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DX FROM A BALLOON

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10-METER EXCITEMENT

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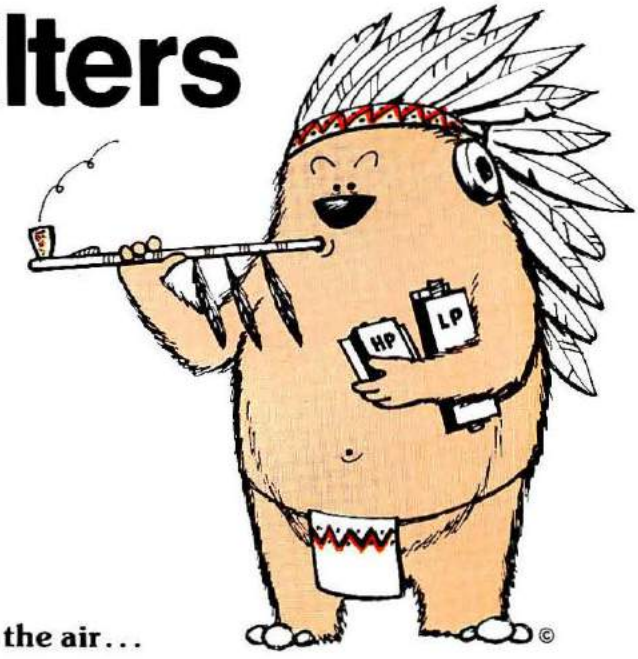
Drake TVI Filters

help you keep peace with your neighbors



Don't let your several-thousand dollar investment in a ham station sit idle because of your concern that you might ruin your neighbors' TV reception...

Drake TVI Filters can keep you on the air...

Although TVI/RFI is a complex subject, basically it has two forms: (1) Harmonics generated by the transmitter which fall on TV/FM channels. (2) Direct radiation from a strong fundamental signal directly into a nearby TV receiver. This is possible because strong signals at ham band frequencies can sneak around the tuned circuits in a TV and cause interference within the set. Even though the signal may be clean, direct radiation interference can occur as far away as several blocks, depending upon your power, antenna system, and the design of the TV.

TWO KINDS OF DRAKE TVI FILTERS:

"Low Pass" Filters will reduce or eliminate TVI caused by harmonics from amateur transmitters. All transmitters generate some harmonics which might be just strong enough to cause TVI. We believe every station should be equipped with a Low Pass Filter, designed to cut off at 41 MHz, the TV i-f frequency. Drake filters are down 80 dB at 41 MHz to provide maximum protection.

"High Pass" Filters are used to reduce or eliminate direct radiation interference at the TV set. There are less expensive High Pass Filters on the market for the TV set, but do they really work? Drake HP Filters provide 40 dB attenuation below 52 MHz; some others have measured at only 3 to 6 dB down.

The Drake "Peacemakers":

Drake TV-3300-LP

1000 watts max. below 30 MHz. Attenuation better than 80 dB above 41 MHz. Helps TV i-f interference, as well as TV front-end problems.

Drake TV-5200-LP

200 watts to 52 MHz. Ideal for six meters. For operation below six meters, use TV-3300-LP or TV-42-LP.

Drake TV-42-LP

For transmitters operating at 30 MHz and lower. Rated 100 watts input.

Drake TV-300-HP

For 300 ohm twin lead. New connectors for "no-strip" installation.

Drake TV-75-HP

For 75 ohm TV coaxial cable; TV type "F" connectors installed. Ideal for master antenna systems for apartments and condominiums.

Certain situations require both a Low Pass and a High Pass Filter to solve the problem, and Drake can provide both types.

Specifications and prices subject to change without notice or obligation.

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***ALL* VOX AND PTT FACILITIES** built-in; 3 VOX controls plus PTT control at front and rear jacks for external PTT switch.

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***ALL* FILTERS INCLUDED:** 4-position CW/SSB filter (150 Hz bandwidth with 3 selectable skirt contours) plus 8-pole Crystal filter (2.4 kHz bandwidth, 1.8 shape factor.)

***ALL* MODE SWITCH** puts all filters to work in any mode.

***ALL* BREAK-IN:** Instant or delayed receiver muting to fit any band condition or mobile operation.

***ALL*-VERSATILE OFFSET TUNING;** dual ranges, ±5 kHz range for off-frequency DX or ±0.5 kHz range for fine tuning.

***ALL*-SENSITIVE RECEIVER;** from 2 μV on 160 m to 0.3 μV on 10 m (10 dB S+N/N) for ideal balance between dynamic range and sensitivity.

***ALL* OVERLOADS HANDLED;** dynamic range typically exceeds 90 dB and PIN diode switched 18 dB attenuator also included for extra overload protection.

***ALL* LINEAR/ANTENNA BANDSWITCHING FROM FRONT PANEL;** auxiliary bandswitch terminals on back panel for external relays or circuits are controlled simultaneously by the OMNI bandswitch.

***ALL* INTERFACE JACKS FOR PHONE PATCH;** access to speaker and microphone signals.

***ALL*-LEVEL ADJUSTABLE ALC;** set output from low power to full, retain low distortion at desired drive to power amp.

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***ALL*-POWERFUL, *ALL*-WARRANTED FINAL AMPLIFIER.** 200 watts input to final. Proven design with full warranty for first year and pro-rata warranty for additional 5 years.

***ALL* 100% DUTY CYCLE.** For RTTY, SSTV or sustained hard usage.

***ALL*-MODE POWER:** basic 12 VDC for easy mobile use, external supplies for 117/220 VAC operation.

***ALL* FRONT PANEL MICROPHONE AND PHONE JACKS.** Convenient.

PLUS *ALL* THE OTHER HANDY BUILT-INS: "Timed" 25 kHz crystal calibrator in OMNI-A with automatic 5-10 sec. "on" time for easy 2-hand dial skirt adjustment . . . Zero-Beat switch for placing your signal exactly on CW listening frequencies . . . SWR bridge switches "S" meter to read SWR each time you transmit for continuous antenna monitoring . . . Separate receive antenna capability . . . Dual speakers for greater sound at lower distortion . . . Plug-in circuit boards for fast, easy field service.

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AND *ALL* THE OPTIONS: Model 645 Keyer, Model 243 Remote VFO, Model 248 Noise Blanker, Model 252MO AC Power Supply.

Model 545 OMNI-A $899 Model 546 OMNI-D $1069

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THIS MONTHS HORIZONS

Hot-Air DX Operating

No, no, it's not a long-winded rag-chew from far-away places, it's the next episode in the "Perils of West." Earlier, Gordon went into the oppressive heat of Death Valley to try 2-meter operation from that lowest of the lows, as reported in our January, 1979, issue. Now he takes to the skies, propelled by the breezes and suspended by hot air and a lot of fabric — a real sky-hook for his antenna. The trip was great, and the operating was fun; read about it on page 12.

Oscillators, And How They Do It

Does that oscillator circuit in the Novice study guide make as much sense to you as the subway diagram for lower Manhattan? Was that a snag you tripped over on your last try at passing your General Class exam? Maybe the name is implying more mystery than the circuit deserves. W1SL exposes the bare bones of oscillator circuitry, and shows you how to tell one from another, starting on page 18.

A Weekend In The Life Of An XYL

Being married to a ham is never dull — often funny (if the XYL isn't a ham), and somewhat mysterious. We invite you to share the experiences of the wife of a ham in California, where the weekend garage sale is popular.

Bean Pole Antenna

Wire antennas are simple to construct and easy to support — if you have trees, buildings, or poles at the right distances and facing in the preferred direction. However, not all locations — especially vacation spots — are blessed with such conveniences for the visiting ham. WB3DBG went shopping in his local garden-supply store and found the solution — simulated bamboo, of all things! The resulting antenna is versatile and light in weight.

Ten Meters — A Hot Band

The ten-meter band is more sensitive to the ups and downs of the sunspot cycle than is perhaps any other band in the lower part of the spectrum. When it's good, it's very, very good; and when it's closed for DX, it still has some interesting types of propagation. Author W8FX tells you what to look for and offers some suggestions for getting in on the activity.

Electro-Thumb

You've all heard of those irrepressible gardeners who can grow magnificient plants in a mixture of concrete chips, sand, and used coffee grounds? There's always been some suspicion that the same sort of "blessing" can be found in other fields of endeavor, and W0ROF confesses the horrible truth about what happens when a ham is one of those so blessed.

Amateur Radio = College Credits

There are many ways to earn credit toward a degree, but Amateur Radio? It can be done, as W8DUV illustrates in her wonderfully detailed article about how it worked for her. However, you'll not make the grade by simply cracking the pile-up for that rare station, for being at the top of the DX Honor Roll, or for keeping a daily schedule with the Good Old Boys Traffic and Coffee Net. You'll have to prove that you know your subject, and that the subject fits the requirements — but what a wonderful reason for getting (and using) your ham ticket!

Equipment Survey

Does your new rig do all that you expected it to? Would you buy it again? Here's your chance to speak out — to let the manufacturer, dealer, Amateur Radio newcomer, and the world in general, know what you like about the equipment, why you bought it, or how you think it could be improved. There's a report form following the introduction, so turn to page 57 and get started.

The Cover

This original painting by Tom Broscius, WA2RWA, captures some of the excitement and color of hot-air balloon launching. It's part of the story about working DX while floating through the air, as told by WB6NOA.

Correction

We goofed in naming that beautiful location and house on our June cover as being that of W0MTK. While Bill did send us the photograph, the spot belongs to friend Robert Davis, KB0DC (formerly WB0UJQ), in Grand Junction, Colorado. Sorry about that, Bob!

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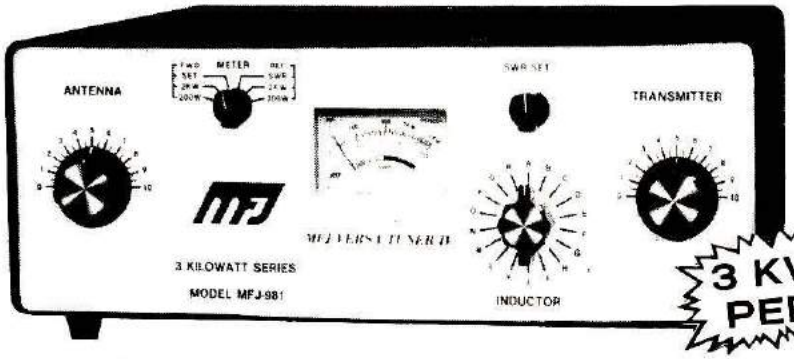
NEW MFJ-981 3 KW Versa Tuner IV

For $199.95 you can run up to 3 KW PEP and match everything from 1.8 thru 30 MHz: coax, balanced lines, random wires. Built-in balun, SWR, dual-range forward and reflected power meter.



3 KW PEP

Built-in balun, SWR, dual-range forward and reflected power meter.

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The NEW MFJ-981 3 KW Versa Tuner IV lets you run up to 3 KW PEP and match any feedline continuously from 1.8 to 30 MHz: coax, balanced line or random wire.

This gives you maximum power transfer to your antenna for solid QSO's and attenuates harmonics to reduce TVI and out-of-band emission.

An accurate meter gives SWR, forward, reflected power in 2 ranges (2000 and 200 watts).

A new all metal, low profile cabinet gives you RFI protection, rigid construction, and sleek styling. Black finish. Rich anodized aluminum front panel. 5x14x14 inches. A flip down wire stand tilts tuner for easy viewing.

Efficient, encapsulated 4:1 ferrite balun. 500 pf, 6000 volt capacitors, 18 position dual inductor. 17 amp, 3000 volt ceramic rotary switch. 2% meter. SO-239 coax connectors, ceramic feedthru for random wire and balanced line. Binding post for ground.

Every single unit is tested for performance and inspected for quality. Solid American construction, quality components. Full one year limited warranty.

For your nearest MFJ dealer, call toll-free 800-647-1800. Stop by your dealer. Compare it feature for feature with other tuners. Compare its value, its quality and its performance.

After a truly side by side comparison, you'll be convinced that its value, quality and features make it a truly outstanding value.

Why not visit your dealer today and see the NEW MFJ-981 3 KW Versa Tuner IV? If no dealer is available order direct from MFJ.

MFJ-982 3 KW VERSA TUNER IV has balun, 7 position antenna switch. Matches everything: coax, balanced lines, random wires continuously from 1.8 to 30 MHz.

- *7 position antenna switch*
- *4:1 ferrite balun for balanced lines*

$199.95

Flexible 7 position antenna switch lets you select 1 coax thru tuner and 2 coax thru tuner or direct, or random wire and balanced line.

Up to 3 KW PEP. Match any feedline from 1.8 to 30 MHz: coax, random wire, balanced line.

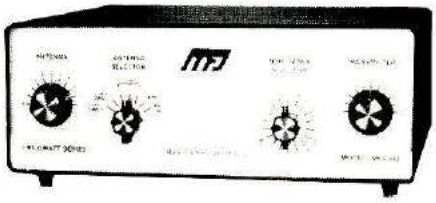
Gives maximum power transfer. Harmonic attenuation reduces TVI, out of band emissions.

Black metal cabinet, anodized aluminum front panel. Flip down wire stand. 5x14x14 in.

Encapsulated 4:1 ferrite balun. 500 pf, 6000 volt capacitors, 18 position dual inductor, 17 amp ceramic switches. SO-239 coax connectors, ceramic feedthru for random wire, balanced line, binding post for ground.

Made in USA. One year limited warranty.

See it at your nearest dealer. If no dealer is available order direct from MFJ.



If you already have a SWR/wattmeter, the MFJ-982 is for you.

MFJ-980 3 KW VERSA TUNER IV has built-in balun for balanced lines. Matches coax, balanced lines, random wires, 1.8 to 30 MHz.

- *Encapsulated 4:1 ferrite balun for balanced lines*

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Up to 3 KW PEP. Match any feedline from 1.8 to 30 MHz: coax, random wire, balanced line. Heavy duty encapsulated 4:1 ferrite balun.

Gives maximum power transfer. Harmonic attenuation reduces TVI, out of band emissions.

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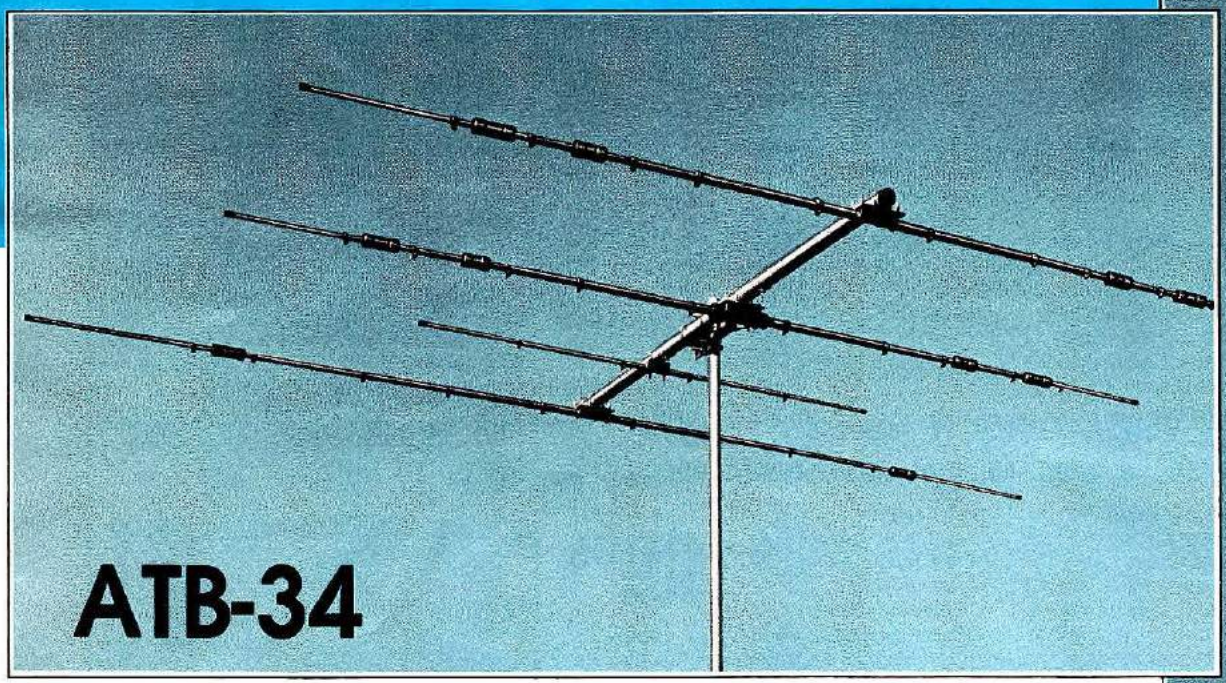

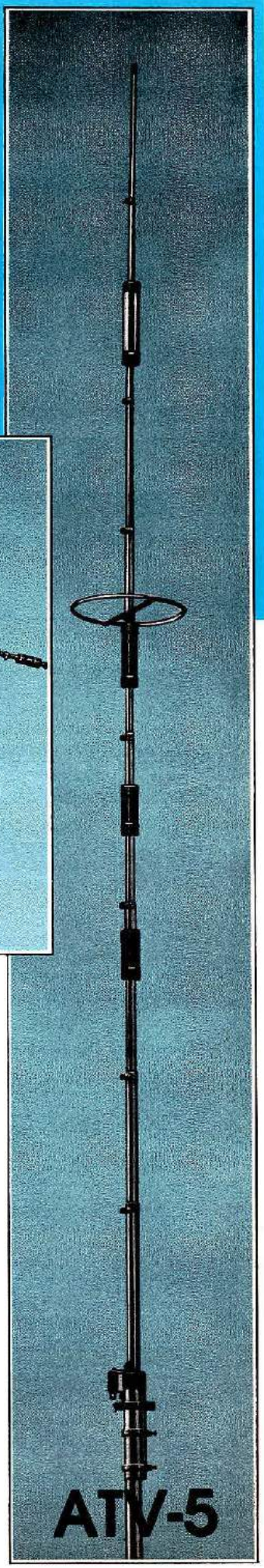

Punch through the pile-ups with an ATB-34. The only three band beam to give you real full size performance. Check ATB-34 element lengths, check the trap design and construction. Check the spacing and the specially developed balun. All of these features add up to the no compromise performance that you expect from Cushcraft.

SPECIFICATIONS

Gain	7.5dBd
F/B Ratio Avg.	24dB
3dB Beam Width	62°
Nominal Impedance	50 ohm
Power Handling	2000 Watts PEP
Boom Length	18'
Longest Element	32'8"
Turning Radius	18'9"
Wind Area	5.4 Ft.2
Weight	42 lbs.
Maximum Mast O.D.	2.5"

Cushcraft vertical antennas are designed to meet the exacting demands of your amateur radio station. They give top performance in easy to use packages. They can be installed at ground level or roof top.

Durability is guaranteed with double wall seamless aluminum base sections and fiberglass high Q traps. If you are interested in local contacts or long path DX communications, a Cushcraft vertical antenna is your best choice.

ATV-3
10-15-20 Meters
Height 13.8' (4.2mtrs.)

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10-15-20-40 Meters
Height 19.4' (5.9mtrs.)

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Height 24.4' (7.4mtrs.)

ALL MODELS
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HAM RADIO HORIZONS

July, 1979
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CONTENTS

Beginning with a small handful of amateur wireless operators in the early 1900s, the Amateur Radio population in the United States has grown to the point where it's now approaching 360,000. Last year the growth rate was about 8 per cent, down slightly from 1977, and this year it is expected to be about the same. And while *orderly* growth is healthy for the hobby, in many ways the Amateur Radio Service is like the proverbial "house that Jack built," with rooms added as they are required, with little thought to future construction — or indeed, to the esthetics of the architecture!

If you study the history of Amateur Radio, it's easy to understand why this happened; for years there were more licensed Amateur Radio stations in this country than all the other radio services combined, many top members of the FCC were hams, and the management ranks of most major radio-electronics firms were filled with licensed amateurs — many, in fact, began their careers as Radio Amateurs. With influential friends in high places who had a vested interest in Amateur Radio, most operators gave little thought to the future. The complexion of Amateur Radio has changed over the years, however, and it's obvious that we can no longer afford such a *laissez faire* attitude toward our future.

One matter that concerns many of the older hams is that in the past 25 years the character of Amateur Radio has evolved slowly away from being a technician's hobby, where much of the operating equipment was homebuilt, to an operator's hobby, where little or no technical expertise is required. This is not necessarily a problem because our activities are closely linked not only to a rapidly changing technology, but to a dynamic society that continually confronts Amateur Radio with new obstacles, challenges, and opportunities for providing useful public service. Nevertheless, more thought must be given to the impact of this trend on the long range future of Amateur Radio.

With a steadily increasing number of amateurs and greater government intervention in terms of changed licensing regulations, restrictive antenna covenants, and RFI requirements (not to mention WARC 79 and the proposed revision of the Communications Act), it's increasingly apparent that *all* of us must give some serious thought to where the Amateur Radio Service should be in the coming decade. While long-range planning is hardly an exact science, it is possible to anticipate some of the problems, to perceive certain distant opportunities, and to develop appropriate recommendations. If we put our collective heads together, we should be able to plot a positive future course for Amateur Radio — rather than drifting out of control as we have for the past few years, reacting to external events as they have occurred. Positive results, however, will require a substantial amount of effort on a continuing basis by a large number of concerned amateurs. Complaining about the current state of affairs or railing about the "system" in the press is neither positive nor constructive.

Those of you who have read my editorials in *ham radio* for the past eleven years know that I have pointedly avoided the politics of Amateur Radio. Therefore, when I suggest that a possible focus for future planning activities is the ARRL's Long-Range Planning Committee, you know that suggestion is not politically motivated. For those of you who are not members of the ARRL, the Long-Range Planning Committee was established by the ARRL Directors in January for the purpose of "reviewing and making recommendations concerning programs which the ARRL is and should be providing to its members and to the Amateur Radio Service . . ."

At its initial meeting in February the members of the committee, according to one of those present, agreed upon several criteria which would govern the committee's activities:

1. The general welfare of the entire Amateur Radio Service was to be served, not just parts of it.
2. No facet of the ARRL's operation was exempt from scrutiny.
3. A subject as complex and far reaching as the future of Amateur Radio cannot be properly appraised without inputs from many different people — *ARRL members or not.*

If *you* have any comments or recommendations about the future of Amateur Radio, make it a point to let the Long-Range Planning Committee (LRPC) have the benefit of your thoughts. A letter or card to Vic Clark, W4KFC (12927 Popes Head Road, Clifton, Virginia 22024), marked for the attention of the LRPC, will be acknowledged, and Vic will make sure that your comments are available to each of the members of the committee.

Jim Fisk, W1HR
editor-in-chief

Imagine All The Places You Can Tuck ICOM's Remotable IC-280. (Think small.)

The **IC-280** 2 meter mobile comes as one radio to be mounted in the normal manner: but, as an option, the diminutive front one third of the radio detaches and mounts by its optional bracket, while the main body tucks neatly away out of sight. Now you can mount your 2 meter radio in pint-sized places that seemed far too cramped before.

Measuring only 2¼"h x 7"w x 3⅜"d, the bantam-sized microprocessor control head fits easily into the dash, console or glove box of even the most compact vehicle. Or if those places are already taken by the rest of your "mobile shack," the **IC-280** head squeezes into leftover nitches under the dash, overhead, under the seat or even on the steering column.

But don't be misled by the petite size of this subdivided radio: the **IC-280** is jam packed with the latest state of the art engineering and convenience features. No scaled down technology here!

With the microprocessor in the detachable control head, your **IC-280** can store three frequencies of your choice plus the dial, which allows you to select from four frequencies with the front panel switch without taking your eyes off the road. These frequencies are retained in the **IC-280's** memory for as long as power is applied to the radio, even when power is turned off at the front panel switch. And if power is completely removed from the radio the ±600 KHz splits are still maintained!

The **IC-280** works frequencies in excess of the 2 meter band with ICOM's outstanding single-knob tuning, so you can listen around the entire band without fooling with three tuning knobs. With steps of 15 KC or 5 KC, the **IC-280** puts rapid and easy frequency change at your single fingertip and instantly displays bright, easy to read LED's.

Available Options:
- Touch Tone pad/microphone combination, which fits the mic plug on the radio face with absolutely no modification
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IC-280
2 meter FM, 4+ MHz
Mobile Transceiver

If you are a newly licensed novice, send for ICOM's catalog and discount purchase coupon. Mail your name, call sign and date of license to your ICOM distributor (see the bottom of this ad).

All ICOM radios significantly exceed FCC regulations limiting spurious emissions.

Specifications subject to change without notice.

IC-280 Specifications: ☐ Frequency Coverage: 143.90—148.11 MHz ☐ Operating Conditions: Temperature: −10°C to 60°C (14°F to 140°F), Duty Factor: continuous ☐ Frequency Stability: ±1.5 KHz ☐ Modulation Type: FM (F3) ☐ Antenna Impedance: 50 ohms unbalanced ☐ Power Requirement: DC 13.8V ±15% (negative ground) ☐ Current Drain: Transmitting: 2.5A Hi (10W), 1.2A Lo (1W), Receiving: 0.630A at max audio output, 0.450 at SQL ON with no signal ☐ Size: 58mm(h) x 156mm(w) x 228mm(d) ☐ Weight: approx. 2.2 Kg ☐ Power Output: 10W Hi, 1W Lo ☐ Modulation System: Phase ☐ Max. Frequency Deviation: ±5 KHz ☐ Spurious Output: more than 60 dB below carrier ☐ Microphone Impedance: 600 ohms dynamic or electret condenser type, such as the SM-2 ☐ Receiving System: Double superheterdyne ☐ Intermediate Frequency: 1st: 10.695 MHz, 2nd: 455 KHz ☐ Sensitivity: 1 uv at S+N/N at 30 dB or better, Noise suppression sensitivity 20 dB, 0.6 uv or less ☐ Selectivity: less than ±7.5 KHz at −6 dB, less than ±15 KHz at −60 dB ☐ Audio Output: More than 1.5W ☐ Audio Output Impedance: 8 ohms

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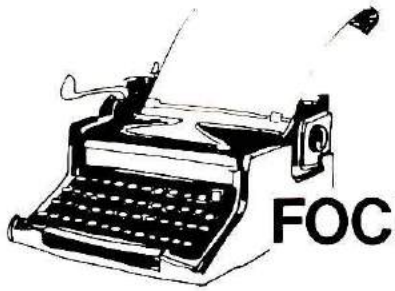

FOCUS & COMMENT

Being in the publishing business, I get to read more books, magazines, and letters in a year than most of you would suspect exist. With all of that input, it's easy for the "system" to become saturated, to reach a point where not much makes an impression. When I first saw the title of a new book on my desk just recently, my reaction was, "Oh, no, not another CBer's quide!" The title certainly follows the well-worn trend of many previous "guide to" books, but the first page of the first chapter caused me to turn to the second page, which led to the next . . . and before I knew it I has half-way through the book. The full title is "CB'ers Guide to Ham Radio," by George McCarthy, published by Van Nostrand Reinhold, New York.

Now, before you jump to a conclusion in the same manner that I did ("there he goes, trying to ram CB down our throats again"), hear me out.

How many times have you, as a "knowledgeable ham," tried to answer the question, "Which polarization is best for shooting skip?" Or, how do you explain repeater operation to a person you know is not acquainted with any of the technical jargon or ideas hams take for granted? How about this one. "Is the Novice written examination really tough? I hear that some of the questions are very technical, and I don't have much of a background in electronics." And, a real stickler, "Even though I can see that the hams got their frequencies legally and have had them for a long time, why not share a few of them with the serious CBer?"

These, and hundreds more, questions are asked and answered in this book. The author has done a commendable job in asking the right questions (in the form of a phantom guest), and in providing answers that really answer. It's not just an attempt to sell Amateur Radio to the CB crowd, but rather to provide real answers to real questions.

McCarthy is a long-time ham, licensed some 38 years, and obtained his CB license a few years ago. In answer to his phantom questioner as to why an old-timer was on CB, he replied "Communicating, isn't that what this radio stuff is all about?"

Just in case you still have not gotten my message, there are answers to questions that even some long-time hams might like to ask, such as how do you handle the situation when you're running a phone patch and the conversation suddenly turns commercial?

Speaking of going commercial — let me state emphatically that I'm not trying to sell books on this page. The fact that it can be obtained from our Bookstore is only a coincidence — I'd recommend the book from any source. (And, just to avoid answering a flock of letters or leaving you guessing about the price, it's $14.95). The real reason for telling you about this find is that it says so many things that need to be said, and in a clear and friendly voice.

Lest you expect more from the book than intended, let me point out that this is *not* a theory book, or a "how to" book. There are no highly technical sections in it. Some ideas do get a mildly technical explanation, such as the fact that the shortest path between two stations may not always provide the best signals. Also, the book does not provide pages of sample questions as a guide to passing an Amateur exam, although there are a few tips on how to be sure you have read the questions correctly. In short, it's just as though you and any non-ham sat down in your shack and engaged in a question-and-answer session over a few cool drinks or cups of coffee.

In fact, the book is so useful to the general public that I'll bet you could talk your nearby library into getting one. Then, when someone starts pinning you down about Amateur Radio (and he may not necessarily be a CBer), you can send them to a good source of information.

