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FEBRUARY 1993
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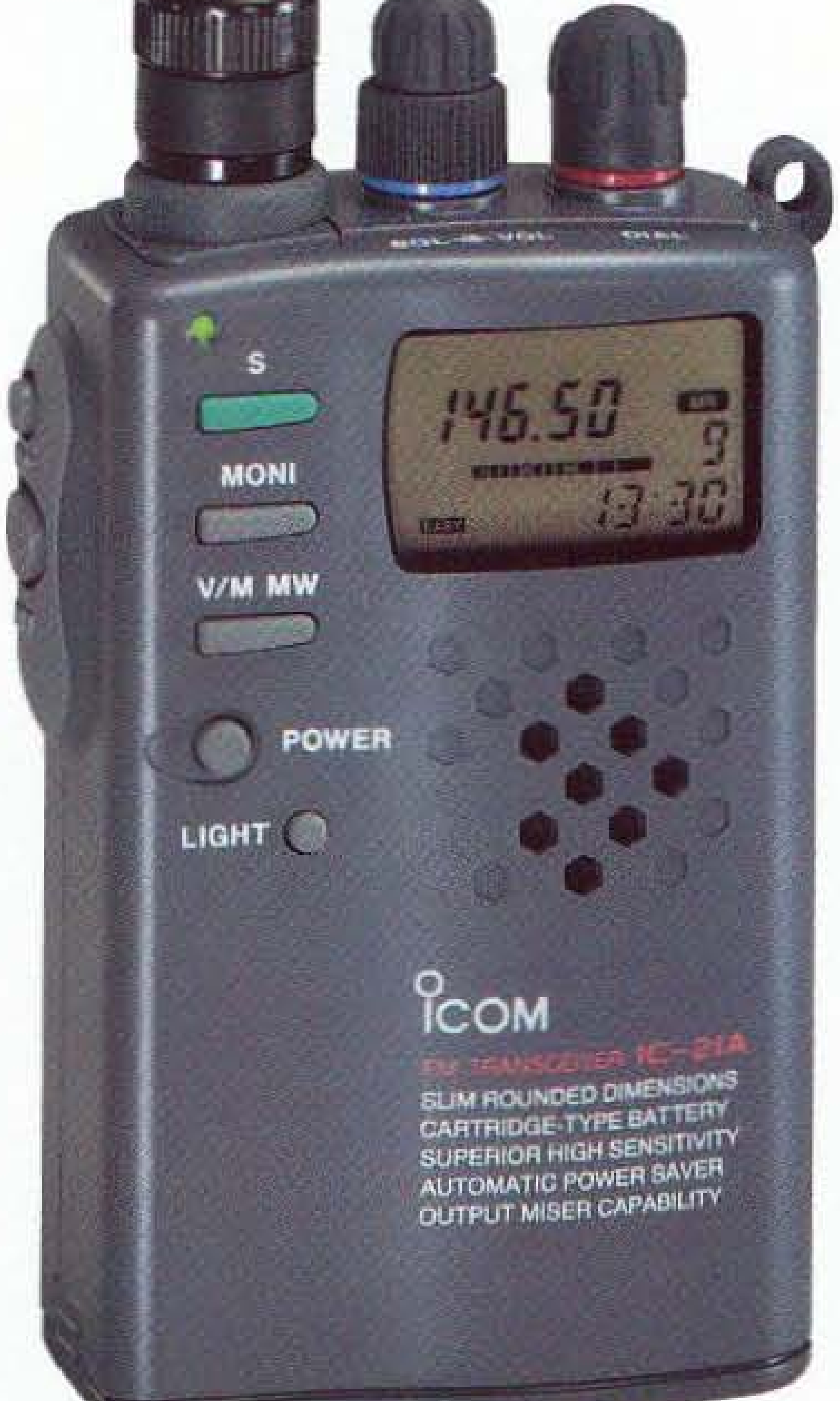

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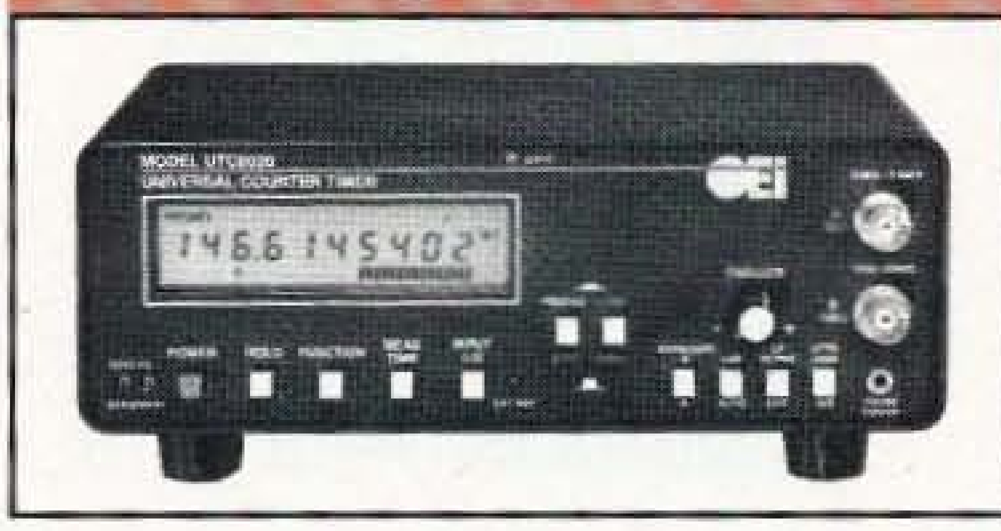

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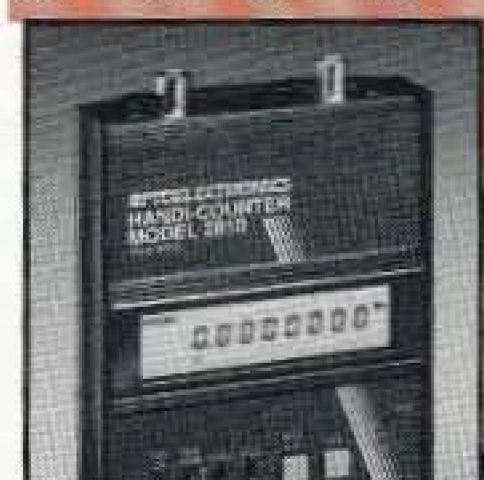

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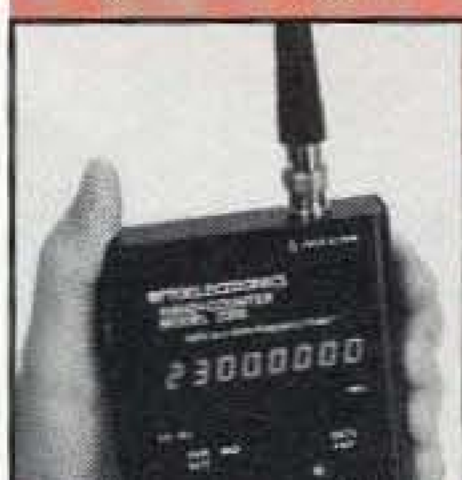

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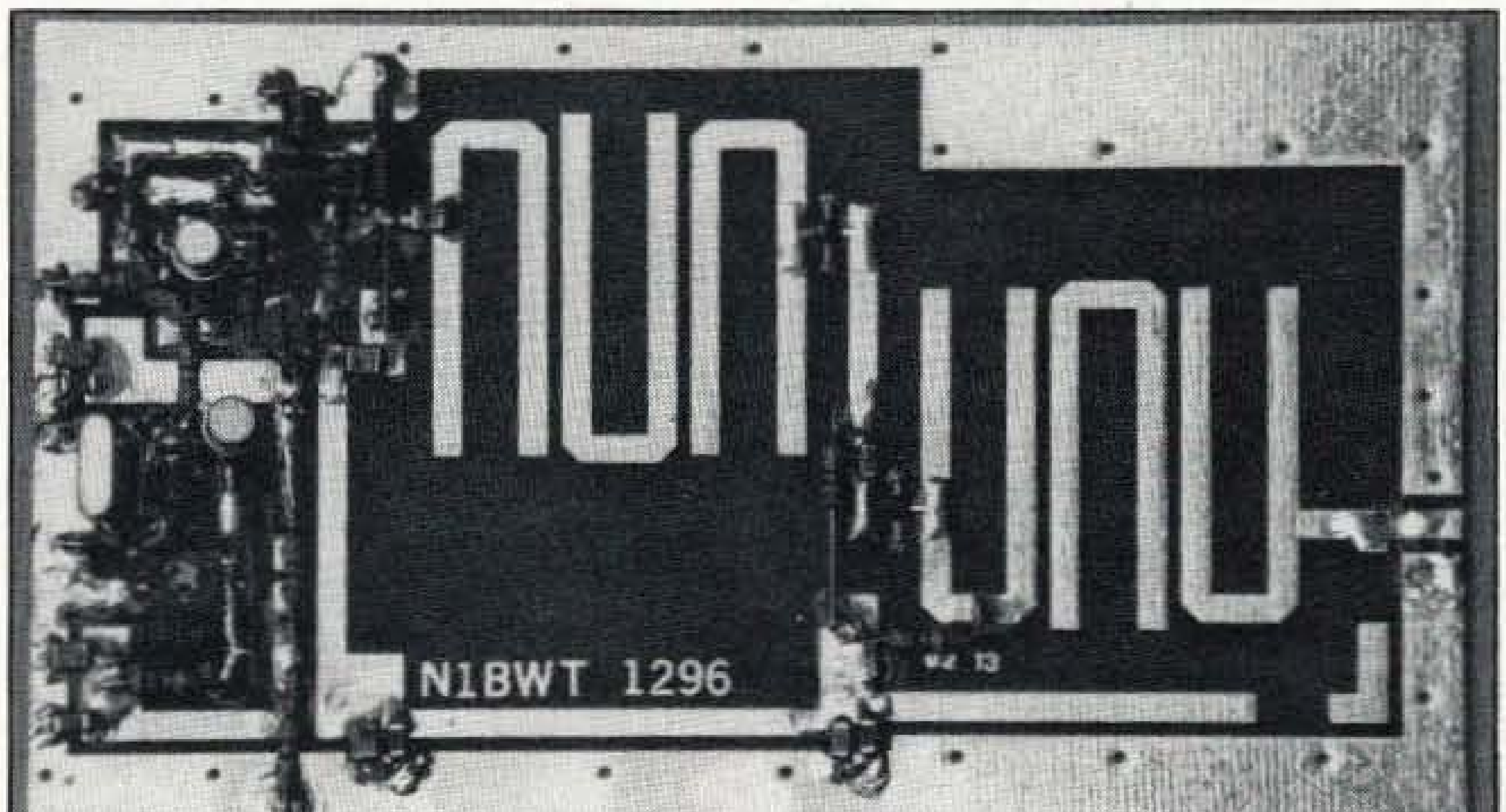

Down East Microwave's WSSK . . . see page 34.

Cover: The WB6NOA dune buggy microwave mobile. Photo by Gordon West WB6NOA.

DEPARTMENTS

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It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card 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. And then we will draw one Feedback card each month for a free subscription to *73*.

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Audit Bureau of Circulations (ABC) membership applied for.

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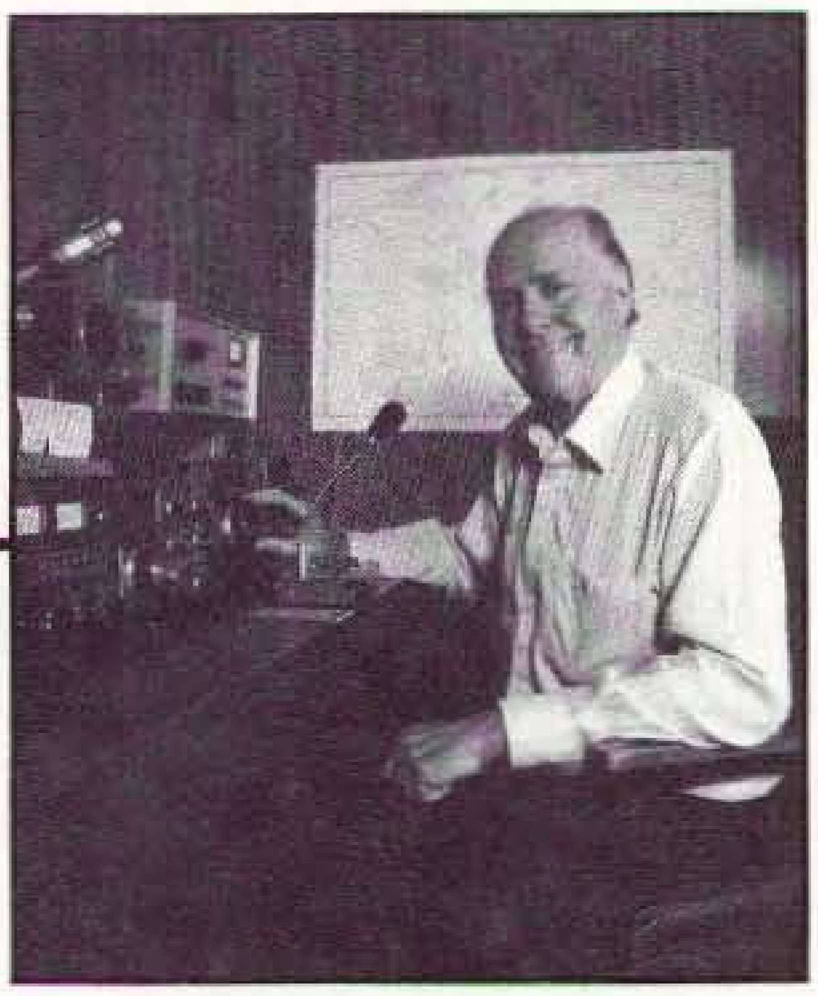

Learning Code Even Faster

The no-code license has doubled our newcomers, but this is only putting off the misery. You still have to learn the code to get in on most of the fun amateur radio has to offer. So why not at least make the process as painless and as fast as possible?

My advice is to go for 20 wpm right off the bat. The weird fact is that it isn't any more difficult to learn the code at 20 wpm as it is at 5 wpm, so why multiply your aggravation? I sure wish I'd known about this when I was learning the code! Alas, I used the ARRL system, which was right out of the Dark Ages and provided a maximum of misery and a minimum of success. The upside, as far as many hams are concerned, is that this system alone was responsible for discouraging millions of potential hams from getting licenses.

We know a lot more about how the brain-mind-body system learns skills now than we did 50 years ago. Not that all this scientific data has perked through to most of the code learning systems, which are still firmly rooted in the 1920s. Now we're having people able to learn the code at 20 wpm within a few days—a skill that often used to take years.

Recent research at the Weizmann Institute of Science in Israel has shown that your best time for learning a skill such as copying code is to do it shortly before going to sleep at night. You do your practicing, and then you sleep on it. This lets the brain-mind-body integrate the skill faster. Experiments where people were awakened during the REM part of their sleep—while they were dreaming—slowed down the learning curve substantially. So go to sleep and dream.

How long should you practice? As long as it's fun. I'd recommend 20-minute sessions. As soon as it stops being fun and exciting, don't push it. Remember, you're building a new skill, one that will be with you for the rest of your life—one that will set you apart from people without that skill. You're learning a new language.

In case you've missed my explanation of how to go about learning the code, or have been too cheap to buy my 20 wpm practice tape, which comes with the instructions, here's the process. It's simple. Instead of learning the dit-dahs of each letter and number and starting out at 5 wpm and gradually speeding up, you jump right in at 20 wpm and start listening for one single character—like an E. Even at 50 wpm you can hear the dit as an E goes by. Every time you hear that dit you write down an E. It won't take long for this to become fairly automatic. Once it's easy, you start listening for did-dits and writing down I's as well as E's, and gradually work your way through the alphabet, numbers and punctuation.

The old system, where you learn all the characters first and then look them up in your mind when you hear a sound pattern, keeps your brain busy shuffling between the two halves of your brain—one which recognizes the sound pattern and the other with that look-up table of characters. This works pretty well until you get to about 10 wpm when you've reached the clock speed of the brain, if I may use the computer analogy. That's the famed plateau, hanging in there just under 13 wpm. So near, yet so far. Unfortunately, no amount of sweat and strain can change this. You just have to start all over and learn the code the way you should have in the first place—weeks or months ago. Years in some cases.

What you're going to do is build a new motor skill, like typing or playing the piano. Only this time it's you writing or typing code characters as they zip by. You hear the sound, your fingers move. Good high speed ops can copy code in their heads while talking with someone, it's so automatic.

I'd recommend you get my 20 wpm practice tape, but I'm sure some crummy nit-pickers would complain that I'm going commercial. Mine is inexpensive, it's a fiendishly-planned class-A bitch to copy, and it'll do the job. You sure aren't going to memorize this baby.

We're ABC!

Oh whee and big deal. Well, it's a big deal for *73*, now that we've had our circulation audited and our sworn claims verified by the Audit Bureau of Circulation. Rough bunch to deal with. But frankly, I got tired of what I've believed to be total baloney sworn circulation claims by some ham magazines I could mention. As it turns out, ABC certified our 1991 circulation at several thousand *more* than we reported ourselves.

In almost any other industry advertisers and their agencies understand that unless a magazine's circulation has been audited and certified, there's little chance that the sworn claims are even in the same ballpark as reality. You have to remember that advertising is normally charged on the basis of so many dollars per thousand paid readers, so the more the publication lies, the more money they make. And money does odd things to people.

It's all the worse when one magazine claims double or even triple its actual paid circulation, while another plays it straight. Honesty just isn't the best policy when your competitor is lying and his lies can put you out of business. That's where ABC comes in for most industries. They make a magazine prove every claimed paid reader. Their accountants come in and go over every record with a fine-toothed comb. But the end result for advertisers is the knowledge that the certified circulation is really true.

About the only reason for a publication not to be certified these days is that a close look at their figures would prove them false, so reputable advertising agencies tend to avoid doing business with them.

In the amateur radio field, *73* is the *only* magazine which has been certified by ABC.

I remember the first time I discovered how wild the circulation exaggerations could be in this field. I was the editor of *CQ* at the time. My assistant editor slipped into the *CQ* offices one night and made a copy of the actual circulation figures and brought it to my house. I was astounded. The actual paid circulation was less than half what I'd been told and what the notarized sworn statements claimed. We were charging over double what we should have for our ads.

The next day I found out that after giving me the figures my assistant editor had gone to the publisher and told him I had the actual circulation figures. He expected, correctly, that I'd get fired and he'd be the new editor. The publisher assumed I'd taken records, so the next morning he demanded I return them. He drove me to my house, picked them up, and fired me. He was terrified that he might be sent to prison for falsely sworn statements.

I was surprised, but not dismayed, at being fired. *CQ* was raking it in, turning a profit of well over a million dollars a year in today's dollarettes . . . mainly because of the bogus circulation claims . . . and I was getting bupkis. Oh, I'd been promised that if I pulled the magazine out of the red I'd share in the profits. Well, I did. For Christmas that year I got a $5 bonus, and then I was fired a few days later. That was my share of the profits.

The magazine had been stiffing the authors. They were at least a year behind on paying every author I checked on, and over a year and a half on most columnists. I had to pay for articles out of my pocket in order to get them. When I was fired they owed me over $10,000 in 1960 dollars . . . around $100,000 today. The publisher promised to repay the loans. I'm still waiting.

That circulation scam worked so well for the publisher that after I'd been fired he sent out sworn statements for about three times the actual paid circulation . . . and advertisers were stupidly paying up.

After getting fired I tried working for an advertising agency. I found this really wasn't what I wanted to do. My hobby was amateur radio, so what better to do than publish a ham magazine? That was *fun*, so I started *73*, even though I only had just barely enough money to print the first issue. It was one heck of a gamble. *CQ* was telling the industry not to advertise in *73* because it would soon fail. Fortunately, not all advertisers believed them, so I made it.

I started out doing everything. I solicited manuscripts, edited them, took the photos, sold the advertising, went to hamfests to sell subscriptions, got the magazine into over 850 ham stores with the help of Jim Morrissett WA6EUX (now K6MH), wrapped 850 bundles of magazines every month and mailed them, cut stencils for new subscribers, printed thousands of magazine wrappers for the subscriber copies, sent out the invoices for advertising and store copies, made the bank deposits, kept the books, and so on. It was a lot of work, but I made it go, despite everything *CQ* was doing to stop me.

In addition to all that I was the president of the Porsche Club, organizing car rallies, helped found American Mensa, helped organize the ARRL New York convention, and was doing my best to cope with a sick wife. 1960 was a busy year. Heck, I was almost as busy then as I am now, over 30 years later.

It'll be interesting to see if *73* being audited by ABC will encourage the other ham magazines to get their circulation figures certified . . . or if advertisers, seeing that they may have been paying for phantom circulation, start demanding audits.

Audited magazines that don't provide the promised paid circulation have to refund advertisers for the shortage. Of course I have no way of knowing for sure if any of the other ham rags are shortchanging the advertisers, or by how much; but when advertisers in *73* tell me their identical ads in another magazine are selling only half as much of their

Continued on page 74

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LETTERS

Number 2 on your Feedback card

From the Hamshack

Richard Ashley N5IZC, Salt Lake City UT Just yesterday I was driving south on Interstate 15 about 35 miles south of Salt Lake City when I had to pull off the highway because of a minor mechanical problem. Within a few minutes a Utah Highway Patrol car pulled in behind me and offered assistance. However, he also took note that my vehicle was registered in Texas and I was not from here. I'm only a temporary resident. After determining my problem the patrolman took close note of my ICOM IC-02AT handheld, my Yaesu HF rig and my ICOM 2 meter mobile rig. The mere appearance of these radios in my vehicle really agitated the patrolman and he literally demanded to know why I had three "scanner radios" in my vehicle! I explained what the radios were and that I was an amateur operator. He flatly refused to believe that and, to top it off, he was going to confiscate my equipment unless I could provide my original license! I explained to him that my "original" was framed on my wall back home in Texas and offered him a copy. That was not sufficient. He believed that anyone with "sophisticated" radio gear was a dope runner or involved in some sort of criminal activity, and made no qualms about being quite vocal about it. I have never been accosted like this by any law enforcement officer, and it was only after I spent over an hour sitting in his cruiser being checked out that I was allowed to finish my Thanksgiving Day journey.

It seems to me that the amateur community should make the law enforcement community more aware of mobile amateur activities and the help they can provide. I may further add that I have made a written report to the officer's superiors here in Salt Lake City. I would be curious to know if this is just an isolated incident, or has this or anything similar happened to other amateurs?

Arnold Samuels, Ocean Shores WA Wayne, as I read your "Never Say Die" column religiously, I see you always refer to the amateur radio *service* as a "hobby." As a hobby, I see no reason why the U.S. taxpayer should support us; as a service, it should. I never see the FCC refer to us as a hobby—why do you? It is high time you change your attitude and start calling this hobby a service, which it rightfully is.

Arnold—You'll find that I am pretty careful about the words I use. Amateur radio is a "service" only because of the hobby it provides. The sorry fact is that very few hams are willing to spend much of their time providing service. Somewhere around 99.9% are rag-chewing, working DX, contesting, mangling useless traffic, jamming nets, certificate hunting, and kerchunking repeaters. Some service.

Of course, as you say, the FCC refers to amateur radio as a service. This is an enormous lie and most of the people at the FCC know it. What we have, in fact, is a government-sponsored entertainment medium mainly of interest to middle-class older white American males and to Japanese youngsters, which allows a very select few of us to use tens of billions of dollars in public frequencies.

On rare (and getting rarer) occasions we're able to provide emergency communications, but with the popularity of cellular phones, our help is being needed less and less. We've contributed pathetically little in technical developments in the last 30 years. We no longer can supply technically skilled operators for the military in time of war as we did during WWII, when 80% of the hams joined the services. Of course, that was before the hobby went geriatric.

Service? Oh sure. Cheers . . . Wayne

Carlos M. Herrera N2OIZ, North Bayshore NY I just received my subscription-ending December issue—subscription-ending because I thought I wouldn't be able to afford to renew due to my current financial condition. So I read your editorial, which is always the first thing I read in *73*. Well, I'll be signing on again and I think I have a simple solution to increase both subscriptions and readership.

I am not only going to renew, but one of my ham friends will be getting a gift subscription this Christmas. Now, if every subscriber you currently have does the same for one of their friends or relations you'd see a definite increase in readership, ergo more interest by the big advertisers. If your current subscribers can't bring themselves to think of a worthy soul maybe they can give a gift subscription to their local library (which probably can't afford it) or to a ham club in a local school. There might even be a tax benefit (for the real skinflints)!

Last point: You're right (again). With all the interest in ham radio there's got to be some way to make a decent living at it. I intend to find it (or them). Wayne, thanks for the inspiring words: Never Say Die!

Bill Roork VE3MBF, Agincourt, Ontario, Canada Wayne, I look forward each month to reading your editorials. As far as I am concerned, you make more sense than the rest of the ham magazines put together.

I particularly want to congratulate you for mentioning the book about electromagnetic fields (November 1992). After reading just part of that book, I am convinced there is a serious problem, one which we no doubt will be hearing about a lot more.

As a member of the Scarborough Amateur Radio Club, I am the educational coordinator. We offer "Code and Theory" classes each year as part of our effort to help save amateur radio. We use a system which is unique in our area. Instead of having one person teach all the lessons, we use a different instructor each week. All instructors are members of the club and donate their services without renumeration. We find that because each instructor appears only once, they go to great lengths to prepare their lecture and, most importantly, they bring in many, many exhibits (resistors, capacitors, diodes, tubes, transistors, coax, transformers, etc.) to illustrate the subject of the evening.

We have two public events per year where we promote amateur radio. One is at a large local shopping mall in the spring. We have a table display, exhibits and signs, plus a working rig to show. We encourage those interested to join our "Code and Theory" class which starts in September. We get quite a few prospects.

Our other major effort is one day (usually a Sunday) at the Canadian National Exhibition in Toronto. This occurs in August, and there is an amateur radio station (VE3CNE) where a local amateur radio dealer loans a number of transceivers, keyers, paddles, tuners and computers to demonstrate packet radio. The antenna system at the VE3CNE station is the property of the station, funded by contributions of metro area ARCs. Since all the metro area clubs participate in the CNE program, amateur radio in the area gets quite good exposure (several million people per year) and we all get cards signed by interested people of all ages.

Over the last four years, our club has had in excess of 160 people join and go through our class. The pass rate has been very high, with many people getting an amateur radio license.

So far as the "Code and Theory" classes are concerned, there is one problem. That is, that while the code is still a requirement for full licensing, it is becoming increasingly difficult to purchase straight keys and code practice oscillators *at a reasonable cost*. The best we have been able to do is to show the students how to make a very inexpensive code practice oscillator using the following: a straight key, a wood block, a 9-volt battery, a piezo-electric buzzer (Radio Shack or other) and two feet of wire for connecting. Thus, for about $12, one can build a quite usable code practice oscillator, provided a straight key at a reasonable price (say, $7) can be found.

In view of the fact that the licensing structure requires Morse code at 12 wpm to gain access to all amateur radio frequencies, we really stress that all students should learn the code. We furnish a cassette tape with computer-generated code at 6, 8, 10 and 12 wpm as a starter. As you have often pointed out, it seems ludicrous that we require people to learn an obsolete discipline like CW so they can be fully licensed—while at the same time the licensing structure almost ignores the important DIGITAL technology, where future development appears to be heading.

You have proved repeatedly that you are a clear thinker with many constructive and innovative ideas. As one old geezer to another, I take my hat off to you for your comments on education, effective government, entrepreneurial opportunities and many other subjects. I hope you will be able to publish your common sense ideas for a long time. As a former Olympic and pro ice hockey official, minor hockey coach, engineer, multi-plant manager and consulting engineer, I find that you are one of my very favorite people.

John Beegan, Streamwood IL I started in radio as a Cub Scout and built a crystal radio with the help of an older student. I still remember how fascinated I was to hear real radio coming out of the headphones. And no battery or wires plugged into the wall socket!

Later, I built a Meisner kit radio which had several tuning coils for various bands. I kept this radio through high school and left it to the science department of the school. Building and soldering and making connections, reaming holes in an aluminum chassis, inserting grommets—it was all fun.

One time I was building a radio that required a battery for power. I made all the connections and checked them. The radio would not work. I asked my dad and he said to re-check everything. I did; it still did not work. Finally, I went to the next-door neighbor, Mr. Miller, who was a bus driver. Mr. Miller looked at my breadboard, looked at the schematics, and said, "This damn thing will never work, the way they got it." He then advised where a connection had to be made (or where a connection was called for that should not have been indicated), and of course, then it worked. Mr. Miller had studied radio and TV repair, and did a "moonlight business" out of his basement, fixing TVs for the neighbors.

It was from Mr. Miller that I learned that the book is not always right. Sometimes the experts know more than the guy who wrote the book. That's why I am writing you. I am a police officer, and the "official" version is: "Radar won't hurt you." I picked up *73* and read your review (November 1992) of *WARNING: The Electricity Around You May Be Hazardous to Your Health* by Ellen Sugarman. As you so correctly pointed out, electrical fields can have an effect on living tissue. That's why they use X-rays for treatment of certain medical conditions.

At present, every American is exposed to high-tension wires, and to scatter radiation from TVs, radios, microwave ovens, electric blankets and police radar. Virtually every motorist in almost every metropolitan community is being dosed with radiation from radar guns. All of this in the name of the law, of course. And to add insult to injury, the citizens themselves are *taxed* in order to pay for the radar that is then used on them. Additionally, there have been several court cases where police officers have alleged that they have suffered serious effects from the use of the police radar—serious effects like cancer.

Of course, there is an alternative. Laser guns that measure traffic speed have been produced and are already on the market. The drawback is cost. The laser guns cost more than the radar units. It also appears that the laser guns are much less likely to be abused or misused than radar guns because they are more precise.

Don't let up. Keep putting out a strong signal, and let the world know. Most people will eventually take the message to the polls. Politicians who do not listen need to be replaced. It's happened before, and it will happen again. 73

QRX . . .

Canadian Amateur Radio Organizations to Merge

Executives of Canada's two amateur radio organizations met in Cobourg, Ontario, on October 3, 1992, to iron out the details of their merger. The new organization, to be known as Radio Amateurs of Canada, is comprised of the members of the Canadian Radio Relay League and the Canadian Amateur Radio Federation. In addition to reviewing the complex legal issues involved in such a merger, the delegates from CRRL and CARF also affirmed maintaining a Canadian national field organization, established a committee to study the national Capital Region headquarters office, reviewed a proposed Radio Amateurs of Canada operating budget, and affirmed that all former CRRL and CARF members will continue as RAC members with all services. *Via ARRL Letter. TNX Westlink Report #638, November 27, 1992.*

Cosmonauts to Fly on the US Space Shuttle

Cosmonauts Sergei Krikalev U5MIR and Vladamir Titov have been selected to fly on the US Space Shuttle next year. Both cosmonauts will be arriving in Houston shortly to begin their training. At this time, it appears that Titov will be trained as a back-up in the event Sergei cannot fly on this mission. There has been no word whether U5MIR will operate SAREX amateur radio equipment from the Shuttle as he has from the Russian space station *Mir* in the past. *TNX KD2BD; W5YI Report, Vol. 14, Issue #20, October 1, 1992.*

Earthwinds Setback

The Earthwinds attempt to circumnavigate the world nonstop in a manned capsule suspended between two special balloons suffered a setback just days before a scheduled liftoff. During a media tour of the launchsite near Reno, Nevada, a 29 mph wind gust ripped a hole in the top of the large inflatable dome that served as a hangar for the project. The dome quickly deflated, exposing the 100-foot-diameter anchor balloon (already inflated in preparation for liftoff) to the high winds. The anchor balloon broke free from its moorings and rolled nearly a quarter mile across the desert floor until it deflated after suffering damage from the sagebrush. Fortunately, no one was hurt and the gondola only experienced minor damage. The top balloon was still in its packing crate and was undamaged.

The anchor balloon will have to be either repaired or replaced. In addition, a new hangar dome will have to be installed. It is expected that repairs should be completed in time for a possible launch in early January 1993. This still gives the Earthwinds crew a two-month launch window.

During this historic flight look for the ham radio tracking experiment on 28.303 MHz. At 30 and 55 minutes past each hour there will be a transmission giving the balloon's latitude, longitude and ground speed during the flight. The callsign will be KB7JGM. *TNX to Bill Armstrong and Erin Porter of the Earthwinds Hilton project for the above information.*

Ban on Cellular Scanners Signed

President George Bush has signed into law legislation that blocks the sale of radio equipment used to eavesdrop on cellular telephone calls. It directs the FCC to withhold its equipment authorization for any radio scanner that can receive cellular frequencies or that can easily be modified to receive such frequencies. The equipment cannot be sold without FCC authorization.

In about a year the law will also make it illegal to manufacture this type of equipment in the United States or import any such equipment made elsewhere. *TNX N7EP; Westlink Report, Number 639, December 10, 1992.*

Hams Aid in the Wake of Killer Tornadoes

Ham radio operators from throughout the South have rallied forces to aid victims of a series of devastating tornadoes that ripped through Mississippi, Tennessee and Alabama on Saturday night, November 21, 1992, and Sunday morning, November 22nd. At least 16 people were killed, with countless others injured and homeless.

All but one of the fatalities occurred in Mississippi Saturday night. At least six died when a tornado hit a trailer park in Brandon. The other reported death occurred in Toone, Tennessee.

The storm knocked out power to many homes in Rankin County, Mississippi, near Jackson. Also disrupted were many normal lines of communications, including telephone and cellular telephone service. At least one 2 meter repeater was damaged and knocked off the air, but most others survived unscathed and were pressed into immediate relief operations service.

With the traditional communications services taken out, hams accompanied rescue workers who used doors from ripped-apart trailers as makeshift stretchers to move away the injured, according to a civil defense official.

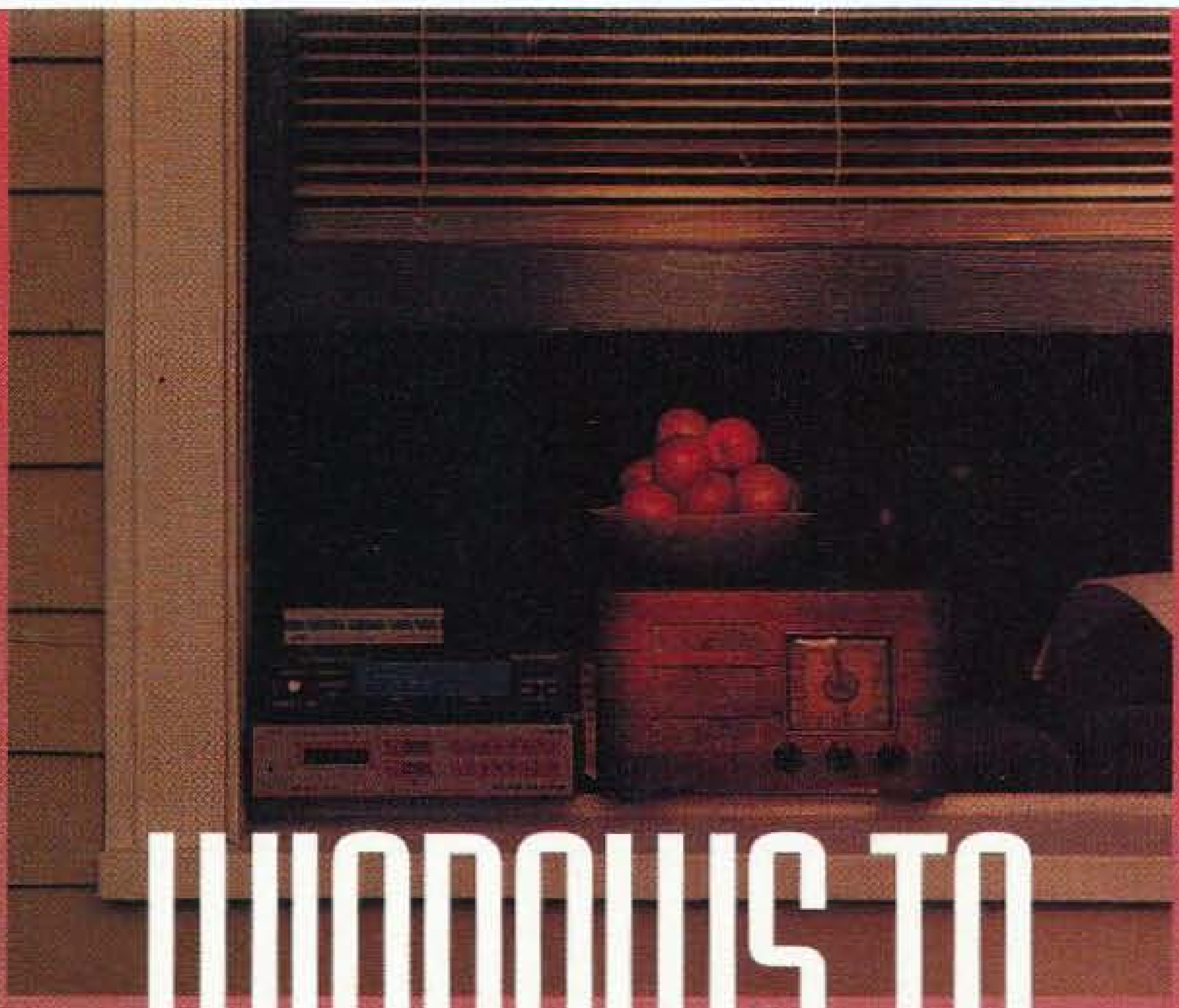
In western Alabama, Danny Buford KC4RLR spent the following day in Ethelsville, which was also hit by a severe twister. Buford used his amateur radio gear to help assess damage for the Red Cross. According to KC4RLR, he saw at least three homes that were destroyed and many house trailers damaged beyond repair. Buford said that it was all but a miracle that nobody was killed in Ethelsville, where seven people were hospitalized.

Amateurs involved in "Skywarn" severe weather spotting nets stayed on the job overnight. They were reported to have seen a tornado touch down about 11 p.m. and reported it and other critical storm information to authorities via 2 meter FM. The National Weather Service confirmed the sightings on Sunday the 22nd, noting that this help may have kept the death toll from growing higher. *Westlink Report*'s Youth Editor Sam Garrett AAØCR and 1992 *Westlink Report* Young Ham of the Year Angie Fischer KBØHXY were written up in the St. Louis, Missouri, newspapers for their participation in Skywarn operations.

Earlier Saturday, tornadoes caused serious damage and several injuries in parts of southeastern Texas. Skywarn hams also reported that a tornado touched down in southern Iowa as well, causing several minor injuries. And in Ohio, members of the Dayton Amateur Radio Association took the DARA Emergency van to a suburb of that city after a twister touched down, causing minor damage on Monday November 23rd. *TNX KB4KCH, N8FPF, NØDN and others; Westlink Report, Number 639, December 10, 1992.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine,* Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one stop bit. News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun.* You can also send news items by FAX at (603) 924-9327.



Fun at 10,000 MHz

Explore the wide open spaces of the 10 GHz microwave band.

by Gordon West WB6NOA

Photo A. The ARR 10 GHz FM system makes an ideal mobile microwave station.

The 10 GHz band has plenty of elbow room for activity—would you believe 500 MHz wide? And on any warm weekend you can usually find plenty of activity on 10 GHz if you take a little drive to the local hill or a mountaintop.

There are two companies that manufacture 10 GHz systems: Advanced Receiver Research Company (wideband FM transceivers), P. O. Box 1242, Burlington CT 06013, (203) 582-9409; and SSB Electronic USA (narrowband SSB/CW transverters), 124 Cherrywood Drive, Mountaintop PA 18707, (717) 868-5643.

For local contacts out to 100 miles line of sight, wideband FM works great at 10 GHz. The Advanced Receiver Research transceiver is completely assembled and is ready to go for voice, MCW, video, or data. You could run up to 100 mW output with a M/A-COM Gunnplexer, part of the $500 TR-10GA transceiver system. Just add 12 volts and a simple Radio Shack mike and you are on the air, full duplex, into a little plastic horn antenna that points in the direction of the other microwave station. For just about a grand you could get on the air INSTANTLY with the two ARR transceiver systems. On a hot summer afternoon you could probably exceed 100 miles of communications range due to the atmospheric condition called tropospheric ducting. The higher you go in frequency, the more pronounced the tropospheric duct gets, and the further you can communicate. My best range with the ARR system was 245 miles from Southern California down into Baja California.

Avid microwavers have not been content to work only out to a couple of hundred miles. They wanted a 300- to 400-mile range, so they switched from wideband FM over to SSB, and as soon as a few SSB 10 GHz systems were on the air, contacts were achieved well beyond 300 miles.

The SSB Electronic USA Station

Fortunately there is a way to easily build a portable SSB or CW station for the 10 GHz band using the modules and components available from SSB Electronic USA.

A typical station would consist of the following:

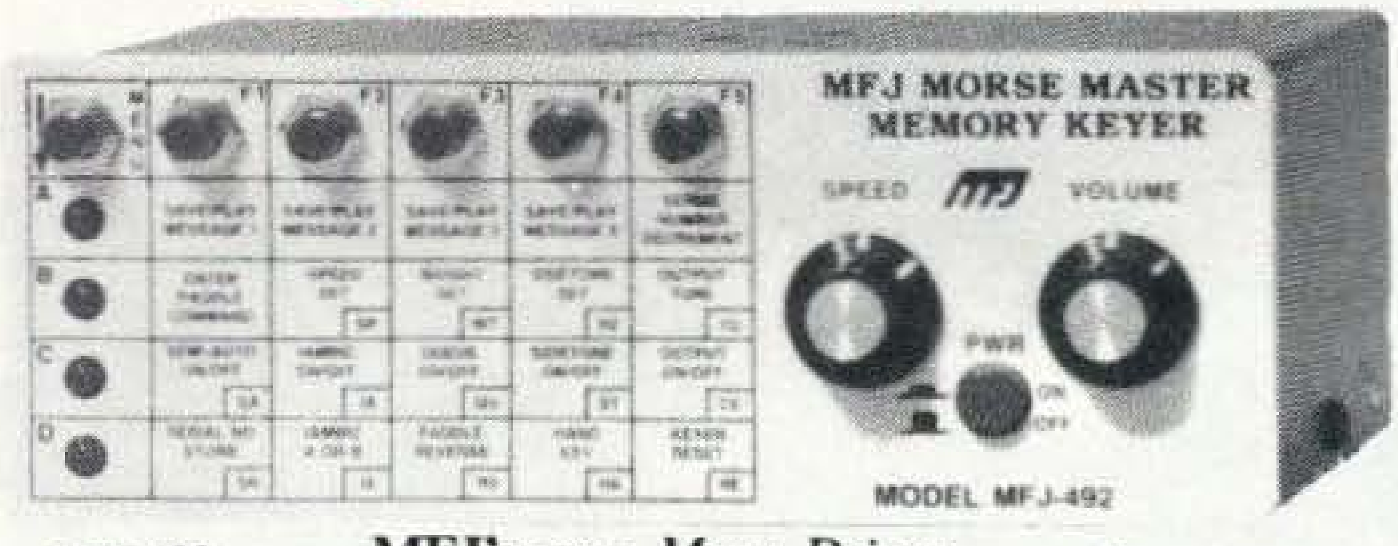
- XLO-1 local oscillator module
- XTM-1 10.368 GHz transmit upconverter
- XRM-1 10.368 GHz receive downconverter
- HP-8761 single-pole, double-throw, SMA RF switch (or equivalent)
- SMA to 10 GHz waveguide adapter
- Control relay
- Output TR relay
- Multimode 2 meter transceiver

The XLO-1 local oscillator module puts 5 mW on 2556 MHz. A fifth overtone crystal at 106.5 MHz is used in the temperature-compensated oscillator circuit, and all multiplier stages are filter-coupled in order to achieve a clean output.

The XTM-1 transmit mixer requires a LO injection signal of approximately 5 mW at 10.224 GHz. We set the on-board attenuator

Photo B. A completely portable 10 GHz SSB station (200 mW output) can be easily assembled through the use of the SSB Electronic USA 10 GHz transverter, a 2m multimode rig and a horn (or dish) antenna.

MFJ *Menu Driven* Memory Keyer™



MFJ-492

$99.95

MFJ's new *Menu Driven* Memory Keyer™ lets you immediately enjoy your MFJ-492 without reading an instruction manual -- there's no keypad, no complex sequences, nothing to remember.

You simply select a menu by pressing a button. An LED lights to show you which menu is active. You select a feature by pressing a feature button. It's as easy as using a computer touch screen! Each menu is clearly printed on the front panel -- there's no confusion.

From the menu you can save and play messages . . . decrement serial numbers . . . set speed, weight, sidetone . . . enter iambic, semi-auto, handkey, message queue, paddle command modes . . . turn on/off sidetone, transmitter tune, keying output on/off . . . select iambic A or B, reverse paddle, Morse trainer and store starting serial number.

You can bypass the menu by keying in simple two letter commands.

When you select a feature the keyer tells you its status in CW.

Memory expandable to over 8000 characters

You can expand the MFJ-492 standard 192 characters in four soft sectored message memories to over 8000 characters in eight message memories by simply plugging in the MFJ-80, $14.95, Memory Expansion Kit. Memories backed-up by lithium battery.

Smooth Speed Control

Matching your CW speed to a QSO is best done by ear. The MFJ-492 lets you match speed by turning a knob or by using MFJ's Analog Set™. In this mode, pressing the dot or dash paddle smoothly increases or decreases speed from 5 to 100 WPM. You can also customize the range of the speed knob for precise control.

Powerful Morse Code Trainer

A powerful Morse code trainer lets you practice or teach code in Farnsworth or normal mode.

You can select letters, numbers, punctuation marks or prosigns or any combination for practice. You can use standard 5 character groups, more realistic random 1 to 8 character groups or select specific six character sets to work on.

You can instant-replay a random session to check your copy.

You can store custom code practice sessions in memory for later replay.

Here's what you can do with Message Memories . . .

Message Repeat™ lets you repeat messages continously. You can also insert pauses within a message. This lets you call CQ, listen for an answer and then resume calling CQ by pressing a single button. Each pause can be up to an hour -- it makes a perfect Automatic Beacon.

Message Call™ calls other messages and *Message Queue* plays messages in sequence. You can store QTH, rig, weather and other information in separate message memories and play these in any sequence you want!

Message Edit™ lets you correct mistakes while recording a message -- you don't have to start all over if you make a mistake.

While you're playing a memory message you can break-in at any time and insert comments from your paddle and then resume playing your message.

Menu Driven Memory Keyer/Bencher Paddle Combo

MFJ-490

$164.95

The best of all CW worlds -- nearly all the features of the MFJ-492 *Menu Driven* Memory Keyer in a compact configuration that fits right on the Bencher iambic paddle! You can buy the combination or just the keyer for your Bencher.

You get message memories, Morse trainer, sidetone, automatic serial numbering -- plus more. 5x3x5½ in. Uses 9 volt battery, 12 VDC or 110 VAC with MFJ-1312B, $12.95. **MFJ-490,** $164.95, Keyer/Bencher Combo. **MFJ-490X,** $109.95, Keyer only. Memory expansion kit not available.

You can insert commands within a stored message. As you play it back, these commands will execute. For example, you can insert automatically incrementing serial numbers, replay messages continuously, call and play other messages, insert pauses or combine all these in one message!

When you play your messages back, automatic word and character spacing make your CW sound like perfect code. Or you can adjust the spacing for a more distinctive individual sound that DX stations will notice.

Plus more . . .

You get contest serial numbering (0-9999) with auto-increment. You can send an N for 9 and a T for 0 to save time.

MFJ's ***Analog Set***™ lets you adjust speed, weight and sidetone just as smoothly as a knob -- dot/dash paddles are used as an up/down control.

You get built-in sidetone, speaker, front panel volume control knob and adjustable 300-3000 Hz tone.

You can use automatic, semi-automatic bug or handkey modes, reverse dot/dash paddles, select iambic A or B or non-iambic modes.

You can adjust weight from 5 to 95% and compensate for transmitter distortion with a special transmitter compensation feature.

A tune feature lets you key your transmitter for tuning.

You can turn off the keying output so you can practice without keying your transmitter or unplugging your keyer.

You get direct and grid block keying. Keys solid state and tube rigs.

Special MARS characters are recognized and can be used in messages.

Uses 9 volt battery, 12 VDC or 110 VAC with MFJ-1312B, $12.95. 6½x2½x6¾ in.

MFJ-80, $14.95, Memory Expansion Kit. Expands your MFJ-492 to 8000 characters and adds four additional message.

MFJ-492X, $114.95. MFJ-492 with MFJ-80 Memory Expansion Kit installed.

MFJ-78, $19.95. Full function Remote Control puts message memories and menu control at your finger tips for real convenience.

MFJ Super *Menu Driven* Memory Keyer™/Keyboard

MFJ-493

$139.95

You get all the features of the MFJ-492 plus these . . .

★ **You** get 32,000 characters of memory.

★ **Plug-in** a standard IBM compatible 101 AT type keyboard and you have an extremely powerful full featured standalone keyboard keyer. All commands, functions and memories can be done through the keyboard. Plus you get additional message memories and features.

★ **Built-in** serial port lets you combine the power of your computer with the MFJ-493. Use your computer to compose, build and store a complete library of often used messages, generate custom code practice sessions and exams and download to MFJ-493, control your keyer, automatically set up keyer for different operators during contest, display, edit and save message memories and keyer settings.

As you key in CW, ASCII is also being sent to the serial port. You can use your computer to record an entire transmission.

★ **In** addition to the powerful Morse Code Trainer, in the MFJ-492 you get . . .

. . . **an** *FCC Exam Simulator* that sends random QSOs exactly like the FCC exams. When you can copy these random QSOs, you're ready to pass your exam and upgrade!

. . . **MFJ's** *QSO Simulator* makes learning Morse code really fun. It's like making real on-the-air contacts. You can answer a CQ or call a station and enjoy a nice a QSO. You'll get operating experience while boosting your code speed.

. . . **a** new *Word Recognition Mode* gives you hundreds of commonly used words in amateur radio for you to practice recognizing entire words instead of individual letters. With practice you can learn to copy words in your head without writing it down and carry on an entire CW conversation without paper -- just like the pros.

Compact 7½x2½x6¾ inches. Use 12 VDC or 110 VAC with MFJ-1312B, $12.95.

MFJ-79, $19.95, full function Remote Control.

Dedicated CW Keyboard

MFJ-451

$89.95

Dedicated CW Keyboard has 200 character type ahead buffer and two 100 character message memories with buffer and memory full indicators. Select features with *One Touch*™ function keys. Use *Analog Set*™ or type-in Speed (5-100 WPM), Weight (5-95%) and Sidetone (300-3300 Hz). Has speaker. 3½x1¼x3½ inches. Use 12 VDC or 110 VAC with MFJ-1312B, $12.95. Keyboard supplied may vary from the one shown here.

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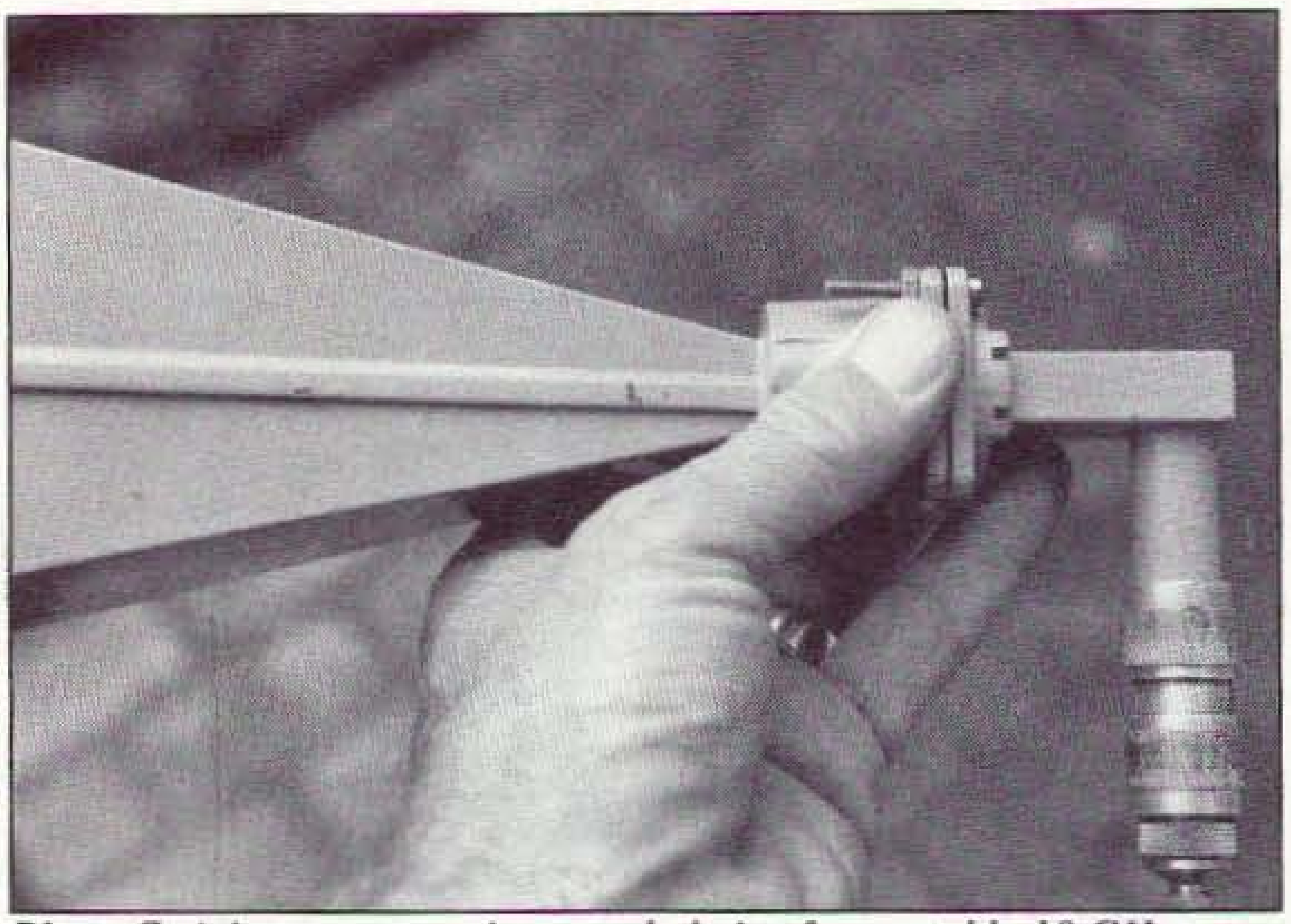

Photo C. A horn antenna is a good choice for portable 10 GHz operation. It can be easily fed with a waveguide-to-N-connector section. Standard coax adaptors reduce the feedpoint to an SMA connector.

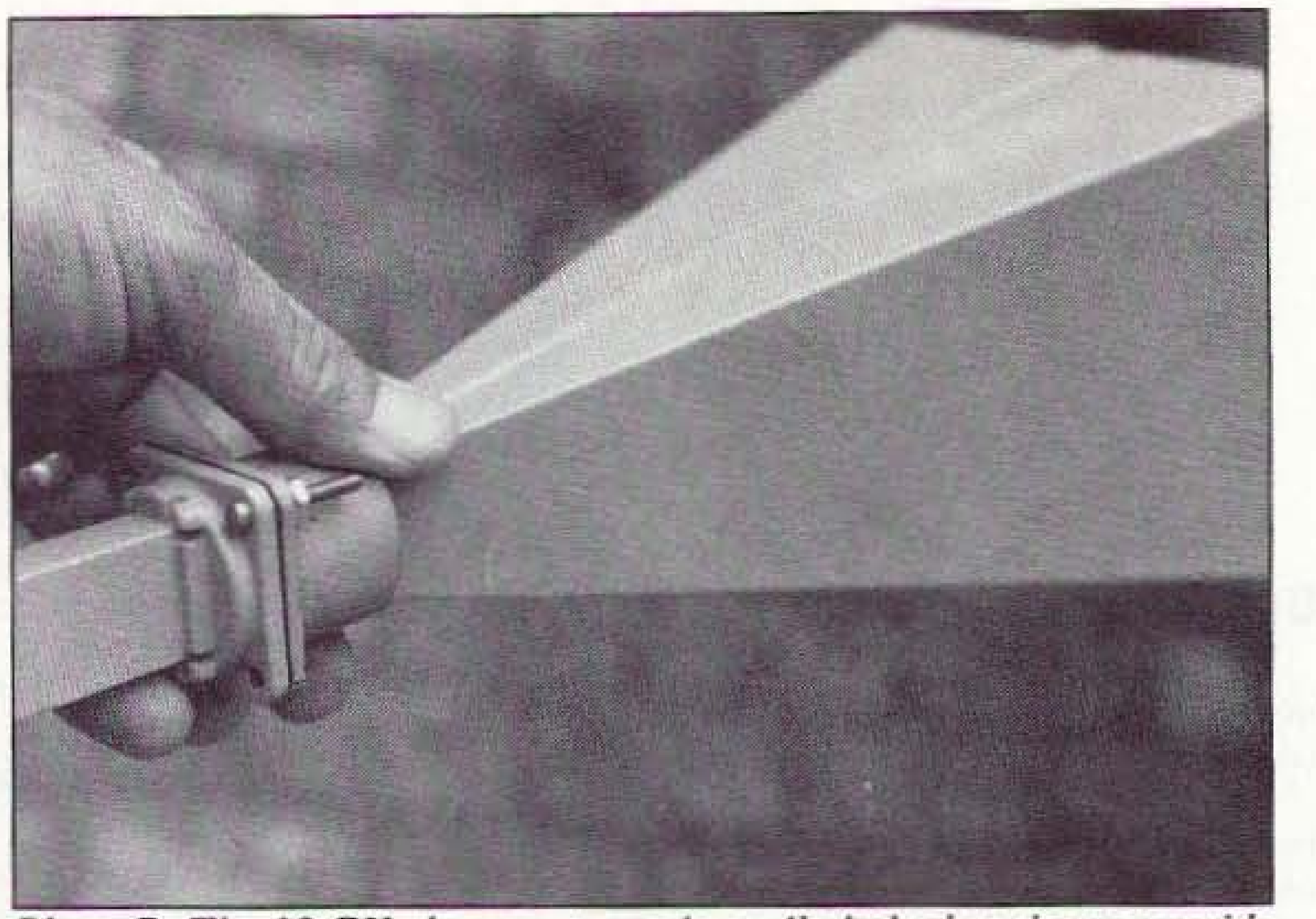

Photo D. The 10 GHz horn antenna is easily bolted to the waveguide flange.

to approximately 100 mW of IF drive from a modified Kenwood, Yaesu or ICOM 2m SSB transceiver. (The transceiver needs to be modified to cut out the PA section in order to limit power output to no more than 100 mW.)

An active GaAsFET mixer is utilized to provide a sum and difference output of 10.224 GHz, plus or minus 144 MHz IF input. The summed output of the mixer is selected by an on-board cavity filter tuned to 10.368 GHz. The resulting signal is amplified to approximately 200 mW output by a three-cavity coupled GaAsFET amplifier stage. That's right, folks, a whopping 200 mW output!

The XRM-1 receive module contains a mixer for an injection signal of approximately 5 mW at 2556 MHz. A separate SMA connector is provided for low output at 10.224 GHz for transmit mixer operation. Received signals are amplified by a two-stage, low-noise GaAsFET preamp with a noise figure of about 2. A cavity filter follows the preamp to provide filtering. A mixer is used to provide IF output at 144 MHz, going to your multimode transceiver.

Assembly

I chose the Kenwood 751 multimode transceiver because it was easy to cut out the PA section for an almost perfect 100 mW output. My thanks to Craig Martin at Kenwood for the documentation to insure no output spikes. On the back of the Kenwood 751 is a jack connected to an internal PTT relay, and this allows me to control the 10 GHz transverter for a simple push-to-talk operation. You must make absolutely sure you don't lose your PTT circuit to the transverter—transmitting while the transverter is still on receive would mean immediate destruction of the receive module.

RF switching is accomplished with an expensive HP SMA 12-volt RF relay. You can find plenty of 28-volt relays at the swap meet, and this is an alternate way to go if you can't locate a 12-volt relay with SMA connectors. You will then need to convert from the SMA jack over to an N-connector, or directly to the 10 GHz wave guide that will match up with your 10 GHz horn or dish. I run a horn and also have an optional two-foot and four-foot dish from Anixter Mark.

The modules are completely pre-tested and pre-assembled inside their rectangular silver cans. Jerry at SSB Electronic USA relies on the hams to do their own setup of the individual modules. Jerry indicates it's a weekend job, and most of the time will be spent in "plumbing" all of the components together to match his suggested layout.

The total component cost for my entire system, INCLUDING THE 2 METER MULTIMODE TRANSCEIVER, was a little over $1,000—exactly twice the amount of a pre-assembled wideband FM transceiver. There was also several days time spent in putting everything together, testing, tuning, and tracking down some of those illusive RF relays.

Performance

Once the system gets turned on and warmed up, stability is rock-solid. I tuned into several 10 GHz CW beacons, and after warm-up there was no noticeable drift. The beacons are an excellent way to double-

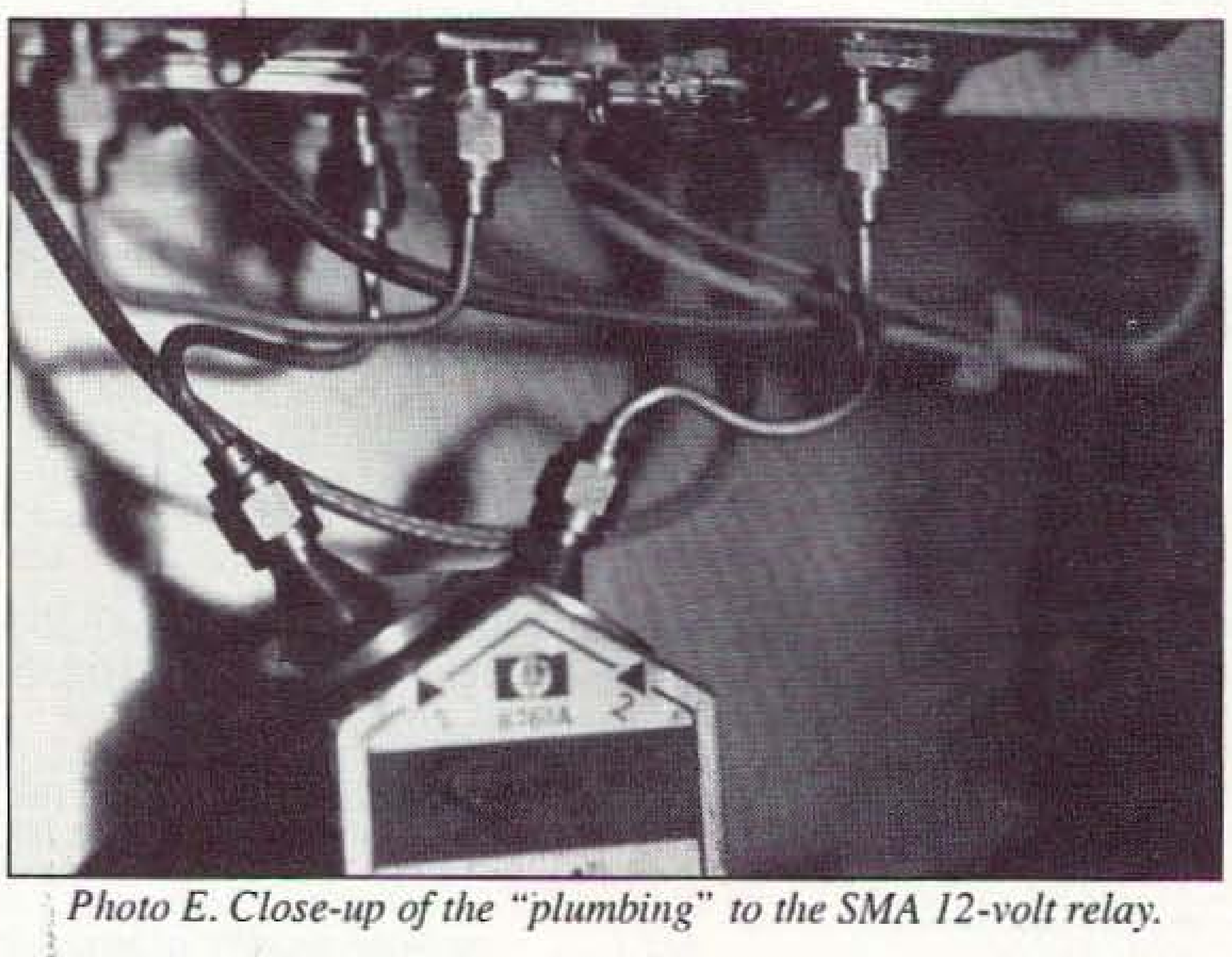

Photo E. Close-up of the "plumbing" to the SMA 12-volt relay.

