 1560
1550  IF Y$ = "W" THEN 1570
1560 C(X) = C(X) * ( + 1): RETURN
1570 C(X) = C(X) * ( - 1): RETURN
1580  REM  *** C(1)=HOME LAT.: C(2)=HOME LONG.: C(3)=OTHER LOCATION LAT.:
      C(4)=OTHER LOCATION LONG.
1600  REM  *** INPUT STANDARD DATA ***
1610 N = 3
1620  REM  *** INSERT YOUR COORDINATES BELOW ***
1630 C(1) = 39.9005:C(2)    = 74.7175
1640  REM  *** INSERT YOUR NAME AND LOCATION BELOW ***
1650 N$ = "TOM--W2XO":W$ = "VINCENTOWN, NJ"
1660  GOTO 1060
1700  REM *** INPUT NON-STANDARD DATA ***
1710 N = 1
1720  HOME : VTAB 8
1730  PRINT : PRINT "WHAT IS YOUR NAME?": PRINT
1740  INPUT N$
1750  PRINT : PRINT "WHAT IS YOUR HOME LOCATION?"
1760  PRINT
1770  INPUT W$
1780  GOTO 1060
1800  REM  *** IDENTIFY OTHER LOCATION ***
1810  HOME : VTAB 10: PRINT "WHAT IS THE OTHER LOCATION?": PRINT : INPUT O
      $: RETURN
1900  REM  *** DO THE JOB AGAIN? ***
1910  HOME : VTAB 12
1920  PRINT : PRINT "DO YOU WANT TO RUN THIS JOB AGAIN?": PRINT : HTAB 25:
      PRINT "(Y/N)  ";: GET Z$: PRINT Z$
1930  IF Z$ = "Y" THEN 1010
1940  IF Z$ = "N" THEN 1960
1950  IF Z$ <  > "Y" OR Z$ <  > "N" THEN 1920
1960  TEXT : HOME : PRINT "BYE!": RETURN
2000  REM *** 'C' TO CONTINUE ***
2010  VTAB 22: HTAB 5: PRINT "ENTER 'C' TO CONTINUE...";: GET C$: PRINT C$
      : IF C$ <  > "C" GOTO 2010
```

Once saved, reload the subroutines and renumber them, so as not to conflict with the main program, using a utility program such as Applesoft's "**RENUMBER.**" Then type the other program into the computer and save the whole program under a different name. The subroutines presented here and saved as is can be reloaded and used again in other programs, again renumbering and resaving under a new name as necessary.

I hope you find these subroutines as useful as I have. Questions? I'll help if I can, but an s.a.s.e. is a must.

Key Perfect

```
          KEY PERFECT 4.0
              RUN ON
         LAT/LONG CONVERSION

      CODE        LINE# - LINE#
      ----        -------------
      571F         1000 -  1090
      9F6A         1100 -  1190
      9FC1         1200 -  1360
      580C         1370 -  1500
      9968         1510 -  1610
      6CAF         1620 -  1740
      6BB6         1750 -  1930
      3E74         1940 -  2010
TOTAL PROGRAM CHECK IS : 07E3
```

Key Perfect is a utility program that generates a "check code" for each 10 lines of BASIC or 80 bytes of machine language for an Apple II or Apple II Plus with DOS 3.2, 3.2.1, or 3.3 with a minimum of 24K. Key Perfect is available from Micro-Sparc, Inc., P.O. Box 325, Lincoln, MA 01773 (telephone 617-259-9710). MSI publishes *Nibble* magazine for Apple users.

First type these subroutines exactly as they appear, with all REM statements, character strings, and line numbers as presented. Save the subroutines, and then boot the Key Perfect disk and follow its instructions. Your table should exactly match the table published here. If it doesn't, check the line numbers where the code differs for typing errors.

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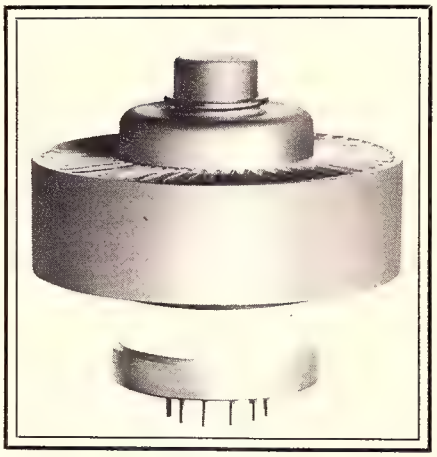
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CQ SHOWCASE

EIMAC Power Triode

The EIMAC division of Varian has announced the new 3CX800A7 ceramic/metal power triode intended for use as a cathode-driven amplifier for h.f. and v.h.f. service. This compact tube is intended for high-power linear-amplifier service. A single tube will produce a full 2 kw p.e.p. or 1 kw c.w. input power. The 3CX800A7 is rated for 800 watts plate dissipation and will deliver full power output with less than 40 watts peak drive power. Power gain is better than 15 dB. The air-cooled anode requires less than 20 cfm with a back-pressure rating of 0.35 cfm for full dissipation at sea level.

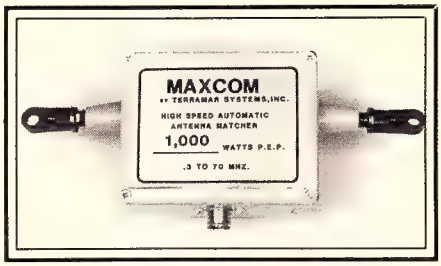


Height of the 3CX800A7 above the socket plane is only 2¼ " (5.7 cm), making the tube suited for compact linear-amplifier design, compatible with modern, low-profile styling. For more information, contact Varian, EIMAC Division, 301 Industrial Way, San Carlos, CA 94070, or circle number 101 on the reader service card.

Magnum Distributing Has "Maxcom" Antenna Matcher

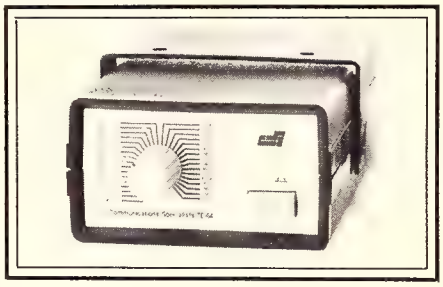
Magnum Distributing has introduced the "Maxcom" automatic, high-speed antenna matcher. "Maxcom" will tune one antenna from .3 MHz to 70 MHz with a v.s.w.r. of less than 1.5, when properly installed automatically without external control leads in either the dipole or long-wire configuration. The matchers are available in three models covering 500, 1000, and 2000 watts p.e.p. Their light weight and small physical size make them useful for self-supporting dipole installations.

"Maxcom" matchers are manufactured by Terramar Systems, Inc. of Fort Lauderdale, Florida. For more information, contact Magnum Distributing Inc., 1000 S. Dixie Hwy. W. #3, Pompano Beach, FL 33060, or circle number 103 on the reader service card.



Communications Specialists TE-64 Test Encoder

The TE-64 test encoder, manufactured by Communications Specialists, will provide a total of 64 audible and sub-audible tone frequencies for test purposes. Measuring 5.25 "L × 3.3 "W × 1.7 "H, it is suitable for shop or service truck use, and with the addition of a 9 volt transistor radio battery it may be made completely self-contained. Mounting brackets are also included.



Frequencies available include all 32 standard EIA sub-audible frequencies, 19 burst tone frequencies (from 1600 Hz to 2550 Hz in 50 Hz increments), 8 touch-tone frequencies, and 5 test frequencies including 600, 1000, 1500, 2175, and 2805 Hz. The TE-64 provides a low-impedance, low-distortion, adjustable sine-wave output at 5 volts peak-to-peak and is powered by 6 to 30 volts d.c. The output level is flat to within ± 1.5 dB over the entire range selected. Separate level adjustment controls and output connections are provided for each tone group (audible or sub-audible). Frequencies are dialed in with a rotary switch located on the front panel and an OFF position is provided for no tone output. The TE-64 comes with a one-year factory warranty. Price is $79.95. For more information, contact Communications Specialists, Inc., 426 West Taft Ave., Orange, CA 92667, or circle number 102 on the reader service card.

Flesher Corp. TU-470 RTTY/C.W. Terminal

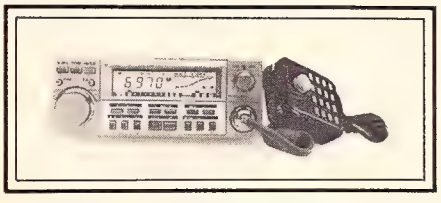
The Flesher Corp. TU-470 receives up to 300 baud on all three shifts, provides TTL and RS-232 compatible I/O, including bi-polar c.w. and PTT outputs for complete remote control and isolation of computer level I/O keying. Each TU-470 RTTY filter board is a high-sensitivity, high-Q, 3-stage, 6-pole active bandpass filter which provides stability and sharpness, maker says. A signal balance restorer circuit has been incorporated to allow reception of non-standard RTTY shifts on mark only. The c.w. filter/demodulator has a 3-stage, 6-pole filter centered at 750 Hz for c.w. reception. The TU-470 also provides xtal-controlled AFSK, FSK, 170 Hz narrow preselector filter, built-in 20 or 60 ma loop supply, and more.



The unit is available wired and tested for $499.95. For more information, contact Flesher Corporation, P.O. Box 976, Topeka, KS 66601; or circle number 104 on the reader service card.

Trio-Kenwood TW-400A F.M. Dual-Band Radio

Trio-Kenwood has announced the addition of the model TW-4000A, a compact combination 2 meter and 70 centimeter f.m. radio. Among the new features are a large, easy-to-read LCD display, 10 channels of memory with off-set recall, lithium battery memory back-up, dual digital v.f.o.'s, priority watch, common channel, programmable memory scan, band scan, and 25 watts of r.f. output on each band.



An optional accessory available for use with the TW-4000A is the VS-1 voice synthesizer unit which announces the operating frequency, v.f.o. "A" or "B", repeater offset, and the memory channel number when the unit is turned "ON", when another frequency is selected, or when a memory is recalled. The VS-1 is designed to be easily installed inside the TW-4000A. Price of the TW-4000A is $599.95; the VS-1 is $39.95. For more information, contact Trio-Kenwood Communications, 1111 West Walnut Street, Compton, CA 90220, or circle number 105 on the reader service card.

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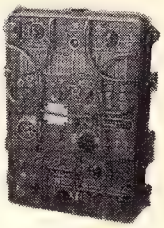
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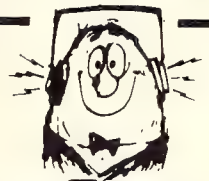
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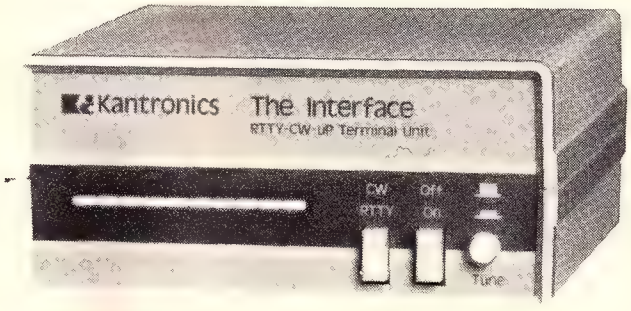


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The Unconventional Sloping "L" Antenna For 160 Meters

BY WALT S. GRADZKI*, KB2MF

Living in a ranch-style home on a 70′ × 110′ lot in a residential neighborhood presented me with a challenge to build a 160 meter antenna.

As a broadcast engineer familiar with antenna operating between 550 and 1600 kHz, I was very concerned with the match between the transmitter and the antenna. Broadcast transmitters are designed to work into a 50 ohm load with zero reactance (expressed 50 ± j0 ohms). The j is used to identify reactance, + for inductive and − for capacitive. If the reactive component is not 0, the power output and transmitter efficiency will suffer. In addition, the bandwidth will be affected and consequently the sound will suffer.

The more I thought about the perfect antenna for 160, the more discouraged I became. There was just no way to erect a halfwave or quarterwave antenna on my limited property. Or was there? The question that kept popping up was is it necessary to achieve 50 ± j0 ohms? The answer was not really. What would suffer and what problems could I expect to see? Bandwidth and efficiency were not major issues, and since an amateur transmitter operates either in the c.w. or s.s.b. mode, the key-down duration period wouldn't put any excessive strain on my finals.

With theory now out of the way, I proceeded to string up a quarterwave antenna any way I could. The result was an antenna wire attached to my tower, end-fed at 30 feet, sloping down to the far corner of my backyard, and attaching to a 6 foot high stockade fence. From that point the wire makes a 45-degree turn to the right and travels 1 foot above the fence for 50 feet. The only ground used is the 30 foot tower and an 8 foot ground rod attached to it. The total length of wire used was about 136 feet.

To make the antenna work, I installed a Bird model 43 Thruline wattmeter in the line at the transmitter end and trimmed the antenna length for a 1:1 s.w.r. at the center of the band. Using this technique I got an s.w.r. of 2.5:1 at the band ends and an s.w.r. of 1:1 at the center.

Just out of curiosity, and since I had the equipment handy, I measured the whole band with a stable URM-25F signal generator and a General Radio 916-AL R.F. Bridge. At 1900 kHz the antenna system read 48 + j0 ohms. However, at 1800 kHz it read 12 + j3.3 ohms, and at 1975 kHz it read 15 − j26 ohms. As you can see, the resistance and reactance varied all over the place.

The end result is that the antenna works great throughout the band. It was cheap and easy to build. The items used were 136 feet of No. 14 copperweld wire, 2 plastic insulators, 1 hose clamp, and a length of RG-8 about 50 feet long with a PL-259 connector on the end.

Will it work DX? Perhaps. Will it work WAZ? Maybe. Can I operate on 160 meters and have fun? You bet! The moral to this story is don't be concerned about a proper antenna. Improvise and trim until you get a good, low s.w.r. and operate.

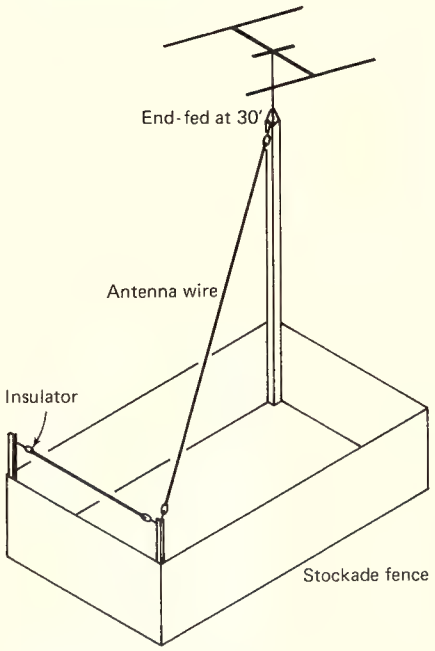


Fig. 1– Diagram showing antenna layout, an unconventional sloping "L."

1800	2.5:1
1825	2.1:1
1850	1.5:1
1875	1.25:1
1900	1.1:1
1925	1.35:1
1950	1.8:1
1975	2.3:1
2000	2.5:1

Table I– S.w.r. measured with the Bird 43 Thruline wattmeter.

1800	12 + j3.3 ohm
1825	15 + j10 ohm
1850	22 + j13 ohm
1875	34 + j16.3 ohm
1900	58 + j8 ohm
1925	51 − j37 ohm
1950	28 − j37 ohm
1975	15 − j26 ohm
2000	10 − j19 ohm

Table II– Resistance and reactance.

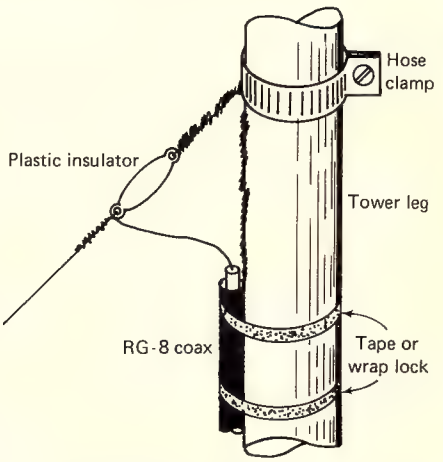


Fig. 2– Typical end-fed installation of the unconventional sloping "L."

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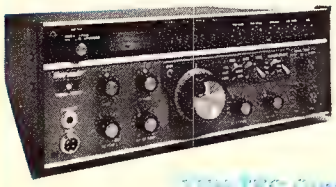
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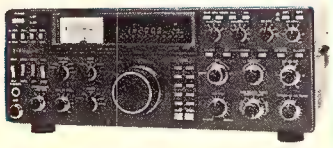
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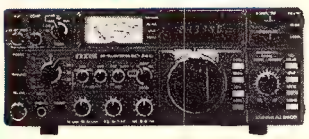
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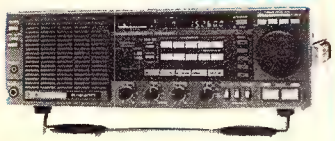
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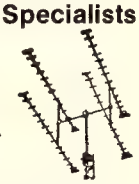
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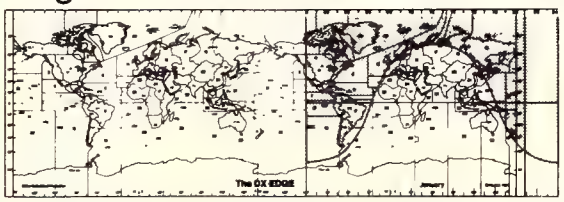
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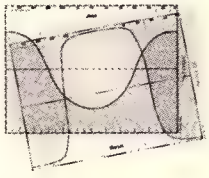


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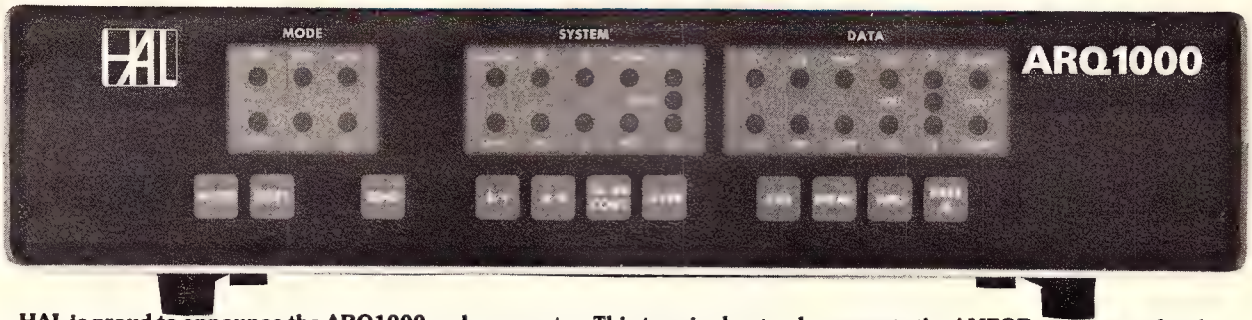
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AMTOR RTTY



HAL is proud to announce the ARQ1000 code converter. This terminal not only supports the AMTOR amateur codes, but meets ALL of the commercial requirements of CCIR Recommendation 476-2. The ARQ1000 can be used with present and previous generation HAL RTTY products. In fact, any Baudot or ASCII full duplex terminal at data rates from 45 to 300 baud may be used with the ARQ1000. Some of the outstanding features of the ARQ1000 are:

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- Automatic listen mode for ARQ, FEC, and SEL-FEC
- Meets commercial requirements of CCIR 476-2
- By-pass mode for normal RTTY without changing cables
- Programmable ARQ access code, SEL-CAL code and WRU
- Programmable codes stored in non-volatile EEPROM
- Keyboard control of normal send/receive functions
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- "Handshaking" control for printer and keyboard or tape
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- Cabinet matches style and size of CT2200 and CT2100
- Table or rack mounting
- Built-in DM170 modem option available
- Encryption option available for commercial users
- 8½" × 17" × 10½"

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BY POPULAR REQUEST



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CIRCLE 10 ON READER SERVICE CARD

NEWS OF COMMUNICATIONS AROUND THE WORLD

Sound, sound the clarion, fill the fife!
Throughout the DX world proclaim
One crowded hour of DX life
Is worth an age without a name . . .

Though August brings the warm, slow days of summer, it is also a sign that the great days of Fall DXing are near. As DXers turn from the rites of summer to prepare for the great *CQ* World-Wide DX Test in October, it is also the time to burnish some of the never-ending worries. Last week one of the burnishers was up the hill to alert us to some of the problems that worriers face.

"It's these contests that are getting to me," he glumly advised us. "Once I would be all fired up when Fall was near, ready to go day and night and not particularly caring what contest was on. If there was a contest, I was there. I would work 'em all. But somehow it doesn't seem to be fun anymore. Sometimes I hardly get excited at all."

As one eventually comes to suspect, there is a reason for most everything; hardly anything ever happens without a reason. The initial suspicion was that the local QRP type had been trampled on in a pile-up, possibly not only having been beaten, but maybe even not getting through with the end of the bunch—those with low towers and lower power. Certainly this one would have been out of place in that crowd.

"Remember the DX Tests this Spring?" he asked, his eyes filled with a question that we suspected we would hear more about. "The bands were opening to various parts of the world. That was good, but the more I'd tune, the more I'd find stations just sitting on a frequency and calling 'CQ DX.' On some bands it seemed as though they were lined up like pickets on a fence." The QRPer leaned closer. "And would you believe? They were mostly W's and K's! What do you think of that?"

"What I want to know," continued the QRPer, quickly getting to the nub of his worries, "is why anyone in a world-wide DX test needs to work or go looking for a 'W' or 'K' station? That's what I'd like to know. Are those prefixes suddenly so rare that all you have to do is announce your availability and you'll be fighting off a pile-up? What's going on anyhow?"

"That all?" we slipped in, and the QRPer was off again. "And what about all these ideas that you read about every time you pick up a magazine? Things like a codeless license, no DXCC credits on the new bands, no license at all for CBers, more phones on the old bands, no phone on the new bands. And what do you think of that idea I saw in one magazine that full-blown pile-ups on a rare station should be confined to 10 kHz of the band?" Again the QRPer was leaning close to nail down our attention. "Can you imagine a true-blue ZA-Albanian showing on the bands and trying to hold things to 10 kHz? I don't think that DX has ever before been in such a precarious state, and I fear for the future." This was a worried DXer for sure, standing there using his hands to shape his words. But what could one say?



