73 Amateur Radio Today

MARCH 1995
ISSUE # 414
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12 200 MEMORIES • Memory capacity of 200 channels, each of which store frequency, mode, AGC and bandwidth.

13 COMPUTER INTERFACE • Built-in RS-232C interface for advanced computer applications.

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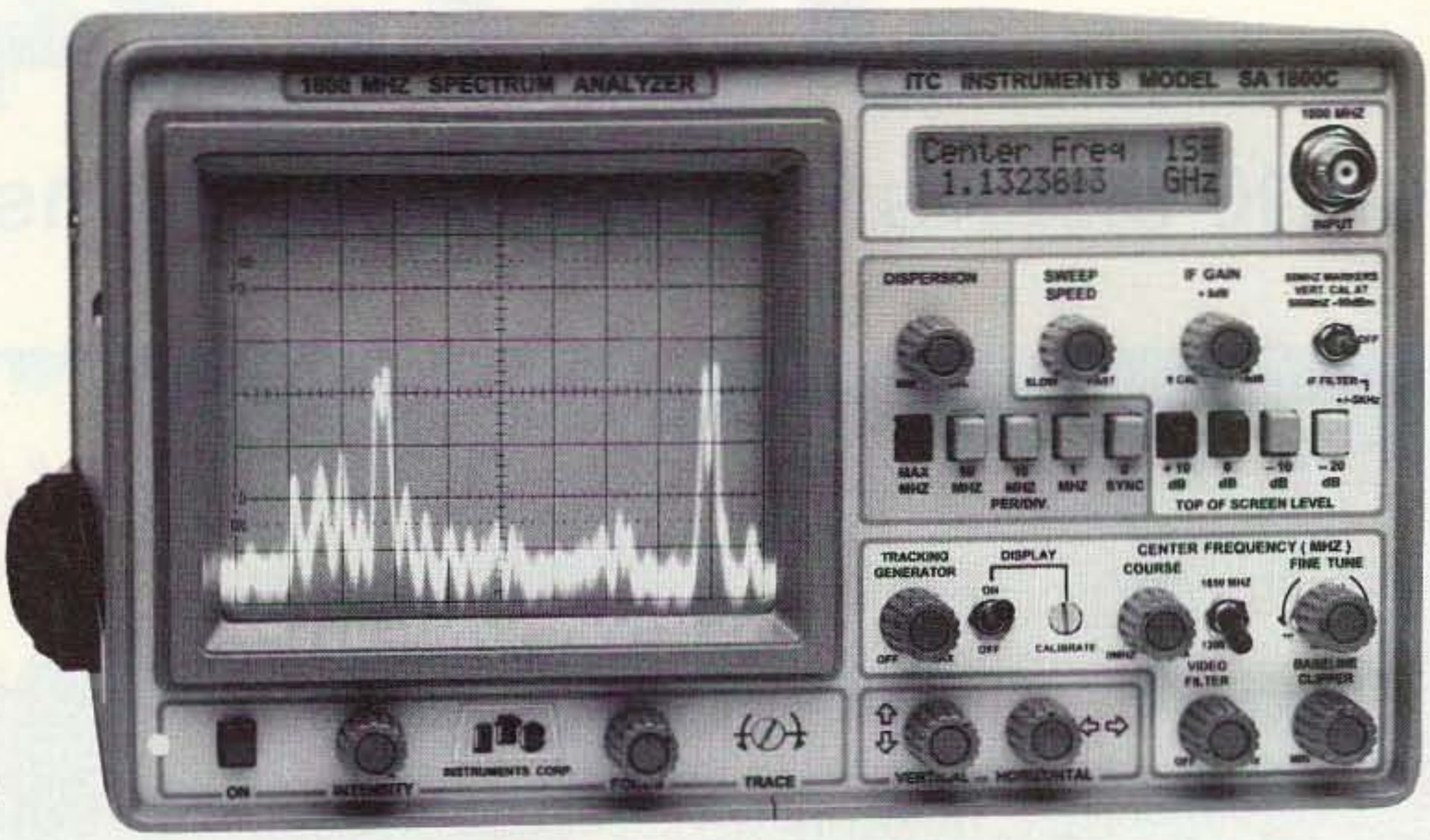

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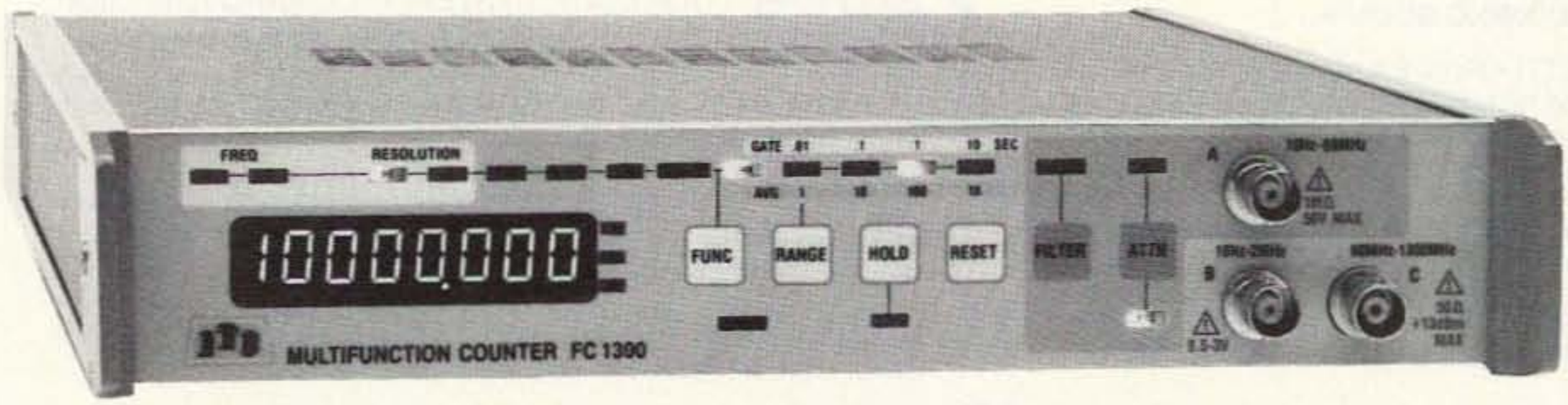

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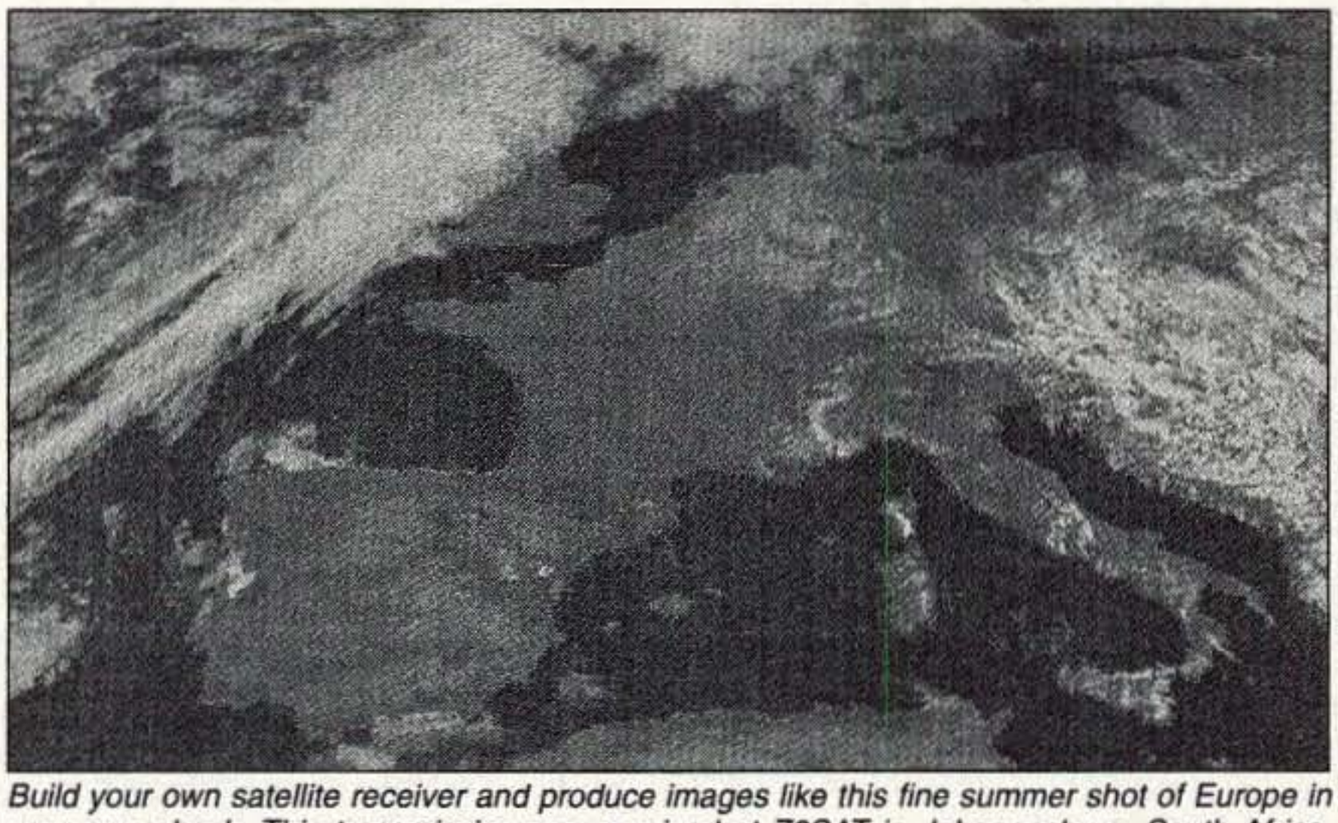

Build your own satellite receiver and produce images like this fine summer shot of Europe in your own shack. This transmission was received at Z6SAT in Johannesburg, South Africa. *To learn more, please turn to page 10.*

DEPARTMENTS

FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK list on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best.

On the cover: Up, up, and away! This photo was taken from a balloon 95,000 feet over Madison, Wisconsin. The balloon was equipped with GPS and a digipeater facilitating 400-mile QSOs. Photo courtesy of Tim Tomljanovich K9SB, Near Space Science Group. A one-year subscription/extension goes to Tim for this FB photo in the 73 Photo Search.

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Contract: Possession of this magazine constitutes a contract with Uncle Wayne and The Team to just say no to LIDS and conduct a stimulating, intelligent QSO today!

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Yes, I'll Be At Dayton This Year

But, as far as I know (and I know pretty far), I won't be speaking this time. However, since less than 1% of the HamVention attendees usually bother to squirm and sweat through one of my endless talks, I doubt I'll be much missed.

Sure, I'd do much better to pick one subject and stick to it for maybe a half hour and then get off the pot . . . er . . . podium. But there are so many interesting things to talk about, and I want to cover them all, that my allotted two hours just barely gets me started.

One of the reasons amateur radio is a hard sell to potential hams is because it's so difficult to explain. Sure, working DX is a part of it. A small part, really. The ham host of a talk show recently said he'd counted 57 different sub-hobbies that make up hamming. I've never tried counting 'em before so I decided just now to see how many I could come up with. I had no problem with counting 53 separate aspects of the hobby that I've pursued down through my 57 years of hamming, and 20 more that I haven't done yet. That added up to a serendipitous number.

How can I cover a 73-hobby group of interests in a two-hour talk? It's worse than that, of course, because I can't help bringing up ham radio history to explain why things are as they are now . . . and what I see ahead for us, drawing on that past. Plus I've been known, on rare occasions, to talk about non-germane subjects like computers, cold fusion, our terrible American school system, and so on. And even to tackle religious matters such as our beloved reminder of Mr. Morse . . . also known by thinking hams as Sam's Curse.

Why Dayton In 1995?

As I explained in an editorial last year, when we here at *73* looked over the cost vs. benefits of exhibiting at Dayton, it didn't make any fiscal sense. With booth costs going through the sky, the cost of flying in an editor, an advertising sales person, and someone to run the booth, plus Wayne to swagger around looking important, and counting the cost of rented cars, hotel rooms, meals, and so on, the tab was up in the thousands. Then there is the cost of shipping the exhibit booth both ways, plus magazines, books, and so on. Offsetting this we might sell a couple of hundred subscriptions, if it is a particularly good year. With a HamVention special of $15, that's maybe $3,000. Sure, that would be pretty good if it didn't cost anything to print and mail the magazine or pay for the staff to produce it.

Why not more sales? Because most of the active hams are already getting *73*. They come by the booth and tell us how much they like the magazine and how they read and enjoy my editorials, though they don't always agree with them. Worse, many of the subscriptions are renewals, so we just get less for the subscription and don't gain as many new readers.

The hams who haven't been reading the magazine have no idea what they're missing, so they don't bother to stop by the booth. Many of them are too busy in the flea market to come inside, even when it rains. Which it always seems to do.

Another big problem with getting new subscribers is that over half of the licensed hams don't subscribe to any ham magazines. They're not involved with much more than talking over a local repeater or rag-chewing on 75m, so they have little interest in knowing what's new or trying packet, satellites, and so on.

In the face of all that, it didn't seem like we had much to lose by not shipping in a team from *73* to run a booth. If we took the same money that it would cost to do the booth and invested it in sending direct mail letters to hams, we'd pull around 3-5% in subscriptions. $4,000 would allow us to mail around 10,000 letters. At a 3% response, that's 300 new subscribers at $20 each. Get out your hand calculator and you'll see why that beats exhibiting by a long shot. We don't even lose the work on the magazine the staff could be doing during their several days away.

The Big Four-O

So why, with all that, will Wayne be there in 1995? With a booth! Well, the biggest reason is that this celebrates 40 years since I first exhibited at the HamVention, back when it was in the Dayton Biltmore Hotel downtown. I haven't missed many years. I wonder if there is anyone else who's been coming to the HamVention for 40 years? I'm pretty sure no one else has been exhibiting for that long. Or that anyone else has given nearly as many talks.

When we stopped exhibiting I was not really surprised that last year the committee decided to move my talk to Sunday morning, after about half of the attendees would be already heading home. I got their message and didn't bother to come.

This year, Sherry said what the heck, let's just you and I go. She offered to run the booth so I could go around to see exhibitors and shake hands with old friends. If you've read any of my travel reports you know how cheap Sherry and I travel. Make that economically, it sounds better. If you haven't read my reports yet, for shame, you're missing out. I'll try to remember to bring some to Dayton so you can rectify your serious oversight. I should bring a few copies of my book to autograph too. They sold like crazy at the last few hamfests I've attended.

We buy yearly senior passes on Continental Airlines, which keeps the cost of our flights to a minimum. Well, you'll find out all our economy secrets when you read my travel stories. Who else could fly first class to Munich with his wife, rent an Audi and drive to Vienna, Prague, Krakow, and back to Munich, staying in very nice hotels, visiting hams in each city, and keep the total cost for the flight, car rental, hotels, and meals under $1,000?

The major expense for the HamVention will be for the booth space, so I hope you'll grab some friends, bring them to the booth, force them to subscribe to both *73* and *Radio Fun*, and buy some of my travel reports. I'll try to spend as much time there as I can so I won't miss you...and I'll be autographing my book, *Declare War*.

Hey, if you make it worth my while, I might celebrate my 41st year at Dayton next year. They're finally changing the HamVention dates next year so it won't come on the same weekend as my WWII submarine crew reunion. I want to get down to Mobile, where our old boat is on display, to celebrate the 51st year since I last sailed on the Drum. I joined the boat in 1943 and was on its last five war patrols. It was an exciting time, with us sinking lots of ships and the Japanese dumping hundreds of depth charges on us. I've a $7.50 book telling just what it was like. It is made up mostly of reprints of the wartime recollections I wrote for the *Drum Newsletter*, which I published for several years. I've included the Amelia Earhart inside story in this book. Exciting stuff.

Say, if you get a chance, how about dusting off your word processor and letting me know how many years you've been going to the HamVention, what you do there, what bargains you've found, and so on. You might have some interesting stories for *Radio Fun* which would encourage new hams to start coming to Dayton.

For those of you who've made an annual pilgrimage to my talks, I'm sorry I won't be speaking this year. It'll probably be a while before I get back enough in the good graces of the chaps running the show to get on the program with a good time slot again. But, since I don't have anything much of importance to say anyway, you won't have missed much. I may come up with a tape of what I might have said that you can buy. Or a booklet. Unless the cold fusion field breaks wide open and keeps me too busy, which is possible.

Almost probable. I'll be attending the fifth cold fusion conference in Monaco three weeks before the HamVention, so I'll have the latest news on what scientists from all around the world are doing in this incredible new field. I'll try to bring enough copies of the latest issue of *"Cold Fusion"* for you. They've also been selling out at hamfests. Selling out much faster than I ever expected. Golly, I haven't been to Monaco in years! I remember my first time in 1958, when I visited Bill Orr W6SAI who was summering there with his family. We later became enemies when I opposed "Incentive Licensing" in 1963 and he was being paid to promote it.

This cold fusion business has faxes coming in from my technical advisors in India, France, China, Australia and the US. Maybe you missed the articles in *Scientific American* or sonoluminescence (Feb. '95).

While Sherry and I are in Europe for the conference we'll take a day or two to visit Paris Disneyland, and another to do the Chunnel train to London, where I'll be getting together with Ron G4OWY. I sure wish you could come along! It's going to be a wonderful conference and trip. Yes, I'll make a day-by-day report available.

Speaking of trips . . . a reminder. If you know or talk to any hams on Yap, Palau, Pohnpei, Truk or Majuro please let me know how I can get in touch with them. Sherry and I will be visiting there this coming November.

Continued on page 7

COMET

MODERN, MULTI-BAND ANTENNA SYSTEMS

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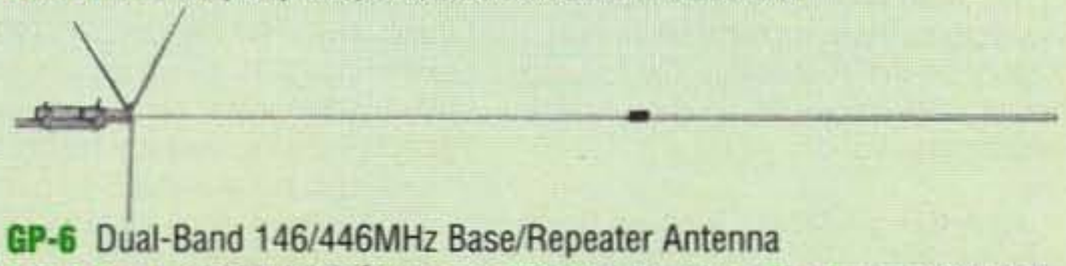
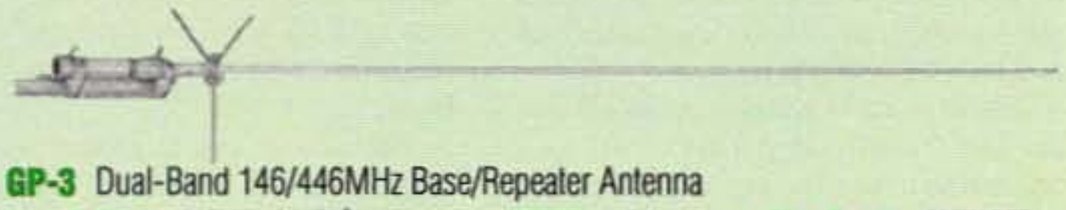
Featuring the COMET exclusive SLC System. The SLC actually increases the gain of the Dual/TriBand Antennas. A completely pre-formed phasing coil and phosphorous copper element produces a low-loss, highly effective, high gain antenna. All COMET antennas are pre-tuned and come complete will all mounting hardware. Simply mount to your mast and experience incredible COMET performance!

COMET DUAL-BAND

GP-9(N) Dual-Band 146/446MHz Base/Repeater Antenna
Gain & Wave: 146MHz 8.5dBi 5/8 wave x 3, 446MHz 11.9dBi 5/8 wave x 8 **VSWR:** 1.5:1 or less **Length:** 17' 8" **Max Power:** 200W PEP **Weight:** 5lbs. 11ozs.
Connector: SO-239 (GP-9), N-type (GP-9N) **Mounts to Mast Size:** 1.25"-2.50"
Construction: Heavy duty fiberglass, 3 sections, 92MPH wind survival



GP-6 Dual-Band 146/446MHz Base/Repeater Antenna
Gain & Wave: 146MHz 6.5dBi 5/8 wave x 2, 446MHz 9.0dBi 5/8 wave x 5 **VSWR:** 1.5:1 or less **Length:** 10' 2" **Max Power:** 200W PEP **Weight:** 3lbs. 8oz.
Connector: Gold-Plated SO-239 **Mounts to Mast Size:** 1.25"-2.50"
Construction: Heavy duty fiberglass, 2 sections, 112MPH wind survival



GP-3 Dual-Band 146/446MHz Base/Repeater Antenna
Gain & Wave: 146MHz 4.5dBi 5/8 wave, 446MHz 7.2dBi 5/8 wave x 3 **VSWR:** 1.5:1 or less **Length:** 5' 10" **Max Power:** 200W PEP **Weight:** 2lbs. 9ozs.
Connector: Gold-Plated SO-239 **Mounts to Mast Size:** 1.25"-2.50"
Construction: Single piece fiberglass, 130MPH wind survival

COMET MONO-BAND

CA-ABC23 Mono-Band 146MHz Base/Repeater Antenna
Gain & Wave: 146MHz 7.8dBi 5/8 wave x 3 **VSWR:** 1.5:1 or less **Max Power:** 200W PEP
Connector: SO-239 **Length:** 14' 12" **Weight:** 3lbs. 8 ozs.
Mounts to Mast Size: 1.25"-2.50"
Construction: Thick-wall aluminum, 3 sections, 70MPH wind survival

CA-712EF Mono-Band 446MHz Base/Repeater Antenna
Gain & Wave: 446MHz 9dBi 1/2 wave x 12 **VSWR:** 1.5:1 or less **Max Power:** 200W PEP
Connector: N-type **Length:** 10' 5" **Weight:** 2lbs. 12ozs.
Mounts to Mast Size: 1.25"-2.50"
Construction: Heavy duty fiberglass, 2 sections, 105MPH wind survival

CA-62DB Mono-Band 6 Meter FM Antenna
Gain & Wave: 52MHz 6.5dBi 5/8 wave x 2 **VSWR:** 1.5:1 or less **Max Power:** 500W PEP
Connector: SO-239 **Length:** 21' 8" **Weight:** 5lbs. 11ozs.
Mounts toMast Size: 1.25"-2.50"
Construction: Thick-wall aluminum, 5 sections, 100MPH wind survival

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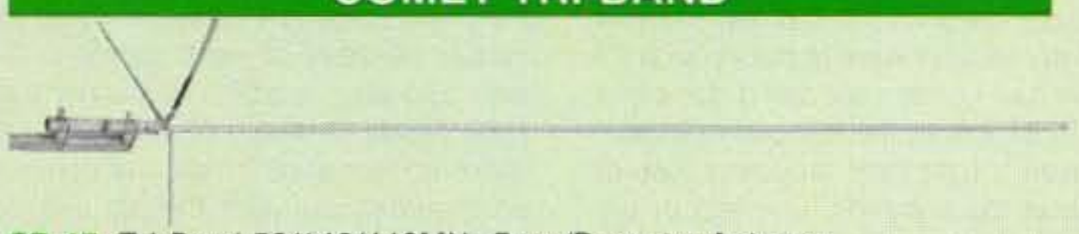
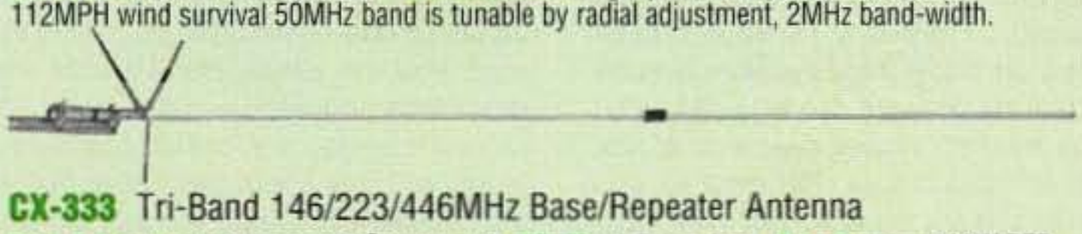
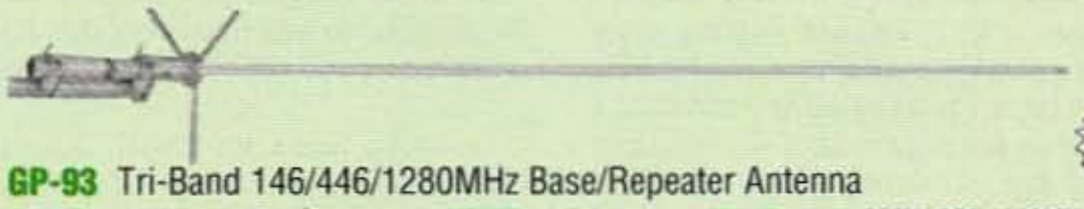


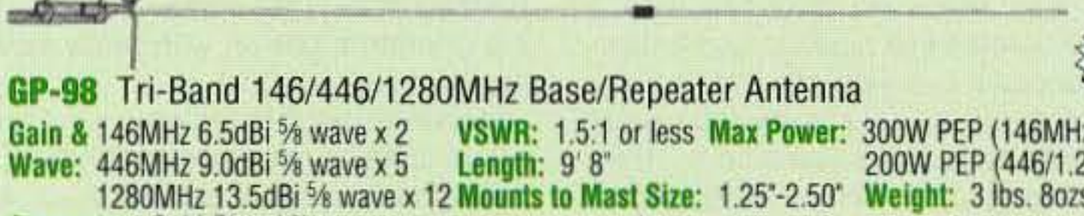
GP-15 Tri-Band 52/146/446MHz Base/Repeater Antenna
Gain & Wave: 50-54MHz 3.0dBi 5/8 wave, 146MHz 6.2dBi 5/8 wave x 2, 446MHz 8.6dBi 5/8 wave x 4 **VSWR:** 1.5:1 or less **Length:** 7' 11" **Max Power:** 300W PEP **Weight:** 3 lbs. 1 oz.
Connector: Gold-Plated SO-239 **Mounts to Mast Size:** 1.25"-2.50"
Construction: Single piece heavy-duty fiberglass, 112MPH wind survival 50MHz band is tunable by radial adjustment, 2MHz band-width.



CX-333 Tri-Band 146/223/446MHz Base/Repeater Antenna
Gain & Wave: 146MHz 6.5dBi 5/8 wave x 2, 223MHz 7.8dBi 5/8 wave x 3, 446MHz 9.0dBi 5/8 wave x 5 **VSWR:** 1.5:1 or less **Length:** 10' 2" **Mounts to Mast Size:** 1.25"-2.50" **Max Power:** 120W PEP **Weight:** 3 lbs. 10 ozs.
Connector: Gold-Plated SO-239
Construction: Heavy duty fiberglass, 2 sections, 112MPH wind survival



GP-93 Tri-Band 146/446/1280MHz Base/Repeater Antenna
Gain & Wave: 146MHz 4.5dBi 5/8 wave, 446MHz 7.2dBi 5/8 wave x 3, 1280MHz 10dBi 5/8 wave x 6 **VSWR:** 1.5:1 or less **Length:** 5' 7" **Mounts to Mast Size:** 1.25"-2.50" **Max Power:** 300W PEP (146MHz) 200W PEP (446/1.2) **Weight:** 2 lbs. 8ozs.
Connector: Gold-Plated N-type
Construction: Single piece heavy duty fiberglass,112MPH wind survival



GP-98 Tri-Band 146/446/1280MHz Base/Repeater Antenna
Gain & Wave: 146MHz 6.5dBi 5/8 wave x 2, 446MHz 9.0dBi 5/8 wave x 5, 1280MHz 13.5dBi 5/8 wave x 12 **VSWR:** 1.5:1 or less **Length:** 9' 8" **Mounts to Mast Size:** 1.25"-2.50" **Max Power:** 300W PEP (146MHz) 200W PEP (446/1.2) **Weight:** 3 lbs. 8ozs.
Connector: Gold-Plated N-type
Construction: Heavy-duty fiberglass, 2 sections, 112MPH wind survival

CROSS NEEDLE METERS

- Separate Meter and RF Sensor allows for convenient placement of the meter.
- Cross Needle Meter provides FWD, REF, and VSWR simultaneously.
- The RF-Sensor is a compact design, and has an extremely low-loss circuit.
- Beautifully illuminated when connected to power supply.
- 6 foot cable standard.
- Optional EKS-3 10 foot extension cable for a total of 16 feet between the sensor and meter.
- Compact Size: (L) 4.75" x (W) 1.75" x (H) 3.5"

CMX-1	CMX-2	CMX-3
1.8-60MHz	1.8-200MHz	140-525MHZ
0-2KW	0-200W	0-200W
30/300/2KW	20/50/200W	20/50/200W

Number 2 on your Feedback card

LETTERS

From the Ham Shack

Edward Hutton N3KEX, Oakdale PA I enjoy ham radio tremendously . . . I've worked as a tech in different categories after my discharge, and have always gravitated to the VHF/UHF bands. I have a couple of gripes. After I hear some of the crap on the HF bands, I seriously question the CW requirement . . . why would I want to put up with it? Hams had better start using our other bands, especially the microwave bands. We won a fight over proposed loss of some of these bands; use 'em or cry over them after we've lost 'em, I say. More of us need to utilize 6 meters, my favorite band. Repeater owners/trustees who carry "ghost" repeaters in the repeater directory had best stop this practice . . . one day I'll claim one of these pairs and get my own machine on line. Not my problem if they don't like it.

Six meters is most likely one of our least utilized bands. I'm glad to see manufacturers coming out with new 6 meter mobile rigs, a very smart move. I predict plenty of newcomers to this band . . . I know I will be very happy to greet them.

I enjoy hilltopping with my different radios . . . 6, 2, 220 and 440 capability here. I like to run QRP and see how far I can go; if I don't make any contacts, I still have fun. I try to take some people with me, and hope the practice spreads.

I like to use FM during VHF/UHF contests . . . I never score a lot of points. This irritates the Grandaddies, but it gets plenty of new hams, mostly no-coders. Hell, I'm a no-coder, and may even renew my license as such. I go to school three nights a week, have a wonderful two-year-old son, a baby girl is due in 30 days (she will probably be here by the time you read this), so learning the code is not very high on my list of priorities. Oh yes, I even hold a full-time job—I'm a field technician for Bell Atlantic Network Integration. We install, maintain and administer LANs and WANs. The wireless LAN is coming!

Mr. Green, I truly enjoy your magazine! I promise to talk up *73;* you just keep those good articles coming.

Emory Schley N4NCU, Dunnellon FL Wayne, you did it again! In your January 1995 editorial you mentioned the two "twin-three" antennas you erected during your college days. I believe this is the *same* antenna you said you were going to publish the specs on, in one of your previous columns (about 10 years ago, as I recall). I know you're a busy guy, so I've been patient, but come on—give us the lowdown. Another couple of years and I won't be able to erect antennas any more! Please! Make that *pretty* please!

Emory—I tried to find that confounded Twin-Three or Twin-Triplex antenna in a recent Handbook, *but it's gone. I found it originally in CQ around 1946. It then was in the* Radio Handbook *for a while. But never mind, I remember the specs. It has two three-wire dipoles spaced 1/6th wave apart. that's about 10' for 20m. I used two 10'2" x 2" poles to hang it up. I used rope to the ends of the poles to swing the whole works between two trees or one tree and the house. The three-wire dipoles were made with #14 wire spaced 6" apart. Each dipole is thus 12" wide. Dipoles for 20m are about 32' long. The ends of the three wires are connected and the center element of each dipole is fed with 150-ohm feedline 1/4 wave long (16'). Hmm, do they still make 75- and 150-ohm twinlead? These are connected together, but with the phasing reversed, and fed, in turn, with 300-ohm feedline to the shack. During the high sunspot cycle this baby puts out one whale of a signal at a very low angle broadside to the elements. It's bidirectional, so I had a whopping signal in Europe and the South Pacific with one, and Africa and Asia with the other. You can do a fair job with the ZL-Special antenna which is about the same, but uses 300-ohm twinlead for the dipoles. This was invented by good old W8JK. I had two of 'em swung between two trees and my fraternity house when I was in college. They were about a half wave above the ground. I hung the 10m Twin-Three in the middle of the 20m antennas.* . . . *Wayne*

John W. Slack WA2BGB, Sunrise FL The other night I tuned in on 17 meters and heard a gentleman working remote. He was working 220 MHz through 440 MHz and working on 17 meters. He was experimenting with his audio quality. As it turned out he had hum and some highs on his audio. As his contact went on, some of the *pro* radio operators got on with nasty comments about his signal.

When I started in radio we were amateur radio hams. If someone had a problem with a rig we put our heads together and tried to help our fellow ham.

I hope this letter will help make some people think before they destroy what radio is all about. It is amateur radio, not *pro* radio, we as hams are in.

Scott Rorex KI5FC, Imboden AR Wayne, I always read your "Never Say Die" editorial as soon as I receive my issue of *73 Amateur Radio Today.* Thanks for the many ideas and encouragement you have provided. I have used some of them, just haven't taken time to give you credit for them. I will try to fix that now.

I at least give you partial credit for my deciding to start my own business using PC-based Interactive Voice Systems in 1991. Most of our systems are used for inbound telemarketing and we now process hundreds of thousands of calls per year. Also, I recently started learning international marketing, which is very interesting, plus goes well with my interest in amateur radio.

Also from your encouragement, I began working with our local school principal, science instructor and computer instructor at Sloan-Hendrix High School with the idea of establishing a school club. We decided that we could interest more students and adults by working with technology in general while emphasizing amateur radio. Our club's name is North East Arkansas Technology Club (NEAT Club). To generate a little excitement, we organized an open house with amateur radio HF voice, 2m voice, and 2m packet demonstrations, as well as other technology related to amateur radio. For example, radio control model race cars, radio control model airplanes and radio control model helicopters. In addition to these, several PC-based exhibits, such as word processors, spreadsheets, games, CD-ROM, and Interactive Voice were included.

Amateur radio demonstrations were set up and operated by other amateur radio clubs located in Northeast Arkansas. Thanks to the Jonesboro Amateur Radio Club, the Respond Amateur Radio Club, and the Lawrence County Amateur Radio Club for helping with the open house.

We were pleasantly surprised when the regional TV news crew arrived to do a story on the Technology Club's open house. The story was aired during the evening news and night news.

Ron Gang 4X1MK, Kibbutz Urim, Israel I was your longest consistent contributor to the "73 International" column for the past 11 years. Anyone reading my contributions over that period will find a complete chronicling of the remarkable growth and development of amateur radio in Israel.

Warm Ham Ties Between Israel and Jordan Developing: The world was heartened to see the signing of a peace treaty between the leaders of Israel and Jordan. This took place not in some faraway foreign capital, but right on the border between our two countries.

What typifies this developing peace is the warmth of feeling between the people of the two countries and the wholehearted manner in which His Majesty King Hussein has gone into the negotiations and peace-making. The same feeling is found with the Jordanian people themselves, and this is indeed the way a peace should be made!

In amateur radio, as in politics, a lot has been going on behind the scenes. I am still not at liberty to disclose what ham contacts have been before the overt peace process between JY and 4X began. But now embassies have opened, there is mutual tourism between the two countries, and by the time you read this joint ham projects between the amateurs of the two countries should be underway.

In the late summer, shortly after the first public meeting between Prime Minister Rabin and King Hussein in Washington, I nearly fell off a Jerusalem park bench when my CQ on the local repeater was answered by a Jordanian ham in Amman. Other JY hams appeared on the Israeli repeaters and we were impressed by the true warm friendliness of these contacts.

On September 22, 1994, a teenage ham in the town of Arad, Jonathan 4Z9FHB, hunting nearby DX, called CQ on the Amman repeater and was answered by none other than King Hussein JY1 himself! They chatted for four full minutes, during which Hussein passed on his warm greetings to all the radio amateurs of Israel.

In early October, still with no official ties between Jordan and Israel yet, the first Jordanian amateur visited Israel. Eli 4X4FD of Beersheva learned of the upcoming business visit, phoned up the Jordanian ham who he had already chatted with on the air (direct telephone lines already operating between the two countries) and invited him to stay with him and his family. One evening the JY4 ham stayed with Leslie 4Z5DG at Kibbutz Re'im, and about a dozen southern hams arrived to meet with our new Jordanian friend.

We learned from him that the hams in Jordan were quite keen about ties with Israel. Peace gave them access to 10 VHF and four UHF repeaters in Israel in addition to their UHF and VHF machines in Amman, access to the 4X packet network (and through it a gateway to the world system) and, in short contact with hundreds of active hams in Israel, greatly enriching their enjoyment of our hobby. We were impressed with the nobility and gentlemanliness of our guest. QSLs for the eyeball QSO were exchanged and, above all, all who were at the get-together came away with the genuine feeling that we had gained a new friend, the greatest of all gains!

There have since been more meetings. Joint projects are planned, like a new repeater to serve both countries on one of the higher mountains in western Jordan. A joint special operation on the international border is planned, with two callsigns: 4X4-SALAM ("peace," in Arabic) and JY-SHALOM ("peace," in Hebrew).

For years, the psychological distance between Israel and Jordan was vast, South America seeming closer. Yet suddenly we see how close we are to each other! Amman is but an hour's drive from Jerusalem, and soon cars from each country will be allowed to freely cross the border. Thus we can expect many eyeball QSOs, antenna raising parties, and who-knows-what. May the future be full of light and joy for us all.

Note: I have purposely not named the Jordanian hams involved (excluding JY1 himself, of course) at this time. The pace of events has been quite rapid and, as is well known, there are more than a few violent opponents to Jordan's ties with Israel. Since some of our new friends have business ties in the rest of the Arab world and have to live peacefully in their reality, I didn't want to cause them any discomfort by naming them. This is out of a deep feeling of respect for our Jordanian colleagues whose sincerity I don't doubt for a minute.

I'm sure glad to hear that His Majesty JY1 is still active on repeaters. I remember 22 years ago when I smuggled a suitcase with a Standard 34-94 repeater and several HT through British and Jordanian customs on my way to visit His Majesty. With the help of Blackie JY9BB, I set the repeater up on top of a hill across from his downtown palace so it could cover the whole Amman area. Its call was JY73. With my new call of JY8AA it was fun saying goodbye to His Majesty, who was at the palace using my old Motorola HYT-220, as I boarded Alia flight to Cairo from way out at the airport via the new repeater. . . . *Wayne*

You get more features for your dollar with the

REP-200 REPEATER

A fully microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

Kit $1095; w&t only $1295!

- Available for the 143-174, 213-233, 420-475, 902-928 MHz bands.
- **FCC type accepted** for commercial service in150 & 450 bands.
- **Six courtesy beep types**, including two pleasant multi-tone bursts.
- **Open or closed access autopatch, toll-call restrict**, auto-disconnect.
- **Reverse Autopatch,** two types.
- **DTMF CONTROL:** over 45 functions can be controlled by 4-digit dtmf command, via radio or telephone.
- **Owner can inhibit** autopatch or repeater, enable either open or closed access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr.
- **Change** cw speed and tone, beep delay, tail timer, and courtesy beep type **at any time** by owner password protected dtmf commands.
- **Auxiliary receiver input** for control or **cross linking repeaters**.
- Color coded LED **status indicators**.

NEW **REP-200T Voice Message Repeater.** As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be **remotely recorded off the air** and played back at user request by DTMF command, or as a periodical voice id, or both. ..... **kit $1145, w&t only $1395**

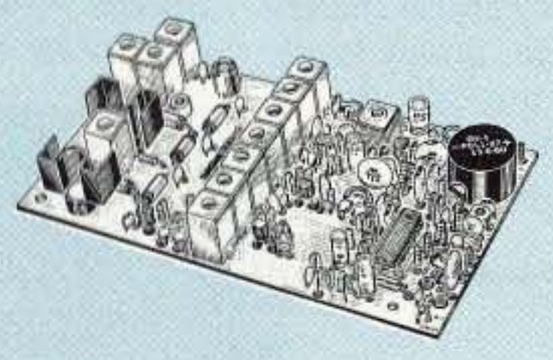
NEW **REP-200C Economy Repeater.** Like REP-200, except uses COR-6 Controller (no DTMF control or autopatch). Features **real-voice ID**. ..... **Kit only $795, w&t $1095**

REP-200N Repeater. Want to use your ACC controller, etc.? No problem! We'll make you a repeater with rf modules only. ..... **Kit only $695, w&t $995**

XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

Also available in rf-tight enclosures, and with data modems.

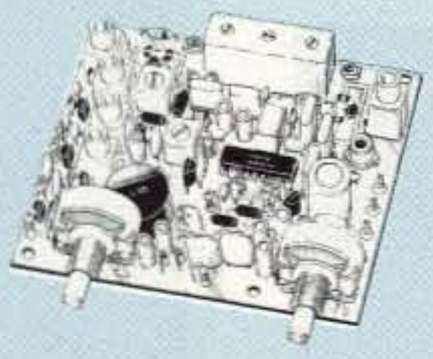
FM EXCITERS: 2W continuous duty. TCXO & xtal oven options. ***FCC type accepted for com'l high band & uhf.***



- **TA51**: 50-54, 143-174, 213-233 MHz .....kit $109, w&t $189.
- **TA451**: 420-475 MHz .....kit $109, w&t $189.
- **TA901**: 902-928 MHz, (0.5W out); w&t $219.

VHF & UHF AMPLIFIERS. For fm, ssb, atv. Output levels from 10W to 100W. Several models starting at $99.

FM RECEIVERS:



- **R144/R220 FM RECEIVERS** for 143-174 or 213-233 MHz. **Sensitive** front end, 0.18uV, both crystal & ceramic if filters plus **helical resonator** front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; .....kit $149, w&t $219.
- **R451 FM RCVR,** for 420-475 MHz. Similar to above. ...kit $149, w&t $219.
- **R901 FM RCVR,** for 902-928MHz. Triple-conversion, ...$169, w&t $249.
- **R76 ECONOMY FM RCVR** for 28-30, 50-54, 73-76, 143-174, 213-233 MHz, w/o helical res, if selectivity >100dB at ±12kHz .....Kits $129, w&t $219

NEW **R76 MONITOR FM RCVR Kit** for 10M, 6M, 73 MHz, 2M, hi-band, or 220 MHz. IF selectivity 60dB at ±12kHz. Great for monitoring repeaters, amateur calling frequencies, or packet radio frequencies, and for listening to commercial two-way radio, police/fire frequencies, or weather forecasts. **Good starter kit, too;** easy to assemble and align. .....**Kit only $59!**

- **R137 WEATHER SATELLITE RCVR** for 137 MHz. Special if filters tailored for wideband fm. Lowest cost receiver available .....**kit only $89, w&t $149.**
- We also have preamps and receiving converters for 137 MHz, and we carry the *Weather Satellite Handbook* by Ralph Taggart.

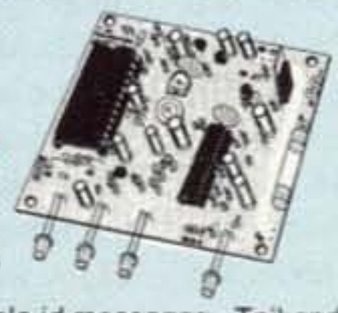
ACCESSORIES

COR-3 REPEATER CONTROLLER. Features adjustable tail and time-out timers, solid-state relay, courtesy beep, and local speaker amplifier. .....kit $49

CWID. Diode programmable any time in the field, adjustable tone, speed, and timer. .....kit $59

COR-4. Complete **COR and CWID** all on one board. CMOS logic for low power consumption. EPROM programmed; specify call. .....kit $99, w&t $159

NEW



COR-6. COR & Real Voice ID on one board. Digital ic records up to 20 seconds of your voice. Can record multiple id messages. Tail and time-out timers, courtesy beep, solid-state relay to key transmitter. kit $99, w&t $149

Versatile DVR-1 DIGITAL VOICE RECORDER Module. As a **voice ID'er for repeaters**, records your voice, using the built-in microphone or external mic. Just the thing for **fox hunt** xmtr id! May also be used as a **contest caller** to play back one or more messages through your transmitter at the press of a switch. Used as a **radio notepad**, it can record the audio output of a receiver — up to 20 sec. of anything you might want to recall later. Play back as often as you like through a small external speaker. Extensive manual tells how to use multiple messages and adapt to many applications.

.....kit $59, w&t $99

TD-4 SELECTIVE CALLING Module. Versatile dtmf controller with 1 latching output. Mutes speaker until someone calls by sending your 4-digit tt code. Or use it with a long tt zero digit to alert anyone in club. Also may be used to control autopatch or other single device. .....kit $49, w&t $79

TD-2 DTMF DECODER/CONTROLLER. 16 digits, programmable, toll-call restrictor. Can turn 5 functions on/off. .....kit $89, wired & tested $149

AP-3 AUTOPATCH. Use with TD-2 for repeater autopatch. Reverse patch and phone line remote control are std. .....kit $89, wired & tested $149

AP-2 SIMPLEX AUTOPATCH Timing Board. Use with above for simplex operation using a transceiver .....kit $39

TD-3 SUBAUDIBLE TONE DECODER/ENCODER. Adjustable for any tone. **Especially for repeaters,** with remote control activate/deactivate provisions .....kit $29, wired & tested $59

DATA MODEMS

MO-202 FSK DATA MODULATOR & DE-202 FSK DEMODULATOR. Run up to 1200 baud digital signals through any fm transmitter & receiver. Radio-link computers, telemetry, etc. .....kit ea $49, w&t ea $79

9600 BAUD DIGITAL RF LINKS. **Low-cost** packet networking system, consisting of MO-96 Modem and special versions of our 144, 220, or 450MHz FM Transmitters and Receivers. Interface directly with most TNC's. Fast, diode-switched PA's output 15 or 50W. CALL.

Low Cost GaAsFET PREAMPS

LNG-(*)

ONLY $59 wired&tested

FEATURES:
- **Very low noise:** 0.7dB vhf, 0.8dB uhf
- **High gain:** 13-20dB, depends on freq
- **Wide dynamic range** - resist overload
- **Stable:** low-feedback dual-gate FET

**Specify tuning range: 26-30, 46-56, 137-152, 152-172, 210-230, 400-470, 800-960 MHz.*

LNW-(*) MINIATURE PREAMP

ONLY $29 kit, $44 wired&tested

- GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.*

LNS-(*) IN-LINE PREAMP

ONLY $89 kit, $119 wired&tested

- GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

**Tuning range: 120-175, 200-240, or 400-500.*

HELICAL RESONATOR PREAMPS

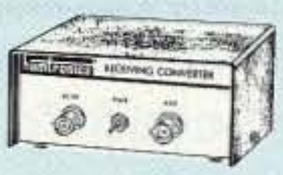
GaAs FET preamps with helical resonators **reduce intermod & cross-band interference** in critical applications.

MODEL HRG-(*), *$80 vhf, $110 uhf.*

**Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-470.*

RECEIVING CONVERTERS

Low noise converters to receive vhf and uhf bands on a 10M receiver.



- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (to chan 3).
- **Kit less case *$49*, kit w/case & BNC jacks *$74*, w&t in case *$99*.**

TRANSMITTING CONVERTERS

XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 220, 222, 432, 435, and atv. 1W output. ***Kit only $89.*** PA's up to 45W available.

- Buy at low, factory-direct net prices and save!
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QRX . . .

Number 3 on your Feedback card

Westlink Goes Under

A major ham newsletter has bitten the dust after 13 years and 330 issues. Publisher Burt Hicks WB6MQV announced that the January 1, 1995, issue of the *Westlink Report* would be the last. "I would like to think that what we have done in the past thirteen years has made a difference for good in the hobby. We know we have influenced some decisions of the Federal Communications Commission as well as informed a few members of Congress, and perhaps helped shape the public debate on issues of interest to amateurs," said Hicks.

The demise of *Westlink* is not a total surprise. The newsletter has been fighting a well-known financial struggle for about eight years. But Hicks says it was lack of ZZZs rather than lack of $$$s that finally caused *Westlink* to fold. He says four to five hours of daily sleep is simply not enough to keep publishing *Westlink* while working the graveyard shift as a Fox Television Engineer.

There are only two other national newsletters comparable to the *Westlink Report:* the *ARRL Letter* and the *W5YI Report*. Hicks calls the League's newsletter "professionally done," but adds that it lacks editorial freedom. The *W5YI Report*, on the other hand, had only three amateur radio stories in the last issue received. *W5YI* was also responsible for erroneous reports of a major financial disaster here at *73*. The *W5YI Report* based that story on interviews with disgruntled former Wayne Green, Inc. employees. *TNX Westlink Report, No. 687, January 1, 1995.*

Vibroplex Bought by Ham

The venerable Vibroplex company, manufacturer of the original "bug" and a number of other types of keyers, has been acquired by Mitch Mitchell, Jr. WA4OSR. Mitch says "The Vibroplex name is older than amateur radio and has come to represent the one piece of equipment in the ham shack that symbolizes the interest, comaraderie, and espirit de corps of the worldwide ham radio community."

Besides the bug, the company plans to continue manufacturing Iambic, Vibrokeyer, and Brass Racer keys at consolidated headquarters in Mobile, Alabama. Mitch also hints that some new products will be introduced from Vibroplex very soon.

Social Interface Coming

Microsoft Chairman Bill Gates said, "We are just at the beginning of the social interface," in a recent article in *Electronic Engineering Times*. His comments were made in conjunction with the release of Microsoft's new Graphic User Interface (GUI) named "Bob," which was recently unwrapped at a major Las Vegas consumer electronics convention. "Bob" uses cartoons instead of icons and menus as a means of communication between human beings and computers.

"Bob" sits atop Windows and allows users to toggle back and forth to the cartoon characters at any time for assistance. Smiley faces, cats, and parrots all greet the user in colorful "rooms" which represent basic aspects of the program, such as e-mail or word processing. Gates says this type of social interface is a key component in realizing the vision of the home filled with smart devices. In an effort to make these devices fun to use, researchers have determined that humans tend to relate more easily with animated beings in a polite, interactive manner, almost as if the device were human.

While some observers found the "Bob" GUI a little too cute, many others are expected to jump on the bandwagon. Expect to see more and more electronic attempts at social interfacing, especially in markets filled with members of the maturing MTV generation. *TNX Electronic Engineering Times, January 16, 1995.*

FAR Scholars Sought

The nonprofit Washington, D.C., based Foundation for Amateur Radio will once again coordinate the distribution of 56 scholarships from a variety of donors for the academic year 1995-96. Licensed radio amateurs may compete if they plan to persue full-time studies beyond high school and are enrolled or have been accepted for enrollment at an accredited university, college, or technical school.

The FAR Scholarships range in value from $500 to $2,000 each. Some have restrictions. More information and an application form may be requested before April 30, 1995, from *FAR Scholarships, 6903 Rhode Island Avenue, College Park, MD 20740. TNX W5YI Report, January 15, 1995.*

AMSAT Phase 3-D Under Construction and On Schedule for April 1996 Launch!

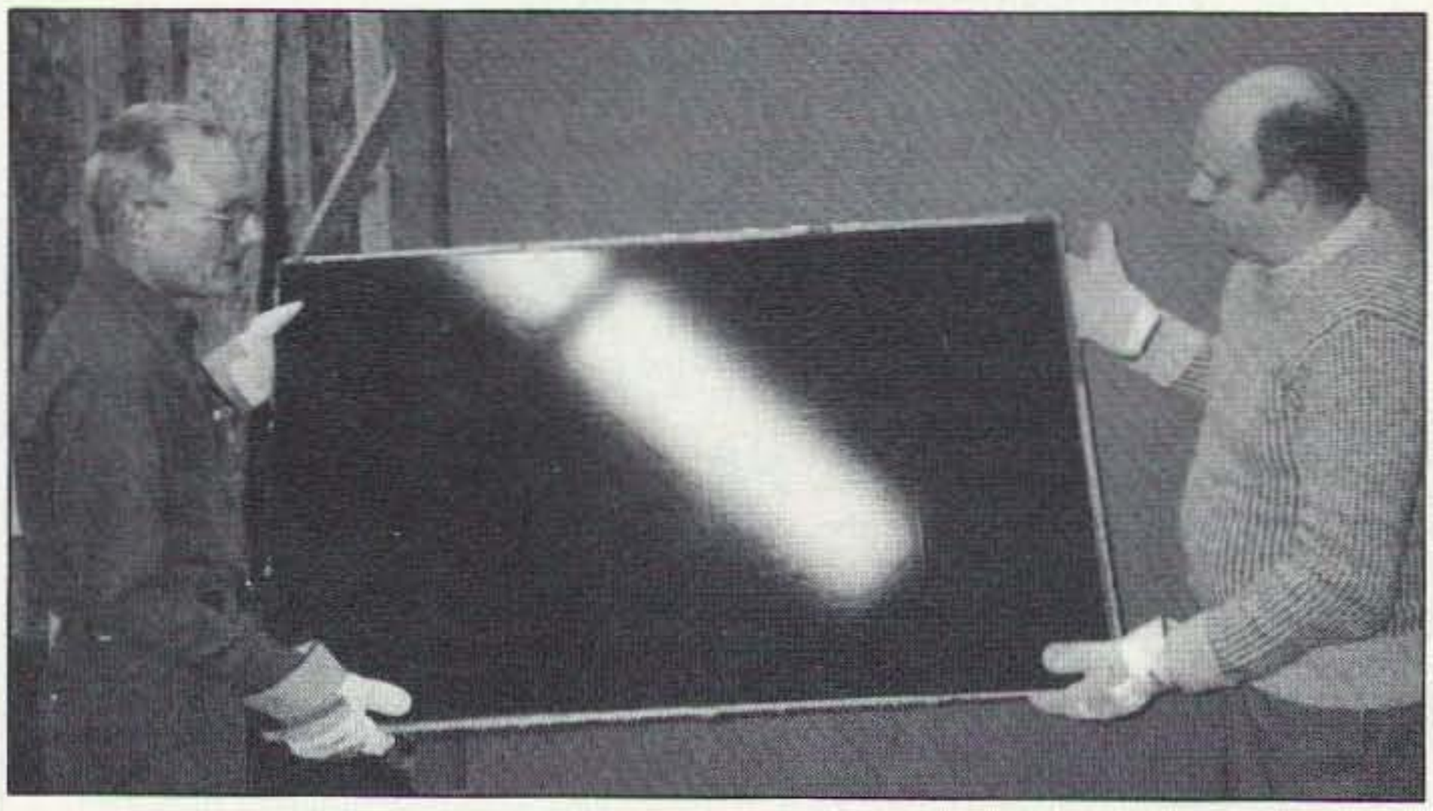

Photo A. AMSAT-NA V.P. Engineering Dick Jansson WD4FAB (L) and Executive V.P. Keith Baker KB1SF (R) inspect one of the flight model solar panels for amateur radio's newest and most advanced satellite. Working at the P3-D Lab at Weber State University in Ogden, Utah, the men display the Kapton electrical insulation layer. These panels, valued at more than $50,000, were donated to the project. (Photo by Ralph Butler, Weber State University.)