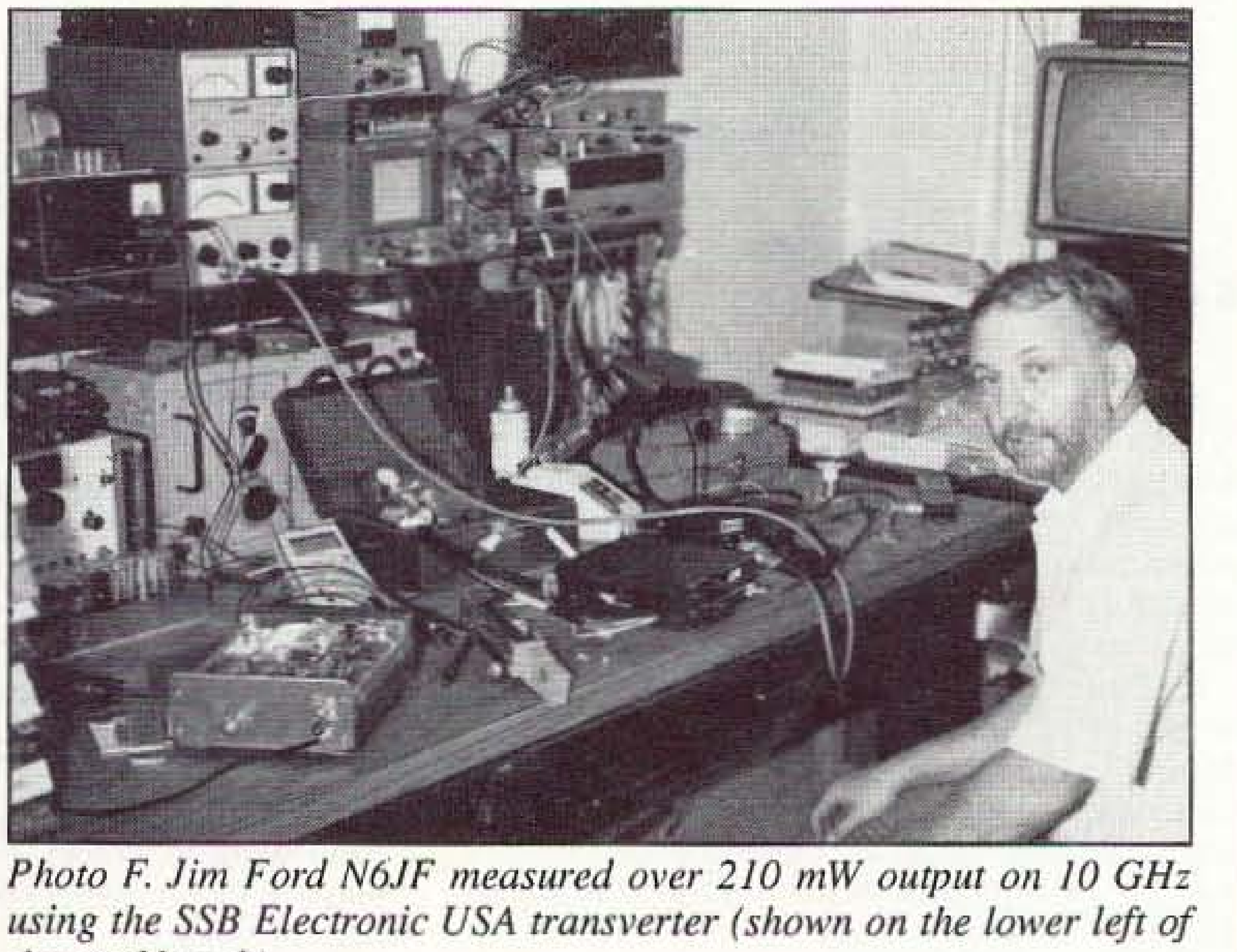

Photo F. Jim Ford N6JF measured over 210 mW output on 10 GHz using the SSB Electronic USA transverter (shown on the lower left of the workbench).

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ATH™ refers to our exclusive new *AUTOMATIC TRIGGER & HOLD* circuit with *AUTOMATIC CLEAN DROPOUT*. With **ATH™** you can say good-bye to almost all of that annoying random counting and the false readings we have become accustomed to when using portable counters. The model **ATH-15** is an *ULTRA HIGH SENSITIVITY*, 1 MHz to 1500 MHz frequency counter with an INTEGRATED BAR GRAPH circuit which *instantly* displays the signal strength of an input signal from < 1 MHz to over 4 GHz. When the **ATH™** feature is used, the counter displays the last readable signal received. It automatically triggers on a readable signal and automatically switches to the "hold" status when the signal dissapears. Because of *AUTO TRIGGERING*, the first reading is correct. If the signal stops in the middle of a sample or gate time, the last complete accurate reading will be displayed and the unit switched back to "HOLD" status, hence the *AUTOMATIC CLEAN DROPOUT* prevents the display of erroneous data, all this is done automatically, with hands free operation - and it works great !!!

We are further responding to user requests by offering a *ONE-SHOT* **ATH™** option. This consists of a *ONE-SHOT* select switch, a push button *RESET* switch and two LED indicators all located on the top of the counter (not shown). When this function is used, the first readable signal that triggers the counter will be held on the display until manually reset. One push of the reset button will reset the display to zeros and enable the one-shot circuit again. The display can be blanked or turned off pending the auto triggering from an input signal, which also saves power under battery operation.

RESPONSE TIME, defined as the time from the beginning of the input signal to a stable, accurate, readable display, has been dramatically speeded up. The RESPONSE TIME is actually 800% faster than previous models and if you consider not having to manually throw the hold switch, at just the right time, the **ATH-15** is functionally the fastest counter you can buy !!

MADE IN USA

SAY *GOOD-BYE* TO RANDOM COUNTING & FALSE READINGS

ATH-15

SIZE: 4"H x 3.5"W x 1"D

#ATH-15	FREQUENCY COUNTER WITH NI-CADs & 110VAC ADP	$235.
FACTORY INSTALLED OPTIONS:		
#O/S-ATH-15	ONE-SHOT ATH™	40.
#HSTB-15	HIGH STAB TCXO 0.2ppm	100.
ACCESSORIES:		
#CC-90	BLACK VINYL ZIPPER CASE	12.
#TA-90	TELESCOPING BNC ANTENNA	12.
#P-110	PROBE, 200 MHZ, 1X-10X	39.
#M207IC	CABLE FOR MFJ-207/208	10.

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CIRCLE 247 ON READER SERVICE CARD

check that your receive system is up and running properly.

For transmit, output at 205 mW was confirmed with some elaborate waveguide tap-off equipment, but was confirmed using a simple microwave leak detector available from Radio Shack. Holding the microwave leak detector near the dish or horn aperture revealed plenty of energy coming out of the system. While the little Radio Shack microwave oven leak detector is not very scientific, it was the best thing going during the recent microwave contest when no one else up on the mountaintop had any real way of knowing that their system was up to par.

Our first contact was with Bill Alber WA6CAX over a path of 305 miles between Southern California and Arizona. He assembled his own SSB Electronic USA system, but opted for manual switching between TX and RX. We both used Anixter Mark two-foot dishes, and we had signal strength to spare.

We found that we could bounce the 10 GHz SSB signals off of passing aircraft, too. After all, 10 GHz is where most marine radars work. It was interesting to hear the Doppler shift as the aircraft was approaching both our stations.

So if you're looking for new frontiers to explore, and want plenty of elbow room, do consider the 10 GHz band. On any warm weekend there may be as many as 20 or 30 operators in your area participating in some mountaintop activity. Use a separate 2 meter transceiver for coordinating your contacts, or switch over to a relatively small horn, point in the general direction of suspected activity, and tune around looking for a signal. You might be surprised at what you hear!

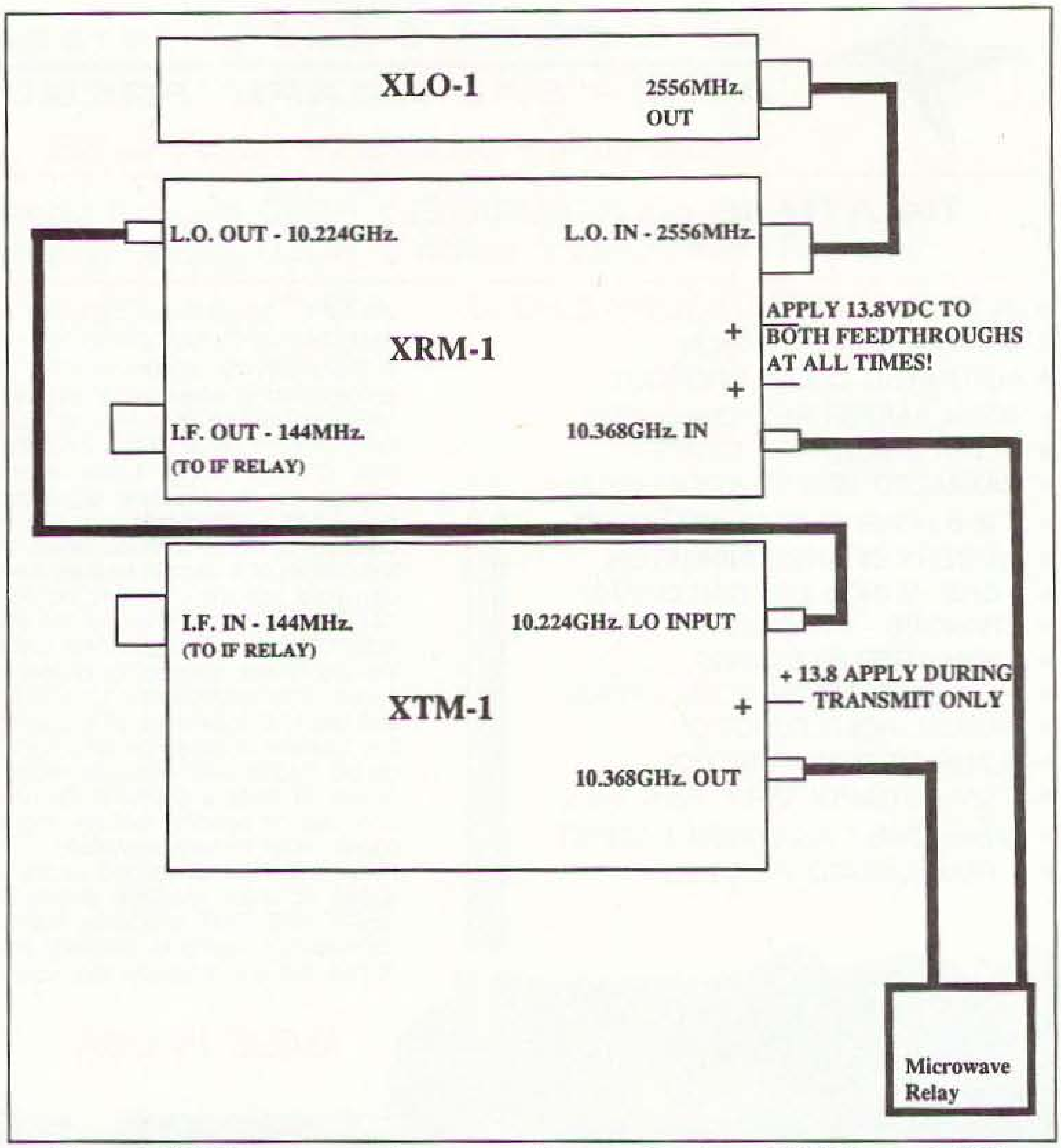

Figure 1. 10 GHz transverter interconnect diagram. Courtesy of SSB Electronic USA.

Presently Southern California ham radio operators have their sights on setting a new 10 GHz SSB record between California and Hawaii, with Paul Lieb KH6HME up and running with 10 GHz equipment. While 10 GHz "experts" say it can't be done at the 200 mW level, time will tell! The right conditions could open up a 10,000 MHz path like no one has ever suspected before.

Come on up to 10 GHz—there's plenty of elbow room, and there's no shortage of pre-assembled equipment.

Build a Super-Horn Antenna for 10 GHz

With the concept that bigger antennas have more gain, I though it would be fun to develop and build a 10 GHz horn antenna with a *lot* of gain . . . one that would just fit into my station wagon for mobile microwave use.

From the 10 GHz antenna bible, the *RSGB VHF/UHF Manual*, I found a passage which described a horn antenna as a "Waveguide feed appropriate to the frequency (WR-90 waveguide) which is smoothly flared in both planes so that a wave inside the guide horn can expand in an orderly manne . . ." In other words, take the usual 10 GHz horn and extend its sides in both the vertical and horizontal planes.

The formula is: $4\pi AB/\lambda^2$

(where A & B are the final aperture dimensions). Figure 2 describes the shape of the horn.

Construction

The local metal shop at the college that I teach ham classes at came up with some 5052 aluminum sheet. At 0.062" thick, it's just rigid enough to hold its shape out to an exit opening of about three feet on a side—just anough room to fit into my station wagon's rear hatch opening.

We fabricated two sheets of aluminum into shape using a pattern press break for nice tight corners. We then manipulated both sections into place for a perfect extension of a small 10 GHz horn that gave us good results in earlier tests. We confirmed our measurements using the RS-GB formula (see above).

The next step in the fabrication of the super horn was to heli-arc the two halves together at 10,000 degrees, using 5356 welding stock. Sanding cleaned up the joints for a smooth finish on the inside surfaces. We held our breath to make sure the entire horn would keep its shape without distorting under its own weight. It held up fine with little warp.

We attached a waveguide feed assembly, patterned after our small-horn sample. A small file gave us an almost perfect match to the WR-90

Continued on page 77

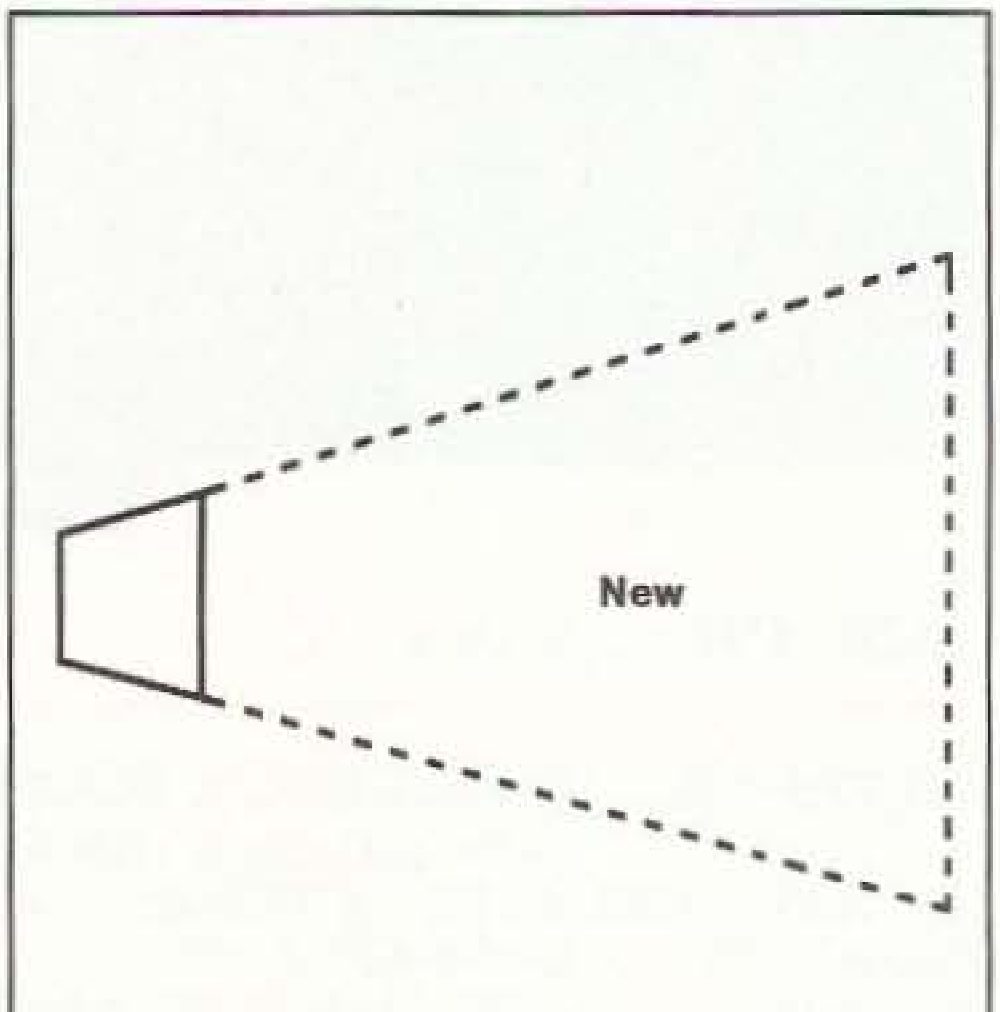

Figure 2. Dimensions and calculations for the 10 GHz Super Horn antenna. The horn formula appeared in the RSGB VHF/UHF manual.

The 23-Foot Indoor Antenna

Make an effective 20 and 80 meter apartment-dweller antenna.

by Richard Q. Marris G2BZQ

Relocating into an apartment for the first time can have a very traumatic effect. This, of course, also applies to any other habitation where an HF outdoor antenna is not permitted or is physically impossible to erect.

This first happened to me (licensed for too many years to remember how many) when, over 30 years ago, new employment meant moving the QTH at regular intervals, and turned me into an apartment dweller. Since then I've tried and evolved many apartment antenna types, including loops and helicals.

My Solution

With just 23 feet of wire across a room, it is possible to quickly get onto 20 and 80 meters in a minimum of time and at minimum cost.

In each successive QTH move, the good old 23 feet of wire has always been used first, to get G2BZQ back on the air again within a few hours of taking up the new residence.

Figure 1 shows the 20 meter version, and Figure 2 that for 80 meters. Note that the same 23 feet of wire (A-B) is used for both bands. Assuming that your transceiver can be placed in the corner of a room, A-B will consist of a drop down of about four feet to your rig, and the remaining 19 feet will be hung horizontally diagonally across the room, at least 9" below the ceiling. White PVC covered stranded hookup wire (#22 gauge—Radio Shack #278-1218) should be used as it is inconspicuous against a white ceiling. It should be supported by nylon fishing line which is also inconspicuous.

This antenna should be kept away from electrical wiring, water pipes, etc. Terminate with a small plastic ring at point B, leaving about 2" of bare wire hanging down. Support the plastic ring to the room corner with 10 lbs. breaking strain nylon fishing line. At the other corner of the room, support the wire to that corner with fishing line, leaving a drop down at A (about four feet), which is near the transceiver. This is the 23-foot antenna!

For 20 Meters

See Figure 1. As an antenna wire is increased in length above 1/4 wavelength long, the terminal impedance increases to a point where the impedance reaches 50 ohms. Unfortunately, at the same time the reactance has also increased, but can be tuned out with a series capacitor (C in Figure 1a). This variable capacitor should be a good quality ceramic type, of equivalent size to that in your transmitter's PA. It should be mounted in a plastic box with a large diameter plastic instrument knob. Coaxial socket SKT1 can be connected to a 50-ohm output having a pi network output, using a short length of RG58 feedline. Better still, an existing 20 meter antenna tuner (ATU) can be inserted between SKT1 and the rig. This will help eliminate TVI.

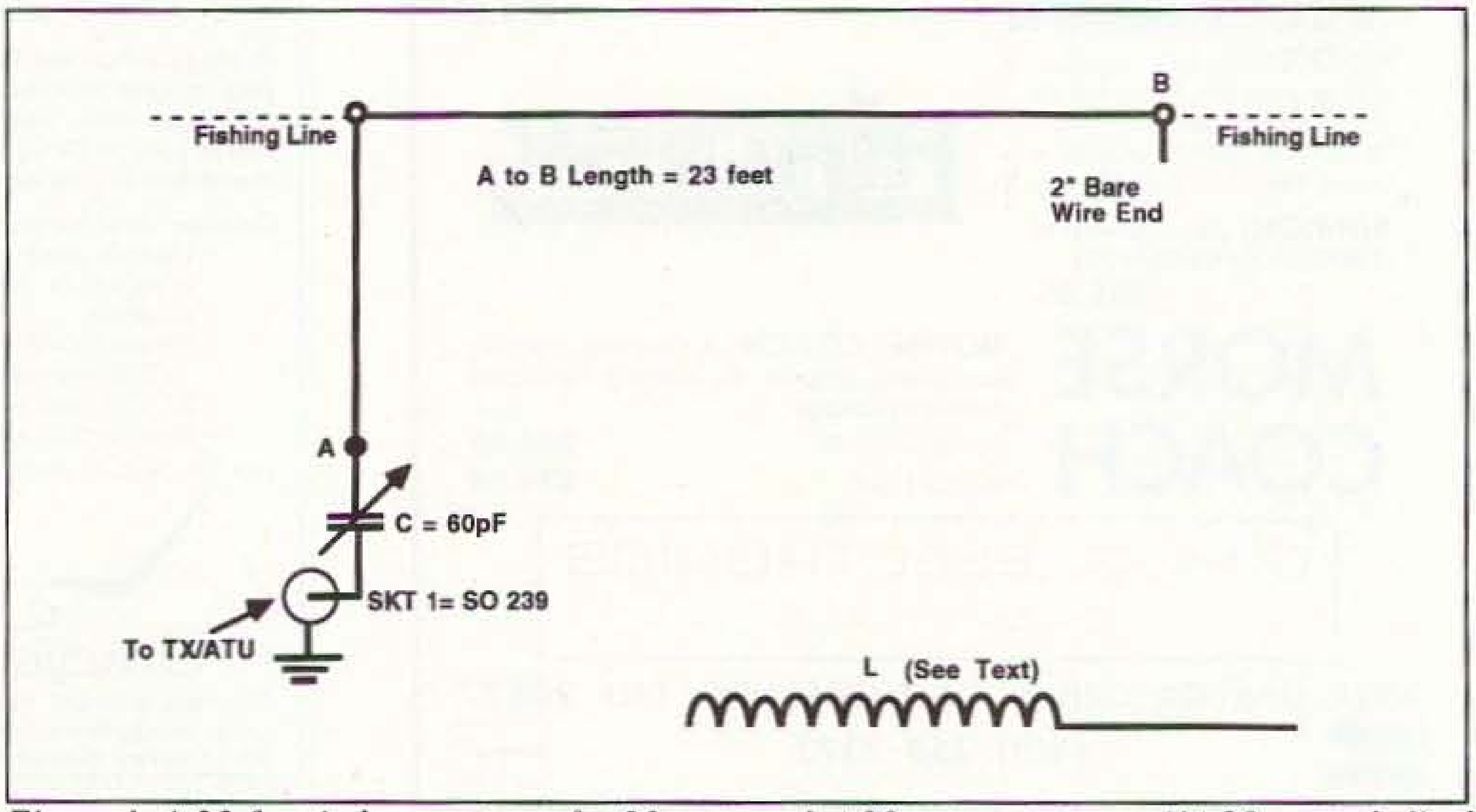

Figure 1. A 23-foot indoor antenna for 20 meters: 1a) 20 meter antenna; 1b) 20 meter helical ground.

For 80 Meters

Figure 2 shows that the same 23 feet of wire is used for 80 meters, with the addition of a vertical end helical coil L2 which, in fact, is a combined loading coil and radiating element added to the end of the 23-foot wire (A-B).

Using 22' 6" of the same PVC covered wire, wind 21 feet helically on a 1/2" diameter wood dowel or plastic tube, spacing the turns over a width of 3' 8". A tail of 18" will be left at the top end and, fitted with a strong clip, it can be attached to the main antenna wire at point B. It will be necessary to fit a suitable wood base to hold L2 vertically.

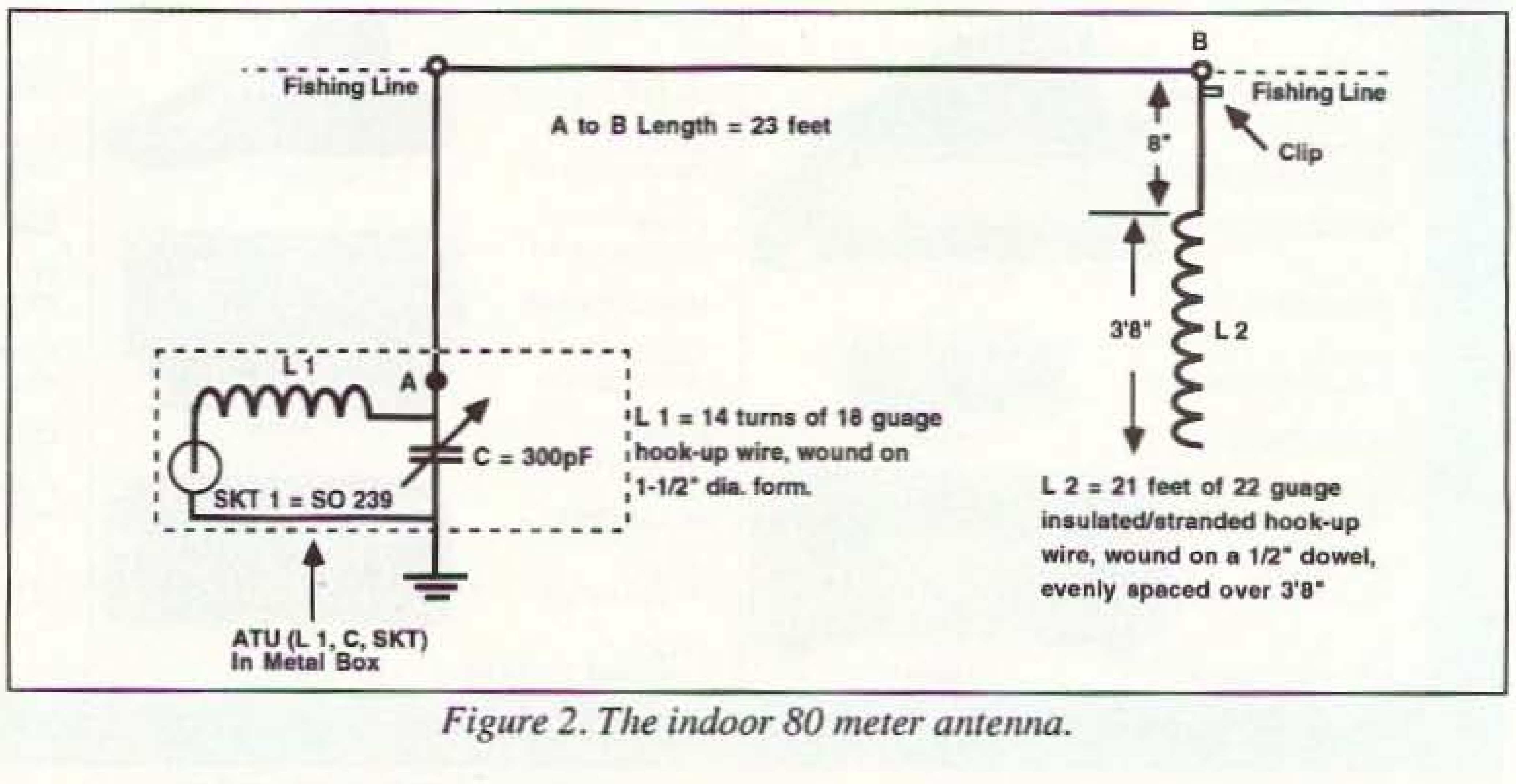

Figure 2. The indoor 80 meter antenna.

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The 23-Foot Indoor Antenna

Continued from page 16

At the transmitter end of the antenna wire, a simple LC ATU matches the antenna to your rig. The ATU should be built into a metal box. L1 consists of 14 close-wound turns of 18-gauge enamel copper wire, wound on a 1.2" diameter PVC form. L1 should be mounted in the metal box with at least a coil diameter of clearance away from metal work. C1 should be a good quality variable capacitor of 300 pF capacity, or even 500 pF.

The simple ATU consists of L1 + C + SKT1, in a metal box. *However*, an existing good LC, "T" or other ATU, could be used in place of the one shown.

Wire length A-B, plus the vertical helical section L2, form the radiating antenna. L2 should be mounted vertically and fitted with a wood base to support it—it should be at least 15" clear of walls, etc.

Ground Systems for 20 and 80 Meters

Ground connections are an ongoing problem with the indoor antenna. If there is a *metal* water pipe close to the TX, then a short wire stout flex can be clipped to it to form a ground. Do not connect to a plastic water pipe, gas pipes or electric wiring conduit. On 20 meters, the connecting lead should not exceed about six feet, and on 80 meters up to 15/20 feet should be satisfactory.

Figure 1b shows an artificial ground for 20 meters. It consists of 36 feet of PVC covered stranded wire (Radio Shack #278-1218) helically wound around a six-foot length of 5/8" diameter dowel of plastic pipe. The turns should be spaced to fill a length of 5'5" on the dowel. The ends of the winding can be secured with tape. The connecting lead should be four feet long. The artificial ground should not be laid on the floor, but provided with supports at least 24" high and mounted horizontally. Various positions relative to the antenna should be tried for the best results.

I developed an excellent artificial ground for 20/80 meters when living in Minneapolis in the 1970s. The operating position was near a very large metal-framed double-glazed window. A short ground lead was clipped to the metal window frame and proved to be most effective on both 20 and 80 meters. I have since tried this idea at other locations. No doubt it formed a vertical ground plane.

Conclusion

This simple 23-foot antenna gives an apartment dweller a quick and effective way of working on the 20 and 80 meter bands. Of course, the higher the antenna the better the results. I have worked DX on 20 meters using both 10 and 100 watts CW, and up to about 3,000 miles on 80 meters. However, in the interests of domestic safety and TVI elimimation, a low power TX is suggested-no more than 20 watts. 73

Number 6 on your Feedback card

Accurate Low Cost VSWR Meter

Convert this CB accessory for 1.8-450 MHz operation.

by Phil Salas AD5X

Nothing beats a good VSWR meter when it comes to playing around with new antenna designs. Unfortunately, meters that work up to 450 MHz can be quite expensive. This article describes simple modifications that can be made to popular CB-style VSWR meters to enable them to accurately perform up through the 3/4-meter ham band.

The Meter

Figure 1 shows a popular CB-type VSWR meter. Made by many different manufacturers, they use an internal directional coaxial coupler. They were very popular up until a few years ago when the transformer type VSWR meter became more popular (undoubtedly due to their lower manufacturing cost). The CB-type meter is widely available at swap fests, and can be had for very little money. I paid $5 for mine at one of our local electronic sidewalk sales.

Upon getting home with this unit, I opened it up and was very impressed with the quality of the coaxial coupler itself. The total internal coupler length measured five inches. For best performance, a directional coupler should be less than a quarter wavelength at the highest frequency used. A quarter wavelength at 450 MHz is about six inches, so it appeared there was some potential here. Unfortunately, the internal components had very long lead lengths and were poorly dressed. Sure enough, a precision 50 ohm load measured with this meter showed a 2:1 VSWR at 146 MHz, and a 2.8:1 VSWR at 445 MHz. Obviously, this would not do.

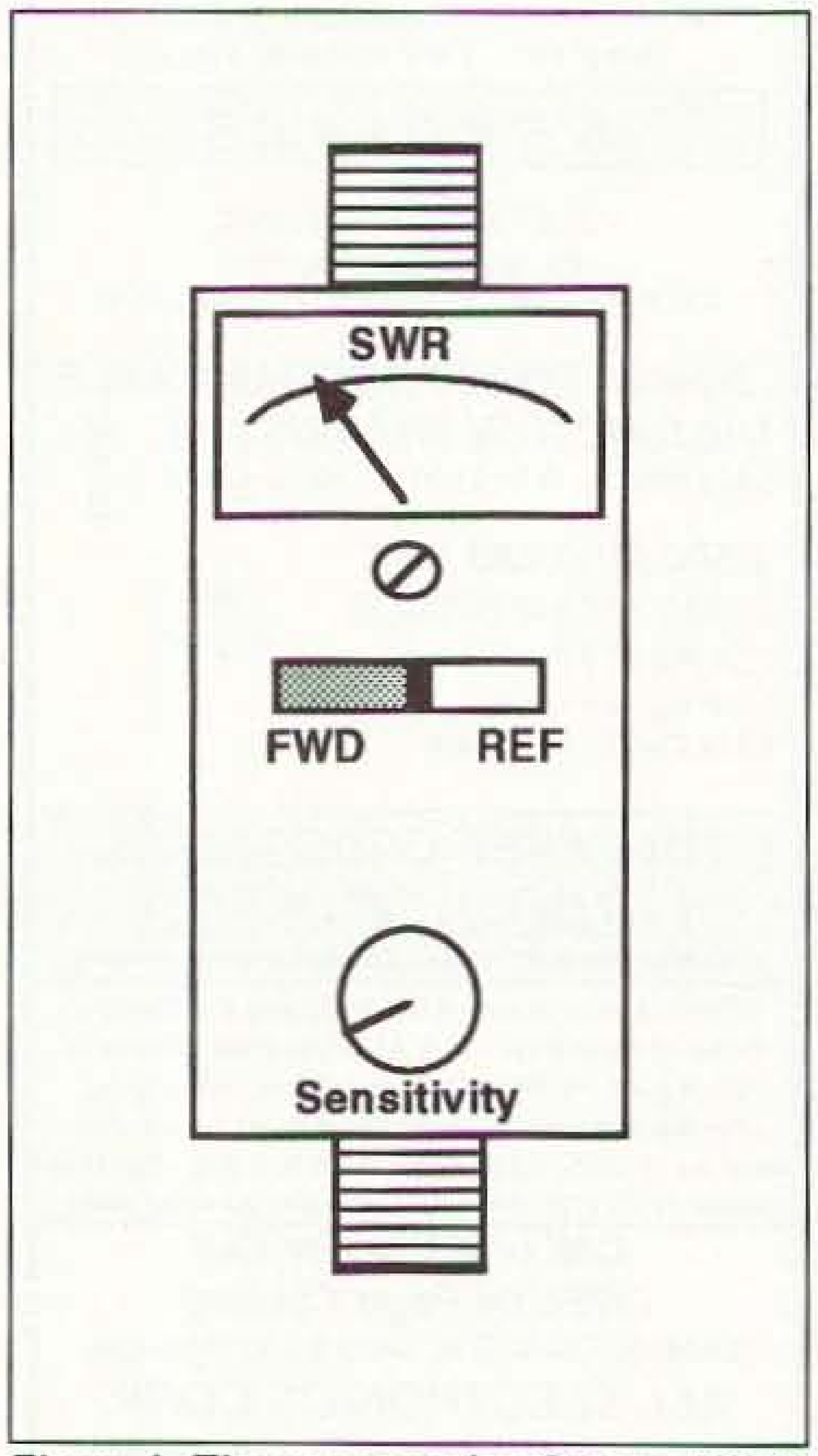

Figure 1. The once-popular CB-type VSWR meter.

Modifying the CB-type Meter

Figure 2 is an internal drawing of the VSWR meter. The first thing I did was remove the detector diodes, 150 ohm terminating resistors, and bypass capacitors. I then cleaned out all excess solder. Next, I made new bypass capacitors by paralleling good rectangular ceramic 0.001 and 0.01 µF capacitors, as shown in Figure 3. The 0.01 µF capacitor is a good bypass at lower frequencies, and the 0.001 µF capacitor is a good bypass at higher frequencies. Mount these capacitors directly to the terminal strips at either end of the coupler, attempting to make the lead lengths as close to zero as possible.

Then I put in new 1/4 watt 150 ohm resistors, as shown in Figure 2. Orient these resistors so as to minimize lead length. Also, position the resistors so that the lead lengths are identical on both resistors. It doesn't matter too much if there is some lead inductance, but it's important that the lead inductance on both resistors be the same.

Next, I put in two new 1N34A detector diodes (available from Radio Shack) as shown. Again, orient the diodes for minimum lead length and ensure that the lead length on both diodes is the same.

That's all there is to it. Now for some measurements.

The Results

For my test loads, I again used my 50-ohm precision termination, a 75 ohm F-type termination with a F-to-PL-259 adapter, a home-built 100 ohm termination, and the Radio Shack RS 21-506 15 watt DC-500 MHz dummy load. The 100 ohm termination was built by sliding a 1 watt 100 ohm metal oxide resistor (RS 271-152) into a RG-6 F-

Results at 445 MHz

	Measured VSWR	Expected VSWR
50 ohm precision load	1.05:1	1:1
50 ohm 15 watt RS load	1.10:1	1:1
75 ohm TV termination	1.50:1	1.5:1
100 ohm termination	1.80:1	2:1

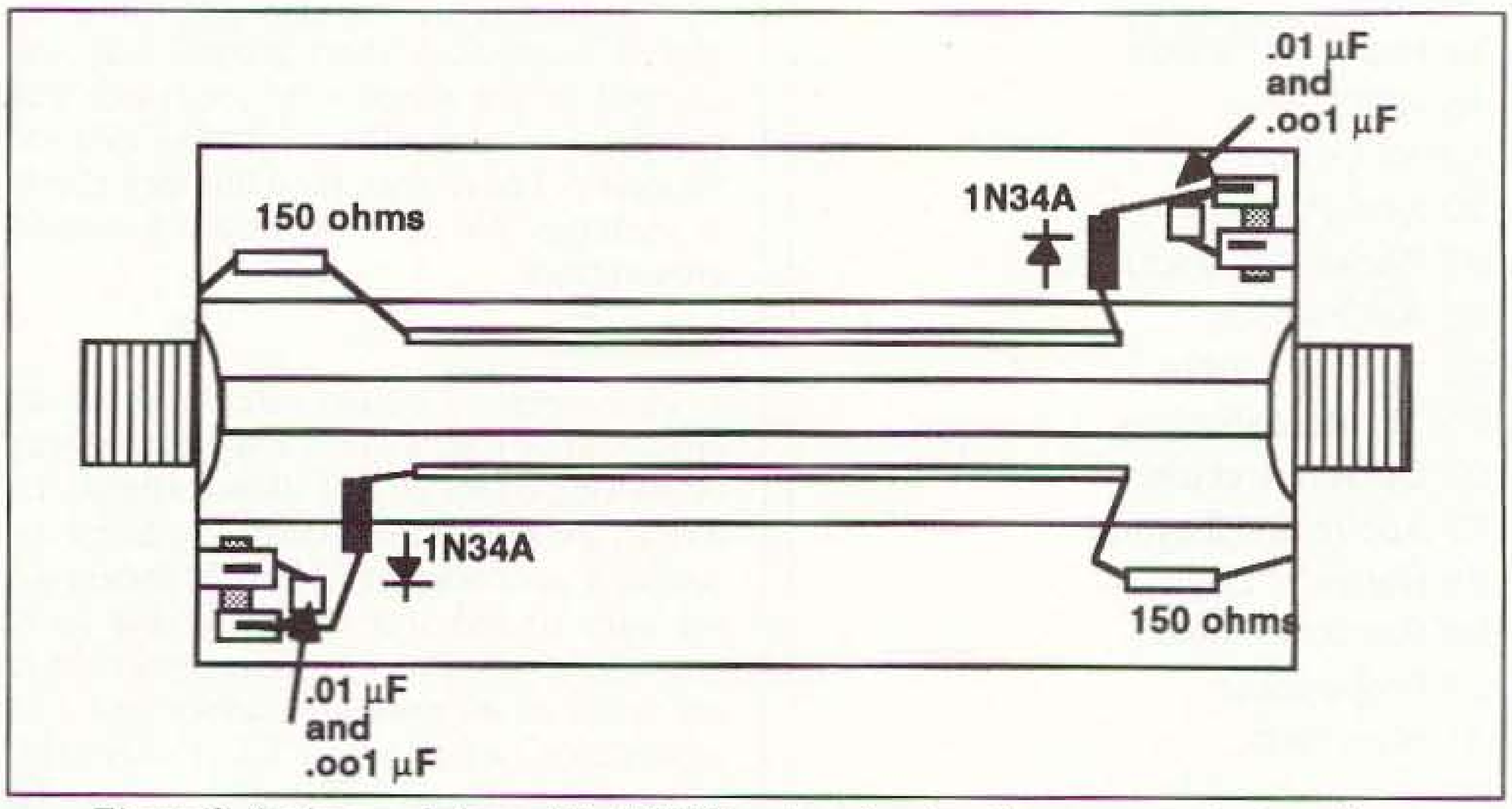

Figure 2. An internal view of the VSWR meter, showing the components to replace.

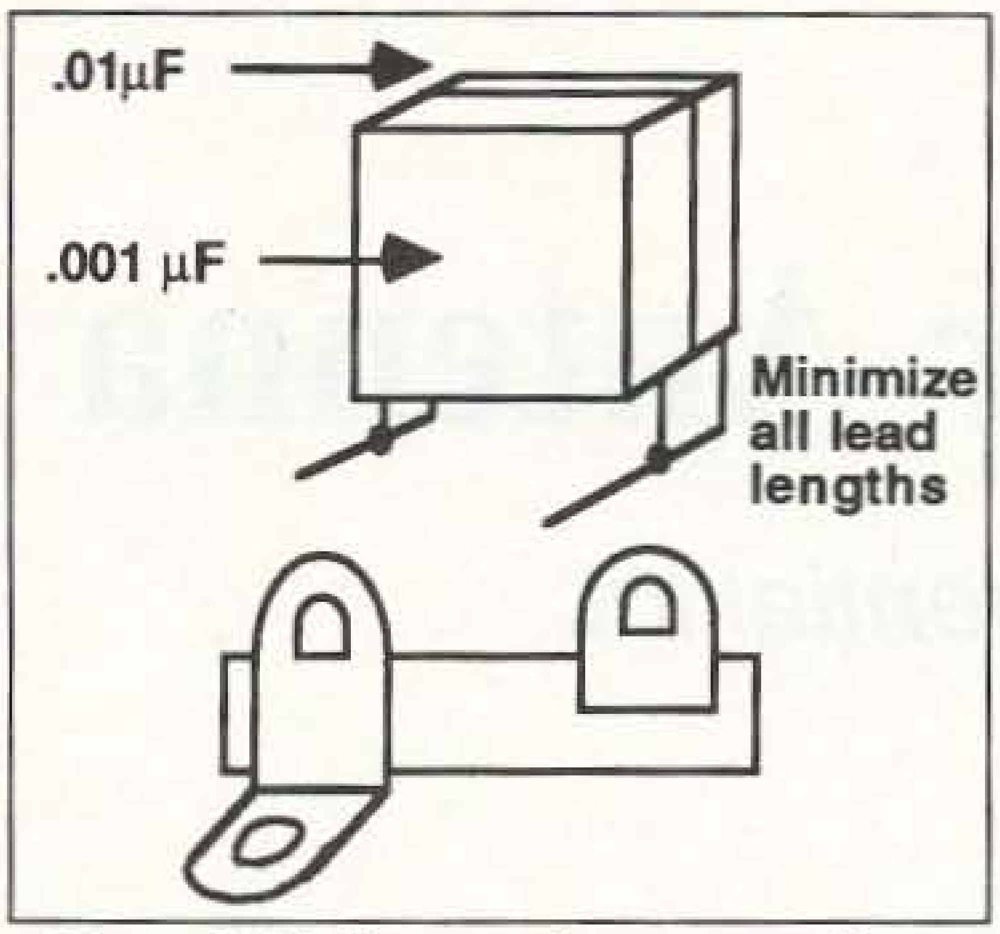

Figure 3. Making new bypass capacitors.

56 connector (RS 278-214). A 1 watt resistor fits perfectly into this connector, and a 1/2 watt resistor fits perfectly into the RG-59 F-59 connector (RS 278-211). The measured results at 445 MHz were as shown in the table.

Not bad! These results are certainly accurate enough for virtually anything most hams would want to do. Also, I was able to get a full-scale forward meter deflection at 450 MHz with only a quarter watt of transmit power.

I have described a means of modifying a common variety CB-style VSWR meter such that it becomes virtually a precision VSWR meter up through 450 MHz. The price is right and you'll have a piece of test equipment you'll be proud of.

An Effective 160 Meter Antenna

How to build one on a small residential lot.

James S. Stanley KA6MMQ

Since the time of the year had arrived when low frequency propagation characteristics are improving, my attention turned to finding a way to erect an effective yet low profile antenna for 160 meter operation. Since we live on a small residential lot, approximately 100 feet by 100 feet square, my options were limited. After reviewing a few designs from several antenna reference books, it looked as though the "inverted L" Marconi antenna was going to be the only practical choice given the space available.

The Marconi L-Type

A typical Marconi L-type antenna consists of a wire which is 1/4-wavelength overall at the desired operating frequency. The length in feet is determined by the formula:

$$\frac{234}{F_{MHz}} = \text{length (feet)}$$

The usual installation of a wire inverted L antenna for 160 meter operation consists of two support poles or other structures spaced approximately 100 feet apart. Both supports need to be 30 to 40 feet overall in height. Figure 1 shows a vertical elevation sketch of the typical L-type antenna. Note that a single wire is used to form the radiator portion of the example antenna.

I chose to use steel mast tubing, sold by Radio Shack in 10-foot lengths, to act as the end supports for the antenna system. The feedpoint had to be located near the back corner of our property so I used the inside wall of the concrete block fence which surrounds our back yard to act as the only support for the 30-foot mast. After drilling the concrete wall and installing expansion bolts, I used two 1-1/4" electrical conduit clamps to fasten the mast to the concrete. The installation is simple: The conduit clamps hold the mast tightly against the wall up to approximately seven feet above ground level. The masts have sufficient tensile strength so as to not break. They do, however, flex a bit in the wind. The other 30-foot mast is anchored to the outside wall of our house. A standard mounting kit was used for the support. Neither mast has any guy wires or ropes attached to it for stabilization—it simply was not necessary.

As you can see from Figure 1, ground radial wires are required in order to achieve satisfactory performance from the typical L antenna. In many cases like mine a few radials can be installed but the number and length are somewhat limited. The basic rule of thumb is to install as many as possible that are 1/4-wavelength long at the frequency of interest. My antenna system has two radials that are 135 feet long and several more that are shorter. You may want to bury the radials to protect them.

After erecting the wire as shown, I made several resistance/reactance measurements at frequencies between 1.800 MHz and 2.000 MHz by using an RF impedance bridge connected to the feedpoint of the antenna. I used a General Radio model 916A RF bridge, along with a General Radio 1211-C unit oscillator as a signal source. I also used a Kenwood model R-2000 receiver as the null detector for the test setup. The results showed that the feedpoint resistance was generally quite low, approximately 10 ohms resistance at the band center, which is 1.900 MHz. This presented a very poor match for the HF transceiver used at my station. I might add that since I use one of those newfangled units with a solid-state output stage, the transceiver is designed to fold back or limit output power if the SWR is in excess of 1.5:1 in order to protect the output transistors from damage. I considered using a tuner, but since the coax cable between the operating position and the antenna feedpoint was rather long, the performance and bandwidth in this particular instance would be quite poor. Some consideration was also given to installing a remotely-controlled matching network at the antenna feedpoint and running the control wiring back to the operating position. This option seemed too complicated. What we really needed was a 50-ohm input impedance for the antenna so that standard RG-8 U coax could be used between the antenna and the operating position, where

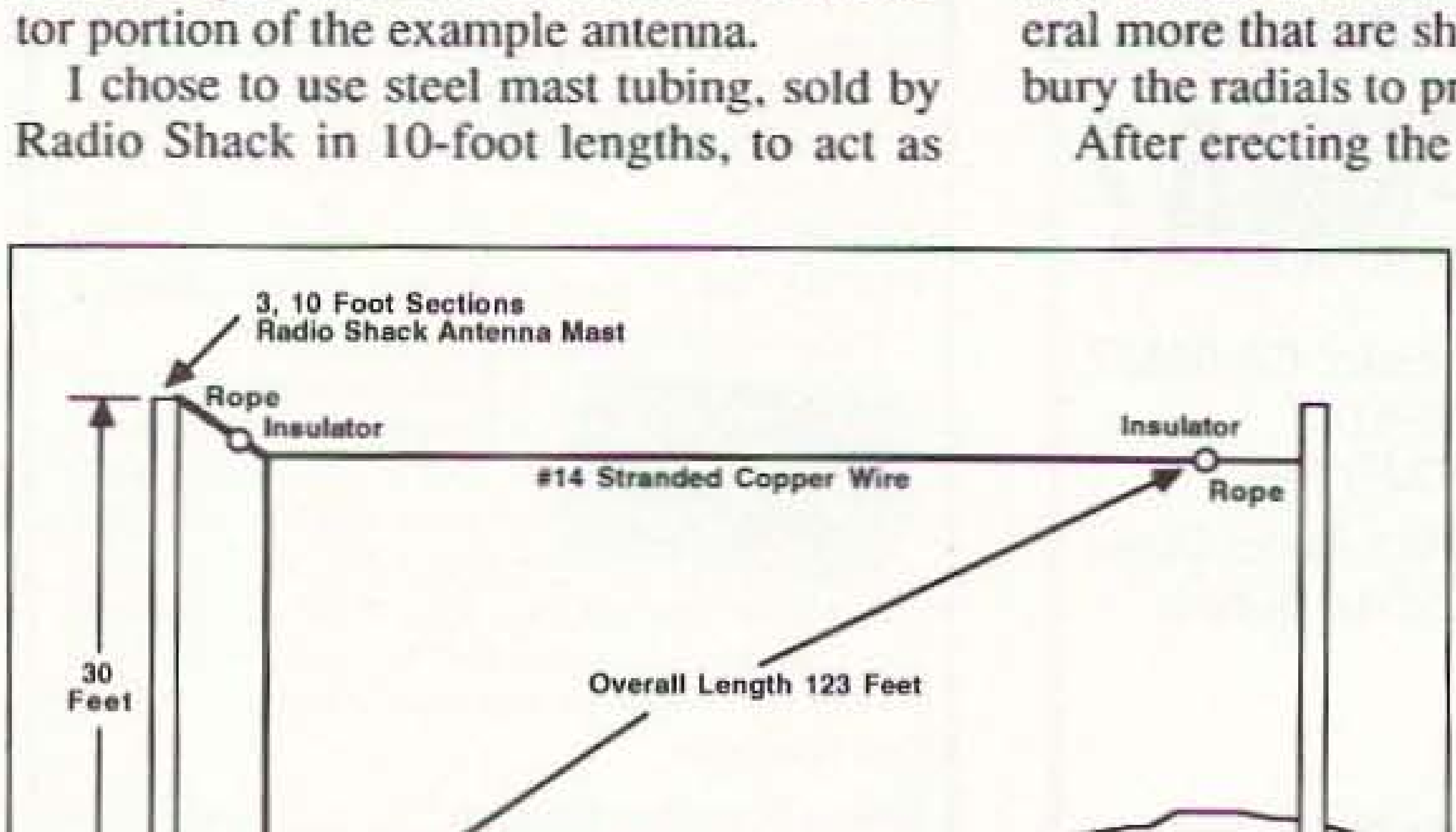

Figure 1. Single-wire Marconi "inverted L" antenna.

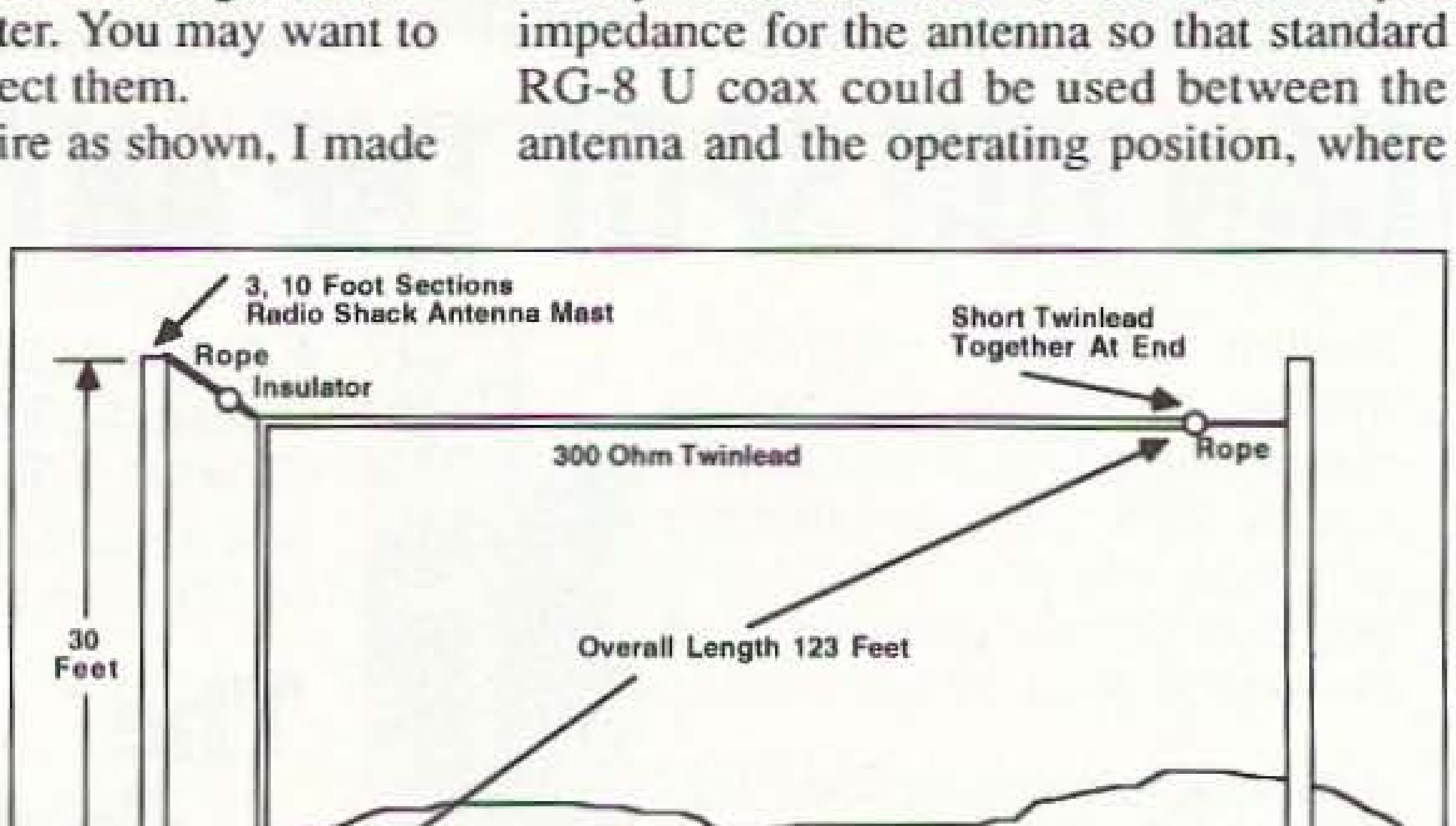

Figure 2. 300-ohm twin-lead Marconi "inverted L" antenna.

CIRCLE 41 ON READER SERVICE CARD

the transceiver was located.

The Twin-Lead L Antenna

After some additional investigation, I found a design for an L-type antenna to be constructed from 300-ohm TV-type twin lead. The physical dimensions were to be approximately the same except the twin lead was to be used to form a loop, similar to a folded dipole. The far end of the twin lead was to be shorted together and one end of the loop connected to ground at the feedpoint, while the other wire was to receive the power from the transceiver. Figure 2 shows a diagram of the "twin-lead L" antenna. The theory of this type of system is that the twin lead acts as an impedance transformer which increases the "radiation resistance" of the antenna, which in turn helps overcome the inherent ground system losses. The result is a more efficient antenna and a higher feedpoint impedance.

After disassembling the antenna shown in Figure 1 and replacing it with the twin-lead antenna shown in Figure 2 , we repeated the resistance/reactance measurements and found that the numbers had changed significantly from the original single-wire unit. The following results were noted:

Frequency	Resistance	Reactance
1.800 MHz	110 ohms	-152 ohms
1.900 MHz	100 ohms	-3 ohms
2.000 MHz	190 ohms	+144 ohms

While these values depart from the ideal 50-ohm figure required for optimum transceiver match, they represent workable parameters which can be transformed to 50 ohms. It would be expected that the impedance measurements obtained would vary somewhat from one installation to another; however, in my case, the center of the band at 1.900 MHz measured 100 ohms resistance with a small amount of capacitive reactance. A review of transmission line theory shows us that a 1/4-wavelength section of transmission line, when presented with a load other than the nominal impedance of the line, will act as an impedance transformer under the mismatched condition. The impedance inverting property of the line provides a good match between a high-impedance circuit and a low-impedance one. I had some RG-11 U coaxial cable on hand which has a nominal characteristic impedance of 75 ohms and decided to put that to a good use. A quarter wavelength of the RG-11 U can be calculated by the formula:

$$1/4 \text{ wavelength} = \frac{246}{F_{MHz}} \times 0.66$$

In this equation, the value 0.66 represents the velocity factor of the transmission line, which provides a correction for the line propagation characteristics when compared to propagation of the radio wave in free space. In this case, I wanted to optimize the antenna for 1.900 MHz and have minimal SWR present at the edges of the band, which are 1.800 MHz and 2.000 MHz. So what we are really talking about is trying to make the transceiver operate across 200 kHz of spectrum. The actual length of RG-11 U coaxial cable worked out to be 85.4 feet. The cable was installed as shown in Figure 2 and the resistance and reactance measurements were repeated for the three frequencies previously outlined.

This time the antenna bridge was looking at the antenna through the 75-ohm cable. The following results were noted:

Frequency	Resistance	Reactance
1.800 MHz	17 ohms	+18 ohms
1.900 MHz	56 ohms	+2 ohms
2.000 MHz	18 ohms	-9 ohms

Due to the physical layout of my ham shack in relation to the antenna and feedpoint, I needed approximately 120 feet of coaxial cable to get to the transceiver from the antenna so I decided to coil up most of the 75-ohm matching section and then install 52-ohm RG-8 U coaxial cable. Again the velocity factor was 0.66. I was a bit apprehensive about the potential attenuation from coaxial cable lengths this long; however, after consulting one of my textbooks, I determined that the worst case loss was 0.45 dB at 2.0 MHz, assuming a matched condition and a total cable length of 205 feet for the RG 11 and RG 8 types. This means that for 100 watts out of my transceiver, 90 watts would arrive at the antenna. After the installation of the coaxial cable to the operating position was complete, I again connected the antenna bridge and noted the following measurements:

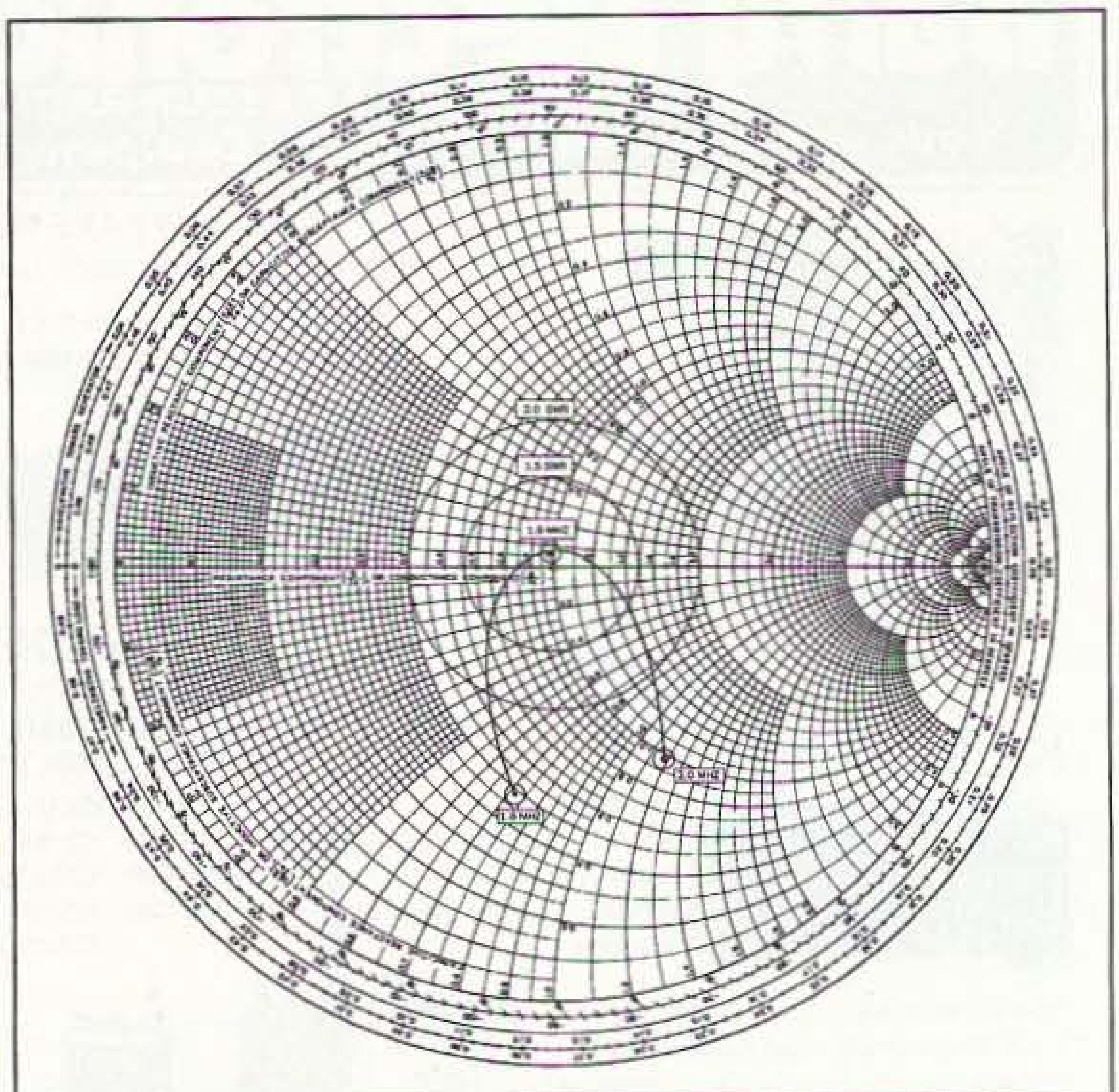

Figure 3. Smith chart showing SWR versus frequency measurements taken at the operating position.

```
0 REM MISMATCHED TRANSMISSION LINE VER. 2.00
1 CLS : SCREEN , 0: COLOR 15, 1
2 CLS : KEY OFF:
3 PRINT : PRINT "  AN RF DESIGN AID DEVELOPED FOR AMATEUR USE BY KA6MMQ"
4 PRINT : INPUT "  TRANSMISSION LINE or MATCHING SECTION IMPEDANCE     "; Z
5 PRINT : INPUT "  ANTENNA RESISTANCE                                  "; LR
6 PRINT : INPUT "  ANTENNA REACTANCE                                   "; LX
7 PRINT : INPUT "  SWR REFERENCE IMPEDANCE (Typical 50 Ohms)           "; N
8 PRINT : INPUT "  OPERATING FREQUENCY IN mHz                          "; F
9 PRINT : INPUT "  TRANSMISSION LINE VELOCITY FACTOR                   "; V
10 PRINT : INPUT "  TRANSMISSION LINE DELAY IF MATCHED ( Degrees )    -"; P
11 IF F <= 1.799 OR F >= 29.999 THEN BEEP: BEEP: GOTO 12 ELSE 14
12 CLS : PRINT : PRINT "  OPERATING FREQUENCY IS OUT OF RANGE!"
13 PRINT : PRINT "  SELECT OPERATING FREQUENCY 1.80 TO 30.0 mHz": GOTO 8
14 IF P > 0 THEN P = P * -1
15 R = .0174533
16 XA = LX - (Z * TAN(P * R))
17 S = (TAN(P * R)) / Z: XB = -LR * S: RB = 1 + (LX * S)
18 ZA = SQR((LR ^ 2) + (XA ^ 2))
19 ZB = SQR((RB ^ 2) + (XB ^ 2))
20  PA = (ATN(XA / LR)) / R
21 PB = (ATN(XB / RB)) / R
22 ZC = ZA / ZB: PC = PA - PB
23 IR = ZC * (COS(PC * R)): IX = ZC * (SIN(PC * R))
24 A = (Z / (TAN(P * R))) + LX
25 LP = (ATN(LR / A)) / R
26 IF LP > 0 THEN LP = LP - 180
27 IF IR < 0 THEN IX = IX * -1
28 IF IR < 0 THEN IR = IR * -1
29 MP = (ATN(IX / IR)) / R: MP = LP - MP
30 IF P <= -180 THEN MP = MP - 180
31 IF P <= -360 THEN MP = MP - 180
32 IF P <= -540 THEN MP = MP - 180
33 W = (983.6) * V / F / 360
34 Q = W * P: IF Q <= 0 THEN Q = Q * -1
35 IF N <= 0 THEN N = N + 1
36 IY = (IR + N) ^ 2
37 IU = (IR - N) ^ 2
38 IQ = (IX) ^ 2
39 E = SQR(IY + IQ)
40 C = SQR(IU + IQ)
41 O = E + C
42 G = E - C
43 H = O / G
44 CLS :
45 PRINT : PRINT "  MATCHED TRANSMISSION LINE DELAY =                 "; P; "Degrees"
46 PRINT : PRINT "  MISMATCHED TRANSMISSION LINE DELAY =              "; MP; "Degrees"
47 PRINT : PRINT "  TRANSMISSION LINE INPUT RESISTANCE =              "; IR; "Ohms"
48 PRINT : PRINT "  TRANSMISSION LINE INPUT REACTANCE =               "; IX; "Ohms"
49 PRINT : PRINT "  TRANSMISSION LINE LENGTH =                        "; Q; "Feet"
50 PRINT : PRINT "  SWR AT TRANSMISSION LINE INPUT =                  "; H; ": 1"
51 PRINT ""
52 PRINT : INPUT "  CHANGE MATCHING SECTION LENGTH  ( Y OR N )"; A$
53 IF A$ = "y" OR A$ = "Y" THEN 54 ELSE 55
54 CLS : GOTO 10
55 PRINT : INPUT "  ENTER NEW DATA & RERUN  (Y or N)"; B$
56 IF B$ = "y" OR B$ = "Y" THEN 57 ELSE GOTO 58
57 CLS : GOTO 4
58 SYSTEM
```

Figure 4. BASIC program: Mismatched Transmission Line.