This is Heitor Vianna Posada Filho who operates from Niteroi across the bay from Rio de Janeiro. Interested in DXing, he signs PY1EQR and works as a flight-control radar operator at the Rio de Janeiro airport.

Most DXers live with the premise of the fairness of men and the goodness of the world. But this one was feeling the edge of something that he could not scratch. "That's just what they were doing," he said, pounding a fist into the palm of the other hand for emphasis, "and some of them were running everything wide open and maybe even a bit more. Why some were buckshotting 5 kHz either side of their frequency, and you know what it takes to do that these days. That isn't the way it is supposed to be, is it?" He said all of this as though there was no room for argument. It was then that we decided to haul him even further up the hill to the Old Timer who has been around so long that he knows personally everything that irritates DXers and possibly even a few more that the newer DX types have not yet thought of. Sometimes a second opinion helps.

The QRPer was quick into his woes. "Sometimes I think," he said, "that the good old days are all gone and there are no good ones left." Then he again told the Old Timer of his fears and troubles. He got an attentive ear. Finally the Old Timer spoke and we listened.

"You've probably heard me say it before, but almost every DXer comes on the scene thinking he's found perfection in an imperfect world. Usually he is so convinced that he wants no change except for possibly adding some new countries. But one learns; one always does." The Old Timer looked at the QRPer. "You following me?" he asked, and the QRPer nodded his head.

"Years ago," the Old Timer continued, "I had moderate power and a beam. In a contest I'd hear someone with a strong signal calling a station that I needed and the strength of the signal discouraged me from even getting in. Then after awhile I continued to listen, and although the signal might have been strong, the results were not. Finally I came to the conclusion that what I was hearing was a signal off a vertical or possibly a dipole, but a signal that was being radiated in more than one direction—sometimes a signal that was stronger at my place than at the DX stations. Understand?

"I'm going to speculate," the Old Timer continued, "that while you hear them calling 'CQ DX,' you also hear sparse results. Maybe once in awhile you'll come across a station with a superb location, high towers, and big antennas. Throw in the adequate power, and they'll work everything. But you'll also find them scanning the bands in a DX Test, hearing what they need for multipliers, working them quickly, and then on to another. When they can't work multipliers, they work counters, and many West Coast stations have done just that by working JA's as long as their endurance lasts when the bands are out to other areas. Certainly you've noticed all of this?"

The Old Timer had the QRPer's attention. "You mean that maybe I'd ignore those camped on a frequency and everlastingly calling 'CQ DX' and search for countries and counters that I might hear and which they probably are not. Is that what you mean?"

The Old Timer was looking off into the distance. "You might try it," was all he would say. The QRPer stood waiting for more advice, but none came. We weren't going to say anything at this point, for it was evident that this QRPer respected words that came from a source of wisdom he thought was denied him. But we knew he'd learn, for DXers always do.

"How many licensed amateurs are there in the U.S. these days?" we asked, already knowing the answer, but trying to divert this QRPer's thinking. The answer

77 Coleman Dr., San Rafael, CA 94901

The WPX Program

Mixed

1051	NU4N	1053	KI2G
1052	DF1SD	1054	YU7DX

S.S.B.

1584	KA0IQR	1587	KI2G
1585	G4KHF	1588	W0CON
1586	JF2IGP	1589	EA7AVU

C.W.

2204	EA7CJM	2207	W9CBE
2205	VE3DAP	2208	W2YVQ
2206	W9VEN		

Endorsements

Mixed: 450 DF1SD, KI2G, KU4N, WA3ZMY, VE3KZE, YU7DX. 500 DF1SD, KI2G, WA3ZMY, YU7DX. 550 DF1SD, KI2G, WA3ZMY. 600 VE5AE, DF1SD, KI2G, VE2PD, WA3ZMY. 650 DF1SD, KI2G, WA3ZMY. 700 NN4Q, DF1SD. 750 NN4Q, JA1VDJ. 800 NN4Q, JA1VDJ. 850 WD9IIC, NN4Q, JA1VDJ. 1000 NN4Q, JA1VDJ, JE1JKL. 1050 JE1JKL. 1150 KL7AF. 1300 N7TT, I2PHN. 1350 IN3ANE, I2PHN, K9BG. 1400 I2PHN. 1450 I2PHN..

S.S.B.: 350 K2POF, KA0IQR, DL3OK, KI2G, KU9C. 400 KA0IQR, KI2G, DL3DK, WD5HEG, EA3BOX. 450 KA0IQR, KI2G, DL3DK, EA3BOX. 500 KI2G, DL3DK, EA3BOX. 550 WD9FOE, KF4EO, KI2G, DL3DK. 600 WD9HAW, KI2G, YB0ACL, VE2PD, DL3DK. 650 JH4PRU, DL3DK. 700 LU3YL/W4, KZ2P. 750 LU3YL/W4, KZ2P. 800 LU3YL/W4. 850 LU3YL/W4. 900 LU3YL/W4. 950 LU3YL/W4, I3ZKD. 1000 LU3YL/W4, I3ZKD. 1050 LU3YL/W4, I3ZKD. 1100 I3ZKD, I2PHN, I6SF. 1150 I3ZKD, I2PHN. 1450 W0YDB. 1600 I4ZSQ.

C.W.: 350 EA7CJM, W9VEN, KN7K. 400 W9VEN. 450 K2POF, W9VEN. 500 OZ5EDR. 600 W6YMH. 900 OK1DKR. 1000 N4YB. 1100 N4YB. 1500 N2AC.

10 meters:	LU3YL/W4.
15 meters:	LU3YL/W4.
20 meters:	DF1SD, KI2G.
40 meters:	LU3YL/W4.
160 meters:	LU3YL/W4, KC8JH.

Asia:	LU3YL/W4, DF1SD.
Africa:	WD9IIC, DL1AM, LU3YL/W4.
Europe:	G4KHF, K3IXD, DF1SD, KI2G.
No. America:	K7DBV, KI2G.
Oceania:	LU3YL/W4, N4YB, W4ZYQ.

VPX 229: 13-72249.

WPNX 215: KA8ISF.

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was right there. This QRPer could think on his own. Come to think of it, most DXers can. We pressed on.

"With some 400,000 or so licenses out, is it really possible that there is spectrum for all of these to be on the air at the same time? Or even half of them? Some who have been close to the action have figured that not more than 25% of amateur licensees are active; the others are holding their licenses, but show little or no activity. Years back when the FCC charged fees for a while, the number of licenses held dropped significantly, as those inactive amateurs apparently felt it was not worth the price to hold on to something they were not using or had no intention of using. Then the FCC fees were rescinded, other factors moved in, and the totals soared." We were moving close to hold the QRPer's attention. "Does any of this have significance for you?" we asked, and the QRPer was lost in thought. After a bit a light started to show in his eyes.

"You mean . . .?" he said, and we nodded. He smiled and again was showing animation. "All these years," he continued, "when you were telling me about listening, I just got to thinking that you were trying to clear the frequency. But I do listen and a lot of other DXers I know also listen. Sometimes when you think that no one's around, a call on the 2 meter box will bring a dozen or more of the locals out into the open. Right?"



This photo was taken during a visit to Japan by OZ5DX. Left to right are JH1WIX, OZ5DX, and JP1BJR, ex-J2JJ, of the 1930s. Anyone ever operating on 21 c.w. has heard the loud signal of JH1WIX. (Photo via W2GT)

He was right, and almost any casual DXer will recognize the scenario. "But what is it like when a really rare piece of DX shows up, possibly even one that you need. Then all the listeners become callers and the bands get a bit tight, right!"

If nothing else, this was taking the QRPer where he wanted to go. "You know," he rushed on briskly, "one of those articles in a magazine said that DX pile-ups interfere with important things like ragchewing. But thinking things over, any increase in activity is always going to crowd the bands for a period. But then again, a DXpedition usually only has a limited run, so the problem is self-correcting.

"You know something," the QRPer finally said. "You were right about politicians learning early to listen. DXers would possibly be in the same category, but listening is not going to be enough. I'm going to do something about it. That's for sure!"

And away he went. But the next time I saw him down in the village, there on his rear bumper was the slogan: "Free the DX Bands." Down in the Oklahoma country some may think he's thinking of gasoline, but most DXers understand.

Spratly

Back in April many Dxers were waiting for a projected Spratly operation by West German amateurs to show on the air. The waiting turned to shock when the group approaching one of the islands reported that they were under fire and went off the air after hurriedly reporting that the vessel was on fire.

For some days there was growing concern over what had happened. Ships in the vicinity reported no sighting of survivors. Then after eight days a report came that survivors had been found floating in an open dinghy by a Panamanian registry vessel and were taken to Hong Kong. The report was that Diethelm Mueller, DJ4EI, was killed in the initial attack, being caught by an artillery blast and blown overboard. Gero Band, DJ3NG, died but hours before the rescue vessel *Linden* sighted the survivors. The leader of the effort, Baldur Dronica, DJ6SI, and Norbert Willand, DF6FK, were hospitalized in Hong Kong, dehydration and exposure being severe. The owner of the vessel, Peter Marx, and another crew member, Jenny, were also receiving medical attention. Apparently the 51 foot vessel was a total loss along with all the equipment.

The vessel had approached Amboina Cay, and deciding that the portents were not friendly, they changed course to head away from Amboina and towards another island in the Spratly group. This was when they were fired on, set afire, and destroyed. The vessel was hurriedly abandoned without time to provide for survival supplies. A sea and air search was made although in some instances this covered the wrong areas. It was reported that the hostile fire came from Vietnamese troops on the island. Several of the countries whose nationals were involved were looking into the matter.

In these DX columns last month there



Amboina Cay in the Spratlys, this taken by the 1979 IDXF effort. They were fired on at that time by troops on the island. This Spring DJ3NG and DJ4EI died as the result of mortar fire which sunk their boat in the vicinity.

The WAZ Program

10 Meter Phone

243	WD5DBV	245	F6FHO
244	F6FFA		

15 Meter Phone

161	N4PB	162	JI1VVB

20 Meter Phone

448	N6CYL	452	W2IJB
449	K4RIG	453	N1ALR
450	KB6YC	454	W4JFE/7
451	KM6B		

10 Meter C.W.

46	JH3JJS

15 Meter C.W.

91	JA1BN

20 Meter C.W.

192	W4WJ	194	W4JFE/7
193	N4KE	195	N5CID

40 Meter C.W.

41	JH7BDS

All Band WAZ

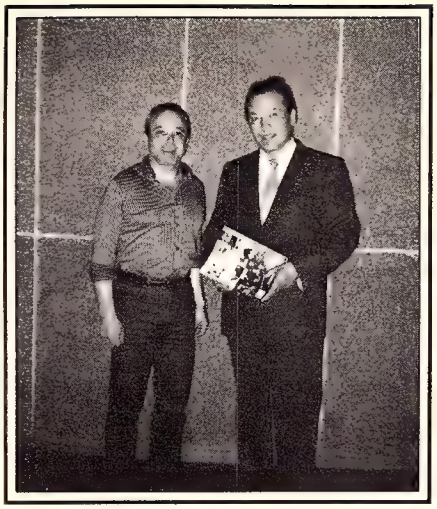
S.S.B.

2660	KD6BV	2672	WD0DMN
2661	JA1UTQ	2673	KB5EK
2662	WA2GEA	2674	F6FWW
2663	KA0FPK	2675	W5UFI
2664	WD4PQF	2676	JA7HMZ
2665	HK8BVN	2677	WN5MBS
2666	KK0L	2678	W3ICM
2667	WD8PKF	2679	PT2LS
2668	WD8KLC	2680	EA7BLU
2669	ON8HF	2681	EA6OB
2670	WB3DWH	2682	EA7AZJ
2671	WB7VHA		

C.W. and Phone

5563	KA2DIV	5572	DK8SV
5564	N6DW	5573	DF3ZK
5565	W4EJH	5574	ON8HF
5566	KJ9O	5575	W7LYO
5567	K9AYK	5576	W9LCQ
5568	JA7UFZ	5577	WA8WMC
5569	KB6EP	5578	DL2NAR
5570	DL9WW	5579	W3CIM
5571	DF9TD	5580	JF3AIE

Applications and reprints of the latest rules may be obtained by sending a self addressed stamped envelope (37 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.



Two choice DXers (left to right) are Ken Cohen, VS6IC, and Arsen Innocenty, JT1AN. Note that Arsen is holding on to a copy of his favorite magazine. For those who may have the opportunity of visiting Hong Kong, Ken has the only kosher delicatessen in all of Hong Kong. (Photo via W7PHO and W2LZX)

was a report from San Hutson, K5YY, on the question of continuing the Spratlys as a DXCC country. Several factors were noted, these including the possible danger to any operation aimed at putting the islands on the air. Although the column was written back in April prior to the events in the South China Sea, San Hutson's words turned out to be prophetic, much more than anticipated. At Visalia in April there was also discussion on the possibility of deleting Spratly, although this ended on an inconclusive note.

Back in the 1960s two other DXers, Chuck Swain and Ted Thorpe, were lost at sea in a small boat when returning to the Samoa area after a DXpedition in the South Pacific. They were caught in a tropical storm. Chuck Swain, then XW8AU, was one who founded the SEANET back in 1963; his home call was K7LMU. Ted Thorpe was out of New Zealand. Chuck Swain was also with Don Miller when they first put Spratly on the air back in 1965 signing 1S9WNV.

More than once there have been DXpeditions where some long chances were taken and where some personal peril was always at hand. More often than might be expected, these efforts came off successfully. But inevitably something happens, something goes wrong, and the results are tragic. No DXer will ever consider that working some of these countries is worth the price.

Spratly Islands are disputed territory with a number of countries laying claim to the reefs. China, Vietnam, and the Philippines are among those who consider the reefs as sacred ancestral soil. It is also an area where seismic exploration has indicated the possibility of oil deposits. Under the proposed Law of the Sea treaty, sovereignty over an island also includes the sea floor for 200 miles around. Although this has not been ratified by a number of nations, including the United States, there has been no hesitancy on the part of many nations to declare a claim for sea bed up to 200 miles offshore. For years no one paid much attention to the Spratlys; now there may be more attention than justified. The loss of the two German amateurs will long be remembered.

Malpelo

Fred Laun, K3ZO, now assigned to Colombia, was the first to confirm that a Malpelo effort by the HK amateurs is on for this Fall (probably in October).

The callsign will be HK0TU, and the effort will be sponsored by the Liga Colombiana de Radioaficionados (LCRA). Early on, those listed for the effort were HK1QQ, HK3RQ, HK3BAU, HK3TF, and HK0BKX. Initial plans called for three, possibly four,

5 Band WAZ

Standings as of May 1, 1983

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 Fernandez (Spain)
8. LA7JO, Stig Lindblom (Norway)
9. EA3SF, Fernando Blenert (Spain)
10. OH1XX, Hannu Nieminen (Finland)
11. EA8OZ, Julio Rosello (Spain)
12. W0SD, Edward Gray (U.S.A.)
13. K0ZZ, 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. SM0AJU, Leif Lundin (Sweden)
20. OZ3PZ, Preben Thomsen (Denmark)
21. I3MAU, Reno Mauri (Italy)
22. I2ZGC, Gianni Zillio (Italy)
23. 4Z4DX, Dov Gavish (Israel)
24. N4KE, Ron Blake (U.S.A.)
25. K5UR, Rick Roderick (U.S.A.)
26. K9AJ, Michael McGirr (U.S.A.)
27. SM3EVR, Tord E. Julander (Sweden)
28. LA5YJ, Bjorn Hugo Ark (Norway)
29. DL3RK, Walter Geyrhalter (W. Germany)
30. N4WJ, Frank McCormick (U.S.A.)
31. G3MCS, W.R. Hawthorne (England)
32. SM5AQD, Hakan "Hawk" Eriksson (Sweden)
33. W0MLY, George McKercher (U.S.A.)
34. I0RIZ, Gianni Rizzi (Italy)
35. ON5NT, Ghislain Penny (Belgium)
36. OH6JW, Antti Kiviuoma (Finland)
37. OK1AWZ, Milan Dlabac (Czech.)
38. IV3PRK, Pierluigi "Luis" Mansutti (Italy)
39. DJ6RX, Klaus Heintzenberg (W. Germany)
40. OH3YI, Ossi Lehvas (Finland)
41. I4RYC, Relli Claudio (Italy)
42. ZL1BIL, Mike Edwards (New Zealand)
43. I4EAT, Fausto Minardi (Italy)
44. ZL1BQD, R.J. Runciman (New Zealand)
45. TG9NX, Francisco Capuano (Guatemala)
46. XE1J, Joe Levy (Mexico)
47. F5VU, Jean Brunner (France)
48. W3AP, Norwood Lowry (U.S.A.)
49. YO3AC, Andrei Giurgea (Romania)
50. K3TW, Tom Warren (U.S.A.)
51. XE1OX, Elicio Munoz (Mexico)
52. VE7IG, Reg Beck (Canada)
53. OK1ADM, Vaclav Vsetecka (Czech.)
54. CT1FL, Carlos Viana (Portugal)
55. WA1AER, Raymond Sylvester (U.S.A.)
56. N4RR, Roger Hoffman (U.S.A.)
57. UW0MF, Mike Filippov (USSR)
58. W4DR, J. Robert Eshlemann (U.S.A.)

The top 10 contenders for 5 Band WAZ:

1. JA3EMU, 199
2. N4WW, 199
3. W1NG, 199
4. W8UVZ, 198
5. LA9GV, 198
6. EA8QL, 197
7. K1MEM, 197
8. K4CEB, 197
9. K7UR, 196
10. F6DZU, 196

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5751	4.00
5814A	3.70
5879	5.75
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stations with plans to lift gear to the top of the rocky pinnacle, which would benefit the western reaches and the deserving W6's and W7's as well as the JA's.

Every Malpelo DXpedition is a major effort with the Colombian Navy giving logistic support to the efforts. This always is an LCRA effort, and over the years there has been little else there other than LCRA operators. HK3DDD was named as the QSL manager for the effort, and by the time you read this, things should be well along in the planning.

Mallorca

The Radio Club of Mallorca has plans to be heard in every major contest coming down the pike and wants DXers to listen for them. The club callsign is EA6RCM, and QSLs go to: EA6RCM, Apartado Postal 1000, Palma Mallorca (Balearic Islands) ESPANA. They promise to be heard on both c.w. and s.s.b.

AMSAT QSL Bureau

This bureau was moved in the Spring and is now located in downtown Obetz in Ohio. With Phase 3 of AMSAT not too far in the future, the bureau is seeking to clean up the accumulations before more come in. Currently the bureau has cards for over 640 stations. An s.a.s.e. sent to: AMSAT QSL Bureau, 1850 Lisle Avenue, Obetz, Ohio 43207, will help. Eventually the dead stuff will be cleaned out, but the bureau would rather ship it to where it belongs. Send #10 envelope (long business type) or 5¢ per card for overseas stations. Cards are sent at the end of each month. Phase IIIB of AMSAT was due to be launched aboard the French *Ariane* in June, although the launch dates were slippery. In efforts to meet launch dates, plans were to ship the third stage of the rocket by airlift to the launch site in French Guiana even though final review had not been completed. It might be recalled that on *Ariane V* the third stage failed, dumping everything into the Atlantic. *Ariane VI* was due to be launched the first week in June, and by now you should know how things have gone.

CQ DX Awards Program

S.S.B.

1245	KP4AAQ	1249	W4JFE/7
1246	EA7AZJ	1250	K5MZG
1247	VO1CW	1251	EA2MC
1248	EA7CZE	1252	EA2AIG

C.W.

582	AC6H
583	W9RY

S.S.B. Endorsements

310	K4CEB/311	275	W0ULU/276
300	W9SS/309	275	WA6DTG/276
300	W2CC/305	250	K4JLD/261
275	W2FGY/298	200	VO1CW/230
275	AI5I/294	200	EA7AZJ/220
275	KB5FU/291	200	WD0DMN/202
275	W4BQY/287	200	KP4AAQ/200
275	WB4KTG/281	200	EA2MC/200
275	W6NLG/279	150	EA2AIG/162
275	W4JFE/7/279		

C.W. Endorsements

310	W3GRS/314	200	K4JLD/221
300	W4BQY/308	28 MHz	KA3R
275	W9RY/283		

Total number of active countries is 315. 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. Please make all checks payable to the awards manager.

Columbia/Shuttle Flight #9

The *Columbia* will be back in service after the completion of the refurbishing and up-dating of the original space shuttle. It is due to be launched in September, and when it takes off next month, Owen Garriott, W5LFL, should have permission to take along a 2 meter rig.

The ARRL and AMSAT are working on a rig that can handle the pile-ups. In late Spring it was strongly anticipated that NASA would be issuing a letter of authorization, and the whole plan seemed to be solid. Keep listening for the frequencies; they should be available.

QSL Bureaus and Stuff

If one works in a QSL Bureau, one knows trouble first hand. The problem often is to determine what might be merited criticism and what might be premature expectations. Or, as in some instances, the good work in certain portions of a bureau is often forgotten in complaining about a section that is not performing satisfactorily. While a bureau seldom gets much praise for an efficient job, it catches more than it wants when there is a dissatisfied DXer in the woods.

Jay O'Brien, W6GO, and Jan O'Brien, K6HHD, were in charge of the program at Visalia and tried to bring everything out in the open so there could be discussion and some understanding. It was not a completely successful program. However, to get any valid questions out in the open, a questionnaire was distributed at Visalia, to be forwarded to the ARRL.

Keeping in mind that QSL Bureaus are mostly volunteer operations, they are not the easiest things to direct, drive, or maintain a consistent level of operation. However, gnashing one's teeth and muttering in the outer darkness does little good. The approach of the O'Brien's will, if nothing else, bring out and substantiate enduring problems. If you are working at the club level and would like a bit more information, an s.a.s.e. with 54¢ postage might bring you a copy of the file on the matter. Throw in another 17¢ and ask for a copy of the QSL list if you are not already acquainted with it. The address is Box 700, Rio Linda, CA 95673.