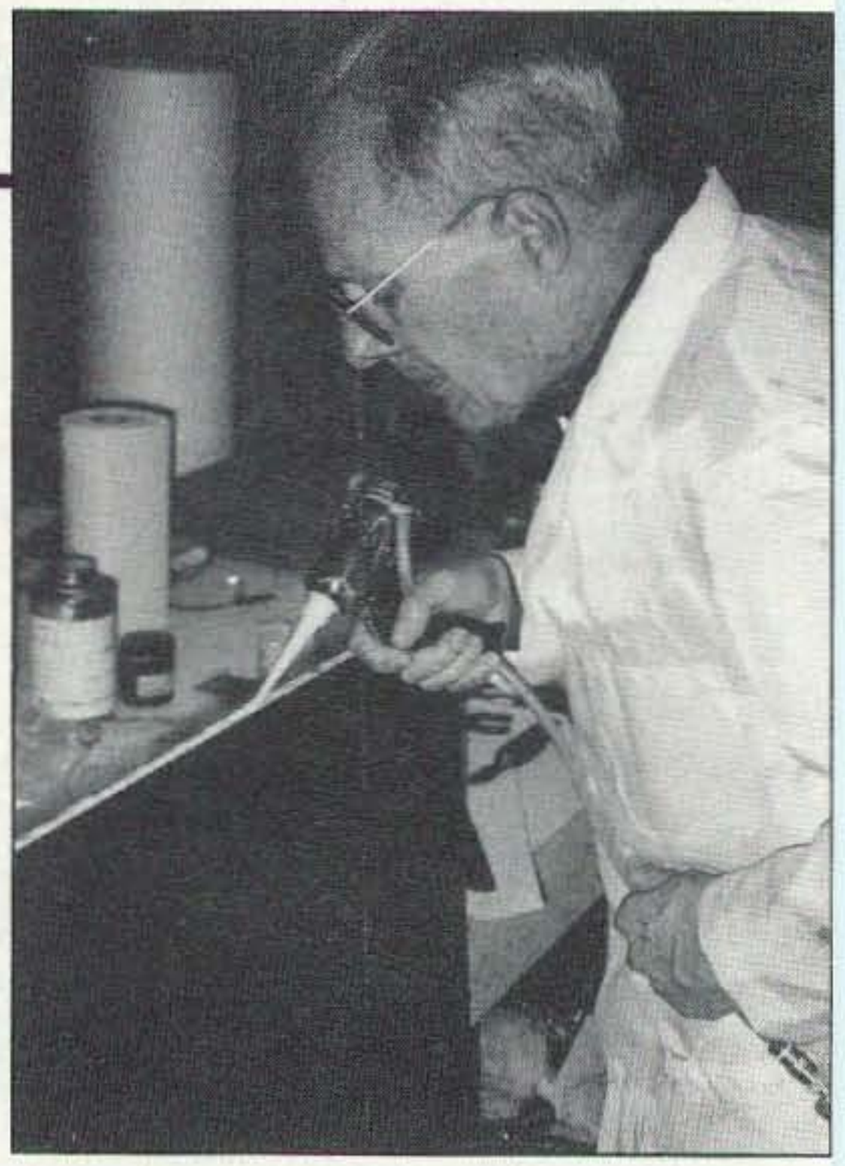

Photo B. Later, Jansson applied epoxy resin to the edge of one of the panels, which are constructed of 1/2" thick aluminum honeycomb material covered by a thin carbon composite facesheet. Each panel weighs only a few kilograms. (Photo by Keith Baker KB1SF.)

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The Drake SW8 – Finally, Professional Desktop Performance In An Affordable, Portable World Band Shortwave.

The company that has been setting the standards in premium-quality world band shortwave performance now puts top-of-the-line features and technology at your fingertips with the SW8…wherever you want to take it. Designed for both desktop use and easy portability, the Drake SW8 includes many of the same features that have made Drake a perennial favorite of experts – superb audio, versatility, and the unique combination of professional quality and functional simplicity. So tune in the world and get the best of all worlds – quality and affordability, desktop technology and portability.

The Drake SW8.

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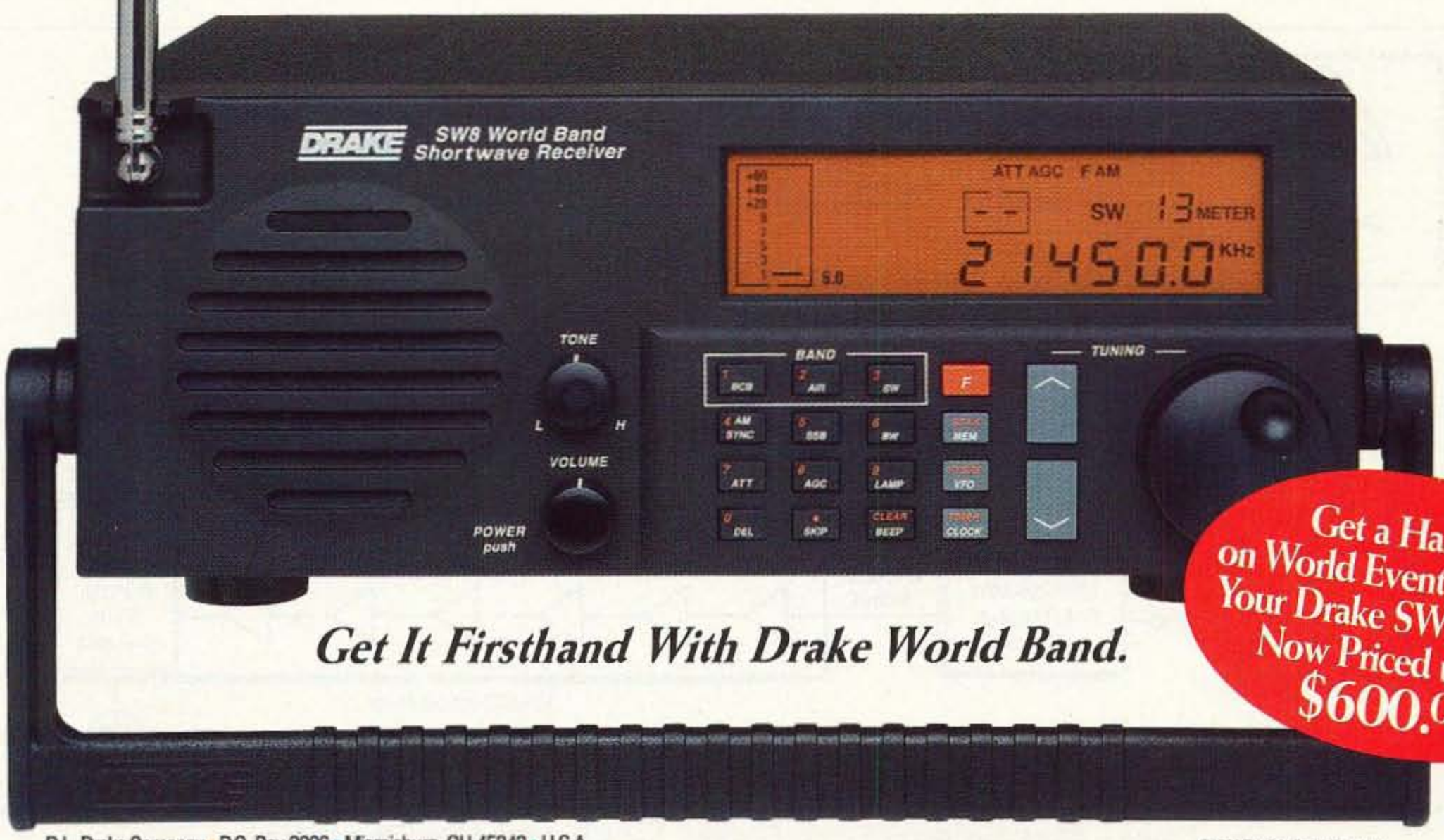

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A Practical Weather Satellite Receiving System, Part 1

Set up your own weather satellite receiver/decoder.

by Angus Anderson ZR6UM

Weather satellites are the penniless technologist's dream come true. How else can an average person look onto the earth's surface from space?

I have been avidly interested in weather satellites for years now, but it took a series of articles by Dr Ralph Taggart WB8DQT in *73* magazine, as well as his excellent publication *The Weather Satellite Handbook*, to get me off my backside and do something about implementing a useable system. I have not been disappointed.

This begins our two-part series on home-building a weather satellite receiving system for Automatic Picture Transmissions (APT) from polar orbiting satellites, using a PC for display and picture storage. The system is flexible and, best of all, uses a sophisticated shareware software display package written by Eberhard Backeshoff DK8JV. This first part of the series will cover the receiver and APT demodulator, and next month the second part will cover the PC parallel interface and a review of the features of the JVFAX 6.0 software package.

We will not be able to cover the construction of a 137 MHz receiver or 1691 MHz down converter in these two articles. However, I gladly offer the kits for these items, with construction manuals, and details of other suppliers of receiving equipment are given below. The two parts of this article will cover decoder, interfaces, and display software only.

Like most hams who like to experiment with radios, I have had to learn the hard way about the pitfalls that await the unwary when setting up a weather satellite receiving and display system. Living at a QTH near the tip of Africa, access to information and specialized components can be difficult and expensive. This article will pass on some of my experiences in building the equipment.

Receiving Options

You really only have two options when receiving lower resolution weather satellite pictures directly from space. The first option is to set up a 137 MHz receiving system to receive and decode the pictures directly transmitted from polar orbiting satellites in the APT format. There are a number of these satellites in operation—at the time of this writing, the American NOAA 10, NOAA 12, NOAA 13 and NOAA 14 spacecraft are transmitting pictures. Also transmitting are the Russian METEOR (and sometimes

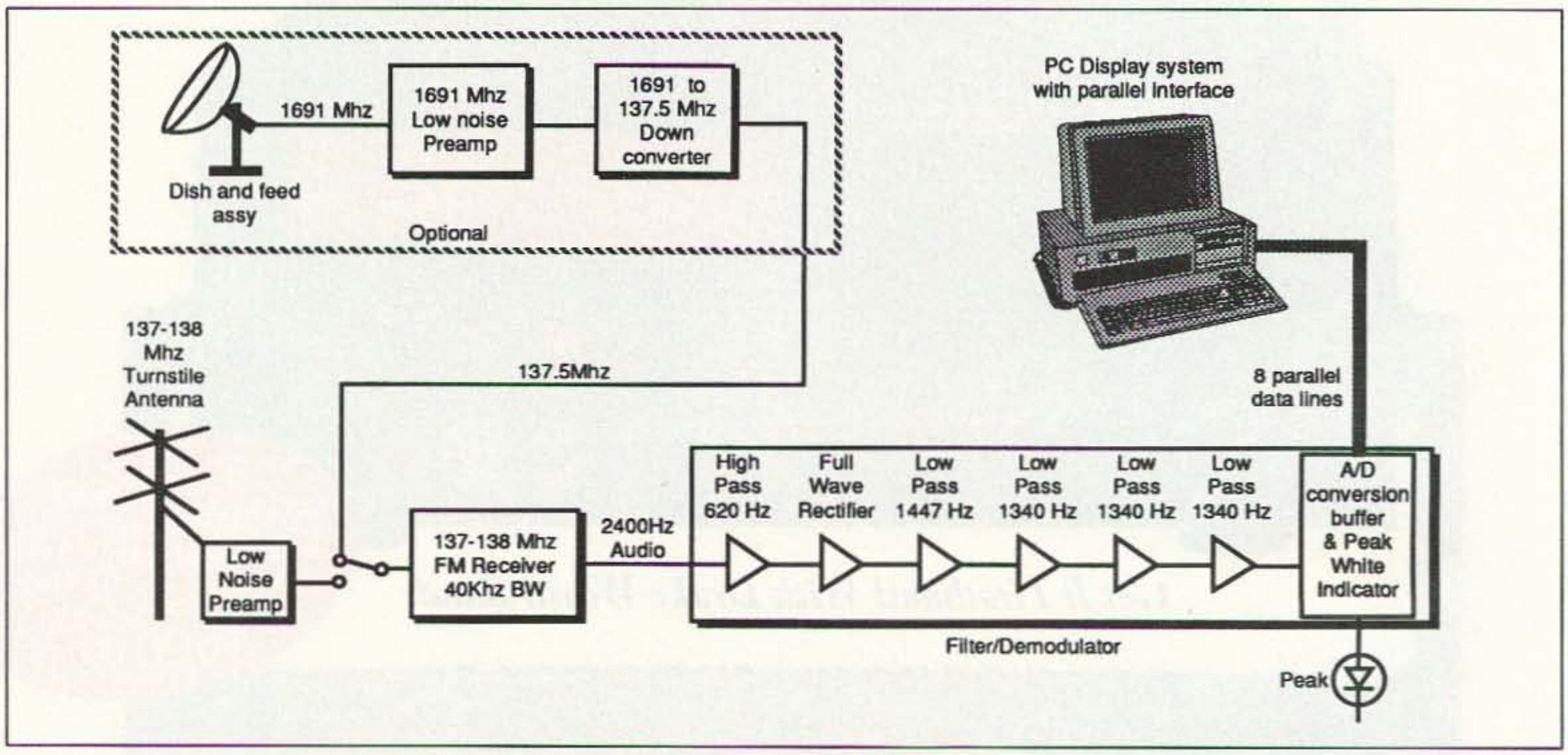

Figure 1. Block diagram of a typical weather 137 MHz satellite receiving system.

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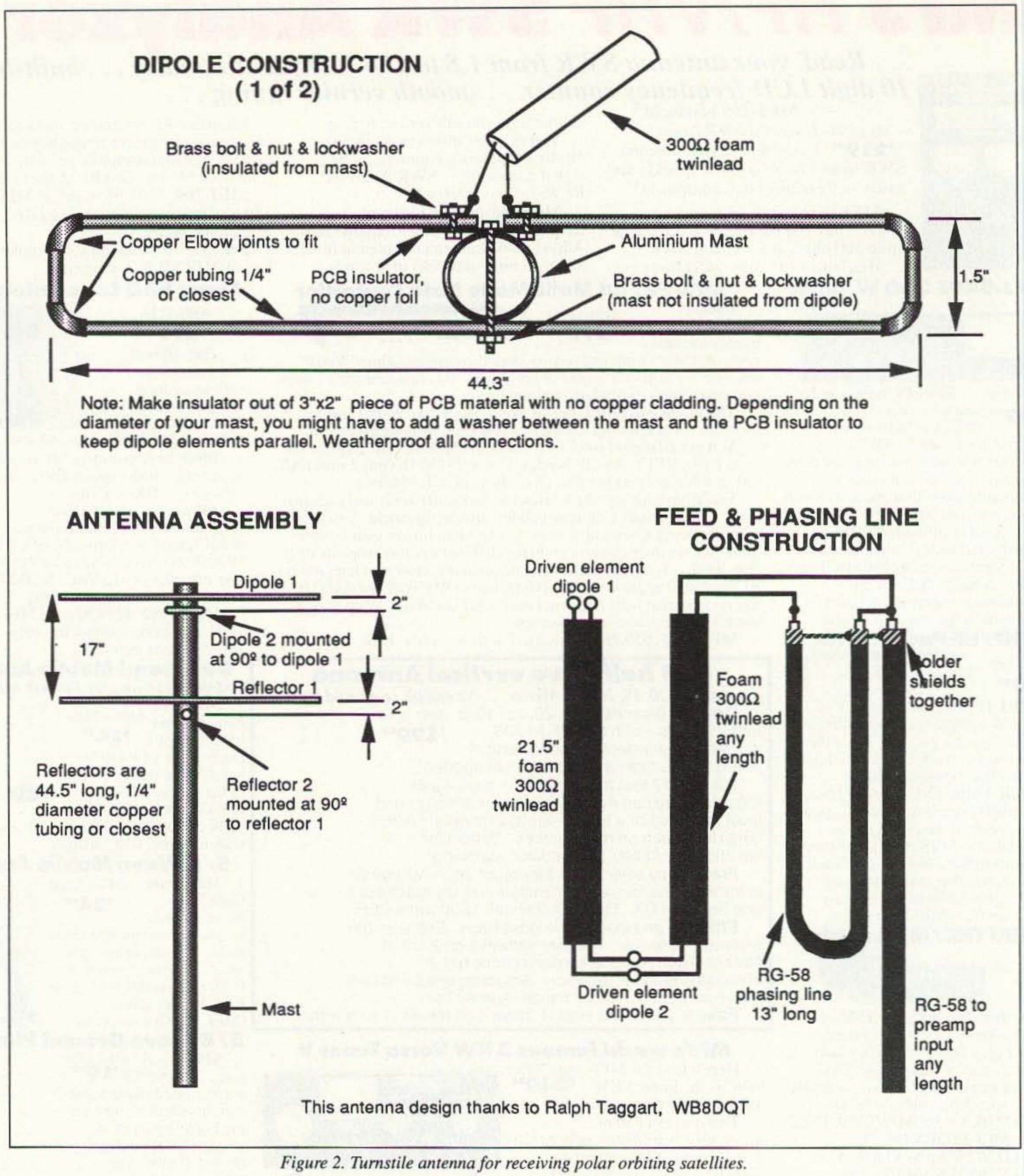

Figure 2. Turnstile antenna for receiving polar orbiting satellites.

COSMOS) satellites, which can provide spectacular pictures due to their strong signals and excellent visible picture resolution.

Polar orbiting weather satellites can give better resolution of geographical features than the geostationary satellites, due to their lower altitude. This can be a bonus on home-built equipment. Because their orbit is at about 950 km altitude (as opposed to the 35,000 km altitude of the geostatonary birds), you can usually resolve surface features better. The NOAA scanning radiometer optics correct for horizon distortion, yielding natural-looking pictures with a geometry that mostly looks like what you would expect to see on a map. This makes it easy to identify ground features from an atlas.

The second option is to implement an S-band receiving downconverter with a small dish or long yagi antenna to receive the geostationary GOES or METEOSAT transmissions. The S-band downconverter receives signals at 1691 MHz and converts this signal to 137.5 MHz—this can feed the input of your existing 137 MHz receiver. Transmission formats for both systems are similar, so the results of both can be displayed on your PC screen. Pictures from GOES or METEOSAT are not as detailed as the pictures from a polar orbiter (they can

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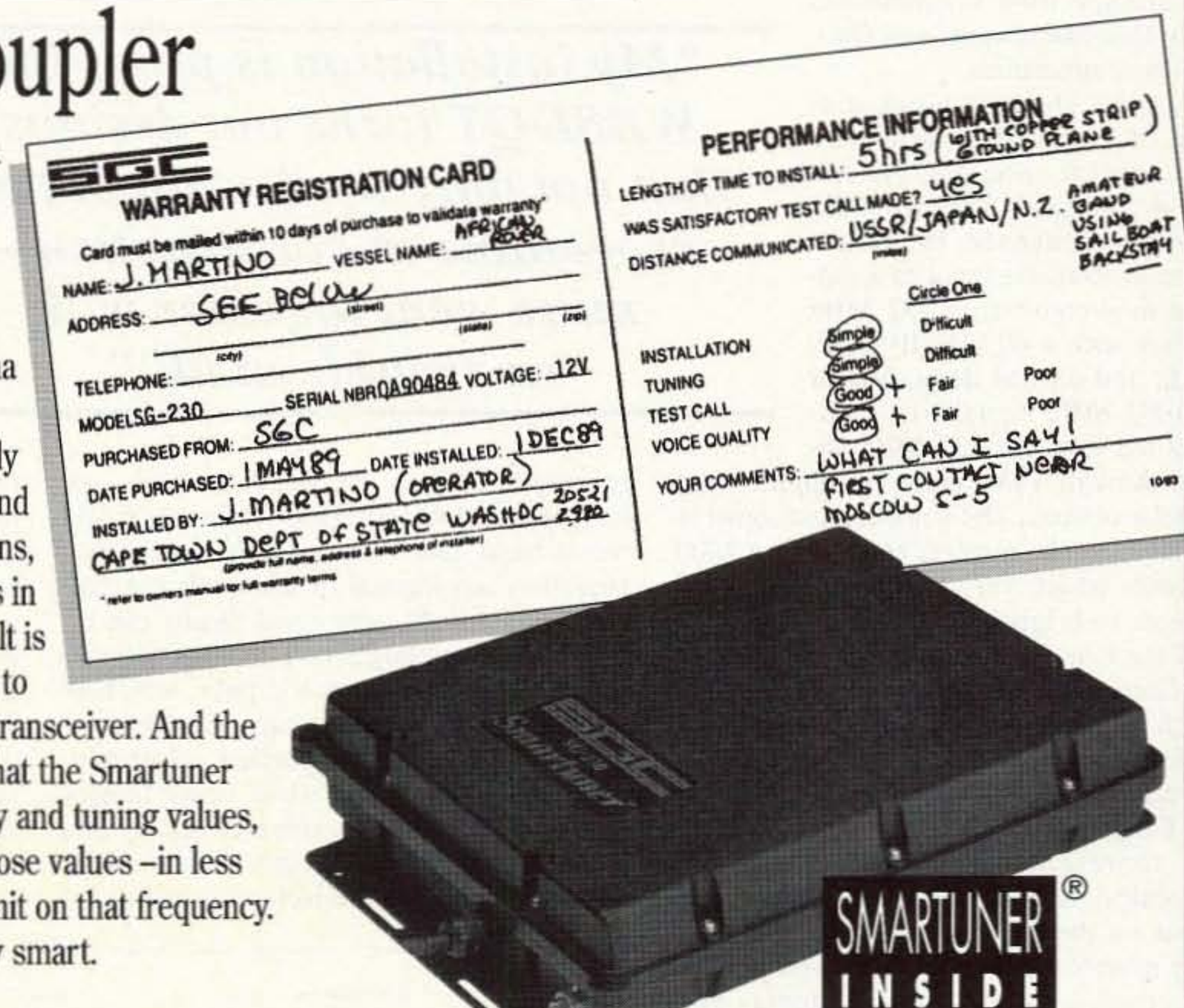
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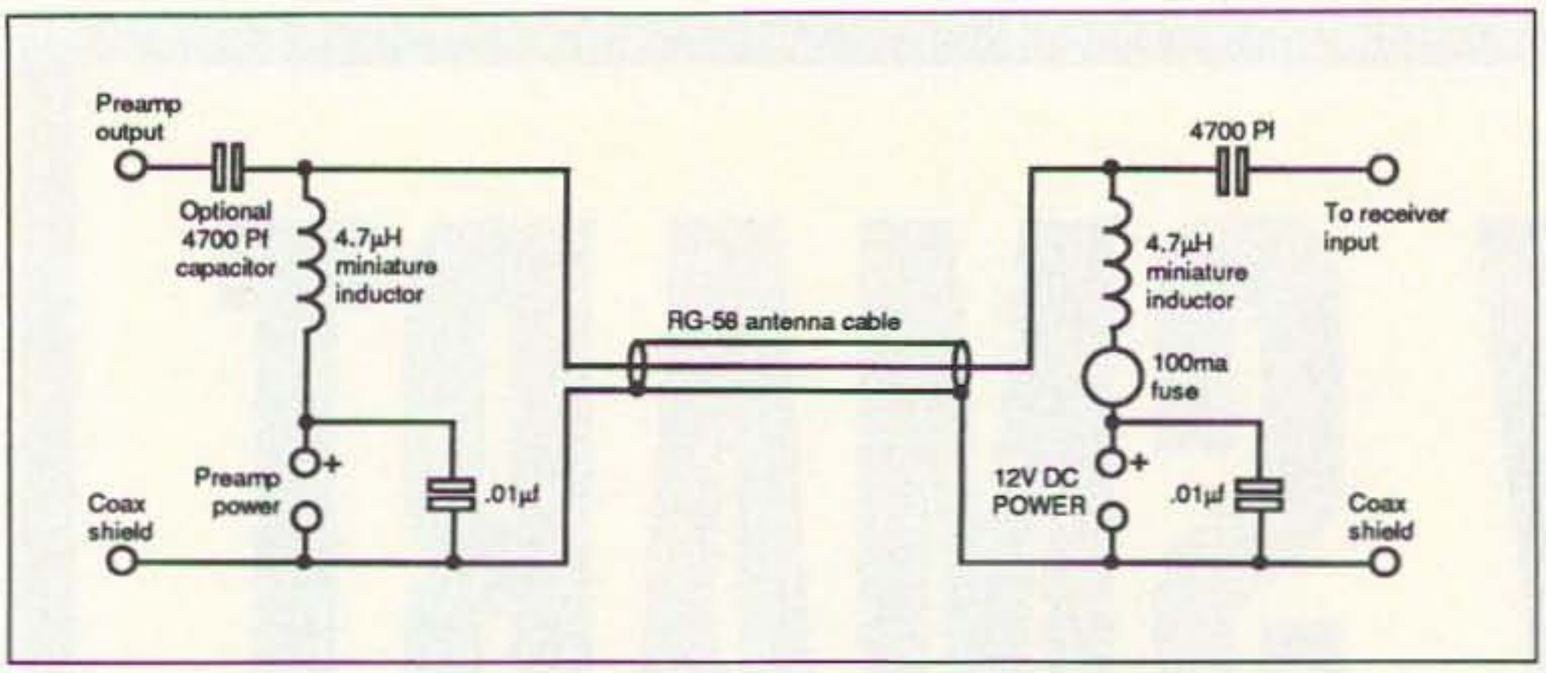

Figure 3. Feeding 12 VDC power to the preamp through the coax feed.

come close), but an added bonus is that the ground computers on the geostationary satellites add political boundaries and latitude and longitude marks to the picture, which makes it easier to orient yourself with an atlas.

For those of you who want to receive transmissions from the geostationary satellites, suitable equipment to implement a downconverter is advertised in the pages of *73* magazine. Some suppliers that I have seen are Spectrum International, Down East Microwave, and Quorum Communications.

Figure 1 shows a block diagram of a typical weather 137 MHz satellite receiving system, with an optional 1691 to 137.5 MHz downconverter. The downconverter feeds the input of a sensitive dual-conversion 137 MHz receiver with a 40 kHz IF bandwidth, and an FM demodulator for 1691 MHz signals, or is directly fed from the 137 MHz antenna through a low noise preamplifier for the polar orbiters. The demodulated signal at the output of the receiver consists of a 2400 Hz tone, which varies in amplitude with changes in brightness in the picture. The 2400 Hz tone is fed through a series of active filters, and is rectified to give a voltage which varies proportionally with picture brightness. This voltage is fed to an A/D converter, which converts the voltage to parallel 8-bit format at TTL levels. Each picture cell represents an 8-bit value (255 grayscales), and 800 or more cells (pixels) appear on the 8-bit parallel interface lines every quarter of a second! The 8-bit parallel TTL signal is routed to the PC display system via a parallel I/O interface in the PC.

The Antenna

Signals from all polar orbiting satellites exhibit changes of polarization and Doppler shift when being received by a ground station. This is because the spacecraft is moving fast with respect to the receiving station. Horizontally and vertically polarized antennas, such as those found in terrestrial installations, exhibit what is called linear polarization. NOAA satellites have Right Hand Circular Polarization (RHCP), where the polarization actually travels in a circular path as it moves through space. Using an antenna with linear polarization on NOAA spacecraft will present the user with deep, slow nulls of 20 dB or more in the received signal at the station as polarization changes. METEOR spacecraft, on the other hand, have linear polarization. With a circularly polarized receiving antenna of the correct sense, a linearly polarized signal such as is transmitted from METEOR spacecraft will show only some 3 dB loss, and NOAA signals can be received at full strength. While it is possible to build gain antennas with circular polarization and manual or automatic antenna tracking facilities, very good results can be obtained by building a simple crossed dipole with a reflector for each dipole, which is mounted facing vertically upwards. This antenna design is generally called a Turnstile. The Turnstile antenna, while being largely non-directional, will receive circularly polarized signals at full strength—exactly what we want. However, the lack of antenna gain on the turnstile will often make an antenna preamplifier necessary to receive noise-free pictures.

"My installation is proof that WB8DQT turns out designs that not only work well, but are repeatable in construction—mine went together with no trouble at all."

Figure 2 shows the details of a suitable turnstile antenna for receiving polar orbiting satellites. This design was taken from the *father* of cheap weather satellite reception, WB8DQT, and was originally called the *Satellite Zapper*. Apart from the use of copper plumbing tubing for the elements, the design is as the original. My installation is proof that WB8DQT turns out designs that not only work well, but are repeatable in construction—mine went together with no trouble at all. The diagram should give all the information necessary to implement a useable antenna.

With the addition of a suitable low-noise preamplifier mounted on the mast, I can get a full quieting signal on a good South-North pass at my QTH (30 km north of Johannesburg, South Africa) from the time the spacecraft rises to an elevation of 4 to 5 degrees above the horizon, to the time just before it sets. This equates to Prince Edward Island in the South Indian Ocean to Lake Victoria in Central Africa. A good S-N pass is one that rises to an elevation of 60 degrees or more above the horizon.

I used 1/2" copper tubing for all elements, available from plumbing shops. This was cut to length, and the folded part of the dipole formed by 90-degree copper elbows which fit over the tubing. The elements are soldered together with ordinary solder, using a 60-watt soldering iron, and form a rigid assembly. Let the solder flow right into the joints. Flatten the free ends of the dipole, and drill holes to accept the 300 ohm twin lead and the insulator which is made from a small piece of Fiberglas PCB material with the copper removed. This is fastened together by brass bolts, cable tags, and washers. The dipoles are fastened to the mast as shown, with the second dipole being 2" below the first, and at 90 degrees to it. The reflectors are mounted 17" below the dipoles by drilling a hole through the mast and fastening the reflectors to the mast with a suitable self-tapping screw. Your mast should be made of aluminium tubing, with the diameter about 1.25" or less. Drill the

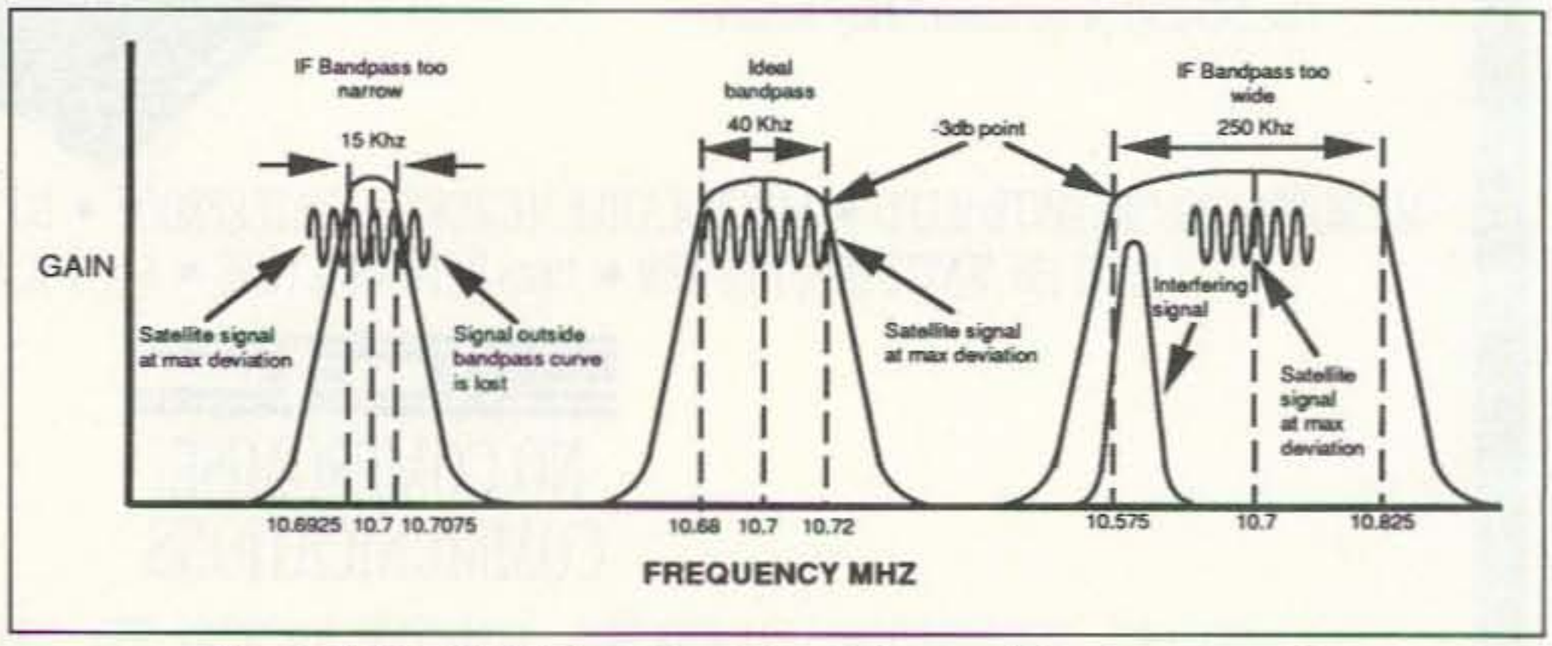

Figure 4. The ideal IF passband should have as flat a top as possible.

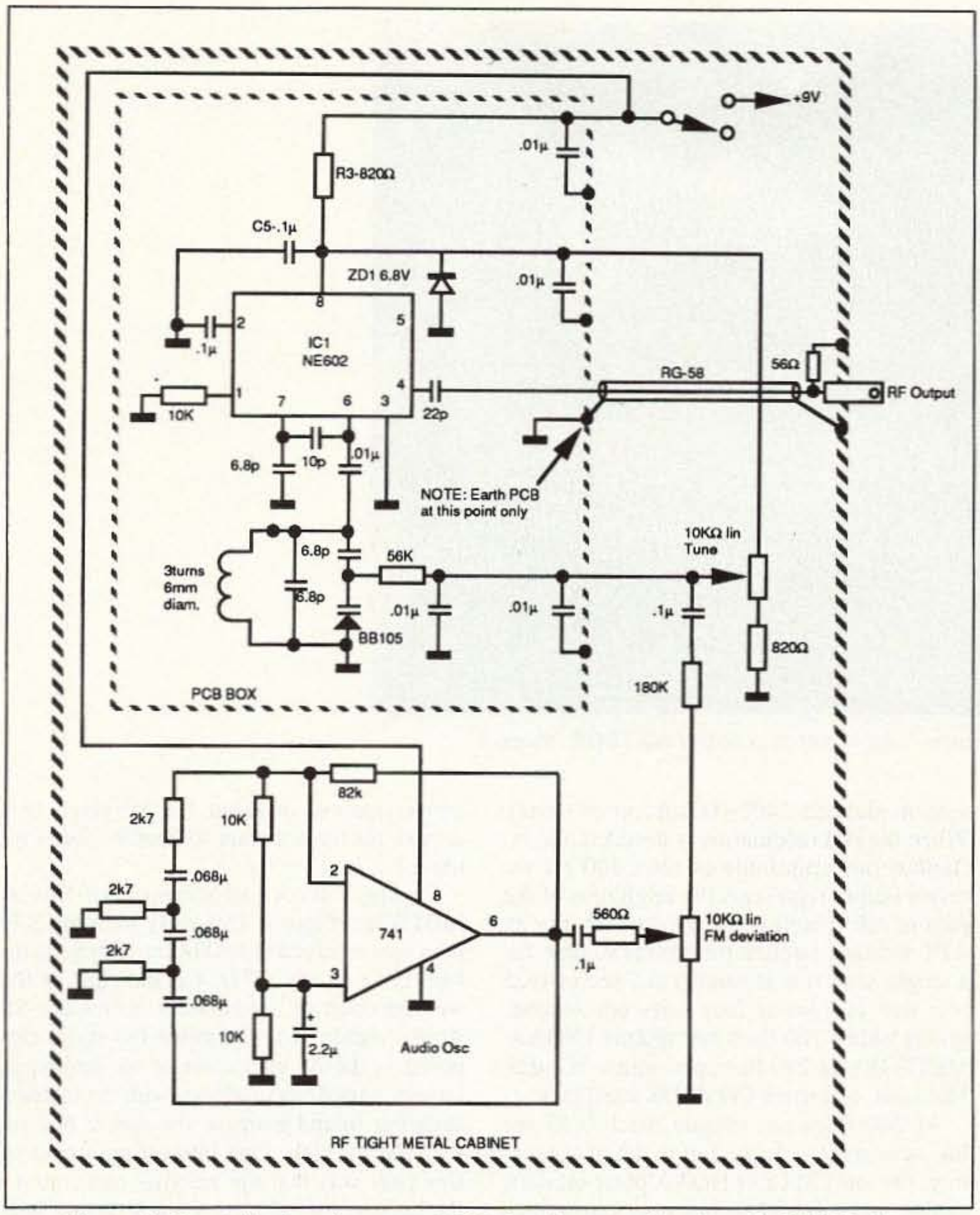

Figure 5. Circuit for a varicap-tuned FM signal source, based on the NE602 chip.

hole in the mast slightly larger than the one in the reflector element, which should be of the right size to accept the self-tapper. A quarter-wave delay line is made with RG58 coax, and soldered as shown.

When constructing the antenna, use good quality foam core 300 ohm twin lead and good quality RG-58 coax (don't go for bargain basement cable), and make sure that the preamplifier is adequately weatherproofed. Suitable mast mounting enclosures for the preamplifier are available from TV suppliers. Loop the cables to enter and exit at the bottom of the enclosure so that moisture drips off and does not creep in. Although it is possible to build your own preamplifier, really hot performers are available already built from a number of suppliers in the pages of *73* magazine. I like the Hamtronics LNA series GaAsFET units because in my opinion they provide unbeatable value for money, as well as having a 0.7 dB noise figure and lots of gain. They are also easy to retune from 144 MHz to 137.5 MHz without changing the noise figure, which was set to optimum at the factory. Since system performance is determined almost exclusively by the noise figure of the preamp, this is an important point. [Manufacturer's note: Hamtronics now offers the LNG-137 Series, $59, already tuned to WX SAT frequencies.]

The most convenient way to feed 12 VDC power to the preamp is through the coax feed. Figure 3 shows how this is achieved with the use of two inductors and some capacitors. Make sure that there is a blocking capacitor at the output of the receiver and the preamplifier. You can, of course, also use a separate wire to feed the DC, using the antenna coax shield as a return. Remember to fuse the feed with a 100 mA miniature fuse.

The Receiver

Your 137 MHz receiver should have an IF bandwidth of 40 kHz to receive decent pictures. Too narrow an IF bandwidth will not allow the full FM deviation (frequency swing) from the spacecraft to be accommodated in the passband, resulting in useless pictures, although the signal will be strong. Too wide an IF bandwidth will decrease receiver sensitivity and allow interfering signals to creep into the IF passband. Most scanning receivers that cover the 137 MHz band either have too narrow an IF bandwidth (NFM position is about 15 kHz) or too wide (WFM position is about 250 kHz). Optimizing your existing scanner would require changing some of the IF filters, not something for the faint of heart! I have been able to receive usable pictures with my AOR-2002 scanner set to the FM "wide" position, but only with a good preamplifier in line, and with a gain antenna. In other words, you will need lots of signal into the receiver if you use a wide passband. The optimum 40 kHz IF bandwidth will allow reception of full spacecraft deviation, as well as accommodating Doppler shift of about 6 kHz without having to retune during a pass. It also maximizes receiver gain and excludes interfering signals. Figure 4 illustrates the ideal IF pass band which should have as flat a top as possible. It also illustrates what happens when the IF passband is either too wide, or too narrow.

While some people have succeeded in modifying narrow or wideband FM receivers for a 40 kHz IF bandwidth, the best bet is either to buy a suitable receiver, or build your own from a kit. In the past, I have used the Vanguard FMR-250 receiver from

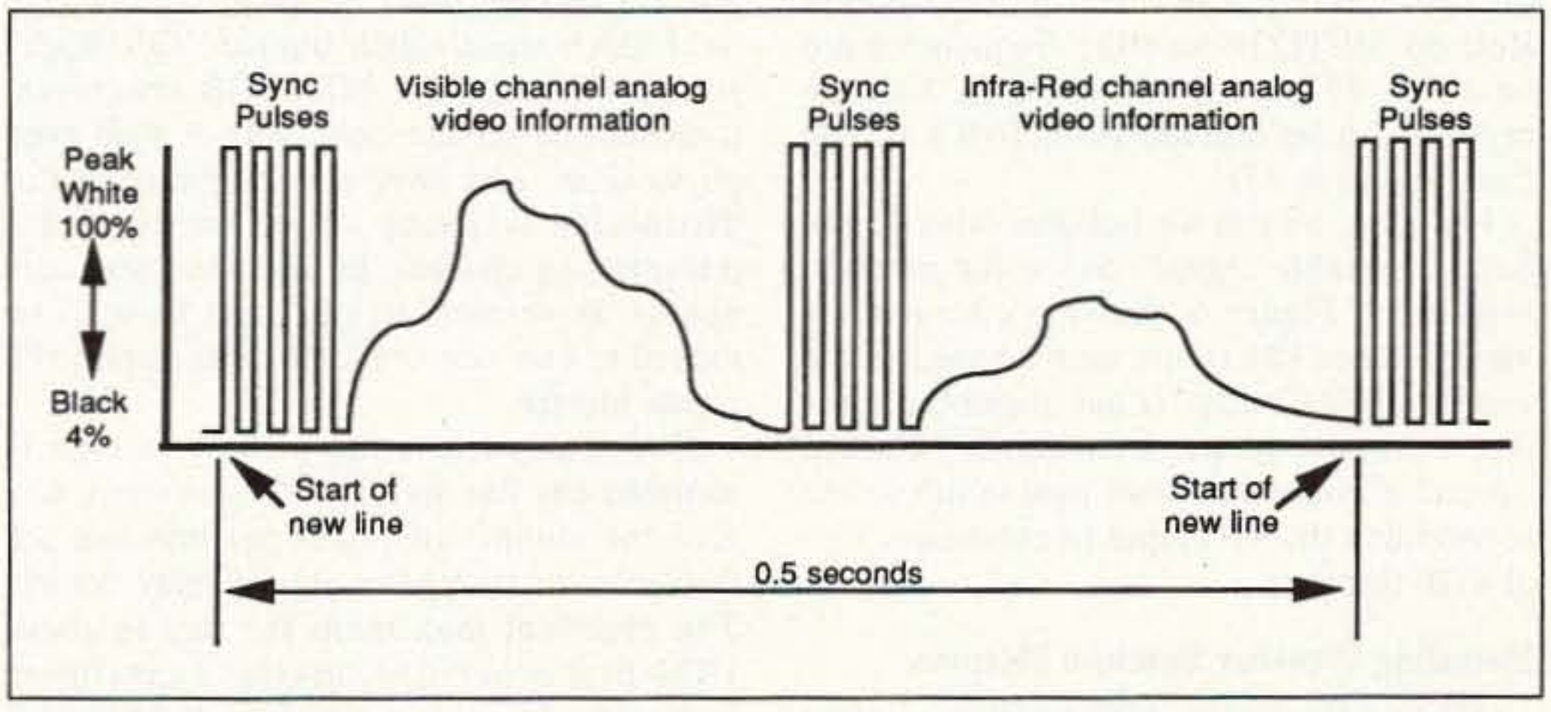

Figure 6. Simplified representation of a single APT scan line from NOAA spacecraft. Sync pulses appear as vertical bars down the picture, and are manually moved to the left-hand or right-hand side of the picture.

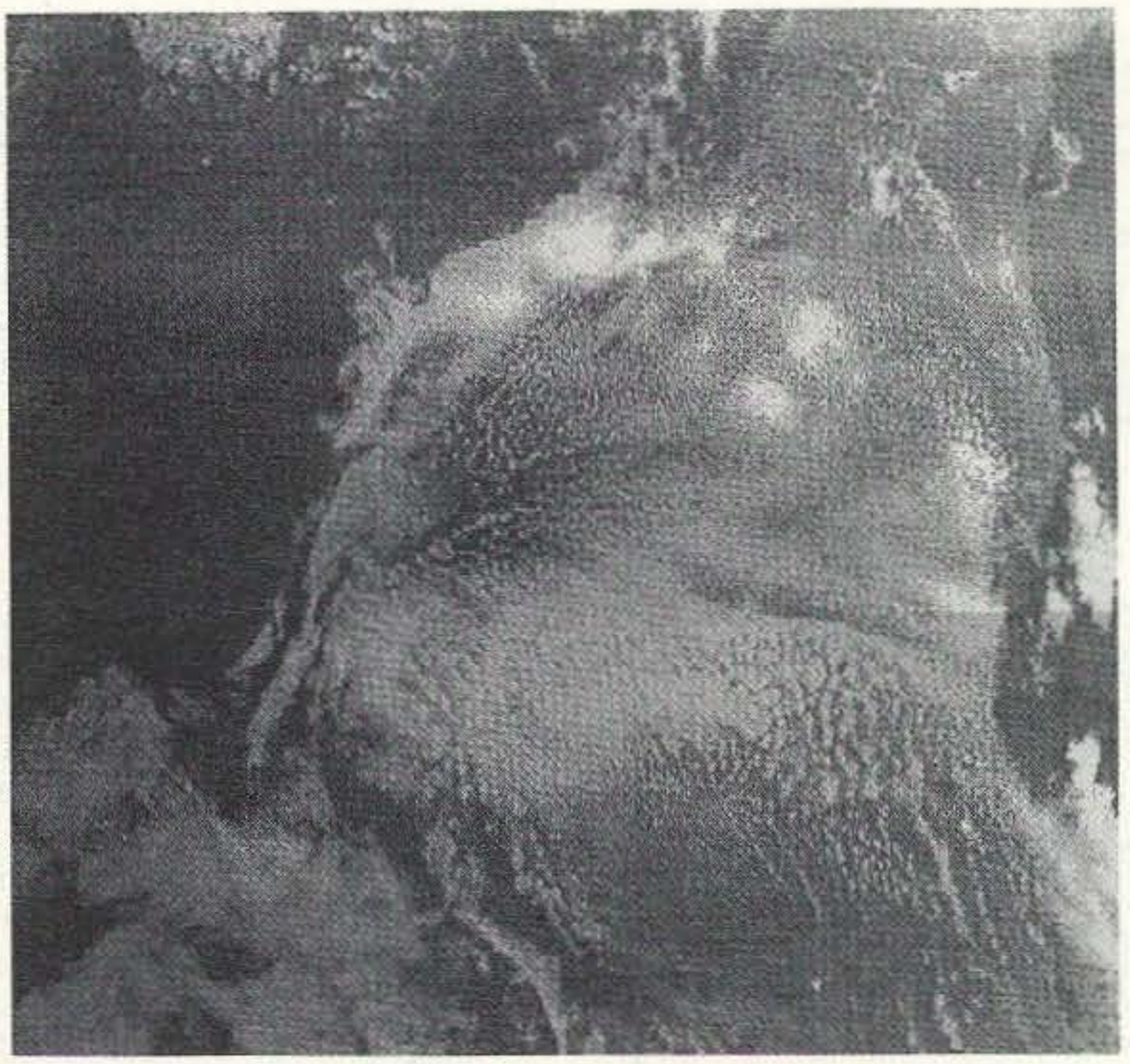

Figure 7. An example of Soviet METEOR imagery.

Vanguard Labs for 137 MHz band reception. This dual-conversion receiver is optimized for weather satellite reception. It is a crystal-controlled unit which I modified for variable frequency use by the addition of a home-built PLL-locked VFO. The results were great. The FMR-250 is now out-of-date, and has been replaced by the WEPIX 2000 synthesised receiver from Vanguard. Hamtronics also makes an excellently priced crystal-controlled 137 MHz weather satellite receiver kit, Model R137, priced at $129 at the time of writing. [Manufacturer's note: This model has been replaced by the R138, $99 kit—including built-in channels.] I presently use a home-built receiver, which is available from me either in kit form or built up. See below.

You have the option of either crystal control or a VFO. If you choose crystal control, don't forget to order crystals for 137.3, 137.4, 137.5, 137.62, and 137.85 MHz—this covers most of the polar orbiter frequencies. NOAA satellites transmit on 137.5 and 137.62. The most common Russian METEOR satellite frequencies are on 137.3, 137.4, and 137.85 MHz. Suitable crystals can be ordered from JAN Crystals (see their ad in *73*).

For those of you kit builders who do not have a suitable signal source for receiver alignment, Figure 5 shows a circuit for a varicap-tuned FM signal source based on the versatile NE602 chip. (I am preparing a further construction article using this circuit. Special attention has been paid in the article to shielding the RF output to obtain low level VHF signals.)

Decoding Weather Satellite Pictures

All low resolution APT weather satellite pictures have a similar transmission format. An FM carrier is modulated with an amplitude-modulated 2400 Hz subcarrier (tone). When the FM modulation is decoded, the instantaneous amplitude of the 2400 Hz receiver output represents the brightness of the picture cell (pixel) being transmitted. For an APT weather satellite transmission, time for a single scan line is usually 0.5 sec or 0.25 sec; that is, two or four lines per second, giving either 120 lines per minute (NOAA, METEOR), or 240 lines per minute (GOES, Meteosat, and some COSMOS satellites).

At 240 lines per minute, each 0.25 sec line scan represents the full width of the picture. On the 120 LPM NOAA polar orbiters, visible and infrared pictures are transmitted side by side. Thus a single scan line will start with visible picture information, followed by the same picture scanned in infrared. Figure 6 shows a simplified single line of weather satellite transmission from NOAA spacecraft. Note that there are two sets of phasing bars of seven lines each, as two pictures are transmitted side by side. It is these phasing signals, one alternating at 832 Hz and the other at 1040 Hz, that give the NOAA signals their unique "Tick-Tock" sound. The Russian METEOR spacecraft transmit one picture only, with a wide sync pulse train, and have a very different but distinctive screechy sound on the audio transmission channel. In practice, these bars appear as vertical stripes, and have to be moved to one side or the other to display the whole picture.

How many times the picture voltage is sampled per line by the A/D converter will give the number of pixels per line that are available for storage in your display device. The practical maximum for this is about 1024 pixels per line, giving a maximum sampling time per pixel of 0.25/1024, or 2405s per pixel on a 240 LPM signal. The A/D coverter free-runs at a much faster conversion rate of about 15s per pixel. This is easy for the software to handle. (See Figure 6.)

Figure 7 shows an example of Soviet METEOR imagery. This early morning S-N pass was received at 0500Z on 15th September, 1993, at my QTH. On the right is the western coast of Madagascar, with Cape St. Andre visible at the extreme top right. Opposite is the African coast of Mozambique, largely buried under cloud, with no features showing inland because the sun is not yet sufficiently high. One interesting aspect of this pass was that the satellite came above the horizon transmitting a black picture with only the sync pulses visible. Suddenly the picture burst into life as the light levels rose and the cameras switched on. The equipment used was the turnstile antenna, no preamp, a home-built 137 MHz receiver using the decoder, an interface and a JVFAX 6.0 running on a PC-386. The display was a 17S Trinitron Super VGA color monitor at 800x800 receive resolution. See further down in this article for how the picture was post-processed.

The Decoder

I chose to make a stand-alone decoder so that I could cross-couple inputs and outputs to a variety of receivers and display systems.

The idea is to take the amplitude-modulated 2400 Hz tone from the receiver, pass it through a set of bandpass filters to clean up the 2400 Hz signal, and then full-wave rectify this AC voltage to produce the varying (DC) voltage that represents picture brightness, with white being the highest voltage (5V), and black the lowest voltage (0V). This signal is then converted to parallel digital TTL form in an A/D converter, which presents a new pixel value at the 8-bit output

Continued on page 18

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. Please rate each feature or column as "Great," "OK," or "No Way." Mail your responses to: 73 Magazine Feedback, 70 Route 202N, Peterborough, New Hampshire 03458.

1 Never Say Die
2 Letters
3 QRX
4 Practical Weather Satellite Receiving System, Part 1
5 HF-SAT Antenna
6 Grounding and Lightning Protection, Part 2
7 Review: The Azden PCS-7200
8 Review: Ham University Interactive
9 Review: LOGic 4
10 Review: S & S Engineering's PC-1 Programmable Counter Kit
11 Ham Help
12 ATV
13 Hamsats
14 Carr's Corner
15 RTTY Loop
16 QRP
17 Homing In
18 Above and Beyond
19 Ask Kaboom
20 Hams with Class
21 Special Events
22 New Products
23 Barter 'n' Buy
24 Propagation

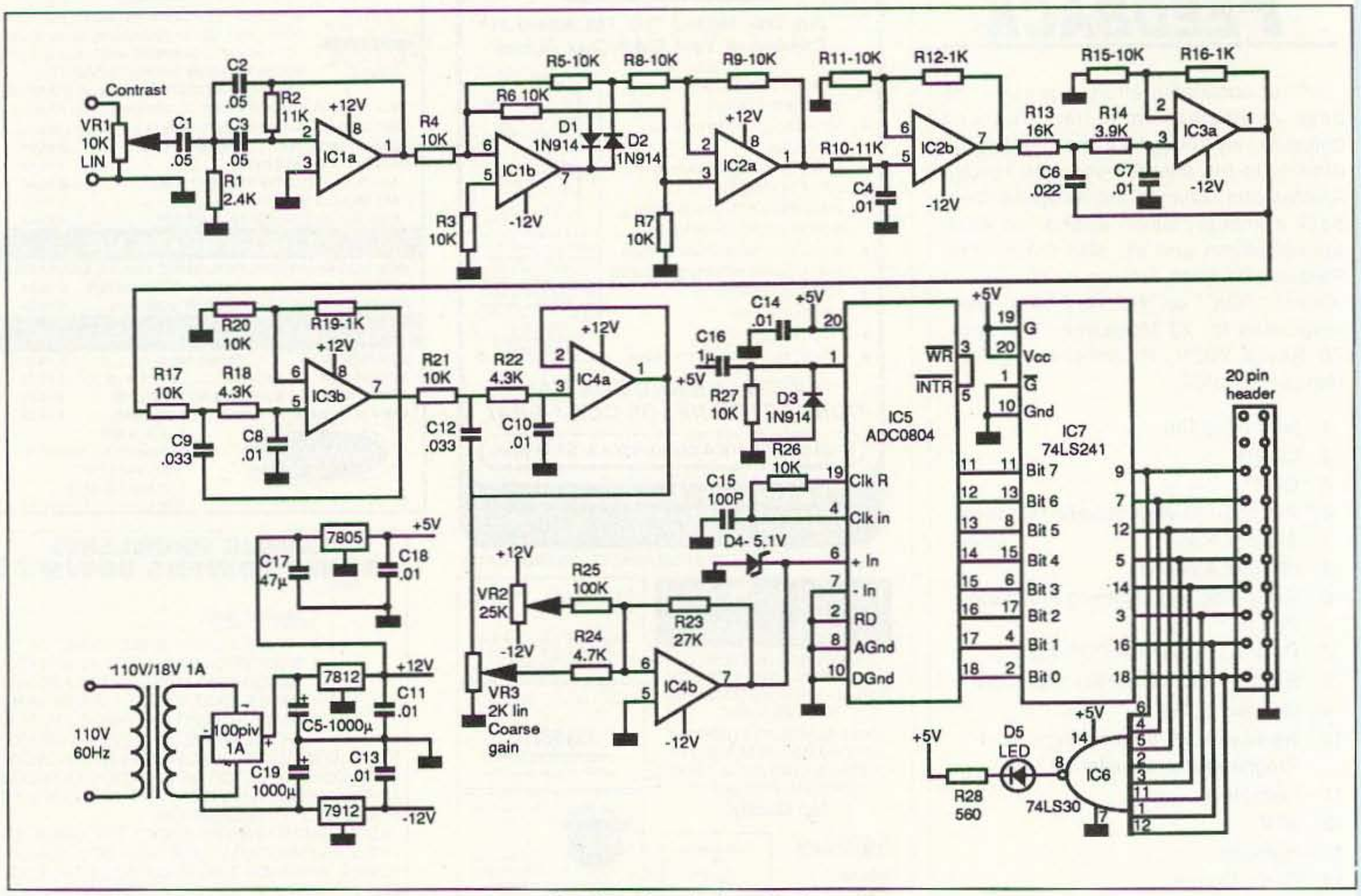

Figure 8. Filter/decoder board schematic.

lines approximately every 205s.

IC1a forms a high-pass filter at 620 Hz, which removes any undesirable 50 Hz and 100 Hz components from the signal, such as 50 or 60 Hz AC hum. IC1b forms an active full-wave rectifier, and is buffered by IC2a. The output of IC2a is fed to IC2b. IC2b, IC3a, IC3b, and IC4a are low-pass filters centered around 1340 Hz. The four 1340 Hz low-pass filter stages form a low-pass filter with an extremely steep high frequency rolloff. This is because it is necessary to remove the twice-2400 Hz (4800 Hz) component of the signal produced by the full-wave rectifier from the analog DC picture voltage. The voltage representing video brightness is then applied to a simple 8-bit analog-to-digital converter IC5, via U4b, where coarse video gain and the offset (black-to-white range) can be controlled by VR2 and VR3. Zener diode ZD1 clips the video at 5.1V max, which prevents possible damage to IC5. The internal conversion oscillator in IC5 is set to free-run at about 500 kHz, which produces a conversion every 205s or so. The output of the D/A is an 8-bit digital word which is placed onto eight parallel output lines through TTL buffer U6 at the A/D conversion rate. IC7 is an 8-bit NAND gate. When all eight parallel output lines from the D/A converter are at logic 1 (representing a video value of 255), the LED will light. This gives an excellent method of judging the peak white level. The LED should be adjusted so that it just flickers on video peaks. This parallel signal is then fed via ribbon cable to an 8-bit parallel I/O interface connected to the PC bus.

Power at 110V or 220V is supplied by a main transformer giving a secondary output voltage of 18 VAC, which feeds a full-wave rectifier feeding three monolithic regulators to provide +5V, +12V, and -12V. Make sure that you have the correct filter capacitor values. Clean DC and careful audio wiring will prevent 60 Hz hum bars from appearing on your pictures.

This decoder was based on a circuit design by A&A Engineering (see "Finding Out More"), with some changes. I understand that a kit is still available from them. Details below.