Frequency	Resistance	Reactance
1.800 MHz	24 ohms	-36 ohms
1.900 MHz	49 ohms	+3 ohms
2.000 MHz	48 ohms	-59 ohms

These final resistance/reactance measurements taken at the operating position are values which can be easily transformed to 50 ohms by using a simple matching network such as an L-type configuration. For the sake of visual interpretation of the final measurements, I

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- 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	2¾ x 7⅝ x 9¾	11

RS-L SERIES

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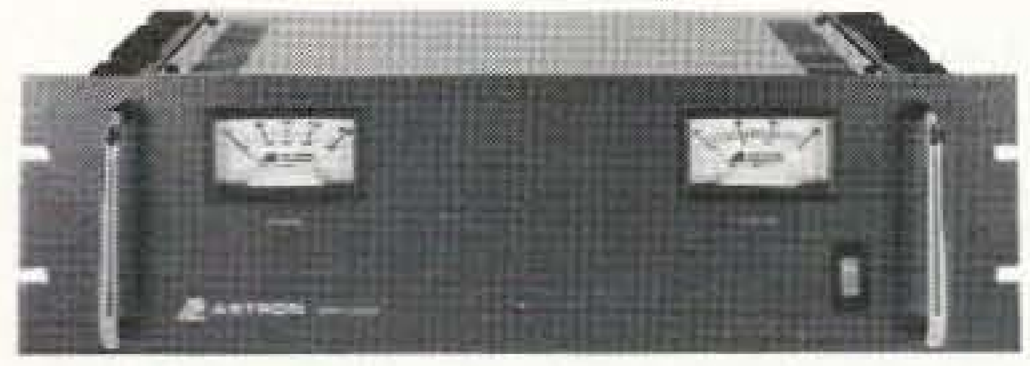
MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ x 6⅛ x 7¼	6
RS-5L	4	5	3½ x 6⅛ x 7¼	7

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-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

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

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

CIRCLE 16 ON READER SERVICE CARD

Parts List, Antenna

Quantity	Description	Source	Part #
6	10' mast sections	Radio Shack	15-843
1	Wall-mount kit	Radio Shack	15-883
3	50' lengths 300-ohm twinlead (to be spliced together)	Radio Shack	15-1153
1	Ground rod	Radio Shack	15-530
2	Egg insulator paks	Radio Shack	278-1335
500'	#18 solid tinned copper wire for ground radials	Pacer Electronics	
85'	RG11/U 75-ohm coax	Pacer Electronics	
120'	Belden 8237-type RG 8/U coax	Pacer Electronics	
2	1-1/4" conduit clamps	Ace Hardware	
20'	5/16" nylon rope	Ace Hardware	

normalized the figures shown above for 50 ohms and plotted them on a Smith chart (see Figure 3) with a 1.5:1 and 2.0:1 SWR circle also drawn on the graph. As you can see in this chart, a substantial portion of the band falls within the 2.0 region, and approximately 40 kHz either side of the band center at 1.900 MHz falls within the 1.5:1 region. This means that from 1860 kHz to 1940 kHz my solid-state transceiver will produce full output power without any additional antenna tuner or ATU.

Program to Predict Impedance

The Marconi L antenna characteristics can vary greatly from one installation to another. It should be understood that, depending upon the resistance and reactance of the antenna feedpoint, it may or may not be necessary to use exactly 1/4-wavelength or -90 degrees of transmission line in order to obtain a satisfactory match. The matching section could be longer or shorter for optimum results.

Since a certain portion of this project could result in tedious trial-and-error cutting of coaxial lines, given the variables involved from one installation to another, I decided prior to beginning the work to write a simple computer program in BASIC to predict the resulting impedance at one end of the transmission line when the other end is terminated with an impedance other then the nominal characteristic impedance of the line.

See Figure 4 for the program listing. If you care to enter the program codes for yourself, it should only require a few minutes of time. Also, I have uploaded the program to the *73* BBS so that it can be downloaded for your use. The program is titled "Mismatched Transmission Line" and will operate on any IBM compatible computer. I should point out that the program and the matching/impedance transformation technology is applicable at any of the amateur HF frequencies you might be interested in.

Matching Network Circuit

Now for a very simple yet effective matching network which will enable you to operate across the entire band from 1.800 to 2.000 MHz without making adjustments. That's right, no knobs to turn or tweak!

The circuit shown in Figure 5 has a basic ATU consisting of a single series inductor with two fixed shunt capacitors, either of which can be selected by switch S2. When operating in the bypass mode the unit is out of the circuit and, as I mentioned earlier, the transceiver will put out full power from 1860 kHz to 1940 kHz. If operation below 1860 kHz is desired, the ATU is switched in circuit and switch S2 is placed in the 1.8 MHz position. If operation above 1940 kHz is desired, switch S2 is placed in the 2.0 MHz position. It is important to understand that the design criteria for this circuit was only to keep the SWR at substantially less than 1.5:1 at all portions of the band, not to effect an absolute 1:1 match at any frequency.

If you examine one of the many graphs published in the various antenna textbooks, it is evident that the loss in transmitted power at an SWR of 1.5:1 is only 4%. That amount of loss is insignificant and will produce no perceptible change in the received signal from your station. If you must have a 1:1 SWR at whatever frequency you happen to be operating on, I suggest you use a standard ATU or transmatch, such as the SPC design. These are described in various antenna textbooks and are also for sale commercially from several equipment manufacturers. In that case, you may omit this ATU from the circuit. The ATU is designed to handle 100 watts CW or RTTY continuously, without heating or other problems. However, if you plan to operate with power levels in excess of 100 watts, you may wish to construct the matching network with components that have a higher voltage and or current rating.

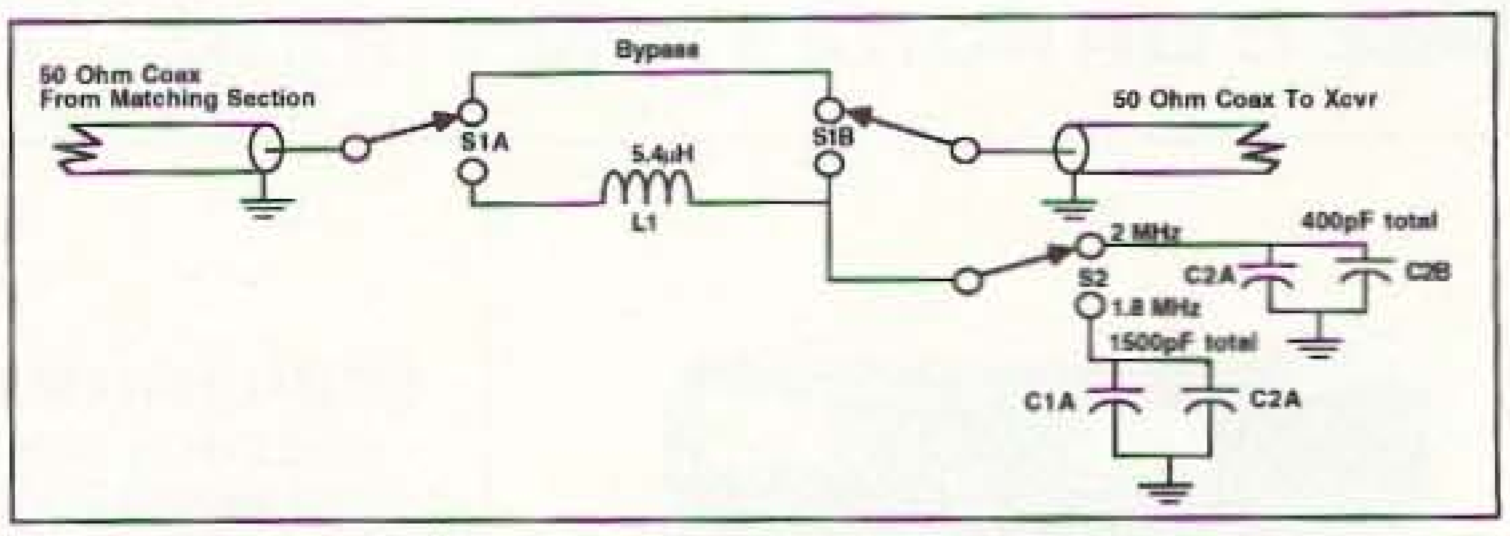


Figure 5. Simple L network antenna matching unit.

Parts List, ATU

Symbol	Rating or Value	Source	Part #
S1	6A @ 250 VAC	Radio Shack	275-652
S2	6A @ 250 VAC	Radio Shack	275-652
L1	5.4 uH	Barker & Williamson	3052

(16 turns #14 solid copper wire on a 1.5" form, six turns per inch)

Symbol	Rating or Value	Source
C1A	ARCO DM19 500-volt 680 pF	Circuit Specialists
C1B	ARCO DM19 500-volt 820 pF	Circuit Specialists
C2A	ARCO DM15 500-volt 200 pF	Circuit Specialists
C2B	ARCO DM15 500-volt 200 pF	Circuit Specialists

Barker & Williamson, 10 Canal Street, Bristol PA 19007.
Circuit Specialists, P.O. Box 3047, Scottsdale AZ 85271.
Pacer Electronics, 1630 W. 12th Place, Tempe AZ 85281.

Construction Techniques

As far as construction techniques go, I constructed my ATU on a small metal plate and mounted it on the wall of my shack so that it was out of the way. If you want to get fancy, you could put the circuit in a metal box with coax connectors.

There you have it, operation across the entire 160 meter band, with no remote motor controlled antenna matching units or other complicated devices. In fact, most of the matching is accomplished by the selection of coaxial cable lengths and types. The coaxial cable is a necessity in order to connect the antenna feedpoint to the transceiver, so why not let it solve the impedance matching problems also? The RF impedance bridge and oscillator I used to make the resistance and reactance measurements were purchased surplus for a modest price. There are also several new solid-state units on the market which have the generator and detector self-contained; one even has a frequency counter built into it.

One last note: I have enjoyed many contacts on 160 meters since installing this antenna and matching system. At night, I am consistently able to work other stations all over the country and receive good signal reports, with only 100 watts out of the transceiver. ■

References:

Antennas, 2nd edition, by John D. Kraus W8JK.

Radio Handbook, 23rd edition, by William I. Orr W6SAI.

Radio Data Reference Book, 5th edition, G.R. Jessop G6JP.

Antenna Engineering Handbook, 2nd edition, Johnson and Jasik.

The "Simplest Transverter"

Check out the 6 meter band with this inexpensive 2 meter interface.

by Bob Witmer W3RW

Interested in trying a new band at minimum expense? Here's a receiving and transmitting converter (transverter) that requires no operating power (other than local oscillator DC) or T/R switching for operation, and will provide a minimum communications capability for checking out a new band such as 6 meters using a 2 meter transceiver.

While checking out the latest Mini-Circuits Labs catalog I was impressed by a new family of low-cost, high-level double-balanced mixers (DBMs): TUF-1H, TUF-2H and TUF-3H. With this in mind I decided to see how simple a transverter could be made. To simplify the design, I selected operation using the 6 and 2 meter bands and a 90 MHz LO. The high level DBM provides a useful output power level even though it is still on the low side (but not as low as the output of a standard level DBM, which is approximately 20 times lower). In addition, the transverter will work with FM, SSB and CW modes.

What is it? Well it really is nothing more than a high-level double-balanced mixer (DBM) with an attenuator on the transceiver side, an output low-pass filter on the antenna side, and a local oscillator (see Figure 1).

As mentioned before, this approach is practical because the high-level DBM's linear power capability goes all the way to 25 milliwatts. Without the need for any additional power (other than the local oscillator) you can get an output that is approximately 5 milliwatts—the actual power depends on a variety of factors. Measured transverter output using a HP 431D power meter was 5.1 milliwatts at 52.29 MHz. The other mixer characteristic that makes the simplest transverter possible is the DBM's bidirectional capability: The RF and IF ports can be interchanged, allowing mixer operation to occur in either direction.

Five milliwatts—you've got to be kidding! Now, before you laugh too much about that power level, consider that one well-known popular 2 meter hand-held transceiver has a 100 milliwatt low power position (one new 2 meter transceiver even has a 20 milliwatt position!) and that when used with the normally supplied inefficient "rubber-duck" antenna, which typically has anywhere from a 6 to 10 dB loss factor relative to a dipole, the resulting radiated power could be on the order of 10 to 25 milliwatts—only several dB higher than 5 milliwatts. In addition, since the free-space line-of-sight path loss at 53 MHz is approximately 9 dB less than the loss at 146 MHz, if that 5 milliwatts is connected to a dipole or better equivalent antenna, communications similar to low power 2 meter hand-held operation is possible. This power level should make the FCC happy!

Receive Performance

If the transverter is used with a 2 meter transceiver with a 500 mW low power output, a 13 dB attenuator is needed on the input to limit the power to the linear operating range of the DBM. In this case, the total loss during receive is the conversion loss of the DBM—7 dB, plus the 13 dB loss of the attenuator pad for a total loss of 20 dB—equivalent to reducing the signal to 1/10 of its value. If your 2 meter receiver sensitivity is 0.2 µV then a 20 dB loss in front of the receiver will be equivalent to using a 2.0 µV receiver—which is not really all that bad considering the stations you can work using a 5-milliwatter!

In actual practice I've had QSOs on simplex and through several local 6 meter repeaters using only 2 milliwatts—approximately half as much power! In all honesty, my signal was noisy, but it was fully intelligible.

My antenna is a Cushcraft Ringo at 25 feet, fed through about 30 feet of RG-8/U. Considering the simplicity of the transverter, the performance was surprising! If you operate CW or SSB, greater performance will be obtained. Figure 2 shows the transverter losses during transmit and receive.

How It Works

Receive: During receive, 6 meter antenna signals are connected via the low-pass filter to the DBM, where they are mixed with the 90 MHz local oscillator injection. The transverter acts as a typical receive converter. The local oscillator's output passes through the input attenuator to the 2 meter rig.

Transmit: The 2 meter rig's low power transmit signal is fed through the attenuator, where it is reduced to a level acceptable to the DBM and passed to the DBM. The 2 meter signal is mixed in the DBM with the 90 MHz LO creating outputs in the 6 meter band and in the 230 MHz region. The output of the DBM is connected to the low-pass filter, which passes the 6 meter signal and attenuates the 230 MHz output and any 2 meter and local oscillator signal feed-through.

Detailed Operation Description

The following sections provide a detailed description of the transverter's operation and refer to Figure 3, the schematic diagram.

Input Attenuator: The input attenuator of the transverter was designed for a 1/2 watt 2 meter power level, using approximate resistor values from the *ARRL Handbook*'s 50 ohm resistive attenuator table, to provide ap-

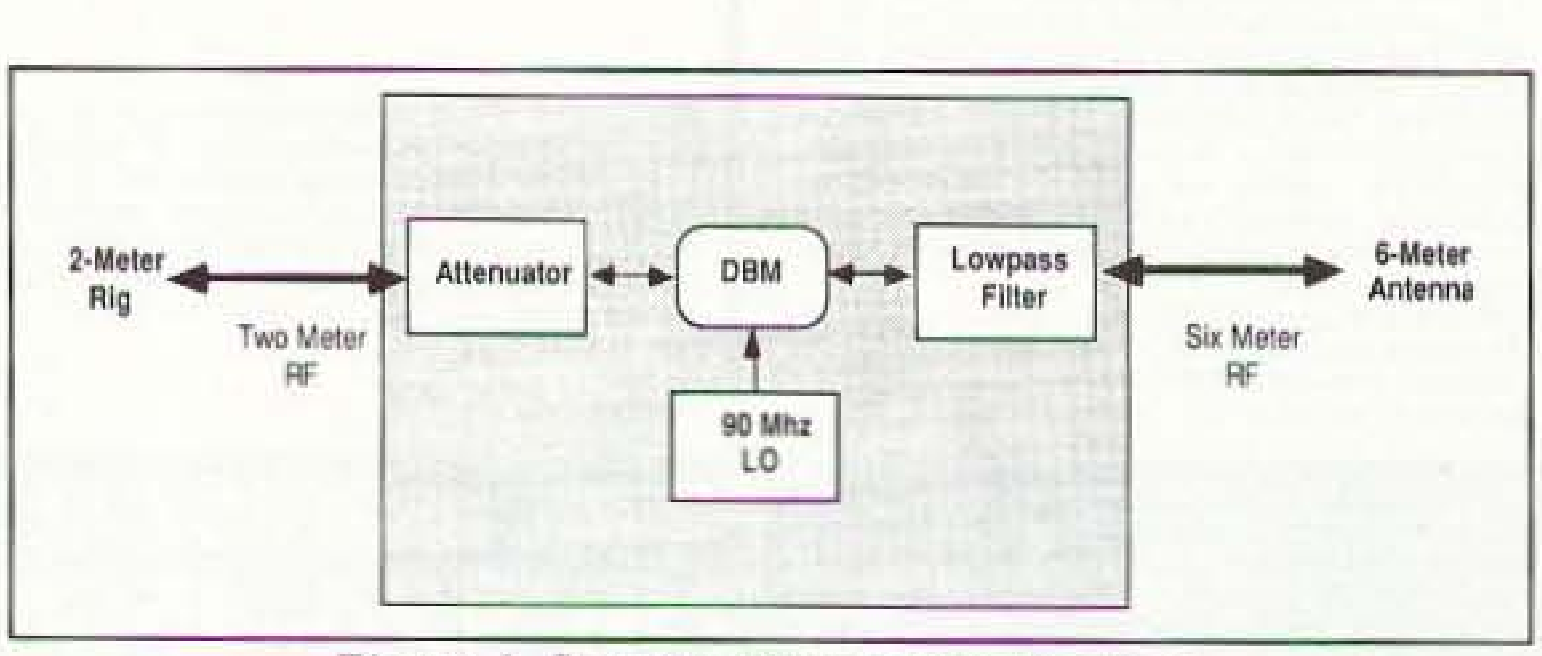


Figure 1. Simplest Transverter diagram.

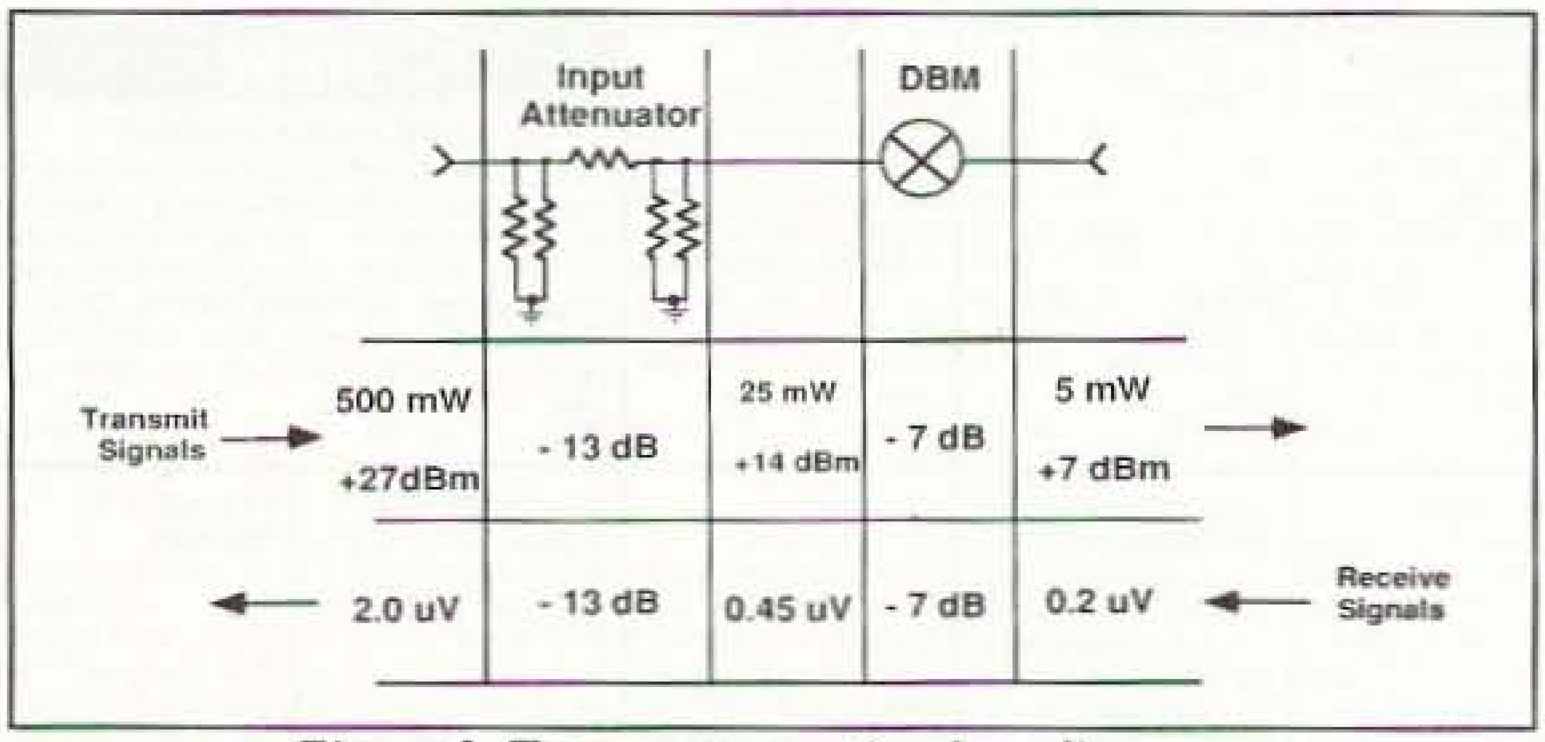


Figure 2. Transverter section loss diagram.

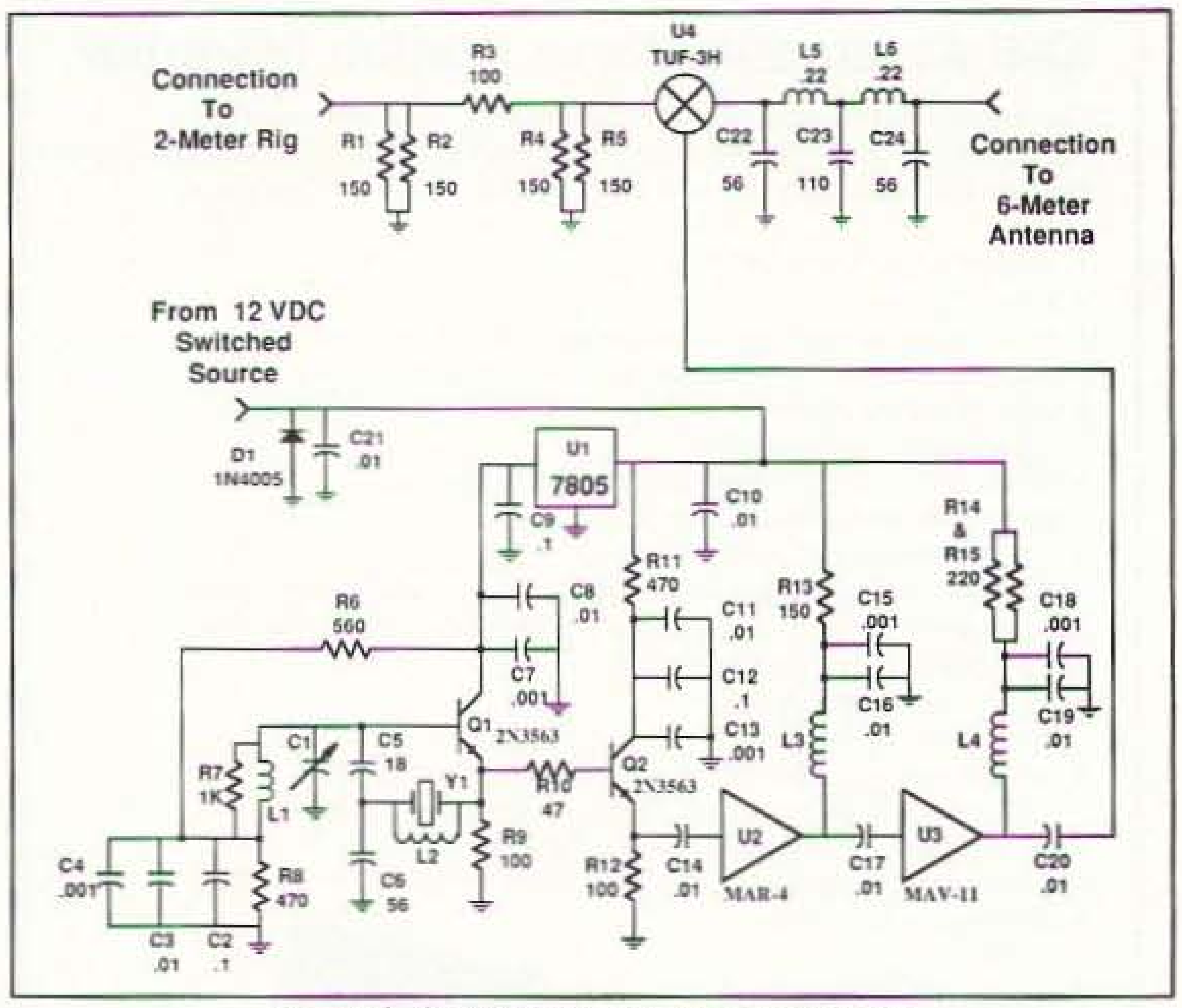


Figure 3. Simplest Transverter schematic.

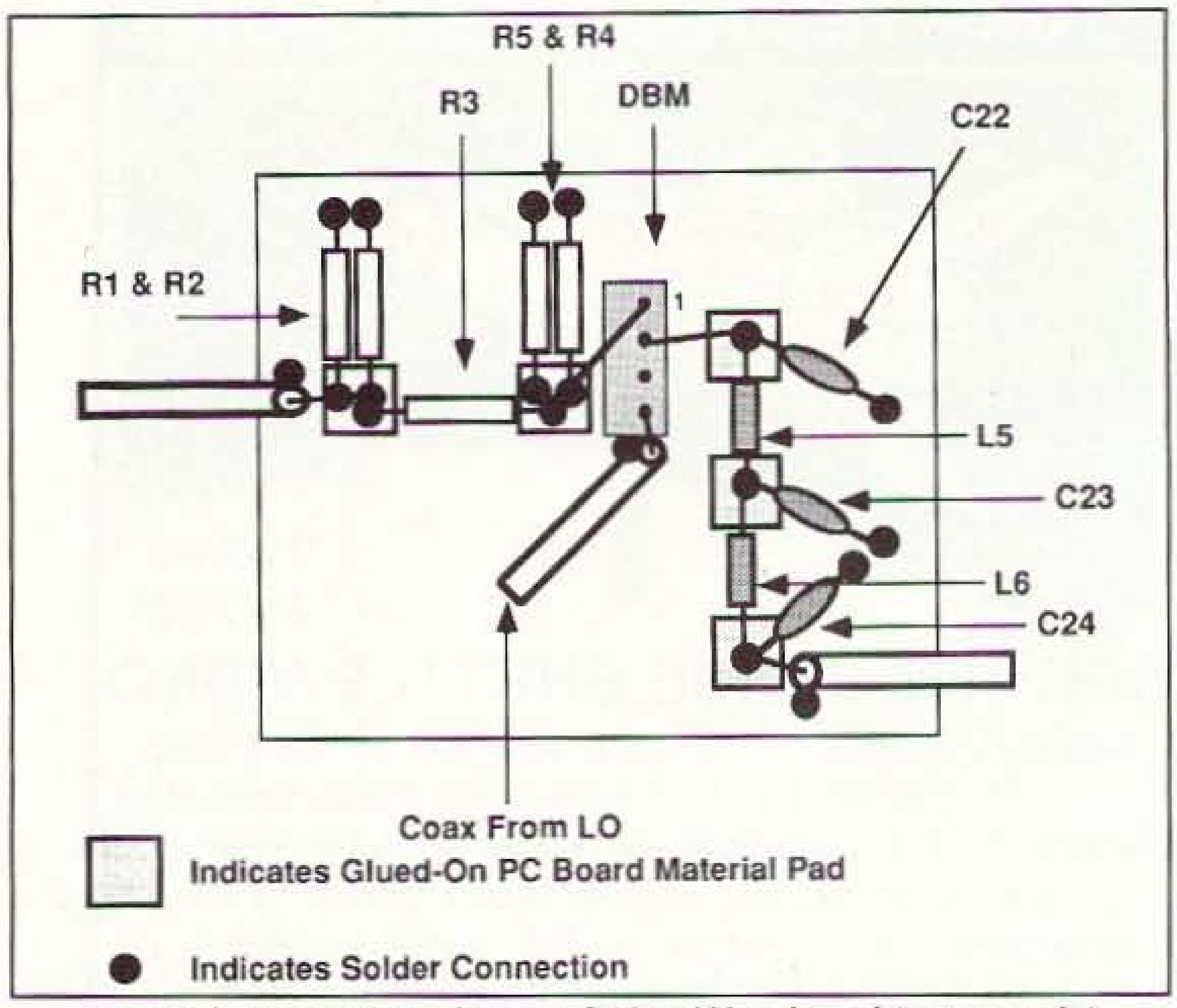


Figure 4. Approximate layout of mixer/filter board (not to scale).

proximately 13 dB of attenuation. This reduces the 1/2 watt to the recommended maximum linear rated input of the DBM, 25 mW. The input and output sections of the attenuator are made up of two paralleled 150 ohm 1/2 watt resistors.

Mixer: As mentioned before, the transverter takes advantage of the DBM's bidirectional performance characteristic. The DBM's ports are matched to the appropriate frequency range sections of the transverter. The IF or lowest frequency port (Pin 2) is used as the 6 meter port. The LO output is connected to the "LO" port (Pin 4) and the 2 meter side is connected to the "RF" port (Pin 1). Pin 3 of the DBM is connected to case ground and does not need a separate connection if the case is grounded.

Local Oscillator: The 90 MHz local oscillator circuit is adapted from the July 1989 *QST* article, "A Clean, Low-Cost Microwave Local Oscillator," by Richard Campbell. Mini-Circuits Labs MAR-4 and MAV-11 MIMICs are used to provide the +14 to +17 dBm injection needed for high-level DBM operation. The circuit will "free" oscillate with a 47k resistor in place of the crystal and L2. This can be used to get the oscillator L1 and C1 components on frequency to insure crystal oscillation. L1 is non-critical. One approach is to experiment until you get a coil that gives you the desired frequency oscillation range when tuned with C1. When the free-run frequency tuning range covers the crystal frequency, remove the 47k resistor and install L2 and the crystal, then adjust C1 for reliable starting and fine frequency trimming.

Local Oscillator Frequency Selection

FM & Repeater Band Segment Operation: A 90 MHz 5th overtone crystal, Y1, was chosen for the oscillator so that the receive range for 53 to 54 MHz would convert to 143-144 MHz to simplify frequency readout. Many of today's 2 meter rigs will operate, or can be modified for full operation, down to 142 MHz, permitting this approach. If your rig will not make this range, I would recommend using a 93 MHz crystal. This will convert the active 6 meter repeater output section of the band (usually the lower half of the 53.01 to 53.97 MHz range) to the repeater input/simplex section of the 146 to 147 MHz band.

CW & SSB Band Segment Operation: Operating the Simplest Transverter with a 94 MHz oscillator will translate 144 MHz to 50 MHz for weak signal work but would convert the 6 meter repeater outputs to the low end of the 147 to 148 MHz range—the repeater output

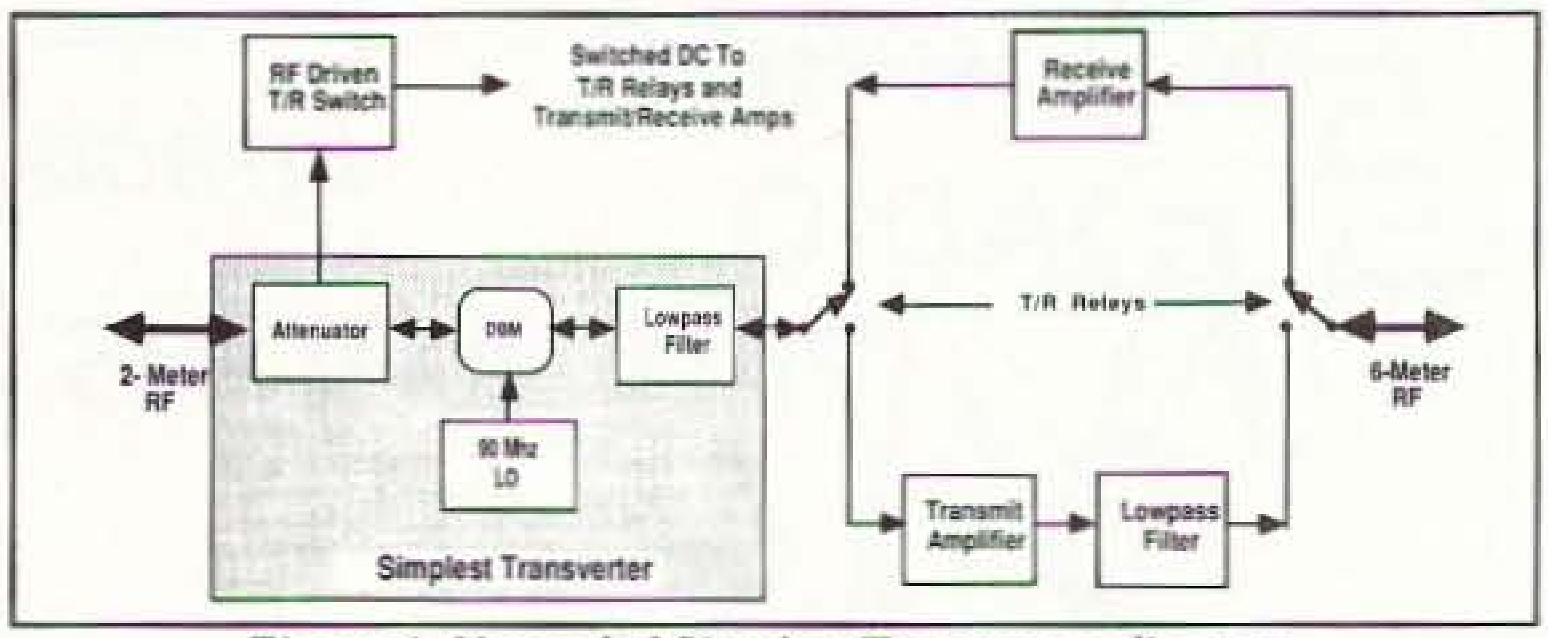


Figure 6. Upgraded Simplest Transverter diagram.

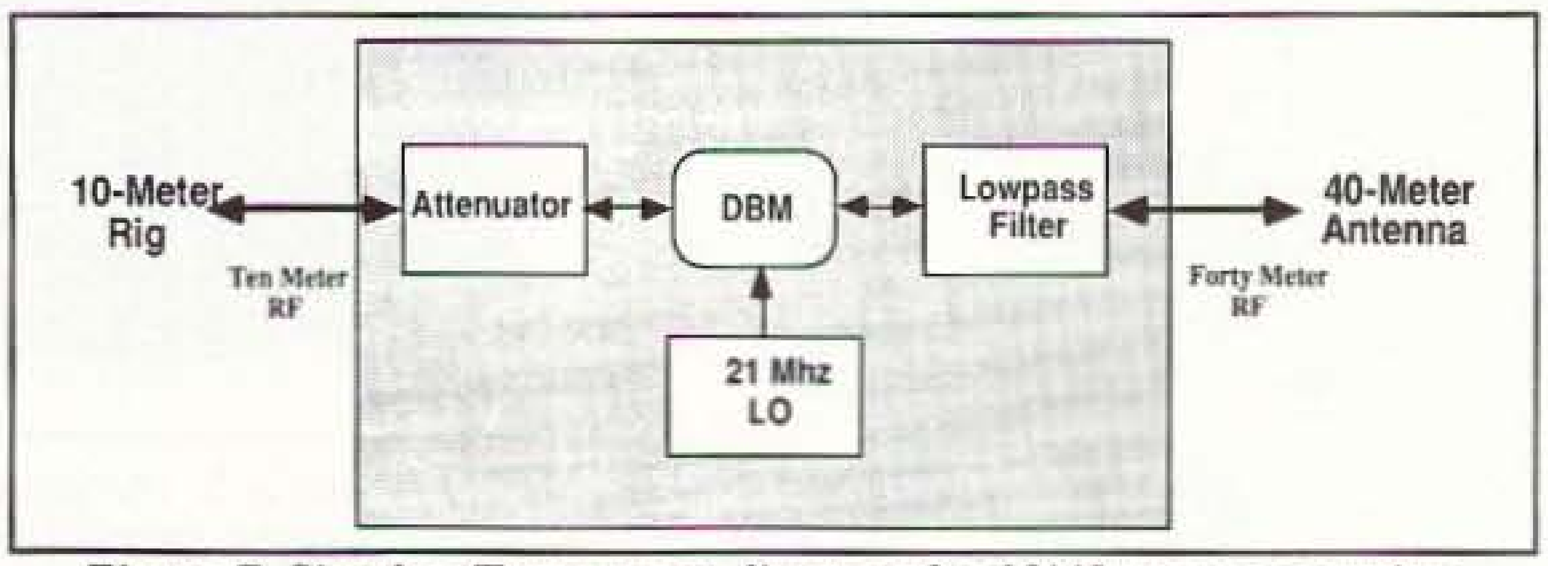


Figure 7. Simplest Transverter diagram for 10/40 meter operation.

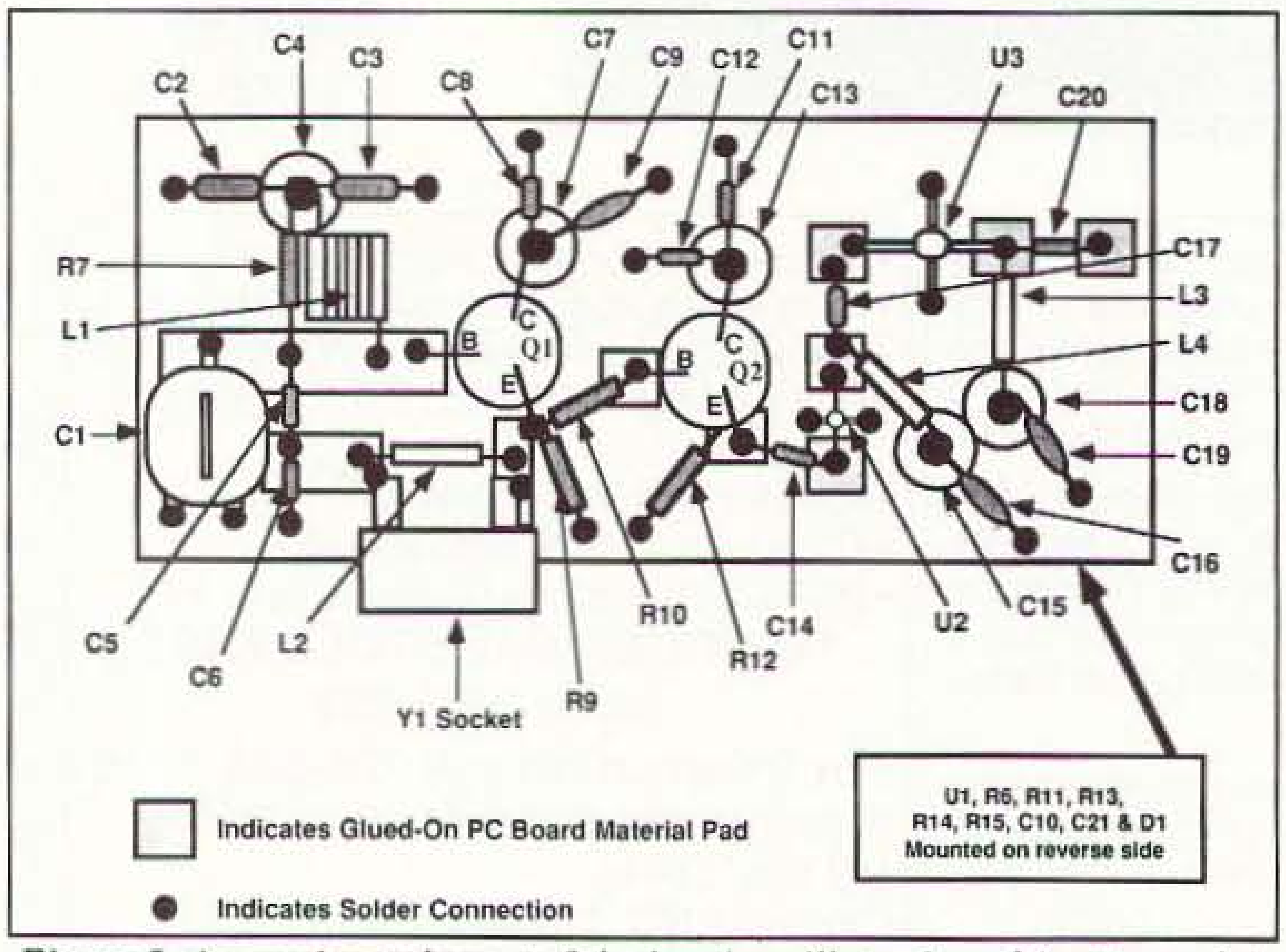


Figure 5. Approximate layout of the local oscillator board (not to scale).

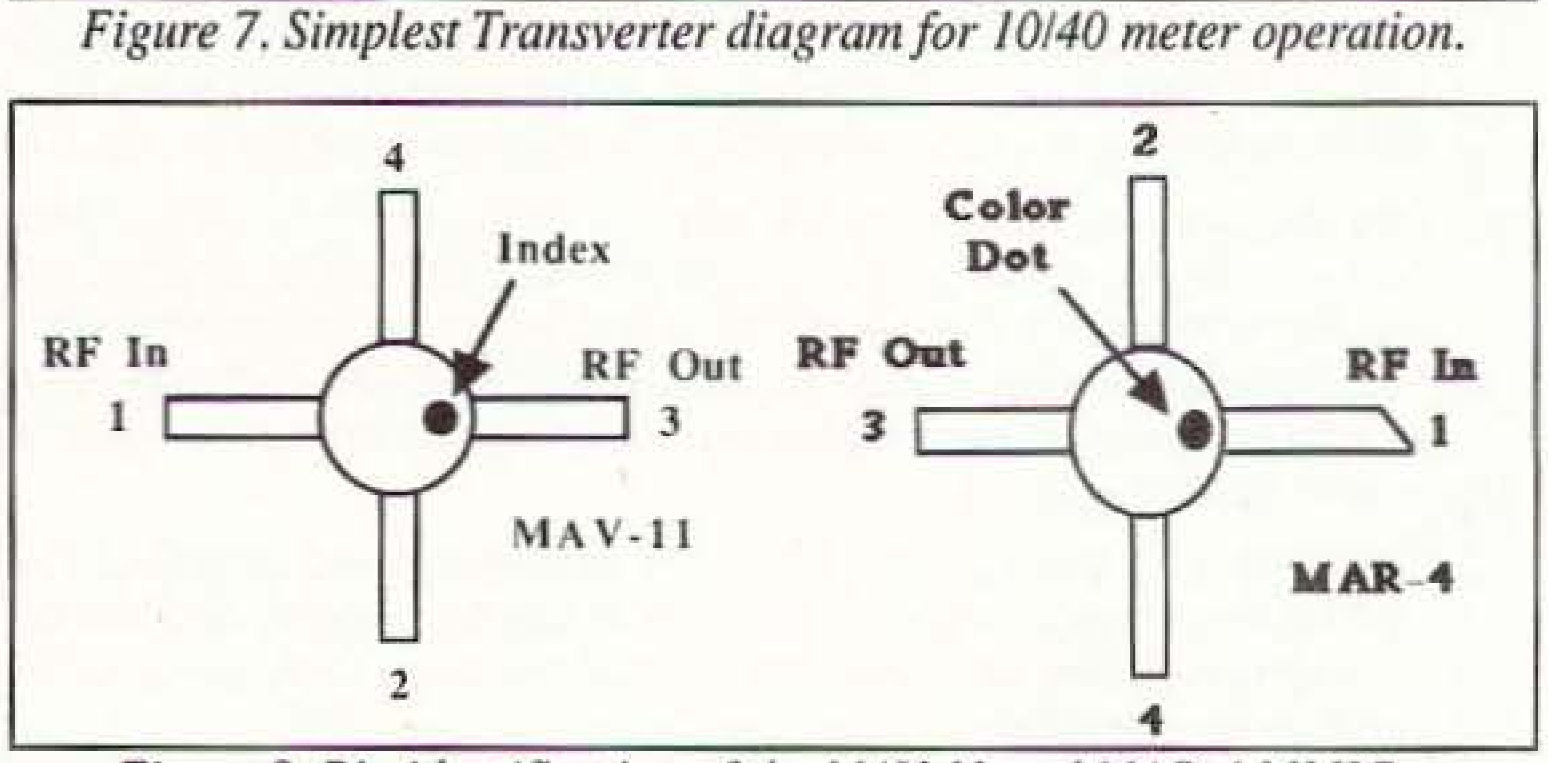


Figure 8. Pin identification of the MAV-11 and MAR-4 MMICs.

section of the 2 meter band. Local 2 meter repeater signals are often strong enough that some bleed-through is noted during base operation with an outside antenna if you use this frequency plan.

Output Filter: Because of the translator's frequency plan and the low output power level, filtering requirements are not severe. The 6 meter side of the DBM is connected to a five-section low-pass filter (L5, L6 C22, C23 and C24) whose values were selected from the five-element low-pass filter table in the *ARRL Handbook*, targeted at a 3 dB corner at 60 MHz with 20 dB attenuation at 83 MHz and 40 dB at 125 MHz.

Construction, Check-Out and Operation

The Simplest Transverter was constructed in two parts to simplify assembly and check-out—the input attenuator/DBM/output low-pass filter and the local oscillator. Both were assembled by gluing small pieces of single-sided board material, cut to the size required for the connection pads, onto a double-sided G-10 circuit board where desired. If a change is required, you can pry the desired pad loose and glue it in the new location. Grounding is accomplished by soldering directly to the ground plane—keeping the RF circuit ground leads as short as possible. Feed-through bypass capacitors are used for bypass requirements and DC power distribution is done on the opposite side of the board. Figures 4 and 5 show approximate layouts.

As mentioned before, local oscillator operation can be checked with a broadcast FM radio. With the LO operating, the transverter can be used as a receive converter for initial check of operation. An FM broadcast receiver (tuned to the second harmonic) can also be used to monitor the output of the transverter during transmit.

When operating with the transverter, use your 2 meter rig just as you normally would (in low power position). Program CTCSS and repeater split parameters as required if repeater operation is intended.

Higher performance can be achieved by adding receiver and transmit amplification stages to the transverter. Figure 6 shows one way that this could be accomplished.

Other Bands

The Simplest Transverter approach can be applied to other frequency band combinations. One example of this is shown in Figure 7, where the Simplest Transverter approach is used to provide 40 meter capability using a 10 meter transceiver. Of course, the input attenuator value and the low-pass filter characteristics must be adjusted, as required, for different power levels and operating frequencies.

Only slightly more complex than a receive converter, the Simplest Transverter provides about the simplest way to obtain operation on 6 meters with a 2 meter rig—any mode. This same approach can be used to obtain similar results on other ham bands.

Many thanks to all those who've had their ears abused by my noisy signals during QSOs while checking out the ability to conduct practical communications with milliwatt level transmit power. 73

Transverter Parts List

Part	Description
C1	2-10 pF ceramic trimmer or equivalent
C2,C9,C12	0.1 µF disc ceramic capacitor, 16-20 volts
C3,C8,C10,C11,C14,C16,C17, C19,C20,C21	0.01 µF disc ceramic capacitor, 16-20 volts
C5	18pF NPO ceramic capacitor, 16-20 volts
C6	56 pF NPO ceramic capacitor, 16-20 volts
C4,C7,C13,C15,C18	0.001 µF feedthrough
C22,C24	56 pF miniature silver-dipped mica
C23	100 pF miniature silver-dipped mica
D1	1N4005 silicon diode
L1	5 turns no. 28 enameled wire, 0.1" i.d., 0.2" long
L2	0.33 µH miniature RF choke
L3,L4	0.33 to 1.6 µH miniature RF choke
L5,L6	0.22 µH air-wound or toroid coil—or miniature choke
R6	560 ohm 1/4 watt carbon film resistor
R7	1,000 ohm 1/4 watt carbon film resistor
R8,R11	470 ohm 1/4 watt carbon film resistor
R9,R12	100 ohm 1/4 watt carbon film resistor
R10	47 ohm 1/4 watt carbon film resistor
R3	100 ohm 1/2 watt carbon film resistor
R1,R2,R4,R5,R13	150 ohm 1/2 watt carbon film resistor
R14,R15	220 ohm 1/2 watt carbon film resistor
Q1,Q2	2N3563, 2N5179—NPN transistor or equivalent
U1	7805 or equivalent 5 volt regulator
U2	Mini-Circuits Lab MAR-4 MIMIC amplifier
U3	Mini-Circuits Lab MAV-11 MIMIC amplifier
U4	Mini-Circuits Lab TUF-2H double-balanced mixer (also 3H & 1H0
Y1	90 MHz 5th overtone, series resonant-crystal

The Mini-Circuits Labs components can be obtained from M. Lader Co., 1495 Alan Wood Road, Conshohocken PA 19428; (215) 825-3177, (800) 442-3177.

The 5th overtone 90 MHz crystal is available from Marden Electronics Co., Inc., 32100 Droster Ave., P.O. Box 277, Burlington WI 53105; (800) 222-6093. The price is $14, including postage and handling.

Build the Tone Processor

Eliminate interfering signals with this versatile switched capacitor audio filter.

by Kazuo Niwa JA1AYO

The tone processor described here uses the National Semiconductor MF4, a four-stage Butterworth low-pass filter. As Figure 1 shows, unlike conventional audio filters, the capacitor filter cutoff **f_c** can be changed by varying the clock frequency **$f_c$lk**. There are two varieties of MF4 switched capacitor filters, the MF4-100 and the MF4-50. The MF4-100 is shown in Figure 1. For the MF4-50, the relationship between the cutoff frequency and the clock frequency is **$f_c = f_c lk/50$**. Referring to Figure 1, the input impedance Zin is 3 megohm for a **f_c** of 3 kHz and 20 megohm for a **f_c** of 500 Hz. The SCF has an ideal filter gain of around about 1. Attenuation for a four-stage filter is 24 dB per octave.

The MF4-100, an 8-pin DIP package is used in this tone processor. The cutoff frequency **f_c** varies from 500—3000 Hz and **$f_c$lk** varies over a range 100 times greater between 50—300 kHz. Two MF-4s are used in series to create an eight-stage low-pass filter in order to achieve greater attenuation.

Once power supply connections are made, a frequency counter can be connected to terminal TP as shown in Figure 2 to measure the clock frequency **$f_c$lk** without affecting the oscillator frequency. As variable resistor VR is adjusted, the cutoff frequency **f_c** and clock frequency

Photo A. Remove interference with this versatile switched capacitance audio filter.

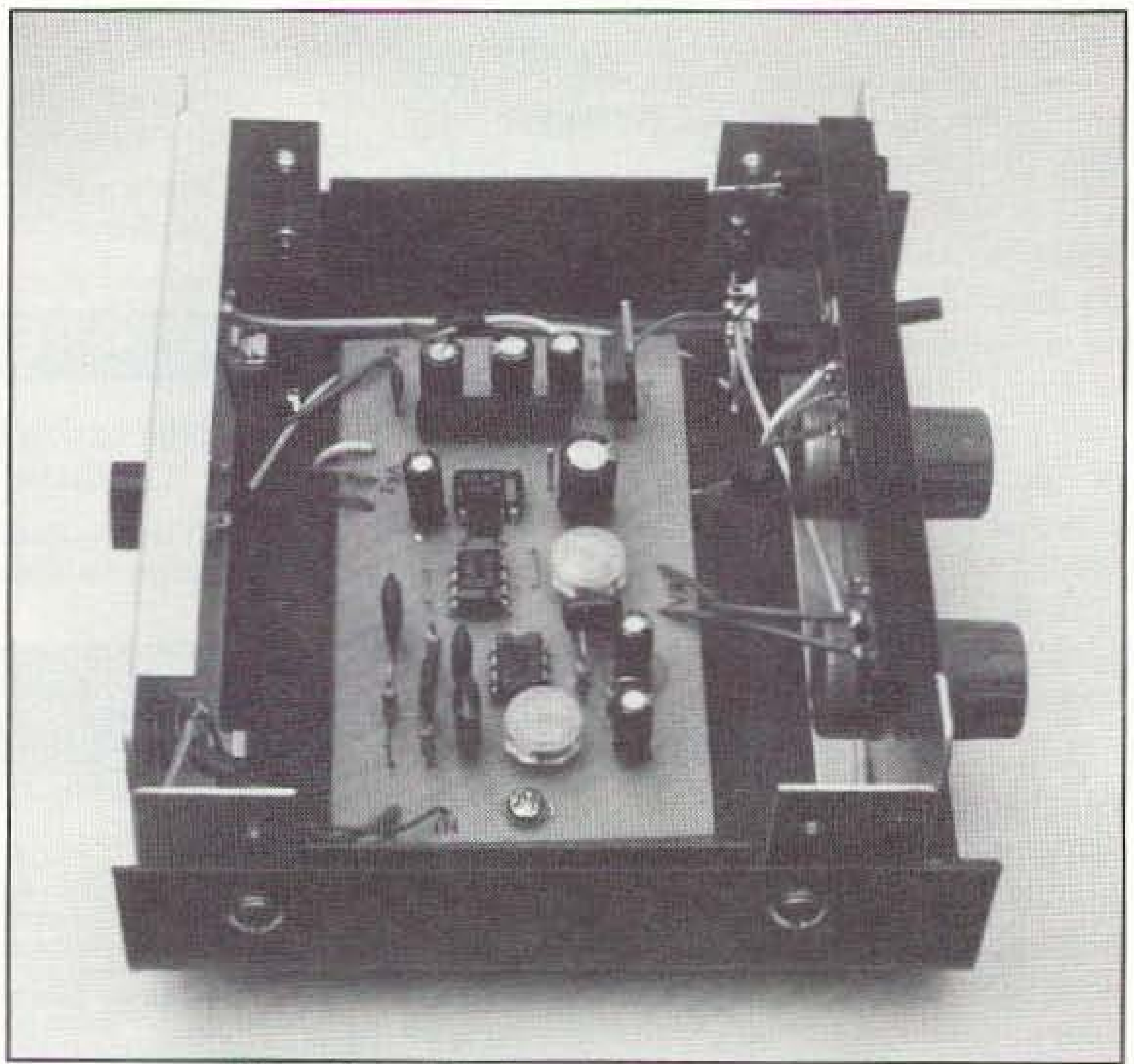


Photo B. Inside view of the tone processor.

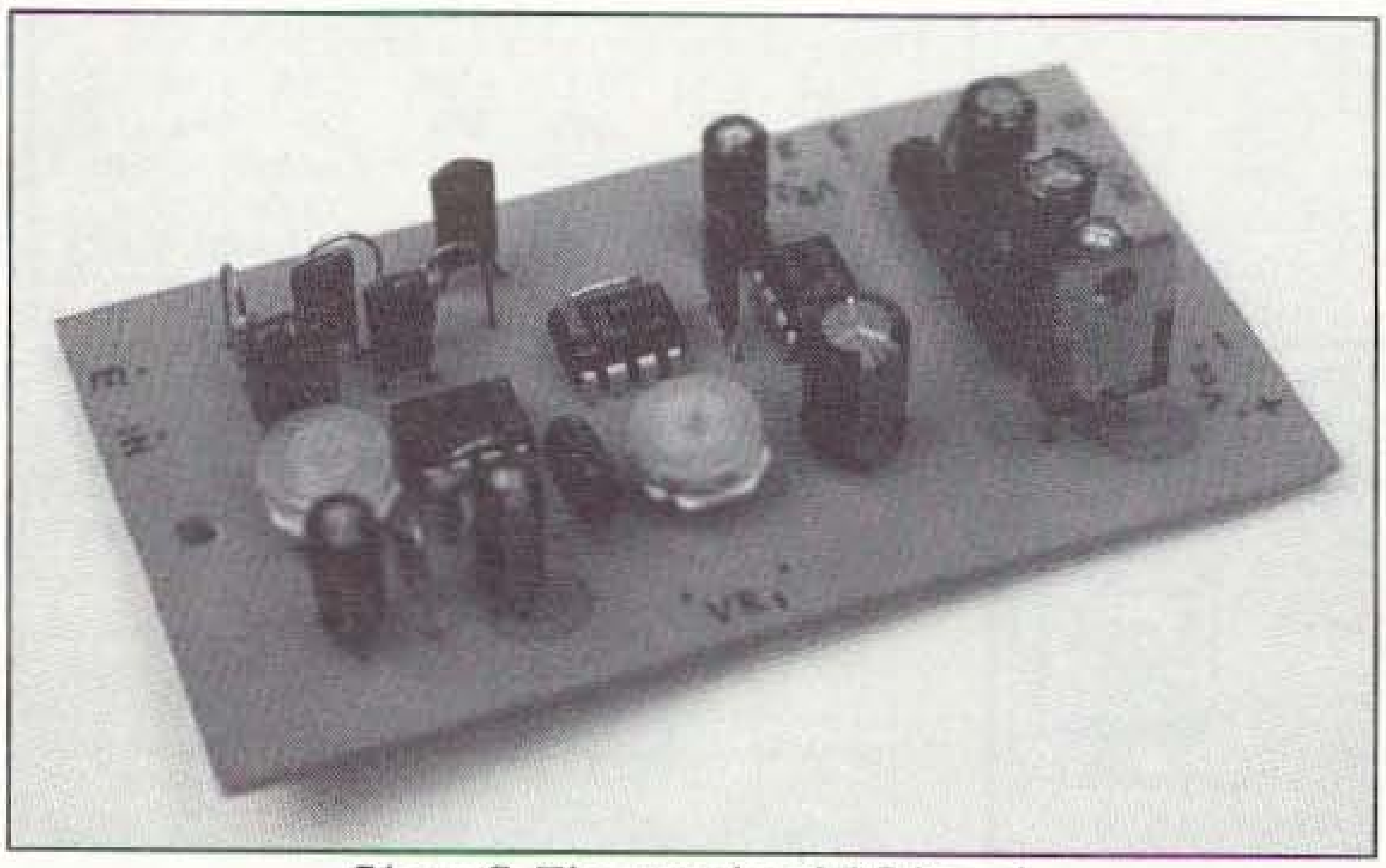


Photo C. The completed PC board.

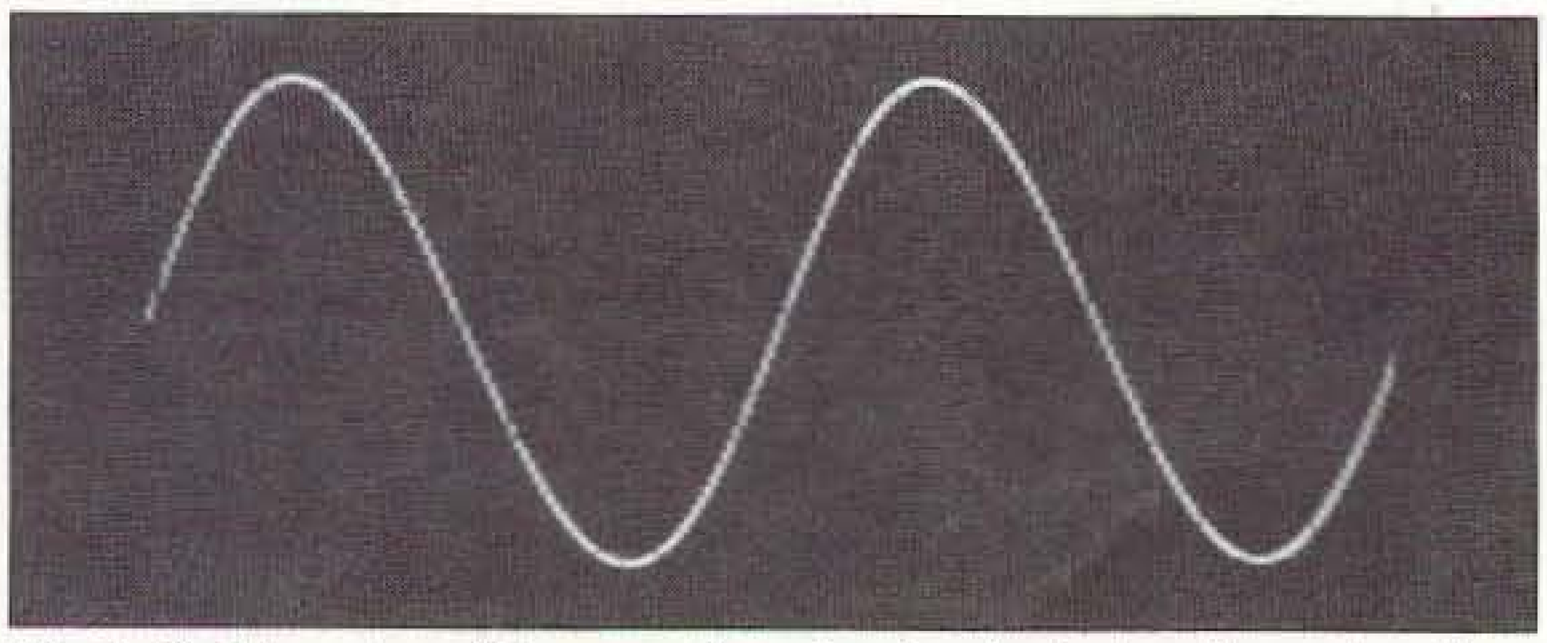


Photo D. Chopping of the waveform by the clock signals can be observed.