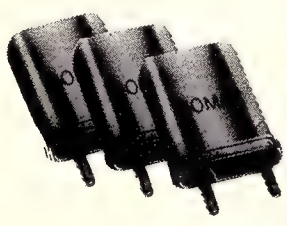
Some Quick DX Notes

Sometimes when feeling in an ebullient mood, we are tempted to be expansive in replying to questions such as "Where do you find DXers?" Our reply is short and quick: "Everywhere!" Sometimes even in your advertising mail you'll find them. Recently reading a solicitation of "Pacific Woodworker," we found Charles Harris listed as the publisher. Then we read further, and it was! "Chod Harris" is sometimes known as VP2ML, and sometimes remembered for staff work at ARRL Headquarters. But then again, we have always said that the woods are filled with DXers, most of them listening on the morning long path.

Bill Early, WA9AEA, has compiled a list of QSL managers for stations on the YL International Single Sideband System. The list is extensive, a bit more than we can fit in, but if you are interested, an s.a.s.e. to Bill at Box 10026, Chicago, IL 60610 might get one into your hand. For a newly minted DXer all QSL information is valuable.

There has also been word from the FCC that there is no intention in the foreseeable future to re-issue unassigned callsigns. Also, the period for renewal of an expired license has been extended to two years, and KP5 has been designated the prefix for Desecheo.

The DXAC has been reported as recommending that Peter I island in the ant-



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2311	F9RM	1619	N2AC	1210	4Z4DX	975	KC8CC	783	JA9FAI
2308	YU4HA	1604	N9AF	1204	DA2DC	958	YU2CBK	768	EA1JO
2169	K6JG	1538	YU7AW	1204	K8LJG	952	WB8ZRL	757	AI8M
2141	W2NC	1520	I6SF	1204	JH1VRQ	937	N4IB	747	VE2FOU
2100	K2VV	1488	SM7TV	1189	W8RSW	892	KA3A	732	N2AIF
2075	VE3GCO	1481	W8CNL	1180	W7CB	859	WD9IIC	722	K7CU
2071	K6XP	1393	I2PHN	1164	N6JM	848	KO8T	718	W6OUL
1924	N4MM	1379	N6FX	1108	DJ2UU	846	YU1DZ	697	KC8JH
1866	YU7BCD	1364	K9BG	1100	KL7AF	825	W6YMH	695	KJ7N
1844	W4BQY	1347	WØSFU	1027	N3ED	822	G3ZRH	658	K8HF
1726	N4NO	1339	KF20	1014	NN4Q	817	N8BJQ	656	K9TI
1703	W7LLC	1312	IN3ANE	1013	W8ILC	814	G4FAM	635	VE2PD
1690	PAØSNG	1287	SM3EVR	1011	I2MQP	808	WØJIE	621	OE1KJW
1690	N6JV	1263	N6AW	995	LA7JO				

S.S.B.

2227	F9RM	1510	YU7BCD	1239	I2PHN	1005	G4CHP	764	N3ED
2024	IØZV	1506	OZ5EV	1107	KF2O	997	ZP5RS	750	N4IB
1970	IØAMU	1458	WØYDB	1101	PY3BXW	971	W6YMV	732	VK6YL
1871	K6JG	1446	PAØSNG	1101	W4BQY	935	N2AC	702	IØSGF
1838	K6XP	1426	K5UR	1099	I6NOA	933	KC8CC	698	W3GXK
1815	K2POA	1399	IØMBX	1098	F2MO	922	TG4NX	670	JH5FQD
1770	K2VV	1391	W9DWQ	1091	VE1YX	874	WB6GFJ	665	DK4AP
1721	N4MM	1322	CT1UA	1070	CT1FL	849	KL7AF	649	OE8MOK
1706	ZL3NS	1300	WD8MGQ	1034	JH1VRQ	842	WA2FKF	646	KB2DE
1687	N6CW	1294	YU7AW	1033	KC4OV	832	K8LJG	638	I1POR
1642	I4ZSQ	1289	N2SS	1032	N6FX	829	WB8ZRL	615	VE2PD
1568	I8YRK	1271	I6ZJC	1029	WA4OIB	805	W8ILC	607	KC8YM
1557	I8KDB	1253	WA4QMQ	1028	W2NC	796	AC2J	604	W8RSW
1530	HB9AAA	1247	N4NO	1009	I2MQP	768	W6LQC	603	KBØC

C.W.

1959	W8RSW	1516	K6XP	1342	N4MM	1101	YU3NP	743	DJ1YH
1919	W2NC	1509	N4NO	1316	VK4SS	1065	K6ZDL	719	KA3A
1763	W8KPL	1508	YU7BCD	1314	K5UR	1045	JE1JKL	695	AG5C
1674	WA2HZR	1486	W9DWQ	1295	W9FD	925	N4YB	656	VE2FOU
1656	ON4QX	1452	N2AC	1281	I6SF	876	K8LJG	644	EA1JO
1652	N6JV	1432	W3ARK	1245	VO1AW	861	YU7SF	616	W8ILC
1609	K6JG	1428	G2GM	1195	VE7CNE	801	N3ED	612	G4FAM
1587	K2VV	1401	W4BQY	1182	YU7AW	799	KL7AF	605	N2AIF
1575	DL1QT	1344	WA1JMP	1105	N6FX	798	KF2O		

arctic be accepted for DXCC country status should anyone ever get there and operate. The island is 68°S and 90°W. Norway has claimed the island, although by international treaty anything south of 60°S is for the time being supposed to be international territory. There have been reports that the Turkish authorities are moving to again allow legitimate amateur radio stations in TA-land. The FCC is looking at the idea of allowing amateurs in the Hawaiian Islands and nearby areas to use A3 and F3 in the 7075–7100 kHz area because of the closeness of the islands to ITU Region III. Possibly something similar may come from KL7 land, some parts of which are only a few miles from Zone 19 in UAØ-land, actually much closer than Hawaii.

Efforts have failed to bring Mt. Athos to the deserving DXers during this Spring, with SV1JG not being successful in getting permission to operate from the monastery. W6LAS/SV/A was reported as being on the air by some European stations, this one operating low-power mobile.

LA5NM has returned to Svalbard and expects to be there until late Spring of 1985. There is a report that a good number (some estimates run as high as 20%) of the Heard Island VKØHI/VKØCW contacts were duplicates in the same band and mode. This is a cheerful bit of information if you tried and did not get even a single contact that you needed. But, as some of the duplicators themselves have noted, they are helping the DX station by showing him that he is getting out, and it also gives them a chance to tell the DX station of the great job they are doing. A side benefit is that everyone listening knows who has the really big signal.

Some Kenya licenses are showing still fresh from the printers. Station 5Z4DJ has been heard in recent months, and 5Z4DP should be on the air late this month or early next month.

Martti Laine, who knows what it is to operate from Albania, says that there still is hope and that in late Spring some of the Albanian types were going to Finland for some training in radio and might be able to take some gear back to downtown Tirana. Never give up hope that the true-blue ZA type will show in your log one of these days.

The JAs who were hoping for a Bangladesh operation a few months back could not get their gear past the customs. But S2BTF was being reported a couple of months back on the SEANET, although he may have gone QRT by now.

1Z5A is rumored to be used by the state of Karen in Burma and is supposedly applying to the ITU for recognition. Memory comes back to remind us that in other days we would have started thinking of a half-wave rectifier tube or even a transistor when we would hear such a designation. But the days when Slim could fool a DXer with a contrived call like that are long gone. Heck, the station said that they were even applying for ITU recognition, and that should prove something. Right?

VR6TC still schedules W6HS, his QSL Manager, at 21350 kHz at 0000Z on Tuesdays. We recall from other years that this was at this place and time on Wednesdays, so you might check the other if you don't find him where expected. VR6KY is also being reported around 21300 kHz from 1900Z.

There is a 28 MHz beacon in lower Connecticut, this signing KA1YE/B at 28284 kHz with 4 watts, a 30 second carrier, then KA1YE/B SE CT, and it goes 24 hours a day.

WA1IOB/B is also on from near Boston and W3VD/B from the Laurel, Maryland, area. All these beacons are in the 28175 kHz to 28284 kHz area. These beacons have been heard in Europe. HB9AVE maintains a list of beacons, and if you are interested, drop Willi a note. There is only a limited spectrum for 10 meter beacons in the U.S., and if you need help or advice, drop a note to W. Keith Hibbert, KA1YE, 25 Hillcrest Road, Niantic, CT 06357.

Slim has been noted in the Netherland

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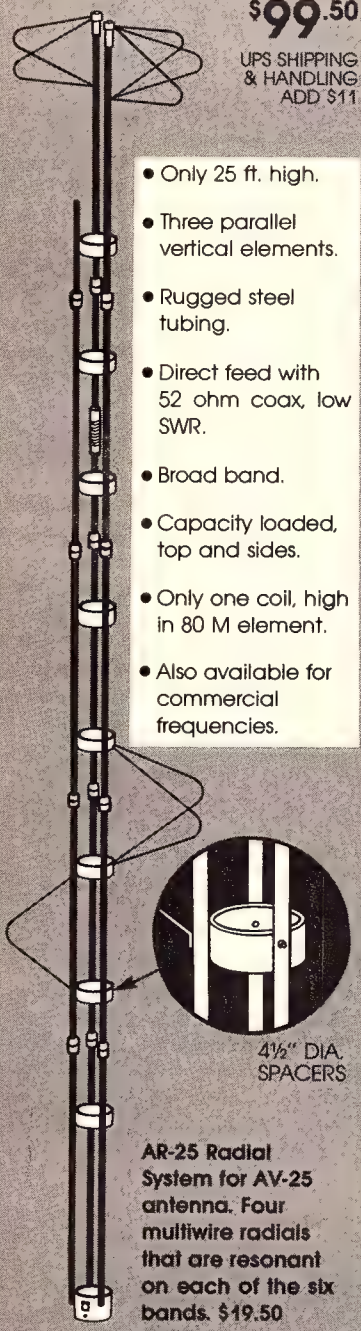
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CIRCLE 27 ON READER SERVICE CARD

Antilles signing PJ8II and PJ0II. Cross-checks indicate that the station is not in the Netherland Antilles, nor is it properly licensed, if at all. PJ8UQ and PJ8YL are reported to be the only active PJ8 stations at present. Visiting DX types must sign their home call plus /PJ. If you hear N8II given as the QSL route, you can be wary. Jeff, N8II, says he is QSL manager for none of these.

Following is some information on the Western Pennsylvania DX Association. Alan Lefcort, WB3GPR, is the current president of this active group; Bill Futrowsky, WB3JWJ, is the vice-president. Wayne Albert, KB3KV, is the secretary, and you can reach him at 1508 Ligonier Street, Latrobe, PA 15650 should you need more information.

Don't let it slip your mind that the First International DX and Contest Symposium will be held at the ARRL National Convention in Houston the first weekend in October. The convention is October 7–9, and Bob Evans, N5DU, is the coordinator for the Symposium.

If you can't wait until October, the big Northwest DX Convention will be held in Seattle the end of July, running from July 29–31 at the Doubletree Plaza Hotel. Jim Hadlock, K7WA, can give you a fast fill-in with details. When *CQ* shows up early in your mailbox, as it always does, and the humidity is at the saturation point, think Seattle!

DX Ten Years Back—August 1973

CR8AM was on from Timor; K4DAO and KS6ES were the visiting operators. VK3JW was still jumping up and down trying to get accreditation for the first Melish Reef effort and was headed for Melbourne to do some shaking. K4IIF was beating the woods trying to raise more action for the coming *CQ* WW DX Contest, especially on 40 and 80. The FCC was calling in Conditional Class licensees for review, the Southwest Division Director noting that about 60% failed to respond to the notice and of the 40% who showed only 10% successfully passed the test. ZD3D was leaving Gambia and working hard to use up all the QSL cards on hand. WK4AH was looking for a November Lord Howe visit. San Hutson, K5QHS, was aiming for Juan Fernandez in September; he now signs K5YY.

73, Cass, WA6AUD

5B WAZ No. 23

If it takes a good suffix, Dov Gavish, 4Z4DX, in Ramat-Hasharon, has what gets the attention. The call also got him 5B WAZ #23, the first from an Asian QTH, and a check of W4KA's list will show that the second 5B WAZ in Asia did not show until #57.

As DXers go, Dov has not been a licensed DXer for long, first being licensed in 1968. He is 31 years old, married, and has two children. He holds 5BDXCC, VE-YL DXCC #20, and a handful of other awards. Dov works both c.w. and s.s.b. using a TS-180 to a KT3YXA beam with another beam on 40 and a vertical on 80. If you wonder about that KT3YXA, Dov says that some of his antennas are homebrew.



Dov Gavish, 4Z4DX, got his start in amateur radio by going to the local radio club meetings in Kibbuz Ramat-David in northern Israel back when he was 13 years old. His father, Israel, 4X4VB, was trying to get Dov headed right—right to DXing, that is. Dov won 5B WAZ #23 to prove that he never stopped heading in the right direction. Here he waits at his operating position for more of the right stuff.

Dov comes from an amateur radio family; his father is 4X4VB, Israel. Dov belongs to the IARC DX Club and tends to keep an eye on the local v.h.f. DX net. There are about 20 members in the local network. Though he has gained 5B WAZ, he still needs some states on 80 to fill out a 5B WAS. You will often find Dov in the WPX and *CQ* DX tests working mostly 80 and 40 c.w. in the WPX.

QSL Information

A35EL to OE2DYL
A6XJC to PE0MGM
AP2KD to JJ1TBB
C53CJ to KB8KS
CE0AE to WA3HUP
CN8AD to F8JL
CN8CO to WB3KGY
CO7AM to WB6QPG
CP5EL to WB1DQC
CQ3BX to CT3BX
CR9EL to OE2DYL
CR0UA to W3HNK
CX5RV to G5RV
HK0COP to W9UCW
G4CPA/OY to VE2FGS
DU4RLC to VE2FGS
J87LTA to K4LTA
JY8JP to K1JPQ
KC4AAA to K9AUB
KC4AAC to W6MAB
LA2EX/3X1 to LA2EX
N6YK/V2A to N0DH
VK9YC to Only direct
VP2KBD to K1IJV
VP2KBE to K1IJV
VS5YY to K5YY
4K1F to UQ2GDW
4N9WC to YU4GYZ
4S7TZG to ON6TZ
4X4MS/5N0 to DL8ME
5K0LR to HK3SO
5N8GM to I8XIU
5W1DD to OE2DYL
5Z4CL to W5DCB
6W8HL to WA4VDE
5N6PDC to K6EDV
7X2HM to I8YCP
9G2XX to AK3F
9L1EX to LA2EX
A92Z to Box 26855, Bahrein
J28DM to BP 2417, Djibouti
HZ1AT to Box 1208, Riyadh, Saudi Arabia
LA5NM/JW5NM to Matt Bjerrang, Longyear Airport, N-9170, Svalbard, Norway
TA8BE to P.O. Box 252, Gaziantep, Turkey
TI5TP to P.O. Box 125, Grecia, Costa Rica
VP8ML to Charles McKenzie, Port Stanley, Falkland Islands
XT2BM to P.O. Box 140, Ouagadougou, Voltaic Republic
5V7WI to P.B. 1499, Lome, Togo
7Z2AP to Box 2537, Riyadh, Saudi Arabia
9L1DR to PMB 502, Freetown, Sierra Leone
9L1YL to P.B. 992, Freetown, Sierra Leone
G4ABI/ST2 to P.B. 974, Khartoum, Sudan
WA4IKZ/CR9T to D. Tanis, CC906, Box 167, Saudi Arabian Airlines, Jeddah, Saudi Arabia

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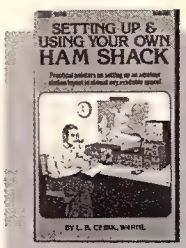
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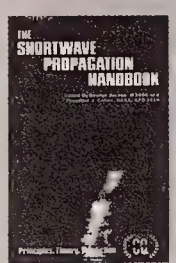
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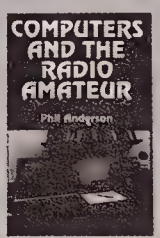
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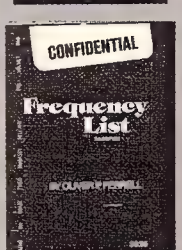


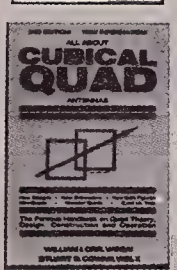


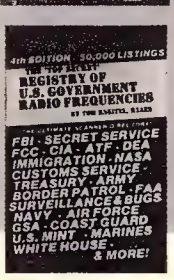














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CIRCLE 76 ON READER SERVICE CARD

Propagation

a monthly feature by
GEORGE JACOBS, W3ASK

THE SCIENCE OF PREDICTING RADIO CONDITIONS

The present sunspot cycle continues to decline steadily. The Royal Observatory of Belgium, the world's official keeper of sunspot records, reports a monthly mean number of 79.7 for April 1983. This results in a smoothed sunspot number of 95.2 centered on October 1982. The intensity of a solar cycle is measured by the smoothed sunspot numbers. A smoothed sunspot number of approximately 75 is forecast for August 1983.

August DX Conditions

Typical summertime h.f. propagation conditions are expected during August. During the hours of daylight look for fairly good DX openings on *10* meters towards southern and tropical areas, with peak conditions expected during the afternoon hours. Conditions should be considerably better on *15* meters, with this band opening to more areas of the world, and with generally stronger and more stable signals than observed on *10* meters. Expect *15* meter signals to peak during the afternoon hours with openings best towards the south and to tropical areas, although some east-west openings should also be possible. World-wide DX should be possible on *20* meters for a window of several hours following local sunrise and again during the late afternoon hours. Intense ionospheric absorption will severely limit DX openings during mid-day.

During the hours of darkness expect good DX openings to most parts of the world on *20* and *40* meters. Some *15* meter DX openings are likely towards southern and tropical areas to about midnight. Look for *80* meter DX openings to many areas of the world during the hours of darkness, but expect seasonally high static levels. Seasonally high solar absorption and static levels will make DX possibilities on *160* meters extremely difficult during August, but some openings may be possible towards the Caribbean area during the hours of darkness.

For more specific information concerning DX band openings for the period August 15 to September 15, 1983, see the DX Propagation Charts, which appear on the following pages.

Short-Skip Conditions

For openings over distances ranging between 50 and 250 miles *80* meters should be optimum during the day and *160* meters at night. Between 250 and 750 miles try *40* meters during the day and *80* meters at night. For openings between 750 and 1300 miles *20* meters should be best during the day, with *15* meters also a possibility. From sundown to midnight try *40* meters, and from midnight to sunrise conditions should be best on *80* meters, with *40* meters also a possibility. For openings between 1300 and the one-hop limit of 2300 miles the best daytime band should be *20* meters, with some possibilities also on *15* meters. Try *40* meters during the hours of darkness, with *20* meters also a possibility. For more specific times for openings, refer to the Short-Skip Charts which appeared in last month's column.

Seasonally high static levels are expected to continue through August and should be most noticeable on the *40, 80,* and *160* meter bands.

V.H.F. Ionospheric Openings

Sporadic-*E* propagation usually tapers off during August, but it should continue to occur fairly frequently. Some *6* meter sporadic-*E* openings are expected during the month over distances of approximately 750 to 1300 miles. During periods of intense and widespread sporadic-*E* ionization, two-hop openings may be possible considerably beyond this range. Also check the *2* meter band for an occasional sporadic-*E* type opening between approximately 1200 to 1400 miles. While sporadic-*E* short-skip openings may occur at any time, there is a tendency for them to peak between 8 a.m. and noon and again between 6 p.m. and 9 p.m. local daylight time.

The *Perseids,* which is expected to be one of this year's major meteor showers, should take place between August 9th and the 14th. Up to 50 meteors an hour are expected to enter the earth's atmosphere during the shower's peak intensity. Ionization produced by this meteor shower, particularly during the period of maximum intensity, is expected to make possible frequent meteor-scatter-type openings on the *6* and *2* meter bands over distances of several hundred miles. The Perseids shower is expected to reach peak intensity on August 10th and 11th.

Although auroral activity is usually at a seasonal low during August, some is likely to occur during periods of radio stormi-

11307 Clara Street, Silver Spring, MD 20902

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for August 1983

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Above Normal: 17-18, 22	A	A	B	C
High Normal: 11-12, 16, 19, 26	A	B	C	C-D
Low Normal: 2-3, 5-6, 8, 10, 15, 20-21, 23-25, 27, 29-30	A-B	B-C	C-D	D-E
Below Normal: 1, 4, 7, 9, 13-14, 28, 31	B-C	C-D	D-E	E
Disturbed: None	C-E	D-E	E	E

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

B—Good opening, moderately strong signals varying between S6 and S9, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S6, 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 fair-to-poor (C-D) on Aug. 1st, good-to-fair (B-C) on the 2nd and 3rd, fair-to-poor (C-D) on the 4th, good-to-fair (B-C) on the 5th and 6th, etc.**

HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts.

3. The *propagation index* is the number that appears in () after the time of each predicted opening. 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) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days
Refer to the "Last Minute Forecast" at the beginning of this Propagation column for the actual *dates* on which an opening with specific propagation index is likely to occur, and the signal quality that can be expected.

4. Time 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. Appropriate *daylight* time is used *not* GMT. To convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 GMT, etc.

5. The charts are based upon a transmitter power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, and 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 10 db loss, it will lower by one level.

6. 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.