I know there have been hundreds of times when I needed a book just like this one. It's going to replace several less-than-satisfactory "CBer's guide to . . ." and "Introduction to . . ." books on my shelf. The next time a non-ham asks me a question, boy, is he going to get answers!

Thomas McMullen, W1SL
Managing Editor

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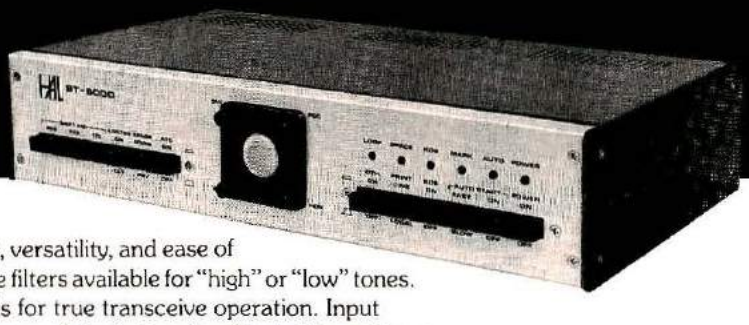

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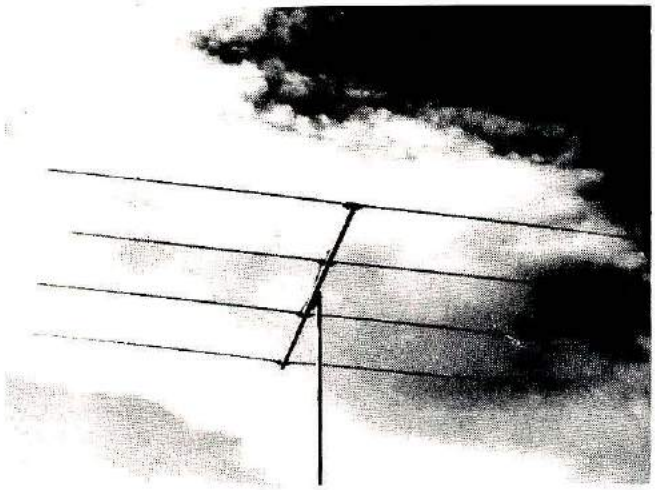

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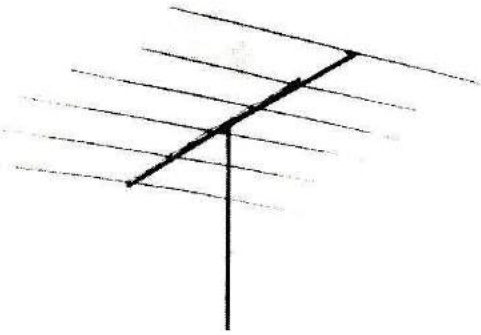

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NEWSLINE

PROPOSED AMATEUR HF allocations did not suffer as a result of the late maneuvering that delayed the submission of the high-frequency band portion of the U.S. WARC proposal. Still included in the U.S. position are an exclusive worldwide allocation of 1860-1900 kHz, with 1900-2000 shared; 3500-3900 exclusive with 3900-4000 shared; 6950-7250, exclusive; 10.1-10.2 MHz (new) exclusive; 14.0-14.35 exclusive; 18.068-18.168 (new) exclusive; 20.95-21.45, exclusive; and 25.11-25.21 (new) also exclusive. Other services were not as fortunate as the Amateur Service, however, as the final document sent to Geneva does show an increase in broadcast spectrum over that proposed in the FCC "final" report and order on WARC 79 as released in December.

A RESCUE AT SEA in which a 13-year old Torrance (California) Amateur starred, received extensive publicity in early May. Mike Davis, WD6FFV, was still up hamming at 1:00 AM when he heard a ZL trying to copy a distress call from the 75-foot fishing boat Carmen, in trouble 75 miles northwest of Jamaica with a hole in its hull. Mike, who was hearing the Carmen much better than the ZL was, joined the contact while telephoning the nearby Long Beach Coast Guard station.

Long Beach In Turn contacted Miami Coast Guard, but since neither had Amateur-band capability Mike remained the sole contact with the slowly sinking vessel. The three-man crew provided Mike with their approximate location, and the Coast Guard dispatched an aircraft with a pump, life raft and marine-frequency radio equipment. Later, the Boston based Cutter Sherman reached the Carmen, towing it into Montego Bay and safety.

Ironically, Mike, along with his dad (K6KAQ) and 15-year old brother Bob (WB6QNN), has been involved in a neighborhood feud over the family's "antenna farm." Needless to say, the family resolve to maintain their station was considerably stiffened by Mike's exploit!

OPERATING ABUSES by foreign-licensed U.S. citizens operating from shipboard, particularly in the Caribbean, are causing concern in the Latin-American Amateur community. A net that meets daily on 7268 kHz from 1100-1300Z, VP5SI (an American with a salvage-tug business) NCS, is causing much of the concern. Non-Amateur yachters are counseled as to how and where to get a "quickie" Amateur license so they can join the group, whose operations seem to include a lot of business-type conversation and phone patches.

Though Much of this activity is not only inappropriate to the Amateur bands but a violation of international regulations, not much can be done about it unless the governments of the offending licensees want to do it. In the meantime, however, U.S. Amateurs should be doubly cautious about the kind of traffic they accept from foreign-licensed maritime mobiles.

AMATEURS RECEIVED HARD KNOCKS in Reply Comments filed by the National Radio Astronomy Observatory and the Naval Research Laboratory on the proposed Virginia-West Virginia "quiet zone" (FCC Docket 78-352). In their very substantial filing the government representatives strongly took the ARRL to task for leading the Amateur community astray into a "party line" response. Words like "propaganda," "fiction," and "parrot-like" abound in the government's lengthy rebuttal. While acknowleding Amateur Radio has some value, the generally critical document was almost contemptuous in its dismissal of the efforts of those concerned Amateurs who made the effort to make their feelings known.

NOVICE LICENSES WILL CONTINUE to have five year, renewable terms, the Commission announced in early April. The Commissioner's reaffirmation of the new Novice privileges came in a denial of a request that the rules-change be shelved.

ST. VINCENT'S VOLCANIC ERUPTION in mid-April essentially destroyed conventional communications throughout the Caribbean island, as it left over 15,000 homeless. Amateur Radio immediately filled the breach, beginning when VP2s SQ, SHE, SAZ, SK, and others set up a communications center at police headquarters. Other Amateurs operating from police stations and relief centers throughout the island have since provided almost all communications for the hard hit nation.

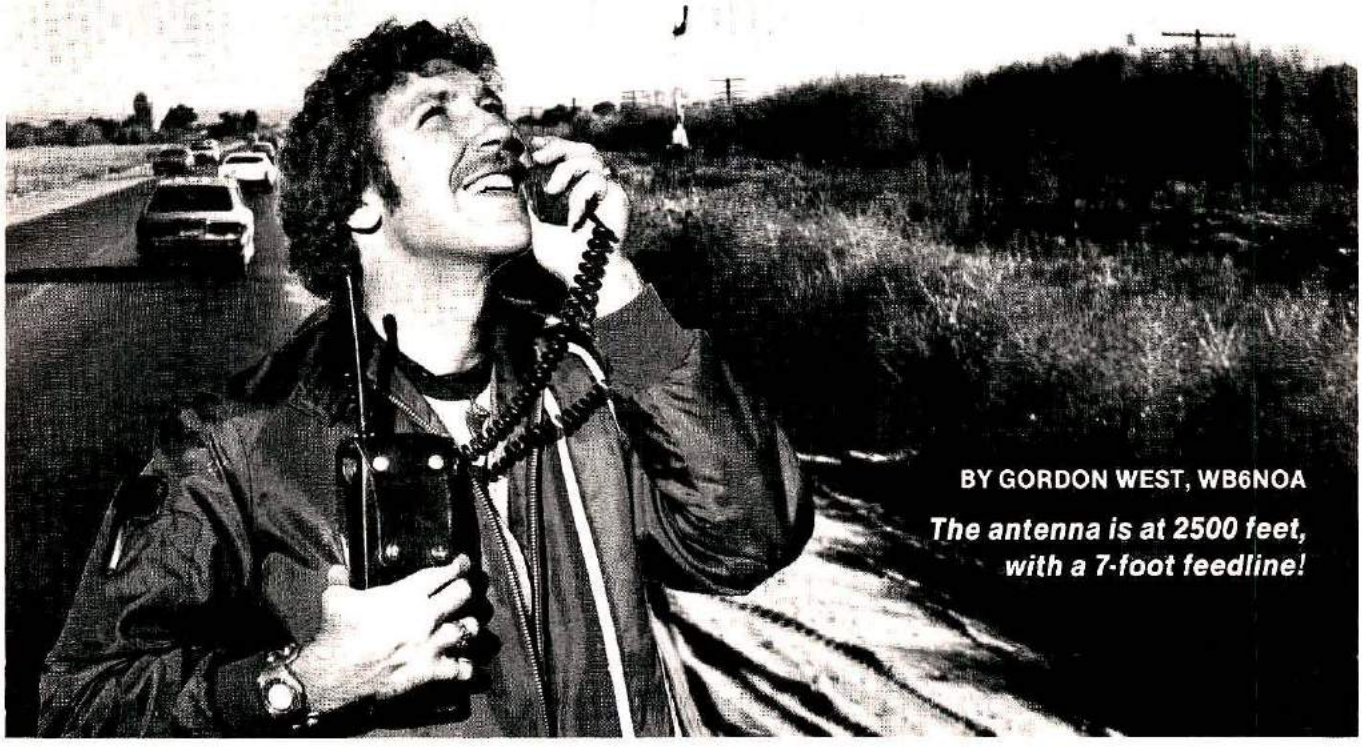
Island Premier Milton Cato requested help via KV4FZ, which was immediately forthcoming with three helicopter-equipped Coast Guard cutters, the Gallatin, Vigilent, and Dallas. Herb also requested an emergency okay for third party traffic from the FCC and State Department — it was granted in only 1½ hours!

Coast Guard And Military, along with Amateurs, all used the Amateur bands for essential communications — K5OPG/MM was on the Gallatin, while the other cutters (without licensed Amateurs) used their Coast Guard identification. C-130 transport planes from the Canal Zone brought in relief supplies, communicating principally on 40 meters.

Amateur Bands supplied inter-island communications, with 8P6AA and 8P6AH on a link operating between the embassy in Barbados and St. Vincent police headquarters, handling all the relief traffic with that near-by country.

AMATEUR RADIO GREW BY 8 PER CENT over the last year, according to figures from the FCC, which put the number of Novice hams at 64,063, with 68,881 Technicians, 119,389 Generals, 83,641 Advanced, and 22,742 Amateur Extras.

HOT AIR DX



BY GORDON WEST, WB6NOA

The antenna is at 2500 feet, with a 7-foot feedline!

Six months ago, Albuquerque, New Mexico, was the site of a gathering of 250 balloons. Hot air balloonists from all corners of the United States participated in this week-long event, taking their craft up, up, and away for early morning hours of fun.

The warm climate of Albuquerque, New Mexico, is just right for good 2-meter DX via tropospheric ducting — especially during early morning hours. A balloon ride with some 2-meter gear and an antenna might be an interesting experiment and a fun thing to do.

The first step in my adventure was locating a hot-air balloonist who would take me aloft with all my equipment. A wicker basket would contain both of us and the radio equipment, and take us up several thousand feet, using the two propane burners. Short "burns" would keep the air inside the balloon's envelope warm enough to provide lift, and soar to altitudes I had never known! About once every 45 seconds, 10 seconds of "burn" would keep us aloft. An altimeter and an envelope-temperature-gauge were the only instruments aboard our wicker gondola.

I decided to use an Icom 202 transceiver because of its portability. Fresh alkaline batteries were chosen over nickel-cadmium types because of their longer life, and because there was no facility for battery charging in a hot-air balloon. A KLM 16-element beam would be the antenna, fed with RG-8X 50-ohm coaxial cable. RG-8X is a very-low-loss cable which has about the same properties as RG-8/U, but is much smaller in size. Since the antenna was located just below the wicker basket, the coax run was a mere 7 feet.

An additional antenna was necessary for our balloon-to-chase-vehicle communications, and a half-wavelength whip was chosen. This particular antenna requires no ground plane, and

"From the looks of those flying objects, we must be getting close."

"And this is the IC-202. Test, 1, 2, 3, 4 . . . how copy?"

"Yes, I'd like a radio check, and what's this good buddy stuff?"

exhibited low SWR even though it was laced into the wicker of the basket. The chase vehicle was a pickup truck, equipped with an Icom 202 and a handheld fm rig.

We chose to operate on two frequencies — 144.2 MHz for possible DX signals, and 144.3 MHz for contact with our ground chase vehicle. Since the balloon travels at the will of the wind, a chase vehicle is necessary to pick us up after we have made a safe descent — avoiding, we hoped, the Indian cattle-ground territories. The Indians get a bit upset with Albuquerque balloonists who frighten their cattle as they silently glide overhead and then startle the animals with a sudden "burn" for more lift. Each time the burners are energized, the noise level inside the gondola rises to 120 dB or more. After the burn, the noise level is zero, and it's quite possible, at altitudes up to 500 feet, to hear people talking on the ground below. Since you are drifting with the wind, there is no sensation of any breeze at all.

DX schedules

Schedules with distant California stations were set up well in advance, with contacts planned for every 15 minutes in the early hours of the morning. A hot-air balloon ascends best just after sunrise, and ballooning is usually confined to a two-hour period before appreciable winds pick up over the desert. At 8:00 AM we began filling the envelope. This was no easy task, with a 16-element beam attached to the bottom of the gondola. Although a few of the elements were bent when a small gust of wind turned the gondola over before we got aboard, the inflation took place without too many problems.

With the captain and me aboard, we were ready. The ground crew let go, and, with both burners roaring, off we went.

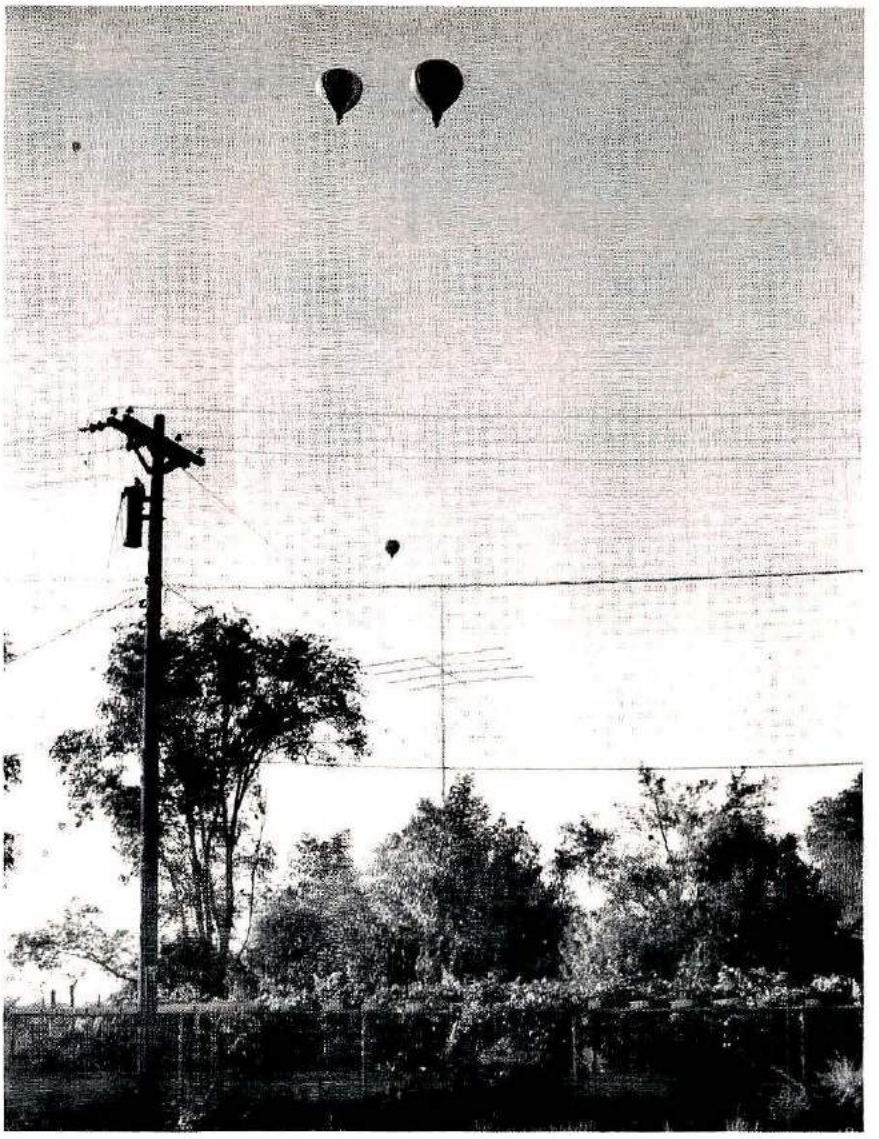
At 0815 hours, approximately 2500 feet up, I began to hear weak SSB signals calling us on 144.200 MHz. The horizontally polarized beam was maneuvered into the proper direction for southern California, and all at once signal levels increased enough to establish a two-way contact.

"No, I'm not ready yet, so hang in there."

A part of the balloon-ride scene is getting that giant bag ready for lift-off, and sometimes it takes all hands to keep it under control. Here's WB6NOA performing double duty, upper left, by communicating as well as holding the fabric up for a preliminary air fill. A fan forces air into the balloon, then the burner is lighted to provide some heat for lift. This balancing act continues until there is enough lift to keep everything upright, then there's a last-minute scramble to get everyone aboard.

"WB6NOA balloon mobile, this is WA6CAX — do you read, Gordo?" With only 2 watts of power at an elevation of several thousand feet, I was able to maintain contact with WA6CAX over a path of 500 miles. The signals were definitely being carried through a tropospheric duct, because if we soared above 3000 feet, transmission and reception were intermittent at both ends. Down at 2500 feet, the California stations could easily be heard. If we dropped to 2000 feet, the signals would once again disappear. We could access this tropospheric duct only at 2500 feet, where signals were at an acceptable level for single-sideband contacts.

Balloon-to-ground communications were a snap — we could see our chase vehicle, a four-wheel-drive pickup traveling over the sand dunes and bushes directly below. "WB6ORK, this is WB6NOA — you're going to have to turn left in just a few minutes because you're approaching a river — go about two miles south, and it looks like you'll be able to cross over without too much trouble." From our vantage spot, we could easily see and direct our chase vehicle to easier routes.



"Yeah, we're right over some ham station with a tri-band beam. He may be working DX, but we're having more fun!"

"Transmitter here is hand-held and air-cooled."

Five contacts

Although we were in the air only an hour, five stations were worked over distances greater than 400 miles. Elevation was not the answer — there was a definite maximum point of access to the tropospheric duct. As the sun rose higher, the duct appeared to drop. Finally, by 9:00 AM, all stations faded away, and we lost our "pipeline" into California.

Special QSL cards were sent out to each Amateur Radio operator who worked WB6NOA balloon mobile. Seconds before our touchdown, we cut loose our beam to allow it to fall to the ground. Although our landing was a bit bumpy — the basket was dragged several hundred feet before we could pull the lanyard to let the hot air out of the balloon — all the equipment was safe.

Amateur Radio operators looking for a new thrill in portable 2-meter DX should try balloon mobile — there are no words to explain what it's like to float along with the breeze, hearing nary a sound except for an occasional signal from miles away. **HRH**

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A radio signal has to start in an oscillator circuit, so you definitely have a "need to know"

BY THOMAS McMULLEN, W1SL

Before I became a Radio Amateur, I thought I knew about oscillators. After all, I had tuned many a transmitter in my Navy days, and it was a snap — set dial A to 34.9, turn on the "TUNE" switch, and adjust knob B for minimum plate current on the master oscillator. Next, tune knob C . . . etc.

The FCC exams of the day specified that you must draw a circuit diagram, and I lucked out — they asked for a neutralized-triode power amplifier. Those I knew about, because we had those in the Navy, too, and it was essential to know how to neutralize the beasts.

However, I met my Waterloo when I tried to build my first oscillator for my first ham rig. I built it "just like the book, except . . . ." It didn't work. I rebuilt, and rebuilt, and rebuilt. It didn't work. By the time I had gone through enough circuits to begin to see what was happening, or not happening, the original circuit was so out of date that I never did go back and try to make it work. But, I *did* learn about oscillators. (The next step was learning how to *stop* a circuit from oscillating, but that's a whole nuther story!)

So, here's the inside workings of oscillator circuits, presented in the hope that you'll have an easier time with them than I did, and that these words will be of some help when you find an oscillator circuit in a rig you're working on, or on your General Class (or higher) exam.

Amplifiers

No, no, I'm not off the track when I start talking about an amplifier circuit. It's just that, in order to understand what makes an oscillator work, you must first know about amplifiers. It is a fact of electronic life that an oscillator is simply an amplifier with positive feedback, *i.e.*, feedback that is aiding the original applied voltage. It is also true that, in order to sustain oscillation, an amplifier must have enough gain to overcome the losses in the circuit.

Tubes and transistors have a trait called, naturally enough, *amplification factor*. This is simply the amount by which a signal is increased as it goes through the device. You'll find a column listing the amplification factor in most vacuum-tube manuals and tables. The nearest equivalent listing for a bipolar transistor is the *beta* (β), or *current amplification factor*, sometimes expressed h_{FE} or h_{fe}. It's the ratio of base current to collector current. For example, if a transistor has a beta of 50, then 1 mA of current through the base would cause 50 mA of collector current to flow.

If you'll look at **Fig. 1**, you will see a representative ampli-

fier circuit with sine-wave drawings — one as an input signal, the other as the output. I've chosen arbitrary values to make the action easy to follow. Assuming an amplification of 10, a 1-volt input signal will produce an output voltage of 10. This is actually a variable dc voltage on the plate of the tube, caused by variations in plate current through the dropping resistor (R_p) to the plate. However, it will be interpreted by following stages (and an oscilloscope) as an alternating current (ac) voltage. (I suppose, if you really want to be picky about it, that it is an alternating-polarity voltage, because it swings both positive and negative with respect to a zero-reference point. However, convention says we've always called it an ac voltage; so be it.)

Phase

That plate resistor brings the discussion to another critical part of amplifier circuitry, which will require a bit of explanation so you can follow what is happening.

Note that the sine wave at the plate is upside-down compared with that at the grid. This is called out-of-phase. Here's why it happens that way.

The current that flows through the plate circuit of a tube is determined by the voltage on the grid. In **Fig. 2**, let's assume the tube has zero volts on the grid, and a plate current of 5 mA. This current flow through the plate resistor causes a voltage drop across it of 50 volts. This is called a "static," or nonmoving voltage; nothing is changing. Now, increase the grid voltage to +1 volt. A positive grid voltage causes more current to flow, which means that the dc voltage on the plate decreases to 40 volts. It's simple Ohm's law; $E = IR = 6\ mA\ (.006A) \times 10{,}000\ ohms = 60\ volts$. Subtract the voltage across the resistor from the plate supply, (100V − 60V) and you have 40 volts left.

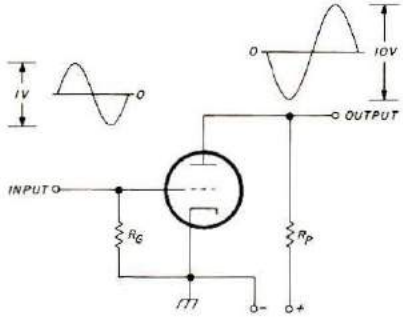


Fig. 1. An amplifier increases the amplitude of a signal applied to the grid. In addition to the increased strength (voltage) of the output signal, note that it is opposite in phase, that is, where the grid voltage goes in a positive direction, the output voltage is moving in a negative direction, and *vice versa*.

Okay, you can see that a positive voltage on the grid causes a plate voltage swing in the opposite (decreasing) direction, so let's try it for a negative voltage. Now, apply negative 1 volt to the grid. This causes less plate current to flow, which means that the voltage drop across the resistor decreases, allowing the plate voltage to climb back up, toward the positive supply voltage. Thus, you can see that the voltage on the plate always does the opposite of that on the grid (out of phase), while the current through the plate circuit follows the grid voltage, therefore is *in phase*. See **Appendix A** at the end of this article for further discussion of phase.

Feedback

Here's the trick that makes an oscillator different from an amplifier. For an amplifier to amplify, you must first give it a voltage to work with. Now, suppose you pried loose a bit of the output voltage and fed it back to the input, letting the amplifier supply its own input voltage to work on. Perpetual motion? Well, no, but self-sustaining . . . almost. As long as the gain of the amplifier is great enough to overcome any losses (resistors in the signal

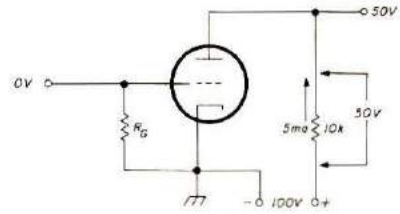


Fig. 2. For purposes of discussion in the text, an amplifier is set up in a *zero signal* condition, with zero bias on the grid, to draw a plate current of 5 milliamperes, causing the voltage drop across the plate resistor to be 50 volts. Changing the bias in either a positive or negative direction will cause a corresponding change in plate current and voltage drop across the resistor.

path, poor insulation, capacitance to ground), the signal will sustain itself, producing an output voltage, which is fed back to the grid, which produces an output voltage . . . on and on.

Just a minute! What's to keep the plate voltage from getting bigger and bigger and bigger? A thing called saturation, that's what. When the grid voltage gets negative enough to completely cut-off the flow of plate current; zero current through the resistor means a voltage drop of zero, and the voltage on the plate is now equal the supply voltage. That's as far as it can swing in that direction. When the grid is positive enough to cause maximum plate current to flow through the resistor, the voltage across the resistor is equal to the supply voltage, and the plate has zero voltage on it (well, almost zero — nothing is perfect). That's as far as it can go in that direction. At either of these two points, the amplifier is saturated; it just can't work any harder, and that's all you can get out of it.

Now, here is where things begin to get tricky: In order for the amplifier to oscillate, the voltage fed back to the grid must be in phase with what is already there. Think about it. If you have a negative voltage on the grid, causing the plate voltage to increase (in a positive direction), and take a

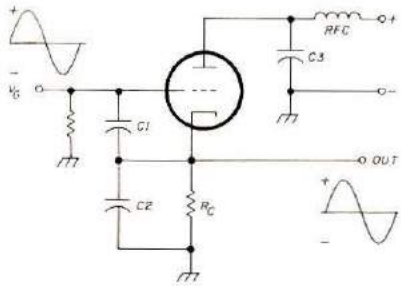


Fig. 3. One type of amplifier can be thought of as a cathode follower — the output voltage is taken from the cathode of the tube (or from the emitter in a transistor), and has the same phase as the input voltage. This feature, plus the two capacitors, C1 and C2, serving as a voltage divider, is particularly useful in one type of oscillator, as explained in **Fig. 4** and the text.

slice of that positive voltage and apply it to the grid, it'll immediately cause the plate voltage to decrease, thus turning itself off! Obviously, there's something missing here.

Reactance

That's the missing word; reactance. Now, don't get scared — it's not all that hard to understand. Reactance in an electronic circuit is pretty much the same as it is in people. It means you (or the circuit) react to a stimulus or input. The result of people reacting is often unpredictable; sometimes the action is delayed, sometimes it is the exact opposite of what was expected. Fortunately, electronic circuits are much more predictable, and they will follow the rules very closely.

Both capacitors and inductors have reactance — they oppose a change in the way things are. A capacitor causes the current to lead (go ahead of) the voltage. An inductor does just the opposite; current lags (falls behind) the voltage. Another term for what these gadgets do is phase shift — they shift the phase of the voltage or current with respect to each other. Does a spark of an idea begin to glimmer about here? How about connecting a capacitor between the plate and the grid of the tube? Introduce some phase shift, allowing the amplifier to keep itself going (oscillate).

Nope, it doesn't work. (You didn't really think it would be that simple, did you?) A capacitor shifts the phase by 90 degrees, and the plate is 180 degrees out of phase, which leaves the other 90 trying to turn the works off again. (Oh, yes, there are some circuits which will oscillate with such simple feedback arrangements, caused mostly by stray circuit defects — it's not always a dependable or predictable thing, however.)

Here's the secret: Get rid of that resistor in the plate circuit! Why? All it is doing is soaking up power, and keeping the plate at exactly 180 degrees out of phase with the grid. Put an inductance in there, or better yet, a tuned circuit (inductance and capacitance in parallel). Now, things can happen! The voltage at the plate end of the tuned circuit doesn't have to stay exactly out of phase with the grid, and if you detour a bit of the voltage and feed it back to the grid (through a capacitor with its 90-degree shift), you'll get the right kind of action through the circuit to keep the oscillations going as long as you feed power to it.

Improvements

This oscillator is pretty basic, and can stand considerable improvement. For one thing, because the plate voltage is deliberately misadjusted (with the tuned circuit) to be something other than precisely 180 degrees out of phase, it is inefficient. It also produces a lot of harmonics because of this slightly off-resonance condition. As the saying goes: "there's gotta be a better way."