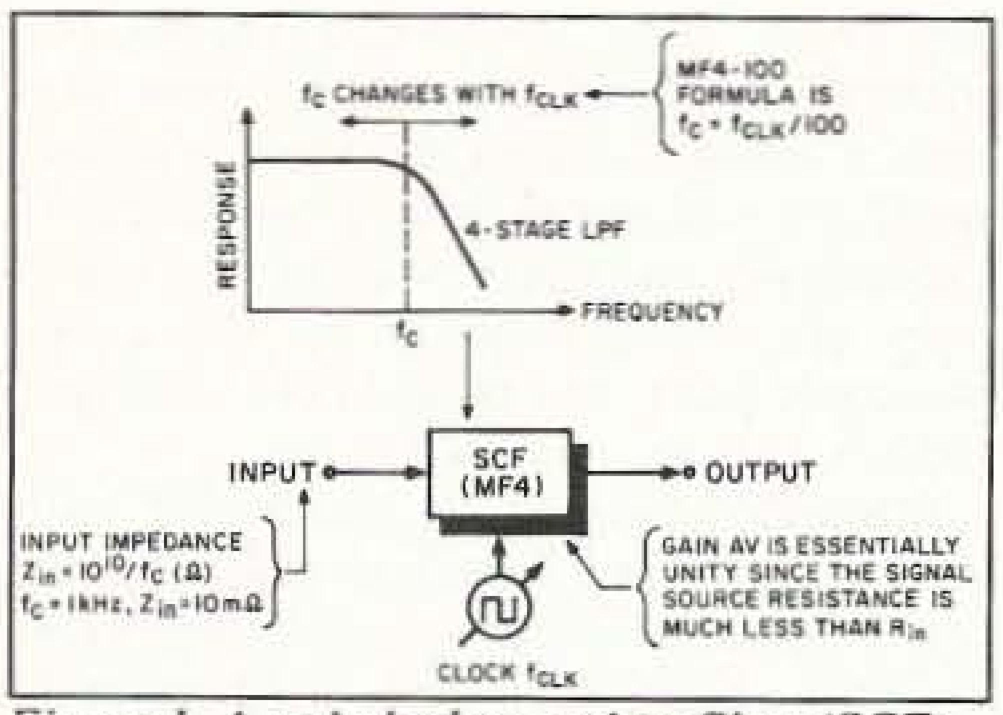


Figure 1. A switched capacitor filter (SCF) can be made using the MF4-100.

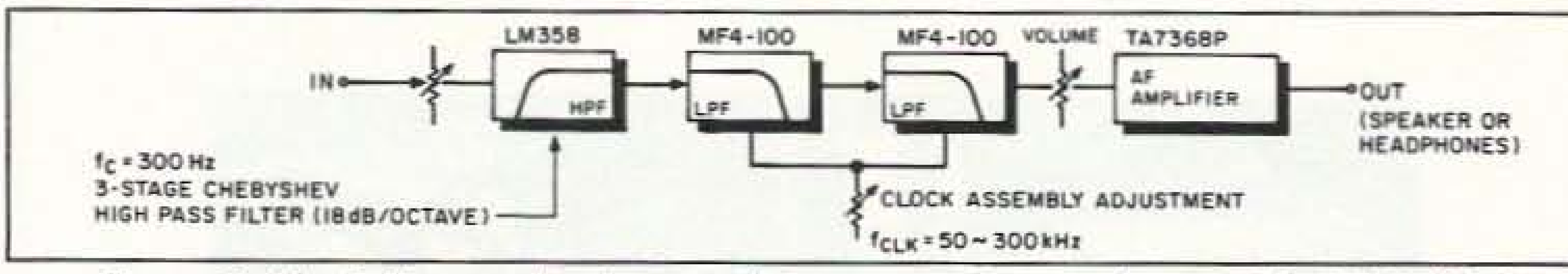


Figure 3. Block diagram for the complete tone processor using two MF4-100 SCFs.

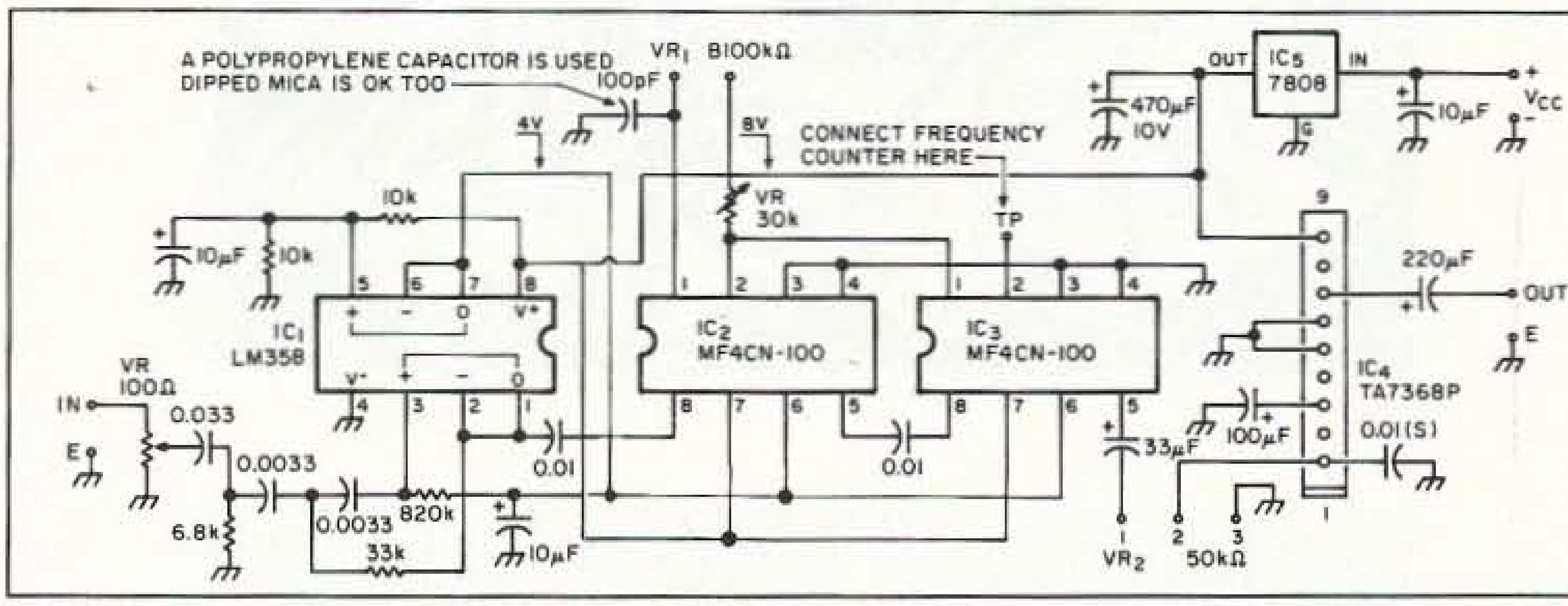


Figure 4. Circuit diagram for the SCF tone processor circuit.

f_{clk} for an 24 dB/octave four-stage low-pass filter and a 48 dB per octave low-pass filter vary as shown in Figure 2b. This tone processor is very effective in removing unwanted noise from SSB signals.

Circuit Description

The final version of the tone processor, shown in Figure 3 and Figure 4, is designed chiefly for improving SSB reception, so low-pass filters (using the SCF ICs) as well as high-pass filters are used to provide audio balance. An LM358 op amp Chebyshev active filter with f_c fixed at 300 Hz has three stages and 18 dB/octave attenuation. An audio amplifier follows the high-pass and low-pass filters to drive a speaker.

The circuit shown in Figure 4 should be connected to a 12-volt power supply. An 8-volt three-terminal voltage regulator is used to ensure that the voltage supplied to the MF4s holds steady to ensure clock frequency f_{clk} stability. IC1, a LM358, shown in Figure 5, is composed to two op amps: One is a three-stage Chebyshev high-pass filter; the other provides a 1/2 Vcc output which is used by the MF4s.

The high-pass filter uses fixed RC passive type components to set the clock frequency, but the two MF4s of the eight-stage low-pass filter use variable resistors to change the low-pass filter clock frequency.

The National Semiconductor ICs are available through Digi-Key Corporation (800-344-4539) and other sources. The

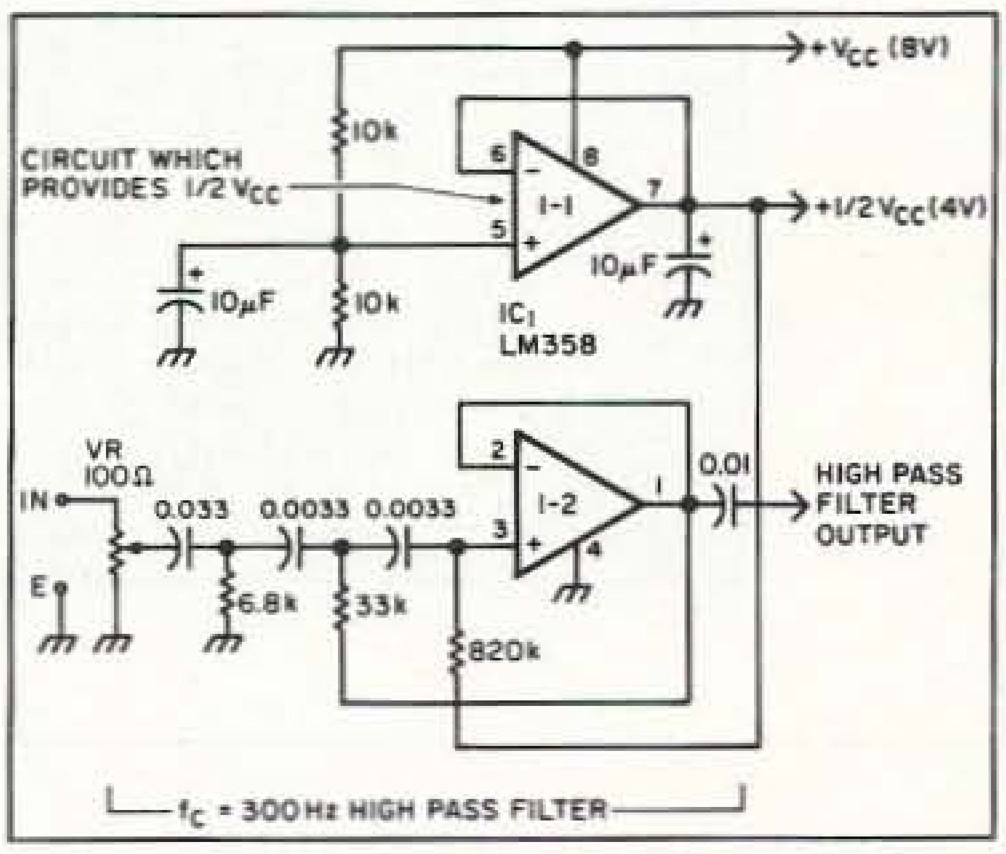


Figure 5. 3-stage Chebyshev high-pass filter and 1/2 Vcc circuit.

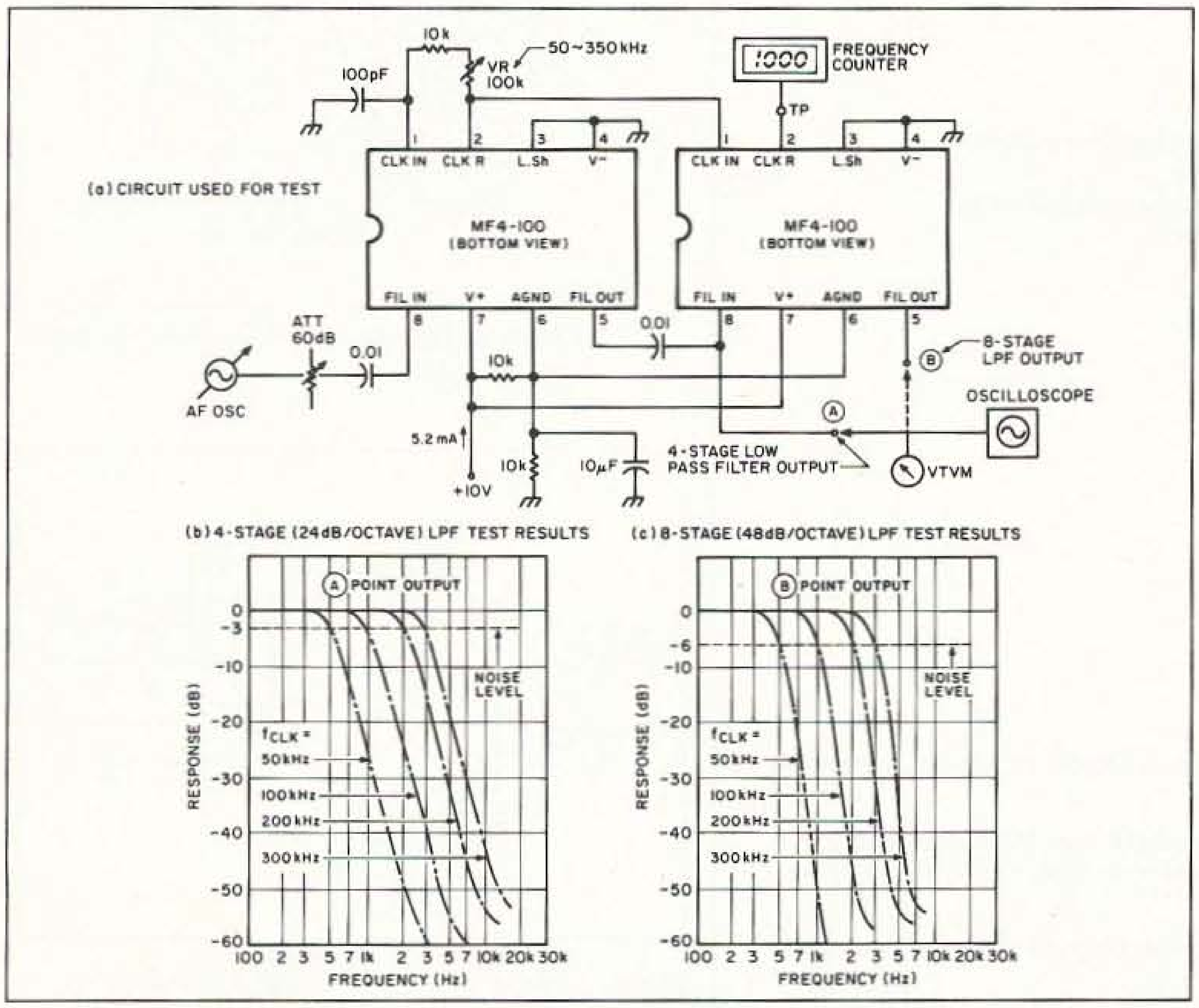


Figure 2 (a). Prototype 4-stage and 8-stage Butterworth low-pass filters. (b). Frequency response for the 4-stage filter. (c). Frequency response for the 8-stage filter.

Toshiba TA7368 audio amplifier IC is available from MCM Electronics, 858 E. Congress Park Dr., Centerville, OH 45459-4072; Telephone: (800) 543-4330 or (513) 434-0031.

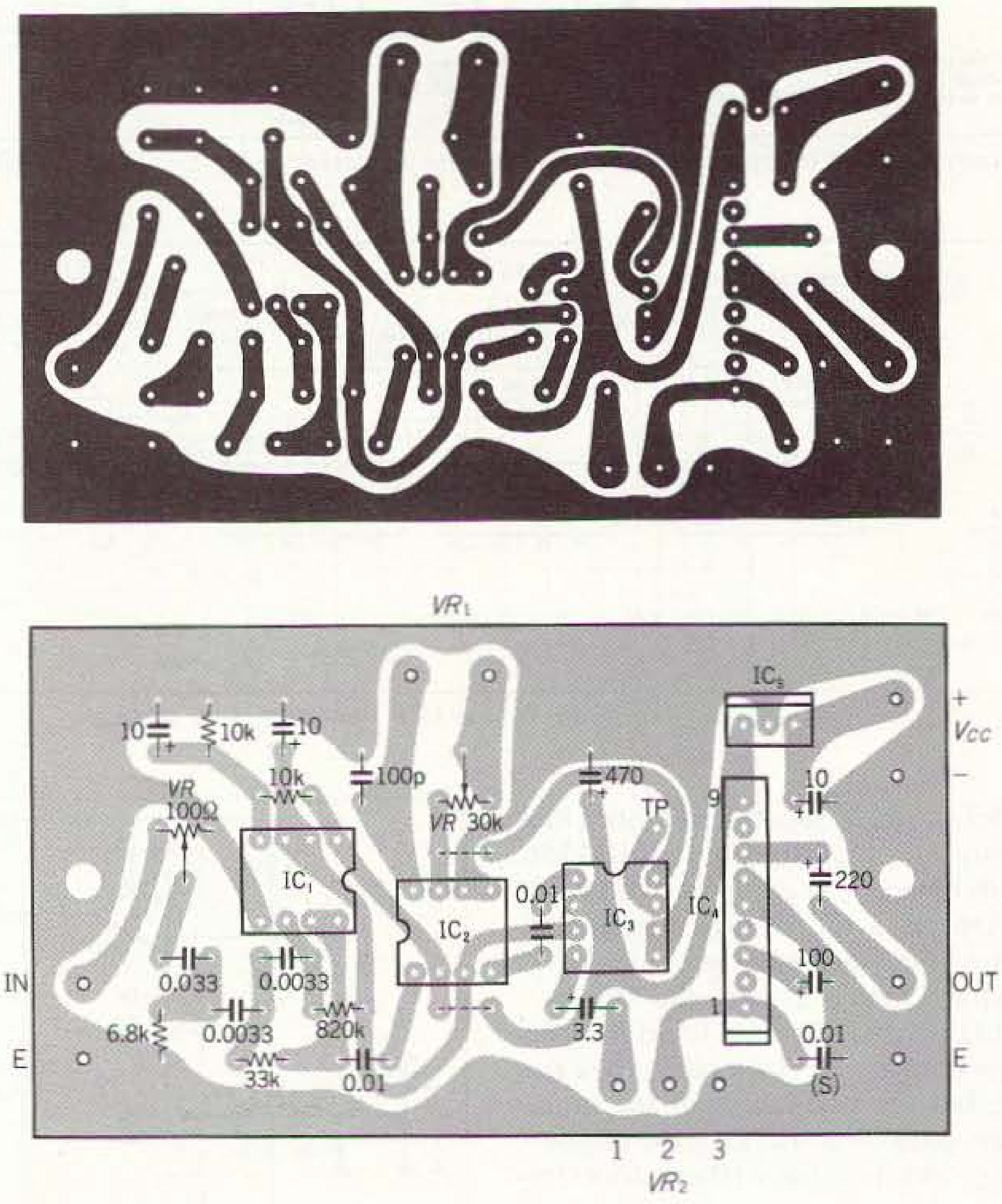
Printed circuit patterns for the circuit boards and the circuit layout are shown in Figure 6. Place a pin in the circuit board hole marked test point (TP). Photo A shows the completed tone processor in its case. The frequency characteristics of the tone processor where the cutoff frequency fc is set to 2 kHz are shown in Figure 7. The upper and lower slopes of the curve illustrate the difference in the characteristics of the low-pass Butterworth filter and the high-pass Chebyshev filter. The circuit board can be put in a project box, as shown in Photos A and B, with two rotary variable resistors on the front panel to control the cutoff frequency of the low-pass filter and the volume, as well as an on/off switch.

Operation

Put the tone processor between a transceiver and external speaker. If the tone processor is OFF, then the speaker line simply runs through the tone processor unaffected. Use insulated wire on the run from VR1 to avoid frequency changes—putting your finger near that wire is enough to shift the clock frequency. The frequency markings on the cutoff frequency control as crowded in the upper range are shown in Photo A. This problem could be solved by a D curve variable resistor, but they are hard to get.

While listening to 40 meter SSB with the tone processor, much unwanted noise could be eliminated by adjusting VR1. For SSB a cutoff frequency of about 1000 Hz proved to be the best for reducing noise; below that frequency, intelligibility suffers. The tone processor generally improves readability 4 signals to readability .

Reprinted from CQ Ham Radio, *November 1991, pp. 404—408. Translated by David Cowhig WA1LBP.*



❮ *Figure 6 (a). PC board foil pattern.*

(b). Parts placement. Please note that this parts placement diagram is shown as viewed from the foil side of the PC board, the components mount on the opposite side of the foil pattern.

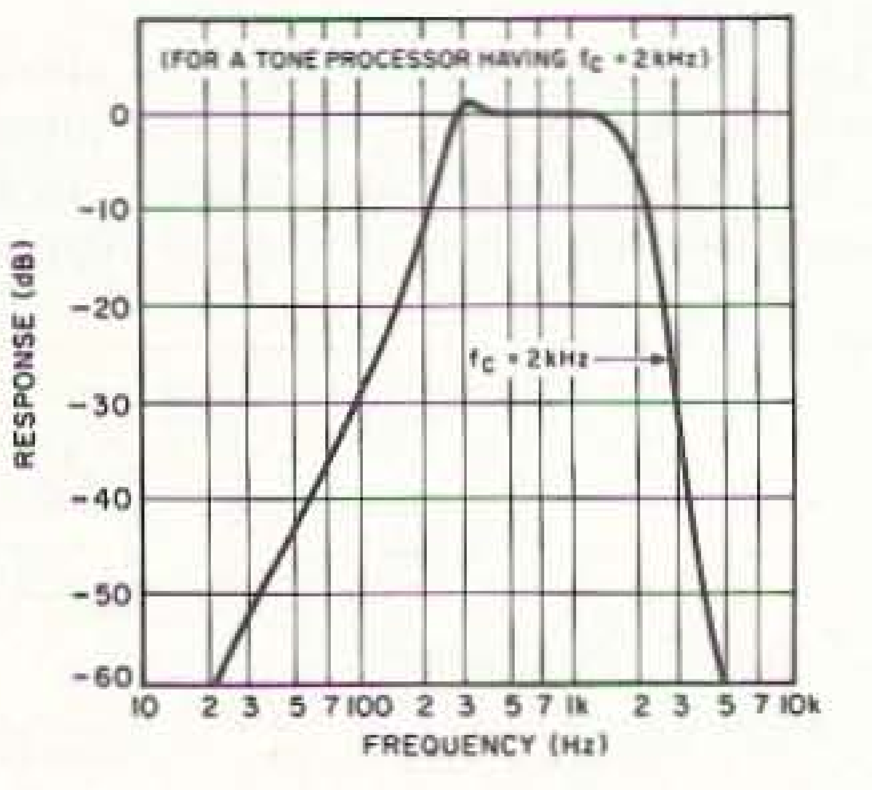


Figure 7. Tone processor frequency response characteristics.

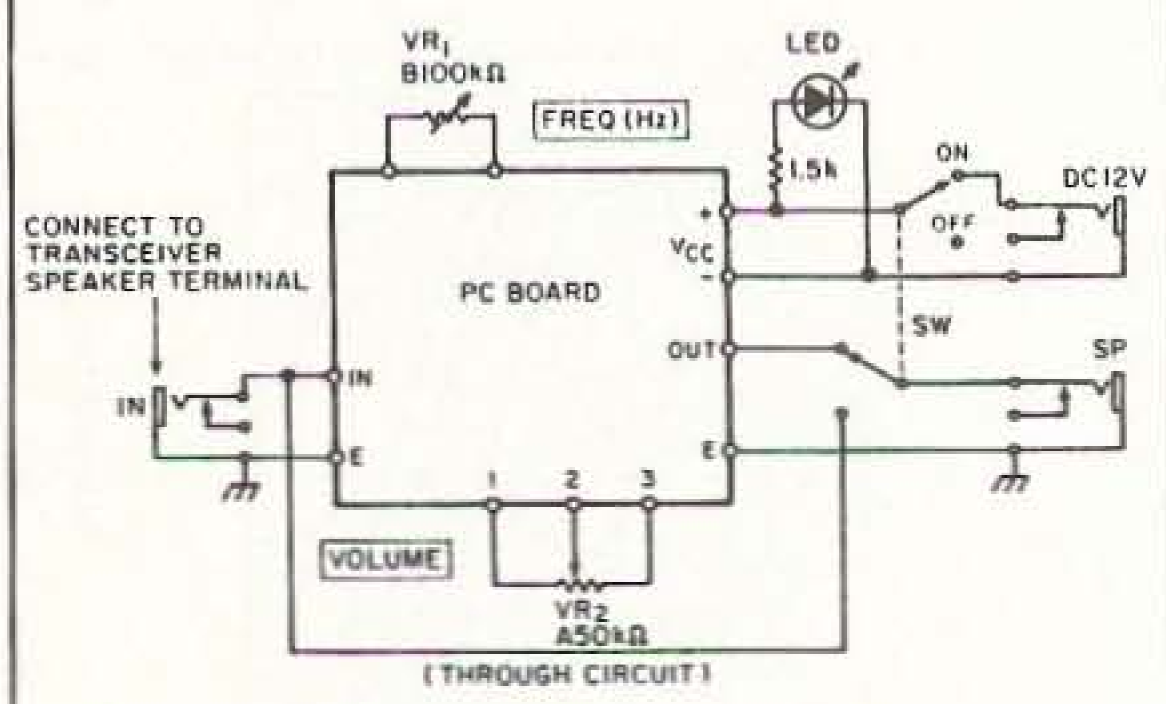


Figure 8. Hook up the tone processor between your rig's speaker output and your speaker as shown. It can be removed from the circuit with the switch.

PARTS LIST

IC1	LM358 op amp
IC2,IC3	MF4CN-100 SCF IC
IC4	TA7368 audio amplifier (see Note 2 for source)
IC5	7808 8-volt voltage regulator
1	100 pF capacitor (polypropylene or dipped mica)
1	0.0033 µF mylar capacitor
1	0.01 µF mylar capacitor
1	0.033 µF mylar capacitor
1	0.01 µF ceramic capacitor
1	3.3 µF electrolytic
3	10 µF electrolytic
1	100 µF electrolytic
1	220 µF electrolytic
1	470 µF electrolytic
1	6.8k resistor
2	10k resistor
1	33k resistor
1	820k resistor
1	100k potentiometer
1	30k potentiometer

Note 1: An etched and drilled PC board is available for $4.50 + $1.50 postage from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Note 2: The Toshiba TA7368 audio amplifier IC is available from MCM Electronics, 858 E. Congress Park Dr., Centerville OH 45459-4072. Telephone: (800) 543-4330 or (513) 434-0031.

Note 3: All other parts should be available from Digi-Key Corporation at (800) 344-4539 or Mouser Electronics at (800) 346-6873.

Number 10 on your Feedback card

73 Review

by Peter H. Putman KT2B

The Down East Microwave WSSK

Microwave weak signal source kits.

Down East Microwave
RR1, Box 2310
Troy ME 04987
Telephone: (207) 948-3741
Fax: (207) 948-5157
Price Class: Complete kit, $65; assembled board, $88; assembled in a box, $120.

To paraphrase a current beer commercial, "Wouldn't it be great if someone made a simple, reliable and inexpensive signal source for the microwave bands?" Well, someone does, and they're called the WSS903K, WSS1152K and WSS1296K kits from Down East Microwave. All three kits can be assembled in one evening (if you're so inclined) and feature on-board interdigital filters, MMIC stages for stability, and a no-tune design.

How They Work

All three sources use a two-stage oscillator/buffer, working anywhere from 90 to 110 MHz, followed by an MMIC amplifier, diode multiplier and two additional MMIC amp stages. Output is typically in the 1-to-3-milliwatt range, which is more than adequate for aligning preamps and mixer stages. The WSS903K is designed for an output frequency of 903.100 MHz using a crystal frequency of 90.3100 MHz, while the WSS1296K pops up at 1296.100 using a 108.0833 fundamental. On the other hand, the WSS1152K is probably the most versatile of the three, with usable harmonics all the way up to and including the 3 cm band (10.368 GHz). It can be used at 2304, 3456, and 5760 MHz as well, and for just fooling around it makes a great local oscillator (add 144 MHz, and mix to get 1296 MHz output).

Construction

Assembly is very easy. You'll need to wind four coils using a 0.1"-diameter drill bit and #24 enameled wire, supplied in the kit. Two BFX89 transistors are used in the oscillator stage, followed by a MAR-3 MMIC, an HP 2835 multiplier diode, a MAR-6 MMIC and another MAR-3 for output. About a dozen chip capacitors are included, and you'll need to use a small pair of needle-nose pliers and a low-wattage iron to solder them in place. Keep all leads as short as possible on the coils and resistors. This isn't hard to do as you can lay each component on top of the board and cut the leads according to the solder pads. I did find some variation from the coil windings in the instructions for the WSS1152, and changed L1 from 10 turns to 11 turns, gaining 3 dB more output and putting the crystal right on frequency (96.0020 MHz).

A good frequency counter would be helpful to check the crystal and trim it in, but if you have a receiver for any of these bands and you know the calibration, just make a note on the board with permanent marker. If you want to be sure of your frequency, allow the unit to warm up and stabilize for a bit . . . say 10 minutes or so.

Down East offers an option to get a bit more "oomph" from the board by adding another MMIC stage just before the output connector. The parts for this stage (another MAR-3 MMIC, a 220-ohm 1/4-watt resistor, and a 22 µF chip capacitor) can be ordered at the same time for a slight additional cost. You'll have to wind another eight-turn 0.1" diameter choke from #24 enameled wire as well.

In Use

Down East suggests a Radio Shack 270-238 box for installation. I would prefer to use a small Hammond or Bud die-cast box with a BNC or SMA connector and feed-throughs for DC power. The board is small enough at 3" x 5" to fit in just about any configuration, and you could put all three together in one box with a power supply and just switch to the desired port. I've used mine to check the sensitivity of several GaAsFET preamps I use on 33 cm, 23 cm and 13 cm. Although the crystal stability would be far better with an oven, drift is pretty minimal after warm up and gives you an easy way to find yourself on any of these bands, especially if you're trying to work another microwave station on a schedule.

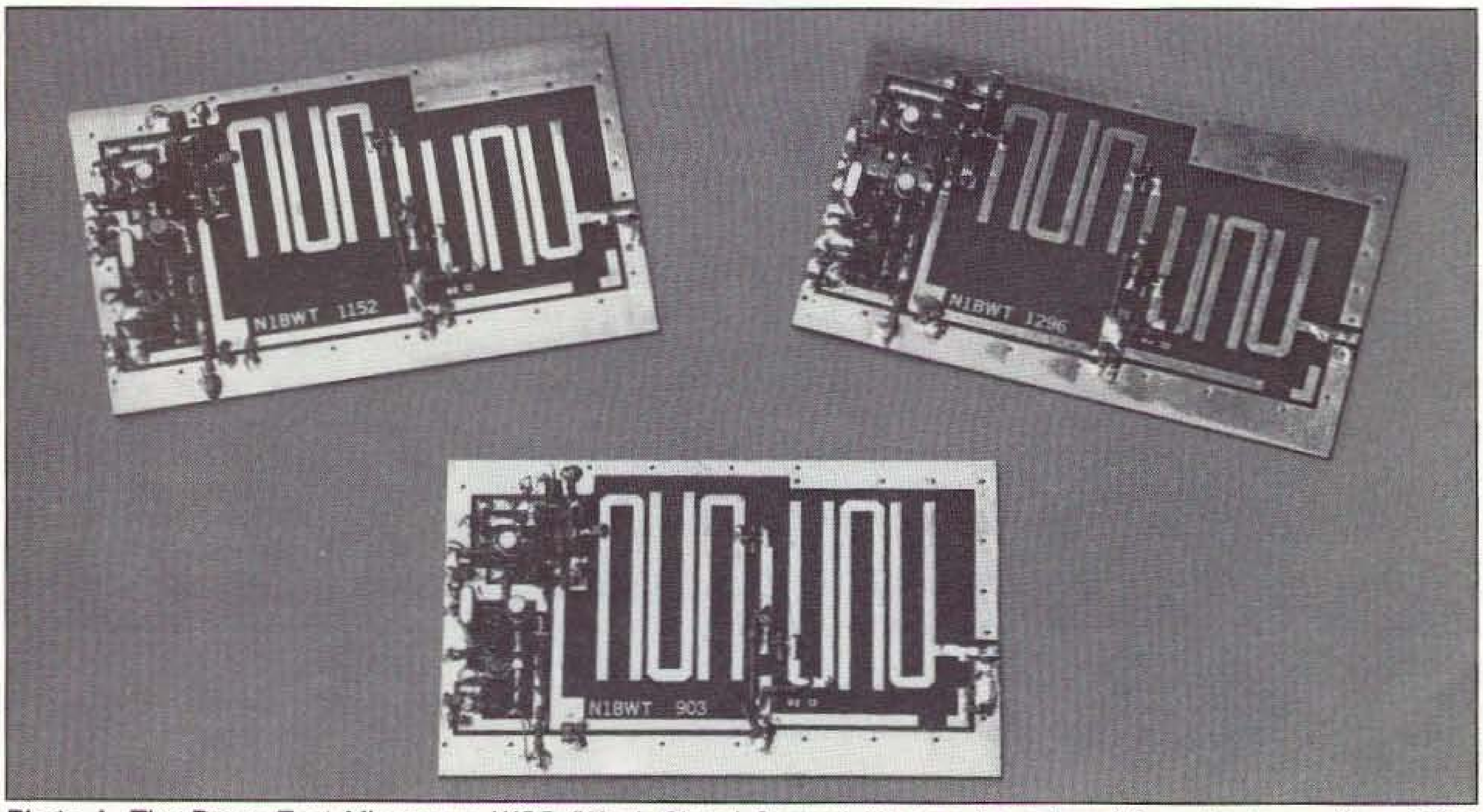


Photo A. The Down East Microwave WSS (Weak Signal Source) kits can be ordered for outputs on either 903.1 (WSS903K), 1152 (WSS1152K) or 1296 MHz (WSS1296K).

ALINCO DOES IT AGAIN...

In keeping with our philosophy of providing the most innovative products, Alinco introduces the SR4 - D repeater controller.

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- It can work as a duplex repeater .
- It can be used with any type of radio. (Any band, any frequency, any mode: AM, FM, SSB).
- It has voice mail.
- It has an automatic voice IDer and Time - out timer.
- It can be controlled remotely Via DTMF tones, with or without a security code.
- It requires no internal connection to your radio, and is simple to use.
- It is compact, it is reliable, it is vibration resistant for mobile installations, and draws very little current.
- There IS no competition.

One Year Limited Warranty
Specifications and features are subject to change without notice or obligation.

ALINCO
ALINCO ELECTRONICS INC.
438 Amapola Avenue, Unit 130, Torrance, CA 90501
Tel: (310) 618-8616 Fax:(310) 618-8758

CIRCLE 67 ON READER SERVICE CARD

NEW PRODUCTS

Number 20 on your Feedback card

Compiled by Hope Currier

COMMUNICATIONS SPECIALISTS

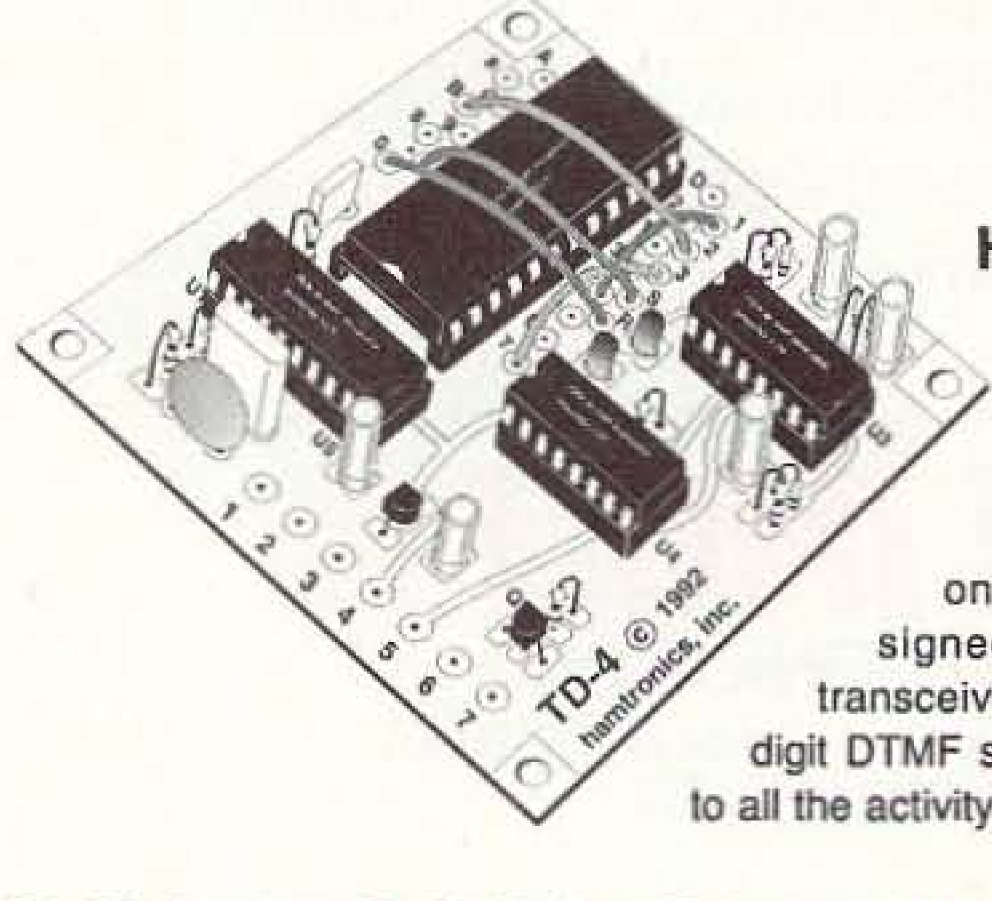
The PE-15 from Communications Specialists is a miniature sub-assembly capable of sending 15 separate codes in the POCSAG (RPC-1) format. The PE-15 is intended for operators of local "in-house" radio systems wishing to signal tone-only pagers. It is ideal for factories, restaurants, sales managers, security operations, oil fields, or wherever direct control of local area paging is desired. The 15 available codes may be used to activate up to 4 distinct alert tones on each pager, 15 individual pagers, or any combination thereof. Communications Specialists also makes the PE-4 four-call and PE1000P 1,000 call POCSAG paging encoders. All of these units can be used on most two-way radio systems, providing enhanced capability of existing systems at low cost.

The PE-15 and PE-4 are factory-programmed to your specific address codes, or may be field-programmed via an available keypad. They each sell for $99.95. For more information, contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; (714) 998-3021, (800) 854-0547, Fax: (714) 974-3420.* Or circle Reader Service No. 201.

J & W TECHNOLOGY

IRACS (Interactive Remote Alarm and Control System) from J & W Technology is a controller that allows you to perform reliable long-range remote control with your hand-held or mobile radio. IRACS is designed to connect easily to the speaker, microphone and PTT lines of any FM transceiver. IRACS uses this transceiver to receive DTMF commands from you and to transmit acknowledgements and system status back to your handheld. Typical uses include remote control and site alarm for your repeater site, home or car. You can use it simply to turn on a remote speaker for selective calling or to turn on a tape recorder remotely.

IRACS is available in the following configurations: fully assembled and tested, with matching case, $149; fully assembled and tested PC board without case, $119; complete parts kit with a single-sided PC board, $99. For more information, contact *J & W Technology, 38 Jade Street, Scarborough, Ontario, Canada M1T2T8; (416) 298-4499.* Or circle Reader Service No. 204.



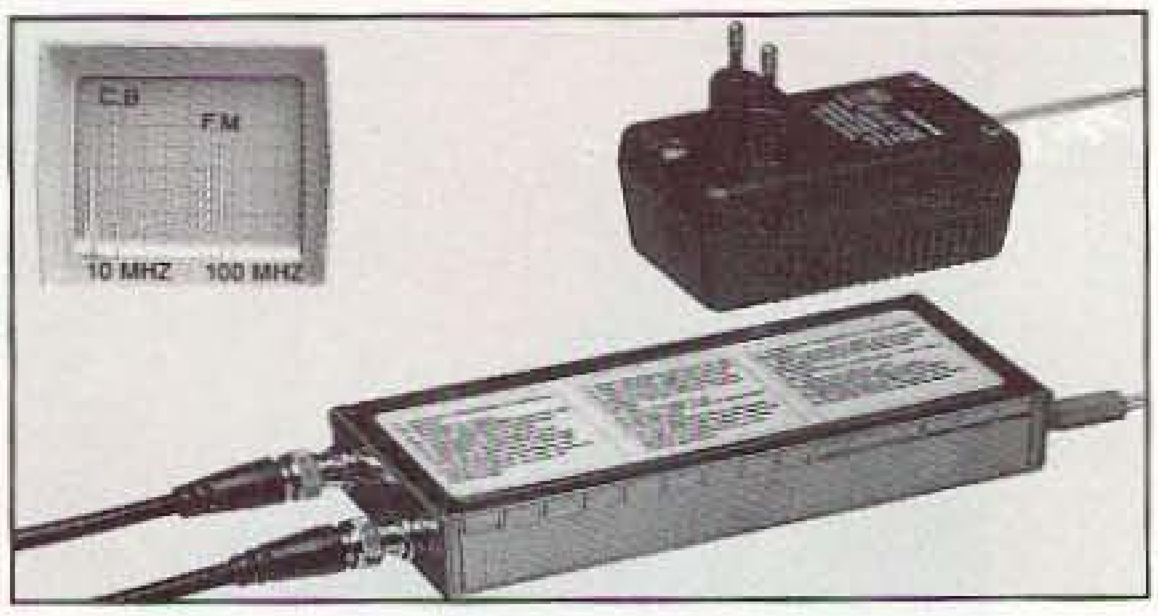
HAMTRONICS, INC.

The Hamtronics TD-4 Selective Calling Module is a relatively new economy touch-tone decoder with one latching output. This versatile module, only a few inches square, is primarily designed to mute the speaker of a receiver or transceiver until someone calls by sending a four-digit DTMF signal, thus making it unnecessary to listen to all the activity on a channel just so someone can call you once in awhile. It is easy to modify the latch input circuits on the TD-4 to perform the LiTZ function, i.e. mute the receiver until a DTMF zero has been received for six continuous seconds, making it a low cost solution for implementing this new emergency warning scheme.

The TD-4 is only $49 in kit form or $89 wired and tested. For more details and a complete catalog, contact *Hamtronics, Inc., 65-F Moul Road, Hilton NY 14468-9535; (716) 392-9430, Fax: (716) 392-9420.* Or circle Reader Service No. 205.

R & D ENGINEERING SYSTEMS

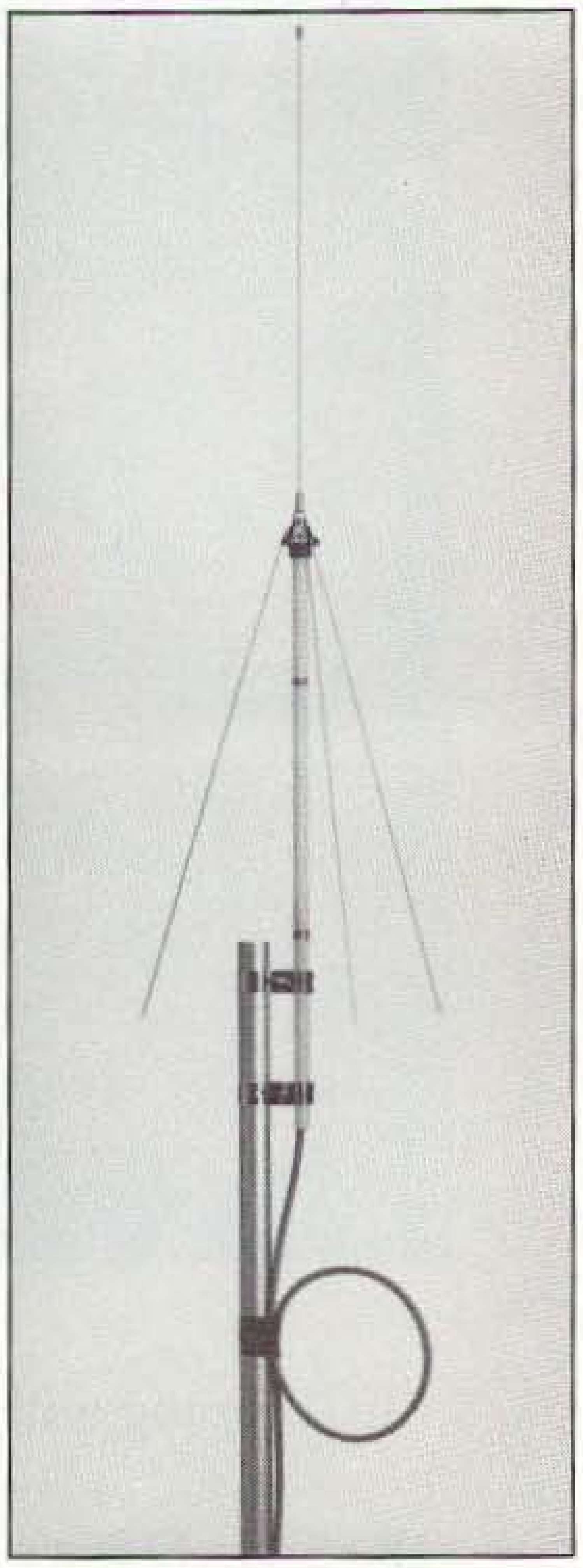
R & D Engineering is offering two analyzers, the AS-100 and the AS-1750. Both analyzers include power supplies and have the same specifications except that they operate in different bands: The AS-100 operates from 2.8 to 105 MHz, and the AS-1750 operates the 850 to 1750 band. The suggested retail price is $179 for the AS-100 and $259 for the AS-1750, plus shipping and handling. Dealer rates are available. For more information, contact *R & D Engineering Systems, 502 Canal St., Folsom CA 95630; (916) 985-2555.* Or circle Reader Service No. 202.

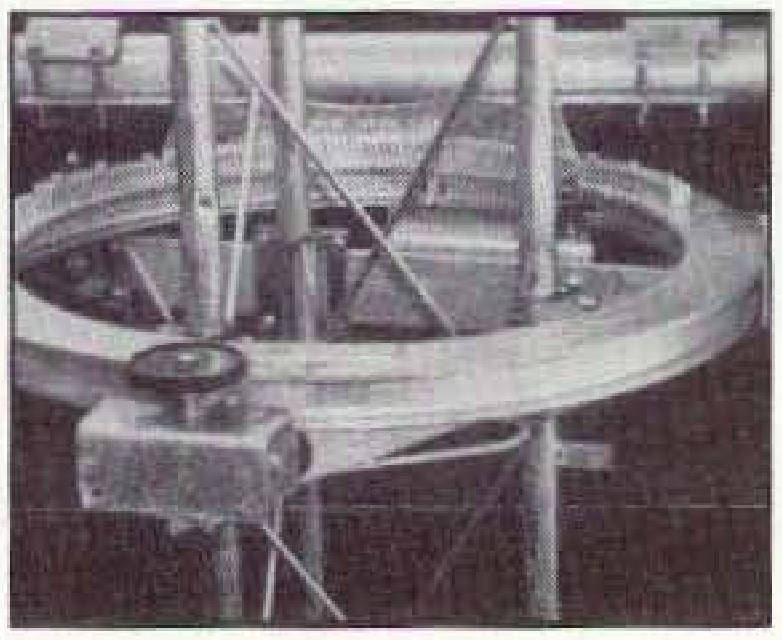


SAGANT ANTENNA

Arrow Line antennas from SAGANT U.S.A. for HF, VHF, and UHF are compact and lightweight, with a low radiation pattern for outstanding performance. Model AL-207F is a base-type 2m/70cm dual-bander (51" long, 0.77 lbs.) that handles 250W FM. The AL-144F is a compact base antenna for 2 meters. Other Arrow Line models for mobile, 2 meters, HF and 1.2 GHz are available. SAGANT also offers a wide range of wire antennas, such as Zepp-type and inverted V, and HF mobile antennas that are slim and short for mounting on the roof.

For prices and more information, contact *SAGANT U.S.A., 360 W. Bedford Ave., Suite 111, Fresno CA 93711; (209) 261-1400, Fax: (209) 261-0662.* Or circle Reader Service No. 203.





TIC GENERAL

TIC General has introduced the Model 1022 TIC Ring, downsizing the larger Model 1023 into a compact yet very powerful rotor. Far more than a rotor, this is a Ringrotor, with rugged steel ring construction, a powerful drive motor, solid worm gear braking and galvanized coating. It will mount, hold and turn large antennas. It offers an analog controller, preset, North center, South stop, analog meter readout, memory backup, and an easy-to-read scale.

The TIC Ring Model 1022 is $649 plus S & H. For more information, contact *TIC General, Inc., P.O. Box 1, 302 Third Street East, Thief River Falls MN 56701; (218) 681-1119, (800) 842-7464, Fax: (218) 681-8509.* Or circle

HAMSATS

Number 12 on your Feedback card

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Future OSCARs

The first amateur radio satellite, OSCAR-1 (Orbiting Satellite Carrying Amateur Radio), was launched into orbit just over 31 years ago on December 12, 1961. The 10-pound package sent the letters "HI" in code on 2 meters. This small unit was designed and built by members of the Project OSCAR group at Foothills College in Los Altos, California, and the Lockheed Amateur Radio Club in Sunnyvale, California. The 100-milliwatt transmitter system lasted three weeks until the batteries discharged. Over 600 amateurs in 25 countries reported reception of the signals. Since then, many more amateur radio satellites have been launched, and several from other countries are on the way.

Current amateur satellite community attention has been focused on Phase 3-D. Phase 1 OSCARs were designed for short lifetimes and low orbits. Phase 2 spacecraft are built for long lifetime (over one year) operation in low orbits. Phase 3 satellites are placed into high orbits and are usually designed with at least a five-year lifetime. Phase 3-A met a watery end in 1980 when its Ariane launcher malfunctioned. Phase 3-B became AMSAT-OSCAR-10 in 1983 and Phase 3-C was renamed AMSAT-OSCAR-13 when it reached orbit in 1988. Although Phase 3-D will be placed into an orbit similar to the other Phase 3 spacecraft, it is much larger and significantly more complex than its predecessors. Participating groups include the U.S., Germany, Belgium, Hungary, Finland, Czechoslovakia, Great Britain, Japan, South Africa, Australia and Slovenia. The main goals of the project are to improve link margins over previous satellites with more power from the satellite, to promote the use of higher frequencies for satellite communications, and to cut the cost of earth stations and retain sufficient commonality with existing hamsats to avoid obsolescence of current equipment. Launch could be as soon as 1995. Many changes have been made to the structural design of the satellite in recent months, so it will be a challenge to have everything ready in time.

Other satellite projects continue with development and construction or have been proposed for future programs. International satellites are expected soon from Mexico, Italy, Russia, France, South Africa, Israel, Chile and other countries. Here in the U.S., efforts continue on SEDSAT in Huntsville, Alabama, and at PANSAT, the Naval Postgraduate School satellite in Monterey, California.

Some programs from other countries and schools have used amateur frequencies for educational orbiting experiments. These "gray area" projects confuse the issue of what is an OSCAR and have caused serious arguments among international groups. Some have said that the French satellite SARA should be called SARA-OSCAR-23, while others argue that SARA's operation on ham frequencies was a matter of convenience for the builders. There are also questions about UoSAT-OSCAR-14, which is still operational for commercial and educational uses but not available to amateur radio operators. While interlopers in the amateur bands should be discouraged, AMSAT organizations wish to aid and promote more ham-originated satellite work through checks of the intent of the various groups and their credentials as amateur radio organizations.

Current OSCARs

New hamsats are always exciting. They provide fresh resources for communications and experiments testing ideas from an orbital vantage point. We have seen the results of imaging advances from the early days of UoSAT-OSCAR-9's camera to the dramatic views seen and transmitted by Kitsat-OSCAR-23. Data experiments have gone from CW and RTTY to 9600 bps packet. Voice transponders have progressed from simple Mode "A" systems using the 10 meter band for a downlink to the Mode "S" system on A-O-13 that comes to earth on 2.4 GHz in the 13cm band.

In the early days of OSCAR with Phase 1 satellites, the time between satellite launches was painful since the operational time of the hamsat was usually limited to a few weeks and launch opportunities were rare. Later, with Phase 2 satellites like A-O-6, spacecraft lifetimes of several years were common. Today we have so many amateur radio satellites it is impossible for one person to keep up with them all. Most enthusiasts focus their efforts on the satellite and mode that interests them the most. Newcomers typically try the easy satellites like RS-10 and RS-12 before progressing to the challenges of the high elliptical orbits of the Phase 3 spacecraft.

It's time to take stock of the incredible resources in orbit and available for use in 1993. Rather than wait for the next round of hamsats, or the promised advances of Phase 3-D, it's time to get on the air now. The hamsats are a limited resource. When the batteries finally die, or a key transistor gives out, it's all over.

AMSAT-OSCAR-10 was launched nearly 10 years ago on an Ariane rocket from French Guiana. This satellite still performs very well on Mode "B" using a 70cm uplink and 2 meter downlink. The computer gave in to radiation damage three-and-a-half years after launch, but the transponder system still works well when the solar cells are properly illuminated. The elliptical orbit favors the Southern Hemisphere, providing excellent DX opportunities not available via A-O-13.

UoSAT-OSCAR-11 was launched from the Western Test Range at Vandenberg Air Force Base in Lompoc, California, in 1984. Nine years later it is still performing extremely well with telemetry, bulletins, digital speech and whole-orbit data transmissions. It is usually heard on 145.825 MHz FM sending ASCII data at 1200 bps. Many stations looking for D-O-17 find U-O-11 instead since they share the same downlink frequency.

RS-10/11 is nearly six years old. Launched from Plesetsk in June 1987, this dual package is part of the larger COSMOS 1861. Andy Mirinov RS3A has acted as the primary control station from the Command Center of RS Satellites in Moscow. Andy has recently begun work at the Moscow Adventure Club, but continues with the RS control activities. RS-10 remains in excellent condition providing Mode "A" operation (2 meters up and 10 meters down) from its 1,000-km-high polar orbit. The satellite pair can be used in other modes, but "A" is primary. RS-11 is held as a back-up should a failure occur in the RS-10 hardware.

AMSAT-OSCAR-13 was one of the payloads on the June 1988 launch of an Ariane 4 series rocket from French Guiana. A-O-13 continues as the primary voice transponder hamsat. Activity is not limited to a single mode. The current schedule includes the popular Modes "B" and "J" (2 meters up and 70cm down), and also Mode "L," which uses 1.2 GHz as an uplink to a 70cm downlink, and Mode "S."

James Miller G3RUH recently posted a complete preliminary mode schedule for 1993, shown in Table 1. Up-to-date

AO-13 PROVISIONAL MODE SCHEDULES 1993

```
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1992 Dec 21 - Feb 08
Mode-B   : MA 0 to MA 256 !
Mode-S:    MA              !
Mode-LS  : MA              !    Attitude Dec 21    130/0
Mode-JL  : MA              !             Jan 04    140/0
Mode-B   : MA              !             Jan 18    150/0
Omnis    : MA 170 to MA  15 !
Eclipses: Transponder OFF MA 170 to 256Jan 28 - Mar 04
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 Feb 08 - Mar 08
Mode-B   : MA      0 to MA  40 !
Mode-S   : MA     40 to MA  50 !<- S transponder; B trsp. is OFF!
Mode-LS  : MA     50 to MA  55 !<- S beacon + L transponder
Mode-JL  : MA     55 to MA  70 !      Alon/Alat 150/0
Mode-B   : MA     70 to MA 256 !
Omnis    : MA    170 to MA  15 !    Move to attitude 180/0, Mar 08
Please don't uplink to B, MA 40- 50. Interferes with Mode S.
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 Mar 08 - May 10
Mode-B   : MA      0 to MA 120 !
Mode-S   : MA 120 to MA 130 !<- S transponder; B trsp. is OFF!
Mode-LS  : MA 130 to MA 135 !<- S beacon + L transponder
Mode-JL : MA 135 to MA 150 !      Alon/Alat 180/0
Mode-B   : MA 150 to MA 256 !
Omnis     : MA 230 to MA 40 !Move to attitude 210/0, May 10
Please don't uplink to B, MA 120-130. Interferes with Mode S.
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 May 10 - May 31
Mode-B   : MA    0 to MA    180 !
Mode-S   : MA  180 to MA   190 !   <- S transponder; B trsp. is OFF!
Mode-LS  : MA  190 to MA   195 !   <- S beacon + L transponder
Mode-JL  : MA  195 to MA   210 !        Alon/Alat 210/0
Mode-B   : MA  210 to MA   256 !
Omnis    : MA  250 to MA    60 !   Move to attitude 120/0, May 31
Please don't uplink to B, MA 180-190. Interferes with Mode S.
Series: 1993 May 31 - 1993 Nov 08
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 May 31 - Aug 02
Mode-B   : MA     0 to MA 256 !
Mode-S   : MA                 !
Mode-LS  : MA                 !        Attitude May 31     120/0
Mode-JL  : MA                 !                 Jun 14     130/0
Mode-B   : MA                 !                 Jun 28     140/0
Omnis    : MA 170 to MA10 !                     Jul 12     150/0
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 Aug 02 - Aug 30
Mode-B   : MA   0 to MA   40 !
Mode-S   : MA  40 to MA   50 !   <- S transponder; B trsp. is OFF!
Mode-LS  : MA  50 to MA   55 !   <- S beacon + L transponder
Mode-JL  : MA  55 to MA   70 !        Alon/Alat 150/0
Mode-B   : MA  70 to MA  256 !
Omnis     : MA 170 to MA   10 !   Move to attitude 180/0, Aug 30
Please don't uplink to B, MA      40- 50. Interferes with Mode S.
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 Aug 30 - Oct 18
Mode-B      : MA    0 to MA    120 !
Mode-S      : MA  120 to MA    130 !  <- S transponder; B trsp. is OFF!
Mode-LS     : MA  130 to MA    135 !  <- S beacon + L transponder
Mode-JL     : MA  135 to MA    150 !       Alon/Alat 180/0
Mode-B      : MA  150 to MA    256 !
Omnis        : MA 230 to MA     40 !  Move to attitude 210/0, Oct 18
Please don't uplink to B, MA 120-130. Interferes with Mode S.
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 Oct 18 - Nov 08
Mode-B      : MA    0 to MA    180 !
Mode-S      : MA  180 to MA    190 !  <- S transponder; B trsp. is OFF!
Mode-LS     : MA  190 to MA    195 !  <- S beacon + L transponder
Mode-JL     : MA  195 to MA    210 !        Alon/Alat 210/0
Mode-B      : MA  210 to MA    256 !
Omnis        : MA 250 to MA     60 !  Move to attitude 120/0, Nov 08
Please don't uplink to B, MA 180-190. Interferes with Mode S.
```

Table 1. AMSAT-OSCAR-13 operation schedule for 1993 from G3RUH.

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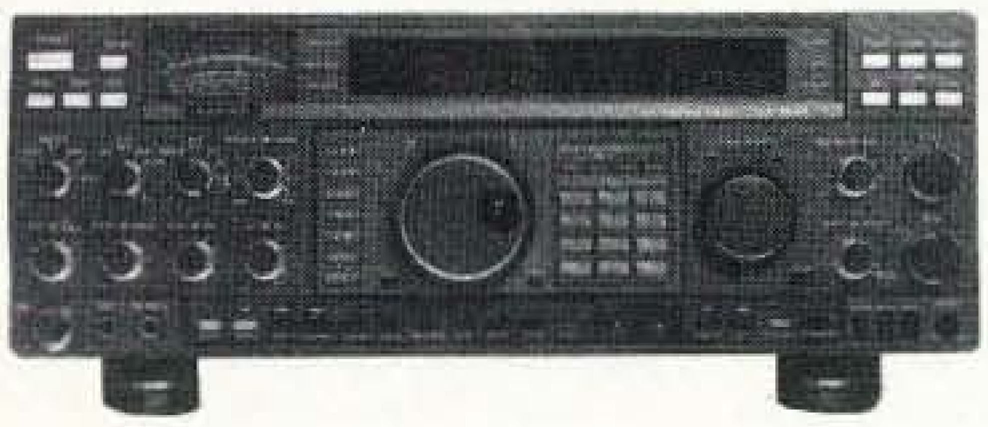

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YAESU U.S.A.

