73 Amateur Radio Today

AUGUST 1994
ISSUE # 407
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CANADA $3.95
A WGI Publication
International Edition

Five Easy Projects You Can Build

73 Reviews Azden's 6m Mobile Drake's New Receiver JPS' Digital Filter

Special Advertising Insert
Summer Catalog from
Radio City, Inc.

0 74820 08725 1 08

The IC-Δ100H Takes The Magic Beyond 3 Wishes!

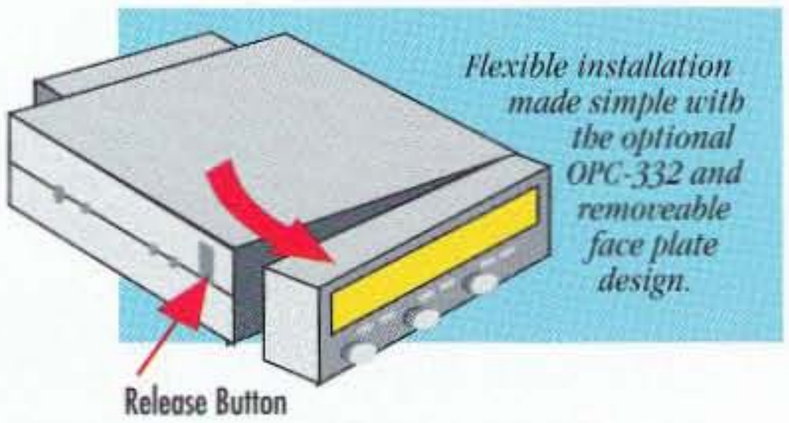
Exclusive Triple Band Capability

- Three independent band units for 2 M, 440 MHz and 1.2 GHz operation (simultaneous receive).
- Three independent displays can freely select the desired band unit.
- Each display indicates S/RF, volume and squelch levels.
- Each display is controlled by a separate volume and tuning knob.
- Select from 3 external speaker jacks.

8 POSSIBLE COMBINATIONS!		
#1	#2	#3
2M	440MHZ	1.2GHZ
2M	440MHZ	440MHZ
2M	2M	1.2GHZ
2M	2M	440MHZ
440MHZ	440MHZ	1.2GHZ
440MHZ	440MHZ	440MHZ
440MHZ	2M	1.2GHZ
440MHZ	2M	440MHZ

More than a tri-band radio, the IC-Δ100H gives you true freedom of choice!

- No removal or installation of additional band units required.
- Each operating band has a separate antenna connector to enable duplexer/triplexer use without any mismatching antenna loss (not one common antenna for multi-signal, one band operation like you see in competitive models).
- Cross band double duplex (transmit on one band while receiving on two others) and full crossband duplex (transmit on one band and receive on another) is possible. The one-touch PTT enables telephone-like conversations without having to continually press PTT.



Flexible installation made simple with the optional OPC-332 and removeable face plate design.

Remote Installation Options

- **One Body** – install as a complete unit.
- **Separate** – detach the front panel and mount each separately (see illustration).
- **Remote** – Mount the main body in the trunk (OPC-333 and OPC-335 req.).

Incredible Performance

- AFC-RIT, AFC-VXO, manual RIT and manual VXO modes to compensate for "off frequency" of the Tx station (1.2 GHz).
- High Sensitivity – less than .16μV.
- Double-conversion superhetrodyne receiver system.
- More than 2.4 W audio output power.

Memory Bank System

- 642 memory channels organized in two separate banks* (very convenient for two ham families).

MEMORY BANK SYSTEM							
Options	Bank/User #1			Bank/User #2			TOTAL
Bank	#1	#2	#3	#1	#2	#3	
Normal*	100	100	100	100	100	100	600
Scan Edge	6	6	6	6	6	6	36
Call	1	1	1	1	1	1	6
Total IC-Δ100H Memory Channels:							642

The memory bank system can even be customized for "his" and "hers" operation!

- Priority Watch – Scans one (or more) memory channels per band while operating on a VFO frequency.
- Transfer call or memory channel contents to VFO. Particularly useful when searching for signals around a memory channel frequency and for recalling the offset frequency, tone frequency, etc.
- 14 DTMF autodial memories for autopatching, accessing repeaters and controlling other equipment, etc.

* Stores operating frequency, duplex direction, offset frequency, subaudible tone frequency, encode on/off, tone squelch on/off and skip information.

Microphone Remote Controls

You Can Control *All* Of These Functions From The Microphone Keyboard!	
☑ Power On/Off	☑ Code Squelch
☑ Select Main Band	☑ Tone, Tone Squelch
☑ Change Operating Band	☑ Pocket Beep On/Off
☑ Volume Adjust	☑ AFC On/Off
☑ Squelch Adjust	☑ Attenuator On/Off
☑ Mode Select	☑ Set Mode
☑ Duplex Select	☑ DTMF Auto or Manual
☑ Frequency Select	☑ Operating Freq. Annce. (with opt. UT-66 synth.)
☑ Memory Channel Select	☑ Write VFO Contents to Memory or Call Channel
☑ Mute Bands	☑ Lock All Mic Keys or Keyboard Only
☑ Scan or Priority Watch	
☑ Pager On/Off	

- A multi-function keyboard with complete control over the IC-Δ100H.
- The beep tones for each band are different and distinguishable so you can keep your eyes on the road.
- Over 22 functions are at your fingertips with the IC-Δ100's unique microphone keyboard (see chart above)!

IC-Δ100H
Triple Band Mobile
Transceiver
(shown with the optional OPC-332)

Other Great Features

- External remote control via another transceiver (UT-75 required)
- Tri, dual or mono band operation
- Sub band access/mute/busy beep functions
- Optional pocket beep and tone squelch
- Opt. pager/code squelch
- Tone encoder built in
- Multiple scans

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Four *AUTO TRIGGER & HOLD* Models, TWO Priced *Below $200!!*

NEW! ATH-10

$149. $179 value

ATH ™ SERIES FEATURES:
- Easy to use - simple controls
- Ultra fast response time
- Extra **BRIGHT LED** digits
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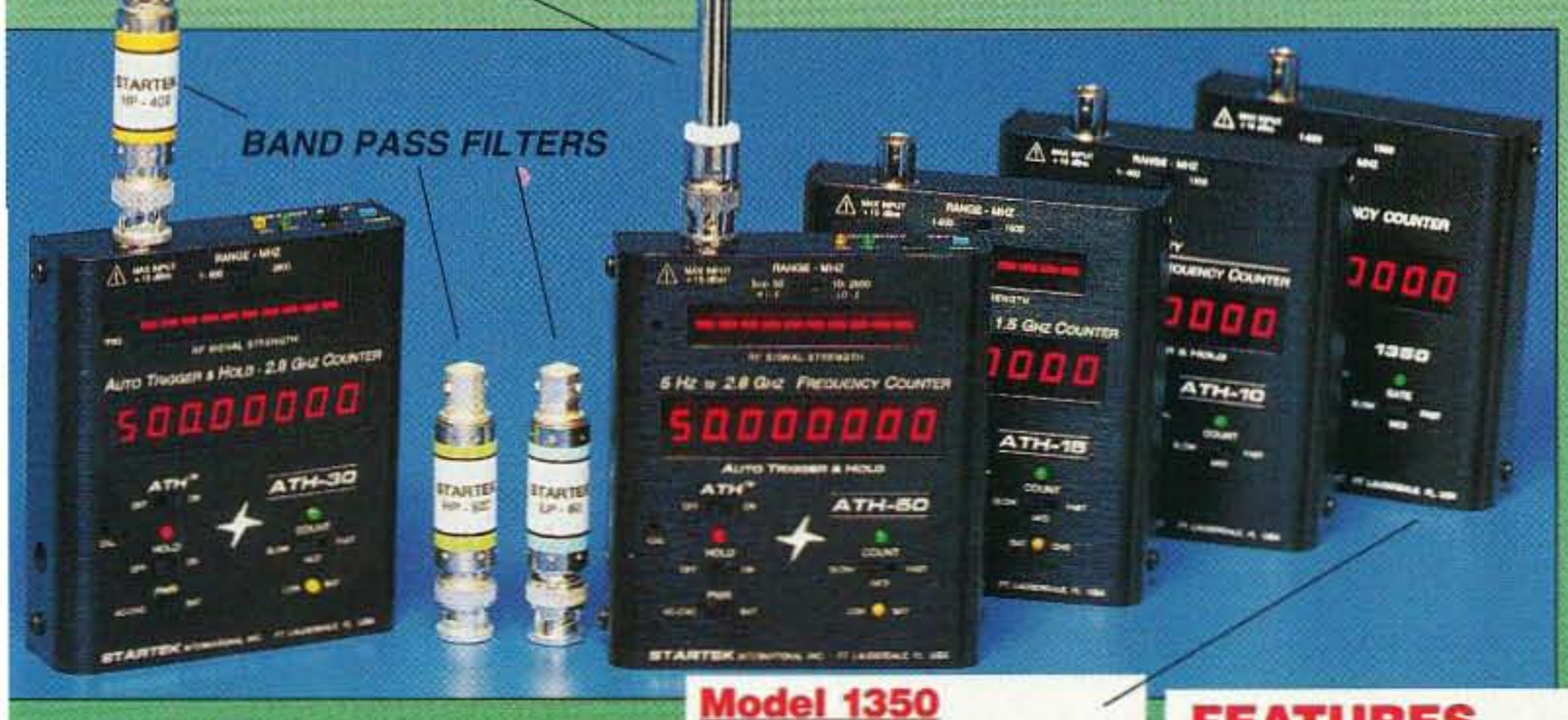
- Maximized sensitivity

MADE IN USA

$189. $235 value

WARRANTY
5 Years Parts
1 Year Labor

Optional #TA-90 Antenna



ACCESSORIES

#CC-90	Soft Case for all models	$12.
#TA-90	Telescope BNC antenna	12.
#TA-90-L	Telescope Elbow BNC antenna	16.
#RD-150	150 MHZ Rubber Duck antenna	16.
#RD-2750	27 & 50 MHZ Rubber Duck antenna	28.
#RD-450	450 MHZ Rubber Duck antenna	16.
#RD-800	Cellular phone band RD antenna	29.
#C/6A	**ABOVE 7 items, SAVE $30**	**99.**
#M-207-IC	Interface Cable MFJ ant. analyzers	10.
#P-110	200 MHZ 1X-10X probe	39.
#LP-22	Low Pass, Audio probe	25.
#DC-10	Direct, 50 OHM probe	20.

Model 1350
Economy Frequency Counter
1-1300 MHZ, 3 gate times,
Hold switch
(No ATH or Bar Graph).... **$119.**

FEATURES

	ATH-10 $149 reg $179	ATH-15 $189 reg $235	ATH-30 $249 reg $299	ATH-50 $289 reg $339
FREQUENCY RANGE	1 MHZ - 1200 MHZ	1 MHZ - 1500 MHZ	1 MHZ - 2800 MHZ	5 HZ - 2800 MHZ
AUTO TRIGGER & HOLD	YES	YES	YES	YES
SIGNAL BAR GRAPH	NO	YES	YES	YES
LOW BATTERY IND.	NO	YES	YES	YES
ONE-SHOT & RESET	NO	OPTIONAL	YES	YES
HI-Z LOW RANGE	NO	NO	NO	YES

OPTION #HST-15 is a high accuracy, high stability, time base upgrade that can be ordered with any ATH series model (0.2PPM TCXO)..... **$100.**

Extend readablilty distance with **BAND PASS FILTERS. $49 ea.**

#LP-60	DC - 60 MHZ	#BP-150	130 - 500 MHZ
#HP-400	400 - 1500 MHZ	#HP-800	800 - 2000 MHZ

#BP-4 All 4 Filters $189

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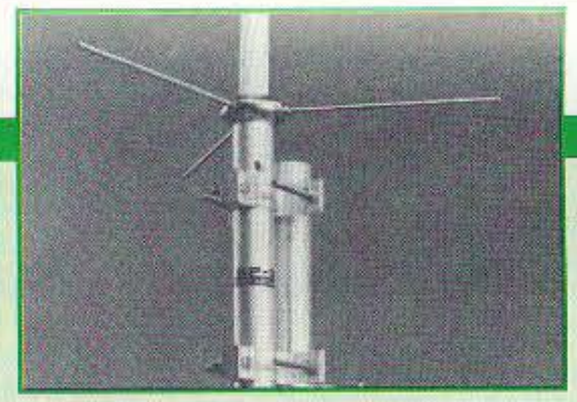
COMET

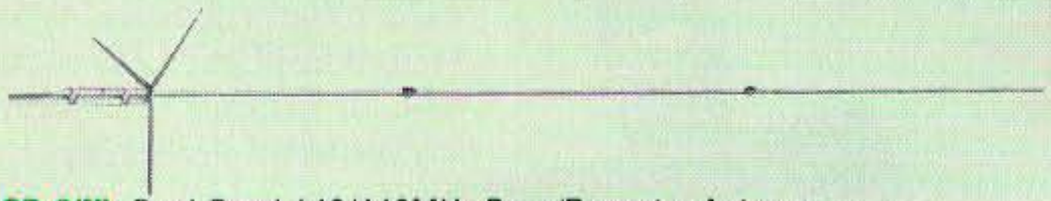
MODERN, MULTI-BAND ANTENNA SYSTEMS

BASE/REPEATER ANTENNA PRODUCTS



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

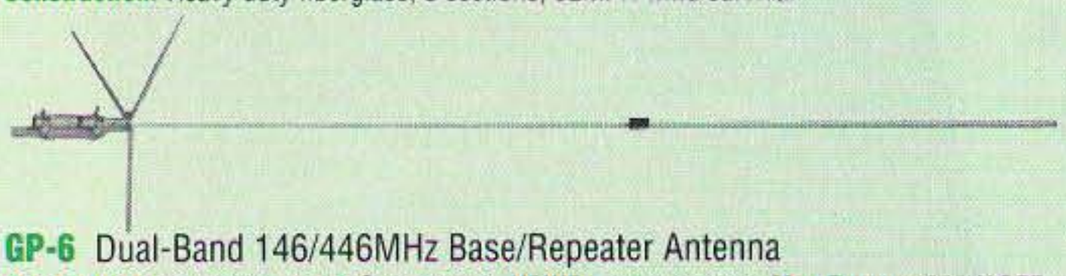
COMET DUAL-BAND



NEW!

GP-9(N) Dual-Band 146/446MHz Base/Repeater Antenna

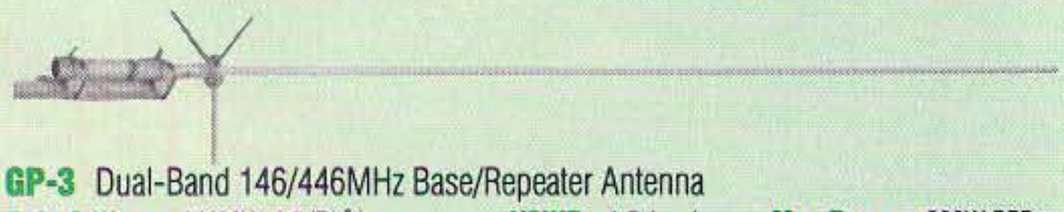
Gain & Wave: 146MHz 8.5dBi 5/8 wave x 3, 446MHz 11.9dBi 5/8 wave x 8 **VSWR:** 1.5:1 or less **Length:** 17' 8" **Max Power:** 200W PEP **Weight:** 5lbs. 11ozs.
Connector: SO-239 (GP-9), N-type (GP-9N) **Mounts to Mast Size:** 1.25"-2.50"
Construction: Heavy duty fiberglass, 3 sections, 92MPH wind survival



NEW!

GP-6 Dual-Band 146/446MHz Base/Repeater Antenna

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



NEW!

GP-3 Dual-Band 146/446MHz Base/Repeater Antenna

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

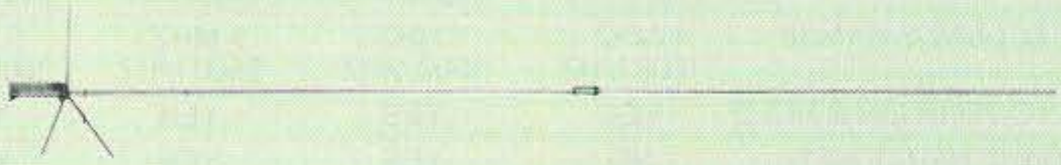
COMET MONO-BAND

CA-ABC23 Mono-Band 146MHz Base/Repeater Antenna

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

CA-712EF Mono-Band 446MHz Base/Repeater Antenna

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



CA-62DB Mono-Band 6 Meter FM Antenna

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

COMET products are available from most major dealers. For customer service, or a complete catalog, please call us at 800/962-2611. We're confident COMET products and accessories will enable you to enjoy Amateur Radio to its fullest!

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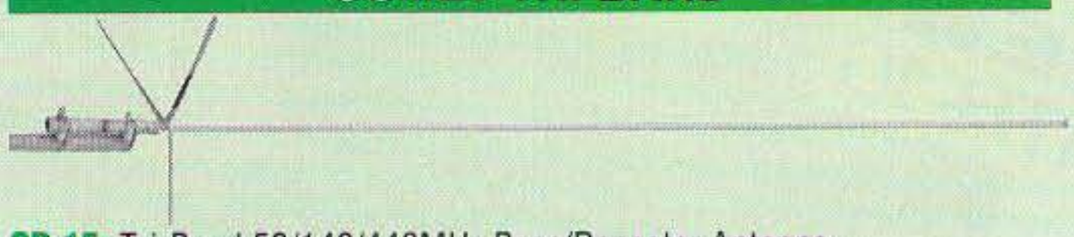
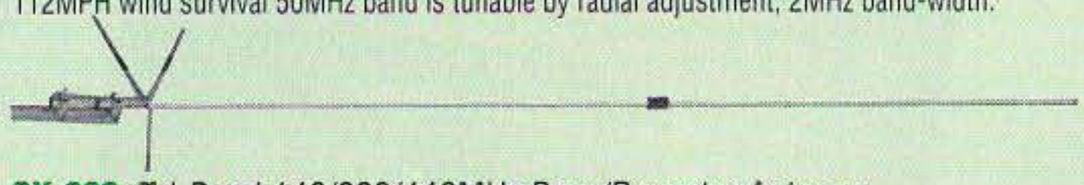
COMET TRI-BAND



NEW!

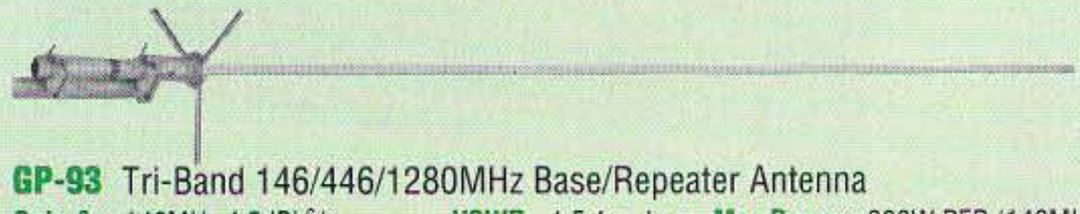
GP-15 Tri-Band 52/146/446MHz Base/Repeater Antenna

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



CX-333 Tri-Band 146/223/446MHz Base/Repeater Antenna

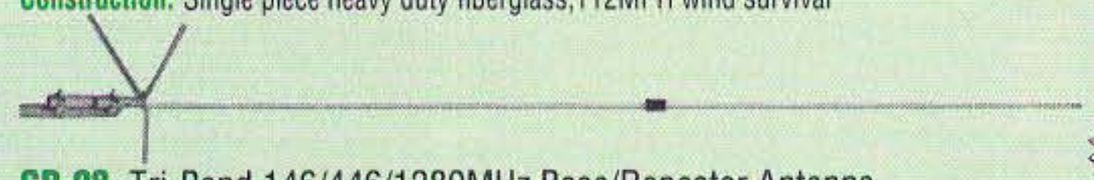
Gain & Wave: 146MHz 6.5dBi 5/8 wave x 2, 223MHz 7.8dBi 5/8 wave x 3, 446MHz 9.0dBi 5/8 wave x 5 **VSWR:** 1.5:1 or less **Length:** 10' 2" **Max Power:** 120W PEP **Weight:** 3 lbs. 10 ozs. **Mounts to Mast Size:** 1.25"-2.50"
Connector: Gold-Plated SO-239
Construction: Heavy duty fiberglass, 2 sections,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



NEW!

GP-93 Tri-Band 146/446/1280MHz Base/Repeater Antenna

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



NEW!

GP-98 Tri-Band 146/446/1280MHz Base/Repeater Antenna

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

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

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

NEW!

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What are these two smiling about? Turn to page 10 to find out.

FEEDBACK... FEEDBACK!

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*.

On the cover: Time to heat up the soldering iron and get into a 73 construction project! (Photo by David Cassidy N1GPH.)

FB

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Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Fan or Fanatic?

I've known several hams whose wives divorced them, naming amateur radio as the correspondent. Look, this is supposed to be a hobby! I know many DXers who stay home from work when there is a new country on the air. I know repeater nuts who have an HT with them day and night, tuned to their repeater.

There have been some times in my life when I've gone overboard hamming. I would spend my afternoons building equipment, my nights operating, and my mornings sleeping. I was so busy hamming that I didn't have time to land a job. I lived happily on my unemployment payments. The positive side was that I sure built a lot of stuff. I had the whole cellar packed solid with steel shelves of ham equipment. I had so much stuff I'd built, and so many parts for building, that when I decided to move to New Hampshire in 1962 it took five truckloads to move everything. I'd kept the stuff beyond what my cellar could hold in several nearby rented garages.

I had a 75m AM kilowatt, another all-band PP-813 kilowatt, an SCR-522 with a surplus kilowatt amplifier on 2m, about 50 watts on 6m with another converted 522, all kinds of Teletype and test equipment. I worked DX. I was active in most of the major contests. I worked RTTY, NBFM, AM, aurora on 2m, and so on. I had tons of fun doing it.

This all turned out to be solid gold for me when I unexpectedly found myself the editor of *CQ* magazine. All that time spent on my background suddenly was useful. Indeed, I couldn't have done the job if I hadn't invested all that time in the hobby.

But outside of gunning for the thankless job of editing a ham rag, the total devotion of your life to amateur radio is dumb. I don't doubt for one minute that there really is a special place in heaven for rabid DXers, I just happen to think that it is well padded. There are probably well-padded cells for our other fanatics.

Mind you, I have no quarrel with hams working DX, as long as it isn't actually important to them. Working DX and earning a place on the ARRL Honor Roll is fine, as long as it isn't important. I got up somewhere over 300 countries worked and stopped counting. I had great fun pioneering NBFM and then SSB. I had fun with SSTV, when that got started. And RTTY. I loved learning and doing. It was wonderful fun exploring 10 GHz and working seven states from my little hill in southern New Hampshire. I've enjoyed competing in just about every contest the ARRL has come up with. In retrospect, I can't think of any amateur radio activity that I regret having investigated. And there aren't many I've missed. But I've never let the hobby become an obsession, and I've never had one word of complaint from my wife about my ham activities.

It's a hobby. It's for fun. So get the most out of it you can. Think about it—are you in a rut? Are you just getting on the air and gassing with the same 75m crowd endlessly? I tried that for a couple of years and got over it. Oh, I had some wonderful time with W1MLJ in Barre (VT), W1IF, Bill and Olga, in Peabody (MA), and Homer W1KPL in Jaffrey (NH). But that didn't keep me from mountaintop expeditions on 2 meters, from racking up a fair DX score, or winning sweepstakes contests for my section.

How come you haven't put up an antenna and tried some satellite contacts? What's the matter with you? It's a ball!

Tried Rallying Yet?

Have you ever, as a ham, provided communications for a local sports car club putting on a rally? You and your ham club can have a ball—just offer your services to car clubs, or even to the Sports Car Club of America (SCCA), which organizes the national rallies.

For that matter, if you haven't ever gone on a rally, you've missed a lot of fun. A bunch of us hams around Brooklyn (NY) used to go on rallies just about every weekend. And you don't have to have a sports car to do it, though it's more fun in a sports car.

There are a lot of different kinds of rallies, but the ordinary garden variety rally consists of from 10 to around 100 cars, each with a driver and navigator team, driving over ordinary roads and highways, and at below the speed limit, following a set of sometimes tricky route instructions.

The cars paste large numbers on their sides so the people at the checkpoints can identify them, and are started at one-minute intervals. The organizers give the teams the route instructions one minute before blastoff. These are called time-speed-distance (TSD) rallies. The instructions give the speed to be driven over each segment of the rally, and usually provide fairly simple instructions for making turns and speed changes.

Saturday morning rallies are often short, running perhaps 75 miles. A weekend rally can cover several hundred to over a thousand miles. On busy rally weekends I used to be able to go on a Friday night rally, another Saturday, and still a third on Sunday. There were a ton of rallies around Long Island.

Every few miles there is a checkpoint—usually hidden. They time you as you pass, usually taking one point off your score for every 1/100th minute early or late. That's about a half second.

The winners are seldom off more than one point per checkpoint on the average. This means, if you have any serious intention of winning, you have to be able to measure your mileage down to a hundredth of a mile, and your time to the hundreth of a minute. Then the navigator, in addition to helping the driver find turns and speed-change locations (change average speed to 35.71 mph at the Wishing Well sign), also has to run a calculator or computer and let the driver know what his odometer should read when the watch's second hand is straight up.

In most sports cars fitted for rallies the hundredths odometer and a stopwatch bracket are mounted on the dash so the driver can see them at a glance. The navigator reads off the instructions and computes. This is no job for anyone who tends to get carsick!

There are little complications which affect the calculations. Since no two cars have odometers that read exactly the same, in order to match your speed with that of the car used to lay out the rally, you need a mileage check. This is usually at 10 miles out. When you reach the point where the official car's odometer reads 10 miles you see what your odometer reads, and from then on you have to correct all of the instruction average speeds to take this difference into consideration. Hey, if it was easy, it wouldn't be so much fun. To win rallies you have to be a precision driver and a navigator who makes faultless calculations on the run and under pressure. If you get hung up in traffic or by stoplights you have to get back on schedule as quickly as possible. There's nothing like getting stuck behind a little old lady on a back country road to cause stress. Tough.

Most rallyists have a shortwave converter to pick up the time signals from CHU or WWV, just to make sure their watch isn't a half second off after a few hours bumping along on back roads.

Hams can help car clubs by helping work the checkpoints and then radioing in the points lost by each team to the finish line. That makes it possible to determine the winners much faster. Without radios, the checkpoint people have to drive to the finish with their scores, and then the organizers have to total them up. With many rallies having a dozen or so checkpoints, this can take awhile. It's better to get the results announced quickly and hand out the trophies so everyone can go home and get some rest.

I was reminded of this the other day when I was out in the barn looking through some boxes and came upon a couple cartons of old rally trophies. The silver is a little tarnished now. I should polish 'em up, I suppose. Back in 1958, when I bought my Porsche Speedster, I got involved with rallies, and I enjoyed them until I moved to New Hampshire in 1962. There's not much in rallies up here in the mountains and I miss 'em.

They've probably got some great computers for TSD these days. Thirty years ago most of us used the Curta calculators. They were made in Liechtenstein and looked like pepper grinders. They were made for currency calculations, but they were ideal for rallies. I liked 'em so much I went to Liechtenstein and became an importer. I found the very best rally watches (Hanhart) in Schwenningen, Germany, and imported those too. I had quite a good importing business going selling rally equipment—including my own special speed tables, which beat the heck out of any others.

I wonder if Walter Cronkite remembers coming to my house in Brooklyn to buy a Curta calculator? He used to be big on rallying—until he and his navigator ended up in a lake one day.

You might want to try some local car rallies and see how much fun they are. Who knows, if you get addicted you might go for a Miata, they're so reasonable. They're the closest thing there is to the good old Porsche Speedster. In the meanwhile your club members can have a lot of fun helping local car clubs with their checkpoints and getting scores in early.

Poisoning Little Minds

One of the things that helped suck

Continued on page 82

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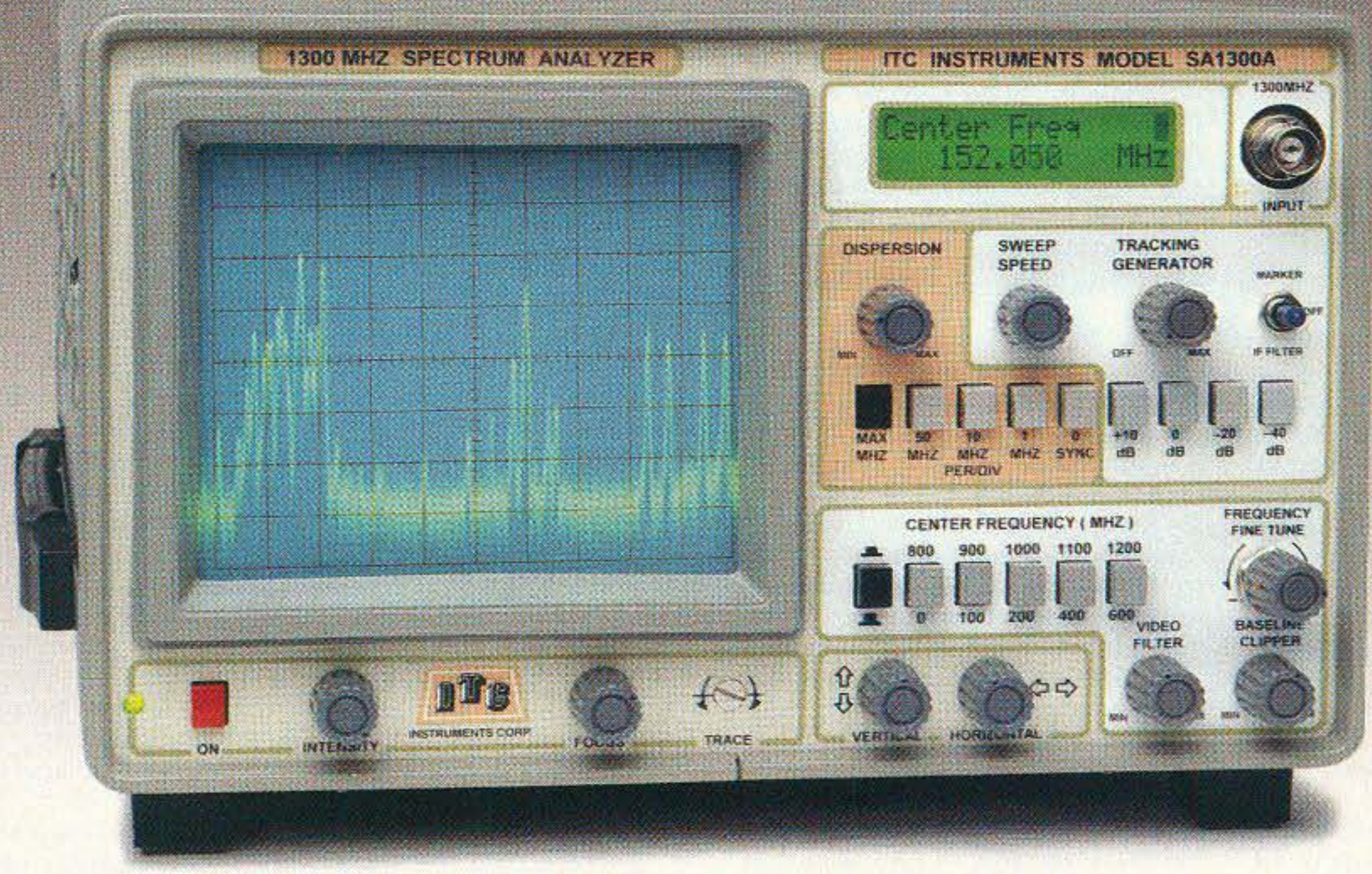

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LETTERS

Number 2 on your Feedback card

From the Ham Shack

Bill Haddad WD9HXH, Whiting IN I wonder how many of the old geezers of our hobby really know how slow their CW communications is compared to modern technology. Perhaps I can get their attention with my own experience. Back in 1942 as a radio operator in the Navy Department in Washington, DC, my first assignment was to monitor the FOX broadcast. This was an 18 wpm CW broadcast to all ships at sea. This broadcast operated 24 hours a day, seven days a week.

I began to wonder how many words I would have sent at that speed in the 50-some years since leaving the Navy Department. I put this on my calculator and found that in 50 years I would have sent 473,364,000 words. At today's 155 megabits per second, *all* of those 50 years of sending could be transmitted in 3.38 minutes. Need I say more?

Paul A. Robertson N2XZF, Rochester NY *[Letter to Steve Katz WB2WIK/6]* With reference to your excellent article on building a half-gallon amplifier in the April 1994 issue of *73 Amateur Radio Today* (page 40), I would like to add a strong admonition about the insulation material used on the tube featured. The material is *beryllium oxide*, an extremely toxic substance if inhaled. It is benign if left undisturbed, but can cause problems if proper precautions are not observed. Possibly we are lulled into a sense of security by the appearance of this material because it looks like plain old ceramic. Not so!

The simple precautions are this: Do not abrade, fracture, or in any other way cause the material to become airborne. These precautions also apply to the insulation (ceramic) used on RF power transistors—you know, those ones that look like butterflies or helicopters.

Paul—Thanks for your nice letter. Yours was one of many letters I've received to date on this article, and the only one pointing out my oversight in not printing a warning regarding the hazards of contact with beryllium oxide, BeO.

You're absolutely right, BeO is horrible stuff. Fortunately, the tube itself doesn't use any (externally), it's only the thermal link which mounts between the tube and the heat sink that does. I did recommend that any potential user of a commercial RF deck get hold of a data sheet on the tube prior to doing anything, *and if you look at the Eimac data sheet on the 8560A tube referenced and shown in my article, it is absolutely loaded with hazard warnings! Thankfully, the thermal link sold by Eimac to go with this family of conduction-cooled tubes has such a polished surface that it would be extremely difficult to come in contact with any BeO powder, which, as you know, is the real hazard. (The polished surface is stabilized and quite safe to handle.)*

Another "fortunately" is: They've now gotten away from BeO in favor of aluminum nitride, which is nearly thermally as conductive and is completely safe to handle in any form. I see that the industry trend is to avoid BeO whenever possible and use aluminum nitride for electrical isolation and thermal conduction. BeO is still used inside a lot of electronic power components, including tubes, but it's pretty safe inside there. . . . Steve WB2WIK

Gene WØGLI and XYL Della Twait, Cylinder IA Wayne, this is just a short note to tell you that my XYL and I enjoyed reading the "Never Say Die" column in the February '94 issue. We are both interested in electromedicine and magnetic therapy. A friend showed us some magnetic pads produced by a Japanese company called Nikken. My wife is a long-term asthma sufferer and has showed improvement since she started using it.

George Gray WB2CHP, Spring Valley NY Wayne, In your otherwise exciting (as usual) "Never Say Die" for May, you included a remark indicating that you have fallen for the propaganda of such outfits as "Handgun Control, Inc." regarding the National Rifle Association, and I would like to try to disabuse you on this. The NRA is not some nut outfit refusing to allow criminals (who will never be disarmed) to be disarmed, but several million citizens who refuse to allow *victims* to be disarmed. (Let's not pretend that these anti-gun groups *only* want to outlaw some nebulous, undefined "assault weapons" [If I attack you with a golf club, is that an assault weapon?], they admit their ultimate goal is to outlaw *all* firearms!)