Building the Decoder Board

See Figures 8 and 9. The decoder board consists of a single-sided PC board. Note that foil traces are shown in what is known as the X-RAYS view, as if you are looking through the board. View the board from the component side. Insert and solder the wire links first. Then mount the IC sockets, being careful to orient them correctly—the socket notch is in line with pin 1 of the IC. This will aid your orientation during the next step, which is inserting and soldering the resistors. Note that some resistors have to be paralled to achieve non-standard values; the Parts List shows which. Insert and solder the filter capacitors, starting at the board area around IC1, and ending at the area around IC4. Then solder the electrolytics, being careful with the orientation of polarity. This is especially true of the tantalum capacitors, whose polarity is difficult to establish at the best of times, especially with my aging eyes! Because the whole performance of your filter system depends on correct resistor and capacitor values, double-check these components before proceeding. Next, insert and solder the 1N914 diodes, the power supply diodes or bridge, and the 5.1V zener diode. Mount the three regulator chips standing up. Current draw is such that they do not need heat-sinking. Then mount the PCB connection pins to the output lines. Mount the preset pots, and wire the audio level pot VR1, and the peak video LED. DO NOT install the chips yet.

Do an ohmmeter check of the +12V, -12V, and +5V power rails to establish if there are any shorts. Wire up the power transformer, and set VR1 to min, VR2 to max, and VR3 to mid-range. Power up the board, and check that the correct DC voltages are present at the +12, +5, and -12V pins on all the sockets. Switch off your power.

Insert all chips into their sockets. Switch the power on again. Voltage at the output pins of all the 1458 ICUs (pins 1 or 7)

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- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

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- LOW PROFILE POWER SUPPLY

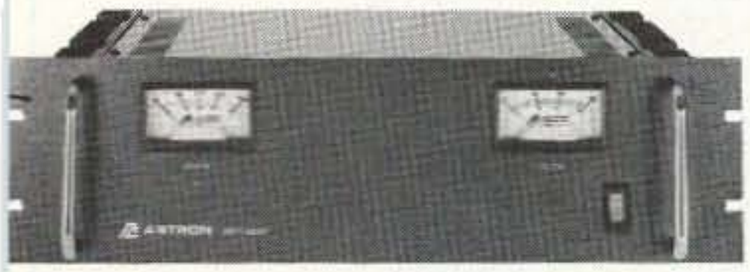
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES

MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

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

CIRCLE 16 ON READER SERVICE CARD

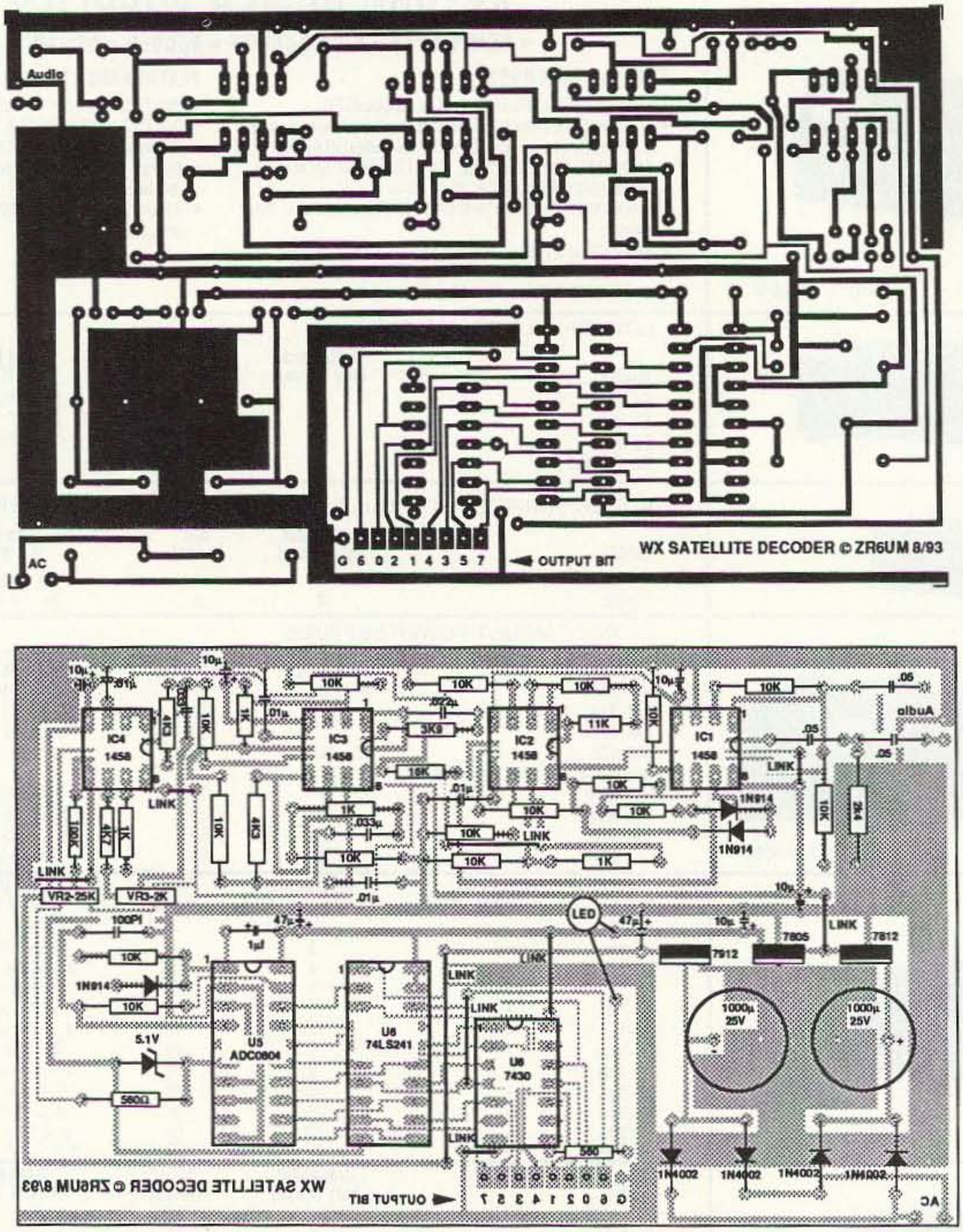


Figure 9. a) Decoder board 1:1 PCB layout. b) Decoder board parts overlay.

should be at or very close to zero, with reference to ground. If this is not so, check the circuit from the first stage to the last to establish which stage has a problem. Remember that all these 1458 stages are DC-coupled, so a wrong voltage on one op-amp output pin will affect all the other stages down the line.

Testing the Decoder

Set VR2 to mid-range, and VR3 to maximum. Feed a stable 2400 Hz sine (preferably) wave source into the input at about 1V P/P, and advance contrast control VR1. If you do not have a source of 2400 Hz signal handy, use a passing satellite signal. Some-

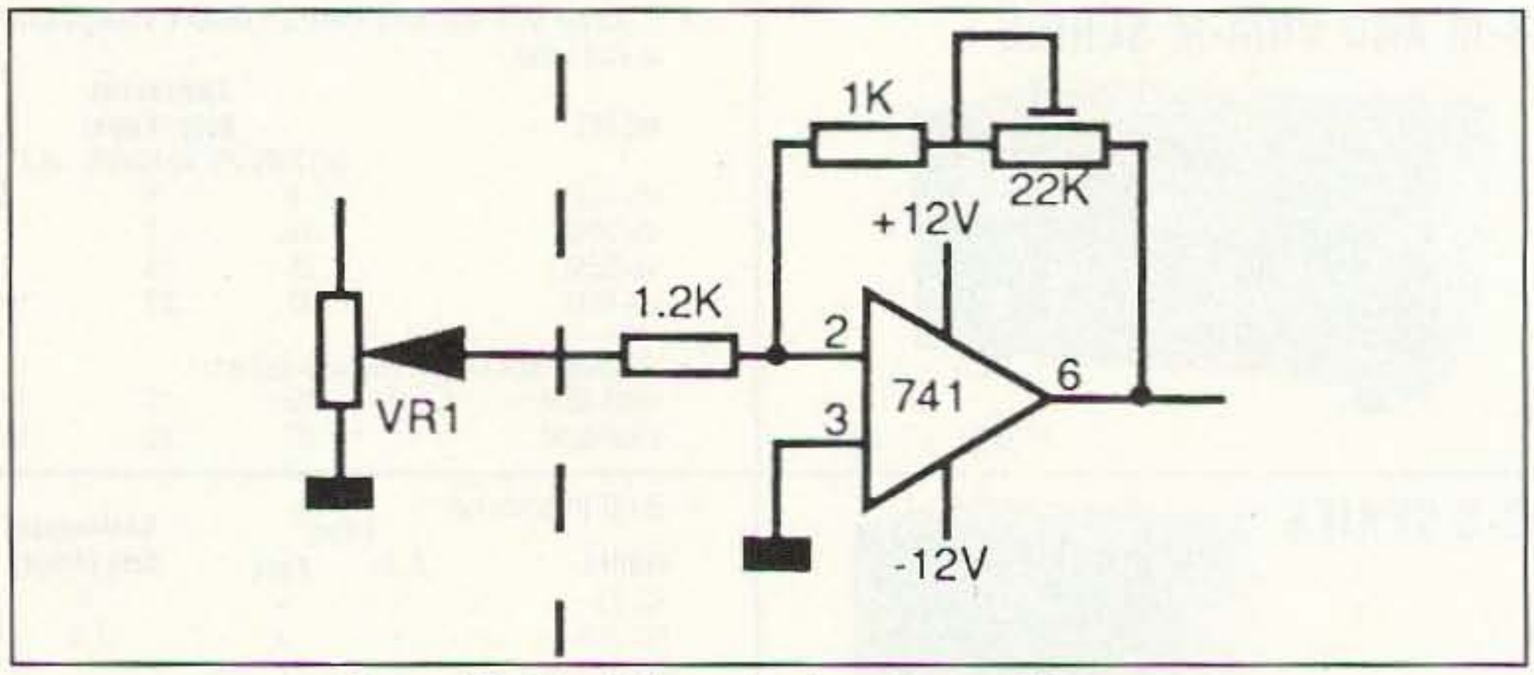


Figure 10. Circuit for a simple audio amplifier stage.

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Hear exciting air-craft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

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FM RECEIVERS & TRANSMITTER

Keep an ear on the local repeater, police, weather or just tune around. These sensitive superhet receivers are fun to build and use. Tunes any 5 MHz portion of the band and have smooth varactor tuning with AFC, dual conversion, ceramic filtering, squelch and plenty of speaker volume. Complete manual details how the rigs work and applications. 2M FM transmitter has 5W RF out, crystal control (146.52 included), pro-specs and data/mike inputs. Add our case sets for a nice finish.

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CFR Matching case set **$14.95**
FT-146 Two Meter FM transmitter kit **$99.95**

MICRO-MIKE

World's smallest FM wireless mike. Smaller than a sugur cube - including battery and mike. Two sets of SMT parts supplied in case you are clumsy! Terrific audio pick-up (pin drop at 5 ft) and transmit range of 300 ft. We include the battery (watch style), electret mike and even a tuning tool! Be a James Bond and learn SMT too!

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Pick the unit that's right for you. All units transmit a stable signal in the 88-108 MHz FM band up to 300' except for High power FM-4 and PB-1 Phone bug that go up to 1/2 mile.

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PB-1, Phone bug needs no battery, hooks to phone line **$14.95**
MC-1, Micro size sensitive mike cartridge for FM-1,2,4.....**$2.95**

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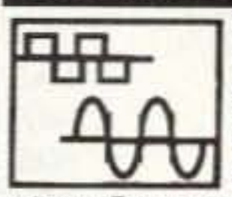

DDS (Direct Digital Synthesis) technology brings you a terrific audio generator at a fantastic price! Generates from 0. 01 Hz to 50 KHz with five digit LED display of frequency. Sine and square wave output adjustable 0-5 volt p-p. Frequency selected by direct keyboard entry and with handy continuous tune tuning knob. Crystal controlled accuracy of 10 ppm and two memories for rapid frequency changes. Retire that jury-rigged old generator and treat yourself to the pleasure of using a new state-of-the-art SG-550!

SG-550 Kit ..**$199.95** SG-550WT assembled **$269.95**

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Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning. AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SR1.....**$29.95**
Shortwave converter kit, SC1 .....**$27.95**
Matching case set for SR1, CSR **$14.95**
Matching case set for SCI, CSC **$14.95**

AM TRANSMITTER

High quality, true AM broadcast band transmitter is designed exactly like the big commercial rigs. Power of 100 mW, legal range of up to 1/4 mile. Accepts line level inputs from tape and CD players and mike mixers, tunable 550-1750 KHz. Complete manual explains circuitry, help with FCC regs and even antenna ideas. Be your own Rush Limbaugh or Rick Dees with the AM-1! Add our case set for a true station look.

AM-1 Transmitter kit.....**$29.95**
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Tune in on the 800-950 MHz action using your existing scanner. Frequencies are converted with crystal referenced stabilty to the 400-550 MHz range. Instructions are even included on building high performance 900 MHz antennas. Well designed circuit features extensive filtering and convenient on-off/bypass switch. Easy one hour assembly or available fully assembled. Add our matching case set for a professional look.

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SCN Matching case set.....**$14.95**
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SURROUND-SOUND/REVERB

Add concert hall realism to your stereo, TV or even 2-way radio! Easily sythesize a stereo effect from mono sources or richly enliven regular music. Add a big-voice reverb to your radio voice that others will envy! Our reverb/surround sound kit uses a Bucket Brigade IC Device for reliable solid-state performance. Adjustable reverb, delay and mix controls to customize your sound. Easily connected to radios, stereos, CB's and TV's. Plently of audio to drive a small speaker for stand-alone operation too. Experierence the fun and realism that surround sound provides - without spending hundreds! Add our case set for a neat, pro look.

RV-1 Surround Sound/Reverb kit.....**$59.95** CRV Matching case set.....**$14.95**
RV-1WT Assembled RV- 1 and case.....**$89.95**

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Control virtually anything by Touch-Tone remote control. The URC-1 has 16 switched outputs, 4 adjustable voltage outputs (20 mV steps 0 to 5 VDC), two 10K digital pots (for volume, squelch, etc.) and 3 timers adjustable from 10 mS to 40 hours! Two level password control allows secure control and multi-level access. Six digit LED display shows currently entered codes and a crystal controlled touch-tone decoder provides reliable operation. There's nothing else like this unit, be in complete control of remote radios, thermostats, hi-fi's, homes or even factories with the URC-1. Add our matching case set for a handsome finish.

URC-1 Remote control kit.....**$129.95** CURC Matching case set **$14.95**
URC-1WT Fully assembled URC-1 and case **$189.95**

FM SUBCARRIER DECODER

Tap into the world of commercial-free music and data that is carried over many standard FM broadcast radio stations. Decoder hooks to the demodulator of FM radio and tunes the 50-100 KHz SCA subcarrier band. Many radios have a demod output, but if your radio doesn't, it's easy to locate, or use our FR-1 FM receiver kit which is a complete FM radio with a demod jack built-in. These "hidden" subcarriers carry lots of neat programming - from stock quotes to news to music, from rock to easy listening - all commercial free. Hear what you've been missing with the SCA-1.

SCA-1 Decoder kit.....**$27.95** CSCA Matching case set.....**$14.95**
FR-1 FM receiver kit.....**$24.95** CFR Matching case for FR-1 .....**$14.95**

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Measure inductors from 10 uH-10mH and capacitors from 2 pF-2uF with high accuracy by connecting the LC-1 to any digital multimeter. Two pushbutton ranges for high resolution readings and we even give you calibration components to assure proper accuracy of your kit! Active filters and switching supplies require critical values, no one should be without an accurate LC meter. For a pro look, add our matching case set.

LC-1 LC meter kit .....**$34.95** CLC case set.....**$14.95**

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Control the speed and direction of any motor. Use our SMD-1 for those nice steppers you see surplus, and our MSC-1 for DC motors. The stepper driver features variable speed, half step rotation, direction and power down mode, can drive most any stepper motor. Our DC driver features pulse width modulation control allowing full motor torque even at low speeds and can drive motors up to 50 VDC @ 10 Amps! Add our case set for a professional assembly.

SMD-1 Stepper kit .....**$24.95** MSC-1 DC motor kit.....**$24.95**
CSMD SMD-1 case .....**$14.95** CMSC MSC-1 case.....**$14.95**

STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

FM-10A Stereo transmitter kit **$34.95**
CFM Case,whip ant set.....**$14.95**

DR. NI-CAD CONDITIONER/FAST CHARGER

Quit spending big bucks for replacement battery packs, rejuvenate and condition your batteries for peak capacity. Advanced circuitry has optimized discharge before charge to eliminate memory effect and to condition batteries that have been poorly cared for in the past. Quick charge rapidly brings battery to full charge in less than an hour-just 15 minutes for some types! And "top-off" charge mode squeezes every last bit of energy into each cell for the absolute most capacity. Switch-mode regulator controls constant current charge while being monitored by a negative delta-V system that cuts off the fast charge at the exact point of full charge-batteries are charged, not cooked! Charges NiCads or NiMH packs from 2 to 10 cells (easily expanded) and current capacities up to 10 Amp-hours. Runs on 12 to 15 VDC. Quit cooking your batteries, buying new packs, waiting hours for recharge, get a Dr. Ni-Cad today! Available in money saving kit form or wired and tested with case at a special price. Kit builders: add our matching case set for a snazzy finish.

DN-1 Dr. Ni-Cad conditioner/fast charger kit.....**$49.95**
CDN Matching case set.....**$14.95**
DN-1WT Fully assembled Dr. Ni-Cad with case **$89.95**

SPEED RADAR

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual Doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

SG-7 Complete kit.....**$99.95**

STEREO PEAK HOLD BARGRAPH

Finally a dual LED bar graph with a peak hold display! Bar graph displays are neat and eye catching but their speed is their downfall - they just can't capture the peaks. Our kit is like two units in one, a fast display to show the signal and a long persistance display to capture peaks, similar units go for hundreds of bucks! We offer 3 models: Linear for general use, Semi-Log for audio VU meters, and Log for power displays. Dual - for stereo! - 10 segment multi-colored LED display for snazzy, eye grabbing display and easily set ranges for virtually any signals, from voltmeters to audio VU meters to audio power amps to SWR meters. Complete intructions for easy hook-up to most any device. Add our matching case set for a sharp looking unit.

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PH-16 Dual Semi-Log bargraph kit.....**$39.95** CPH Matching case set **$14.95**

SPEECH SCRAMBLER

Descramble most scramble systems heard on your scanner radio or set up your own scambled communication system over the phone or radio. Latest 3rd generation IC is used for fantastic audio quality - equivalent to over 30 op-amps and mixers! Crystal controlled for crystal clear sound with a built-in 2 watt audio amp for direct radio hook-up. For scramble systems, each user has a unit for full duplex operation. Communicate in privacy with the SS-70. Add our case set for a fine professional finish.

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CSSD matching case set.....**$14.95**
SS-70WT Assembled SS-70 and case set **$79.95**

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Relive the radio past with a crystal set like your grandfather built. Uses genuine Galena crystal and catwhisker. Several different types of radios are built, including standard AM broadcast, shortwave and even WW II foxhole style. To compare modern semiconductor detectors, we include a diode for comparison. No soldering required and we even give antenna ideas. Radio for free, get it now before Clinton taxes it!

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CIRCLE 34 ON READER SEVICE CARD

where toward the end of VR1Us travel, the LED should flicker. If this is happens, you have a working system, and all that remains is adjustment. If it does not, use an oscilloscope to check the outputs of IC2, IC3, and IC4. These should vary in DC voltage when you vary VR1. If you get variation at pin 6 of IC5, your filter system (ICUs 1 to 4) is most likely working. Check with a scope that IC5 is oscillating at about 500 kHz (pins 4 and 19 of IC 5). If you still do not get an LED indication, check that the max DC voltage at pin 6 of IC5 is close to 5V with VR1 near max. Adjust VR1, VR2 (offset) and VR3 (coarse gain) to achieve this. I have come across some ADC0804Us that latch up on power on; this could be your problem. Set VR1 so that the DC voltage at pin 6 of IC5 is 5V, and then switch the power on and off a couple of times. If the LED comes on, check that it goes off when you decrease VR1, and comes on again when you increase VR1. If this is the case, you have nothing wrong except a latching A/D converter. I choose to live with this problem. Sometimes I switch power on and off a couple of times when starting up until I get a flickering satellite signal LED, then all is well! Remember to have a 2400 Hz peak level signal present at the input when switching on. If you still do not get a signal, check with a scope that there are TTL signals at the output pins of IC5, and also at the output pins of IC7. You should finally adjust VR1, VR2, and VR3 to get about 0.3V for black level, and about 5V for white level on a live satellite signal at the input of the A/D converter. A scope is useful here.

One final point on the decoder: Although I have not tried it, the decoder PCB is small enough so that it can piggyback on the parallel interface board inside the PC, using standoffs. You will then save all the power supply components needed for a stand-alone decoder because you will be able to use the PC power supply voltages to power the decoder. You will, however, need to lead the LED indicator out to the front panel, and the input level control can also be remotely mounted. If you are going to use this option, remember to mount the offset and gain set preset pots at right angles to the PCB, so that they face upward and are adjustable when the boards are mounted in a PC slot.

Connecting the Decoder to your Receiver

You should connect the decoder directly off a tap led from the top of the volume control in your receiver. If you do not have enough gain from your receiver audio, Figure 10 gives the circuit for a simple audio amplifier stage, which may be simply built using perf board. Put this between VR1 and the decoder.

Summary

At this point, we have created the receiving path which starts with a satellite signal, and ends with the 8-bit parallel TTL A/D signal suitable for feeding to a PC based display system. Next month we will cover the PC I/O interface card, and the installation and use of JVFAX 6.0 display software.

Finding Out More

The *Weather Satellite Handbook*, written by Ralph Taggart WB8DQT, is available from the Uncle Wayne's Bookshelf. This contains almost everything that you might ever want to know about setting up a weather satellite station. Another good source of knowledge is the Dallas Remote Imaging Group (DRIG) bulletin board at (214) 394-7438.

A full kit of parts for the decoder with power supply (excluding cabinet) can be obtained for $55, or fully-built and tested for $95, from the author. Air postage to US, Canada, and Europe paid; other destinations on request. (Angus Anderson, P.O. Box 41544, Craighall, 2024, South Africa; Tel.: Business hours, country code 27, city code 11, 468-1106; Fax: country code 27, city code 11, 468-1034; CompuServe: 70262,1702. I accept Visa, MasterCard, cash, or money orders. No cheques please. South Africa is nine hours behind PDT, six hours behind EDT, and two hours behind GMT.)

A high performance weather satellite receiver kit with PLL-locked VFO tuning 136 MHz to 138 MHz (excluding cabinet, P/S, and tuning mechanism) can be ordered for $185.

The decoder board can also be obtained from A&A Engineering, 2521 West La Palma #K, Anaheim, CA 92801. Tel 714-952-2114. Prices on request.

A PLL-controlled VFO kit only for a 10.7 MHz Rx IF can be ordered for $95 from the author. This contains all parts, crystals, and the PCB, but no cabinet.

Parts List

R1	2.4kΩ (2.2kΩ & 220Ω in series)
R2,R10	11kΩ (10kΩ & 1kΩ in series)
R3,R4,R5,R6,R7,R8,R9	10kΩ
R11,R15,R17,R20,R21,R26,R27	10kΩ
R12,R16,R19	1kΩ
R13	16kΩ (15kΩ & 1kΩ in series)
R14	3.9kΩ
R18,R22	4.3Ω (3.9kΩ & 390Ω in series)
R23	27kΩ
R24	4.7kΩ
R25	100kΩ
R28	560Ω
VR1	10kΩ log (contrast)
VR2	25kΩ lin preset (A/D level)
VR3	2kΩ lin preset (coarse gain)
C1,C2,C3	0.05 µF
C4,C7,C8,C10,C11,C13,C14,C18	0.01 µF
C5,C19	1,000 µF 25V electrolytic
C6	0.022 µF
C9,C12	0.033 µF
C15	100 pF
C16	1 µF tant.
C17	47 µF 16V tant.
D1,D2,D3	1N914
D4	5.1V zener, 400 mW
IC1,IC2,IC3,IC4	MC1458 or LF353
IC5	ADC0804
IC6	7430
IC7	74LS241

All resistors are 1/4 watt, 5% tolerance or better.
Tantalums are miniature bead type.
Other non-electrolytic caps are disc ceramic type, 16V or higher. Try to purchase or select these capacitors to 5% tolerance.

Decoder Power Supply
100 PIV 1 amp diode bridge
110V/18V 1 amp mains transformer
7812 monolithic +12V regulator, TO-220
7912 monolithic -12V regulator, TO-220
7805 monolithic +5V regulator, TO-220
Note: For safety, insert a lamp fuse and suitable holder in the live leg of the mains supply.

Miscellaneous
4 x 8 pin DTL sockets
2 x 20 pin DTL sockets
1 x 14 pin DTL socket
Red LED & panel mounting plastic collar
PCB Vero solder pins x 9
Stranded insulated hookup wire
Tinned copper wire
PC board

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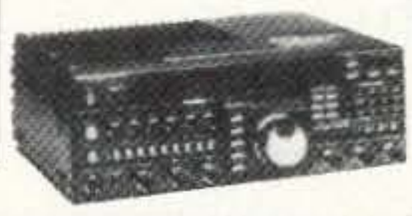

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CIRCLE 41 ON READER SERVICE CARD

HF-SAT Antenna

An easy-to-build dual-band HF satellite antenna.

by Edward Oros AC3L

Here is an antenna for the nineties. It's strong, computer designed, and has lots of gain.

This is a no compromise dual-band antenna. Instead of using traps, this design interlaces two separate antennas (the 10 meter band and the 15 meter band) on one boom. This is a full-size, four-element beam on 10, and three elements on 15 meters!

The design uses large 1"-diameter aluminum tubing to keep ohmic losses to a minimum, to survive heavy winds and withstand ice build-ups in the winter.

Since it is both a 10 and 15 meter antenna, it is the perfect antenna for anyone interested in working the RS satellites which have uplinks on 15 and downlinks on the 10 meter band.

The HF-SAT produces plenty of gain on both bands. The antenna was computer optimized for maximum forward gain (hence the low front-to-back). The 10 meter band has close to 9 dBd gain (free space), and the 15 meter band produces over 7 dBd (also free space). (See the sidebar.)

Photo A. The finished HF-SAT Antenna in service. (Photo by N3LSS.)

Construction

Since all elements are of 1" tubing, it's just a matter of laying out each element end-to-end and cutting the last piece to the required length for that element. Each 1" section is joined to the next piece via a third piece of aluminum (0.875" diameter) which slides into the 1" sections (see Figure 1). Drill holes on either side of the joint and use bolts to secure each section in place. The elements are attached to the boom by muffler clamps.

Feeding

Current baluns should be used at each feed point. They can be commercial models, or just loop several turns of the cable to create your own balun. Separate cables are run to each feed point and then run to a mast-mounted switch box or straight into the shack. You can choose you own favorite matching method but in this case a gamma match was used at each feed point, and this worked well. If the antenna is mounted at 40 feet, the 10 meter antenna should have an impedance near 13 ohms.

The 15 meter antenna is around 27 ohms. If you'd like, you could just use a two-to-one (2:1, 50-25 ohms) balun to match the 15 meter antenna, and skip the gamma match here. Figure 2 and Table 1 show all of the necessary measurements for the beam.

Test Out

The initial tests of this antenna were per-

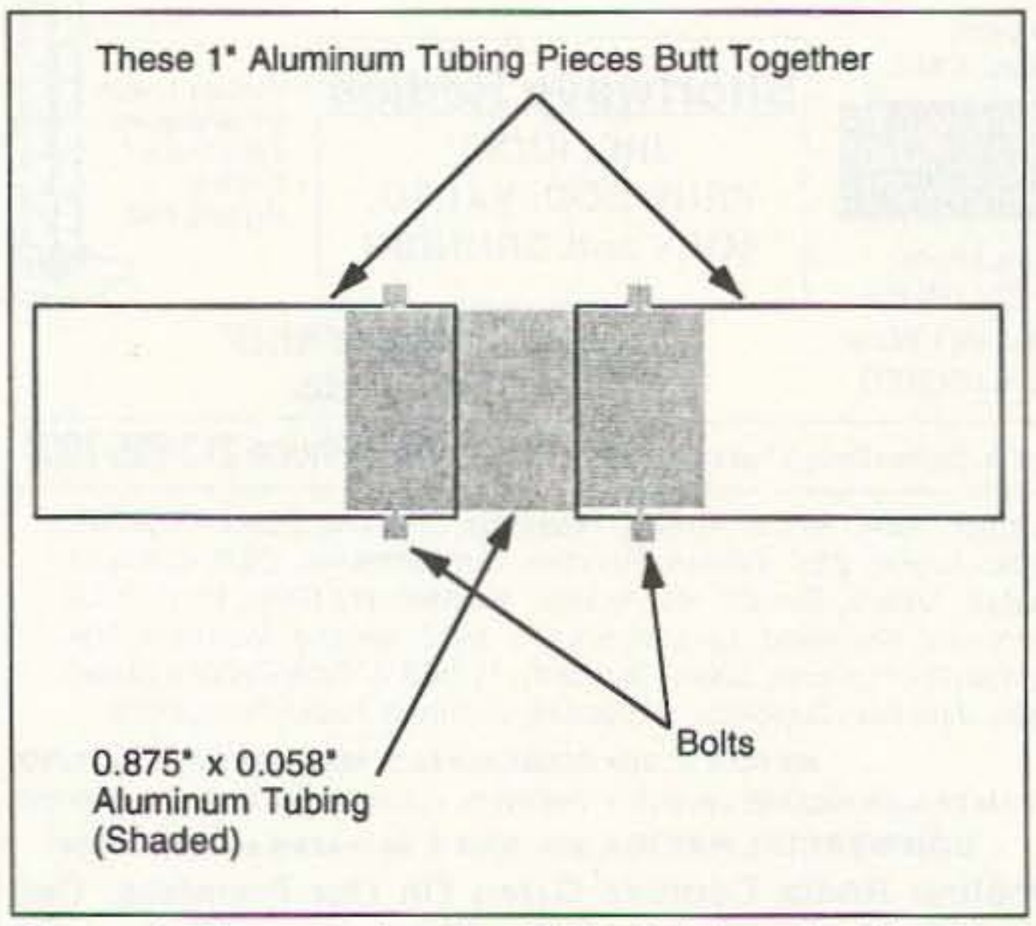

Figure 1. Construction detail for joining the 1" tubing sections.

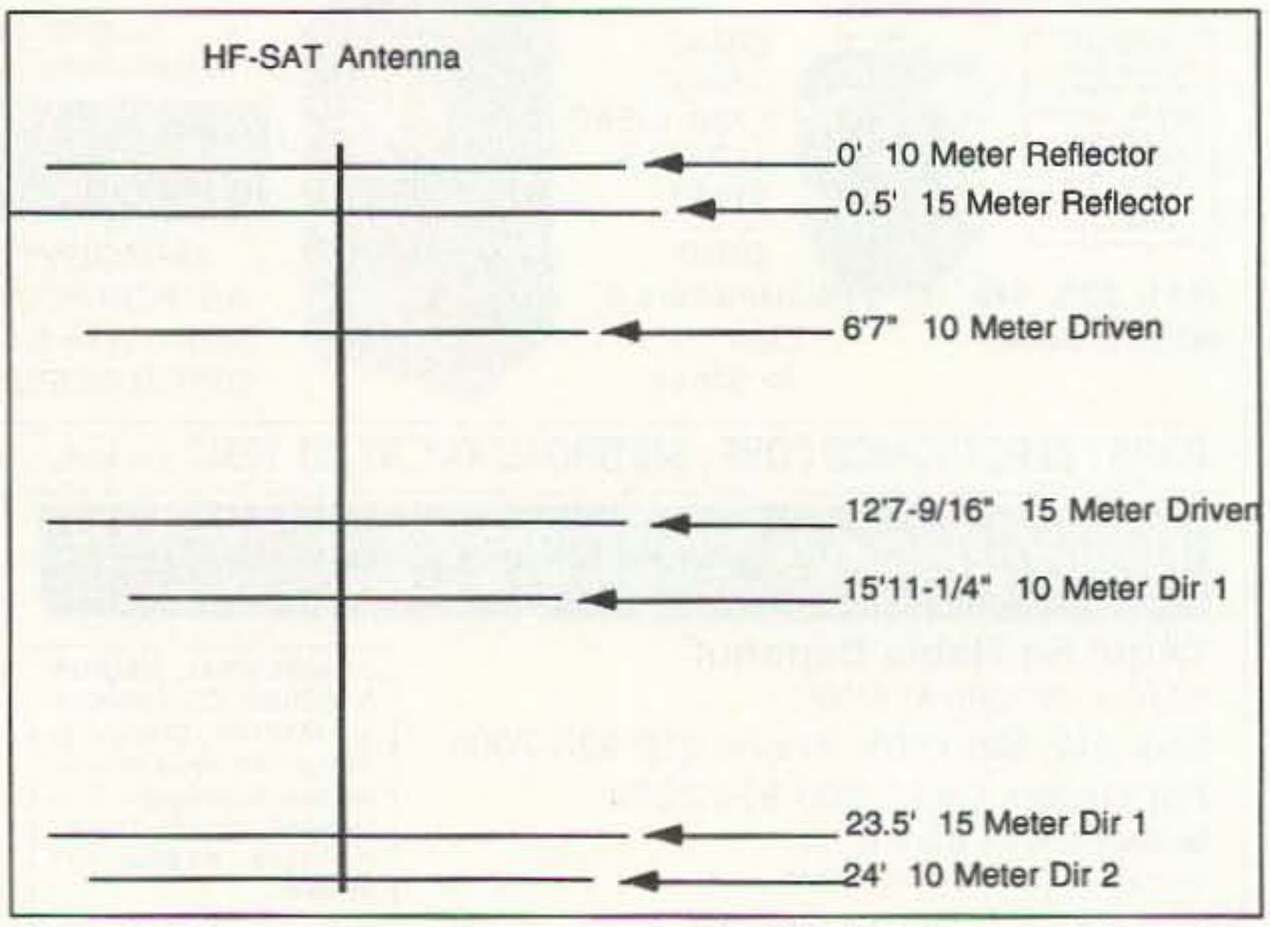

Figure 2. Construction measurements for the HF-SAT Antenna. Dimensions shown indicate element positions on the beam.

Gain Figures for the HF-SAT Antenna

10 Meter Band		15 Meter Band	
Free Space	Above Ground (40') Max Gain @ 12 Deg	Free Space	Above Ground (40') Max Gain @ 15 Deg
Gain 8.92 dBd	13.82 dBd	7.36 dBd	12.22 dBd
F/B 12.47 dB	12.08 dB	7.13 dBd	6.86 dB
Imped. 13.1+ j 2.1	12.8 + j 1.4	27.40 + j 1.5	27.00 + j 1.3

Table 1. Element Lengths

Reflector	16' 10-13/16"	22' 2-1/4"
Driven	15' 10-9/16"	21' 1-3/4"
Director 1	15' 9-9/16"	20' 11-5/8"
Director 2	16' 6-1/2"	N/A

formed while on a 10-foot pole. The comparison antenna was a three-element, 10 meter monobander created using standard beam formulas and was not computer designed. Local tests showed that the HFSAT antenna was already slightly better signal-wise than the 40-foot-high three-element beam. Once the HF-SAT antenna was taken up to the 40-foot height it proved to be 10 dB stronger than the original casually-designed antenna—an impressive and worthwhile increase in gain, to say the least. The antenna has been excellent on both bands. 73

Grounding and Lightning Protection, Part 2

Effective RF grounding for the shack.

by Glen E. Zook W5UOJ

The first part of this article, which appeared in last month's edition, covered information about lightning and lightning protection for the amateur radio station. This month we'll continue with information and suggestions about RF grounding.

Grounding for radio frequency protection is different from that required for lightning protection. The lower the frequency of the amateur radio transmitter, the easier it is to get a good ground. Because the wavelength gets shorter as the frequency increases, the possibility of hitting "hot" spots on the ground system increases dramatically. Thus, on frequencies above 6 meters, a true ground is, for all practical purposes, impossible to achieve.

In this installment we will describe a good RF ground system for 160 through 6 meters. It will help on 2 meters and above, but, as stated before, achieving a truly good ground on those frequencies is extremely difficult.

First of all, it is imperative that the ground wire be kept as short as possible. In the case of the ground at W5UOJ, it is less than four feet long! Use of stranded #6 wire or heavier copper is strongly recommended. If your station is installed above the ground story of a building, special techniques must be employed to achieve a good ground. Those grounding techniques are beyond the scope of this article. However, many of the tips outlined herein will still apply.

A very low impedance ground system is necessary to prevent all sorts of ills in the RF world. Things such as TVI, BCI, etc., can be greatly reduced and even eliminated when a proper ground system is employed. Because of this, I strongly suggest that you use a large surface ground within the ham shack. Aluminum flashing, available from handyman centers in varying widths, is excellent.

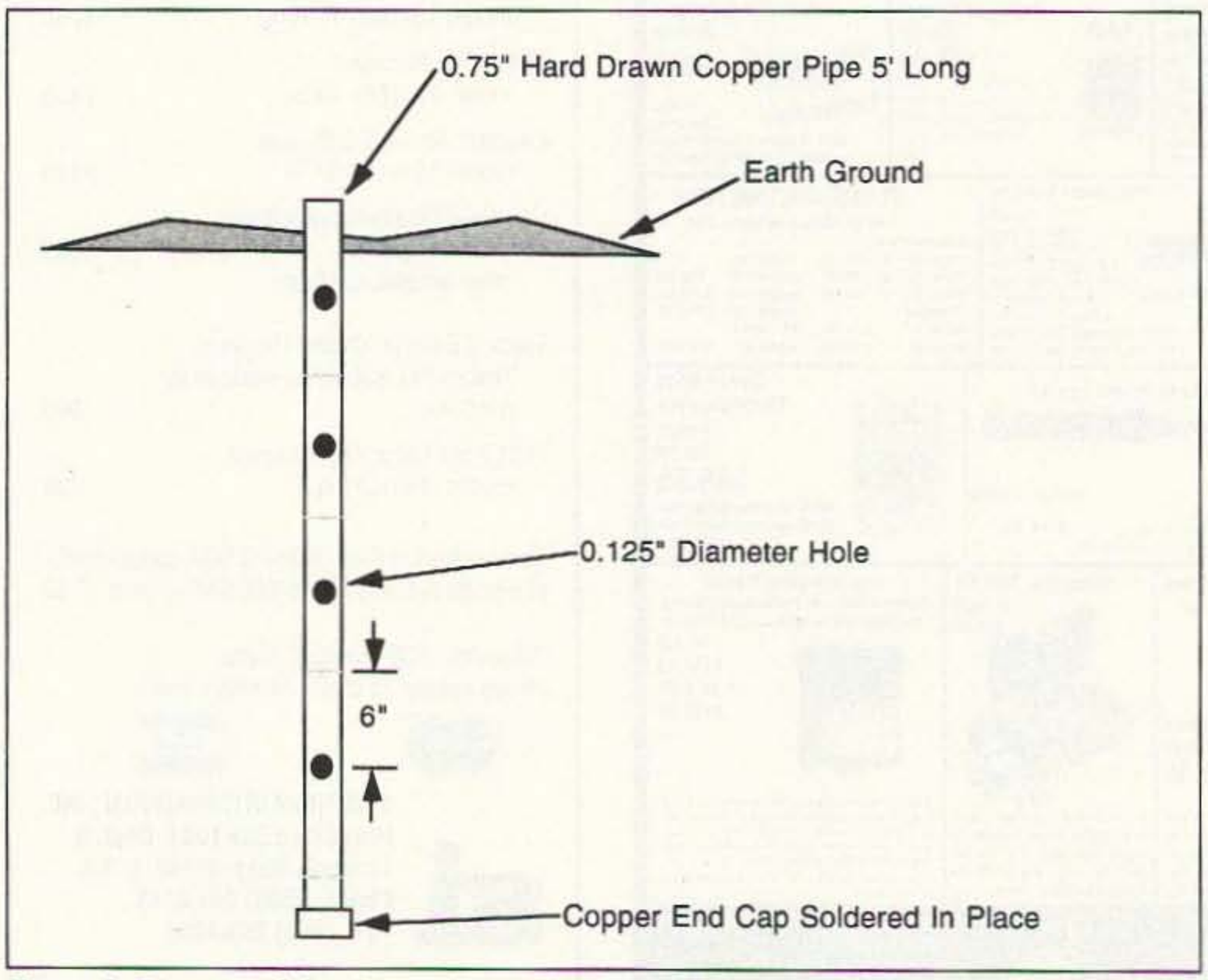

Figure 1. Diagram of the chemical ground rod. Fill it with rock salt (calcium chloride) after driving it into the ground.

This flashing can be placed on the tabletop or under the equipment, or mounted on the wall behind the operating center. W5UOJ uses the latter method. Since the operating console is two-layered, two separate runs of flashing are placed along the wall behind the console. A third piece of flashing runs between the two, making a horizontal "H." The three pieces are bolted together in several places with #8 bolts.

Grounds to each piece of equipment (and I do mean each piece of equipment) are made with short pieces of braid. Although available as just braid from various sources, it is usually cheaper to remove the braid from old RG58/U coax. Just cut the coax a few inches longer than desired, remove the outer jacket, and then pull the center conductor from the braid. Flatten the braid and either attach it directly to the equipment or add a solder lug and then attach. Connect the other end to the aluminum flashing using #8 bolts. Put the heads on the back side of the flashing and then put a nut on the front side. A second nut with two washers is used to attach the ground braid.

Grounding each and every piece of equipment means that you must ground rotor control boxes, keyers, table lamps (if made of metal), antenna switch boxes, oscilloscopes, etc., in addition to the usual grounding of the receiver, transmitter, linear amplifier, antenna tuner, and the like. Even the low-pass filter (You do use one?) should be grounded separately from the transmitter or linear amplifier. Speaking of linear amplifiers: Use a low-pass filter between the exciter and the amplifier, as well as between the amplifier and the antenna, grounding it as well. This helps limit the possibility of TVI by several factors.

Outside the building there are several possibilities for making the ground connection. The simplest, and not necessarily the best, is a 6- to 8-foot rod driven into the ground. Depending on the soil conductivity, this may or may not be a good ground. Of course, amateurs living in extremely rocky conditions have special considerations, which will not be outlined here because they represent a completely different set of problems.

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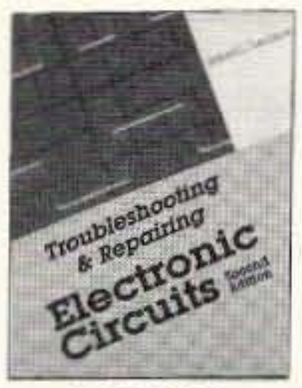

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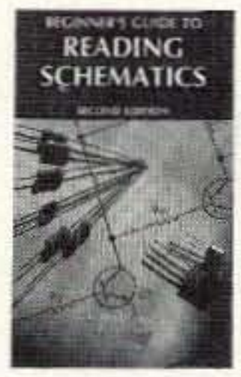

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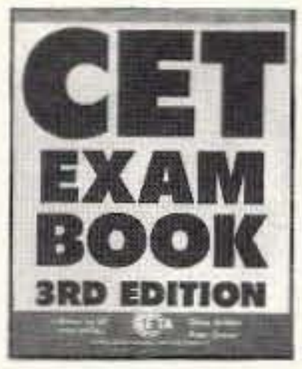

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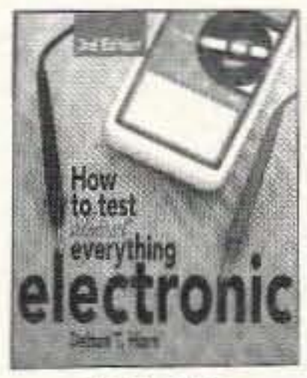

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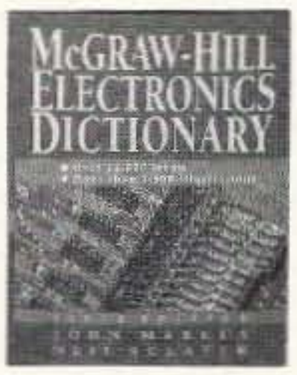

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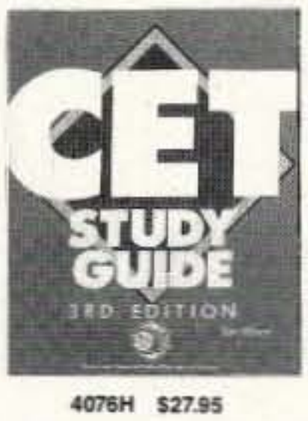

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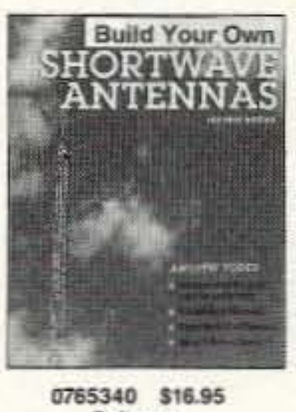

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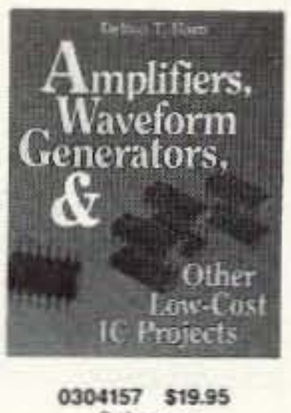

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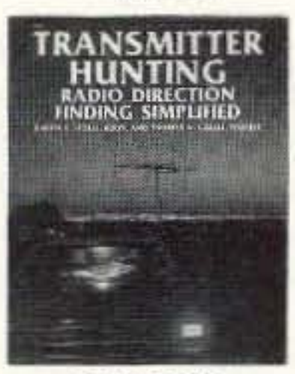

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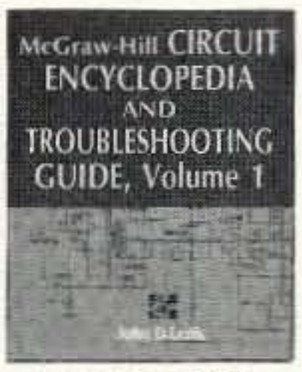

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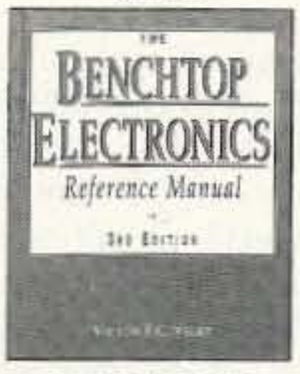
Counts as 2



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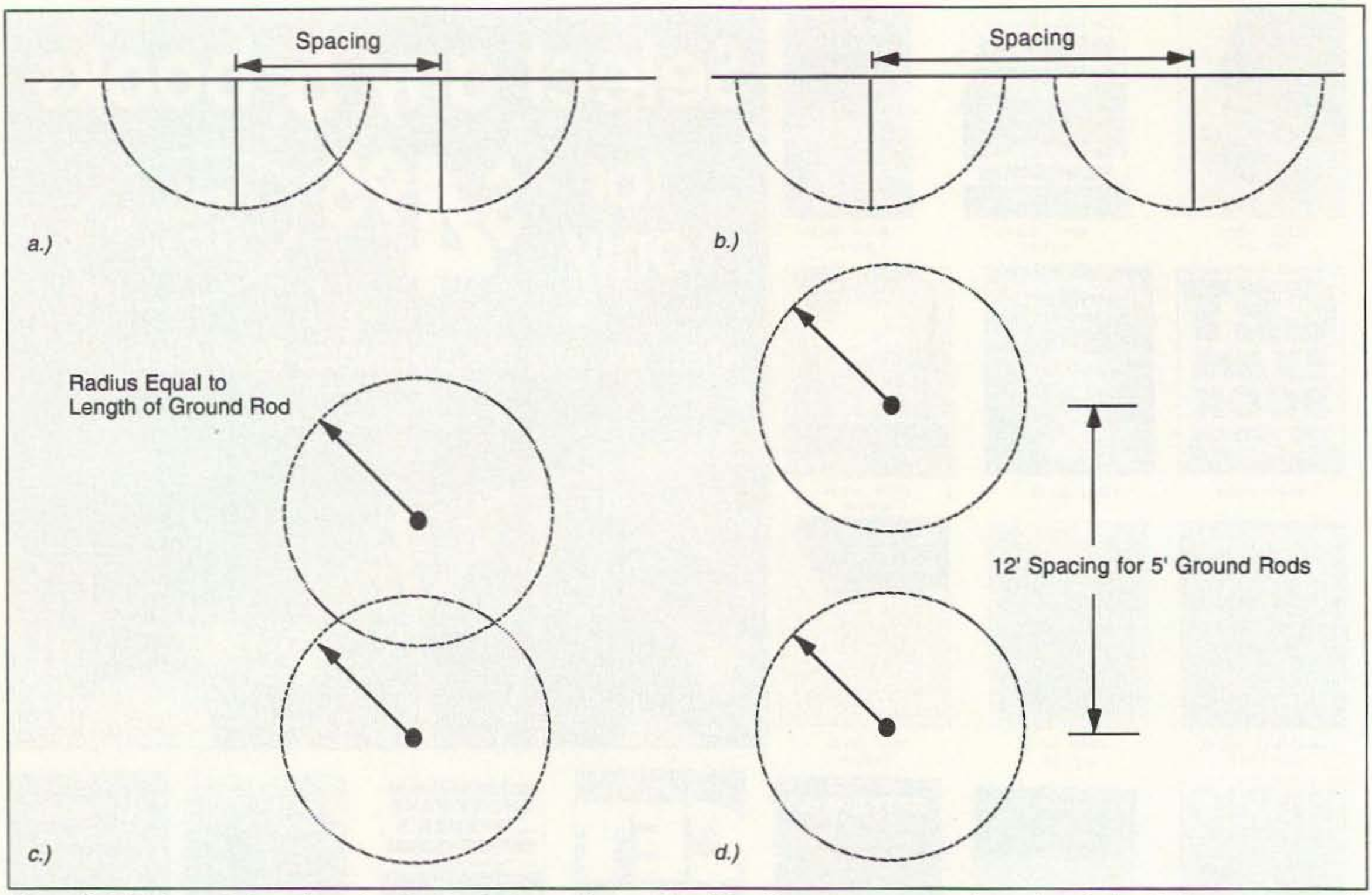

Figure 2.a) Horizontal view of overlapping hemispheres of grounding. The effects are not as good as when the hemispheres are not quite touching. b) When installing two or more ground rods, the spacing should be approximately 2.4 times the length of the rods. For a 5-foot ground rod, the proper spacing is around 12 feet. c) Vertical view of overlapping hemispheres. d) Vertical view of proper spacing of the ground rods.

ground system can be constructed from hard-drawn copper pipe. Sections of this material are available from handyman centers in 10-foot lengths. By cutting the lengths in half, two 5-foot rods are available. It would seem that one 10-foot rod would be better than two 5-foot rods, but this is usually not the case. Installing two 5-foot rods 12 feet apart makes a much better ground system than if a single 10-foot rod were used.

Actually, the copper pipe is made into a very effective chemical ground system by the addition of one 39-cent item and drilling a few holes! See Figure 1. By soldering a pipe cap on the end of 0.75" (3/4") pipe and then drilling 0.125" (1/8") holes every 6" from the capped end, the potential for a chemical ground is achieved. Rotate the drilling 90 degrees each time, going all the way through the pipe. Then, drive the first pipe into the ground (with the capped end going into the ground). After driving, the end of the pipe will be flared, but this causes no problems. Don't use water to help wash the pipe into the ground. This will cause problems with the chemicals added later.

Next, drive the other ground 12 feet away. If you want, you can construct other ground rods and place them 12 feet away from any other ground rods (in whatever direction desired). Then, attach at least #12 (or larger diameter) wire between the ground rods. Attach the ground wire coming from the shack to the rod nearest the shack. Next, fill the pipes with rock salt (often sold in grocery stores as ice cream salt). This is calcium chloride, and will not hurt the environment as will copper sulfate or other chemicals.

Do not wet the area around the ground rods. The natural moisture in the ground will slowly dissolve the salt and increase the ground conductivity immensely. After about a month, refill the pipes with rock salt. Then, every six months refill again. The rock salt costs less than $2 a bag, and a bag will last several years.

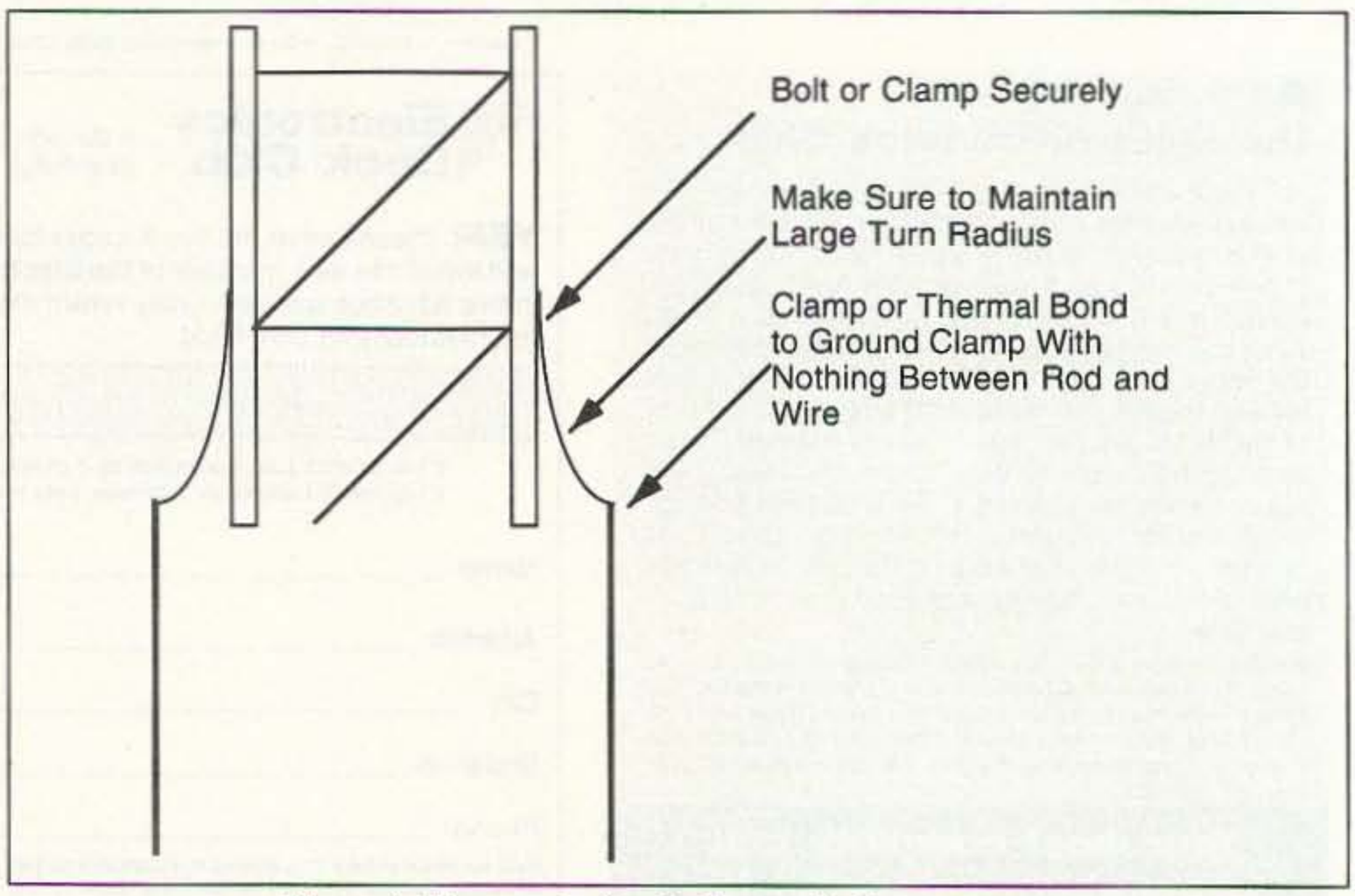

Figure 3. Placement of typical ground wires on a tower.

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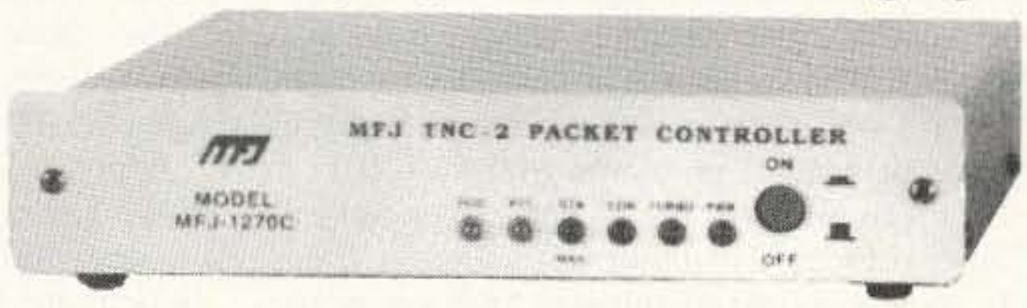

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The MFJ-1270C *super* TAPR TNC clone has a world wide reputation as *the most reliable TNC in the world!*

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If you want a TNC that'll work 24 hours a day without failure -- *one that has more features than any other* -- get the ultra reliable MFJ-1270C today and enjoy packet for a long, long time.