• FT33R/TTP	220MHZ HT	$328.00
• FT411E	2M HT	$299.00
• FT811	440 MHZ HT	$339.00
• FT470	2M/440 HT	$404.00
• FT911	122 MHZ HT	$429.00
• FT5200	2M/44 MOBILE	$629.00
• FT757GXII	ALL MODE HF PORTABLE	$929.00

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SAN JOSE, CA 95128

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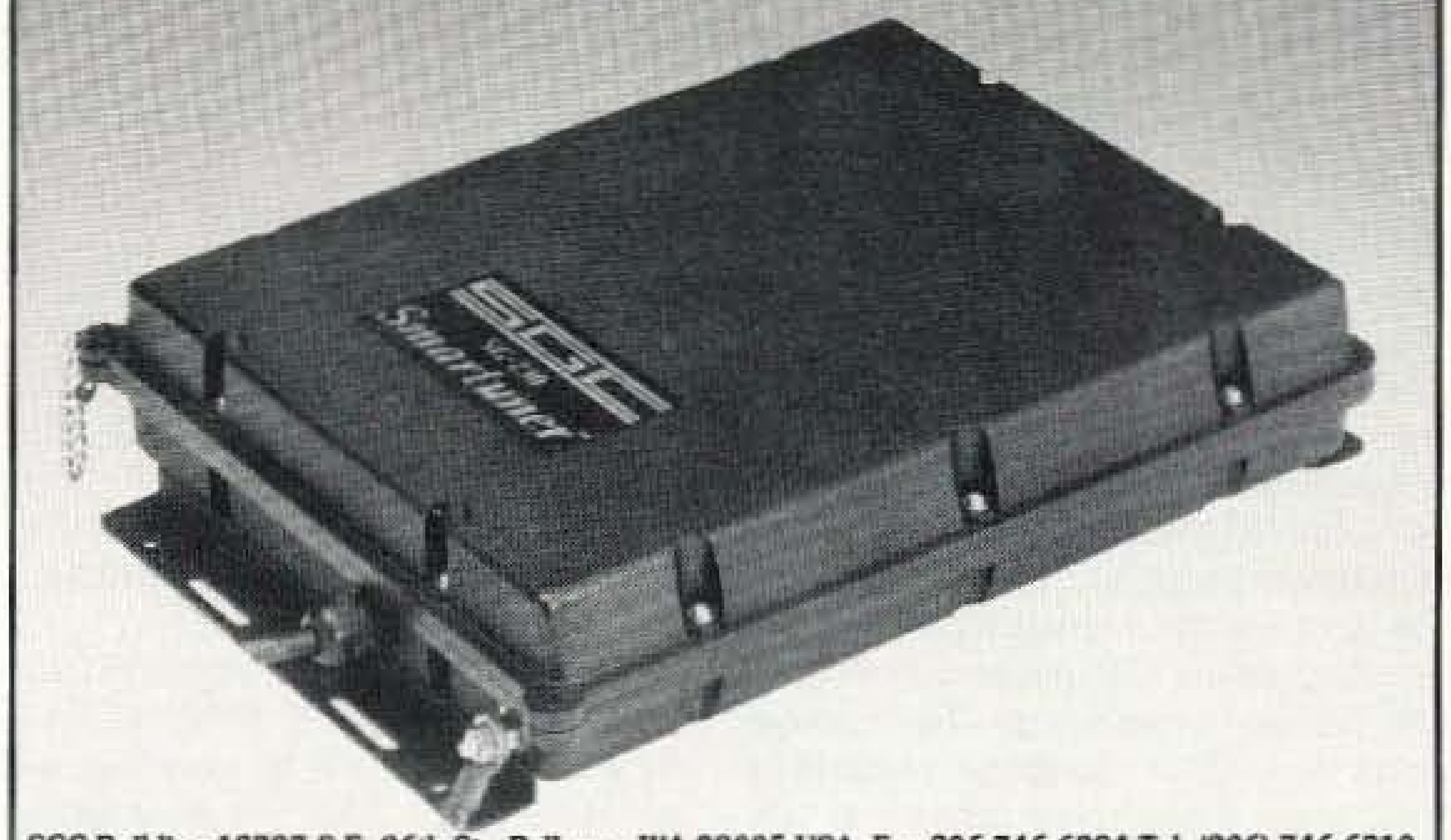