Let's look at what a wonderful world we could have if the NRA's lobbying failed and these anti-gun nuts had their way. The Colombian drug cartels could expand into smuggling guns and ammunition (increased employment), we could have hundreds of thousands of bathtub (all right, garage) shotgun and ammo makers (big cottage industry), half a million ATF agents making raids similar to the ones in Tulsa or Waco (more increased employment plus a reduction of the surplus population). Every college student will have to carry a pistol in his hip pocket (remember Prohibition?), and organized crime will get another big boost. More increased employment!

Of course there is a downside. Massacres such as the LIRR shooting (notice how effective New York's gun laws are; no one else on the train was armed!) would become commonplace, armed robbery would become *very* commonplace, and we would become subject to coups by the armed forces any time they did not like the way the government was handling some specific problem. (No one would have the power to oppose them.)

So maybe the NRA's lobbying is not having a bad effect on our quality of life, but is an attempt to keep it from deteriorating further!

George—I'm deeply disappointed in you. If you've been reading my editorials for any length of time you should know that I don't "fall" for any propaganda. I do my homework and think for myself . . . even about guns.

George, there are nuts on both sides of the gun arguments. I believe I've read and heard all sides, to the extent that I haven't seen a new idea from either camp in a long time. It's the same old crap both ways.

You are probably 100% right. We should allow kids of any age to take guns to school and kill each other when they get mad . . . or even slightly irritated. Even assault guns. We can always have more kids, and teachers are cheap. That's the easy part. I doubt we'd have any problem keeping our population up, but even if we did see it dropping a bit illegal immigration would take up the slack. and that means still more gun customers and money for the industry.

The survival of the fittest is nature's way, right? If everyone on the LIRR train had been armed, the surviving passengers could have blasted the guy out of his shoes after he emptied his first clip. Of course, you might also blast the little old lady who pushes in first when the door opens and grabs the seat you were heading for. That'll teach her a lesson. Just blow away one of her knees so she won't be so dammed fast next time.

So let's keep importing those assault rifles and cheap handguns. It'll make everyone a lot more polite. It'll also help the sale of bulletproof glass for cars.

George, my approach is every bit as reasonable as yours. America has the world's record for murder with guns and I say let's go for double or nothing. Cheers . . . Wayne

Al Margheim, Cumberland TX Wayne, I received the May 1994 issue of *73* on the same day I received my subscription renewal reminder for *73*. I was still considering whether to renew my subscription or not when I read your editorial. I noted with approval your comment on page 4 that you always do your homework before you write. Then I read your sarcastic comment on page 92 about the National Rifle Association, and you blew your credibility completely. Had you really done your homework on the National Rifle Association you would never have made such a statement.

I suppose your opinion of the NRA is based on what you've read or heard in the popular media, but you should know that the media often presents only one side of an issue. It is a fact that the media has been engaged in a smear campaign against the NRA for many years. Almost everything about the NRA in the major news publications and on TV is either incorrect or twisted in some way to make the NRA look bad. (I do not believe the NRA is beyond criticism; however, their lobbying efforts have benefited the citizens of the United States of America far more than any other organizations that I know of.

I have a challenge for you. I've renewed my subscription for one year. In the next year I want you to tell us in one of your editorials how the lobbying efforts of the NRA have damaged the quality of our lives. I expect you to make statements of fact, not opinion. If you won't address this in an editorial, then write me a personal letter. Then I'll write to you again and respond with facts refuting your statements. If you don't respond in some way, this will be my last year reading *73*.

If you are truly interested in doing your homework, I suggest you contact the National Rifle Association for their side of the story. I also *strongly* suggest you read *Point Blank: Guns and Violence in America* (Aldine, 1991) by Gary Kleck. Gary Kleck is a respected criminologist with Florida State University. His book was awarded the Hindelang Prize by the American Society of Criminology as the most important book written in the last three years. His studies show that America has benefited greatly from our system of firearms ownership.

If you care what the Constitution says, and what the authors of the Bill of Rights intended when they included the Second Amendment, you should also read the scholarly work *That Every Man Be Armed—The Evolution of a Constitutional Right* (The Independent Institute) by Stephen P. Halbrook.

Al—Here we are in an almost totally religious controversy and you are demanding facts? Having read all of the arguments on both sides, I can understand the people who believe that kids of six should be allowed to carry loaded guns to school; who believe that criminals are the problem, not guns. I can understand that they believe that kids should be able to take live hand grenades to school, and be allowed to handle deadly poisons and flame throwers.

After all, they say, don't we really have more population than the world can handle already? Darwin says it's the survival of the fittest, and we can see that our socialist namby-pamby government has gone to lengths to protect the unfittest. A few more guns, grenades, and assault weapons and some napalm in the right places might just be a good thing. Right? Once we all agree that everyone is entitled by the Constitution to carry arms anywhere they want, we are infringing on their rights if we want to prevent them from owning a tank or a dive bomber. Or an atom bomb, for that matter. It's a right, and never mind that this made sense a couple hundred years ago when it was written, but might just be a wee tad out of date now, considering technological advances in weaponry that were never imagined when our country was formed.

I guess it all depends on what kind of a society you prefer to live in. You want one where everyone is armed and ready to avenge any slight with any weapon on up to an atom bomb. And it makes wonderful TV shows. and it's all real.

So much for the religious part of our program. Now, I'm polishing up my Weatherby 300 and my Winchester 30-30 for some real action. Weatherby was a ham operator, by the way. I got my gun directly from him. I can whack a deer from 500 yards. Cheers . . . Wayne 73

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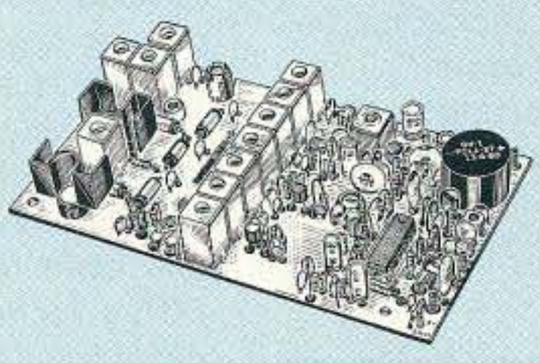

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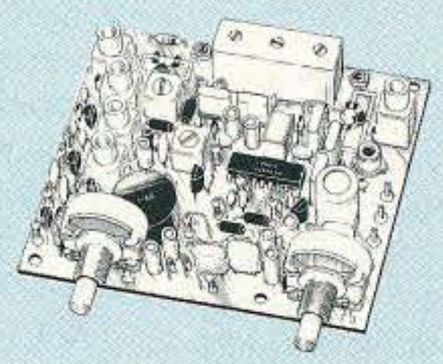

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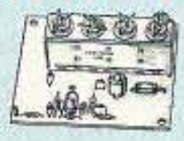

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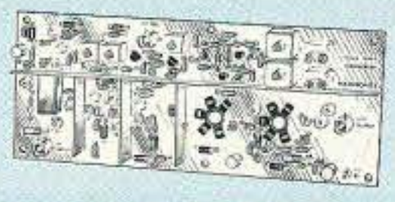

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Wayne Green: Coast-to-Coast

73 Publisher Wayne Green W2NSD/1 will be the featured guest on *Ham Radio & More*, a nationwide broadcast band talk show hosted by Len Winkler KB7LPW, on August 14, 1994.

The program is carried by 23 stations nationwide on the Talk America Network on Sundays at 6 p.m. EST. You can also listen in on satellite on Spacenet 3, transponder 9, 6.8 audio. For more information on stations carrying the program, contact flagship station KFNN at (602) 241-1510.

Entire ARRL Bio-Effects Committee Quits

The American Radio Relay League's Bio-Effects Committee has disbanded en masse. The handpicked group of internationally acknowledged experts in the field of potential health risks from exposure to RF radiation formally resigned in writing on June 1st.

In the letter of resignation, signed by all five members, chairman Ivan Shulman, M.D. WC2S wrote: "We will, however, not allow our names to be subject to the political machinations and narrow views of individuals who seek to use us for their own aims as 'window dressing' . . ."

The ARRL published an article in the April 1994 issue of *QST* by Wayne Overbeck N6NB which stated, "Fortunately, enough research has now been done that we know most amateur radio activities are quite safe." Meanwhile, the May issue of *73* carried actual Congressional testimony by former ARRL committee member Ross Adey, M.D., K6UI in an article called "The Radar Gun Reality." Dr. Adey stated that federal agencies " . . . should assume direct responsibility for developing and implementing urgently needed safety guidelines for RF/microwave exposures." He added that more research was desperately needed, especially in the athermal effects of radiation.

The ARRL Bio-Effects Committee was appointed in January 1990 by then ARRL President Larry Price W4RA " . . . with the distinctive charge of revitalizing organized amateur radio's concern for the limitation of bio-effects hazards that might arise from the participation of individuals in the hobby of amateur radio." *TNX W5YI Report, Issue #12, June 15, 1994; QST, April, 1994.*

FCC Can't Relax Anymore

The Federal Communications Commission has denied two Petitions for Reconsideration of its decision to relax restrictions on the scope of permissible communications in the Amateur Service. The commission amended its rules to allow licensees to use Amateur Service frequencies to facilitate events such as races and parades, to support educational activities, to provide personal communications such as making appointments and ordering food, to collect data for the National Weather Service, and to provide assistance voluntarily, even where there are other authorized radio services available.

Three National Capitol DX Assn. members collectively worked 665 countries in the NCDXA 12-month DX hunt. Pictured (L to R) are: Dave Hammond WC4B (201), Ken Miller K6IR (227), and ARRL Director John Kanode N4MM (237).

David B. Popkin and Rolland D. Cummings filed petitions requesting further relaxation of the rules to permit the retransmission of time broadcasts originated by government stations. Popkin also asked the commission to permit the retransmission of other information originated by government stations, and to substitute the phrase "instructional activity" for the phrase "classroom instruction."

The FCC denied reconsideration, saying the petitioners had merely reiterated views already expressed in comments to the Notice of Proposed Rulemaking. *TNX Westlink Report, No. 673, June 6, 1994*

Majority Call Ham Radio Valuable

H.J. Res. 199, the Joint Resolution recognizing the Amateur Radio Service, now has a majority of the U.S. House of Representatives as cosponsors. On April 11th, four additions to the list of cosponsors brought the list total to 220 (of which three are non-voting delegates). The four are Rep. James Talent (R-MO), Del. Eleanor Holmes Norton (D-DC), Rep. Thomas Ridge (R-PA), and Rep. Don Young (R-AK).

The resolution seeks formal recognition of the value of amateur radio to the country. It would support amateur radio as "national policy." It would also encourage rules and regulations to facilitate amateur radio as a public benefit by encouraging new technologies. There are now 218 voting sponsors, including Resolution sponsor Jim Cooper (D-TN). There are currently 434 Representatives in the House. *TNX Westlink Report, No. 673, June 6, 1994.*

10 WPM Generals?

"Slow-code" is the name given to an Amateur Radio Industry Association proposal to lower the General Class code speed requirement to 10 words per minute. So far, it has gained far more support than criticism in ham radio circles. Most of the packet radio postings on slow-code praise the industry group's leadership. Some even say 10 WPM doesn't go far enough, with 5 WPM being suggested instead.

Slow-code is also getting support from users of various public bulletin boards. An unofficial poll being conducted by Newsline is so far five-to-one in favor of the Amateur Radio Industry Association's slow-code proposal.

The association has yet to announce a firm date for filing its slow-code rule making request before the FCC. *TNX Westlink Report, No. 673, June 6, 1994.*

Let Market Forces Decide

FCC Chairman Reed Hundt said his agency's goal in devising rules for auctioning the airwaves for new communications devices later this year is to let market forces decide who will conduct business profitably within that spectrum. Hundt said the commission will not limit the number of licenses that result from the bidding for that spectrum, nor will it prevent a licensee from piecing together spectrum to reach a big geographic area.

Speaking before the Harvard Business School Club of Greater New York, Hundt stressed the need for greater competition in telecommunications, at times defending the FCC's recent regulatory actions as laying groundwork for greater competition.

The FCC plans to auction spectrum for a new breed of wireless communications. This summer it will auction spectrum for narrowband wireless communications such as paging. Later this year it plans to auction spectrum for transmitting broadband wireless signals—from phone calls to video images. *TNX Westlink Report, No. 673, June 6, 1994.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine*, 70 Route 202 North, Peterborough, NH 03458. Or you can reach us on CompuServe ppn 70310,775@compuserve.com; or at 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. 73

Data Controllers Put You In Control

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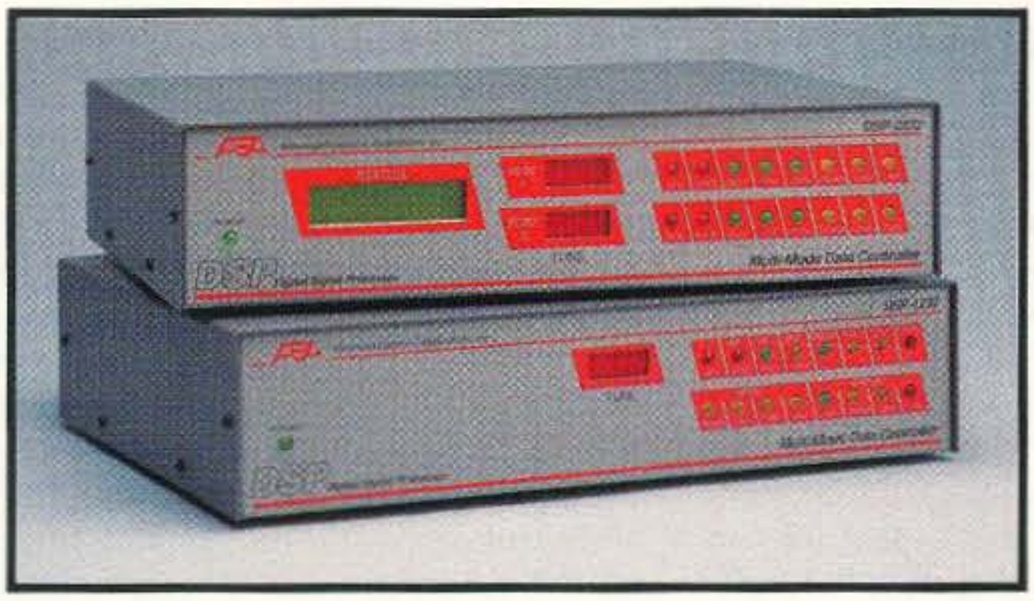
- Dual-port Gateway: Packet to AMTOR, Packet to PACTOR, and Packet to Packet.
- Twenty software selectable modems.
- 17K Packet, PACTOR, and AMTOR MailDrop.
- 16-level gray scale fax with opt. software.
- Same modes as the PK-232MBX.
- Full PACTOR Memory ARQ.



DSP-2232
DSP-1232

- DSP-1232 has two switchable ports.
- DSP-2232 has two simultaneous ports.
- Same modes as the PK-232MBX.
- Includes modems for satellite use.
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- DSP-2232 has dual-port Gateway: Packet to AMTOR, Packet to PACTOR, & Packet to Packet.
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- PK-12 offers 1200 bps VHF packet at less than 80 mA of power.
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Stand-Alone DDS

The Kendraboard provides PC-free frequency control.

by Bruce Hodgkinson VA3BH (ex-VE3JIL)

After I finished the Julieboard DDS synthesizer design (see "Julieboard: An easy-to-build DDS synthesizer for the PC printer port." in the August 1993 issue of *73 Amateur Radio Today*) and built some prototypes, I spent some time using the board and quickly concluded that, even though it worked well, the requirement for a PC was sometimes a problem. This opinion was confirmed overwhelmingly in the phone calls and letters I got from readers after the article came out—it became obvious that the next step would be a stand-alone controller. Here, I want to not only describe my design (the Kendraboard), but also give some hints and suggestions to help readers develop their own designs.

Why a Dedicated Controller?

When paired with a dedicated controller, a DDS synthesizer can be used in a stand-alone configuration:

- No bulky PC needed.
- No time needed for boot-up.
- Extremely fast operation.
- Low power/small package (ideal for QRP).
- Much lower radiated digital noise.

As a self-contained digital tuning unit for home-brew gear, it is an ideal way to prototype design ideas and develop software for a future digital transceiver. Also, there are many other excellent CPU-controlled parts, such as D/A and A/D converters, PLLs, and displays which can be used with a controller to form a complete system.

Choosing the Right Microcontroller

There are many different types of computer chips (and systems) available on the market—the first design decision will be to pick one. It is tempting to choose a device because of cost or because there's lots on hand, but there are other considerations which are generally more important:

- Can it easily do the job?
- What development systems are available?

If the candidate will not work, or is only marginally capable of doing the job, it is not suitable even if free. Future needs should be considered to avoid hardware/software obsolescense and to allow for new features. For example, I chose the Motorola MC68HC705C8 largely because of its serial and SPI ports. Even though the present software does not use these functions, future versions will, and I will be able to use the existing hardware as is. Next, the availability of development systems (especially affordable ones!) should be considered—if you can't get the code into it, that otherwise-perfect processor is worthless.

Development Systems

Unlike a PC, a single-chip microcontroller usually does not have an operating system resident on it. This can make code development a bit tricky without the proper tools. The development process requires the designer to:

- Write the code.
- Assemble or compile into machine code.
- Get the machine code into the device.
- Test the device in its intended place.
- Find any bugs.
- Rewrite the code as required.

Photo A. Kendra and her board. (Photo by Sandy VE3AAC.)

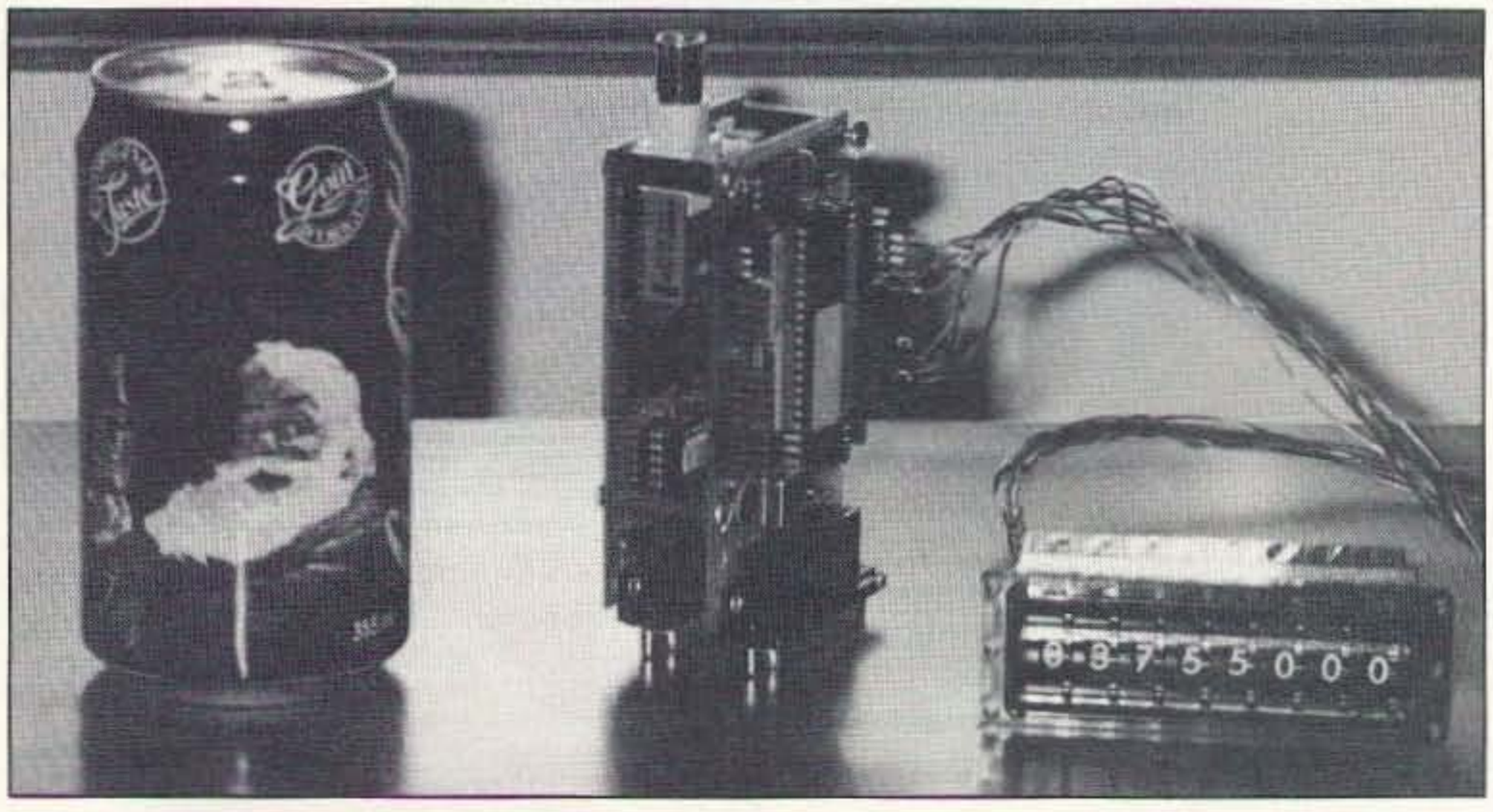

Photo B. Two boards make stand-alone DDS. (Photo by Sandy VE3AAC.)

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MFJ's lighted Cross-Needle Meter shows you SWR, forward and reflected power *simultaneously*. It reads both *peak* and average power on 300 or 30 watt ranges.

The meter is illuminated for easy reading in dim light and has an ON/OFF lamp switch. The meter lamp uses 12 VDC or 110 VAC. A *free* AC adapter is included at no extra cost.

Tunes *any* Antenna

The MFJ-949E tunes out SWR on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas . . . nearly anything!

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MFJ's 8 position *super* antenna switch lets you select two coax fed antennas, random wire/balanced line or built-in dummy load for use through your MFJ-949E or direct to your transceiver.

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MFJ's *QRM-Free PreTune*™ lets you pre-tune your MFJ-949E off-the-air into a built-in dummy load without causing QRM.

Pre-tuning into a dummy load makes tuning your actual antenna faster and easier.

Why take chances?

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MFJ's 300 watt 50 ohm dummy load makes tuning up your transceiver and pre-tuning your antenna easy. It reduces needless QRM and saves your finals.

You'll find it handy for testing and repairing your rig, setting power level, adjusting your mic gain and more.

The MFJ-949E has a *full size* non-inductive dummy load measuring 3/4 inch diameter by 5 inches. It *easily* handles 300 watts of abusive tune-up power.

Watchout for cheap midget size dummy loads that changes resistance as it heats up -- marginal ones could burn up your rig.

Custom Inductor Switch

The inductor switch is the most likely component to burn up in *any* antenna tuner.

The inductor switch in the MFJ-949E was *custom* designed to withstand the extremely high RF voltages and currents that are developed in your tuner -- it's not a flimsy *plastic* switch made for small signals and wired with *tiny* gauge wire.

Unbeatable Quality . . . *built to last*

Each MFJ-949E cabinet is chemically treated and has a new tough scratch-proof *vinyl* cladding -- not paint that can scratch or chip off. You won't find a tougher, longer lasting finish anywhere.

Detailed logging scales and legends are *permanently* silk screened on a *real* aluminum front panel and back panel -- it's not merely a plastic decal or glued-on paper strip that can peel off.

Superior construction -- MFJ-949Es use Teflon® insulating washers, counter sunk screws for meter bracket, *real* binding posts, wing-nut for ground post.

No Matter What™ Guarantee

Every MFJ-949E is backed by MFJ's famous one year *No Matter What*™ unconditional guarantee. That means we will repair or replace your MFJ-949E (at our option) *no matter what* for a full year.

Others may give you a *limited* warranty on defects in material and workmanship.

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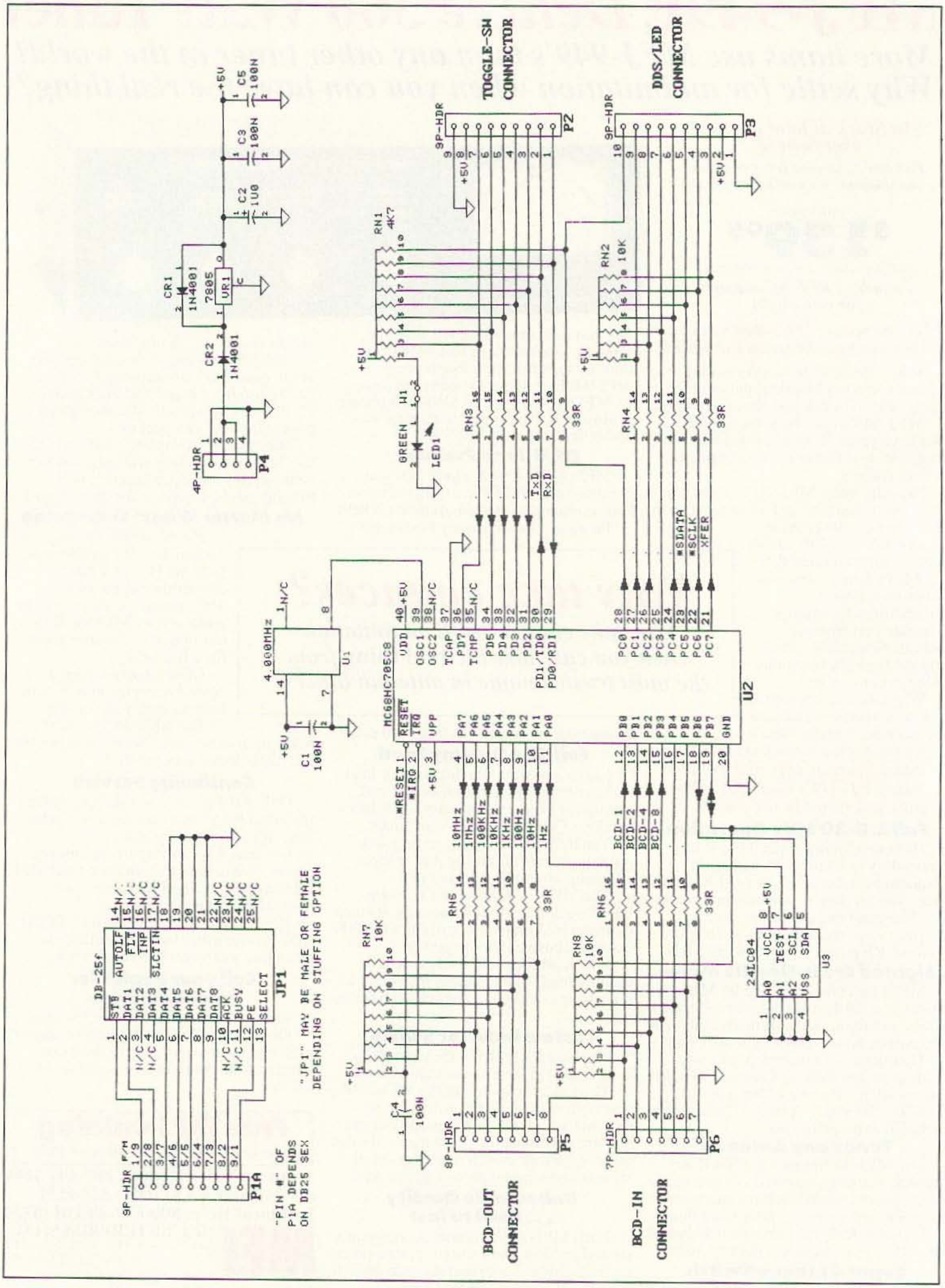

Figure 1. Schematic.

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- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
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- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

- LOW PROFILE POWER SUPPLY

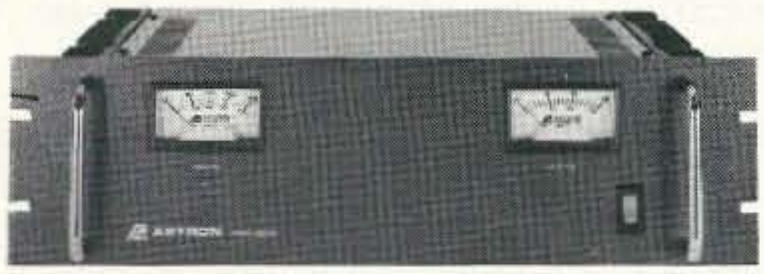
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

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

RM SERIES



MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

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

RS-A SERIES

MODEL RS-7A

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

RS-M SERIES

MODEL RS-35M

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

VS-M AND VRM-M SERIES

MODEL VS-35M

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

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

RS-S SERIES

MODEL RS-12S

- Built in speaker

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

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

CIRCLE 16 ON READER SERVICE CARD

The best approach is to get an evaluator board and development software which allows the user to write the program in whatever language is convenient, translate it into machine code, and transfer it into an emulator system which mimics the intended device. With this scheme, the developer can write a bit of code, try it out, and confirm that the routine works as intended by looking at internal memory and registers. It is possible to write the code blind, manually transfer it into an EPROM, then into the device via bootstrap mode, but that makes debugging very difficult—much like building a mechanical machine, welding the covers on, then trying to figure out its behavior by whether the wheels turn!

Fortunately, vendors such as Motorola make available freeware assemblers which take the English-language source code, convert it into the machine-readable object code, and put it into file transfer formats suitable for downloading. (Motorola uses the "S19" format.)

Also, Motorola markets low-cost evaluation and programmer boards—these can be used to emulate and program single-chip micros. With the "M68HC05PGMR" board, for example, small programs can be downloaded into the 'C8 device's internal RAM and executed without having to program the on-chip EPROM. Once the routine is verified, it may be programmed (by the same board) into the MCU and used as a building block by other routines. With careful strategy, quite a long program can be developed chunk-by-chunk without needing fancy tools. My programmer board (bundled with some pretty good software) cost me about $68.05 (US) three years ago and I believe it is still available.

Ask around at the computer club or local college and look in the ads in magazines such as *Midnight Engineering* and *Circuit Cellar* for possible development board candidates. If the price for a good system is too steep (they can run a couple of hundred dollars) for one budget, consider finding a buddy (or buddies) to split the cost with. Not only do you get access to a system at less cost, but if you share your experiences, it makes the learning curve a lot easier!

Hardware Description

The circuitry for the Kendraboard fits on a small single-layer 2.5" x 4.5" printed circuit board (same size and shape as the Julieboard). It is a very low-tech board which is well within the fabrication abilities of the average ham. I made mine using an "ironed-on" reversed-image photocopy as an etch resist! My design objectives were simple: lowest possible density for ease of home fabrication, mechanically compatible with the Julieboard, and capable of future expansion with the existing design.

"If the price for a good system is too steep (they can run a couple of hundred dollars) for one budget, consider finding a buddy (or buddies) to split the cost with."

Board logic is very simple; it consists of a Motorola MC68HC705C8 single-chip microcomputer (MCU) and its support circuitry. The micro itself provides all operational functions, except for master clock generation. (It was easier to fit in a small clock oscillator module than the discrete oscillator components and I didn't want to spend a lot of time making them fit). The 'C8 was chosen because an MC68HC05EVM evaluation board was on hand and the chip features:

- 7.7K bytes EPROM (or OTP).
- 176 bytes RAM.
- 24 bidirectional TTL I/O lines.
- 7 input/special purpose TTL lines.
- Serial (ASCII) communications interface.
- Serial (binary) peripheral interface.
- Easy-to-use 40-pin DIP package.

This device is considerably more powerful than what this application actually requires, but I wanted to provide for future growth.

The series resistors are used as a buffer between the "outside world" and the MCU for ESD and as an aid to EMI suppression. The pullup resistors are needed to define input levels for idle I/O pins (this is important for CMOS devices such as the 'C8).

All I/O connectors, except for one, a male or female DB25, are 0.100 friction-lock SIPs and are intended to be used with matching housings loaded with crimp terminals. The DB25 can be wire-wrapped for plug-in compatibility with the Julieboard, either via a DB25/ribbon cable "backplane" as a female, or directly to the Julieboard DB25 as a male. The serial EEPROM is a future item for when I want to do nonvolatile channel storage and clock frequency error calibration. Presently, the software does not support the EEPROM, so it may be left out, if desired.

Like the Julieboard, supply voltage input can range from about +7VDC to +12VDC, and is protected against reverse-polarity damage.

Software Description

In order to simplify the software as much as possible for the initial version, BCD thumbwheel switches were used for frequency control and display. (A keypad and LCD display could have been implemented, but the software required would have been much more complicated.) To drive the DDS, the software must perform these functions:

- Set up the microcomputer internal registers.
- Read the thumbwheel switches digit by digit.
- Do a BCD-to-binary conversion.
- Send the binary data to the DDS chip.

Set Up the Micro: The I/O lines used for the BCD digit "commons" and DDS control are set up as outputs, while the BCD read-back lines are set up as inputs. Unused I/O lines are configured as inputs and are pulled HIGH by the board pull-up resistors. Other processor functions (SPI, SCI, timer, etc.) are not presently used, but will be used in the future. At that time, code will have to be added to initialize these items. Once the micro has been initialized, control passes to the BCD thumbwheel switch read-routine.

Reading the BCD Thumbwheel Switches: Each BCD switch consists of a COM terminal and four output bits which are connected/disconnected to the COM terminal, depending on code. The required switch function is:

Code:	8	4	2	1
0	off	off	off	off
1	off	off	off	on
2	off	off	on	off
3	off	off	on	on
4	off	on	off	off
5	off	on	off	on
6	off	on	on	off
7	off	on	on	on
8	on	off	off	off
9	on	off	off	on

The output bits are paralleled via diodes: The cathodes go to the individual 8-4-2-1

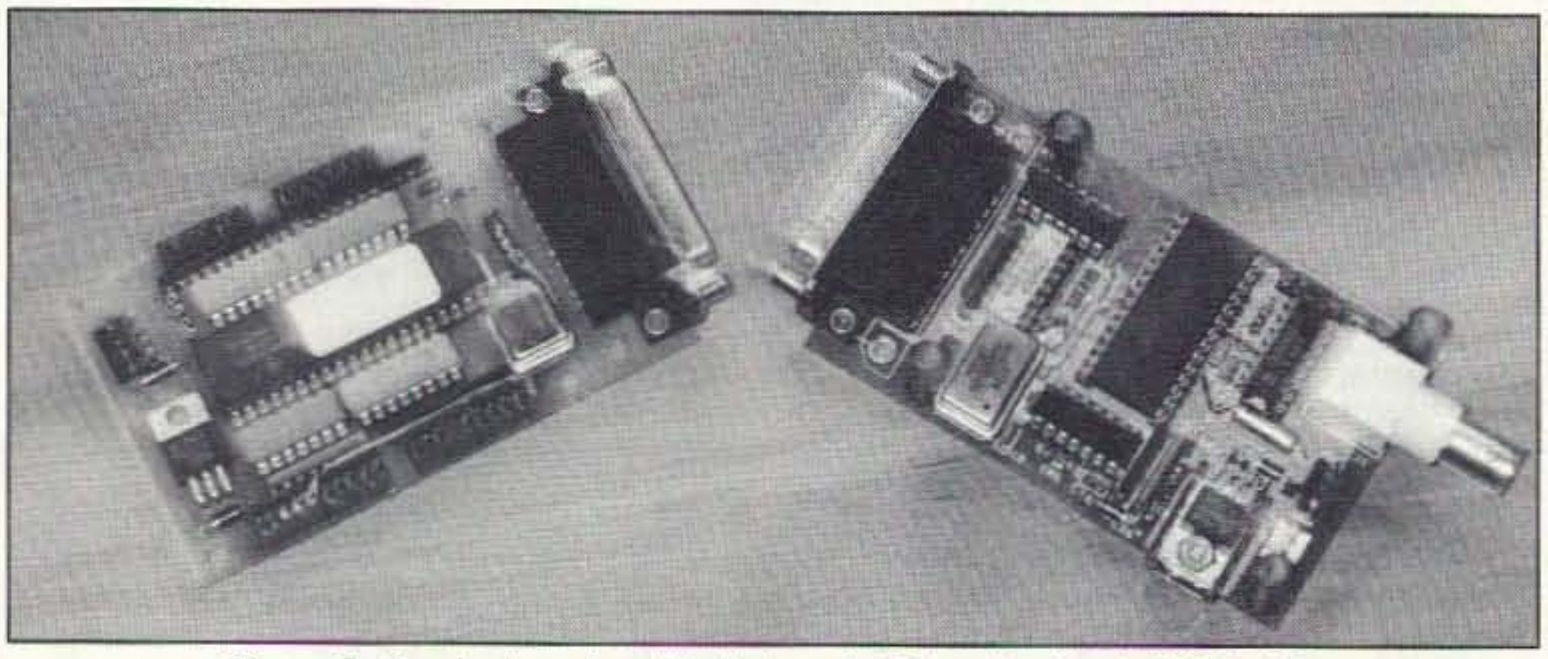


Photo C. Kendraboard and Julieboard. (Photo by Sandy VE3AAC.)