There definitely is, and one of them is shown in **Fig. 3**. Note that the plate circuit now has a simple inductance in it — no tuned circuit at all. You could even put the resistor back in. That inductor, by the way, is called an rf choke (RFC). In combination with C3, it keeps any rf voltage that may be on the plate from getting into the power supply where it could cause trouble. Where's the feedback? Look at the cathode. It has a resistor connected to it, right? Note that the resistor is still in the path the current must take to get from the power supply through the tube, and back to the supply again.

That means that whatever goes through the plate also must go through the cathode, which means that the signal (a voltage change caused by varying current) will appear on the cathode too (as long as there is no big capacitor to shunt it to ground, that is).

So, just connect a capacitor from the cathode to the grid, and there's the feedback path again, you say? Golly, you're almost right. You've noticed that the phase is the same (the cathode voltage is in phase with the grid), so the feedback will help the amplifier, creating oscillations. Actually, there is no need to apply the entire cathode voltage to the grid — you would drive it into saturation right away. Let's use a voltage divider. Remember, capacitors have reactance, which appears to be resistance at radio frequencies. The larger the value of capacitance

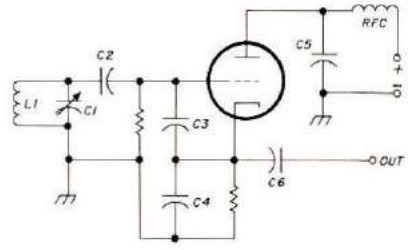


Fig. 4. In this oscillator, called a Colpitts, the feedback path is from the cathode to the grid, through C3. C4 helps limit the maximum value that the voltage can reach. The frequency of oscillation is determined by the tuned circuit L1/C1. The plate of the tube is at rf ground because of the bypass capacitor, C5. The rf choke prevents stray rf from getting into the power supply.

(bigger numbers), the smaller the apparent resistance (and vice versa). Two capacitors in series make a convenient voltage divider for rf energy, with C2 (in **Fig. 3**) shunting part of the cathode voltage to ground, and C1 feeding some of that voltage to the grid. This circuit is called a Colpitts oscillator, by the way, in honor of its inventor.

How does it know what frequency to oscillate at? Well, if you left it alone, it would work at whatever frequency was "fed back" the most efficiently, *i.e.*, with the correct amount of phase shift. Fortunately, it is easy to coerce (that's a polite word for arm-twisting) it into doing what we want — just connect a tuned circuit to the grid, as in **Fig. 4**. A tuned circuit appears to be a high resistance at its resonant frequency, but a very low resistance at all other frequencies. Any signal that was fed back to the grid, but not at the same frequency as the tuned circuit, would see what appeared as a short-circuit to ground. A signal at the proper frequency would face several thousand ohms to ground, and thus would reach the grid and be amplified.

If you change the value of the variable capacitor (C1), or the inductor (L1), or both, you'll change the frequency at which the combination is resonant, thus changing the frequency of oscillation; you've just invented a variable-frequency oscillator (VFO)!

Oscillator types

There are many different ways of providing proper feedback for an oscillator, and **Figs. 5** through **7** show some of the more common circuits. They travel by different names, usually based on the early experimenter who developed them. Some are called by different names in foreign countries because they, too, had plenty of experimenters and some of them worked on a particular circuit at the same time as Americans did. Some circuits are simply variations of a basic type, named after the guy who made a modification or improvement to the original. As an example, you might hear of a Clapp oscillator — in England it's called a Gouriet-Clapp oscillator — which is basically a modification of the Colpitts wherein the tuned circuit is arranged so that the capacitor and inductor are in series, rather than arranged in parallel.

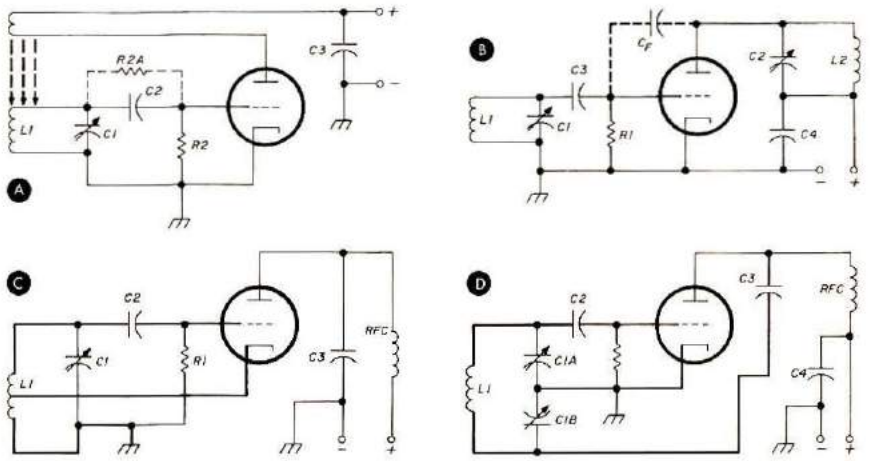


Fig. 5. Some representative oscillator types. The one at **A** is an Armstrong circuit, with the feedback path by means of magnetic coupling shown by the dashed lines between the top coil and the one to the grid. This small coil was called the "tickler," and in early receivers, the strength of oscillation could be adjusted by changing the position of the tickler with respect to the grid coil. Many circuits had the grid resistor, R2, positioned across capacitor C2 as shown by the dotted R2A — it was then referred to as a "grid-leak" resistor because it allowed a small amount of current to leak across the capacitor. Frequency of oscillation was determined by L1/C1. The oscillator at **B** is a "tuned-plate/tuned-grid" type, with the feedback path being mainly the internal capacitance from grid to plate of the tube. A Hartley oscillator is shown at **C**, with its characteristic tapped coil. The feedback path is shown in heavy lines, from the cathode, through the coil to ground. This induces current in the upper half, which reaches the grid. The Colpitts oscillator, at **D**, avoids the nuisance of a tapped coil by using the voltage-divider principle to control the amount of signal on the grid. Feedback is from the plate to the bottom of the oscillator coil.

Another version of the Colpitts is called a Vackar oscillator in some parts of the world, and a Vackar-Tesla in others. Many improvements or modifications were made in an attempt to obtain an oscillator that was more stable than the original.

At any rate, the object is to find the basic feedback path so you can identify the oscillator and understand what makes it work. The feedback is not always provided by capacitors, as you'll note in **Fig. 5A**, which is called an Armstrong circuit, and **Fig. 5C**, a Hartley circuit. The path in both is inductive, meaning that the magnetic lines of force around a coil of wire cut across another coil of wire, thus inducing a voltage across it. It's easy to follow in the Armstrong circuit, but perhaps not so obvious in the Hartley. The current from the cathode, through the lower portion of the coil, causes a build-up of lines of force, which cut across the windings above the tap point, thus providing some voltage on the grid.

Incidentally, if you're worried about remembering the names of some of these oscillators — it's not absolutely vital that you do, except as a means of impressing newcomers with your knowledge — a trick I've used is to say, "It's *hard* to tap the coil in a *Hartley*, but easy to *split* the capacitor in a *Colpitts*."

The Armstrong oscillator circuit saw a lot of use in the early days; it was a favorite for

regenerative receiver types, but is seldom seen in modern equipment.

The representative circuits I've shown here have the feedback path emphasized by heavy

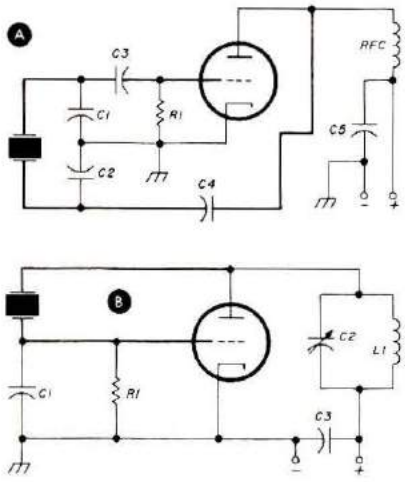


Fig. 6. Crystal-controlled oscillators use a quartz crystal in place of a tuned circuit. Shown at **A** is the familiar Colpitts circuit with the capacitors forming a feedback-control circuit. The Pierce circuit, **B**, is somewhat of a "brute force" oscillator, with the crystal connected directly from plate to grid. Some circuits use a capacitor in series with the crystal to keep plate voltage from appearing at the crystal socket.

lines in the drawings. Also, I have included a couple of circuits which are crystal controlled. A crystal is simply another means of selecting one particular frequency; it takes the place of a tuned circuit made up of a coil and capacitor.

One of the crystal-controlled circuits which has been a favorite among vhf enthusiasts for years is the Pierce, **Fig. 6B**. Note the crystal between the plate and grid of the tube. The crystal in this instance is providing the correct amount of phase shift, at the proper frequency, to allow the circuit to oscillate.

I've used tubes in the circuits talked about, mainly because it is a bit easier to follow the signal path and current flow with vacuum tubes. Some transistor circuits require tricky dc biasing circuits, and the feedback path is not always so obvious as with tubes. However, a transistorized Colpitts (note the split capacitor, C1a/C1b) is shown in **Fig. 7**.

Identification, please

All right, you've gone through some of the basic circuits, let's try to sort out a stranger. Look at **Fig. 8**. What is it?

It's crystal controlled; that's obvious. But, what is all that junk in the cathode circuit, and what are those extra grids doing there? And, what type of oscillator would you call it?

Okay, let's eliminate the forest and find a tree. There is a crystal from grid to ground, so that controls the frequency. There is a small capacitor from the control grid to the cathode, so it must be part of a voltage divider for feedback. So far, so good. How does C2 and C3 fit in? C2 is 0.001 μF, which represents 19.8 ohms at 8 MHz (the crystal frequency), therefore it is almost a short circuit for rf energy (see **Appendix B**). That means C1 is essentially connected to the top of C3, so there's the voltage divider. Aha! it must be a modification of a Colpitts. But, how about the resistor and rf choke? The resistor is in the current path through the tube, and the more current through it, the more voltage developed across it. If the voltage *across* the resistor becomes too high, the tube will not conduct (there must be an appreciable difference between plate voltage and cathode

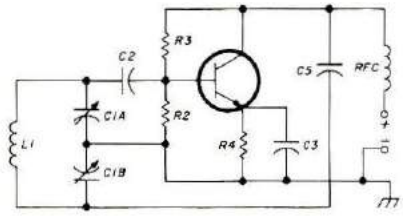


Fig. 7. In some transistorized oscillators, the type is easily recognized, as in this representative Colpitts circuit. Many of the more complex-appearing transistor circuits are really simple, but with extra components to take care of a transistor's bias, impedance, and current-protection needs.

voltage for a tube to conduct). That's it. The resistor is a biasing device, to protect the tube from overload. The rf choke seems to be a high resistance as far as radio

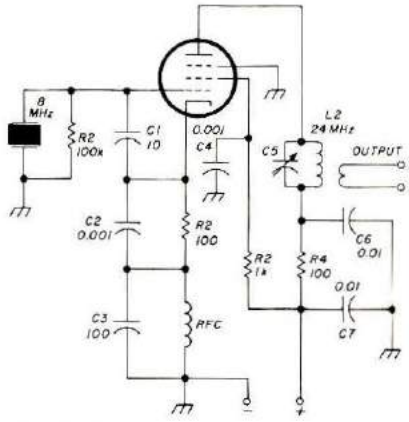


Fig. 8. This crystal-controlled oscillator has been a long-time favorite among vhf enthusiasts. It is an electron-coupled type, with the first stage of oscillation taking place in the grid/cathode circuit. The signal generated here is then coupled to the output (plate) circuit by means of the electron stream as it passes through the tube. Further details of this circuit are discussed in the text.

frequency energy goes, but is very low resistance for dc, therefore, it simply provides a dc path while letting the voltage divider (C1 and C3) handle the rf.

Okay, so far we have a modified Colpitts oscillator with cathode bias for the tube. The screen grid in a tube is there to provide some isolation between the control grid and the plate — it's sort of a shield to cut down internal capacitance. That capacitor, C4, is of the same value as the one in the cathode circuit, therefore it must provide a low-resistance path to ground for the rf signal, right? Yes, it does. The screen must be "cooled off" as far as rf is concerned, otherwise it will try to behave like a plate, and that leads to problems you don't even want to think about. That extra grid, near the plate, is called a "suppressor grid," and provides more isolation between elements.

The plate circuit — what is it doing? Well, first, it is supply-

ing a dc path to keep things going. Second, it has a tuned (resonant) circuit connected to it, and the circuit is working at three times the crystal frequency! It emphasizes the harmonic energy that is produced by the crystal-oscillator portion of the circuit, thus providing useful output on multiples of the crystal frequency. Because of the peculiar phase relationships that exist in a circuit of this type, it works out that the odd multiples are most emphasized. You can get useful output on three, five, seven, or nine times the crystal frequency. The higher the order of multiplication, the lower the power output, however. In practice, most circuits of this type are limited to a multiplication of either three or five.

So, there you have it. The oscillator is a modified Colpitts, with harmonic output at three times the crystal frequency. It has been used in many vhf rigs to obtain some of the frequency multiplication necessary for transmitters operating at 50 or 144 MHz. Oh, yes, just to cover the remaining unexplained components — R3 and R4 are in the circuit to provide a bit of over-current protection for the tube, and C6 and C7 bypass any stray rf energy to ground, keeping it out of the power supply wiring.

That's what oscillators are all about. It wasn't too difficult, really. Oh, of course there are any number of refinements that can be made to these basic circuits, but once you know what to look for it is easy to ignore the distractions. Note that I've left a lot of bias circuits and the filament (heater) connections out of the diagrams, just for clarity. These are just incidental to the operation of an amplifier with positive feedback — alias an oscillator!

Appendix A

The term "cycle" is another way of saying circle — returning to the point of start. When you push a person on a swing, you start a cycle with a push, the swing moves away, goes through an arc, swings back toward you, and you give it another push. That's one complete cycle. Electrical (and electronic) terms use degrees around a circle to keep track of the exact position of a voltage or current as it goes through a cycle, see **Fig. 9A**. The importance in being in phase or out of phase can be seen in **Fig. 9B**. Sine wave **X** starts at the zero-voltage point, moves toward the positive side, then negative, and completes a cycle. If you start sine wave **Y** just a bit later, it is said to "lag" sine wave **X** by 90 degrees. In an extreme case, sine wave **Z** is started after **X** has already completed half of its cycle — **Z** is going positive at the same time **X** is going negative, therefore **Z** "lags" **X** by 180 degrees. The two voltages cancel each other, and the net result is zero, assuming that both are of equal strength.

Appendix B

Capacitors have reactance (resistance) to alternating current energy, and it varies with frequency, that's why you cannot buy a "1-ohm" capacitor, as you can with resistors. The formula for calculating capacitive reactance is:

$$X_c = \frac{1}{2\pi FC}$$

Where F is in megahertz (MHz) and C is in microfarads (μF).

To work out the reactance of C2 at 8 MHz in **Fig. 8**:

$$X_c = \frac{1}{6.28 \times 8 \times 0.001}$$

$$= \frac{1}{0.05024} = 19.9 \text{ ohms}$$

The reactance of C2 at the output frequency, 24 MHz, is:

$$X_c = \frac{1}{6.28 \times 24 \times 0.001}$$

$$= \frac{1}{0.15072} = 6.63 \text{ ohms}$$

You can see that this valuable feature of reactance dependent upon frequency allows you to play all sorts of games with the circuit. Radio-frequency energy can be led through a circuit just the way you want, simply by providing a series of high- or low-resistance paths for it.

HRH

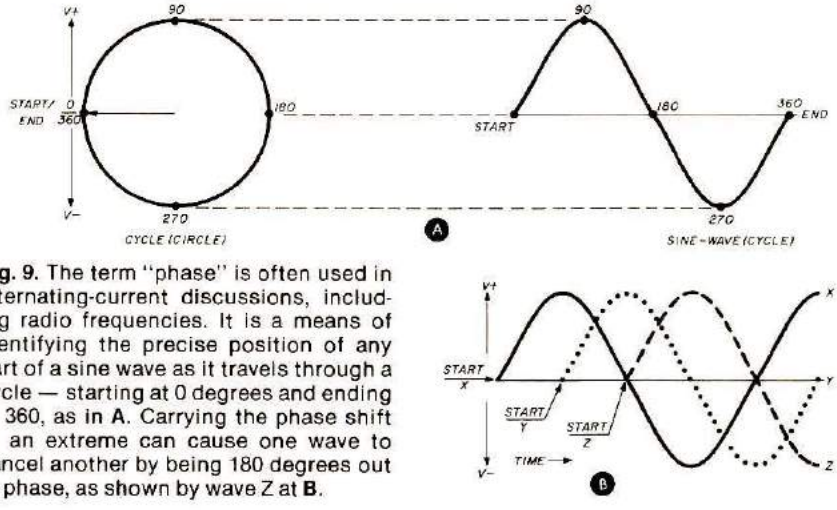
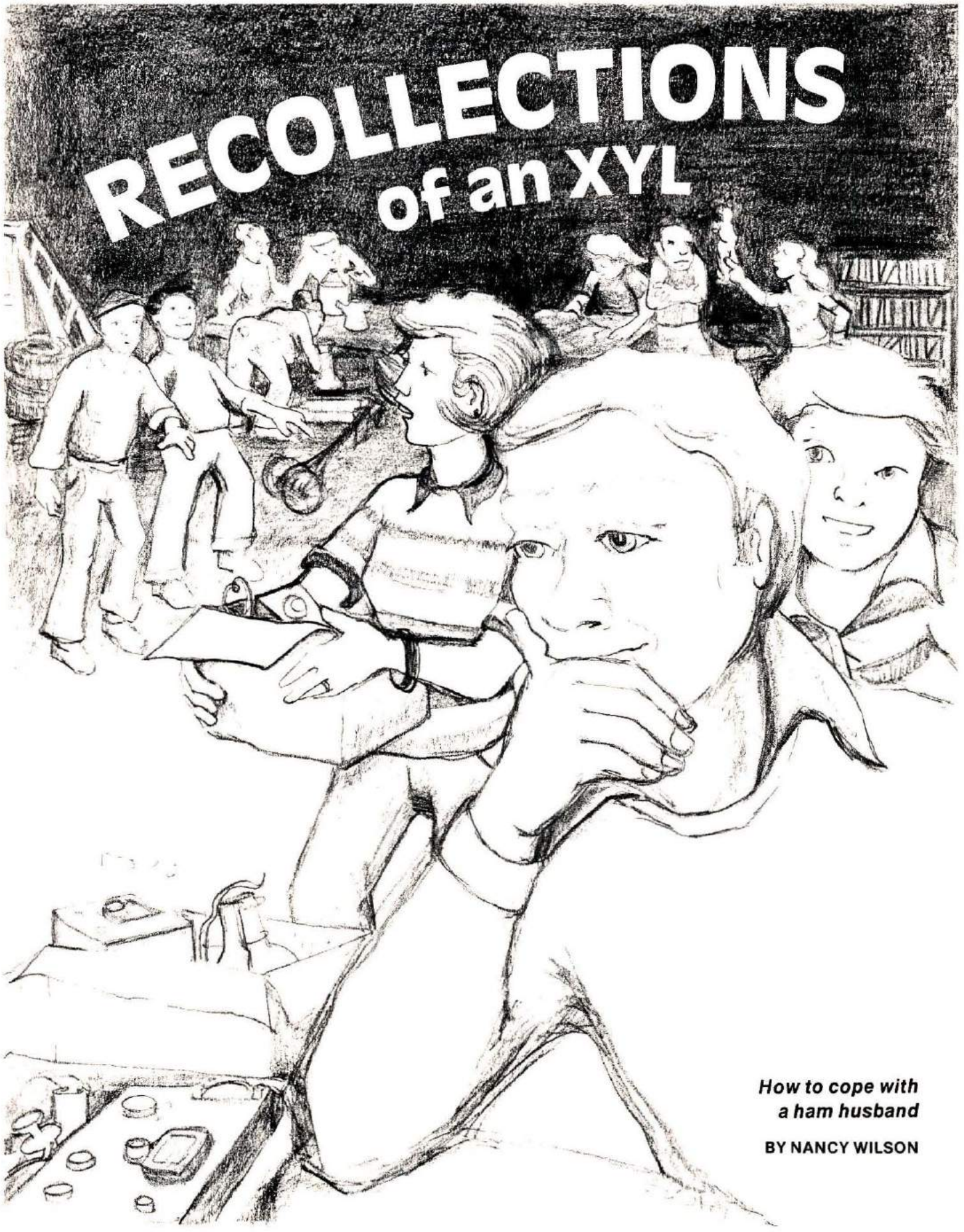


Fig. 9. The term "phase" is often used in alternating-current discussions, including radio frequencies. It is a means of identifying the precise position of any part of a sine wave as it travels through a cycle — starting at 0 degrees and ending at 360, as in **A**. Carrying the phase shift to an extreme can cause one wave to cancel another by being 180 degrees out of phase, as shown by wave Z at **B**.

RECOLLECTIONS of an XYL



How to cope with a ham husband

BY NANCY WILSON

If you're the wife of a radio ham you have to make certain adjustments. You must resign yourself to the fact, that on one night a month, your house is not your own. I'm referring to the night of the "club meeting." On this one night you may as well forget the usual routine in your home and face the fact that your ham husband is hosting a meeting for his ham friends. Your job: coffee chef. Sometimes you must postpone certain household chores, such as running the washing machine (it creates noise). At other times, often in the middle of the night, you might be awakened by the telephone. "Lower Kumupistan is coming through on 20 meters, OM!" Adjustments!

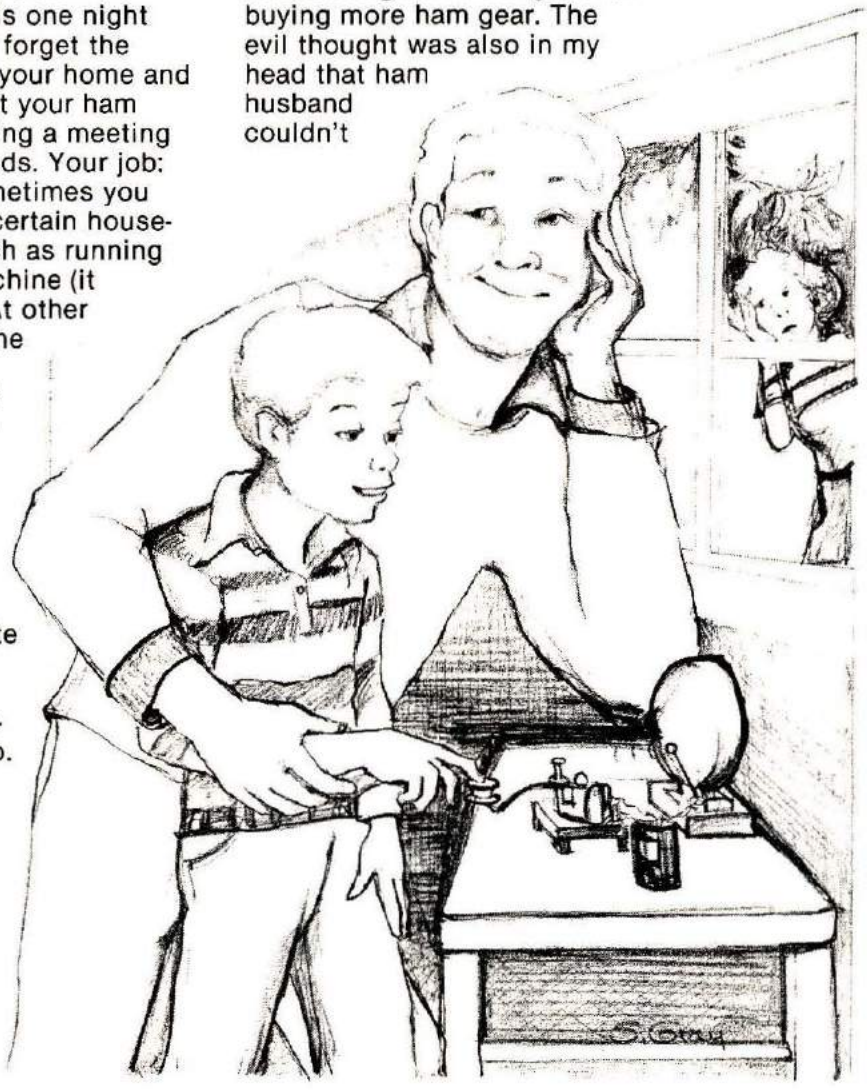
I'd like to relate an episode that occurred at our house one weekend not long ago. Perhaps other non-ham wives will gain some insight as to how their ham husbands think and act. It's part of making adjustments.

Friday morning

Last weekend we had a garage sale, or what I prefer to call a recycling sale (we didn't want to sell our garage). In a garage sale, you accumulate everything you don't want and set up shop in your front yard, or in the garage if it's raining. Several other people and I collected things for six months; all items were stored in my closets. I wrote a lengthy advertisement for the local paper and included ham gear in the ad. There were two motives. First, I thought that the ham I'm married to could unload some of his junk. Second, I figured hams would come to the sale and buy some of the other stuff offered to take an edge off their guilt for buying more ham gear. The evil thought was also in my head that ham husband couldn't immediately turn around and trade or buy more stuff from other hams.

On Friday morning we moved out all the broken cuckoo clocks, rusty bird cages, chipped, lidless pots, and tired-looking Christmas ornaments — but no ham gear.

"Honey," I said, "You can't let your buddies down. Where's all your ham gear?" Honey said, "Later."



"This combination created an ear-shattering noise that could be heard blocks away. The boy hung around the shack clanging loudly."

People arrived in hordes. We started putting out stuff at 6:30 in the morning; the sun was just coming up. At 7:00 there was a traffic jam on our street. Incredible! People swarmed across our front yard and bought things: small appliances without cords, junk, junk, and more junk.

Out of the corner of my eye I saw my husband eye-balling (a ham phrase I picked up) the scene. I could almost read his mind. Lights flashed! "Wow!" he said, "I guess I don't really need that old receiver or the dipsy meter." Earlier he'd said, "Who's gonna buy all my castoffs?"

"You'll see," I'd said, "They will."

As I was trying to make fast change for a $20 bill out of quarters, I noticed Honey hauling his equipment out of the garage. A strange look was on his face — almost euphoric. He arranged the gear neatly over in a far corner of the lawn, away from the mob scene.

The hams arrive

Later in the day the hams came. For me it was an interesting lesson in human behavior. The hams circled the tables, looking bored. Finally one said,

"You advertised ham gear?"

"Over there," I said, pointing to Honey, who was hovering

over his ham gear as if it were his first child (maybe it was).

A separate little group formed around the ham gear display. I resisted the urge to dash out for donuts and coffee. All ham meetings and swap meets serve them, right? The hams eat donuts and talk their arcane jargon. I don't know of any other group of people who use letters and numbers for their given names. Ham meets ham. Each puts out his hand, and says, "Hi. PB4ICU here. What's happening on 40?" Forty what? Sounds like Big Brother talk to me. But I'm adjusting.

Honey plays Elmer

You know what an Elmer is. An Elmer is a ham who helps a newcomer get his ham ticket (license, that is) by offering help with code practice and radio theory.

Our neighbor's 10-year-old boy joined the group. His allowance and lawn-mowing money were burning a hole in his jeans. He spotted something that appealed to him, but he didn't know what it was. On one of the tables Honey had placed an old straight key and an alarm bell. He explained to the little fellow that both could be hooked up to a battery and used as a code-practice set — something to help learn Morse code, which is required for a ham ticket.

The little boy expressed a real interest, so my husband took the boy and the code- practice stuff into the garage/ham-shack and hooked it up to a big battery. This combination created an ear-shattering clanging noise that could be heard blocks away. The little fellow didn't go home; he hung around the shack, clanging loudly. My husband even took 15 cents of the boy's hard-earned money for the contraption.

At this point I'd decided to stop calling Honey "Honey." But everything worked out okay. My husband substituted a small door-bell buzzer for the alarm bell, and, believe it or not, the neighbor boy was well on the way to learning the Morse code. I must say, however, the clanging alarm bell probably brought more customers to the garage sale.

My day was complete when one of the little old ladies wandered over and said to me, "My dear, I noticed all the antennas on your roof and that big one in your back yard." She pointed to the tower with the yagi beam on top. "Can you get Channel 13 with that?" I didn't tell her what the antennas were. Honey says it pays not to advertise ham antennas.

Later that night we were eating Chinese food that we had picked up from a local restaurant. We talked about our day.

Honey said, "Wasn't it fun? Let's do it again."

I opened a fortune cookie. The message said, "Practice what you know and you shall attain perfection."

Honey opened his fortune cookie: "Sell ham gear and you will find true happiness."

As a non-ham XYL, I'm adjusting.