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```
RUDAK2>BEACON:++ Hi, this is the RUDAK-II experiment on AMSAT OS-
CAR 21 ++
RUDAK2>TLM-1:RUDAK-II Telemetry              (92-12-02 13:59:00):
   Voltages          RM1-TCMD-Interface      Lock    Memory Errors
 5V-R1 : 0.80 V         1-TX-ON: OFF         RX2: *     Single: 1
 5V-RTX: 5.04 V      2-RX12&48: OFF          RX3: -     Multi : 0
RUDAK2>TLM-2:5V-RAM: 4.95 V3-RNG             : OFF       AGC
 Total Current          4-Soft: 13.9 V      RX3: 143  Temperature
    14V-I :               315 ma            RX4: 207   21.6 deg C
RUDAK2>BEACON:RUDAK-II Schedule:            Downlink    145.987
UTC (Min. MOD 10)      Beacon Mode          Uplink/MHz
      0...8            FM Repeater           435.016
        9             AFSK Telemetry           no
RUDAK2>BEACON:++ Hi, this is the RUDAK-II experiment on AMSAT OS-
CAR 21 ++
RUDAK2>BITFAT-1:S^BHX@
RUDAK2>BITFAT-2:
RUDAK2>BITFAT-3:
RUDAK2>BITFAT-4:
RUDAK2>EPROM:RUDAK-2 EPROM-Test
```

Table 2. Example of A-O-21 AX.25 AFSK FM data received on 148.983 MHz by N2AAM.

information about A-O-13 operations is always available via the A-O-13 telemetry beacons on 145.812, 435.658 and 2400.646 MHz in CW, RTTY and 400 bps PSK. Active command stations include Peter DB2OS, James G3RUH and Graham VK5AGR. Messages to these volunteers about A-O-13 operations can be sent via the Internet (callsign@amsat.org) or via Compuserve (>INTERNET:callsign@amsat.org). They also get mail via U-O-22. Computer predictions still show a projected reentry of late 1996 for A-O-13.

Several special interest groups can be found on specific frequencies when the appropriate mode is on, but unlike HF, interference is light. The VHF, UHF and microwave signals are not subject to band conditions. DX chasers can be found on 145.890 MHz almost daily. AMSAT schedules operations nets on 145.950 and 435.970 MHz, and directly afterwards on the same frequencies are SSTV nets.

The MICROSATS, Pacsat-OSCAR-16, DOVE-OSCAR-17, Weber-OSCAR-18 and Lusat-OSCAR 19 were launched on January 22, 1990, on an Ariane 4 rocket from French Guiana with UoSAT-OSCAR-14 and UoSAT-OSCAR-15. U-O-14 is no longer performing amateur radio service and U-O-15 failed shortly after launch.

The microsats P-O-16 and L-O-19 are currently operational with 1200 bps (potentially capable of 4800 bps) flying mailbox activity. The uplinks are on 2 meters FM with 70cm PSK (phase-shift keying) downlinks. Software changes are uploaded to provide enhanced operation. These satellites also provide terrestrial packet forwarding services.

DOVE-OSCAR-17 is functional but has not spent much time with the popular 2 meter downlink on 145.825 MHz. Efforts by WDØE and others have focused on restarting the 2 meter 1200 bps AX.25 FM telemetry. DOVE stands for Digital Orbiting Voice Encoder and was sponsored by AMSAT Brazil, or BRAMSAT. Since launch, the goal was to send digitized voice messages through the satellite for educational purposes. DOVE has only spoken once and it was with limited fidelity. Those efforts will continue.

Weber-OSCAR-18 continues to take pictures of the earth. This satellite was primarily built by Weber Sate University in Ogden, Utah. It is slightly taller than the other microsats since it has a camera "penthouse" on top. Images of Peru, Chile, Northern Australia and the southern tip of India were targets for the winter season. The images are sent to earth at 1200 bps using PSK on 70cm. WEBERWARE software is used to collect the received data and display the results. Students at Weber State have also been studying battery telemetry and other data available from the sat-ellite. Comparisons of battery data from just after launch to the present will provide valuable information for future microsats.

Fuji-OSCAR-20 was sent to orbit from the Tanegashima Space Center in Japan on February 7, 1990. It replaced the older F-O-12, which lasted about three-and-a-half years. F-O-20 has both a linear Mode "J" transponder (Mode "JA") and a digital mailbox system (Mode "JD") at 1200 bps PSK. The satellite spends most of its time in "JD" but is scheduled for "JA" operation on Wednesdays, UTC. Signals are strong but careful management of the satellite's power budget and temperature by ground control stations is necessary.

RS-14 went to orbit on January 29, 1991. It is also known as RADIO-M1, RUDAK-2 or AMSAT-OSCAR-21 and is attached to the Soviet INFORMATOR-1. While its linear Mode "B" transponder was very popular at first, today the FM "repeater" mode of the German RUDAK (Regenerative Transponder for Digital Amateur Radio Communications) experiment has sparked the interest of many new satellite chasers. Telemetry and the FM voice (uplink on 435.016 MHz) mode share portions of each 10-minute period. When the system is not acting in the repeater mode, the telemetry can take on many forms, including 1200 bps AX.25 AFSK, 400 bps PSK or even digital voice. Messages of greeting in different languages and even a "get well soon" message sent to Matjaz Vidmar YT3MV have been heard on the RUDAK downlink of 145.983 MHz. Table 2 shows an example of recent AX.25 packet telemetry from RUDAK. The signals were monitored by Dave N2AAM in early December.

RS-12/13 was launched on February 4, 1991, aboard the COSMOS-2123 NAVSAT. COSMOS-2123 is a replacement for COSMOS-1861, which carries RS-10/11. The RS-12/13 package is capable of the same linear transponder modes as RS-10/11, but is most commonly found with RS-12 active in Mode "K," which uses a 15 meter uplink and a 10 meter downlink. Signals are usually strong. Most users call "CQ RS" when accessing the satellite to avoid confusion with other terrestrial 15 meter activity. Many more years of service are expected from RS-12/13, based on the results of RS-10/11.

UoSAT-OSCAR-22 joined the now large group of hamsats on July 17, 1991, primarily as a replacement for the failed U-O-15. After complete commissioning, it has taken over the 9600 bps duties of U-O-14. In addition to serving as a packet mailbox eight times faster than the microsats, it also has a camera experiment on board and has taken some excellent shots of the earth. The 70cm transmitter is not as clean as that of U-O-14 but, with today's modems, copy is very good for the several hundred regular users. Significant amounts of terrestrial packet messages are forwarded through the satellite and its health has been excellent. Messages, programs, pictures and even voice mail have been sent via U-O-22.

Kitsat-OSCAR-23 joined the amateur satellite corps on August 10, 1992. It has a 9600 bps system very similar to U-O-22, but with better transmitter characteristics. The camera system is more sophisticated, with both wide and narrow angle lenses and has provided some fantastic images from space. The mailbox system was released for general use this winter. The orbit is slightly higher than the other University of Surrey-built spacecraft and gives more access time per pass. Some newcomers to satellite packet activity have found the 9600 bps FM mode of the UoSATs and Kitsat less expensive than the 1200 bps PSK mode of the microsats. The link margin advantages of PSK versus FM are overcome by excellent signal levels from the FM satellite transmitters. ■

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73 Review

by David R. Margolis AG8L

The GAP Voyager DX-IV Vertical

GAP Antenna Products, Inc.
6010 Bldg. B
N. Old Dixie Highway
Vero Beach FL 32967
Telephone: (407) 778-3728
Price Class: $390; guy rope, $39.

Operate 160 through 20 meters with this high performance antenna.

For the last two years I've been DXing with 100 watts and two verticals, the Cushcraft R5 and the GAP Challenger DX-VI. The GAP DX-VI is a fine antenna, but its performance on 80 meters is limited by its size and narrow bandwidth. I wanted something better for 80, and also some way to get on 160 meters. Dipoles seemed like a poor choice because of the difficulty in getting them to an effective height. At the 100 watt power level 80 and 160 meters are especially difficult because of the typically higher noise levels and weaker signal strengths, so an effective antenna is a must.

Enter the GAP Voyager DX-IV, the big brother to the GAP DX-VI. The DX-IV is 45 feet tall and covers 160, 80, 40 and 20 meters. The DX-IV was created specifically to provide an antenna solution on 160 and 80 meters; the coverage of 40 and 20 meters is something of a bonus. About 90 kHz is covered on 160 meters, with full coverage on the other bands.

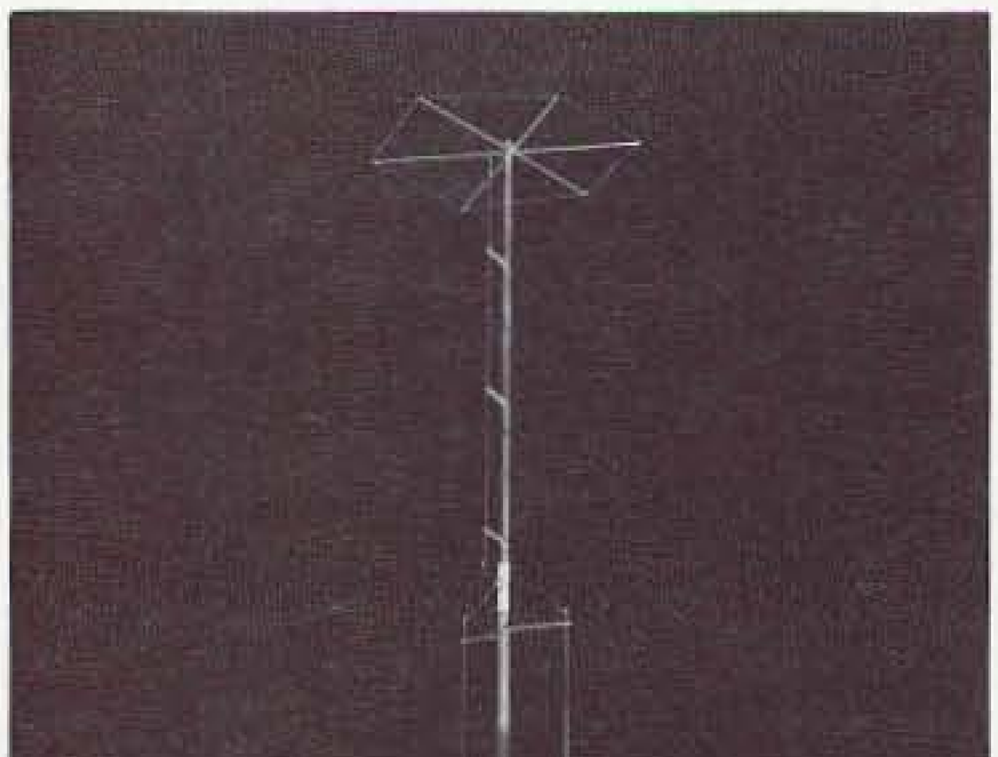

Photo A. The GAP Voyager DX-IV offers 160 through 20 meter operation.

Description

If you're not familiar with GAP verticals, picture a dipole mounted on end. That is the best way I have to describe the GAP DX-IV to you. The feedline attaches to a center insulator (the "GAP") about halfway up the antenna. From there, the feedline comes down inside the lower section of the antenna and exits through the bottom, terminating in a PL-259 connector. Tuning rods attach to three sides of the antenna to provide multiband coverage, and a capacitance top hat (a wire ring six feet in diameter) at the top of the antenna increases the electrical height for 80 and 160 meters.

Unlike traditional verticals, an extensive ground radial system is not required. Only three radials (the manufacturer calls them counterpoise wires) measuring 57 feet are required. The only restrictions on them are that they must be insulated, and they must not run too close to your feedline. They can be buried, and they can zigzag, if necessary, to fit your site. You'll need to provide the wire (it doesn't come with the antenna), but just about any insulated wire will do fine.

I had my DX-IV shipped to my office. It can be shipped by UPS, but you should be prepared to receive a long box. I got some sense of this when the receptionist called and told me, with a note of panic in her voice, that there was an antenna for me in the lobby. She didn't sound too happy. The box is nine feet long, which is the longest allowed by UPS, and weighs about 30 pounds. I managed to get it home in my Taurus by running it diagonally through the car with one end sticking out the front passenger window. If you try this during rush hour, remember to stay on the left side of your lane.

When you unpack the box, you will find several large pieces of tubing, the GAP section with pre-attached coax, and many smaller pieces of tubing. The smaller pieces of tubing are packed inside the larger diameter tubing for protection during shipping. A small box of hardware, the top hat wire, instructions, and a nut driver round out the parts inventory.

Before You Start . . .

Before the antenna can be put up, several things must be done. A suitable site is the first requirement. You'll need a clear area at least 45 feet long with no obstructions (like tree branches or electrical wires) above it. Four pairs of guy ropes spaced 90 degrees apart support the antenna and attach to the ground 25 feet from the base of the antenna, so the 45-foot figure should really be closer to 70 feet to take this into account. The location of the counterpoise radials should also be considered when selecting a site, although you have more flexibility with their placement. The tuning rods at the bottom of the antenna will be hot with RF during use, so an enclosure should be included if children or pets can enter the area.

Another site consideration is the proximity of other vertical metal objects. Allow at least 70 feet separation from towers, other vertical antennas, aluminum-sided buildings, and so forth. My GAP DX-VI antenna is the closest metal object to the DX-IV, at a distance of just over 70 feet, and it has not caused any problems.

The second requirement is to obtain suitable guy ropes. I assumed this would be easy as I ordered them with the antenna. Unfortunately, the rope was out of stock and had to be back-ordered. With a major contest quickly approaching, I was determined to get the antenna up, so I looked for suitable rope locally. Despite being in a major metropolitan area, I was unable to find a good replacement. The guy rope for the antenna should be rated for 300 pounds load, have good UV resistance, and not stretch under tension. This combination of requirements is almost impossible to find in hardware store rope. I settled on a 240-pound-rated Poly (polypropylene) rope, but I used it knowing that it would need replacement within a season due to its poor resistance to sunlight. The 300-pound load rating will keep the antenna standing in a 80 mph wind, so you can get by with something less for temporary use, like Field Day. You'll need 350 feet of rope in all, cut into eight pieces during assembly for the eight guy ropes.

You can use a variety of ground anchors for the guy ropes. I took a different approach as I didn't want to give up any lawn space to the guy ropes angling down from the antenna. Instead of ground anchors, I placed four 10-foot treated 4x4s in the ground, 25 feet from the base of the antenna, spaced 90 degrees apart. The 4x4s were buried four feet deep and anchored with one bag of ready-mix concrete each. Screw eyes were placed about 5-

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1/2 feet up each 4x4 to hold the guy ropes. With this system, the guy ropes don't get in the way when you mow the lawn. More importantly, since the guy ropes are the only thing keeping the antenna up, they are much better protected from accidental damage. I found bite marks recently in the coax that runs to one of my antennas. Unbelievably, the bite penetrated all the way through to the inner conductor of the 9913 (large size) coax. So consider the "critter" factor when deciding how to locate the guy ropes.

The antenna sits on a base mount made of two pieces of angle iron. The bottom of the antenna sits between the base mount and pivots on a bolt. Although the base mount can just be pounded into the ground, I installed mine in concrete. One bag is plenty if you decide to go this route. If you decide to use 4x4s as guy mounts as I did, the base mount should be turned about 10 degrees instead of lining up directly with the 4x4s. Otherwise, one of the 4x4s will be in the way when you try to raise or lower the antenna.

Assembly

Assembling the antenna is quite easy. There is little to measure; most pieces just slide together and connect with screws through pre-drilled holes. The tuning rods are a little less precise. Clamps are used to hold standoff insulators to the main mast, and you must position the clamps. Labels attached to the main mast get you in the ball park. An adjustment step later in the instructions helps you compensate for any inaccuracy. The instructions are adequate, although the supplied 3-D sketch of the assembled antenna is not very detailed and could be improved.

I had a few problems. A short wire was missing (promptly replaced by GAP). The labels for the standoffs on one mast section were reversed, causing the tuning rods to be out of position. This was caught and easily corrected during the adjustment step previously described. The top hat wire (which comes to you as a closed loop) had a knot in it. I just pulled the knot tight (although this requires pliers because the wire is copper-clad steel). The rods that hold the top hat were difficult to insert through the holes in the main mast (corrected by slightly increasing the size of the holes with a pocket knife).

The most disturbing problem was finding out that the pivot holes at the bottom of the antenna were 90 degrees off their correct position. When you assemble the antenna as it lies on the ground, tuning rods extend away from the top and both sides of the main mast. In this position, the bolt that goes through the pivot holes at the bottom should be parallel to the ground. This way, you can just attach the base of the antenna to the base mount and walk the antenna up. With mine, the antenna would have needed to be rotated 90 degrees, and the tuning rods on the side prevent this.

With some head scratching (and being further motivated by falling snow), I found an easy solution. I unscrewed the base section from the sleeve that connects it to the next section (two screws), rotated it 90 degrees, drilled two new holes in the sleeve, and refastened it. Bingo. Easy fix. I talked to GAP later to review the structural impact of my field modification (no problem), and to find out what had happened. Apparently there was no coordination of holes between the top and the bottom of the base piece, and it usually just worked out OK. They plan to check this better in the future.

Raising the Antenna

With the assembly completed and the site prepared, it was time to raise the antenna. I had three helpers, although you could get by with two—two people should walk the antenna up while the third fastens the guy ropes. Walking the antenna up must be done very slowly. My dad was helping and he was certain that the top of the antenna was going to snap off, but the antenna has been designed to handle this, provided you don't go too fast and let the end whip about. After the antenna is vertical and the first set of guys are attached, you can relax a bit. With both the top and bottom guy ropes attached, the antenna is quite stable and the individual guy ropes don't seem to be under much tension. We had problems because a few of our guy ropes had been routed the wrong way and made contact with the tuner rods, but we were able to correct this without taking the antenna down by threading the offending guy ropes through the tuner rods with a long pole while standing on a stepladder.

Performance

How does the antenna work? My first two CQs on 160 brought replies from stations about 500 miles away and 589 signal reports. On 80 meters a short time later I worked a 6W in Senegal through a pile-up. During an SSB DX contest, and using just 100 watts, I worked about 10 countries on 80 meters and 30 countries on 40 meters during the contest weekend. My country total on 80 meters has been steadily climbing, and getting through on 40 meters has been a breeze.

Compared to the GAP DX-VI, the Voyager DX-IV not only adds 160 meters capabilities, it provides several S-units of transmit improvement on 80 meters. I often heard stations before on 80 meters while using the DX-VI but they didn't hear me calling them. With the DX-IV, I usually get through. On 40 and 20, both antennas seem close, with the DX-IV getting the edge by a slight margin. Both are great DX antennas for 40 meters. On 20, I usually use the Cushcraft R5, but to be fair, I have it mounted up on the roof of the house where it has a significant height advantage. On the other hand, the GAP antennas are usually much quieter than the R5 (the difference can be like turning on a noise blanker, with noise sometimes dropping as much as five S-units), so sometimes the GAP antenna is the only way to go.

The GAP DX-IV met the manufacturers SWR specifications without difficulty. As assembled, I had a usable frequency span on 160 of 1.800 to 1.895 MHz, full band coverage on 80 with 1.7:1 as the highest SWR at the band edges, full band coverage on 40 with 1.6:1 as the highest SWR at the top end of the band, and full band coverage on 20 meters with 1.3:1 as the highest SWR.

Long-term reliability of this antenna should be excellent. Except for a small encapsulated tuning device at the top of the antenna for setting the frequency coverage on 160 meters, everything else is tubing and wire. There's not a whole lot that can go wrong with this antenna, and nothing that couldn't be easily repaired in the field.

Customer Service

Customer service at GAP Antenna Products is excellent. I have talked to several different folks there, and they all were knowledgeable about the product and eager to please. Even though I purchased the DX-IV through their distributor, Amateur Electronic Supply, I received complete support direct from GAP, with no questions asked. It is rare to find a company where the employees have such enthusiasm for their product and treat their customers so well.

Conclusion

If you want a single package providing access to 160 meters, great DX performance on the entire 80 and 40 meter bands, and coverage of 20 meters as a bonus, the GAP Voyager DX-IV is your antenna. Great performance, a rugged design, wide bandwidth and superior customer service add up to an outstanding product.

Number 14 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041

Using the NE-602 IC in Ham Circuits

The Signetics NE-602 integrated circuit is one of those few devices that strike the imagination because it is well conceived and behaves like it's supposed to. That latter attribute means that it will work well when amateurs design and build circuits without the aid of SPICE tools or an engineering degree. One of the other chips I place in that category is also a Signetics product: the venerable 555 IC timer.

The NE-602N is an active double-balanced mixer (DBM) based on a transistor circuit called a "transconductance cell." It also contains internal power supply regulation and an oscillator transistor. The DBM works to 500 MHz, while the local oscillator works to 200 MHz.

Figure 1 shows the pinouts of the NE-602 8-pin miniDIP device. Pins 1 and 2 form inputs "A" and "B," respectively. In single-ended circuits, input "A" is typically used, while input "B" is decoupled to ground through 0.05 µF or 0.1 µF. In differential or push-pull input circuits, both input "A" and input "B" are used. The push-pull outputs are pins 4 and 5. Again, both single-ended and push-pull configurations are accommodated. The local oscillator transistor base and emitter are brought to the outside world via pins 6 and 7, respectively. The DC power connections are pin no. 3 for signal and DC ground, and pin no. 8 for +V DC. The DC power supply should be less than +7 volts, or regulation provided.

Figure 2 shows the DC power configuration for the NE-602. In this circuit it is assumed that a higher voltage (e.g. +12 volts) is being used, so a voltage regulator is provided to reduce it to a stable +5 VDC. The regulator can be one of those little 78L05 100-mA IC devices because the NE-602 is not exactly a current hog. A 100-ohm series resistor is used to limit current and improve decoupling. At the power terminal of the NE-602 (pin no. 8), there are two decoupling capacitors: a 100 µF unit for low frequencies and a 0.1 µF unit for higher frequencies. I've used just the 0.1 µF unit with no problems, but I note that most articles on the NE-602 tend to include both capacitors.

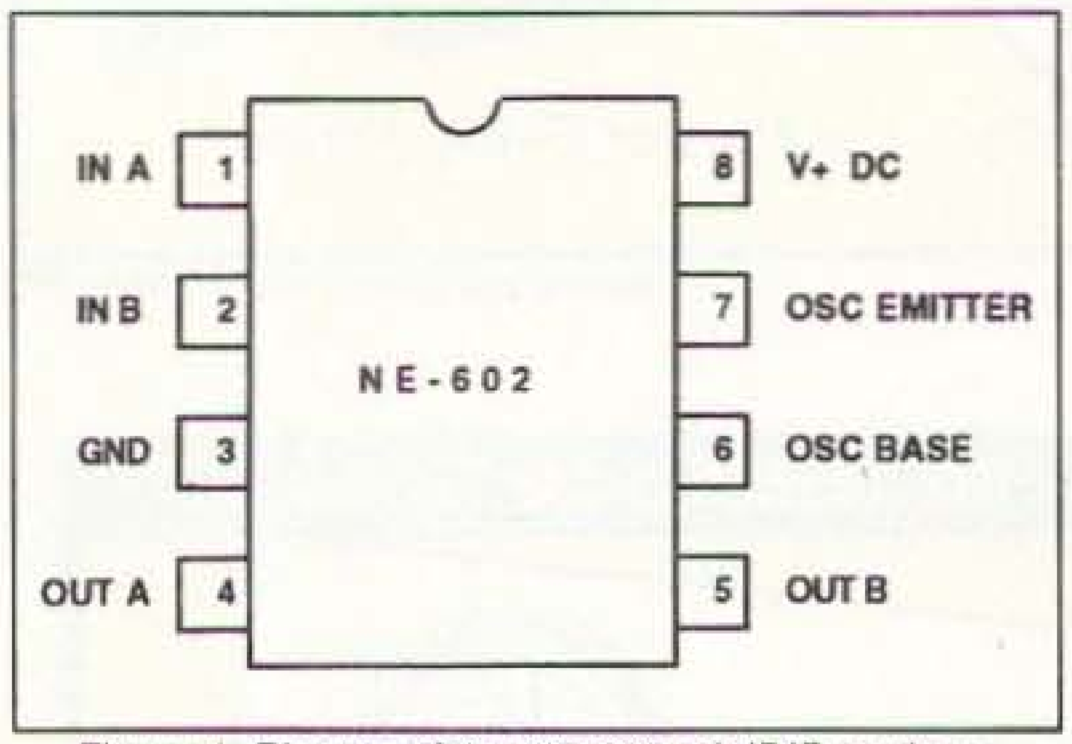

Figure 1. Pinouts of the NE-602 miniDIP package.

You can use a +9 volt DC power supply if a 1,000-ohm resistor is used for R1. The goal is to keep pin no. 8's voltage less than +7 VDC when about 15 mA is drawn. Even so, I recommend that the 78L05 device be used instead of depending on a voltage-dropping resistor.

Input Circuits

Figure 3 shows several input configurations. These circuits are quite varied, and which to use depends somewhat on application and somewhat on preference and convenience. For untuned or high impedance applications, use the direct input circuit shown in Figure 3A. This circuit capacitor couples signal to pin no. 1, and decouples pin no. 5 through a capacitor. The signal level applied to pin no. 1 should be less than 200 mV peak-to-peak.

An untuned differential circuit is shown in Figure 3B. This circuit uses an RF transformer that is not tuned for the input signal coupling. I've used two forms of transformer. First, I've salvaged or adapted, as you prefer, 10.7 MHz IF transformers intended for FM IF amplifier service in transistor radios. The tuning capacitor on the secondary of such transformers can be easily removed in most cases. It is located external to the base of the transformer, in a small recess in the bottom. A small screwdriver or sharp pointed tool will allow access where the capacitor can be crushed into oblivion. The other approach is to wind a toroidal core. I've used the Amidon T-50-2 and T-50-6 cores in 75/80, 40 and 20 meter NE-602 receiver applications with good success. Each core was wound with about 20 turns of #26 AWG enameled wire on the secondary, and about four turns of the same wire on the primary.

The same sort of transformer can be used for the tuned variant shown in Figure 3C. In this particular instance the tuning capacitor floats across the secondary of the transformer. This method works when the capacitor is a trimmer type, or can be insulated from ground. But most variable tuning capacitors are designed to be grounded when mounted to the chassis, so a circuit similar to Figure 3D must be used. In this case, the

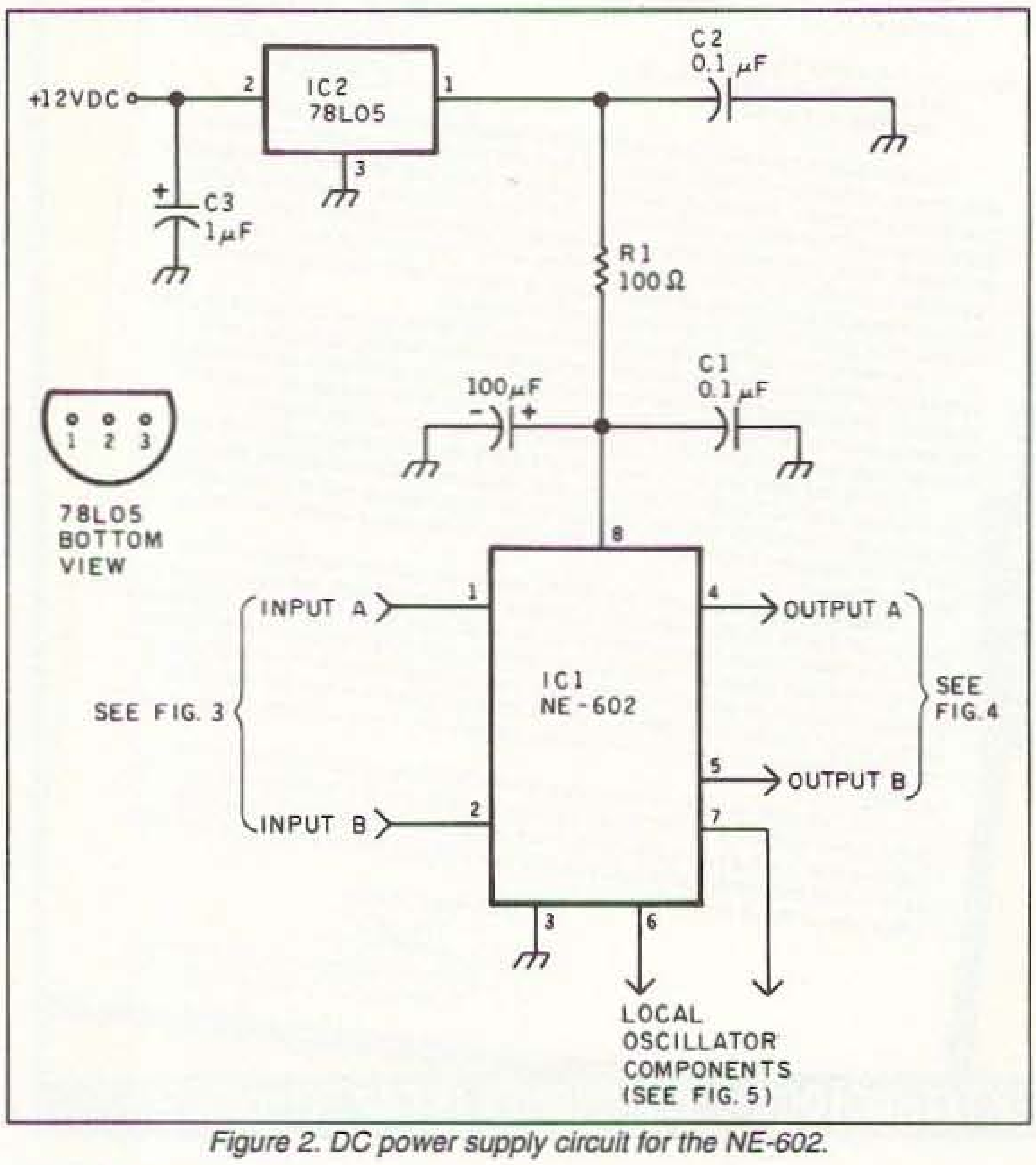

Figure 2. DC power supply circuit for the NE-602.

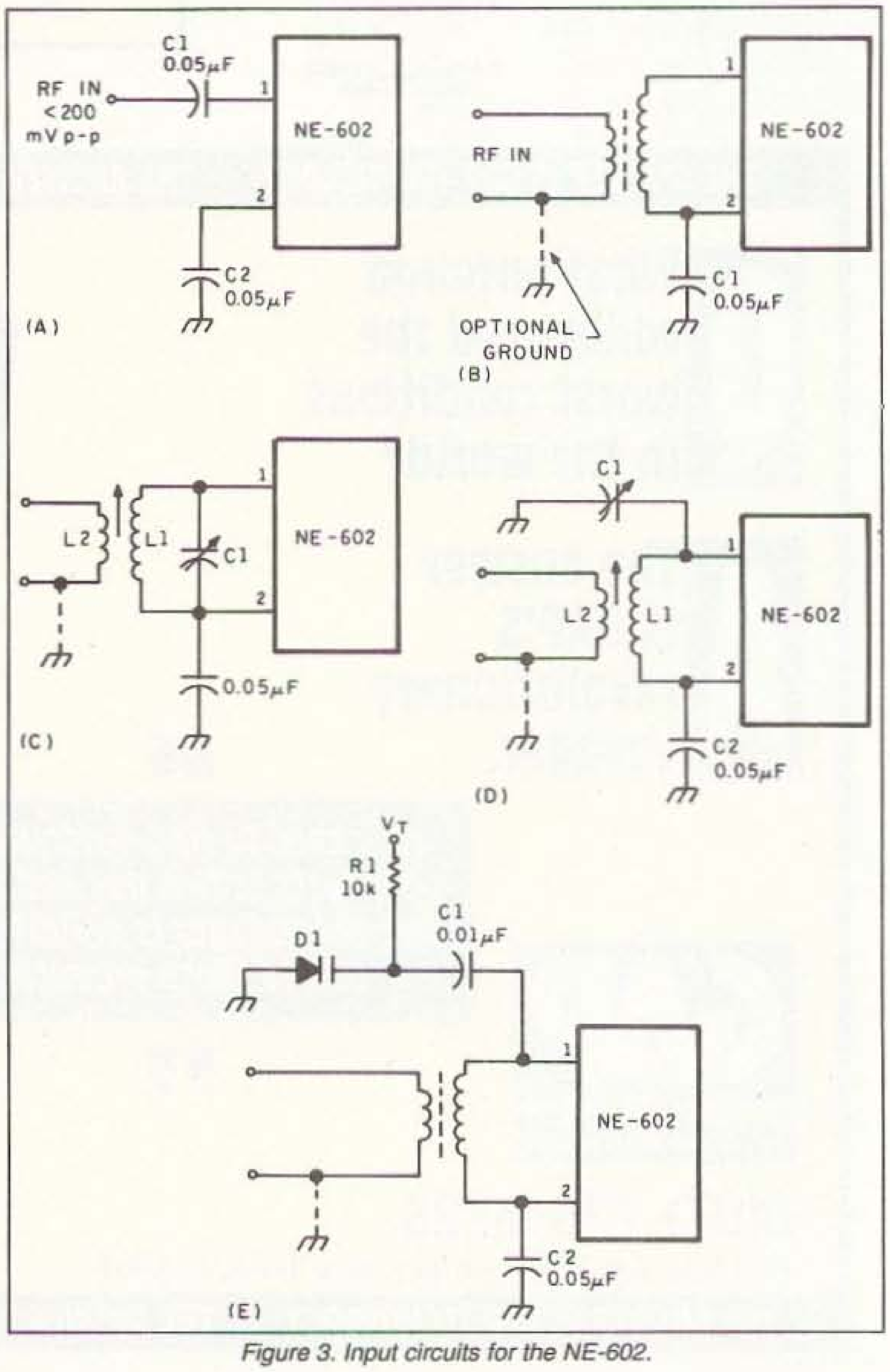

Figure 3. Input circuits for the NE-602.

tuning capacitor is connected from pin no. 1 of the NE-602 to ground. As long as C2 has a value that is considerably larger than the value of C1, the circuit will tune very much like that of Figure 3C.

Finally, given that air dielectric capacitors are hard to find, and often quite costly when available, a varactor-tuned variant is shown in Figure 3E. This circuit uses a voltage-variable capacitance diode to tune the transformer. A tuning voltage Vt from a potentiometer will set the resonant frequency of the circuit.

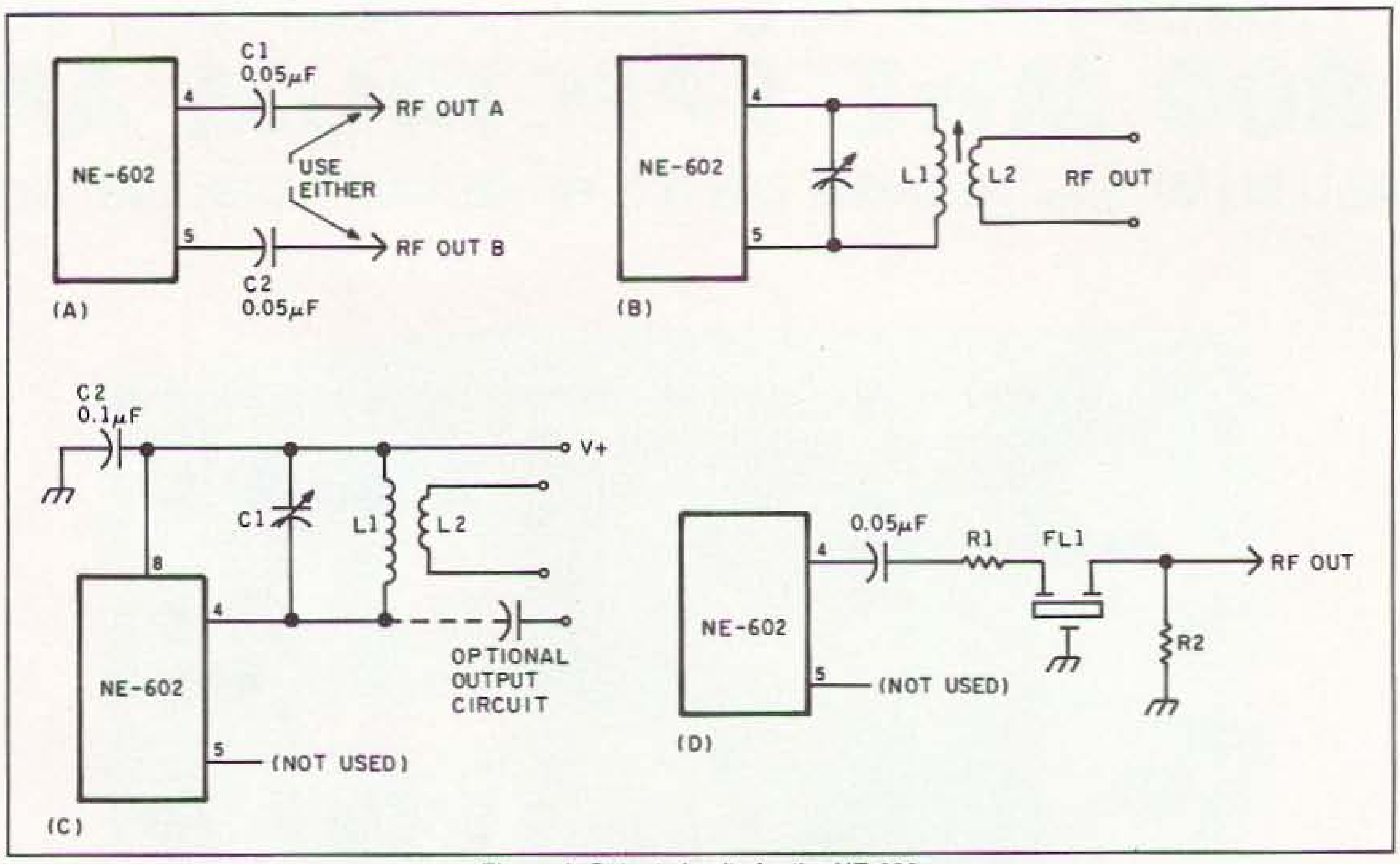

Figure 4. Output circuits for the NE-602.

Output Circuits

Figure 4 shows typical output circuits. Again, several variations are shown. In Figure 4A, the untuned single-ended output circuit is shown. This circuit capacitor couples the signal from either pin no. 4 or pin no. 5 (it rarely makes any difference which) to the rest of the circuit. A balanced output transformer version is shown in Figure 4B. This circuit can use an ordinary IF transformer that matches the 1,500-ohm output impedance, or be specially wound for other applications. A single-ended tuned circuit is shown in Figure 4C. This circuit uses a parallel-tuned resonant tank circuit connected with one end to either pin no. 4 or pin no. 5 of the NE-602, and the other end to V+. Although the output signal is taken from a link winding (L2) on the tuning inductor (L1), it is also possible to capacitor-couple the output with the tank circuit in place. In either event, the output frequency selected will be that of the resonant tank circuit.

In most modern receivers a ceramic, crystal or mechanical filter is used for the IF resonator. Connection of these types of filters is shown in Figure 4D. Resistors R1 and R2 are set to match the impedance of the filter.

The internal local oscillator can be used in either VFO or XTAL configurations. Figure 5 shows several variations on the theme. The circuit in Figure 5A is a crystal-controlled Colpitts oscillator. The two capacitors are semi-critical. The values of these capacitors should be on the order of:

$$C1 = \frac{100}{\sqrt{F_{MHz}}} \text{ pF} \quad [1]$$

and,

$$C2 = \frac{1{,}000}{F_{MHz}} \text{ pF} \quad [2]$$

Although these equations give the impression of a fair degree of precision in the matter of capacitor values, I've found that they are only semicritical. In one NE-602 oscillator that I built I found that changing the crystal frequency more than an octave (i.e. 2:1) did not overly disturb the operation. Those capacitors should be some sort of low tempco type, however, such as polystyrene, silvered mica or NPO ceramic (these same capacitors can be used for any of the oscillators shown here).

The rest of the circuits in Figure 5 are variable frequency oscillators (VFOs). The circuit of Figure 5B is a parallel resonant Colpitts design. Note that the parallel resonant tank circuit (L1/C1) is tied on the "cold" end to either V+ or ground (and it doesn't seem to matter which). The other capacitors in the circuit are selected similarly to those of the crystal oscillator, except that C2 is a 0.01 μF unit.

"The NE-602 is one of those well-designed little chips that has a lot of amateur radio uses."

A Hartley variant is shown in Figure 5C. This circuit uses a tapped inductor for feedback. The capacitors in the circuit (C2 and C3) are 0.05 μF disk ceramic or polystyrene devices. The tuning capacitor is an air variable with a grounded frame.

Another VFO circuit is shown in Figure 5D. This circuit has worked well from 80 meters up through 20 meters. It is based on the use of a varactor ("voltage variable capacitance diode") capacitor. The capacitance of this diode is set by the level of tuning voltage Vt applied to the reverse biased junction of D1.

The NE-602 is one of those well-designed little chips that has a lot of amateur radio uses. Space does not allow us to go further in depth on the device. I am currently writing a book for TAB called *Mastering RF Circuits* (the actual published title may be a little different, but the "Mastering" part will remain because it is part of a series). It will deal in depth with the NE-602 and certain related chips. In the meantime, I would be interested in hearing from readers who have used the chip. Please relate your experiences and any novel uses for it. You might see your name in print if the application is interesting to a broad spectrum of readers.

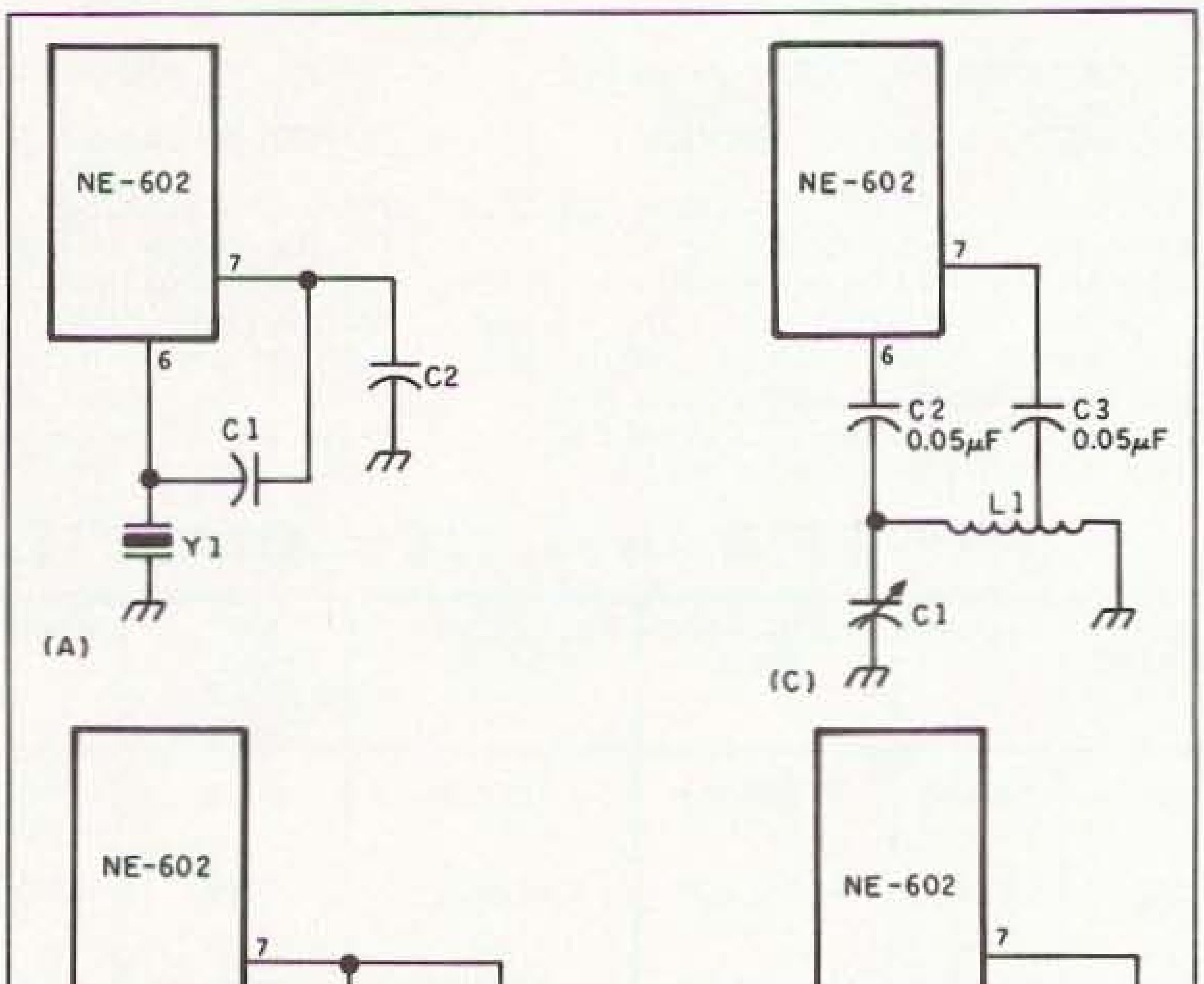

Figure 5. Local oscillator circuits for the NE-602.

HOMING IN

Number 15 on your Feedback card

Radio Direction Finding

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

A Computer on Your Team

Part of the attraction of ham radio as a hobby is the opportunity to use new gadgets to communicate. Hams were among the first to embrace the personal computer as a tool. PCs send and receive CW, RTTY, packet, AMTOR, and SSTV. They log contests, design antennas, and predict band openings. And now resourceful hams are using them to help win radio direction finding (RDF) contests, sometimes called foxhunts or T-hunts.

Last month you saw how Albuquerque T-hunter Jerry Boyd WB8WFK uses a continuously-turning potentiometer at the bottom of his mobile antenna mast to drive a "heads up" direction display on the dashboard (Photo A). The azimuth reading, S-meter voltage and some other signals go to an interface box for digitizing. A laptop computer crunches the data and displays a polar plot of amplitude versus direction on the computer screen. The polar display makes it easier to sort through multipath and noise to find the best bearing to the hidden T.

Although this isn't a project for beginners, WB8WFK's design is straightforward. Hams with a moderate amount of experience with analog and digital circuits can readily reproduce it or adapt it to their own T-hunting needs. This month, we'll examine Jerry's design in greater detail.

Bearings Into Bytes

Figure 1 is the schematic for the analog-to-digital (A/D) circuitry. Each of the eight analog inputs (three are unused at present) passes through an RC filter (R1-8/C1-8) to remove high frequency noise. The filters are on a small circuit board near the BNC analog input connectors.

Filter outputs (even-numbered pins of J2) go via ribbon cable to the main board and into U5, a CD4067 analog multiplexer (MUX). Odd-numbered pins are grounded to minimize noise pickup. Inputs D0 through D2 select the channel address. Only eight of the 16 inputs on the CD4067 are used.

U4 is a National Semiconductor ADC0801 8-bit A/D converter. R3, R4, D1, and D2 provide input protection. Input/output connections to the microcontroller board are made through P1.

U1 and U2 perform address decoding. The A/D is placed at microcontroller address $8000 hex. Since only address lines A12-A15 are decoded, the ADC0801 responds to addresses from $8000 to $8FFF. The A/D is the only hardware in this I/O address space. To start a conversion, the microcontroller program writes to address $8000, then reads from the

Photo A. Jerry Boyd WB8WFK is ready to go T-hunting with his yagi connected to a digital bearing display system. His analog display and interface box are on the dashboard.

same address to get the data.

The A/D's INTR line is connected to memory-mapped port B7. The microcontroller can read this bit to determine if data is ready after a start command. This is not necessary with BASIC programs, but would be needed if a machine code program is used in the future. Jumper JK2 is included to disable this function. Jumper JK1 allows a test voltage from R2 (read at TP1) to be fed to the A/D.

Jerry uses a Micromint model BCC11 computer/controller, which contains a Z8 CPU. It also has a Tiny BASIC interpreter, 6K bytes of RAM and EPROM, one RS232 port, and two parallel ports. It costs $139 and is available from Micromint, 4 Park Street, Vernon CT 06066; (203) 871-6170. If you don't want to build your own MUX-A/D circuit, Micromint sells an 8-bit 8-channel MUX-A/D board for $129.

The Z8 board requires 5 volts at 250 mA for the logic and +/-12 volts at 30 mA for the RS-232 port. You'll need a regulator to supply 5 volts to the microcontroller and A/D board. Small DC-to-DC converters are available to supply -12 volts.

The digital circuitry could produce RFI on 2 meters. WB8WFK had no problems on his local hunt frequency (146.565 MHz), but has "birdies" elsewhere on the band. If this bothers you, check to see if the problem comes from the laptop or the A/D box. Try EMI filters on the power supply and analog inputs. Use good shielded cable for the RS232 link. Powering the system from a battery separate from the vehicle may also help.

Upon starting the program, the PC downloads the Z8 control program from disk to the BCC11 via the RS-232 port at 4800 bits per second. Then it sends a run command to start the BCC11 and displays the main menu.

Jerry prefers the Tiny BASIC method of Z8 programming. "You could burn the program into the on-board 2732 EPROMs," he says. "That would allow faster link speed. But it's nicer doing it my way. On the first hunt, I found something I needed to change. So I typed in a mod to the program file on the PC and reloaded it on the fly.

"You can use any microcontroller instead of the BCC11," he continues, "as long as the software looks like the host mode of a TNC. My PC software sends a command, the Z8 interprets the command and sends back the data in the format that the PC wants. It would be easy to rewrite the PC software to go with another microcontroller because command definition is simple. For instance, when you go into data acquisition, my software sends a '-3' to the controller and it sends back the data packet. There are similar commands for the other modes.

"One thing to watch out for is that the PC software needs a routine to flush out stuff that's echoed from the microcontroller. For example, the BCC11 echoes the command, carriage return, line feed, a question mark and a space. My software strips that stuff out."

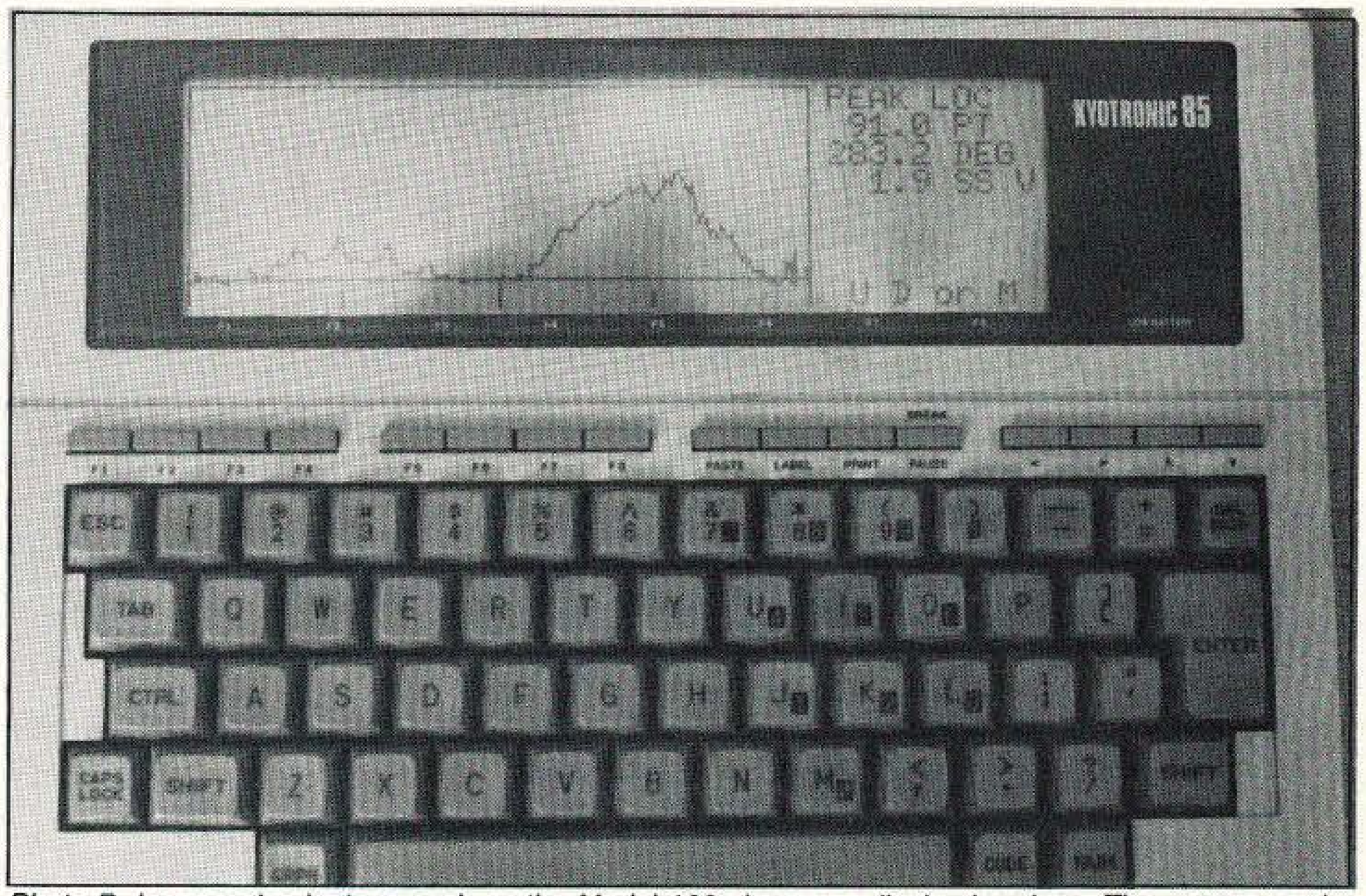

Photo B. Inexpensive laptops such as the Model 100 clone can display bearings. The screen resolution is good enough for an X-Y plot of signal strength versus azimuth, but not a polar plot.

Crunching the Data

A computer with 386 CPU is best for the display because of its high speed. WB8WFK and KA8JMW have experimented with an inexpensive Kyotronic 85 laptop, which is the same as a Radio Shack Model 100 (Photo B). This computer's communications buffer is so small and slow that the Z8 overruns it. If you want to use a Model 100, you will need to implement hardware flow control and a data buffer on the Z8 board. Plotting time will be greatly increased, a disadvantage on mobile T-hunts.

Last month I described WB8WFK's Data Acquisition Mode, which takes data for 25 seconds, plots it, and records it to disk for later playback if desired. Since then, Jerry has added an automatic scaling feature that "blows up" the polar pattern to full size, if required.

"It will cover almost the full dynamic range of the A/D," he says. "Suppose the data has only a 20-count range. I can blow it up to full scale. The user has the option to enter a manual scale factor instead. The display informs the operator if the program is in auto-scale or manual mode."

In addition to the Data Acquisition and Playback modes, WB8WFK has added two new modes, selected from the main menu. In the Calibration Mode, the PC instructs the Z8 to send 8 bytes of data. The PC then displays the channel number, D/A value in counts, and the voltage in volts.

In the Live Mode, the PC instructs the Z8 to send data representing S-meter reading, antenna angle, and amount of attenuation in dB. The display continuously shows and updates this data until the user enters another command.

Like all other T-hunters who use mobile beams, WB8WFK lowers receiver sensitivity as he approaches the T, to keep the S-meter on scale. The internal attenuation system in his ICOM IC22S is adapted from a design by Vince Stagnaro WA6DLQ (see "Homing In" for March 1989).

Jerry discovered that the usual practice of reducing the supply voltage to the first IF amplifier along with the RF preamplifier resulted in improper S-meter action at high attenuation. "On the IC22S," he says, "it worked much better to lift the supply side of R7, R13, and R25 and connect them to the gain control voltage. This attenuates the RF preamp (Q2), first mixer (Q3), and second IF (Q5) stages."

There is a sharp "knee" in the voltage versus sensitivity curve. From full sensitivity at +12 volts, the supply voltage into the three stages must be reduced to +4 volts to attenuate the signal by 15 dB. Lowering the voltage further reduces sensitivity by approximately 40 dB per volt, down to -90 dB at +2 volts.

To display the attenuation value on the screen, this supply voltage is sampled into the A/D (channel 4 "AGC"). The PC program converts the digitized voltage value to attenuation in dB using a fifth-order equation in the BASIC program.

More to Come

Like all projects of this complexity, especially those employing computers, Jerry's RDF system is still a "work in progress." Ideas for enhancements and performance improvements suggest themselves during each hunt. An example is replacing the azimuth sensing pot with a digital shaft encoder. This will eliminate the "dead zone" and improve bearing accuracy.

Jerry recently obtained a 10-bit shaft encoder and matching Hewlett-Packard interface IC. The output of the HP chip will go directly into the Micromint controller. He says his next software version will support both the analog pot and the shaft encoder. Changing a global variable will switch between them.

Jerry also wants to try increasing the sample rate to 100 per second by changing to a machine code program on the Z8. This would provide even faster plotting. He envisions connecting a Loran or GPS receiver to the system to allow computerized triangulation, and a flux gate compass to determine vehicle heading.

To encourage experimentation with digital RDF techniques, Jerry is making his data acquisition and plotting software available to "Homing In" readers. His package includes a disk with the DIGDF source code for the Z8 computer and his latest DIGDF.EXE display program, plus sample bearing files. There is also detailed documentation for the hardware. In return, he is asking for $15 to cover his expenses.