A NEW CONCEPT IN HF TRANSCEIVER DESIGN FROM A NEW COMPANY

Patent Pending

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Specifications are subject to change without notice.
* IBM XT is a registered trademark of the IBM Corporation.

- Basic display lets you know exactly where you are.

```
14.03510-T   0930
14.03510-R   M000
```

- Standard Display shows RX/TX VFO freq's, time and current memory

- Send & Receive in: CW / RTTY(BAUDOT) / ASCII

```
TNX FER QSO. 73
```

← Incoming data

← Outgoing data appears here

- Store up to nine 256 character messages.

```
14.03510-T   0930
3>CANNED     MSG
```

- Messages can be: edited, sent & appended to outgoing message

← Format & Edit stored MSG's here

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CIRCLE 321 ON READER SERVICE CARD

switch outputs and the anodes go to the common 8-4-2-1 bus (which goes to the MCU for readback.) This configuration has the ON bits for a given digit pulling LOW during readback, with the OFF digits staying HIGH. (Yes, this means 32 diodes for a full eight-digit interface! Look for switches with provision for on-board diode mounting—they do exist.) The COM line for each digit is connected to a unique microcontroller output line which is driven LOW by the processor while that digit is being read. After a digit is read, its value is placed in a memory location reserved for that value, to be used by the BCD-to-binary conversion routine. Once all eight lines have been read (and the eight memory locations filled by switch values), the routine passes control to the BCD-to-binary conversion routine.

BCD-to-Binary Conversion: At first glance, this appears to be a complicated function with lots of floating point math, but it's actually a very simple routine. What I did was to work out a binary weighting constant for each BCD digit, then accumulate (add to a running total) it a number of times equal to the value of that digit. For example, suppose that I have dialed up "03755200," which corresponds to 3.7552 MHz:

First, I clear a binary register then, one-by-one, I examine each BCD digit and accumulate its binary constant that number of times:

0—add the 10 MHz constant 0 times
3—add the 1 MHz constant 3 times
7—add the 100 kHz constant 7 times
5—add the 10 kHz constant 5 times
5—add the 1 kHz constant 5 times
2—add the 100 Hz constant 2 times
0—add the 10 Hz constant 0 times
0—add the 1 Hz constant 0 times

This accomplishes the conversion simply by doing a trivial binary calculation many times. In the worst possible case, 99.999999 MHz, only 72 accumulates of weighting constants need be done, so this routine is fast.

Since the DDS binary register size is 32 bits, this would suggest that weighting constants should be 32 bits each. Initially, I used 32-bit values for the weighting constants, but found that 70-odd repeated calculations could cause what I considered to be an excessive amount of round-off error. I then redefined each constant as being 40 bits—32 bits whole and 8 bits fractional—accumulated them to a 40-bit register, and took the upper (non-fractional) 32 bits as the binary result, discarding the 8 bits fractional remainder.

I am now happy with the results of the improved algorithm. Another nice thing about this scheme is that it can be used to do any other channel-to-DDS-binary conversion just by using a different initial value (not necessarily zero) and re-doing the weighting constants for each programmable digit. For this design, using a Julieboard with 40 MHz clock, the weighting constants are:

10 MHz: 4000000000
1 MHz: 0666666667
100 kHz: 00A3D70A3E
10 kHz: 0010624DD3
1 kHz: 0001A36E2E
100 Hz: 000029F16B
10 Hz: 00000431BF
1 Hz: 0000006B61

Send Binary to the DDS Chip: This is a simple routine: Shift 32 data bits into the DDS, then pulse the *XFER line to capture the new frequency value. Once this has been done, the micro goes back to "Reading the BCD Thumbwheel Switches" and the cycle endlessly repeats. Cycle time is quite fast: The loop time is about 6mS—instant response as far as human perception is concerned.

The machine language listing is shown in Figure 4. This is a modified Motorola ".S19" file with spaces added to separate address, code, and formatting fields. The first column, "Sxxx . . . " is a formatting field used to show the beginning of each file line. The next field represents the start address for each block of binary data. The third field (in bold) shows the actual code/data as burned into the EPROM.

The first block is data placed in EPROM addresses $1000-1027, which represents the binary weighting constants described above (in scrambled form). The second block is machine code placed in EPROM addresses $0100-0216. This code can be translated by hand (albeit tediously) back into the original assembler format to show what the program does, in a human-readable form. The last 2-byte "block" of data which is placed in the RESET vector at $1FFE-1FFF to tell the computer the starting address upon power-up.

Continued on page 18

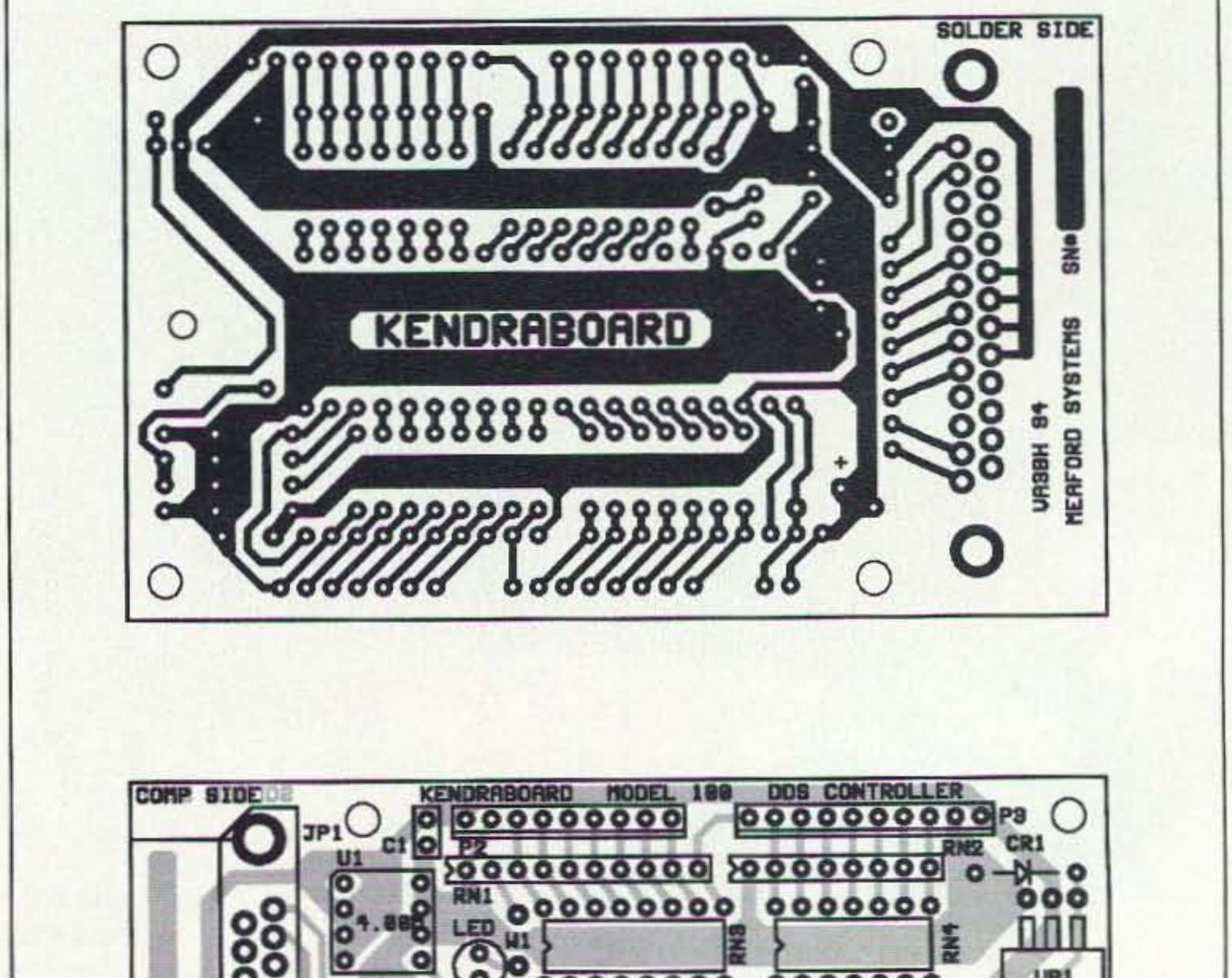

Figure 2. PCB layout.

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8 Review: Drake SW8
9 Review: JPS Communications' NRF-7
10 The Coleman (Mini)-Kilowatt
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20 Above and Beyond
21 Ask Kaboom
22 Dealer Directory
23 Updates
24 73 International
25 Special Events
26 Barter 'n' Buy
27 New Products
28 Random Output
29 Propagation

Stand-Alone DDS

Continued from page 16

Finally, the final column (and all of the last line) represents checksums, one per line.

This format is a very compact way to list a computer program (the source code, with comments, is 342 lines long!) and is used by Motorola as a protocol for data transfer into a programmer. To restore the magazine copy back to the .S19 format, type the text into a word processor (omitting all spaces and bold-ing of the binary code). The file, when correctly saved as an ASCII file, is 918 bytes long and should load into an EPROM programmer or evaluator board.

Developing the Software (Hints)

The software is not difficult to write, especially if a few simple rules are followed:

- Use a development system, pick MCU accordingly.
- Use modular program structure.
- Use RAM for inter-routine interface.
- Use flow-charts/"pseudo-code."
- Test algorithms in higher-level language.
- Use in-line code to avoid branches (initially).
- Change or add just one thing at a time.

A development system is so useful that the choice of micro often depends upon which systems are available and for what price. Nothing beats hands-on/real-time access to your code for bug-killing. Keeping the code in RAM allows for easy patches and experimental code without having to re-compile or assemble, then program, over and over and over again. I chose the 'C8 because I have the evaluation board (and paid less than $70 for it!). Also, some means of EPROM "blasting" of the single-chip is needed—also done by the evaluator board.

Partitioning the software into smaller routines is generally done for all but the most trivial programs. By reducing a complicated program into a group of simple programs, the job will go much quicker—it is far easier to debug several simple routines one at a time than it is to sort out one large complicated one. The ideal approach is to write the routines one by one and graft them into the existing work as they are debugged. This was done here by defining several tasks which were done sequentially at single points in time. For example, once the micro is initialized, it never has to be re-initialized. Likewise, once the BCD switches are read, they are not re-read until the BCD values are converted to binary and sent to the DDS chip. For my system, partitioning was obvious: initialize, read switches, binary-convert, and send to DDS.

Use RAM locations for inter-routine interface. This means defining a block of RAM for the input data and (if possible) another block of RAM for output data. Try to keep the two blocks separate—this makes debug and patching much easier. Routines can be debugged independently by placing values in input RAM, running the routine, and looking at the output RAM to see if the expected results are there. If the program does not destroy its input variables upon execution, it can be run and re-run until debugging is done; otherwise, the input data has to be reloaded prior to each run. Naturally, if RAM space in the micro is limited, this rule may not always be practical, but it is a generally good strategy and makes the code more modular.

It is tempting to just dive in and start writing code, but programmers generally use flow charts or "pseudocode" to map out logic flow and settle in their minds how the finished routine will work. There is probably no better way to catch errors than to document how something works. Often something which seemed right in one's mind will look strange on the printed page and, sure enough, a closer look will spot the bug. Also, once a program has been "put to bed," it tends to be forgotten, so if documentation is not done up-front, the routine might have to be "reverse-engineered" later if it ever has to be modified or if a future bug pops up.

Flow charts use boxes, diamonds, and ellipses to show program flow, while pseudocode is an "English-language" task-by-task description of what has to be done. I favor pseudocode—it is compact, takes no extra time for box-and-line drawing, and I can do it on my word processor.

Here is some of my pseudocode (done for the BCD-to-binary routine):

```
START:
8x digit 40-bit constants in ROM
8x BCD digits in RAM: A = 10 MHz value
                      B = 1MHz value
                      C = 100KHz value
                      D = 10KHz value
                      E = 1KHz value
                      F = 100Hz value
                      G = 10Hz value
                      H = 1Hz value
clear/init forty-bit register FREG
add (10MHz) constant 'A' # of times to FREG
add (1MHz) constant 'B' # of times to FREG
add (100KHz) constant 'C' # of times to FREG
add (10KHz) constant 'D' # of times to FREG
add (1KHz) constant 'E' # of times to FREG
add (100Hz) constant 'F' # of times to FREG
add (10Hz) constant 'G' # of times to FREG
add (1Hz) constant 'H' # of times to FREG
32 MSB's of FREG equal DDS binary code
EXIT:
```

Note that there are no branches and loops in this pseudocode—it is written "in-line." Branching errors are very common

Parts List

Qty.	Loc.	Description	Digi-Key #
1	U1	40.00 MHz osc. module	CTX155
1	U2	Motorola MC68HC705C8S microcomputer	(Note 1)
1	U3	EEPROM (not presently used)	24LC04/P-ND
1	U2	40p machined (gold) IC socket	ED3640
2	U1,U3	8p machined (gold) IC socket	ED3308
1	VR1	7805 regulator (TO-220)	AN7805
1	LED1	Green-light-emitting diode	P309
2	CR1,CR2	1N4001 diode	1N4001
2	RN3,RN6	33R resistor network (16dip8)	761-3-R33
2	RN4,RN5	33R resistor network (14dip7)	760-3-R33
1	RN1	4K7 resistor network (10sip9)	Q9472
1	RN2	10k resistor network (8sip7)	Q7103
2	RN7,RN8	10k resistor network (10sip9)	Q9103
3	C1,C3-4	100N ceramic cap (0.1" L.S.)	P4917
1	C2	100N ceramic cap (0.2" L.S.)	P4887
1	C5	22U aluminum electrolytic cap	P5411
1	"JP1"	Male or female right-angle DB-25	(Note 2)
1	P4	4x1 male header	WM4202
1	P6	7x1 male header	WM4205
1	P5	8x1 male header	WM4206
2	"P1A,"P2	9x1 male header	WM4207
1	P3	10x1 male header	WM4208
1	@P4	4x1 female housing	WM2002
1	@P6	7x1 female housing	WM2005
1	@P5	8x1 female housing	WM2006
2	@P1A,@P2	9x1 female housing	WM2007
1	@P3	10x1 female housing	WM2008
1		Blank printed circuit board	(Note 3)

Note 1. Blank C8s available from FUTURE Electronics; programmed C8s available from author (Box 232, Pakenham, Ontario, Canada K0A 2X0; 613-624-5247).

Note 2. You can use either male or female DB25 at JP1, depending on the desired option.

Note 3. Available from the author (see Note 1).

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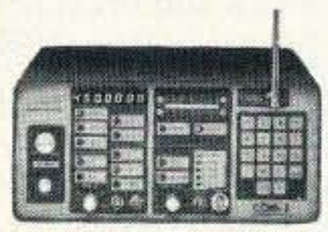

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CIRCLE 34 ON READER SEVICE CARD

in raw code and the loops and branches can make following the program flow difficult. The use of in-line code is not "efficient" as far as memory space is concerned, but it is good for debug efficiency and it is better to have good fat code than compact buggy code. Once the code is debugged, *then* it can be "optimized." Also, in-line code generally runs faster and is much easier to follow if it has to be modified at a later time by a third party.

The last item is a lesson that I seem to have to learn every time I do a program. *Change only one thing at a time*! It is tempting to change several things at once before doing another download or PROM-blast, but if you do it this way it can be hard to see just which change caused which bug.

Using the Controller Board

Connections are made to the Kendraboard as follows:

Pin	MPU Port	Signal
P6-1	PA7	x10MHz COM
P6-2	PA6	x1MHz COM
P6-3	PA5	x100KHz COM
P6-4	PA4	x10KHz COM
P6-5	PA3	x1KHz COM
P6-6	PA2	x100Hz COM
P6-7	PA1	x10Hz COM
P6-8	PA0	x1Hz COM
P5-1	PB0	BCD "1" line
P5-2	PB1	BCD "2" line
P5-3	PB2	BCD "4" line
P5-4	PB3	BCD "8" line
P3-1	GND	Julieboard ground
P3-3	PC7	Julieboard ★XFER (P1-7)
P3-4	PC6	Julieboard SCLK (P1-6)
P3-5	PC5	Julieboard SDATA (P1-2)

The connections on P3 can be made directly to the Julieboard via a cable or via wire-wrapped jumpers bridging P3 to the DB25 connector (P1). Note that the physical wiring differs for male vs. female DB25—examine the chosen connector carefully and locate the right pins. (The ground connection need not be made if a DB25 of either sex is used.)

The single in-line connectors are end-stackable, so some connectors could be partitioned into two smaller connectors. For example, "P6" could be implemented with a 4-pin connector to bring in the 4-bits BCD from the switch matrix and a 3-pin connector to bring out the spare two Port B bits and ground. This allows a more modular system where the thumbwheel switch cabling is completely separate from the cabling to those two spare bits. Likewise, connectors P2 and P3 may be partitioned into subsets.

Note that Julieboard signals ENPHACC, SHIFTEN, and BANKSEL are not presently used, but could be in future versions. One advantage of using the DB25 is that an opposite-sex multiple DB25 "backplane" arrangement can be used to allow addition of future boards to the set. (For example, a T-R adapter/amp board and updated software will allow me to use this combo in VFO service for my Atlas 210 transceiver.)

My favorite use for the stand-alone combo is as the LO for a tunable mixer. I have a Mini-Circuits SRA-1 mixer in a BNC-equipped box: The RF port goes to the antenna, the LO port goes to the Julieboard, and the IF port goes to a surplus crystal-controlled SSB/AM receiver tuned to 6.300 MHz. I program the Julieboard to produce an output 6.300 MHz above/below the desired frequency, set the proper sideband, and . . . voilà! Someday, I will mod the software so I won't have to do the frequency offset in my head.

Of course, this controller is suitable for controlling things other than just Julieboards. For example, one of the newer high resolution D/A converters could be driven to make a digital power supply or voltage source. How about -16.384V to +16.383V adjustable in 1 mV steps via thumbwheel? Or one of the new PLL chips and thumbwheels for a synthesized 6m or 2m rig?

There is no reason why the processor has to be a '6805 (or even a Motorola device). For example, PIC chips are available via DigiKey, and one quite intriguing product is a "BASIC stamp" which runs BASIC programs kept in an on-board EEPROM and is about the size of a large postage stamp.

Machine Code Listing (Modified .S19 File)

```
S113 1000 40060000000000000066A31001000000 7C
S113 1010 0066D762A329040000680A4D6EF1316B A3
S10B 1020 00673ED32E6BBF61 93
S113 0100 A6FFB704A6FFB700A600B705A6FFB706 6B
S113 0110 A67FB702A600B7B0B7B1B7B2B7B3B7B4 4A
S113 0120 B7B5B7B6B7B7AE00A67FCD0209A6BFCD A7
S113 0130 0209A6DFCD0209A6EFCD0209A6F7CD02 7A
S113 0140 09A6FBCD0209A6FDCD0209A6FECD0209 32
S113 0150 3FA83FA93FAA3FAB3FACAE00CD01D1AE 13
S113 0160 01CD01D1AE02CD01D1AE03CD01D1AE04 9A
S113 0170 CD01D1AE05CD01D1AE06CD01D1AE07CD B5
S113 0180 01D1B6A8CD01DDB6A9CD01DDB6AACD01 58
S113 0190 DDB6ABCD01DD1A02CD01FF1E02CD01FF 9C
S113 01A0 1F02CD01FFCC012698B79FB6ACD91020 11
S113 01B0 B7ACB6ABD91018B7ABB6AAD91010B7AA 5A
S113 01C0 B6A9D91008B7A9B6A8D91000B7A8B69F 80
S113 01D0 81E6B02707CD01A84ACC01D381BF9EAE EA
S113 01E0 08CD01EA5A26FABE9E814824051B02CC 9A
S113 01F0 01F41A029D9D9D1D029D9D9D1C0281B7 C7
S113 0200 9FA6104A26FDB69F81B700CD01FFB601 17
S10A 0210 43A40FE7B05C81 79
S105 1FFE 0100 DC
S9030000FC
```

"Not having to wait for boot-up is great and there is a noticeably lower RF noise level vs. the PC."

What's Next?

I plan to evolve my design as I go, and add (in rough order):

- External BCD display via '595 shift registers.
- Option for up/down non-mechanical tuning.
- SCI support (remote operation via serial port).
- EEPROM support.
- Offsets for use as transceiver VFO.

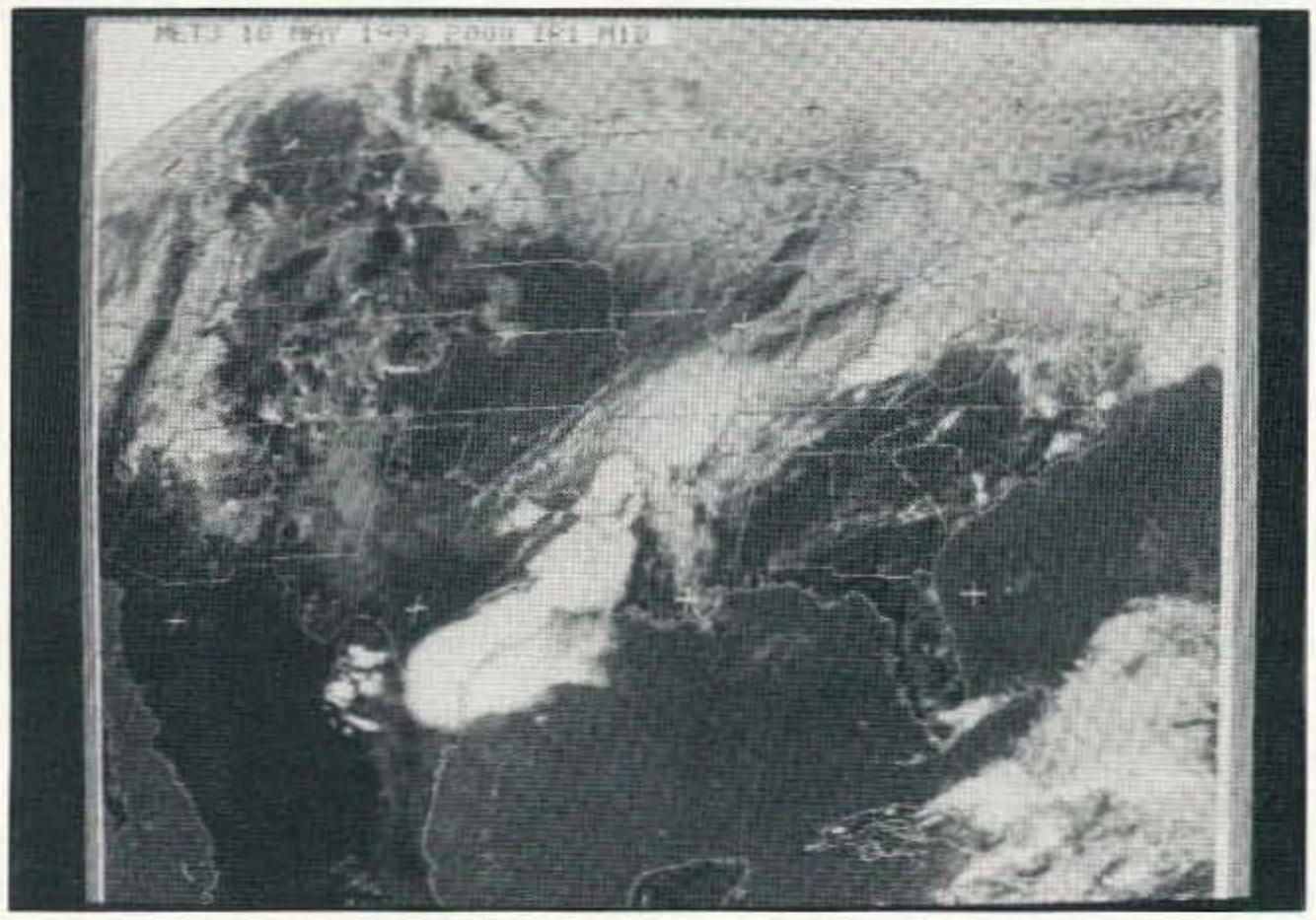
Conclusions

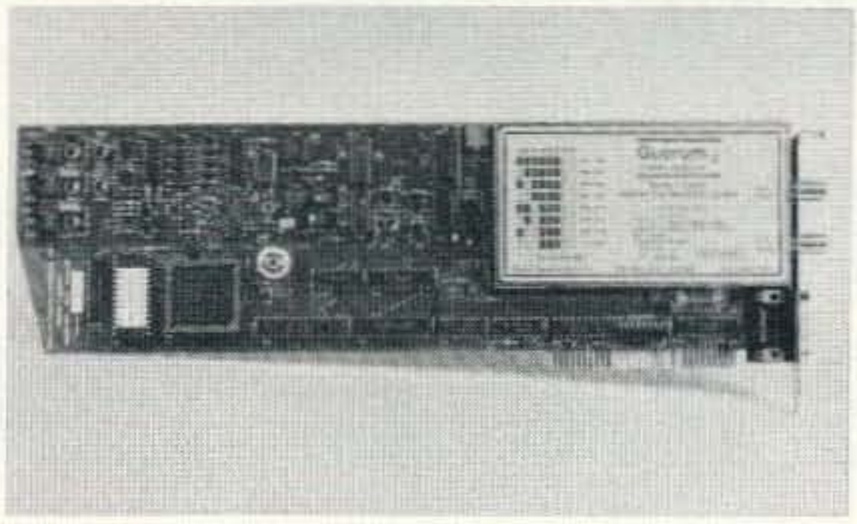
I have had the stand-alone controller running the Julieboard DDS synthesizer in my shack for several weeks and am very happy with it. I can't wait to incorporate it in my portable QRP transceiver project. Right now, I have the best of both worlds—if I need special programming functions, the Julieboard can be unhooked and reconnected to the PC; otherwise, it is left attached to the Kendraboard for general purpose operation. Not having to wait for boot-up is great and there is a noticeably lower RF noise level vs. the PC.

Personal Note

Why "Kendraboard"? Readers familiar with the "Julieboard" article will recall that Julie had two (now three!) sisters and that they expected equal treatment. Kendra thought that naming the controller after her was a great idea. Now Karen wants to know when I'm going to do *her* board . . . 73

Explore The World of Quorum Wefax





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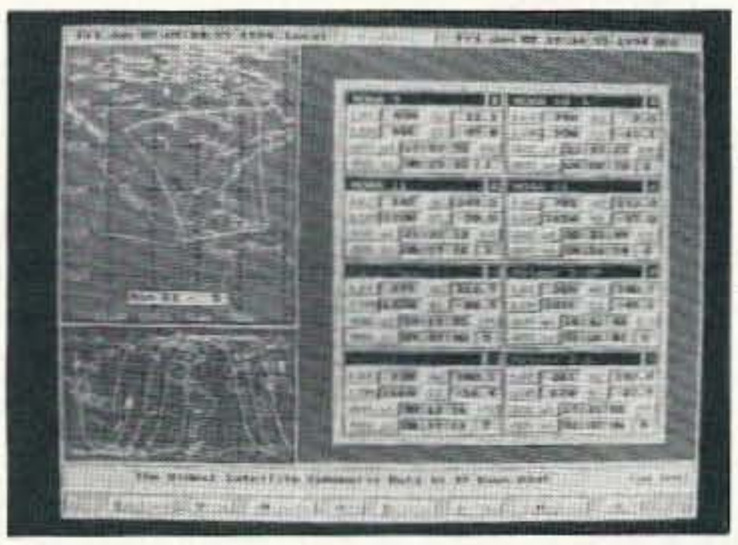

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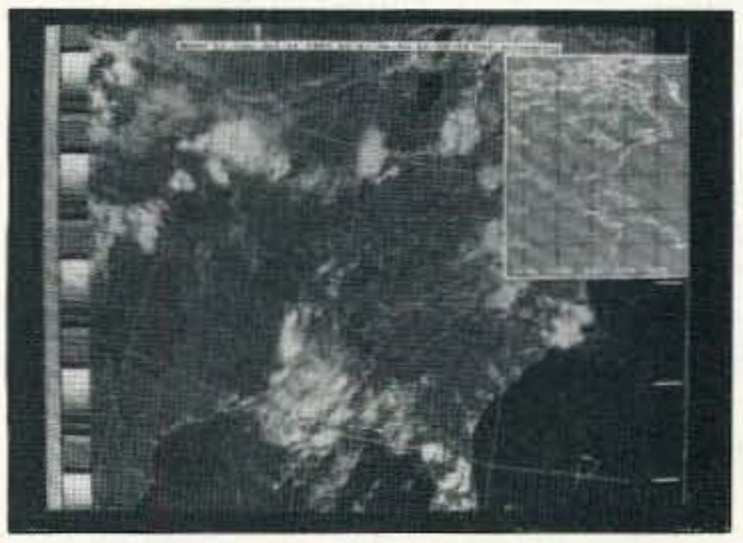

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CIRCLE 257 ON READER SERVICE CARD

73 Review

Number 5 on your Feedback card

by Steve Katz WB2WIK/6

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The Azden PCS-7500H 6 Meter FM Transceiver

50 watts on 6 in an attractive, low-cost mobile.

Azden Corporation is the only manufacturer of monoband mobile FM transceivers for all the popular bands from 28 through 440 MHz and really has a corner on the market for 6 and 10 meter FM rigs. When given the opportunity to review the new PCS-7500H 6 meter FM rig, I was happy to jump right on it, since the 50 MHz band is full of FM simplex and repeater activity here in Southern California.

Six meters is a unique band that combines the propagation advantages of both VHF and HF. For line-of-sight (direct wave) work, 6 is not much different from 2 meters or 135 cm (222 MHz), although the longer wavelength produces less rapid signal strength flutter. Because a quarter-wavelength at 6 meters is about 4'9" long, peaks and nulls in signals are produced by considerably more movement than, say, at 2 meters, where a quarter-wave is only about 19". Tropospherically-enhanced propagation, especially "tropo ducting," occurs less on 6 than on 2 or the higher frequency bands, making those occasional DX contacts a bit more rare; however, the 50 MHz band does afford its users much more frequent sporadic-E ("E-skip") propagation, especially from May through July, and again in December, and 1,200-mile QSOs on 6 meters are not rare. Plus, 6 meters enjoys occasional F-layer propagation, producing contacts to several thousand miles with relatively low power during solar-cycle peaks. If you haven't tried 6 yet, it is surely an interesting band that has its share of die-hard users.

Overview

The first thing anyone notices about the PCS-7500H (or any of the new Azden PCS-7000 series) is how incredibly beautiful it is to look at. It is a fine-looking radio, with every single panel button illuminated with a dark orange glow for easy viewing. The LCD display screen is similarly backlighted and has a warm, inviting glow. Even the push-buttons on the DTMF ("touch-tone") microphone are all illuminated; a nice touch. The rig comes equipped with a convenient and sturdy mounting bracket, a PTT/DTMF microphone, a long DC power cable with the positive side fused, a connector disconnect point about eight inches from the rear of the radio, and all mounting hardware. It also comes with a CTCSS ("PL") encoder built in. The PCS-7500H is rated to produce 50 watts RF output power (with a 10 watt "low power" mode front-panel selectable), programmable frequency steps, and other features normally found on modern FM transceivers.

The PCS-7500H has good and bad points, and I'll try to discuss both fairly. I like thoughtful touches, with which the Azden is loaded. For example, they used a flat-blade automotive-style fuse in the DC power cable. Small point, but these have real advantages over the old-fashioned 3AG, AGC, MDL (etc.) glass cartridge fuses used in most other equipment: They can really handle a lot of current without thermal meltdown, are readily available at gas stations, and are very inexpensive. I also like the connectorized power cable, which uses an automotive-style molded connector set that has also proven its reliability in years of service. Its coaxial antenna cable receptacle, a standard "UHF" SO-239, is firmly mounted to the rear panel of the radio, not hanging on a short coax extension cable as in many modern mobile rigs. Its hand-held PTT microphone has a solid feel and produces excellent transmit audio. (More on this later.) Its receiver audio is full, loud and undistorted, and sounds better than many mobile rigs. And the rig is beautiful, especially at night when one can enjoy all the warmly lit controls. The Azden can accommodate any frequency "split" between transmit and receive, since each channel can be separately programmed (into memory) with TX/RX frequencies, and its 20 memories are adequate for 6 meters. As with all modern FM rigs, each memory will store frequency "split" and PL tone (if required).

I also like the built-in heat-sink fan in the PCS-7500H. It activates after a few minutes of continuous transmission at normal room temperature and helps maintain a "cool-to-the-touch" heat sink, undoubtedly prolonging the operating life of the final amplifier stage.

On the other hand, the Azden is full of quirks, some of which I found a bit annoying. First, the PCS-7000 series all seem to share one instruction manual, written around the PCS-7000(H) 2 meter rig. The PCS-7500H manual contains an "addendum" sheet (one page) which modifies the PCS-7000 manual to suit the 6 meter rig, but this means referring back and forth between two sets of information. And the original PCS-7000 manual contains mistakes and typographical errors. Most aren't meaningful, but I started to proofread the manual in search of errors and stopped when I found a dozen by the fourth page. This reminded me of how badly written the older Japanese equipment manuals used to be, before the manufacturers employed English-speaking technical writers to make them better.