Say You Saw It In CQ

August 15-September 15, 1983
Time Zone: EDT (24-Hour Time)
EASTERN USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Central Europe & North Africa	09-15 (1)	08-10 (1) 10-12 (2) 12-15 (3) 15-17 (2) 17-18 (1)	05-06 (1) 06-07 (2) 07-10 (3) 10-11 (2) 11-13 (1) 13-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-22 (1) 22-00 (2) 00-02 (1)	19-21 (1) 21-23 (2) 23-01 (3) 01-02 (2) 02-03 (1) 20-21 (1)* 21-00 (2)* 00-02 (1)*
Northern Europe & European USSR	09-13 (1)	08-09 (1) 09-10 (2) 10-12 (3) 12-14 (2) 14-16 (1)	05-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-17 (3) 17-19 (2) 19-22 (1) 22-00 (2) 00-01 (1)	19-21 (1) 21-00 (2) 00-02 (1) 20-21 (1)* 21-00 (2)* 00-01 (1)*
Eastern Mediterranean & Middle East	11-14 (1)	08-09 (1) 09-13 (2) 13-16 (3) 16-17 (2) 17-18 (1)	07-09 (2) 09-14 (1) 14-16 (2) 16-20 (3) 20-22 (2) 22-01 (3) 01-03 (2) 03-07 (1)	19-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
Western Africa	11-14 (1) 14-16 (2) 16-17 (1)	07-09 (1) 09-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-23 (4) 23-02 (3) 02-06 (2) 06-09 (1)	20-23 (1) 23-02 (2) 02-03 (1) 21-02 (1)*
Eastern & Central Africa	13-16 (1)	10-12 (1) 12-14 (2) 14-15 (3) 15-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-01 (2) 01-03 (1)	20-02 (1) 21-01 (1)*
Southern Africa	10-11 (1) 11-13 (2) 13-14 (1)	09-11 (1) 11-13 (2) 13-14 (3) 14-16 (4) 16-17 (2) 17-18 (1)	08-15 (1) 15-17 (2) 17-21 (3) 21-22 (2) 22-00 (1) 00-02 (2) 02-03 (1)	20-22 (1) 22-01 (2) 01-03 (1) 21-02 (1)*
Central & South Asia	*Nil*	09-12 (1) 20-22 (1)	07-08 (1) 08-10 (2) 10-12 (1) 19-20 (1) 20-22 (2) 22-00 (1)	05-07 (1) 19-21 (1)
Southeast Asia	*Nil*	08-10 (1) 10-12 (2) 12-14 (1) 18-19 (1) 19-21 (2) 21-22 (1)	06-08 (1) 08-10 (2) 10-11 (1) 19-22 (1) 22-00 (2) 00-01 (1)	*Nil*
Far East	*Nil*	09-11 (1) 18-20 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-13 (1) 18-20 (1) 20-22 (2) 22-00 (1)	05-06 (1) 06-07 (2) 07-08 (1) 06-07 (1)*
South Pacific & New Zealand	11-15 (1) 15-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	09-15 (1) 15-18 (2) 18-21 (3) 21-22 (2) 22-23 (1)	12-20 (1) 20-22 (2) 22-00 (3) 00-01 (4) 01-03 (3) 03-05 (2) 05-07 (1) 07-08 (2) 08-10 (3) 10-12 (2)	01-02 (1) 02-03 (2) 03-06 (3) 06-07 (2) 07-09 (1) 02-04 (1)* 04-07 (2)* 07-08 (1)*
Australasia	16-17 (1) 17-19 (2) 19-21 (1)	09-11 (1) 16-18 (1) 18-21 (2) 21-23 (1)	06-08 (2) 08-10 (3) 10-11 (2) 11-16 (1) 16-18 (2) 18-22 (1) 22-01 (2) 01-03 (1)	03-04 (1) 04-07 (2) 07-08 (1) 04-05 (1)* 05-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	09-11 (1) 11-13 (2) 13-15 (3) 15-17 (4) 17-18 (2) 18-19 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-14 (4) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	07-08 (3) 08-10 (4) 10-12 (3) 12-15 (2) 15-18 (3) 18-21 (4) 21-23 (3) 23-01 (4) 01-03 (3) 03-04 (2) 04-06 (1) 06-07 (2)	19-20 (1) 20-21 (2) 21-03 (4) 03-05 (3) 05-06 (2) 06-08 (1) 20-00 (1)* 00-05 (2)* 05-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina, & Uruguay	09-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	07-08 (1) 08-11 (2) 11-14 (1) 14-16 (2) 16-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	13-16 (1) 16-18 (2) 18-19 (3) 19-23 (4) 23-03 (3) 03-04 (2) 04-06 (1) 06-07 (2) 07-09 (3) 09-10 (2) 10-12 (1)	20-23 (1) 23-05 (2) 05-07 (1)) 03-06 (1)*
McMurdo Sound, Antarctica	*Nil*	14-16 (1) 16-18 (2) 18-19 (1)	18-20 (1) 20-21 (2) 21-01 (3) 01-03 (2) 03-07 (1) 07-09 (2) 09-10 (1)	01-05 (1)

Time Zones: CDT & MDT
(24-Hour Time)
CENTRAL USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Southern Europe & North Africa	09-14 (1)	09-11 (1) 11-12 (2) 12-13 (3) 13-15 (2) 15-17 (1)	05-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-21 (2) 21-00 (1)	19-22 (1) 22-01 (2) 01-02 (1) 20-01 (1)*
Northern & Central Europe European USSR	08-12 (1)	11-16 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-17 (3) 17-19 (2) 19-21 (1) 21-00 (2) 00-01 (1)	19-20 (1) 20-00 (2) 00-01 (1) 20-00 (1)*
Eastern Mediterranean & Middle East	*Nil*	10-11 (1) 11-13 (2) 13-15 (1)	06-08 (1) 08-10 (2) 10-15 (1) 15-16 (2) 16-18 (3) 18-19 (2) 19-22 (1) 22-00 (2) 00-02 (1)	19-00 (1) 20-23 (1)*
Western Africa	10-12 (1) 12-16 (2) 16-17 (1)	07-10 (1) 10-13 (2) 13-15 (3) 15-17 (4) 17-19 (3) 19-21 (2) 21-22 (1)	13-15 (1) 15-17 (2) 17-20 (3) 20-22 (4) 22-01 (3) 01-02 (2) 02-09 (1)	20-23 (1) 23-01 (2) 01-02 (1) 21-00 (1)*
Eastern & Central Africa	13-15 (1)	11-13 (1) 13-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	13-15 (1) 15-17 (2) 17-22 (3) 22-00 (2) 00-02 (1)	20-00 (1) 21-23 (1)*
Southern Africa	11-13 (1)	08-10 (1) 10-12 (2) 12-14 (3) 14-16 (4) 16-17 (2) 17-18 (1)	06-09 (1) 13-15 (1) 15-18 (3) 18-20 (2) 20-22 (1) 22-00 (2) 00-01 (1)	19-21 (1) 21-00 (2) 00-01 (1) 21-00 (1)*
Central & South Asia	*Nil*	09-11 (1) 18-19 (1) 19-21 (2) 21-22 (1)	07-08 (1) 08-10 (2) 10-11 (1) 17-19 (1) 19-21 (2) 21-23 (1)	06-08 (1) 19-21 (1)
Southeast Asia	*Nil*	10-12 (1) 17-18 (1) 18-20 (2) 20-21 (1)	07-08 (1) 08-10 (2) 10-13 (1) 19-21 (1) 21-23 (2) 23-01 (1)	06-08 (1)
Far East	*Nil*	09-11 (1) 15-16 (1) 16-19 (2) 19-21 (1)	19-22 (1) 22-00 (2) 00-02 (1) 07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-15 (1)	03-06 (1) 06-07 (2) 07-08 (1) 05-07 (1)*
South Pacific & New Zealand	09-15 (1) 15-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	09-13 (1) 13-17 (2) 17-18 (3) 18-20 (4) 20-21 (3) 21-22 (2) 22-23 (1)	08-10 (3) 10-13 (2) 13-18 (1) 18-20 (2) 20-23 (3) 23-03 (4) 03-05 (3) 05-08 (2)	00-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1) 01-03 (1)* 03-06 (2)* 06-07 (1)*
Australasia	09-11 (1) 14-16 (1) 16-19 (2) 19-20 (1)	09-11 (1) 15-16 (1) 16-18 (2) 18-21 (3) 21-22 (2) 22-23 (1)	08-10 (3) 10-13 (2) 13-20 (1) 20-22 (2) 22-23 (3) 23-02 (4) 02-03 (3) 03-08 (2)	02-04 (1) 04-05 (2) 05-06 (3) 06-07 (2) 07-08 (1) 03-04 (1)* 04-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	09-11 (1) 11-13 (2) 13-15 (3) 15-16 (4) 16-17 (2) 17-18 (1)	07-08 (1) 08-10 (2) 10-13 (3) 13-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	08-10 (4) 10-12 (3) 12-16 (2) 16-18 (3) 18-23 (4) 23-02 (3) 02-05 (2) 05-07 (3)	19-20 (1) 20-21 (2) 21-03 (4) 03-05 (3) 05-06 (2) 06-07 (1) 20-23 (1)* 23-05 (2)* 05-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina, & Uruguay	08-11 (1) 11-14 (2) 14-15 (3) 15-16 (4) 16-17 (2) 17-18 (1)	07-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	12-16 (1) 16-17 (2) 17-19 (3) 19-22 (4) 22-02 (3) 02-04 (2) 04-07 (1) 07-09 (2) 09-10 (1)	20-22 (1) 22-05 (2) 05-07 (1) 02-05 (1)*
McMurdo Sound, Antarctia	*Nil*	13-15 (1) 15-17 (2) 17-20 (1)	17-19 (1) 19-21 (2) 21-01 (3) 01-04 (2) 04-07 (1) 07-09 (2) 09-10 (1)	01-06 (1)

Time Zone: PDT (24-Hour Time)
WESTERN USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Southern Europe & North Africa	*Nil*	09-11 (1) 11-13 (2) 13-15 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-14 (2) 14-15 (3) 15-16 (2) 16-18 (1) 22-23 (1) 23-01 (2) 01-02 (1)	20-21 (1) 21-23 (2) 23-00 (1) 22-23 (1)*
Central Europe & European USSR	*Nil*	09-11 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-17 (1) 22-00 (1)	18-20 (1) 20-22 (2) 22-23 (1) 21-22 (1)*
Eastern Mediterranean & Middle East	*Nil*	08-09 (1) 09-11 (2) 11-12 (1)	07-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-17 (1) 19-20 (1) 20-22 (2) 22-23 (1)	20-22 (1)
Western & Central Africa	13-16 (1)	08-11 (1) 11-13 (2) 13-16 (3) 16-18 (2) 18-19 (1)	13-15 (1) 15-17 (2) 17-18 (3) 18-20 (4) 20-21 (3) 21-01 (2) 01-07 (1) 07-09 (2) 09-10 (1)	21-00 (1)
Eastern Africa	*Nil*	09-13 (1) 13-16 (2) 16-18 (1)	13-15 (1) 15-18 (2) 18-20 (3) 20-22 (2) 22-23 (1)	20-22 (1)
Southern Africa	10-13 (1)	07-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	07-09 (1) 13-15 (1) 15-16 (2) 16-18 (3) 18-19 (2) 19-22 (1) 22-23 (1) 23-00 (1)	19-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)*
Central & South Asia	*Nil*	09-11 (1) 17-19 (1) 19-21 (2) 21-22 (1)	07-08 (1) 08-10 (2) 10-12 (1) 18-20 (1) 20-22 (2) 22-23 (1)	06-08 (1)

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Southeast Asia	16-19 (1)	09-11 (1) 15-17 (1) 17-20 (2) 20-21 (1)	21-01 (1) 01-03 (2) 03-04 (3) 04-07 (2) 07-09 (3) 09-10 (2) 10-12 (1) 19-21 (1)	03-07 (1)
Far East	15-18 (1)	09-11 (1) 14-15 (1) 15-17 (2) 17-19 (3) 19-20 (2) 20-22 (1)	21-23 (2) 23-01 (3) 01-04 (2) 04-07 (1) 07-08 (2) 08-10 (4) 10-11 (3) 11-12 (2) 12-14 (1)	02-03 (1) 03-05 (2) 05-07 (3) 07-08 (1) 02-05 (1)* 05-06 (2)* 06-07 (1)*
South Pacific & New Zealand	09-15 (1) 15-16 (2) 16-19 (3) 19-20 (2) 20-21 (1)	09-13 (1) 13-17 (2) 17-18 (3) 18-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	05-09 (2) 09-11 (3) 11-13 (2) 13-17 (1) 17-19 (2) 19-22 (3) 22-02 (4) 02-05 (3)	22-23 (1) 23-04 (3) 04-06 (4) 06-07 (3) 07-08 (1) 23-01 (1)* 01-03 (2)* 03-05 (3)* 05-06 (2)* 06-07 (1)*
Australasia	09-14 (1) 14-18 (2) 18-20 (1)	09-11 (1) 14-18 (1) 18-19 (2) 19-21 (4) 21-22 (2) 22-00 (1)	13-20 (1) 20-22 (2) 22-23 (3) 23-03 (4) 03-05 (3) 05-08 (2) 08-10 (3) 10-13 (2)	01-02 (1) 02-03 (2) 03-06 (3) 06-07 (2) 07-08 (1) 02-04 (1)* 04-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	09-11 (1) 11-13 (2) 13-15 (3) 15-17 (2) 17-18 (1)	07-08 (1) 08-10 (3) 10-12 (2) 12-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	06-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-21 (4) 21-01 (3) 01-05 (2) 05-06 (3)	19-20 (1) 20-21 (3) 21-04 (4) 04-05 (2) 05-06 (1) 20-22 (1)* 22-03 (2)* 03-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina, & Uruguay	08-11 (1) 11-14 (2) 14-15 (3) 15-16 (2) 16-18 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-01 (2) 01-07 (1) 07-09 (2) 09-11 (1)	20-23 (1) 23-04 (2) 04-05 (1) 00-04 (1)*
McMurdo Sound, Antartica	*Nil*	13-17 (1) 17-19 (2) 19-21 (1)	09-11 (1) 17-19 (1) 19-21 (2) 21-01 (3) 01-03 (2) 03-04 (1)	23-03 (1) 03-05 (2) 05-07 (1)

* Indicates best time for eighty 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.

ness on the h.f. bands. Check the Last-Minute Forecast which appears at the beginning of this column for those days during August that are expected to be Below Normal or Disturbed. These are the days on which auroral activity is most likely to occur. Auroral-scatter-type openings, on both 6 and 2 meters, can range from a few hundred up to about a thousand miles, and they are usually characterized by very rapid flutter fading and Doppler shift on s.s.b. signals.

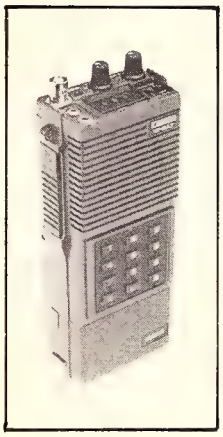
For the very patient, check the 6 meter band for possible Trans-equatorial (TE) openings between 8 and 11 p.m. local daylight time. This type of propagation favors openings from the southern tier states into deep South America, with the signal path crossing the magnetic equator at a right angle. TE openings during August are rare, but they can occur. They are usually characterized by very weak signals and severe flutter fading.

73, George, W3ASK

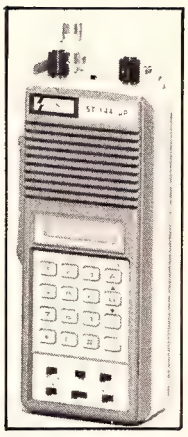
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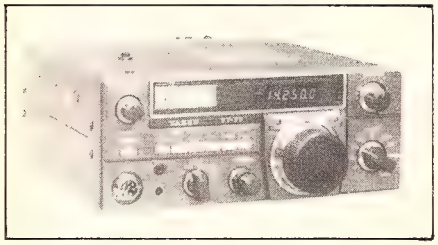
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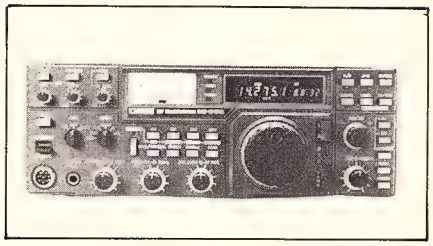
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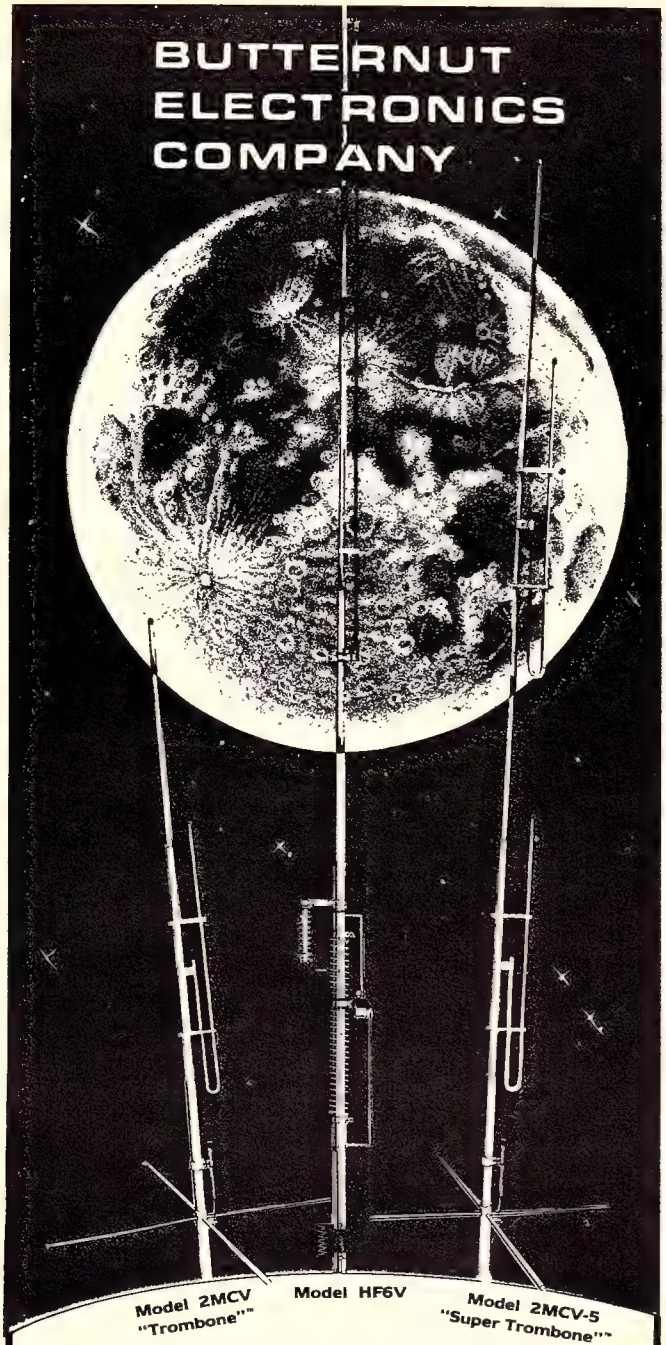
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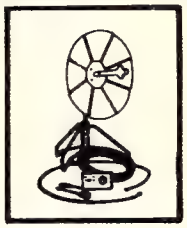
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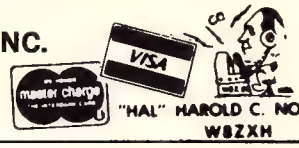
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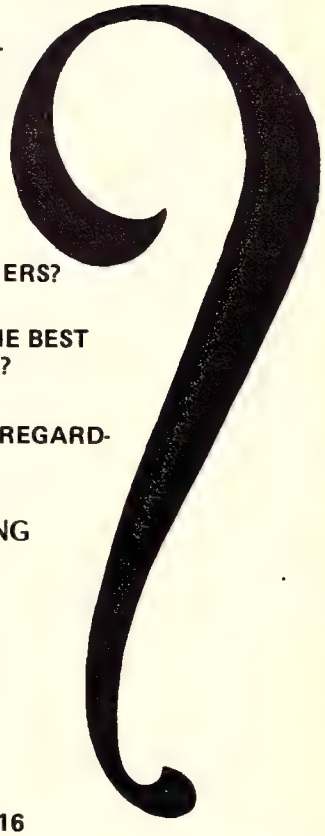
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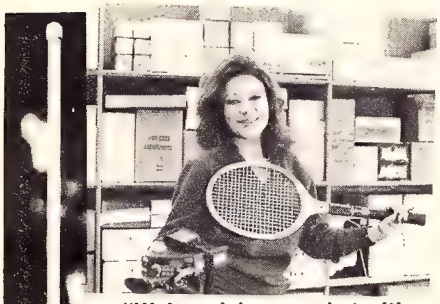
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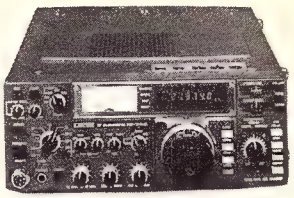
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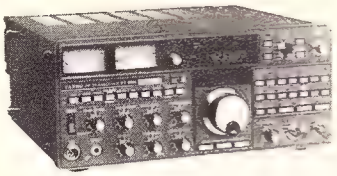
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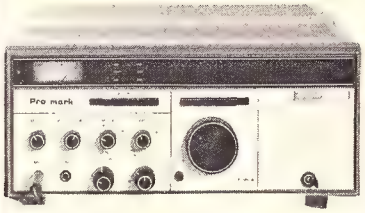
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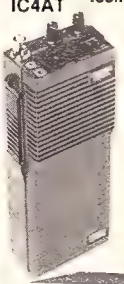
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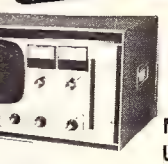
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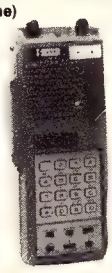
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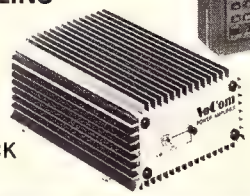
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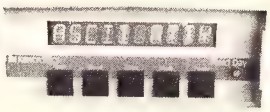


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a monthly feature by
DAVE INGRAM, K4TWJ

A LOOK AT THE WORLD AROUND US

Selection and Use of Today's "Dream Rigs"

The continuing introduction of new and exciting commercial h.f. transceivers often creates a perplexing situation for today's radio amateurs. While on one hand we may be unsure if all of a rig's "bells and whistles" would be useful, we also don't want to be shortchanged in communications capabilities. As a result of this dilemma, we may purchase a unit and later (or sooner!) trade it without ever realizing its full benefits. The "do everything rig of our dreams" may thus have slipped through our fingers without our even knowing it. There are also many times (such as for mobile or portable operations) when a simple and straightforward transceiver is noticeably more useful than a multi-knob unit.