HRH

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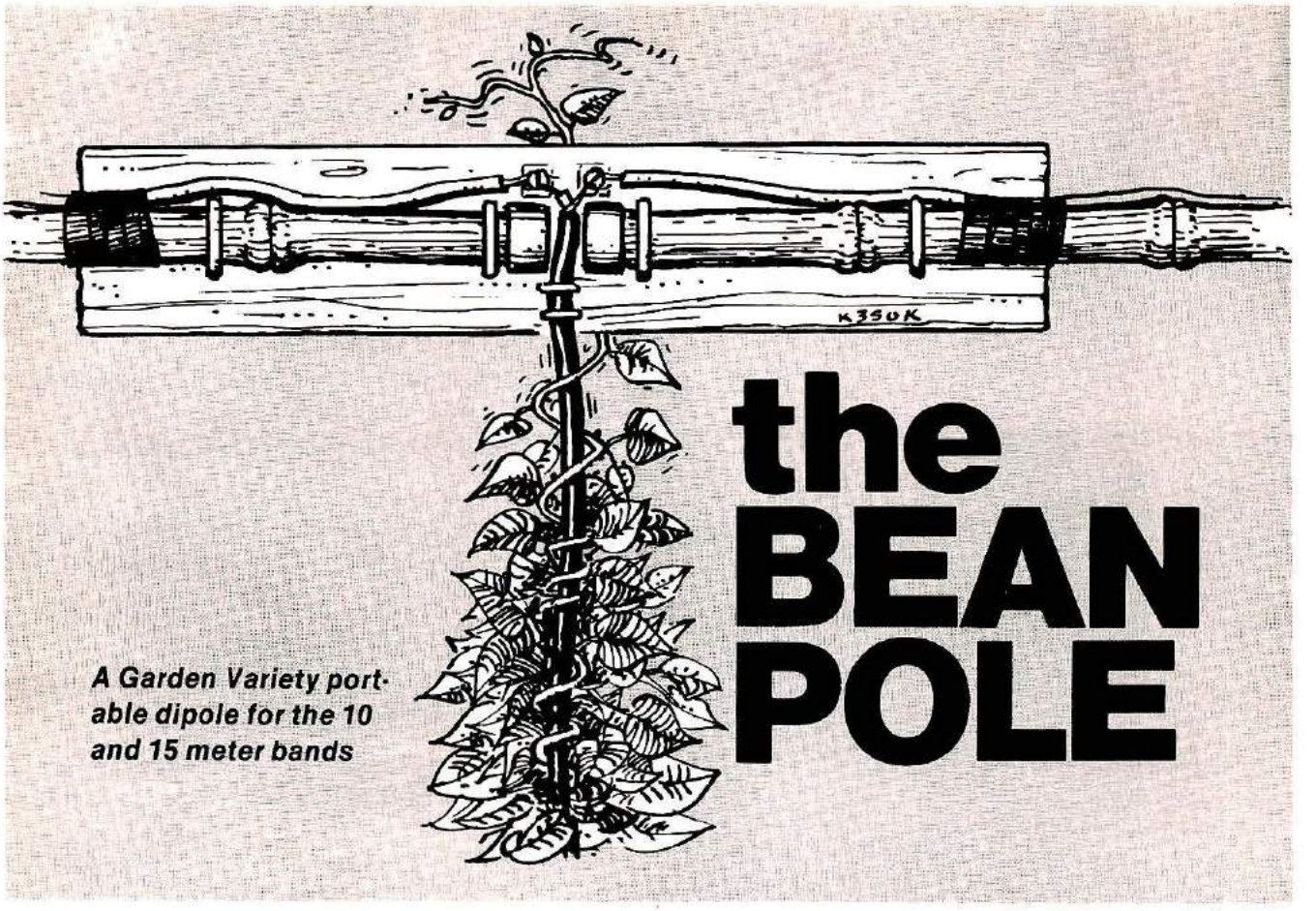


the BEAN POLE

A Garden Variety portable dipole for the 10 and 15 meter bands

BY DAVID OREM, WB3DBG

This is either an article on how to build a portable dipole for the 10- and 15-meter bands, or a recommendation for Rehoboth Beach, Delaware, as the best DX location on the East Coast. Regardless of the reason, this garden-variety portable dipole put out a signal that enabled me to make European contacts, some W5s, W6s, and a whole bunch of W0s, from a balcony overlooking the boardwalk at Rehoboth Beach on the weekend following Thanksgiving. The U.S. contacts were to be expected, I suppose, although a 599 report from a W6 is better than I get at home. What impressed me was the 459 signal report I got from I0YWK in Rome, Italy, on my first try. That was on Friday morning. Early Saturday, DF1RB in Munich, Germany, gave me a 559 report, and that was followed by another 559 from PA0LHM in the Netherlands. At that point, I figured I might be on to something.

The need

To start with, the objective was to build a rigid dipole that could be transported on a car-top carrier, be easily assembled in the field, and would require a minimum of effort to erect under a variety of conditions. It had to be insulated so that contact with tree branches, balcony railings, or other supports, would not interfere with performance. The conventional copper-wire dipole between two insulators is fine, but it requires traps to work on more than one band, and a clear space between two tall trees to get it up in the air. Finding two trees the proper distance apart isn't always easy, and traps are getting expensive. The "Bean Pole" is cheap, it's rigid, and it travels almost anywhere.

The idea was to use a multi-conductor antenna wire, taped to a rigid spreader, without using guy wires to keep it from sagging at the ends. The conductor was easy. I happened to have some left-over cable from an old-style intercom system. It has five insulated wires inside a plastic outer covering. Five-conductor rotor control cable should work well too. It may be that simple lamp wire will also do the job, but with that you get only two conductors, and there is an advantage to having at least four, as I will explain later.

Support

The next step was to find something rigid and lightweight for the spreaders. I didn't want to use electrical conduit or conventional aluminum tubing because of the possibility of shorting the radiator to the spreader at some point, and because it has a "roof top" look about it that is not always compatible with the environ-

ment in the field. I wanted it to look more like a surf caster's fishing pole extended in hopeful anticipation. The obvious material — tapered fiberglass fishing-pole stock — is prohibitively expensive for this purpose. Bamboo is a possiblity, but the ends droop and it has a tendency to split. Any solid material, like wood poles, would be much too heavy.

While poking through the garden-supply section of a neighborhood hardware store, I found a display of what looked like green bamboo poles in uniform lengths and sizes, known as *A.M.I. Lifetime Stakes*. They are available from 2.4 meters (8 feet) down to 91 cm (3 feet). They are covered in green plastic, complete with simulated bamboo "knuckles" every foot or so, and the ends are closed with a green plastic cap. Just the thing! For less than $7, two 2.4 meter (8 foot) poles and two 1.2 meter (4 foot) poles went home with me. On closer inspection, the longer poles turned out to be steel tubing encased in plastic; they are sold to the gardener as garden poles or stakes for training plants like tomatoes, beans, and the like, or for staking flowers. Being wrapped in green plastic, they won't get hot in the summer sun and are impervious to rot — and they look nice too. Hence the name of my antenna, the Bean Pole.

I cut through the plastic cap on one end of the 2.4-meter (8-foot) pole, and found that I could insert the end of the 1.2-meter (4-foot) pole through the cap and into the longer pole, up to the first knuckle. This done, the two were joined by drilling through both and securing them with a sheet-metal screw. The screw goes all the way through both poles, and the point is filed off to prevent snags. The small irregularity that remained where the short pole passed through the plastic cap was sealed with epoxy to keep water out. This gave me a spreader arm about 3.45 meters (11 feet six inches) long, and with two in combination, I had a spread distance of 6.9 meters (23 feet) — more than enough for the CW band on 15 meters.

It remained then, to devise some kind of mounting board for the center where the two spreaders came together. I wanted the hardware to be as simple as possible, but strong enough to hold the poles straight out without breaking. Wasting no time on fancy solutions, I used simple U-bolts through a piece of pine board about 53 cm (21 inches) long. The U-bolts fit over the poles with enough clearance on the other side of the board to thread on the nuts and washers.

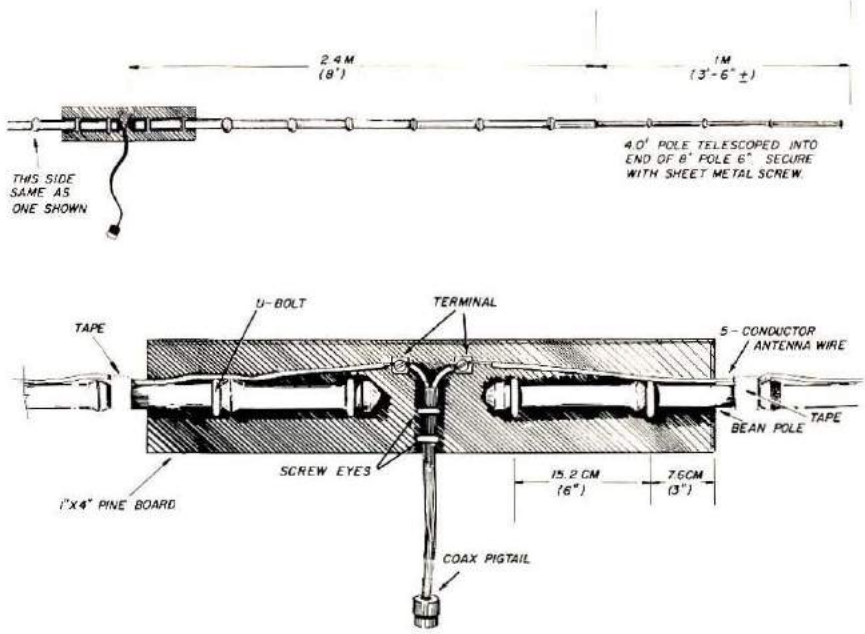
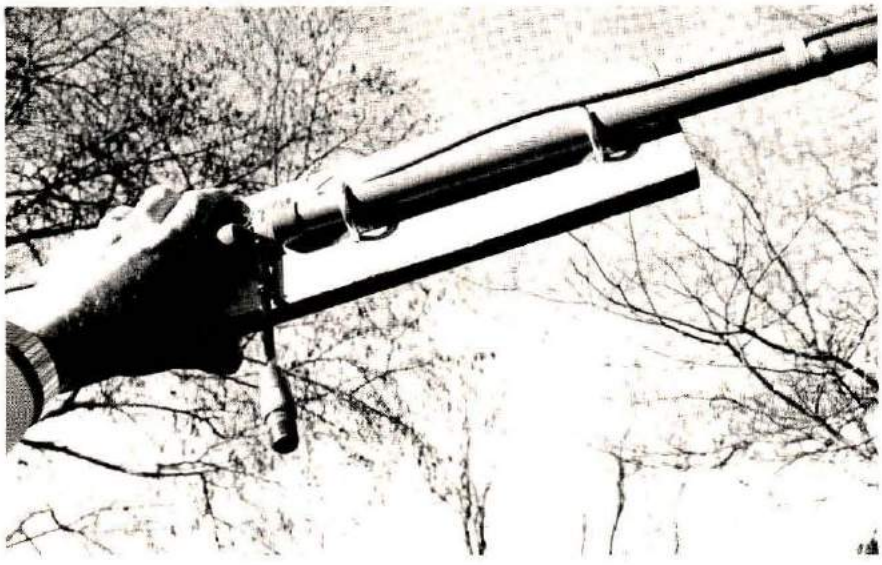


Fig. 1. Multiple-conductor cable forms the dipole. In the field, the Bean Poles are bolted to the wood center support, and the cable ends are connected to the coax terminals. Field assembly requires only a pair of pliers and a screwdriver.

The "feed" end of the Bean Pole. Simulated bamboo poles are fastened to a board by means of U-bolts. The wire is taped to the poles, and fed by a piece of coaxial cable. The short cable makes the assembly easy to handle — you can add any length you need to reach the rig.



The ends of the poles don't quite meet in the center, leaving space for the coax cable and the antenna terminals. I made the terminals from two pieces of sheet copper, each about the size of a large

Two Bean Poles ride easily on the car-top carrier when you are traveling. The board and coaxial cable are carried inside but can be assembled in a few moments when you arrive at your destination.

washer. The copper terminals are drilled to receive the screws, then cut so that the conductors of the coax can be crimped and soldered to them. The coax passes through two screw eyes (which are gently squeezed with a pair of pliers) to hold the coax in place and help take the strain off the terminals. The short piece of coax ends in a female connector fitting, sealed with tile caulk or epoxy, and ready to be joined to a 15-meter (50 foot) coax lead-in. I used RG-58/U to reduce weight. The board was then given several coats of tung-oil varnish or similar preservative.

The wire

Now for the antenna. Lay out a length of multi-conductor cable, about 3.45 meters (11 feet four inches) long, and remove 5 cm (2 inches) of outer covering from one end. Identify the individual conductors inside by color coding, and assign one to each frequency you wish to use. Refer to a table of lengths and frequencies for this purpose, (see *Ham Radio Horizons*, January, 1978, page 20) and use metric measurements if possible. The math is easier, and you're less likely to make a mistake. Strip the insulation from all the conductors at the end, and twist them together in the shape of a hook. Solder this hook, or use a terminal lug of your choice. This end will receive some wear as you use your dipole, so it should be sturdy. If it breaks off from too much bending, you're in trouble.

Measure from the center of the hook or lug, outward to the first frequency distance (for example, the OSCAR band on 10 meters), 2.42 meters or 7 feet 11½ inches, and make a mark on the outer covering with a pen. Continue marking the wire through the last frequency you wish to use. The end of the cable should then be cut at 3.38 meters, or 11 feet 1 inch from the center of the lug. This is in the 15-meter band, at 21.100 MHz. If you're using 5-conductor wire, select four frequencies. One conductor must run the full length.

Using a sharp blade, carefully make a slit about 12 cm (5 inches) long and three quarters of the way around in the outer covering at your first set of marks. Open it up, and begin cutting the conductors according to your color code — red, for the Oscar band, green for the 10-meter phone band, for instance. Cut a 12-mm (½-inch) piece out of the conductor, so it won't accidentally reconnect. Be careful not to cut any others except where they're supposed to be cut. When this is done, close the outer covering, and tape it up well, using a weather-proof electrical tape. Perform the same operation for the other half of the dipole.

Assembly

Now assemble the Bean Pole where you have 6.7 meters (23 feet) of clearance, and connect the lugs or hook ends to the screw terminals. Stretch the cable along the top of the spreaders and wrap tape around to hold it in place. This can be done every 20 cm (8 inches) or so, at the "knuckles," to keep it lined up. The exposed ends of the cable should be sealed with epoxy or something similar to keep water out. While you have the sealer out, press some into the end of the coax where the braid is exposed, and wrap that with tape.

Now, if you're doing this inside, you have to take it apart to get it outside. No problem. Poles go out through a window easily. Once outside, reassemble the Bean Pole, attach your coax, and shove the thing into the branches of the nearest tree. Try to get it horizontal. Mine works standing up, leaning against the house, but the SWR is too high. In the horizontal attitude, it performs

much better. And, of course, the higher up you haul it, the better it will perform; that's critical for any dipole. The minimum distance should be at least a wavelength at the lowest band, or about 13.7 meters (45 feet) up, but we can't always get it that high. You can roughly tune the Bean Pole by varying the distance between the two terminals, and by moving each cable in or out along the spreaders. This involves only retaping the cable to the spreader and drilling new holes for the terminal screws.

As made, my antenna has a fairly high SWR, but not enough to worry about. Performance speaks for itself, and as long as I can work Europeans with 30 watts, I'm not going to get excited about 3:1.

When traveling, I tie the two poles to the car top carrier of my station wagon. The center mounting board goes inside the car along with the run of coax and the rest of the station.

In the field, you can haul it up in any number of ways. Two large screw eyes in the top edge of the mounting board will be helpful, and a length of fishing line hanging from each end could be used to change direction, or adjust for field conditions. In raising it to my balcony at Rehoboth Beach, I lowered the coax down from the balcony, tied one end of the assembled Bean Pole to the coax with lightweight rope, and hauled it up vertically until I could reach the pole by hand. The rest was easy. Coax has a lot of lifting strength, as long as you don't tie a knot in it.

So, it may have been that location on a third-floor balcony overlooking the ocean, or it may have been the Bean Pole. But the next time I go on vacation, the Bean Pole goes along. It's portable, cheap, easy to erect, and fun to build. Now the two-meter boys have nothing on us high frequency types, and *they* can't work Europe.

HRH

TRY TEN METERS

BY KARL THURBER, JR., W8FX

Ten is really hopping from dawn to dusk these days, with DX signals pounding in from all areas of the globe. But, as anyone who has witnessed the "lows" of the sunspot cycle can tell you, it has not always been this way. In fact, three or four years ago, with sunspot activity at its lowest point, the band was usually dead for DX work, save an occasional short-skip opening.

Those who remember these lean years on ten will attest to its usefulness as a good band for local communications and mobile work with the added spice of never quite knowing when a quiet band would suddenly open up for a few hours of good skip, with strong DX signals suddenly materializing out of nowhere — to be worked with low-power equipment and simple antennas.

Propagation on ten

While no band appears quite so forlorn as ten meters during the depths of a sunspot cycle low, when the "spots are up" ten probably produces more DXCC members using QRP and simple antennas than any other band. Indeed, to one who has not witnessed this band's performance during a sunspot high, the signal strength of long-haul DX from all continents — from stations running 10, 25, or 50 watts into simple dipole and vertical antennas — is almost unbelievable. Sunspot cycle 21 has already turned the corner, with peak DX conditions expected in late 1979 and 1980. Perhaps half of the world's amateur population today has climbed on board since the last cycle's peak in 1968, and there are some real surprises in store for them as ten gets better and better for intercontinental DX.

As a rule, the ten-meter, or "28-MHz" band, lying as it does from 28.0 to 29.7 MHz (vhf starts at 30 MHz), is thought of as a daylight DX band over about *half* the sunspot cycle, or slightly less than six years at a time. During the sunspot peak, the band is frequently open late at night for long-haul DX. However, as the 11-year sunspot cycle bottoms out, the band is normally dead for long-distance skip via the ionospheric F2 layer, especially in the northern latitudes. What DX does roll in during the lean years usually results from special kinds of propagation that don't especially depend on the sun for stimulus, such as Sporadic E refraction and tropospheric bending. More on these later.

Ionospheric propagation, especially from the sunspot-sensitive F2 layer, is responsible for most of the really long-haul work on ten. Radiation from the sun impacts the ionosphere (the region between 80 and 400 km, or 50 and 250 miles), ionizing individual particles there. The atmospheric particles gather in layers, known as the D, E, F1, and F2 layers.

When ionization is strong enough (and if the signal frequency isn't too high), signals can be bent, or *refracted*, back to earth, especially from the upper F layers, which are more highly ionized. When sunspot activity is high, the ionosphere can return signals as high as 50, 70, or even 100 MHz or more; but when sunspot numbers are low, signals below 15 or 20 MHz (far below 10 meters) penetrate the weak ionosphere and are lost into space, unable to return to earth.

The skip distance in the F-layer is mostly of the long-haul type, normally from 2000 to 4000 km (1300 to 2500 miles); the actual skip distance changes from hour to hour due to changes in F-layer density and as a result of the sun's action during the day. Typically, ten-meter DX is best at midday, and how long the band remains open depends on the sun's relative position over a given signal path. For example, in the Southeast one might start off by working African and European stations in the morning, the West Coast in the afternoon, and the Pacific around dusk or just after dark.

(A related propagation mode is known as Trans-Equatorial, or "TE," which is responsible for much U.S. to South America work, especially during the early evening hours of the summer and fall, throughout the sunspot cycle.)

An important concept to remember is that of the *maximum usable frequency*, or MUF, since long-haul work on ten is very sensitive to its position. The MUF is the *highest* frequency that can be propagated over a certain signal path, and it depends on the degree of ionization in the ionosphere. The MUF is highest during periods of maximum sunspot activity, especially in the winter. When ionization is low, the MUF may be as low as the 80-meter band, but when high, it can reach well into vhf; ten meters straddles a part of the radio spectrum across which the MUF tends to shift frequently. At frequencies just *below* the MUF, the ionosphere forms a nearly-perfect "radio mirror." This tends to explain why ten-meter signals from certain areas of the world are so often extremely strong even from stations running low power. Strangely, ten may *seem* to be dead for DX, when in fact it may really be open. It may appear *not* to be open simply because there is no one on the air at the right time and in the right place to take advantage of a high MUF.

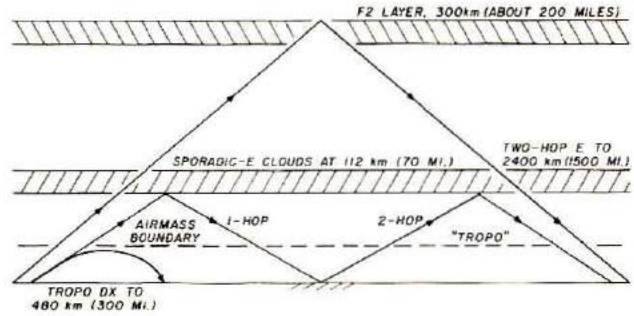


Fig. 1. The principal modes of ten meter propagation combine some of the F-layer characteristics found on the lower bands, and a type of short-skip called sporadic E. Tropospheric or air-mass bending can also extend the range.

Because one of the most exciting and thrilling aspects of ham radio for both old-timers and Novices alike is working distant stations (DXing), there is a tendency to write off bands like ten meters during the years when sunspot activity is down. But ten can be useful for DX work throughout the sunspot cycle, though on a somewhat reduced and less-reliable scale; good DX is possible out to 2400 km (1500 miles) or more when a special propagation form known as sporadic-E is active.

Sporadic E, sometimes abbreviated as "Es" and known popularly as "short skip," is one of the most interesting propagation modes known to 15-, 10-, and 6-meter operators; when "short skip" is in, a seemingly dead band can suddenly come alive with loud signals from all directions. This condition is the result of intensely ionized particle "patches" forming in the E-layer of the ionosphere at heights of around 45 km, or 70 miles. While regular E-layer ionization follows the path of the sun (greatest during the daytime and least at night) and is usually ineffective above 20 meters, ionization can "sporadically" be so intense that signals as high as 10 and 6 meters can be refracted back to the earth. Some of the characteristics of this kind of propagation are its unpredictability, its tendency to occur mainly during the summer (between mid morning and late afternoon), the surprising strength of signals (which can fade in and out at a moment's notice), and its habit of giving signals a sort of hollow or fluttery note. Best of all, sporadic-E isn't directly dependent on the sunspot cycle, and so it can occur even during the low years.

Another form of propagation important on ten is *tropospheric bending*, sometimes known as "tropo." This mode is dependent to a great extent on weather conditions and is often noticeable in the morning hours and at dusk, especially during temperature inversions; the effect is to dramatically extend the "radio horizon" out to a few hundred miles. Although the effects are more noticeable on six meters and

Fig. 2. The ten-meter band is structured for different operation modes which were, for the most part, developed by mutual agreement or from long-standing practice. Some portions are allocated by the FCC for a specific mode, such as CW from 28.0 to 28.5, and Novice/Technician CW at 250-watt maximum power level from 28.1 to 28.2. That power level applies to all stations operating in that segment, no matter what class license is held.

Frequency (MHz)	Mode of Operation
28.000-28.100	CW, RTTY
28.090	RTTY calling frequency
28.100-28.200	Novice CW (250W limit)
28.200-28.300	Propagation beacons
28.300-28.500	Foreign SSB
28.500-28.900	SSB (USB)
28.680	SSTV calling frequency
28.800	"Ten-Ten" Net calling frequency
28.900-29.300	AM, FM (simplex)
28.965-29.405	Typical converted CB set channelization
29.300-29.500	OSCAR satellite downlinks
29.510-29.700	Repeaters

up, it's an important factor in medium-distance ten-meter work, being most noticeable during the spring, summer and fall.

These are the main forms of propagation that affect ten and make it a prime DX band at certain times. But there are other marginal modes you should be aware of, particularly if you want to work over extended distances under conditions where the band would otherwise be closed. These modes are ionospheric and tropospheric scatter as well as back-scatter. These are specialized means of propagation known mainly to vhf DXers, who depend on high-power equipment and large antennas for good results. But they can be fruitful modes for the ten-meter experimenter who wants to work beyond the usual range of groundwave coverage; if you're interested in this kind of work, read the propagation chapters in *The ARRL Radio Amateur's Handbook* or *The Radio Amateur's VHF Manual* for details.

While sporadic-E, tropo, and scatter modes may not be as important in these days of high sunspot activity where world-wide F-layer DX is an everyday affair, they will again become important when the current cycle starts its downward slide beginning around 1981 or 82. Also, bear in mind that the current high level of solar activity is accompanied by frequent magnetic storms and other high-intensity disturbances which can disrupt and even blank out all high-frequency F-layer propagation for days at a time; other modes can sometimes be used to good advantage during such periods.

You may ask, "How do I know when DX propagation is likely to be good on ten meters?" This is an important question, since the band is a very temperamental one, even during periods of good overall conditions such as those now being experienced. There are several ways to improve your batting average on ten through better knowledge of the band's characteristics and behavior patterns.

First, know *when* to listen. The DX and propagation columns of the major amateur magazines publish a variety of propagation information by day of the month and to different parts of the world; by using the information contained in these columns, you can get a pretty fair idea of when ten should be open to various areas. The ARRL headquarters station, W1AW, also broadcasts daily bulletins which contain a summary of timely propagation information.

Until recently, the NBS (National Bureau of Standards) broadcast real-time propagation forecasts over WWV; they discontinued them in 1975. However, the station still continues to air propagation reports (which must be interpreted by the user), at 18 minutes past each hour over the standard WWV frequencies of 2.5, 5, 10, and 15 MHz. *Solar Flux* and *K-index* figures are given; as a general rule, the higher the solar flux and the lower the K-index numbers, the better the conditions will be. Solar flux numbers have been increasing in step with the sunspot cycle; K-index numbers greater than about four on the zero-to-nine scale suggest disturbed geomagnetic activity and probably poor band conditions.*

Another way to get a feel for ten's current state (even if few signals are coming through) is by listening to the adjacent 27-MHz CB channels for long skip, and to commercial and public-service stations below and above ten meters, using a general-coverage receiver or scanner. Bear in mind, too, that many ten-meter operators seem to spend most of their time listening, tuning their receivers across an apparently dead band; hearing no signals, they give up trying and flip to

Fig. 3. This is one of the more popular schemes for converting channelized CB rigs for ten-meter use. Another plan involves using the 23-channel ssb sets from 28.560 to 28.850 MHz, and 23-channel a-m rigs from 28.760 to 29.050 MHz. For Novice CW work, they can be converted to cover 28.105 to 28.195 MHz. No single plan enjoys universal acceptance, however.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	28.965	21	29.215
2	28.975	22	29.225
3	28.985	23	29.235
4	29.005	24	29.245
5	29.015	25	29.255
6	29.025	26	29.265
7	29.035	27	29.275
8	29.055	28	29.285
9	29.065	29	29.295
10	29.075	30	29.305
11	29.085	31	29.315
12	29.105	32	29.325
13	29.115	33	29.335
14	29.125	34	29.345
15	29.135	35	29.355
16	29.155	36	29.365
17	29.165	37	29.375
18	29.175	38	29.385
19	29.185	39	29.395
20	29.205	40	29.405

*See "Understanding and Using Propagation Information," By T. R. Sundstrom, W2XQ, in *Ham Radio Horizons* for April, 1979.

another band. Thus, while listening or calling for DX may be a waste of time if the band is really dead, a snappy CQ may raise an answer from half a continent or half a world away.

Equipment for ten

Getting on ten is usually no big problem, as most high-frequency transceivers are designed for five-band operation, 80 through 10 meters. Certain transceivers such as the Ten-Tec Century 21 and Argonaut are especially popular for low-power work (remember that high power is not necessarily required for good results on ten). Several new transceivers hold a good deal of promise for mobile work, such as the Palomar PTR-130K and the Kachina 1 (which also covers six meters), as well as Yaesu's relatively low-priced FT-7 and Swan's 100 MX transceivers.

The most important factor in ten-meter work is having good receiving equipment; we all know that if you can't hear 'em, you can't work 'em — and this is especially true on ten. Most receivers begin to lose sensitivity above 15 meters, and many older tube-type sets have completely unacceptable sensitivity; some of these are also not stable enough for good CW and ssb work on ten. If you use a separate receiver which is decently stable and sufficiently selective to cut through QRM but loses its pep on ten, you might want to add either a converter or preamplifier ahead of it. The *converter*, of course, beats or heterodynes incoming signals with an internal oscillator to produce an output at some convenient lower frequency, such as 7 or 14 MHz. The *preamp*, or "preselector," is connected between the antenna and the receiver's antenna input jack; it simply amplifies the desired signals before they hit the receivers. Both converters and preamplifiers are easy to install and use, and they are well worth the trouble if your receiver has marginal performance on ten. Inexpensive kits or factory-built models are available from several firms, such as Hamtronics Inc. (182-D Belmont Rd., Rochester, New York 14612) and Vanguard Laboratories (196-23 Jamaica Ave., Hollis, New York 11423).

If you want to get your feet wet on 10-meter CW (such as in the 28.1-28.2 MHz Novice segment), one of the older, low-power, CW-only transmitters popular during the fifties and sixties may fill the bill, and, of course, most of them can be used on the lower Novice bands as well. Heath, Johnson, Ameco, Eico, and several other companies produced a variety of transmitters that can serve this purpose and which can be obtained today from used equipment dealers, at flea markets, and from "graduate Novices" for a fraction of their original cost. One caution: some of these transmitters added ten meters as an "afterthought," so that a required multiplication stage following the crystal oscillator was omitted to save money.