Next, there is no easy way to use the rig with tone-activated (CTCSS) repeaters when in the "VFO" or "Direct" mode. PL-tones are easily programmed into memory, and once this is performed, tone-activated repeaters are easy to use; but if you're "scanning around" looking for activity in an unknown region and stumble across a tone-activated repeater not already in memory, there's no easy

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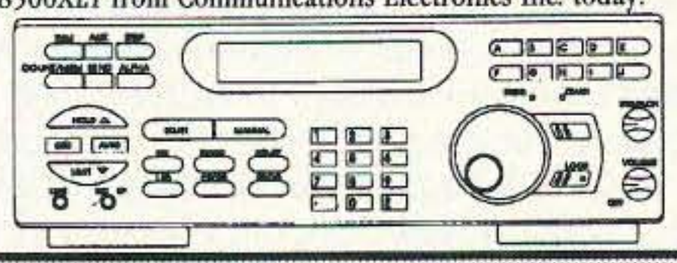

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ANTMMBNC-J magnet mount scanner antenna w/ BNC connector $29.95
ANTMMMOT-J magnet mount scan antenna w/Motorola plug $29.95
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CIRCLE 356 ON READER SERVICE CARD

way to access it without programming the required frequency, offset and tone data into memory first. Azden did provide me with an updated sheet entitled, "Error in Azden PCS-7000H Instruction Manual" which does describe how to use a PL tone in the "Direct" mode, but the procedure is so complicated it couldn't possibly be performed while driving.

The rig's 20 memory channels are stored in two banks of 10, called A0-9 and B0-9. No big deal, although simply calling them 0-19 or 1-20 might have been nicer. But the rig always "powers up" on memory A0, regardless of where you used it last. This is frustrating, especially since all my other modern FM transceivers "remember" where they were last used and "power up" on the last-used channel.

Also, there's no VFO/memory knob of any kind on the Azden, nor may frequencies or memory channel numbers be entered directly with keypad strokes. The only way to go from, say, memory A3 to memory B5, is by using the "up" or "down" buttons (either on the front panel or on the PTT microphone) to go through all the memories in between. And if you depress the "up" or "down" button more than momentarily, the rig begins scanning through the memory channels very quickly, much too fast to stop on the channel of your choice. With the technology and chip sets available today, there's no reason for any channelized radio to not have "direct frequency entry" with keypad strokes. (That is, if you wish to "dial up" 52.525 MHz, you'd just depress 2-5-2-5 on the keypad, and the rig would go there instantly.) This used to be tricky in the old days, but can now be done with one $2 chip. In Azden's defense, however, I must admit that many modern FM mobile rigs still don't contain this feature. Darned if I know why not.

Another minor annoyance is that a user of the PCS-7500H must refer to a "Tone Code Table" when programming PL tone frequencies. That is, the CTCSS frequencies, of which there are 38 in common use, are not actually displayed by the Azden during the PL selection process. Instead, tones are selected and displayed by two-digit codes which might only be memorized by The Amazing Kreskin. Since I'm not so amazing, I had to constantly refer to a chart on page 14 of the instruction manual to determine which two-digit code corresponded to each PL tone frequency. For example, Code "19" corresponds to a CTCSS frequency of 127.3 Hz. Sid Wolin at Azden in New York did advise that the newer-generation PCS-7000 series (unavailable at this writing) would incorporate a new microprocessor which allowed direct PL frequency address and readout, as on their handie-talkies.

Programming the PCS-7500H takes some getting used to if you are more familiar with one of the other brands of equipment. It's not difficult, but might be too complex for use "on the fly" while driving. Again, to be fair, most of the mobile rigs I've used are too complicated to program without focusing complete attention on the task. But the Azden instruction manual makes the job sound more difficult than it is, with 12 paragraphs assigned to the description. The Azden is unique in that it only stores the memory data when you turn the rig off, and then back on. To quote from the manual, "Note: Be sure to turn off the power when you have completed programming. This procedure is required to get each setting programmed in and then to get out of the programming mode." Weird, but it works.

With all these quirks to write about, you may get the idea that I really don't like the Azden. This isn't true. I do like the rig, but it took more getting used to than it should have. In terms of performance, the Azden is an impressive package.

The Technical Side

One thing I like a lot is that Azden provides "full-sized" schematic diagrams for their rigs. They are clear and easy to read without a magnifying glass, and will be of value to those who like to perform modifications or do their own service work. The schematic for the PCS-7500H reveals the transmitter final power amplifier to be discrete (2SC2097), rather than a molded hybrid "brick" (modular) amplifier as used by most other manufacturers. I like the discrete approach better because it is more user-serviceable for reasonable cost. Should the PA "final" ever go out, it will be much cheaper to replace a $10 transistor than a $90 module. Not that I would expect the final to fail; the people at Azden assured me they've never seen one fail yet.

The PA circuit board also contains a discrete driver stage (2SC1972), the thermal detector which switches on a cooling fan if the heat-sink temperature gets too hot, the VSWR protection detector circuit (which shuts the transmitter down if a gross antenna mismatch occurs), and a bandpass filter circuit which is in line with the antenna to both the receiver and the transmitter. PA stage tuning is accomplished by a three-section low-pass matching network. One drawback to the discrete PA stage is its critical tuning: The PCS-7500H does deliver 50 watts as rated into a perfect 50 ohm resistive load, but power output falls off rapidly when the transmitter is faced with any mismatch at all. The antenna I used for most of my testing, a vertical with a measured VSWR of 1.5:1, only allowed the transmitter to deliver between 28 and 42 watts, depending on the operating frequency and exact nature of the mismatch. Some of the "brick" stages, while costly to replace, are more forgiving of mismatches.

The receiver's front end, a 3SK101 dual-gate MOSFET, is protected against transients by "back-to-back" signal diodes and features bandpass tuning of both its input and output to help reduce interference and intermodulation from adjacent services. The first RF mixer, another 3SK101 with an output of 14 MHz, is followed by a four-pole crystal filter whose output drives the IF SYSTEM integrated circuit, an MC3361D. The receiver's second IF at 455 kHz is filtered by a 15 kHz bandwidth ceramic filter, type KBF455R15A. The receiv-

er isn't razor-sharp, but suffices nicely with the 20 kHz channel spacing commonly used on 6 meters. One might think that a VHF rig with a first IF at 14 MHz could be easily interfered with by strong 20 meter signals, but I didn't find this to be a problem.

The transmitter uses what Azden proudly describes as "true FM" for modulation, and I guess it is, with the microphone amplifier stage directly driving the VCO variable-capacitance tuning diodes. However, I've never been able to tell the difference between "true FM" and "phase modulation," since, mathematically speaking, one is the reciprocal of the other and a phase-modulated signal, when integrated, becomes "FM."

I did have a problem with the unit as received, in that the transmitted modulation was tinny and distorted. Azden was surprised to hear this, and immediately shipped a new microphone, thinking that was likely to be the problem. It was, and the new microphone produced clear, crisp modulation that received compliments on the air. (I must say, Azden's service in this instance was remarkable. They must have shipped the new mike the day I called them on the telephone, because I received it the next day, 3,000 miles away!)

One thing I think is a bit "clunky" about the Azden is that it uses an old-fashioned relay for transmit-receive RF switching. Relays work fine, and Azden claims they've never had one fail, even in prolonged packet radio service, but their switching "turnaround" speed is rather slow compared with solid-state switches, and if the radio is used for packet, the user may have to re-set switching parameters in his TNC program. I was used to using 30 milliseconds (mS) or less in packet switching, but this is too fast for a relay. I'd recommend more like 300 mS for a relay-operated rig. There's not a lot of packet activity on six anyway, but if you really wanted to, you could home-brew a PIN diode modification fairly easily.

A listing of manufacturer's ratings vs. bench measurements made on the PCS-7500H is contained in the sidebar.

Summary

It took me a while to get used to the Azden. It does have quirks, as described earlier, that make it more troublesome to use than I'd like. But for an affordable, single-band 6 meter FM rig, it's almost the only game in town. Same goes for 10 meters, with the PCS-7800H. I understand the Southern California Six Meter Club, which actively promotes the use of this band, has ordered a great number of these radios for their members and they are well accepted. In speaking with local 6 meter repeater owners, I found they were all very aware of the Azden and were either using one personally or had at least had their hands on one. It does disturb me a bit that the transmitter power output falls off so sharply when connected to other than a perfect load, but since the FM subband on 6 meters is a narrow window of our spectrum (3 MHz), I suppose anyone with a lick of sense could tune his antenna to provide a good match if he had to.

The radio as reviewed is good. With the improvements Azden has planned, such as eliminating the two-digit PL tone codes, it will be even better. If they also rewrote the instruction manual, and had one specifically dedicated to the PCS-7500H, it would be better still. *[Factory Note: New and improved manuals are in the works.]* On a scale of one to 10, with a "10" being perfect, I'd rate the PCS-7500H a strong 8: a good rig for the money and, as I said earlier, maybe the only game in town for a modestly-priced 6 meter FM rig. 73

Manufacturer's Specifications vs. Bench Measurements

Variable	Specification	Measured
TX output power	50 watts (high)	47-52W (H)
RX sensitivity	<0.35µV/20 dB NQ	0.30µV/20 dB NQ*
Squelch sensitivity	<0.12µV threshold	0.10µV threshold
Selectivity	15 kHz/-60 dB	15 kHz/-57 dB
RX audio output	2W, 10% THD	2.2W, 10% THD
Power consumption	0.6A RX	0.5A RX
Frequency coverage	50.0-53.995 MHz	50.0-53.995 MHz

*Receiver Sensitivity is usually measured in µV/12 dB SINAD. For comparison purposes, the 0.35 µV/20 dB Noise Quieting would be a lower number if measured using SINAD. At 50 MHz, the difference in this specification for anything less than 1 µV is not critical.

Items unspecified by manufacturer, but noted:

Display window bar graph, number of bars illuminated for 50W TX output: 10. For 10W TX output: 3 to 10, varies with frequency and VSWR.

Display-window bar graph used as RX S-meter, number of bars illuminated vs. received signal level:

1 bar	=	0.9 µV	(-108 dBm)
2 bars	=	1.2 µV	(-106 dBm)
3 bars	=	1.4 µV	(-104 dBm)
4 bars	=	1.8 µV	(-102 dBm)
5 bars	=	2.0 µV	(-101 dBm)
6 bars	=	2.2 µV	(-100 dBm)
7 bars	=	3.0 µV	(-97.5 dBm)
8 bars	=	4.0 µV	(-95 dBm)
9+10 bars	=	5.5 µV	(-92 dBm)

Note: The 9th and 10th "bar" in the bar graph display illuminate together. Signal level change from "S1" (1 bar) to "S9+" (all 10 bars) is 16 dB. This makes the resolution extremely good for weak signal beam peaking, but results in "full-scale" readings for any reasonably strong signal. Not uncommon for FM receivers.

A Novel Dual-Band, Single Feedline, VHF/UHF Antenna

Good performance for less than a sawbuck.

by Don Schendel W7KOH

The introduction of modern 2 meter/440 MHz dual-band transceivers has ushered in a new era in VHF/UHF amateur antennas. For mobile operation, including handhelds, small helical-wound antennas have been designed to cover both bands for dual operation. Other types, used mostly in mobile applications, include quarter-wave vertical elements (2 meter band) that have a phasing coil positioned at a quarter wave (440 MHz) from the feed point for additional operation on the three-quarter meter band. Both types suffer from basic design deficiencies and various trade-offs associated with these forms.

The basic quarter-wave antenna cut to frequency is a well-behaved radiator when properly configured. Its one drawback is that it will only work on one band. This is where various modifications such as phasing coils, stubs, traps and the like come into play, to make it perform at other bands as well. An old matching trick from the 1950s is resurrected here to enable the design of a dual-band antenna that will allow simultaneous operation on both VHF (146 to 148 MHz) and UHF (440 to 450 MHz) with reasonably well-behaved characteristics. 147 MHz and 440 MHz were chosen as the design centers by virtue of their relationship to band activity. Notice a key feature here: The two frequencies relate by a factor of 3!

Photo A shows the actual antenna in a vehicle application. This application is good because of the large metal roof that provides a good ground plane for operation. It also provided a good test bed for performance data such as feed impedance, VSWR, antenna pattern, and the like. Photo B shows a close-up of the constructed antenna. Its basic parts are a length of steel piano wire, a small-diameter brass tube, a PL259 connector and some epoxy adhesive or silicone sealant. The total part cost, not including labor, is less than a $10 bill.

Figure 1 shows the basic relationships involved in the function of the antenna. First, the antenna functions as a standard quarter wave on the 2 meter band, working into a ground plane—in this case, the vehicle's roof. The feed impedance measured at the base of the antenna is approximately 40 ohms at 147 MHz. The vertical length (L) of the antenna is three-quarter wavelengths at 440 MHz. Length S of the sleeve is a quarter wavelength at 440 MHz (6.5") and is electrically/physically connected to the 50 mil piano wire at the bottom of the configuration. Since I scavenged a short piece (7.0") of nickel-plated brass tube from an old antenna rod that happened to have an outside diameter of approximately 0.35", soldering the wire and cut-bent bottom end of the brass tube was no particular problem. It should be noted that the wire must run down the center of the tube and stay parallel to the inside of the tube for its entire length. The top of the brass tube should be sealed with either a

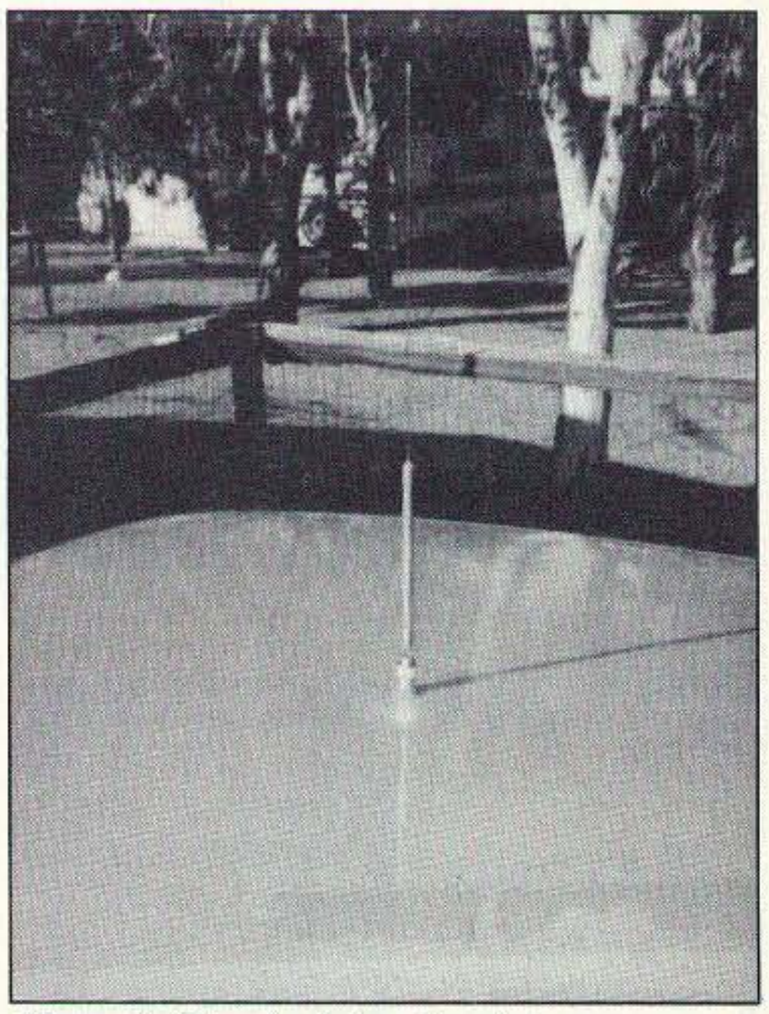

Photo A. The dual-band mobile setup on a truck roof.

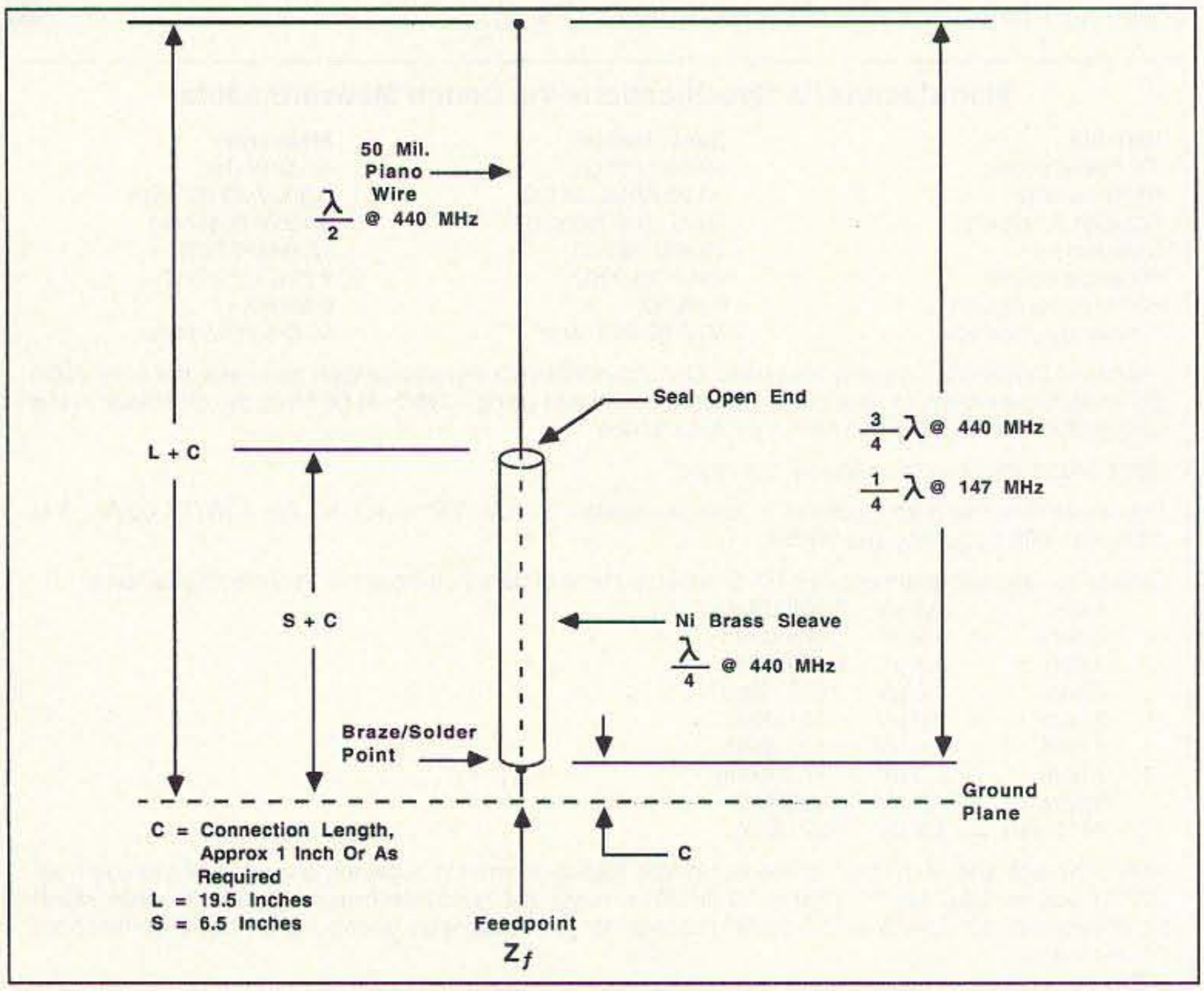

Figure 1. Detailed drawing of the dual-band antenna.

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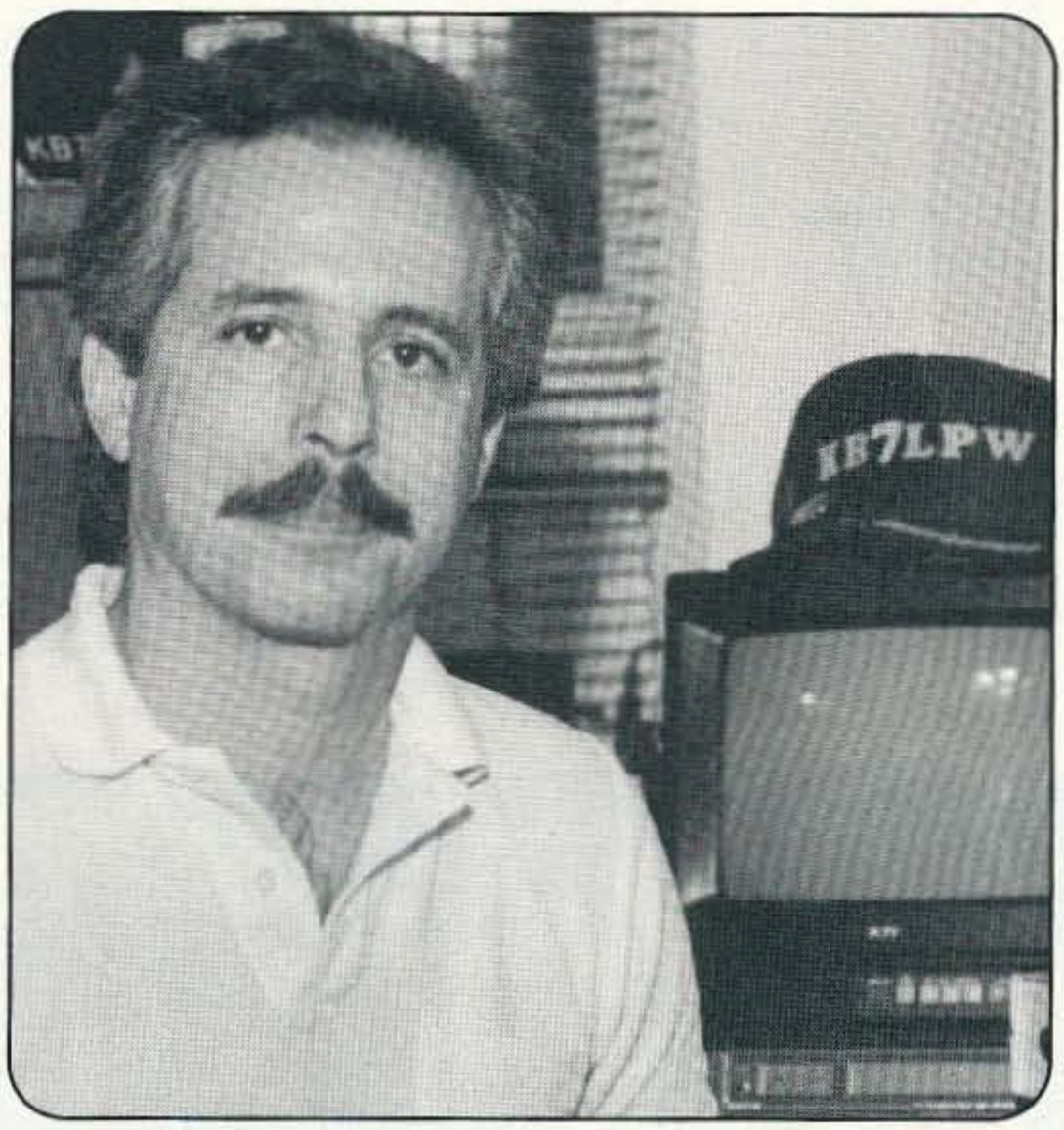

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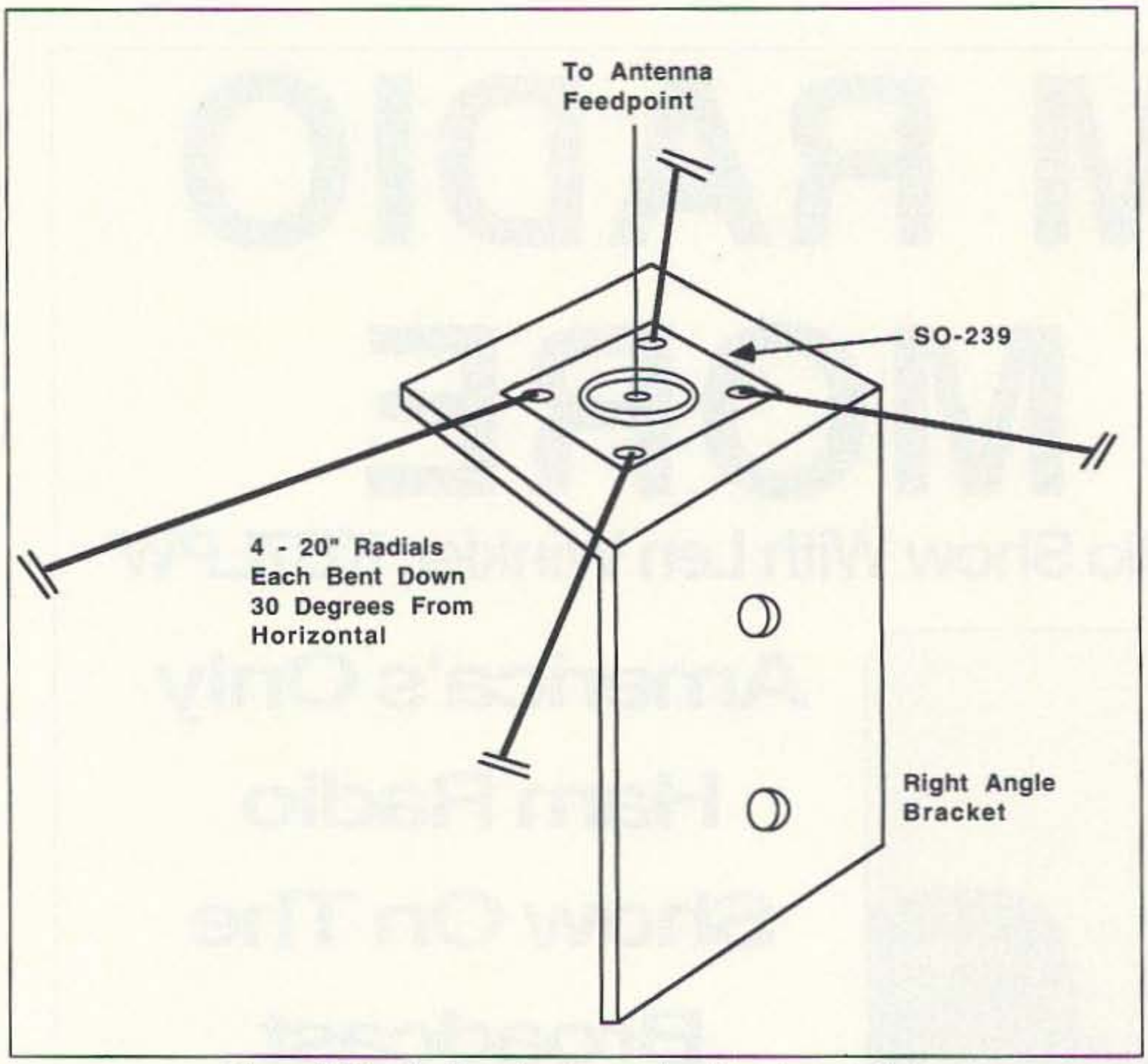

Figure 2. The dual-band antenna set up for a base station.

good grade of epoxy adhesive or silicone sealant. The top end of the brass tube stays "Electrically Open" to the vertical wire!

The brass tube acts as a coaxial sleeve/transformer, sometimes referred to as a "Bazooka," when operated on 440 MHz. The sleeve allows the top portion of the antenna to radiate as a bottom-fed half-wave vertical. The gain is 3 dB greater than a standard 440 MHz quarter-wave antenna. The diameter of the sleeve (tube) is reasonably non-critical and aluminum tubing could be cut and used in place of brass tubing. There is only one problem with aluminum tubing, and that is in the soldering or brazing that is required to join the steel wire and the modified tube end into permanent contact. There are several types of pre-fluxed rods and solders available to do this if you are handy with a shop torch. Otherwise, my recommendation is to scavenge a length of brass or hard-drawn copper tubing for the project, which is much easier to work with. A good rule of thumb is that the ratio of the wire diameter to the outside tubing diameter for reasonably thin-wall tubing is about 10 to 1.

There is nothing difficult or magical about the antenna. It performs well on both bands when properly sized. It is important to cut dimensions accurately. This is true in all antenna configurations, but even more so here because of the transformer properties exhib-

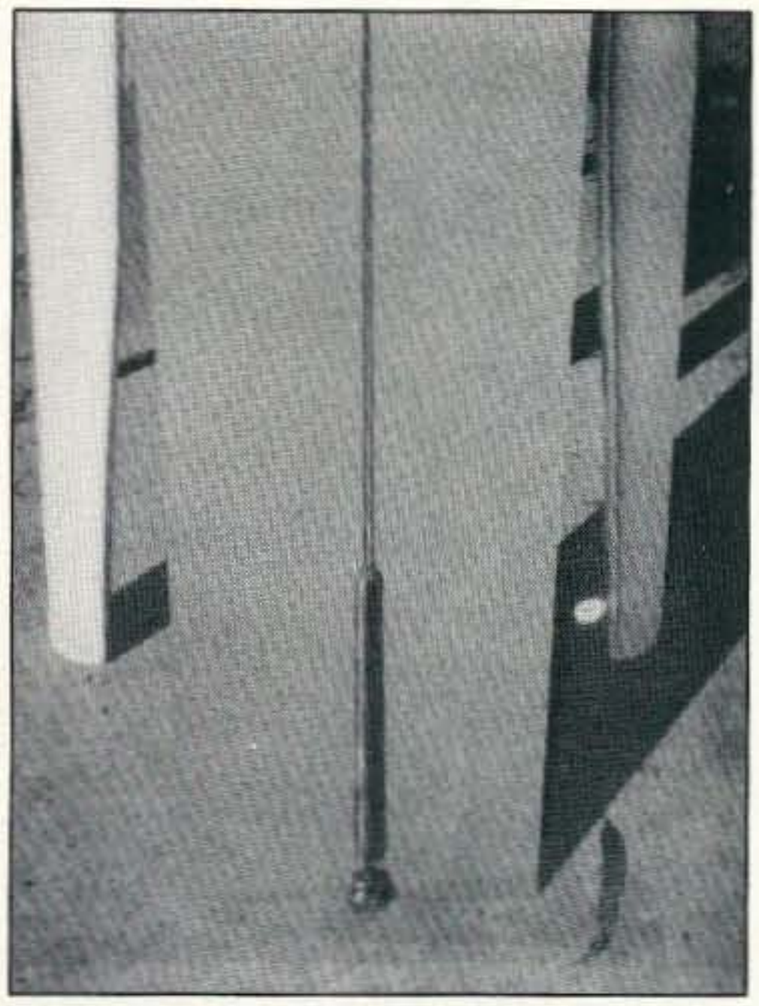

Photo B. A closer look at the dual-band antenna.

Parts List

5 Standard length (30" to 40") of 0.050" +/- 0.005" steel (or stainless steel) tempered wire, one cut to 19.5" (four radials, each cut to 20"). Source: Any craft, hobby or materials supply store.

1 Standard length (10" to 18") of nickel (Ni) plated brass tube of 0.350" +/- 0.005" (up to 0.500", non-critical), cut to 7.0". Source: Any hardware or material supply store.

1 Two-tube set of standard, generic epoxy. Source: Any craft, hobby or hardware store.

1 Solderable PL259 plug. Source: Radio Shack, item 278-205.

1 Solderable SO239 chassis—mount socket. Source: Radio Shack, item 278-201.

1 Right-angle bracket at least 1" wide. Source: Radio Shack, item 15-888 or hand fabricated from aluminum, brass or mild steel flat stock.

Technical Reference: *The Antenna Engineering Handbook,* 2nd edition or later, by Johnson and Jasik, editors; McGraw-Hill, publisher.

ited by the sleeve. Dimensions of antennas become more demanding as the frequency of operation increases. A velocity factor of 97% was used in calculating the quarter wavelengths at each frequency. The operating characteristics on the 2 meter band were plotted, and it was interesting to notice how the resistive part of the feed impedance of the antenna behaves over the operating bandwidth. The VSWR is reasonably well-behaved in the operating bandwidth: It is less than 1.5 to 1. On the 440 MHz end, again the feed impedance seems to be reasonably well-behaved and the VSWR is staying below 1.5 to 1. Overall, dual-band operation is good, with no profound surprises. My test transceivers would not allow both 147 MHz and 440 MHz simultaneous transmission, so I was restricted to single emission mode only for both bands.

The antenna is relatively easy to construct and does not demand complex tools to build with. Except for the soldering or brazing step, everything else is either glued with an adhesive or sealed with an RTV type sealant. The wire can be obtained from your friendly hobby store in 30"-plus lengths. The connector, epoxy and brass tube are available at your local Radio Shack. If you want to use this antenna in a fixed-station mode, don't forget the ground plane! An SO 239 connector on a right-angle bracket makes a good foundation for such an antenna. Four 20" radials (50 mil piano wire) attached to the four corners of the assembly that are bent down 30 degrees with the horizon allow for an almost perfect match of 50 ohms for both bands. Radials must always be longer than radiators by a factor of 2% to 5%. Don't be afraid to experiment and try other construction techniques—this is a good way to optimize an antenna to best fit your personal needs. 73

Design and Build a Dummy Antenna

A 40W, 50 ohm RF dummy load with a VSWR of 1.3:1 at 500 MHz.

by Geoff Koehler VE5ZE

A dummy antenna is one of the most basic and essential pieces of test gear in the ham shack. A good dummy antenna must meet two requirements. First, the dummy must be resistive and not reactive at the frequency of the transmitter. The impedance of most military and amateur transmission lines and equipment is 50 ohms, so it is most useful to build a dummy with a 50 ohm impedance. A 50 ohm dummy must present this impedance to the transmitter for maximum transfer of power and proper tuning of the transmitter. Moreover, to be versatile the dummy should not change impedance significantly as a function of frequency. Second, the dummy must be able to safely dissipate the RF energy supplied by the transmitter as heat, and not radiate RF.

The purpose of this article is to describe the design and testing of two simply-built dummy loads that maintain a more-or-less constant impedance at VHF frequencies, and are able to dissipate the power of hand-held amateur radios or low-power mobile rigs. In addition, comparisons are made to the performance of a few commercially available dummy loads, one of which was measured (the MFJ-264 dry dummy).

Back to Basics: The Smith Chart

Basically, the Smith chart is a circular graph (Figure 1) where circles of constant resistance and constant reactance form the grid. The only straight line on the chart is the axis of reals, marked "resistance component," along which are centered the circles of constant resistance (Figure 1a). All the points on a circle of constant resistance have an equal value to where they intersect the axis of reals and represent the resistive component of a complex impedance. Constant resistance circles are tangent to the edge of the chart at the infinite resistance point.

Superimposed on these circles are partial circles of constant reactance (Figure 1b) whose centers lie on a line normal to the axis of reals and are tangent to the axis of reals at the edge of the chart. The layout of the chart allows a complex impedance to be plotted in its two components, a resistive component and a reactive component.

Finally, radial scales complete the Smith chart (Figure 1c). Two scales are calibrated in terms of wavelength, and form the outer ring of the Smith chart. One is measured as "wavelengths toward generator," and the other "wavelengths toward load." The entire circumference of the chart represents one-half wavelength.