2400 Baud *Turbo*™ TNC

MFJ-1270CT, $209.95. Has all the features of the MFJ-1270C plus built-in fast 2400 baud modem. Operate 300, 1200 and 2400 baud packet with the MFJ-1270CT. Radio modification is *not* necessary when operating 2400 baud packet.

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An MFJ Starter Pack, $24.95, gets you on the air instantly. You get interface cable, software on disk and instructions -- just plug it all in and start enjoying packet. Order **MFJ-1284** for IBM or compatibles, **MFJ-1282** for Commodore 64/128, **MFJ-1287** for Macintosh or **MFJ-1290** for Amiga. For VIC-20 or C64/128 with tape drive use **MFJ-1283**, $24.95.

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MFJ-2400, $89.95, operates 300, 1200 and 2400 baud packet and works with any radio. **MFJ-9600,** $109.95, G3RUH compatible 9600 baud modem. Not all radios compatible with 9600 baud. Both plug into MFJ TNCs for easy installation.

Mailbox Memory

For MFJ-1270C/1276. Plugs into RAM socket for extra *mailbox* memory. **MFJ-45A** (32K), $14.95, **MFJ-45B**(128K), $34.95, **MFJ-45C** (512K), $219.95.

Real Time Clock

MFJ-43, $29.95, ends re-setting TNC clock everytime you turn it on. Maintains correct time even when TNC is off. Plugs into RAM socket. Works with MFJ TNCs and TAPR TNC clones.

FM Deviation Meter

MFJ-52, $29.95, plug this board into your TNC configured as TheNet X-1J Node and users can check their transceiver packet FM deviation. Requires X-1J or later nodeware. See *CQ Magazine*, Nov. 1993 .

Firmware Upgrade 1.2.9

For older MFJ TNCs. **MFJ-40C**, $19.95, gives you enhanced mailbox and supports mailbox up to 512K.

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For older MFJ TNCs. **MFJ-47A**, $49.95, 32K RAM; **MFJ-47B**, $69.95, 128K RAM; **MFJ-47C**, $239.95, 512K RAM. Complete with firmware.

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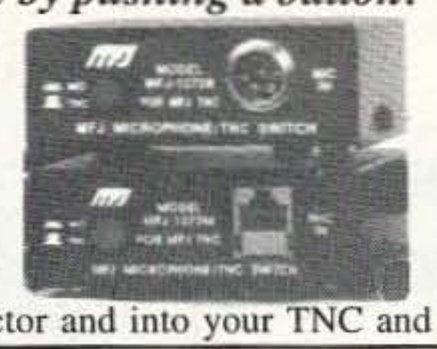
Switch between your TNC or Mic by pushing a button!

Switch between your microphone and TNC by pushing a button!

MFJ-1272B/M **$34.95**



You won't have to unplug your microphone and plug in your TNC *everytime* you want to work packet or other digital modes.

Just plug these pre-wired cables into your rig's microphone connector and into your TNC and you're ready to go -- no more hard-to-find connectors and wiring up cables.

Works with HF, VHF and UHF radios with 8 pin mic connectors -- including Kenwood, ICOM, Yaesu, Alinco and others. *For radios with 8-pin RJ-45 modular telephone jack, select the new "M" models.*

Plug-in jumpers let you quickly set-up for virtually any radio. Factory set for Kenwood and Alinco. Includes easy-to-follow instructions. Has audio-in and speaker jacks. 3¼x1¼x4 inches.

MFJ-1272B/1272M, $34.95, for MFJ TNC/multimodes,TAPR TNC-2 clones.
MFJ-1272BX/1272MX, $39.95, for PK-232.
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Pre-wired Radio-to-TNC cables . . . $14.95

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[1]Kenwood HTs	MFJ-5026	MFJ-5026X	MFJ-5026Z	MFJ-5026YV
Yaesu 8 pin radios	MFJ-5080	MFJ-5080X	MFJ-5080Z	MFJ-5080YV MFJ-5080YH
[1]Icom 8 pin radios	MFJ-5084	MFJ-5084X	MFJ-5084Z	MFJ-5084YV MFJ-5084YH
Kenwood/Alinco 8 pin radios	MFJ-5086	MFJ-5086X	MFJ-5086Z	MFJ-5086YV MFJ-5086YH

1 does not include IC-W2A 2 does not include 2500 3 does not include 25A & 25A
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Cables with connector *pre-wired* for your radio

MFJ-5082, $9.95, open end cable with 8-pin mic connector
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You get all the features of the MFJ-1270C HF/VHF TNC plus . . . PACTOR . . . precision HF tuning indicator . . . extra 32K mailbox memory . . .

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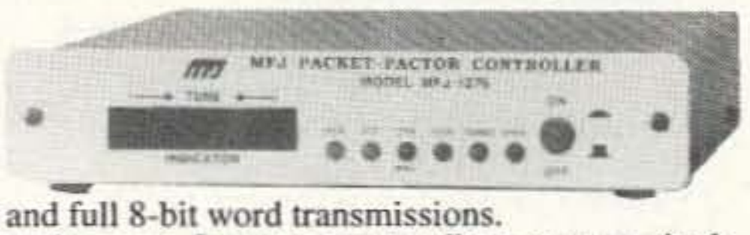

A 20 LED bargraph makes HF tuning easy. Just tune your radio to center a single LED and you're precisely tuned in to within 10 Hz -- and it shows you which way to tune!

You also get an extra 32K of memory for your enhanced *Easy Mail*™ packet mailbox.

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MFJ . . . making quality affordable

You can buy commercial ground rods which do this job. However, they cost well over $100 each! By building your own, you cut the price to less than $10 per ground rod!

There is a definite reason for placing the ground rods 12 feet apart: The hemisphere of grounding which takes place around each ground rod (see Figure 2). Basically, you want the hemispheres to not quite overlap, but not be too far apart. Thus, 12 feet works out to be virtually optimum with 5-foot ground rods. If you use ground rods of a different length from 5 feet, place them 2.4 times the length apart.

Place chemical grounds at the base of vertical antennas to get the best ground possible. Then, attach radials to the connection between the coax shield and the ground rod. Again, the placement of two or more chemical ground rods will help the performance of the vertical.

In this area, the cost of a 10-foot section of hard-drawn copper pipe (use the more expensive type since it is much harder and drives into the ground easier) was $8.40. The cost of the end caps was $0.39 each, and a ground clamp cost $2.15. These were purchased at a local handyman center. This makes a total cost of $13.48 (plus tax), or $6.74 per ground rod. The rock salt ("ice cream salt") was $1.39 for a 10-pound bag.

Power Line Grounds

A number of years ago there was a president of a major electric company who also happened to be an amateur radio operator. Over a very short period of time he began to have all sorts of problems with TVI, HiFi I, BCI, telephone I, etc. After exhausting all other sources, the author was called in. It only took a couple of minutes to discover the problem, for the president was relying on his own power company's ground! Needless to say, the very next day there were no less than three power company crews present at his house making the necessary changes to the ground system.

Remember, never rely on any ground that has been provided by the power company, telephone company, or other utility company. Never rely on a ground made to a cold water pipe for, even if your system is a complete soldered copper tubing or copper pipe system, it will still probably be a poor ground since the outside waterpipe is usually something other than copper. In houses with metal pipes other than copper, the pipe joint compound used in making connections is a very good insulator!

It is a good idea to connect these systems to the ground system, but never rely on a water system for a ground. Besides, many houses these days use PVC piping, which is an excellent insulator. Stay away from gas pipes at all costs! You don't want problems.

If you have a chain link fence, include it in the counterpoise system by connecting it to your ground system. If you are running a vertical, the inclusion of the chain link fence will almost certainly improve the performance of that antenna. But, in all cases, make sure to ground the fence to your primary ground system.

There are all sorts of hints which apply to ground systems. However, by following the guidelines outlined herein, you gain a good ground for your RF. A little work on the front end can save much grief in the long run. I am a firm believer in the practices outlined in this article! Yes, there are probably other methods which can be utilized in grounding, but those outlined here have proven their usefulness. Try them, you won't be disappointed! 73

J-Pole in your Pocket?

Tough dual-band antenna for the travelin' man or the condo dweller. Hang-anywhere style and extra range can save life in an emergency.

James H. Gray W1XU

During my years of traveling around the eastern United States on business or vacation, I often wished I had a small, inexpensive and easy-to-use antenna to match my little hand-held 2 meter radio. Occasionally I had an HF rig in the car, but more often it was the little 2 meter radio which was useful and fun. On long road trips it alleviated boredom, kept me awake and almost always assisted me to find a motel, restaurant, or other ham's QTH. On such trips the mobile antenna was fine until I needed more range from the motel.

When I traveled by plane, the rig was the handheld with no amplifier. It had only a small telescoping whip that I could extend to about 19 inches. If I happened to be close enough to a repeater in a large city, that was fine and I managed to "work" the locals in spite of low power and a minimal antenna.

But there were occasions when there was no local repeater, or when I was inside a steel-and-concrete building. At such times I wasn't able to make any contacts at all and had to resort to dull tedious television programs before going to bed.

If you face similar problems when traveling light and by air, you know how it feels to be alone among the many.

The Pico Solution

Today, the travelin' man has a ready solution to the problem: a neat antenna produced by Antennas West and called the "Pico-J." It meets all the requirements set forth in the first sentence. Pico means "small," as in "picofarad," and "J" stands for "J-pole," the well-known low-angle, omnidirectional vertically polarized antenna—just what's needed for 2 meters.

Antennas West's Pico-J offers some features not found in the usual J-pole. For example, the feedpoint is already found and matched for you, and the antenna is small and light—so much so that it can be rolled up and slipped into a small eyeglasses case. It looks like a sleek black ribbon 55 inches long. A six-foot small-diameter coax feedline comes off the bottom. Its gold-pin BNC attaches directly to your radio.

A small loop at the top may be slipped over a curtain rod or a nail or any other suitable projection. But, if by chance you don't happen to find a suitable support, Antennas West thoughtfully provides a small suction cup with an embedded hook that can be slapped up on a window or any smooth surface, and presto!—you're on the air!

Pico-J is completely weather-sealed and could be hung outdoors if you wish. Otherwise, you can hang it in a closet or a doorway; in fact, anywhere that is convenient and where your signal won't be blocked. The extra reach provided by this beauty could save life in an emergency, and is always useful when just plain chatting with the locals.

Your Pico-J stretches range, improves reception, reaches far-away repeaters, and saves your battery pack.

The measured VWSR is less than 2:1 between 142 and 150 MHz—ideal for CAP, MARS, and other services near the 2 meter band—and is a very beautiful 1:1 at 146 MHz. Not bad, eh?

Best of all, considering the benefits, is the price: $19.95 for the 2 meter model, $26 for the 2m/70cm dual bander, both complete with the soft vinyl case to store your Pico-J when it's not in use.

On a recent trip I tucked Pico-J into my briefcase, right next to the handheld. No, I didn't even use the "duckie" or the telescoping whip because I had all I needed in this one neat antenna. Maybe you'll find the same.

–condensed from ***RadioFun***

Can You Find theTiger'sTail?

If your eyes are sharp you can spot the **TigerTail™** in the photo above. It's not attached to something that bites; instead it puts extra growl into the signal from the HT it's attached to.

TigerTail™ improves SWR, lowers radiation angle, and extends range. You can use low power and save your battery pack, but still have a big signal.

Better than an amplifier, it improves reception too. **TigerTail™** does all this by simply slipping under your flex antenna and just hanging down— without sticking up or out or getting in the way.

No Antennas Allowed?

Who will see ***Pico-J*** *hanging in your closet or on the balcony? But your signal will be heard.* ***Pico-J****'s half wave radiator is sleek and unobtrusive. his thin flexible feedline is barely noticeable. When his work is done Pico-J rolls up and slides into his pouch like the Genie slipping back into the bottle.*

Carry ***Pico-J*** *on hikes or trips as you would carry a pair of glasses. Keep him in your emergency jumpkit. When you need gain and low angle omnidirectional coverage pull out* ***Pico-J*** *and be full quieting when it counts.*

New Pico-J's for 1995

PJ Packet $22—*Maximum efficiency on 2m packet frequencies.*

PJ 220 $19.95—*Go everywhere gain for the "private" band.*

Pilot's Pico-J $39—*Aviation band range booster for pilots on the go.*

73 Review

Number 7 on your Feedback card

by Steve Katz WB2WIK/6

Azden Corporation
147 New Park Road
Franklin Square NY 11010
Telephone: (516) 328-7501; Fax (516) 328-7506
Price Class: $409

The Azden PCS-7200

A solid 222 MHz Mobile FM transceiver.

The Azden PCS-7200 may be a little-known entity, but it is alive and well and putting out good signals on 135 cm FM around the country, and likely elsewhere. Azden is not one of the "big three" Japanese ham equipment manufacturers, and they don't make HF-SSB equipment. But like Alinco, they make some very usable VHF-FM gear that should not be overlooked when it is time to go shopping for that new rig.

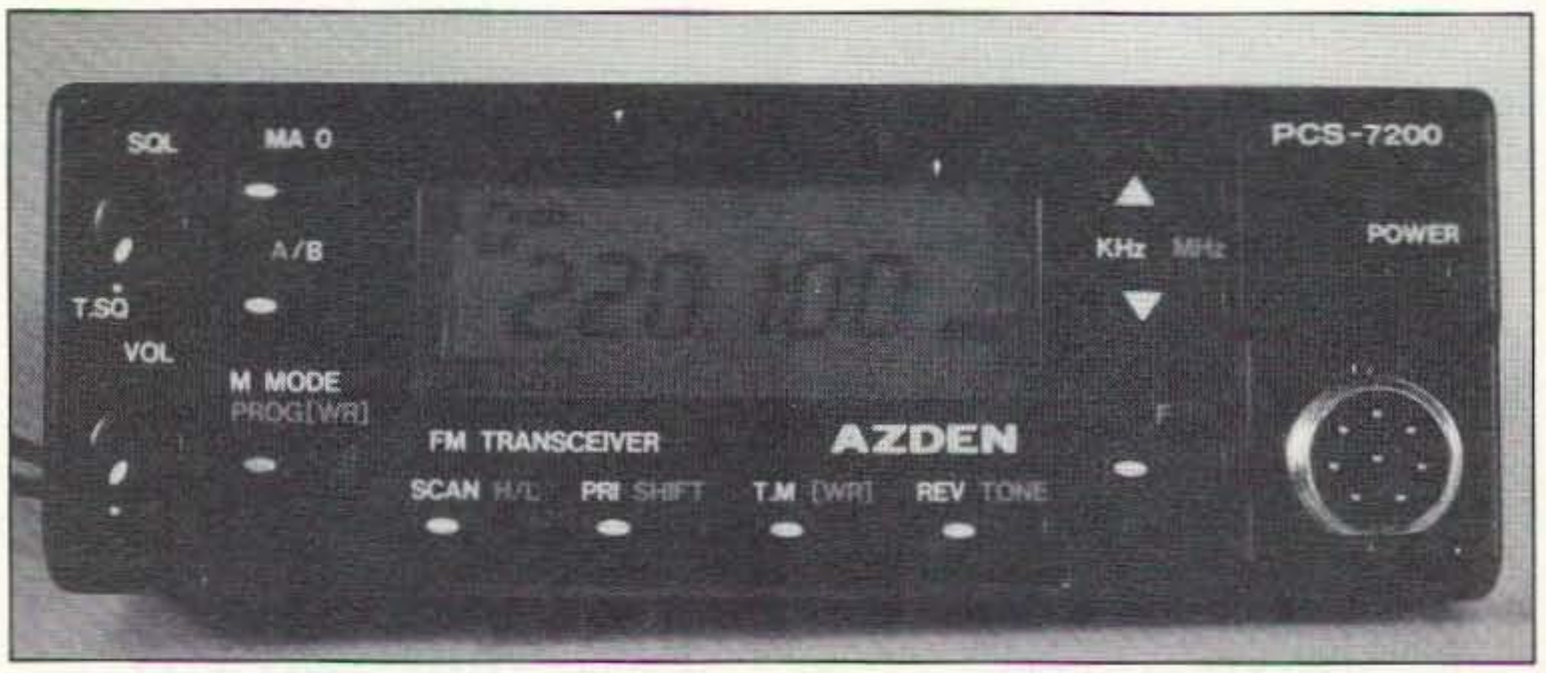
Azden's "claim to fame," so to speak, is that they manufacture budget-priced mobile and portable transceivers for 50 and 28 MHz FM. Although Azden has been around selling 2 meter rigs for 19 years now, they have little competition in the 6 and 10 meter arena, which most manufacturers have chosen to almost ignore. But Azden also makes high-quality FM rigs for 144, 222 and 440 MHz, and the PCS-7200 is one of only two 135 cm FM mobile monoband transceivers currently on the market.

I don't know how things are where you live, but here in Southern California 135 cm is almost as popular as 2 meters. There is considerable simplex activity and a great number of high-level 222 MHz repeaters occupy every single available channel on the band. Many of these "machines" offer autopatch, almost unheard of on 2 meters in densely-populated areas; and coverage on 135 cm is almost exactly the same as it is on 146 MHz. This is the only popular amateur band in the U.S. where every class of licensee has voice privileges, and Novices cut their teeth on "phone" daily by making contacts on 222 MHz.

The Azden PCS-7200 is an excellent entry-level radio for newcomers and old-timers alike. With 25 watts output power and a sensitive, selective receiver, it's a "workhorse" radio that will serve a variety of needs from simplex to repeater, to autopatch, to packet work. It's a pretty radio, like the other Azden mobiles, and is a pleasure to just look at, with its deep orange-backlit LCD display and orange-illuminated microphone pad buttons.

"I don't know how things are where you live, but here in Southern California 135 cm is almost as popular as 2 meters."

The PCS-7200 comes factory-equipped with a PTT/DTMF ("TouchTone") microphone, mike hanger, DC power cord and spare fuse, mobile mounting bracket and hardware, and owner's manual with schematic diagrams. Like most Japanese gear, the Azden does not come with any real service information, but Azden does offer a two-year limited warranty, where all repair costs are borne by the company for the first year and the cost of replacement parts (but not labor) are covered for the second year.



Initial Use and Programming

There are a couple of downsides to the Azden. One: The documentation is a bit lacking. The PCS-7200 does not have its own instruction manual, but uses the PCS-7000 (2 meter rig) manual, with an "Addendum" sheet to clarify the differences. The PCS-7000 manual has typographical errors and other mistakes, and using it with an "Addendum" sheet means referring back and forth between two papers to get things right.

Secondly, the Azden is not particularly "user friendly," and requires real study of the instruction manual. Probably the most important thing to know for FMers is how to program a transceiver's memories with frequency, offset and tone data. The Azden is surely programmable, and has 20 memories which do store all the important data—but the instruction manual uses a page and a half of text describing how to do it, and until you've programmed the radio a few times, it's a nearly incomprehensible task. As I've said in other product reviews, I rate new equipment for "user friendliness" based on whether I can figure out how to do everything required without ever referring to the instructions. With the PCS-7200, to program each memory you must push the PROG(WR) key six times, and make other keystroke entries as well. It's a task that only Superman could accomplish while driving the freeway, although I'll admit that once I had programmed the first few, the rest of the memory channel programming went quite well (at home, on the bench).

Like the PCS-7500H 6 meter rig, the PCS-7200 defaults to memory "A0" (the first of its possible 20 memory channels) on power-up and does not remember where it was last used. This can take a bit of getting used to, if you're accustomed to other popular brands of FM gear. Also like its 6 meter brother, the 7200's memory storage is only accomplished by turning the radio off at the end of the programming sequence. The following NOTE appears in the manual: "Be sure to turn off the power when you have completed programming. This procedure is required to get each setting programmed in and then to get

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April 28, 29,30, 1995

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out of the programming mode." Weird, but it works.

The PCS-7200 is able to program any frequency offset ("split") on every single memory channel, which is a plus in my book. (Although all our local repeaters here use a minus 1.6 MHz offset, anyway. But that could always change, and it might be different elsewhere.) However, because the Azden lacks any preconceived "offset" of any kind, when programming for use, one must enter both the transmit and receive frequency for every single channel intended. This is quite different from other FM mobile rigs on the market, and takes a bit more time to accomplish. This isn't a big deal if you do all your programming at home and then intend to keep the memory channels as they are for a long time, but it could be an inconvenience for those who fiddle around a lot and like to change memories daily.

A "temporary memory" is also available, and does not occupy one of the main 20 memory channels. Unfortunately, using this feature is too complex to be of much use when driving, so its usefulness might be limited to fixed operation, where one could use the "temporary" memory like one additional channel.

Also, the PCS-7200, like the PCS-7500H, uses a "Tone Code Table" as a reference for CTCSS ("PL" tone) programming. That is, if you wish to program a "PL" tone of 156.7 Hz, this corresponds to Tone Code #25. When entering "PL" data into the Azden, the tone code display is a two-digit one, corresponding to the Tone Code Table printed on page 14 of the instruction manual. If you don't have the manual with you and need to enter some unique "PL" tone on the fly, you'll be hard pressed to remember which two-digit code corresponds to which tone. All the standard 38 CTCSS tones are in there, but it's nearly impossible to remember which one is which without the Table.

The Workhorse

The PCS-7200, for all its quirks, actually works very well. They call it a "MIL-STD-810" radio, which I assume means it is not actually military qualified, but is built to withstand the environmental extremes specified in this military document. I live in a "high-RF" environment that makes many inexpensive VHF/UHF rigs go bonkers with intermodulation products and receiver images: I'm up on a rise with a clear view for 20 or 30 miles in some directions, and that view is of a large city with countless high-powered transmitters populating every hilltop. I'm also just "under" a popular 3600'-high mountaintop bristling with so many transmitting antennas it appears much like a porcupine from here. While most handie-talkies and some mobile radios just roll over and die under the pressure of zillions of high-level signals pouring down the antenna feedline, the Azden doesn't. It just sits there, receiving even weak, distant signals, without a trace of "intermod." Its 25-watt transmitter is competitive enough (although some 222 MHz rigs run 35 watts, this is only 1.46 dB more power, hardly worth discussing) and is rock-solid. After 10 full minutes of continuous key-down time (OK, so I'm long-winded!), the Azden's power output doesn't fall off. Many of the "50-watt" 2 meter rigs start out running 50 watts or more when cold, but wind down to maybe 40 watts after several minutes of key-down time. The 25-watt Azden doesn't do this, and would probably make a good "remote base" unit capable of rather severe service.

Another "plus" in the Azden's favor is its remarkable receiver audio output stage and speaker. The rig is rated to produce 2 watts of audio power into an 8-ohm load at 10% maximum THD (total harmonic distortion), and it sounds loud, much like a commercial radio. I never had to crank up the volume control more than about halfway to produce room-filling (or car-filling) volume. The rig's top-mounted speaker is also top-notch and doesn't rattle the little rig's cabinet, even with the volume full up. This may sound insignificant, but I think it's a wonderful feature for a mobile rig—one I miss dearly when a rig can't provide enough receive audio to overcome road noise when operating mobile.

"While most handie-talkies and some mobile radios just roll over and die under the pressure of zillions of high-level signals pouring down the antenna feedline, the Azden doesn't."

Other Features

The memory and band scanning features of the PCS-7200 are as good as those found in any rig I've used. One can scan just the memory channels in "Bank A" (10, A0 through A9), "Bank B" (another 10, B0 through B9), or both A and B. When in the "direct" (VFO, non-memory) mode, the rig will scan between any two frequency limits; however, those limits must be stored in memories. For example, you could store 222.01 in memory A8 and 224.99 in memory A9 and scan between these two limits, thus covering the entire amateur band. You could store another set of lower and upper limits in memories B8 and B9, and scan just between those two. Pushing the PTT button on the mike, or depressing the UP or DOWN keys, the REV(erse) key, the M(emory) MODE key or the F(unction) key will stop the scanning, which may be immediately resumed by depressing the SCAN key again. The only problem is, if your scanning receiver stops on a repeater frequency which was not previously stored in memory, you can't just grab for the mike and start chatting on that channel. This is because the rig won't know exactly where to transmit: It does not have an automatic repeater offset function.

Like most modern FM rigs, the Azden also contains a PRIORITY mode feature. Activated by depressing the PRI(ority) key, this feature enables the receiver to look for activity on memory channel A0 (automatically the designated priority channel) every four seconds, regardless of where the receiver is actually tuned. If activity is present on the priority channel, a "beep" tone sounds in the speaker to alert you. A momentary press of the M A0 key on the front of the PTT hand mike immediately switches the rig from whatever channel it was on to the priority channel (A0). If you make this fast frequency change and then decide you didn't really need to, another momentary press of the same key will return you to the last channel you were on before switching to the priority frequency. I find this feature very handy, since I really do have a priority frequency around here—222.080 MHz, a popular simplex channel for the San Fernando Valley.

The factory-supplied PCM-499-23 dynamic hand mike contains a 16-key DTMF (TouchTone) encoder, as well as UP/DOWN (frequency selection) buttons, the "M A0" (priority channel) button described above, and a rugged coiled cord with attached 8-pin connector. The 16 keys are all softly lighted the same color as the Azden's panel displays, making buttons easy to find in the dark. (I wish all mobile microphones had lighted keys!) The TouchTone encoder produces an audible sound from the microphone itself, so you can tell if it is working. However, the PCS-7000 manual contains some misleading information regarding operation: It states, "To enable the DTMF encoder function, press the keypad keys correctly in the desired sequence. As each button is pressed, the LED will light. The transceiver is automatically put into the transmission mode when any keypad is pressed. The built-in 'hang timer' causes the transmitter to operate continuously if the delay between keystrokes is less than 2 seconds."

I didn't find any of this to be true. Depressing a key does not make the transmitter operate. I had to depress the PTT button on the side of the mike first. As for the "LED" lighting, there was no LED on the mike supplied with the review unit, so I don't know what LED they're talking about. Also, the "hang timer" doesn't exist on the review unit. If you release the PTT button, even if you're in the middle of a keying sequence on the tone pad, the rig stops transmitting. All these "faults" are forgiveable, but I wish Azden would update the manual to make it less confusing for neophytes who may actually become upset if the rig doesn't operate exactly as described. (In speaking with Azden since the review unit arrived, I determined that the new PTT mike does not function as described in the instruction manual, and that is normal. They say most users did not like the "push any button and you're transmitting" function, so they have revised this to be as I have described above.)

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I like the mobile bracket Azden supplies with the PCS family of mobile rigs: uncomplicated, unobtrusive, sturdy and easy. Two of the four radio-mounting machine screws have attached plastic knurled surfaces which allow hand-tightening with no need for tools. The other two machine screws do require a Phillips screwdriver, but at least you can get the radio mounted temporarily, without it falling in your lap or on the floor, while you casually install the remaining two screws. This is a thoughtful touch. I also like the Azden schematic diagrams, which are large enough to read without an eye loupe and include a block diagram that clearly details (at least for the technically inclined) what's actually happening inside the rig.

Inside the Radio

Let me take a moment to describe the radio's "guts." Signals entering the receiver from the antenna jack pass through a diode T/R switch (hooray—no relay!) to a 215-230 MHz bandpass filter which is varactor-tuned to resonance by a special "loop filter" circuit programmed by VCO data. Signals are then amplified by a 3SK177 dual-gate MOSFET and bandpass-filtered once again by still another varactor-tuned circuit before driving the first receiver RF mixer. All this "track-tuned" bandpass filtering is probably what makes the Azden's receiver so immune to interference from outside the amateur band. The first mixer is another 3SK177 having LO injection at 200.4 to 203.4 MHz (for tuning 222.0 to 225.0 MHz), provided by a 2SC3838 "RX Lo AMP" buffer stage which receives its local oscillator signal from the VCO UNIT which is common to both the transmitter and the receiver. The receiver's first IF at 21.6 MHz is shaped by a 15 kHz bandpass crystal filter and this IF signal is then applied to "IC7," the receiver IF subsystem which contains a bipolar (2SC2715 common-emitter) IF amplifier, and an integrated circuit (MC33610) containing the second local oscillator, second mixer, second IF amplifier, discriminator and squelch circuit. The second LO runs at 21.145 MHz and produces a second IF at 455 kHz, which is bandpass-shaped by a 15 kHz multipole ceramic filter.

Demodulated signals from the IF subsystem are applied to a bipolar 2SC2712 audio preamp whose output is high-pass filtered by an integrated "HPF" 270 Hz rolloff filter (to strip away CTCSS "PL" tones from being heard) before being postamplified by a power integrated audio amplifier, IC5 (a TA7252). The receiver circuit contains other niceties like a three-stage "S METER AMP" circuit that amplifies then rectifies the 455 kHz filtered 2nd IF signal and an "AF MUTE" gate which switches off the drive to the final audio power amplifier on transmit. All in all, a good receiver design that results in sparkling performance under real-world conditions.

On the transmit side, speech from the microphone is first adjusted in level by a "MIC SENS" (mike gain) control VR2 before being applied to an integrated MIC AMP stage, IC11, which both amplifies and shapes the audio response before driving IC10, a 3.4 kHz integrated low-pass filter which rolls off noise and voice harmonics above the range of human speech. The speech audio from this filter is applied to the DEV(iation) control VR4 and then directly drives the integrated VCO UNIT (IC8), the same system which provides local oscillator injection for the first receive mixer. The voltage-controlled oscillator provides frequency-modulated signals directly in the 222 MHz range on transmit, so only RF power amplification, and no frequency multiplication, follows this stage. This surely reduces "phase noise" on the transmitted signal and helps assure close-in spectral purity.

The output from the VCO is amplified by three cascaded bipolar stages (Q11, Q12, Q13). The last of these stages (Q13, a 2SC2407) has "APC" (automatic power control) bias applied by the APC control circuit, which contains the HI/LOW power switching function and power output level adjustments for both HI (VR9) and LO (VR8) ranges. Bias from the APC circuit is also applied to the final RF power amplifier, IC501, a Toshiba S-AV15 hybrid ("brick") module located on the rear heatsink of the radio. The transmitter output from IC501 is filtered by two separate dual pi-section low-pass networks. Also located on the PA board is the transmit-receive (T/R) diode switch, which uses a pair of HI407s, one in series with the transmitter, and one in shunt with the receiver, to perform the switching function. I am unfamiliar with the HI407 and do not know if this is a P-I-N diode or not (but I hope so, as PINs are far better RF switches than conventional P-N

Table I. PCS-7200 Tests and Measurements

Specification	Measurement
Frequency range, 215-230 MHz (RX)	As specified
222-224.995 MHz (TX)	As specified
Transmitter output power: 13.8 VDC source, 50 ohm load	
25 watts (high)	24W
5 watts (low)	5.5W
Transmitter current drain: 13.8 VDC nominal source	
6.0 A (high)	5.5A
Unspecified (low)	2.3A
Transmitter overall power efficiency, Pout(W)/Pin(W):	
Unspecified	31.6% (high)
	17.4% (low)
Receiver sensitivity:	
<0.12 µV at squelch threshold	0.10 µV threshold
<0.35 µV for 20 dB NQ	0.45 µV 20 dB NQ
<0.19 µV for 12 dB SINAD	0.27 µV 12 dB SINAD
Receiver selectivity:	
12 kHz min (total BW) at -6 dB	12.3 kHz/-6 dB
30 kHz max (total BW) at -60 dB	28.5 kHz/-60 dB
IF rejection:	
Unspecified	1st IF (21.6 MHz), 102 dB
	2nd IF (455 kHz), >136 dB
Receiver current drain: 13.8 VDC nominal source	
0.6A	0.28A squelched
	0.55A unsquelched
Audio output power:	
>2W into 8 ohms, 10% THD	2.4W, 10% THD

S-meter and power output meter bargraph display:
PCS-7200 uses a 10-segment display but segments 9 + 10 illuminate together, making for 9 increments of resolution.
Bargraph reading for full (25 W) output power: 10 segments
Bargraph reading for low (5 W) output power: 2-3 segments
S-meter readings vs. input signal strength:
1 bar = 0.45 µV
2 bars = 0.55 µV
3 bars = 0.65 µV
4 bars = 0.75 µV
5 bars = 0.87 µV
6 bars = 0.95 µV
7 bars = 1.35 µV
8 bars = 2.00 µV
9 bars = 5 µV

Note: PCS-7200 receiver can detect very readible signals before its S-meter bargraph display indicates any signal present.

All data taken by WB2WIK 12/26/94.

junction diodes, having less loss and better distortion product performance). Between the first dual pi-section TX filter and the series RF switch diode (and the second set of dual pi-section filters) is the directional coupler sampling network, which uses a 1SS106 detector diode to drive the APC amplifier system.

Again, the transmitter circuit appears to be thorough, complete and designed with minimal adjacent-channel interference in mind. Although I pointed out some shortcomings in documentation and operator convenience earlier, I must admit Azden does a pretty good job of making radios that work, even when the going gets tough. The PCS-7200 contains circuitry not always seen in amateur gear and more frequently found in commercial two-way equipment. I applaud their RF engineering, and only wish they'd make this rig more "user-friendly," without the complicated channel programming sequence.

I got the review unit programmed with 20 channels of local simplex and repeater activity, made a few dozen contacts (including bringing up some repeaters more than 150 miles distant not bad for a 25-watt radio!) and then spent a few hours conducting "bench tests" for receiver sensitivity and selectivity, and transmitter output power and current consumption. The results of my testing are shown in Table 1.

One additional comment I might make regarding the PCS-7200's transmit modulation: When I first tried the review unit, I received reports of unclear sibilancy (harsh "S" sounds), and "popping" B's and P's. I reported this back to Azden, who promptly provided me with another microphone. The second mike sounds the same as the first. Azden's Communications Division Manager, Sid Wolin K2LJH, recommended I try speaking across the mike, rather than directly into it, because this is a noise-cancelling microphone designed for the "talk across" technique. I tried this, but still received reports of uncrisp modulation. Listening in a second receiver with headphones, I must admit the modulation is not as crisp and clear as I'd like it to be. Some of this is attributable to the noise-cancelling dynamic microphone; when I tried a different brand of "desk" microphone, it sounded better and more natural. I won't downgrade the PCS-7200 for this, but must relate the experience in the interest of accuracy. Azden boasts about their "true FM" modulation (as opposed to phase modulation, used by some other FM transmitters), but without a better microphone transmit audio isn't all that great.

In all, I like the PCS-7200. What it lacks in ease of setup and documentation it makes up for with good, solid RF performance. Azden used to sell their products only "factory direct" in the U.S.; however, I see that Amateur Electronic Supply now distributes Azden products, and perhaps others will follow. The company has a loyal following among 10 and 6 meter FM enthusiasts, and there's no reason for 135 cm (and probably the other VHF band) users not to take a serious look at their products. 73

73 Review

Number 8 on your Feedback card

by Gordon West WB6NOA

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Learning Morse code and amateur radio theory on your laptop or home computer has now taken a giant step forward where no one else has gone before—interactive learning on a Windows format. No shareware nor existing code and theory programs come close to the excitement found in Ham University from ARE (Amateur Radio Education, Inc.), a new company specializing *specifically* in amateur radio software.

Ham University and the Pentode Morse code game cover any level of amateur radio education, from just getting started and not knowing a dot from a dash up to first class radiotelegraph speeds of 20 and 25 wpm. All levels of amateur radio written examinations cover the latest question pools, including the *new* Advanced question pool going into effect July 1, 1995. Ham University includes two sections to help you with the written exam, two sections to help you learn and speed-build your Morse code proficiency, plus the addictive game, Pentode, to help you master Morse code without really trying. We found Pentode a terrific way to get kids interested in learning the code and getting into ham radio.

Ham University installs easily on any 386 or higher computer, Windows 3.1, DOS 5.0 or higher. For the Pentode Morse code game, a sound card is required.

I really recommend the sound card for the entire program because of all of the great sound effects and code-shaping features that the program includes. Code shaping? This allows a code instructor or a volunteer examiner to create code audio with smooth attack and release sounds to eliminate the harshness of most computer-generated CW. Many code programs produce a "thump" that is quite disturbing when practicing the code, or sitting for a code test with a computer creating the exam. With Ham University, code, tone pitch, dit-dah ratio, sound shape, and spacing intervals are fully adjustable on the Windows format screen.

We found you could also begin learning the code with the exact progression of letters recommended by the American Radio Relay League, or the exact progression of letters, numbers, and punctuation marks recommended in our own Gordon West Radio School method. Or you can create your own method of learning the letters, numbers and required punctuation marks for CW.

"Several instructors have their own personal way of teaching certain letters and numbers first, and they can easily tailor the program specifically for their classes," comments Roy Stephens AC6CQ. "The program defaults to the lesson section first, which sets up a series of lessons that introduce the code gradually using the West or ARRL educational methods," adds Stephens.

We set aside 20 minutes twice a day to work a few students through the code practice, and in less than a week they were listening to "easy word" sentences made up of the code letters they had just learned.

Pentode

We then switched our students over to Pentode, a Michael Crick exclusive game for making code practice *fun*. You select which code characters you want to practice. The challenge is to click on the appropriate square for points. Your job is to get rid of the code character boxes by placing them in a central panel. Two characters placed side by side eliminate themselves. This is called a diode. You can keep the screen clear just by making diodes, but if you want a high score, you need to make triodes, tetrodes, and then the pentode.

When you play the code game, you make a triode when you place two similar characters on a diagonal, and then place a third character in the angle so that all three explode at once. You score when you place the final "A" into the slot marked "—." Your score increases very fast as you progress from diodes to pentodes.

If you're good at Morse code, you can keep several characters in your head and not

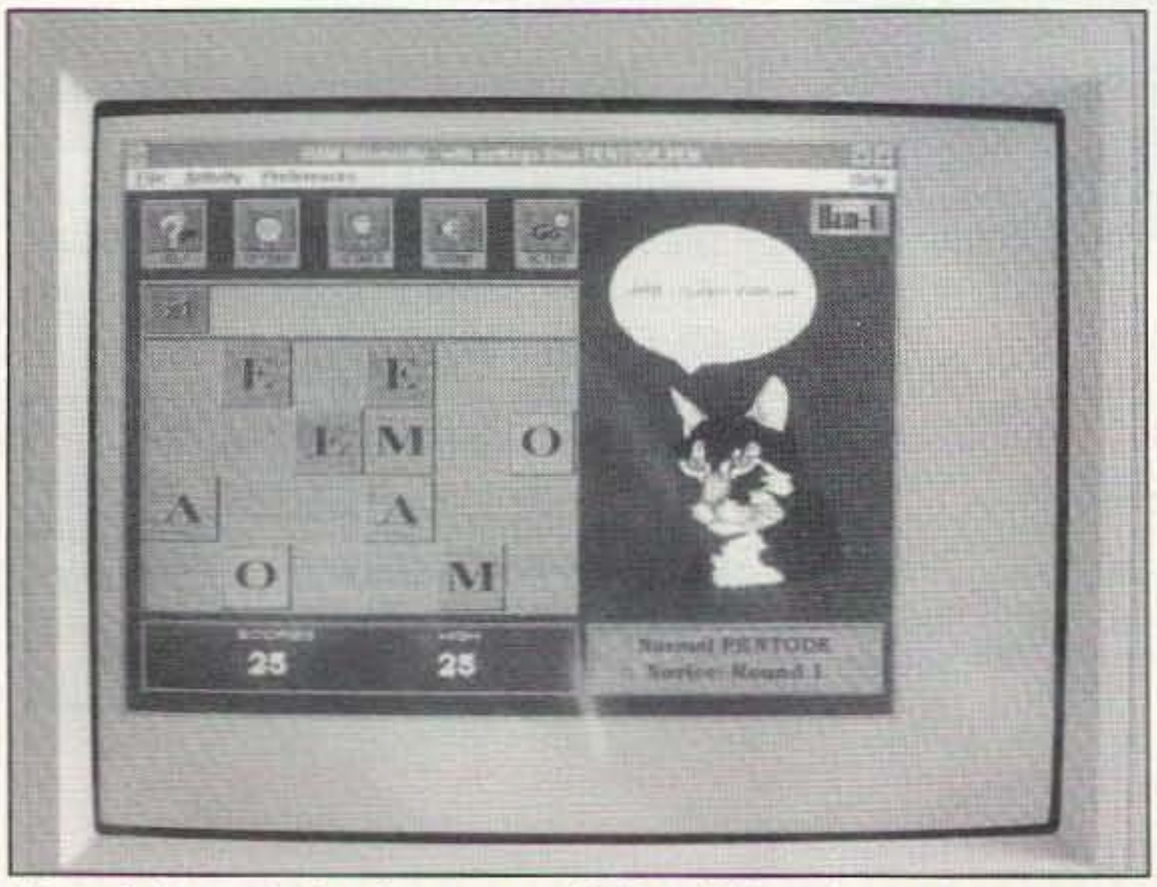


Photo A. Pentode is a fun game with Ham University to learn the code and to build speed. (Photo by Roy Stephens AC6CQ.)

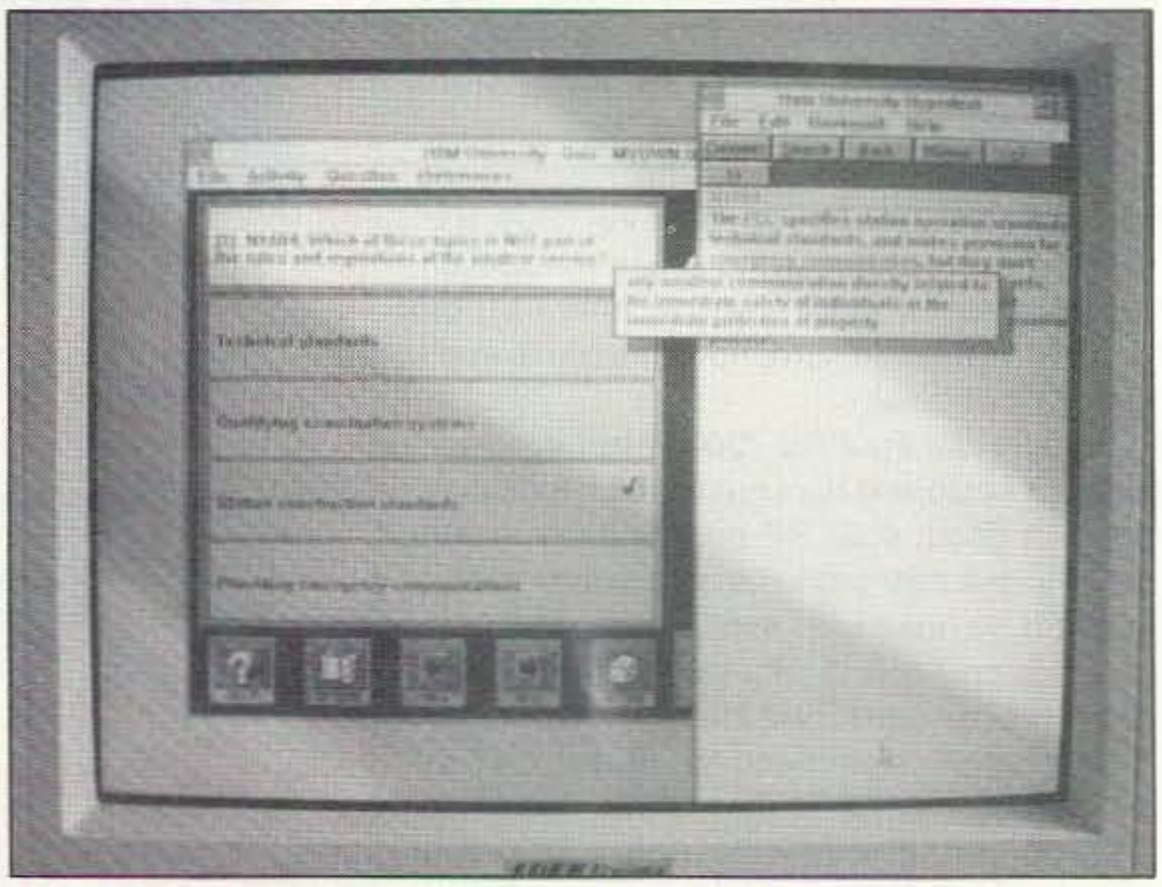


Photo B. All amateur test question pools are on the program, plus Hypertext help files. (Photo by Roy Stephens AC6CQ.)

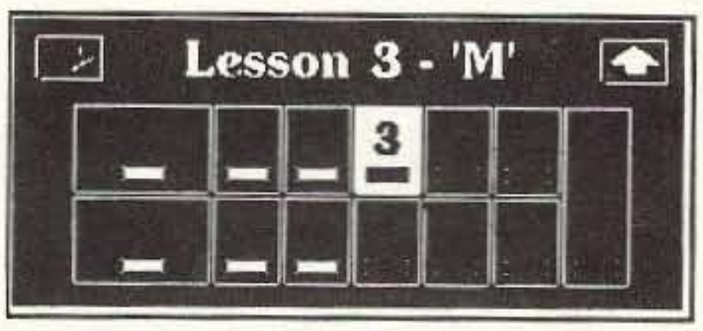
lose track of what is coming out of the speakers. This gives you multipliers that reward you for this type of stacking.

After 10 rounds (if you survive), you go from Novice to General, and then up through Advanced and ultimately to Extra. At each level, the Morse transmission rate increases.

If you don't know Morse code yet, and just want to play the game, Ham University Pentode can provide the option of having spoken characters instead of Morse code. This option is set from the Pentode dialogue box.

When you complete a game, your score may be eligible for the Hall of Fame. Your kids will probably get there first. And for you grown-ups, if this game sounds a little bit complicated, let the kids try it and they will soon be telling you how to play the game. Chances are they have played other Crick games of this style and the only thing new will be learning the sounds of Morse code to come up with letters.

They don't even realize they're learning a new language called "Morse code"!



The Upper Panel (above) shows you which lesson you are on and shows you which drill is next. You can change the drill by clicking the appropriate button. Each lesson emphasizes a given letter -- the drills in the top row strongly emphasize the current letter and those on the bottom row mildly emphasize it. You can advance through the drills in order or skip them if they are too easy. You can **not** advance to the next level until you pass the drill marked **End**. The first drill in each row marked **Free** lets you go at your own speed -- the others present groups of letters at a fixed speed (which can be set in the Lesson Plan Dialog Box).

You start each drill by clicking or pressing **Enter**. Then type the letters you are receiving into the lower panel. Case is ignored and spaces are added automatically. When you complete the drill, the letters that were sent appear in the upper panel so that you can compare them to what you typed.

Sent	ME~EE~ET~MT~MM~TE~ET~MM~TM~TM~TM~MM
Recd.	ME~EE~ET~ME~MM~TE~ET~MM~EM~TM~TM~MM

Morse Code Test Preparation

We found the Morse code test preparation exercises identical to the methods used by volunteer examiners and VECs who create code tests. And while there are many variations of how a 5, 13, and 20 wpm code test can sound, and what the basic format of the QSO will be, Ham University has so many different types of code tests that you will be well-prepared for anything that may come down the earphones or speakers at your upcoming VE exam.

And for credentialed volunteer examiners with Ham University, you can create a legal 5, 13, 20, or commercial radiotelegraph second class or first class code test that specifically meets the FCC guidelines for CW test administration. This includes the new code tests for both random and text for the commercial radiotelegraph code examination Elements 1, 2, 3, and 4, and amateur Elements 1A, 1B, and 1C.

The Morse code section of this program had almost twice the variable features as other CW programs I have seen and have used extensively for my own code teaching and code tapes. This was instantly recognized when I saw I could actually shape the sound of the code characters coming out of the audio board speakers!

Theory Preparation

For amateur radio theory learning, Ham University gives you more than just questions, answers, and a beep or boop on the correct answer. You get applause. You get cheers. You get AAAHHHAAASSS when your high score appears after a sample exam. And this makes taking the tests *fun* because there is a surprise right around the corner with every click of the mouse.

We also see "hypertext" in case you have a problem with any one of the questions on how the correct answer was developed. Theory instructor Bob Gregg AB6CH patterned the "hypertext" similar to the brief descriptions found in my theory books, and he came up with some great descriptions on how to solve for the right answer, with some shortcuts that I never even thought of! Gregg actively teaches ham radio, so he knows what the students are looking for.

Having the code, theory, and Morse code games in a Windows format puts this program in a timely step with popular computer technology. You're learning 1995 code and theory at a 1995 computer level unlike other programs running much slower and on a basic DOS format. Needless to say, you need a modern computer to work this program, so this could very well be a great excuse to upgrade your system and make ham radio education more fun.

Priced at under $75, Ham University is available from Amateur Radio Education, Inc., 19032 Pauline Lane, Huntington Beach, California 92646; 714/968-0042; Internet BGREGG@CALSOFT.COM. 73

73 Review

Number 9 on your Feedback card

by Richard Goodman WA3USG

Personal Database Applications
2616 Meadow Ridge Rd.
Duluth GA 30136-6037
Telephone: (404) 242-0887
Price Class: LOGic 4 Windows—$99; LOGic 4 DOS—$79.

LOGic 4

Ham radio software for Windows or DOS.

In the May 1992 issue of *73* I reviewed Personal Database Applications (PDA) LOGic II Version 2.1 Ham Logging Software. I was favorably impressed and have since been using it for my personal amateur logging requirements. About a year later, I received LOGic Version 3. This included many enhancements, the foremost being a Packet Cluster interface and a move to a "Windows-like" environment. While LOGic Version 3 was still a DOS application, it used several windows that could be individually moved, sized, and configured. It also made liberal use of pop-up menus and included mouse support.

The programming environment that LOGic is written in has also changed. The original Version 2.1 was written in "DBMAN," a fine commercially-available applications development system in its day. Version 3 and above are written in FOXPRO, a state-of-the-art applications development system providing considerably more performance and features than its older cousin. Finally, I was impressed by the fact that the LOGic System has gracefully evolved over the years from a capable but complex DOS application to an integrated system of amateur radio control. LOGic now provides a Graphical User Interface through Windows or DOS to: logging, rig control, communications (Packet Cluster Interface and terminal program), awards tracking, access to several ham databases on disk or CD-ROM, and an extremely powerful reports generation system.

Installation and Configuration

LOGic-4 requires an IBM-compatible PC with at least a 386SX microprocessor, and 7 megabytes of free disk space for installation. If LOGic is to be installed and run as a Windows application, Windows Version 3.1 with at least 4 megs of RAM are required.

LOGic is available in DOS and Windows versions. The DOS version features a Windows-like interface with full mouse support. The Windows version is the product of choice for those who prefer a true Windows interface. Both versions may be purchased at a substantial savings and will allow you to access the same data from DOS or Windows.

This review covers primarily the Windows version. The DOS side works just as well with access to all the same data. (The Windows version allows changing of screen font types and sizes that are not available under pure DOS, which does support 25-, 43-, or 50-line display modes).

Installation is virtually automatic. Run Windows and insert the first 3.5" floppy containing the LOGic system. From the "FILES" option in the Program Manager select "RUN" and type: X:\SETUP (where "X" is the floppy drive designation). Installation under DOS is even simpler. From the DOS prompt type: X:\SETUP (where "X" is the floppy drive designation). You will be prompted to install additional disks as necessary.

As the system installs itself, you will be graphically appraised of the installation status. PDA makes liberal use of bar charts and other graphical indicators to show the creation of files, indices and tables.

Upon completion of installation you must enter the "General Ham Setup" menu and tell the system a few things about yourself (e.g.: callsign, lat/long, operating modes, UTC offset, etc.). Once this is done, the fun can begin.

Documentation

The documentation included with LOGic 4 is excellent. It is professionally bound and typeset with laser print quality. It is easy to read and includes both a table of contents and an index. The document is broken down into two sections. Section 1, "Basic Operations," consists of 64 pages and will do for us what we hams seem to demand: get us going quickly with little reading. Section 2, "Advanced Operations," contains 41 pages and gets into all the nuances of this system.

LOGic 4 lends itself well to the neophyte who wants to start with basic logging requirements. Many people would be happy using only 25% of its capabilities. To realize the true potential of the LOGic system, however, it is necessary to thoroughly read all of the documentation and experiment with the program.

Operation

To the experienced Windows user, the basic functionality of LOGic 4 will be almost intuitive. The first screen presented after clicking on the "PDA LOGic" icon from the program manager will be the PDA logo with the main menu. Menu options may be selected by either typing the first letter of the option or clicking on it with the mouse. Noted that this system may be totally navigated with the mouse; it is no longer necessary to tab or navigate with the arrow keys. The cursor may be placed anywhere on the screen by positioning it with the mouse and clicking on the

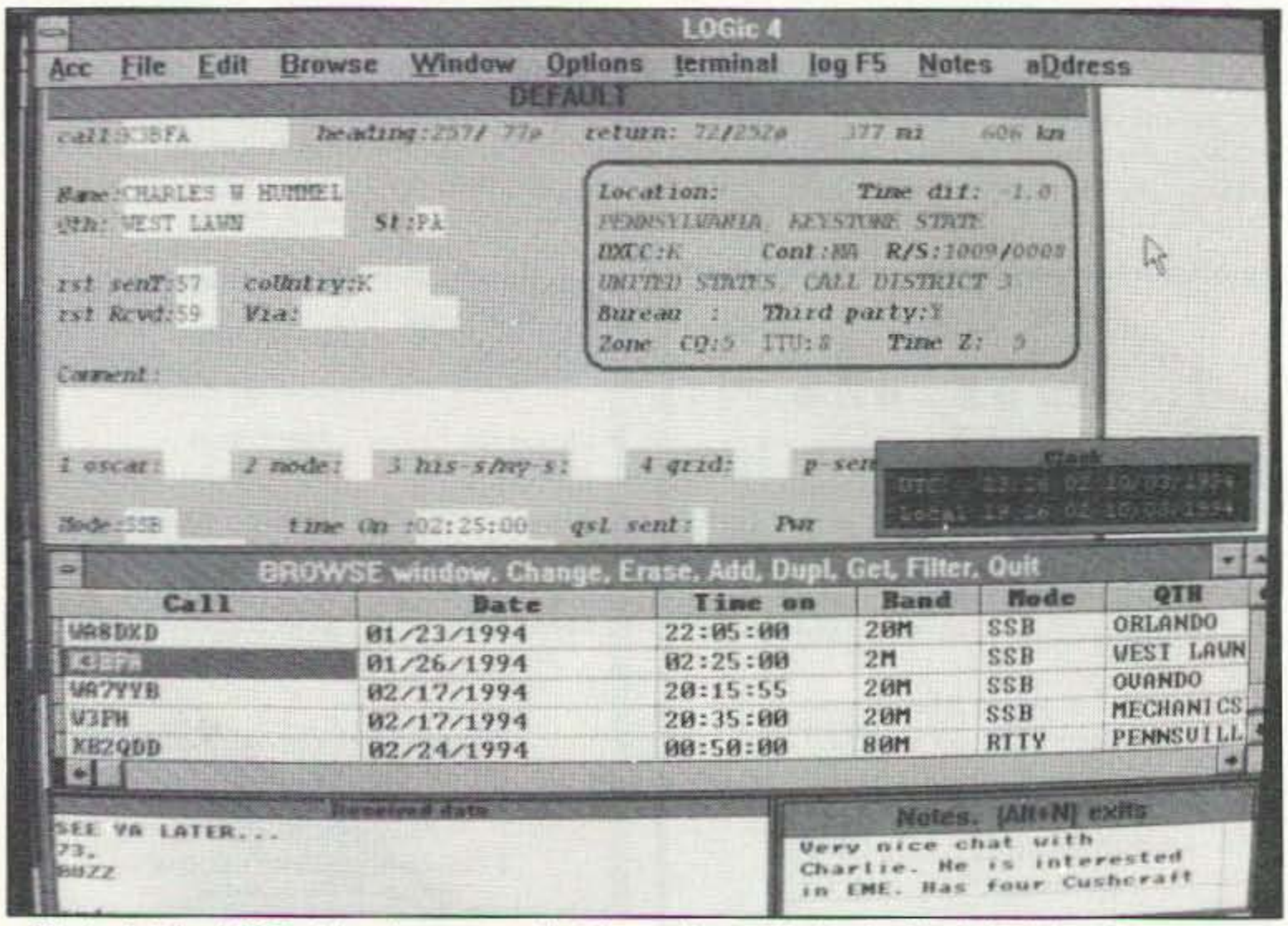


Photo A. The LOGic 4 logging screen that the author edited to be his default logging screen.