The keynote to selecting and enjoying an h.f. rig thus involves analyzing what is desired and what capabilities various rig designs offer. Confusing? Not really. We're merely saying, for example, that it wouldn't be quite logical to purchase an FT-102 or TS-830 if your primary style of operating involves brief on-the-air stints with a fair amount of band hopping and "fast operating." Likewise, a serious DXer probably wouldn't be fully satisfied with a TS-430, FT-77, or KWM-380 as his only h.f. transceiver. There are a number of additional aspects worth considering in the h.f. equipment game, and although any rig can be made to perform in an outstanding manner, a unit equally suited to one's own style gives the greatest returns, regardless of its age or popularity.

Some of the ideas I'm going to present this month may not appeal to all of you, but that's necessarily part of the concept—to present a variety of ideas and ideals which you can separate as desired and from which you can then draw your own conclusions on selecting and using a modern h.f. rig. This will not be a technical discussion, but rather an operational and user-oriented overview of rig capabilities. Technical and circuit-design information on modern rigs was covered very well by Doug DeMaw in the January 1983 issue of *QST*.

Tubes Versus Transistors

As you are aware, all modern transceivers use fully solid-state receivers. Considered in terms of r.f. energy generation, though, we are presently amidst a period of transition between tubes and transistors. Transceivers with tube finals are still being manufactured, but high-power transistors are pushing this era. This same situation will soon hold true for linear amplifiers (several solid-state 1 kw broadcast transmitters have been available for 5 or 6 years). Some amateurs feel tubes are exceptionally rugged devices with output unequalled by transistors. That's a misconception. A TS-830 and a KWM-380, for example, both produce a stout and beautiful sounding transmitted signal. Likewise, an ICOM 740 or a Yaesu FT-102 are equally suited for SSTV or RTTY use. Naturally, the output power of these (or any other) rigs must be reduced for long-duty-cycle modes. Frankly, there are so many warnings and tuning limits with modern tube finals (plus a number of tuning adjustments) that one may realize more use and pleasurable returns from a fully solid-state transceiver. The "switch on and operate immediately" plus "instant bandswitching without tuning" ability is like a totally new ball game of enjoyment. S.w.r. cutbacks? If you're wasting time with a high s.w.r., you deserve the consequences. Both tubes and transistors suffer from impedance mismatches.

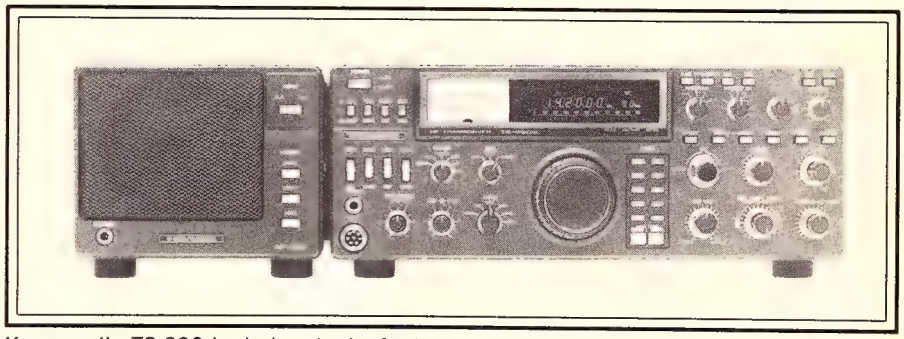


The ICOM 740 transceiver features dual independent v.f.o.'s, one tunable memory per band, both RIT and XIT, an i.f. notch filter, plus continuously adjustable AGC and noise blanker. These features allow you to both chase several DX stations simultaneously and survive numerous environmental noises. If the optional internal supply is used, this is today's most compact "single box" rig.

Having a tube-type linear amplifier attached to an all solid-state exciter is a downer. The transceiver is ready for action on a moment's notice, but tubes can't continuously survive that kind of "waking." Sure, some operators switch on an amplifier and immediately drive it wide open, just as some folks jump in a car and hit 90 m.p.h. before they get to the end of the block, but continuous repairs soon curtail those shenanigans. Solid-state linears may run slightly less output power, but their overall agility gives greater on-the-air returns for multiband operators. Think about that. Super power isn't mandatory if you're onto DX *before* the wolf pack and battle cruisers arrive. Start pileups; don't join them!

Casual Versus Serious DXing

As we all know, one of the oldest and most popular activities in amateur radio is DXing. While each of us has his own thoughts in this area, we must agree that there is a special feeling of achievement in such long-distance communications. Whether you'll go to almost any ends to land those rare DX contacts (multiple antennas, 20 hours a day monitoring, numerous DX newsheets, etc.) or whether



Kenwood's TS-930 includes dual v.f.o.'s and eight memories which store both band and frequency information. One may thus operate 30 c.w., 20 s.s.b., 15 c.w., and 10 s.s.b. with a single switch throw. Separate controls are used for setting c.w. and s.s.b. bandwidths, and XIT is not included. Rig draws approximately 500 watts on transmit and delivers approximately 110 watts r.f. output.

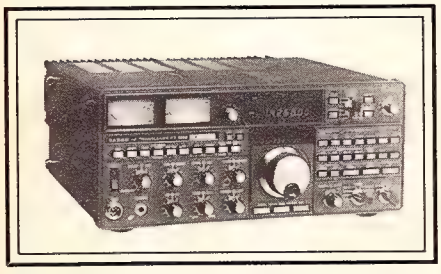
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Say You Saw It In CQ

you're equally satisfied working more common DX (and/or being content without a heavy QSL chase) generally describes whether you're a casual or a serious DXer.

The serious DXer places special importance not only on his abilities, but also on all h.f. equipment. His main transceiver usually includes a super speech processor, variable selectivity, switchable steep skirted filters, and at least two v.f.o.'s with a number of programmable memories. These measures are necessary if maximum operating time returns are to be realized. Before the days of dual v.f.o. transceivers many of these DXers used two or more rigs for frequency agility. One setup (usually that with the highest output and most rugged final amplifier) was left operational on 20 meters while another rig (usually with the "hottest" receiver) clamored from band to band, dragging a nerve-wracking tuning process with it. Once these "battle cruisers" were swung into action, they could plow through any band and easily reach their target. Meanwhile, the less-equipped but frequency-agile boys may have quickly hopped in, worked the DX, and headed for higher ground. Properly used, today's instant-on and no tune-up solid-state rigs have a decided advantage! Times are now changing, and many of today's "Big Guns" are also obtaining gear capable of instantly jumping on the air and popping onto any frequency with a respectable (although somewhat less powerful) signal.

The casual DXer is noticeably more flexible in both operating habits and equipment selection. Unrestrained from the needs of "special artillery," these amateurs comprise the major market for new "bells and whistles" rigs (a general category in which most of us fall). Quite surprisingly, however, such fancy transceivers are seldom put through their paces and used to their maximum benefit. Otherwise there would be substantially more top DXers and high-scoring contesters. Want to gain a leading edge on DXing and contesting tactics? Learn how to *really use* that new h.f. transceiver!



Leading the pack of present "bells and whistles" rigs, Yaesu's new FT-980 may include more features than most operators will ever need or use. The independent and continuously adjustable i.f. bandwidth and i.f. shift are great. Not a lightweight, but one heck of a rig! Home troubleshooting and repairs could be difficult on this complex unit.



A super "bells and whistles" version of the popular TS-130, Kenwood's TS-430 features eight band-and-frequency memories, i.f. notch, and selectable s.s.b. or c.w. filters. Noise blanker is not adjustable. Processor is fair, and i.f. shift is relatively good. This rig has unlimited capabilities for amateurs in good locations. Unit delivers approximately 110 watts output; mating a.c. supply draws approximately 390 watts.

Using Bells and Whistles Effectively

This is an area that's difficult to describe in a brief magazine column, so try to read between the lines and ponder these ideas as we go.

How useful are those memories and dual v.f.o.'s in many rigs? Not a bit unless they are put into action. Let's take an example of an IC-730 outrunning a TS-830. Let's say we're up early and hit 20 meters right before it opens. Tuning 14.000 to 14.030, only one very weak signal is heard on 14.010. Leaving v.f.o. "A" there, we punch up v.f.o. "B" and tune 14.200 to 14.240. A VK7 is heard on 14.222. Switching back to v.f.o. "A," the c.w. signal is now readable—a 3B8—in QSO. The frequency is quickly stored in memory and v.f.o."A" is then synced with v.f.o. "B" (merely punch "write"). The VK7 is signing, but there's time to scan 14.200 to 14.230 again and spot a DU. The 3B8 now signs; you call him and check the VK7. A DX station caught the 3B8, but the VK7 signs clear. You call and he returns. The DU is about to sign. You now return to the VK7 while using fast VOX and split v.f.o.'s to monitor the DU. Upon turnover, the VK7 begins to "wrap up" with you while the 3B8 again signs. You call the 3B8 (his frequency is in memory) and get him, return a final to the VK7, then copy the 3B8's info and quickly check 14.000 to 14.020 during his call sign over (merely release memory and repunch it to return to 3B8). A ZL was spotted on 14011.3. Unless your rig has multiple memories, you'll need to write down this frequency until a v.f.o. can be moved. Next, it's on to the DU, more tuning, etc.

Approximately 10 minutes soon will have passed, and you'll notice others are beginning to pile up over your previously worked DX. It's time to increase pace! Between band scans on 20 meters, start lining up similar tactics for 15, 30, or 40 meters. Remember that it's more important to be there first than to run high power. Remember also to scan the second

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band with v.f.o. "A" (freed after the VK7 QSO) so a desirable station can be snapped into memory. If you've played your cards smoothly, you can now work DX on two (or three!) bands almost simultaneously. Using the separate memories for each band permits controlling everything with a single throw of the bandswitch. If you have ICOM's mating IC2KL linear amplifier, it will automatically follow the transceiver's band hopping. Ole'!

Now we reach the point of either needing more memories, having to write down frequencies spotted from memory tuning, or taking time to move v.f.o.'s. Almost 20 minutes of operating time has elapsed; the bands are coming to life, and we'll need to move a little quicker to snag the good ones. At this point, however, we're doing more button pushing than knob turning. If a pileup becomes ridiculous, we simply move to another, or jump to another band or two and snap back later.

Now don't tell me these operating tactics don't work. I've successfully done this for some time. In fact, I've occasionally used two rigs (both with memories) on two separate desks feeding separate antennas simultaneously. On one occasion a curious VK called to ask why he heard me working two DX stations almost simultaneously on different frequencies. I asked the fellow to stand by. You guessed it. I was signing with a UA0 on another band at that time. Heck, with today's rigs one can work OSCAR, 30 meters, and listen to underworld communications all at once. Why miss any of the action!



Aggravated with the "bells and whistles" game? Tired of super complex rigs? Yaesu's FT-77 is a "plain Jane" unit with a super smooth, rubberized tuning knob and (hopefully) very reliable circuitry. No VOX, no processor, just a very nice, easy-to-use unit.

During the previous discussion it may seem that we overlooked frills such as bandpass or i.f. shifts, variable bandwidths, notch filters, etc. Not necessarily. When you hit the bands at the right times and move at a smooth clip, wasting moves with those frills isn't logical. True, they're nice to have available (especially a good speech processor and noise blanker), but many operators merely set and forget these controls. How about you? If you live in a city, an adjustable or dual-mode noise blanker will be a blessing ("wide," or "full" blanking reduces man-made noises with the sacrifice of minor distortion). A tunable notch filter at the i.f. level (not a.f.) also lowers noise levels. A signal quality sacrifice is again necessary, but the alternative is lost communications. Variable bandwidth and i.f. shift are useful for weekenders facing crowded bands (what are your main operating times?). One very useful frill is the recent inclusion of XIT to mate with RIT (assuming that control covers ±5 kHz the dial's frequency). In addition to use for easy net QSY's, it's also good for "leap frog" contacts or working adjacent frequency DX when memories are tied up.

In Conclusion

As previously mentioned, this collection of ideas was presented for your sorting and knowledge when contemplating a new h.f. rig. If you liked the DXing examples of supreme knob twiddling, remember that DX bulletins, magazines, etc., help decide game plans *before* switching on any rig. Remember also that rigs and trends are continually changing and improving. As we said, a new rig well may be your best bargain. If you would like us to delve further into this area (maybe previewing new gear?), drop us a note or catch us on the air . . . if you can.

73, Dave, K4TWJ

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Contest Calendar

a monthly feature by
FRANK ANZALONE, W1WY

NEWS/VIEWS OF ON-THE-AIR COMPETITION

Rules for the 1983 WW DX Contest will appear in next month's issue. At this writing no changes are anticipated, and the list of Trophies and Plaques should remain the same with a few possible additions. We have received several inquiries from potential donors, and they will be included if the necessary requirements are fulfilled in time. Anyone wishing to be included in the upcoming 1983 contest must make the necessary arrangements before August 15th. This will give us time to get the info out before contest time.

As I have often suggested, a Memorial Plaque is an excellent way to perpetuate the call of a departed club member. There are several single-band areas that are still available. (Check the Sept. '82 issue for last year's rules.) Write to me as soon as possible and I will give you all the details.

Practically all the plaques that are processed via *CQ* have been awarded. A good portion of them were presented at Visalia and Dayton. If you have not received yours, especially those provided by the donors, contact me and I'll try to track it down for you. We are holding two for lack of mailing instructions: KG6JIA in the 1979 WW Phone Contest and S83T also on phone in the 1980 contest. Anyone knowing the whereabouts of the above please drop me a line.

The Abruzzo region of the A.R.I. is having a "Gabriele D'Annunzio Trophy" activity scheduled for September 3rd to the 11th. It appears that stations in the above regions may be worked each day on all modes, both on v.h.f. and u.h.f., making it oriented more toward European participation. There are other requirements, so if you are interested I would suggest you write for more details. Address your inquiries to: Awards Manager, A.R.I. Section, P.O. Box 63, 65100 Pescara, Italy.

A final reminder: Deadline for material for the November issue is August 15th; September 15th for the December issue.

73 for this time, Frank, W1WY

Calendar of Events

*	Aug.	6-7	Illinois QSO Party
	Aug.	13-14	European C.W. Contest
†	Aug.	13-14	SEANET Phone Contest
	Aug.	13-14	New Jersey QSO Party
	Aug.	20-21	SARTG RTTY Contest
	Aug.	20-21	New Mexico QSO Party
	Aug.	20-21	Alaska QSO Party
**	Aug.	27-28	All Asian C.W. Contest
	Aug.	27-28	Alabama QSO Party
	Aug.	27-28	Occupation Contest
	Aug.	28	GARTG RTTY Contest
	Sep.	3-4	"Corona" 10 Meter RTTY
†	Sep.	4	Bulgarian C.W. Contest
	Sep.	3-5	FOUR Land QSO Party
	Sep.	3-11	"G. D'Annunzio" Contest
	Sep.	10-11	G-QRP Club Activity
	Sep.	10-11	Cray Valley SWL Contest
	Sep.	10-11	European Phone Contest
	Sep.	10-11	YLRL "Howdy Days"
	Sep.	10-11	ARRL VHF QSO Party
	Sep.	17-19	Wash. State QSO Party
	Sep.	17-18	SAC C.W. Contest
	Sep.	24-25	SAC Phone Contest
	Sep.	24-25	Delta QSO Party
	Sep.	24-25	Maine QSO Party
	Oct.	1-2	Oregon QSO Party
	Oct.	8-9	GARTG SSTV Contest
	Oct.	22-23	Pennsylvania QSO Party
	Oct.	22-23	ARCI QRP QSO Party
	Oct.	22-23	YLRL Anniv. C.W. Party
	Oct.	22-23	CLARA AC/DC Contest
	Oct.	**29-30**	**CQ WW DX Phone Contest**
	Nov.	5-6	YLRL Anniv. Phone Party
	Nov.	12-13	European RTTY Contest
	Nov.	**26-27**	**CQ WW DX C.W. Contest**

* *Covered last month.*
** *See June issue.*
† *Not official.*

European DX Contest

C.W.: Aug. 13–14 Phone: Sept. 10–11
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

This is the 28th annual contest sponsored by the DARC. The activity will be between European countries and the rest of the world on all bands 3.5–28 MHz.

Following are updated rules, including two new features. U.S. states will now count as a multiplier. Also, QSO dupe sheets will now be required for each band on which 200 or more contacts are made.

Only 36 hours out of the 48-hour contest period may be used by single-operator stations. The 12-hour off periods may be taken in one, but not more than three, periods anytime in the contest and must be indicated in the log.

Classes: Single operator and multi-operator single transmitter, both all bands. Multi-operator stations are allowed to change bands one time only within a 15-minute period. A quick band change and return is allowed to work a new multiplier.

Exchange: RS(T) plus a QSO number starting with 001. In addition, W/K stations will include their state (*i.e.*, 599011 MA).

Scoring: One point per QSO and one point for each QTC reported.

Multiplier: The multiplier for non-European stations is determined by the number of European countries worked on each band (WAE list). Europeans will use the ARRL DXCC list. In addition, each call area of the following countries will be considered a multiplier: JA, PY, VE/VO, VK, ZL, ZS, UA9Ø. *Each W/K state will also be considered a multiplier.*

In addition, the multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14/21/28 MHz by 2.

Final Score: Total QSO points, plus QTC points, times the sum total multiplier from all bands.

QTC Traffic: Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and was later sent back to a European station. It can only be sent from a non-European station back to a European, the general idea being that after a number of Europeans have been worked, a list of these stations can be reported back during a QSO with another station. An additional one point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported (i.e., 1300/DL2DN/134). This means that at 1300Z you worked DL2DN and received #134.

A QSO can be reported only once and not back to the originating station.

There is a maximum of 10 QTC's to a station. The same station may be worked several times to complete this quota. Only the original contact, however, has QSO value.

Keep a uniform list of QTC's sent; 3/7 indicates that this is the 3rd series of QTC's sent and that 7 QSO's are being reported.

Awards: Certificates to the top scorers in each class in each country and areas listed in the multiplier. Continental leaders and stations having at least half the score of the continental leader will also be honored.

Disqualification: Violation of the rules of the contest, unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification.

Logs: It is suggested that you use the official DARC or equivalent forms. Figure 40 contacts to the page, and use a separate sheet for each band. A large-size s.a.e. and IRC's will get you a supply.

Remember, all entrants are required to submit cross-check dupe sheets for each band with 200 or more QSO's.

A penalty of 3 contacts will be deducted for each duplicate QSO that is removed by the Committee.

Mailing deadline is Sept. 15th for c.w.

14 Sherwood Road, Stamford, CT 06905

entries, Oct. 15th for the phone entries.

This year all entries go to: The WAEDC Contest Committee, P.O. Box 1328, D-895 Kaufbeuren, Fed. Rep. of Germany. (The U.S.A. address is no longer available.)

European Country List: C31, CT1, CT2, DL, EA, EA6, EI, F, FC, G, GD, GI, GJ, GM, GM Shetland, GU, GW, HA, HB9, HBØ, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH OHØ, OJØ, OK, ON, OY, OZ, PA, SM, SP, SV, SV Crete, SV Rhodes, SV Athos, TA1, TF, UA1346, UA2, UA Franz Josef Land, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, Y2, YO, YU, ZA, ZB2, 1AØ, 3A, 4U1, 9H1.

New Jersey QSO Party

Two Periods UTC
2000 Sat. to 0700 Sun. Aug. 13–14
1300 Sun. to 0200 Mon. Aug. 14–15

This is the 24th annual party sponsored by the Englewood A.R.A. Phone and c.w. are part of the same contest, the same station may be worked on each band and mode, and NJ may work in-state stations for QSO and multiplier credit.

Exchange: QSO no., RS(T) and QTH. County for NJ, ARRL section or country for others.

Scoring: NJ stations score 1 point for W/K and VE/VO contacts, 3 points for DX. Multiply total by ARRL sections worked (maximum of 74). KP4, KH6, KL7, etc., are 3 point contacts and section multipliers.

Out-of-state stations multiply total NJ QSO's by total of NJ counties worked (maximum of 21).

Frequencies: 1810, 3535, 3900, 7035, 7135, 7235, 14035, 14280, 21100, 21355, 28100, 28610, 50–50.5, and 144–146. Try phone on even hours, 15 on odd hours, and 160 at 0500 GMT.

Awards: Certificates to the top scorers in each NJ county, ARRL section, and DX country. Second-place awards if four or more logs are received from that section; also Novice and Tech. awards.

Use UTC, indicate the multiplier only the first time it is worked, include a QSO check sheet and a summary sheet showing the scoring, etc. Also include a large s.a.s.e. if you wish a copy of the results.

Stations planning activity in NJ are requested to advise the E.A.R.A. by August 1st so that coverage of all counties may be planned.

Logs must be received no later than Sept. 10th and go to: Englewood A.R.A., P.O. Box 528, Englewood, NJ 07631.



You may recall that in the Seville contest announcement last May, I casually mentioned that the Grand Prize of an all-expense-paid trip to Spain to attend the Seville April Fair Feast was for real. Here's Steve Sussman, W3BGN, the overseas winner, with a few of the local club members, who made sure that Steve and the XYL got to see the feast and other points of interest, not to mention being wined and dined and meeting dignitaries at special affairs. Left to right are Steve, EA1ABT, Steve's XYL, EA7CFW, and EB7EB.

S.A.R.T.G. RTTY Contest

Three Periods GMT
0000–0800 & 1600–2400 Sat., Aug. 20
0800–1600 Sun., Aug. 21

This is the 13th annual contest sponsored by the Scandinavian Amateur Radio Teletype Group. Use all bands 3.5 through 28 MHz. The same station may be worked on each band for QSO and multiplier credit.

Classes: Single operator, multi-operator single transmitter, and s.w.l.

Exchange: QSO no., signal report.

Points: QSOs with own country, 5 points. With other countries on same continent, 10 points. With other continents, 15 points. The U.S., Canada, and Australia call areas count as separate countries for scoring.

Multiplier: Each DXCC country and each W/K, VE/VO, and VK call area. A multiplier will not be considered unless the claimed station appears in at least five logs, or a log is received from that station.

Final Score: Sum of QSO points from all bands times the sum of the multiplier from each band.

S.w.l.'s use same scoring but based on sum of stations and messages copied.

Awards: Certificates to the top-scoring stations in each class in each country and each call area of the U.S., Canada, and Australia.

Use a separate sheet for each band, and include a summary sheet showing the scoring, comments, and other essential information, and your name and address in block letters.