All Smith charts have a characteristic impedance of 1 ohm, and are normalized to the characteristic impedance of the system that you are working with. For example, a 50 ohm transmission line has a normalized value of Z/Zo (50/50) = 1. On this scale a resistive 120 ohm load would have a resistive component of 120/50 = 2.4 ohms. In this way, the same chart can be used for any characteristic impedance.

Any impedance, regardless of value, can be plotted on the Smith chart. Impedances can be generally broken down into two components: a resistive component and a reactive component (either capacitive or inductive). These usually take the form of a complex number: Za = Ra + jXa, where R represents the resistive (real) component and X represents the reactive (imaginary) component. The sign of the reactive component determines whether the reactance is capacitive (negative) or inductive (positive). The completed Smith chart is shown on Figure 1d. Smith charts are also available in expanded form, which is useful when measured impedances all plot close to the center of the chart, or are already normalized to 50 ohms.

"It is also important to use only carbon and not wire-wound resistors because wire-wound resistors will become reactive at high frequencies."

The primary use of the Smith chart in this article is to display graphically the complex impedances measured in the dummy loads at VHF frequencies, and convert these impedances to a more familiar form, the calculated VSWR at the transmitter. A good article on the various uses of the Smith chart, written by Jim Fisk W1DTY, appeared in the November 1970 issue of *Ham Radio* magazine (see "References" at the end of this article).

Dummy Load Design

Two dummy loads of different design are considered (Figure 2). While a simple carbon resistor remains resistive to several hundred MHz, a dummy capable of dissipating more than about 2 watts must be built from a number of resistors. At VHF frequencies, most multi-resistor dummies become reactive, as well as simply resistive. Therefore, as the frequency increases the design of the dummy load becomes important.

Both dummies are constructed from about 20 2 watt carbon resistors, some double-sided copper-clad board, and an RF connector. I used a type-N connector, but a BNC connector will work, too. UHF connectors should work up to about 150 MHz, but at higher frequencies these connectors may compromise the performance of the dummy. All other things being equal, UHF connectors should not be used, although they are the most common on amateur equipment. It is also important to use only carbon and not wire-wound resistors because wire-wound resistors will become reactive at high frequencies. One dummy, which I call the DIP dummy, consists of a dual-in-line arrangement of resistors, while the other is of radial design.

To build the DIP dummy, 22 1.5k 2W resistors and two pieces of double-sided copper-clad fiberboard are needed (Figure 2a). Both are about 5/8" wide; the top board is 5" long, and the bottom board is 6-3/4" long with a tapered end. For the resistors, a total of 22 small holes are drilled in two rows of 11, about 3/8" apart. Solder the resistors between the two boards. You will have to solder all the resistors on one board first, and then fit the other board onto the resistor leads, and solder. Make sure to use a hefty soldering iron, because good solder joints are important. Mount the RF connector in the aluminum box, and solder the tapered end of the bottom plate directly to the center conductor of the RF connector. The top plate is grounded to the box by a sheet of copper foil which can either be soldered directly onto the top plate or bolted through with 4-40 machine screws. The purpose of the tapered bottom plate and the copper foil is to decrease, as much as possible, lead inductance in the dummy. Finally, mount the bottom plate on an insulating stand-off to the bottom of the aluminum box.

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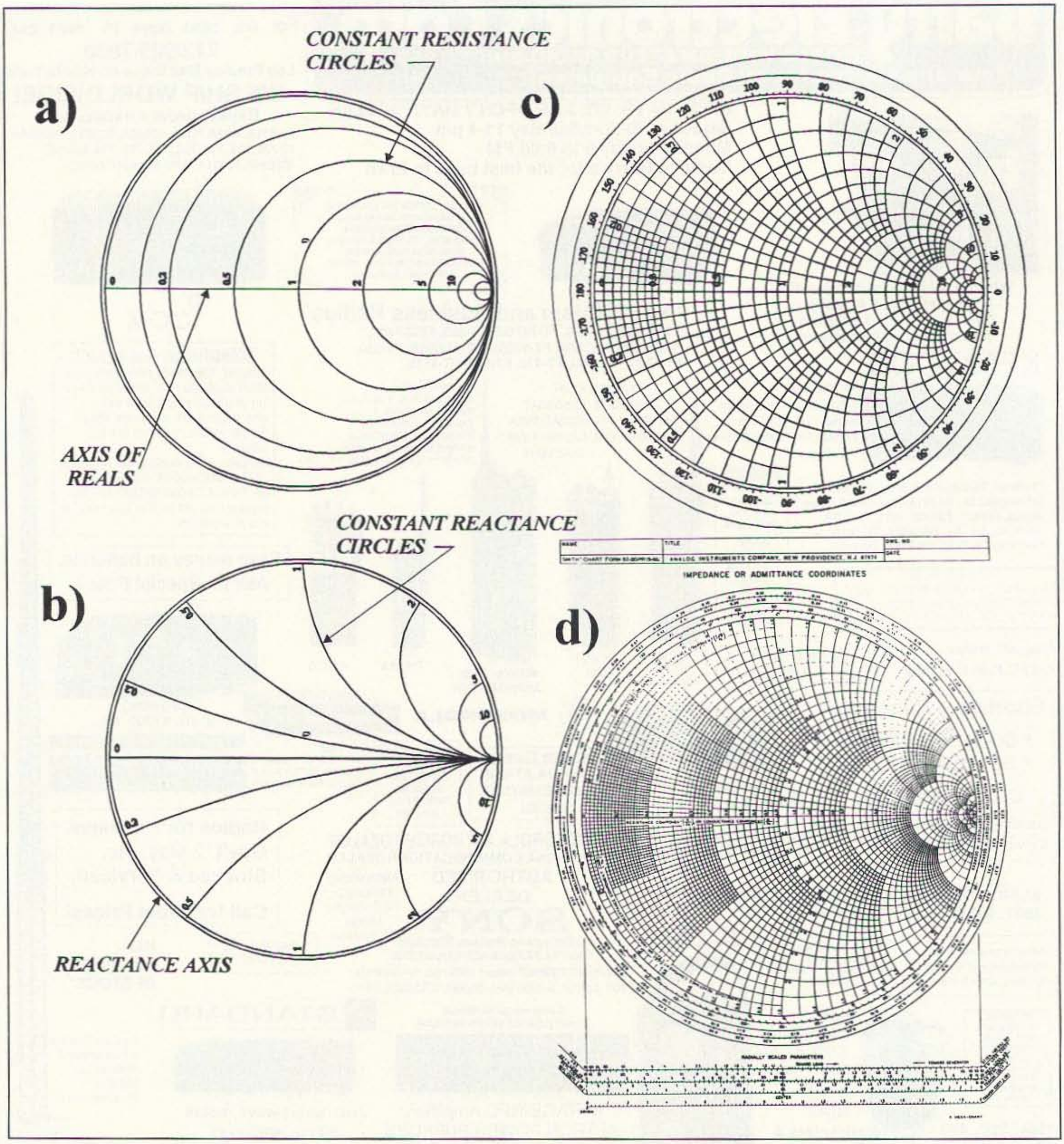

Figure 1. Construction of the Smith chart: a) constant resistance circles; b) partial circles of constant reactance; c) radial scales; d) completed Smith chart. Modified after Fisk, 1970.

The radial dummy is built in a similar manner, except that the RF connector is bolted directly to the ground plate, with the center conductor soldered to the back plate with a piece of large (less inductance) hookup wire (Figure 2b). Twenty 1k resistors are arranged around a 1-1/2" circle. As with the DIP dummy, it would be a good idea to mount the dummy in an aluminum box to help shield the dummy and prevent any grounded surface from contacting the back plate of this dummy, where there will be RF voltage.

Measurement of Complex Impedance

Measurement of complex impedances can be performed with an impedance bridge and a signal generator. An impedance bridge that, with careful attention to construction, should work at VHF frequencies is described by Henry Keen W2CTK. For the dummy antennas in this article, I used an alternate setup which consisted of a Hewlett Packard 608A Signal Generator, a power divider, a couple of 10 dB pads, and a Hewlett Packard 8405A Vector Voltmeter (Figure 3).

In this setup, V_A represents the incident voltage only, because the end is terminated in a purely resistive 50 ohm load and therefore there is no reflection. V_B, however, will represent the vector sum of the incident voltage and the reflected voltage. The ratio

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Only MFJ gives you 6 *factory pre-set* filters and 10 *programmable pre-set* filters that you can customize. Instantly remove QRM with a turn of a switch!

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

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

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

Automatic notch filter

MFJ's *automatic* notch filter searches for and eliminates *multiple* heterodynes in *all* filter modes -- it's so fast interfering CW and RTTY signals are also eliminated.

If you leave the *automatic* notch filter on during a phone contest, you'll never be worn down by the heterodynes of tuner-uppers.

Voice signals aren't degraded. The *narrow* automatic notch is silently working in the background destroying unwanted tones when they appear.

With up to 50 dB attenuation, you'll copy stations that would otherwise be masked by heterodynes. You'll miss fewer calls and be less exhausted when the contest is over.

When you need to *selectively* remove tones -- like when you're enjoying a CW ragchew and a couple of annoying CW stations appear nearby -- you can use the *two* MFJ *tunable* notch filters to completely knock them out.

Adaptive noise reduction

Pressing the "ON" button silences background noise. Some SSB signals sound like a local repeater! It makes noisy FM and AM signals readable and works with CW, Data and other signals.

It works in all filter modes and on all types of random noise including -- white noise, impulse noise, static, ignition noise, power line noise, hiss and atmospheric noise.

The LMS algorithm gives you up to 20 dB of noise reduction depending on the type of noise. You can adjust the amount of noise reduction to prevent distorting some signals.

Reducing random noise reduces fatigue and makes QSOs more fun -- especially, when the band is full of tiring noise.

Tunable highpass/lowpass filters

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

You can *tune* the lower cutoff frequency 200 to 2200 HZ and the upper cutoff frequency 1600 to 3400 Hz.

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

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

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

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

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

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

Tunable bandpass filters

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

You can *tune* the center frequency from 300 to 3400 Hz. And *vary* the bandwidth from 50 Hz to 680 Hz -- from super tight CW filters to wide razor-sharp Data filters.

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

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

Even with the narrowest 50 Hz bandwidth, you'll never have a problem with ringing.

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

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

With a turn of a switch you can select from *sixteen* convenient *pre-set* filters. You can use them for SSB, AM, CW, packet, AMTOR, PACTOR, RTTY, SSTV, WeFAX, FAX or any other mode you can think of.

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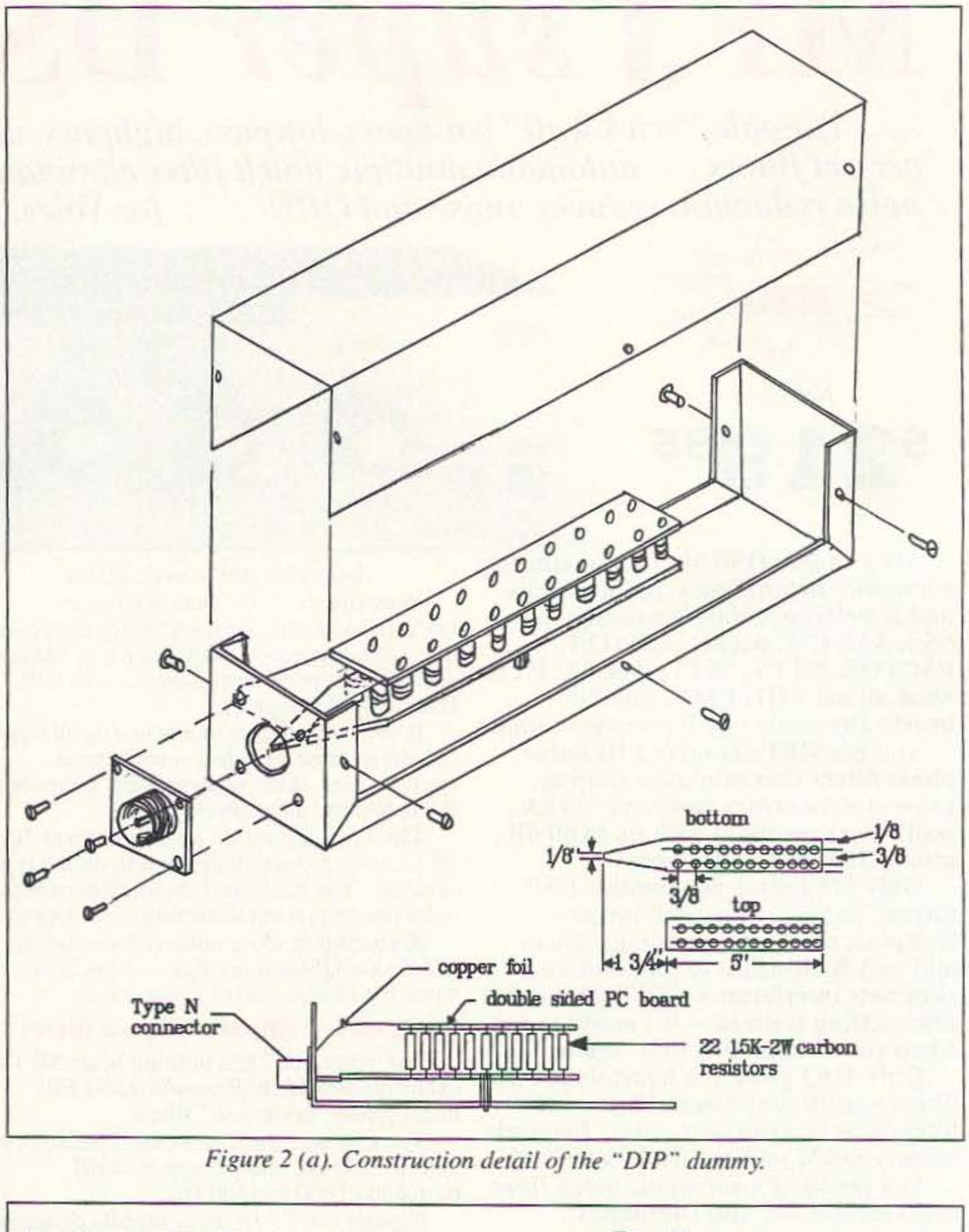

Figure 2 (a). Construction detail of the "DIP" dummy.

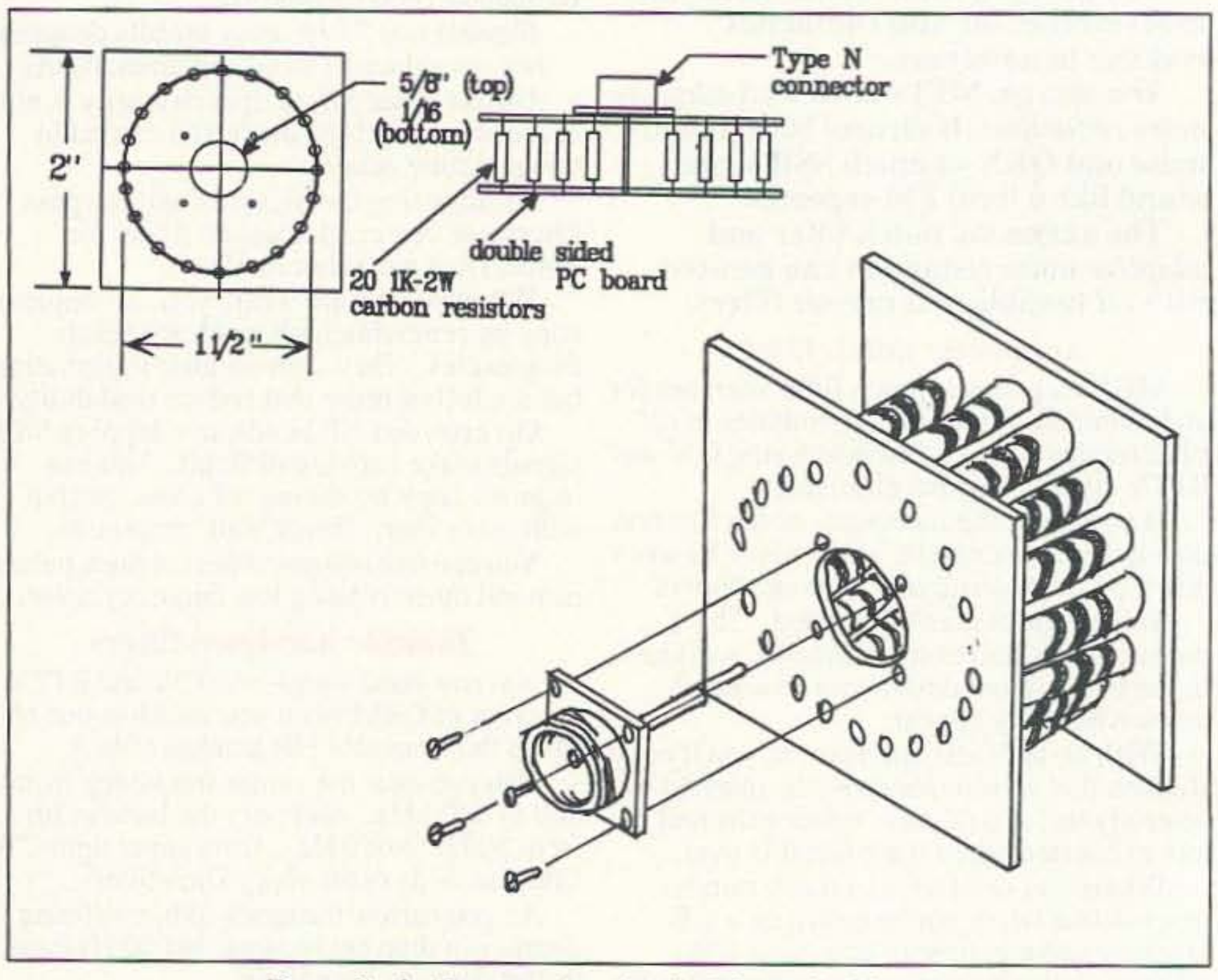

Figure 2. (b) Construction detail of the radial dummy.

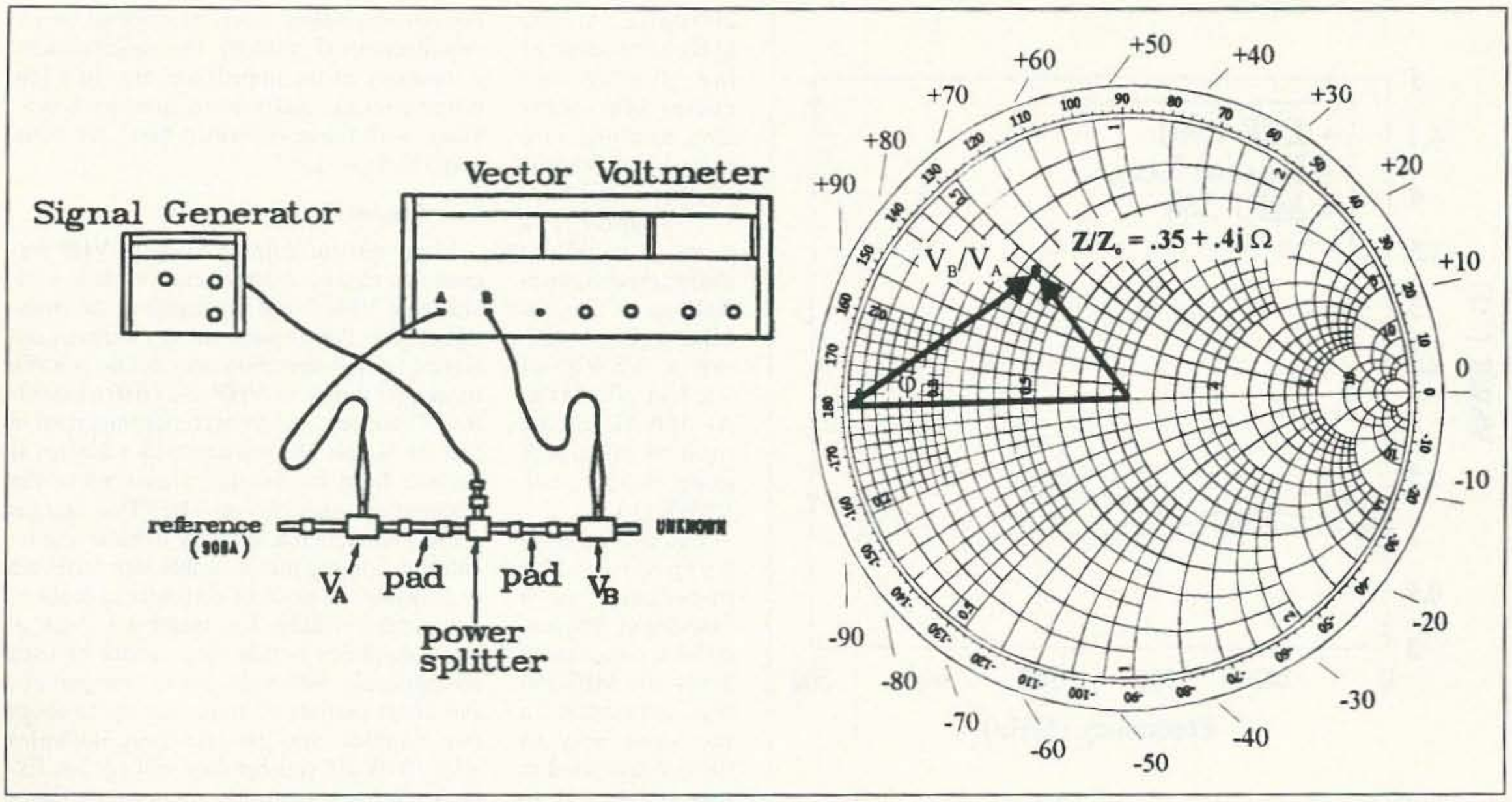

Figure 3. Complex impedance measurement using the Vector Voltmeter.

V_B/V_A is the vector voltage ratio between a 50 ohm resistive load and the load under test. This is the resistive (or real) component of the complex impedance of the load. To find the reactive component, the phase difference (m) between V_A and V_B are measured. If V_B lags V_A, the reactive (imaginary) component is capacitive and the phase difference is negative; if V_A leads V_B it is inductive and the phase difference is positive. These two measurements, V_B/V_A and øB-A, can be plotted on the Smith chart (Figure 3). This task is then repeated for a variety of frequencies to calculate the impedance of the load as a function of frequency.

Results

Measured complex impedances of these two loads are shown in Figures 4 and 5. The DIP load remains essentially resistive up to about 10 MHz, after which it becomes reactive to a maximum VSWR of 1.5:1 at 100 MHz. Because it has a DC resistance of 68 ohms, there is a small mismatch with 50 ohm equipment at low frequencies (VSWR = 1.4:1). The experimenter may be able to get better results at VHF frequencies by simply clipping off pairs of resistors with a pair of diagonal cutters. However, this will probably result in a higher VSWR at low frequencies. This aside, this dummy is surprisingly good, and should be usable up to about

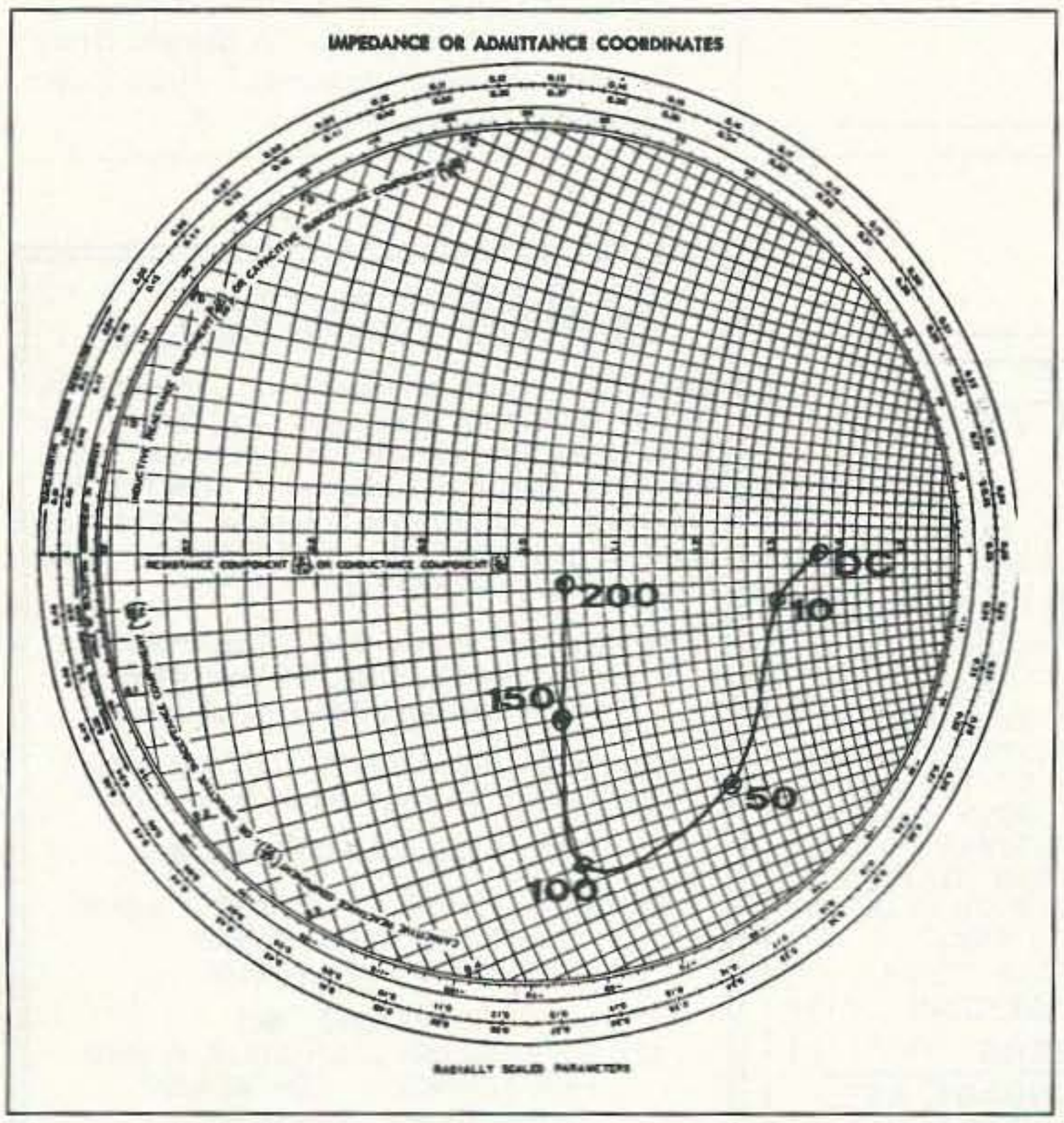

Figure 4. DIP dummy impedance from 0 to 200 MHz. The Smith chart is in expanded form.

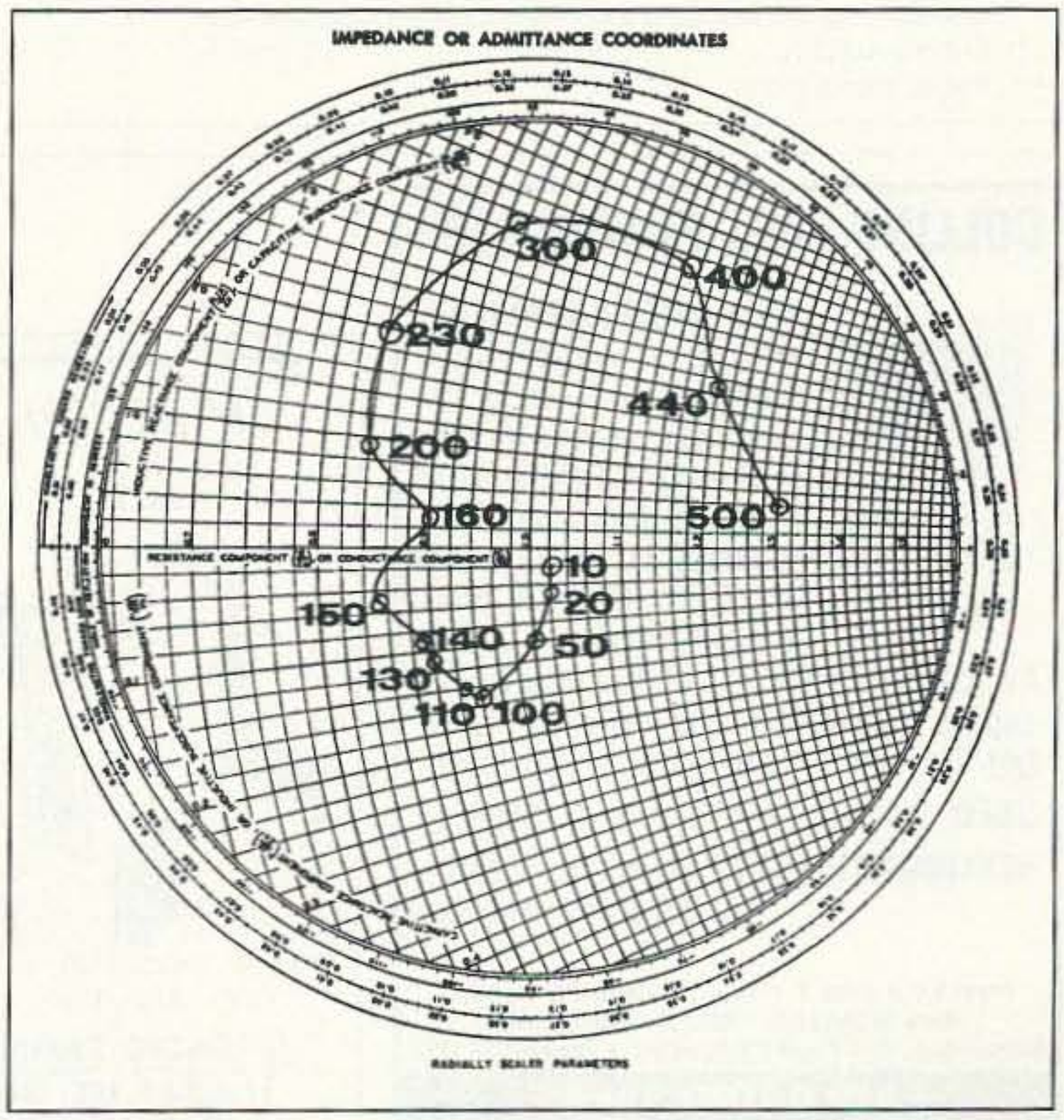

Figure 5. Radial dummy impedance from 10 to 500 MHz. The Smith chart is in expanded form.

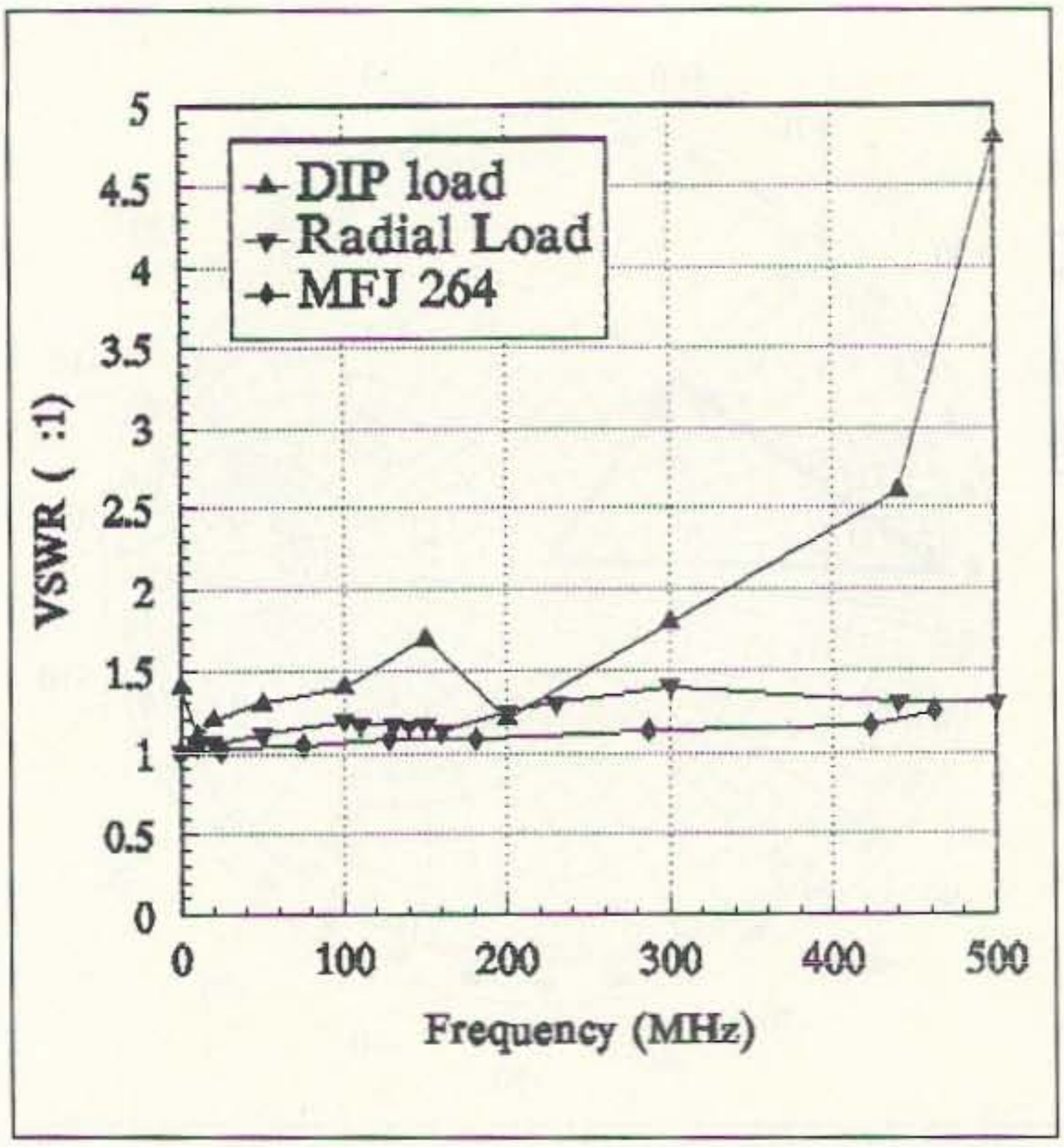

Figure 6. VSWR of dummy antennas at various frequencies. Included for comparison is the MFJ 264 dry dummy.

200 MHz. At 300 MHz (not shown) the dummy becomes very reactive, resulting in a calculated VSWR of greater than 4:1!

The radial load displays excellent characteristics, even well up to the 300 MHz region, reaching a VSWR of 1.2:1 at 300 MHz. At 500 MHz (the limit of my signal generator) the VSWR is 1.3:1.

For comparative purposes—the impedance as a function of frequency of a commercial load—the MFJ-264 was measured in the same way as those constructed in this article. Up to 500 MHz, the VSWR of this dummy remains below 1.3:1, as claimed by the manufacturer (Figure 6). For completeness, a summary of the impedance, etc., of a few other commercially-built dummy loads, along with those described here, are compared in Table 1.