To order or inquire, write to Jerry Boyd WB8WFK, 9128 Surrey N.E., Albuquerque, NM 87109. As usual, this offer is not warranted by *73 Amateur Radio Today* or by me. Kits and circuit boards are not available at this time.

Congratulations to Jerry and Ed for helping bring T-hunting and computers together. Let's hear what the rest of you are doing. 73

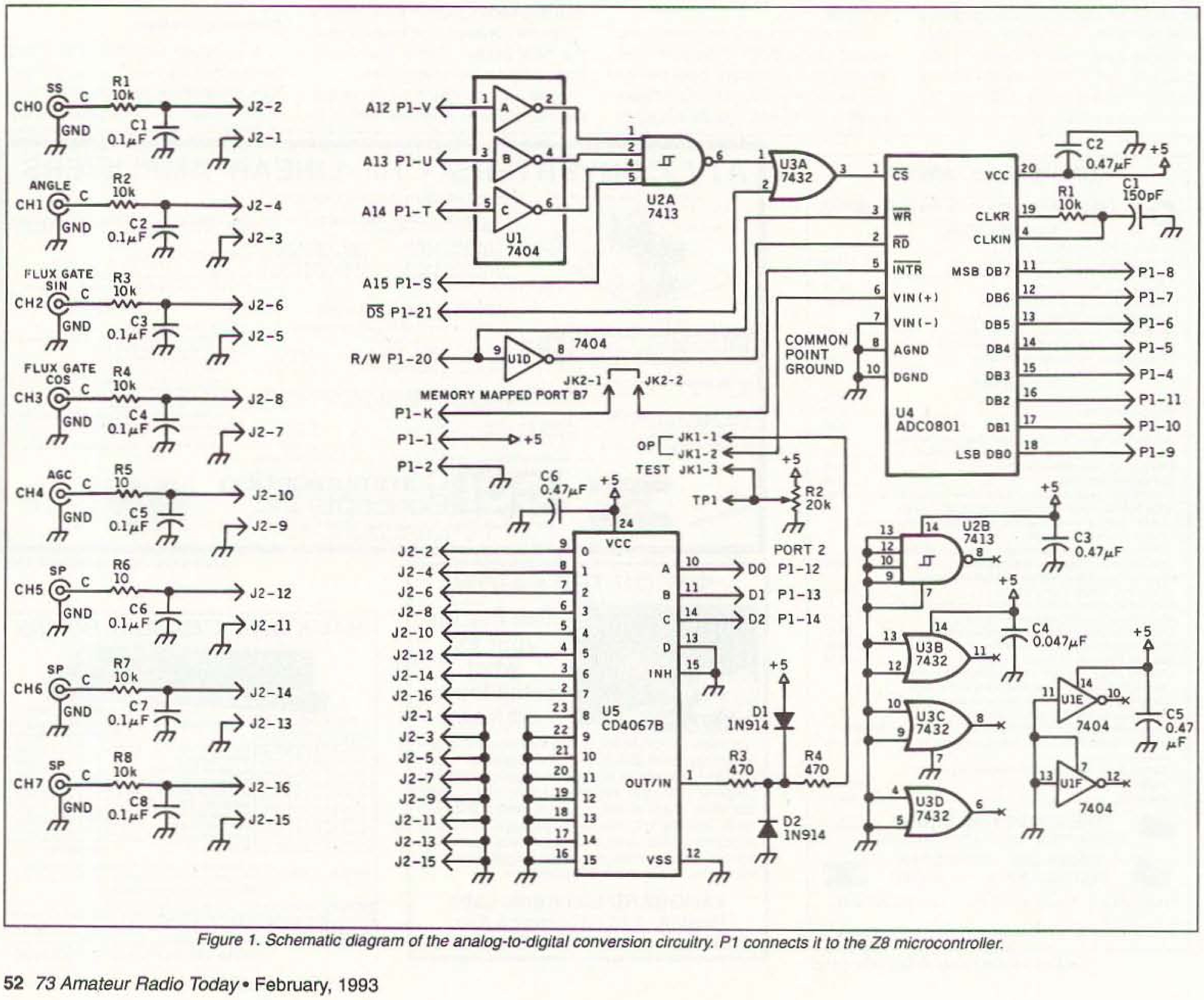

Figure 1. Schematic diagram of the analog-to-digital conversion circuitry. P1 connects it to the Z8 microcontroller.

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CIRCLE 159 ON READER SERVICE CARD

Ham Television

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Peterborough NH 03458

ATV in Monterey, California

When your ATV group pools resources and equipment, the ability to support public events with an impressive display of visual communicatons becomes possible.

This month I'd like to feature one such group from Monterey, California. The Monterey portable public service ATV group was started by Doug McKinney KC3RL in 1987. Prior to that time, ATV was primarily a base station activity. Doug came to Monterey from Washington, D.C., where he had developed expertise in portable ATV public service events through the Metrovision ATV Club (featured in Chapter 16 of the *ARRL Operating Manual*).

The following is a description of the Monterey group's recent activities as described by Doug McKinney KC3RL:

Portable Public Service ATV

In 1987, a group comprised of Doug KC3RL, Elliot KB3LY and Don KB6BZL began to use portable ATV equipment at small 5K runs. These small events generated enthusiasm. Within two years, the ATV group had grown to six ATVers supported by extra equipment loaned by the original group of three. Having a supply of extra portable ATV transmitters, antennas, downconverters, coax and masts really helps when covering these public events. One of the benefits is that you have someone else at the other end to receive your picture!

Today we have nine ATV operators with equipment and 11 trained operators without ATV equipment. In addition, we have coordinated with the South Bay Amateur Television Club members to help with events (in particular Don KK6MX and Renie KC6NBS). The Santa Clara Red Cross ATV coordinator, Bob KB6FEC, has been very helpful by loaning us ATV equipment. Bob's equipment loans have also helped a brand-new group in Alameda County, spearheaded by a dynamo ATV public service coordinator, Sue KC6WXO.

Our public service group has two main purposes: audio and visual communications to help assure public health and safety, and to give operators experience that would enable them to be prepared to assist in the case of a disaster. There are two major events that our group covers that are significantly different in complexity and require what we call the *serial* and *parallel* mode for public service support.

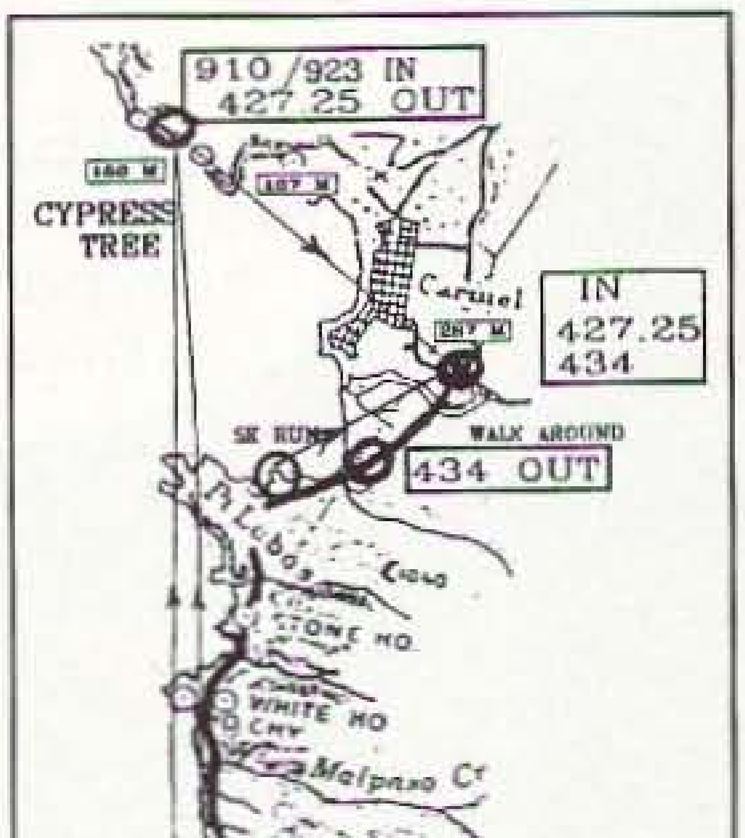

Figure 1. System diagram of the Base Station Control Center for the Hot Air Affair balloon festival.

The Hot Air Affair

The Hot Air Affair is a three-day hot air balloon event held in February at the Laguna Seca Recreation Area and Raceway in Monterey. Laguna Seca is a crater-shaped valley that is 200 feet below the encircling foothill ridge line. This event requires us to use a *parallel* reception path (all transmitters sending to one control site).

In this event we transmit video from the ridge lines into Laguna Seca so the event leaders can see outside of the crater to monitor the sunrise and where the fog is (or isn't). This ensures approriate start times for safe launches. Once the balloons are launched the event leaders are able to monitor where *all* of the balloons are going and direct chase crews for recovery. Additionally, the event leaders wanted ATV from one of the balloons, providing a unique observation platform for spotting any unexpected problems.

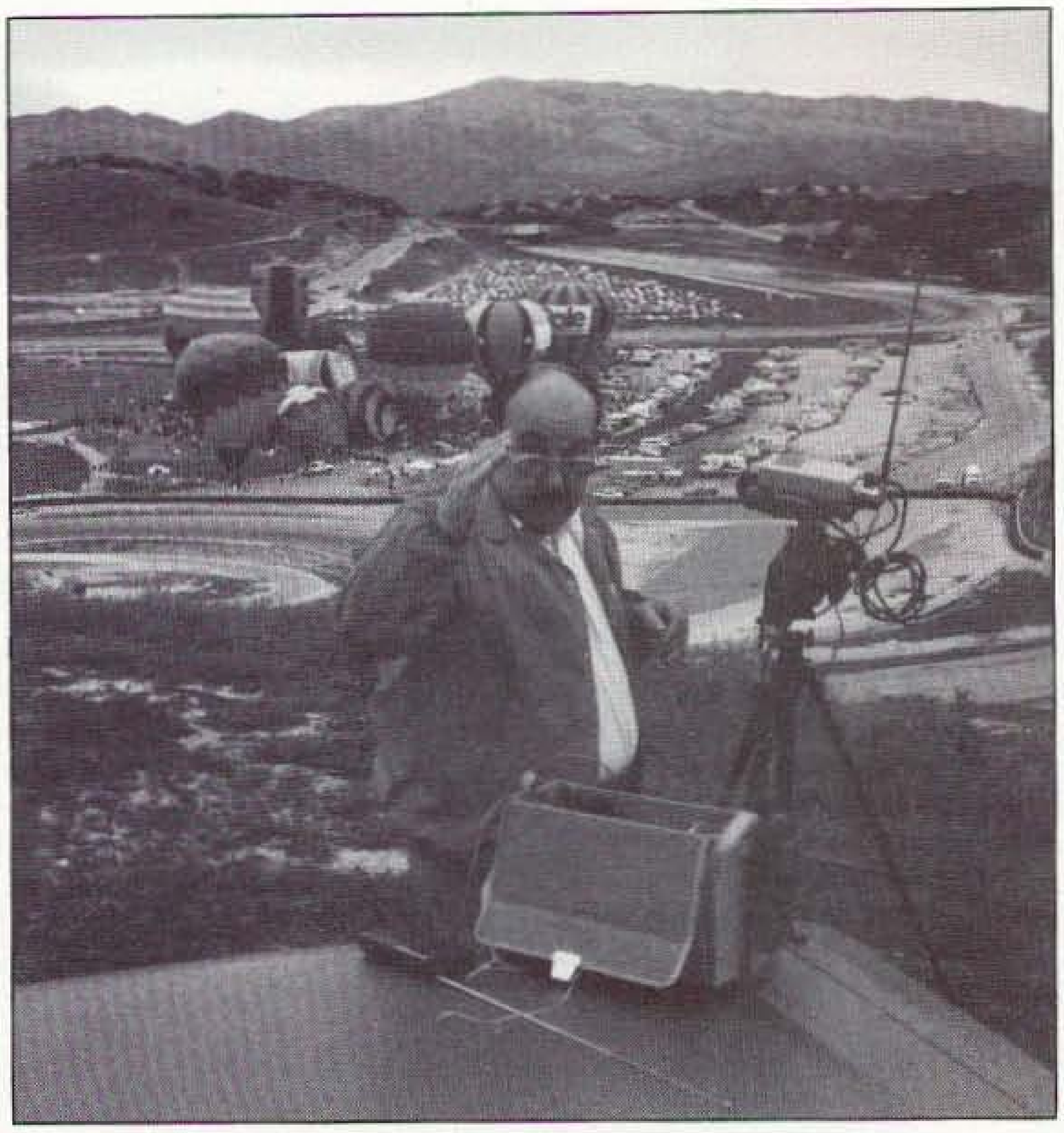

Photo A. Don KC6BZL transmits a bird's-eye view of the hot air balloons back to the launching area from his location on the ridge overlooking the Laguna Seca Recreation Area.

Photo B. Reception from the remote transmission sites is displayed on monitors in the control tent at the hot air balloon launch point. (l to r): Ron KM6DZ, Elliot KB3LY and KC WA6TMK.

The Hot Air Affair has been 100% successful for the last four years due primarily to performing field tests prior to the event to ensure P5 performance from each site.

The Big Sur International Marathon

This is a one-day event held in April. The runners start at Big Sur and run 26 miles to the north, ending up in Carmel Valley. It's a 26-mile "straight line" run on Pacific Coast Highway 1. If you have ever been on Hwy. 1, you know it's anything but straight! The Pacific Ocean is on one side and a very steep mountain range (2000+ feet) is on the other. This rugged 26-mile section isn't accessible by either fixed ham repeaters or cellular phones. The ONLY communications available for this event are portable ham radio remote bases (2m, 220 and 440) and portable ATV repeaters! The nature of this terrain requires us to use what we call the *serial* mode of ATV transmission (signal A going through repeater B and repeater C to arrive at station D).

Each remote ATV site is completely isolated from outside help. As a result, what you have with you is all that you will have during the event.

We have never been completely successful in getting a picture to the finish line throughout the duration of the Marathon. Any number of factors can result in failure in a serial system

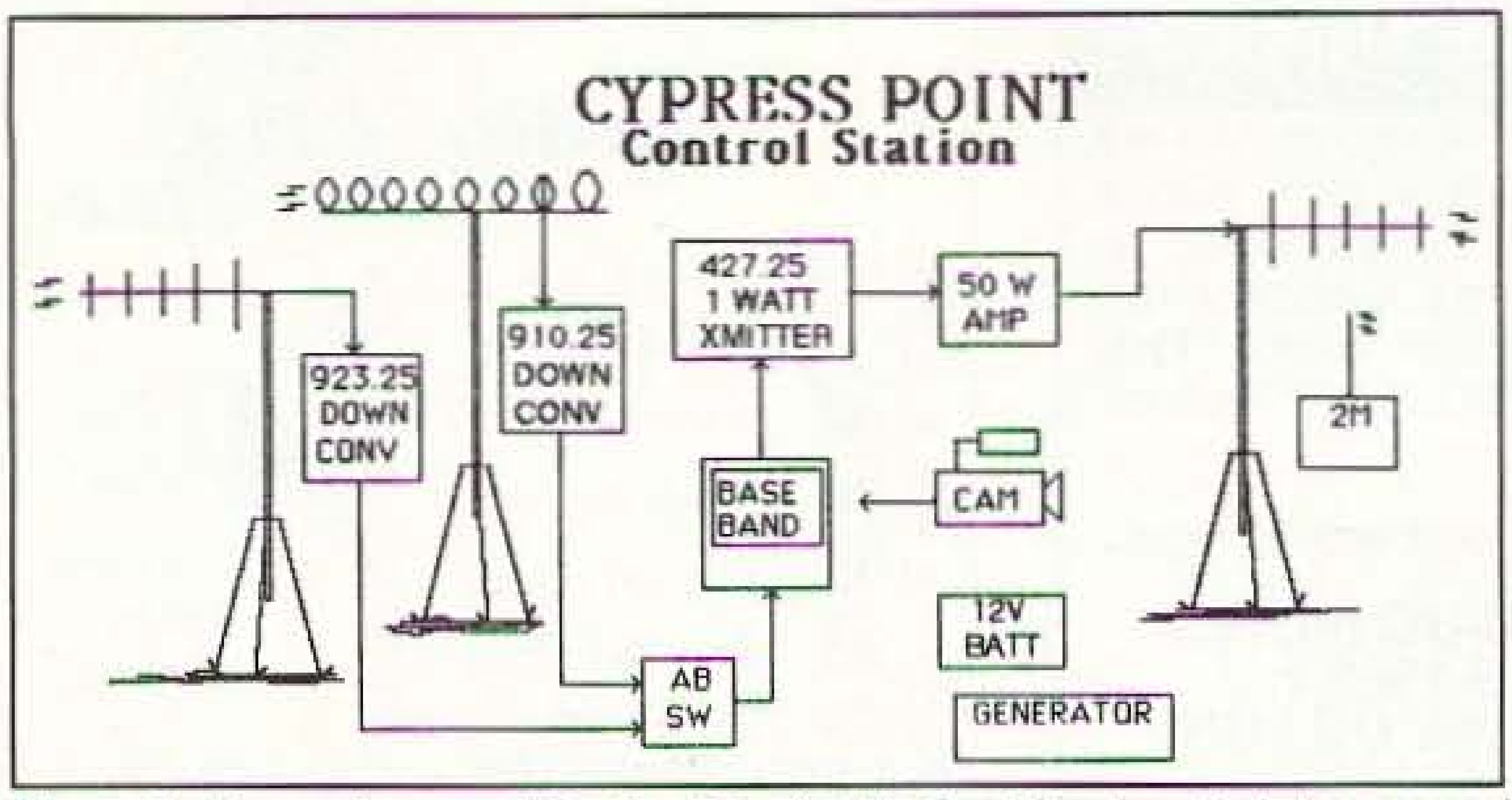

Figure 2. The system used for the 26-mile Big Sur Marathon includes several crossband repeaters at strategic locations along the rugged Pacific Coast Highway 1.

(if just one site goes down, the whole system is out of the picture). In pre-Marathon testing everything worked well, but problems developed during the actual event.

We've listed some of the things we now watch out for (gathered from the School of Hard Knocks) during testing of this kind of system that may be useful for those planning such a event:

•Check *all* of the equipment and operators in the pre-test.

•Use good coax and standardized connectors.

•Have the ability to do on-site repairs (butane soldering irons come in handy on top of a remote hill).

•Use a power source with proper connectors and an ATV transmitter adjusted for operation on 12.5-volt battery power (instead of the normal 13.8 volt shack power). The pedestal adjustment on our 910 MHz ATV transmitter seemed particularly sensitive to voltage changes.

•Have a portable TV at each site to monitor your signal (LCD sets work great for this) to verify that your transmitted signal is good.

•Reduce interference by using high-gain antennas before resorting to increasing transmitter power.

•Cross polarize antennas for multiple inband transmitters (about 20 dB or about two P-units reduction in interference is possible).

•For crossband repeaters, use a portable 5" color TV which has video in and out capability (i.e. downconverter into channel 2/3 and baseband video out to the transmitter). This arrangement lets you see the video quality of the received signal.

•Use interdigital (VSB) filters to reduce inband and crossband interference.

PORTABLE ATVERS IN MONTEREY

Operators with equipment:

Doug KC3RL	Don KB6BZL
Allen KC6VJL	Bev KC6AMI
Elliot KB3LY	Pat KA6IRS
Paul KQ6G	Mike WA6EOC
Smitty K6DYX	

Trained operators:

Cal WW7G	Keith WE6R
Charles KN4DG	Judy KD6FYL
Pat AA6EG	Mario KD6ILO
Ron KM6DZ	Rick K6TST
Renei KD6OCP	Charles KC6UXP
Barbara KC6AWM	

Planning for Success

Good planning is absolutely required for success. If your group would like to cover an event, here's some basic elements you should investigate before you start:

•Determine the public service need.

•Develop a detailed plan with the resources available.

•Coordinate with the event leaders to ensure that their needs are met.

•Test the full plan well before the event (see the previous section for problem areas you may encounter).

•Since our early efforts, we have found our limitations and we have found new solutions. Coverage of these events is a great way to get the local ham population involved in ATV and public service. By following these simple guidelines, our group has become proficient in point-to-point and remote base repeater ATV operations.

There is another benefit to our experience in covering public events. In the event of a disaster, our group is ready to provide portable video capability for emergency relief efforts wherever needed. To this end we periodically participate in disaster preparedness drills. It's always great to impress the ARES coordinators with P5 video at the command center during a disaster drill. 73

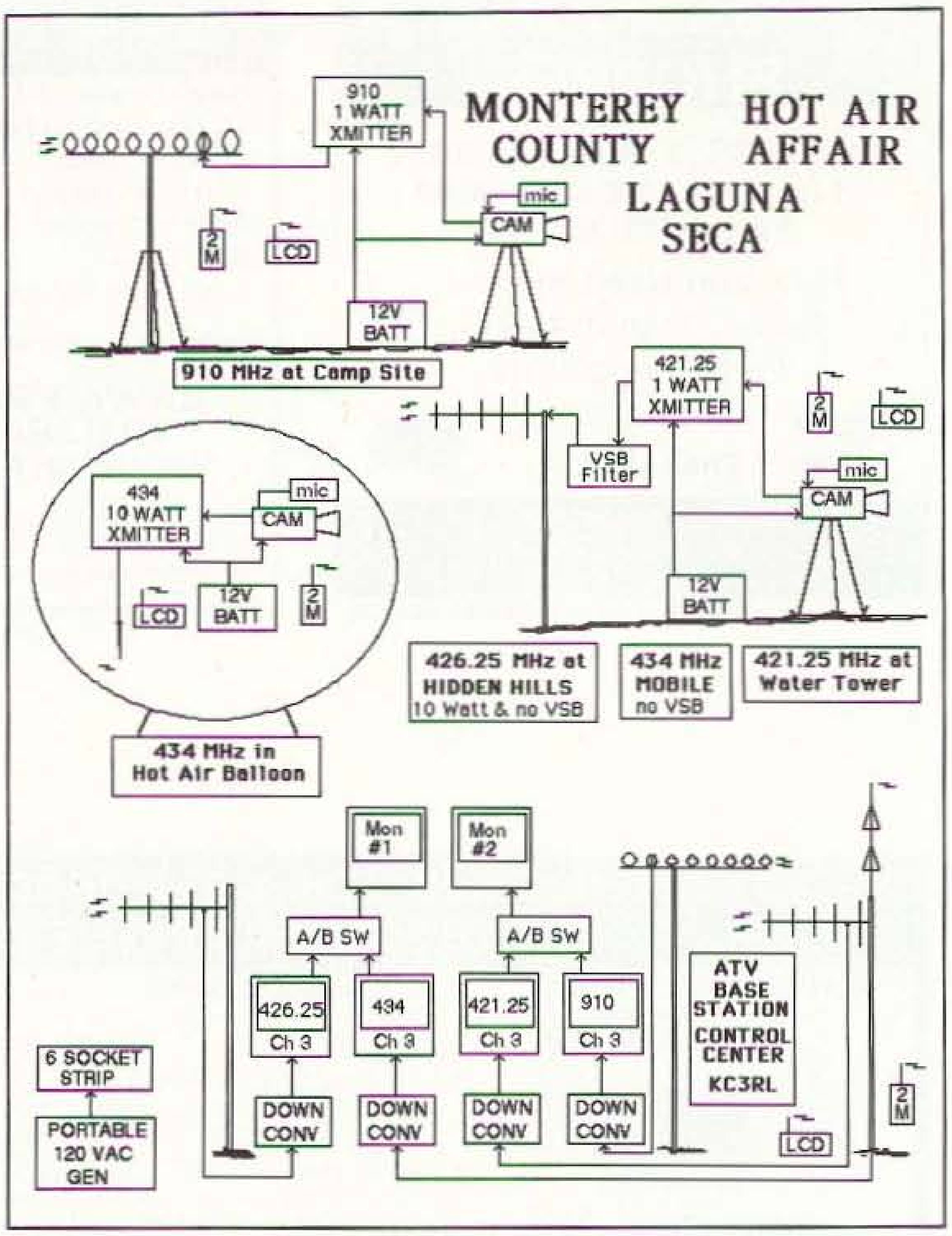

Figure 3. The Cypress Point relay and control station has two 900 MHz band inputs which can be selectively repeated out on 427.25 MHz.

Photo C. Bev KC6AMI operates mobile ATV from the press truck during the Big Sur Marathon. Note the small LCD TV she uses to monitor her transmissions.

Number 17 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors, Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Discovering The Discovery Place

When Ervin Jackson N4BIG and Tom Bradbury NU4G first began telling me about their exciting efforts at Discovery Place in Charlotte, North Carolina, I knew that there would be lots of great ideas worth sharing with other teachers and instructors. The Mecklenburg Amateur Radio Society envisioned a place where thousands of visitors, especially youngsters, could be attracted to an exhibit that would educate them in ham radio, electronics, and world geography.

Over 500,000 people a year come to visit the South's largest science and technology museum, and its mammoth new Kelly Space Voyager Planetarium and Charlotte Observer Omnimax Theater. Discovery Place, now the W4FB Amateur Radio Education Center, is part of the museum's new $14 million Michael J. Smith Wing, which opened last fall. It was named for the North Carolina astronaut who was killed in the horrific space shuttle *Challenger* explosion.

Ervin tells me that the very newest attraction is the addition of TV. This attraction has really excited the student visitors (over 100,000 schoolchildren each year) because they can easily identify with TV. The television input frequency is 439.25 and output is 421.25. If you are a home viewer in the Charlotte area, you can tune into cable channel 60 for the input picture and cable channel 57 for the output picture. The audio input is on 2 meters at 147.45 and the output audio rides on the subcarrier of the TV channel. The TV repeater is W4PHN.

Both Ervin and Tom speak enthusiastically about how popular Discovery Place is once the school year begins. All the science classes of the Mecklenburg School System attend Discovery Place for lectures that are considered part of their regular curriculum. Until 2:30 p.m. each day one can see school buses coming and going; then there is a lull until the after-school crowd arrives. It seems that everyone goes by the station at least once during a visit to the "hands on" museum.

The station sits behind sliding glass doors between the museum cafeteria and the gift shop, just down the hall from the Omnimax entrance. Station manager Bob Southworth KI4YV is a retired electrical engineer who, by all accounts, has a world of patience with the youngsters who line up for on-the-air demonstrations. Two ham radio volunteers are needed to handle the large crowds that come through the exhibit—one of them keeps the QSOs going while the other answers specific questions from the students and visitors. Those who visit the station can see demonstrations of the hobby with a packet station, an all-mode 2 meter rig and an HF setup, complete with a beam atop a 60-foot tower mounted on the roof of the five-story museum addition. There is even an SWL corner where they can tune the shortwave broadcast bands.

The station also has groups who visit with prearranged appointments. These groups are given a 20-minute lecture about amateur radio. Live demonstrations follow, and then a question-and-answer period. Ervin also informs me that they have enjoyed the visits of

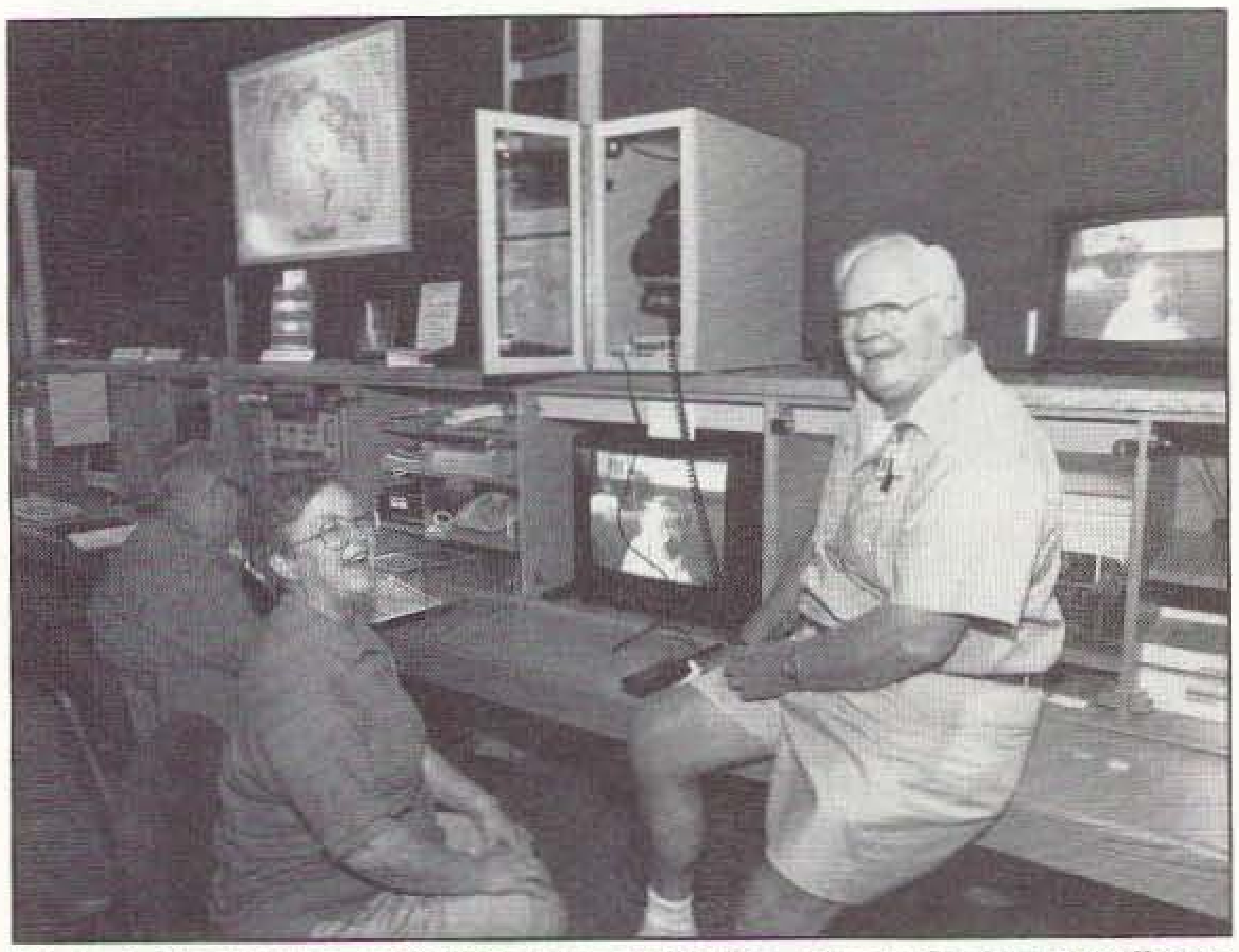

Photo A. David W. Lewis K1CBB pictured with Mrs. Beverly Sanford, a staff coordinator of Discovery Place. This was the museum's first viewing of ham radio TV (ATV)—Discovery Place's newest attraction. Photo by Ervin Jackson, Jr. N4BIG.

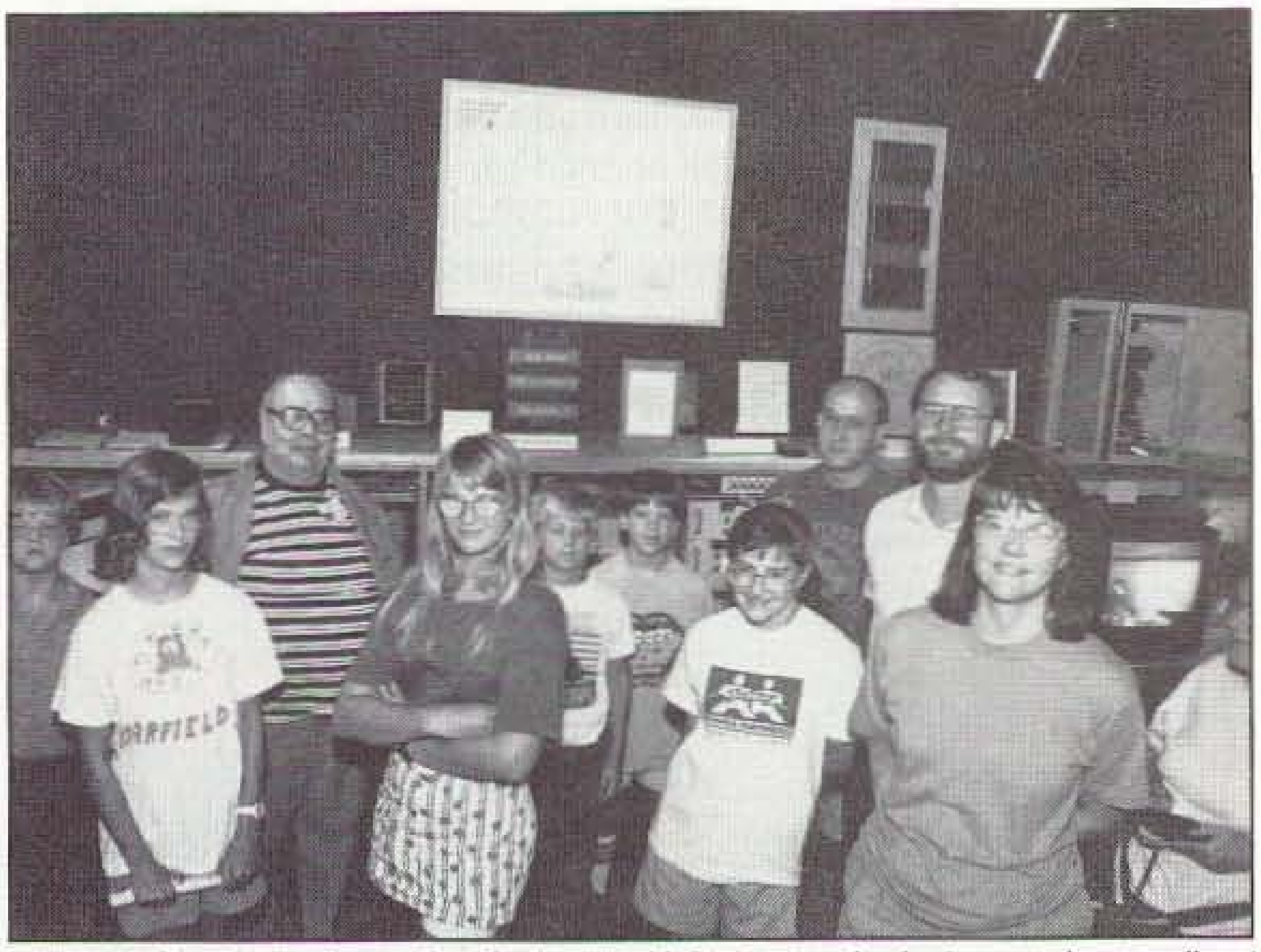

Photo B. Members of the Mecklenburg 4-H Club attend a lecture on ham radio at the station. Photo by Ervin Jackson, Jr. N4BIG.

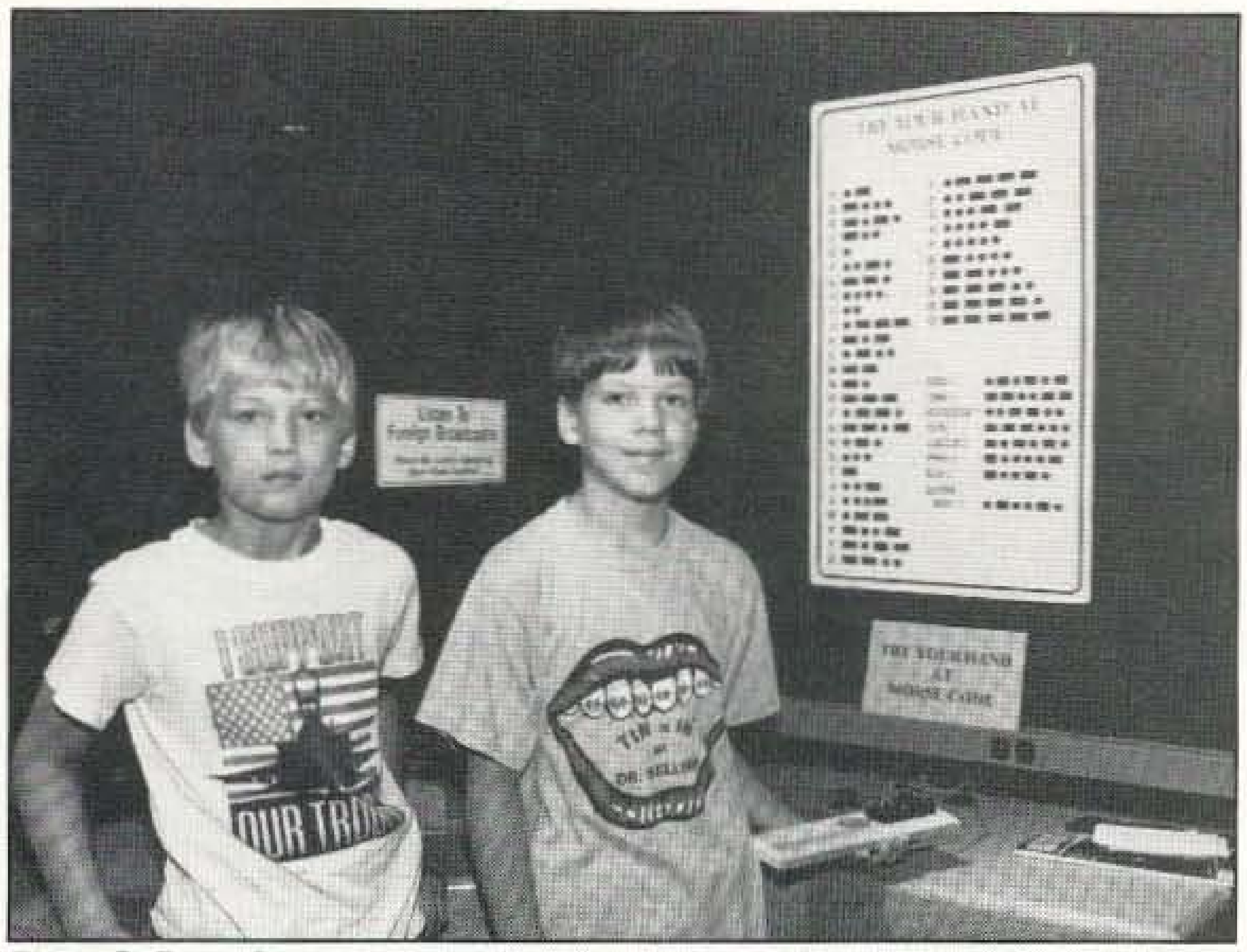

Photo C. Peter Gable and Dana Rucker, members of the Mecklenburg 4-H Club, attend a lecture on ham radio conducted by Bob Southworth KI4YV, manager of the W4BFB Discovery Station.

many foreign hams who have talked with the station previously and wanted to see it. Wonderful contacts have developed between other science museum stations, notably Montreal, Canada, and London, England.

Guidelines for a Ham Radio Exhibit

The group has put together an excellent list of suggestions for anyone interested in assembling a ham radio exhibit. I'll list some of the key suggestions, along with a reminder that these exhibits are excellent projects not limited to museums—they can do wonders for your recruiting efforts when properly set up in a mall, at a school, at a convention center, in a church, at a scouting meeting, at a local fair, or anywhere large groups of people, especially youngsters, will be attending.

1. **Display of QSL cards from all over the world.** This has a high visual impact and conveys the message that we talk to the world. Be sure to include an insert explaining what the information on the card means, i.e. RST means readability, signal strength, tone.

2. **Frequency spectrum chart.** Like the QSL cards, this is visually attractive and requires no personnel. It can show where the ham frequencies are located with respect to radio, TV, police, and fire, etc.

3. **Chart showing requirements for a ham license.** List the license categories, with a brief description of the requirements for and privileges of each.

4. **Handouts.** Hand out the many attractive ARRL brochures, along with an ARRL coupon to mail in for more information. Distribute a sheet listing club meetings for all local radio clubs and a list of where the Novice classes are held. A handout with the Morse code and Q signals on it is always a favorite.

5. **Comparison chart showing the differences between CB and ham radio.** Folks are particularly interested in noting the power and frequency differences. I do this with my own ham radio classes every year, and the children can relate to it since most of them are already familiar with CB.

6. **Photo collage showing ham radio activities.** Be sure to have lots of pictures of children having fun in various ham radio activities. Include Field Day, hamfests, emergency communications, local parades, satellites, contests, repeaters, traffic handling, antenna installations, etc.

The club also suggests having two booths with a key and buzzer in each, along with a copy of the Morse code, a ham-band-only receiver behind a protective plastic shield, but extended tuning knob, volume knob, and band switch through the plastic, along with earphones to hear ham radio QSOs.

Other good ideas for the exhibit include: a price list showing station costs, starting with a very modest setup—debunk the notion that it is a very expensive hobby; a world map showing call letter prefixes; a Morse code decoder box to decode received CW signals, or a continuous tape to feed the decoder box at about 5 wpm, and a set of earphones; a small terminal to monitor packet radio activity on 145.01; and an exhibit of old radio gear and new radio gear as a contrast.

Through the outstanding efforts of groups like the ham radio operators who support and maintain the station at the Discovery Place, and other such museum groups throughout the country, hundreds of thousands of children and adults are being exposed to the excitement and diversity of amateur radio. These museum groups are to be commended for their achievements. We as educators and instructors should support their good works and take advantage of what is being offered by bringing classes to these exhibits and by publicizing what they're doing.

For information on operating hours for Discovery Place and the W4FB Amateur Radio Education Center, write to: Discovery Place, 301 N. Tryon Street, Charlotte NC 28202; or call (704) 372-6261. ■

QRP

Number 18 on your Feedback card

Low Power Operation

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Power MOSFETs

The schematic shown in Figure 1 shows how a power MOSFET is configured as a high-side switch. Also, note the difference between the "P" channel device and an "N" channel device. The use of a "P" channel power MOSFET allows the designer to cut the number of discrete components because a charge pump circuit will not be required. On the other hand, the use of a "P" channel power MOSFET, with its higher RDS(on), will generate more heat and thus diminish operating efficiency. It then becomes a trade-off in the number of extra parts needed for the gate driver (voltage pump) or the loss of efficiency with the "P" channel device. Even the best "P" channel power MOSFET on the market has a rather high RDS(on) of an ohm or two.

You can use the power MOSFET as a simple switch. I have used them to replace a switching transistor in some projects. A common example is to use a transistor switch to operate a relay for T/R control. As shown in Figure 2, a power MOSFET will work quite nicely in this configuration. The only requirements will be the proper gate voltage and, of course, the amount of current the relay will draw. This is normally not a problem with a power MOSFET; a drain current of several amps is common.

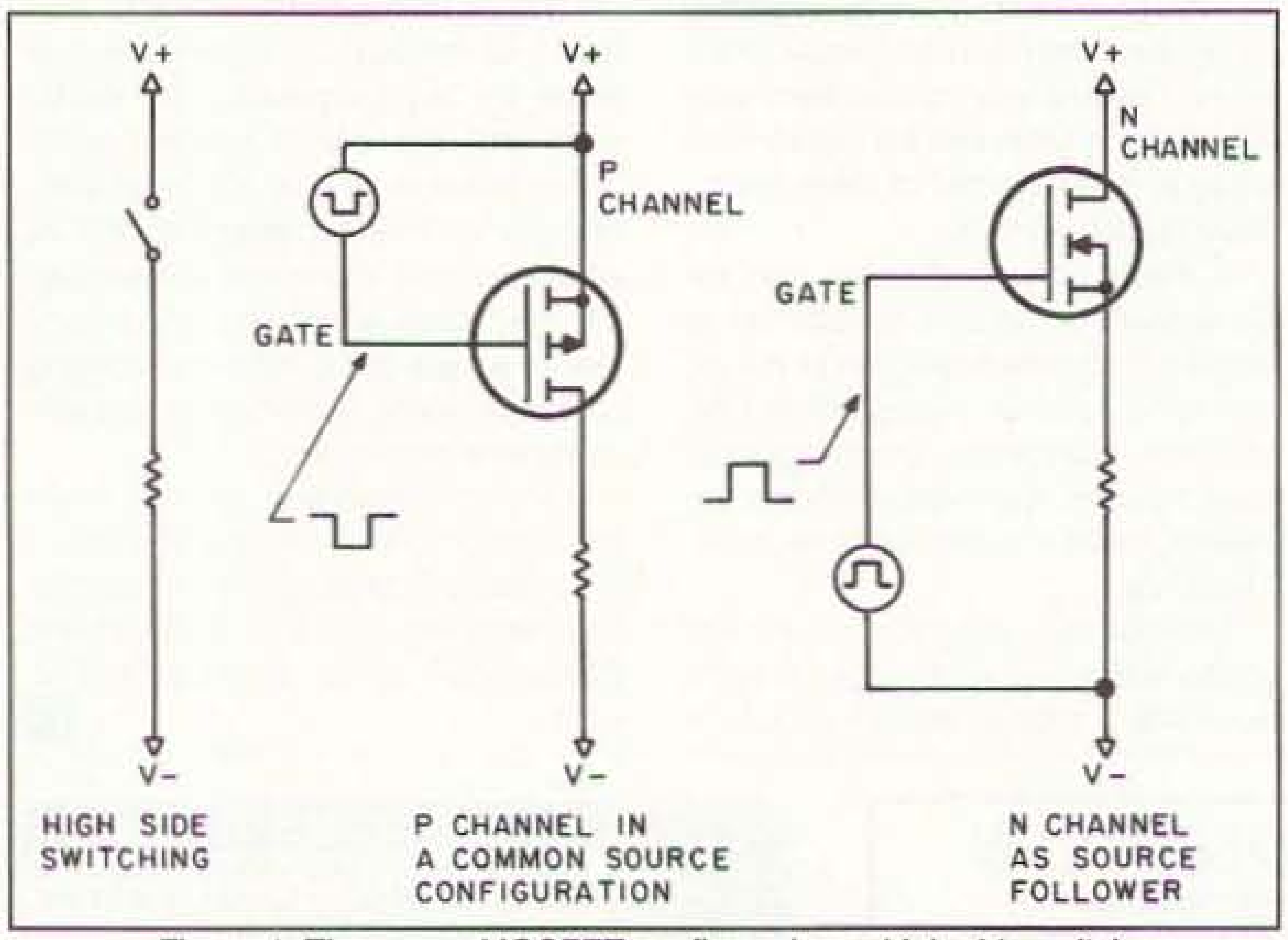

Figure 1. The power MOSFET configured as a high-side switch.

The power MOSFET is turned on by applying +10 volts to the gate. This requirement is easily handled by using a CMOS gate since the output of the CMOS gate is usually over 10 volts when operating with a 12-volt VCC line. Depending on the MOSFET, gate capacitance may cause some distortion when rapidly switching the MOSFET. In the case of our T/R relay, the distortion will never be noticed. Capacitance of several pF to several thousand pF is common, depending on die size. In some cases, paralleling CMOS gates together will help overcome the difficulty in driving the power MOSFET directly from a CMOS IC.

With the extra gate capacitance, the turn-off time may be too long. A transistor switch may be added to reduce the on time after the gate drive has been removed.

Using TTL logic will increase the drive current, but the normal VCC of TTL logic, just +5 volts, will not drive the power MOSFET fully on. In this case, a transistor switch may be employed to supply the gate drive. Such a circuit is shown in Figure 3. Notice the use of a PNP transistor. When the base of the transistor is pulled low, the transistor is turned on and voltage appears on the collector. This voltage then turns on the power MOSFET. Again, this circuit will work up to several kHz before the switching distortion becomes troublesome.

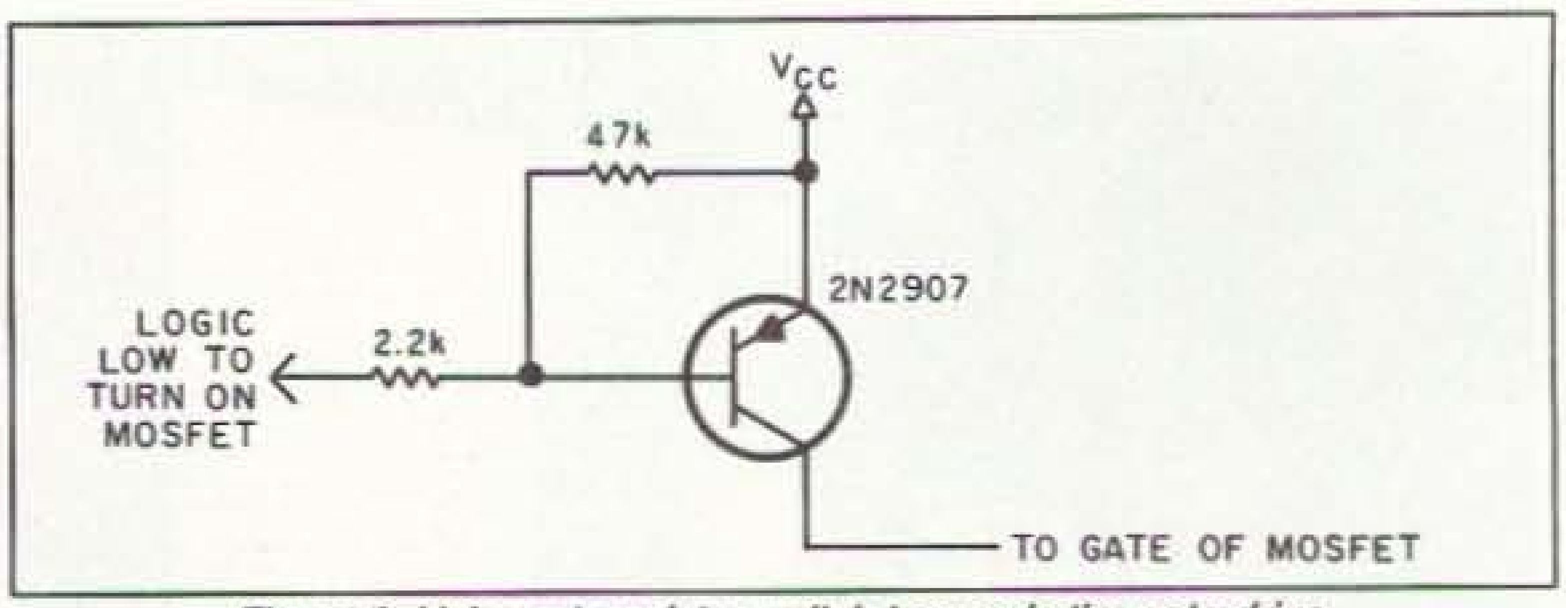

Figure 3. Using a transistor switch to supply the gate drive.

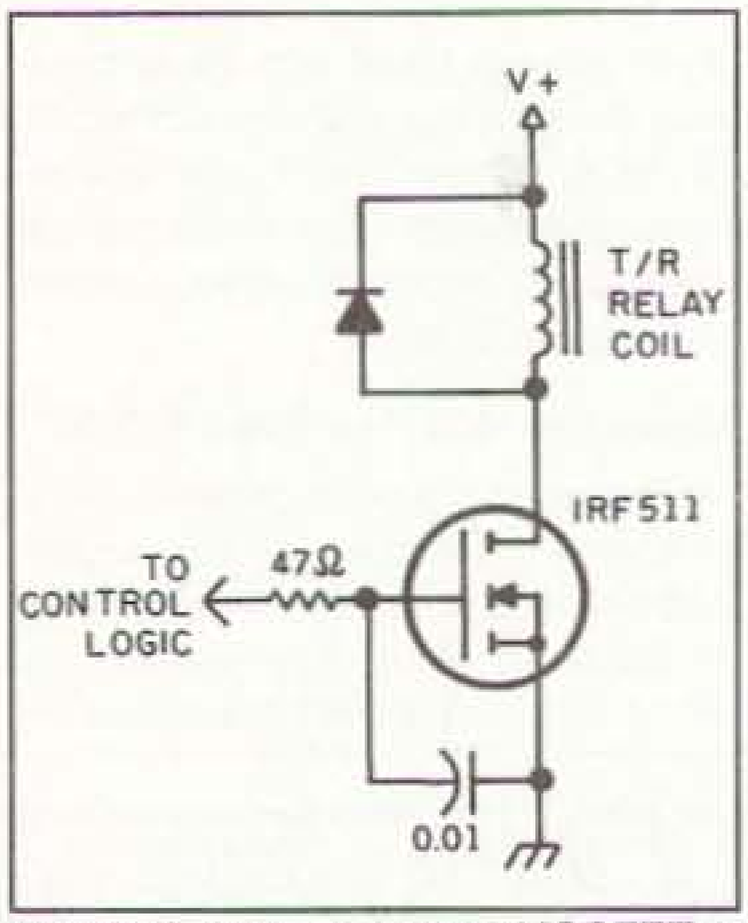

Figure 2. Using a power MOSFET to operate a relay for T/R control.

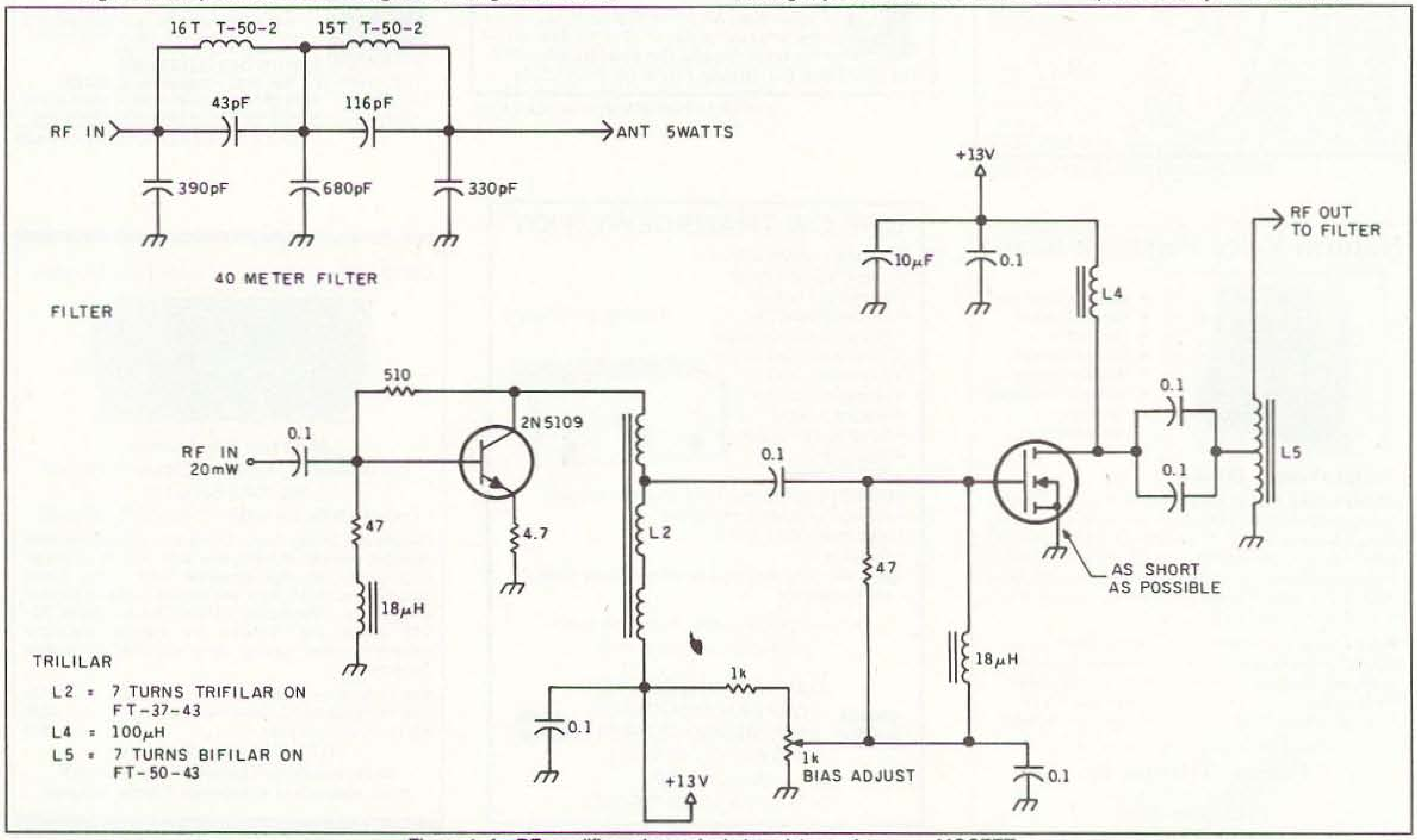

Figure 4. An RF amplifier using a single transistor and a power MOSFET.

RF Amplifier Circuit

Only now are we seeing designs using power MOSFETs in RF applications. Figure 4 is a simple RF amplifier using a single transistor and a power MOSFET. I did not design the circuit—credit for it goes to Bruce Franklin KG7CR. The circuit originally came from the NorthWest QRP club newsletter, June 1992. Bruce kindly gave me permission to present it here to you. I have not had the time to build the circuit myself, therefore I can't comment on its performance. Bruce says the circuit will produce 5 watts of RF with only 20 milliwatts of drive. Bruce's original schematic contained some fancy band-switching features using reed relays and a 4015 IC. This schematic shows only the driver and the MOSFET PA components, along with one section of the output filters. The output filter values are for the 40 meter band.

You can use the amplifier for SSB, too! All you have to do is set the bias t o about 50 mA with no drive. If you're a CW-only person, then a much lower bias will do. Bias is set by R5, the 1k trimmer.

Suitable sources of RF drive may be VFO, VXO or even the output of a mixer such as the NE602. In the case of the VFO, an extra stage of buffering may be needed if you notice pulling of the VFO frequency.

Also notice that the VCC for the amplifier is only +12 volts. It would be possible to get better efficiency at a higher voltage, but then you would need to re-compute the values of the LC networks. Of course, you would have to split the circuit in half as the +28 volts would be too much for the bipolar transistor used as a driver.

Bruce uses the IRF510. The IRF511 is available from Radio Shack for under $2. If you can't find it, an IRF531 would be a good substitute to try.

A very good application of a power MOSFET used as an RF amplifier is described in the November 1990 issue of *73 Amateur Radio Today*, page 36: "The MOuSe-FeET," by Bill Heishman N5HNN. I had the good fortune to work on this amplifier and can say that it works first-class all the way.

As shown in the original article, the filter values are for the 40 meter band. The values for the 20 meter band are as follows:

L1	6T x 1/2
L2	3T x 1/4
L3	9T x 1/2
L8	6.8 µH
C1	1000 pF
C2	Not used
C3	1360 pF (2 x 680 pF or 2 x 500 + 270 pF)
C4	250 pF

All coils are 20-gauge copper magnet wire air wound on 3/8" form and spread to proper length.

With my HW-8 on 40 meters and running both the amplifier and the HW-8 on a 12.6 volt supply, I had 20+ watts (my QRP wattmeter only goes to 20 watts and the needle was pegged) going into the dummy load. I know had I increased the supply voltage to 13.8 volts, my output power would have been close to 30+ watts. The heat sink became rather warm with the 20 watts and more than likely a larger hunk of aluminum is necessary at higher power. My aluminum heat sink measured the same size as the PC board and was 1/8" thick. The relay-less QSK keying is a real pleasure to use, too. If someone really wanted to, a band-switching model could be constructed to give multiband performance. Operation on 10 meters may result in slightly lower output as noted in the original text. Circuit boards for the amplifier are available from Far Circuits, 18N640 Field Court, Dundee IL 60118.

Toroids and the Wattmeter

Several months ago when discussing the directional wattmeter, I mentioned the cores used as being "special." That's true and I still don't know what kind of material is used for the core. I mentioned I'd try a T-50-6 core as a start. Several readers wrote to tell me that's the wrong type of material for use in this type of project. I mentioned the T-50-6 core primarily because the ones used in the project are yellow, just as a T-50-6 core is. Hold up a T-50-6 core beside the one in the wattmeter and you'll have a hell of a time trying to tell the difference. That is why I made the suggestion. The core should be of ferrite material instead of the powdered iron material used in the T-50-6 core. 73

RTTY LOOP

Number 19 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
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Baltimore MD 21208

February may mean many things to many people, but here in Baltimore, February is the most common time for the "big snow" to hit. Presuming that many of you may find yourself in that situation this time of year, I thought it might be a good time to pull out that old mechanical teleprinter and try to get it on the air.

Thanks to Dave Gearhart WA4GVT of Huntingtown, Maryland, I am in receipt of some basic information needed to get these machines running.

Figure 1 is a drawing of a Model 28 cabinet, showing the location of the various cables and terminal strips which need to be accessed. The "C" terminal strip, which contains all the vital connections, runs across the back of the machine. As detailed in Figure 2, the cable connects to the top of the strip, with the permanent wiring coming in on the bottom of the strip.

Figure 3 shows a schematic diagram of the Model 28-RO (receive only) wiring, and should be helpful to anyone trying to resurrect an old machine.

Another popular machine is the Model 33-ASR, commonly used on computer circuits. This ASCII machine with Automatic Send and Receive capability (ASR) can frequently be obtained from old computer mainframe sites, and can be used as a hard copy teleprinter, particularly when connected to an interface which accomplishes the ASCII-to-Baudot translation. Figure 4 is a similar schematic of wiring for this machine.

All in all, I hope this information is a useful addition to the attempts to get that old greasy piece of hardware on the air.

To get that computer on the air, don't forget the RTTY Loop software collection. At this time, there are three sets of programs available. Set One is the "original" RTTY Loop program disk, containing an assortment of RTTY and ham radio programs. Set Two is the "archive" collection, containing the programs needed to deal with all of the commonly used archives, along with DOS and Windows shells. The newest collection, Set Three, has even more RTTY and ham programs. Each collection is about one megabyte of stuff, and will fill a 5-inch 1.2 Mb or 3.5-inch 1.44 Mb disk. If you send me 360 kb

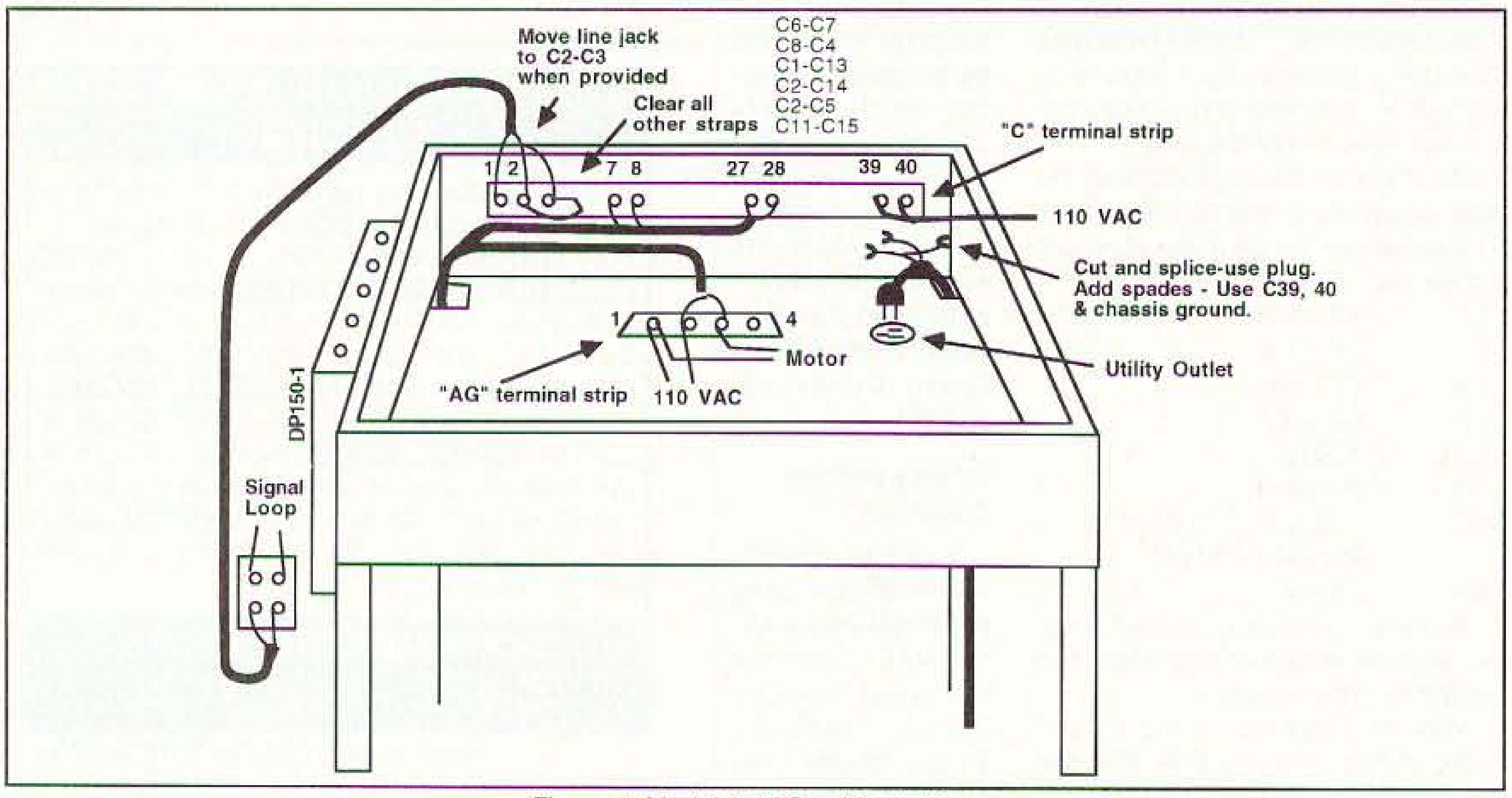

Figure 1. Model 28-RO cabinet wiring.

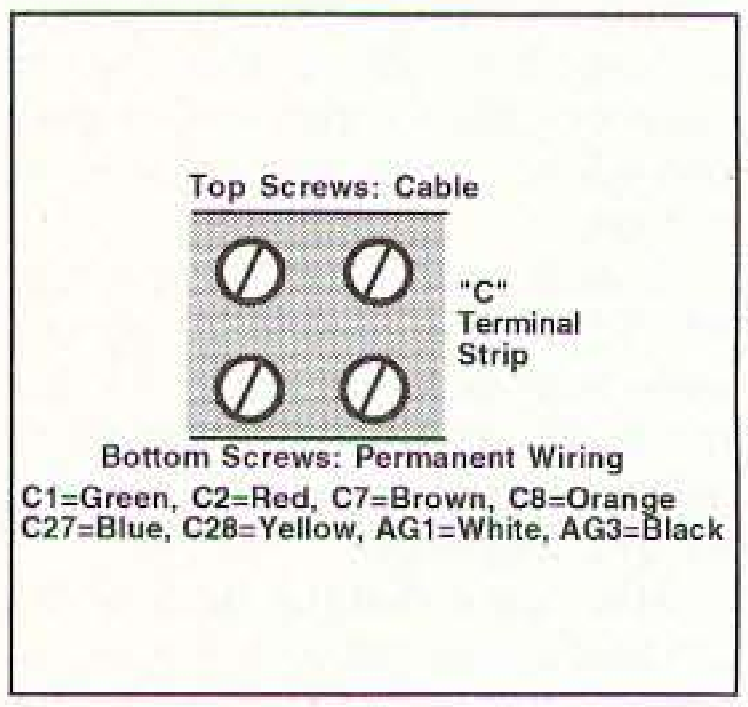

Figure 2. Model 28-RO cable routine details.

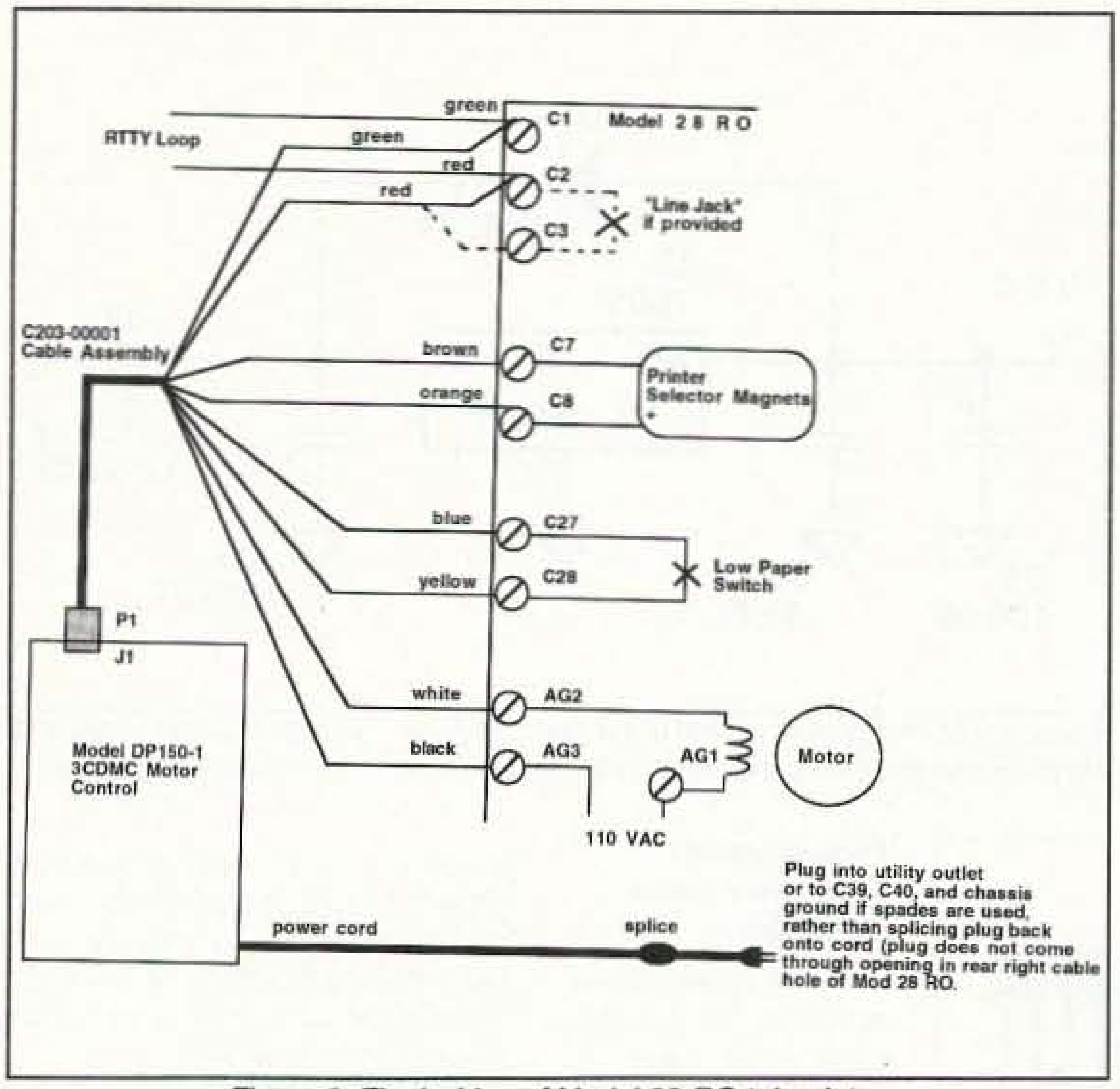

Figure 3. Final wiring of Model 28-RO teleprinter.

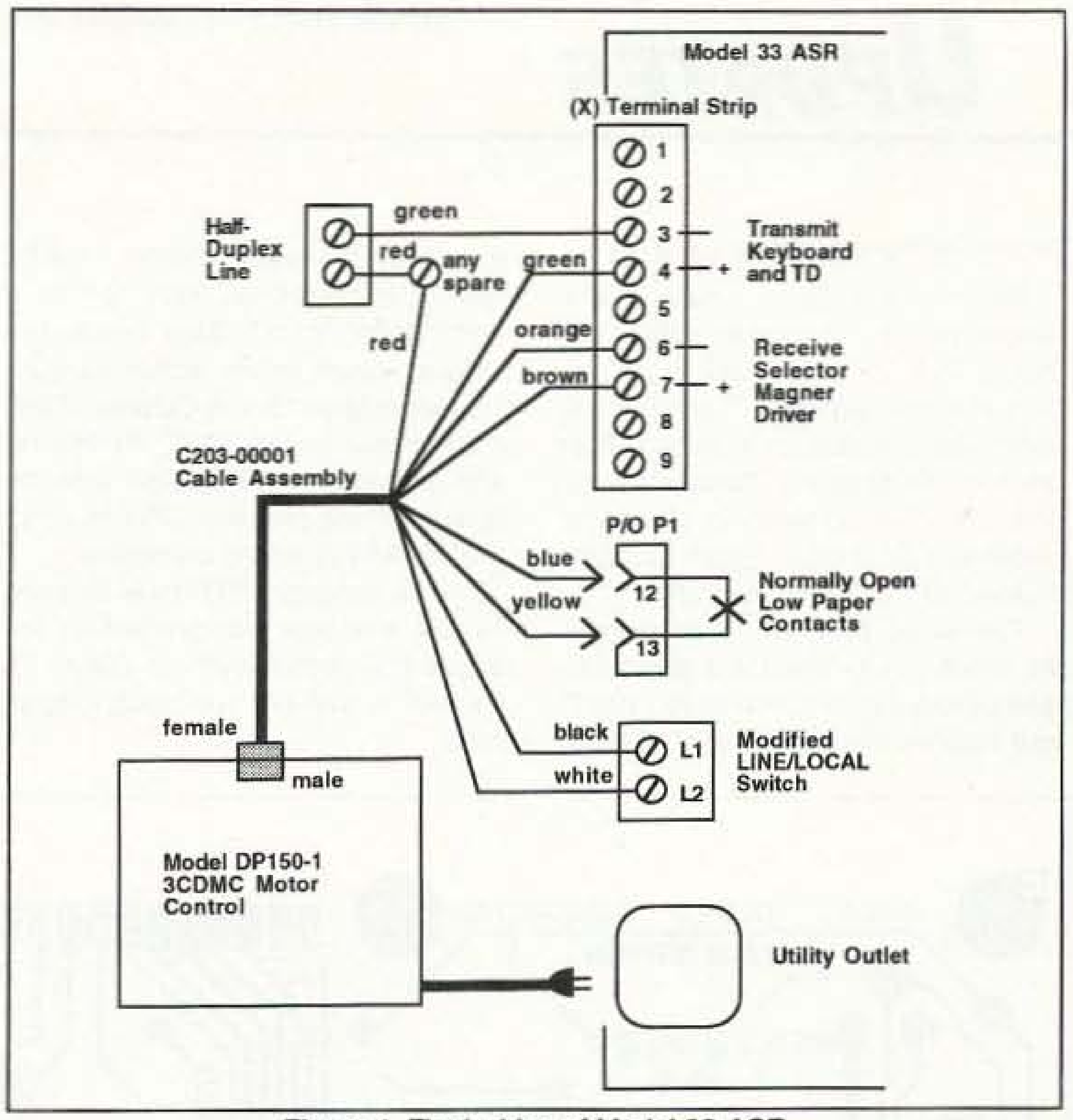

Figure 4. Final wiring of Model 33-ASR.

or 720 kb disks, it will take correspondingly more disks, typically four of the former or two of the latter, per set. To obtain any or all of this stuff, you must send: a note telling me which set you want (I am not clairvoyant); sufficient media (5" or 3.5", low or high density, no need to format the disks) to hold the data; a self-addressed, stamped disk mailer to return the media to you; and $2 in US funds per disk. Send all this to me at the above address and I'll do my best to turn it around in a few days.

Glen Johnson WB2MPK of West Orange, New Jersey, wins the prize for being the first to correct me on a typo from the December column. I stated that the ARC program was originally developed by a company called "Software Engineering Associates," and Glen was quick to point out that the correct name of the company is "System Enhancement Associates." Well, at least I got the initials right! I only hope the program's author, Thom Henderson, is not upset at me.

Meanwhile, I look forward to your cards, notes, questions and comments. As always, you can reach me electronically, as many of you have, on CompuServe (ppn 75036,2501), on Delphi (username MarcWA3AJR), or on America Online (screen name MarcWA3AJR). I look forward to hearing what you want to know, and what you think. Who knows, you might see your topic become the next focus of "RTTY Loop!" 73

UPDATES

Number 11 on your Feedback card

Techno-Whizzy 1, Parts 1 & 2

Refer to the above article in the December 1992 issue, page 12. Diode D1 is backwards in the schematic diagram (Figure 3), it should be installed as shown in Figure 1 below. Note that the diode position is shown correctly in the parts placement diagram in Figure 4b. *TNX to Joe Leikhim for the correction.*

The Basic program to determine the diode placement for a given frequency has a typo in line 9000 ("0101" was entered twice instead of "0110"). It should read: 9000 DATA "0000","0001","0010","0011","0100","0101","0110","0111". As a result, the values shown in the accompanying sidebar entitled "Some Common QRP Frequencies for the TW-1" are in error and should be recalculated with the updated Basic program. *TNX to Jean-Claude Abrazit for the correction.*

In the January 1993 issue on page 14, the wire size was omitted for the output filter toroid windings (Table 1). It's best to use #26 enameled magnet wire.

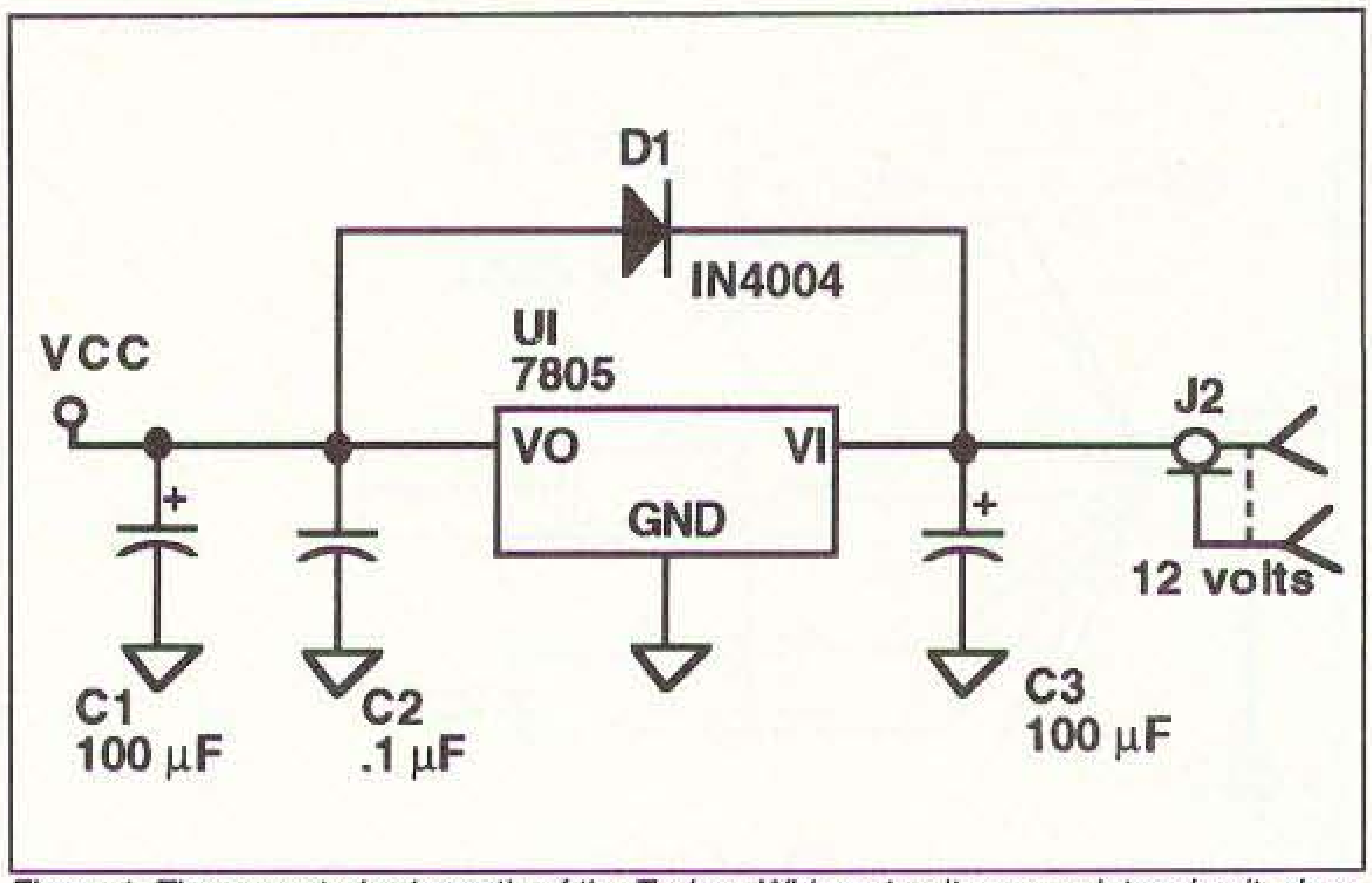

Figure 1. The corrected schematic of the Techno-Whizzy 1 voltage regulator circuit, showing the proper placement of diode D1. Refer to Figure 3 in the December 1992 issue.

Programmable Frequency Audio Generator

Refer to the above article in the January 1993 issue, page 16. The PC board foil pattern shown in Figures 5 & 6 shows U9 as a 8-pin device; it should be a 16-pin device. Figure 2 shows the corrected version of the PC board foil pattern and parts placement.

In addition, author Loyd Redman has some comments and improvements that will help you the circuit up and operating:

It is recommended that you use only a 74LS73 for U7. If you substitute a 7473, the circuit may start operating at a random frequency when power is applied since the 7473 triggers on a positive-going pulse while the 74LS73 triggers on a negative-going pulse. If you do use a 7473, the connections to S1 should be changed so that U7 does not toggle until S1 is activated.

When using the ML2035, its output frequency may initially be half or double the desired frequency specified by the digital word. This indicates that the 16 bits of the digital control word are shifted either one bit right or one bit left. I noted that the pulse directly out of pin 2 of the CD4049 (U9) was poorly shaped, depending on the value of C3, Rt and Rin. I remedied the problem by first routing the output from pin 2 through one of the unused inverters in the CD4049, then on to pin 2 of the ML2035 and to pin 14 of the 74LS93 (see Figure 3). I also recommend that you not use the same PC board for both the ML2035 and the ML2036 (i.e. populating the board for both parts but removing one of the ML parts). I used separate boards for each version of the IC and carefully cut any traces not needed.

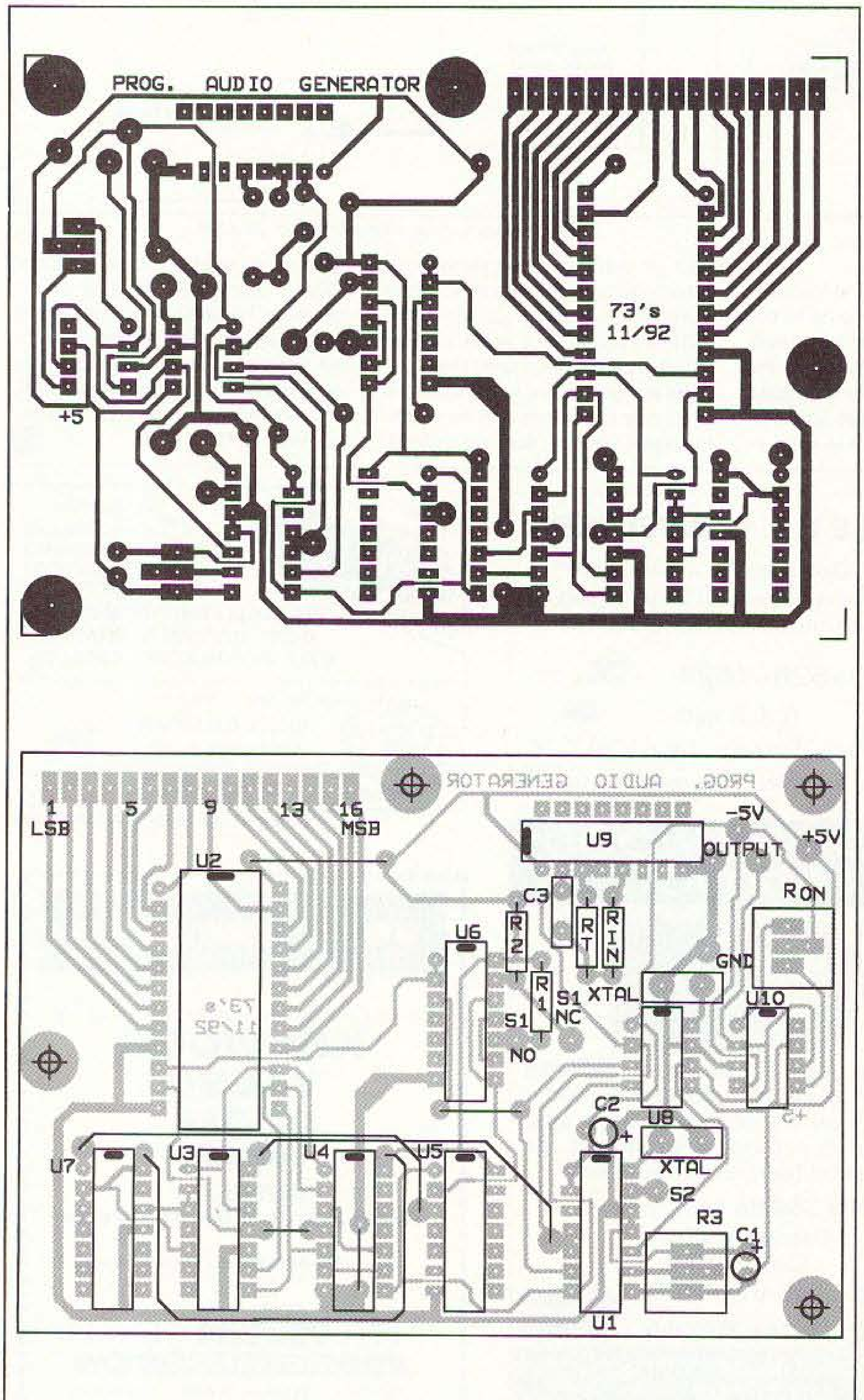

Figure 2 (a). The corrected PC board foil pattern for the Programmable Frequency Audio Generator. (b). Parts placement.

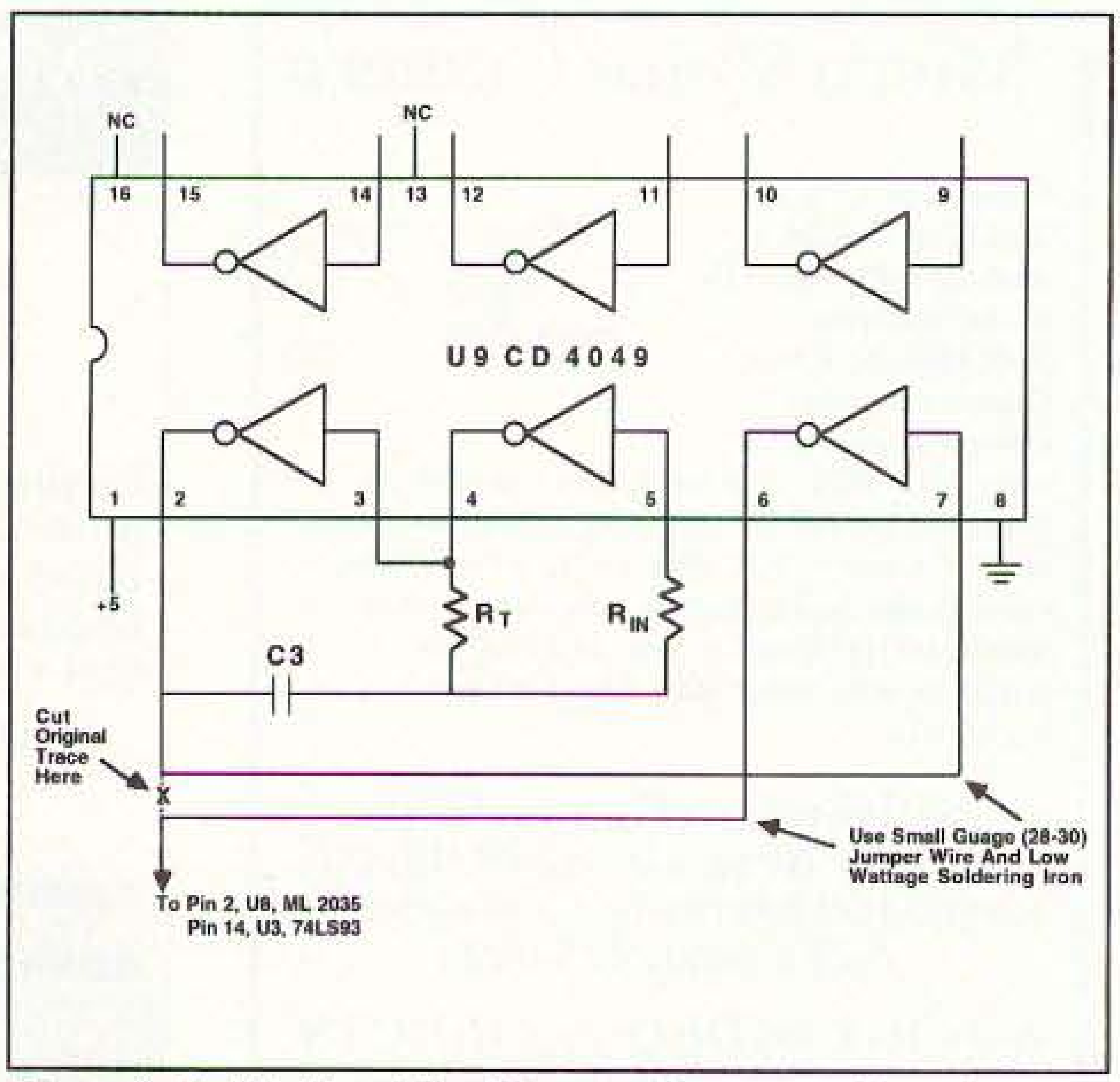

Figure 3. Modification of the U9 connections to provide an improved pulse shape to the serial clock input of the ML2035 and to the CPO clock input of the 74LS93 counter.

Number 21 on your Feedback card

PACKET & COMPUTERS

Jeffrey Sloman N1EWO
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Franklin IN 46131

9600 Baud Backbone—Lone Star Style

What do residents of Texas, Oklahoma, Colorado, Indiana, and Michigan have in common? Well, among some other possible answers, they've got a 9600 baud packet backbone called TexNet. Though the regional systems aren't linked, the Indiana-Michigan system (called GLNET, for Great Lakes Network), Oklahoma and Colorado systems use the hardware and software designed in Texas as a high-speed route for BBS forwarding and user traffic.

TexNet began in 1985 as a summer project for Texans Tom McDermott N5EG and Tom Aschenbrenner WB5PUC. The idea was to create a low-cost, high-speed backbone for packet radio traffic. By the October of '86 the system was operational, and Texas hams now have connections among eight cities, with more on the way. This expansion is thanks to the coordination effort by TPRS (the Texas Packet Radio Society), the organization championing TexNet. Unlike high-speed backbones dedicated to BBS traffic forwarding, TexNet was designed from the start to provide services to the end user, and to allow message forwarding.

Multi-Talented

In addition to the 9600 baud backbone connection, each TexNet node provides a primary and secondary user port designed to communicate with the LAN (Local Area Network) where it is located. The usual case is 1200 baud AX.25 ("normal" packet), but other protocols can be supported. This makes direct access to the high-speed backbone readily available to users for connections to remote stations in range—direct or via digis—of a TexNet node. The system makes long distance keyboard-to-keyboard QSO operations not only possible but fun.

If that isn't enough, how about adding local digipeater service, a mailbox, and a pair of conference bridges for round-table nets? Looking at everything a TexNet node provides, TPRS's description of one as a "multi-resource" is fitting.

The Hardware

The heart of a TexNet node is a TPRS NCP (Node Control Processor) board. This board has connections for a pair of radio modems, also available from TPRS. One of the things that makes a TexNet node inexpensive to implement is the choice of RCA 700 radios for the 9600 baud side. These are land mobile service, mobile radios which can often be found surplus at a low price. They are easily tuned into the ham bands, and are very rugged. Any appropriate radio can be used on the 1200 baud side. The low cost and simple nature of the hardware makes TexNet an attractive option for areas wanting to build a backbone.

GLNET

So attractive, in fact, that when a first effort at a Northern Indiana-Southern Michigan backbone on 6 meters fizzled in 1989, the Michigan sysops latched onto TexNet's already integrated design as the answer. Over the next year, things started to happen in Indiana, too. Today, GLNET will get you keyboard-to-keyboard from as far south as Franklin, Indiana, using the Indianapolis node (atop the State Office Building) to Mount Pleasant, Michigan, north of Grand Rapids (more than 300 air miles). TexNet nodes are easily interfaced with the more common networking schemes, such as TheNet and KaNodes. This means that the usable coverage of the GLNET system is extended from each node by these other systems.

A TexNet network is also a great way to provide special data services to end users. The GLNET system offers a centralized mailbox, a weather server, and—thanks to N8IMO in Grand Rapids, Michigan—an Internet gateway. For those not familiar, the Internet is an enormous network of government, educational, and commercial computers all over the world. It is a patchwork of technology, with everything from high-speed (56 Kilobits per second and up) backbone segments, to 1200 baud dial-up connections keeping the data moving. The Internet uses a protocol called TCP/IP for Transport Control Protocol/Internet Protocol. This is often referred to as simply "IP." IP has some advantages over the AX.25 (Amateur X.25) protocol typically found on packet radio networks, and most TNCs can be made to run IP directly; however, it is not an easy thing to get going. There are many pitfalls in getting TCP/IP running; if you are interested, find an IP Elmer.

Hams use the Internet through what are called "wormholes." An Internet wormhole is accomplished by a technique called encapsulation, where a TCP/IP packet is wrapped in another TCP/IP packet. Why is this necessary? Because on each end of a wormhole are radios, and the users of those radios must be licensed. Encapsulation ensures this by hiding the actual destination, preventing users who did not start from an amateur connection from getting into a place where their data could end up on the air.

The N8IMO TCP/IP mailbox offers AX.25 users a way to connect to the wealth of resources available on the Internet. In addition to being a full service PBBS itself, N8IMO offers users telnet services. Telnet is an IP utility that allows users to log onto remote computer systems—the same way you would if you were to dial up. The difference in this case is that it is accomplished across the Internet, not phone lines. With telnet, an Internet connected user can hop all over the globe. N8IMO, for example, offers connections to the University of Michigan, where there is both a weather server—provided by Zephyr of Massachusetts—offering all of the NWS (National Weather

Service) text weather products, and a geographic server—which can tell you the elevation, longitude, latitude, and other vital geographic data for most places in the world.

With Internet telnet, connections to nearly anywhere is possible—Australia, the Netherlands, Canada, all over the US—just about anywhere there is a ham and a university. Personally, I find it amazing to have fast, reliable communications with amateurs in Australia, completely independent of propagation conditions. Some may argue, "It uses land lines—it's not ham radio." Perhaps it is not DX, and QSL cards for the contacts wouldn't be very meaningful, but this sort of reliable, routine communications—previously available only to local or regional repeater systems—lifts ham radio up to a new level, in my opinion.

Easy to Use

The TexNet software is very simple on the user side. It has a minimal command set that is easy to remember. If it has a shortcoming, it is cryptic error messages—which are often only indicated with a number. Without a list, you're lost. Figure 1 shows a typical session with the Indianapolis GLNET node (Indy). You can see that the first step is to connect—via normal AX.25—to the node itself. TexNet convention has the node using the SSID (Secondary Station ID) of 4, so I could have connected to WA9ZCE-4. Instead I used the nodes alias. Once connected I am presented with the Network CMD? prompt, which indicates that the node is ready for my commands. Typing "?" at this point would get me a brief list of commands. I knew that I wanted to connect to the N8IMO gateway, so I entered "c grip @ ngrapid."

"C" is for connect, just like you are used to on your TNC. "GRIP" is N8IMO's GLNET alias—for Grand Rapids IP. The "@" indicates that what follows is a GLNET node. The same method can be used to connect to any station in range of a GLNET node. For example, to connect to my station, a user could type:

c n1ewo @ indy

Or, if I wasn't able to connect to the Indianapolis node directly, up to two digis (digipeaters) could be included:

c n1ewo v eocmbx @ indy

Here the connection would be made via eocmbx—the alias for the Johnson County, Indiana, RACES PBBS. Other simple TexNet commands are:

C CQ@(node)—sends a CQ message from the specified node.

B—disconnects.

L—lists the locations of all known nodes.

M—connects to the designated message server (mailbox).

M@(node)—connects to a specific message server.

S@(node)—displays various connection statistics for a node.

S Y@(node)—yesterday's stats.

As you can see, TexNet is pretty easy to use. Its designers intended it to be used by the general packet community and so made an effort to make it easy. This easy-to-get-along-with orientation has also made its integration into existing networking schemes especially easy.