MFJ *super* DSP *filter*

. . . Tunable "brick wall" bandpass, lowpass, highpass, notch, SSB, CW filters . . . programmable pre-set filters . . . automatic multiple notch filter eliminates heterodynes . . . adaptive noise reduction reduces noise and QRN . . . for Voice, CW, Data . . .

Only MFJ gives you
tunable and programmable "brick wall" DSP filters

MFJ-784

$219.95

MFJ's *super* DSP filter

automatically eliminates heterodynes, reduces noise and interference *simultaneously* on SSB, AM, CW, packet, AMTOR, PACTOR, RTTY, SSTV, WeFAX, FAX, weak signal VHF, EME, satellite -- nearly any mode you'll ever encounter.

You get MFJ's *tunable* FIR linear phase filters that minimize ringing, prevent data errors and have "brick wall" filter response with up to 60 dB attenuation just 75 Hz away.

***Only* MFJ gives you *5 tunable* DSP filters. You can *tune* each lowpass, highpass, notch, and bandpass filter including optimized SSB and CW filters. You can *vary* bandwidth to pinpoint and eliminate interference.**

***Only* MFJ gives you 5 *factory* pre-set filters and 10 *programmable* pre-set filters that you can customize. Instantly remove QRM with a turn of a switch!**

You get MFJ's *automatic notch filter* that searches for and eliminates *multiple* heterodynes.

You also get MFJ's advanced *adaptive noise reduction*. It silences background noise and QRN so much that SSB signals sound like a local FM repeater.

The *automatic* notch and *adaptive* noise reduction can be used with *all* relevant tunable and pre-set filters.

***Automatic gain control* (AGC) keeps audio level constant during signal fading.**

Automatic notch filter

MFJ's *automatic* notch filter searches for and eliminates *multiple* heterodynes. It's *milli*-second fast -- interfering CW and RTTY signals are also eliminated.

Voice signals aren't degraded because the notch is *extremely* narrow.

With up to 50 dB attenuation, you'll copy stations otherwise masked by heterodynes, miss fewer calls and be less exhausted.

Leave the *automatic* notch filter on during a phone contest and you'll never hear unwanted heterodynes of tuner-uppers.

You can *selectively* remove tones. Say, you're on CW and a couple of annoying CW stations appear nearby. You can use the *two* manually *tunable* notch filters -- *an MFJ exclusive* -- to completely knock them out.

Adaptive noise reduction

Turning on *noise reduction* silences background noise. Noisy SSB, FM, AM, CW and Data signals become readable.

Noise reduction works in all filter modes and on all random noise -- white noise, impulse noise, static, ignition noise, power line noise, hiss and atmospheric noise.

The LMS algorithm gives you up to 20 dB of noise reduction. Noise reduction is adjustable to prevent signal distortion.

Reducing random noise reduces fatigue, especially when the band is noisy.

Tunable highpass/lowpass filters

For Voice and Data, nothing beats MFJ's exclusive *tunable* highpass/lowpass FIR linear phase "brick wall" filters.

You can *tune* the lower cutoff frequency 200 to 2200 HZ and the upper cutoff frequency 1400 to 3400 Hz.

Signals *just 75 Hz* away literally disappear -- they are reduced a *thousand* times, 60 dB!

Unlike other filters, speech clarity is not reduced by envelope distortion caused by unequal time delay.

By adjusting the highpass and lowpass filters you can create *custom* filters for Voice, Data and other modes.

When signals are weak, you can improve copy by removing high and low speech frequencies. They contain little information but are full of noise that reduce readability.

On crowded HF bands, overlapping SSB signals make copying difficult. You can improve copy by slicing off some overlap with razor sharp "brick wall" responses.

You can also highpass filter out hum, pulses, rasp and other irritating low frequency noise.

Tunable bandpass filters

Narrow band signals like CW and RTTY jump out of QRM when you switch in an MFJ *tunable* FIR bandpass filters.

You can *tune* the center frequency from 300 to 3400 Hz. And *vary* the bandwidth from 30 Hz to 2100 Hz -- from super tight CW filters to wide razor-sharp Data filters.

As you narrow the bandwidth, interfering signals drop out, because, just 60 Hz away, they're down by over 50 dB.

You can use *narrower* bandwidths to fight tough QRM because these linear phase filters don't distort signals with unequal time delays.

Even with the narrowest 30 Hz bandwidth, you'll never have a problem with ringing.

One position gives you *two* tunable filters you can use together on one signal. For example, on RTTY, tune one filter to mark, the other to space and set the bandwidth tight for an incredibly sharp RTTY filter.

15 *pre-set* filters -- use factory set or program your own

You can select from *fifteen* convenient *pre-set* filters. Use them for SSB, AM, CW, packet, AMTOR, PACTOR, RTTY, SSTV, WeFAX, FAX or any mode you can think of.

If you don't like our *pre-set* filters, you can program your own -- *an MFJ exclusive!* Save center frequency/bandwidth, lowpass/highpass cutoffs, auto/manual notch and noise reduction --all filter settings-- in 10 *programmable* filters.

Only MFJ gives you the best of both worlds -- *tunable* filters to eliminate nearly any QRM and fast convenient *pre-set* filters customized for any mode.

Plus more . . .

A push-button bypasses your filter -- lets you hear the *entire* unfiltered signal.

Built-in two watt amplifier. Has volume control, input level control, speaker jack, headphone jack, accessory jack, PTT line and PTT sense and line level output. 9x2½x6 in.

It plugs between your transceiver or receiver and external speaker or headphones. Use 12 VDC or 110 VAC with MFJ-1315, $14.95.

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desired destination.

Clicking on the "Logging Screen" option from the main menu selects the default logging screen. I say "default" because this logging screen may be edified to show more or fewer fields, completely new user-defined fields may be added, and windows may be moved, resized or minimized. Photo A shows the logging screen that I edited to be my default logging screen. Since I work satellites, I added an "OSCAR" field to note what satellite I was using. I also added a "MODE" and "S-meter" reading fields to enable the collection of some specialized data. Since I am also active on fast-scan ATV, I added a "P-SENT/RCVD" field to record ATV signal report readings.

I like to use one logging screen for all my routine requirements. There is no reason, however, that separate logging screens for satellite operation or other specialized modes couldn't be created. With LOGic 4, Personal Database Applications supplies logging screens for all major contests. These are accessible from the main menu under the "Select Logging Screen" option. There you will find a menu-driven selection of contests, from "CQ World Wide" to the ARRL VHF Sweepstakes. If you should find a contest that is not included, an existing screen may easily be modified by the user and saved under the "Logging Screen Select" menu. For all contests, LOGic knows how to calculate multipliers and other unique contest parameters.

Another nice feature of all logging screens is that the fonts in most windows may be changed and resized. If you have obtained additional fonts for Windows (eg: Adobe Fonts), they may also be used with LOGic. Their selection is as easy as with any other Windows application: Simply click on the font type and click on the size.

The logging screens are attractive, colorful, and functional. There is a "Browse" window that emulates the *ARRL Logbook* format. It may be moved and sized to the preference of the user. In this window, the fonts may be changed and resized, allowing for a lot of data to be displayed. An individual QSO may be selected with the mouse, or by using the arrow keys to navigate. The "Browse" window also uses horizontal and vertical scroll bars to display data off the top or bottom of the screen.

The log screen itself may be configured by the user to display any data desired. The log screen is where the user actually enters the data applicable to a QSO. Upon entering a DX callsign, the LOGic system computes and displays a variety of information about the station. The long and short path headings, distance, location, time zone, third-party traffic restrictions, CQ zone, and many other attributes of the station are quickly and attractively displayed. As you enter data in the different fields, many entries are automatically edit-checked for validity and accuracy. You will be notified if you enter an invalid mode, or any parameter outside of the program specifications. The system can even warn you if you're outside the frequency limits of your license class. LOGic also interfaces to a variety of ham databases and will display in real time all available information about the station as soon as you enter the call.

I like to keep a lot of free-form notes about my QSOs. LOGic 4 has a "Notes Window" on the logging screen that may be selected by a click of the mouse. This window is accessible from anywhere on the logging screen, even if you are in the middle of logging a QSO. It may be resized and moved anywhere you want on the screen. A virtually unlimited amount of text may be entered. LOGic provides automatic text wrap and scroll bars if there is more text then can be displayed in the window.

The logging screen also displays a real-time clock in both local time and UTC. Finally, it includes a window to your TNC as part of a complete Packet Cluster Interface.

LOGic will interface to a TNC or multimode controller connected to either COM1 or COM2 (the on-line help also explains how to use COM3 & COM4). The system will use its awards table to notify you in real time of stations that are needed for DXCC, CQ zones, ITU zones, WPX prefixes and others. It will even filter the packet data through the band table to suppress announcements of stations that are outside of your license class. The extent of the filtering for this function is con-

trolled by the user. This data will appear in the Packet Cluster Window on your logging screen with an audible CW signal (or voice announcement if you have a sound card) for those stations that meet the selection criteria. LOGic also contains a terminal program useful for logging on to BBS systems and holding packet/RTTY/AMTOR QSOs if you are equipped with a multimode controller.

While I did not review this function, LOGic also contains a CW keyer that uses a parallel printer port (LPT1 through 3) via a simple interface. LOGic includes a schematic on how to build the interface in the on-line help! Alternately, you can purchase a completed interface from PDA.

Complete control of most transceivers capable of computer interface is included in LOGic. Between the documentation and online help there is a wealth of information that should enable this to be accomplished without undue hardship. I was impressed with the detail that PDA included in support of this function. They even included a transverter offset to enter/display the correct frequency for those rigs driving a VHF or UHF transverter.

Finally, LOGic will interface with any antenna rotor with an RS232 interface. If enabled, it will automatically point your antennas along the short or long path as displayed on the logging screen. There is also a table to hold user-definable azimuth offsets to compensate for coupling between antennas on the same boom or non-standard antenna patterns.

Awards Tracking and Reports

Awards tracking with Logic 4 is almost too easy! Click on the "LOG" option from the main logging screen and select "Awards Tracking." You will be presented with a pull-down menu of award categories (LOGic tracks all known awards and user-definable awards may be added). Click on the award whose status you need to know and a "Progress Summary Modification" menu is presented. Here you can modify the filtering criteria for the award (e.g.: single-band WAS vs. summary of all bands). Select your modifications (or leave it blank for all-band/all-mode summary) and press <enter>2. A window pops up displaying all necessary statistics. Here are my stats for Worked All States (Gee . . . not too good for 21 years of hamming!)

Worked	49
Confirmed	43
Worked (QSL pending)	0
Worked (no QSL requested)	6
Worked (unconfirmed)	6
Unworked	1
Total Uncomfirmed	7

While this data may be displayed in real time on the screen, LOGic also allows the user to generate various hardcopy reports for all known amateur awards! These reports are attractively formatted and will be indispensable to the serious certificate hunter.

Finally, on the subject of reports: LOGic will print your logbook, awards, and other statistics in virtually any format that you wish. The system comes with a variety of "canned" reports that will satisfy 99.9% of even the most serious operators. However, all reports may be modified in format and content with mouse-driven point, click and drag commands. All reports may be edited and previewed in true "What You See Is What You Get" graphical format. New reports may also be created with virtually any information entered in LOGic displayed.

PDA also offers a QSL route list. This option is a database of QSL managers that is automatically accessed in real time as you enter a DX call into your log. It contains over 28,000 QSL managers and addresses.

Summary

There is simply not enough room for this article to completely cover all aspects of LOGic. PDA has entered the marketplace with a state-of-the-art Graphical User Interface (GUI) system of amateur radio control that will set standards of performance. Functionally and cosmetically, LOGic met or exceeded all of my expectations and would be a real asset to any computer equipped ham shack.

LOGic 4 Windows is $99; LOGic 4 DOS is $79. If you purchase the Windows Version, the DOS version may be purchased for an additional $20. There are also upgrade prices from earlier versions. 73

73 Review

Number 10 on your Feedback card

by Jeff M. Gold AC4HF and Michael A. Czuhajewski

S & S Engineering's PC-1 Programmable Counter Kit

S & S Engineering
14102 Brown Road
Smithsburg MD 21783
Telephone: (301) 416-0661;
Fax (301) 416-0963
Price Class: Without case—$69.95;
With case—$99.95;
Assembled—$139.95

A low-cost, add-on frequency counter you can build.

I work hard and I play hard. Many times my play centers around ham radio. I find building very relaxing. Sometimes I work so hard that although I really feel like building something, I don't feel like tackling a large project. At times like these I really enjoy building station accessories. I have an HW-9 QRP transceiver that I built. It has the extra WARC pack so it covers eight bands. The analog dial is fairly accurate on most of the bands, but not all. When arranging schedules it is often nice to know exactly where I am. A digital readout that could sit on top of the rig was just what I wanted.

S & S Engineering puts out top-quality kits. They use top-quality parts and provide excellent clear instructions. They have recently come out with the PC-1 programmable frequency counter kit. This counter was designed to provide builders and experimenters with a low-cost counter which can be programmed to start its count at any desired figure. It can also be programmed to count either up or down, and to suppress or not suppress leading zeros. There is an option for AC power and a super-sturdy extruded aluminum case. When the counter is built and put in the case it makes an excellent external digital display.

S & S takes great care in preparing their kits. Parts are packaged separately and clearly labeled. It is usually a good idea when you first get a kit to take out the parts and separate and label them. This helps avoid putting parts in the wrong place on the printed circuit board (one of the two leading causes for failure of the kit to operate properly once built.) It also allows you to check off the parts and ensure all have been included with the kit. I found that with the way the parts were packaged, I didn't have any need to separate them any more than had already been done. I even found that the IC chips were placed on the foam packing in the order in which they were to be placed on the printed circuit board. Since separating out parts is not something I enjoy, all this made the kit more enjoyable to build.

The printed circuit board is of the absolute highest quality. It is solder-masked on the bottom, which almost eliminates the possibility of solder bridges (the other major cause of kit failure.) The silk-screening is excellent, which makes parts placement much easier. The board also has plated-through holes, making it easier to solder. The solder almost seems to get sucked up into the holes. It also makes for much more secure solder joints. The downside is that you must be much more careful placing parts: With plated-through holes it is much harder to remove a part once it is soldered on the board.

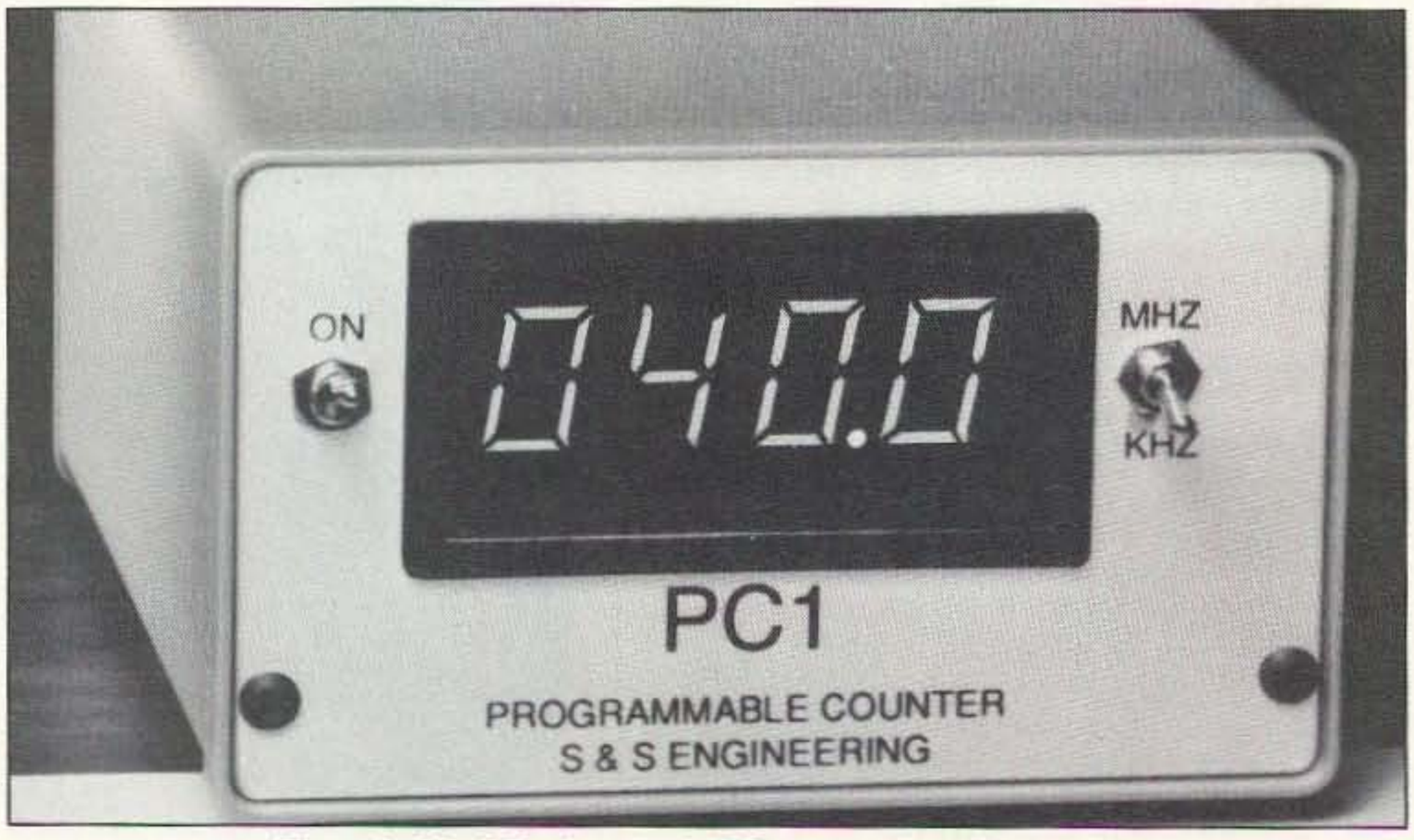

Photo A. S & S Engineering's PC-1 programmable counter.

Another area of detail that makes a kit more pleasurable to build is the quality and clarity of the instructions. I would rather have almost no instructions and a schematic than confusing instructions. S & S provides very clear instructions. The instructions are divided into an introduction that tells you how to get started and the options you have to build the kit as a counter with the display attached to the board, or how to separate the display if you are going to use the counter as a frequency display for a rig. There are then two pages of building instructions. They aren't in the Heathkit form that tells you which hand to hold the wire in, but they are very complete and clear. Next come two pages of alignment instructions. You only need to set one variable capacitor to get the frequency correct at a test point. Next, you set the DIP switches in various positions and test out the functioning of the counter. If you are going to install the counter in a case, instructions are provided for that. I installed mine in one of the S & S cases to use for a display for the HW-9. There are six pages of instructions on how to operate and program the counter for use with various types of VFOs and for different applications. There is also a page on theory of operation. I always appreciate this information as I am continually trying to learn more about how things work. There is a very clear page that shows the parts placement on the PCB (printed circuit board), nice schematics and detailed parts description sheets. I use the parts description sheet as I am placing the parts on the PCB.

I found building the kit to be a total pleasure. The parts count is relatively low and the quality and preparation that S & S has put into the kit really adds to the enjoyment of building it. I did not encounter any problems

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First-rate electret mic element and full size speaker gives superb audio on transmit and recieve. Earphone jack, PTT, lightweight retractable cord. Gray. 1¼x2x3 in.

MFJ-284 fits Icom and Yaesu.
MFJ-286 fits Kenwood.

MFJ-284 or MFJ-286
$24.95

Mini Speaker/Mics

These **tiny** *MFJ Speaker/Mics are so small and so lightweight you'll forget they're there -- until you get a call.*

Excellent audio from electret mic element and speaker. Has swiveling lapel /pocket clip, PTT button with transmit LED, earphone jack, lightweight retractable cord. Available with L or regular connector. *Tiny* 2x1¼x¼ in.

Order MFJ-285/MFJ-285L for ICOM, Yaesu, Alinco; **MFJ-287/MFJ- 287L** for Kenwood; **MFJ-283** for split plug Alinco; **MFJ-285W** for IC-W2A.

MFJ-283, MFJ-285, MFJ-285L, MFJ-285W, MFJ-287 or MFJ-287L
$24.95

L Connector also available - order L model.

MFJ Artificial RF Ground

IFJ-931
79.95

Creates tifical RF round that eliminates or reduces RF ot spots, RF feedback, TVI/RFI, weak gnals caused by poor RF grounding.

Greatly improves your signal if ou're using a random wire or longwire ntenna with an ineffective ground.

Electrically places a far away RF round directly at your rig by tuning t reactance of connecting wire.

20 Meter CW Transceiver

IFJ-9020
.79.95

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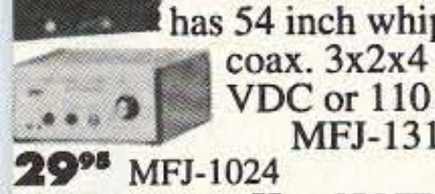

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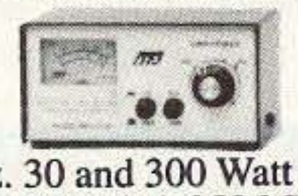

Covers 2 Meters and 220 MHz. 30 and 300 Watt scales. Relative field strength 1-250 MHz, SWR above 14 MHz. 4½x2¼x3 in.

Code Practice Oscillator

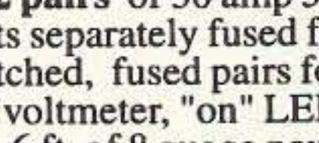

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Photo B. The completed PC-1 used as a digital display for the author's HW-9. (Photo by AC4HF.)

with the instructions or with parts not coming with the kit. If you run into any problems you will find the folks at S & S to be a great and friendly source of help.

Technical Description

Operation is straightforward and, for the most part, similar to other counters. The input signal is conditioned a bit, then allowed to pass to the counting circuitry during a precisely controlled sample period. The results are then displayed with four digits, in either MHz or kHz format. Unlike most counters, the PC-1 can also be used as an external digital display with any VFO-controlled rig.

After a bit of preliminary division, counting is done by a 7217A chip, which also drives the readout. A switch toggles the display between MHz (00.00) and kHz (000.0). Since the PC-1 is intended mainly as a digital display, it has provisions for presetting the counter chip. Normally, a counter would start at zero and increment as it counts a signal. However, many rigs use a mixing scheme to generate signals, with the VFO at something other than the operating frequency. To accommodate "odd" VFO frequency ranges, the starting count can be offset from zero; this programming is done with DIP switches, and is explained in detail in the manual. The PC-1 can, of course, also be used as an ordinary counter by leaving the offset at zero.

In some cases, a VFO might tune backward, i.e. decrease in frequency as the output frequency increases; another dip switch lets the PC-1 take this into account. Finally, the user can turn off leading zeros in the display (although the manual recommends against that, to avoid confusion).

The signal from the input jack is applied to a resistor and a pair of diodes to provide protection for the input circuitry. It then goes through three transistors—an emitter follower buffer amplifier, a stage of gain, then another buffer. Next, it is applied to a divide-by-two counter; the output of this stage is allowed to pass for the duration of the 200 millisecond gate period. The 200 ms sample of the input frequency is then passed to a divide-by-10 counter, followed by a divide-by-100 stage. Depending on whether the MHz or kHz

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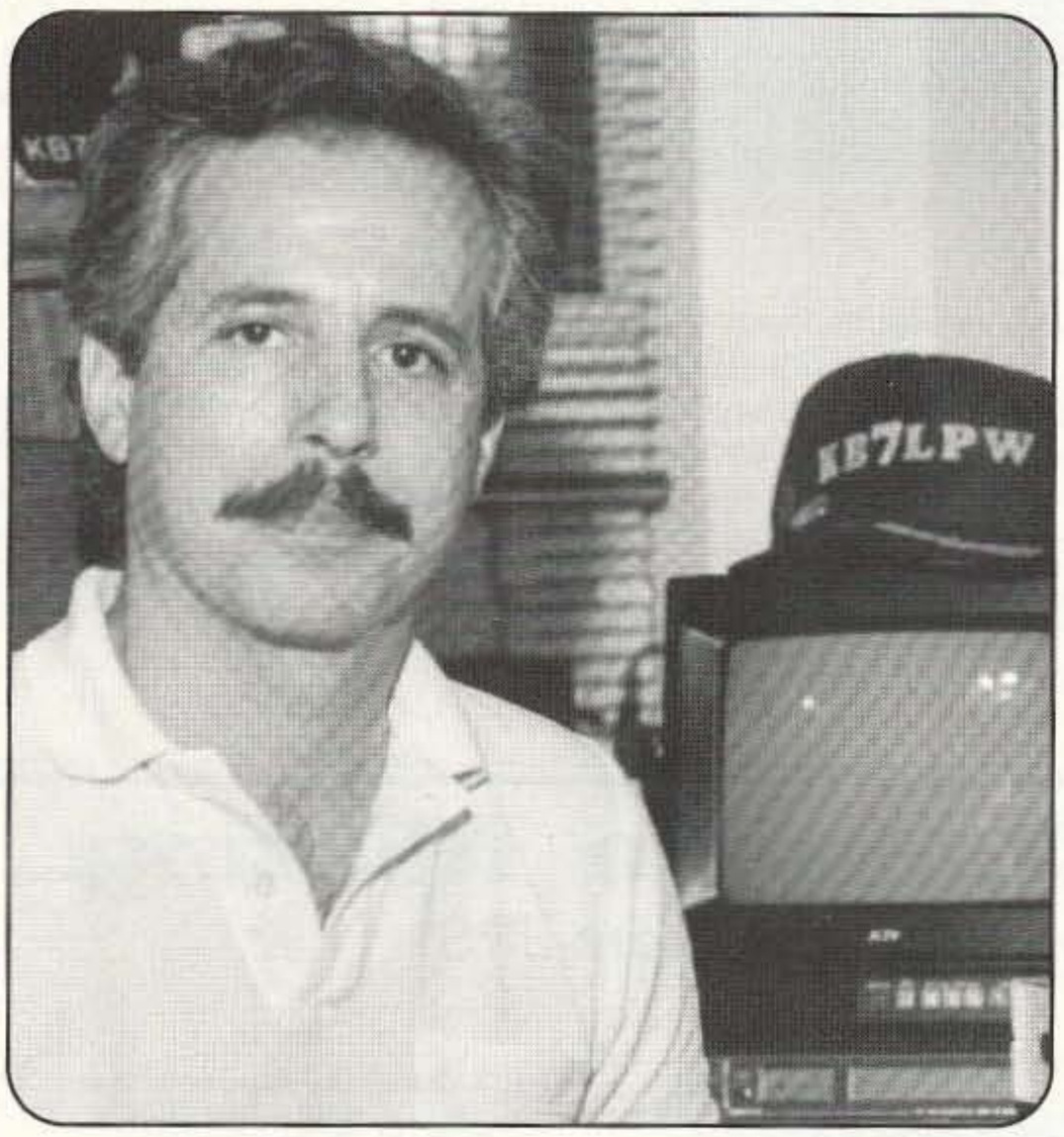

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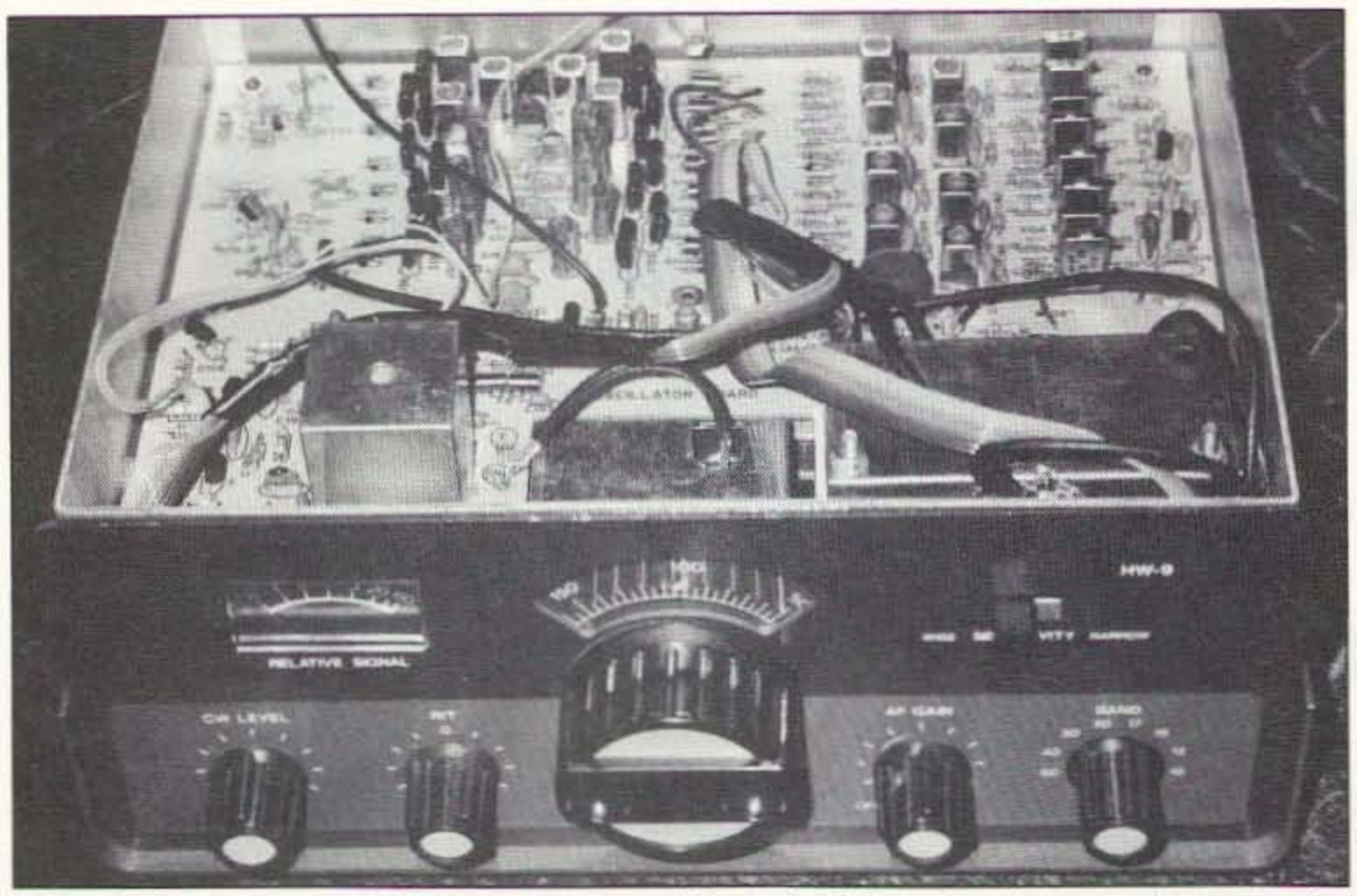


Photo C. Only one wire (which you can see exiting at the left rear) and a ground were needed to connect the PC-1 counter to the HW-9.

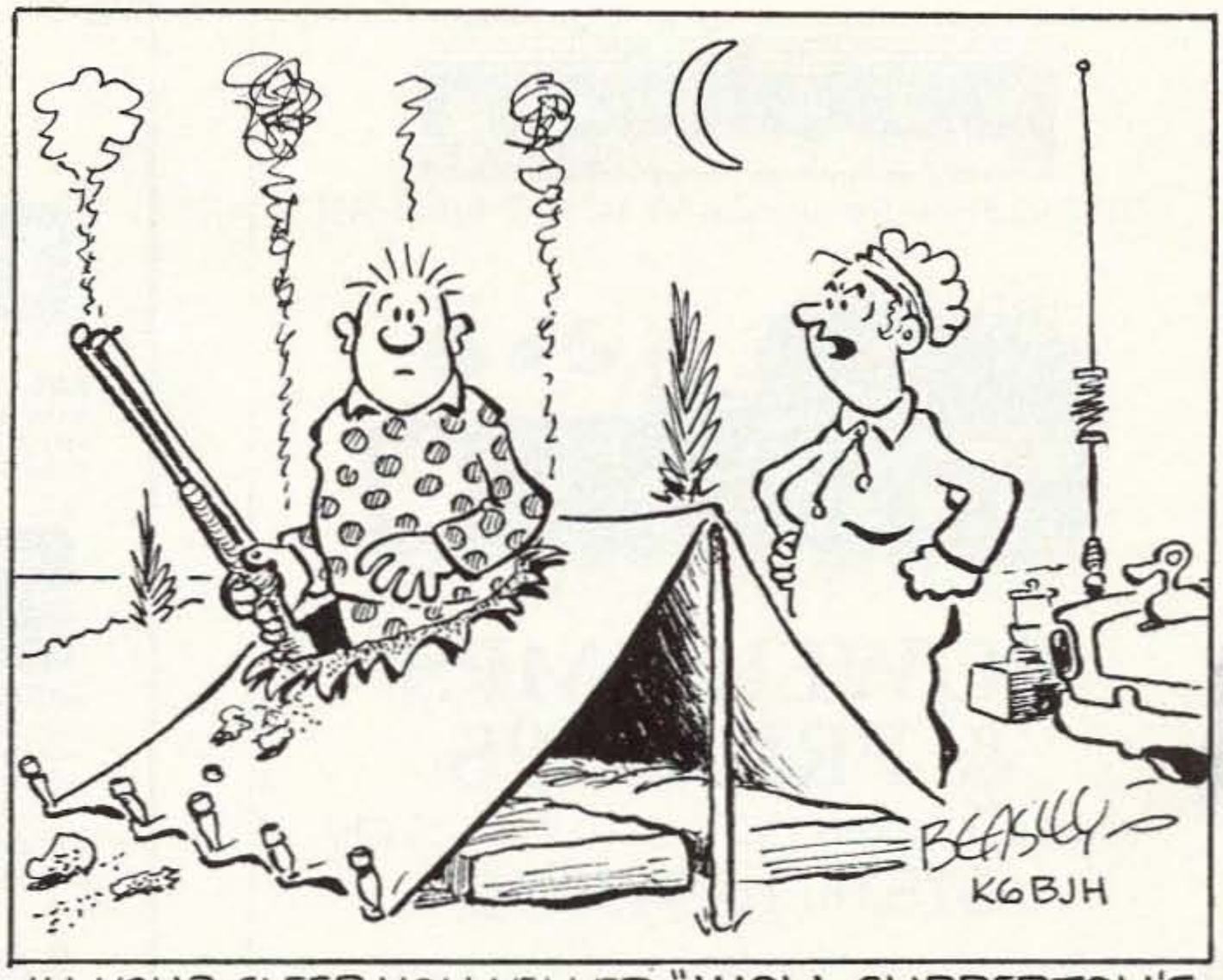
display is selected, the signal from either the input or output side of the divide-by-100 stage will be fed into the counter/display chip. The signal is then counted and the results are displayed.

The sampling period is developed by a 4.096 MHz crystal and a 4060 oscillator/divider chip. Its output of 250 Hz is further divided to provide the 200 millisecond gating pulse. Adjustment of the oscillator requires another counter or a synthesized general coverage receiver capable of tuning to 4096 kHz. Unlike many counters, its timebase cannot be compared directly with WWV. DC voltage of 7 to 15 is required to power the PC-1, with an internal three-terminal regulator dropping it to 5 volts. Nominal current draw is about 120 milliamperes. With the AC option, it may also be powered from 6.3 to 12 VAC.

Using the Accessory

After I went through the alignment and checkout procedure, I was anxious to try my display on my Heathkit HW-9 QRP transceiver. I want to keep my HW-9 in original condition, so I am careful to make sure any modifications I do are easily reversible. I wanted to attach the PC-1 without drilling any holes or changing any wiring if possible. I decided I could run the one necessary wire into the rig by leaving out one of the case screws and hook the ground for the counter to a grounded case screw in the rear of the rig. I soldered the counter wire to a test point in the rig and read the frequency. Using my main station rig and another counter as checks, I determined the frequency the HW-9 was actually on. I next followed the programming instructions provided in the S & S documentation and programmed the counter to read the actual operating frequency.

It worked great. I now know exactly where I am on any band. I love turning on the display and tuning across the band. One of the nice things about ham radio is having these flashy gadgets to watch as you are operating. The counter works great and it was worth the price simply for the enjoyment of building the kit. 73



IN YOUR SLEEP YOU YELLED "WOW, CLIPPERTON'S COMING IN, WHERE'S THE MIKE?" GRABBED THE SHOTGUN, AND SQUEEZED "THE PUSH-TO-TALK!"

HAM HELP

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Anyone needing a QSL from WA9KAG can get one from N9OZW (his son). WA9KAG became a silent key on 18 Sept. 1994. Please include QSO info and SASE. *Pat Malott N9OZW, 1515 W 1000 N, Laporte IN 46350.*

NEEDED: Any manuals or programming information for ROCKWELL-COLLINS HF-281. I am willing to pay copying and/or postage costs. Thank you. *Art Kenck WA7STB, 2452 Skyline Dr., Salt Lake City UT 84108, Tel. (801) 583-1519.*

I am trying to locate Heriberto Sanchez TI5HK, who resided in St. Louis MO in 1958. *Nate Williams W9GXR (ex K0CHE), 6915 Prairie Dr., Middleton WI 53562.*

Does anyone have an address for Electro-Voic Inc. of Buchanan MI? I am also looking for information on a log-period that covers 6m and up. Thank you. *Noel P. Larson, HC86 Box 3860, Merrifield MN 56465.*

I am trying to locate Radio or Radar Techs who served at Site #12, Sakata, Japan. *Roger Freeman, 2134 Allegheny St., Duluth MN 55811-3210. Tel. (218) 722-6890.*

WANTED: To complete my collection: February 1989 issue of *73 Magazine*. I will pay postage and a fair price for the magazine. Thanks. *Sieb Klaassens VE3JUA, RR #3, Elmwood ON, Canada N0G 1S0. Tel. (519) 369-3262.*

I need a tube 4QP2 or 4QP31 for an older Army-Scope. Offers by mail or FAX to *H. Schroeter DK3VF, Moorfleeter Deich 503, 21037 Hamburg, Germany. Tel/Fax: 040 / 7374246.*

NEEDED: Instructions to convert the RADIO SHACK Handheld Realistic FM Transceiver (49 Mc.), Model TRC-505; Cat. #21-405, to the 6 meter ham band. I will pay for magazine or copy, and postage. Thanks. *John Wora K2KFG, So. 4907 Clifton Pkwy., Hamburg NY 14075-3341.*

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ATV Christmas Present

'Twas the night before Christmas and all through the house not a creature was stirring 'cepting me in my shack. When all of a sudden there came such a clatter, from out of the speaker came 2 meter chatter. With visions of DX dancing 'cross my eyes, I tuned up my TV and was quite surprised! There were Iowa, Missouri, Illinois and Wisconsin; Ohio, Indiana, Kentucky and PA; New York, Arkansas and Michigan too; it was certainly an ATV dream coming true!

The Big Opening

As some ATVers put it during the marathon band opening that began Christmas Eve and continued for three straight days, this had to be the Granddaddy of ATV band openings; conditions not seen since the great opening of Thanksgiving '86. Although contacts exceeding 2,500 miles have taken place over water (Hawaii/CA—the Great-Granddaddy of openings), it's pretty rare for contacts exceeding 500 miles to take place over land. These contacts took place with regularity during this opening with signal levels often approaching P5.

The 2m ATV calling frequency (144.34 MHz) sounded like 20 meters during a rare DX pile-up. Video was flying fast and furious on 439.25 MHz over a several-state area stretching from Arkansas and Missouri all the way east to western New York State.

There was a large high pressure area centered over the region that produced clear, cold weather conditions with nearly 100% humidity and no wind. Thick layers of frost settled over everything and a dense fog formed over a large portion of the Midwest. This set up an incredible tropo condition that slowly worked itself toward the east over the next few days. Christmas Eve saw many contacts between Ohio, Michigan, Indiana and Illinois, as well as Iowa to the west. During Christmas Day, Tom Para WA8ZAH in Cincinnati, Ohio, worked Elmo Knoch K4YWL in Osage, Arkansas, with nearly P5 pictures exchanged (a distance of 540 miles; see Photo A).

The opening never seemed to die out even during daylight hours and really stretched out on Monday night and into the wee hours of Tuesday morning. The most notable contacts were between Dave Williams WBØZJP (O'Fallon, Missouri) and Jim Dallas KA3FZF (Monroeville, Pennsylvania), with P4 to P5 signals over a 594-mile path (see Photo B), and between WBØZJP and KA8VWV in Moundsville, West Virginia, (P2 levels) at 535 miles.

Many ATV repeaters could be seen across the region; it was quite fascinating to watch the DX rolling through a repeater that was hundreds of miles away. There was even one report that the Columbus, Ohio, ATCO repeater was seen in Nashville, Tennessee.

By Tuesday evening there were dozens of ATVers still active (most with cases of severe sleep-deprivation). This time contacts were made in a mostly north-south path between Michigan, Ohio, Kentucky and Penn-

Photo A. Tom WA8ZAH in Cincinnati, Ohio, and Elmo K5YWL in Osage, Arkansas, exchanged nearly P5 pictures during Christmas Day over a 540 mile path. Off-the-air video digitized by Tom WA8ZAH.

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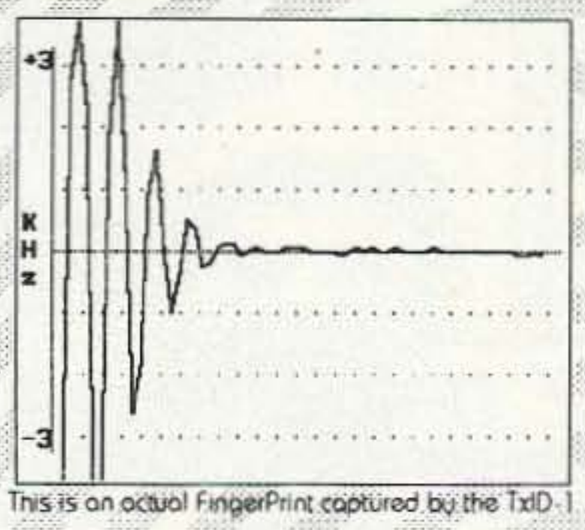

This is an actual FingerPrint captured by the TxID-1

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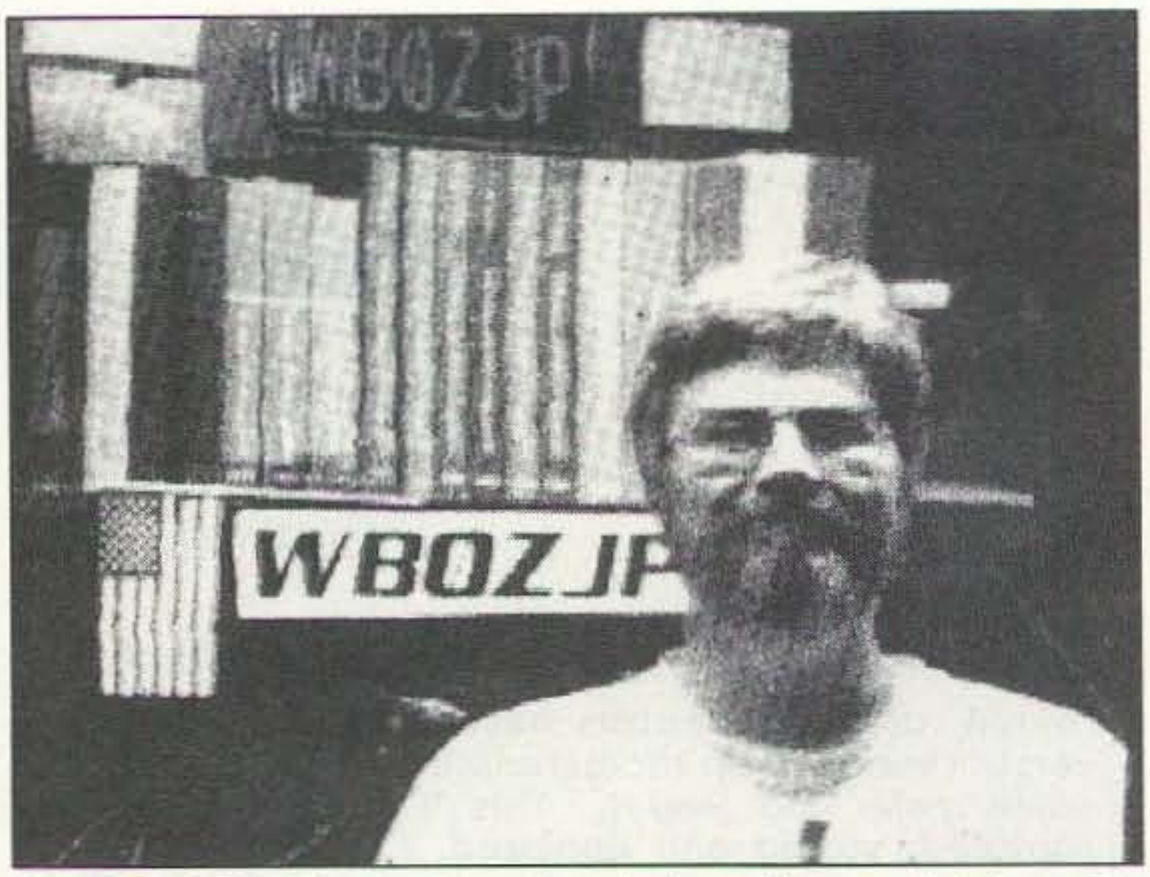

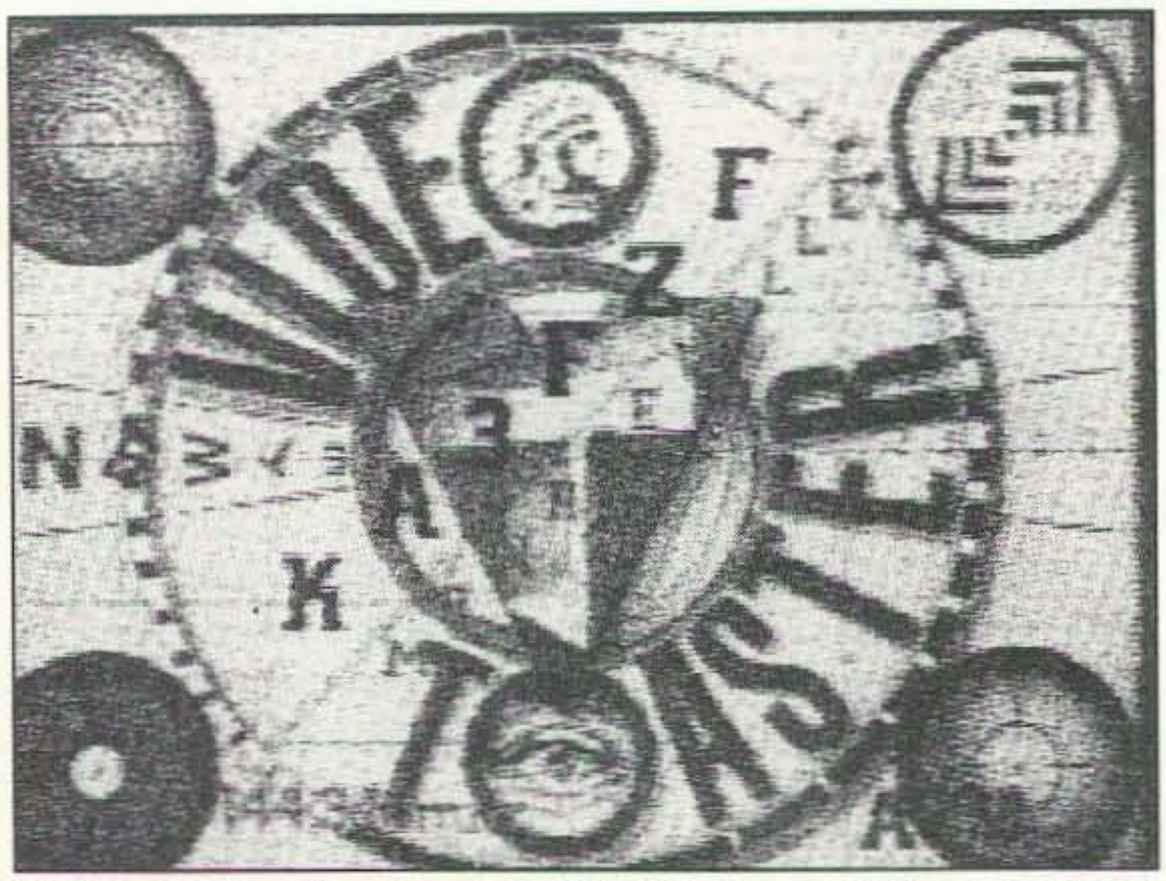

Photo B. This 594-mile contact, a new overland record, was made between Dave WBØZJP in O'Fallon, Missouri, and Jim KA3FZF in Monroeville, Pennsylvania, during the height of the opening. (Photo by Tom WA8ZAH.)

sylvania. I was having fun working through the WA4GSS repeater in Huntington, West Virginia. It was great to watch the local ATV gang, sending pictures through a repeater over 200 miles away (round-trip distance of 400 miles). Just before midnight a front moved through the area and the band finally slammed shut! It had been quite an adventure and once everyone catches up on their sleep I'm sure they'll be looking forward to the next big DX adventure.

DX Hints

You don't need a super-station to work DX. Paying attention to a few details when building up your ATV shack will help you reel in the rare ones. The number one key to success, in my opinion, it to put the most effort into your antenna and feedline. Sticking your antenna above the treetops and using a decent type of feedline (9913-type or hardline) will vastly improve your reception. Cheap hardline can be usually had for the asking at your local cable TV office. They have lots of surplus end runs that they'd love to have you take away. You can then use matching sections (ZD Engineering, 419-424-8765, makes an economical version) to transform the impedance to 50 ohms. In the Midwest, mount your antenna horizontal for most DX work.

One trend I've seen in areas that have ATV repeaters is the tendency for newcomers to fix a low-gain antenna at the repeater. These stations will be left out in the cold during a band opening, seeing only the very strongest stations that happen to make it through the local repeater. It's well worth adding a rotator to your antenna, even if it's only the cheapest type available. In those areas with vertically polarized repeaters, one trick I've used with great success is to mount my antenna to a U-100 type rotator that actually flips the antenna sideways to change polarization. I now have the best of both worlds and can easily change from repeater reception to DX with the flip of one rotor control.

Also pay attention to large high pressure conditions with clear, still nights and high humidity. The best conditions seem to occur during late evening and just before sunrise. I've seen some truly amazing openings occur at 3 a.m., but there's usually no one to work! I always check out the lower UHF commercial channels, if you see lots of new channels coming in strong, it's time to check out the ham TV band!

The large number of participants in this opening can be attributed to the holiday season (lots of ATVers home in their shacks) and to the use of a single ATV calling frequency on 2m (144.34 MHz). If you live in or near the Midwestern part of the country, give a listen to 144.34 and you might be in for a real surprise! 73

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HAMSATS

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knights Way Drive
Houston TX 77083

A New Russian Star

On December 26th of last year, RS-15 became our newest amateur radio satellite. Launch was from the Baikonur Cosmodrome, 1,200 miles southeast of Moscow, near Tyuratam, at 0300 UTC. The launcher was a three-stage "Rokot." The first two stages came from a modified SS-19 intercontinental ballistic missile, while the third stage was a new booster called "Briz." Rumors of the impending launch of RS-15 have been circulating for years. The long wait is over.

RS-15 carries a single Mode "A" transponder with the standard 2 meter uplink and 10 meter downlink. The uplink passband is from 145.858 to 145.898 MHz, while the downlink spans from 29.354 to 29.394 MHz. The transponder output power can be varied with a maximum output of 5 watts. There are two telemetry/message beacons on the craft, one on 29.352.5 MHz and the other on 29.398.7 MHz. Power output of the beacons can be set at 400 mW or 1.2 watts.

The satellite is spherical and just over a yard in diameter. The system is built on a structure similar to the popular RS-3 through RS-8 satellites. It weighs approximately 154 pounds and has no orientation or stabilization systems. Early observations indicated that it was spinning about 34 times per minute shortly after launch.

Who Built It

The radios and control circuitry for RS-15 were built by a group of radio amateurs in Kaluga, 112 miles southwest of Moscow, under the direction of veteran satellite designer Aleksander Papkov at the Tsiolkovskiy Museum for the History of Cosmonautics. Valentin Yamnikov at Nilakt Posto (Aero-cosmic Laboratory) in Moscow provided coordination for the effort.

Control of the spacecraft is implemented by the RS3A control station in Moscow, headed by Leonid Maksakov and sponsored by Unicom in Russia and UTC in Rhode Island. RS3A is also the control station for RS-10/11 and RS-12/13. Reports and comments can be sent to RS3A at P.O. Box 59, Moscow 105122, Russia. They also have the packet address of RS3A @ RS3A.MSK.RUS.EU and the Internet address of regroup@olymp.msk.su. If all else fails, use the FAX with appropriate prefix: 7-095-916-2949.

A Tall Orbit

Although RS-15 has an orbit that classifies it as LEO (Low Earth Orbit), this satellite is the highest operational hamsat of its type. The *MIR* space station flies at just under 250 miles. *DOVE*-Oscar-17 has twice the height at almost 500 miles. The other RS systems, RS-10/11 and RS-12/13, orbit near 620 miles but RS-15 tops them all with a mostly circular orbit near 1,250 miles. *Kitsat*-Oscar-23 is the next highest LEO hamsat at 815 miles.

RS-15's high altitude requires nearly 128 minutes per orbit. The *MIR* space station takes less than 90 minutes for one revolution.

Another feature of RS-15's orbit is the inclination. It is 65 degrees. A polar orbit is near 90 degrees, while an equatorial orbit is at zero.

The high altitude means more passes per day for a given location, more time per pass and the possibility for better DX. The 65-degree inclination changes the pattern of the orbits with respect to timing of passes and the path across the sky. Polar-orbit satellites travel from pole to pole. RS-15 may often track like a polar satellite until it reaches higher latitudes when it begins an apparent curve.

RS-15 is not in a sun-synchronous orbit. This means that it does not come by at the same time each day. Over a period of weeks orbits over a given location will occur a few hours earlier. For satellite users the situation is not bad since RS-15 is in view for many passes each day.

Telemetry

Those monitoring the CW telemetry beacon on RS0-15 during the first weeks after launch were treated to the following message: CQ CQ CQ DE RS15 AND RS3X MERRY CHRJSTMAS AND A HAPPY NEW YEAR. The spelling may have been a bit off, but the message was clear and the results delightful. RS-15 would provide new opportunities for satellite enthusiasts and was an excellent Christmas present.

Along with the message, telemetry can be heard. The basic format is 16 groups of letters and numbers. A typical line of four groups might copy as: IIR43 INW13 IAR45 IMW45. Each group is composed of three letters and two numbers. The separator "RS15" is sent at the beginning of each set of 16 groups.

Decoding details were not available in the first few weeks after launch, but when available can provide important data for those interested in monitoring the satellite's health.

Many parameters are measured, including power output, temperatures of various modules and voltage/current levels at important points in the system. The letters in each group usually signify the status of a system, while the numbers provide a related measurement. Simple equations are used to convert from the two-digit value to degrees C, volts, amps or watts.

Some European observers have heard transmissions that sounded like high-speed data. These transmissions from the satellite have not been at regular intervals and are likely activated by the ground command station RS3A.

Early Activity

The first reports of signals from RS-15 came from Europe. Oscar DJØMY monitored RS3A using CW and calling "CQ" in the transponder passband less than 12 hours after launch on December 26th. Oscar later made an SSB contact with a station in the Canary Islands.

U.S. contacts through the satellite were reported later between N2NRD and K6GZ. Others began hearing of activity through the new Russian hamsat and joined in to make contacts or study the orbit.

Those making contacts through RS-15 found that signals were not strong. The beacon on 29.352 MHz was much louder than signals in the passband. Observers were hopeful that the system was simply set for a low power setting on the transponder until check-out by ground controllers was complete.

As with almost all other new ham satellites, orbit determination was a guessing game. The best early element sets for RS-15 came from a ham and not NORAD. Ken N2WWD provided data for tracking programs that gave better signal acquisition and loss predictions than others.

Several sets of NORAD data were tested and posted to the Internet and amateur-radio CBBSs. About a week after launch one ham observed that, "I have now received over 20 some sets of KEPs for RS-15 to date from everyone and his brother, and none of them are correct . . . What gives?"

After many fit tests a set of elements will be defined and identified as those of RS-15. They will then become a part of the orbital postings from AMSAT to the Internet and packet-radio network. It took many weeks to sort out RS-3 through RS-8 when they were launched together on one booster in December 1981.

Working RS-15

Two approaches can be taken for RS-15 work. The first is to treat it like the other current RS-series hamsats and use simple antennas and gear. The second is to consider it as a vehicle for low-earth orbit DX.