Table 1. VSWR of Dummy Loads from 0-500 MHz

Dummy	0-100 MHz	200 MHz	500 MHz	Power**(W)	Price***
Ten Tec 239	1.1:1*	1.1:1*	2:1*	75	$60
MFJ 260 B	1.3:1*	1.5:1*	——	90	$30
MFJ 262	1.5:1*	——	——	200	$80
MFJ 264	1.1:1 (<1.3:1)	1.1:1 (<1.3:1)	1.3:1 (<1.3:1)	75	$60
DIP	1.3:1	1.1:1	5:1	40	$10
Radial	1.2:1	1.2:1	1.3:1	40	<$10

* Manufacturer's specifications: Where both manufacturers specifications and measured values are available, the manufacturer's values are shown in parentheses.
** Continuous duty.
*** Prices approximate.

Conclusions

Multi-resistor dummy loads at VHF frequencies can be reactive and result in considerable VSWR and mismatch to the transmitter. For this reason, those dummies designed for HF operation may not be suitable for proper tuning of VHF and UHF transmitters. Therefore, design becomes important in that the simple DC resistance of a dummy is not the total impedance presented to the transmitter, especially at VHF. Two designs are offered here that are easy to build and result in a dummy that is usable into VHF, are well below the price of commercial loads of comparable quality. The major drawback of these dummies is that they cannot be used continuously with high-power transmitters. For short periods of time, say up to about two minutes, you can use these dummies with 100W HF rigs but they will get hot. Experience has shown that about two minutes of keydown at 80W will melt the solder on the dummy!

Acknowledgments

I would like to thank the members of the Institute of Space and Atmospheric Studies at the University of Saskatchewan, who were nice enough to loan me their Vector Voltmeter, and always had the time to answer my questions. 73

References

Jim Fisk W1DTY, "How to Use the Smith Chart," *Ham Radio*, November 1970, p. 17.

Henry Keen W2CTK, "A Simple Bridge for Antenna Measurements," *Ham Radio*, September 1970, p.34.

73 Review

by Bill Clarke WA4BLC

Number 8 on your Feedback card

The Drake SW8 World Band Shortwave Receiver

R.L. Drake Company
230 Industrial Drive
Franklin OH 45005
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Fax: (513) 743-4576
Price Class: $599

A constant companion, at home or on the go!

There are table-top SWL receivers and there are portable SWL receivers. Being a hardware hound, I was never very much impressed by portable SWL receivers. They always seemed lacking in size, weight, sound, etc. Then along came the new Drake SW8, a semi-portable SWL receiver.

What is a semi-portable receiver? First, the term semi-portable is mine, not that of the R.L. Drake Company, manufacturer of the SW8. Second, it is a receiver equally at home on my radio operating table as it is on a picnic table at a campground, on the roof of my car at the airport, or in a motel room.

Physically, the SW8 is not a lightweight (it weighs a little over 10 pounds with batteries) and it certainly won't fit in your shirt pocket. But, it will perform on a par with most table-model World Band receivers costing at and above its price class.

For portable use, the SW8 uses a built-in 41" whip antenna or other external antenna of the user's choice, and is powered by six "D" cells. For fixed use, the unit is powered by an AC adaptor and connected to the world via any number of antenna types that can be connected via PL-259 coaxial connector, or by wire-type terminal connector.

Features

The SW8 comes loaded with top-of-the-line features, yet is so very simple to look at and operate. The front panel consists of an ON/OFF VOLUME control, TONE control, TUNING knob and a multi-purpose key pad. It's similar to its more expensive relative, the R8, but don't let the simplicity fool you—this is a very powerful receiver.

The Liquid Crystal Display (back-lit, amber-colored) shows: frequency, bar-graph-type S-meter, band, AGC, memory, clock, mode, bandwidth, and more. Readability is excellent due to the generous size of the display.

The SW8 receives the shortwave, AM broadcast, FM broadcast, and AM aviation bands (Air Band).

Receive bandwidths are panel-selected at: 2.3, 4, and 6 kHz, making it easy to limit adjacent channel interference.

There are 70 programmable memories which will store all user-selected parameters including mode, frequency, bandwidth, and AGC. These memories can be selected by number or tuning control, and they can be scanned.

A selectable AM synchronous mode reduces the effects of fading.

There is selectable (fast/slow) AGC.

A large carrying handle doubles to hold the front of the receiver up, for viewing ease.

There is AM squelch for the aviation band (on the rear apron).

Direct digital frequency entry is possible via the keypad.

It has an FM stereo headphone jack and an external mono speaker jack.

Antenna selector switches on the rear apron allow the use of several different antennas.

The Manual

The operator's manual for the SW8 is adequate for most users, but it is lacking in specific technical information, block or schematic drawings, and an explanation of the theory of operation. However, the operational instructions are very complete, and at no time was I at a loss in the operation of the receiver.

A convenient log for listing the programmed memories is included in the back of the manual.

Operating the SW8

I found the SW8 very easy and enjoyable to operate. Simplicity is the best word to de-

scribe its operation, but do not equate simplicity to limited performance.

For testing purposes, I used a Carolina Windom antenna (available from The Radio Works, 804-484-0140) at my station location, and a selection of active antennas for portable use. In general, I found the built-in whip antenna to be of limited use for worldband reception. It was, however, excellent for AM and FM broadcast and the Air Band.

I was first impressed by the receiver's excellent tonal quality. There is a real presence to the sound reproduction and the TONE control has real authority. Voices seem to leap out at you.

The receiver is very quiet, with no discernible internally-generated noise from the microprocessor (an unfortunate side effect too often heard in modern receivers).

There are three methods of direct frequency selection on the SW8:

1. Selection can be made by manually rotating a tuning knob.

2. Or, press the UP or DOWN frequency buttons that step through the bands at 10 kHz or 9 kHz (selectable on the AM broadcast band), 100 kHz on the shortwave bands and FM broadcast band, and 12.5 kHz on the Air Band. Digital readout is displayed to 100 cycles. Stepping is continuous while either button is held down.

3. Also, you can use direct digital entry via the keypad. This is extremely handy for quick movement from one frequency to another.

Strong adjacent channel interference can be reduced by use of the ATT (attenuate) control and proper selection of bandwidth. To some extent the audio TONE control will help also.

The receiver selects the proper antenna for the band chosen, based upon selections made from switches on the rear apron. For example, I connected the Carolina Windom to the SO-239 connector as antenna one and switched the shortwave antenna select switch to #1. I then put the FM/air antenna select switch on whip. Thus, when changing from shortwave to FM broadcast or the Air Band, the receiver chooses the correct antenna.

Although not used in this test, the #2 antenna connector is designed for wire termination and provides connection for 300 ohm VHF antennas and a choice of 500 or 50 ohm shortwave antennas. *[Manufacturer's Note: Although it is not marked on the cabinet, this unit also has a balun on the VHF antenna terminals. You can attach a 75 ohm antenna by connecting one lead to either terminal and the other to ground.]*

The beep tones produced when the keys are pressed helps to monitor what the receiver is doing. For example, the beeps are coded by length and note to indicate different functions or error conditions.

My test site is located about 14 miles from two regional airports (one shared with a military reserve unit). I found no problems in receiving most aviation-related communications using the built-in whip antenna. For a quick check of the current weather conditions at the airports, I switched to the Automated Terminal Information Service (ATIS) frequency.

"It does its job very well and has outstanding audio. It will serve well on a desk, and being portable only makes it more versatile."

When listening to international broadcasts I found that the choice of bandwidths aided considerably in interference elimination. Also, there were times when I used the ATT control. The fidelity from the speaker was very pleasing to me, particularly when listening to music (true not only for shortwave, but for local broadcast also). The AM SYNCHRONOUS feature does very well in reducing the effects of fading; however, the receiver's frequency must be set very accurately for proper use. If you set the frequency incorrectly, you will be reminded by a whistling sound.

Using SSB (single sideband), I was able to listen to the amateur radio bands. This allowed me to monitor the various nets I participate in, while away from my station. Here again I noted that the audio appeared to really jump out at me.

The 70 memory locations are all user-programmed and will store frequency, mode, bandwidth, AGC setting, attenuator selection, and synchronous detector (if chosen). When a memory is selected, the tuning knob can be used to tune up or down from the memory frequency.

Scanning is done by memory block, by time. There are six blocks of 10 memories each. Each frequency is checked for five seconds. Memory positions can be tagged for SKIP, and will not be checked during scanning.

The internal clocks (two 24-hour units) allow for local and UTC time to be selectively displayed. I set them to WWV, and when I rechecked them two weeks later, they were on the money. The times can be set to act as a clock radio with wake-up and good-night features, or as event features capable of selecting specific memories at user-programmed times.

While testing the receiver in preparation for this review I found the SW8 could easily become a constant companion. It was my alarm clock, window to the world, monitor of the HF amateur radio bands, airport buddy, and reproducer of Country Western music when I tired of all else.

Recommendation

Drake has done a nice job with the SW8 receiver. It does its job very well and has outstanding audio. It will serve well on a desk, and being portable only makes it more versatile.

I do, however, have two recommendations for improvement to the receiver:

1. Provide a means of covering the selector switches on the rear apron to make them dirt- and sand-proof.

2. Install a preamp for use with the built-in whip antenna when tuning the World Bands.

Overall, I can comfortably recommend this receiver. It does what it is supposed to, and does it with class! 73

Specifications

Frequency Range	500-30,000 kHz (0.5 - 30 MHz) 87-108 MHz (commercial FM band) 118-137 MHz (aviation band)
Modes	AM, USB, LSB modes (0.5-30 MHz) AM mode only for 118-137 MHz FM mode only for 87-108 MHz
Sensitivity	SSB: <.5 µV (.5-30 MHz) AM: <2.0 µV (.5-30 MHz) AM: <4.0 µV (118-137 MHz) FM: <4.0 µV (87-108 MHz)
Frequency Stability	+/-10 ppm (0-50 degrees C)
Frequency Accuracy	#+/- 100 Hz (at 25 degrees C)
Selectivity AM/SSB	6 kHz at -6 dB (<12 kHz at -60 dB) 4 kHz at -6 dB (<9 kHz at -60 dB) 2.3 kHz at -6 dB (<5 kHz at -60 dB)
IF Frequencies	AM/SSB 1st IF: 55.845 MHz 2nd IF: 455 kHz FM 1st IF: 10.7 MHz (single conversion)
Image Rejection	>60 dB (.5-30 MHz) >60 dB (118-137 MHz) >50 dB (87-108 MHz)
IF Rejection	>80 dB (1st IF) >80 dB (2nd IF)
Dynamic Range	>95 dB at 20 kHz spacing SSB 2.3 kHz bandwidth
IP3 Intercept Point	>+10 dBm at 20 kHz spacing >-20 dBm at 5 kHz spacing
AGC Performance	Threshold 1.0 µV Attack Time 1 mSec Release Time Slow: 3 sec Fast: 300 mSec <4 dB change in audio output for 100 dB RF input change, referenced from the AGC threshold point.
Internal Antenna	41" metal telescoping whip (all bands)
Antenna Inputs	0.5-30 MHz: S0-239 (50 ohm coaxial connector) or three-terminal compression connector for either 50 ohm or 500 ohm and ground connection. 87-108 MHz: 300 ohm balanced input 118-137 MHz: 300 ohm balanced input
Audio Output	2.0 watts into 4 ohm speaker at less than 5% distortion with a 9 VDC supply voltage. Line audio output is 300 m Volts at 4.7k ohms.
DC Power Requirements	Input: 7-10 VDC at 1 amp. Can be supplied from AC Adaptor, external DC power supply, or (6) internal "D" cells.
Operating Temperature	00 to + 50 degrees C
Weight	10 lbs. (includes AC Adaptor, batteries NOT included)
Dimensions	11.5" x 5.25" x 13" (WHD)
AC Adaptor	Input 120 VAC at 15 watts, output 9 VDC at 1A (as supplied)

73 Review

Number 9 on your Feedback card

by Larry Antonuk WB9RRT

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JPS Communications' NRF-7

Clean up your audio with state-of-the-art DSP!

"Real hams don't use audio filters." This was the prevailing wisdom, at least until a few years ago. If you were using an "add-on" audio CW filter, for instance, it simply meant that you were too cheap to spring for the optional narrow crystal IF filter that went into your rig. Even worse, it might have meant that your rig was so cheap that it didn't even have an option for different IF bandwidths! Heavens!

A narrow crystal IF filter was obviously the way to go—as long as money wasn't a concern. An IF filter would produce steeper "skirts" than an audio filter, and prevent adjacent signals from overloading the AGC circuits and wiping out your receiver entirely. Audio filters were also prone to "ringing." While they might enable you to pick signals out of a pile-up, the very act of listening to a cheap audio CW filter for an entire contest could drive an operator bananas. (Imagine listening to someone hitting a steel pipe with a wrench—with your head underwater.)

It's hard to get rid of preconceived notions, but audio filters are not what they once were. The main reason, of course, is that it's now a digital world. The NRF-7 from JPS Communications makes use of technology that was non-existent (or economically unavailable) just a few years ago. But what makes a digital audio filter better than a conventional analog audio filter?

The main function of a filter is just what the name implies—it filters out unwanted signals. An IF filter does this at the IF frequency by providing a low impedance at the main IF frequency, and higher impedance as the frequency varies from the center frequency. Obviously, the faster the impedance goes up as the frequency varies from the main IF frequency, the sharper the response of the filter (the steeper the "skirts"). In other words, the sharper the filter response, the thinner the "slice" of band that the filter will pass.

An audio filter works in a similar manner, except that it operates on the audio tones from the speaker rather than the IF frequencies. For instance, an audio filter configured for CW might have a center frequency of 800 Hz. It will provide little or no attenuation at 800 Hz, but the attenuation will increase

greatly at 750 and 850 Hz, increasing as the tones move away from the center frequencies.

The ideal filter would have attenuation that would increase to infinity as soon as the desired cutoff frequency was reached (a vertical "skirt"). In the reality of analog circuitry this is not possible, due to circuit design considerations, component tolerances, and financial problems. In either the IF or the audio filter, then, the attenuation increases gradually, rather than sharply, as the frequency moves off from center frequency. But what if we didn't have to deal with the design problems of filters made with toroids, or active IC circuits? What if we were just dealing with numbers? As an example, what if instead of filtering the audio signal we just fed it into an analog-to-digital converter, and wound up with a stream of numbers? We could then analyze the stream of numbers and determine what was useful, and what wasn't.

In our CW example, we could just check and see what numbers were part of the 750 to 850 Hz bandwidth that we desired. If a number came along that wasn't part of this desired slot, we'd just toss it out. We could then feed the stream into a digital-to-analog converter, and reconstruct the audio. A microprocessor would be able to make the necessary decisions at an extremely fast rate—much faster than the audio frequencies involved. In addition to decisions on bandwidth, the system can also identify unwanted carriers or white noise, making for an exceptional filtering system.

Features

The preceding discussion provides an extremely simplified explanation of Digital Signal Processing (DSP), the main component of the JPS NRF-7. This is the equivalent of saying "Exploding fuel makes an automobile move." It's true, but somehow you get the sense that it's a little more complicated than that. The best part about DSP is that you don't really have to know anything about Fourier transforms and sampling rates to appreciate it—any more than you need to know about fuel injection in order to drive to work in the morning. As a matter of fact, installation of the NRF-7 is a lot easier than driving to work in the morning. RCA-type jacks on the rear of the unit connect to the receiver output and the speaker, and a coaxial power plug is used to provide 12 VDC to the unit. Once hooked up, the front panel power switch controls the on/off function, a mode switch lets you select the type of filtering to apply, and a bypass switch lets you take the filter in and out of the circuit.

The 10-position mode switch allows various combinations of SSB and CW filters, both wide and narrow, along with notch, peak, and data filters. Filter use is best accomplished by first leaving the filter out of the circuit, and tuning in the desired signal. A front panel signal LED provides a means of determining if the signal is in the desired passband—simply tune until the LED flashes along with the signal of interest. At this point, select the proper mode and press the bypass button, activating the filter. The LED will continue to blink along with the desired signal, but the vast majority of surrounding signals will be gone. (When listening to a CW signal in a pileup, it's difficult to remember that the BYPASS button is hooked to your filter. It seems more like it's hooked to the power plugs on all of the offending transmitters!) Obviously, the filter can be left in as you tune along, but it's nice to put it in and out of circuit, if only to keep in mind how much of a dramatic difference it makes. CW operators will have a choice of 400, 800, or 1000 Hz center frequencies to accommodate rig variations and personal preference.

In addition to the CW and SSB modes, the NRF-7 also has a DATA mode. This mode uses a passband of 500 Hz, centered at 2200 Hz to accommodate standard RTTY mark and space tones. The DATA mode is just as impressive as the CW mode. During tests of the unit during a recent RTTY contest, it was impossible to tune in more than one signal at a time, even in intense pileups.

The other two modes available are PEAK and NOTCH. The PEAK mode provides a constantly varying peak around whatever signal happens to be in the passband, reducing the audio bandwidth to the minimum required for the given signal.

The NOTCH function is one of the more interesting features on the filter. Your first response after flipping to the NOTCH position might be "Hey . . . where's the notch adjustment??" In other words, how do you adjust the frequency of the notch? Well, you don't. The DSP chip knows what a carrier sounds like, and simply removes it. Or them. No trying to fiddle with the notch control, or shifting the receiver IF—the tones just disappear. As a matter of fact, tune to a CW pileup, hit NOTCH, and all you'll hear will be a series of clicks. The DSP circuitry gets rid of all of the tones in the audio, leaving just a short click as the filter starts to kick in. Obviously, this means that there is no way to use the NOTCH filter in the CW or DATA modes, but due to the performance of these filters the NOTCH filter isn't necessary.

The only drawback noted in the entire review process relates to the fact that the NRF-7 is designed to be placed in-line with the speaker audio. In fact, it has a built-in 2 watt amplifier to drive the speaker you disconnect from your rig (and headphones, via the front panel jack). This works well for the CW and SSB modes, but for us RTTY fans it presents a problem. Audio from the filter needs to be passed to the RTTY decoder, such as a PK-232, but then there's no way to hook up a speaker. If you normally use headphones this doesn't present a problem, but you may have to hook up a small switching or pad arrangement to make things work with both a speaker and decoder. A second output port on the NRF-7, perhaps at line level, would have made interfacing a little easier for AMTOR, RTTY and HF packet types. Provisions are made, however, for changing the input impedance to a high or low level by on-board resistor changes.

The only other shortcoming is the fact that the NRF-7 is indeed an audio filter. While it can do some truly amazing things with receiver audio, it won't help the actual selectivity of the receiver. In other words, you might be carefully separating two QRP CW signals when some guy kicks in his kilowatt, 200 Hz up the band. Your QRP signals are history. In the same manner, the unit won't make up for front-end deficiencies in a cheap receiver. The NRF-7 is pretty amazing, but it won't do miracles.

Documentation

Documentation with the unit is adequate, even more than might be needed due to the simplicity of operation. A troubleshooting chart is included, listing most of the basic problems likely to be encountered when first hooking up a perfectly good unit—the plug-in power supply is bad, you've used the wrong audio plug, the speaker connections are tarnished, etc.

If things are a little more serious there is a schematic included, but it covers only the power supply and audio input/output sections. (The actual Digital Processing Section is shown only as a block diagram since, according to the manual, the digital section is "virtually impossible to troubleshoot without highly specialized equipment." Well, sure, but what isn't these days?? As it turns out, the factory *will* send a complete digital schematic to any product owner who is interested enough to ask for one. In any case, there's no reason to be overly concerned with repairs—the NRF-7 is very well built, and is covered by a one-year parts and labor warranty. 73

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KANTRONICS KPC-9612

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patterned after the successful KPC III, this product will give you both 9600 & 1200 baud packet with a small footprint. CMOS design allows for battery operation. Optional 32K. **$229.95*** Mail Box available.

*This device has not been approved by the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased until the approval of the FCC has been obtained.

COMET CMX Family

This new cross needle S.W.R. meter gives forward and reverse readings without switching and provides for three different power levels. You can even monitor your 12 volt power source. The remote R.F. sensor allows you to place the meter near you and the sensor at the radio.

CMX-1	1.8 to 60 MHz @2 kW	**$189.95**
CMX-2	1.8 to 200 MHz @ 200W	**$179.95**
CMX-3	140 to 512 MHz @ 200W	**$169.95**

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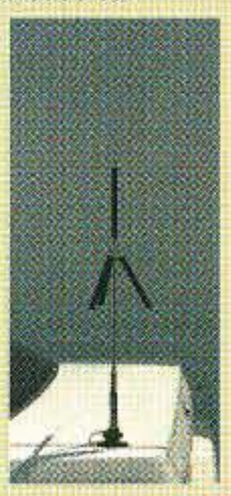
HA-4S

This multi-band HF mobile antenna comes factory equipped for 10, 12, 15, 40 meters with 20 meters optional (L14HA). This antena is rated for 200w input and features a hinged base to ease car porting or parking ramp access. The antenna is shown attached to the RS-820 low profile trunk lip mount.



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COMET

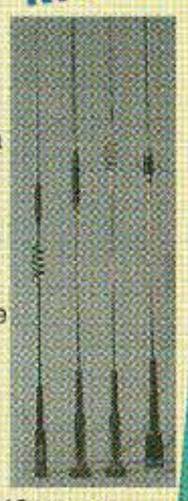
Comet offers a wide selection of single, dual, triple band antennas for your needs. Be it Base,mobile or HT's, these antennas offer a wide variety of gain, matching mounts and cable assemblies. T6 duplexers are available with and without leads.

TIMEWAVE

NEW DSP-59+ in Stock

• DSP-9	$169.00
• DSP-9+	$219.00
• DSP-59+	$299.00

COMET Mobiles



Comet offers a new SB5 and SB7 NMO-style dual-band antenna. They feature a fold-over "Motorola" style base, great styling and performance to match. Use the SB5 for more compact installations and the SB5 for those hard-to-reach locations.

- **B-20** Dual band standard and NMO mount 2.15/5.0 dbi **$49.95**
- **SB7NMO** Dual band NMO mount 4.5/7.2 dbi **$79.95**
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COMET RS-820

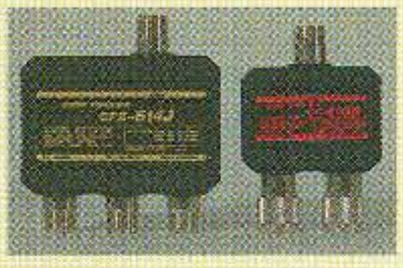
RS-820 **RS-9** **RS-25**

The RS-820 is a new adjustable low profile trunk lip mount antenna base offering style with rugged design. **$34.95**

Also shown

- **RS-9** trunk lip mount **$13.95**
- **RS-25** **$32.95**

COMET Duplexers/Triplexers



Comet produces over eighteen combinatons of duplexers and triplexers. These units are available with and without lead-in cables and feature high power handling with low loss.

• **CFX-514J**	50/146/446 MHz	**$69.95**
• **CF-4130**	446/1200 MHz	**$75.95**
• **CF-4160J**	146/46 MHz	**$49.95**

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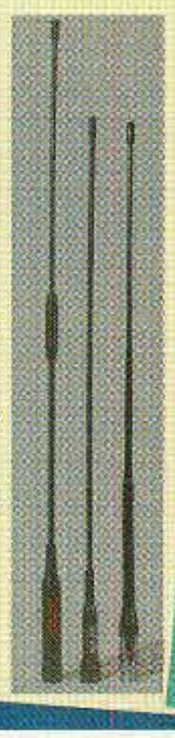
- **CH-72S** Chrome base 2m/70cm **$32.95**



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We offer factory authorized warranty service for Icom, Kenwood and Yaesu. We service all makes and models. Our customers may send any product requiring service to us, and we will handle it for them. This is a one-stop service that keeps our customers having more fun than hassle in this hobby. If you need a custom cable for packet and don't have time to make it, let us do it for you. C.A.P. & M.A.R.S. mods are also available at reasonable rates to authorized hams only.

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ICOM IC-736

Be Ready for E

Here's the H.F. rig you've been holding out for! It features a full 100 watts output from 160 meters, 100 watt through 6 meters with a built in antenna tuner and power supply, VOX, PBT, RF Gain, 101 memories and more provides you with the latest features and fun.

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ICOM IC-737A

SAVE $100 MORE

NOW with VOX

This advanced transceiver features DDS, dual antenna ports, dual VFO display, 101 memories, internal antenna tuner, built-in keyer and 105 dB dynamic receive range. Join the DX scene with the latest design.

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SUMMER SIZZLER

ICOM IC-820H

This new satellite dual band all mode base is designed to provide critical performance and is competitively priced. Features include data port, 50 memories, TXCO, noise blanker, DDS, compact size and much, much more.

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ICOM IC-728

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The IC-728 is a fully equipped compact transceiver. It comes with the basic features plus additional functions required for pleasurable HF operation such as passband tuning and a speech compressor. Perfect for mobile operation with a bright display and simple controls.

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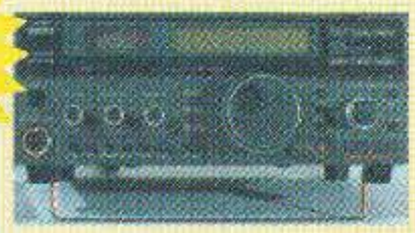
ICOM IC-729



The IC-729 includes the exciting 50 MHz band in an HF all-band/ all-mode transceiver. For DX hunting, there is passband tuning to effectively eliminate interface, and a speech compressor to increase talk power for long distance communications. In addition, the IC-729 has remarkable basic transmitting and receiving capability while remaining compact and lightweight.

$1239.95

ICOM IC-707

SAVE $50 MORE

Here's 9 pounds of fun with a display that's easy to see, a front panel that's easy to work with, and performance to spare. You get big rig specs in an HF transceiver designed for mobile and portable use. Features include a noise blanker, pre-amp, 100 watts out, 32 memories and great sensitivity.

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ICOM IC-R1

In a world filled with signals and sounds you need a communication system you can rely on. Now you can hear communications around the globe with a tiny package that fits snugly in your pocket– Icom's IC-R1, one of the smallest communications receivers ever produced. Other features include 100 memories from 100 KHz through 1300 MHz, AM, FM and FM wide modes and clock function.

* Note 800 MHz-900 MHz blocked

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ICOM IC-781

Seeing is believing, so enjoy the view. The built-in video display is your spectrum scope, frequency readout, terminal monitor and control screen. Dual receive, 150 watt output, 99 memories and wide dynamic range add up to a performance leader.

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ICOM IC-765

Performance with easy-to-use features. With a full-featured front panel and a large fluorescent display, this radio was designed to be used! Wide dynamic range, full duty cycle heat sink, 99 memories, DDS and high speed antenna tuner will expand your fun.

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ICOM R-7100A

Continuous frequency coverage from 25 MHz through 2000 MHZ with all mode capability (W.F.M.opt.). This unit offers a clock, timer, 900 memories, scanning and more than there's room to list.

- **IC-7000A** available

* Note 800MHz-900 MHz blocked

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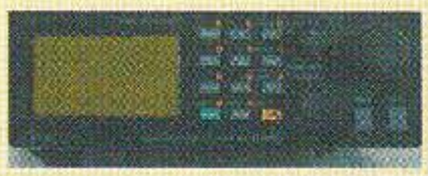
ICOM IC-R100



Bring the world to your car. Now you can enjoy a wider world of broadcasting- VHF air and marine bands, AM, FM, WFM modes, emergency services and many more- in your vehicle. Fully covers all the stations worth hearing in the 500 kHz-1.8 GHz range.

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The IC-Δ1A and IC-Δ1E are the first VHF/UHF triband handhelds in the amateur world. 144 MHz, 430(440) MHz and 1200 MHz band units are included in one compact body.

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* CTCSS optional

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ICOM **IC-W21AT**

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This new dual band handheld transceiver offers unsurpassed performance and the kind of innovative features amateurs have come to expect from Icom. From the unique new whisper function, auto-output power selection to many other trendsetting features, so impressive you'll want to experience it for yourself. This radio sports 70 memories, pager, CTCSS, and many other features.

$499.95

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ICOM **IC-2iA**

$199.95 with coupons & discounts

This ultra-slim transceiver is designed for maximum portability and convenience. Even with its NiCd battery pack attached, this transceiver can fit in your shirt pocket or hand bag.

CTCSS, clock and 100 memories are standard features.

Great for
• Packet • Travel
• Ultra lights • Spare
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ICOM **IC-W2A**

SAVE $30 MORE

A return to design fundamentals has produced something truly unique in dual-band FM transceivers. Even though it is the smallest in its class, it is packed to the limit with features to expand your fun out-of-doors, on the road, or at home.

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ICOM **IC-2GXAT**

7 watts on 12V

High power & compact design set a new performance pace. This HT offers 40 memories, Die cast case, CTCSS. Its new and exciting from Icom.

• **IC 2GX** with out key pad

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NEW LOW PRICE!

This new 2 meter/440cm Dual band is another star in a new product line up for Icom. Features include separate tuning, volume and squelch controls for each band, 100 memories, high power out-put make this competitively priced unit a real winner.

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FREE SMA/BNC Adapter!

Dual receivers with single band transmit makes this HT truly versatile. The 6 watt output, lit keypad, fast scan, DSQ, clock, 114 memories and a compact design add up to a great new product.

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2 & 220

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ICOM gives you a choice with this great dual band radio, 90 memories, dual watch, encode/decode, digital squelch, scan, DTMF pad & more. Join the fun now.

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Here's a triple band mobile ready to go out of the box. This rig is packed with features such as 642 memories, 3 external speaker jacks, detachable front panel and a mult-function mike. This rig is sure to please your operating needs. Experience the magic of Icom.

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ICOM **IC-2700H**

This new 2 meter/70cm dual band mobile will wow you with all its new features. It sports a removable front panel, separate controls for tuning-volume and squelch,Remote control mike. See it at Dayton along with the IC-3700H for your 70cm/ 1.2 GHZ needs.

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ICOM **IC-281H**

9600 Packet Tested

This 50 watt 2 meter mobile is equipped with a data port, crossband repeat opt.,440 MHz receive, 60 memories, auto dialer, auto off and cross band duplex operation. There's more to discover with Icom.

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KENWOOD TS-790A

The TS-790A breaks new ground in terms of features and performance. With the optional 1200 MHz unit, it offers tri-band coverage for maximum versatility. Supporting its dual-frequency receive capability are separate readouts and controls for main and sub bands, even full-duplex cross-band operation is possible.

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Enjoy high performance communications plus go-anywhere convenience with the world's smallest 100w mobile HF transceiver. It opens up a whole new world for the amateur radio operator. It can be mounted in a vehicle, taken on a DX-pedition, or even permanently installed as a base station transceiver. **Supplies Limited**

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A rewarding experience. Kenwood's renowned digital technology endows the TS-850S/AT HF transceiver with specs that put it firmly in the top ranks of amateur radio equipment. Features include a preprogrammed automatic antenna tuner (built-in or optional), Kenwood's Advanced Intercept Point system for enhanced dynamic range, 100 memories with three scan modes, a Direct Digital Synthesizer (DDS) and digital PLL system, plus an optional digital signal processor. **Limited to supply on hand.**

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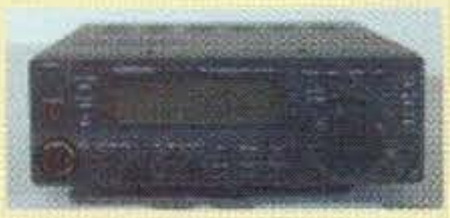
KENWOOD TS-60



Here's the twin to the TS-50. Enjoy high performance communications plus go-anywhere convenience with the world's smallest 90w mobile HF transceiver. Engineered for 90 watts of fun on 6 meters. Features include 100 memories, compact size, DDS, L.C.D. panel and more.

$997.95

KENWOOD TS-690S

A radio that can star in virtually any role with it's 100w transmission capabilities on nine amateur bands plus 50 watts output on 6 meters. Compact, lightweight construction makes this HF transceiver particularly suited for DX-ing. Rugged reliability is matched with leading edge electronics, Kenwood's AIP system for improved dynamic range, DDS for fine tuning and the optional DSR-100 digital signal processor.

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Kenwood provides a variety of devices to add computer control or allow some units to be worked remotely. **IF-232C** converts personal computer RS232 levels, to levels used with Transceivers such as; TS-950 series, TS-850 series, TS-690 series, TS-790A series, TS-450 series and the R-5000.

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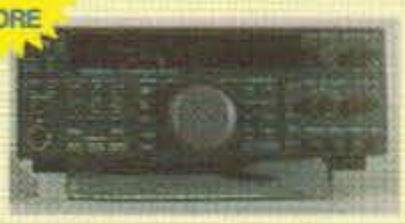
KENWOOD TS-450

SAVE $50 MORE



A radio that can star in virtually any role with its 100w transmission capabilities on all nine amateur bands. Compact, lightweight construction makes this HF transceiver particularly suited for DX-ing. Rugged reliability is matched with leading-edge electronics-automatic antenna tuner, Kenwood's AIP system for improved dynamic range, DDS for fine tuning and the optional DSR-100 digital signal processor. **Limited to supply.**

$1269.95

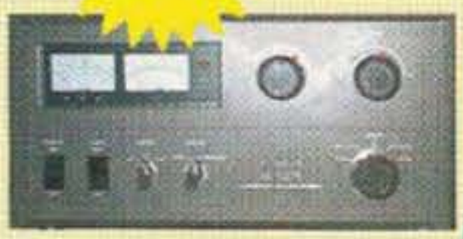
KENWOOD TS-140S

The perfect entry-level HF transceiver. All-mode performance is enhanced by numerous by numerous user-oriented features such as 31 memories, a dual-mode noise blanker with level control, CW full & semi break-in, built-in speech processor and it's light enough for DX-peditions and mobile use.

$899.95

KENWOOD TL-922A

Rugged 3-500Z's



The TL-922A is an HF Linear amplifier designed to provide maximum legal power. By utilizing two 3-500Z high performance transmitting tubes, you'll have plenty of reserve power for those DX and contest contacts. Features include 2kw PEP output, 2 meters, variable ALC, delay cooling, class AB, bias and a look to match those Kenwood products.

$1799.95

KENWOOD HAM WINDOWS

Graphic control of your amateur radio station with Ham Windows. The LogWindow monitors the DX cluster, shows your current log and provides current DXCC and WAZ award status. The system also interfaces to HamBase. Spot, work and log new countries with the latest point-and-shoot technology.

$149.95

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Radio City

Expires September 1994

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CIRCLE 153 ON READER SERVICE CARD

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*Up to 12 lbs. in Continental USA

1-800-426-2891

Fax (612) 786-6513

Call for Catalog
Ask for Ext. 22

Phone Hours
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CST

MasterCard VISA DISCOVER

KENWOOD TH-78A

SAVE $30 MORE

Compact and confident, it sets exciting new standards for portable communications, combing simplicity of operation with a multiplicity of features. In addition to built-in DTSS and paging functions, it provides a dual-frequency transceive capability, wide band receive, a sliding keypad cover, and many other features. While supplies last.

$429.95

KENWOOD TH-733A

SAVE $20 MORE

NEW

Exciting new features make this dual band mobile a class leader. The 6 new program mode memories, AIP, 72 memories, CTCSS & DTSS encode set the performance pace while the wireless, removable front panel makes installation any place a breeze. More features await your inquiry.