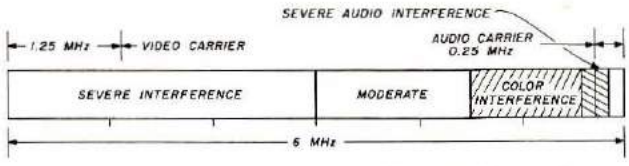


Fig. 4. Harmonics from ten-meter rigs can cause TVI, especially in the lower channels. The second harmonic can bother channel 2; the third, channel 6; and the sixth, channel 7. This drawing shows the severity of interference, depending upon where in the channel the harmonic falls. Each U.S. television channel is 6 MHz wide. Filters, shielding, and good grounds are often needed to cure TVI. Many publications have information on how to eliminate or reduce the interference problem, including *The Radio Amateur's Handbook* (available from Ham Radio's Communications Bookstore — write for free catalog).

Television interference can be very troublesome for 10-meter operators. This B&W filter is designed for low-power use (100 watts or less), and has a cutoff frequency of 44 MHz. Its maximum attenuation is at 57 MHz, in the center of channel 2, thus it is very effective on the second harmonic of a 10-meter rig (*photo courtesy Barker and Williamson, Inc.*).

These units relied on the final output stage to double the frequency from 14 to 28 MHz, resulting in very poor efficiency, the possibility of out-of-band radiation, and increased television interference (TVI). Be sure to obtain the instruction manual for any such equipment, and, if the manual indicates that the final "doubles" to hit ten meters, don't try to use it on ten. Most of these early rigs run under 75 watts power input, and require crystals for frequency control, therefore a VFO (variable frequency oscillator) would make a handy accessory for increased frequency agility.

If you're interested in casual mobile operation using ssb or a-m, converted CB transceivers can make excellent, low-cost, fun rigs. They also make good second sets for emergency, portable, and vacation operation.

Should you not wish to tackle such a conversion job, several enterprising companies have made preconverted CB transceivers available; one such company is Bristol Electronics Inc., 651 Orchard St., New Bedford, Massachusetts 02744. Another is Standard Communications Corp., P.O. Box 92151, Los Angeles, California 90009.

Antennas are easy!

So much for equipment. Like equipment, antennas for ten

need not be cumbersome; many outstanding DX contacts can be made with surprisingly low power, and simple antennas such as verticals and small beams. And, due to the FCC's action, banning the manufacture of linear amplifiers that cover ten, there undoubtedly will be a long-term reduction in the "power competition" on ten as compared with the other high-frequency bands. High power and high-gain directive antennas do help when propagation conditions are marginal, but otherwise the effects of high power and large antennas are much less pronounced than on, say, 20 or 15 meters.

Ten *is* a part of the high-frequency spectrum, of course, and most of what can be said about antennas for the lower bands is true for ten, so need not be repeated here. In fact, you may *already* have installed an antenna for the lower frequencies that will work without modification on ten, such as a trap vertical or dipole, or perhaps a center-fed, multiband antenna that can be fed on ten using an antenna tuner or coupler. If not, you may find that you can tie together the ends of your present transmission line and feed the whole system as a "random-wire" through a coupler. More than one ten-meter newcomer has converted a guy wire on his antenna tower to a sloping vertical dipole, with good results.

Of course, it's nice to plan for ten-meter operation from the start if you are in the market for an antenna. If you're contemplating a multiband antenna such as a trap vertical or dipole, why not purchase or construct one that already has provision for ten-meter operation? And if in the market for a beam, why not a "tri-bander" covering 20, 15, and 10 meters? The relatively small size of ten-meter arrays also allows five- and six-element antennas to be practical, so that if your tower and rotator will support the added weight and wind loading, you may want to stack a multi-element 28-MHz antenna above the low-band beam.

Not to be overlooked is relatively low-cost CB antenna hardware. Dollar for dollar, CB equipment — including antennas — is a good deal.

A well-designed antenna tuner helps to get power from your rig to the antenna, and it does extra duty by suppressing harmonics and spurious signals that might bother vhf television reception. This is the Millen "Transmatch Junior," a wide-range, 300-watt coupler designed for use from 80 through 10 meters (*photo courtesy Caywood Electronics, Inc.*).

Most 27-MHz CB antennas can be converted for ten-meter use by simply cutting off a few inches from each antenna element and retuning the antenna. The run-of-the-mill quarter-wave CB base station vertical antenna makes an outstanding ten-meter radiator, and usually does well in DX work. Even better is the extended vertical, usually either 1/2 or 5/8-wavelength, which offers an even lower-angle omnidirectional pattern. The vertical will also yield good results for local net or emergency work, particularly when in contact with mobile stations (which normally use vertical polarization).

Most CB beam antennas can also be cut down for ten, although care must be taken to correctly "proportionalize" the element length reduction to preserve the antenna's gain and directivity pattern. If you plan mobile ten-meter operation, CB antennas provide a nearly unlimited source of antennas; practically any mobile antenna that works well on CB can be made to work on ten. I suggest buying a second CB antenna of the type you find works best for CB work (assuming you work CB, of course!) and simply cut down the whip element until a low SWR is indicated in the center of the desired ten-meter frequency range; in most cases, that'll all that's required. Being a "scrounger" of old CB antenna components helps. For example, it's possible to use the same CB antenna mount and lead-in for *both* a CB rig and a ten-meter mobile transceiver by using interchangeable whip-and-loading-coil combinations. A two-position coax switch installed inside the vehicle allows the antenna lead-in to be switched between the two transceivers at will.

Operating on ten

Ten meters has been with us for many years as a working amateur band. Before World War II the band stretched from 28 to 30 MHz. It has long been an immensely popular band, especially for emergency and RACES (Radio Amateur Civil Emergency Services) operation as well as for mobile work (since it is the lowest amateur band on which a physically short mobile antenna can be made to work efficiently). Since the vhf and uhf bands have been occupied to any great extent only since the fifties, ten, for many years, held the position as the "high band," much as two meters does today. In fact, many old-timers still think of ten as a "vhf" band.

FCC regulations require that 28.0 to 28.5 MHz be used for CW work in the U.S., with 28.1 to 28.2 being available for Novice operation. Many foreign ssb stations operate above 28.3 MHz, sometimes working "crossband" with U.S. phone stations above 28.5 MHz. (Canadians can work phone down to 28.1 MHz, however,

and some foreign phone stations operate well into the U.S. CW segment.)

Not by FCC requirement but by convention, slow-scan TV operations center around 26.680 MHz as a calling frequency, with RTTY activity centered about 28.090. Most stateside ssb stations operate on the lower portion of the phone band, from about 28.5 up to about 28.9 MHz or higher; some specialized ten-meter groups such as Ten-Ten International have ssb "calling frequencies" at 28.6 or 28.8 MHz.

In addition, 28.2 to 28.3 MHz is also used by amateur "beacon stations," which are coordinated by the IARU (International Amateur Radio Union) International Beacon Project. These beacons help fill a real need on ten: they provide an "on-the-air" indication of propagation status and band openings, even when the band may not be occupied by many stations. Dozens of beacon stations are on the air from widely separated points: Australia, New Zealand, Germany, Norway, South Africa, the Falkand Islands, and other countries (see **Table 1**).

Above about 28.9 MHz, operating modes get a bit complicated. Amplitude modulation is still popular on ten, because of the availability of inexpensive, easily converted CB sets. As a rule, most a-m operators stay above 28.9 to avoid conflict with ssb stations operating below that frequency. And, while narrowband fm (NBFM) can be used anywhere above 28.5, *wideband* fm is restricted to use above 29-MHz. The range of 29.3 to 29.5 is left clear for the OSCAR 7 and 8 satellite downlinks, and repeaters are found at the very high end of the band, from 29.5 to 29.7 MHz.

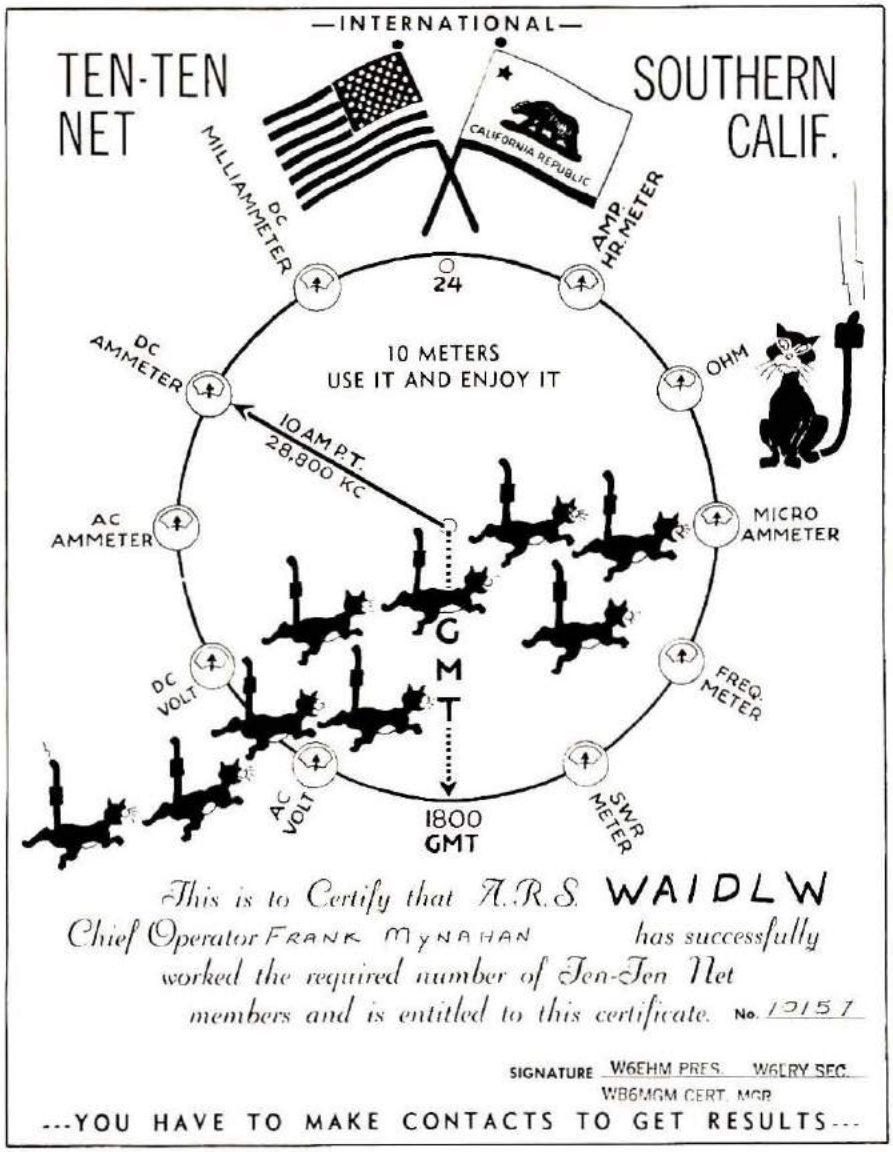
While repeater activity is not nearly as popular on ten as on the vhf bands, activity is growing by leaps and bounds; 29 are listed in the 1978 ARRL Repeater Directory. Since the repeater sub-band is close to the OSCAR window, most ten-meter repeaters use a "high-in/low-out" scheme with 10-kHz-wide channels starting at 29.510 MHz. Only nine repeater pairs are thus available, the majority use fm, and most use very low power levels, tone access, and directional antennas to help prevent undue interference from skip conditions.

The relatively new 10-meter Novice band (28.1 to 28.2 MHz) offers the greatest potential for foreign DX of any of the Novice bands. It's also a good band for Technicians to get their code speed up, get their feet wet on the high-frequency bands, and at the same time experience the thrill of DX work far beyond the horizon. With its capability for easy worldwide contacts,

Table 1. International 10-meter beacons, as of late 1978.

Frequency (kHz)	Station	Location	Frequency (kHz)	Station	Location
28,185	OA4VHF	Lima, Peru	28,227.5	FX3TEN	France[2]
28,200	Common				Mt. Climie,
28,202.5	9J2BB	Lusaka,	28,230	ZL2MHF	New Zealand
		Zambia	28,232.5	VP8	Falkland Is.[2]
28,205	DLØIGI	Mt. Predigtstuhl,	28,235	VP9BA	Southampton,
		Germany			Bermuda
28,207.5	N4RD	Englewood,	28,237.5	LA	Norway[1]
		FL, USA	28,240	PY1CK	Rio de Janeiro
28,210	3B8MS	Signal Mt,			Brazil[4]
		Mauritius	28,242.5	ZS	South Africa[1]
28,212.5	ZD9GI	Gough Island	28,245	A9XC	Hamala,
		S. Atlantic[3]			Bahrain
28,215	GB3SX	Crowborough,	28,247.5	EA2OIZ	Spain
		England	28,250	W	U.S.
28,217.5	VK2WI	Sydney,	28,255	W6	California[1]
		Australia[1]	28,257.5	DKØTE	Germany
28,220	5B4CY	Limassol,			
		Cyprus	28,260	VK5	Australia[1]
28,222.5	YU	Yugoslavia[1]			
28,225	VE3TEN	Ottawa,	28,265	VK6	Australia[1]
		Canada	28,270	VK8	Australia[1]

Notes:
1. In planning stage
2. Under construction
3. Expected to be operational soon
4. Being rebuilt



The 10-meter band has a group of enthusiasts with the purpose of keeping the band alive and enjoying its benefits and peculiarities. They have contests, exchange assigned "Ten-Ten" numbers, and get certificates for joining. This Ten-Ten certificate is shown by courtesy of WA1DLW. For more details write Ten-Ten, 21518 Marjorie Avenue, Torrance, California 90503.

ten offers a good deal for the Novice and Technician alike. With a 100-kHz-wide slice of ten meters available, there's plenty of space to avoid QRM, and the fact that higher-class licensees are *themselves* limited to 250 watts power input when operating in this segment serves as a sort of equalizer in trying to work overseas stations. In fact, the 250-watt power limit is no real obstacle at all; if you can hear a weak CW station riding in just above the noise level, odds are you can work him! As we have indicated before, however, ten meter band conditions can be deceptive, and I offer a beginner the suggestion that he not give up hope when tuning through an apparently dead band; a short CQ will often bring several unexpected replies. The Novice who takes the time to become familiar with the ins-and-outs of ten-meter operation will be amply rewarded.

A real boost for activity on ten has been the Ten-Ten International organization, which has as its objective keeping ten meters active; listen any day and you will hear countless "CQ Ten-Ten" calls from hams wanting to exchange Ten-Ten identification numbers as part of their search for various certificate awards. The Ten-Ten group is said to have started as a ten-meter traffic net in southern California around 1962, meeting on the air at 10 PM — hence the name "Ten-Ten." The number of members is well into the thousands and there are over 100 active chapters. The club requires that one first contact ten members and submit the list of contacts along with a small fee to a district manager in order to become a member. The club publishes a net bulletin and has a very challenging awards program. Many local chapters have their own unique programs and a broad spectrum of certificate awards as well.

Before closing out this discussion of ten meter operation, let's not forget that in the "off hours," ten behaves much like a vhf band and thus can provide excellent local and extended groundwave coverage for a variety of purposes — emergency communications, traffic handling, ragchewing, club activities (including hidden transmitter hunts), civil defense, and the like. The band is fine for work out to about 80 km (50 miles) or so between well-equipped stations, either base or mobile. Mobile operation on ten is much like 27 MHz CB, but minus the difficulties of operating on a severely overcrowded band. And, the added spice of frequent and easy DX contacts from one's automobile is not be to sneezed at. Indeed, operating on ten is fun!

From just a few years ago when the band was known as a no-man's land, ten has increased in popularity to the point where it is a "near traffic jam" when the DX is rolling in. But traffic isn't yet "bumper to bumper," so get into gear for some real fun on ten. The light's green for years to come!

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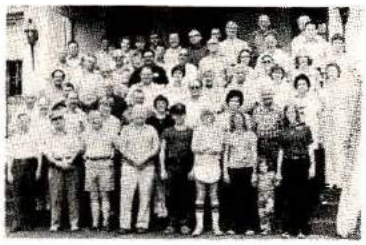

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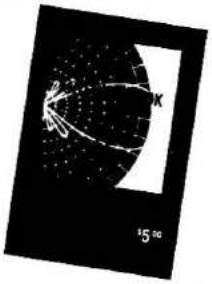

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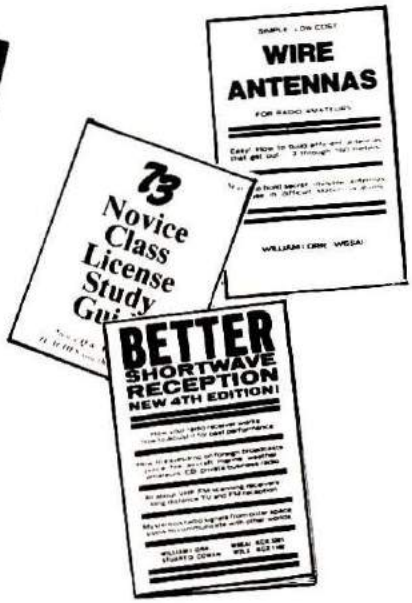

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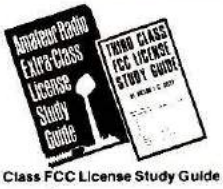

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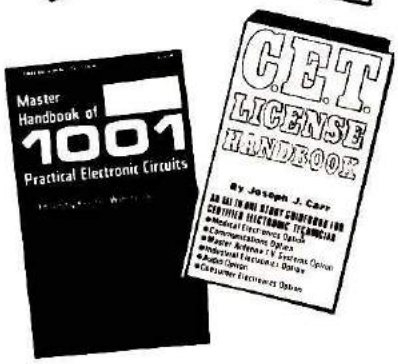

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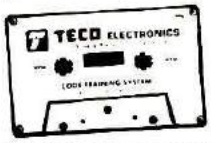

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BY TROY WEIDENHEIMER, WØROF

Some folks can grow any plant known to botany by merely smiling ingratiatingly at the new sprouts and blowing a bit of CO_2 their way once a month. It's laughingly explained as the "green thumb" syndrome. There's a correlated-condition in hamming, and, unfortunately (or fortunately), I seem to be blessed with it. I simply can do no wrong when there are electrons running about. Everything I build works the first time. Every call I make is greeted with an immediate and enthusiastic response. Some call this condition "electro-thumb."

From the moment I slapped together that little Viking Adventurer in 1954 and rattled out my first shaky CQ on 7186 kHz, I knew I was different. It was a very sultry July day when

my chirpy twenty-five watts of pleading Novice signal went sailing into the stratosphere, banged off the ionized layer, splattered down into the muddy flats of the Mississippi, careened off a rolling wave in the mid Pacific, and broke into thousands of tiny CQs somewhere over Europe. I signed, pushed the big antenna knife-switch, and sat back expectantly.

It seemed as if the whole front end of my NC-98 receiver had yawned wide like a hippo and engulfed every CW signal in the world. The din of stations calling me was awesome. Stations with CW notes like chain saws, and with primitive ape-like whoops that whipped back and forth over a 10-kHz range, made copy as simple as wild guesswork. Those were just the Europeans. The locals had heard, too. There was a brain-rending drone of 40-over-9 oscillators under the devastatingly loud, yet pear-shaped, notes from Collins rigs. As the chaos tapered down to about S8, I regained enough composure to venture a timid "QRZ?"

Later that night, exhausted, I tallied the QSOs and checked each country, state and county against the official lists. I then cleared the wall space which would be needed to display the DXCC, WAZ, WAS, and Worked 500 Counties awards which were the fruits of my first day's operating. I stuck with hamming for a few weeks longer to pick up WPX and a particular VU award that caught my eye, then sold all the gear. My thoughts turned to a just-blossoming young lady up the street who had been avoiding my passionate gaze. After all, a few challenges should remain for a bright-eyed, thirteen-year-old boy — challenges formed of sterner stuff than the DX which threw itself at my shack doorstep.

Twenty-odd summers came and went before that vague uneasiness born of scientific curiosity sent my mind in search of new and lofty technological truths. Tales of unimaginable sunspot activity and propagation-gone-wild turned my head and I soon passed all formalities and was issued W0ROF. The ease with which I passed the Novice through Extra exams with no

"Without a doubt this rig will put a damper on your *electro thumb*."

studying brought back faint memories of my first hamming venture, but it wasn't until I walked across the hall and passed the First Class Radiotelephone exam that I realized the "electro-thumb" was still active.

What was I to do to avoid a repeat of the discouragingly dull "king of the airways" number which put me off Amateur Radio as a youth. I settled on a new approach. This time no more blasting the bands with a dipole and 25 watts. I had to be extremely selective to un-optimize each element which was to go into the new rig and associated components. Many pieces of gear were offered by well-meaning locals who knew of my hardship, but nearly a year went by and still my operating table was bare.

*QRP_p = *Very* low-powered rig.

Finally, in a spider-infested junkbox tucked into a nearly forgotten corner at the home of W9MLT, a dedicated QRP_per,* I discovered the perfect rig.

My friend assured me that no one, to his knowledge, had ever been able to make a contact with the transmitter. Certainly its forlorn appearance supported that testimony. It looked like the handiwork of someone in the last stages of an extreme nervous disorder. I noticed something artless about tube sockets nailed to a plywood chassis, and the exclusive use of 14-gauge, brown lampcord did grate slightly on my esthetic teeth. I knew all was well as soon as we fired her up, and the sad little thing had barely the get-up-and-go to light a single flashlight bulb. After all, that was my main criterion.

"Without doubt," warranted my friend, "this rig will put a damper on your electro-thumb."

The next step in gaining the excitement and challenge enjoyed by all "regular" hams was to find the perfect QTH.

I found it in the form of a long, narrow ravine, flanked on three sides with vertical granite faces rising hundreds of feet and, at the fourth side, a newly constructed concrete dam. The home was built and, after considerable research, I decided upon the final factor, the ideal antenna.

A low chain-link fence looked just right for my main antenna, grounded every ten feet and within touching distance of the granite cliffs surrounding my lot. To be sure of minimum energy transfer to the fence, I fed power through a three turn link positioned about two yards from the fence. This coupling system, I reasoned, would be just enough to effect some transfer of power and avoid the immediate destruction of the rig's oscillator/amplifier tube.

Oh yes, I had for some years held on to a marvelous Zenith shortwave radio and this I pressed into service as the

primary receiver in my new shack. It had no BFO, but since anyone blessed with the electro-thumb can copy three stations simultaneously at 65 or 70 WPM under massive QRM, certainly I could handle the good solid hissing of this old horse.

At last, I was nearing countdown. I surveyed my QRPppp station, connected the feedline with care, slipped into the tan leather swivel chair and tickled a brief "QRL?" from the gleaming Bencher paddles.

The two sides of the V on the Zenith's *Magic-Eye* signal detector slammed together and my ears exploded as KV4AA came crashing into my operating room, gave me a 599 + 30, and offered me his working frequency so I could start hewing away at the pile of JAs which assembled instantly in response to my call. I immediately signed, "SRI OMs, LL . . . must QRT," and, crestfallen, switched off the rig. "Terminal electro-thumb," I concluded in total despondence. But suddenly it struck me. The ac level control. Why, I was feeding that old breadboard with a full 110 volts. That would have put out a crackling watt-and-a-half to the chain-link fence, and that would account for my dismal failure.

Quickly, I cut the supply line voltage to the 18-volt level and tuned up again. As a final precaution I switched the Y feedline to the transmitter output, which coupled a Heath Cantenna in parallel with the fence.

Plate voltage ON. Keyer ON. T/R to T. Boldly, I zipped off a "QRZ?" in my flashiest "Southern California Style" Morse.

Suck in my breath. Wait as the receiver recovers from the transmitter rf overload. And . . . NOTHING! Glorious, divine, harmonious nothingness. Brazenly, I CQed. Nil. And again. In jubiliation I CQed for a solid hour.

I knew I was on the way to true happiness in hamdom.

Now at last, the "big guns" would kick sand in my face just as they do to everyone else. The QRPpers would never again accuse me of secreting a Voice-of-America megawatter in my basement. And every QSO would be a true test of my patience, perserverance, and operating skill. Those were the thoughts which swirled in my head as a great pounding

"The perfect QTH."

shook the shack door. It was forced open and a very official looking chap glared at me and shouted, "Do you realize the havoc you're causing on the 20-meter CW band?"

I blinked inquisitively as he thrust his FCC badge under my nose and snarled.

"But . . . but . . ." I replied, to very little effect.

I then pointed to the faintly glowing one-lunger crouched inauspiciously on the table, and then to my log with 134 CQ entries followed by an equal number of NC entries.

The official stalked over to the big Zenith console and pointed emphatically at the *Magic Eye* in the center of the dial. It was either sound asleep or I had forgotten to turn the receiver back on after the first call of the evening. I reached for the volume/power knob and snapped the set on.

At first, silence, then an incredible flash and the speaker cone came literally blasting through the fancy grille which decorated the front of the cabinet and disintegrated into a black snowstorm of cardboard chips with the last gasps of no less than 300 stations calling me. They were frantic, shifting frequency with each call, tailending, calling five up and ten down . . . and, as I later found out, even crossbanding in hopes of attracting my attention.

The official seemed puzzled as he examined my extensive network of signal attenuating devices. Slowly, the truth dawned. He turned and inquired somberly, "electro-thumb?"

I nodded gravely.

"Want some friendly advice?"

"Sure," I said.

"Give me the breadboard."

"It's yours."

He unhooked the maze of cables from the transmitter and placed it by the door near his coat. Then walked to the window and opened it a crack. He placed my keyer with the one-inch side-tone speaker aimed out the slightly opened window and pointed meaningfully at the key. I sent a series of "BTs" while the official carefully adjusted the sidetone level to a whisper and marked that position on the volume dial.

The official bowed low and glided out the door saying, "Ham in peace, and always sign . . ./ET after your calls."

If, by some remote chance, you hear a ham working 20-meter CW and signing /ET, please don't bother calling. It will be me on the 200-mW audio oscillator with a one-inch vibrating antenna. Don't bother, because I've undoubtedly worked your state more often than you have, and now that I've cleared the 300 country mark on "ET" I need all the time I can get to look for the last few. I sure will be glad when all these sunspots go away, won't you?

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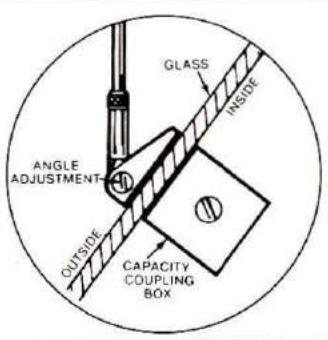

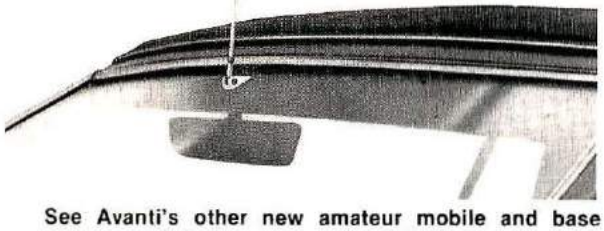

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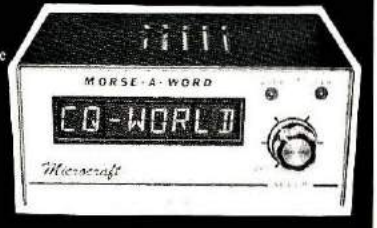

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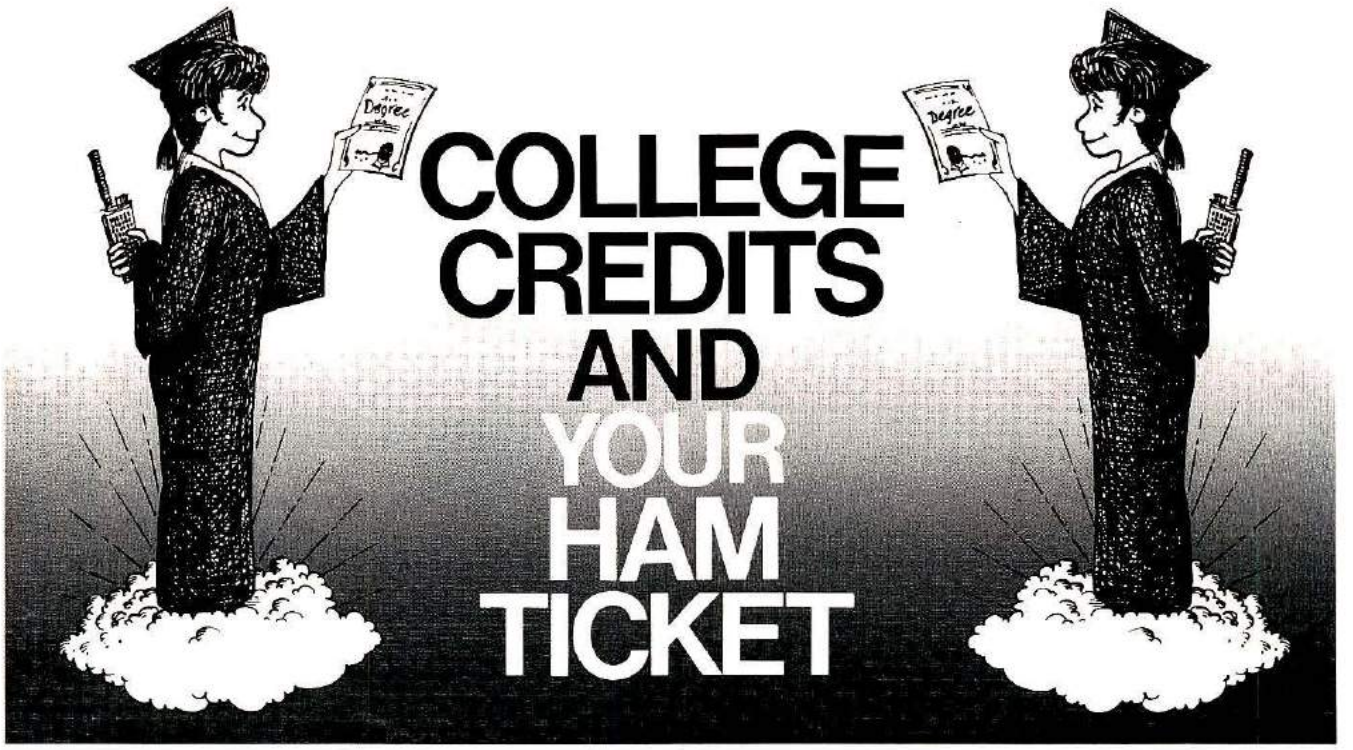

COLLEGE CREDITS AND YOUR HAM TICKET

BY KAY ANDERSON, W8DUV

Ham radio has been a rewarding avocation for me in many ways during the past twenty-five years, but recently it proved even more rewarding when I used my hobby experiences to save both time and money. Being an Amateur Radio operator earned for me fifteen hours of college credit toward my Bachelor's degree. That is equivalent to one whole semester of work, plus savings in tuition and book fees. This credit, in addition to other credit allowed for work and life experiences, enabled me to graduate in two years instead of four. You might be able to do the same thing, or do even better, if you are presently enrolled in college or are thinking of going back.