The typical setup for working RS-10 will do well for RS-15. Using a 2 meter system capable of about 100 watts ERP (effective radiated power) coupled with a 10 meter receive system employing a dipole or ground-plane antenna, contacts can be made with relative ease. Operating through the satellite when it is near the horizon though will be difficult. Some of those low, horizon-grazing passes or brief moments at the edge for a higher-elevation pass can yield great DX for the properly equipped.

To put together a Mode "A" DX station, better antennas and some height are needed to get the most from RS-15. A good view of the horizon is necessary. A good DX station will have a three-element, 10 meter yagi at 30 feet or higher with at least a seven-element, 2 meter yagi just above it. A quiet 10 meter preamp and quality feedline also help.

To pursue DX via RS-15 the orbits must be studied. Passes should be checked from both the home location and the DX area of interest. Sometimes slightly sub-horizon passes can provide surprising results if conditions are right. Avid DX chasers may not even bother with elevation rotators.

Whether you put together the ultimate Mode "A" station, or just try your hand at casual contacts via the new satellite, it will be worth it. RS-15 provides another "easy-sat" for newcomers and more opportunities for fun contacts and serious satellite study for long-time enthusiasts.

Congratulations to the RS-15 crew in Russia and thanks for the Christmas present. 73

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Some Ham-Type Products

Every now and then I like to take a look at some products that might interest readers of this column. I don't do it very often, but every now and then the urge strikes me. I don't look at transceivers and other major pieces of equipment that *73* has covered elsewhere anyway, but I do look at minor equipment and things of use to the workbench ham/hobbiest builder. This month we take a look at some of each class.

RF Shielded Boxes

At one time I loathed small RF electronic projects above about 75 meters because they were "too hard," but as I grew in confidence I learned a few things about RF construction (e.g. layout, grounding, shielding, etc.), and found that by following the rules, one can be as successful building RF stuff as at lower frequencies.

One problem that has always been something of a hassle, however, is the shielding that's required. One could learn layout and grounding, but shielding usually required a better box than I had. Most of the low-cost aluminum electronic hobbiest boxes on the market are OK for DC to the AM broadcast band, but as frequency climbs into the HF and VHF region problems begin to surface. What you thought was shielded "ain't." If you've read this column or my feature articles over the years, you will recall that I caution RF constructors to use the kind of aluminum box with an overlapping flange of at least 0.25", and a good tight fit. Many hobbiest-grade boxes on the market just simply aren't good enough.

Enter SESCOM, Inc. (Dept. 73-JJC, 2100 Ward Drive, Henderson, NV 89015-4249; 702-565-3400; for voice orders only, 1-800-634-3457; for FAX orders only, 1-800-551-2749). SESCOM makes a line of cabinets, 19" racks, rack mount boxes and RF shielded boxes. Their catalog, "Constructor's Hardware for the '90s," has a lot of interesting items for radio and electronic hobbiest constructors. I was particularly taken by their line of RF shielded boxes. Why? Because it seems that RF projects are the main things I've built for the past five years.

Photo A shows one of the SESCOM RF shielded steel boxes in their SB-x line. Note that it uses the "finger" construction in order to get a good RF-tight fit between the lid and the body of the box. Note also that the box comes with some snap-in partitions for internal shielding between sections. The box body is punched to accept the tabs on these internal partitions, which can then be soldered in place for even better stability and shielding.

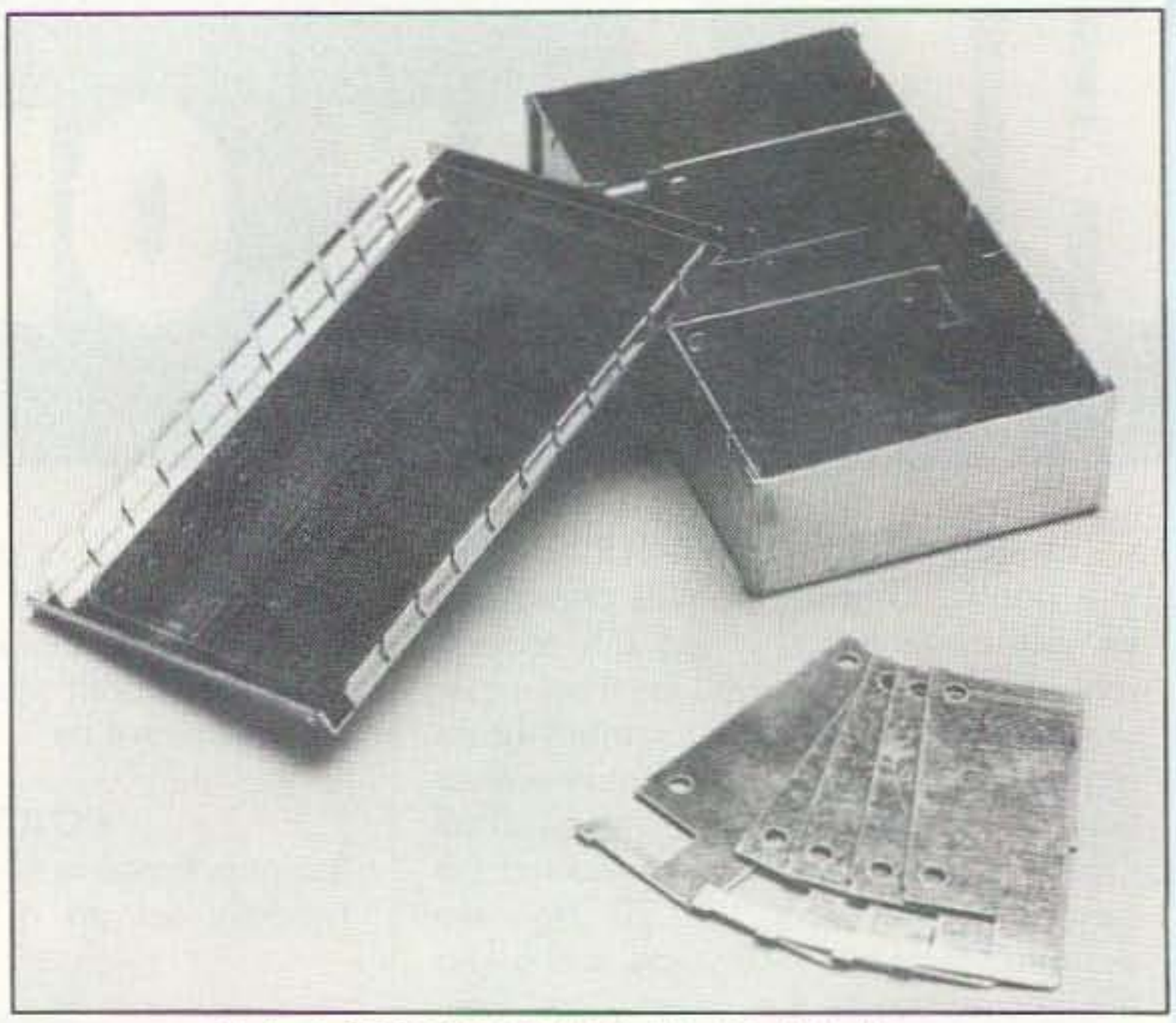


Photo A. SESCOM RF-tight hot tin plated steel boxes.

At first, I was a little concerned about the material the boxes are made of—hot tin-plated steel. The tin plating makes soldering easy, but steel is hard on drill bits. I found, however, in experimenting with the SB-5 box supplied to me by SESCOM, that a good-quality set of drill bits had no difficulty making a hole. Sure, if you use old, dull drill bits, and lean on the drill like Attila the Hun, then you'll surely burn it out. But using a good-quality, sharp bit, and good workmanship practices making the hole, and there shouldn't be a real problem.

The boxes come in eleven sizes: 2.1" x 1.9" footprint to 6.4" x 2.7" footprint, with heights of 0.63", 1.0" or 1.1".

Prices range from $4.50 to $13.20 . . . which compare quite favorably with the prices of the better quality aluminum boxes that don't shield so well at RF frequencies.

SESCOM also makes chassis feedthrough capacitors that can be used to carry DC power into the boxes, as well as control lines, low-frequency signals and so forth (in or out of the box). Two models are offered: FTS-1 is a 1000 pF/50 WVDC solder-in type ($0.85 each), while FTSI-1 is a screw-in type of the same ratings ($3.50 each). If you've priced screw-in feedthrough capacitors recently, you'll find out why they give them the fancy name "EMI filters" . . . a $6 price tag! The SESCOM prices are considerably bet-

Photo B. MFJ Voice Keyer.

ter, especially for a guy like me who buys them by the 10-lot or score-lot (that's 20 of 'em for you who think "score" means something else).

Voice Keyer

The literature that comes with the MFJ Enterprizes, Inc. (P.O. Box 494, Mississippi State, MS 39762; voice 601-323-5869; FAX 601-323-6551; and, orders only, 1-800-647-1800) model MFJ-432 Voice Keyer (Photo B) asks: "Ever wondered what kind of tricks you could pull if you had a clone? . . . Now you can have a cloned voice with the new MFJ-432 Voice Keyer." With the Voice Keyer you can operate a long contest weekend without having your voice crack (instead of "CQ Contest . . . " you start sounding like "Ceeech koo context" after the first 12 hours). The Voice Keyer will store up to four messages of 20 seconds each. The messages are stored in an EEPROM, and will last up to 10 years without a back-up battery.

The Voice Keyer is inserted in the line between the microphone and the mike jack on your rig. Internal jumpers let you customize the Voice Keyer to your rig (Kenwood, Yaesu and ICOM configurations are supported).

The Voice Keyer costs $99.95. It has a built-in speaker for monitoring the messages off-the-air, and a jack for remote control operation. It operates off a 9-volt battery (not included) or from 110 VAC with the MFJ-1312B adapter ($12.95).

Morse Code Tutor

I know Wayne has bad-mouthed the code, but I'm a dyed-in-the-wool CW fan, and (although out of practice) got pretty good at it at one time. If you want to learn the code, either for an FCC examination or for the pure heck-of-it, then the MFJ-411 Morse Tutor (Photo C) might the "key to success" (I couldn't resist that pun, sorry). The MFJ-411 Morse Tutor allows you to learn code letters and numbers by association and relation, yet it also has a word recognition mode (nice for the current exam format). You can customize the sessions at speeds from 5 to 60 WPM, and with audio sidetones from 300 to 3,300 Hz. Either earphones or a built-in loudspeaker can be used. Like the Voice Keyer above, the MFJ-411 Morse Tutor will operate from 9 volts DC or 110 VAC with the same AC adapter.

New Books . . .

Recently I bought the latest *ARRL Handbook* and the *ARRL Antenna Book*. I believe that all hams should have a relatively recent *Handbook* available, so buy one every two or three years. Similarly with the *Antenna Book*. This year, the *Antenna Book* comes with a software disk that has some antenna software that runs on IBM-compatible computers. If you haven't seen these books, they're both winners. Contact "Uncle Wayne's Bookshelf" for details and prices . . . or see a local ham dealer. Note: If you have a technical book dealer in your area, most of them carry these books even though they are intended for amateurs . . . it seems that a lot of pros use them too.

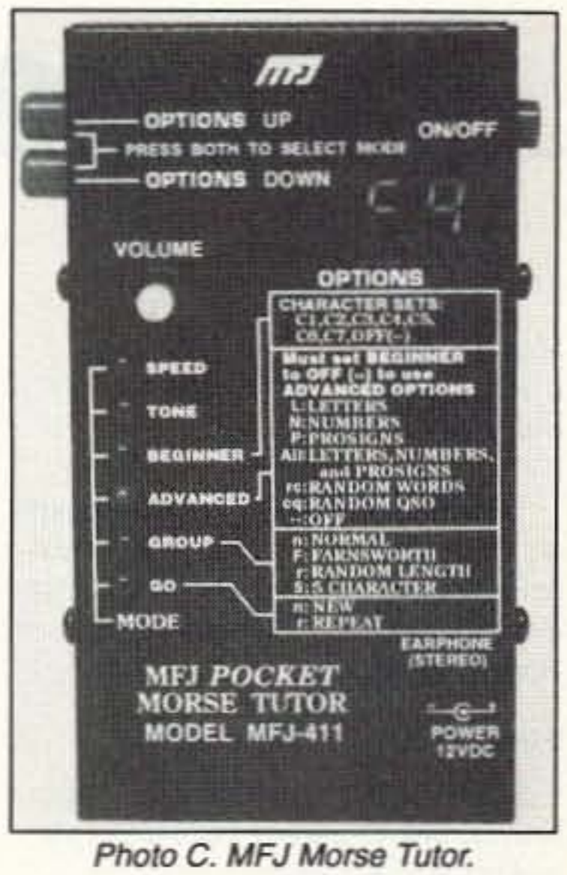


Photo C. MFJ Morse Tutor.

Every writer dreams of having their book come out as a movie. My tech books never come out as movies, but HighText Publications, Inc., who publishes my book *The Art of Science,* adapted material from the book and added a very powerful CD-ROM multimedia product. The new product, including a book and the CD-ROM, is called *A CrashCourse in Statistics,* and is available from booksellers at $29.95, from Uncle Wayne's Bookshelf, or from HighText directly (125 North Acacia Avenue, Solana Beach, CA 92075).

Number 15 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

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

Once again, I turn to you, the readership, for the seed of this month's column. I have told you before, your letters are read, your E-mail is digested! Here is the latest offering.

Subband Info for a New Ham

Don Young N2SLS of Cranford, New Jersey, drops me a line via America Online which says:

"As a relatively new ham, I've been interested in trying RTTY, packet and Pactor for their obvious communication advantages. Thus, I assembled VHF and HF packet systems via a KAM Plus and a Macintosh SE, running Hostmaster Mac purchased from Kantronics. The hardware seems to operate fine, and I've easily connected to a local packet BBS for DX clusters. However, the newness factor, combined with a shortage of time, has caused me to achieve little or no success on HF. The main stumbling blocks seem to be: locating the various subbands where these modes are located, and then distinguishing one mode from another to achieve a contact within a reasonable time (<1 hr). The latter seems to be strictly trial and error, and my ear hasn't yet grown accustomed to RTTY vs. AMTOR vs. packet vs. Pactor, etc. Could you provide more info on the subbands, and a source of info on how to distinguish various modes so I waste less time just tuning around and trying to figure out what I'm listening to?"

Well, Don, you ask some questions that many a new, or older, for that matter, ham has asked. Let's try to look at what you have posed, and see if we can't help others with the information, as well.

The station you have assembled is a good one. The newer multimode controllers, such as the KAM Plus you have, do a fine job of decoding the various digital modes. In truth, having assembled the hardware, you have conquered the most challenging task facing the typical amateur.

Although the frequencies of packet communications are well established on VHF, with 145.01 MHz being one of the most common, things do not appear to be so well organized on the HF frequencies. Unless someone sends me a listing, my advice would be to scan around the RTTY neighborhood of the HF bands, particularly 3620 kHz on 80 meters and 14.080 MHz on 20 meters, and *listen!*

Listen for what? OK, as best as I can put this into print, it goes like this. Classic RTTY has a deedle-deedle-deedle continuous sound. Certain specific sequences, such as "CQ" or the standard "RYRY" test signal, have readily identifiable sounds, which you will recognize as you gain experience. AMTOR and Pactor have very similar sounds, since they are very similar systems, best described as brief pulses of RTTY-sounding signals. Packet is rougher, and almost sounds like tuned static, being sent in bursts. If you are lucky with these latter methods, you might hear the receiving station's signal acknowledging the sender, with brief response packets.

Now, this is, of necessity, a rough—very rough—description. While an experienced ear may be invaluable for identifying these signals, a little bit of hardware doesn't hurt, either. While I am not aware of whether or not the KAM can identify signal types, the AEA PK-232 does have a signal identification and acquisition mode, called SIAM, that can listen to and identify many different signal types. Once again, something tells me that if I am wrong, I'm going to hear about it!

On the other hand, many of you continue to look for that "ideal" program to interface your multimode controller with your computer. To wit, I offer the following two items.

LAN-LINK

LAN-LINK version 2.32, the latest version of Joe Kasser's monumental terminal controller program for DOS-based computers has arrived, and boy, it is something!

LAN-LINK works with just about any controller, from the simple PK-88 to the latest PK-900 or DSP-2232. Its start-up modes are fully customizable, and its dBase-compatible logbook can serve as the source of station information or can be used to help control contact features. There is even a computer-based guide, ELMER, which uses artificial intelligence to help you through various tasks. With an assortment of 10 brag tape files available for each of six communications modes, operating digital modes with LAN-LINK may reach new heights of sophistication.

Various commands may be handled through menus, Alt-key combinations, or function keys. This allows a degree of personalization of the program rarely possible with most communications packages. There is full support for packet cluster, bulletin board, and other such techniques. The logbook is even operative as a contact checker for contest work.

As you can see, this newest version of LAN-LINK may be just the answer for the ham looking to operate a TNC or multimode controller from the DOS prompt. It is a significant update to previous versions, and its appearance on the scene is much appreciated.

PacketPet Lite for Windows

For those of you who prefer the Windows environment, Chuck Harrington has released a fully-functional version of his PacketPet Lite for Windows that is one sharp package, also!

Containing most of the features of the full commercial program, PacketPet Lite for Windows is a full-featured controller for most TNCs and multimode controllers, operating as a full-fledged Windows application. There is extensive help, provided as a standard Windows Help file, as well as context-sensitive help with a mouse click, and detailed information for using COM ports in non-standard fashions, essential if your computer has "extra" devices, such as CD-ROM drives, scanners, or sound boards.

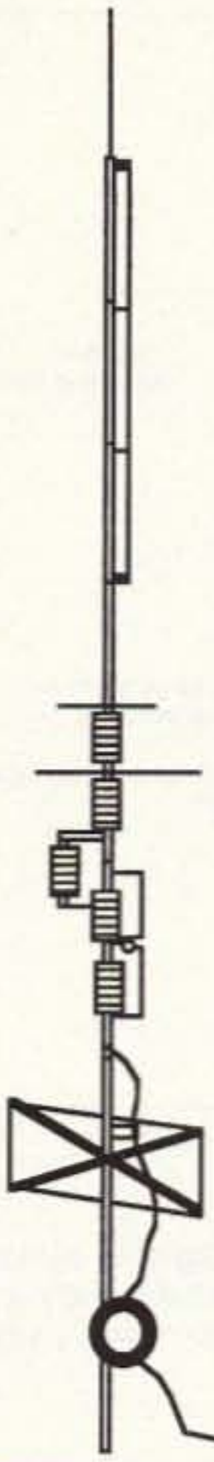
Chuck notes that PacketPet Lite requires some kind of hardware TNC, and will work with most of them! Host or KISS Modes *are not* required, and even the *retail version* of PeT, PacketPeT For Windows, is able to implement its advanced features without resorting to the restrictions of Host Mode.

PacketPeT can send and receive two types of graphics that are frequently seen on packet networks. The first graphic, sometimes known as a "brag," is a simple text file that contains characters of the IBM OEM character set arranged in such a manner as to appear to be a picture.

The second type of graphic that has recently started to appear is an ANSI Graphic. These are in color, and contain control codes to control text and background colors. Registration of the shareware program is required in order to enable the display of ANSI graphics.

Now, I woudln't tease you about these two programs without providing a way for you to get them easily enough, so surely I have done just that. These two programs make up the nucleus of Disk #8 of the "RTTY Loop" Software Collection. I can't tell you at this writing what will fill out the disk, but I'm sure I'll find something of interest. Feel free to drop me a self-addressed, stamped envelope, or a piece of E-mail, for a listing of all that is available. Those of you who are anxious to get started can just send me the standard $2 in US funds, a self-addressed stamped disk mailer for return, and a 3.5" disk, and I'll fill it and return it to you.

Otherwise, I look forward to your comments and questions every month. Send your missals to me at the above address for SnailMail, or on Email via CompuServe (75036,2501), Delphi (MarcWA3AJR), AOL (MarcWA3AJR), or Internet (MarcWA3AJR@aol.com). Next month, I think I might have an easy way to get on the air! No fooling! 73



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NEW! **Model HF9V-X (shown to the left) for 80/75, 40, 30, 20, 17, 15, 12, 10 and 6 meters.**

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Help your children, your wife and your friends get their ham licenses with this ultra-fast code system. Get your kids to help their friends to get their licenses. If we're going to try and keep our ham bands we need tens of thousands more hams. Millions will be even better.

Help start kids on their way toward high-tech careers by getting them hooked on hamming. The biggest obstacle to a ham license in the past has been the code. Now, with this new miracle system, this is just not even a minor problem. No longer will there be the slightest stress when taking that stupid code test that the ARRL Board of Directors has forced the FCC to continue to use as the primary method for keeping newcomers away from the hobby.

With the success of America in the next century dependent on our ability to provide high-tech career workers to deal with the information highway and the computerization of the workplace, amateur radio provides a fun way to ger kids interested in leaning about technology. It beats the heck out of Nintendo and Sega, which teach nothing. It even beats sports, which provide a good living for a handful of stars and disappointment and poverty for the losers.

We need to see radio clubs sprouting in our secondary and high schools again. We need to see hamming become a major activity in retirement homes and villages. We have room for millions of hams on our bands...of which we're using less than 0.2% today on any regular basis. Yep, that's right, 99.8% of our ham bands are just sitting there almost totally unused, with us waiting around for the FCC to sell them off and pocket the money without even a word of thanks.

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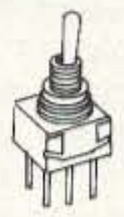

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Number 16 on your Feedback card

QRP

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

This month I have some rather unusual circuits for the QRP builder. Some are brand-new, while others are improved versions of old favorites.

Have you ever needed a minus supply for a project that runs from a battery? In the past, you could add a second battery, but that always proved to be a pooper. With projects running from an AC power source, generating a minus supply voltage was easier, but still required a center-tapped transformer. Here's a circuit that only requires two capacitors to generate a negative supply: the CPA7660S by Harris. Digi-Key carries this 8-pin DIP IC. It's about $3 or so.

You input a positive voltage and you get a negative voltage out. It really is that simple. I've used a 555 timer running in astable mode and a voltage multiplier combination of zener diodes to generate a negative voltage in the past. But by using this chip, it's oh so easy. So, the next time you look at a CW filter requiring a negative supply, reach for a CPA7660S.

High-Side FET Driver

I've been using more and more power MOSFETs in my projects lately. From RF amplifiers to high-side switches, the power MOSFET is quite a device.

However, applications requiring high-side switching all require some sort of charge pump, and the associated components to turn the gate on and off. Again, as in the negative power supply, I've used everything from 555 timers to a section of a LM324 op amp. They've all worked, but whoa! All those parts to do such a simple task.

Well the answer is again a special 8-pin DIP IC made by Linear Technology. It's called an LT. The LT is avaiable from Digi-Key for about $3, too. A surface-mount version is also available.

The LT has some very special features hiding inside. One is the overtemp shutdown. When this pin is pulled high, the output is pulled low and will stay that way until the overtemp is pulled low and then the chip resets. Normally, this pin is tied to ground.

The output of the charge pump should be connected to a high impedance load. It's very easy to load the charge pump down so its output nears the supply voltage.

Connected as shown in Figure 1, pulling the input lead high will cause the output to pop up to about 28 volts, depending on the supply voltage. The enable pin is normally held low, but you can tie the input to ground and use the enable pin as an inverted input. The status pin is normally not used. It's an open collector switch that will go low when the overtemp shutdown is active.

Unusual to this chip is the drain sense pin. By sensing the voltage drop across a resistor in the drain lead, you can come up with a clever over-current protection. You can even add a delay to this line so it will ignore sudden high current loads such as a cold light bulb turning on. If this pin is not used, tie it to the VCC pin, 8. What it used to take over 30 parts to do can now be done with one chip. Amazing!

Pulse Maker

Ever have a need for some good ol' fashion' square waves? See Figure 2. Here is the notorious 555 timer IC put to good use. This circuit makes square waves that are very good, with nice rise and fall times. By changing the values of the two timing resistors, you can change the duty cycle of the oscillator. With the values shown, the duty cycle is about 50 percent. This is one of my favorite building-block circuits. It's great for testing digital circuits.

DVM

I've given several examples of expanded voltmeters in this column. However, here is a circuit that will display voltage digitally. (See Figure 3.) It uses two common ICs and a handful of parts. I would like to take the credit for this one, but I can't—Dick from S & S Enginnering came up with it. I don't have a PC board layout for this circuit, but may work on one if there is enough interest. Digi-Key carries all the parts you'll need. Assembly is best done on perf board, using point-to-point wiring.

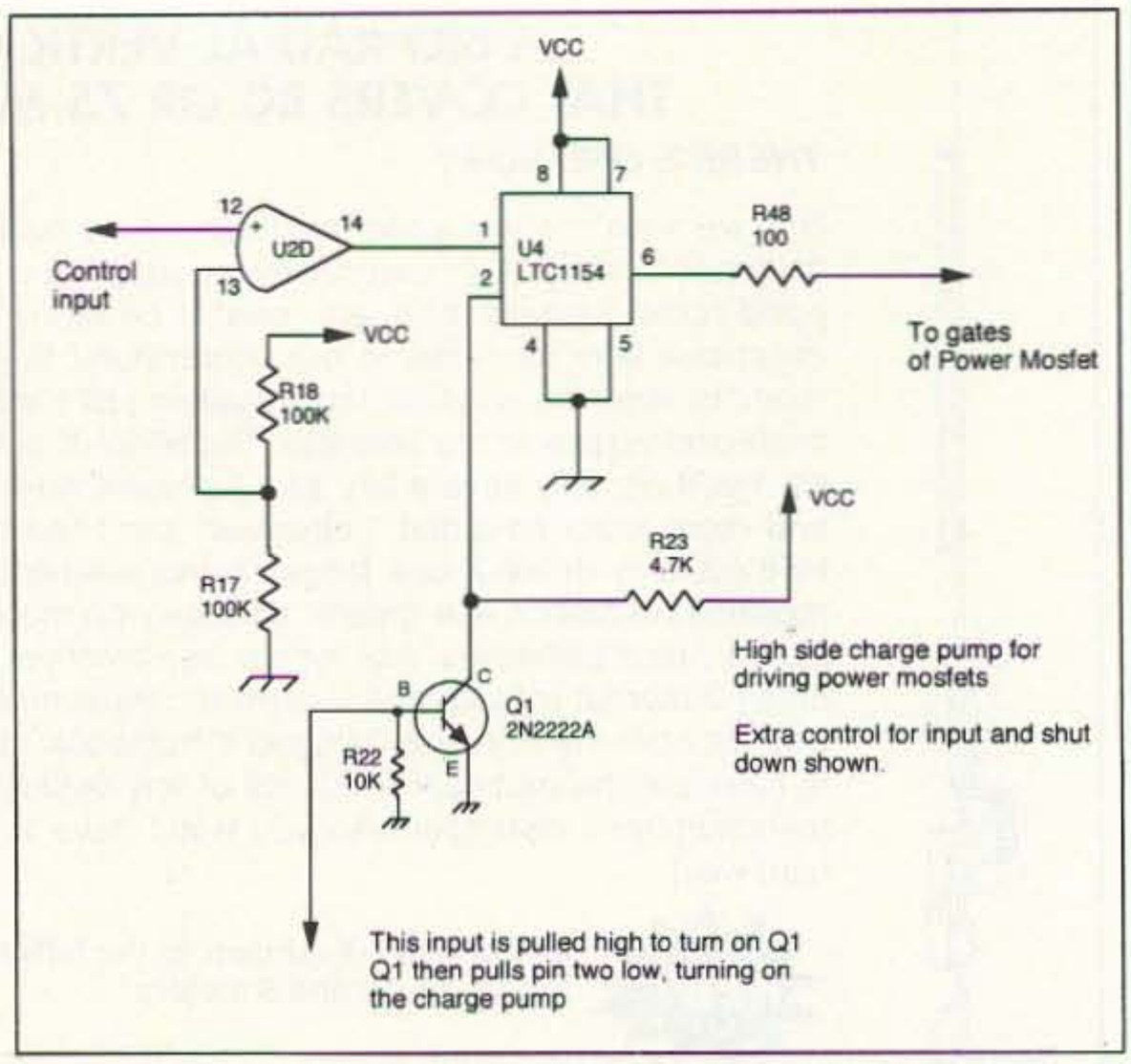

Figure 1. A high side MOSFET driver with control circuitry.

Dayton '95

Yup! It's that time of year. Again, the town of Dayton, Ohio, will be overrun with QRPers. We'll again be staying at the Days Inn South.

What started out last year on a whim grew into a full-blown banquet on Saturday night. We had a huge turnout and gave away several rather slick door prizes. Nope, we're not talking a coffee mug or two, but MFJ QRP rigs, solar panels, assorted kits and other goodies.

Of course, there's the usual story-telling and those great DX catches to hear about. But, it's also a time to get to see some of the newest stuff coming down the road. Last year we saw

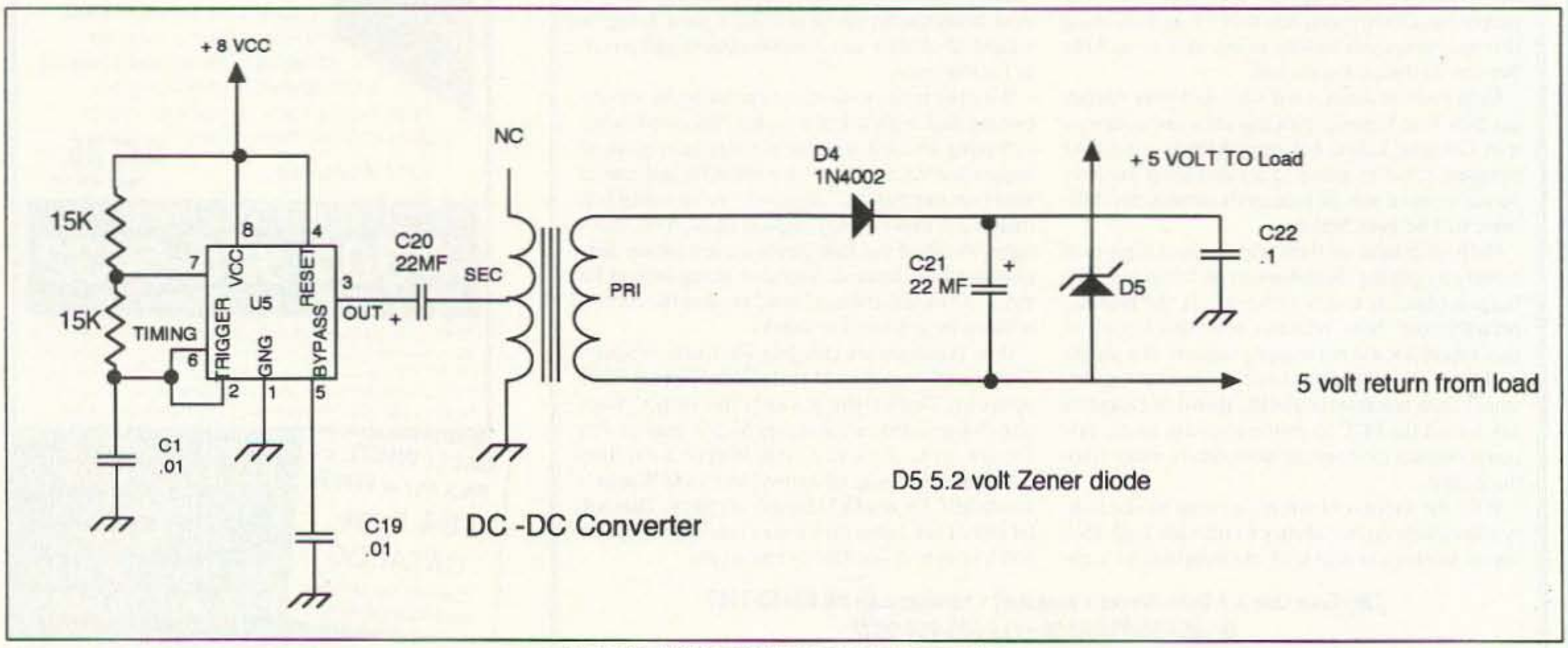

Figure 2. A DC to DC isolated power converter.

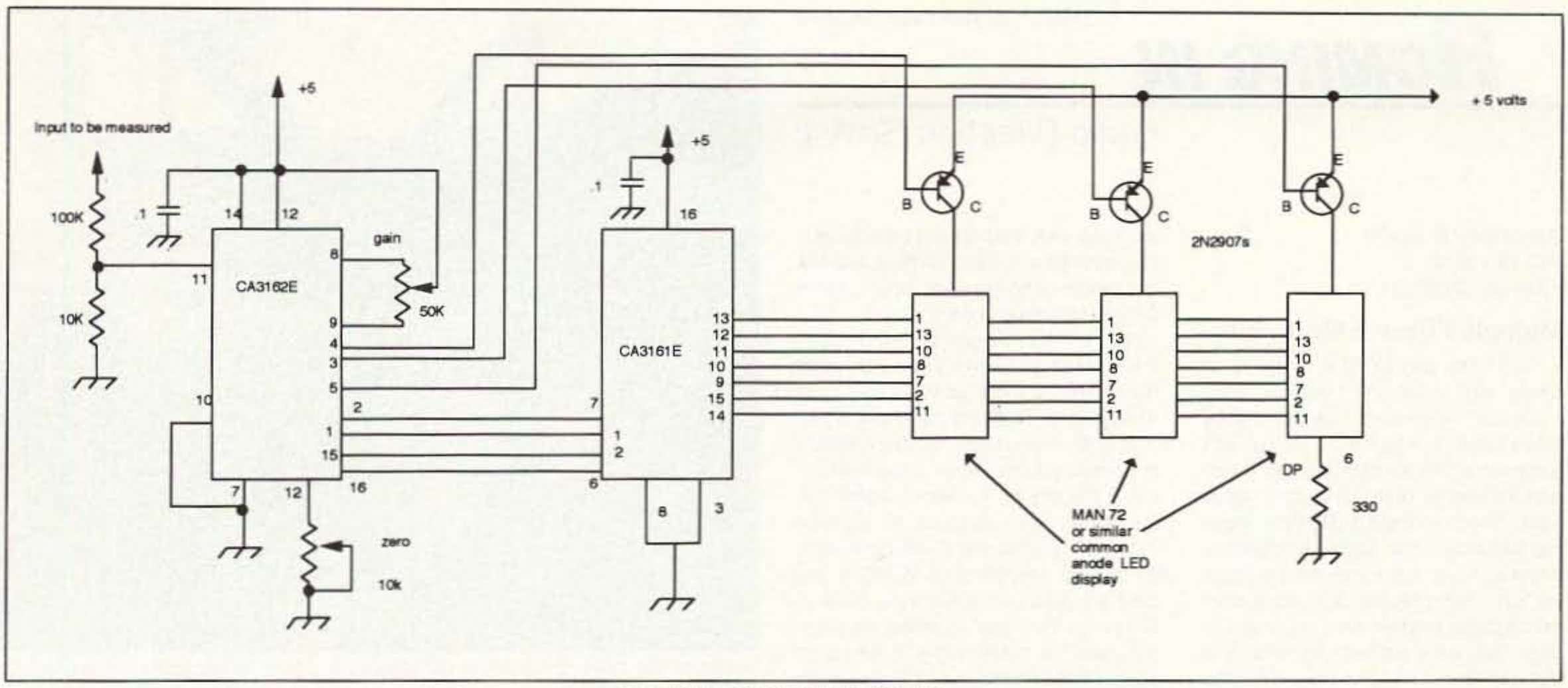

Figure 3. A simple 3-digit voltmeter.

the ARK-4, the Norcal, the New England 40-40, and goodies from Radio Kit as well. This year there'll be even more!

We'll have forums and a sign-up booth inside the arena. QRP clubs from Michigan QRP, G-QRP, QRP ARCI, QRPP, New England, and more will be there signing up new members. It's a lot of fun, even though it has rained the last several years. I'll be there as usual, and perhaps give a talk this year as well on QRP.

It's time to get going if you want to make the trip. Send a check for one night's stay, made out to the Days Inn, to Myron Kyole, 1101 Miles Ave. SW, Canton, Ohio, 44710. You can call Myron at (216) 477-5717. Be sure to include an SASE when sending your check to Mryon. DON'T WAIT! Rooms went fast last year and there was a long waiting list for canceled rooms. 73

Number 17 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
P.O. Box 2508
Fullerton CA 92633

Multiple Foxes = More Fun

"It's 'hide and seek' for kids of all ages, with radios!" That's a one-sentence explanation that passers-by often receive when they ask what's going on at the starting point of a hidden transmitter hunt. Of course, these radio direction finding (RDF) exercises, which are also called foxhunts or T-hunts, have more important purposes, too. They prepare us to track electromagnetic interference, bootleg stations, and even aircraft and vessels in distress. But mostly, we're out for the fun of it.

Until a few years ago, no one in my area considered having more than one hidden station per hunt. After a full evening of hunting one T, few teams were ready for more. But hunting capabilities vary. A fox that takes five hours for one team to find might take only two hours for another.

On a couple of occasions, a team that found the fox quickly would go away and put out its own transmitter for other early finders to track. Within months, some hiders were putting out one or more low-powered extra T's as optional targets for early finders.

To this day, some RDFers continue to scorn the idea of mobile multiple T-hunts. "If you can hide one transmitter really well, that should be enough," they say. Others have come to like the challenge of trying take bearings on several targets at a time.

Photo B. Can you find the transmitter in this picture? The shirt-pocket T by Don Lewis KF6GQ is in a 3-3/4" x 2-3/8" x 1" plastic box with RCA phono jack for your antenna.

For the Los Angeles area 2 meter Pathfinder Saturday night hunt last November, Byon KD6BCH and Lara KD6AYO Garrabrant padlocked five half-watt ammunition-can transmitters in various places within a two-mile circle in the city of Torrance. On/off timing of each was random. All were on the same frequency. Each generated its callsign identification in MCW and sent a distinctive audio tone pattern. Only one T's signal reached the starting point 32 miles away. It was atop some children's playground equipment in a hilltop park. The other four were in public areas such as schoolgrounds and horse trails.

Of the 13 teams that started, eight found all five foxes. Elapsed times ranged from four to seven hours. This monthly hunt is normally scored by odometer readings. In this case, the winning team was determined by the lowest total mileage from start to the last transmitter. They could be found in any order. For even greater difficulty, Byon could have required the transmitters to be found in numbered order.

Make A Weekend Of It

Southern California's famous All Day T-hunts now feature multiple foxes whenever the hiders so choose. As regular readers know, the "All Day" title is a misnomer; these hunts frequently last 24 to 36 hours. Hunters start from a hilltop in Rancho Palos Verdes at 10 a.m. Saturday, remembering that the boundaries include the entire continental USA, and that the record distance for a 2 meter hidden T is 344 air miles (Photo A). Lowest total mileage wins this hunt.

The apparent holder of the record for greatest number of T's hidden on an All Day hunt is Don Lewis KF6GQ, who has been a part of the Southern California RDF scene for over 20 years. On the weekend before last Halloween, he and his family, along with Mark Harris KD6LAJ, scattered nine emitters in the Holcomb Valley, all on the same frequency. This area is north of Big Bear Lake, at about 8,000 feet elevation, in the San Bernardino Mountains, about 90 miles from the starting point.

"The T's were all within about a 2-1/2 mile radius from our campground in the center of the valley," KF6GQ told me. "Four transmitters had KD6LAJ's call on their CW ID, numbered 1, 2, 3, and 4. In addition, there were five shirt-pocket size T's with my call on them, numbered 1, 2, 3, 5, and 17. We deliberately tried to make it as confusing as possible. That's why the numbers were similar and they sounded the same except for the CW IDs.

"Three KD6LAJ foxes ran about 2 watts each on separate hillsides around the valley," Don continued. "They went on and off at exactly the same time. The one you could hear at the start ran into a long beam pointed southwest. The three T's antennas were pointed toward each other. Furthermore, each of the three was situated so you had to approach on its beam's backside, where the T's from across the valley would give stronger signals.

Photo A. "No rules, boundaries, complaints, or clues" is the motto of many intrepid Southern California T-hunters. Magnetic door signs to proclaim this have been designed by Cathy Livoni KD6CYG and procured by Peter Ernster WA6TQQ. Several teams' vehicles now sport them, but it's too soon to tell if the number of pullovers by curious law enforcement officers has been reduced.

"At the beginning of the hunt, we told the hunters that no matter how many transmitters they tried to find they must be sure to find KD6LAJ #1, the only one they could hear at the start point, in order for their mileage to count. We would determine the winning team by mileage and total number of T's found.

"Because the three KD6LAJ foxes were synchronized, it drove everybody crazy. As soon as they would get close to one, they would have to go to the backside, with either a hill there or the back of the antenna—something to cause its signal to become much weaker.

"There were five teams that claimed afterwards to have found KD6LAJ's #1. But as it turned out, only two found it, because besides the real T #1, there was a decoy. The real antenna was down in a bush on the southwestern facing slope of a ridge line. To get to it, you had to come up the back side, over the top of the ridge and then down toward it. In plain sight on top of the ridge was a shiny antenna on a mast and what appeared to be a transmitter.

"Actually, this was a transceiver with the transmit light wired to work in reverse. It lit when it received the real T's signal. It was only about four feet from the real antenna. Hunters saw the light come on and the meter go up, and thought it was the real T. They should have checked it with their sniffers, but three teams just signed the check-in sheet there and left. Two other teams were lucky because they got there at night, didn't see the dummy, and sniffed out the real T.

"It was funny because the next morning as they were driving home, some of the teams were talking on a repeater, describing what they had found. They suddenly realized they were talking about two different setups for KD6LAJ #1. We let them go on and on before we confessed to them. One other hunter didn't find out he was fooled until the next weekend.

"The fourth KD6LAJ transmitter was at our campground. It had different timing and had a very strong signal in the hills, so we could get the hunters into the campground and greet them at least once. The hunting teams worked really hard—the last one quit at 9:30 Sunday morning.

"My boys helped hide the five KF6GQ milliwatt-level transmitters. One was tied to a barbed wire fence. Another had an 'invisible' beam made of piano wire in a tree. Nobody found three of them, yet they were all copyable at the campground.

"One was atop a ridge on what we call 'The Road of a Thousand Forks.' As soon as you enter it off the main road, it splits. And each fork goes into another Y, and so on. To get to the right ridge, there was one fork with chunks of big rocks on the road. I suppose you could have gotten up that road with four-wheel drive. But if you went a half mile farther to the east, there was a real easy fork that went up and then across the ridge to where we hid a mini-T."

If One Is Good . . .

Imagine the RDF fun your club could have with a few low-power mini-T's like these! Unlike higher power transmitters that need large battery packs, foxes in the 3 to 30 milliwatt range can be smaller than a pack of cigarettes. They will run for days on

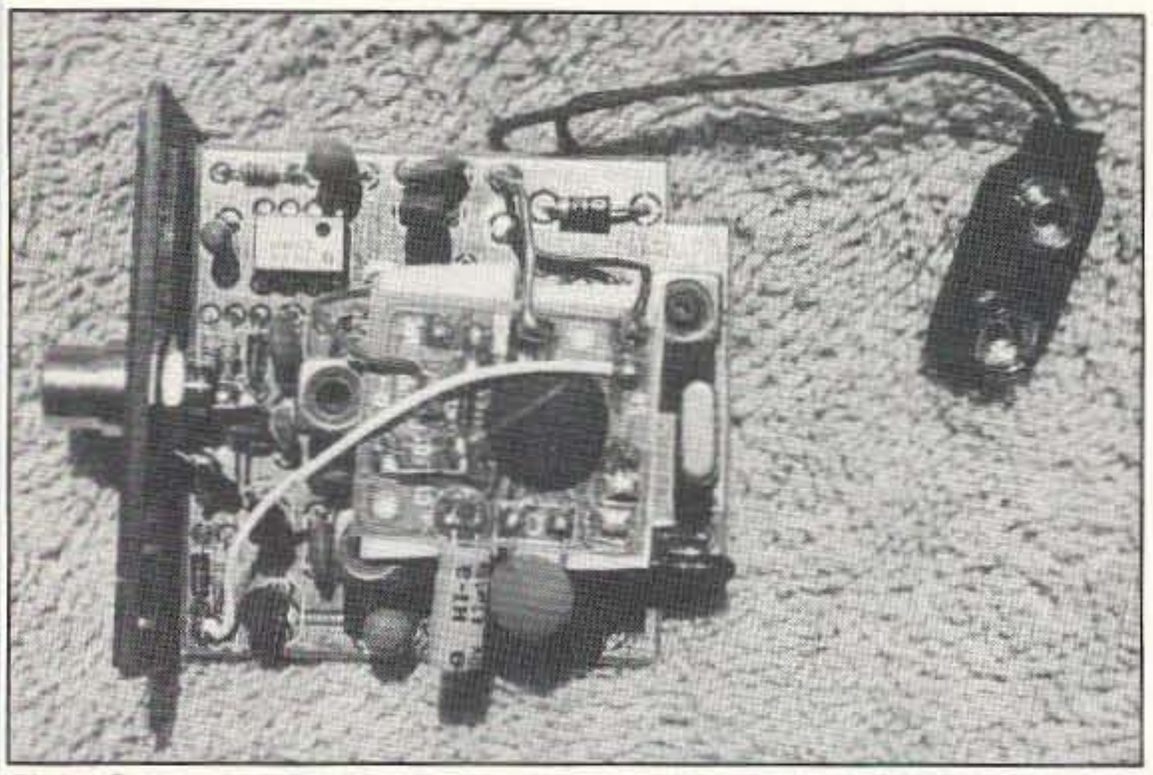

Photo C. A stamp-sized audio board sits atop the 2-1/8" x 2" RF board in the HT-101. There are about 30 components on the RF board.

throwaway alkaline batteries.

Put one or more mini-T's near the main fox at the end of your club's next T-hunt for added fun. Or scatter a bunch of them in the park during your club's next picnic, and encourage the kids and adults try to find them using just their handhelds.

Home-brewers can find information on how to build low-power foxes in my book.* For those who prefer to let someone else wield the soldering iron, KF6GQ is assembling and selling his shirt-pocket T's (Photo B). Don designed his HT-101 around the Motorola MC2833 FM Transmitter IC. His double-sided glass epoxy circuit board includes a voltage regulator and CMOS 555 timer (Photo C). The oscillator is crystal-controlled at 1/12 the 2 meter output frequency.

Modulation comes from a second board with an analog storage IC. It holds 10 seconds of audio indefinitely, even when unpowered. Don programs the station ID in either MCW or computerized voice. Unfortunately, he did not design his unit to be easily field-programmable, but it is possible for users to change the audio message by feeding 5-millivolt audio into the sub-board and jumpering some pads on it.

You cannot get an accurate power measurement on a milliwatt-level transmitter with an ordinary wattmeter. I hooked the HT-101 to a dummy load, viewed the output voltage waveform on a sensitive 275 MHz bandwidth oscilloscope, and computed power with Ohm's Law. KF6GQ promises 5 milliwatts minimum. I measured 9 mW on one I tested. It drew 33 milliamperes from a fresh 9-volt battery when transmitting, 560 microamperes when idle.

"I used tantalum capacitors for the on/off cycler, so I make no claims for timing accuracy," says KF6GQ. As supplied, the RF is on for six seconds and off for about 25 seconds. You can change the value of a fixed resistor to get other ratios.

With a typical 20% duty cycle, you should get about 36 hours operation before the battery dies. RF output voltage decreases in proportion to supply voltage. At 4.5 volts, power is down by a factor of four. The audio chip works normally down to about 4 volts. It is easy to tell when the battery voltage goes below that, because the audio pitch gets lower and the ID cycle stretches out.

The MC2833 IC has a very wide temperature range. When I sprayed Chemtronics Freeze-It directly on the chip, the HT-101 output power didn't budge. "When we hid in the mountains in October, it got so cold at night that my dog's four-inch-deep water bowl froze solid," says KF6GQ. "Two T's died, but it was because of the batteries, not the transmitter." Carbon-zinc batteries work poorly in the cold, so be sure to use alkaline batteries under these conditions.

GQ Enterprize, Don's company, sells the HT-101 only as a wired/tested/programmed unit, not as a kit. The price is $79.95, plus $3.50 shipping/handling. It is crystalled and tuned for 146.565 MHz, a popular foxhunt frequency in many cities. For another frequency, add $10 and allow three weeks for procurement of your crystal. Checks should be made out to Don Lewis. Of course, here is the usual disclaimer: Neither I nor *73 Amateur Radio Today* warranty this offer.

For more information on the HT-101, send a self-addressed stamped envelope to GQ Enterprize, Suite 524, 129 East Colorado Boulevard, Monrovia, CA 91016. (By the way, this return envelope courtesy is greatly appreciated when you write to *73*'s authors, too.)

Watch for reviews of other new foxhunt transmitters in upcoming columns. Please let me know of any new RDF products you encounter. Tell me what you like and dislike about them. Write to my California address at the beginning of this column, or send electronic mail to me via the Internet (joemoell@cup.portal.com) or at CompuServe (75236,2165). 73

* *Transmitter Hunting—Radio Direction Finding Simplified,* a 323-page illustrated text on RDF by Joe Moell KØOV and Tom Curlee WB6UZZ (TAB/McGraw Hill #2704), is available from Uncle Wayne's Bookshelf.

Number 18 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

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San Diego Microwave Group
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San Diego CA 92119

Surplus VHF Downconverter

This month I want to cover a simple 1240 MHz ATV converter that can be constructed out of a cable TV converter. These units are electronically tuned by a DC voltage rather than a mechanical adjustment. They are starting to show up on the surplus market both used and new. This unit can cover frequencies from low VHF to about 400 MHz, depending on the model you obtain. A used TV or VCR tuner is also suitable but I could not cover all the variations you might run into. What I am describing is a unit that we obtained and will make available; it should be similar in operation to other units and the conversions covered should be similar as well.

What sprouted this idea was of course, the prime mother load of all surplus material that was just sitting in front of Kerry N6IZW and myself. You don't look a gift horse or any other critter in the mouth before you take advantage of good fortune; we made arrangements to pick up the whole load. On close examination, these units, being new, would be suitable for many different RF amateur conversions. We knew that we would make good use of this material.

The first step in the conversion process was to draw a basic block diagram and determine the operating voltages required to put it in operation. See the system block diagram shown in Figure 1. (In this simple test circuit I used a bench supply of +20 volts and wired in a +5 volt regulator for the prescaler chip.) We used reverse engineering to develop this schematic. The specifications of the tuners are as follows. The tuning range of the converter was from 50 MHz to just over 400 MHz. The primary IF output was TV channel 3 or 4. The tuning between TV channels was done electronically with a varactor diode to tune the voltage-controlled oscillator (VCO). This was accomplished in one range, 50 to 400 MHz, or 2 volts to 20 volts on the "VT" line. The output of the VCO feeds a mixer and a Toshiba frequency divider chip internal to the tuner. This divider chip allows the RF VCO frequency to be divided in frequency to a much lower frequency for RF readout on a counter or processor (PLL) control.

In the surplus lot of tuners that we picked up there were three different models. Under close examination the basic circuitry is all the same but minor changes exist within each one, making them somewhat unique. The major differences relate to the Toshiba divide-by chip. In model 113 the divide step is 256; in the 151 it is 64; and in the last unit, 333, it is 128. Knowing the divide-by ratio is only important when you want to know what the VCO frequency is.

For instance, if you have a control voltage of 9 volts on the (VT) voltage tune line this should represent a frequency of about 788 MHz, according to the VCO voltage/frequency chart in Table 1 (unmodified). By connecting a low-frequency counter to the prescaler (PS) pin this can be confirmed. All you need to know is the divide-by ratio of your tuner; so let's assume it's 256. In this case you would read with 9 volts on the VT line, a frequency of 3.078125 MHz. Of course the reverse is also true: Read the prescaled frequency and multiply to determine the LO frequency.

This PS output can be used with a low-frequency counter to set frequency or, if we get our act together, an upgrade in the form of a processor (PLL)

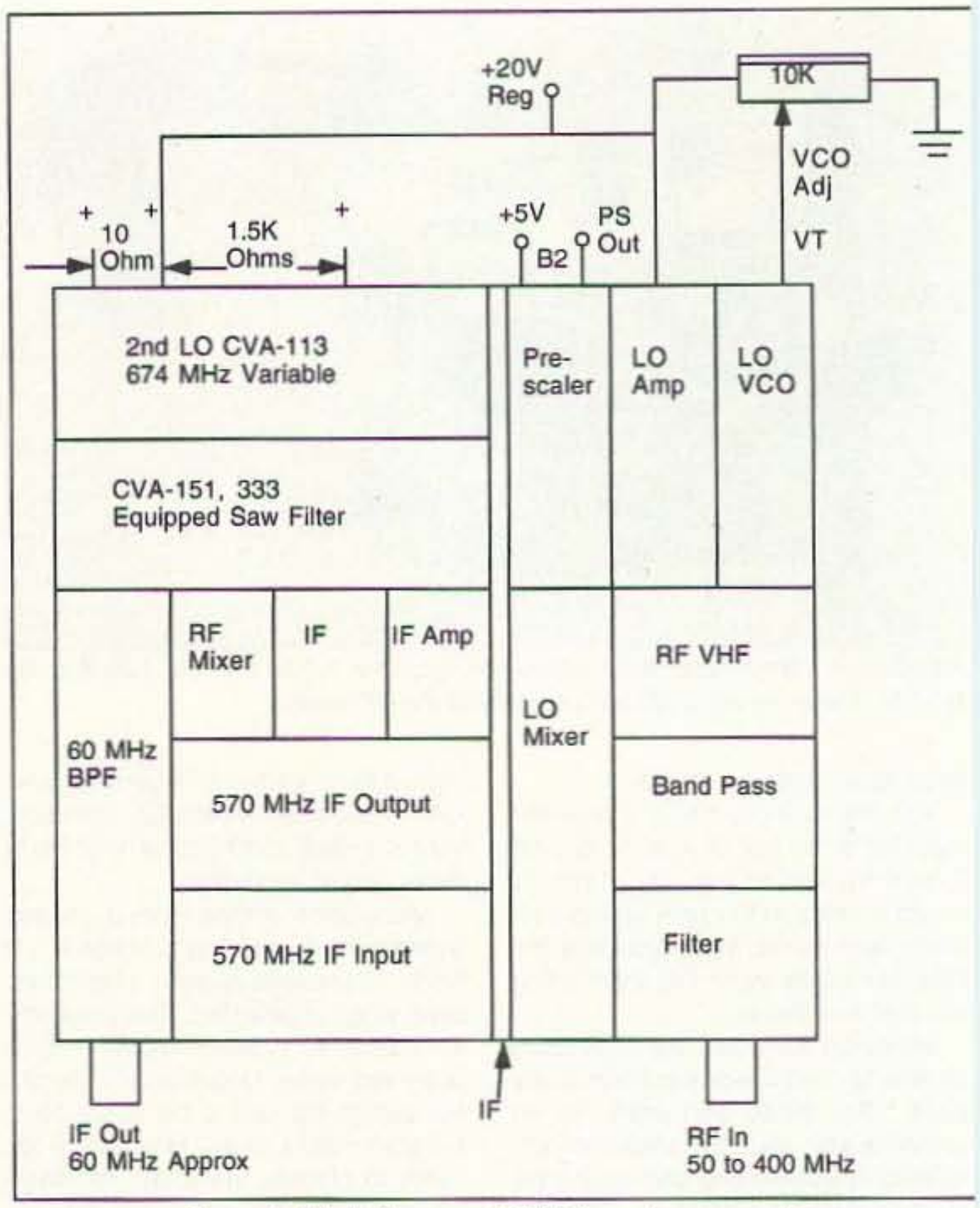

Figure 1. Block diagram of CATV-type downconverter.

controlling frequency to exactly the frequency we desire. We will update you on that circuit development next month. In the meantime let's get back to the rest of the tuner's circuitry. After the mixer we have an IF amp at 570 MHz, which feeds the second mixer. The second conversion oscillator runs at about 674 MHz and mixes the IF to about 60 MHz or TV Channel 3.

Conversion to 1240 MHz ATV

In the simplest of conversions, the local oscillator in the CATV tuner is used to supply the LO for an external mixer. We connected a surplus amplifier for RF amplification to complete the converter package. There ar several variations to this scenaric you just pick the variation that applie to your requirements. The reaso for going to an external mixer is tha the original CATV mixer works we with high level signals from a CAT line, something we don't have the lux ury of having. The SRA-11 is a bette mixer, giving lower conversion los and more sensitivity to this systerr See Figure 2.