```
c indy
*** CONNECTED to INDY [12/04/92  06:16:05]

WA9ZCE-0 at INDY Virtual connection 03 at 06:16:09 on 12/04/92
      ***   Welcome to GLNET  v1.60 Copyright 1990 TPRS  ***
Network CMD ?
c grip @ ngrapid

Your connection is established
[JNOS-1.07-H$]

Welcome wa8ure,
to the N8IMO TCP/IP Mailbox (911229 (WG7J v1.07-beta release 5 /
N8IMO))
Currently 1 user(s)
Type:
  H  for Help use!
  ?  for command list
  A  for mail Areas
  A  NAME to change mail Area (ex A ALLMI)
 LA  to List All msgs at current Area
 WX  for WEATHER SERVER
  C  for CONVERSE BRIDGE
  D  SITES for resource list

New mail in: AMSAT  HELP  KEPS  MICHNET  NOS-BBS  SKYWARN
SPACE  SPACENEW  TCPGROUP
Area: wa8ure Current msg# 0.
?,A,B,C,D,E,F,H,I,IH,IP,J,K,L,M,ML,MS,N,NR,O,P,R,S,T,U,V,W,WX,X,Z
>
Oh, a GLNET user - Switching callsign to: nlewo.
Area: nlewo Current msg# 0.
?,A,B,C,D,E,F,H,I,IH,IP,J,K,L,M,ML,MS,N,NR,O,P,R,S,T,U,V,W,WX,X,Z
>
```

Figure 1 shows a typical GLNET session with the Indianapolis node. In this case, I connected to the N8IMO Internet gateway, whose alias is GRIP. N8IMO's software has been modified to recognize a GLNET connect and to adjust the callsign appropriately. See the text for more.

How Can You Get Involved?

If you are in the service area of GLNET (Indiana, Michigan, and surrounding states), try contacting IDEA (the Indiana Digital Experimenters Association) for information on supporting or expanding GLNET (more good node locations are always welcome).

For membership information, contact: IDEA, Les Cattin KD9LP, 219 Woodland Hills, Peru IN 46970. If you are in the TexNet service area, or would like information/equipment to start your own TexNet backbone, contact: TPRS, P.O. Box 50238, Denton TX 76206-0238.

Special thanks to Tom Frisz N9DD for information on GLNET. 73 de N1EWO. ■

Number 22 on your Feedback card

ASK KABOOM

The Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

What's New?

Lots of new things have been happening in radio technology. Let's take a break from the repair theme this month and look at some of the new developments and how they affect us.

Digital

Aren't you sick of that word? It seems like you just can't get away from it! Is there anything made today that *isn't* digital? Well, the basic guts of receivers and transmitters are still analog, but with digital control. That, however, is slowly changing as advances in IC manufacture make possible very-high-speed chips. These new silicon products are opening up all kinds of exciting possibilities. Let's look at a few.

DSP

Digital Signal Processing is going to change our radios, and it will be a very positive change. Already there is a product being marketed to hams which can improve HF SSB quality to something approaching the wired telephone. I haven't actually tried it, but I suspect it works pretty well because it is an offshoot of a military product. The basic idea is to put a low-frequency pilot tone in with the audio on transmit. Also, the transmitted speech is processed to permit maximum intelligibility. The real trick, though, happens during receive. The unit at the receiving end detects the pilot tone and analyzes it to determine how it has been affected during its trip. Then, a digital signal processing chip compensates for the various kinds of degradation. That, along with dynamic expansion to undo the transmitter's speech compression, goes a long way toward restoring the original voice quality. Finally, new DSP techniques permit real-time analysis of the speech signal to remove noise and static. The result is that most of the garbage is removed, making the processed signal sound tremendously better than regular old SSB. And, it doesn't require one extra Hz of bandwidth to do it.

There are some trade-offs, of course. First, the inclusion of the pilot tone means that some transmitter power is being "wasted" on something other than your voice. In a way, it's kind of like having a carrier, except that it is much weaker than a regular AM carrier would be, so the amount of waste is much smaller. In the long run, of course, the signal-to-noise gain of the system far outweighs the amount of lost power. Second, both radios need to have the devices for the scheme to work. I expect that eventually there will be an accepted set of standards for this kind of processing, allowing the system to be built into new rigs. I certainly hope that comes to pass.

Some receive-only DSP noise filters are already available. These range from notch filters which can remove multiple heterodynes to noise filters which can separate speech from static and adjacent-channel "monkey chatter." As prices drop, they'll get more popular.

Fast Modems

DSP is allowing the creation of some really fast modems. It is now common to send 14.4 kilobits per second over standard 5-kHz telephone lines. For that matter, compressed-format moving *video* is being sent along with digitized voice on the same lines. I wonder how long it will be before we send digitized voice over our allotted 3-kHz bandwidths. Hey, I wonder if anybody has managed to send the AT&T videophone's signal over the radio. I suspect it may use a synchronous modem system, which would make that impossible, except perhaps on VHF or UHF full-duplex links. Has anybody messed with it?

True Digital Radio

The ultimate use for DSP would be to make the entire radio digital. Incoming signals would be digitized at the antenna, perhaps after one stage of amplification. Tuning, filtering and detection would be accomplished through digital signal analysis. The resulting bit stream would pass through a digital-to-analog (D/A) converter. An amplifier and speaker would be all that would be left! Imagine a multimode receiver with digital tuning, variable passband, memories, the whole works, that you could wear on your wrist. It's going to take awhile, but it will happen. I suppose you couldn't wear much of a transmitter because of the power requirements, but the same DSP technology can and will be used in full-sized transmitters. The only analog parts will be the RF power amplifiers.

DDS

Direct Digital Synthesis is a new technique for generating local oscillator frequencies. Until now, frequency synthesizers have suffered from some wobble and jitter (called "phase noise"). This aberration causes various symptoms, the most annoying one being muddy, hissy receive audio and an apparent widening of the receive passband. Although synthesizers have improved quite a bit over the early designs, the problem couldn't be completely solved because it is inherent in the design; as long as an analog oscillator must be kept on frequency through constant correction, it will wobble around its center frequency. Now, there's another way.

In a direct digital synthesizer, there is no analog oscillator. Instead, sine waves are built up as a series of digital steps and then low-pass-filtered into clean, jitter-free waves. It might seem that the step-like nature of the sine waves would make them rather distorted, but that just isn't the case. If enough steps are used, the distortion frequency will be much higher than that of the sine wave itself, and it becomes fairly easy to filter the junk out. The filtering leaves lovely, smooth waves. Exactly the same technique is used to reconstruct the music signal in CD players, and you know how great they sound!

So why haven't we been doing it that way all along? Well, in order to have plenty of steps, the chip must operate at many times the speed of the signal we want to create. For music, that's not too hard because we don't need a signal over about 20 kHz anyway. But, when we want to generate signals in the multi-megahertz range, it's another story. Until recently, the D/A converters and related circuits just weren't fast enough. Heck, 10 years ago the average desktop PC ran at between 1 and 5 MHz. Now, 50 MHz computers are common, and even faster ones are coming soon.

The advantages of DDS over previous synthesizer designs are very reduced phase noise (in other words, spectral purity), ability to settle to a new frequency quickly (great for spread spectrum and split CW), and smaller tuning steps. Some DDS rigs can tune in 1-Hz increments! Do we need such precision? It sure doesn't hurt. It seems like overkill now, but it may become important later on as synchronous signal processing schemes are devised. Those schemes may require that the transmitter and receiver be on precisely the same frequency. Of course, the master reference oscillators driving those synthesizers will have to be improved in order to back all that precision with equivalent accuracy. It's not of much use to be tuned to within 1 Hz if it ain't the *right* 1 Hz!

There's one other advantage of DDS: simplicity. Without all the analog parts, a DDS can be reduced to a few chips. The insides of those chips may be complex, but the resulting circuits can be quite simple. Are there any disadvantages? Just one that I can think of: cost. Right now, high-performance DDS parts are expensive enough that traditional synthesizer designs are still competitive. That's changing, as it always does, and I expect DDS to completely take over in the next few years. Today's non-DDS rigs will soon seem nearly as antiquated as all-analog rigs do now.

Power, Please

The weakest link in modern electronics still is power. Sure, there's no problem if you're near an AC outlet, but batteries are positively primitive. Nickel-cadmium batteries are an old technology that never worked all that well unless the cells were used under carefully controlled conditions. If you've owned your walkie for more than a year or two, you know what I'm talking about.

That's changing too. New nickel-metal-hydride batteries are coming. They have about twice the energy of NiCds, and there's less "memory" problem as well. They're rumored to be coming to ham radio and camcorder applications soon. I'll let you know more as I learn it.

There haven't been any recent breakthroughs in power supplies, but switching supplies are evolving and getting quieter. The old ones made an awful lot of RF noise, which limited their radio applications. Better shielding and design are resulting in cleaner supplies, and I expect them to start showing up more and more in HF rigs. Their primary advantages are size and weight; they can be dramatically smaller than linear supplies of equivalent power output. Historically, switchers have had reliability problems, but those have been pretty well solved, due to the popularity of desktop computers, all of which use switchers. In fact, the little wall cube which powers my laptop is actually a miniature switcher, as is the small supply for my camcorder. I look forward to seven-pound, 100-watt HF rigs with built-in AC supplies. With today's surface-mount technology, it should be possible to make an HF rig the size of a large 2 meter mobile rig. Sounds good to me.

Let's look at a letter:

Dear Kaboom,

My Alinco model 110 2 meter rig has an odd problem. In the low power position, it works fine. In the high power position, however, the transmitter draws more than 25 amps for a moment and then it drops to zero, with no RF output. It seems to be clamping itself off, but I don't know why. Any ideas?

Signed,
On-Off

Dear On,

25 amps?? Yikes, at 13.8 volts that's 345 watts! Something's breaking down here. I agree that it's shutting off because the clamp circuit is working, but the question is, what's causing that huge current drain in the first place? I suspect the final output transistor. It may work fine at lower power and break down when full power is applied to it. Or, it could be a capacitor or other part in the output filter, or even a bad connection. More than likely, though, it's the silicon. If the transistor is discrete, you can try changing it. Of course, that will force you to do all kinds of adjustments, some of which may require specialized equipment. If it's a module, the whole module will have to go. Because this problem is so hard to determine, though, I'd send it off to Alinco and let them do it. After all, it sure wouldn't feel too good to shell out for a new output module and then discover that the real problem was something like a bad capacitor or antenna connector. Hey, here's a thought: Are you sure your antenna or coax isn't breaking down? Try using another antenna system before you do anything else. Good luck!

Until next time, 73, all, de KB1UM. 73

Number 23 on your Feedback card

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 January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check ***Special Events File Area #11*** *on our* ***BBS (603-924-9343)****. for listings that were too late to get into publication.*

FEB 2

ROANOKE, VA VE Exams will be held by the WCARS for upgrades only, at Hollins College at 8 PM. Pre-registration only. Contact *Fred L. Horton KZ4Y, (703) 366-6266,* or *Ben Giavaden N4BG, Route 7, Roanoke VA 24022.*

FEB 6

HAMPTON ROADS, VA Sign up for Hampton Roads Radio Assn's W5YI Exams. Please contact *Bill Runyon N4BDH, (802) 487-8611,* for details.

KNOXVILLE, TN WCARS VEC Exams, for up-grades only, will be held in Room B-129 at Pellissippi State Tech. Comm. College, Pellissippi Campus, at 10 AM, 10:20 AM, and 10:40 AM. Written elements at 11 AM. Please pre-register. Contact *Ray Adams N4BAQ, (615) 688-7771,* or *Rich Slover ND4F, (615) 539-4821.*

PARIS, TN Henry County H.S. will be the location for WCARS VEC Exams at 9 AM. Call *Mackie Gallimore AA4YF, (901) 247-5489,* or *Les Merrell KQ4F, (901) 642-5966.*

ST. CATHARINES, ONT., CANADA The Niagara Peninsula ARC Inc. will hold a Hamfest and Dinner-dance at the C.A.W. Hall, 124 Bunting Rd. Talk-in on 147.24/.84. Dinner-dance tickets by advance only. For info, please write *N.P.A.R.C. Inc., P.O. Box 692, St. Catharines, Ont. L2R 6Y3, Canada. Tel. (416) 934-3231,* or *VE3KLM@VE3SNP.*

FEB 8

MARYVILLE, TN WCARS VEC Exams will begin at 7 PM at St. Andrews Church Hall, W. Broadway. Contact *Carroll Peabody W4PCA, (615) 982-5839* for details.

FEB 13

GOSHEN, NY The Orange County ARC Computer Fair/Winter Hamfest will be held at John S. Burke Catholic H.S. on Fletcher St. Talk-in on 146.760 -600, plus 100 Hz tone. For more info, call *Jim Capicotto, (914) 564-2707.*

MARION, NC VEC Exams by WCARS will be held at Asheville Federal Bank Bldg., Main St. Contact *Cecil D. Potter WB4UCF, (704) 724-4007.*

WEST MEMPHIS, AK WCARS VEC Exams will be held at 9 AM at Rosewood United Methodist Church, 2303 E. Barton Ave. Get details from *Gene Bagley AB5BL, (501) 739-4029* or *Rev. Richard Gregory AB5CH, (501) 735-4060.*

FEB 14

JASPER, TN WCARS VEC Exams will be held (by pre-registration only) at 1 PM at Jasper Public Library. Contact *Charles Wooten KD4XX, (615) 942-5116,* or *Wallace S. Brown KD4XV, (615) 942-2836.*

MANSFIELD, OH The Mansfield Mid*Winter Hamfest/Computer Show will start at 7 AM at the Richland Cnty. Fairgrounds. Advanced Ticket/Table Orders must be received and paid by Feb. 1st, 1993. Talk-in on W8WE 146.34/94 rptr. Contact *Dean Wrasse KB8MG, 1094 Beal Rd., Mansfield OH 44905. Tel. (419) 589-2415 after 4 PM EST.*

FEB 20

CHARLESTON, SC The Charleston ARS, Inc. will hold their Hamfest in the Geodesic Dome at Charlestowne Landing, 1500 Old Town Plantation Rd., from 8:30 AM-4 PM. Talk-in on 146.19/.79, 144.65/145.25, and 147.87/.27 MHz. Walk-in VE Exams will be given on the campus of Trident Tech. College at 11 AM. For Exam info, call *(803) 871-4368 or (803) 572-1164.* For Hamfest details, call *Jenny Myers, (803) 747-2324,* or *Linwood Sikes, (803) 556-5566.*

COLUMBIA, SC The Red Cross Bldg., Bull St., will be the location for WCARS VEC Exams at 8:30 AM. Get details from *Ray Rogers N4WR, (803) 345-3373.*

NEW ALBANY, IN WCARS VE Exams will be held in Room 204, Knob View Bldg., Indiana U. South, Grant Line Rd., from 10 AM-2 PM. Contact *Dick Truax K8GVU, (812) 246-6377,* or *"Mac" McCrory NM9A, (812) 944-6661.*

SALEM, OR The Salem and Oregon Coast Emergency Repeater Assns. will sponsor their 1993 Ham Fair at the Polk Cnty. Fairgrounds, beginning at 9 AM. Talk-in on 146.26/.86. For more info, write to: *Salem Repeater Assoc., P.O. Box 784, Salem OR 97308.*

FEB 21

ASHEVILLE, NC WCARS VE Exams will take place AB Tech Room 134, Elm Bldg., at 2 PM. Get details from *Hary Dull AA2AB, (704) 891-5481* or *Don Lovelace W4TMT, (704) 765-5311.*

DEARBORN, MI The Dearborn Civic Center will be the location for the Annual Swap 'n Shop sponsored by the Livonia ARC. Doors open from 8 AM-4 PM. VE Exams in the afternoon. Talk-in on 144.75/145.35 and 146.52 simplex. For more info, send 4 x 9 SASE to *Neil Coffin WA8GWL, Livonia ARC,* *P.O. Box 2111, Livonia MI 48151. Tel. (313) 427-3905.*

NEW HYDE PARK, NY A Hamfest, sponsored by the Long Island Mobile ARC, will be held from 9 AM-4 PM at the Nassau County Police Activity League, 375 Denton Ave. Talk-in on 146.25/.85. For further info, please contact *Neil Hartman WE2V, (516) 462-5549.*

ROCK ISLAND, IL The 22nd annual Davenport (Iowa) ARC Hamfest will be held at the QCCA Expo Center. Large indoor Flea Market. Talk-in on the WØBXR 146.28/.88 rptr. Advance payment deadline is Feb. 15th. Contact *Al Broendel N9OK, 2712 38th St., Rock Island IL 61201*, for Exam details; or Talk-in on the WØBXR 146.04/.64 rptr. For Hamfest info, contact *Kent Williams K9UQI, 4245 10th St., East Moline IL 61244.*

FEB 27

DALTON, GA WCARS VE Exams will be held at 3 PM at Unity Baptist Church, Burleson Rd. No walk-ins. Contact *Bert L. Coker N4BZJ, (706) 259-5625* or *Harold W. Jones N4OTC, (706) 673-2291.*

FEB 27-28

CINCINNATI, OH The ARRL 1993 Great Lakes Div. Convention will be held from 8:30 AM-5 PM (both days) at the Cincinnati Gardens Exhibition Center, Seymour Ave. and Langdon Farm Rd. Advance deadline is Feb. 17th. Contact *Stan Cohen WD8QDQ, (513) 531-1011*, or *Joe Halpin W8JDU, (513) 851-1056.*

MAR 6

ABSECON, NJ The Shore Points ARC will sponsor "Springfest '93" at Holy Spirit H.S. on Route 9. Doors open at 9 AM. Talk-in on 146.385/.985. For more info, write to: *SPARC, P.O. Box 142, Absecon NJ 08201.*

MAR 7

CUYAHOGA FALLS, OH The Cuyahoga Falls ARC 39th Annual Hamfest will be held at the St. V. Center, 3479 State Rd., from 7 AM-3 PM. Talk-in on 87/27. Get details from *Bill Sovinsky K8JSL, 2305 24th St., Cuyahoga Falls OH 44223. Tel. (216) 923-3830.*

NORTHAMPTON, MA A Hamfest will be held at Smith Voc. School, Rte 9, by the Mt. Tom ARA, beginning at 9 AM. VE Exams at 10 AM. Pre-register by calling *(413) 245-3228.* Talk-in on 146.34/.94. Get details from *Jim K1MEA, 316 Main St., Easthampton MA 01027. Tel. (413) 527-3199, 7-9 PM.*

MAR 13

FARGO, ND Hamfest '93, from 8 AM-3 PM, will be sponsored by Red River Radio Amateurs at The Bowler, 2630 S. Univ. Dr. Talk-in on 146.16/.76. Ask about Banquet tickets. Contact *RRRA, P.O. Box 3215, Fargo ND 58108-3215. Tel. (218) 233-2584 7 PM-10 PM.*

SPECIAL EVENT STATIONS

FEB 6-7

NORTH CENTRAL, WI A group of hams will operate KF9MG on 28.360, 21.360, 7.260 and 38.860, to commemorate the 1993 Badger State Winter Games. For certificate, send QSL and large SASE to *Mike KA9VFP, 1104 E. Lieg Ave., Shawano WI 54166.*

FEB 13-14

CONCORD, NH The Contoocook Valley RC will celebrate the Grand Opening of the K1BKE Club station, at the Christa McAuliffe Planetarium during the New Hampshire QSO Party. Tune in on the 80-10 meter bands. For QSL, send a #10 SASE to *Contoocook Valley RC, P.O. Box 88, Henniker NH 03242.*

FEB 13-15

1993 NEW HAMPSHIRE QSO PARTY The NH ARA will sponsor this event from 1900 UTC Feb. 13th-0700 UTC Feb. 14th, and from 1400 UTC Feb. 14th-0200 UTC Feb. 15th. Open to all license classes. For more details, write to *G.E.A.R.S., Conrad Ekstrom WB1GXM, P.O. Box 1076, Claremont NH 03743-1076.*

FEB 19-21

MARQUETTE, MI The Hiawatha ARA will operate N8GBA from 1700Z Feb. 19th-1700Z Feb. 21st, to honor the UP 200 Sled Dog Championship. Use the lower end of the 10, 15, 20 and 40 meter phone bands. For a certificate, send a large SASE (with 2 stamps), to *Richard Schwenke N8GBA, 21 Smith Ln., Marquette MI 49855.*

FEB 20

BREMERTON, WA The North Kitsap ARC of Washington, will operate K7SXL at the Olympic College in conjunction with VoTech Week. Operating hours are from 1600Z to 2400Z. Frequencies: CW—3.65/.69, 7.04/.08, 14.04/.08, 21.04/.08, 28.025/.075 MHz; SSB—3.84/.88, 7.24/.28, 14.24/.28, 21.34/.38, 28.44/.48 MHz. Send QSL with SASE to *North Kitsap ARC, P.O. Box 2268, Silverdale WA 98383-2268.*

FEB 25-28

BROWNSVILLE, TX The Faulk Intermediate School ARC will operate N5SMH from 1400Z-2200Z, to commemorate the annual Charro Days Festival. Tune the General portion of 40, 20, 15, and Novice portion of the 10 meter bands. For Certificate, please send a QSL and SASE to *Faulk Intermediate ARC, 2200 Roosevelt, Brownsville TX 78521.*

FEB 27-MAR 2

HUNTSVILLE, TX The Huntsville ARS will operate WA5SAM from the campus of Sam Houston State U., from 0000Z Feb. 27th-2400Z Mar. 2nd, during the celebration of General Sam Houston's 200th birthday. Frequencies: Lower portion of the HF General phone subbands, and the Novice 10m phone subband. For a 3-color Certificate, send QSL and a 9 x 12 SASE; for a QSL card, send QSL and SASE, to *HARS Special Event, P.O. Box 7516, Huntsville TX 77342-7516.*

RANDOM OUTPUT *Continued from page 88*

grammar and punctuation and use it. The same thing goes for a dictionary. When a manuscript crosses my desk with spelling errors and errors in basic grammar, my first thought is, "What else did this guy get wrong?"

Any manuscript you submit should be typed, double-spaced, on standard bond paper (like photocopy paper, *not* that thin so-called "typing paper" you can buy in stationery stores). It is becoming a common practice to include a computer disk containing the text file of your manuscript. IBM format is still the standard, but Macintosh is becoming more and more acceptable (especially in publishing). Include a copy of your word processing document (most can be transferred to whatever the publisher uses), and also include a standard ASCII text file, just to be sure.

It is considered unprofessional to submit the same article to more than one publisher at the same time. This is called "simultaneous submission" and most magazines (including *73*) will not even consider a manuscript that is not offered exclusively to them. If the magazine rejects your article, then you can try again somewhere else. Make sure you mention that your article is being offered "exclusively to *73*" in your cover letter (if you don't know what a cover letter is, buy a book on free-lance writing and look it up).

Every once in awhile we get an article where the author, in trying to *sound* like a "professional writer," will say something like, ". . . and I can offer you one-time worldwide rights to this fabulous article for only $500!" This is an immediate tip-off that this person is not only unpublished (no problem, many of *73*'s writers are first-time writers), but he is also uneducated (which is inexcusable, when you consider how many books about free-lance writing are available). Every magazine has standard policies regarding pay rates and publishing rights. *73* pays anywhere from $50 for a short filler to over $200 for longer, more involved articles (*Radio Fun* pays a bit less, usually between $40 and $120). We buy first-time North American and reprint rights. We do not negotiate (neither does any other magazine I know of). This is the way the business works, and anyone who tries to stipulate pay scale and publishing rights (at least in this market) is showing their ignorance.

What We Need—What We Don't Need

73 is always looking for good construction articles, antenna articles and tutorials on new or different modes. We love to get good "how to" pieces on club activities, amateur radio PR and just about any other subject that your fellow amateurs might benefit from. Make sure you include several clear photographs.

73 does not generally publish fiction, nostalgia or what are commonly referred to as "human interest stories." *Radio Fun* does publish a certain amount of human interest stories, though, so it wouldn't hurt to send one in.

I hope I've answered some of your questions. Even more, I hope I have prompted a few of you to take the plunge and try writing for us. You won't get rich, but I can tell you that there's nothing like the thrill of seeing your name in print the first time. 73

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS Special Events Message Area, #11. (2400 baud, 8 data bits, no parity, 1 stop bit.) Tel. (603) 924-9343. Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

WANTED: Service Manual for Regency Scanner Model ACT T16K. *Lisle T. Hines K2QLA, 11 Meadow Dr., Homer NY 13077-1214.*

Service information wanted for: CONAIR Model 452 synthesized transceiver; SILTRONEX Model 90 VFO; SAILOR Model RT144 Marine transceiver. I will pay copy and shipping charges. *Errol May, P.O. Box 362, Buffalo NY 14207-0362.*

I need replacement or repair for the modulation transfomer Heath Kit Apache transmitter TX-1, part #51-34 or equal. Please advise. *Ben Gelfand, 81 Macy Rd., Briarcliff Manor NY 10510.*

I just purchased a brand new 10 watt Motorola speaker Model SSN 2005B. No instruction sheets came with it. The pin-out info sent to me by Motorola hasn't been much help. No matter which wire I feed to my audio, I still can't get anything out of that speaker. Does anyone out there know of a simple hook-up to make use of the internal amplifier? *N.B. Sadorian N6WGX, 500 Via Val Verde, Montebello CA 90640.*

NEEDED: Manuals, schematics, anything for Hammarlund HQ120/HQ129 receiver, and Hallicrafters S-38C receiver. Thanks. *Robin Okelly, 39400 Howard Rd., Marcola OR 97454. (503) 933-2217.*

ADVERTISERS

Bold Listings are 73's new advertisers this month.
***Advertisers who have contributed to the National Advisory Committee (NIAC).**

NEVER SAY DIE

Continued from page 4

product, it's almost enough to make me wonder.

What To Do

This New Hampshire Economic Development Commission thing has been fun as well as frustrating. It's gotten me to read dozens of books, participate in dozens of conferences and subcommittee meetings, hear testimony from educational and financial experts, and work with some outstanding New Hampshire businessmen.

When I discovered that the Commission was being controlled by politicians and was going to be prevented from any possible success, I started sending the other Commission members reports on what I was discovering. I came up with creative proposals for solving our major state problems. I made proposals for cutting crime by about 80%, the cost of government by 50% within five years, education by 30% (with a far better educational result), eliminating welfare costs, creating thousands of new jobs, and so on. These reports were published in my book, *We the People* ***Declare War*** *on Our Lousy Government.*

Since publishing the book I've been continuing my reports to the Commission, with creative approaches to cutting health care costs, going into more detail on educational changes, and many other ideas. These are being published two or three times a month as *What To Do,* with six having been published as of this writing. If you're interested in this series they're available by subscription for $10 a dozen. They're worth a hundred times that.

Of course the chances are that you really aren't interested in solutions to unemployment, crime, health care, our educational mess, our crooked Congress, the deficit, welfare, and so on. Not even interested in being able to talk about these things on the air since that might interrupt your memorized spiel. So I don't suppose you'll want to get the book or the newsletter. The book is $10 from Uncle Wayne's, plus $3 S/H per order. You can save money by getting a 20 wpm practice tape at the same time. And maybe a handbook. Something to read on those long February nights after the DX bands have died out.

Magnetic Fields . . . Again

An article in another ham rag poohpoohed the dangers of being exposed to 60 Hertz magnetic fields, citing the IEEE as a source of the pooh. Just in case you have any question about magnetic fields causing your body harm, you should look up the new article by Paul Brodeur in the Dec. 7, 1992, issue of *The New Yorker* and see what's going on.

Paul's persistence broke the lid off the damage asbestos in schools was doing to our children, despite the insistence of scientists paid by the asbestos industry that there was no danger. He was opposed by a similar pattern of paid-off scientists when he blew the whistle on the Love Canal mess. Now it's the might of the electric power industry, which is faced with who knows how many billions of dollars in litigation over the deaths it has knowingly caused, plus the costs of making our homes, schools, and work places safe. This will easily dwarf the savings and loan costs, so one can understand why the utilities are fighting such a desperate battle.

The government has been one of the big bad guys in all this . . . in the name of not causing panic. What would happen if Americans suddenly became aware that nearby power lines, pole transformers, and even their electric blankets are killing or damaging their children, causing miscarriages, and hastening their own deaths? Paul picked one particular California school for his article. The wonder to me is that, considering the evidence of such a high incidence of cancers and tumors in teachers working on the side of the school near the high tension lines, Paul was able to be so patient in reporting the government and power company cover-up.

The Dec. 14, 1992, issue of *U.S. News* (p. 94) added an even darker side to all this with a report on the effects to men's sperm when they drink alcohol, smoke cigarettes, or take other drugs. It's turning out, according to a March of Dimes research report, that these all have a profound influence on the resulting child. I've been writing about the impact of drugs and emotional problems on children in the prenatal period. Now I'm going to have to go back one more step and include preconception influences on a child's life.

If drugs and other shocks to the system during the preconception or prenatal periods can cause miscarriages, is there any question that when slightly less damage is done we're likely to have children with damaged DNA to try and raise and educate?

One of the shocks to every cell in our bodies is our exposure to power-line magnetic fields. These fields are affecting us . . . including men's sperm and women's eggs. They're affecting children permanently in the prenatal months. Later on they're gradually wounding or killing our children . . . and us.

I've been writing about this for several years. Have you been shrugging me off or have you gone out and bought a milligauss meter and swept your home for dangerous fields? How about your work place? I've recommended that ham clubs, as a public service, buy meters and offer to sweep local homes and offices. I haven't yet seen one single example of a club doing this reported in a club newsletter.

Here we are, an almost unknown hobby . . . one desperately in need of PR . . . and we're going to lengths to hasten our own death as a hobby by avoiding PR. I've mentioned lecturing to college classes on entrepreneurialism and finding that maybe two or three percent of the kids have ever even heard of amateur radio! Then there are the reports of police stopping mobile hams and not even knowing about the hobby. How much is it going to take to get ham clubs to start being responsible?

Have you already forgotten how the ARRL refused to cooperate with a researcher checking into ham deaths by cancer to see if our proximity to magnetic fields might be hurting us? He found that hams were dying at double the average rate. Did you read *that* in *QST*? Well, it's no wonder if your ham shack is anything like mine. My main rig was okay, but my amplifier was radiating a death-dealing magnetic field. If a few ham widows started suing amplifier manufacturers we might see them at least suggesting that their amplifiers be positioned several feet from the operating position. A few hundred million dollars in lawsuits might get their attention.

In the meanwhile, we're sitting there being gradually and silently destroyed by the radiation around us. Worse, we're passing on this damage to our children in the form of damaged sperm.

Our amplifiers are particularly nasty death-dealers because not only are they radiating strong magnetic fields, but these fields are varying as we key our rigs or as we talk on sideband. The deaths near power switching stations and to power company workers has shown that transients are even more destructive to our cells than steady fields. You may have read the recent reports on facial cancers and their connection to electric razor use.

The power companies know what's going on. The asbestos industry knew for years what their product was doing to people. The cigarette industry has known for decades what their product has been doing, yet they're still publicly denying there's any proven relationship between cigarette smoking and death. Just coincidence. If the coincidence of death hits you, will your widow blame the manufacturer of your linear and go after them?

When the coincidence of a defective child hits, will the family go after the manufacturer of their electric blanket? Or the power company for putting that distribution transformer just outside their home? Or if it's a ham's child who's been harmed, will an amplifier company be asked to pay?

It's easy to recognize miscarriages and leukemia. It's easy to recognize brain cancer and other major reactions to magnetic fields. But what about the less than death-dealing changes all these carcinogens are causing? What about less obvious illnesses, personality problems, learning disabilities, dyslexia, and so on? There's no reason not to expect a whole array of abnormalities to result.

One of the leading research scientists in this field is Bill Adey K6UI. I've put a long list of the research papers he's authored or recommended on the *73* BBS. His research on the effects of distressingly low levels of magnetic fields on cellular growth leaves no room for doubt that these fields are far more destructive than people ever imagined.

We know that every living cell lives and communicates via minute electric currents. We also know that when we put any kind of a conductor into a magnetic field it generates a voltage in the conductor. So why should we be even slightly surprised when we find that our body's cells are being screwed up by stray magnetic fields . . . some of them of relatively enormous intensity. We should be surprised if this *didn't* mess things up.

What do you do about all this? (1) Get informed. Read the Brodeur article. Get the book *Electromagnetic Man* by Cyril Smith, St. Martin's Press 1989, 344p, and also *Warning: The Electricity Around You May Be Hazardous to Your Health* by Ellen Sugarman, Simon & Schuster Fireside 1992, 238p, $11. (2) Get or build a milligauss meter . . . or get your club to buy one. (3) Go on your local talk radio programs and get the word out, offering a club service to check on magnetic fields in homes, work places and particularly schools near high tension power lines. (4) Let me know what successes (or failures) you've had. (5) Get coverage in your local newspapers, showing this as a public service by your ham club. (6) Meet with your local school principal and arrange to talk with the kids about magnetic field dangers . . . and please don't forget to put in a big plug for amateur radio. It's a safe hobby as long as you keep the RF in the shack down and your death-dealing linear amplifier several feet from where you operate.

Money Talks . . . Again

In case you haven't been keeping up with the magnetic field situation, you might like to know that the Environmental Protection Agency (EPA) had a report ready to release citing electromagnetic fields as a probable carcinogen. This aspect of the report was blocked by the Bush White House Office of Science and Technology Policy on the basis that it "would alarm the public."

On September 30, 1992, Sweden's National Board for Industrial and Technical Development said they would be acting on the assumption that there is a connection between exposure to power frequency magnetic fields and cancer, in particular childhood cancer. This was the result of a five-year research program, following over 400,000 people, which showed a clear relationship between magnetic fields and childhood leukemia. They found that children exposed to more than one milligauss had twice the risk of leukemia. At two milligauss it went to three times the risk. Men exposed to 2.9 milligauss had three times the leukemia of those exposed to less than 1.6 milligauss.

So how about TV and computer terminals? In Helsinki the Institute of Occupational Health found that women exposed to three milligauss suffered miscarriages at three-and-a-half times the rate of those exposed to one milligauss . . .a result quite similar to the Swedish leukemia rate. The University of Adelaide's Department of Community Medicine found women working with computer monitors developing brain tumors at nearly five times the expected rate. There's also good reason to suspect that much of the elevated incidence of breast cancer may be VDT related, though I know of no study having yet been done to find out about that.

Will all this be enough to get the White House to back off? Will it force the electric industry to at least stop trying to stonewall the problem? In the meantime, thousands of kids are dying of cancer and probably tens of thousands of adults. Worse, we haven't even a clue as yet as to what cellular damage these fields are causing. We only count the dead, not the wounded. As I've pointed out before, we have no reason whatever to expect that children born of mothers exposed to these magnetic fields are going to be other than genetically damaged . . . it's just that the damage wasn't serious enough to cause a miscarriage.

All of which brings us to your home and your ham shack. If you have a pole transformer near your house, it's time to either get it moved or move your family. Check it out with a gaussmeter and make sure you're living in an under-one-milligauss field. Gauss out your shack, too. You're certainly going to have to move your linear several feet from your operating position, even if it's a nuisance to have to get up to tune it. And if your children are going to schools which are near high tension lines it's time for them to change schools.

In case you missed it, not only are these fields damaging your body, they're even damaging your sperm . . . which means that you have a good chance of permanently damaging your children's lives even before they're conceived. Of course cigarettes, alcohol and other drugs also affect your sperm and your wife's eggs before conception, or have you missed the recent March of Dimes research report?

What about HTs? We don't know yet, but there are some good reasons to believe that the use of subaudible tones may damage brain cells. Research has shown that our cells are able to detect HF, VHF, UHF and microwave energies, but it may be the demodulated components which cause damage.

What does it take to generate one milligauss? Well, I measure 1 mG at 30" from my laser printer and 2 mG at 18". I haven't used my laptop PowerBook Mac in my lap since measuring 25 mG leaking out the bottom. There's about 5 mG by the keys, and less than 1 mG at 3" in front of it. My electric blanket measures 150 mG . . . a death trap.

Help Wanted

Whoo, are we shorthanded! With both *73* and *Radio Fun* growing, we need help. And that's not to even mention a couple dozen other projects we're all working on . . . like a "Wayne Green's World" TV series which will be promoting amateur radio, my book and music; a new series of amateur radio books; new publications in the vacation, video, and educational industries, and so on.

I'd like to find a couple hams with experience in newer communications modes . . . like packet, RTTY, and repeaters. An ability to read and write is critical, as is the ability to meet deadlines and have at least an outward appearance of being a human being. An Extra class license will be acceptable only if you cheated on the code test, otherwise we'll have to administer some tests to measure the extent of the inevitable brain damage which results from CW use . . . a semi-vegetative state known as Morse-Cauliflower Brain (MCB). This can be detected by (a) a loss of a sense of humor; (b) a hating of *73;* (c) a totally without factual basis conviction that not everything I write is true.

If you're interested in living in New Hampshire, where we have the highest quality-of-living index of all 50 states; where we have vacationers driving for hundreds of miles to enjoy our state four seasons of the year, let me hear from you. Let me know what you'd like to do and what you've done so far that would encourage me to think you might be able to actually do what you propose. What *have* you accomplished in life so far? What have you to show? No, I'm not interested in the usual baloney resumés. I want some proof that you can write . . . that you have a sense of humor . . . and that you have initiative. And what's the big reward, if you win? A whole lot of work . . . work you'll love. Naturally this is made up for by a generous pay schedule . . . not! You and your family won't starve, but keep in mind that two of our staff had to sell their yachts recently. But isn't it a whole lot better to be doing something you really enjoy rather than that miserable ugh job you've been wasting your life on so far? I know that once I got snookered into amateur radio publishing I was a goner for life.

The Great Twins Fallacy

Yes, I know you have absolutely no interest in this, but who else am I going to tell? This has to do with all this baloney you've been reading . . . which makes the perhaps over-generous assumption that you have been reading . . . about what scientists have learned about genetics by studying identical twins separated at birth.

The results of the studies have been amazing. Twins turn out to often smoke the same cigarette brand, be married to wives with the same names, name their children the same names, and so on. Golly, how astounding that all this is genetic.

Even the gays have been cheering at studies which show that about 50% of identical twins are both gay when one is. Genetics at work, obviously.

Maybe. Maybe not. I think we may be able to rule out a lot of the coincidences between twins if we start investigating the possibility that there is some sort of completely unconscious communications between twins. That isn't too difficult a concept to consider, is it? Since there are millions of people who've experienced some kind of ESP communications, we know that there are times when this happens. We haven't had much luck in repeating it on demand. Scientists are very unhappy with non-repeatable experiments. Most of 'em refuse to accept anything non-repeatable as even being possible.

Having personally experienced such communications where there was not even the remotest possibility for it to be a coincidence, I know it's possible. We just have to learn more about it . . . and refusing to investigate the phenomenon because some scientists believe it's impossible isn't a very good scientific approach.

Anyway, the next time you read a report on how amazingly similar twins separated at birth are, forget the genetic implications. Sure, there may be some, but they aren't going to be isolated this way.

We do need to see if we can find out how people can communicate on a subconscious level. If we can make this repeatable we may be able to start sending QSL cards to confirm mental communications. Alas, at the pace we're moving now in our research on the mind it'll be another 50 years before we learn enough to harness its incredible power. Maybe a hundred.

Music, Music, Music

A note from Rob AA6BN claims that not all hams are nerds with no interests but ham radio, and henceforth I should tell you about my new music magazine. Now, while I doubt that Rob has one scintilla of evidence to back up his obviously ill-considered claim, on the mere wildest chance that somewhere out there, despite the dictates of reason, some of you might be interested in music, I'll tell you about one of my new projects.

Yes, I know, we *all* like music. But there's a whale of a difference between liking music and actually buying records . . . they're CDs these days. When I was a kid I liked music. I even bought a 12" RCA Red Seal 78 record of Strauss' Tales of the Vienna Woods and his Blue Danube Waltz when I was 12, to play on the family wind-up Victrola.

I didn't get involved seriously in buying records until they threw us off the air when WWII started. Unable to ham, I turned to music and building hi-fi systems. In the 1950s, in addition to helping pioneer RTTY, I manufactured a new kind of loudspeaker which did very well. Alas, my RTTY interest sucked me into ham publishing.

When the compact disc came along in 1982 I started a magazine to help speed its acceptance. It eventually became the country's leading music magazine. Since I enjoy starting new publications more than running mature ones, I sold *CD Review* last year and started a new music magazine. If you're into buying music you'll enjoy, it since we mercilessly review over 200 CDs each month. I know you'll find this hard to believe, but we don't take ourselves seriously. It's kinda like *Mad*.

The reader uproar over my editorials disappearing from *CD Review* got us to capitalize on this in our *Secret Guide To Music*. Our readership has turned out to be a bunch of men (95%) who buy 7.6 CDs a month, average age of 41, average $57,000 income, 68% like classical music, and so on. If you'd like to see a copy drop me a line. You've been wanting to write anyway to tell me how you don't always agree with my *73* editorials, so this is a good excuse. My *Guide* editorials are shorter.

The same basic drive that keeps me publishing *73*, a genetic defect which forces me to try and get others to share things I enjoy, is at work in my pushing people to enjoy music. So I urge my readers to try classical music, ragtime, theater organ, and so on. Like a good book, a recording is something you can enjoy for the rest of your life.

To help make it easy for my readers to find interesting music, I've a mail order service. Far's I know, it's the only place any one can buy CDs and return them if they don't like them for a measily $1 restocking charge. Love it or return it. And I've been turning out samplers to help people discover music they might otherwise have missed. We've produced nearly a hundred samplers so far and they're all totally, completely 100% free . . . except for an insignificant, hardly worth mentioning, $3.89 S/H.

In A Rut?

I'm not sure why so many people get into ruts. I had a great time working DX, but after 300 countries confirmed I lost interest. I'd *done* that. I had a ball with RTTY for several years . . . then I'd done that. DXpeditions were fabulous fun. I won't forget one minute of any of 'em. But I've done that. It was exciting working seven states on 10 GHz, now that's done. I loved contests and won certificates for DXing, Sweepstakes, and VHF. Done. OSCAR was a challenge and great fun. I had one of the early repeaters back in 1969. Then there was Navy MARS. It was enormous fun pioneering NBFM, SSB and slow-scan. So I keep urging you to try new things . . . to find new excitement in our hobby, as I have. I tried aeronautical mobile in my own plane . . . fun. I've been hot air ballooning with my HT and used it while skiing the slopes. If someone comes up with something new to do in amateur radio I'll probably hop aboard.

Then I talk to hams who have been exchanging signal reports and handles for 20 years or so and have done little else. How can I open their minds to the fun of trying satellite communications? Of working RTTY and packet? Of getting on top of a mountain and working DX on 10 GHz . . . way over in a neighboring state a hundred miles away? Of looking for a temperature inversion band opening and working through a repeater five hundred miles away? Of working a thousand miles or so on 2 meters via aurora skip? Or seeing if you can work 100 countries in one weekend? How about some 75m DXing? Now there's a real challenge! To do much of this you have to go up to the higher bands, make a DX contact, and then get 'em to come down to 75. I'll never forget the thrill of talking to my home station on 75m while visiting Ray VK3ATN and hearing W2NSD/1 coming through 5/9+. Wow! Have I ever shown you the aerial pictures I took of Ray's amazing antenna farm? He did a great job of working the U.S. on 2 meters via moonbounce.

Where's your spirit of adventure? How can I get you out of a rut?

And the same thing goes for music. There are a couple hundred different kinds of music. Some aren't all that exciting, but there's a lot of fabulous music you've never heard just waiting for you to reach out. Have you ever heard Gottschalk's Tarantella? How about Nazareth's music? Delius? Gliere? 73

Build a Super-Horn Antenna for 10 GHz *Continued from page 14*

waveguide adaptor that takes waveguide down to an SMA fitting.

Road Test

Finally, we were off to the test area where we could tune into the N6CA beacon about 40 miles away. Using a Kenwood 751 with the SSB Electronics transverter, we could barely make out the beacon with an omnidirectional 10 GHz antenna. A small ARR horn improved signals up to an S-4 level and a longer military 10 GHz horn (of a much more slender design than conventional horns) gave us an S-6 signal with tight directionality. We were now ready to give the Super-Horn the big test. We had quite a time getting it lined up with the transverter so that we didn't stress the delicate SMA connector. We knew we had a winner as we inched the equipment up to the horn: Reception to the distant beacon was coming in loud and clear, even before we were on the waveguide!

When the connection was made, the big horn pulled in the beacon at a fantastic S-9 level, better than we had anticipated. Side lobes were not as clean as the smaller horn, but at 10 GHz, that might be an advantage to find distant signals.

If you are already on 10 GHz, take out your standard horn antenna and see what you might do to easily extend its sides for increased gain. 73

Photo G. No, this is not a rocket-assisted station wagon. Suzy N6GLF operates portable 10 GHz SSB using the Super Horn antenna.

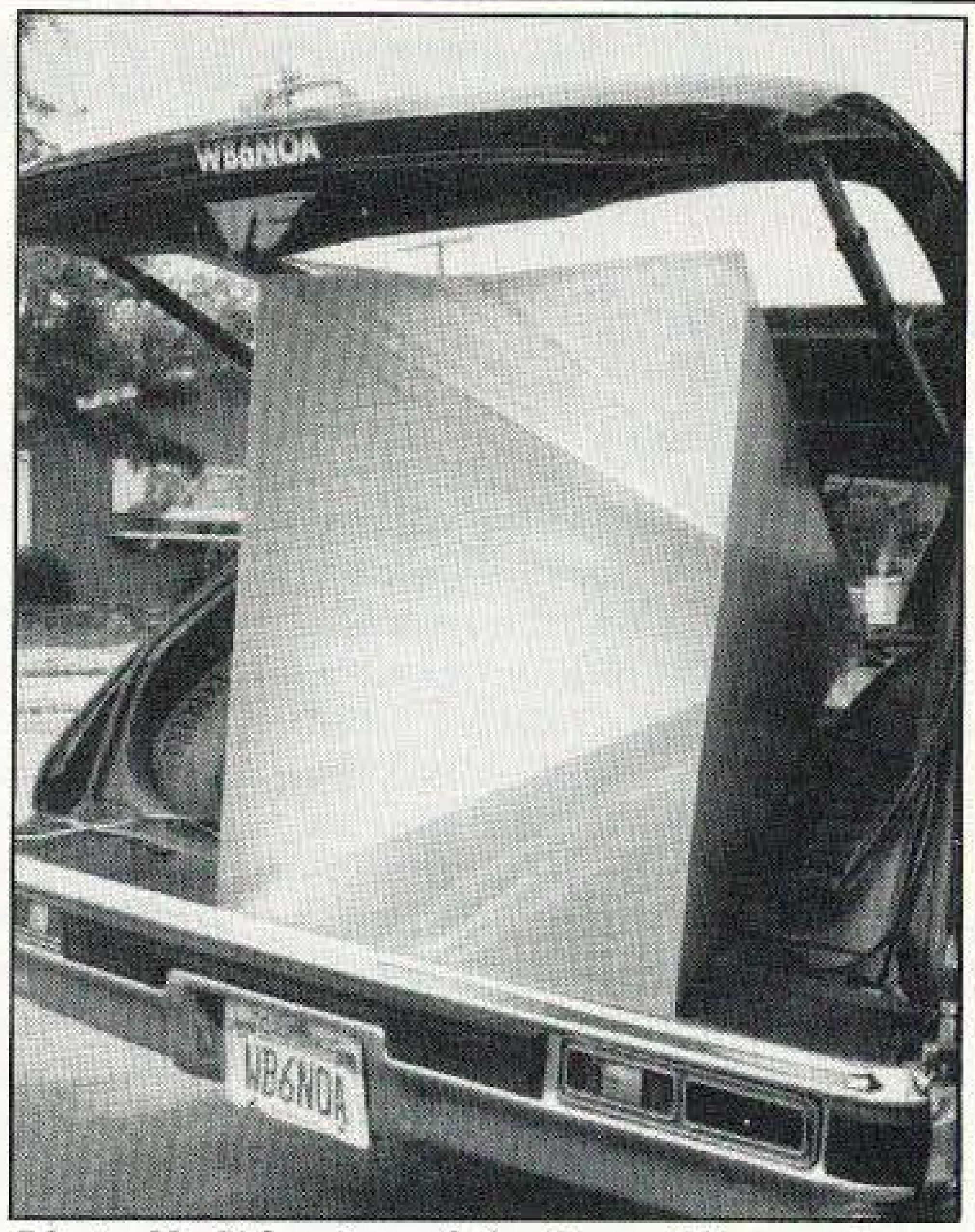

Photo H. Side view of the Super Horn antenna. The two halves are joined at the top and bottom for maximum strength (i.e. each half has two bends in it).

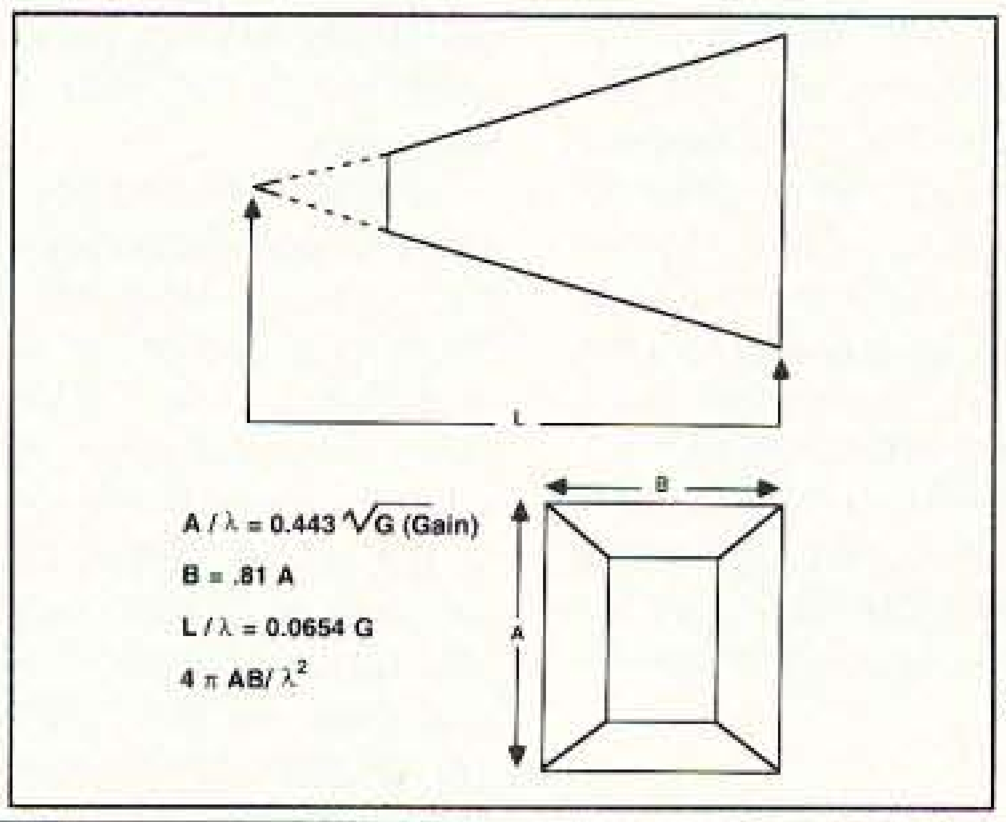

Figure 3. An existing horn antenna can be increased in size for improved gain by extending the sides.

Number 25 on your Feedback card

73 INTERNATIONAL

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Notes from FN42

I missed a very interesting meeting several nights ago. Some of the local hams decided to see if there were other hams in the area who might want to develop an amateur radio club. I had to be very honest with them and say that I had heard that organized clubs don't seem to make it here in the Keene, New Hampshire, area. Many have started and many have failed.

That didn't seem to deter them. Through a mass mailing of 250 letters to hams listed in a ham data base for this area, 30 replied that they would be interested and would show up at the informational meeting. One of the hams, who is a DJ for one of the local FM broadcast stations, was able to get a meeting room at a local motel.

When the evening came there was a BIG surprise waiting for the organizers. Over 50 hams showed up, including the mayor, who is also a ham. I have only received tidbits of what happened at the meeting, but I understand that it was SRO (Standing Room Only).

As I am writing this, some of the hams who were at the meeting are discussing it on 75 meters. The discussion is very positive, even exciting! I have been involved in the starting of several clubs, ham and non-ham. It is always exciting to see that others share your visions. Most of the other clubs had a very definite purpose, such as DXing, contesting, repeater operation, etc., but this one, from the feeling of the group, seems to go in many different directions. Many of the attendees would like to learn more about ATV, traffic handling, packet, contesting, DXing, etc. Luckily we have many hams in the local area who have expertise in many of those areas, such as Bill Brown WB8ELK, ATVer and high altitude balloon experimenter; Dawn K1TQY and Alan W1FYR, who are dynamite with traffic handling; Joel WA1ZYX, Scott WA1YTW, and Buzz WA1NHP, who are actively involved in packet; and many hams who have been contesting and DXing for years, both HF and VHF/UHF. Plus, they don't want to spend most of the meetings discussing the management aspects of making it all happen.

I would be very remiss if I didn't mention the names and callsigns of many of the hams who have had leading and supporting roles in this beginning effort: Doug and Deborah KD1GJ and N1NGC, Randy N1KWF, Gary and Karen KD1JR and KB1AGP, Bob KA1ZMF, Paul WK1P, Peter KA1ZRI, Buzz WA1NHP, Joel WA1ZYX, Scott and Ann WA1YTW and KA1OQH, and Bruce WA1YZN. If I left someone out of this list it is certainly not intentional.

As I review what I have written, one word seems to stand out in the previous paragraph, and that word is "supporting." An organization is only as good as the members supporting the leadership. Organizations live and breathe with the members, not the leaders. The leaders live only with the continued support of the members. How can you be a leader when there is no organization to lead?

I plan to continue my discussion of the starting of new clubs in the future because there may be many of you who wish that there was a club in your area but there isn't. It isn't that hard to start one; the hardest part is to keep it going! The club only continues if its members want it to continue. I just dug out my trusty Webster's dictionary and a short definition for "club" is: "persons organized together"; "organized" means: "place in orderly arrangement, unite"; and "together" means: "in a group, at the same time, with one another." That means that the members have to get involved and continue to be involved. And those of you who are presently members of a club, please read or re-read my January column and the letter in "Roundup" from Rainier Bautista DY9CKQ titled "CQ, CQ,CQ . . . OUR RADIO CLUB IS DYING!" and don't let your club get to the level that OSCAR-MARBEL got to. Get involved and keep involved!—Arnie N1BAC.

Roundup

People's Republic of China *China News from BY1QH, edited by Rick Hunter:* There are two Tsinghua Universities in China—one is in Beijing, where BY1QH is located; and the other is in Hsingchu, Taiwan. October 17 and 18 saw a first-ever Jamboree-On-The-Air (JOTA) activity between the two universities on both sides of the Taiwan Straits. JOTA is annually sponsored by the World Scout Bureau and anyone may take part. A number of students spoke to each other and talked about things of interest and curiosity. Many would like to build up a "pen-pal bridge" between individuals and the student-run associations. Wang BV3AV, an EE graduate student, devoted a lot of his time getting things organized for this unprecedented 10-hour QSO.

BY1QH is preparing for the installation of an SSTV station but we are lacking some information on activating this mode. We need to learn about the scan converter and how the equipment is connected. Can anyone send us this information? We have heard that some articles were published in *73* in the past but we have no way of researching this. *I'll try to do some research on this.—Arnie*

Amateur radio is still a brand-new concept to many young men and women here in the People's Republic. As the country becomes more prosperous, we believe that there will be lots of people getting involved in ham radio as soon as the government allows. Under such circumstances, we truly hope that our friends in the USA, Canada, Australia, Europe, and elsewhere come and visit us. We would love to have those visitors talk to our students in either English or Mandarin and spread the knowledge. Tsinghua University has a small but nice hotel on the campus which is a good place to stay. BY1QH will make arrangements for you, just let us know as early as possible.

VE7UBC, the University of British Columbia (UBC) Amateur Radio Society and BY1QH have successfully re-established the weekly schedule we held several years ago. Doug and Darby, two UBC graduates, talked with Rick on November 11th. The Canadians kindly introduced two other active Canadian university ARS groups—Concordia University ARS in Montreal and Ryerson Polytechnic ARS in Toronto. We are looking forward to getting in contact with them via the packet BBS system. BY1QH is very eager to get in touch with other university ARS groups. It would be great fun to talk with friends of the same age.

We are very happy to have received many messages via packet radio, especially from Jeff AA1LG of the Bronx High School of Science Amateur Radio Club. TUARC congratulates them for their activities and would definitely like to stay in touch.

We will be starting an amateur radio class at TUARC very shortly. The "two-boy vs. two-girl" combination will add more fun to BY1QH. All of them are students at Tsinghua and have a good command of English and great enthusiasm about SSB QSOs. I think that it is great that two YLs are interested in becoming hams because the vast majority are males.

Thanks to all who have been supporting our efforts. We would like to hear from all of you. Contact us via mail at: Rick Hunter, Room 316, Building 25, Tsinghua University, Beijing 100084, Peoples Republic of China, or via packet: BY1QH @ JA5TX.JPN.AS, or to George VE7CIZ @ VE7KIT.#VANC.BC.CAN.NA.

Switzerland *From the International Telecommunication Union Press:* Moldova, Bosnia and Herzegovina have joined the International Telecommunication Union (ITU). The instruments of accession of the governments of the Republic of Moldova and of the Republic of Bosnia and Herzegovina were both deposited with the ITU on 20 October 1992, bring ITU membership to 174 countries. Moldova (also known as Moldavia), a former USSR republic, is bordered in the east and south by the Ukraine and on the west by Romania; it has an area of 33,700 square kilometers and a population of 4,335,360 (1989). Its capital is Kishinev. It became independent in August 1991 and became a member of the Community of Independent States (CIS) in December 1991. Bosnia Herzegovina is southeast of Croatia and west-northwest of Yugoslavia. Its area is 51,129 square kilometers and it has a population of 4,335,000 (1991). Its capital is Sarajevo.

REPUBLIC OF KOREA

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Happy New Year to all. There is a new club in Pusan! The Pusan Packet Users Club has had two meetings so far. The second meeting was at the Pusan Yacht Harbor (branch office of the KARL) on September 26, 1992.

The club packet repeater station is set up on the mountain of "Hwang Ryong San," and the frequency is 144.74 FM, 24 hours a day. We are also planning to build a repeater on 435 MHz as a duplex system soon. HL5BMM donated a transceiver to the club for this purpose.

My station now consists of an IBM PC/XT for data communications with an MFJ-1278. These are hooked into my new Kenwood TS-850SAT. I also operate portable with my Yaesu FT-290 at 2.5 watts. I am hoping to meet many new hams on 160m CW, because Korean hams can operate between 1800-1820 kHz.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel

Six Meter Expansion Over a year ago a 50-kHz-wide splinter of 6 meters was opened in Israel, but for the benefit of Class "A" licensees only. Now this license class has a 200-kHz-wide band to work in—50.000 to 50.200 MHz. The Class "B" ticket holders have been allowed into the band (and presumably the Class "D" Technical codeless license—the first exams were just passed a week before the writing of this) from 50.100 to 50.150 MHz. In all cases, maximum output power may not exceed 25 watts and all operations on this band shall be on a secondary non-interfering basis.

Asia 100—Ahziv Island Since the 19th of September, 4X is also on the IOTA (Islands On The Air) map. It was the first time that, for several hours, Israeli radio amateurs activated a station from Ahziv Island, about one kilometer off the coast of Israel, in the Mediterranean Sea. Ahziv Island is not more than a rock about 100 by 60 meters, just barely above the surface of the sea, and on stormy days is completely covered by waves. Headed by Dov Gavish 4Z4DX, aided by volunteers Mark 4Z4KX, Eliezer 4X6DL, Gershon 4X6PW, Moni 4X6ZK, and Ziv 4Z9GAB, the group sailed for the offshore island, erected some dipoles and got on the air.

Ahziv Island is one of an island group in that area protected as a nature reserve, and as such it was forbidden to drill any holes for anchoring the antennas. Everything had to be self-supporting or tied by strings to rock protrusions. A lot of red tape had to be cut in order to procure permission from the various authorities. The easiest to obtain, of course, was from the Ministry of Communications, always ready to aid and issue licenses with special calls, like the one used here, 4XØAI, standing for "Ahziv Island." All in all, some 1,050 QSOs were made, 330 of them in CW. Four bands could be activated; namely, 21, 14, 18, and 7 MHz, while operating most of the time simultaneously with two transceivers and, for short periods, even with three. The group managed in this short period of time (only 390 minutes of activity, the time permitted to remain on this island) to work 56 countries. There was no permission to stay overnight, just for those few hours. If the authorities check and find out that no damage whatsoever was done to the island, we can hope that repeats of this activity will be permitted in the future to enable all the collectors of IOTA QSOs to receive the needed QSL cards that will be sent for each and every contact.

In summation: The activity was highly successful and all the participants are congratulated on a job well done.

Israel Represented at Friedrichshafen The Ham Radio Fair at Friedrichshafen, Germany, has been rightfully called "Europe's Dayton," and attracts hams from all over the world. Chock-full of manufacturers' exhibits, national radio societies' booths, a huge flea market, and special presentations, this ham radio haven gets larger year after year.

This past summer the Israel Amateur Radio Club had an official booth there with our official representative being Naomi Dor 4X6DW. Naomi is well-known as one of the net controllers of the European DX Net meeting daily on 14.246 MHz. Her OM, by the way, is 4Z4 Kilo Banana. Also on hand were Shalom Meltzer 4X4MS, well-known for his operations from many African countries, Ahron and Shoshana Kirschner 4X1AT and 4X6OL, Ruth and Joseph Obstfeld (the IARC chairman) 4X4CM and 4X6KJ, Yitzhak Markado 4X6ZH, and Gad Golan 4X6RT.

At the booth were films on special activities of the IARC, Keren Kayemet (National Land Reclamation Authority) films on Israel, 6,000 mini chocolate bars weighing 250 kilos (a gift from Elite, the country's largest producer of sweets) and miniature bottles of Israeli wines. Of course, there were specimens of all the different Israeli diplomas, IARC publications, and other goodies from the Israel Amateur Radio Club.

OKINAWA

JAPAN

David Cowhig 7J6CBQ
US Consulate General Naha
FBU PSC 556, Box 840
FPO AP 96372-0840

Okinawan Hams Celebrate the Re-Opening of Shuri Castle The re-opening of Shuri Castle was the big event during the month of November 1992 in Okinawa. The kings of the Ryukyu Kingdom, an independent state until the 1879 merger with Japan, regularly entertained emissaries from the Emperor of China in Shuri Castle. The castle, first built in 1395 and restored several times thereafter, was destroyed during a 1945 battle in which one-third of the civilian population perished. A group of Okinawa hams went on the air as JR6RL from Shuri Castle on the weekend of November 14-15 to celebrate the reopening of the castle to the public. Okinawans are rediscovering their strong links to China and their history as an important trading nation from the 14th through the 17th centuries. A novel and upcoming NHK national TV series entitled "The Winds of the Ryukyus" has aroused intense interest in the Ryukyu kingdom, which as a trading nation absorbed the cultures of China, Indonesia, and Thailand and eventually created a distinct Okinawan culture.

Okinawa lies 300 miles off the Chinese coast and halfway between Kyushu, Japan's southernmost large island, and Taiwan. Okinawa prefecture, the southernmost of Japan's 47 prefectures, has a population of over one million. Okinawa was for many centuries a borderland between China and Japan so Chinese influence on Okinawan history, culture and religion is very strong.

On the HF bands Chinese stations are often stronger than Tokyo stations. There are only about 70 stations, all club stations of one kind or another, in mainland China, but with many operators per station Chinese stations are often heard on the ham bands. Taiwan now has 1,700 licensed hams and 1,200 ham stations, so much activity from Taiwan and mainland China is to be heard here on the HF bands. An Okinawan station can easily join in a round table with Chinese mainland and Taiwanese stations.

I often hear Japanese hams practice their Chinese with Chinese hams. The NHK Educational TV network has a weekly "learn Chinese" program—as it does for a variety of other languages, including English, Russian, Italian, and Spanish. So these hams can work on their Chinese systematically in a formal course right at home and then get on the air for language practice.

So far I have been able to exercise my Chinese in talking with stations in Tianjin, Nanjing, Shanghai, Fuzhou, and Hangzhou. I was worried about understanding Chinese ham slang, but they will oftentimes use English for special ham words. In Taiwan, hams are not only called hams but are also known as the sausage tribe (xiangchangzu). China now has about 70 club stations in schools, local government sports associations, and some factories. Most of the Chinese hams I have talked with have been YLs. They tell me that YLs are fully half the Chinese ham population. Wang Min, an engineering student at Zhigong University in Tianjin, a port city near Beijing, told me that of the 30 members of the Zhigong University ham radio club, 20 are YLs. China should be an excellent recruiting ground for the Young Ladies Radio League! 73

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Mixers and Other Small Case Devices

This month I will cover mixers: prepackaged, home-brewed, and a few others. Applications for mixers are numerous. I will show how a surplus mixer can be used at 10 GHz in my home-brewed station. Most of the mixers to be covered will be the small commercially available hermetically-sealed types associated with Mini-Circuits Labs. Be aware that these are not the only types available as they do not need to be hermetically-sealed to work at high frequencies.

There is some confusion associated with this type of device in that not all devices in similar packages are mixers. They can be power splitters, mixers, phase splitters, attenuators and even amplifiers. These devices have become quite common in the surplus market, making their use very popular in most amateur design projects. Take a look in any *ARRL Handbook* for the last 10 years and you will find articles peppered with SRA-1s or similar type mixers. The beauty of these devices is that if you have to go out and purchase them, they are available right off the shelf and the cost is not prohibitive: under the $20 mark.

First, let's cover mixers of the SRA-1 type. This type is made for operation up to 500 MHz and is one of the most popular mixers produced to date. It has been used and observed in so many different types of projects over the last 10 years that I think it is a household word synonymous with mixer.

The SRA-1 and its cousins are produced by Mini-Circuits Labs and are constructed using the double-balanced configuration shown in Figure 1. Case styles may vary, as well as the frequency and level (dBm) handling capabilities of similar type devices available from them. Be warned: Mixers are not the only devices that can occupy similar case styles. I have observed people purchasing surplus PC boards with devices looking like mixers on them, only to find out later that they were not mixers at all. A quick scan of a catalog will identify the device you have. I find that attenuators, phase splitters and mixers comprise the most common devices found in surplus. I have not yet observed amplifiers in these case styles. Mini-Circuits Labs does provide several series of amplifiers fully packaged and some of them look very similar in case style to our mixer cases, but I have never seen one in surplus.

If you can remember all the part numbers in the catalogs you have no problem identifying surplus parts. However, we are not computers and we don't carry data books with us so just try to recall some of the more memorable devices when out scrounging. What I try to do is generalize my memory bank to common types and use the catalogs for others. There are just too many part numbers and variations to try and remember. Don't memorize the more specialized components, just form some mental note on the most popular devices to look for in surplus. That limits most mixers to the GRA, SRA, SBL, TAK, TSM, TFM and SAM type mixers. The following prefix on these mixers is not important at this time if the highest frequency of use is 500 MHz. Most mixers will work to these limits. Sure, some go much lower but the odds are that the device you will find is good to 500 MHz. The SRA-2000 and the SBL-11 are good examples of mixers that go up to 2 GHz and seem to populate surplus boards.

Re-Pack Mixers

Re-packs, as I call them, are nothing more than commercial mixers in a small pin configuration housing placed in a container that connects the pins to coaxial connectors. Most of the repack mixers use some of the previously described mixer products as their main component. Some of these mixers with coaxial connectors are denoted with the prefix of ZLW, ZAD, ZEM, and ZFM identifiers. They are constructed with easy-to-use coaxial connectors for bench tests and lots of other applications requiring sturdy packages and quick connect/disconnect coaxial connectors. They can be furnished with almost any type of coaxial connector. These mixers are usually much harder to locate in surplus than the pin-packaged ones previously described, and when they are available they have a higher price.

Photo A. OZ1UM with his microwave setup in Denmark for 10, 24, and 47 GHz operation.

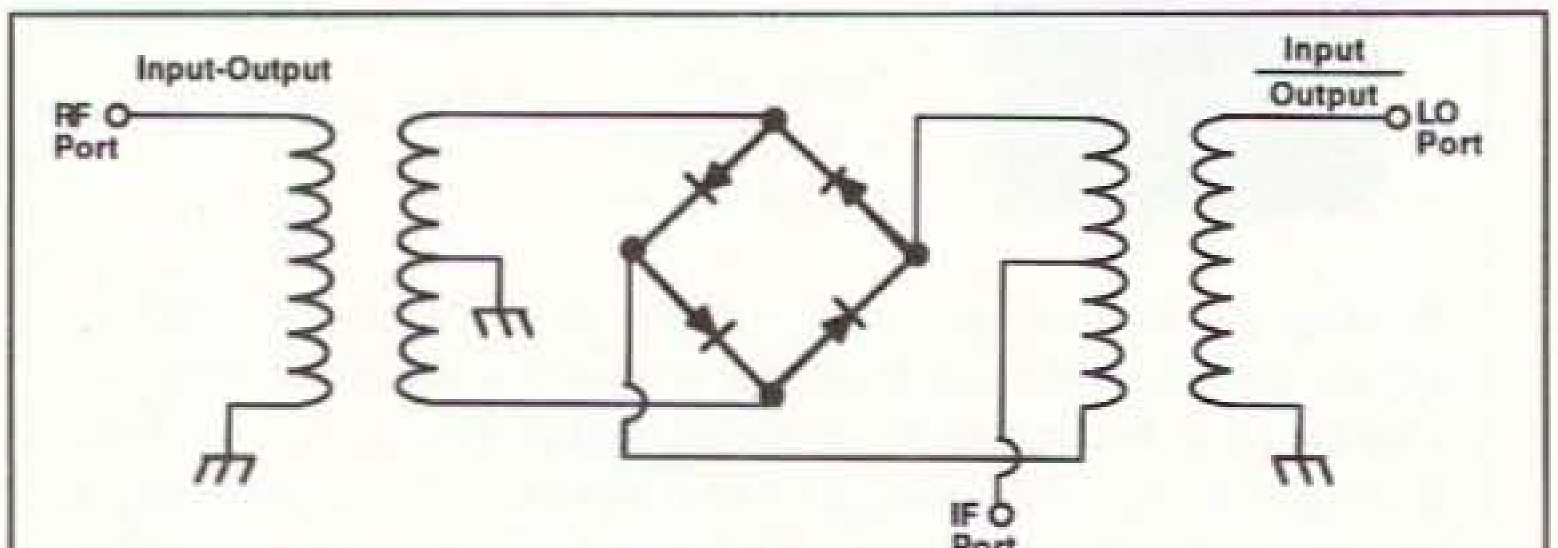

Figure 1. Basic double-balanced mixer (DBM) wound on two toroid cores, usually ferrite.

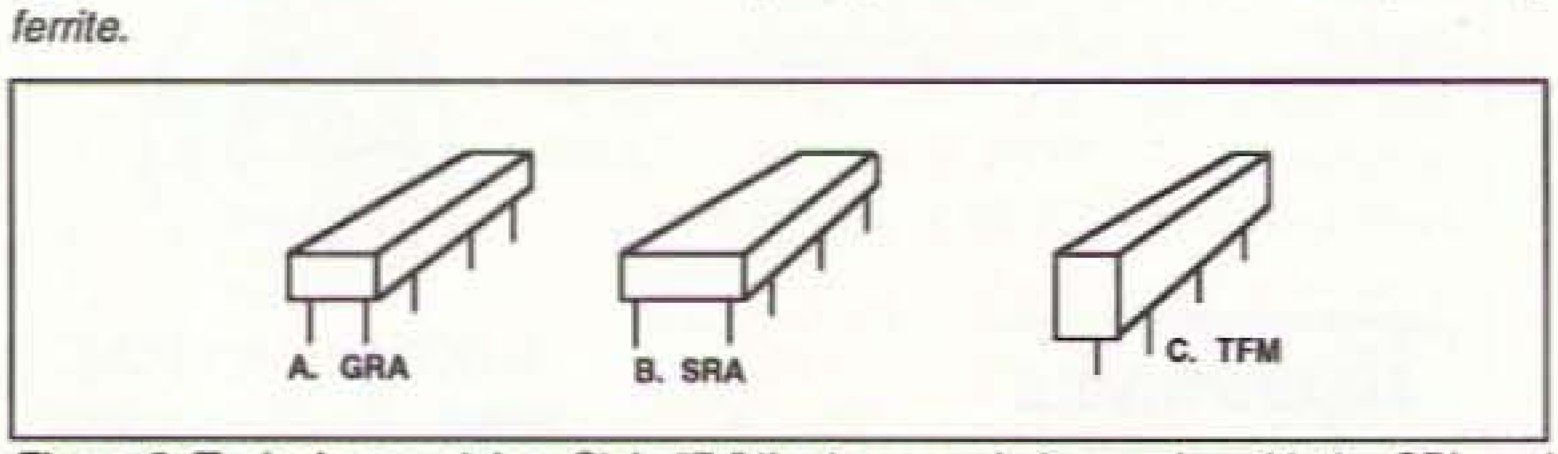

Figure 2. Typical case styles. Style "B," the larger unit, is popular with the SBL and SRA mixer types. Style "C" is typical for TFM types.

As I stated before, power splitters or power dividers are packaged in similar case styles and can be confused quite easily. The differences in some of them lie in the labeling of the component parts, such as PSC, or PSCQ or PSCJ. If the part you find has a "P" in the part identifier, you can be assured it is some form of phase splitter or combiner. There are variations such as the PDC identifier, which is a directional coupler. Again, packaged directional couplers use ZFDC, still retaining the "DC" notation directional coupler. It's just like the "PSC" or "SC" part denoting the splitter coupler above. With most Mini-Circuits components you can make a basic determination on the function by word similarity of their code identifier.

This can be depressing. Possibly I am giving up part of my gray matter for ransom by this description, but that's how I try to group the miniature parts in my mind. The trick is to remember in generalities how the scheme works and make some rules for your use. It's necessary when looking at surplus PC boards as you never seem to have the proper catalog along when you find something interesting.

There are exceptions to any rule but in this case they seem to be unusual components and there aren't enough of them to worry about. For detailed information, contact: Mini-Circuits Labs, P. O. Box 350166, Brooklyn NY 11235-0003; (718) 934-4500.

Be aware that there are also filters, RF solid-state switches, and even RF transformers available. If new demands are present and the market wants them I suspect almost anything that can be produced will be put into a similar package for ease of use. Please note that this is not the only company that manufactures this device but it is the most popular from both an advertising and a surplus availability basis. See Figure 2 for some of the more popular case styles. These units all look alike and even have the same pin counting method, so just consult a catalog for your device on pinout connections. In most cases a blue insulating bead lets you know which pin is pin #1.

Open-Frame Mixers

The market is also saturated with open-frame mixers constructed on small PC boards in the open. They are used in cable TV converters and even in amateur radio transceivers. These are configured the same but are constructed using discreet components instead of the prepackaged types. I am not sure that this is cost effective, but in any case the circuitry is quite the same. The basic diode mixer is connected in a quad double-balanced mixer configuration. This ring of four diodes has input and output toroid transformers connected in such a way as to form three ports.

The primaries of these two transformers are the actual input and output for the mixer, while the center tap of one secondary serves as the third port, the IF port. The other secondary center tap is grounded in normal operation. The input is the "L" or local oscillator and the output is the "RF" port. Keep in mind that the RF and IF ports are bidirectional. They can be used for receiving and transmitting.

See Table 1 for port identification. As shown in Table 1, RF and IF terminals are bidirectional—that is, receive or transmit. Only the LO (local oscillator) terminal is singular in that the LO is maintained for either receive or transmit states. The specific type of mixer you use does not make much difference as long as it will work at the frequency of interest. Most mixers are good to 500 MHz and some to just over 2,000 MHz, then stripline or spe-

cial construction type mixers take over.

10 GHz Mixers/Applications

The easiest mixer for microwave use is the 3 dB hybrid mixer. See Figure 3. This is the mixer that is used on my 10 GHz system. It can be easily reproduced in larger scale for other lower microwave frequencies and is very forgiving of construction errors. The local oscillator injection is on 10.223 MHz and uses an IF frequency of 145 MHz (a 2 meter SSB HT) for receive and transmit.

On the mixer RF port, coaxial relays are used to switch preamp direction to change from receive to transmit. In this way only one low-noise amplifier is needed for normal receive and then it serves as a gain block in the transmit direction to boost the output from the mixer to a higher level. In my application, I use the amplifier to drive a 10 watt TWT (traveling wave tube) to full output power. A TWT requires about +2 dBm drive power and has about 40 dB gain. For reference: 0 dBm = 1 mW, +20 dBm = 100 Mw, +30 dBm = 1W and +40 dBm = 10 watts.

To construct a converter for any frequency, all you need is a mixer and local oscillator source, and an i-f amplifier. The frills for transceiver and filtering can be added later as the converter progresses. All stages in the mythical converter can be individual circuit blocks made up of surplus or salvaged components (gain blocks/mixer blocks) and hooking them together in a coaxial connection. It's really quite easy. If you don't believe this, look inside any high quality spectrum analyzer or microwave test set as this is basically the approach they take.

The same is true in my 10 GHz station. The mixer used was surplus and a bare-bones 3 dB hybrid type. It was enclosed in a box fashioned out of 1/2"-wide brass strips. Again, SMA coaxial connectors were soldered to the appropriate ports on the PC board for the RF, LO, and IF connections. See Figure 4 for a description of this type of mixer construction. This surplus mixer was intended for use at 12 GHz with an IF of 1.4 GHz. We had to modify the IF port to make it usable at 145 MHz. This was accomplished by cutting dead the 1.4 GHz RFC (stripline) and replacing it with small wire-wound RF chokes resonant at 145 MHz.

Recently, during the ARRL 1992 10 GHz contest, I took this same mixer, using it in my 10 GHz system. Operation on the last weekend was mobile 10 GHz SSB with my partner N6IZW. Both of us operated 10 GHz mobile in motion along the coast road from San Diego towards Los Angeles. We used the waveguide slot omni antennas described in this column some time ago. This omnidirectional antenna made mobile operation possible. The omni performed well, giving about 10 dB nominal gain.

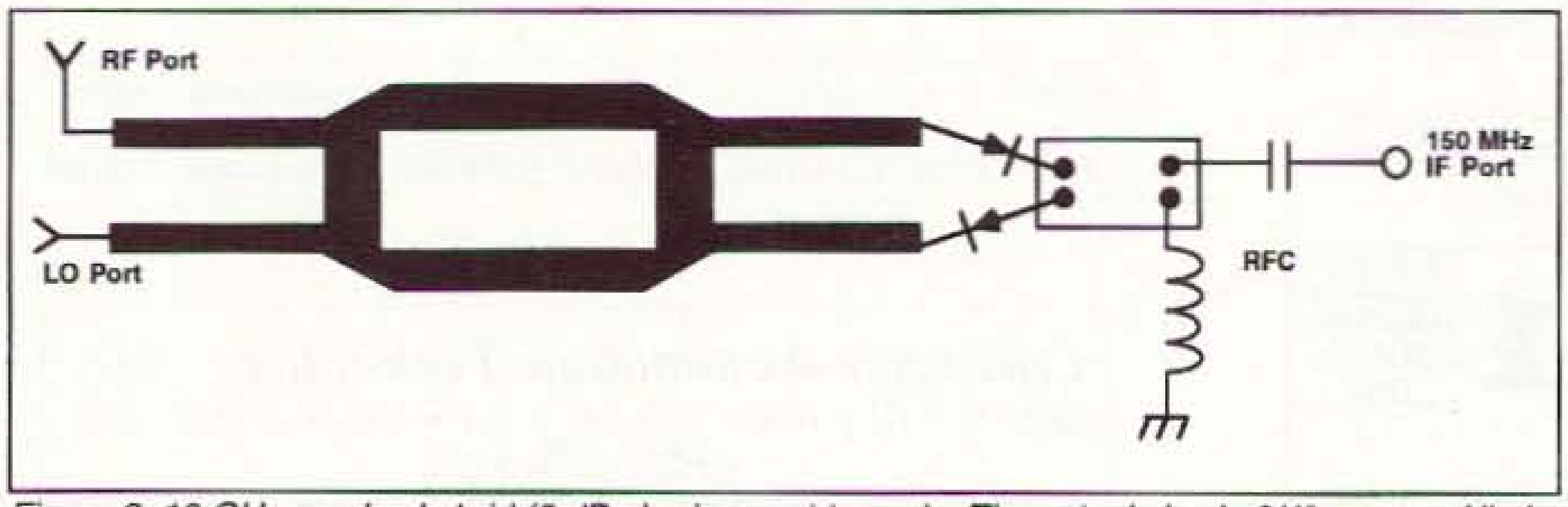

Figure 3. 10 GHz surplus hybrid (3 dBm) mixer, not to scale. The actual size is 3/4" square. All elements are constructed with 1/4-wavelength stripline. The IF port has a 1/4-wavelength stub acting as a short to 10 GHz and passing low frequency 2 meter IF.

How was operation? Well, we both logged about 27 SSB contacts from Kerry N6IZW's truck. The rigs we used were placed in boxes in the bed of the truck and they had to be modified for mobile operation. We had been using toggle switches to transfer relay-controlled circuit functions from receive to transmit.

The circuit was modified by constructing an RF actuated relay circuit that would do the required switching in the 10 GHz converter when we pushed the PTT on our 2 meter HTs in the cab of the truck. In this configuration, the 2 meter HTs act as a rec/xmit IF of our 10 GHz system. When we operated the PTT on the 2 meter HT, RF was detected in the truck bed detect circuit and it in turn operated a myriad of coaxial relays in the rear of the truck. This re-configured our equipment from receive and went to transmit, activating the TWT amplifier last. Quite a hunk of junk going on, but it performed flawlessly for the entire day's operation on both Kerry's and my system.

With the switching in good operation and planing operation using omnidirectional antennas several things had to be proved. As far as I know, mobile operation in motion has not been done before, at least with omnidirectional antennas. In actual use the antennas worked out quite well, as shown by the 27-some contacts we made. Of course, we took advantage of the terrain along the coast highway, making most paths over the water. However, many contacts were made over land paths and communication

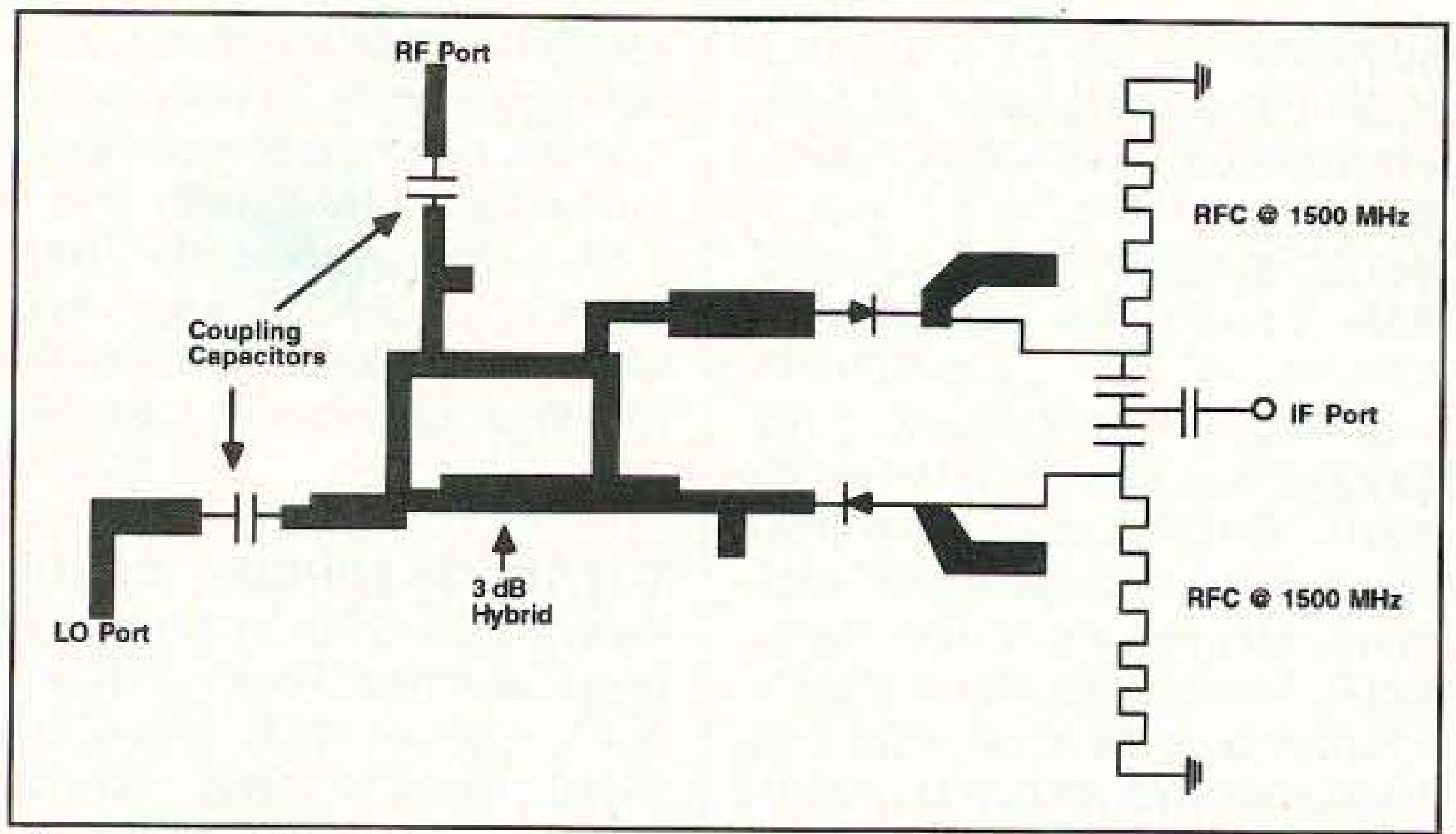

Figure 4. 12 GHz commercial mixer with 1500 MHz IF to modify the IF port for 150 MHz/2 meter IF. Cut out 1.56 GHz RFCs and replace with 2 meter RFC. RFC (choke) must be a miniature device the size of a 1/4-watt resistor as the PC board is 3/4" wide by 2" long.

was just great. When the Doppler shift became too great due to our motion and signals were strong, we shifted to FM narrowband operation with our HTs (a flick of the mode switch). FM worked quite well. As a matter of fact, in a few cases communications on 10 GHz was so good it was a vast improvement over simplex 2 meter communications.

We made no attempt to aim antennas, other than trying to locate a parking space or drive until signals peaked up to higher levels. On one stop temptation was rampant as the best signal strength was obtained when parking in front of a bakery. Normally, traveling from San Diego to Los Angeles is done on freeways and little is noticed of the small coastal communities. But, since time was not important, we took the coast road and it proved to be an additional pleasure for a Sunday outing.

So much for our operation. The point I wanted to make is that our rigs worked well and they were constructed out of surplus components. You don't have to pay dearly for an expensive commercial unit, just watch the surplus sales and swap meets. What you want may be disguised as part of a much larger PC board. In our case, we had to cut the mixer out of a much larger PC board and attach connectors to it. It worked well. Keep your eyes open and you too can possibly find some rare goodies in surplus.

International Microwave Operation, Denmark

I received another bit of information from Steen Gruby OZ9GI in Denmark. Steen sent the logs of operation from their group's (the North Zealand and Procom's Amateur Radio Club) activity. They operated on not only 10 GHz but 24 GHz and 47 GHz as well. Quite an accomplishment. In 1990 the best they did on 24 GHz was 227 km, set by OZ1UM and DB6NT, just 52 km off the world record for 24 GHz distance. This year they planned to work 47 GHz and from their notes never believed that they would equal or better their previous distances set on 10 GHz or even 24 GHz. However, DB6NT, DF9LN and DF2CA succeeded in carrying out a two-way SSB/CW QSO with OZ1UM. That equates to a contact on 47 GHz of 90 km, and a European record.

The equipment at DB6NT was a transceiver with 5 mW output and a noise figure of 15 dB. They used a 30 cm parabolic dish with a Cassegrain feed system. OZ1UM's transceiver had 100 microwatts and a similar noise figure, 15 dB. See Photo A. The antenna was a 25 cm Procom dish with an open waveguide feeding system, referred to as a "shepherd's crook." They all appear quite active and look like they are mounting a very serious effort towards breaking the world distance record of 104 km on 47 GHz. I have to add that they must have had a good source for components especially for 24 GHz and 47 GHz materials. Members of our microwave group here in San Diego are looking for materials for these frequencies as they are quite hard to obtain. You have to watch out for lots of those components that start with the "M" word ("microwave") that makes components expensive at swap meets and other gatherings.

Well, watch out for that "M" word. I hope you enjoy it as much as I do. As always, I will be glad to answer any questions concerning this or other related topics. Please enclose an SASE for a prompt reply. 73

TABLE 1. PORT IDENTIFICATION FOR DBMS.

	SRA	SRA	SRA	SBL	GRA
Type	1-3	2-4	5-11-12	1-3	A11
LO	8	8	8	8	1
RF	1	3-4	1	1	6
IF	3-4	1	3	3-4	4
Ground	2-5-6-7	2-5-6-7	2-5-6-7	2-5-6-7	2-3-5

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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 Barter 'n' Buy, Judy Walker, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

The deadline for the March classified ad section is January 2, 1993.

PRINTER FOR SALE: Vic 1525, very low useage, with stand. $130. Klaus Spies, POB 48185, Niles IL 60714-0185. BNB820

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Uncle Wayne's Bookshelf

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RANDOM OUTPUT

David Cassidy N1GPH

Writing for *73*

At least three or four times a week, somebody asks me about writing for *73*. Since we are always on the lookout for good articles, for *73* and for our sister publication *Radio Fun*, I thought I'd use this space this month to give you all some pointers on getting published. I hope many of you will give it a try.

What to Write

This is the easy part. Any book on free-lance writing will tell you that the best way to know what kind of articles a particular publication is looking for is to read that publication. Not just one or two issues, either. You want to get intimately familiar with a magazine's style and content, so that means looking at recent back issues (the last year or two) and every new issue as it comes out (writers who we use on a regular basis get free subscriptions—newcomers have to earn one). Reading current issues will keep you from writing about something we've already covered recently.

If you read *73* on a regular basis, you know that we mostly publish construction articles, other "how-to" type articles and product reviews. Product reviews are almost always assigned to writers who we've worked with for a while. Every once in awhile a product review will come in for some item that we hadn't thought of. If the product is relevant and the writing is good, we'll buy it. This is probably the toughest way to get published in *73*, but it does happen on a regular basis. If you want to try a product review, stay away from the major manufacturers—or at least their main products. The latest 2 meter HTs and HF rigs are *always* reviewed by writers we know (in case you're wondering, yes . . . we *do* have to return the items to the manufacturers). Also, stick to products that have been introduced or upgraded within the last year. Things like antennas (especially beams or other "heavy iron"), testbench gear, electronic kits and gadgets from some of the smaller manufacturers are good products to think about. If you've recently bought something that you particularly like, study a few of our recent reviews, then go to it. You can make it as technical as your testbench and knowledge allows, or you can do a more informal "user review" (we publish both kinds, but tend to lean toward the more informal). One word of caution: Do *not* call a manufacturer and try to get a piece of free gear from them by telling them you're "writing for *73*." All the manufacturers know (or at least they should) that equipment loaned for review is shipped to our editorial offices before going to the author, and all of our regular reviewers know that they should never call a manufacturer on their own.

The easiest way to get published in *73* is with a good "how-to" article. It could be anything—a construction article, a clever solution to a tough antenna installation, an article about how your club ran a successful membership drive or licensing class. If your article has to do with amateur radio and it shows others how to do something, you've already won half the battle. The other half is the writing part.

How to Write

While I don't pretend to be the last word on good writing, I *have* read a lot of books on the subject by those who are. Writing well is not difficult. A few simple rules, if followed, will help anyone with an average education to write acceptable prose.

Rule Number One: Read! If you are not a reader, chances are you are also not much of a writer.

Rule Number Two: Do not try to write about something you are unfamiliar with. An editor can smell BS from across the room, and so can a reader. Write about what you know.

Rule Number Three: Do not use a big word when a small word explains your point just as well.

Rule Number Four: Do not use two words when one word will do.

Rule Number Five: Do not repeat yourself. Make your point, then move on.

Rule Number Six: Your article (story, novel, screenplay) should be exactly as long as it needs to be—not one word longer, not one word shorter.

Rule Number Seven: Get your facts straight. Not close enough. Not "it sounds right." Anything that you present as a fact must be 100%, no exceptions, accurate.

In magazine writing, you need to grab the reader in the first sentence or two. If you don't, he'll move on to the next page. Don't spend the first three paragraphs with a cute story about how you came up with your whiz-bang antenna. Explain the problem, propose the solution then get on with it. Also, don't get overly concerned with style and vocabulary (see Rule Three). Write as if you were writing a letter to a close friend.

One final thing . . . and this is the absolute most important thing for any new writer to get into his or her head right from the start. Are you ready? Here it is: All good writing is REwriting. Nobody—not your high school writing teacher, not Ernest Hemingway, not Walt Whitman, not Rachel Carson, not John Irving, not Alice Walker, not Stephen King—nobody writes so well that they don't need to rewrite. The first words on paper are just that—words on paper. The craft of writing is taking those words and making them say *exactly* what you want them to say, in the best way you can say it. If you haven't gone through at least two or three rewrites, you're not writing, you're just typing.

Be Nice to Editors

Despite what some professional writers might say, editors *do* have hearts and anything you do to make their job easier will make them all warm and fuzzy inside. The first thing is to reread the above paragraph about rewriting. A good editor (or even a bad one, for that matter) can tell a first draft before opening the envelope. You can't fool us, so don't try.

Other things you can do to make an editor think of you kindly all fall into the "common sense" and "common courtesy" arenas. Get yourself a good book on

Continued on page 72

PROPAGATION

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As this is being written (mid-November) the solar flux that had been declining steadily for several months has turned around and increased to the 150s during the past three weeks or so, and the higher HF bands have been very good for DX. This happy situation, however, is likely to have returned to normal by the time you read this, and turned downward again. February is *not* expected to be a particularly good month for communications on the HF bands.

Look for a disturbance in the magnetic field on or about February 1st, with possibly *very poor* band conditions, perhaps even a DX "blackout." There is likely to be an even worse situation surrounding the 10th of February (give or take a day or so) which is likely to last for four or five days. HF bands are likely to be very upset again, and you might even find some very disturbed geophysical conditions, like heavy winter storms, and other effects on earth. Finally, a day or two surrounding the 21st is likely to exhibit very poor HF band conditions once again. Between these times (see chart) you will find Good-to-Fair band conditions—typical of February. On "Good" days there ought to be openings into Europe in the morning, to Africa at midday, and to the Pacific in the afternoon or early evening, on the bands between 20 and 10 meters. Although the higher bands like 10, 12, 15, and 17 meters may close by sunset, 20 meters should stay open until early evening hours. Short-skip will be available on most bands above 30 meters during daylight hours. On 30, 40, and 80/160 meters, you can expect late-afternoon-to-early-evening openings into Europe, with the lower bands becoming better and better as darkness overtakes all of the U.S.A. In the early mornings, expect openings into the Pacific on "Good" days. As always, 160 meters—and to some extent 80 meters—are best at night and poorest during the day because of high absorption of these lower frequencies.

The daily forecast can be followed for times of "Good," "Poor," or "Fair" band conditions. On "Fair" days there will be some propagation east and west, but more likely on north-south paths. On "Poor" days the HF bands may exhibit polar path echo and garbling, with little or no propagation to Europe or the Pacific. There could be some trans-equatorial communication. There can be abrupt signal drop-out and much fast QSB or fading—even on decent signals. Use the band-time-direction chart to pick the best hours for DX on the various bands, modified by what you see on the daily forecast. WWV is your best friend for current information of Solar Flux and Magnetic Field indexes. Remember, the *higher the Solar Flux and the lower the Boulder K and A indexes*, the *better* conditions will be for worldwide propagation.

Let me know how these forecasts work out for you, and if more explanation of their use is needed. See you next month. Jim Gray W1XU. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	-	-	-	-	20	20	-	-	-	15
ARGENTINA	20	40	40	40	-	-	20	15	15	10	10	15
AUSTRALIA	15	20	20	-	40	40	40	-	-	20	20	15
CANAL ZONE	20	20	20	20	20	20	20	15	10	10	15	15
ENGLAND	40	40	40*	40*	-	20	15	10	15	20	20	-
HAWAII	15	20	-	-	-	-	20	20	20	10	10	15
INDIA	-	-	-	-	-	-	20	20	-	-	-	-
JAPAN	15	20	-	-	-	-	20	20	-	-	-	15
MEXICO	20	20	20	20	20	20	20	15	10	10	15	15
PHILIPPINES	-	-	-	-	-	-	20	20	-	-	-	-
PUERTO RICO	20	20	20	20	20	20	20	15	10	10	15	15
SOUTH AFRICA	20	40*	-	-	-	-	20	10	10	10	15	20
U.S.S.R.	-	-	-	-	-	-	20	15	20	20	-	-
WEST COAST	15/20	20/40	80	160	160	160	-	-	-	10	10	15

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	-	-	-	-	-	-	20	-	-	-	15
ARGENTINA	20	20	20	40	40	-	20	20	15	10	15	15
AUSTRALIA	15	20	20	-	-	-	40	-	-	-	15	10
CANAL ZONE	15	20	40	40*	40*	-	20	15	10	10	10	15
ENGLAND	40	40	80	-	-	-	-	20	15	15	20	40
HAWAII	15	20	-	40	40	40*	40*	20	20	15	10	15
INDIA	-	-	-	-	-	-	-	20	-	-	-	-
JAPAN	15	-	-	-	-	-	-	20	-	-	-	15
MEXICO	15	20	40	40*	40*	-	20	15	10	10	10	15
PHILIPPINES	15	20	-	-	-	-	-	20	-	-	-	15
PUERTO RICO	15	20	40	40*	40*	-	20	15	10	10	10	15
SOUTH AFRICA	20	40	-	-	-	-	-	15	10	10	15	20
U.S.S.R.	-	-	-	-	-	-	-	20	15	20	-	-

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20	-	-	-	40	40	40	-	-	20
ARGENTINA	15	20	-	40	40	-	-	20	-	10	10	15
AUSTRALIA	10	15	20	20	-	-	40*	40*	20	20	15	15
CANAL ZONE	15	20	20	-	-	-	-	20	15	10	10	10
ENGLAND	20	40	40	-	-	-	-	-	15	15	20	20
HAWAII	20	15	20	40	40	40	-	20	20	15	15	10
INDIA	-	15	20	-	-	-	-	-	20	-	-	-
JAPAN	10	15	20	-	-	-	40	40	40	-	-	20
MEXICO	15	20	20	-	-	-	-	20	15	10	10	10
PHILIPPINES	10	15/20	15/20	-	-	40	40	40	-	20	-	20
PUERTO RICO	15	20	20	-	-	-	40	40	40	-	-	20
SOUTH AFRICA	20	20	-	-	-	-	-	-	15	10	15	15
U.S.S.R.	-	-	-	-	-	-	-	-	20	20	-	-
EAST COAST	15/20	20/40	80	160	160	160	-	-	-	10	10	15

*Try 80 meters.

The bands shown represent the highest usable a these times on "Good Days."

Note that the lower frequency bands open first and close last.

FEBRUARY 1993

SUN	MON	TUE	WED	THU	FRI	SAT
	1 V-P	2 P-F	3 F-G	4 G	5 G	6 G-F
7 F-P	8 P	9 VP	10 VP	11 P	12 P	13 P-F
14 F-G	15 G-F	16 G-F	17 G-F	18 F-G	19 G-F	20 F-P
21 P	22 P	23 P-F	24 P-F	25 F	26 F	27 F-G
28 G						*VP=Very Poor

KENWOOD

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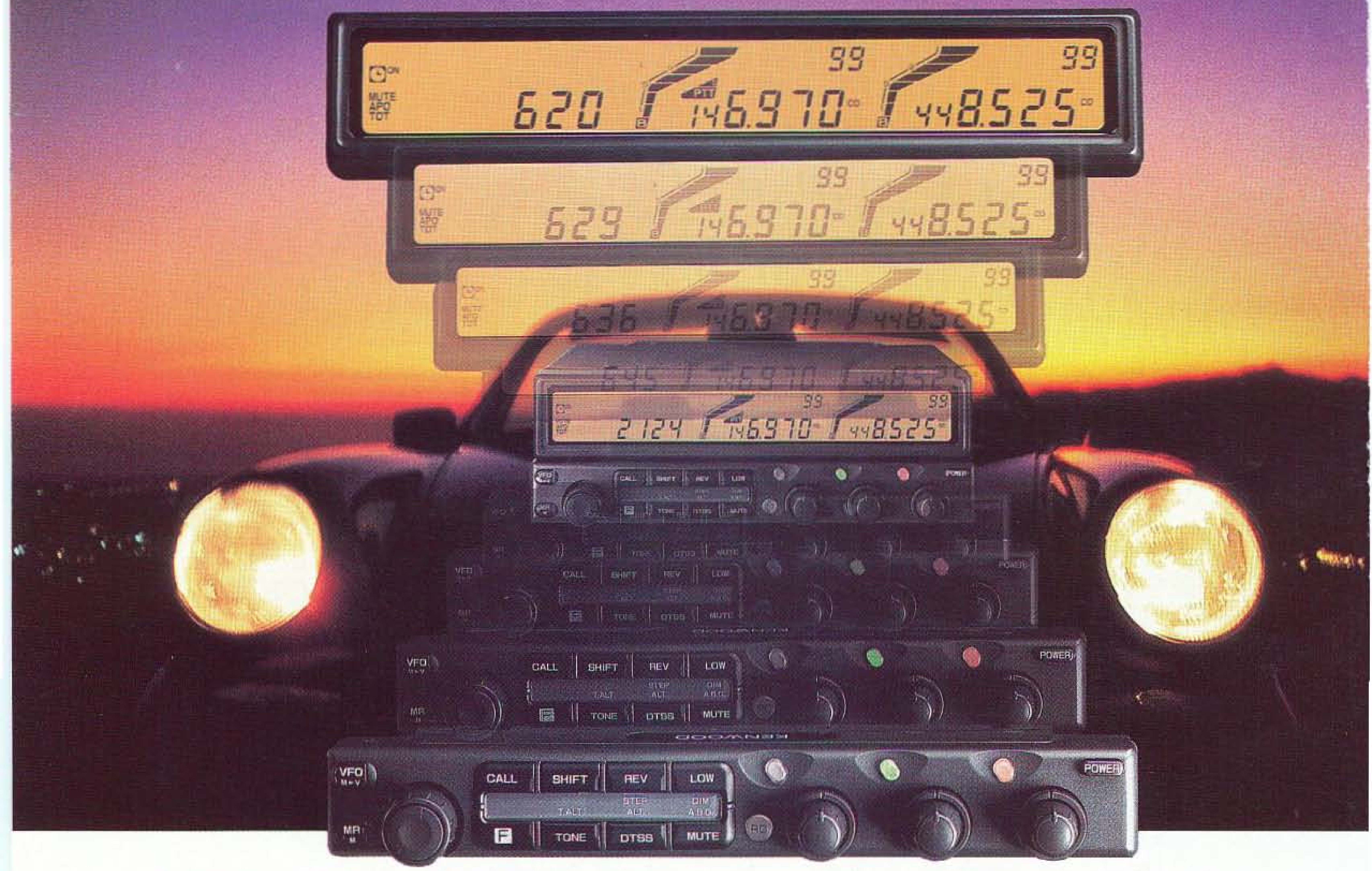
NEW!

Split Decisions

Introducing the TM-742A and TM-942A—high-performance mobile transceivers with innovative 3-way convenience



Deciding on where to mount a transceiver can be a tough call. But with Kenwood's new TM-742A (144MHz/440MHz) and TM-942A (144MHz/440MHz/1200MHz) FM multi-banders, you get to enjoy real freedom of choice, because controls and display can be installed separately (requires optional kit). With their top-flight features and turbo-charged performance, these transceivers bring stylish sophistication to the world of mobile communications.

●High output—50 watts (144MHz), 35 watts (440MHz), 10 watts (1200MHz) ●100 memory channels+1 call channel and memory bank system ●8 scan modes per band, plus CO and TO scan stop modes ●Independent SQL and VOL controls for each band ●Automatic band change (A.B.C.) ●S meter squelch, noise squelch & auto squelch ●Tone alert with elapsed time indicator ●Date & time display, stopwatch, alarm, on/off timer ●Direct frequency entry with supplied microphone ●Cross-band repeater, dual-in repeater, fixed-band repeater

TM-742A/942A

Mobile Transceivers

●New & improved detachable front panel

Total 3-way convenience. For example, the main unit can be installed in the trunk, while the display and controls are mounted either side of the steering wheel (with DFK-3, 4, 7).

●Tri-band receive/display

The TM-942A can receive three bands simultaneously, with all three frequencies displayed on the LCD panel. The TM-742A can be upgraded to tri-band status with one of four optional band units (28MHz, 50MHz, 220MHz, and 1200MHz).

●Built-in DTSS with pager function

DTSS allows DTMF access to the transceiver: the squelch is opened only when a specific 3-digit code is received. Also, a pager alerts the operator to an incoming call.

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