Logs must be received by October 10th and go to: S.A.R.T.G. Contest Manager, P.O. Box 717, DK 8600 Silkeborg, Denmark.

Alaska QSO Party

0200Z Sat. to 0200Z Sun., Aug. 20–21

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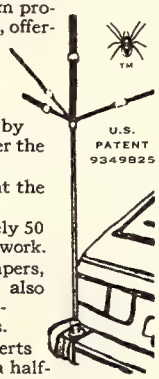
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CIRCLE 20 ON READER SERVICE CARD

tion. Several changes have been made in this year's rules and scoring.

The same station may be worked on each band, both c.w. and s.s.b., for QSO credit, but it will only count once as a multiplier.

Exchange: RS(T) and judicial district (1, 2, etc.) for KL7's. RS(T) and QSO number (001, etc.) for non-Alaskans.

Scoring: *For KL7's*—2 points for each QSO on 10, 15, and 20; 5 points if on 40, 80, and 160. Multiplier—sum of states, VE provinces, and DXCC countries worked on each band.

For non-Alaskans—5 points for QSO's on 10, 15, and 20; 10 points if on 40, 80, and 160. Multiplier—sum of Alaskan judicial districts worked on each band.

Final Score: Total QSO points times the sum of the multipliers from each band.

Frequencies: C.W.—1807 and 60 kHz up from low edge of each band. S.S.B.—1813, 3895, 7270, 14285, 21360, 28660.

Awards: Certificates to the winners in each state, province, and DX country. An Alaskan Goldpanner Plaque to the Top Alaskan and non-Alaskan.

Include a summary sheet with your log, and mail no later than October 1st to: Alaska DX Association, KL7AF, P.O. Box 1614, Kodiak Island, Alaska 99615.

New Mexico QSO Party

1800Z Sat. to 2100Z Sun., Aug. 20–21

The Albuquerque DX Assoc. is again sponsoring this year's party, which is being held a month earlier than last year.

There are two categories: single and multi-operator. The same station may be worked on each band and each mode for QSO credit, and New Mexico mobiles in each county change.

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

Scoring: 2 points for phone contacts, 3 points if on c.w.

New Mexico stations multiply total QSO points by NM counties, states, VE provinces, and DX countries worked for final score. All others multiply total QSO points by number of NM counties worked (maximum of 33).

Frequencies: C.W.—1805 and 60 kHz up from low edge of each band. Phone—1835, 3985, 7230, 14280, 21370, 28570, 147,510. (No repeater.) Novice—25 kHz up from low end of Novice bands.

Awards: Certificates in each category to top-scoring NM station in each county and in each state, VE province, and DX country. A special certificate to the highest scoring NM mobile or portable. Plaques to the highest scoring NM and non-NM stations in each category, and NM Club with three or more entries.

Include a summary sheet and a dupe sheet if your log contains 200 or more QSO's, and a large s.a.s.e. for a copy of the results.

Mailing deadline is October 1st to: Ed Graham, N5HH, 12449 Regent NE, Albuquerque, NM 87112.

Alabama QSO Party

1600Z Sat. to 2300Z Sun., Aug. 27–28

This party is again being sponsored by the Chattahoochee Valley A.R.C. The same station may be worked once on each band and each mode, mobiles on each county change, and Alabama to Alabama contacts are permitted.

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

Scoring: One point per QSO. Alabama stations multiply total by sum of states, VE provinces, and countries worked. All others multiply total Alabama contacts by sum of Alabama counties worked (maximum 67).

Frequencies: C.W.—3565, 7065, 14065, 21065, 28065. Phone—3965, 7265, 14285, 21365, 28565. Novice—3725, 7125, 21125, 28125.

Awards: Certificates to top scorers in each state, VE province, and DX country. Also to anyone contacting 15 or more Alabama stations. Plaques to the overall Alabama and out-of-state winners, and to the Alabama Club with the highest aggregate score.

Mailing deadline is September 30th to: Johnny Royster, WA4VEK, P.O. Box 494, Fairfax, AL 36854. Include a large s.a.s.e. for a copy of the results.

Occupation Contest

1800Z Sat. to 2400Z Sun., Aug. 27–28

This is the third annual Occupation Contest sponsored by the Radio Association of Erie, PA. The purpose of this activity is to contact other amateurs and exchange occupations. Try to keep titles in general field—i.e., engineer, technician, machinist, salesman, etc. Note the change in the scoring this year.

Exchange: RS(T), your occupation, state, province, or DX country.

Scoring: One (1) point for each similar occupation worked. Two (2) points for each retiree worked. Three (3) points for each *new* occupation worked. There is no multiplier. Total QSO points is final score.

Frequencies: C.W.—40 kHz up from bottom of each band. Phone—1820, 3920, 7250, 14300, 21400, 28600.

Awards: Certificates to highest scoring stations in each state, VE province, and DX country, and a plaque to the overall winner.

Mailing deadline is October 1st to: Chris Robson, KB3A, 6950 Kreider Road, Fairview, PA 16415.

1982 SAC Contest Results
U.S.A. and Canada

C.W.

W1END	10,498	AG5C	5,124
W1BL	9,063	W5ZR	4,884
KA1CY	8,050	N5BA	4,576
W1CNU	4,182	W5UNW	774
KA1CLV	3,737	W5EIJ	110
AA2Z/1	1,014		
W1OPJ	897	K6DDO	6,192
		W6UA	3,626
W2ZZ	7,742	N6ZZ	2,808
K2SX	5,720	AA6EE	12
WA2UDT	2,210		
W2XQ	1,566	W7QK	5,000
W3GM	31,872	AI9J	28,314
W3ARK	10,865	K9BG	15,340
K3FN	4,104	KO9Q	4,107
WA3DMH	3,800	K9IL	2,139
KA3EOA	2,139	W9YCV	4
W3ICM	132		
N3RL	91	W0WP	21,896
		W0RSG	2,040
K4FPF	4,500		
WA4OML	1,357		

Phone

KA1CY	6,660	KC7V	726
		KO7G	576
K3FN	8,064	W7QK	425
W3ARK	5,445		
W3ICM	5,203	WD8CRY	2,052
		W8VEN	132
N4MM	7,521		
K4RZ	4,263	AI9J	12,300
KD4PP	2,982	W9SS	3,652
W4WIT	1,357	KI9A	1,224
W5EIT	285	VE3GCO	7,965
		VE3LKR	238
W6EVF	1,232		

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G.A.R.T.G. RTTY Contest

0700Z to 1100Z Sun., Aug. 28

The German Amateur Radio Teleprinter Group sponsors a series of these contests each year. This is the fourth in a series of five. The next one will be on Saturday, October 15th from 1300Z to 1700Z. (There is also a v.h.f. section.) Activity is on 40 and 80 meters in that section of the band used for RTTY operation.

Exchange: RST, QSO no., name, QTH.

Scoring: One point per QSO on each band. (No multiplier was indicated.)

There is an s.w.l. section. Log should show calls of both stations in contact.

Reports and requests for additional information should be sent to Wolfgang Puenjer, DL8VX, P.O. Box 90 11 30, D-2100 Hamburg 90, Federal Republic of Germany, within 20 days of the end of the contest.

DARC "Corona" 10 Meter RTTY

1100Z to 1700Z Sat., Sept. 3

Here's another contest for those interested in RTTY. This one is sponsored by the Deutscher Amateur Radio Club. There are four of these a year. This is the third. The next one will be on Sunday, November 6th.

Activity is on 10 meters only, in that portion of the band used for RTTY.

Exchange: RST, QSO no., and name. U.S. stations will also include their state.

Scoring: One point per QSO. Use the ARRL and WAE country list for your multiplier. W/K, VE/VO, and VK call areas will be considered separate multipliers.

There is also an s.w.l. section.

Reports and inquiries should be addressed to: Klaus K. Zielski, DF7FB, P.O. Box 11 47, D-6455 Erlensee, West Germany, within 30 days of the end of the contest.

Bulgarian C.W. Contest

0000Z to 2400Z Sun., Sept. 4

This is a world-wide contest open to all, but with emphasis on working LZ's.

Classes: *A.* Single operator, single band. *B.* Single operator, all band. *C.* Multi-operator, all band. *D.* S.w.l.'s. Use all bands, 3.5 through 28 MHz.

Exchange: RST plus your ITU zone.

Scoring: One point for QSO with stations in the same continent (including same country), 3 points if in another continent, and 6 points for LZ contacts.

S.w.l.'s score 3 points if both calls and exchanges are reported, and 1 point if both calls but only one exchange.

Multiplier: Sum total of ITU zones worked on each band.

Final Score: Total QSO points from all bands times the total multiplier.

Awards: Medals to the top three world scorers in classes *A* and *B*. Cup and medals to classes *B* and *C*. Medals to continental leaders and s.w.l.'s.

Use a separate log sheet for each band, a summary sheet showing the scoring, and the usual signed declaration, plus your name and address in block letters.

Contest contacts may be used for the many LZ awards. Write to the BFRA for details.

Mailing deadline for logs is October 5th to: Bulgarian Federation of Radio Amateurs, P.O. Box 830, Sofia 1000, Bulgaria.

European WAEDC Contest 1982 Phone Results

U.S.A.

*K1KI	1,334,127	KI9A	5,656
*W1ZM	1,293,630	N3GB	5,564
*AK1A	1,046,848	W8VEN	4,902
*K1OX	412,638	KA1GHR	3,250
	(Opr. KC1F)	W7QK	3,124
*KC4OV	253,890	KA4MBC	2,244
*N6AW	236,076	W6BYH	1,748
AK1B	167,698	KU7Z	1,690
*N2VW	140,273	W4YN	1,568
N1AU	119,042	K1XM	1,350
*K3FN	116,772	N4MM	1,218
W3CM	110,751	WA4VEK	988
W3ARK	91,396	AA2Z	858
W1HJF	68,400	W9QWM	192
*W8UVZ	65,208	AA6EE	96
*WA4MOJ	60,636		
*W3ICM	57,754	**Multi-Opr.**	
AB2E	42,660	*N5AU	505,136
K9MWM/Ø	38,916	*AD6P	112,322
*W9RE	38,125		
*K4FPF	37,950	**Canada**	
W5CWQ/6	32,830	*VE3CGO	286,281
W3BGN	29,696	*VE4RP	58,752
W3IJT	26,230	*VO1QU	27,090
*AB8K	26,144		
*N4BS	21,948	**Continental Winners**	
WA3DMH	18,128	Europe	YU3MY
N3RL	15,120	Africa	5N8ARY
WA5IYX	9,344	Asia	UF6CR
WA2UDT	8,880	N. Amer.	K1KI
KC1V	6,732	S. Amer.	ZY5EG
KF4EO	6,120	Oceania	VK6AJW
WD8QVD	5,949		
KA2MRP	5,876		

Certificate winners

FOUR Land QSO Party

1800Z Sat., Sept. 3 to 0600 Sun., Sept. 4
1300Z Sun., Sept. 4 to 0100 Mon., Sept. 5

The Brightleaf ARC is again sponsoring the 13th annual QSO Party to make the many counties in the eight 4th district states available to county hunters.

The same station may be worked on each band and mode, again if operating portable or mobile from each county change. Stations in the 4th area may work each other for QSO and multiplier credit.

Exchange: RS(T) and QTH. County and state for the 4th district; state, province, or country for all others.

Scoring: *4th call area*—One point per QSO. Multiply total QSO points by the number of states, provinces, and countries worked.

All others—Two points for each 4th area station worked, times the total 4th area states and counties worked counted *once* only. Contacts with the club station W4AMC count 5 QSO points.

Frequencies: C.W.—3575, 7055, 14070, 21070, 28090. Phone—3940, 7260, 14290, 21360, 28600. Novice—3710, 7110, 21110, 28110.

Awards: Certificates to the top scorers in each state, VE province, and DX country, 2nd and 3rd place where warranted. Also county awards to 4th call area states and Novices.

Mail logs within 30 days to: Contest Chairman, Bob Knapp, W4OMW, 105 Dupont Circle, Greenville, NC 27834. Include a large s.a.s.e. for results.

1983 CQ World Wide DX S.S.B. Contest
October 29-30

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PRE-1946 TELEVISION SETS wanted for *substantial* cash. Finder's fee paid for leads. Also interested in spinning disc, mirror in-the-lid, early color sets, 9AP4 picture tubes. Arnold Chase, 9 Rushleigh Road, West Hartford, Conn. 06117. Phone (203) 521-5280.

QSLs & RUBBER STAMPS—Top Quality! Card Samples and Stamp Information 50¢. Ebbert Graphics D-2, Box 70, Westerville, OH 43081.

NEW KID on block: For QSL free samples write Kings Grove Press, Box 9, Ellerslie, MD 21529. Also custom printing—instructions included. Stamp appreciated.

ATLAS RADIO REPAIR SERVICE: Specializing in the 180, 210, and 215. Ninety Day Written Guarantee—Parts and Labor. A.R.R.S., 1320 Grand, San Marcos, CA 92069. Phone (619) 744-0720.

QUADS, * dB QUADS * 2, 3 & 4 elements, complete kits, fiberglass spreaders, components, wire. 3 first class stamps for complete brochure. db + Enterprises, Box 24, Pine Valley, NY 14872.

HELP! English amateur library needs back issues of CQ magazine, no matter how old but in fair condition. Willing to pay freight. G3YMM, 9 Cloister Road, North Acton, London W3 England.

WANTED: Early Hallicrafter "Skyriders" and "Super Skyriders" with "Silver" panels. Also "Skyrider Commercial" early transmitters such as HT-1, HT-3, HT-19, and other Hallicrafter gear, parts, accessories, manuals. Chuck Dachis, WD5EOG, The Hallicrafter Collector, 4500 Russell Drive, Austin, TX 78745.

TRS-80C COLOR COMPUTER PROGRAMS and Hardware to send and receive Morse Code or RTTY, parallel I/O card, EPFROM Programmer. Frank Lyman, P.O. Box 3091, Nashua, NH 03061.

STAMP COLLECTOR desires contact with radio operators with accumulation of overseas mail. All inquiries will be answered. Contact Mr. J.D. Williams, 1207 Murl St., New Orleans, LA 70114.

FOREIGN QSL CARD HANGERS: 12-18 pocket plastic holders, size 4¼ × 6, $9.95. Envelopes with Call, Name, QTH, 100-$6.95. RCO PRODUCTS, Box 7333, Kansas City, MO 64116.

VIC-20 FCC TYPE Q&A COMPUTER TAPES: Novice, Tech., Gen., Adv., Expert $3.75. Weiss, 168 Kirch, York, PA 17402.

QUALITY TOWER ACCESSORIES TO SOLVE YOUR PROBLEMS: SO-1 standoff brackets for small 2 meter, Ringo, TV antennas, $34.50. SO-2 Heavy-duty standoffs for large 2 meter, beams, commercial, $59.50. MA-1 and MA-2 mast adapters put the top of your tower mast to good use, $22.50. GP81 and GP51S Ginpole Kits provide safety for your tower work, $129.50. BG-18 tower mast for those big beams, $249.50. These accessories work fine on all tubing-type towers. Special accessories can be custom made to order. Request our 1983 catalog. Visa, Mastercharge. IIX Equipment Ltd., P.O. Box 9, Oak Lawn, IL 60454. Phone 312-423-0605.

IMRA-International Mission Radio Assn. helps missioners—equipment loaned; weekday net, 14.280 MHz, 2:00–3:00 PM Eastern. 1 Pryer Manor Rd., Larchmont, NY 10538.

THE CENTRAL KENTUCKY ARRL HAMFEST, sponsored by The Bluegrass Amateur Radio Society, will be held Sunday, 8:00 AM to 5:00 PM, August 14, 1983, at Scott County High School, Longlick Road and US Route 25, Georgetown, Kentucky (Off I-75/64). Technical Forums. Awards and Exhibits in A/C facilities. Outside Flea Market space, no charge. Tickets $3.50 advance and $4.00 at the gate. For more information or tickets write Edward B. Bono, WA4ONE, P.O. Box 4411, Lexington, Kentucky 40504.

KNOW FIRST! Ham radio fanatics—you need THE W5YI REPORT, a twice-monthly award-winning Hot Insider Newsletter. Acclaimed best! Confidential facts, ideas, insights, nationwide news, technology, predictions, alerts. Quoted coast-to-coast! We print what you don't get elsewhere! $18.00 annually w/money-back guarantee! FREE SAMPLE for S.A.S.E. (two stamps). W5YI, Box 10101-C, Dallas, Texas 75207.

HATS WITH NAME AND CALL $4.95 plus $1.50 postage. SASE for hat information. Colorful QSL's Samples $.50. Specialty Printing, Box 361, Duquesne, PA 15110.

QRP INFO FREE. Large s.a.s.e. (2 oz. postage) to: QRP, Box 12072, Austin, Texas 78711.

RTTY/CW COMPUTER INTERFACE in easy-to-build kit, includes built-in power supply. Introductory price $99.95. RTTY/CW software from $34.95. Ham Log program for VIC-20 + 8K, printer option with logbook format, $9.95 cassette. Add $3.00 per order shipping/handling. VISA/MC/MO. SASE for complete catalog. Wes-Com, Inc., D.G. Miller, 4915 Galena Dr., Co. Springs, CO 80918. Phone 303-598-5745 7–10 PM.

ELECTRON TUBES: Current and hard to find types. Special purpose, transmitting, receiving, and cathode ray tubes. SASE for our free list. RUTAN ELECTRONIC SALES CO., 202 Miriam Parkway, Elmont, NY 11003.

SELL: Swan 500 xcvr, 410 vfo, 117xc P.S./Spkr, Autek QFI filter, VSWR meter. Orig. owner, no mods, vy good cond. All $200. Will ship. J. S. Hubbard, KB2VK (82/83 CB). Phone 518-584-3821. No collect calls.

TEN-TEC STATION FOR SALE: Omni-D transceiver with noise blanker, Model 218, 1.8 SSB filter, 255 deluxe power supply, 243 remote VFO, 234 RF speech processor, 215 P microphone. All mint condition, $795. Also Dentron CM-1 Tuned Input for Clipperton L, $35. Call 915-677-3675, W5SGT.

RADIO WEST! High-quality general-coverage receivers with Collins filters, and special DX modifications installed. Catalog 50¢ (refundable). RADIO WEST, 3417 Purer Rd., Dept CQ, Escondido, CA 92025. Phone (619) 741-2891.

OUTGOING DX QSL SERVICE. Mo membership fee, $.08/card. SASE for complete details. Bob Gaudio, WD8AWS, 1613 Merrill St., Kalamazoo, MI 49008.

SEND $18.95 plus $3.00 shipping for 2 meter, 5/8 wave magnet-mount antenna. Satisfaction guaranteed. For listing of mobile antenna bargains send SASE to WD4BUM, Rt. #7 Box 101-I, Anderson, SC 29624.

YOU'RE CORDIALLY INVITED to join the Senior Citizens Amateur Radio Society, an informative, constructive, and beneficial organization. Handicapped amateurs Free. Several awards. SASE for particulars to: SCARS, P.O. Box 6631, Ithaca, NY 14851.

HALLICRAFTERS Service Manuals. Amateur and SWL. Write for prices. Specifiy Model Numbers desired. Ardco Electronics, P.O. Box 95, Dept. C, Berwyn, IL 60402.

SCHEMATICS: Radio Receivers, 20's/60's. For details send namebrand, Model No., SASE. Scaramella, P.O. Box 1, Woonsocket, RI 02895-0001.

TOWERS: Galvanized steel stack/crankup. Factory direct savings. California Antenna Systems, 6020 Windy Ridge Road, Shingle Springs, CA 95682, phone (916) 677-9540.

QSL's by W4TG. Prices from $16 per 1000. Send SASE to P.O. Drawer F, Gray, GA 31032.

83 CALLBOOKS: US $19, DX $18, both $35 Ppd. W9JVF, 1147 N. Emerson, Indianapolis, IN 46219.

MUSEUM now open for radio historians and collectors. Free admission. Old-time amateur (W2AN) and commercial station exhibits, 1925 replica store and telegraph displays. 15,000 items. Write A.W.A. for details: Bruce Kelley, W2ICE, Holcomb, NY 14469.

REPLACE RUSTED ANTENNA BOLTS with Stainless Steel Bolts. Small Quantities, Free Catalog. ELWICK, Dept. 482, 230 Woods Lane, Somerdale, NJ 08083.

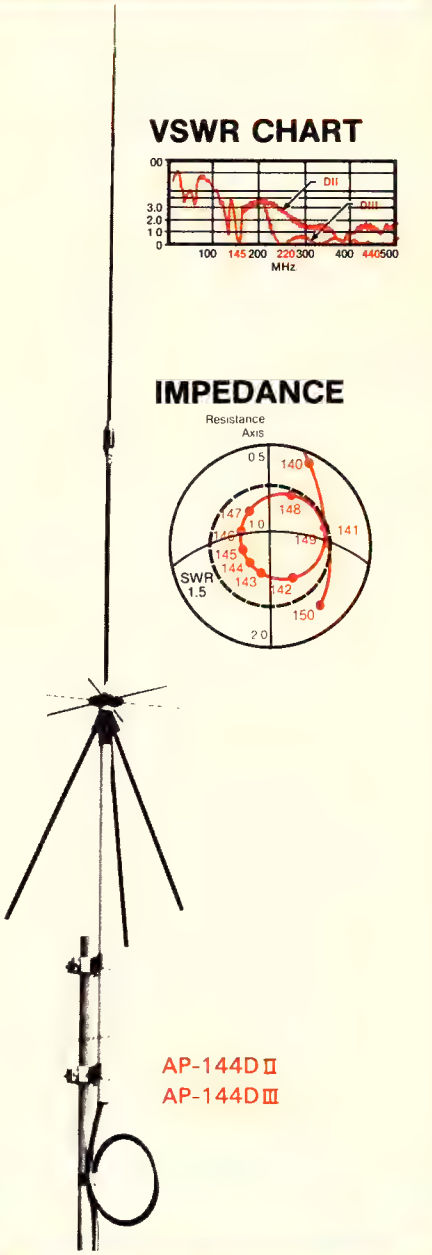
IBM PC/APPLE Aftermarket products; Hobbysts' Electronics Project Kits: $50.00 complete Modem Kit, Subscription/Satellite TV Decoder Kits, Eprom Programmer/Duplicator, Popular Memory IC Testers, Data Sheets, Application Notes, and more than 6000 parts in stock: Semiconductors, Discretes, Video Products, Tools, etc. Please write for your free literature/catalog. Independent Electronics, 6415-06 Airline Rd., Dallas, TX 75205.