For the RF amplifier for the syster we found a unit that works well a 1240 MHz without modifications to it circuitry. The amplifier in question ex hibits about 30 dB gain with a modes

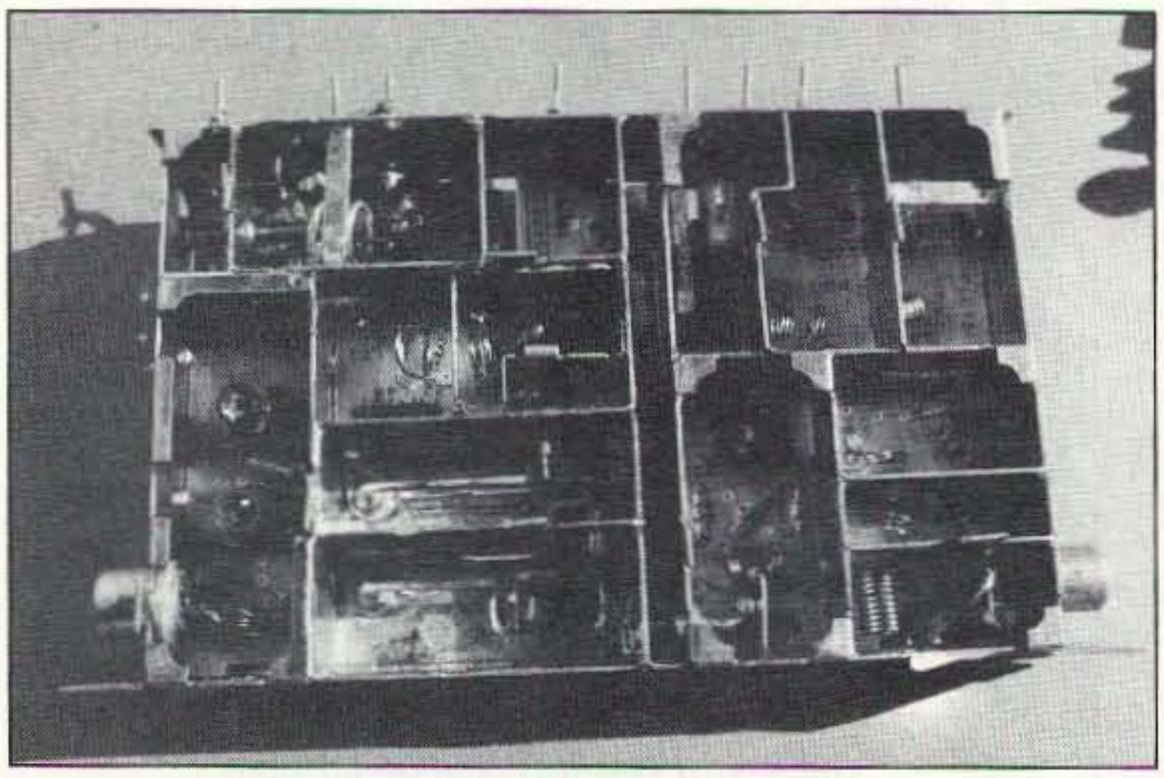

Photo A. CATV Model 151 tuner (second VCO adjustable); orientation of the coax connection at the bottom same as in the block diagram.

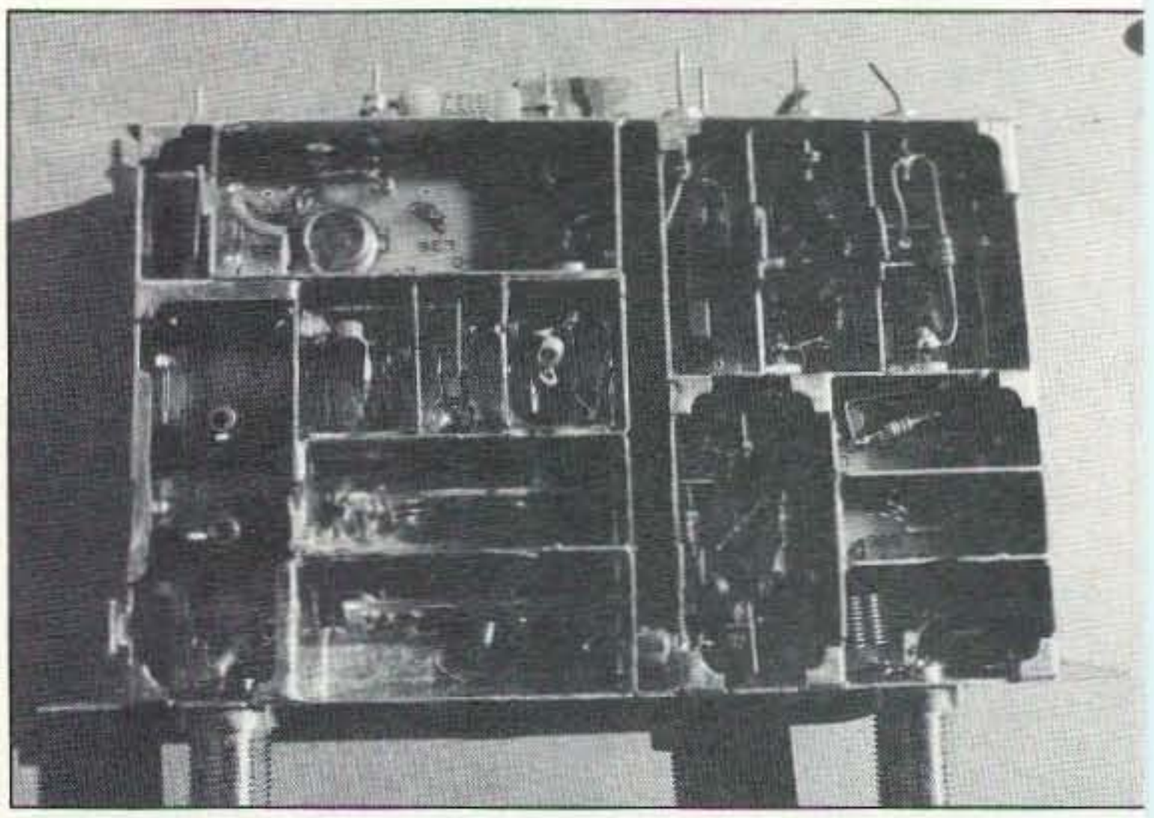

Photo B. CATV Model 113 tuner (second VCO uses SAW filter); orientation of th coax connection at the bottom bottom same as in the block diagram.

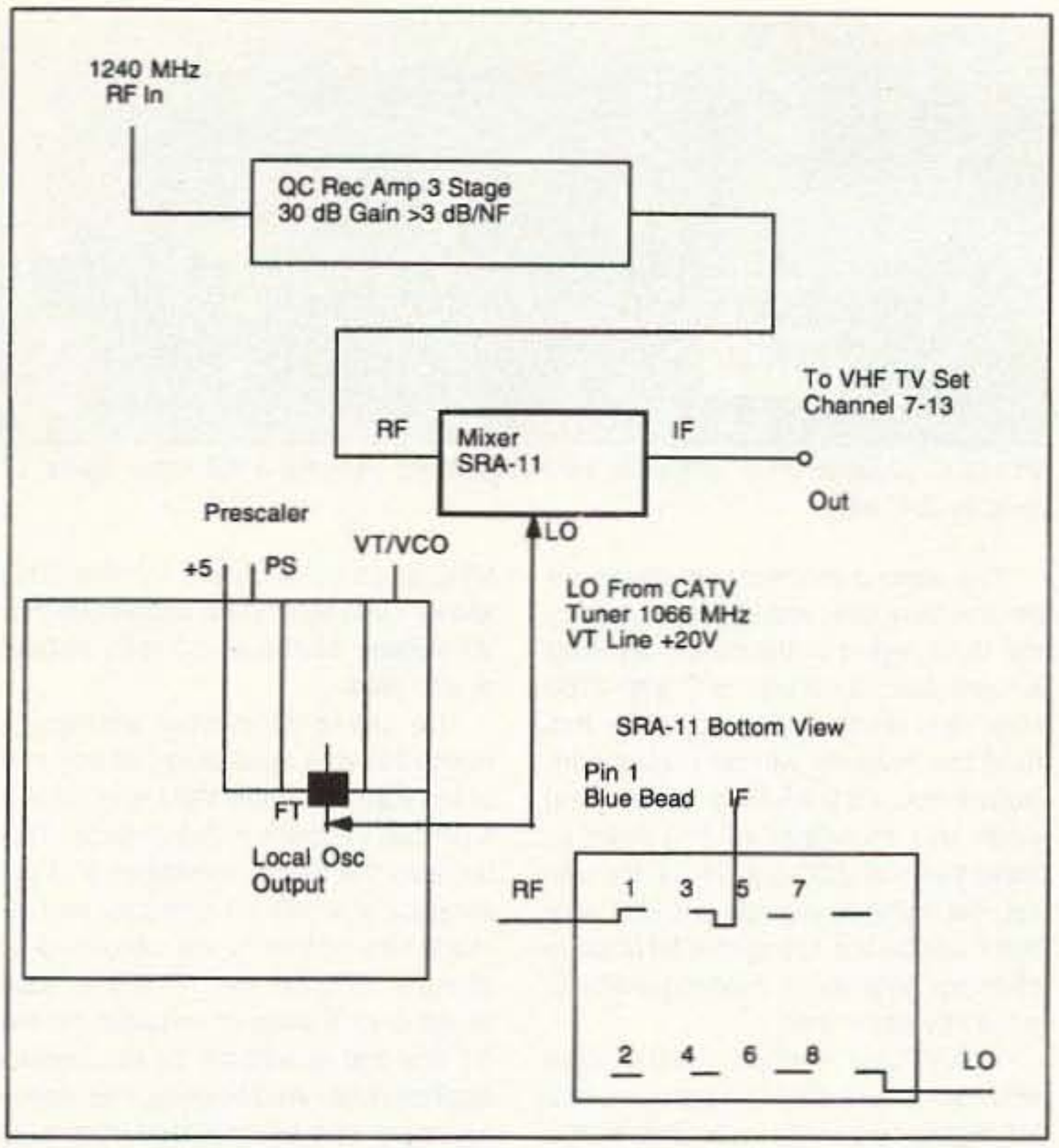

Figure 2. Diagram of 1240 MHz ATV converter using local oscillator (VCO) of CATV converter.

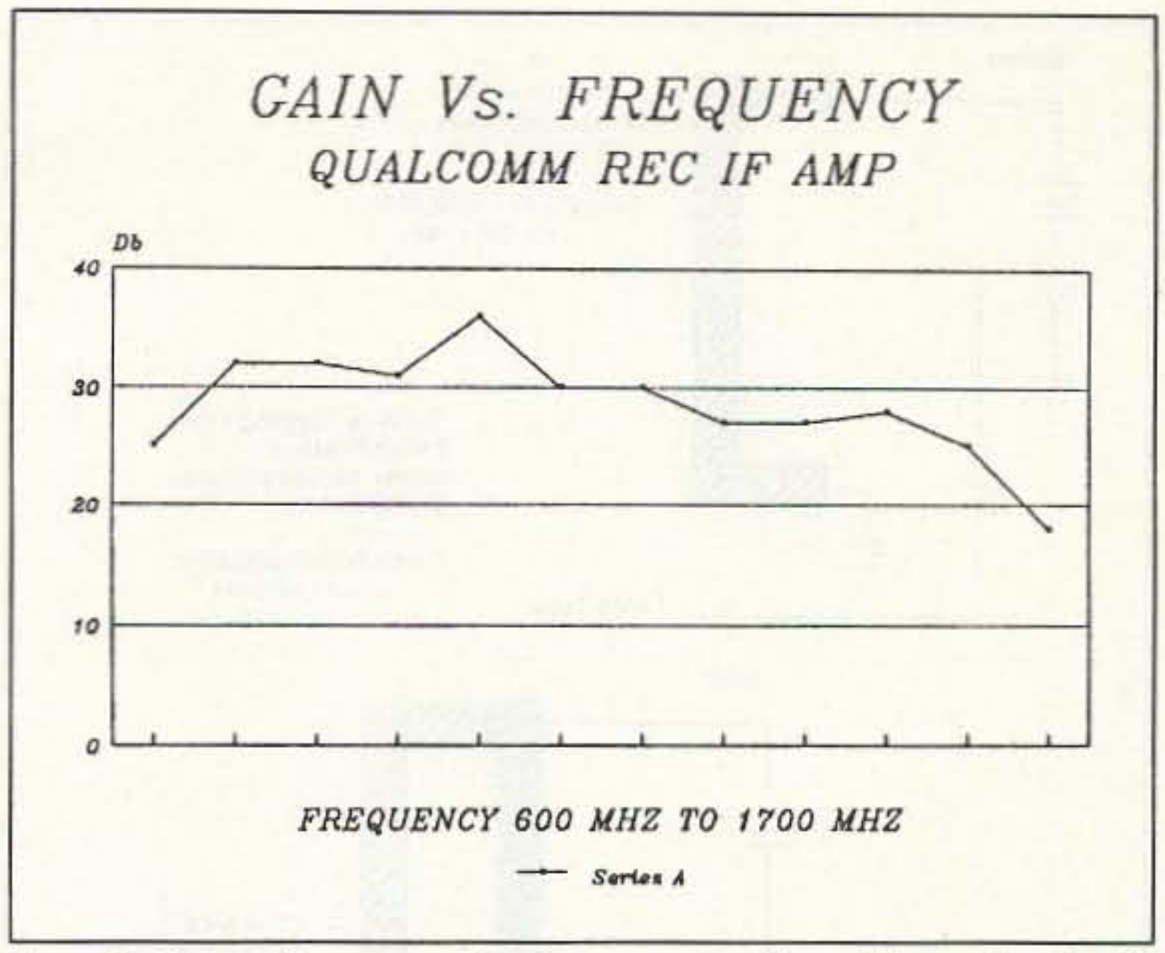

Figure 3. Gain vs. frequency of Qualcomm receive IF amplifier used as the RF amplifier. Operation from 600 to 1700 MHz with a noise figure of 2 dB.

noise figure of about 2.5 dB. This amp is in fact a QUALCOMM IF amplifier that functions well as an RF amplifier. See Figure 3 for the gain vs. frequency operation of this amp. I have a quantity of these amplifiers and will make them available with the CATV tuners. Or you can roll your own amp and CATV tuner together to put this converter together.

Well folks, this is the basic project and it works well for ATV reception. The prototype construction by Art K6UQH proved out the basic concept. We would have gotten there ourselves but Art was motivated and did the modification. I was still drafting the schematic and mechanics of the project at that time. Initial tests in the San Diego area were made using the Mt. Palomar ATV repeater and the WA6VLF ATV repeater, with very good results.

Art placed his RF amp at the rear of a helical antenna. DC power was supplied up the coax for the amplifier. The remainder of the equipment was located at the TV receiver. This unit did use two RF amplifiers, a small preamp at the antenna and the Qualcomm amplifier, in addition to several bandpass filters to limit frequency response to 1200 MHz ATV.

First-Cut Modification

In the converter that Art K6UQH modified he used the VCO of the tuner and an external mixer coupled with the surplus receive IF amplifier serving as the RF amp. In the initial tests with this system Art was able to copy, from his QTH in Escondido, a video signal from the Mt. Palomar ATV repeater. Art used a workbench TV set on VHF Channel 7 for reception. Needless to say this was a no-frills converter that was functional and inexpensive to duplicate—prime goals in any project; soft on the pocket.

Let's get into the meat and potatoes of this conversion and cover each aspect towards completion. There are several different twists and turns you might take in your own ATV converter's development. Basically, it all turns into the same conversion with different twists. The twists relate to the level of complexity you are willing to delve into as each add-on or development requires more circuitry.

Let's for starters assume the minimum circuitry for a functional 1240 MHz ATV receiver converter system. The local oscillator frequency for the simplest converter is the IF frequency minus the RF frequency. In this case we will use TV Channel 8, which is an IF frequency of 180 MHz. Full video occupies 180 MHz to 186 MHz, 6 MHz wide. Now, 180 MHz (IF) minus 1240 MHz (RF) = 1060 MHz (local oscillator frequency). On all of the tuner models this frequency can be derived by applying a regulated +20 volts to the "VT" line of the VCO. See Table 2.

The VCO output is tapped out with a small coax lead of RG-174 (mini coax cable) where the input of the VCO previously fed the mixer. (Disconnect the capacitor from the mixer center-tapped ferrite coil and tie the coax to the capacitor. This same coax cable now connects to the LO port of an external mixer.) SRA-11 mixers from Mini Circuits Labs have very good performance to 2000 MHz; we used one of these in the first prototype. The IF port of the SRA-11 mixer is terminated in a 3 dB pad that is used to feed the TV receiver via a coax to a 300 ohm balun; or by coax directly, depending on your TV set's configurations. The pad is used to provide the IF port with a good termination.

The TV receiver is set to Channel 8 to receive the 1240 MHz ATV signal. Use Table 1 for other frequency IFs to suit ATV requirements in your area, and adjust accordingly. The Qualcomm receiver IF amplifier is connected to the RF port of the mixer and serves as the new RF amplifier. This amp is hot out of the shute without modification. The amp has about 25 to 30 dB gain at 1240 MHz, with a noise figure of about 2.3 dB. It's not the ultimate but, as I said, it makes a very hot RF preamplifier for this receiver that is ready-made.

You say your ATV frequency is something other than 1240 MHz? Well, if it's higher in frequency, switch the TV set channel selector to a higher TV channel, say 10 or 13. Each channel number increment adds 6 MHz to the RF frequency of operation. Any instability of the VCO is taken care of by the TV AFT circuits. A filter should be used before the RF amplifier but a

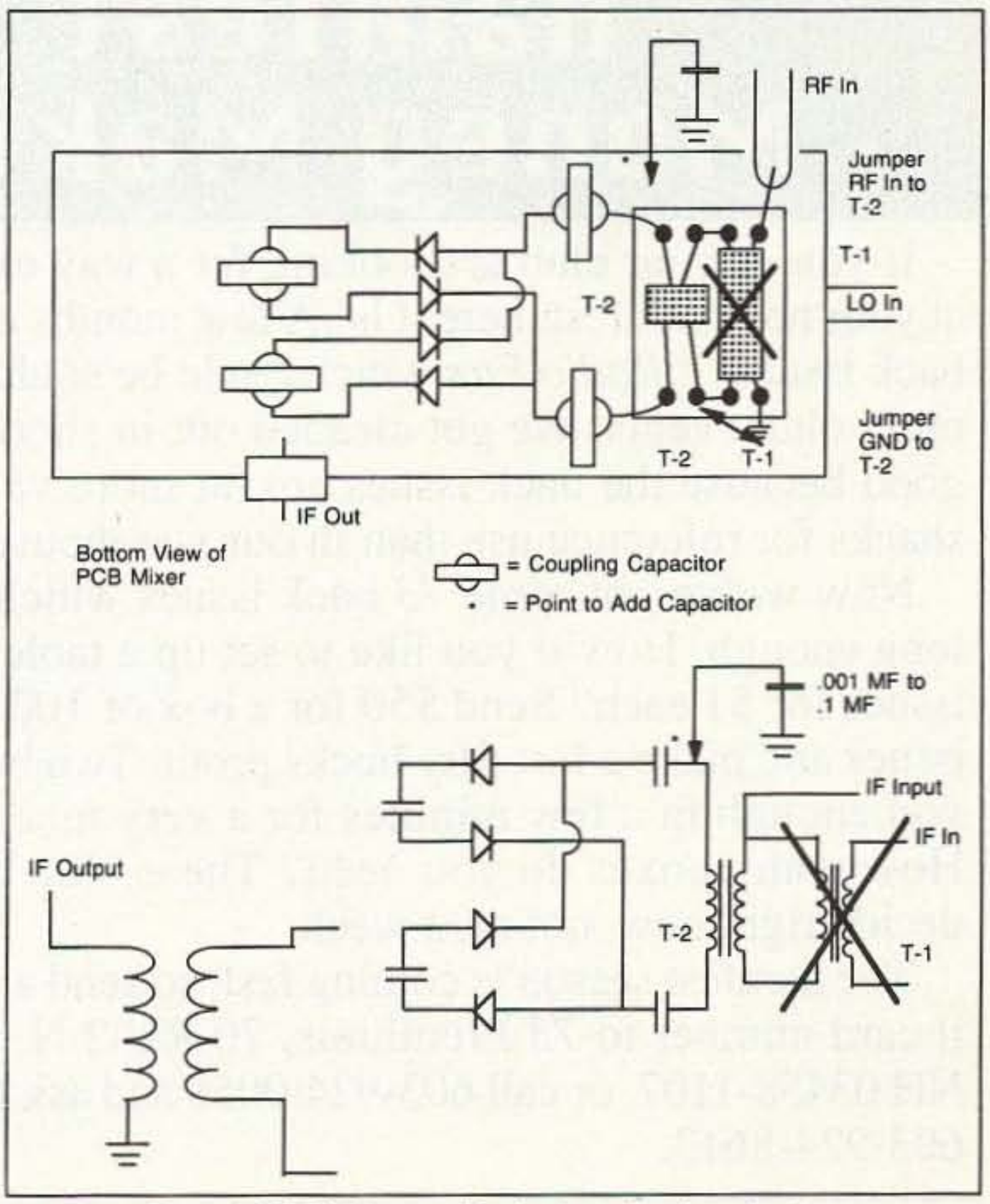

Figure 4. CATV mixer modification to reduce insertion loss.

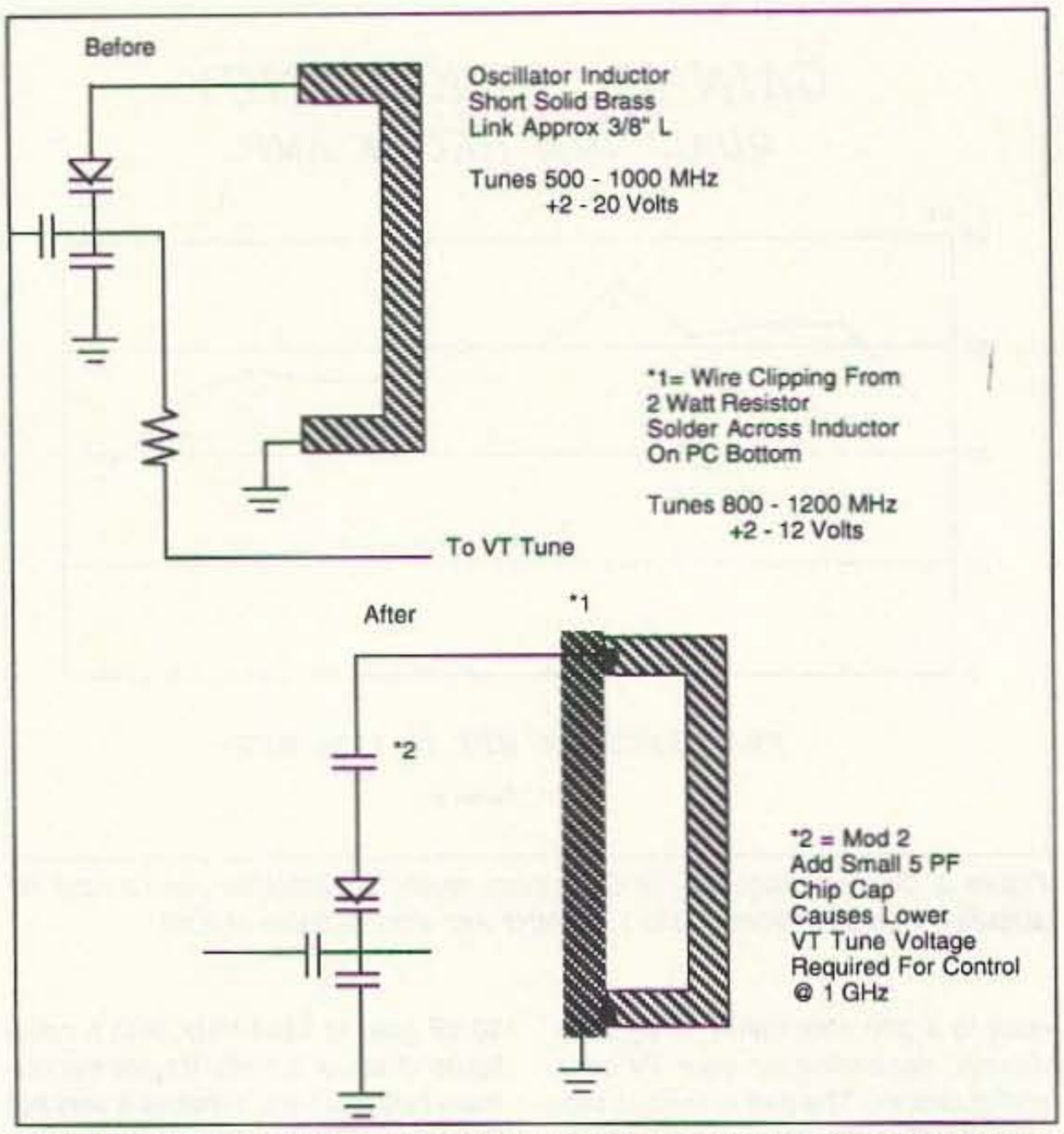

Figure 5. CATV Oscillator Modification to increase frequency of circuit and lower "VT" tune voltage for control of circuit from 12 volts vs. 20 volts unmodified.

"poor man's filter" could be the antenna. For best rejection to cellular and other services a filter is best. The filter should limit the input signals to just the 1200 MHz band before amplifying in the wide bandwidth (600-1700 MHz) of the Qualcomm receiver IF amplifier. I won't get into filters here as you can find several designs in most any ARRL *Handbook* for 1296 MHz.

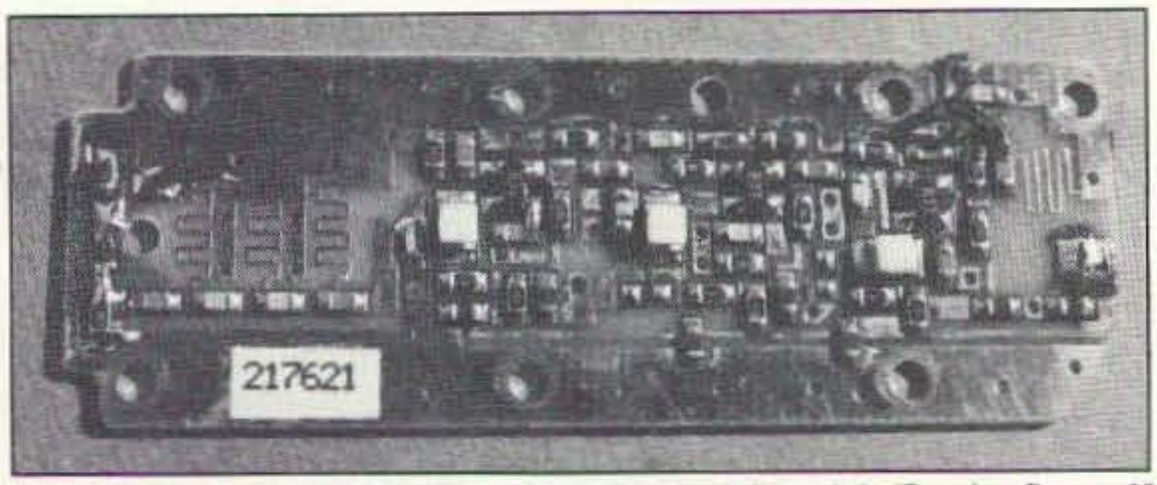

Photo C. Qualcomm IF amplifier, 600-1700 MHz, about 2.3 dB noise figure, 2" long by 3/4" wide.

The second modification, which will be covered next month, is to modify the VCO higher in frequency, allowing a lower control voltage "VT" with 1060 MHz. For those willing to follow this mod the rewards will be crystal-controlled PLL VCO stability. Before you enter this modification you need to know that the VCO stability is not critical, like trying to pick out a 5 kHz segment as you are tuning in 6 MHz video channel segments, making stability not a key parameter.

The VCO is modified in either case (PLL or manual control) to provide better higher frequency operation with a lower "VT" tune line voltage. See Figure 5. I placed a wire clipping (0.375" long) from a 2 watt resistor across the oscillator's tank circuit link inductor. This raised the minimum frequency from 600 to over 800 MHz with 2 volts on the VT line. The upper frequency limit was increased to about 1200 MHz at 12 volts on the VT line. This allows 1060 MHz to be obtained with a VT voltage of about +10 volts instead of +20 volts.

If a lower VT control voltage is needed in your application, lift one end of the varactor in the VCO and place a 5 pF cap in series with the diode. This reduces the higher capacitance of the varactor at lower VT voltages and allows 1060 MHz to be obtained at about 4 volts on the VT. In this case about 3 to 5 volts is required on the VT line and is suitable for PLL control applications. Additionally, the entire converter can be operated from a 12 volt power source. If you want to use the simpler manual control only, place the wire across the oscillator inductor and omit the varactor changes. See Figure 5 for oscillator modification details for +12 volt modifications.

The third option is to convert the input bandpass filter of the CATV tuner

Hamfest Money Maker

If you or your club are looking for a way to make money at your next hamfest, here it is! A few months ago we offered back issues of *Radio Fun* which could be sold at hamfests or other club events. We got cleaned out in short order. That's good because the back issues are far more valuable in ham shacks for reference use than in our warehouse.

Now we've got some *73* back issues which we've saved long enough. How'd you like to set up a table and sell back issues for $1 each? Send $50 for a box of 100 assorted back issues and make a fast fifty bucks profit. Two boxes could net you enough in a few minutes for a very nice new antenna. How many boxes do you need? These won't last long, so decide right now, not next week.

The hamfest season is coming fast, so send a check or credit card number to *73* Premiums, 70 R202 N, Peterborough NH 03458-1107, or call 603-924-0058 and ask for Sheila. Fax 603-924-8613.

(varactor tuned from about 50 to 400 MHz) and connect it to the output of the mixer for a tuned output filter. This filter can be used to remove any unwanted products in the output IF path to the TV receiver as it covers the required tuning range of our new IF, from 174 to 216 MHz (that is, TV channels 7 to 13), that we use as our receiver IF.

If You Don't Have an SRA-11 Mixer

Not to worry, the mixer that is part of the tuner is a good mixer, but for our application requires some surgery to make it functional for our application. In the original CATV application conversion loss (about 25 dB) was not a priority due to the high-level signals being received. To amateurs this is undesirable; we need all the gain (or least loss) we can obtain. A simple modification will render the onboard mixer usable for our application, yielding a conversion loss on the mixer of about 10 dB.

To achieve this lower loss we need to remove the input ferrite transformer (T1) entirely. Just cut it off the PC board with an X-Acto knife. Leave the ferrite transformer (T2) that is center-tapped with a capacitor going through a feed-through in the case wall. This is the local oscillator input to the mixer. On the rear of the mixer PC board, the input coil that remains (T2) needs to have one side grounded. The other side connects to the IF input. These leads previously went to toroid T1 which is now removed; add two jumpers: ground on the right and the jumper to the IF input on the left. A 0.001 to 0.1 µF capacitor needs to be added to one side of the mixer to complete the modification. The capacitor connects to the output of T1 at the coupling capacitor to ground. The capacitor value is not critical; 0.001 to 0.1 µF will work well. See Figure 4 for exact placement. This spot is marked by an asterisk. This simple mixer modification improves the mixer conversion loss to about 10 dB at 1200 MHz.

Well, there you have it: the first cut at a 1240 MHz ATV converter. Of course, there are other possibilities as well for the CATV tuner. An ATV converter could be constructed for 450 MHz as well. To put these ideas into reality all I have to do is to set up some more antennas to allow all this testing. What I really need (as long as I am putting together a shopping list) is a small stepstairs to the roof to provide access to an elevated test platform. On this platform there would be AC power and devices for antenna testing of projects such as this. Oh well, dream on.

As with any modification of circuitry there will always be questions on where exactly to make the connections. Don't be intimidated—dive in and give it a try. Go slowly and think each step through before cutting circuitry. Treat each circuit element as just that, not as a complete unit in one whole diagram. If you refer to the block diagram and photos provided in this article you shouldn't have any trouble.

To gain access to the internal components I used a pair of long-nosed pliers and straightened each of the metal "ears" that hold the cover plates on. When all ears are straight, the covers should pop off easily without undue pressure. Follow the circuitry and look for obvious connections between compartments as only the DC and signal paths make connections between compartments. All other circuitry is contained within a compartment.

In Figure 1 where I placed labels (RF, IF, LO) by the mixers, these are the approximate PC board locations where the interconnections are actually made for these circuit elements.

DC	Freq.
0	566
1	582
2	601
3	630
4	658
5	685
6	711
7	738
8	763
9	788
10	812
11	844
12	866
13	898
14	926
15	954
16	979
17	1000
18	1023
19	1040
20	1061

Table 1. Frequency of VCO before modification. With Mod #1 (Figure 5) circuit will tune about 800 to 1200 MHz from +2 volts to +12 volts.

Well, that's it for this month. Next month I plan to complete the synthesizer and dive into a simply-constructed 1200 MHz antenna. I would like to develop a sweep driver to use the tuner as a spectrum analyzer, but for now that part will have to be put on hold. First, the ATV projects; then let's see what happens. By the way: The synthesizer we constructed uses a Motorola synthesizer chip, the MC-145106.

I will make the CATV tuners available. For those who wish to purchase a CATV tuner with a Qualcomm amplifier cost is $25 postpaid. The CATV tuner or Qualcomm amps are available for $15 each; for additional tuners or Qualcomm amplifiers add $10 each. Units are surplus/brand-new. Prices are U.S./Canada postpaid.

As always, I will be glad to answer questions concerning this and other aspects of our upper frequencies. Please send an SASE for a prompt reply. 73, Chuck WB6IGP

Std. TV Channel	Frequency (MHz)
2	54-60
3	60-66
4	66-72
5	76-82
6	82-88
7	174-180
8	180-186
9	186-192
10	192-198
11	200-204
12	204-210
13	210-216

Table 2. TV frequency.

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Phase-Locked Loops

A long time ago, I did a column on phase-locked loops (PLLs) and their use in frequency synthesizers. This time, I'd like to look at PLLs with regard to their many other uses.

What Is It?

Just what is a PLL and why is it so useful? Basically, a phase-locked loop is an oscillator which can be made to track, or lock to, an incoming signal. You might wonder just what the point of that is. After all, if you already have an incoming signal at the frequency you want, why bother to create another one just like it?

The beauty of the PLL is that, while its output normally does track its input's frequency, it can have various other characteristics, some of which can be important and useful. For instance, the output signal can be of a different shape than the input. It could, perhaps, be a lot cleaner, or it could be a sine wave when the input is a square wave. In fact, that's a common use for a PLL: creating a sine wave from a pulsed, digitally controlled source. Another great use for the PLL is when you want to recreate a badly degraded signal, as is done in a shortwave radio's synchronous detector. A PLL sync detector phase-locks to the incoming AM carrier. Then, when the signal fades in and out, the loop stays locked and continues to supply the radio with a constant, clean carrier, which really helps reduce fading distortion in the demodulated audio. In fact, a well-designed loop can stay on frequency even if the carrier completely disappears for a second or so, which really helps with deep fades.

The output signal of a PLL also can be made at a multiple or submultiple of the input. In other words, the loop can be used as a frequency multiplier or divider, and it will track the incoming frequency while it performs its division or multiplication chore. For division, that might seem overkill. After all, darned near any old digital gate can be made to do division. Yes, but only if you want square waves! For multiplication, though, the PLL represents one of the easiest ways to do the job. If you want, say, a frequency at three times the input, which tracks some modulation in that input, how else are you going to do it? Sometimes a simple harmonic tripler would work, but the frequency range of such a circuit could be too narrow. With a PLL, you can do it from audio on up to RF.

Finally, a PLL's output doesn't have to be from its oscillator! What else is there? A particularly useful output is the control voltage which is used to make the oscillator track. Using that voltage as an output, it is easy to make FM and FSK demodulators.

How?

To understand the operation of all these circuits, it's necessary to grasp the basic operation of a PLL. This circuit scares a lot of people, and it really shouldn't. I don't know where the mystique about PLLs came from, but they're really not that complicated. Let's examine the basic operation of a PLL.

A phase-locked loop consists of three basic parts: an oscillator, a phase detector and a feedback network. The oscillator is not much different from any oscillator you already know, except that it's a VCO, or voltage-controlled oscillator. That lets the rest of the PLL adjust the frequency by varying a DC voltage. And, just as gross adjustment can change the frequency, fine variations in the DC control voltage can adjust the oscillator's phase. After all, the only difference between frequency and phase change is amount. In fact, that's where the phase-locked loop gets its name; it can lock its oscillator's phase to another signal, and it controls it with a feedback loop configuration, in which it monitors its own phase and corrects it until it matches.

The phase detector is at the heart of the loop. This thing has two inputs; one for the incoming signal and another for the PLL's oscillator. The output of the phase detector is a voltage which rises and falls according to which input leads or lags the other in phase. When the two are not even on the same frequency, the output of the phase detector goes up and down at a rate which equals the difference frequency between the two signals. It does that because the two are periodically crossing each other in and out of phase. I suppose that's the difference between a phase detector and a frequency detector; the phase detector has no way to tell which input is higher or lower than the other's frequency.

A Weird Idea

I suppose that, if you disconnected the oscillator's DC control line and fed it with a fixed voltage, you could use a PLL as a kind of IF subsystem for an FM receiver, as it would have both an oscillator and an odd kind of mixer (the phase detector), which would produce a difference frequency which could then be demodulated, perhaps with another PLL! It would only work for FM, though, because you'd lose the AM envelope in the phase detector. I've never seen it done, most likely because commonly available PLLs won't operate at high enough frequencies to be very useful as radios. Besides, real FM subsystem chips are already cheap and common. Still, it would be an interesting thing with which to experiment, perhaps in a project which had some characteristic that made the use of standard FM chips unfeasible.

Back To Our Show

Sorry for that digression, but the idea just seemed too cute to ignore. Anyway, back in our conventional PLL circuit, we have our phase detector connected to the feedback network, also known as the loop filter. Usually, this is no more than a resistor and capacitor, although it could contain some coils or, in the case of a frequency multiplier, some active circuits. The purpose of the feedback network is to control the oscillator in a specific way. Let's say we want the PLL to track the input as fast as possible. If we just connect the output of the phase detector directly to the oscillator's control input, what happens? Well, it's safe to assume that, at first, the incoming signal and the VCO will not be on exactly the same frequency. So, the phase detector's output will swing back and forth as the two periodically cross in phase. That'll swing the oscillator back and forth, causing the phase detector's periodic swing to change its rate, because the oscillator feeds one of its inputs. The whole thing will continue to bounce up and down, out of control, and the VCO will *never* get locked to the input signal. That's not very useful. But what if we slow the action down a bit? Specifically, what if we make our feedback network significantly slower than the rate of change of the signals themselves? Let's say we have a 1-MHz signal rate, and we make the loop filter react no faster than 1/10 of that rate. What happens then? Now, the initial swings in the phase detector's output will be integrated into a rising DC voltage, which will gradually pull the oscillator up (or down, depending on the design). When its frequency gets to be the same as the incoming signal's, the phase changes will stop, and the detector's DC level will freeze at a specific level. If, as is likely, the VCO's phase does not match the incoming signal's, the DC will adjust slightly up or down until the oscillator exactly matches the signal. The whole process can still be very fast, and loop instability can be completely prevented. And that is how a real PLL works!

"A phase-locked loop consists of three basic parts: an oscillator, a phase detector and a feedback network."

Getting Loopy

Often, a simple RC loop filter is all you need for your feedback network. There are ways, though, to make filters which have special characteristics. For instance, you may want your PLL to lock up very fast but then tolerate some wobbling in the input frequency without pulling on the oscillator. And that leads us to another powerful use for the PLL: as an FM detector.

Up to now, we've been considering the PLL's oscillator output as the reason for using it. What if, though, we pick our output off another part of the loop? What about the VCO's control voltage? What does it represent?

In the previous circuit, all it represents is the PLL's internal housekeeping. You can, however, make it represent *information*. Let's say we feed the PLL an incoming signal which contains FM information. In other words, the signal deliberately wobbles around in frequency a little bit. Now, when we feed it to our PLL, we set the loop's VCO frequency to nominally rest at about the frequency the incoming signal would have with no modulation. As the signal wobbles around, what happens? The loop attempts to track it, right? In doing that, it moves the control voltage around each time the signal wobbles. As its frequency goes up and down, so does the control voltage. Does that sound familiar? Yes—the control voltage is tracking the frequency changes in the incoming signal, so it represents the same modulation signal it originally *took* to wobble the signal around. Thus, the control voltage has demodulated the FM information, and can be directly used as an output! And, the time constant of the loop filter sets the loop's upper frequency response. If we set it to be just a little bit faster than audio, we can feed in the output of an FM IF stage and out will come audio! If we want to limit the response to, say, 5 kHz, we just slow the loop down with a bigger loop filter, and it will be unable to respond faster than 5 kHz. Thus, the varying control voltage will never move faster than that. Pretty slick, huh?

Going Up?

One of the most fascinating uses for the phase-locked loop is as a frequency multiplier. Frequency multiplication is inherently different from frequency division. In division, all you're really doing is making the circuit change state on every certain number of changes in the original frequency. So, if you want to divide by three, you just count every third cycle and you're done. But in multiplication, you need *more* changes than you start out with. To multiply by three, you need three

changes for every one in the original signal. That doesn't sound so hard, but how do you make them all evenly spaced so that the output is a continuous signal? How do you make something change state when there's nothing to tell it when?

Divide and Multiply

Using a PLL for this task lets you pull a clever trick. Let's say you take the PLL oscillator's output and run it through a frequency *divider* before you send it to the phase detector. What happens then? If we divide the oscillator by three, then the phase detector thinks that VCO is running at one third the speed it really is. Let's make up an example to see how it works:

Fooled Ya

Let's say our incoming signal is at 1 MHz, and we want our output at 3 MHz, phase-locked to the input. If we divide the VCO by three, using a couple of digital gates or flip-flops, the loop will think both the input and the VCO are running at 1 MHz, and will phase-lock the VCO to the input. But, in order for the divided VCO to be at 1 MHz, the *true* VCO frequency has to be 3 MHz, thanks to the divider, so, when the phase director looks up the loop, the VCO will be phase-locked at the same multiple of the input frequency as the divider is set to. If you divide by three, you wind up multiplying by three. And, as the input signal changes in frequency, the multiplied signal will follow it, as long as the input's changes are not so far off that the loop can't stay locked.

Everything Has Limits

That brings us to the last important point about PLLs. All of the design parameters are adjustable, and some of them fight each other. One important one is the frequency range the input signal can have while still keeping the loop locked. If it goes far enough off, the loop will unlock, making its outputs meaningless. Normally, PLLs have a "locked" signal which changes state when lockup occurs, so you know when you're in range. Still, the lockup range can be deliberately set, and sometimes you really want it narrow, to avoid having the loop lock to unwanted signals near the desired frequency. Other times, you want as wide a range as you can get, to allow a signal to wander all over the place and still keep the loop locked.

Try It!

Well, I hope you've enjoyed this little journey through the innards of the phase-locked loop. Why not play with one? Get yourself an LM565 or a 4046, read the data sheets, and see if you can make those chips play. I'll bet you can! Until next time, 73 de KB1UM. 73

Number 20 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors, Inc.
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Staten Island NY 10313-0006

A Shocking Experience

There are certain experiments and science demonstrations that simply lend themselves to fun in the classroom. One of my personal favorites to do with youngsters is the one that demonstrates some of the principles of electricity via static electricity experiments.

Depending on the age level of the group you teach, you can have a brainstorming session to introduce or reinforce the meaning of "shock." Almost every child will have a "shocking" example or story to tell. We discuss the different kinds of shocks there are, and how in the wintertime we can do some really "shocking" things in our classroom.

We review that electricity is caused by movement of electrons from one atom to another. Static electricity, however, unlike the current that flows through the outlets at home, is at rest. The electrons (negative charges) in static electricity are passed from one object to another and stop there. The object that has gained electrons is negatively charged and the one that has lost electrons is positively charged.

Except for having fun with dramatic demonstrations in front of people, static electricity is most often just a nuisance. Point out to your audience how unruly our hair can get when we brush it on a dry, winter day. When walking briskly across the carpet we can get shocks; and sometimes static electricity causes our clothes to cling. This is all harmless enough; but on a larger scale, lightning is caused by static charges that develop in the clouds. The energy released by a lightning bolt is thousands of times stronger than any other the children are likely to encounter.

Class Experiments

The classes always enjoy the experiments we do with static electricity. Here are some that can help kids learn more about the properties of things around us.

Thousands of years ago in ancient Greece, a scientist named Thales observed an unusual property of amber, a plastic-type material commonly used for jewelry. When rubbed briskly with fur, pieces of amber (or "elektron," as it was called) would attract small bits of cork, wood, or similar objects in much the same way that a magnet attracts iron-based metallic objects. Thales didn't understand why this occurred and assumed there was an unknown force in the amber. This force, of course, became known as electricity.

With this as a background, have the children bring in a large plastic comb (instead of the amber), and a warm, dry flannel cloth (instead of the fur). This demonstration works best on a dry day. Hold the comb in one hand and the cloth in the other. Briskly rub the comb a dozen or more times. Now bring the comb near some small bits of cork or paper and watch the pieces "jump" to the comb.

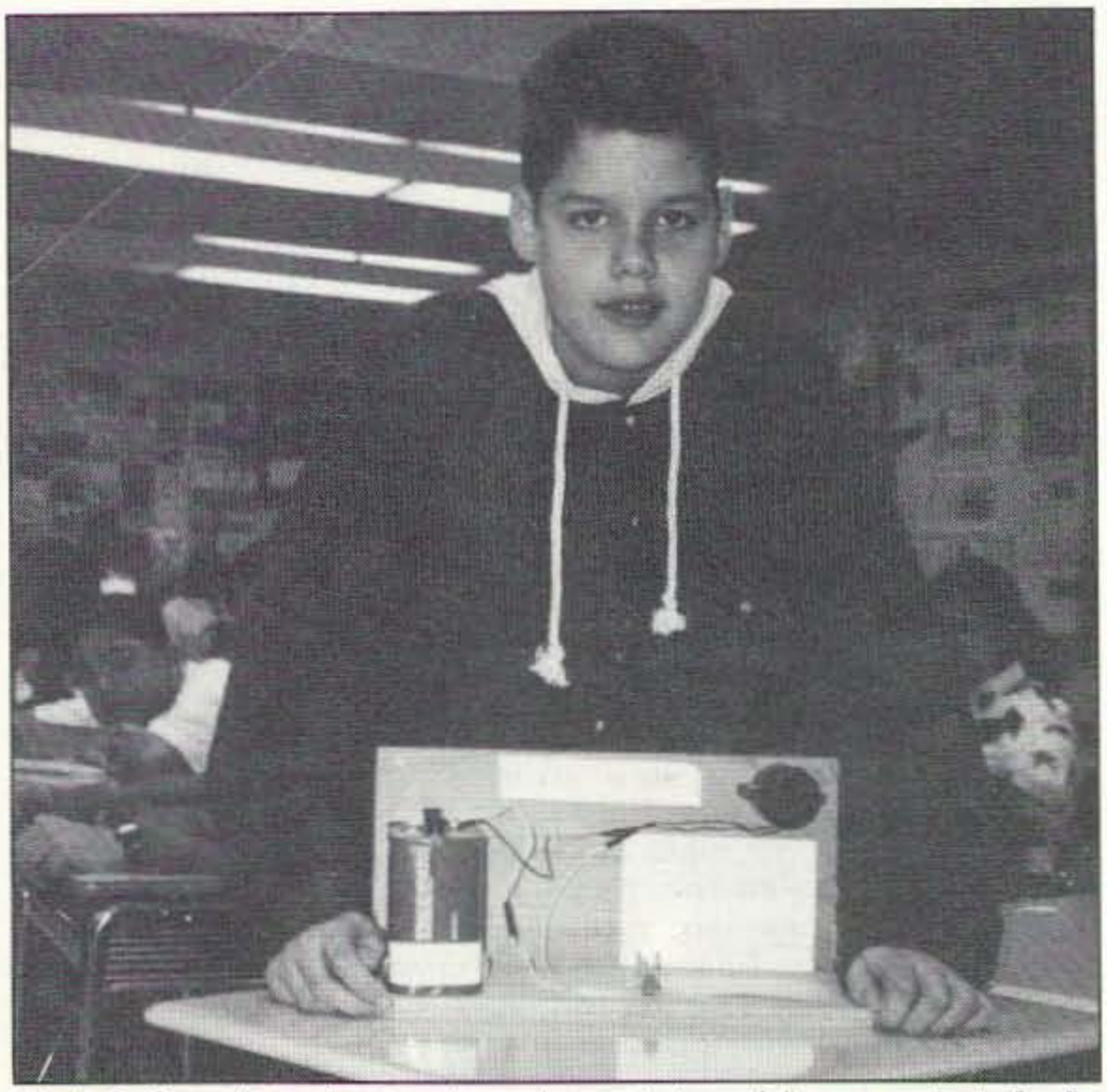

Photo B. Seventh-grader Juan Lugo demonstrates a follow-up project of a fire alarm he made.

"Except for having fun with dramatic demonstrations in front of people, static electricity is most often just a nuisance."

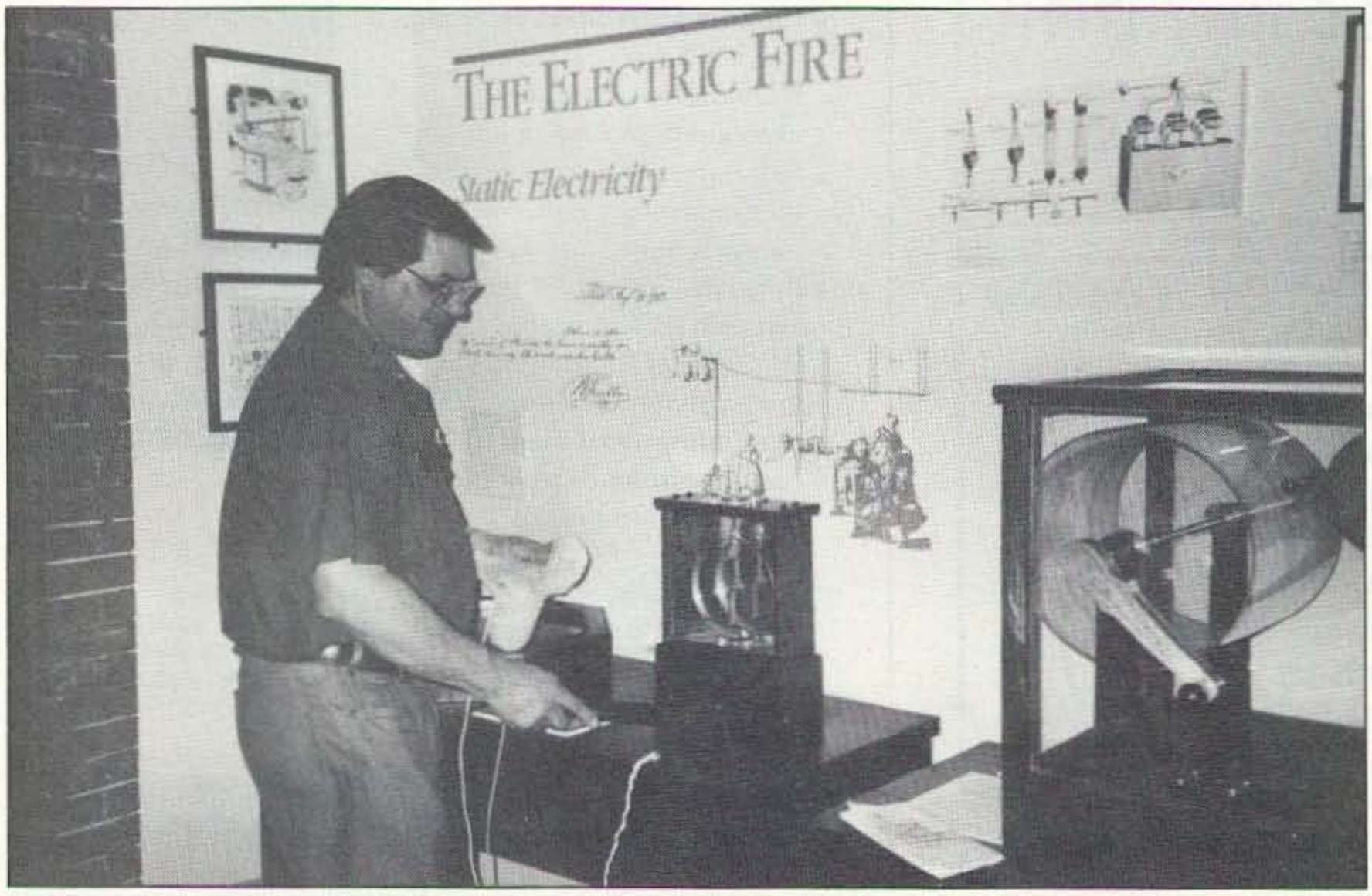

Photo A. Many museums, like the Franklin Institute in Philadelphia, have hands-on displays demonstrating static electricity.

Here are some more static electricity experiments from *Planet Earth* by Clay Wollney. The supplies you will need are: two or more balloons, a coat hanger, three feet of string, a piece of wool clothing, and a spray bottle filled with water.

1. One of the easiest ways to demonstrate static electricity is to blow up a balloon and rub it vigorously against your hair. Touch the balloon to a wall. Electrons picked up by the balloon as you rubbed it on your hair caused the balloon to become negatively charged. It is attracted to the wall since the wall is not negatively charged.

2. Blow up a second balloon to the same size as the first. Place the string over the hanger and tie a balloon to each end of the string. Hang the hanger so that the balloons dangle alongside one another. Now rub one balloon with the wool and then release it. Is the other balloon attracted or repelled? Now, rub both balloons with the wool and release them. Do they still behave the same way? When only one was charged the balloons clung together (unlike charges attract). When both are charged, they push each other away (like charges repel).

3. Static electricity is more of a problem on dry days than on rainy ones. Water acts as a conductor, allowing charges to flow easily from one object to another, so charges don't build up. Charge both balloons, then spray the finest mist possible between the balloons. Does the moisture in the air change their behavior?

Be sure to take pictures of the children's faces while they do these experiments. Send me your best photos so we can share our experiences with other instructors. 73

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NEVER SAY DIE

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Hamming Irrelevant?

Will the development of the "information superhighway" eventually make amateur radio irrelevant? The Internet is already offering far better communications facility than amateur radio. Our ham contacts with other countries are severely limited by (a) propagation conditions, (b) interference (QRM), (c) noise (QRN), (d) fading (QSB), (e) language differences, and (f) time differences.

We could overcome some of these limitations if we developed a worldwide satellite repeater communications system. This could help us avoid our problems with ionospheric propagation, noise, and fading. We might even be able to develop systems which would reduce interference. And the time isn't far off when we could even overcome language differences with software. But I have to admit that despite my endless nagging and urging that such a system be developed, I see little sign of any amateur interest in the project.

That being the case, the Internet approach will win by default. E-mail does about the same thing as packet radio, only without all the miseries we're fighting with shortwave packet circuits. Worse, while amateur slow-scan is creeping along, the growth of MPEG and other systems of reducing video bandwidth will be making not just good quality photos available over the Internet, but full motion, high quality video.

Right now you can get on the Internet and strike up a live conversation with people anywhere in the world. It is already providing the service we only wish we could. It's better, in that once you get familiar with the Internet you can find like-minded people to talk with on virtually any subject. One time, many years ago, I proposed the development of such a system for amateurs. I'd love to find hams interested in the things I want to learn about and talk with them. I'm getting less and less interested in taking potluck, and finding it difficult to discover any area of mutual interest from among the largely retired hams inhabiting 20m these days.

I'd love to talk about cold fusion, sky diving, scuba diving, cooking, and any of a hundred or so things I'm interested in. One time on a ski lift in Aspen I met one of the leading astronomers and we had a momentary talk about the bubbly nature of the universe, which he'd recently helped discover. Another time I went up the lift with Mike Markkula, the chap almost singularly responsible for Apple's growth in the early days. Mike is not a ham. Nor was the astronomer.

Sure, I might luck into contacting King Hussein, but even if I did, after about 10 microseconds the frequency would be totally wiped out by DXers frantically calling him to get a QSL card. I remember trying to get through to Arthur Godfrey one time when he was on a DXpedition to the Sahara. He had Colonel Carroll Cone with him, an aviator friend of my father's I'd known from childhood. He and my father were in the Army together when they learned to fly in San Antonio in 1921. I desperately wanted to get through and say hello. No way. I still remember that frustration.