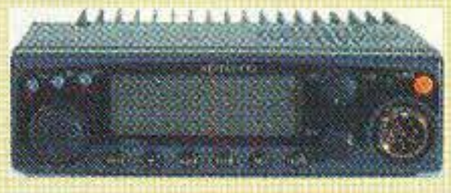
$649.95

HURRY! Coupons Expire July 20, 1994

PRICE BREAK THROUGH!

SUMMER SIZZLER

KENWOOD TM-241A



This 2 meter FM mobile provides the user-friendly operation the amateur radio operator expects from Kenwood. It comes complete with extra-large display, DTMF microphone, wide band receive and illuminated switches. For the experienced operator, an additional feature is available which allows you to connect to as many as 4 mobile transceivers by remote control. **Hurry coupon expires 7/20/94.**

$327.62
-30.00
$297.62
with all coupons & discounts

KENWOOD TH-28A

This state of the art HT has numerous features- the ability to store both alphanumeric and frequency data in non-volatile memory, AM aircraft, alphanumeric message paging–in addition to DTSS and pager functions–plus switchable dual-band receive. As an added bonus the number of memory channels can be increased to 240 (option).

$299.95

KENWOOD TM-251A

This new 2 meter transceiver provides dual band receive and gives you a data port that's 9600 baud ready. CTCSS encode, 41 memories are expandable, cross band repeat, time out timer, DTSS and much more.

- TM-451A 70cm Tx,2m Rx *TBA
- TM-551A 1.2GHz Tx 70cm Rx *TBA

***FCC Approval pending**

$439.95

KENWOOD TM-742A

SAVE $40 MORE

New VHF/UHF tri-bander with third band optional. This new transceiver has all the features and advantages of the TM-741 plus these enhancements-direct frequency entry, the unit can separate into three pieces (requires remote cable kit), CTCSS encode is built in, and it can be controlled remotely with DTMF signals from any transceiver. Also available in a tri-band model (the TM-942A).

PRICE WATCH

KENWOOD TH-22AT

SAVE $20 MORE

Small just got smaller. Kenwood's new TH-22AT (144MHz) and TH-42AT (440MHz) are in a category all their own, redefining "handheld communications" with a stylish palm size format and equally impressive performance. Besides being compact enough to slip into a shirt pocket, these two FM transceivers feature long battery life, DTMF keypad, user-friendly menu system, multiple scan functions, 41 memory channels, CTCSS encode, DTSS, and much, much more. **Limited supplies.**

$249.95

KENWOOD FILTERS

TU-7	$49.95
VS-1	$67.95
YG-455CN-1	$169.95
YK-88C-1	$99.95
YK-88CN-1 (1st F)	$94.95
YK-88S-1 (1st F)	$94.95
YK-88SN-1	$94.95
YK-455C-1 (2nd F)	$109.95
YG-455C-1 (2nd IF)	$144.95
YG-455CN-1 (2nd IF)	$159.95
YK-455C-1	$109.95
YK-88S-1	$99.95

KENWOOD ACCESSORIES

BC-15A	$114.95
BH-6	$39.95
BT-8	$26.95
HM-2	$16.95
HMC-2	$66.95
KLF-3	$23.50
ME-1	$36.95
PB-13	$63.95
PB-14	$89.95
PB-17	$99.95
PB-18	$86.95

KENWOOD ACCESSORIES

We're a Kenwood Warranty Center

SP-31	$99.95
SP-23	$84.95
SP-950	$124.95
DTU	$29.95
UT-10	$545.95
UT-50S	$329.95
UT-28S	$309.95
UT-220S	$329.95
UT-1200	$389.95

KENWOOD ACCESSORIES

PG-2W	$15.95
KLF-3	$23.50
SC-33	$20.95
SC-34	$21.95
SC-35	$19.95
SC-36	$21.95
SMC-31	$59.95
SMC-32	$46.95
SMC-33	$59.95
SMC-34	$62.95

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YAESU FT-1000D

SAVE $100 MORE

Fun's fun, but you can be very serious with this heavy duty competitor. Dual receivers, 200 watt output, 99 memories and 108 dB dynamic range gives you the performance edge. This radio will help you collect more points in a contest and add more cards to your DX collection. The specs tell the story, but it's the ride that's exciting.

- **FT-1000** $3099.95

$3855.95

YAESU

HURRY! Coupons Expire July 20, 1994

Factory Warranty Center

SUMMER SIZZLER

YAESU FT-890/AT

A fine blend of high performance features borrowed from the FT-1000 and the FT-990 are combined in this affordable transceiver. Pass band tuning, variable notch filter, variable noise blanker and VOX dress out of this 100W rig. This model includes a built-in antenna tuner to expand your mobile fun. Great for base operation also.

- **FT-890** $1149.95

SAVE $100 MORE

$1299.95 -100.00 = $1199.95 with all coupons & discounts

YAESU FT-990

SAVE $100 MORE

Based on the acclaimed performance and easy operation of the FT-1000, the new FT-990 combines the basic technical features of that top-of-the-line model with several new advances in both transmitter and receiver circuitry, resulting in a spectacular performer at a reasonable price. Digital filter, 90 memories, wide dynamic range and much more!

- **FT-990/DC** $1739.95

$1995.95

YAESU FT-690RII

Portable or mobile, this 6 meter all-mode transceiver delivers fun and function. The 10 watt linear amplifier clips on in place of an optional battery case to extend your operating horizon.

FBA-8	Battery Case $42.00
CSC-19	Soft Case $21.00
FTS-7A	Encode/Decode $41.00
MMB-31	Mobile Bracket $22.00

$657.50

YAESU FT-290RII

Portable or mobile, this 2 meter all-mode trans-ceiver delivers fun and function. The 25 watt linear amplifier clips on in place of an optional battery case to extend your operating horizon.

FT-790RII	70 cm transceiver $649.95

$558.62

YAESU FT-840

SAVE $50 MORE

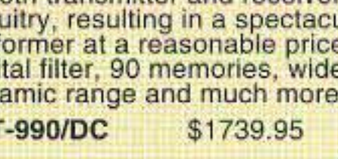
This new transceiver delivers the fun and performance you're looking for while staying on a budget! It has 100 watt output, 100 memories, DDS, IF Shift FET front end and a general coverage receiver, all for a low price.

FC-10	Matching antenna tuner, external $349.95
FC-800	Remote antenna tuner $469.95

$799.95

YAESU FL-7000

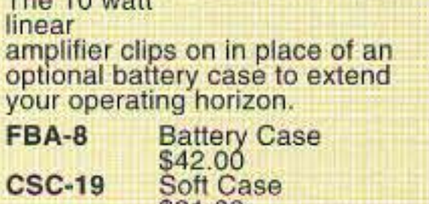
SOLID STATE



Solid state design with a built in antenna tuner makes for a no fuss QSO in tough conditions is a full 1200 watts input on all bands with automatic or manual tuning lets you decide the best way to drive this competitor.

$1999.95

YAESU FRG-100B



This new high performance table top receiver provides general coverage from 50 KHz - 30 MHz in all and FM at an affordable price. Features include 50 memories, noise blanker, 10 MHz, 100 and 1 KHz tuning steps, selectable attenuate, twin clocks and scan mode.

$599.95

YAESU MOBILE ACCESSORIES

• AD-3	$49.95
• DVS-1	$105.95
• DVS-3	$139.95
• FRC-4	$42.00
• FTS-22	$58.00
• YKS-1L	$59.00
• MMB-37	$16.00
• MMB-48	$18.00
• SP-3	$21.00
• SP-4	$30.00
• SP-7	$37.00

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YAESU FT-736R

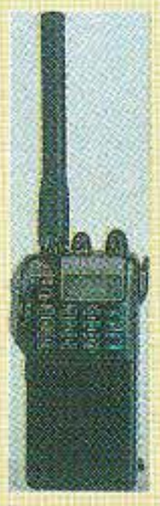
Satellite and all-mode 2m/70cm work gets exciting with this full-feature transceiver. Linked tuning, 12 unlink memories, 100 general purpose memories, and room for 2 optional modules offering band extensions for 6m, 220MHz, or 1.2 GHz operation.

$1695.95

YAESU FT-416B

SAVE $25 MORE

This new VHF handheld transceiver provides the latest features- auto tone search, automatic battery saver, automatic power off, 41 memories, CTCSS encode/ decode, DTMF paging, backlit keypad and display and a choice of two colors (black or gray).



FT-816 UHF version available.

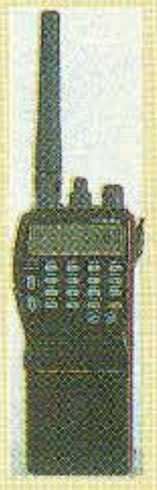
$264.95

YAESU FT-530

SUMMER SIZZLER

FREE BATTERY FNB 25G Limited Supply

The newest member of the dual band family. This handheld sports auto tone search, 82 memory channels, automatic power off, built-in VOX, dual in-band receive feature, built-in cross band repeat function and much more.



$449.95
-25.00
$424.95
with all coupons & discounts

YAESU FT-5200

SAVE $25 MORE

The removable front panel lets this dual bander fit any installation. It features 50w out on 2 meters, 35w out on 70 centimeters, 32 memories, CTCSS encode and PAGE mode.

$619.95

YAESU FT-5100

SAVE $25 MORE

This dual band mobile features 100 memories, cross band repeat, lighted keypad, built-in duplexer and a small footprint. Dual watch capability rounds out this 50/35 watt VHF/UHF transceiver. Packet ready.

$599.95

YAESU FT-2500

NEW

This new mobile borrows its ruggedness from the FT-2400H while adding great new features such as advance track tumer, time out timer, A.P.O., 9600 bps option, 31 memories, the new "omni-glow" LCD and more!

$349.95

YAESU FT-11R

SAVE $25 MORE

This new HT packs the features you want in a small size. It features a new alphanumeric display, super small profile, new square "D" battery design, lit keypad, AM air craft receive, DSQ & CTCSS encode.

- **FT-11RH** Hi power version $309.95

$294.95

YAESU ROTORS

SAVE $25 MORE ON:
- G-2700SDX
- G-1000SDX
- G-800SDX
- G-800
- G-500A

G-1000SDX
$499.95

Whether you are installing a station for professional HF communications, a satellite ground station or merely a rotator-controller combination for you. Designed to last a lifetime, all Yaesu rotors are housed in weatherproof melamine coated die-cast aluminum and permanently lubricated to insure maintenance-free operation under all climate conditions.

G-500A
$289.95

G-5400B
$499.95

YAESU FT-411E

SAVE $25 MORE

This full featured handheld provides hours of fun on a small budget without compromising on quality. Check out the wide band receive, 40 memories and dual VFO!

$295.95

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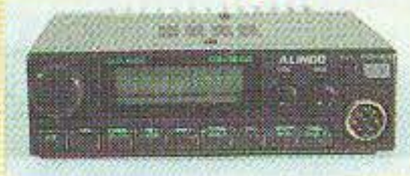
ALINCO ELECTRONICS INC. DR-1200T



The Alinco DR-1200T, 2m data radio is engineered to optimize packet radio performance and operating convenience into a compact package. 25w RF output, 1220/2400bps utility, 14 memory channels, 4 scanning modes, and other excellent features are provided at an economical price. The DR-1200T is the smartest way to connect you and packet radio.

The DR-1200TH provides 25w RF output with hi/low power selection switch and output switching designed to work at 9600 bps. **$299.95**

$269.95

ALINCO ELECTRONICS INC. DR-130T

SAVE $20 MORE

Alinco is very pleased to introduce the newest addition to our quality line of amateur radio transceivers, the DR-130T, 2 meter mobile. Engineered with the most advanced technology, it is designed with the beginner and the most experienced ham radio enthusiast in mind! It is powerful, boasting 50 watts in high power transmit to reach those distant repeaters. It is compact and ideal for even the tightest mobile installation applications.

$319.95

SUMMER SIZZLER

ALINCO ELECTRONICS INC. DR-600T

Experience all of today's exciting VHF/UHF FM action with Alinco's DR-600T and enjoy dual band operation at it's absolute best. This powerful and easy to use 2 meter/70cm FM transceiver is jam packed with special features like simultaneous dualband receive, removable front panel, full duplex operation, scanning, DTMF code paging and remote controlled cross band repeating. Your most wanted options are factory installed, thus making it an outstanding value.

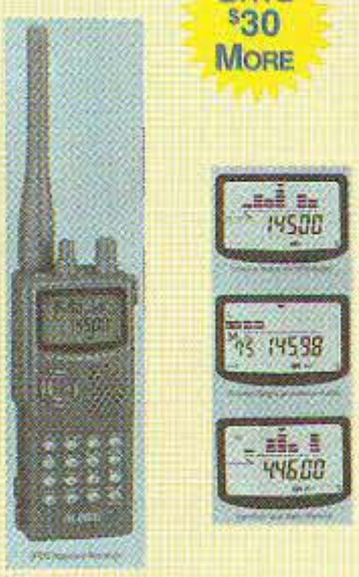
SAVE $20 MORE

$578.55

ALINCO ELECTRONICS INC. DJ-G1T

SAVE $30 MORE

HURRY! Coupons Expire July 20, 1994



with Channel Scope

$329.95

ALINCO ELECTRONICS INC. DR-570T

The DR-570T VHF/UHF FM Mobile Transceiver has been specially designed to combine two radios into one compact package with maximum operating performance. You get 45 watts on 2 meters and 35 watts on 70cm, 20 memory channels, wide frequency coverage, large multicolor dual digital LCD display, plus much more!

$525.95

ALINCO ELECTRONICS INC. DJ-180T

SAVE $10 MORE

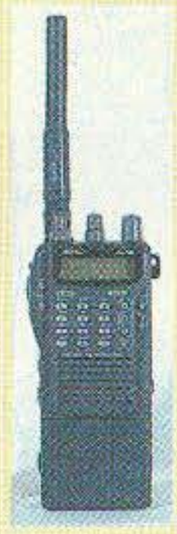
The DJ-180 has great audio and tough as nails construction, simple, and intuitive operation designed with command keys that are laid out so you won't have to spend hours studying the manual.

- **DJ-180TH** $239.95

$219.95

ALINCO ELECTRONICS INC. DJ-580T

SAVE $20 MORE



A super-compact handheld, the tiny DJ-580T is a powerful, feature packed twin bander. This super-compact HT is the smallest you'll find, and literally fits in the palm of your hand. Ergonomic design combined with excellent sensitivity and unbelievable great sound, sets a new standard for miniature HT's.

$399.95

TELEX

Satellite Station in Store

The OSCAR Link antenna system is today's most flexible system for satellites. Both 145.9 and the 435 MHz antenna's have polarity switching. The entire system balances on a 5' fiberglass boom. The latest NBS design 435 MHz and logarithmic 2 meter spacing make this the best OSCAR antenna available today.

$385.95

ASTRON

RS-12A	12 amp power supply	$79.95
RS-20A	20 amp, power supply	$96.95
RS-35A	35 amp, power supply	$149.95
RS-50A	50 amp, power supply	$219.95
RS-20m	20 amp w/volt/amp meter	$116.95
RS-35m	35 amp w/volt/amp meter	$169.95
SL-11A	11 amp, slim style	$79.95

DAIWA

NS-660A
Cross needle, 1.8-150 MHz SWR meter with remote capability. **$185.95**

CN-101
Cross needle SWR and power meter 1.8-150 MHz. **$89.95**

DX-100
Duplexer SO-239 in and two PL259 out connector only. **$28.95**

DX-10M
As above with 6" leads on PL259 connector. **$37.95**

DX-10N
As above with 1 "N" connector and 1 PL259 connector. **$37.95**

AEA PK-900

This next generation of multi-mode controller is made in the USA with a front panel designed for you! Enjoy dual port action for packet, RTTY, PACTOR, CW, fax, and more!

$475.95

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CIRCLE 153 ON READER SERVICE CARD

The Coleman (Mini)-Kilowatt

Extend your station's working range for next to nothing.

by Steve Katz WB2WIK/6

Whenever you use a lengthy transmission line to connect a radio to an antenna, you can expect to encounter considerable loss. Even the very best commonly-available cable for UHF/SHF pioneers (7/8" diameter hardline) is costly, heavy, requires expensive connectors, and still has measurable losses. Most of us, even those with multiple feedlines and limited budgets, aren't using cable that good. We're using RG8/U, RG213/U, 9913, 9086, 9096, or some similar 0.405"-diameter 50 ohm transmission line which is nearly lossless at lower frequencies, but measures more loss than most of us would like to have at VHF or UHF.

If you're using 50 feet of feedline, it's probably no big deal unless you're operating at 1.2 GHz or higher frequencies. But if your setup is anything like mine, you're using hundreds of feet of coax to feed each antenna because you have a tall tower or antennas far away from the shack. Thus, you are undoubtedly encountering considerable feedline loss, which limits your station's capabilities.

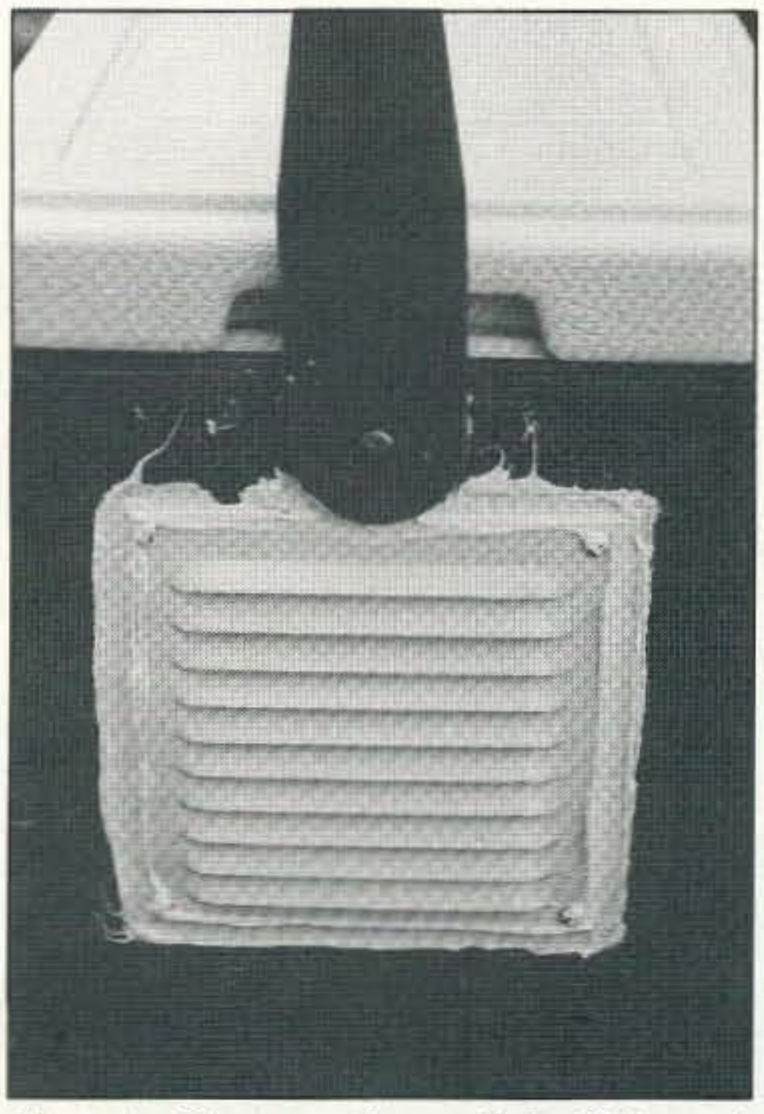

Photo A. Close-up of one of the Coleman's side vent covers. Note the thorough caulking job.

Most satellite enthusiasts and moonbouncers use masthead preamplifiers to boost received signal levels at the antenna feed point, thus overcoming transmission line losses on receive. But even these folks rarely locate their transmitters at the antenna, which in many cases could boost transmitted ERP (effective radiated power) by 3 dB or more, because the transmitting equipment is more bulky and normally not weatherproof. Who wants two inches of water inside their $500 transmitter?

My Solution

Luckily, there is a solution to this problem, and it's easier than you might think. I have a VHF simplex autopatch installed at my home. It uses a conventional 2 meter FM rig and a simplex patch interface between the rig and the telephone line, and allows me to make non-business, no-cost telephone calls from my car as long as I'm within range of my home station. (In my case, this can be a large radius, since my home station antenna is quite high.) The problem is, the patch gear is set up in the shack, while its antenna is atop a 40-foot tower, up on a hill behind my house. This means using a transmission line more than 250 feet long. I could have put the whole "patch" station up on the hill, closer to the antenna, but this would mean losing local control of the rig. There are new, very costly radios that allow full remote-control of all functions, but I don't own one of these and didn't want to shell out more than $1,000 for a radio that doesn't work any better in most respects than my old $250 rig. Plus, I don't know how well the radio would work if installed in a severe environment (like outdoors). It doesn't get very cold here, but it does get mighty hot. If I installed a rig inside a weatherproof box it might reach 150 degrees F or higher on a sunny day, even if the box were well-ventilated.

My situation isn't unusual. Many of us hams use antennas located a distance from our homes, and some of us have really tall towers. In either case, a long and lossy feedline is required. Here's my solution:

I purchased a Coleman 28-quart cooler with a tight-sealing lid for $20 at a local discount store. It was just large enough internally to house a solid-state power amplifier/RX preamplifier combination and a 12V power supply. Thermos, Igloo and others make similar coolers. Shop around for your own deal. Even huge coolers with 40-quart

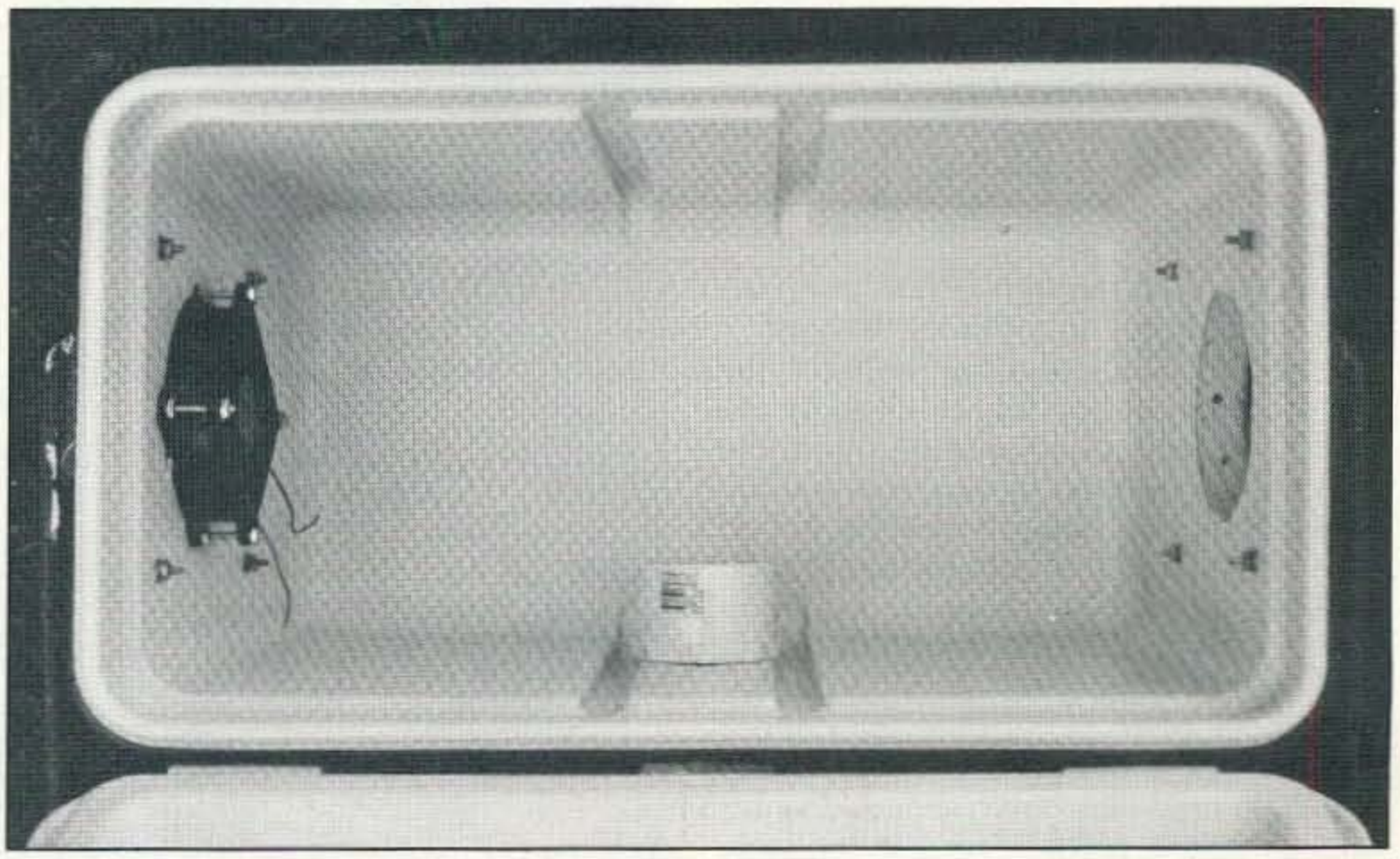

Photo B. The Coleman (Mini)-Kilowatt under construction. The cooling fan can be seen at one end-side vent hole, and a 4" hole is directly opposite.

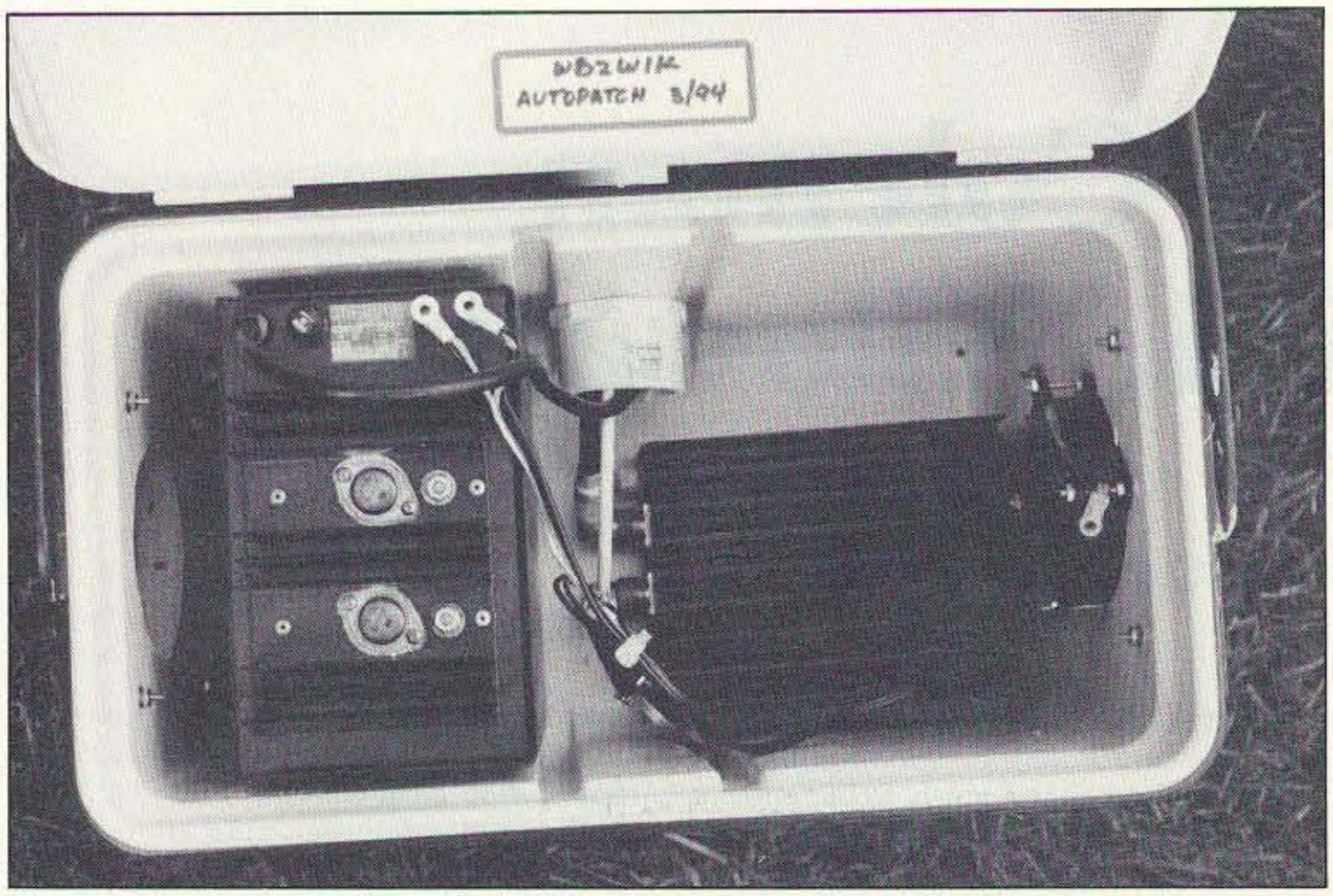

Photo C. Inside the cooler, with the 12 volt power supply and the 80 watt amp/preamp installed. Everything fit with room to spare. A larger cooler could likely accommodate a real *kilowatt amplifier.*

or larger capacity cost less than $40. They are all thermally insulated, reasonably weathertight, and rugged enough to be installed outdoors permanently.

Because these coolers are normally sealed tight when their lids are closed, heat generated by the equipment they contain will build up to destructive levels unless some provision is made for cooling. I purchased a couple of small vent covers which had louvers and metal screening already preattached. After cutting suitable vent holes in both sides of my cooler, I installed the vent covers over these holes with the louvers on the outside and facing downward, to prevent rain from entering the vents (see Photo A). These vent covers cost 99 cents each at a local discount home supplies store. After cutting a 4" diameter hole in each side of the cooler using a portable jigsaw (the cooler materials cut very easily—they're just PVC and styrofoam), I mounted the vent covers using four 2-1/2" #8 stainless-steel bolts each, with lockwashers and nuts inside the box. Then I used weatherproof window caulking compound (GE, Dow, DAP or whatever, from a tube) to caulk all around the small cracks between the vent covers and the cooler itself.

I mounted a small cooling fan inside the cooler, over one of the vent holes, to exhaust air out that vent (see Photo B). When the cooler cover is closed, the fan draws outside air in the opposite vent and blows air out the vent over which the fan is located. This means the temperature inside the cooler will always be about the same as the air temperature outside. (Those of you living in extremely cold climates might wish to block the vents off during the winter season and then open them during the summer. Another option would be to add some type of heating unit to the project.)

See Photos C, D and E. To allow access to and from the equipment contained by the cooler, I used 2-1/2" diameter PVC water fittings. A short, straight section of threaded PVC pipe passes through the rear wall of the cooler and joins to a 90-degree PVC elbow attached to it on the outside of the cooler. Since I used pre-threaded PVC, this just screwed together. If you can't find threaded PVC accessories, use unthreaded pieces and glue them together with the specialized cement sold just for this application. The outside elbow faces downward to prevent rain from entering, and is large enough internally to pass three or four cables. The hole for the PVC inlet/outlet pipe was also quickly cut with my jigsaw, and the straight PVC section is held in place with an internal threaded PVC nut. The exit point is weather-sealed with window caulking, just like the vents. If you use similar procedures, be sure to allow at least 12 hours for the caulking to fully cure before proceeding with other work.

Installing the Electronic Guts

Once the vent covers, fan and PVC pipe are in place and the caulking is cured, it is time to install the electronics. I used a Mirage B108G 2 meter power amplifier/RX preamplifier combination. This "brick" runs 80 watts output power when driven by 10 watts, and contains an RF-switched GaAsFET receive preamplifier with about a 1 dB noise figure. It requires about 12 amperes at 13.8 volts DC for power when transmitting, and I used a Kenwood power supply I happened to have on hand. An Astron RS-20 or similar commercial unit would have done as well and also fit in the box. The DC power supply requires only about 3 amperes at 117 VAC for line power, so it can be supplied by a very long #12 or #14 gauge line cord.

There's no sense in putting the amplifier in the field and running DC power up to it, since the DC load current is so high. My modest little 80 watt (output) amplifier "brick" requires 12 amperes, and a larger solid-state amp will require much more. (The popular 160-170 watt bricks all consume about 25 amperes at 13.8 VDC.) If I had run DC from the shack all the way up to the box, I would have needed #10 copper conductors as a minimum, preferably #8 or #6. This is very heavy and costly wire that isn't even commonly available in paired conductors with a weatherproof covering. By putting the DC power supply in the box with the amplifier, I could use inexpensive #12 or #14 outdoor AC extension cord, like that sold for outdoor garden tools (electric lawn mowers or hedge clippers). Two 100-

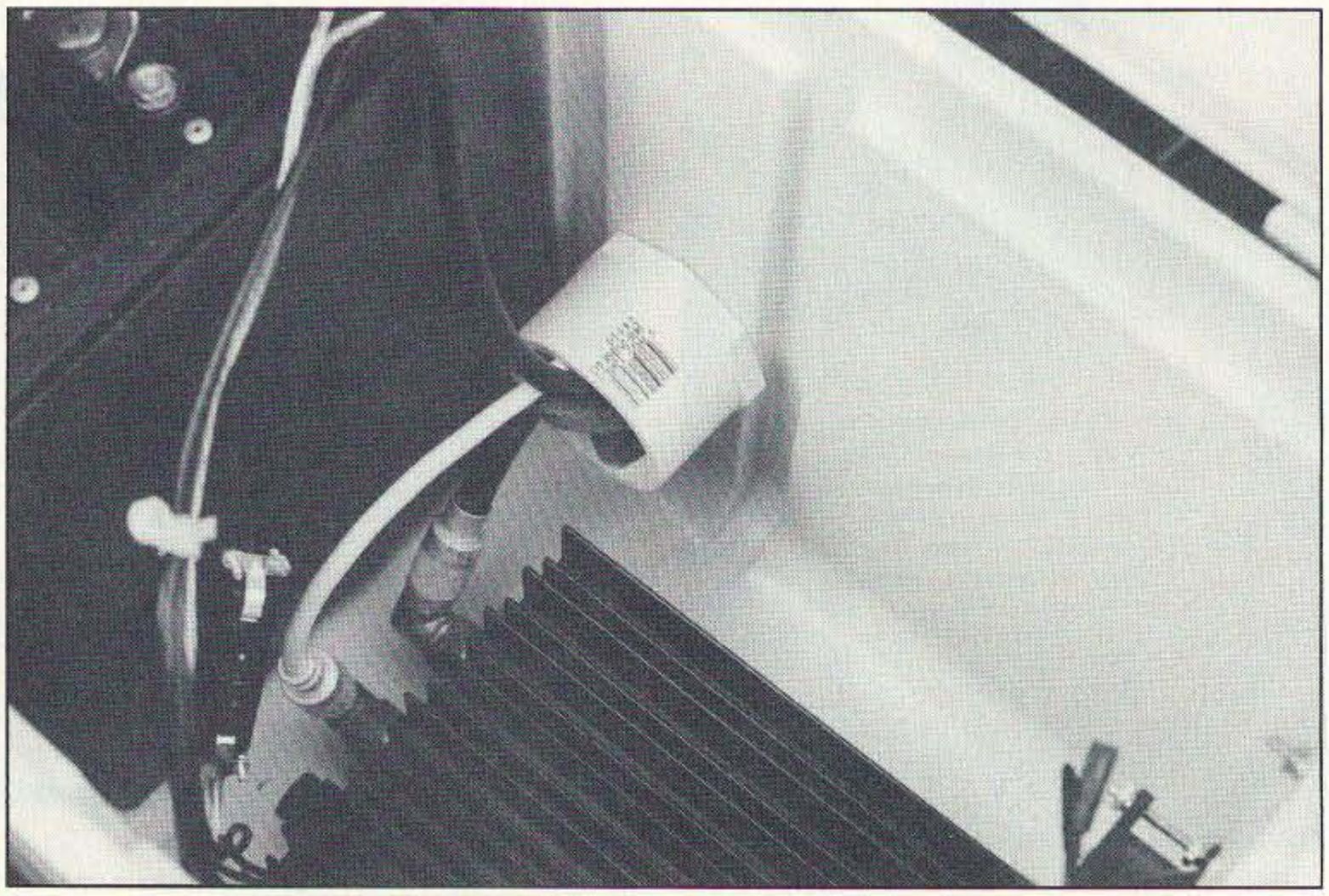

Photo D. Close-up view of the cables exiting the PVC pipe feed-through. The gaps in the pipe are filled with foam-rubber gasketing material, my "Black Widow Protection."