HAM HOLIDAY SRI LANKA: Write to Spangles Travels, 84 Templers Road, Mount Lavinia, SRI LANKA, + 5 IRCs.

WANTED: Cash paid for used SPEED RADAR EQUIPMENT. Write or call: Brian R. Esterman, P.O. Box 8141, Northfield, Illinois 60093, phone (312) 251-8901.

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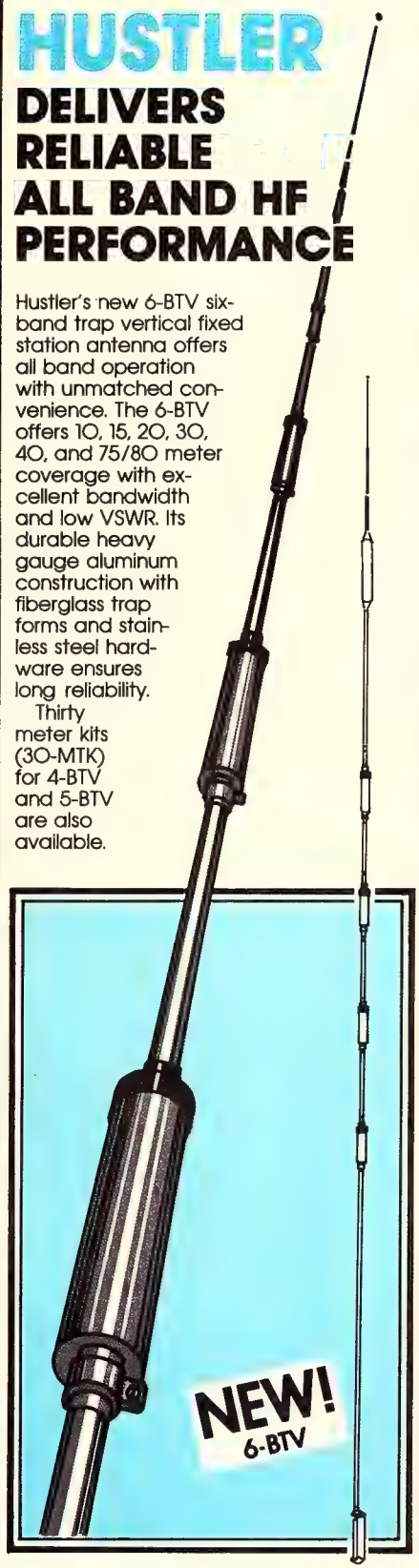
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ALL BAND TRAP ANTENNAS!

PRETUNED - COMPLETELY ASSEMBLED - ONLY ONE NEAT SMALL ANTENNA FOR UP TO 7 BANDS! EXCELLENT FOR CONGESTED HOUSING AREAS - APARTMENTS LIGHT - STRONG - ALMOST INVISIBLE!

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COMPLETE AS SHOWN with 90 ft. RG58U-52 ohm feedline, and PL259 connector, insulators, 30 ft. 300 lb. test dacron end supports, center connector with built in lightning arrester and static discharge - molded, sealed, weatherproof, resonant traps 1"X6"- you just switch to band desired for excellent worldwide operation - transmitting and receiving! Low SWR over all bands -Tuners usually NOT NEEDED! Can be used as inverted V's - slopers - in attics, on building tops or narrow lots. The ONLY ANTENNA YOU WILL EVER NEED FOR ALL DESIRED BANDS - WITH ANY TRANSCEIVER - NEW - EXCLUSIVE! NO BALUNS NEEDED!

80-40-20-15-10-6 meter - 2 trap --- 104 ft. with 90 ft. RG58U - connector -Model 998BUC . . . $89.95
40-20-15-10 meter — 2 trap --- 54 ft. with 90 ft. RG58U - connector - Model 1001BUC $88.95
20-15-10 meter --- 2 trap --- 26ft. with 90 ft. RG58U - connector - Model 1007BUC. $87.95

SEND FULL PRICE FOR POSTPAID INSURED. DEL. IN USA. (Canada is $5.00 extra for postage - clerical - customs etc.) or order using VISA - MASTER CARD - AMER. EXPRESS. Give number and ex. date. Ph 1-308-236-5333 9AM - 6PM week days. We ship in 2-3 days. ALL PRICES MAY INCREASE . . SAVE - ORDER NOW! All antennas guaranteed for 1 year. 10 day money back trial if returned in new condition! Made in USA. FREE INFO. AVAILABLE ONLY FROM

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With INLINE "wireless" weatherproof coaxial relays, you simply add more antennas without costly control cables. INLINE also takes the guesswork out of point-to-point HF communications. By selection, you can instantly compare one antenna to another, switch monobanders, switch from horizontal to vertical, add WARC band antennas, create simple directable wire or vertical arrays, or whatever else you can dream up.

Remember — multiband trap antennas are much less efficient and have much less bandwidth than resonant dipoles On VHF—UHF you can significantly reduce hardline usage, eliminate tower-caused directivity, change polarization, change frequency, or simply switch antennas.

Install INLINE Virtually Anywhere

And there are no expensive and unsightly multiwire control cables They can be placed in the attic, on the roof, on a mast, on a tree, on a tower, anywhere the antennas are. They are ideal in apartment houses to overcome restrictions

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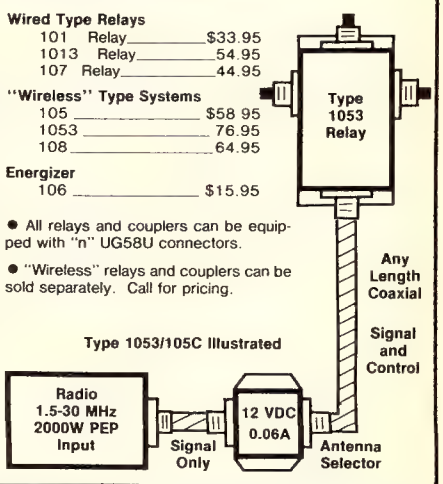
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ARIES ZERO INSERTION FORCE SOCKETS –

cam actuated, true zero insertion – tin plated solder tail pins – capable of being plugged into dip sockets, including wire wrap.

Stock No.	No. of Pins	1-9	10-49	50
11055	24	4.98	$4.35	$3.90
11056	28	5.15	4.50	4.05
11057	40	6.81	5.95	5.35
11058	64	12.02	10.50	9.45

IC-KOOLERS™ from UNITRACK® dissipate over 2 watts of heat from IC's, producing longer life and better performance. Just push IC-Kooler on – heat is collected from top and bottom of IC and dissipated. Won't shake loose!

Stock No.	No. Pins In IC	Price
22225	14	$.29
22226	16	.29
22227	18	.29
22228	20	.29

DIGITAL MULTIMETER
Single rotary switch operation. Large, easy to read 5" 3½ digit display. 800 hours operating life with single 9v battery. Seven functions—(DC Volts, DC Amps, Ohms, AC Volts, AC Amps, Diode and Resistor Junction, Audible Continuity Check)

Stock No 62503 **$79.95** Full 1 year warranty

Stock No 62504 Carrying case with belt loop **$9.95**

WILD ROVER

Touch switch capsule. Operating motion is .005" without the use of a levered arm. Extremely fast on and off with low noise. Normally open – rated 115 VAC 1.6 amp-30 milliohm resistance – 615° radius by .160 thick.

Stock No.	1-9	10 & Up
12098	$1.42	$1.28

60/40 ROSIN CORE SOLDER

Stock No	Dia	Length (feet)	Weight (oz.)	Price
50075	062	9	1.5	$1.16
50076	062	25	4	2.39
50077	062	50	8	4.25
50078	032	33	1.5	1.31
50079	032	88.5	4	2.47
50080	032	175	8	4.57

TI WIRE WRAP SOCKETS

Tin plated phosphor bronze contact – 3 wrap

Stock No.	No Pins	1-99	100-499	500
11301	8	$.40	$.36	$.30
11302	14	.59	.54	.45
11303	16	.64	.58	.48
11304	18	.73	.66	.55
11305	20	.99	.90	.75
11306	22	1.12	1.02	.85
11307	24	1.25	1.14	.95
11308	28	1.52	1.38	1.15
11309	40	2.05	1.86	1.55

TI LOW PROFILE SOCKETS

Tin plated copper alloy 688 contact pins with gas tight seal.

Stock No.	No Pins	1-24	25-99	100-999
11201	8	$.10	$.09	$.08
11202	14	.14	.13	.12
11203	16	.16	.15	.14
11204	18	.18	.17	.15
11205	20	.20	.18	.16
11206	22	.22	.20	.18
11207	24	.24	.22	.20
11208	28	.28	.26	.25
11209	40	.40	.37	.33

ELPAC POWER SUPPLIES – DC/DC CONVERTERS

Stock No. 13801 – "Floppy Disc" Power Supply For Winchester Drives **$109.00**
13801-1 Data Sheet for 13801 ... .25

SINTEC Stock No. 300 MW Type	ELPAC No.	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (MA)	Dimensions (HxWxD) in Inches	Price
13825	CB3801	3.0-7.0	12±0.6	0-25	.48x.51x3.05	$ 7.95
13826	CB3811	3.0-7.0	-12±0.6	0-25	.48x.51x3.05	7.95
13827	CB3802	3.0-7.0	15±0.7	0-20	.48x.51x3.05	7.95
13828	CB3812	3.0-7.0	-15±0.7	0-20	.48x.51x3.05	7.95
13829	CB3804	3.0-7.0	28±0.7	0-10	.48x.51x3.05	7.95
13830	CB3814	3.0-7.0	-28±0.7	0-10	.48x.51x3.05	7.95
1.5 W TYPE:						
13831	CL3801	4.0-7.0	12±0.6	125	.651x1.2x1.77	$24.95
13832	CL3811	4.0-7.0	-12±0.6	125	.651x1.2x1.77	24.95
13833	CL3802	4.0-7.0	15±0.7	100	.651x1.2x1.77	24.95
13834	CL3812	4.0-7.0	-15±0.7	100	.651x1.2x1.77	24.95
13835	CL3804	4.0-7.0	28±1.4	50	.651x1.2x1.77	24.95
13836	CL3814	4.0-7.0	-28±1.4	50	.651x1.2x1.77	24.95
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Strips can be broken by hand into desired number of contact pins. Solder tail version features gold collet/tin shell, wire wrap features gold collet/gold shell.

Stock No.	No. of Pins	Style	Sale Price Each
10240	25	Solder tail	$1.75
10241	25	Wire wrap	3.25

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Miniclamp AC Volt-Ammeter allows singling one conductor out of many without disarrangement

SET of THREE $99.00

Stock No	AC Amperes	Price
13730	0-25A	$39.50
13731	0-50A	39.50
13732	0-100A	39.50

ACCESSORY LINE SPLITTER allows fast readings of AC power consumption of plug in equipment without separation of leads. Stock No. 13727 **$9.95**

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VOLT-I-CATOR automotive diagnostic meter plugs into lighter socket and indicates battery condition and charging rates. Stock No. 13736 **$15.95**

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SINTEC Stock No.	ELPAC Part No.	Output Voltage	Output Current Rating	Dimensions (HxWxD) in Inches	OVP	Price
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13803	SOLV15-12	12	1.5A	4-7/16x4x2	Fixed included	39.95
13804	SOLV15-15	15	1.2A	4-7/16x4x2	Fixed included	39.95
13806	SOLV15-24	24	0.75A	4-7/16x4x2	Fixed included	39.95
13808	SOLV30-5	5	6.0A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
13809	SOLV30-12	12	4.0A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
13810	SOLV30-15	15	3.3A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
13812	SOLV30-24	24	2.0A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
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PIN FORMING TOOL

puts IC's on their true row to row spacing. One side is for .300 centers. Flip tool over for devices on .600 centers. Put device in tool and squeeze.

NEW! Stock No. 10200 $14.95 (ANTI-STATIC MODEL)

ONE TOOL DOES 8 thru 40 PINS! Stock No. 11059 $12.95

OK MACHINE AND TOOL

IC INSERTION/EXTRACTION KIT includes DIP IC extractors and inserters to accommodate all ICs from 14 to 40 pins. Tools that engage conductive surfaces are CMOS safe and include grounding lugs. Stock No 13309 **$37.74**

SOCKET WRAP ID DIP socket sized plastic panels with numbered holes in pin locations. Slip onto socket before wire wrapping to identify pins. Also write on them for location, IC part number, function, etc. Simplifies initial wire wrapping, troubleshooting and repair. **$1.82** per pack

13295	14 pin
13296	16 pin
13297	18 pin
13298	20 pin
13299	22 pin
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IC EXTRACTOR One-piece, spring steel construction. Will extract all LSI, MSI and SSL devices with 8 to 24 pins. Stock No. 13313 **$2.10**

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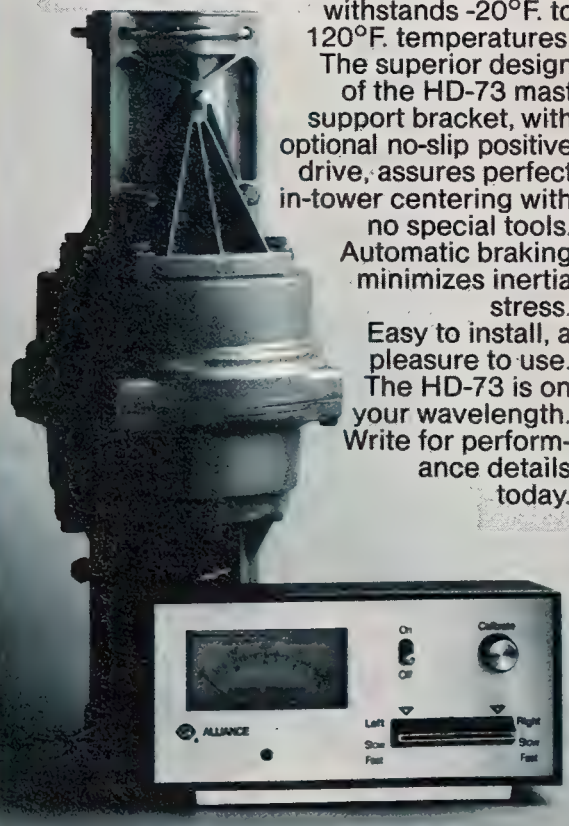
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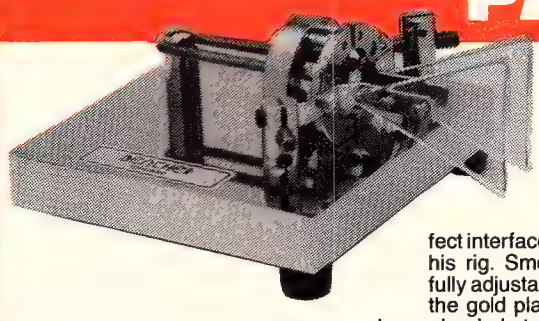
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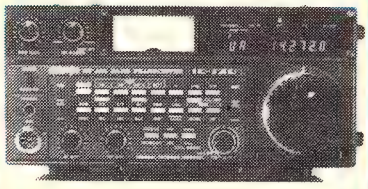
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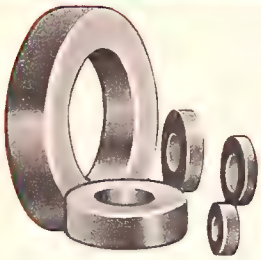
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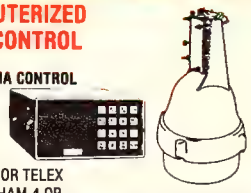
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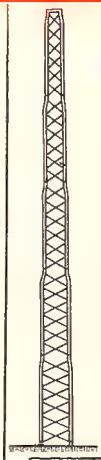
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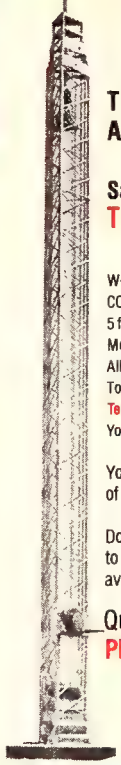


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Tower Model	Tower Ht.	Load Rating	Ship Weight	Tower Base	Tower Price	Base Price	Total Price
HBX40	40 ft	10 sq ft	164	BXB6	289	24	313
HBX48	48 ft	10 sq ft	303	BXB7	369	26	395
HBX56	56 ft	10 sq ft	385	BXB8	449	30	479
HDBX40	40 ft	18 sq ft	281	BXB7	339	26	365
HDBX48	48 ft	18 sq ft	363	BXB8	429	30	459



Tri-Ex®

TRI-EX/MOSLEY/ALLIANCE Antenna System SPECIAL!

Save $44 on this Super Offer from TRI-EX and TEXAS TOWERS

W-51 Tower, Tri-Ex's most popular . . . reg. list $998
CO-3 Coax arm kit (set of 3) . . . . . reg. list $33
5 ft. 2 in. dia. Heavy-Duty Mast . . . . . reg. list $30
Mosley TA-33 3-el Triband Beam . . . . . reg. list $303
Alliance HD-73 Antenna Rotor . . . . . reg. list $155
Total package list price $1519
Texas Towers Special Promotional Discount less $400
Your Total Cost for this Complete System $1119

You can substitute any other antenna or rotor of your choice at comparable savings.

Don't miss out on this Fantastic Opportunity to own one of the Finest Antenna Systems available.

Quantities are limited. Please Hurry!

RG-213U

$.29/ft $279/1000 ft
Up to 400 ft via UPS

- RG-213/U—95% Bare Copper Shield
- Mil-Spec Non-contaminating Jacket for longer life than RG8 cables.
- Our RG-213/U uses virgin materials.
- Guaranteed Highest Quality!

RG-8X

$.19/ft $179/1000 ft

- RG8X—95% Bare Copper Shield
- Low Loss
- Non-contaminating Vinyl Jacket
- Foam Dielectric

Coaxial Cable Loss Characteristics (DB/100 ft)

Cable Type	Imped.	10MHz	30MHz	150MHz	450MHz
RG-213/U	50	.6	.9	2.3	5.2
RG8X	52	.8	1.2	3.5	6.8
RG-58/U	52	1.4	1.9	6.0	12.5
½" Alum	50	.3	.5	1.2	2.2
½" Heliax	50	.2	.4	.9	1.6
⅞" Heliax	50	.1	.2	.5	.9

HARDLINE/HELIAX™

Lowest Loss for VHF/UHF!

½" Alum. w/poly Jacket . . . . . $.79/ft
½" LDF4-50 Andrew Heliax™ $1.49/ft
⅞" LDF5-50 Andrew Heliax ™ $3.99/ft
select connectors below.

HARDLINE & HELIAX™ CONNECTORS

Cable Type	UHF FML	UHF MALE	N FML	N MALE
½" Alum	$19	$19	$19	$25
½" Heliax ™	$22	$22	$22	$22
⅞" Heliax ™	$49	$49	$49	$49

AMPHENOL CONNECTORS

Silver PL259 . . . . $1.25 Nickle PL259 . . . . $.90
UG21B N Male . . $2.95 UG23D N Female . $2.95

ANTENNA WIRE & ACCESSORIES

12 Ga. Copperweld . $.12/ft 14 Ga. Copperweld . $.10/ft
14 Ga. Stranded . . . $.10/ft 18 Ga. Copperweld ¼ mi $30
450 Ohm H.D. Line . $.16/ft H.D. End Insulators . . $2/ea
Van Gorden 1:1 Balun $11
Van Gorden Center Insulator $6

HUSTLER

4BTV 40-10 mtr Vert . . $79 5BTV 80-10 mtr Vert . . $99
G6-144B 2-mtr Base . . $79 G7-144 2-mtr Base . . $109

Mobile Resonators	10m	15m	20m	40m	75m
400W Standard	$10	$10	$12	$15	$19
2KW Super	$14	$15	$19	$24	$33

Bumper Mounts - Springs - Folding Masts in Stock!

BUTTERNUT

HF6V 80-10 mtr Vertical $129
RMK-II Roof Mount Kit w/radials $39
STR-II Stub Tuned Radial Kit $20
TBR-160HD 160-mtr Coil Kit $49
2MCV-5 2-mtr Base Vertical $39
Free Shipping in Continental U.S. on HF6V Antennas!!

CUSHCRAFT

A3 3-el Tribander	$179	A4 4-el Tribander	$229		
R3 20/15/10mtr Vert	$229	A743/A744 40mtr Kit	$69		
10-3CD	$76	10-4CD	$89	15-3CD	$99	15-4CD	$109
20-3CD	$179	20-4CD	$239	40-2CD	$279	AV5	$99
A50-5	$65	A50-6	$89	A147-4	$25	A147-11	$39
214B	$69	214FB	$69	3219	$79	220B	$75
228FB	$189	416TB	$59	424B	$63	617B	$179
147-20T	$63	144-10T	$45	144-20T	$69	432-20T	$49
14TMB	$25	ARX2B	$39	AMS147	$29	PD-2	$25

Many other Cushc. aft models in Stock—CALL!

HY-GAIN

The ALL NEW Broadband 3-el Triband Beam Explorer-14, In Stock—$289

30/40-mtr. Add-On-Kit . . . . . Call for price
V2S 2-mtr Base Vertical $39
TH5MK2S Broad Band 5-el Triband Beam $319
TH7DXS 7-el Triband Beam $379
TH3JRS 3-el Triband Beam $159
TH2MK3S 2-el Triband Beam $139
HY-QUAD 2-el Triband Quad $279
402BAS 2-el 40-mtr Beam $199
205BAS 5-el 20-mtr Beam $299
155BAS 5-el 15-mtr Beam $179
105BAS 5-el 10-mtr Beam $119
204BAS 4-el 20-mtr Beam $229
203BAS 3-el 20-mtr Beam $139
153BAS 3-el 15-mtr Beam $79
103BAS 3-el 10-mtr Beam $59
DB1015BAS 3-el 10/15 mtr Beam $159
64BS 4-el 6-mtr Beam $55
66BS 6-el 6-mtr Beam $109
18HTS 80-10 mtr Hy-Tower Vertical $339
LC-160 160-mtr Coil Kit for 18HTS $39
214 14-el 2-mtr Beam $35
2BDQ 80/40 mtr Trap Dipole $49
5BDQ 80-10 mtr Trap Dipole $99
BN86 80-10 mtr KW Balun W/Coax Seal $19

MOSLEY

CL-33 3-el Triband Beam $229
TA-33 3-el Triband Beam $199
TA-33JR 3-el Triband Beam $149
S-402 2-el 40-mtr Beam $279

HYGAIN/TELEX CRANKUPS

ON SALE! FREIGHT PAID! SPECIAL PRICES! SAVE$$!