Credit for life experience

Many states now offer a degree program to encourage the adult dropout to return. In West Virginia it is called "The Board of Regents' Bachelor of Arts Degree." Basically, it is designed to help the student complete requirements for a baccalaureate degree without having to take courses in subjects in which he is already proficient. Credit is given for life and work experiences, but not just any experience; one must show that what has been learned is comparable to courses offered in college. And, credit is not lightly handed out; I had to show that I really earned it. I'm proud of my diploma. It is not one that was bought; it is not an "honorary" degree; nor is it worthless. I can enter graduate school, if I

Here's Kay at the beginning of her Amateur Radio career, as W4BLR in Richmond, Virginia. The rigs were imposing things in those days, and leaned heavily on surplus equipment and the skills of a homebrew artist.

wish, or do whatever anyone else does with a bona fide, four-year Bachelor of Arts degree. Right now it hangs in a conspicuous place in my home above all other certificates and plaques.

The process

I was already enrolled in part-time courses at Marshall University in Huntington, West Virginia, when I first learned of the Regents' BA program. Working full time as a secretary while taking only two evening classes per week made a college degree seem like an impossible goal. Suddenly, the Regents' plan offered hope; I decided to look into it. Sure enough, the program coordinator told me that many of my endeavors and achievements during the thirty years absence from school might be translated into academic credit. I was advised of the procedures to follow, given suggestions as to how to write up *résumés* for evaluation, and helped with all the necessary red tape involved in transferring from the College of Arts and Sciences to the Regents' BA program. Then, there was a one-time fee of fifty dollars for admission to the program. This is a small fee compared with the tuition and book costs saved.

At home, following the suggestion of the plan coordinator, I began reading the 1976 Marshall Undergraduate Catalog. Courses were listed alphabetically — Accounting, Anthropology, Art, etc. Whenever I found a course in a subject I already knew, I made a checkmark. Most of my experience seemed to fall into four categories: secretarial, home economics, journalism, and computer studies. The next, and most tedious, chore was to write up my claim for credit. Claims had to be supported with evidence. In my *résumé* claiming credit for typing and shorthand, for instance, I had to attach documents and letters of reference from present and former employers. It was not enough to simply show that I could type and take shorthand; I had to show that I'd gone through a learning experience. The same was true in my *résumé* for computer studies. I'd taken three evening courses and I had the pretty certificates to prove it, but I still had to outline in narrative form the learning process. I had to show it was comparable to the course listed in the college catalog. Most of the credit I asked for was allowed; some, however, was not. The Department of Journalism, for instance, returned my presentation without credit even though I'd submitted copies of newspaper columns, magazine articles, and samples of a monthly newsletter I edited (*West Virginia Amateur Radio News*). I felt that my monthly column in *QST* (I was Section Communication Manager for West Virginia at the time) should have earned at least three hours' credit in Journalism 101, but it was not to be. It was clear that college credit was not being dispensed generously. One must prove without a doubt that it is deserved.

Bitten by the academic bug

Just as the ham radio bug bit me in 1952, so the academic fever grabbed me now. With the acceleration of credits piling up, I became very enthusiastic about college. My goal of obtaining a degree was in sight. To make it happen even sooner, I decided to resign from my job and attend classes full time. It was fun! All the things I'd always wanted to know were available to me, and I was impatient to taste everything at once. At registration time I signed up for Psychology, Anthropology, Political Science, Art, Acting, Golf, and Spanish — twenty hours. It was a big class load. Needless to say, something had to give; my hobby was the victim. While I pondered over the origins of man and tried to understand the mechanics of politics, cobwebs formed intricate patterns around my NCX-5, the Teletype printer began to disintegrate into rust, and the twenty-meter beam froze

Kay, now as W8DUV, on a TV program over Channel 13 in Huntington, West Virginia. She's explaining what's behind the awards and certificates her Amateur activities have earned. This experience on TV earned credit for her in the course "Introduction to Radio and Television."

pointing north. My newsletter — *West Virginia Amateur Radio News* — was put on "hold," and eventually died a natural death. W8JM, former and longtime SCM of West Virginia, graciously agreed to take the job back. Instead of making contacts on the air, I talked to a mirror! I'd been given a part in the university production of Brendan Behan's play *The Hostage*. (Someday I'll tell what goes on backstage and at the rehearsal parties — wow!) All this and sports too? Yes, I took up golf, bowling, tennis, and swimming. Somehow, during the years I was so active with my Amateur Radio hobby, I'd neglected to try anything else. Now golf became my favorite activity. My husband, Ed, W8DUW, also became interested. After each class I'd come home and teach him what I'd learned. Every weekend we headed for the golf course to practice. Surprise — he is better at it than I am; he's already won a trophy!

College credit for a ham license?

I was having the time of my life. I loved all the reading that was required. Writing theses and reports was no problem. I participated in every possible college activity with enthusiasm and enjoyment. My Regents' coordinator brought me down to earth again at the end of the semester: "What are you going to do about the requirement for eight hours of science and math?" That was the only requirement I hadn't fulfilled. Remembering the difficulty I'd had trying to learn basic electricity just to get my Novice ticket, I knew I'd have a hard time in any science class. My five children had grasped the "new math" concept easily, but I could *never* understand it, and I cringed at the thought of college algebra or trigonometry. As I sat there, looking as though my world had just caved in, the coordinator came up with an idea: "Why not use your hobby?"

"You mean I can get credit for a hobby?"

"Sure," she said, "if it's taught here, or at any other college, and you can demonstrate that you know the subject, you may be able to get credit for it."

"But, has anyone else ever done that?" (I needed some guidelines, some example to follow.)

No one, to her knowledge, had used Amateur Radio for credit before — at least not at Marshall University.

We looked through the undergraduate catalog for courses which might describe what one had to learn in order to be a ham. The Science Department offered *Fundamentals of Electronics* and *General Physics Lab*. This would amount to only five hours credit. Remembering how hard I had studied to get my license, I felt it was worth more.

"Try the Case Western Reserve University catalog," the coordinator advised, "they offer many engineering classes, and your hobby sounds like a lot of engineering to me."

I could certainly agree with that. The college librarian helped me find the needed catalog. The problem then was not where to find enough course descriptions, but, rather, to choose the right ones. There were plenty to choose from! Some taught things that had nothing to do with my hobby, others went deeper into the subject than was needed to describe the material I had learned. Finally, I selected just the course descriptions I needed for my proposed *resumé*. Two came from Marshall's catalog and two from Case Western's.

Writing the resume

As I had done in previous presentations, I began by copying the course description directly from the catalog:

154. Fundamentals of Electricity. 3 hrs. Basic electrical concepts and definitions, basic dc circuits involving Ohm's and

In 1971, West Virginia Governor Arch Moore signed an "Amateur Radio Week" proclamation, with W8DUV and W8JM in attendance. Don Morris, W8JM, was then president of the State Radio Council, and Kay was secretary.

Kirchoff's laws, magnetism, simple magnetic circuits, reactance, impedance, and single-phase ac circuits.

Next, in narrative form, I told how I learned the subject and had received my Novice license. I told about my teacher (my husband) who insisted that I build my first transmitter, not from a kit, but from junkbox parts. Not only were all the parts "used" (except the crystal), but they were all thrown together in several boxes of junk which he'd accumulated, and they were not identified. I didn't know a resistor from a capacitor, a transformer from a coil. The transmitter schematic was drawn on a piece of cardboard.

"Where do I start?" I remember asking.

"You'll need to strip a chassis first," he told me.

"You mean I have to take all this old stuff off then put the new stuff on?" (Since I didn't know one part from another, it was all just "stuff.") Armed with the ARRL *Handbook*, a little card which showed the resistor color code, and Ed's hand-drawn schematic, I tackled the job. Unsoldering was easy; soldering wasn't. I made a lot of mistakes. The biggest one was completely soldering all the pin connections to a tube socket, then finding out that the 6L6 tube didn't fit the socket. I had to start all over. But I finished it in less than a month — while husband/teacher was out of town. At the local electronic supply store I asked for a Novice crystal. "What frequency?" the man wanted to know. I didn't know, or care. He disappeared into the back of the store and came back with a crystal — 3717 kHz — no charge (he was a ham and recognized a very novice Novice).

Not mentioned in my *résumé*, but useful later in Speech class, was the feeling I experienced when I plugged that crystal in and called "CQ."

Kay's work in the Military Affiliate Radio System (MARS) earned more than college credits. Here Lt. General Claire E. Hutchin, Jr., Commanding General, First U.S. Army, at Fort Meade, Maryland, presents the Commander's Annual MARS Trophy to Ed and Kay Anderson (*U.S. Army photograph*).

Another Novice in Illinois answered my call! It wasn't my first QSO because I had been making contacts using Ed's station, but it was a very emotional moment. The rig lasted for several minutes — just long enough to exchange names, addresses, and signal reports. Then it began to smoke, and smell. But I had logged "RST 589 from ILL." with my first transmitter. I let it cool down, and waited for the OM to check it out when he got home on the weekend. Several things were wrong; too many turns on my hand-wound coil, an electrolytic thing installed improperly, and I had remembered to "dip and load" but forgot to "dip again."

For credit based on passing the General-class examination, I used the following course descriptions:

255. Fundamentals of Electronics. 2 hours
336. Antennas And Propagation. 3 hours
202-204. General Physics Lab. 2 hours

Using the same narrative form, I tried to show that the material covered in my studies of the license manual and the ARRL *Handbook* compared closely with what was taught in the above courses. Those three classes could be completed in one semester at college, but it had taken me a year to earn my General-class ticket. I didn't just study two or three days per week; I studied *every* day, and several nights too. Ed quizzed me at the supper table, while traveling to and from work, and before going to sleep at night. I drew oscillator and power-supply circuit diagrams everywhere — even in my Bible on Sunday. I added, in my *résumé*, that the learning process didn't stop with issuance of the FCC license; it is continuing. I mentioned ssb, repeaters, OSCAR, and Teletype. A ham, I stated, had to keep learning all the time to stay abreast of the ever-changing state of the art. To help substantiate my claim, I attached copies of my licenses, the license manual, the ARRL *Handbook*, and some recent copies of *QST*, *73*, and *Ham Radio* magazines. It worked! I was awarded the ten

hours I requested. (Those of you who hold Advanced and Extra class licenses should be able to receive even more credit.)

Some of my ham experience didn't fit into the Physics or Engineering categories. I had been SCM of West Virginia and President of YLRL (Young Ladies' Radio League), for example. Even though they were not salaried positions, these jobs were like any other office manager's job. They required decisions, answering correspondence, policy making, filing reports, and even expense reports. This seemed to be covered by the course title: *421: Office Management*. For an outline of this experience I was awarded another three credit hours. Finally, the Speech Department allowed me two hours credit for a course entitled *Introduction To Radio and Television*. To qualify for this one I was able to show that the U.S. Rules and Regulations Governing Amateur Radio (a section found in the back of ARRL's *License Manual*) was not too different from the rules governing broadcast radio and television. Again, I submitted copies of my licenses and added a cassette recording of my voice — calling a net on the MARS (Military Affiliate Radio System) frequency — to show that I had overcome mike fright and knew how to speak in a broadcast fashion. I offered to spend the required number of hours working at the university's fm broadcast radio station, WMUL, but this was not necessary. This credit made a total of fifteen hours based solely on my Amateur-Radio experience.

No more résumés

At that point I had piled up 57 hours of credit for life experiences and 46 hours of actual classroom credit. I was fast approaching the necessary 128 hours for graduation. I loved college! Not only had I learned many of the subjects I'd been only vaguely aware of before, but I had participated in college activities that I never dreamed possible. (After all, I had been a high-school dropout, married at 19, raised five children, and now had seven grandchildren. Just imagine, ME — in a college play, bowling in the mixed league, and playing golf!) I entirely

The smiling graduate proudly wears the mortarboard and the stole for honors, and part of that smile is because Amateur Radio played a large part in making it possible.

forgot my age. So I declined the coordinator's offer to search out new areas of experience. Even if there was some knowledge I possessed which was also taught at college (and there are some pretty weird things being taught these days), and, even if I could get credit for that knowledge by writing a story about it, I resolved not to do it. I'd rather take the class. The last semester was the easiest. It's true — senior classes are easier than freshman classes, so take heart all you college freshmen out there.

Additional benefits

I've always placed a great value on my FCC license and the operating privileges it allows me. Today, I realize that it is more valuable than I had thought. Even when I took a two-year vacation from on-the-air activity, my license was a valuable asset. Not only did it provide me with fifteen hours of college credit, but it proved to be a constant source of topics for Speech and English classes.

Once in Speech class we were asked to talk about something we had made with our own hands. With all my years of experience I could have chosen from many articles — quilts, pottery, dresses, rugs, and such. But I chose, instead, to talk about my first transmitter, mentioned before. Naturally, I was the only one in class with that subject. (One fellow said he had never made or built anything, but he talked about some "messes" he had made.) Another assignment was to describe some physically painful experience. I could have talked about childbirth, but remembered just in time the painful experience of trying to remove a 6146 tube when the transmitter was still ON. It was difficult to explain how rf energy feels, but I think they got the message. Anyway, I received a good grade on the speech.

In English classes the same thing happened. Without notice, the professor would assign a paper to be written in class on "any subject of your choosing." This would cause some students deep despair or automatic agony; not me. My ham-radio memory bank would immediately provide me with a topic such as, "The Day I Talked to King Hussein," or "How to Conduct a Celebrity Auction for Charity." The latter episode happened a few years ago at a West Virginia State Radio Convention. Well-known people who also happened to be hams were contacted and asked to send a gift which would be auctioned off to the highest bidder. The proceeds would go to help handicapped hams and would-be hams. Gifts came from all over the world, and not only did it raise money, but it was great fun for all of us

who were involved. Things like that are easy to write about on short notice. My problem was not the lack of a subject, but how to condense the story down to three or four pages. My classmates seemed to have the opposite problem. (Senior citizens take note: don't be afraid to go back to college and

— cap and gown, even a red stole to show graduation with honors. Everyone in the family wanted to know: "What are you going to do now?"

Well, I could stay home and just enjoy being W8DUV for a while. I could, on the other hand, get a better job than I had before. Then, there's

The ham shack is still a favorite part of the Anderson home, with plenty of modern equipment to accompany a few remaining pieces of homebrewed gear. Kay is well at ease with either straight key or bug, and recently received a keyboard keyer as a present from husband Ed.

sit in class with the younger people. Sure, they are quick and bright, and fresh out of high school, accustomed to studying and learning. But we "oldies" have something in our favor — experience. It's not just ham radio experience, it's all kinds of life experience, and it's worth a great deal, believe me.)

There was one more example of how ham radio helped me in class. A tape recording of some Spanish-speaking hams on twenty meters provided my Spanish class with some new and fascinating material to translate; and it helped my grade.

All good things must end

Graduation day was May 13, 1978. It was a dream come true

graduate school. Just think, in two years, or maybe a year and a half if I attend summer school, I could have my master's degree.

Can you do it?

If you are thinking of going back to school, or even if you are presently enrolled and would like to accelerate the process, you might want to look into such a program as the Regents' Bachelor of Arts program in your own state. For more information, call or write your nearest college or university, or write: United States Department of Labor, Employment Standards Administration, Washington, DC 20210, and ask for Leaflet 56, *Get Credit For What You Know* — Cost 70¢.

Good Luck! **HRH**

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An unprecedented DSI VALUE . . . in a high quality, LSI Design, 50 HZ to 550 MHZ frequency counter kit. And, because it's a DSI innovation, you know it obsoletes all competitive makes, both in price & performance.

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Every 3550 QUIK-KIT® PC board is factory assembled and tested before shipment.

The problems of bad LED's, IC's, and Capacitors are a thing of the past. No manufacturer except DSI offers a 550 MHZ frequency counter with . . . 8 digits, .5 in. LED's, TCXO, 1 HZ resolution and a one year warranty on parts for under $100.00. We do not know how long we can hold this low, low price.

Model	Price	Frequency Range	Accuracy Over Temperature	@ 146MHz	@ 220MHz	@ 450MHz	Number of Readouts	Size of Readouts	Power Requirements	Size
3700	$269.95	50Hz - 700MHz	Proportional Oven .2 PPM 0° - 40°C	10MV	10MV	50MV	8	.5 Inch	115 VAC or 8.2 - 14.5VDC	3"H x 8"W x 6"D
3600A	$199.95	50Hz - 600MHz	Oven .5 PPM 17° - 37°C	10MV	10MV	50MV	8	.5 Inch	115 VAC or 8.2 - 14.5VDC	2⅛"H x 8"W x 5"D
3550W	$149.95	50Hz - 550MHz	TCXO 1 PPM 65° - 85°F	25MV	25MV	75MV	8	.5 Inch	115 VAC or 8.2 - 14.5VDC	2⅛"H x 8"W x 5"D
3550K	$ 99.95									

1 HZ Resolution to 55 MHZ • 10 HZ Resolution to 550 MHZ • .1 and 1 Sec. Gate Time • Auto Zero Blanking

3550K Kit	**$99.95**
T-101 Ant.	**3.95**
AC-9 AC Adp.	**7.95**
Shipping, Handling, Ins.	**10.00**

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3550W Wired	**$149.95**
T-101 (incl.)	**NC**
AC-9 (incl.)	**NC**
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TERMS: MC — VISA — AE — Check — M.O. — COD in U.S. Funds. Orders outside of USA and Canada, please add $20.00 additional to cover air shipment. California residents add 6% Sales Tax.

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Transistor Tester — VOM

Diode Protected • Fused • Gold Plated Selector Switch

- DC VOLTAGE
- DC CURRENT
- AC VOLTAGE
- Ω RESISTANCE
- AF OUTPUT — DB
- 20kΩ PER VOLT
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- ICEO LEAKAGE

$29.95
MODEL YF-370
COMPARATIVE VALUE 49.95

YF-370 ..... $29.95
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Every YF-370 is factory assembled, tested, and includes diode protected meter movement with a fused input and an extra fuse. The switch assembly has double wiping gold plated contacts to assure years of trouble-free service. At this low price buy two...one for the car and one for the shop.

SPECIFICATIONS

Measurement	Measurement Ranges	Accuracy
DCV	0 - .1V - .5V - 2.5V - 10V - 50V - 250V - 1000V	± 3% fs
ACV	0 - 10V - 50V - 250V - 1000V 30Hz to 30kHz	± 4% fs
DCA	0 - 50μA - 2.5ma - 25ma - .25A	± 3% fs
Ω	.2 to 20mΩ Range x 1 x 10 x 1k x 10k	± 3% arc
dB	+ 10db ~ + 22db for 10VAC	± 4% fs
ICEO	0 - 150μA x 1k 0 - 15ma x10 0 - 150m x 1	± 3% arc
HFE	0 - 1000 @ x 10 $\frac{I_C}{I_N}$	± 3% arc

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DSI INSTRUMENTS, INC.
7924 Ronson Road, Dept. G, San Diego, CA 92111

Dear Horizons:

Ham radio just ain't what it's pictured to be. Did you ever see a *picture* of a ham station that didn't appear well arranged and neat; but did you ever actually *see* a station that didn't have coffee cups, beer cans, ash trays, scratch pads, a tape recorder, a call book, a book of matches and cigarettes — all vying for space on the desk? Now, my contention is that the ham with the clean desk has been up all night calling CQ DX, and is completely "pooped." The reason the desk is devoid of coffee cups etc., is that you can't see them on the floor where he has brushed them so he can rest his head and get a little shut-eye before he has to go to work.

I first became interested in ham radio when I saw a photo of a bikini-clad model sitting on the edge of the desk while the O.M. played with his radio gear. That just ain't the way things are. No bikini-clad model has ever sat on my desk . . .

My XYL explains that the model is really the ham's wife, and after he spent so many green stamps for his rig there wasn't any money left for her to buy anything but a bikini . . .

Yours for truth in advertising.

Donald E. Cole, W7EJP
Ryegate, Montana

Dear Horizons:

I am a new ham, 69 years old.

I suppose you could call me the "Rip Van Winkle of Radio," as I studied to be a ham operator in 1931, then went into Radio Servicing, and combined piano tuning and repairing with my radio work.

In the meantime, World War II came along, and I became an Aircraft Technician, and resumed my piano servicing after the war. I had forgotten practically everything I had ever learned about radio, so I had to start from the beginning.

After dreaming that I was back in school again (this dream reoccurred three times), I heard of a ham-radio course being organized in Duncan, Oklahoma. I enrolled. I found that at my age, learning was more difficult than in my younger years, but with much encouragement from my instructors, I finally passed my code test after the fourth try. The theory test was very easy, and I got my Novice license.

I find that *Ham Radio Horizons* is the best magazine for the novice that I have ever seen. It is easily readable, and especially geared to the Novice, who needs all the help he can get. Another feature that I appreciate, rarely found in other magazines, is that of the old circuits, many of which are those of the 1920s and 1930s. It is quite interesting to compare those with the gear being used today.

Ham Radio Horizons fills a definite need, and I could not suggest any changes!

William H. Updegrove, WD5FRD
Marlow, Oklahoma

Dear Horizons:

Is it okay for a General-class ham to get on the Novice band and give a hand to the Novices? Is the allocation exclusive?

Eugene H. French
Eastford, Connecticut

Not only is it okay to do so, but it is a wonderful idea, Eugene. The only restriction is that when you operate in the Novice segment you observe the same power limit they have, 250 watts input to the final stage of your transmitter. ***Editor***

Dear Horizons:

The article on "The Doerle Shortwave Receiver" in the March issue was most interesting.

Many years ago I purchased a Doerle Signal Gripper and remember it well. My first error was in switching the filament control with the regeneration control and shorting the batteries due to lack of control insulation. Also, it would really "howl" if you changed position in the room. Your article sure brought back memories. Keep them up.

Joseph F. Dineen, W1JSS
Westwood, Massachusetts

Dear Horizons:

What happened to the original *Ham Radio Horizons*? When it surfaced as a new publication, it was a fresh look in ham radio magazines.

However, time has taken its toll and today we are treated to DX-peditions which are only confined to individuals blowing their own horn, the IARU story which was boring, and who cares about the "ole ole" days?

Let's get back to the real constructive format of the original *Horizons*, even though it may be a hard decision to make.

Dr. A. W. Slapkowski, K4AWS
Sumterville, Florida

Dear Horizons:

A great many articles show circuit boards with etched circuits. I would like to read some articles on how to etch circuits on boards.

Max Mendelson
Delray Beach, Florida

Etched circuits are not necessarily the answer for all projects, Max. For most small jobs you are ahead of the game to order a board from one of the many suppliers. Their cost per board is reasonable when you add up what you will spend for everything needed to produce one yourself — such as trays, chemicals, a supply of film, a means of exposing it, and the time and materials to produce the negative itself. The only way to save money is for a group to get together on the purchase of basic supplies and equipment. In that case, you can turn out several identical boards at very low cost per individual. If you have access to files of ham radio *through a friend or library, there are articles on etched circuit techniques in the August and September, 1971, April, 1973, and January, 1975, issues. Perhaps, in time, we'll put a pc-board story together for* Horizons *as well.* ***Editor***

for the experimenter

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Crystal controlled transistor type. 3 to 20 MHz, OX-Lo, Cat. No. 035100. 20 to 60 MHz, OX-Hi, Cat. No. 035101.

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MXX-1 TRANSISTOR RF MIXER

A single tuned circuit intended for signal conversion in the 30 to 170 MHz range. Harmonics of the OX or OF-1 oscillator are used for injection in the 60 to 179 MHz range. 3 to 20 MHz, Lo Kit, Cat. No. 035105. 20 to 170 MHz, Hi Kit, Cat. No. 035106.

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Resistor/capacitor circuit provides osc over a range of freq with the desired crystal. 2 to 22 MHz, OF-1 LO, Cat. No. 035108. 18 to 60 MHz, OF-1 H, Cat. No. 035109.

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PAX-1 TRANSISTOR RF POWER AMP

A single tuned output amplifier designed to follow the OX or OF-1 oscillator. Outputs up to 200 mw, depending on frequency and voltage. Amplifier can be amplitude modulated 3 to 30 MHz, Cat. No. 035104. *Specify when ordering.*

$6.06 ea.

SAX-1 TRANSISTOR RF AMP

A small signal amplifier to drive the MXX-1 Mixer. Single tuned input and link output. 3 to 20 MHz, Lo Kit, Cat. No. 03512. 20 to 170 MHz, Hi Kit, Cat. No. 035103.

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BAX-1 BROADBAND AMP

General purpose amplifier which may be used as a tuned or untuned unit in RF and audio applications. 20 Hz to 150 MHz with 6 to 30 db gain. Cat. No. 035107.

Specify when ordering.

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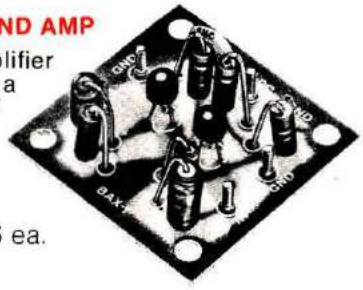

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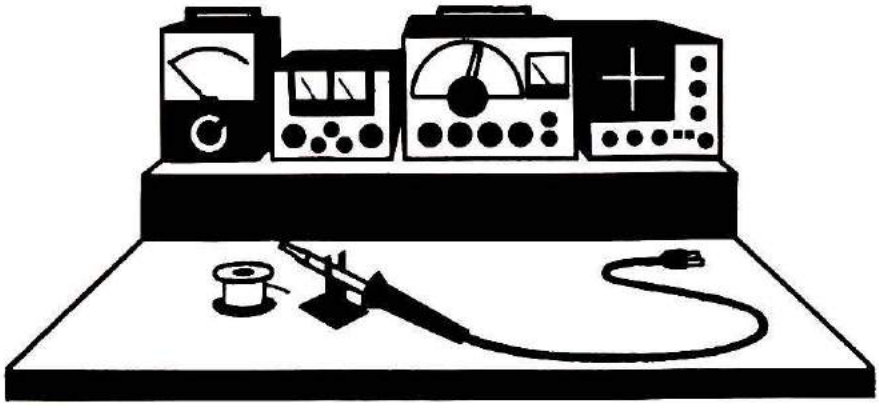
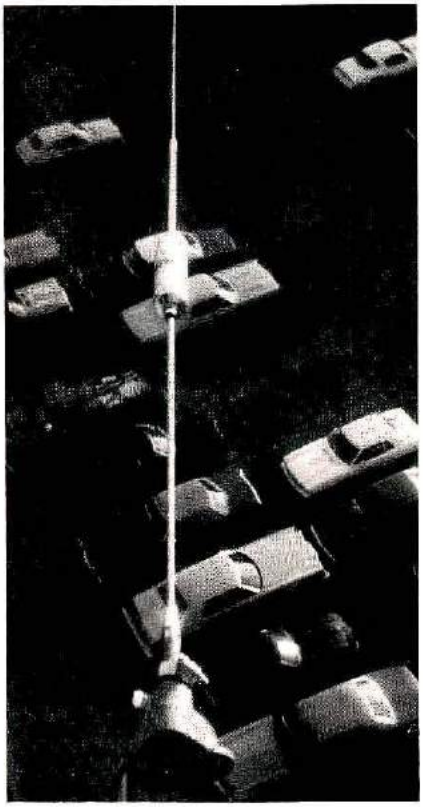


BENCHMARKS

Apartment Hamming

I have just joined the ranks of the married population, which means I had to leave my home of long standing. This also meant leaving behind a tower, beam antenna, and several fixed antennas. I am now living in an apartment, which is far from the most desirable place for hamming.



A mounting bracket and Hustler HLM trunk-lid mount hold the antenna in a horizontal position outside the window. It normally works on 2, 10, and 15 meters, and by adding a resonator as shown here, will hit the lower bands too.