Many of the cold fusion scientists are on the Internet, where I can communicate live or via E-mail. The rest of them will soon be on. I'll be there too, looking for interesting news about kit planes, ultralights, hang gliding, places to go diving, new countries to visit, and a whole bunch of new ways to generate power. Then there's my growing interest in finding out more about life. I've been cluing you in as I've discovered exciting books about this. I know there are probably hundreds more books I'd love to read, if only I had some way of finding them. This is what the Internet will eventually offer. Yes, it's something amateur radio could offer, but only if we had the pioneers to make it happen. Alas, we seem to have killed off the interest that attracted youngsters to the hobby, and without young blood, we've run out of steam in the pioneering department. How many famous explorers started when they were at retirement age? And that's what our average ham is approaching.

I wonder if there will ever develop on the Internet anything like our ham contests? Well, they already provide contest areas for chess, and probably some other games. How long will it be before an Internet computer shuffles and deals the card for bridge, canasta, and even poker? I've spent weekends doing the Sweepstakes contest, DX contests, and VHF contests. They were fun and exciting. I'm glad I did them, but there's no way I'd get involved with doing them again. I no longer have the time to invest in that kind of entertainment.

Is the collection of QSL cards any better than collecting matchbooks, stamps, or even sugar packets from restaurants around the world? I've got boxes of QSLs, stamps, matchbooks, and sugar. They're only a problem for my heirs. Heh, heh. Imagine being faced with six big boxes of sugar packages from maybe a hundred countries. Can you throw them all out? Who would want them? Are they worth anything? I guarantee that old QSLs have zero value, so they'll hit the trash can soon after you win your Silent Key award from the League. Hey, you don't even have to be a member to win that one. Of course, you can only win it once.

How many of you are checking into a ham group on CompuServe? Prodigy? America Online? The Internet? As soon as we reach the 50% level we can start petitioning the FCC to auction off our bands and agree to split the proceeds with them. If only the chaps actually using the bands pocketed the money, they'd all be able to retire immediately.

The FCC, which already has the taste of blood from their recent frequency auction, may already be sniffing at the 99.8% of our ham frequency allocations that we're not using. And, unless something major happens, will never use.

What could change all this? Only a miracle, and it's been a couple of millennia since the last big miracles. First, the ARRL directors would have to change their minds about the code, and you know how likely that is. Without the code obstacle we might stand a chance of attracting youngsters into the hobby. That, alone, won't do it. The League directors would also have to change their minds about keeping out newcomers. They seem to feel that we have more hams than we need . . . just listen to the QRM on 20m, if you think otherwise.

If we were to change things. If we were to think in terms of marketing the hobby, of making it attractive to youngsters, of advertising and promoting it, we might be able to bring in enough newcomers to hold our bands. And none of this 20 wpm stuff for the Extra Class license. We need a couple million young hams, and we're not going to get them while we're using the code as a barrier. But I've written about all that before. You didn't agree then and you probably don't agree now, or you'd have done something. That's OK, I'll keep publishing my magazines as long as amateur radio (or I) survive. Right now I think the odds favor my surviving a lot longer than amateur radio, and I've got a long list of ailments. Ask me about that sometime on the air.

No, I'm not going to petition the FCC for the changes I propose. I'm not your leader, I'm just the coach. Ham radio is still mostly a hobby for me and I intend to keep it that way. Oh, I thought about the leader business years ago, but that takes building something like the ARRL, complete with all the nitty-gritty of dealing with government agencies, militant gays demanding the "right" to advertise for members of their gay club, militant femmes demanding an end to the use of "YL" in the club publications, militant crippled hams demanding a column for the physically challenged, and so on. I'm trying to think of something I can militantly demand as a right.

Meanwhile, thousands of people are signing onto the computer networks every week, and the more youngsters that go that route, the less need there will be for amateur radio. Unless you can come up with some benefit that amateur radio can provide that the nets can't. Please advise.

One more thing. I don't want to get any messages from you that you don't always agree with me. If you disagree on the above, you damned well let me know why. That means you've got to do some thinking. For some of you, it's about time.

Better Junior Ops

My search for a way to generate more young hams has taken a strange turn. My original goals were to (a) provide a solid excuse for our hobby to be kept alive, despite the pressures for our valuable spectrum by rapidly expanding commercial interests and (b) help provide the high-tech work force our country is going to need to compete against the other industrial countries in the next century.

If we're going to do this we have to get kids interested in hamming. This brought me head-to-head with the mess our schools are in. And that, in turn, got me to reading about our educational system. I've found that I'm not alone in criticizing our school system.

Now, before I get really started on how lousy our schools are, let's just consider what you might do if you were interested in having the very best child or grandchild you could. First, let's talk about what can go wrong, and then we can discuss how to fix the situation. I'm presuming, of course, that you might have an interest in giving your children the best start in life that you can. Maybe you don't care.

By the time your kids are seven the largest part of their characters will have already been formed. The child at seven won't be very different fundamentally from the teenager at 15, or the grown-up at 30.

Your child starts with the sperm and the ova. Anything you do to screw up your DNA before conception is going to affect your kid, and not positively. If you mess your sperm up enough, there'll be a miscarriage. But a lesser change in the DNA message will just burden your child with problems. There may be health, behavioral, or even cosmetic problems.

So what can we do to give our kids the best possible start? Well, research has shown that there are a lot of things that affect our sperm. There are drugs such as nicotine and alcohol. There are magnetic fields such as we find with electric blankets or living near power lines or power sub-stations. There are poisons such as mercury, silver, and nickel, which we can get from amalgam fillings in our teeth. Most of us already know about crack babies, and problems from cocaine, pot, and the hard stuff.

So let's say that you and your wife go out of your way to give your kid the best start you can. Then comes birth. I've got to get you to read *The Continuum Concept* by Liedloff. That'll keep you from letting the hospital put your baby in their nursery. This is a wonderful guide book for the first year of life.

Next comes the pre-school era from one to five. This can be a time of incredibly rapid learning. It's a wonderful time to teach babies several languages, if you have a way to continue and develop their use later on.

Unfortunately, even if we've done everything the best we can until we send them to school, this is when we will permanently screw up their lives. I

hope I can get you to get the book by John Gatto, the New York State Teacher Of The Year, *Dumbing Us Down, The Hidden Curriculum of Compulsory Schooling.* It's inexpensive and a humdinger. Of course, since you are an alumni of this school system, the chances are great that you do not have any interest in reading books. Do you know that the average American school teacher only reads one book a year? And then, even if you do read Gatto's book and get all upset when you find out what's been going on in schools, you have been so conditioned by your own school experience that you are gutless and won't have the initiative to even try and do anything about it.

Heck, I've discussed the major problems facing our society and proposed inexpensive, creative solutions to them in my *Declare War* book. Several thousand people have bought it, yet I've seen no movement to try to implement any of the proposals. "It can't be done. It's hopeless." Until I read Gatto's book I hadn't realized why I was getting verbal and written support, but not seeing any sign of people doing anything.

I was around 11 when it finally dawned on me that kids had no more rights than slaves. By law I had to go to school. The only rights I had in school were those the authorities let me have, and they have been backed up by the Supreme Court in this. I was forced to comply by the use of embarrassment and humiliation. You do nothing unless the teacher tells you to . . . which stifles thinking and makes you dependent on the teacher. I see this pattern in many of the youngsters I've hired, who are unable to think for themselves. They sit and wait until they're told what to do. They are unable to plan work. They've always been stopped before finishing something by the bell, so they're not familiar with the concept of completing work.

Gatto says, "It is the great triumph of compulsory government monopoly mass-schooling that among even the best of my fellow teachers, and among even the best of my students' parents, only a small number can imagine a different way to do things. Only a few lifetimes ago things were very different in the United States. Originality and variety were common currency; our freedom from regimentation made us the miracle of the world; social-class boundaries were relatively easy to cross; our citizenry was marvelously confident, inventive, and able to do much for themselves independently, and to think for themselves."

Gatto points out that it only takes about 100 hours for a person to learn to read, write and do arithmetic, as long as they're willing to learn. From then on they can teach themselves. "Schooling, through its hidden curriculum, prevents effective personality development. Indeed, without exploiting the fearfulness, selfishness, and inexperience of children, our schools could not survive at all, nor could I as a certified teacher. Nobody survives the curriculum completely unscathed, not even the instructors. The method is deeply and profoundly anti-educational. No tinkering will fix it . . . don't be fooled into thinking that good curriculum or good equipment or good teachers are critical determinants of your son's or daughter's education."

He points out that before television children had enough time to themselves to learn about self-motivation, perserverance, self-reliance, courage, dignity, and love. Now kids, on the average, spend 55 hours a week in front of the TV. That's one-third of their time. Add to that the stresses of a two-income or single-parent family, and our kids have too little time to learn to become human.

Is it any wonder that our engineering universities are running out of potential students, and are having to continuously lower their admission standards? Only 7% of the high school graduates in America have enough math and science background to be accepted by an engineering college. The colleges have responded by turning to foreign students. That's great for other countries, but it sure leaves ours in a fix. Here we are heading into a high-tech future and we're turning out fewer and fewer engineers, technicians and scientists.

The time was, 50 years ago, that youngsters wanted to be hams so badly that they'd put up with learning the code as a barrier. I did, even though I hated being forced to do something which did not make sense to me even then. Very few of the kids these days have the passion to surmount obstacles, so we've instituted the no-code license. Well, we've been lowering the standards for school grades in order to get our kids through school, which is the same thing. They're even lowering the SATs because our kids' scores have dropped so much. Now I see some hams pleading that we lower the technical exam standards so kids won't have to memorize so much to get a ticket.

There may be some American schools that are pretty good. I've read about a few. But most of the better-educated children today are being schooled at home by their parents. Maybe you've read about it in *Newsweek.*

Home schooling will be a lot simpler once we have a good video educational series parents can use. These would use top-notch performers, plenty of graphics, and be fun to watch. PBS has been producing some superb educational videos. Now we need to have them to cover everything being taught in the K-12 years, plus everything that should be being taught. And also plus everything kids might want to learn, but which isn't being taught. We need thousands of these videos.

We'll still need schools to provide the hardware and facilities to teach skills. You can teach a lot about driving with a simulator, but then you need a car. Ditto flight simulators, etc. You can't learn to juggle with a simulator, or to throw a boomerang. Or do glass blowing.

College? There may be some that are okay, but if you read the books on education you'll find that most aren't much good. Most of the "teaching" is done by student instructors. Get a copy of Thomas Sowell's *Inside American Education,* 1993, Free Press, $25.

If you learn much about nutrition you won't let your kids near a McDonalds. Granted, it's difficult to get the facts on nutrition. The field is overgrown with fads and scams. But if you want to raise healthy, happy, intelligent children, you'd better learn.

So much for today's sermon. If you're interested in learning more about education, I've got a bibliography available of the more important books I've found on the subject. Send me an SASE and then head for a good library.

Oops!

Did you or did you not send for the ham CD composed and sung by Andrew OZ1XJ and Lissa OZ1XY which I wrote about in the December issue? What do I have to do to get you to support ham entrepreneurs? Particularly ones with outstanding products? Sigh . . . sometimes you almost discourage me. The songs on XJ and XY's CD are by far the best ham-oriented songs I've ever heard . . . and "ever" is a long time for someone who's been hamming for 56 years. One picky-picky reader noticed that I got Andrew's call wrong in my write-up. It's OZ1XJ.

No, please don't tell me that you don't have a CD player. Compact discs have been out for over 10 years now and LPs have almost disappeared, which tells me that you are either making do with the garbage music you get from radio, or that you are missing one of life's great pleasures. No, I don't expect you to go berserk buying music, but good grief, you certainly should have a decent CD collection by now. It's like not reading books and magazines. It shows a poverty of intellect and imagination.

You need to spend some time quietly thinking, some reading, both for enjoyment and furthering your education, and some time listening to music. It wouldn't hurt for you to spend some time writing too. Far too many hams that I talk with on the air seem to be one-dimensional (or less). Now and then I run across someone I can talk music with. What pieces by Gottschalk or Nazareth are you familiar with? Lamb, Ippolitov-Ivanov, Gliere? Songs from the 1890s, show music of the 1930s and 1940s? Sousa, Strauss? If you hear me on the air let me know what music you've heard recently that you think I may have missed. Or what books you think I might particularly enjoy.

How'd You Do?

Yes, I tried to make my little 33-country DX contest in December (p.76) a nasty one. I have to uphold my reputation, right? Plus I got to brag, since those are all countries I've visited. I should have started writing my travelogues years ago. Of course my main reason for bringing all this up is to put a burr under your blanket and get you off dead center. It's great fun to visit and get on the air from rare countries, and it doesn't have to cost a fortune. You're a ham, so how about doing some real hamming?

If you don't want to be bothered with the weight of a rig and the customs hassles, make a deal to use the station of someone in the country, with the promise to take care of the QSLs. Most hams in rare countries really hate being forced to make 30-second contacts by the gross just to have to fill out a QSL card. A few are taking advantage by asking for green stamps, and making a nice profit on the deal. I remember one famous DX-peditioner I knew very well who charged $50 each for QSLs from the rare countries he put on the air and bragged that he was pulling down over $50,000 a year tax free with this scam. He got so greedy that he made thousands of contacts from countries he didn't even visit.

I've never had any problem finding a station I could use during my visit to most countries, so I've rarely had to take a station along on my trips . . . except for a 2m HT.

Religion and Politics

We sure seem to have a problem in America with religious zealots trying to force the government to pass laws supporting their religious beliefs. We had prayers every day in schools for years without it hurting anyone . . . then someone decided to make a big deal out of it and look at the mess we have with the school prayer pro and con groups. Then there's the creationist baloney, where a few religious fundamentalists want to force our schools to teach their religion. And look at the awful mess we have with the pro and con on abortions!

The "Right To Life" bumper-sticker crowd are basing their rhetoric and beliefs on the lie that life begins at conception. That's a crock. Both the ova and the sperm are demonstrably quite alive well before they ever get together. Indeed, we have a ton of published research reports showing that a man's sperm can be damaged by smoking, drinking, or taking drugs before conception . . . and that this damage results in often serious problems for the resulting child. Ditto the mother's eggs, which can also be damaged by pre-conception drugs in her system.

Will the right-to-lifers start trying to get laws passed making it illegal to kill sperm? The Catholic Church already is on record as opposing the frivolous waste of sperm, right? But what about the 499,999,999 sperm that don't make it at the moment of conception? They're all alive and every one of them has the potential to start a child. Will we start seeing movements to

make sure that none of a woman's eggs are allowed to die? Will they picket the Kotex Company, which is abetting this terrible loss of life? Millions of potential American babies are being killed every day! Let's put a stop to this awful human carnage.

OK, maybe we shouldn't consider life starting at conception. So when does it start? You're not going to like this, but my earlier concept of life being alive and well before conception is, in my professional experience as a psychotherapist, quite accurate.

The psychotherapy I used involved using hypnotism to regress people to the moment when a current day psychological problem or illness was triggered by a past traumatic incident. While most problems resulted from incidents after birth, not a few involved things that happened during pregnancy, and every now and then some patients would go back even before conception with recollections of traumas. I'm not talking about past lives incidents, but those which involved the sperm or the ova before conception. If you know a good hypnotist you, too, can go back to that period of your life and rerun it. It's there and it's recorded in some way we still don't understand. You can even fast-forward it, if you want.

The death of someone we love is a tragedy. The death of a wanted baby is a tragedy. But I remember all too well one woman who's mother cursed her every day of her life because the mother got pregnant and "had to" marry the father, who was an unmitigated louse. The daughter, who was beautiful, grew up totally believing that she was ugly and worthless. She was a real mess mentally. Manic depressive. She, in turn, passed along this heritage to her daughter.

Subtle Energies?

One of the more interesting conferences I've attended was a subtle energies conference in Monterey (CA) put on by the International Society for the Study of Subtle Energies and Energy Medicine in 1993. I missed their 1994 conference because I was all tied up with the mess I told you about, when a couple of employees, with the help of a certain pinko opportunist most of you know, tried to put me out of business. I won't miss their 1995 conference.

OK, what are "subtle energies?" No one knows. Yet. Indeed, they may not be energies, though they act like them. The main thing I appreciated with this group was their open-mindedness. Let me quote from one of the presenters, Larry Dossey, M.D., "And anyone who at the present day expresses confident opinions, whether positive or negative, on ostensibly paranormal phenomena, without making himself thoroughly acquainted with the main methods and results of this careful and long-continued work, may be dismissed without further ceremony as a conceited ignoramus.

"The failure to understand how something happens in science, however, is not a particularly damaging admission. At the turn of the century, scientists were unable to explain a very common event: sunshine. An explanation of how the sun shines had to await the development of nuclear physics. In the meantime, the lack of an explanation hardly annulled the fact that the sun did indeed shine."

The lack of radio signals from other civilizations may have more to do with our primitive communications system. There could well be some sort of life-force communications system which is instantaneous and not limited by distance. Once that is discovered we may suddenly find ourselves in communications with an infinity of other beings. Once a civilization progresses to using thought for communications, why would they need slow, bandwidth-bound, interference-prone, radio? That might explain the lack of radio signals from space.

We have a host of hints that there may be some new kind of communications medium that we haven't identified yet. At the last conference I was fascinated by a video showing a psychic influencing the surface tension of water on cue from hundreds of miles away. She also was able to disturb a cloud chamber on cue.

I hope some of you who are interested in learning more and have the time to attend the conference will be there with me this year June 23-26th in Boulder (CO). You can get more information from ISSSEEM, 356 Goldco Circle, Golden CO 80403; 303-278-2228; 279-3539 Fax; CompuServe 74040,1273.

IBM and Apple Both Fail? That's Ridiculous!

There's still time for either or both companies to be rescued, but I'll be very surprised if it happens. Are you interested in what's gone wrong and why I think the problem probably is terminal? Well, I'll tell you anyway.

Both companies have had recent CEO changes as a result of poor performance. But the new CEOs, unfortunately, aren't the right people for the emergency. With both companies having financial problems, their boards have reacted reflexively and put in bean counters. Financial men to handle financial problems, right? Bad decision. If I'd been on either board it never wouldn't have happened that way.

But then I haven't seen any sign that the boards of either corporation have anyone who really understands the business they're in and the sweep of history in this industry. I guess you had to have been there to know what's been going on inside the industry.

Let's Take Apple First

Steve Jobs has been hailed as a visionary because of the popularity of the Apple. Ditto John Scully after him. I think I can make a good case for neither really being visionaries. Indeed, Scully was brought in to rescue Apple from Jobs' monumental blunders, which were sinking the company. We've had a good practical example of Jobs' vision in the dismal failure of his NeXT computer, which is now kaput except for its operating system.

The original Apple was put together by Steve Wozniak. Jobs, his friend, had been selling those illegal blue boxes to people wanting to cheat the phone company out of long-distance charges and saw Woz's Apple as a marketing opportunity. In that he was right, but it didn't take a lot of vision to see where the microcomputer industry was heading, just a reading of my editorials in *Byte*. By the time Apple was getting started I was already starting *Kilobaud*, my second computer publication.

The Apple computer took off and soon had 40% of the microcomputer market. Radio Shack's TRS-80 had another 40% of the market, and about 200 small companies (all now gone) shared the other 20%. This was the way it was when IBM came into the market with their PC and blew everything up.

Meanwhile, the rift between Jobs and Wozniak was widening. The Woz was pushing to keep on improving the Apple II. Jobs, who'd had little to do with its design, had delusions of grandeur and wanted to invent his own computer. This resulted in the Apple III and the Lisa, two bombs. Woz left in disgust.

The Lisa was based on a new approach to computing that had been developed by Xerox in their Palo Alto Research Center, one which allowed the user to work with icons and menus instead of typed in commands. It was a good approach, making computers much easier for beginners to use. Friendlier. Except that the Lisa was pitifully slow.

The Apple II was based on the 6502 microprocessor, which was pretty good when it came out in 1975, but was getting to be an antique by 1979. The Intel 8080 had been improved with the 8086 and the 8088. Then came the Z80 and the 80186. It was a steady improvement and growth of the basic 8080, and all designed by one chap. The same thing was happening to the 6502, but Jobs wouldn't let the Apple II be upgraded to the 65816, a 16-bit and much faster version. He had a vendetta against the Apple II and Woz, and this doomed the II.

I visited the chap who had designed the 65816 to get some samples for projects I was working on and he had a 65832 all designed and ready for prototyping. This would have run 8, 16, or 32-bit software, it ran at 30 MHz, and had built-in circuits to speed up the disk drives and output to a printer. This chip would have put the Apple II into the minicomputer power bracket. Jobs said no, a decision that cost Apple billions.

When the Lisa laid an egg Jobs rounded up a development team to speed it up. In 1983 he introduced the Macintosh with the usual hoopla. The Mac was much better than the Lisa, but it had almost no application programs, so its acceptance was slow. It was supposedly aimed at the business market, but there were no business programs for it. The first software made use of its graphic abilities and soon was being accepted by artists. The real breakthrough came when desktop publishing software was developed. The Mac still is a stranger in offices, where the IBM format completely dominates.

The mess all this made at Apple resulted in their bringing in Scully, who got rid of Jobs as quickly as he could. But the damage had been done and Apple today has only 13% of the market. If Jobs had let The Woz keep on developing the Apple II the company might have had two winners today, and a few billion dollars more in sales.

There is a wide-open opportunity for either Apple of IBM to take the next logical major step in the market, but with bean counters in the CEO chairs instead of visionaries, the chances of either company taking this step are minuscule. Such a step would quickly leave all the clones behind, knocking many of them out of the business. The step would require the least change for IBM, and could reverse their gradual disintegration. I've written to both of the new CEOs, but have not had any answer.

The step involves the development of industry niche specific computer systems, complete with local service. I've written about this in greater depth in my *20/20 Foresight* pamphlet (#14).

The IBM team which developed the PC saw the importance of third-party support for the Radio Shack TRS-80, so instead of going the old IBM route of a closed operating system, they cooperated with software and accessory suppliers. Radio Shack, meanwhile was still fighting these suppliers, so they dropped their support of Radio Shack and moved to IBM. And that's when the Radio Shack computer share of the market dropped from 40% to around 4%, losing them tens of billions. Radio Shack has never recovered from this blunder by Tandy Chairman Roach.

Now the IBM PC is getting thrashed by clones, but the real long-range disaster for IBM is the loss of the mainframe market to super-micros, as I predicted over 10 years ago. Apple, by keeping their operating system closed, has discouraged software support of business-oriented systems, so even though the Macintosh has been ahead of the PC in graphics and publishing, it's been behind with business applications . . . and that's over 80% of the market. Only a bold step in a new direction by Apple or IBM can reverse these trends. They are both in desperate need of a visionary to keep them from being history. 73

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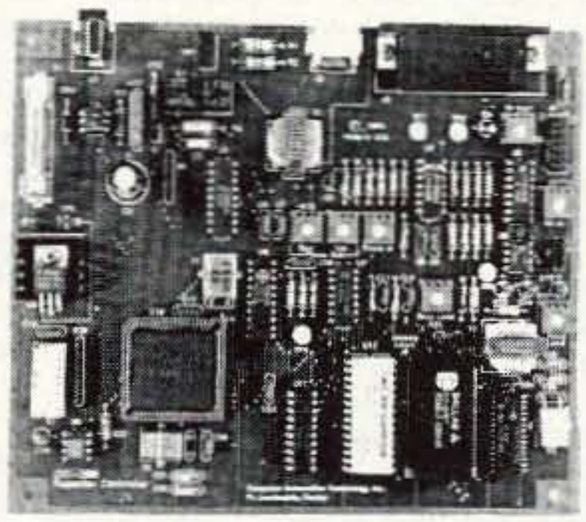

- ✓ *Voice Synthesizer*
- ✓ *(412) Word Vocabulary*
- ✓ *Twelve Voice Messages*
- ✓ *Two Voice Identifiers*
- ✓ *CW Identifier*
- ✓ *Full Feature Autopatch*
- ✓ *User Speed Dials*
- ✓ *Emergency Speed Dials*
- ✓ *Reverse Autopatch*
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- ✓ *DTMF Repeater Access*
- ✓ *DTMF Repeater Muting*
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- ✓ *Hardware Logic Inputs*
- ✓ *DVR Controller Ready **
- ✓ *Female Voice & Sound Effects*
- ✓ *Programmable Courtesy Tones*
- ✓ *Programmable Codes and Timers*

** (Requires MF-1000 Serial Interface Card $59.00)*

Write or Call for a brochure describing the CAT-300 Controller, including schematic, voice word list, and control functions.

CAT-300 Controller Board $299.00 Wired and Tested

Computer Automation Technology, Inc.
4631 N.W. 31st Avenue, Suite 142, Fort Lauderdale, Florida 33309
(305) 978-6171

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- **Cable TV Leaks**
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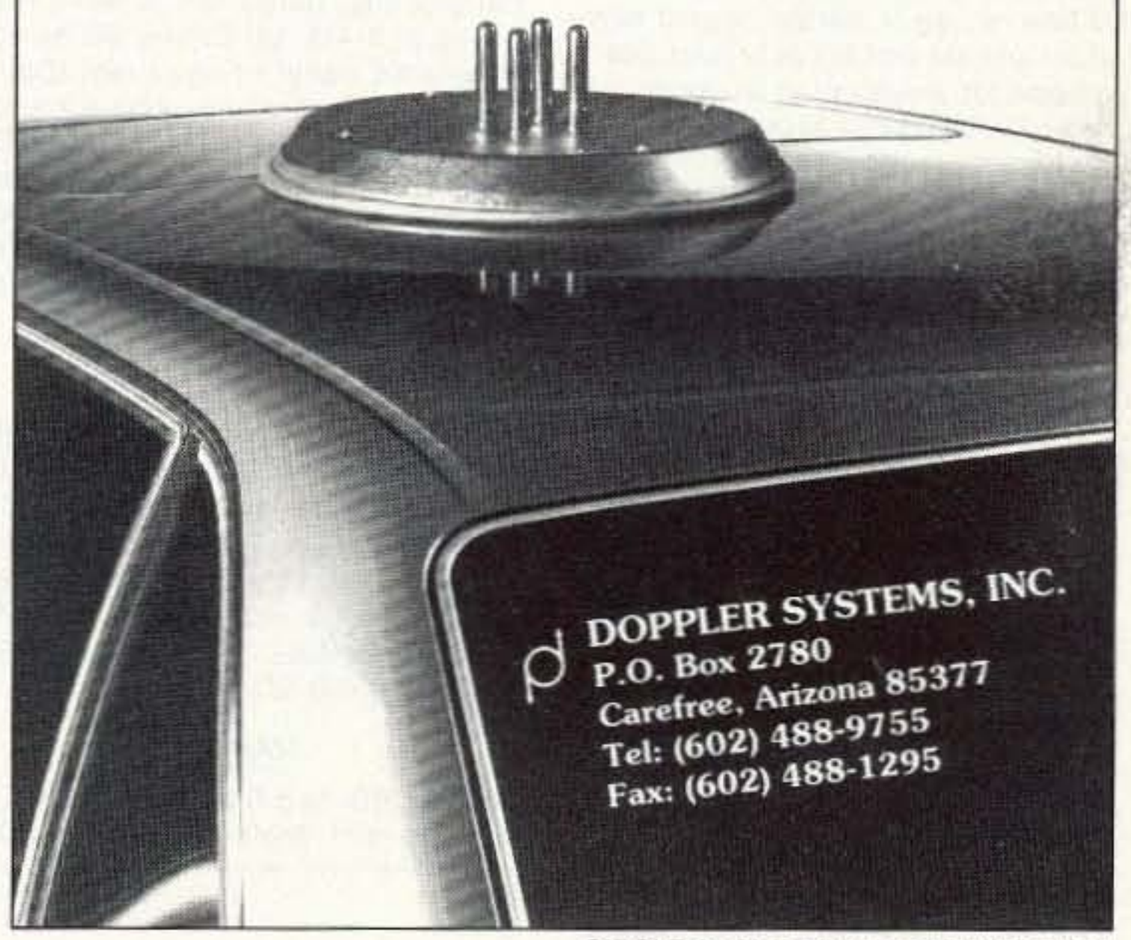

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SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the March issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event.

ANNOUNCEMENT

WASHINGTON, DC The Foundation For Amateur Radio, Inc., a non-profit organization with headquarters in Washington DC, plans to administer 56 scholarships for the academic year 1995—1996, to assist licensed Radio Amateurs. Licensed Radio Amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college or technical school. The awards range from $500—$2000 with preference given in some cases to residents of specified geographical areas or the pursuit of certain study programs. Additional info and an application form may be requested by letter or QSL card, postmarked prior to April 30th, 1995, from *FAR Scholarships, 6903 Rhode Island Avenue, College Park MD 20740.*

MAR - APR

ST. LOUIS COUNTY, MO The 1995 SKYWARN weather observer training seminars, sponsored by St. Louis County Emergency Management, are as follows: Basic SKYWARN Class: Mar. 21, 7 PM-10 PM; Apr. 10, 7 PM-10 PM; Apr. 22, 9PM-Noon. Advanced SKYWARN Class: Apr. 19, 7 PM-10 PM; Apr. 22, 1 PM-4 PM. Damage Assessment: Apr. 29, 1 PM-4 PM. All classes are open to everyone, and certification is provided. For more info, contact *Mike Redman KAOYXU, P.O. Box 16673, Clayton MO 63105. Tel. (314) 889-2362.*

MAR 5

CLEVELAND, OH The Cleveland Winterfest will be at the Cuyahoga County Fairgrounds, Berea OH, 8 AM-2 PM. Set-up at 6 AM. VE Exams will be administered early; bring proper IDs, a copy of your license, and a check payable to ARRL/VEC. DXCC/WAS QSL Checking. Talk-in on 146.73. Contact *Hamfest Assn. of Cleveland, P.O. Box 81252, Cleveland OH 44181-0252. Tel. (800) CLE-FEST (253-3378);* or *999-7388* in the Cleveland area.

MAR 10

ST. LOUIS, MO The Jefferson Barracks ARC will host their 35th annual Ham Radio Auction starting at 7:30 PM at Concordia Turners Hall, 6432 Gravois Ave. Talk-in on 146.34/.94 or 144.61/145.21. Contact *Carl H. Hohenberger WB0BZP, 5266 Parker Ave., St. Louis MO 63139-1340. Tel. (314) 351-7084.*

MAR 11

FARGO, ND Red River Radio Amateurs will present their Amateur Radio/Computer Electronics Fair at the West Fargo Fair Ground, 8 AM-3 PM. VE Exams start at 1 PM; pre-registration required. Talk-in on W0ILO 146.76(-). Contact *A.R.C.E.F. '95, P.O. Box 3215, Fargo ND 58108-3215.*

MAR 11-12

CHARLOTTE, NC The Mecklenburg ARS welcomes you to the 1995 Charlotte Hamfest/ComputerFair and ARRL Roanoke Div. Convention. Location: Charlotte Merchandise Mart, 2500 E. Independence Blvd., in Liberty Hall, (US 74). Hours: Sat. 9 AM-5 PM; Sun. 9 AM-2 PM. VEC FCC Exams Mar. 12th; preregister, or walk-ins accepted as space permits. Contact *Charlotte Hamfest, P.O. Box 221136, Charlotte NC 28222-1136. Tel. (704) 841-HAMS.* Talk-in on W4BFB, 144.69/145.29.

MAR 12

BRISTOL, CT The Insurance City Rptr. Club Inc. will hold its annual Hamfest Flea Market from 9 AM-1 PM (snow date Mar. 19th), at Bristol Eastern H.S., King St. (RT 229). Talk-in on 146.88 and 224.80. To reserve tables, send an SASE to *Al Gerke N1JWF, 63 N. Washington St. Apt. 2, Plainville CT 06062-1921;* or call *(203) 747-1925.* VE Exams at 10 AM; no walk-ins. To register, send an SASE to *ICRC, P.O. Box 165, Pleasant Valley CT 06063.*

INDIANAPOLIS, IN The Indiana Hamfest & Computer Show will be held at Indiana State Fairground's Pavilion Bldg., by the Morgan County Rptr. Assn. Doors open at 8 AM. Talk-in on 147.06. For table reservations or info, send an SASE before Feb. 21st, to *Deanne Martin N9TEJ, 39 Lake Shore Dr. #14, Martinsville IN 46151. Tel. (317) 342-4307.*

MAR 18-19

MIDLAND, TX The Midland ARC will hold their annual St. Patrick's Day Swapfest Sat. from 9 AM-5 PM; Sun. 8 AM-2:30 PM at Midland County Exhibit Bldng. Flea Market. T-hunts. VE Exams at 12 PM Sat. Contact *Midland ARC, P.O. Box 4401, Midland TX 79704.*

MAR 19

JEFFERSON, WI The Tri-County ARC annual Hamfest will be held at Jefferson County Fairgrounds, starting at 8 AM. Set-up at 7 AM. Contact *W9MQB, 213 Frederick St., Fort Atkinson WI 53538. Tel. (414) 563-6381 eves.*

LEXINGTON, MA A Ham Radio Fleamarket will be held at Westboro MA H.S., by the Minuteman Rptr. Assn., 10 AM-2 PM. Set-up 8 AM-10 AM. Walk-in VE Ex-

ams (ARRL-VEC) at Noon. Contact *Walter N1HBR, P.O. Box 2282, Lexington MA 02173. Tel. (508) 489-2282.*

NORTH TARRYTOWN, NY WECAFEST 1995 will be held 9 AM-2PM by the Westchester Emergency Comm. Assn. Location: Yonkers Raceway (Intersection of I-87, Central & Yonkers Ave., Yonkers NY. Talk-in on 147.06/.66. Contact *Tom Raffaelli, (914) 962-9666.*

STERLING, IL The Sterling-Rock Falls ARS 35th annual Hamfest will be held at Sterling H.S. Field House, 1608 4th Ave. Radio, electronic, computer, and hobby Flea Market. Doors open 7:30 AM. Setup Sat. 6 PM-9 PM; Sun. 6:30 AM. Talk-in on 146.25/.85 W9MEP Rptr. Contact *Lloyd Sherman KB9APW, Sterling-Rock Falls ARS, P.O. Box 521, Sterling IL 61081-0521. Tel. (815) 336-2434.*

MAR 25

ELIZABETHTOWN, KY The Lincoln Trail ARC will sponsor a Hamfest 8 AM-4 PM at Pritchard Comm. Center. Setup Fri. 7PM-9 PM. Talk-in on 146.98. Contact *Whitey Hensley, P.O. Box 342, Vine Grove KY 40175. Tel. (502) 877-2234.*

MICHIGAN CITY, IN The Michigan City ARC will sponsor their annual Hamfest/Computer Show at Rogers H.S., 8466 Pahs Rd., 8 AM-2 PM. Setup at 6 AM. VE Exams. Talk-in on 146.97(-) 131.8 PL. Contact *Ron Stahoviak N9TPC, 213 S. Dickson St., Michigan City IN 46360. Tel. (219) 872-6594.*

TEXARKANA, TX A Hamfest will be held at Texarkana College Student Center 7 AM-6 PM. VE Exams. Set-up Fri. after 6 PM. Talk-in on 146.620. Contact *Four States ARC, c/o Bill Wilson KB5WDV, #34 Dustin Terrace, Nash TX 75569. Tel. (903) 832-5644.*

MAR 26

MONROEVILLE, PA The Two Rivers ARC will hold its 23rd annual Hamfest/Computer Show at the Pittsburgh Expomart (Eastwing) on Business Route 22. Forums. Talk-in on 146.73 and 147.12. Check-in (good for a prize) on 146.52. For tickets, tables or info, send a business size SASE to *Two Rivers ARC, P.O. Box 225, Greenock PA 15047-0225. Phone/Fax: (412) 754-0562.*

APR 1

NORWICH, CT A Saturday Ham Radio Auction will be sponsored by the Radio Amature Soc. of Norwich, beginning at 10 AM. Setup at 9 AM. Talk-in on 146.730(-). Bring your gear to sell. For details, call *Tony AA1JN, (203) 859-0162;* or *Mike N1HFX, (203) 546-9498.*

TEANECK, NJ The Chestnut Ridge RC will hold its annual Flea Market, 8 AM-2 PM, at the Saddle River Reformed Church Education Bldg., East Saddle River Rd., corner Weiss Rd., Upper Saddle River NJ. Talk-in on 146.955 Rptr. Contact *Jack Meagher W2EHD, (201) 768-8360.*

APR 2

MADISON, WI The 23rd annual Madison Swapfest, sponsored by the Madison Area Rptr. Assn., will be held at the Dane County Expo. Center Forum Bldg. Doors open at 8 AM. Setup at 7 AM. Ask about special Sat. set-up time. Talk-in on the M.A.R.A. Rptr. WB9AER, 147.75/.15. Reservations deadline is Mar. 20th. Contact *M.A.R.A., P.O. Box 8890, Madison WI 53708-8890.*

TRENTON, NJ The 23rd annual Hamfest "Hamcomp '95" will be sponsored by the Delaware Valley Radio Assn. at Trenton State College. Admission at 7:30 AM. Setup at 6:30 AM. Talk-in on 146.67(-) and 442.650(+). For info contact *HAMCOMP '95, DVRA, P.O. Box 7024, West Trenton NJ 08628. Tel. (609) 882-2240.*

APR 8

LAWTON, OK The Lawton Ft. Sill ARC will hold the 49th annual LFSARC Hamfest 8 AM-5 PM at the Comanche County Fair Grounds. Talk-in on 146.91/.31. Contact *Bob Morford KA5YED, 1415 N.W. 33rd St., Lawton OK 73505;* or *(405) 355-6120.*

PICKERING, ONT. CANADA The Durham Region AR Hamfest will be cohosted by the South Pickering ARC and North Shore ARC at the Metro East Trade Centre. Talk-in on 147.375/.975 and 147.120/.720. Contact *David Herve, South Pickering ARC, P.O. Box 53, Pickering ON L1V 2R2. Tel. (905) 837-2127;* or *FAX (905) 831-5556.*

SPECIAL EVENT STATIONS

MAR 11

KINCARDINE, ONT. CANADA Station VE3LPE will operate 1400Z-2200Z to commemorate the birthday of Albert Einstein, and the peaceful use of nuclear energy. Operation will be in the lower portion of the General 80, 40, 20, 15, and 10 meter subbands. For a certificate, send QSL and a 9" x 12" SASE to *Kevin Pickles VE3LPE, 638 Johnston Cresc., Kincardine, ONT N2Z 1S7, Canada.*

MAR 12-13

WATERFORD, WI The 1995 Wisconsin QSO Party will be on the air 1800Z Mar. 12-0100Z Mar. 13. Entries must be postmarked by Mar. 31st, 1995. Contact *Wisconsin QSO Party, West Allis RAC, P.O. Box 1072, Milwaukee WI 53201* for complete details.

MAR 18

MACON, GA The Macon ARC will operate W4BKM 1400Z-2300Z at the 13th annual Cherry Blossom Festival. Phone: 7.235, 14.235, and 21.335; CW: 7.135, 14.035, and 21.135. For a certificate send QSL and a 9" x 12" SASE to *Macon ARC, P.O. Box 4862, Macon GA 31208.*

MAR 18-19

PISCATAWAY, NJ Members of the Piscataway ARC will operate "VOA" starting Mar. 18th at 0000 UTC-2400 UTC Mar. 19th, to commemorate the WWII operation of the Voice of America relay station WBOU. CW: Novice subbands. Phone: Lower third of the General 80—15 meter subbands and the Novice 10 meter subband. RTTY operations will be conducted on 80, 40, and 20 meters. For a certificate, send QSL and a 9" x 12" SASE to the station worked.

APR 8

STREATOR, IL The Streator ARC will Operate Station K9CAU to commemorate the 50th Anniversary of the Streator Hobby Show. Operation will be from 0900 UTC-2300 UTC on the 40 and 20 meter General phone band. For a certificate, send SASE to *N9PLM, 1705 Florence St., Streator IL 61364-1337 USA.*

Number 22 on your Feedback card

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW

ICOM

Work all the HF bands and receive 300 kHz to 29.995 MHz with Icom's *next generation* IC-738 transceiver. SSB, CW, AM, and FM are built into this rig, which provides a full 100 watts output (40 watts in FM). A heat sink with two large cooling fans ensures stable 100% duty cycle operation—great for DXing marathons.

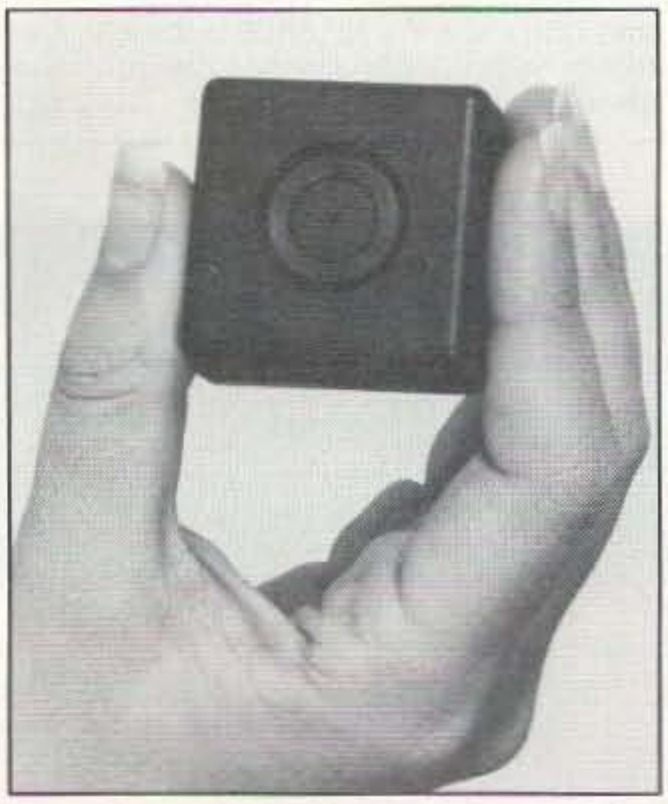
The IC-738 incorporates *next generation* circuitry with Icom's unique Direct Digital Synthesizer (DDS) IC. High-tech and compact, the PLL unit provides precise frequency resolution to 1 Hz. Other features include built-in antenna tuner, Double Band Stacking Register (DBSR), three scanning functions, passband tuning (PBT), and a notch filter.

The suggested retail price for the IC-738 is $1,935. For more information, please visit your favorite dealer or contact *ICOM America, Inc., 2380-116th Avenue N.E., Bellevue, WA 98004; (206) 454-8155*. Or circle Reader Service No. 201.

CCTV

CCTV Corporation has announced the introduction of the GBC CCD-600PH Pincam. This new camera's revolutionary design allows users to place the camera virtually anywhere for completely undetectable surveillance and many ATV applications. The camera is 1-1/2"W x 1-1/2"D x 3/4"D. The Pincam's ultra-miniature size is enhanced by the built-in 3.6mm or 5.5mm pinhole lens.

This camera's built-in electronic shutter automatically compensates for lighting changes. Simply mount the camera behind a 1/16" hole to obtain a clear picture. The Pincam's resolution is over 400 lines, with a sensitivity of 0.2 lux. For more information contact *CCTV Corp., 280 Huyler Street, South Hackensack, NJ 07606; (201) 489-9595, (800) 221-2240, FAX (201) 489-0111*. Or circle Reader Service No. 206.



AEA

Advanced Electronic Applications has begun shipping the new AEA FAX III. The AEA FAX III is a stand-alone, multi-intensity, gray-scale, HF weather fax demodulator and display software package. This product allows amateurs to colorize received weather fax images. This pseudo-color feature allows users to choose from 256 colors to clarify images or just to make them more appealing. Export to GIF or PCX files for manipulation in other graphics programs, then include them in newsletters, letters, or other publications.

This IBM-compatible software receives satellite maps and WEFAX images in 16 levels of gray. It also receives and decodes CW, RTTY, and NAVTEX transmissions. There are many more features, too. The suggested retail price is $149. For more information, please visit your favorite dealer or contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Lynnwood, WA 98036; 206-774-5554, FAX 206-775-2340*. Or circle Reader Service No. 207.

CABLE X-PERTS

CABLE X-PERTS has a new 1995 catalog available for interested amateurs. This catalog provides a lot of technical information on coax cable and related products, prices included. In addition, CABLE X-PERTS has a solution for hams who have difficulty installing PL259 or N type connectors. The company will install these connectors at $5 per connection plus the cost of the connector on any of their coax cables (except LMR series). All connections are soldered, HI-POT tested, continuity checked, and sealed with UV-resistant heat-shrink tubing. Normal turnaround time is 10 business days.

For a catalog, please mail a Self-Addressed Stamped Envelope (SASE For more information contact *CABL X-PERTS, Inc., 113 McHenry Rd Suite 240, Buffalo Grove, IL 6008 1797; (800) 828-3340 (orders only (708) 506-1886 (technical info), (70 506-1970 (FAX)*. Or circle Reade Service No. 204.

TEKTRONIX

Tektronix, a leader in oscilloscope technology and instrumentation for nearly 50 years, has introduced a complete portfolio of products called TekBench, representing high-value low-cost products. More than 40 differ ent basic test and measurement prod ucts are available in the TekBenc portfolio, including oscilloscopes, func tion generators, universal counter and counter/timers, bench-top multi meters, power supplies, and measure ment accessories.

All TekBench instruments are com patible, fully integrated, and have uniform look and feel for simple, eas use by folks with a wide range of tech nical skills. For the name of an autho rized dealer call 1-800-426-220 (press "1" when prompted). Or contac *Tektronix, P.O. Box 500, Beavertor OR 97077-0001*. Or circle Reader Se vice No. 203.

MFJ

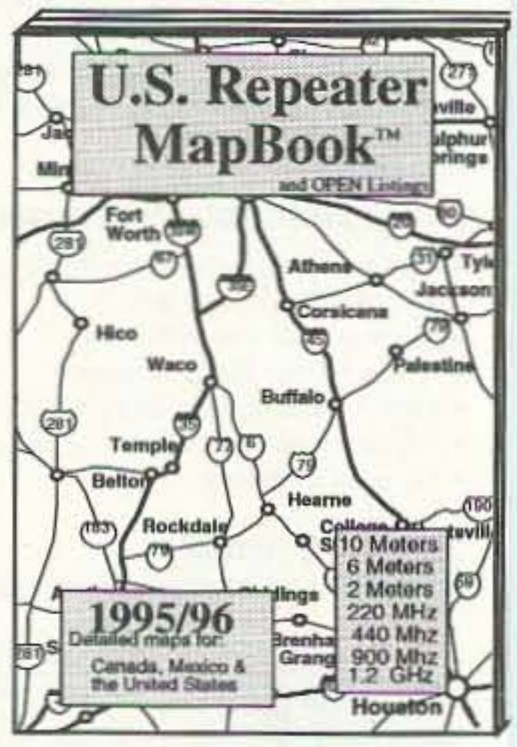
MFJ Enterprises has introduced the MFJ-114 12/24-hour 2.3" LED digit clock. This clock is so large it could time a football game, but it is really made for the ham shack. It features giant 2.3" red LED digits—nearly the width of a 2 meter handheld. The display is especially bright, too.

The MFJ-114 can be mounted to the wall or the ceiling, and the clock is easy to operate. It is powered from house current and features a battery backup. The price is $39.95. For mor information or to order, visit your fa vorite dealer or contact *MFJ Enterpris es, Inc., P.O. Box 494, Mississipp State, MS 39762; (601) 323-586 FAX (601) 323-6551, or toll free 80 647-1800 (orders only)*. Or circl Reader Service No. 205.

ARTSCI

ARTSCI's *1995/1996 U.S. Repeater MapBook* is the perfect traveling companion for the radio enthusiast. This 5th edition has been totally redesigned to better serve the traveling amateur. New highly detailed maps enhance the presentation of the popular amateur repeaters. In an effort to show every open repeater, a detailed city-by-city listing accompanies every state map.

Maps show all major highways and cities in each state. New in this year's edition are table listings of all open repeaters in each state. Ask for the new *MapBook* at your favorite dealer or contact *ARTSCI Inc., P.O. Box 1428, Burbank, CA 91507; (818) 843-4080, FAX (818) 846-2298*. Or circle Read Service No. 202.



Number 23 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Joyce Bocash, *73 Magazine*, Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

The deadline for the May 1995 classified ad section is March 9, 1995.

ALL ABOUT CRYSTAL SETS. Theory and construction of crystal set radios. $9.95 each, ppd USA. Send to: **ALLABOUT BOOKS**, Dept. S, P.O. Box 22366, San Diego CA 92192. BNB200

DWYER WIND SPEED INDICATOR only $55.00 plus $4.00 S/H. For home or office. Accurate, low-cost, practical. Roof mounted pickup. Send check or M.O. to: **RAD-MON COMPANY,** Dept A, Box 751, Marathon NY 13803-0751. (NY Residents add Sales Tax) BNB285

COMMODORE 64 REPAIR. Fast turn around. **SOUTHERN TECHNOLOGIES AMATEUR RADIO,** 10715 SW 190th Street #9; Miami FL 33157. (305)238-3327. BNB295

WANTED: Electron Tubes, ICS, Semiconductors. **ASTRAL,** P.O. Box 707ST, Linden NJ 07036. Call (800)666-8467. BNB307

KENWOOD AUTHORIZED REPAIR. Also ICOM, Yaesu. **GROTON ELECTRONICS,** Box 379, Groton MA 01450. (508)448-3322. BNB310

UNIQUE INDOOR/OUTDOOR ANTENNA gives 30 dB gain on 160m-10m. Plans: $6.95. **BOB CHRISTIE AA2KE**, 215-28 Spencer Ave., Queens Village NY 11427. BNB319

NOW ON 80 METERS! New, knob-tuned w/digital display, synthesized QRP transceiver. Complete kit only $199.95. S&H $6.50 (continental US). GUARANTEED TO WORK. For info send SASE: Call/write to order: **S & S ENGINEERING,** 14102 Brown Road, Smithsburg MD 21783; (301)416-0661. BNB334

Continued on page 82

Number 24 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

HF propagation this month is expected to be Poor (P) or Very Poor (VP) on the days 9-12 and again 15-17. The Good (G) days for DX are likely to occur during the first five days and the last two weeks of the month. The remaining days will be days of transition.

Although March is traditionally a good month for DX because of the approaching equinox and increasingly favorable springtime ionization of the upper atmosphere, we are now approaching the lowest part of Sunspot Cycle 22 . . . expected in late 1995 or early 1996. That means less overall ionization and fewer opportunities for worldwide HF communication, particularly on the 17, 15, 12 and 10 meter bands. Better directional antennas and a careful choice of operating hours will be required to maximize DX opportunities.

10 and 12 Meters

Occasional F2 openings to the Southern Hemisphere during daylight hours. The bands close at sunset.

15 and 17 Meters

Consistent openings to Africa and Latin America, and short skip to about 1,000 miles during daylight. Bands close at sunset or shortly after.

20 Meters

Your best band for DX to all areas of the world between sunrise and well past sunset, and short skip to 2,000 miles during daylight hours.

30 and 40 Meters

Good DX from slightly after local sunset to just before local sunrise. Signals from the east peak between sunset and midnight, and from all other areas between midnight and sunrise. Daytime short skip to 1,000 miles, and nighttime skip to 2,500 miles.

80 and 160 Meters

Good DX from sunset to sunrise on nights of low atmospheric noise, and skip to 2,000 miles or so. Requires vertical transmitting antennas and horizontal (preferably Beverage) antennas for best results on receiving. Little, if any, daylight activity on 160, but some on 80 meters.

Final comments require me to warn of possibly violent weather and other geophysical occurrences centered around the 9th and 10th, and again around the 16th and 17th. Hang on to your hats! As always, check WWV at 18 minutes after any hour for the latest updates on propagation. See you here next month.

MARCH 1995

SUN	MON	TUE	WED	THU	FRI	SAT
			1 G-F	2 F	3 F-G	4 G-F
5 F	6 F	7 F-P	8 P-VP	9 VP	10 VP	11 VP-P
12 P	13 P-F	14 F-P	15 P	16 P-VP	17 VP-P	18 P-F
19 F	20 F-G	21 G	22 G-F	23 F	24 F-G	25 F-G
26 F-G	27 G	28 G	29 G	30 G	31 G	

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
AGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WESTCOAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
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EAST COAST		80	80	40	40	40	40	20	20	20		

Continued from page 81

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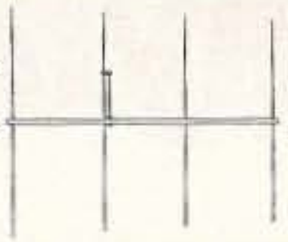

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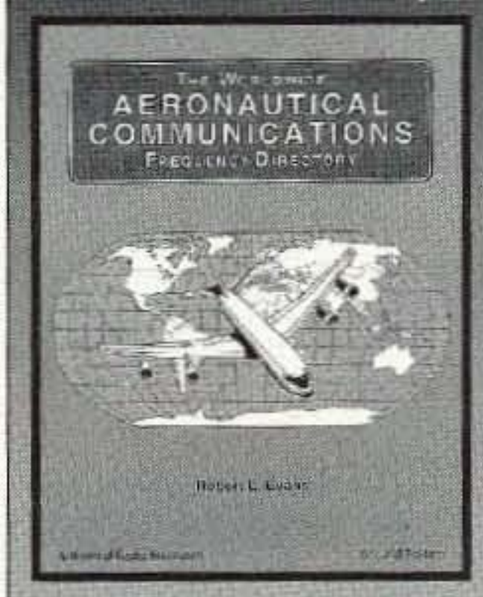

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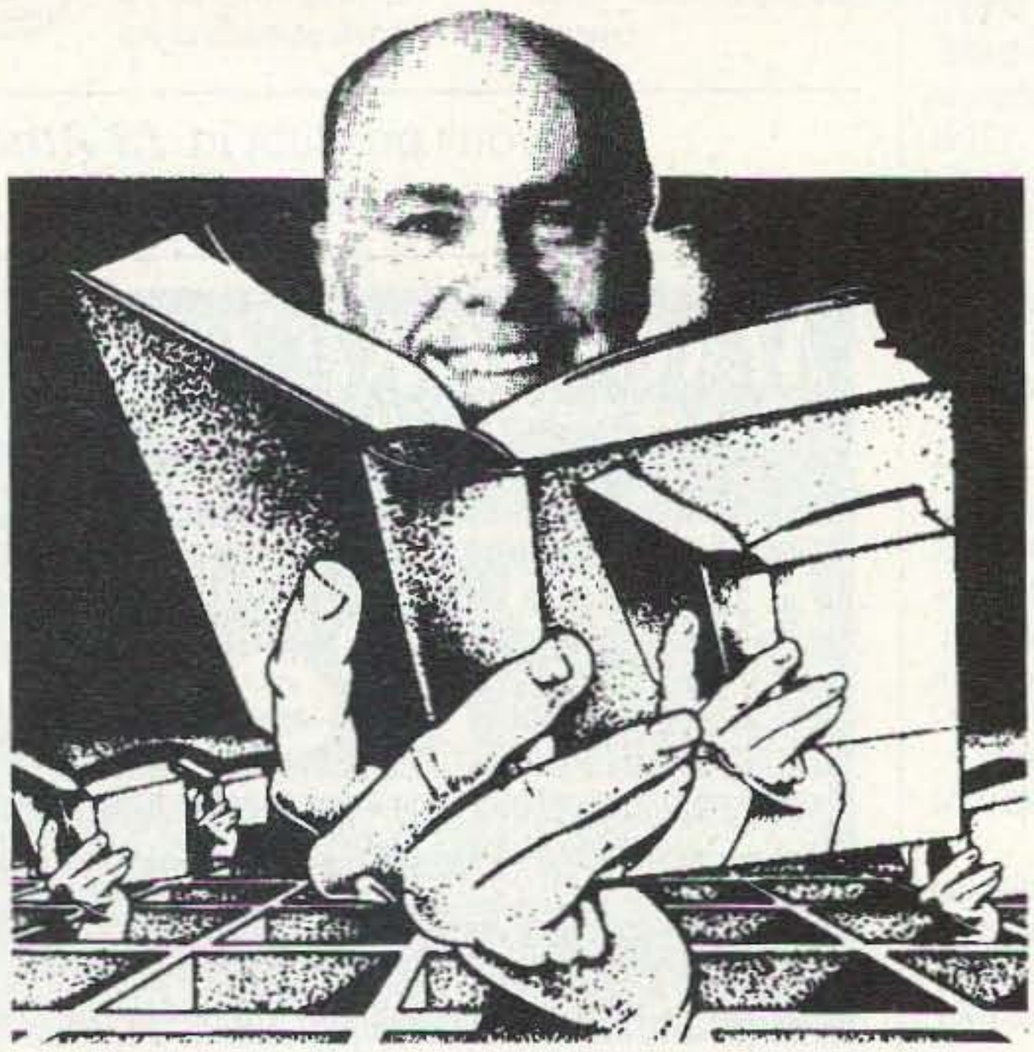

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