Model	Height Up	Down	Wind Load	List	Sale
HG-37SS	37.0 ft	20.5 ft	9.0 sq ft	$777	$669
HG-52SS	52.0 ft	20.5 ft	9.0 sq ft	$1095	$949
HG-54HD	54.0 ft	21.0 ft	16 sq ft	$1818	$1499
HG-70HD	70.0 ft	23.0 ft	16 sq ft	$2850	$2399
HG-33MT2	33.0 ft	11.5 ft	8.5 sq ft	$898	$779

ALPHA DELTA COMMUNICATIONS

Transi-Trap™ Surge Protectors—In Stock Now!



Model LT 200W UHF Type . . $19
Model HT 2KW UHF Type . . $29
Model LT/N 200W N Type . . $39
Model HT/N 2KW N Type . . $44
Model R-T 200W Deluxe . . . $29
Model HV 2KW Deluxe $32

KLM

KT34A 4-el Broad Band Triband Beam $309
KT34XA 6-el Broad Band Triband Beam $469
3.8-1 80-mtr Rotatable Dipole $429
7.2-1 40-mtr Rotatable Dipole $159
7.2-2 2-el 40-mtr Beam $289
7.2-3 3-el 40-mtr Beam $439
7.2-4A 4-el 40-mtr Beam $599
6el-20mtr Big Stick Monoband Beam $599
6el-15mtr Big Stick Monoband Beam $389
6el-10mtr Big Stick Monoband Beam $229
10-30-7LP Log Periodic Broad Band Beam $599
144-148-13LBA 13-el 2-mtr Beam $79
143-150-14C 14-el 2-mtr Satellite Antenna $79
420-470-18C 435 MHz Satellite Antenna $59
432-16LB 432 MHz Long Boom Antenna $59

MINI-PRODUCTS HQ-1 only $139!



Wing Span - 11 ft
Boom - 54 in. long
Wind Area - 1.5 sq ft
1200W P.E.P. Input
6-10-15-20 mtrs

ROTORS & CABLES

Alliance HD73 (10.7 sq ft rating) $99
Alliance U100 (for small beams & elevation) $49
Telex HAM 4 (15 sq ft rating) $199
Telex Tailtwister (20 sq ft rating) $249
Telex HDR300 Heavy Duty (25 sq ft rating) $439



Standard 8 cond cable $.19/ft (vinyl jacket 2-#18 & 6-#22 ga)
Heavy Duty 8 Cond cable $.36/ft (vinyl jacket 2-#16 & 6-#18 ga)

UNR-ROHN GUYED TOWERS

10 ft Sections 20G $32.50 25G $43.50 45G $95.50

Foldover Towers	Model	Height	Ant Load*	Price
	FK2548	48 ft	15.4 sq ft	$789
	FK2558	58 ft	13.3 sq ft	$879
	FK2568	68 ft	11.7 sq ft	$959
	FK4544	44 ft	34.8 sq ft	$1099
	FK4554	54 ft	29.1 sq ft	$1219
	FK4564	64 ft	28.4 sq ft	$1329
	25G Foldover Double Guy Kit			$199
	45G Foldover Double Guy Kit			$229

*Above antenna loads for 70 MPH winds and Guys at Hinge & Apex.

All Foldover Towers Shipped Freight Pre-Paid!
Foldover prices 10% higher west of Rockies.
All Rohn 25G & 45G Accessories in stock - Call!

TOWER/GUY HARDWARE

3/16" EHS Guywire (3990 lb rating) . . . . . $.12/ft
1/4" EHS Guywire (6000 lb rating) . . . . . $.15/ft
5/32" 7 × 7 Aircraft Cable (2700 lb rating) . . . . $.12/ft
3/16" CCM Cable Clamp (3/16" or 5/32" Cable) . . . $.35
1/4" CCM Cable Clamp (1/4" Cable) . . . . . $.45
1/4" TH Thimble (fits all sizes) . . . . . $.30
3/8EE (3/8" Eye & Eye Turnbuckle) $5.95
3/8" EJ (3/8" Eye & Jaw Turnbuckle) $6.95
1/2" EE (1/2" Eye & Eye Turnbuckle) $8.95
1/2" EJ (1/2" Eye & Jaw Turnbuckle) $9.95
3/16" Preformed Guy Grip $1.79
1/4" Preformed Guy Grip $1.99
6" Diam - 4 ft Long Earth Screw Anchor $12.95
500D Guy Insulator (5/32" or 3/16" Cable) . . . . . $.95
502 Guy Insulator (1/4" Cable) $1.95
5/8" Diam - 8 ft Copper Clad Ground Rod $11

PHILLYSTRAN GUY CABLE

HPTG2100 Guy Cable (2100 lb rating) . . . . . $.29/ft
HPTG4000 Guy Cable (4000 lb rating) . . . . . $.43/ft
HPTG6700 Guy Cable (6700 lb rating) . . . . . $.69/ft
9901LD Cable End (for 2100/4000 cable) $4.95
9902LD Cable End (for 6700 cable) $6.95
Socketfast Potting Compound (does 6-8 ends) $8.95

GALVANIZED STEEL MASTS

Heavy Duty Steel Masts 2 in OD - Galvanized Finish

Length	5 FT	10 FT	15 FT	20 FT
.12 in Wall	$25	$39	$59	$79
.18 in Wall	$39	$69	$99	$109
.25 in Wall	$69	$129	$189	$249

SOUTH RIVER ROOF TRIPODS

HDT-3 3 ft Tripod . . . . $19 HDT-5 5 ft Tripod $29
HDT-10 10 ft Tripod . . $49 HDT-15 15 ft Tripod . . $69
Heavy Duty Tripods include mtg hdw-UPS Shippable

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COMMUNICATIONS EQUIPMENT SALE!

MIRAGE AMPLIFIER SALE!

B1016 2 Meter Dual Purpose $249
H.T. 1-2W In - 35-90W Out
or Transceiver 10W In - 160W Out



Model	Band	Pre-amp	Input	Output	DC Pwr	Sale Price
B23	2M	No	2W	30W	5A	$ 79
B108	2M	Yes	10W	80W	10A	$159
B1016	2M	Yes	10W	160W	20A	$249
B3016	2M	Yes	30W	160W	17A	$199
C22	220	No	2W	20W	5A	$ 79
C106	220	Yes	10W	60W	10A	$179
C1012	220	Yes	10W	120W	20A	$259
D24	440	No	2W	40W	8A	$179
D1010N	440	No	10W	100W	20A	$289

RC-1 Remote Control for Mirage Amplifiers.....$24
MP-1 and MP-2 Peak-Reading Wattmeter.....$99

ASTRON POWER SUPPLIES

Heavy Duty - High Quality - Rugged - Reliable

- Input Voltage: 105-125 VAC Output: 13.8 VDC ± .05V
- Fully Electronically Regulated—5mV Maximum Ripple
- Current Limiting & Crowbar Protection Circuits
- M-Series With Meter—A-Series Without Meter

Model	'Cont. Amps	ICS Amps	Price
RS4A	3	4	$ 39
RS7A	5	7	49
RS12A	9	12	69
RS20A	16	20	89
RS20M	16	20	109
RS35A	25	35	135
RS35M	25	35	149
RS50A	37	50	199
RS50M	37	50	229

MODEL RS-50A



HAL Communications Sale!

CWR6850 $849!



CT2200
KB2100 $959!



CWR6700 Receive Only Telereader.....$439
CWR6750 Receive Only Telereader.....629
DS3100ASR Deluxe RTTY Terminal.....1699
MPT3100 Message Processor Terminal.....2199
RS2100 1" Scope w/Loop Supply.....289
ST5000 RTTY Demodulator.....219
ST6000 Deluxe Demodulator/Keyer.....649
DSK3100 Disc Storage Unit.....829
ARQ1000 Amtor Error Correcting Terminal.....649
KG-12 12" High Resolution Monitor.....169

YAESU FT-230R



List $359
Call For Your Special Price

YAESU FT-726R



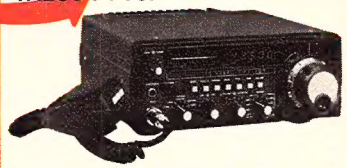
List TBA
Call For Your Special Price

KDK FM2030



SALE PRICE $269!

YAESU FT-707



List $699.95 Special Price $589

R.L. DRAKE



TR-7A Transceiver On Sale $1389!
Accessories In Stock - Call!
L7 HF Amplifier Only $969 (Less Tubes)
Eimac 3-500Z Tubes $199/pair

TEN-TEC SUPER SALE!







Corsair List $1,169
Your Special Price $1,029

Model 229...$259.00
Model 4229 Kit...$189.00

New Argosy
Digital Transceiver
List $599.95 Sale $539

ALL ACCESSORIES IN STOCK—CALL!

SANTEC

ST144μP Handie Talkie ON SALE! Only $279

IN STOCK FOR IMMEDIATE DELIVERY

- 142-149 995 MHz
- 3 5W/1W/ 1W Output
- 24 Hour Clock
- Liquid Crystal Display



OTHER SANTEC ITEMS

ST-440μP 440 MHz H.T.	$299
SM-3 Speaker Mic	33
ST-LC Leather Case	29
ST-6BC Base Charger	29
ST-500B3 Ni-Cad Battery	29

TOKYO HY-POWER LABS



Regular $69.95 SALE $59!
HL-30V 2 Meters, 2W In - 30W Out

OTHER TOKYO HY-POWER ITEMS

HL-82V 2 Mtr, 2-12W In - 35-85W Out.....$139
HL-160V 2 Mtr, 1-15W In - 160W Out.....299
HL-20U 440 MHz 1-3W In - 20W Out.....99
HL-90U 440 MHz 10W In-80W Out w/Preamp.339
HC-200 HF Ant Tuner w/Wattmeter.....89
HC-2000 Deluxe 2KW HF Antenna Tuner....299

AEA CP-1



Computer Patch Interface
List Price $239.95
Call For Special Price
On All AEA Products.

RF POWER LABS AMPLIFIERS

A1000 160-15 Mtr. KW w/AC Supply.....$1329
V76 6 Mtr. 8-15W In - 120W Out w/AC Supply...499
V360 6 Mtr. 5-10W In - 450W Out w/AC Supply..1189
V70 2 Mtr. 10-15W In - 90W Out w/AC Supply...499
V71 2 Mtr. 1-3W In - 90W Out w/AC Supply.....519
V180 2 Mtr. 5-15W In - 200W Out w/AC Supply...599
V350 2 Mtr. 10-20W In - 400W Out w/AC Supply..1189
Fan Kits and Rack Adapters Also Available—CALL!







JANEL QSA5 PREAMP $39!

QSA-5	$41	432PL	$53
PB-30	$21	PB144	$21
PB-50	$21	PB220	$21

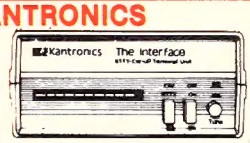
DAIWA CN-620B $111!
160/2 mtrs
20/200/2000 wts

BENCHER PADDLE
BY-1 Blackbase $39
BY-2 Chrome $49

MFJ MODEL 104 On SALE For Only $33!

202B Noise Bridge.....$54
250 2KW Dummy w/Oil.....31
260 300W Dry Load.....25
262 2KW Dry Load.....59
422 Keyer w/Paddle.....89
482 4 MSG Mem Keyer.....89
484B 12 MSG Keyer.....125
494 Keyboard.....249
496 Keyboard.....299
525B RF Processor.....109
624 Phone Patch.....59
901 300W Tuner.....54
940B Tuner w/Meter.....72
941C Tuner w/Meter.....79
949B Deluxe Tuner.....129
989 Deluxe 2KW Tuner.....289

KANTRONICS



THE INTERFACE Reg. $169.95 SALE $149.00!

OTHER KANTRONICS ITEMS

Mini-Reader	$239	Hamtext VIC-20	99
Mini-Terminal	259	Hamtext Model-64	99
Apple Hamsoft	29	Atari Hamsoft	49
VIC-20 Hamsoft	49	TRS-80C Hamsoft	59

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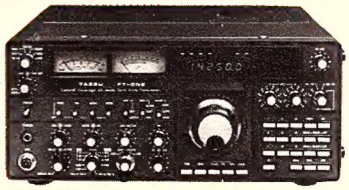
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YAESU SALE!



FT-ONE

GENERAL COVERAGE—ALL MODE DELUXE SOLID STATE TRANSCEIVER

Buy Now and Receive These Accessories Free:

300Hz CW Filter..$FREE	600Hz CW Filter..$FREE
800Hz CW Filter..$FREE	6Khz AM Filter..$FREE
Memory Backup..$FREE	Installation.....$FREE

List Price $3074. CALL FOR YOUR SPECIAL PRICE!
Quantities Limited — Hurry!

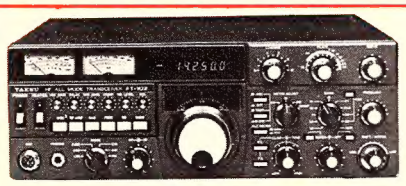


FT-980

CAT SYSTEM—Computer Aided Transceiver

- Wide Dynamic Range
- Low Noise Front End
- General Coverage
- 10Hz Digital Readout
- All Mode Transceive—CW/SSB/AM/FM/FSK!
- Full Break-in CW
- RF Speech Processor
- Variable Bandwidth
- IF Shift
- APF/Notch
- AC Power Supply
- Adjustable Noise Blanker
- 12 Internal Digital VFO's with Memories
- Much, much more—call or write for info

Computer Interface now in development—
Own Tomorrow's HF Transceiver—Today!!
Manufacturer's Suggested List Price $1499
Call For Your Special Price Today!!



FT-102

160-10MTR WITH WARC BANDS TRANSCEIVER

- Digital Readout
- Built-in AC Supply
- Variable Bandwidth
- IF Shift
- CW/SSB/AM/FM Modes
- RF Speech Processor
- Noise Blanker
- Much, much more—

List Price $1149—Call for Special Low Texas Towers Discount Price and Save $$$

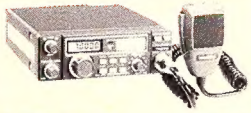


FT-77

New 80-10mtr Compact HF Transceiver

- Digital Readout
- Adj Noise Blanker
- CW/SSB/FM Modes
- CW Wide/Narrow
- Optional AC Supply, CW Filter, FM Unit
  External VFO, Antenna Tuner Available

List Price $599—Call for Special Low Texas Towers Discount Price and Save $$



FT-230R 2mtr FM.....$359
FT-730R 440Mhz FM.....$399

- 10 Memories
- Two VFO's
- LCD Readout
- 25W Out
- Memory or Up/Down Scan

Call today for Special Discount Price & Save $$



FT-726R
VHF/UHF
All Mode Tri-Band Transceiver

- 50-54 Mhz
- 144-148 Mhz
- 10 watts output on all bands
- 430-450 Mhz
- 21, 24.5 & 28 Mhz
  option available soon

Please Call For Price & Delivery Information



VHF/UHF Multimode Portables

FT-690R 50Mhz.....$379
FT-290R 144Mhz.....$399
FT-790R 430Mhz.....$399

Call today for Special Discount Price & Save $$



FRG-7700

All Mode Digital Communications Receiver .15 to 29.99Mhz—Receives SSB/AM/FM/CW, Built-in S Meter, Speaker, Noise Blanker, Timer, FM Squelch, AC Supply and More!

Manufacturer's List $499—Call today for Your Special Discount Price!!

FT-208R 2mtr HT.....$319
RF Out: 300mw/2.5W

FT-708R 440Mhz HT....$319
RF Out: 200mw/1.0W

- LCD Display
- 10 Memories
- Up/Down and Memory Scanning
- Complete w/Nicad Battery, Charger and Rubber Duck Ant



Accessories Available:

LCC-8 Leather Case	$35
YM24A Spkr/Mic	$39
FNB-2 Nicad	$29
NC-8 Base Chgr	$99

Call for Special Yaesu Discount Prices!!

**IMPORTANT — Prices shown are suggested by the Manufacturer.
You can Save Money with a Big Texas Towers Discount!
Call today for our Special Yaesu Sale Prices and Save $$$!!**

ETO ALPHA



76PA $1699



ALPHA 78

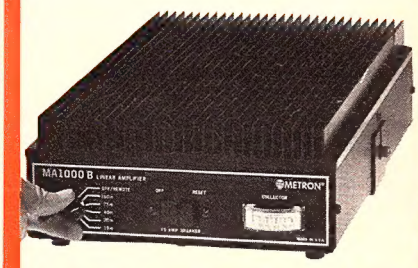


ALPHA 374A

SPECIAL SALE PRICES

Model	List	Sale
77DX	$5450	*
78	$3495	*
374A	$2595	*
76A	$1985	*
76PA	$2395	*
76CA	$2695	*

***Sale Prices Too Low To Print!!**
Call For Your Special Prices!!



METRON MA1000B AMPLIFIER

1 KW Mobile Or Portable!

- All Solid State—13.6 VDC Operation!
- No Tuning—Switch bands and Operate!
- Bandswitching can be Remotely operated to allow Trunk installation!
- Use separate battery and existing auto charging system for reliability!

There fine units in stock now at special price of only $895 delivered anywhere in Continental U.S.A.!—Call for yours!

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CIRCLE 137 ON READER SERVICE CARD

YAESU FT-726R TRIBANDER

NEW GALAXIES OF PERFORMANCE ON VHF AND UHF

FULL DUPLEX!!

TELLITES!!

SCATTER!!

!!!

EME!!



The New Yaesu FT-726R Tribander is the world's first multiband, multimode Amateur transceiver capable of full duplex operation. Whether you're interested in OSCAR, moonbounce, or terrestrial repeaters, you owe yourself a look at this one-of-a-kind technological wonder!

Multiband Capability

Factory equipped for 2 meter operation, the FT-726R is a three-band unit capable of operation on 10 meters, 6 meters, and/or two segments of the 70 cm band (430-440 or 440-450 MHz), using optional modules. The appropriate repeater shift is automatically programmed for each module. Other bands pending.

Advanced Microprocessor Control

Powered by an 8-bit Central Processing Unit, the ten-channel memory of the FT-726R stores both frequency and mode, with pushbutton transfer capability to either of two VFO registers. The synthesized VFO tunes in 20 Hz steps on SSB/CW, with selectable steps on FM. Scanning of the band or memories is provided.

Full Duplex Option

The optional SU-726 module provides a second, parallel IF strip, thereby allowing full duplex crossband satellite work. Either the transmit or receive frequency may be varied during transmission, for quick zero-beat on another station or for tracking Doppler shift.

High Performance Features

Borrowing heavily from Yaesu's HF transceiver experience, the FT-726R comes equipped with a speech processor, variable receiver bandwidth, IF shift, all-mode squelch, receiver audio tone control, and an IF noise blanker. When the optional XF-455MC CW filter is installed, CW Wide/Narrow selection is provided. Convenient rear panel connections allow quick interface to your station audio, linear amplifier, and control lines.

Leading the way into the space age of Ham communications, Yaesu's FT-726R is the first VHF/UHF base station built around modern-day requirements. If you're tired of piecing together converters, transmitter strips, and relays, ask your Authorized Yaesu Dealer for a demonstration of the exciting new FT-726R, the rig that will expand your DX horizons!

Price And Specifications Subject To Change Without Notice Or Obligation

CIRCLE 48 ON READER SERVICE CARD

YAESU

The radio.

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1.2 GHz!

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Now you can move out of the crowded 144 and 440 MHz bands into the wide spectrum of 1200 MHz because ICOM gives you the opportunity to explore the spectrum from 1260 to 1300 MHz . . . 40 MHz . . . with all the features found on popular 2 meter and 440 MHz rigs plus some:

Memories. Six memory channels plus 2 VFO's provide storage of most used frequencies in this wide band. Each memory allows memory of frequency, offset direction, offset frequency, and tone encoder frequency. Internal memory backup available.

Scanning. Scan the memories, scan all 40 MHz or program a segment to be scanned. All scanning has the option of scanning for a busy or open channel.

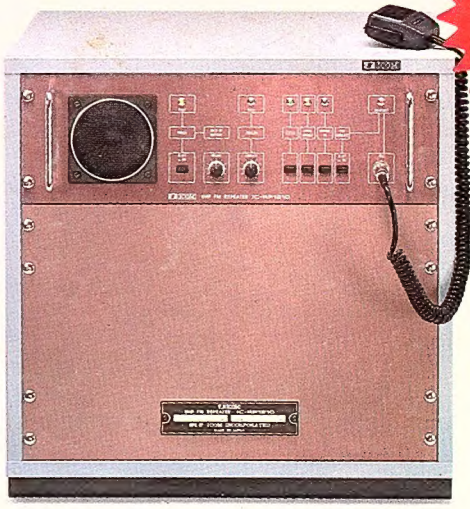
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The ICOM IC-120 gives you all of this plus a very quiet PLL circuit, with excellent signal to noise ratio, high sensitivity and a stabilized power amplifier to provide full power over its temperature and voltage ranges, and the IC-120 is small, only 2"H x 5½"W x 8⅛"D.



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- ID'er.

CIRCLE 132 ON READER SERVICE CARD

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All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emiss