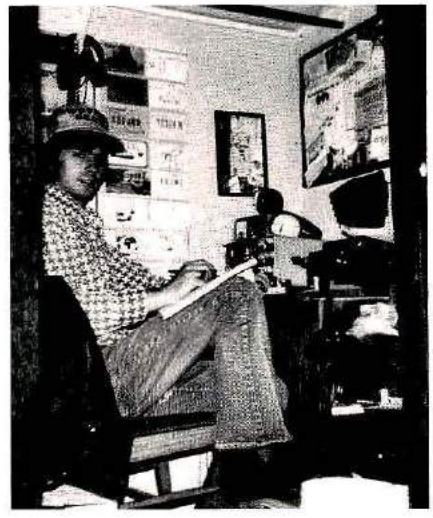
The first couple of months that I lived here, I tried different sorts of loop antennas; end-fed, top-fed, window-screen-fed, but nothing seemed to work very effectively. The window screens loaded fine on 10 and 15 meters, (SWR about 2:1) but the pattern just wasn't there.

I finally found an antenna stuffed away in some boxes; one I had used for two-meter operation. It was a Hustler 5/8-wave mobile antenna. After experimenting for a while, I found that I could get it to efficiently load up on 10 and 15 meters.

Here is the arrangement I finally ended up with. The 5/8-wavelength (2.1 meters, or 84 inches) on 2 meters is very close to 1/4-wavelength on 10 meters. I rolled a 5-meter (50-foot) length of RG-8/U Polyfoam coax cable into a coil about 30 cm (12 inches) in diameter. I connected 6 meters (20 feet) of RG-59/U cable to the coiled coax, and ran it through the window beside the air conditioning unit to the mount for the antenna. For support, I used a mobile-radio mounting bracket bolted to the window sill. The antenna mount is an "HLM" New-Tronics Hustler trunk mount.

When I operate on 2, 10, or 15 meters I use the complete model CG-144 antenna. I have found that it will load up across the whole 2-meter band with an SWR of about 1.7:1. It will load up on 10 meters on 28.000 to 28.200 to about 1.5:1, and up at 28.500 to 28.800 about 1.8:1. If you go above 29.100 it goes back down to 1.5:1. On 15 meters, the SWR is 2.8:1 across the whole band. (As soon as I can afford it, I'm going to purchase a 15-meter mobile resonator!) For 20, 40 and 80 meters I am using the Hustler RM-20S, RM-40, and RM-80 mobile resonators. This is where the MO1 or MO2 mast would come in handy. Instead of slipping these resonators over the bottom portion of the CG-144 antenna, as in the photograph, they could be screwed onto the mast more securely.

Our tenth floor antenna arrangement is inconspicuous from the ground, and is very fast and easy to install. Don't let its size fool you! I've worked New Zealand, Australia, and Germany so far, on 10 and 15 meters. I am also trying for WAS on 40.



Having solved the antenna problem, the next challenge was a place for a shack. A cozy 3 by 6 foot closet serves the purpose.

I failed to mention one other drawback about apartments, especially a one-bedroom apartment — there's not much room to operate! My XYL has put me in company with all of our extra boxes and coats in the coat closet, see photograph. See you farther down the old coat hanger!

Eugene F. Gabry, WB9VTF

Amateur Radio Equipment Survey

Here's your chance to tell the world what you think of your equipment.

BY THOMAS McMULLEN, W1SL

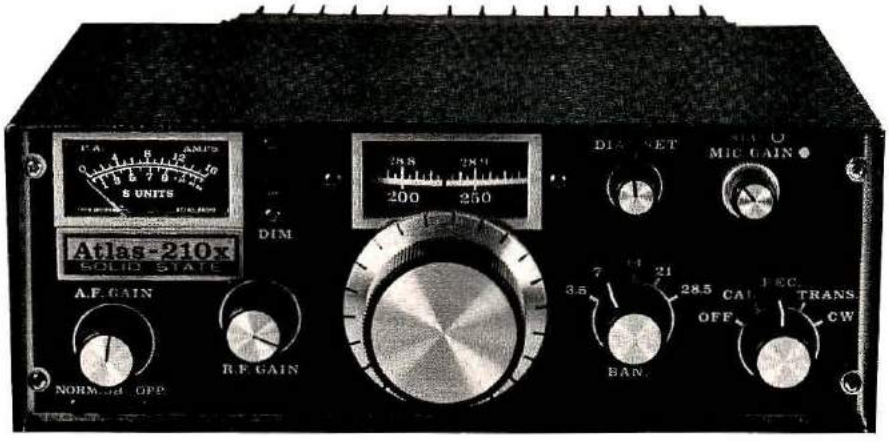
When you mention public service among a group of Amateurs, the reaction is usually something like "Oh, yeah, that message-handling stuff," or, "Well . . . I'm a member of the Sunday Morning Pizza-Parlor Net on the local repeater, and we handled twenty-one messages during the blizzard last winter."

That's public service, but it's the Amateur Radio community performing a service for the rest of the world. Let's try it the other way around; how about some service *for* Amateurs for a change, especially for the newcomers.

The idea is simply this: evaluate your Amateur equipment and let *Ham Radio Horizons* know about it. The results will be published for all to see and heed (or disregard, as they see fit).

This type of test is based upon the old truism that the marketplace is the final test of a product. Problems can arise when you rely just on what you hear — only those who are grossly dissatisfied will make noises about it, and they may *not* represent a fair cross-section of equipment in use. There may be 100 satisfied owners (the silent majority) for every ham who thinks he got a lemon (and he may have very valid reasons for thinking so).

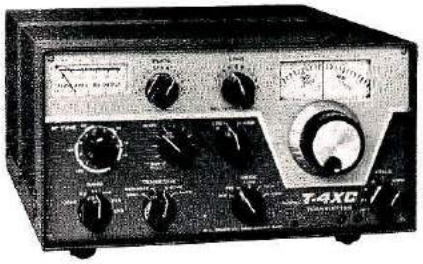
That's why we would like to hear from everyone who has a rig of the types indicated on the Owner Report form: This month, we're looking for evaluations of the Atlas 210X/215X, the Drake Twins T4XC/R4C, or the Kenwood TS-820. In coming months, we'll be requesting reports on other popular rigs.



To make the processing of responses a manageable job, it was necessary for us to design the Owner Report as a questionnaire. Obviously, to allow someone to ramble on for page after page about his pet or his "lemon" would present an impossible problem in evaluating the reports and sifting the data. The *Ham Radio Horizons* staff has carefully considered the type and number of questions we would like you to answer, and we believe they will provide valuable feedback. This information will serve as a guideline to new Amateurs who want to know what kind of rig they should consider, what they should expect of it, and what to avoid. It will also provide equipment manufacturers and designers with some useful guidelines for the engineering of new gear, or for correcting major problems (if any) in equipment they now have in the hands of Amateurs. The end result should be better service to all Amateurs. We'll all be winners.

Guidelines

It should take you only a few minutes to fill out the Report form on the next two pages. Most answers can be a simple **Yes** or **No**, or an **X** or a checkmark. In some cases, comments are asked for. Don't be afraid to say what you really think about the point in question. Was the dealer uncooperative? Did it take too long to obtain a part needed for service? Was the equipment damaged in shipment? Was the sales promotion or the advertisement misleading? Say so. Don't worry — if you indicate that you don't want your name used, we will honor that



request. We're not out to "get" anyone, nor are we out to let anyone off easy. As a line in an old TV show used to go . . . "Just the facts, sir," (or Ma'am, as the case may be).

We're looking for *Owner's* reports, please; if you've listened to a buddy praise or grumble about his rig, talk him into filling out the report. A club station? Well — okay, we'll accept *your* report based on your use of it.

Note that we're asking about three rigs on the first Report. Just indicate which of the three you're talking about in your response, and we'll sort them out. Our published report will be on one rig at a time. Important: if you have more than one rig of the type you're talking about, or if you own (or have owned) one or more of the other brands and models indicated, send us an addressed, stamped envelope and we'll rush extra forms right back to you.

Note the optional personal data section, item 26, on the second page. You don't have to fill in every line — you can leave them all blank if you wish. We have no desire to get you in trouble with your friendly local dealer if you feel that might be a problem. However, if you wish to "stand up and be counted," then fill in the name

and address portion, and sign the form. We may, or we may not, publish portions of your comments, depending upon space available.

As the saying goes, this can be a fun thing. However, it also has its serious side. If there are outstanding problems in the rigs we depend upon, here's the chance to call them to the attention of the people who make and sell (and service) Amateur equipment. If your rig has always lived up to your expectations, and you couldn't ask for anything better — that's a great recommendation to new Amateurs, and a pat on the back for the engineers who designed the thing in the first place.

Deadline

Note the cutoff date for getting your comments back to *Ham Radio Horizons* — August 31. It will take quite a bit of time to evaluate and arrange the responses, which means you'll see the results later this year. Results for each type of equipment will be published in separate issues. Note that there is a space on the form for you to tell us what rig(s) you would like to see reported on in the future. We have several in mind, but your voice counts, too. If you don't have a rig of the type named, send us a *postcard* with your choice of equipment to be reviewed.

Obviously, very new models would not get a fair shake until enough of them are out in the field to obtain a meaningful number of comments. This will all work out well, though — by the time we have gathered and published results on the rigs that have been around a while, the newer ones will have been used and evaluated by more hams. Keep watching the pages of *Ham Radio Horizons* for announcements.

An important point must be made here: this is *not* a comparison. We're not comparing any make or model with any other make or model. The

Report Form No. 1 concerns the Kenwood TS-820, the Drake C-line, or the Atlas 210X/215X. Future reports will cover equipment by Yaesu, Ten-Tec, Swan, Alda, Heath, and Icom, as well as other models by Drake, Kenwood, and Atlas. All popular equipment will have its day in the sun.

We're looking forward to some interesting results and comments. There may well be some pleasant surprises in store, as well as some that are unpopular. That's fine, and, to borrow a modern cliche, the bottom line tells it all: would you buy this rig again?

Fill in the Report Form, and mail it in right away to *Ham Radio Horizons*, Owner's Report No. 1, Greenville, NH 03048. **HRH**

HAM RADIO HORIZONS

Owner Report on Amateur Radio Equipment

(Fill out this form in accordance with your experience. Please type or print clearly.)

1. Make and Model (circle *one* only) Atlas 210X/215X Drake Twins T4XC/R4C Kenwood TS-820
2. What year did you buy it? _____ New? _____ Used? _____
3. Where did you buy it? Dealer_____ Mail Order_____ Individual_____ Flea Market_____
   800 Number_____ Other_____
4. Would you buy from the same source again?_____
5. Amount of use: Daily_____ Often_____ Occasional_____ Seldom_____
6. Is this your primary_____ or backup_____rig?
7. What modes have you used? CW_____ SSB_____ RTTY_____ SSTV_____ AM_____
   Other_____
8. What is the rig's best feature? _____
9. Why? _____
10. Worst feature? _____
11. Why? _____
12. Have you had any problems?_____ Explain _____
13. Have you had the rig serviced?_____ Where? Manufacturer_____ Dealer_____ Other_____
14. Was the service satisfactory? Yes_____ No_____
15. What accessories have you purchased for this rig? _____
16. Have you been able to obtain all the accessories and parts you need? _____

17. Have you been satisfied with these accessories? Yes_____ No_____

18. If not, why? _____

_____

19. Accessories you would like for this rig _____

_____

_____

_____

20. Additional features you would like to see in a rig of this type _____

_____

_____

_____

21. Give the equipment a score from 1 to 10 (with 1 being poorest, 5 average, and 10 excellent).

Ease of operation _____ Performance _____

Reliability _____ Maintenance _____

Durability (in continuous use) _____ Parts Availability _____

Instruction Book _____ Accessories (ease of connection) _____

Dealer Service _____ Price _____

Quality of Workmanship _____ Flexibility _____

22. How long have you been licensed?_____ Your Age_____ License Class _____

Principal activities: Contest_____ DX_____ Rag Chewing_____

Traffic Handling_____ Experimenter_____

23. What antenna do you use most? Beam_____ Wire_____ Other_____

24. What rig would you like to see reported on in the future? _____

25. Would you buy this same rig again? _____

26. (Optional: fill in the following only if you wish.)

Submitted by: Name _____ Call_____

Address_____

City _____ State_____ Zip_____

_____
(Signature)

(Your signature authorizes *Ham Radio Horizons* to quote portions of your comments in our report.) May we use your name and/or call?

Yes_____ No_____

Note: If you own more than one of the rigs indicated, please write to us for additional copies of this form. Use a separate form for a report on each rig.

Completed survey forms must be returned no later than August 31, 1979, to be included in our report.

The Last Amplifier You Will Buy - LUNAR

You've tried the others with letters and directions in their names — NOW buy the Reliable **LUNAR** Amplifier, the one with the built in receiver preamplifier.

INTRODUCING OUR NEW AMP MODEL 2M10-250P

- 3 watts in, 125 watts output.
- 10 watts in, 250 watts output.
- Linearized amp for SSB use.

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6M10-120P	10W in 120W out 50 MHz	269.95
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2M25-150P	25W in 150W out 144 MHz hi-linearity	269.95
2M30-160P	30W in 160W out 144 MHz	269.95
2M10-250P	10W in 250W out 144 MHz	419.95
1.3M10-70P	10W in 70W out 220 MHz	199.95
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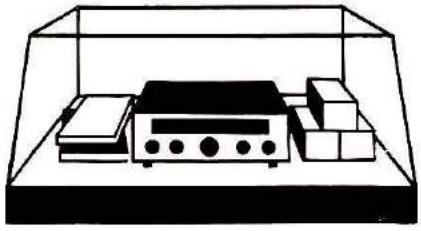
PRODUCT SHOWCASE



For literature on any of the Product Showcase items use our *ad-check* service on page 78.

IC-280 Mobile Transceiver

The versatility of a microprocessor is exemplified in the introduction of the ICOM IC-280 fm mobile radio for two meters. Referred to as the "remotable" radio, the IC-280 actually comes assembled for immediate operation as one box. However, the same radio may be operated as separate units by removing the head and connecting the optional remote cable to each unit. You can then mount the central head in a small place where almost no other radio will fit.

"Remotability" is not the only reason to have an IC-280. The microprocessor covers all 4 MHz of the 2-meter band, plus some at both ends, in 15- or 5-kHz steps which are selected by the user or the microprocessor. In addition, there are three memory channels to store any frequency which can be programmed on the dial.

The modular 10-watt output stage has plenty of power to drive the most popular amplifiers to full output. The continuous display of frequency in transmit, receive, or memory position makes the IC-280 the easiest-to-use fm radio, and the best-performing fm radio that ICOM has designed to date. All ICOM dealers should have them in stock and on display now. See one today at your authorized ICOM dealer, or contact ICOM East, Inc., 3331 Towerwood Drive, Dallas, Texas 75234; or ICOM West, Inc., 13256 Northrup Way, Suite 3, Bellevue, Washington 98005.

Hy-Gain Model TH5DX Antenna

Hy-Gain Electronics, division of Telex Communications, Inc., introduces the newest member of the famous Thunderbird line of tri-band antennas. The TH5DX offers outstanding performance on 20, 15, and 10 meters. It features 5 elements on an 18-foot boom, with 3 active elements on 15 and 20 meters and 4 active elements on 10 meters. The TH5DX also uses separate air-dielectric Hy-Q traps for each band. This allows the TH5DX to be set for the maximum front-to-back ratio, and the minimum beam width possible for a tri-band antenna of this size.

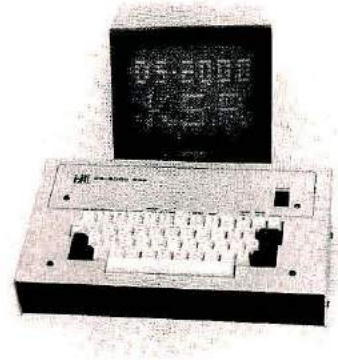
Also standard on this antenna are Hy-Gain's unique beta-match, rugged boom-to-mast bracket, taper-swaged elements, and improved element-compression clamps.

Contact your nearby Hy-Gain dealer, or write to Hy-Gain Electronics, Division of Telex Industries, 8601 Northeast Highway 6, Lincoln, Nebraska 68505.

DS2000 RTTY Terminal

HAL Communications is proud to announce a new compact and low cost RTTY terminal — the DS2000 KSR. The new terminal features operation with Baudot, ASCII, and Morse codes (Morse receive capability optional) and incorporates many of the features of more expensive terminals. A new 72-character line by 24-line display format, two 32-character programmable "Here Is" messages, and CW identification at the touch of a key simplify operation. A terminal-status line keeps the operator aware of data rate, data code, and other terminal conditions. Text is transmitted one word at a time and editing is possible anywhere in the line being composed. All terminal functions are controlled by a combination of a control key and a key from the top row of the keyboard.

Other deluxe features such as unshift-on-space, synchronous idle, keyboard-operated switch, and both QBF and RY test messages are available at the stroke of a key. Connect the DS2000 KSR to a standard 18-120 mA,



200 Vdc (maximum) current loop for Baudot and ASCII operation.

Morse output is accomplished via a transistor switch to ground for keying either "grid-block" or "cathode" circuits. An optional Morse receive board (MR2000) is available for reception of Morse code at rates from 1-175 wpm, and is customer-installable — allowing purchase at any time. An optional 9-inch (diagonal-measure) video monitor is also available.

The terminal weighs 6 lbs (2.73 kg) net (10 lbs/4.55 kg shipping) and comes in an attractive blue and beige cabinet. The price of the DS2000 KSR is $449.00. The MR2000 Morse receive option sells for $149.00 and the optional ESM-914 9-inch video monitor for $150.00. All prices include shipping within the United States. Contact HAL

Communications Corp., P.O. Box 365, Urbana, Illinois 61801 for further information.

Yaesu FT-101ZD

Yaesu Electronics Corporation of Paramount, California, is pleased to announce the introduction of the FT-101ZD, a transceiver that is all new in design and offers many of the features of the internationally acclaimed FT-901DM.

The FT-101ZD is a no-compromise, high-frequency SSB/CW transceiver which offers variable i-f bandwidth from 2.4 kHz to 300 Hz, digital plus analog display, a built-in rf speech processor, built-in ac power supply, a new

highly effective noise blanker, rugged 6146B final tubes, all-band coverage of 160 through 10 meters, WWV reception, plus WARC band expandability and a true frequency counter.

In addition, the FT-101ZD is compatible with all of the FT-901DM accessories. It is now available from your local Yaesu dealer.

Morse Code Transceiver

Xitex Corporation in Dallas, Texas, has just introduced a Morse code transceiver designed around a preprogrammed, single-chip microcomputer for the generation and reception of Morse-code signals using a standard ASCII or Baudot terminal (such as Xitex Model SCT-100). Applications include military, Amateur Radio, plus certain commercial communication systems.

The microcomputer's on-chip 2048-byte ROM contains both the SEND and COPY algorithms, plus a software UART with multiple ASCII and Baudot baud rates. All timing signals are generated internally from a 4-MHz crystal. This not only reduces system costs, but also virtually eliminates RFI generation or susceptibility.

The COPY portion of the device provides automatic synchronization from 1 to 150 WPM

while it is continuously computing and displaying the corresponding WPM value.

The SEND mode features include precise control of the output Morse WPM rate in unit increments from 1 to 150 WPM, plus a 32-byte buffer which can be edited prior to transmission.

Another feature permits both SEND and COPY operation in a unique "RTTY emulate" mode. This permits the transmission of a 60 character ASCII subset using standard Morse codes, plus new codes defined for special symbols and control characters (such as line feed, space, carriage return, etc.).

The MRS-100 Morse transceiver will be available in October from authorized distributors or directly from Xitex. It will be offered in three basic configurations: a partial kit including the microcomputer and blank printed circuit boards for $95; a full kit including an enclosure, power supply, and all other components necessary to construct a complete system (less terminal) for $225; plus an assembled and tested unit for $295. All inquiries should be made to Xitex Corporation, 13628 Neutron, P.O. Box 402110, Dallas, Texas 75240.

RCA 1979 SK Solid State Replacement Guide

A 1979 edition of the RCA SK Top-of-the-Line Solid-State Replacement Guide lists 957 solid-state replacement devices that will replace over 153,000 domestic and foreign types. It is the only guide that features a dual numbering system, consisting of the SK stock numbers and the stock numbers used in the other leading numbering system.

Along with the SK stock number, all SK listings in the Guide feature, where applicable, the stock number of the numbering system used by ECG,* REN, and TM. For example, the SK 3444, a direct replacement for the ECG 123A, is now listed as SK 3444/123A. This dual numbering system makes it easier than ever for a dealer to locate the correct solid state replacement device by using the 1979 RCA SK Replacement Guide.

This new edition, RCA's largest SK Replacement Guide to date, features easy-to-read information on RCA's full line of replacement transistors, rectifiers, thyristors, integrated circuits, and high-voltage triplers. The Guide also includes an index and a comprehensive data section with listings grouped according to type of device. Obtain the 339-page Guide from your local RCA SK Distributor, or send check or money order for $1.50 to RCA Distributor and Special Products, P.O. Box 597, Woodbury, New Jersey 08096. Ask for 1979 SK Directory SPG202X.

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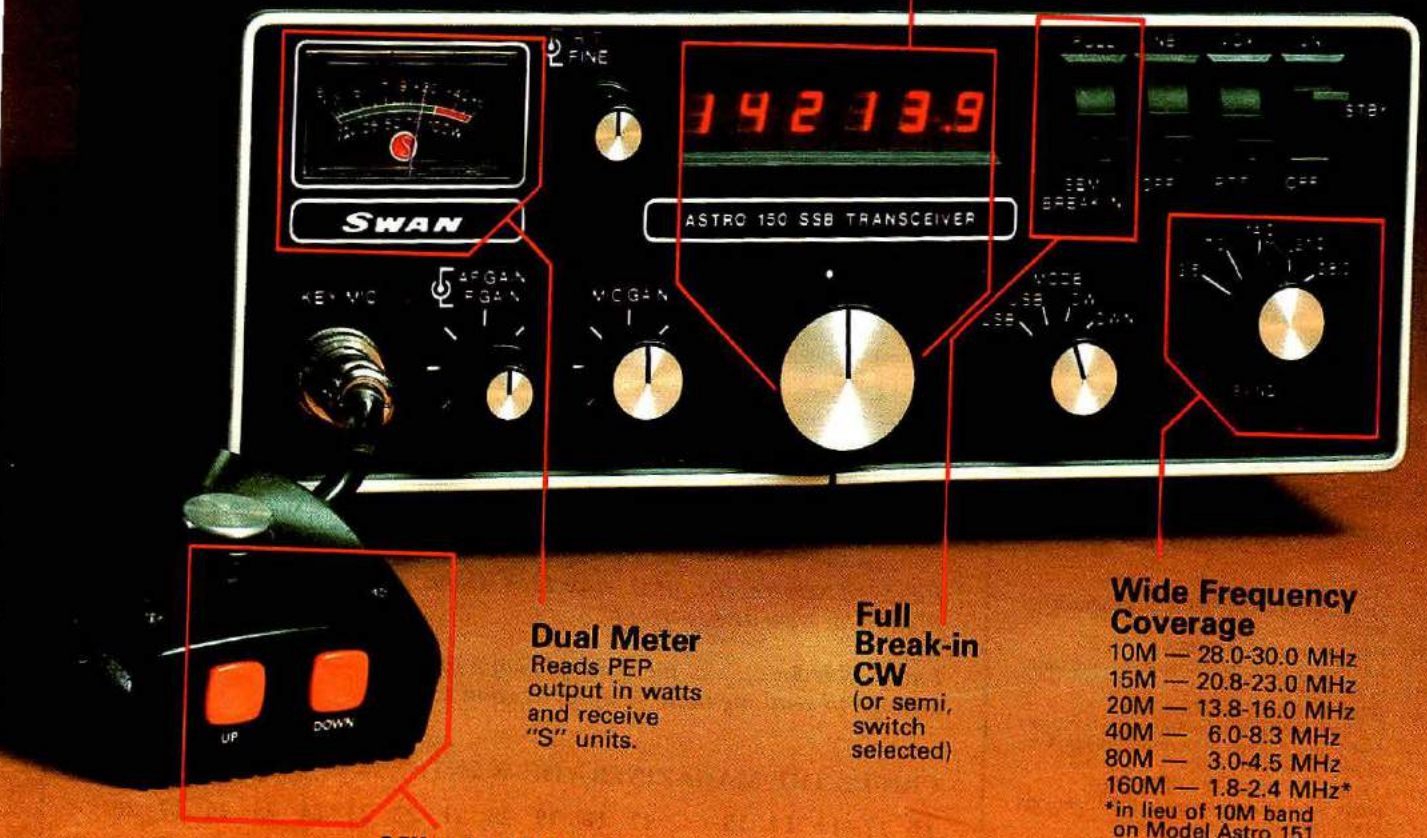

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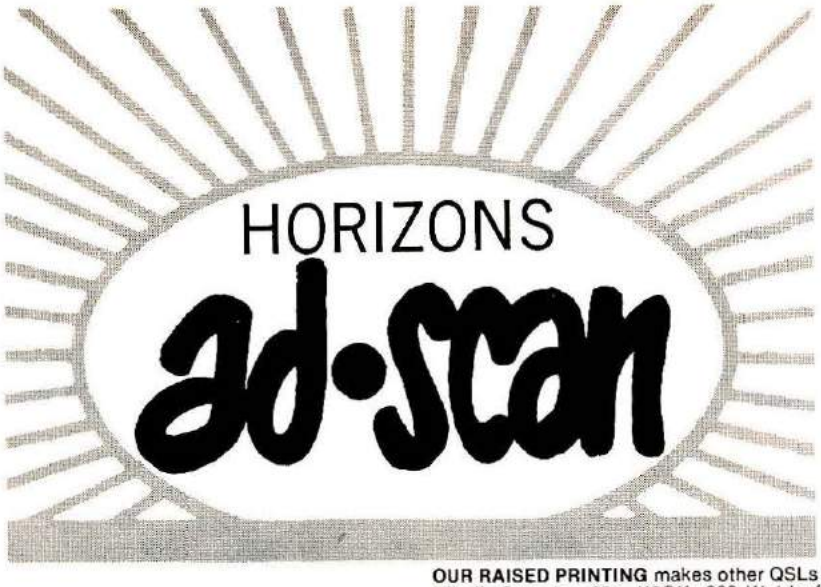

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COPY No special layout or arrangements available. Material should be typewritten or clearly printed (not all capitals) and must include full name and address. We reserve the right to reject unsuitable copy. *HORIZONS* cannot check each advertiser and thus cannot be held responsible for claims made. Liability for correctness of material limited to corrected ad in next available issue.

DEADLINE 15th of third preceding month.

SEND MATERIAL TO: Ad Scan, Ham Radio Horizons, Greenville, N. H. 03048.

MICHIGAN: Special Event Station, W8IGV, July 18-22, at the National Blueberry Festival, South Haven, Michigan. Listen 3975, 7275, 14275, 21375, and 28675 kHz phone; and CW at random in Novice/Tech sub-bands. QSL to National Blueberry Festival, P.O. Box 224, South Haven, MI 49090.

ELECTRONIC BARGAINS, CLOSEOUTS, SURPLUS! Parts, equipment, stereo, industrial, educational. Amazing values! Fascinating items unavailable in stores or catalogs anywhere. Unusual FREE catalog. ETCO-059, Box 762, Plattsburgh, N.Y. 12901.

BRITISH COLUMBIA: Okanagan International Hamfest, Saturday and Sunday, July 28th and 29th, 1979, at the Gallager Lake KOA Kampsite, 8 miles north of Oliver, B.C., Canada. Prizes, entertainment, flea market, white elephant sale (bring your hobbies and crafts), bunny hunts, etc. Activities from 1 P.M. Saturday to 2 P.M. Sunday, PDT. Potluck lunch Sunday noon. Information from VE7DTX, 8802 Lakeview Drive, Vernon, B.C., Canada V1B 1W3, or VE7DKL, 584 Heather Road, Penticton, B.C., Canada V2A 1W8.

HAMFEST — Official ARRL 5th Annual Hall of Fame Hamfest, Stark County Fairgrounds, Canton, Ohio, Sunday, July 15. Mobile check in on 19-79 or 52-52. $2.50 advanced; $3.00 at gate. Contact WA8SHP, 10877 Hazelview Ave., Alliance, Ohio 44601.

OUR RAISED PRINTING makes other QSLs look "flat". Samples 25¢. K3QK, 226 Waldorf St., Pittsburgh, PA 15214.

EZ DEALS are hard to beat. Try me and see for new or used ICOM, Cushcraft, KLM, Yaesu, Drake, Wilson, VHF Eng., Ten-Tec, Swan, DenTron, CDE, Hustler, Larsen, and more. W0EZ, Bob Smith Electronics, RFD 3, Fort Dodge, Iowa 50501. (515) 576-3886.

30 AMP POWER SUPPLY, 13.8 VDC (115 VAC input). Five year limited warranty. Hammertone metal case. $124.95. All ratings continuous duty. Other models: 20 amp, $99.95; 16 amp, $79.95; 10 amp, $69.95; 8 amp, $59.95; 6 amp, $44.95. Add shipping; COD accepted. S.A.S.E. for info. JRS Electronics, (WA8OGS), P.O. Box 1893-B, Cincinnati, Ohio 45201.

SCANNER OWNERS! "Top Secret Registry of U.S. Government Radio Frequencies (25 to 470 MHz)" by K2AES! Only book of its kind ever published! 2,250+ listings of: FCC, FBI, Secret Service, CIA, Customs, Border Patrol, Immigration, NASA, Treasury, FAA, military, and more! Only $4.95, ppd. CRB Research, Box 56-HR, Commack, NY 11725.

CALL TOLL FREE for an EZ deal. 800-247-2476/1793. Iowa call 800-362-2371. See ad elsewhere. W0EZ, Bob Smith Electronics, RFD 3, Fort Dodge, Iowa 50501.

MASSACHUSETTS: NoBARC Hamfest July 21, 22 at Cummington Fairgrounds. Tech talks, demonstrations and dealers. Flea market, $1.00; advance registration $3.00 single, with spouse $5.00 to Tom Hamilton, WA1VPX, 206 California Avenue, Pittsfield, Massachusetts 01201 or $4.00/$6.00 at gate. Mobile talk-in on 146.31/91. Gates open at 5:00 P.M. on Friday for free camping.

QSLs & RUBBER STAMPS — Top Quality! QSLs: Glossy Inks and Cardstock. Rubber Stamps: Report forms, Call Letter, Address, State outlines — More! Stamp Catalog and Card Samples 50¢. Ebbert Graphics 5H, Box 70, Westerville, Ohio 43081.

PRINT YOUR OWN QSL Cards with a custom made 3" x 5" Rubber Stamp. Guaranteed to please. Send your copy with a check or money order for $12.50 to: Market, 305 So. Hudson St., Westmont, Ill. 60559.

QSL CARDS — Eyeball Cards — Rubber Stamps — Name Tags — Emblems — Gift Items — Free Catalog — Rusprint, Box 7575, Kansas City, MO 64116.

QSLs SECOND TO NONE. Same day service. Samples 50 cents. Include your call for free decal. Ray, K7HLR, Box 331, Clearfield, UT 84015.

WANT UP-TO-DATE INFORMATION? "Radio-Hobbyist Newsletter" issued every two weeks. Only $5.00 per year! Guaranteed! ARC; Box 1171-G; Garland, Texas 75040.

MOBILE IGNITION SHIELDING provides more range with no noise. Bonding strap sale less than 50¢ each. Literature. Estes Engineering, 930 Marine Drive, Port Angeles, Wash. 98362.

CODE got you stumped?

RELAX and worry not! Learn international Morse Code the EASY, Rus Farnsworth way. No books, no gimmicks, just listen & learn. Using the word method, based on modern psychological techniques, you can zoom past 13 w.p.m. in **less than half the time!** Available in cassettes @ $10.95 and LP records at $9.95 — you get over **two hours** of instruction!

EPSILON RECORDS
P.O. Box 626, San Jacinto, CA 92383

OHIO: Wood County Ham-A-Rama, July 29th, Bowling Green Fairgrounds, Bowling Green, Ohio. Gates open at 10 A.M. Free admission and parking. Dealer tables and space available. Trunk-sale space and food also available. Prizes. Talk-in on 146.52 simplex K8TIH. Tickets $1.50 advance, $2 at door. Write Wood County A.R.C., c/o Eric Williams, 14118 Bishop Road, Bowling Green, OH 43402.

NEW CONCEPT — Novice instructional package, theory tape & study material. Complete license study package, $17.95. General study package, $19.95. MARI, 1320 Canary Drive, West Columbia, SC 29169.

ANTENNA HOMEBREWERS: Complete line of aluminum, fiberglass, and stainless-steel antenna hardware. We will custom-design for you or supply to your design at prices you can't beat! GL Enterprises, Route 1, Box 10G, Brownsville, Wisconsin 53006. (414) 583-4001.

QSLs with class! Unbeatable quality, reasonable price. Samples: 50¢ refundable. QSLs Unlimited, 1472 SW 13th Street, Boca Raton, FL 33432.

CUSTOM Printed and photo QSL's, very economical; free samples, stamp appreciated. Stu, K2RPZ, Box 412, Rocky Point, N. Y. 11778. (516) 744-6260.

RADIO EXPO '79 September 15 and 16, 1979, Lake County Fairgrounds, Routes 120 and 45, Grays Lake, Illinois. Manufacturer's displays, flea market, seminars, ladies' programs. Advance tickets $2.00. Write EXPO, P.O. Box 305, Maywood, IL 60153. Exhibitors inquiries: EXPO Hotline (312) 345-2525.

NAMETAGS — 1½" x 2½" — One line $2.50. Each additional line $0.50. 12 colors. Tag-it Co., Box 2062, Indianapolis, IN 46206.

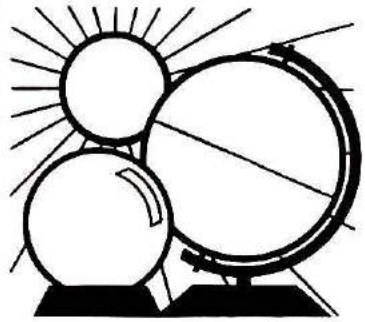
CODE PRACTICE OSCILLATORS, hand keys, electronics keyers, other products. Free catalog. Globalman (W6PHA) Products, Box 388-HO, El Toro, CA 92630. 714-533-4400.

STOP LOOKING for a good deal on amateur radio equipment — you've found it here — at your amateur radio headquarters in the heart of the Midwest. Now more than ever where you buy is as important as what you buy! We are factory-authorized dealers for Kenwood, Drake, Yaesu, Collins, Wilson, Ten-Tec, Atlas, ICOM, DenTron, MFJ, Tempo, Regency, Hy-Gain, Mosley, Alpha, Cushcraft, Swan and many more. Write or call us today for our low quote and try our personal and friendly Hoosier service. HOOSIER ELECTRONICS, P.O. Box 2001, Terre Haute, Indiana 47802. (812) 238-1456.

WANT QSLs FAST? Send $9.95 for 100 multi-colored sent return mail! ($4.00 each additional hundred!) Satisfaction guaranteed! ARC; Box #1171; Garland, Texas 75040.

MICHIGAN: Black River A.R.C. VHF Picnic and Swap-N-Shop, Sunday, August 5th, Allegan County Park, tenth mile north of South Haven on Interstate 196. Talk-in on 147.90/.30 and 146.52 simplex. Bring family and picnic basket. Contact Ed Alderman, WB8BNN, R.R. #2, Box 98AA, Bangor, MI 49013; Tel: (616) 427-8830.

OREGON: Lane County Ham Fair, July 21st and 22nd, 1979, Oregon National Guard Armory, 2515 Centennial Boulevard, Eugene, Oregon. Registration $3, with advance registry receiving extra drawing ticket. Displays, lectures, contests, swapshop, transmitter hunt, entertainment. Snack bar, plenty of free parking for motorhomes and trailers. Contact Earl or Wanda Hemenway, 2366 Madison, Eugene, Oregon 97405; telephone (503) 485-5575.



DX FORECASTER

The summer doldrums on the hf bands during the peak of a sunspot cycle are a far, far cry indeed from the summer doldrums during a sunspot minimum. In fact, if you weren't on the lookout for a slump, you probably wouldn't find one!

It's true that summer conditions on the high frequencies are not quite as good as those during the fall and spring months, but this year they will be good by any standards.

Last-minute predictions

The most likely time for solar upsets and geomagnetic disturbances is between July 2nd and 5th, with the 4th likely to show celestial "fireworks," as well as terrestrial fireworks of the expected variety! The week between the 8th or 9th and the 15th or 16th of July could be active, with possible bursts of mini-flare activity around the 19th or 20th. The remainder of the month looks relatively calm from a geomagnetic standpoint, and the indexes should be fairly stable at low-to-moderate levels. Full moon will occur on July 9th, perigee on the 11th. Vhf enthusiasts will be happy to know that a variety of meteor showers takes place in July, with the largest, the S. Delta Aquarids, taking place on July 29th.

Band-by-band propagation

DX activities will center around the *ten*, *fifteen*, and *twenty meter* bands, but there will be a great deal of DXing on *six meters* between the eastern and western hemispheres, and between the northern and southern hemispheres, as well. Even *two meters* will show some sporadic E activity during the month, with surprising signal strengths over 1600-1700 kilometer (900 to 1000 mile) paths. When your TV begins to show signs of interference from "skip" stations, run to the *six* and *two meter* gear for some good DXing.

You will notice that long-path openings are shown on the chart by the dagger (†). To try long-path DXing, turn your beam in a direction *opposite* that for normal path openings, at the times indicated. The asterisk (*) symbol means that the *next higher* band could also be open at the time indicated for that path.

Forty and *eighty meters* are substantially closed for DX purposes, except for an occasional evening when the noise levels are low enough to hear some weak stations. For some fun, try DXing on *forty* and *eighty* at dusk and daybreak. Your best chances will be on *forty*, however.

One sixty meters will be substantially a local band, although some South American DX possibilities exist when conditions of clear, cool evenings and low noise-levels exist.

It would be helpful in planning future DX Forecasters if you would let us know just how accurate (or inaccurate) these predictions are in *your* location, and what unusual conditions (if any) occur on the days predicted. These forecasts are made up about four months before the date you see them, so chances for inaccuracies are quite high. Your help will be much appreciated.

HRH

GMT	PDT	WESTERN USA N	NE	E	SE	S	SW	W	NW	MDT	MID USA N	NE	E	SE	S	SW	W	NW	CDT	EDT	EASTERN USA N	NE	E	SE	S	SW	W	NW
0000	5:00	15	15*	15	10	20	10	10	10	6:00	15	15*	20	15	20	10	15	15	7:00	8:00	15	15*	20	15	20	10	15	15
0100	6:00	15	15	20	10	20	10	10	10	7:00	15	15	20	15	—	10	15	15	8:00	9:00	15	15	20	15	20	10	15	15
0200	7:00	15	15	20	10	20	10	10	10	8:00	10	15	20	15	—	10	15	15	9:00	10:00	15	15	—	15	20	15	15	15
0300	8:00	15	15	—	10	20	10	10	10	9:00	10	15	20	15	—	15*	15	15	10:00	11:00	20	15	—	15	—	15	15	20
0400	9:00	15	15	20	15	—	10	15*	10	10:00	10	15	20	15	—	15	15	20	11:00	12:00	20	15*	—	15	—	15	20	20
0500	10:00	15	15	10	15	—	10	15	10	11:00	10	15	20*	15	—	15	15	20	12:00	1:00	—	—	20	15	—	15	20	20
0600	11:00	15	15	10	15	—	10	15	10	12:00	20	15*	15	15	—	15	15	20	1:00	2:00	—	—	15	15	—	15	—	20
0700	12:00	20	15*	10	15	—	15	15	10	1:00	20	10	20	15	—	15	15	20	2:00	3:00	—	—	15	20	—	20	—	—
0800	1:00	20	10	10	—	—	15	15	10	2:00	20	10	20	—	—	15	20*	—	3:00	4:00	—	—	20	—	—	20	—	—
0900	2:00	20	10	10	—	—	20	15	10	3:00	20	15	20	—	—	20	20	—	4:00	5:00	—	—	20	—	—	20	—	—
1000	3:00	20	15	10	—	—	20	15	10	4:00	20	15	20	—	—	20	20	—	5:00	6:00	20	15	20	—	—	20	—	—
1100	4:00	20	15	15	—	—	20	15	15	5:00	20	15	20	15	—	20	20	—	6:00	7:00	20	15	15	—	—	20	—	—
1200	5:00	20	15	15	20	—	20	15	15	6:00	20	15*	20	15	—	20	20*	—	7:00	8:00	20	10	15	—	—	20	—	—
1300	6:00	20	15*	15	20	—	20	15	15	7:00	20	10	15	10	—	20	15	20	8:00	9:00	10	10	15	15	—	20	20	20*
1400	7:00	20	10	15	20	—	20	15	15	8:00	10	10	15	10	—	20	15	20	9:00	10:00	10	10	15	15	—	20	20	15
1500	8:00	20	10	15	15	—	20	20	15*	9:00	10	15	15	10	—	20	20	20	10:00	11:00	10	10	15	10	—	20	15	15
1600	9:00	15	15*	15	15	—	—	20*	15	10:00	10	15	15	10	15	—	20	20	11:00	12:00	10	10	15	10	—	—	—	15
1700	10:00	15	10	15	15	15	—	15	15	11:00	10	15*	15	10	15	—	15	15	12:00	1:00	10	10	10	10	—	—	—	15
1800	11:00	15	10	15	15	15	—	15	15	12:00	10	10	15	10	15	—	15	15	1:00	2:00	10	10	15*	10	—	—	—	15
1900	12:00	15	10	15	10	15	—	15	15	1:00	10	10	15	10	—	—	15	15	2:00	3:00	10	10	15*	10	20	—	—	15
2000	1:00	15	10	15	10	—	—	10	15*	2:00	15	10	15	10	20	—	15	15	3:00	4:00	10	10	10	10	20	15	15	15
2100	2:00	20*	10	15	10	20	20*	10	10	3:00	15	10	15*	10	20	20*	15*	15	4:00	5:00	15	10	10	10	20	15	15	15
2200	3:00	20*	10	15	10	20	15*	10	10	4:00	15	10	10	15	20	15*	15*	15	5:00	6:00	15	10	10	10	20	15*	15	15
2300	4:00	20*	15*	15	15*	20	10	10	10	5:00	15	10	15	15	20	10*	15*	15	6:00	7:00	15	10	10	15	20	10	15	15
	JULY	ASIA FAR EAST	EUROPE	S. AFRICA	S. AMERICA	ANTARCTICA	NEW ZEALAND	OCEANIA AUSTRALIA	JAPAN		ASIA FAR EAST	EUROPE	S. AFRICA	S. AMERICA	ANTARCTICA	NEW ZEALAND	OCEANIA AUSTRALIA	JAPAN			ASIA FAR EAST	EUROPE	S. AFRICA	CARIBBEAN S. AMERICA	ANTARCTICA	NEW ZEALAND	OCEANIA AUSTRALIA	JAPAN

HAM CALENDAR

July 1979

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Champaign Logan ARC Hamfest — Logan County Fairgrounds — Bellefontaine, OH — W8HFK THE CANADIAN AMATEUR RADIO FEDERATION IS SPONSORING A NEW ONE-DAY CONTEST, CALLED THE "CANADA DAY CONTEST." Open to all Amateurs everywhere, the contest is to promote contacts with Canadian stations on all bands and to facilitate the working of Canadian stations for those Amateurs trying for the "CANADAWARD," which is a separate contest. The one-day event will mark the celebration of Canada's founding on July 1, 1867. The period is from 0001Z to 2359Z July 1. The 1.8 to 148 MHz bands may be used — Phone & CW. Logs to CARF Canada Day Contest, Box 76752, Vancouver, B.C. V5R 5S7 1	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB WEST COAST BULLETIN Edited & Transmitted by W6ZF 9PM PDST 3540 kHz, A-1, 22 WPM 2	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 3	ARRL Straight Key Night Harrisburg PA RAC Firecracker Hamfest — I81 N., Exit 27 or Racetrack Exit 28, Shellsville VFW Picnic Grounds 4TH OF JULY 4	5	6	Northern Ohio ARS "NOARSFEST" — Lorain County Fairgrounds — Wellington, OH TEX-LA Hamfest — Red Carpet Inn — Beaumont, TX — 7-8 7
Indianapolis Hamfest — Marion County Fairgrounds — Indianapolis, IN 8	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30 PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB 9	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 10	11	12	13	ARRL (ARU) Radiosport Competition — 14-15 Pacific Northwest Hamfest — Info: H.A.M., Inc., P.O. Box 78442, Seattle, WA 98178 — 14-15 Quad County RC Breakfast Club Picnic/Hamfest — Terry Park, Palmyra, IL — 14-15 South Milwaukee ARC Swapfest — American Legion Post #434 — Oak Creek, WI 14
BARC Hamfest — Pocono Downs Race Track — Wilkes-Barre, PA Hall of Fame Hamfest — Stark County Fairgrounds — Canton, OH — WA8SHP Tri-Club Hamfest — Allentown Police Academy — Allentown, PA Zero Beaters ARC Hamfest — Info: P.O. Box 24, Dutzow, MO 63342 15	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB WEST COAST BULLETIN Edited & Transmitted by W6ZF 9PM PDST 3540 kHz, A-1, 22 WPM 16	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 17	The Black River Amateur Radio Club will be operating a special event station during the National Blueberry Festival in South Haven, Michigan on July 18-22, 1979. The call of the station will be W8IGV and the frequencies used will be on or near 3975, 2225, 14275, 21375, and 28675 kHz. CW operation will be conducted randomly throughout the Novice/Technician sub-bands. Any station working W8IGV during the Festival can receive a colorful, post-paid certificate by mailing a QSL card to: The National Blueberry Festival, P.O. Box 224, South Haven, Michigan 49090 18	19	ARRL National Convention — Baton Rouge, LA — 20-22 20	Cary ARC Swapfest — Lion's Club Shelter — Cary, NC Glacier-Waterton Hamfest — Three Forks Campground — 10 miles E. of Essex, MT on U.S. Highway 2 — 21-22 Lane County Hamfair — Oregon National Guard Armory — Eugene, OR — 21-22 NoBARC Hamfest — Cummington Fairgrounds — Pittsfield, MA — WA1VPX — 21-22 QRP Summer Contest — 21-22 Seanet Contest — CW — 21-22 VHF Space Net Contest — 21-22 21
Big Thunder ARC Hamfest — Boone County Fairgrounds — 1 mile N. of Belvidere on ILL 76 Indian Foothills ARC Hamfest — Saline County Fairgrounds — Marshall, MO — WB0SZI Rocky Mountain Radio League Field Demonstration Day/Swapfest — Info: Charles Kaufman, WA0GUN, 3743 S. Poplar, Denver, CO — (303) 757-3081 Sheboygan County ARC Swapfest — Wilson Town Hall — Sheboygan, WI Two Rivers ARC Hamfest — Green Valley Fire Department Fairgrounds — E. McKeesport, PA 22	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB 23	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 24	25	ARRL Oklahoma State Convention/Ham Holiday — Lincoln Plaza — Oklahoma City, OK — 27-29 Moose Jaw ARC Hamfest — Saskatchewan Technical Institute, 600 Saskatchewan St. W., Moose Jaw, Saskatchewan, Canada — 27-29 WIMU Hamfest — Macks Inn, ID — WB7FGV — 27-29 26	27	Central Nebraska ARC Hamfest/Steak Fry — Victoria Springs State Park near Anselmo, NE — WBDLM — 28-29 County Hunters Contest — CW — 28-30 Dansbian Bent Contest (HA) — 28-29 New Jersey QSO Party — 2000Z 7/28 - 0700Z 7/29 — 1300Z 7/29 - 0200Z 7/30* — Phone & CW Okanagan International Hamfest — Gallagher Lake KOA Kampsite, 8 miles N. of Oliver, B.C. Canada — VE7DTX VE7DKL — 28-29 28
BRATS Maryland Hamfest — Howard County Fairgrounds — Routes 32 and I-70, 15 miles W. of Baltimore Wood County Ham-A-Rama — Bowling Green Fairgrounds — Bowling Green, OH 29	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB 30	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 31		Members of the North Texas High Frequency Association in Denton, Texas, are planning two Mini-Expeditions during the summer for interested hams who might like to work the portable 5 stations. The first Mini-Expedition will be to Telegraph, Texas in July. Operation will be by **CW ONLY** on the 40 and 15 meter bands. The second Mini-Expedition will be to Telephone, Texas in August. Operation will be by **PHONE ONLY** on the 40 and 15 meter bands. Special QSL cards are printed specifically for these two Mini-Expeditions and all QSOs will be confirmed if requested. Hours of operation will be from 8:00 AM to 6:00 PM CDST. Calls to be used are WD5ICY and WD5IKY. For info: Duncan Engler, WD5IKY, 812 Crescent Street, Denton, Texas 76201	Sonomacounty Radio Amateurs will be operating W6LFJ from the Sonoma County Fair Exhibit from July 9 thru July 20, 1979. Hours of operation 1000 PDT to 2200 PDT daily. Tentative frequencies are: CW — 7.050, 7.110; SSB — 3.9, 7.235, 14.285, 21.360, 28.600 MHz; FM — 29.5/29.6, Rptr 146.13/73, RTTY 14.075, 21.075, 28.075. Skeds may be arranged via Don Bremer, KB6LO, 3200 Tobin Lane, Santa Rosa, CA 95401 *All international events such as contests are shown on the GMT days on which they take place even though they may actually begin on the evening of the preceding day in North America.

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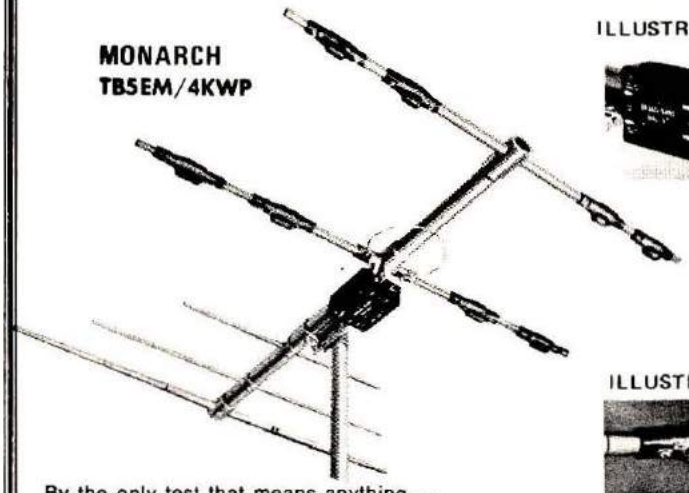
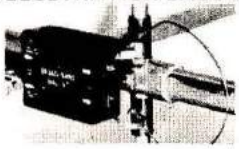


ILLUSTRATION BALUN



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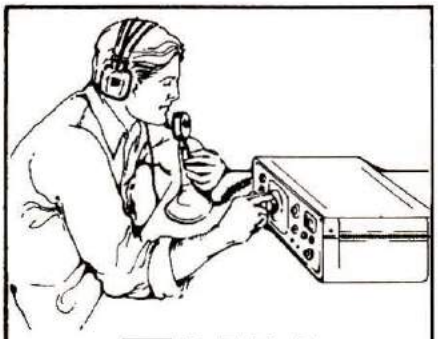

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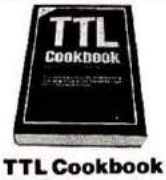

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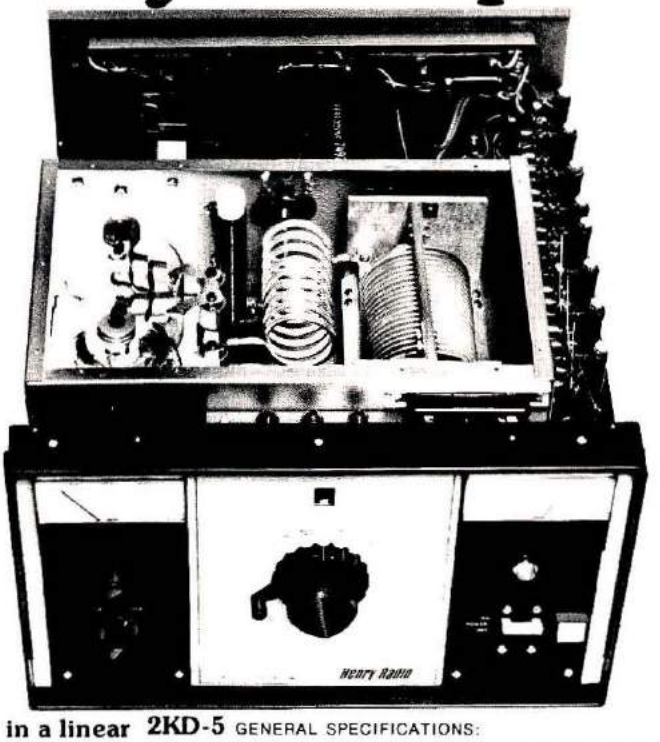

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2KD-5 GENERAL SPECIFICATIONS:

- The 2KD-5 is a 2000 watt PEP input (1200 watt PEP nominal output) RF linear amplifier, covering the 80, 40, 20, and 15 meter amateur bands.
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- Pi-L plate circuit with a rotary silver plated tank coil for greatest efficiency and maximum attenuation of unwanted harmonics.
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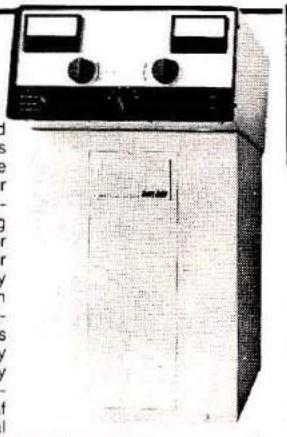
- Jumper for 115 or 230 VAC, 3 wire single phase.
- 10.5" high x 15" wide x17.5" deep
- Price . . . $945.00

2K-4A



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1KD-5

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Price $695.

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TR-7600

TR-7625

RM-76

TS-700SP

Compact in size... big on performance!

TR-7625
Featuring 25 watts RF output (switchable to 5 watts low power), the TR-7625 is a high-performance 2-meter FM transceiver with memory, and is designed to permit multi-channel (800-channel) operation. Compact and perfect for mobile or ham shack use. When used with optional RM-76 Microprocessor Control Unit, the TR-7625 offers a whole new dimension in channel memory and scanning capability.

TR-7600
Looks the same as the TR-7625, but offers 10 watts RF output (switchable to 1 watt low power). Also uses RM-76 Microprocessor Control Unit. For the Amateur Operator who's looking for optimum versatility in a 2-meter FM transceiver!

RM-76
Combined with either the TR-7600 or TR-7625, this optional Microprocessor Control Unit allows the operator to store frequencies in six memories (simplex/repeater); scan all memory channels; automatically scan up the band in 5-kHz steps; manually scan up or down in 5-kHz single or fast continuous steps; set lower and upper scan limits; clear scan (for transmitting); stop scan (with HOLD button); scan for busy or open channel; select repeater mode (simplex, transmit frequency offset (±600 kHz or ±1 MHz), or one memory transmit frequency. Operates on 143.95 MHz simplex (MARS). Display indicates frequency (even while scanning) and functions (such as autoscan, lower scan frequency limit, upper scan limit, and error, i.e., transmitting out of band).

TS-700SP
Here's an outstanding 2-meter all-mode transceiver that provides an extra dimension of versatility over the entire 2-meter band. Feature-packed and equipped for SSB, FM, CW and AM. Complete with built-in digital frequency readout, receiver preamplifier, VOX, sidetone, and microphone.

SPECIFICATIONS	Models TR-7600/TR-7625*	Model TS-700SP	Model TR-8300
Frequency Range:	144.00 to 147.995 MHz	144.0 to 148.0 MHz	TX: 445.0 to 450.0 MHz RX: 442.0 to 447.0 MHz
Mode:	FM	SSB (USB, LSB), CW, AM, FM	FM
Dimensions:	161mm (6-5/16") wide 61mm (2-3/8") high 230mm (9-1/16") deep	278mm (10-7/8") wide 124mm (4-7/8") high 320mm (12-5/8") deep	180mm (7-1/16") wide 60mm (2-3/8") high 240mm (9-7/16") deep
Weight:	1.75kg (3.85 lbs) Approx.	11.0kg (24.2 lbs)	2.3kg (5.1 lbs)
RF Output Power:	High: 10(*25) watts (min.) Low: 1(*5) watt approx. (adjustable to 10 watts)	SSB, FM, CW—10 watts AM—3 watts FM (Low)—Approx. 1 watt	High: 10 watts Low: 1 watt Approx.
Modulation:	Variable reactance direct shift	SSB: Balanced modulation FM: Variable reactance frequency shift AM: Low power modulation	Variable reactance phase shift
Microphone:	Dynamic microphone with PTT switch, 500 Ω	Low-impedance microphone (500 Ω)	Low-impedance microphone (500 Ω) with PTT switch
Sensitivity:	Less than 0.4 μV for 20 dB quieting	Less than 0.4 μV for 20 dB quieting SSB & CW: 0.25 μV for 10 dB (S+N)/N AM: 1.0 μV for 10 dB (S+N)/N	1 μV for 30 dB (S+N)/N 0.5 μV for 20 dB noise quieting
Squelch Sensitivity:	Less than 0.25 μV	0.25 μV	0.3 μV
Selectivity:	More than 76 dB at 30 kHz of adjacent channel	SSB, CW & AM: 2.4 kHz/-6 dB, 4.8 kHz/-60 dB FM: 12 kHz/-6 dB, 24 kHz/-60 dB	20 kHz/-6 dB 40 kHz/-70 dB
Image Rejection:	More than 70 dB	Better than 70 dB	

ACCESSORIES – VFO-700 remote VFO; SP-70 external speaker; KPS-7 power supply; MC-50 base microphone; MC-30S mobile noise-cancelling microphone, and MC-45 Touch-Tone microphone.

See your Authorized Kenwood Dealer for more details.

TR-8300
Designed for use in the 70-cm amateur band. Unique design of the TR-8300 makes it a great choice for mobile or fixed-station use. This FM transceiver is capable of F3 emission on 23 crystal-controlled channels (three supplied). Transmitter output is 10 watts.

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