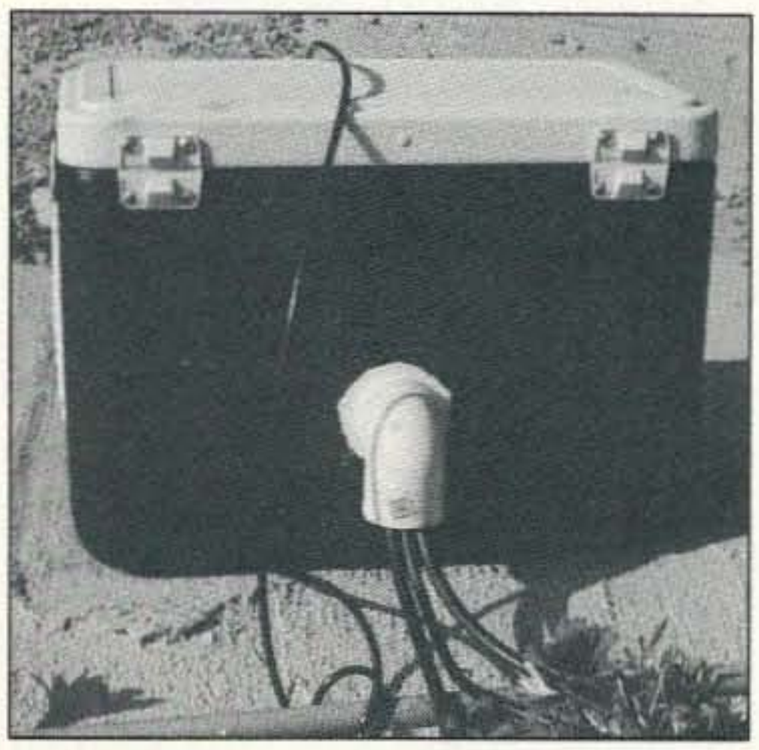

Photo E. The completed Coleman (Mini)-Kilowatt as it sits on the ground alongside the base of the antenna tower to which it's connected.

foot extensions cost only $26 total and these are very weatherproof, with a tough rubber jacket that even resists garden "critters" with sharp teeth! (Note: For a permanent installation that meets existing electrical codes, you'd need to use wiring inside a metal conduit. But I consider my installation "temporary," like using an electrically-powered garden tool, and therefore use outdoor extension cords instead. In a semi-rural area, anyone can get away with this.)

As you can see in the photos, everything fit in the box quite nicely. Before installing the cooler at the antenna site, I checked it for water leaks (with the cover closed, of course!) by spraying it with a garden hose from various angles. I found the cover did leak a bit, and there was no place for water to exit the box, so I drilled half a dozen 1/4" holes in the bottom of the box, at the lowest points inside the container, to allow any water that leaks in to exit quickly. A second "garden hose" test revealed that this solution was a good one. Another solution might be to use duct tape to seal the lid of the cooler once it's closed, and not drill any "weep" holes.

This whole project took maybe an hour to complete, not including the 12-hour cure cycle for the caulking, and cost $35 (not including the electronic equipment). After installing the cooler "up the hill" near the base of the autopatch antenna tower, and having the AC line cord plus the coaxial input and output lines routed through the PVC elbow and connected, I pushed some foam-rubber weatherstripping material into the remaining voids in the PVC pipe. This was done in hopes of keeping insects out of the box. Tiny insects like fleas or gnats might still enter through the holes in the window-screening material at the vents, but I was more concerned with black widow spiders, common in these parts. Black widows are too large to pass through the window screens, but might've entered the PVC pipe. I don't want any "surprises" the next time I open the lid of the cooler!

To keep the cooler from moving much during an earthquake, or from disappearing altogether in the event "visitors" with vandalous intentions happen to spot it in my yard, I attached the box to a nearby irrigation pipe (3/4" galvanized—pretty strong stuff) with a steel bicycle anti-theft cable, as shown in Photo E, using a padlock. If you install your Coleman (Mini)-Kilowatt in an unprotected yard or alongside your tower, you might consider taking some similar precaution.

The Results

Was this small project worth the effort? You bet it was! My original autopatch system, with a rig running 40 watts in the shack, had an effective radiated power of 60 watts, factoring in feedline loss and antenna gain. By adding the remote amplifier, its ERP is now 260 watts, a 6.4 dB improvement. Had I located the same amplifier in the shack, instead of near the antenna, the resultant ERP would have been 115 watts, or 3.5 dB less effective power. Now I have only about 0.8 dB feedline loss between the amplifier and the antenna, whereas with a shack-mounted amplifier the loss would be 4.3 dB.

And how about on receive? With the shack-installed rig, my receiver sensitivity was 0.48 µV for 20 dB noise quieting (this is 0.28 µV, degraded by 4.3 dB of transmission line loss). Now, with the remotely-located preamp in the B108G, my receiver sensitivity is 0.32 µV for 20 dB quieting. This is a receiver sensitivity improvement of 3.5 dB. The system can now "hear" much weaker signals than it could before. Had I installed the receiver preamp in the "shack," the resulting improvement would have been essentially zero, since the preamp noise figure and the original rig's noise figure are about equal. (No amount of preamp gain makes any difference unless the noise figure is improved.)

In all, I've improved my system performance by 7 dB: 3.5 dB on transmit, and 3.5 dB on receive. The difference in working radius for the autopatch system described is several miles. I can now access and hear the "patch" from many places farther away than previously. All this improvement cost was $35 for the cooler, modified as described, and $26 for extension cords to power the equipment. A mere $61 total investment. I could have raised the antenna another 50 feet to yield a similar improvement, but at 10 times the cost.

Whether you have an autopatch system, or just want to extend your working range for normal simplex modes (FM, SSB, packet, etc.), remoting your final power amplifier and receiver preamplifier will help. One precaution I should mention is to be sure the AC extension cord is plugged into a "GFI" outlet, or protected by a GFI circuit-breaker. GFI stands for "ground-fault interrupter," and this is not only prudent for any AC power line used outdoors, but is an electrical code requirement nearly everywhere. A GFI might occasionally "trip" on rainy days, rendering your remotely-located equipment powerless until it's reset, but the protection afforded against accidental electric shock is well worth the possible nuisance.

I don't know about you, but I like almost-free station improvements. I picked up 7 dB for $61. This is $8.71 per dB, an excellent return on investment. And after all, this is only a hobby. 73

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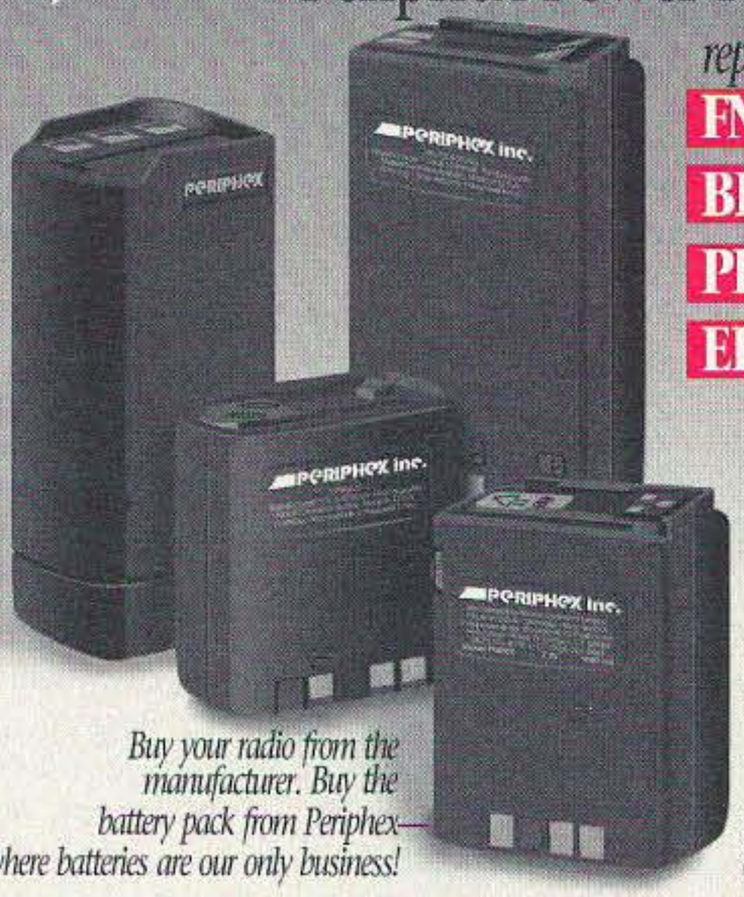

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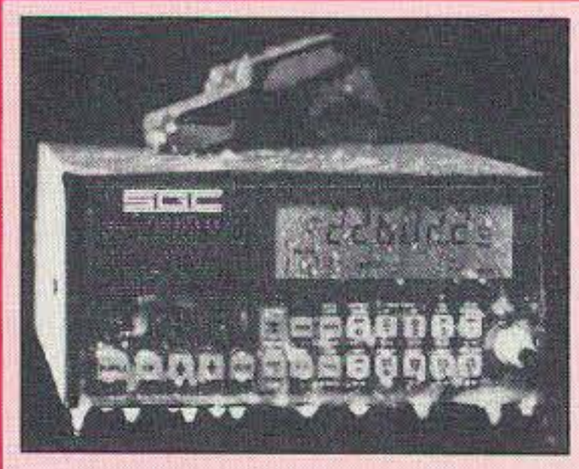

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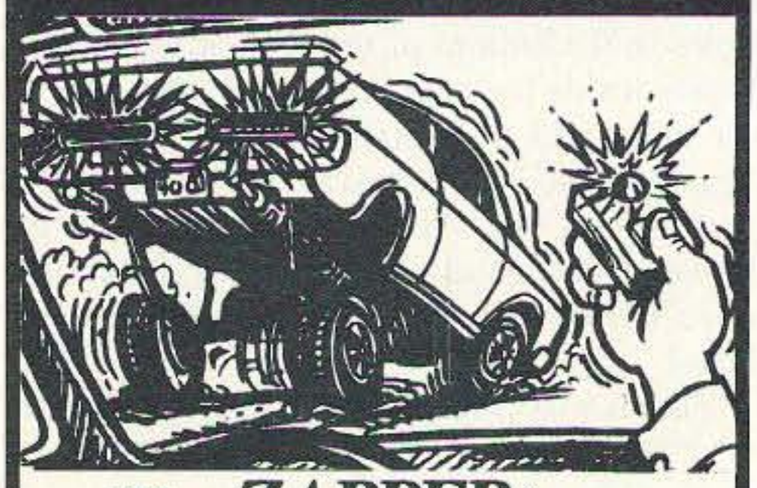

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Satellite Portable

I go fishing at least once a year with a small group of friends. The goal is to get away from the city, while chasing fish is secondary. We use ham radio to communicate between boats and always try out some new idea for satellite chasing after a day out on the water.

This year a new antenna from Cushcraft looked like a good candidate for portable hamsat work. The antenna is a dual-band, linearly-polarized yagi called the A270-10S. It has five elements on 70 cm and five on 2 meters. The two yagis are mounted in the same plane, but on opposite sides of the boom. The antenna comes with aluminum components, stainless hardware and a wiring harness allowing a single coax cable feed. While this arrangement is fine for dual-band rigs, separate feedlines were more appropriate for the multimode single-band rigs on hand.

Antennas tried in previous years for 2 meters and 70 cm included short crossed-dipole systems from KLM and Cushcraft, small quads from Lightning Bolt Antennas, ground planes from Lakeview, and even an AEA HR-1 telescoping half-wave HT whip. All of the antennas tried have been useful, depending on the satellite and local working conditions. While the ground planes did well for low-earth-orbit (LEO) satellite contacts, they were quite difficult to use for AMSAT-OSCAR-13 in its high elliptical orbit due to the weak signal levels. Crossed yagis were better for A-O-13 due to their polarization compatibility and higher gain, but they were harder to transport and, due to the lack of rotators, very difficult to use for LEO hamsats.

The short dual-band yagi from Cushcraft provided several A-O-13 contacts from a camera tripod mount. The antenna was mounted near its balance point rather than at the rear. To help make up for the antenna's lack of gain, a good quality preamplifier was used on 2 meters and a 100-watt linear employed for the 70-cm uplink. Antenna alignment was accomplished with a compass from the Scout shop and an inclinometer from the hardware store. Aiming predictions were printed prior to the trip.

Contacts were few on the low-orbit satellites using this antenna, due to a lack of rotators or volunteers. For a small home installation some very inexpensive rotators could be incorporated for azimuth and elevation because of the light weight and small size of the A270-10S. As a portable or emergency VHF/UHF satellite antenna, it's a good performer.

RS-12

While the contacts on A-O-13 were fun to make using the simple portable system, chasing RS-12 was like getting back to the days of Sputnik-1 but proved to be more difficult than anticipated. RS-12 is currently running Mode K, the HF mode, which calls for a 15 meter uplink and a 10 meter downlink. Sputnik-1 transmitted just above 20 MHz. At our lakeside station, a NCG Co. Model 15M mobile transceiver was tried with a modified "CB" magnet-mount, base-loaded whip for the uplink. A Uniden HR-2510 transceiver and a dipole were used for reception. Downlink signals were strong, but the low-power output of the NCG 15M did not produce any contacts. We could hear the resulting downlink from our 15 meter transmissions, but were not having any luck catching the attention of others.

As the upper shortwave bands decline in long-distance usefulness due to the present sun-spot cycle, the use of Mode K gets easier. Activity on the satellite has increased dramatically and it has become harder to compete for a contact.

RS-12 is part of a larger civilian navigation satellite, COSMOS 2123, launched by the former USSR on February 4, 1991. RS-13 is another part of the system, but is not currently in use. RS-12 is capable of three different modes including "A" with a 2 meter uplink and 10 meter downlink, "T" using 15 meters up and 2 meters down, and K. The satellite is also able to run dual simultaneous modes using "KA" or "KT." Almost since launch, however, RS-12 has been running K.

The K transponder system on RS-12 is 40 kHz wide and non-inverting. This means that an upper sideband (USB) signal sent by a ground station high in the transponder input band will come out as a USB signal, high in the transponder output band. For RS-12, the uplink band goes from 21.210 to 21.250 MHz, and the downlink is from 29.410 to 29.450 MHz. The main CW telemetry beacon can be heard on 29.408 MHz. Unlike other hamsats, RS-12 transponder operation requires at least an Advanced Class license due to the uplink frequencies; however, the lower 15 kHz of the transponder uplink are in the Extra band.

After the failure to effect contacts from the fishing site, attempts were made employing the home system. Using a 25-year-old HF transceiver for the uplink and a 15-year-old HF transceiver on the downlink in conjunction with dipoles in the attic, several contacts were easily made during the first 15-minute pass. The increased number of users on RS-12 heightened contention for the limited space in the 40-kHz-wide transponder. The typical RS-12 operator was using more power, single transceivers and sometimes a beam, or at least a good outdoor antenna. This was verified by a survey over the air and from QSL cards.

Many of today's amateur HF transceivers can operate crossband, i.e. they can be used to monitor one band (like 10 meters) and transmit on another (15 meters for example). While they cannot operate full duplex (simultaneous receive and transmit), a few calculations and some practice provide prospective RS-12 users with methods for satellite operation. RS-12 operators have discovered that Doppler shift is minimal on HF. When transmitting on 21.240 MHz, the downlink will be within a kHz of 29.440 MHz. Since the transponder is linear, the same correlation holds true throughout the 40 kHz passband. Many hams have avoided RS-12 activity due to the problems encountered with a 15 meter transmitter in close proximity with a 10 meter receiver. Those with only one HF rig don't even know about the problem, they just make contacts. After chasing digital satellites and high-orbit, high-tech hamsats, RS-12 is a refreshing change—back to basics.

Check *The RS Satellite Operating Guide* by G. Gould Smith WA4SXM for more information about the RS-series hamsats. The booklet is available from AMSAT at (301) 589-6062, or you can write to them at 850 Sligo Avenue, Suite 600, Silver Spring MD 20910. 73

Photo A. Portable satellite rigs for 15, 10, 2 and 0.7 meters.

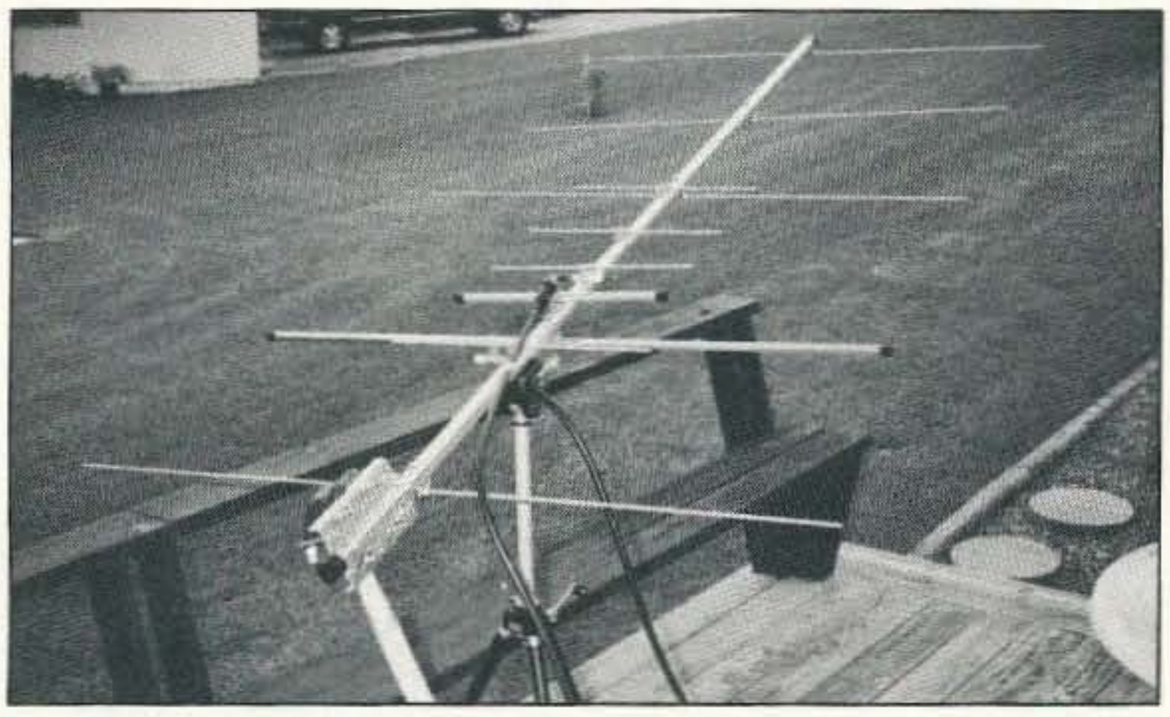

Photo B. A Cushcraft A270-10S dual-band yagi on a camera tripod did a great job for some A-O-13 Mode B contacts.

Photo C. Andy WA5ZIB at the controls during an A-O-13 pass. (Photo by Stuart Ross.)

RTTY LOOP

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Marc I. Leavey, M.D., WA3AJR
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How RTTY Works

I am constantly reminded by your correspondence that many "RTTY Loop" readers have not been in digital communication these past few decades. Even some of you old-timers (whose original ham tickets pre-date my birth certificate) are just now barely getting started in RTTY, packet, or the like. Thus, I often find more basic questions mingled in with letters about this or that program, computer, or piece of equipment; such as "Just how is RTTY transmitted, anyway?" This month's column is addressed to that segment of the readership. To those of you who already know all this, you are excused. For those who want a quick refresher, jump to the end of the article. The rest of you, here we go.

Unlike CW, where the various letters of the alphabet, figures, punctuation, and special functions are represented by groups of long and short signals ranging in length from one unit (the letter E) to 20 or more, the various forms of radioteletype each use a unique vocabulary of alphabets. While none of these alphabet sets is exactly the same, they each share one characteristic. Within each set, each character is precisely the same number of bits as any other.

The two most common alphabet sets used are the five-level code commonly called "Baudot" (but more properly called "Murray"), and the seven-level code commonly called ASCII, which is also represented as an eight-level scheme in some circles.

Having established that, the next problem is how to send these codes along a radio circuit. The most direct means would be to key a CW transmitter directly with the TTY pulses. The result is often called "ON-OFF" keyed RTTY. ON-OFF keying was, in fact, the earliest method used to transmit TTY over the air. Advantages are related to simplicity in transmitting: merely hooking the teleprinter to the key jack. Receiving is also easy, with simple demodulation of a single tone. Disadvantages relate primarily to interference susceptibility and fading. A nearby CW signal can wipe out an ON-OFF RTTY station, and fading can remove letters or words.

A better way to send RTTY is by presenting a constant signal for the MARK, or resting, state and changing it in some way for the SPACE, or signaling, state. Changes may be introduced in amplitude, frequency, or by a superimposed modulating waveform. Direct amplitude modulation with the RTTY signal approximates ON-OFF keying, with all of its attendant flaws. Some fancy forms of modulation will be discussed at the end of this column, but the two most-used ham techniques are FSK and AFSK.

FSK

In FSK or frequency shift keying, a carrier is shifted in frequency to correspond to the MARK and SPACE frequencies. Figure 1 (b) diagrams this nicely. Like those that follow, this is a redundant system. That is, information is obtainable by looking at either MARK or SPACE, even in the absence of the other one. Remember that in ON-OFF keying, if you lose the SPACE you have a steady MARK, and if you lose the MARK you have nothing! Transmission of FSK is accomplished by shifting the transmitter VFO in step with the RTTY signal, and reception by decoding either or both the MARK and SPACE. Done properly, this system is very immune to interference and, since fading normally affects only one of the MARK or SPACE frequencies at a time, proper use of the built-in redundancy makes fading no problem, either. The frequency shift involved may be anything from kilohertz to fractions of a hertz, which might be more properly called "phase shift." In amateur circles, the standard shift these days is 170 Hz, while for many years, a shift of 850 Hz reigned supreme.

AFSK

Unfortunately, FSK presumes very stable transmitters and receivers. The level of shift is less than 1 kHz, and drift in the VFO of any significant degree would be intolerable. Early VHF transmitters could not maintain this degree of stability. Use of an audio tone, shifted in frequency in a manner similar to FSK, became the standard on VHF. Take a look at Figure 1 (c). This AFSK is quite useful in its own right, and note that the MARK, which is the lower frequency in standard FSK, becomes the higher frequency in standard AFSK.

Now, some fancy stuff. What if I send a pulse during each 22 ms window which represents a bit at 45.45 baud Baudot speed? By changing the pulse's amplitude or position within the window, I could encode MARK and SPACE with a decodable system. Figure 1 (d) shows what I mean. Such Pulse Amplitude Modulation (PAM) or Pulse Position Modulation (PPM) is not used much in the amateur service, but it is neat, right?

Overall, these techniques remain the standards, whether at that fabled 45.45 baud Baudot, or even at superspeed packet. With experience, one can even begin to appreciate the subtleties which make a RY sound different from a CQ. When you begin to copy straight text by ear, though, tell me about it!

As always, I look forward to your comments, questions, and comments. On Delphi (username MARCWA3AJR), you will find the "RTTY Loop" index and at least the first in the series of "RTTY Loop" software collections in the Radio SIG's data library. I often check in there as well, so feel free to leave me messages there. Email can be sent on Delphi, as well as CompuServe (ppn 75036,2501), America Online (MarcWA3AJR), or via Internet (MarcWA3AJR@aol.com). 73

QRP

Number 13 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
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There seem to be a lot of people who feel the same way I do about the Ten-Tec Argosy. The amount of mail I received on the series about the Argosy tells me that we should take one more look at this surprising little rig.

The Argosy Revisited

First, I would like to thank all those who have sent me copies of the *Ham Radio* article I mentioned earlier. That article was written by Cornell Drentea WB3JZO, and appeared in the November 1986 issue of *Ham Radio*. The article, "Upgrading the Ten-Tec Argosy," is must reading if you own one of the first Argosys built by Ten-Tec. Also, the January issue of the *QRP Quarterly* has an excellent article by WB3JZO with updates from his *Ham Radio* piece.

Linear Amplifier Switching

Although the Argosy can produce only 50 watts of RF output, you can use this rig with an external amplifier; provided you have some means of controlling the T/R function of the amplifier. Ten-Tec used a small T/R module installed inside the rig. That module, model 1126, is no longer available but that's not a problem because you can roll your own with just a handful of parts. A small piece of perfboard would be ideal for this project. Figure 1 shows the complete T/R switch for an external amplifier.

Its operation is very simple. When the "T" voltage goes +12 during transmit, it charges the 33 mF capacitor. This turns on the switching transistor and pulls in the relay. The capacitor is discharged through the delay control. Any time the Argosy goes into transmit the relay will close. The contacts from the relay are routed to the "spare" phono jack on the rear apron.

The circuit board mounts on the side panel in the left rear corner. There are two mounting holes for the original board; they will work just fine for our home-brew circuit as well. The cable plug is there, too. The colors are violet, red, and yellow. This plug is hidden by the wire harness. Using an 0.100 center header, you can just plug it in. Of course, you have to wire your header correctly to mate with the rest of the circuit. This is the type of circuit I like. It's simple and oh so easy to get working.

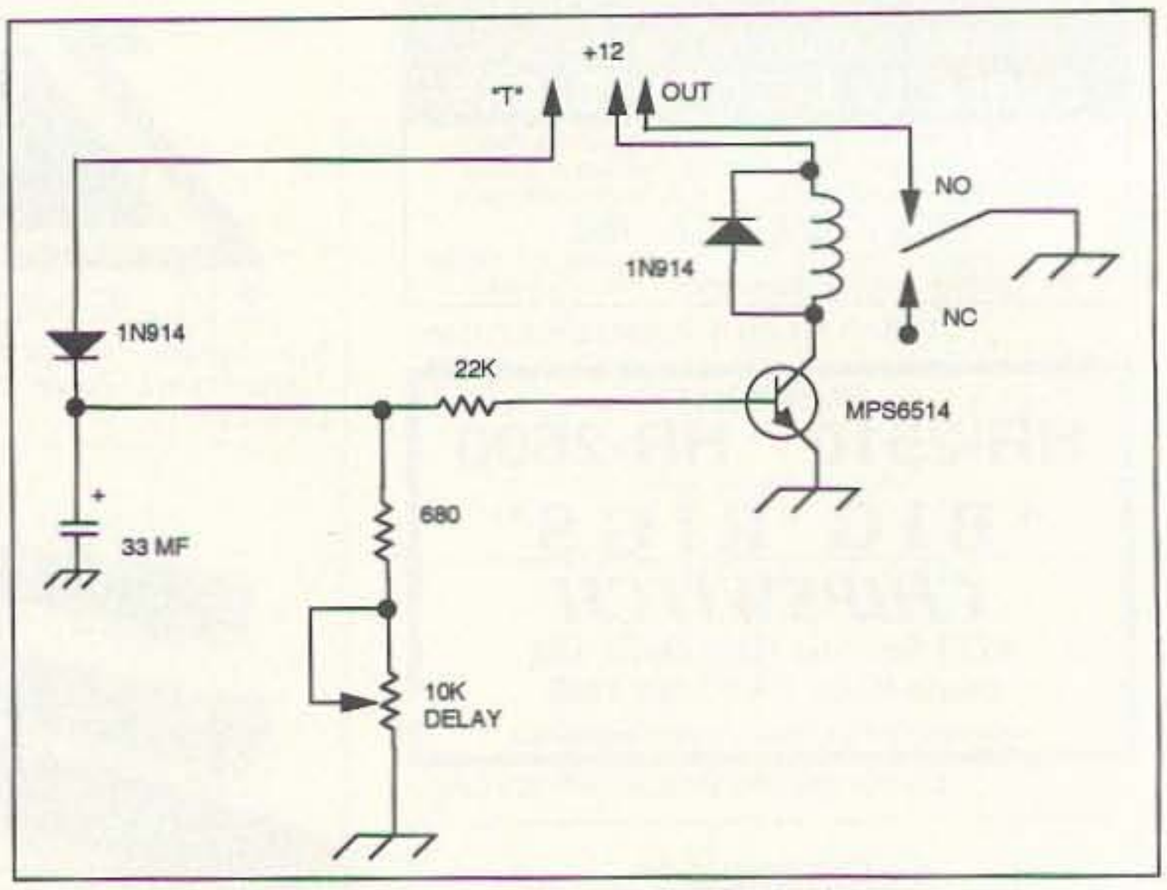

Figure 1. Amplifier T/R switching for the Argosy.

Improved RF Gain Control

While neither the Argosy nor the Argosy II came with an RF gain control, you can add your own. Ten-Tec's technical note TN2-525 is the official version of an RF gain control. If you use the values in the technical note, you'll end up with an RF gain control that functions over only 40 percent of its range. The solution is to insert a 10k resistor from the other end of the pot to ground. This expands the tuning range of the RF gain pot. The MC1350 IF amplifier is controlled by a very narrow voltage range in the rig. This "RF Gain" voltage is only 1.5 volts, the difference from 5.0 to 6.5 VDC applied to the MC1350. The new RF gain control should provide 5 to 6.5 volts to the junction of D9, D10 on the IF/AF board. Again, this modification is only for the Argosy. I don't know of any for the Argosy II, but I'm sure they're out there. Readers?

"If you're really into contests, or weak signal CW work, then you might want to check out this modification."

Selectable AGC Time Constants

Personally, I think the AGC works just fine in my Argosy II. But if you're really into contests, or weak signal CW work, then you might want to check out this modification.

By far, the easiest method of installing an AGC switch into the Argosy is to unsolder D9 from R26 on the IF/AF board (80785). A better method is to bring one side of R58 to a switch, with the other side of the switch grounded as shown in Figure 2. If you use a three-position switch, you'll end up with three AGC time constants: slow, fast and AGC off. Use a high quality capacitor for the AGC circuit. Tantalum or low leakage electrolytic capacitors are the best ones to use. The values shown provide a good comprise between CW and SSB time constants.

There's no place on the front of the Argosy to install such a switch. It's going to be a challenge to find a place for

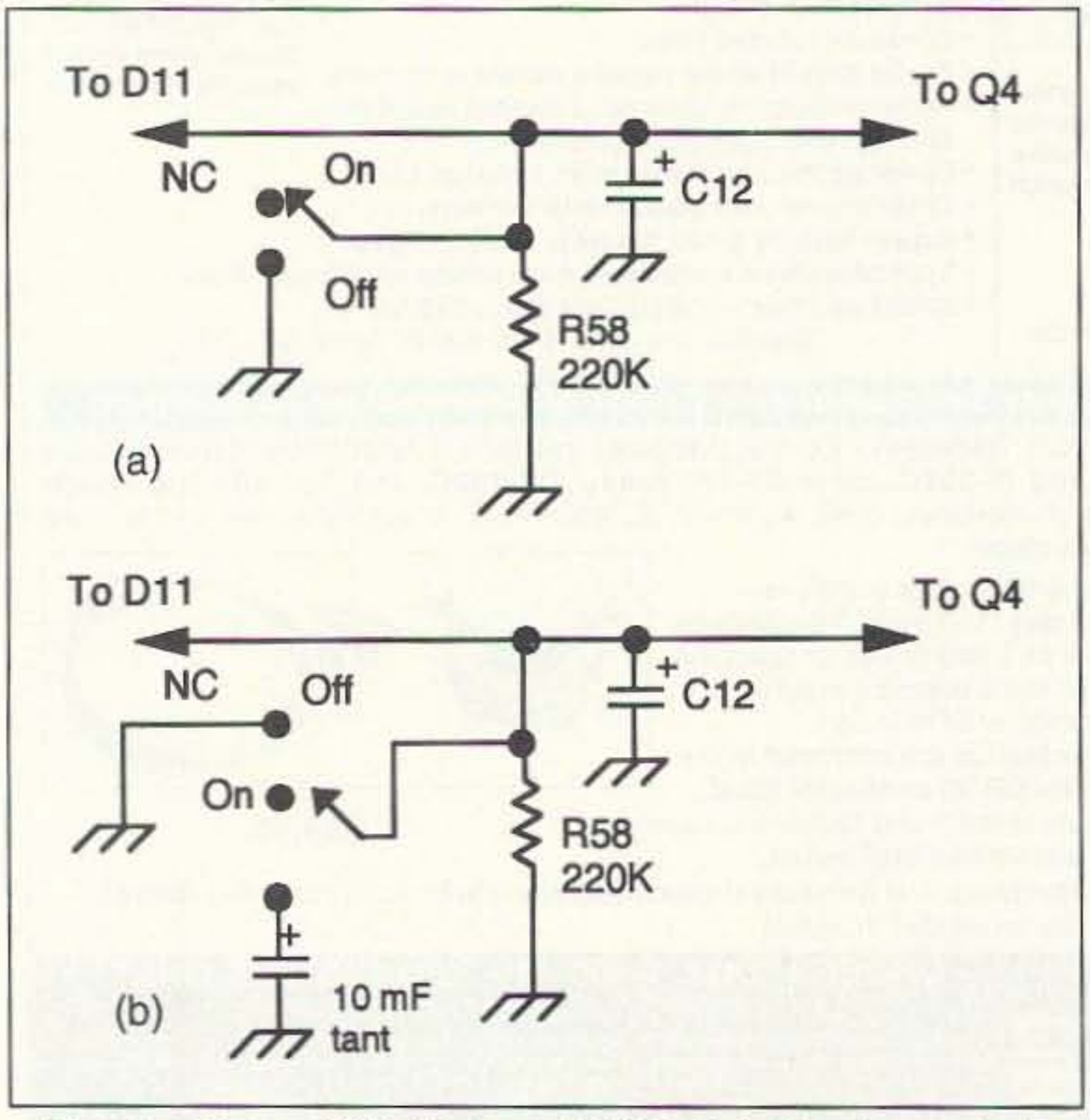

Figure 2. a) Simple AGC for the Argosy. b) ACG with fast/slow time constants.

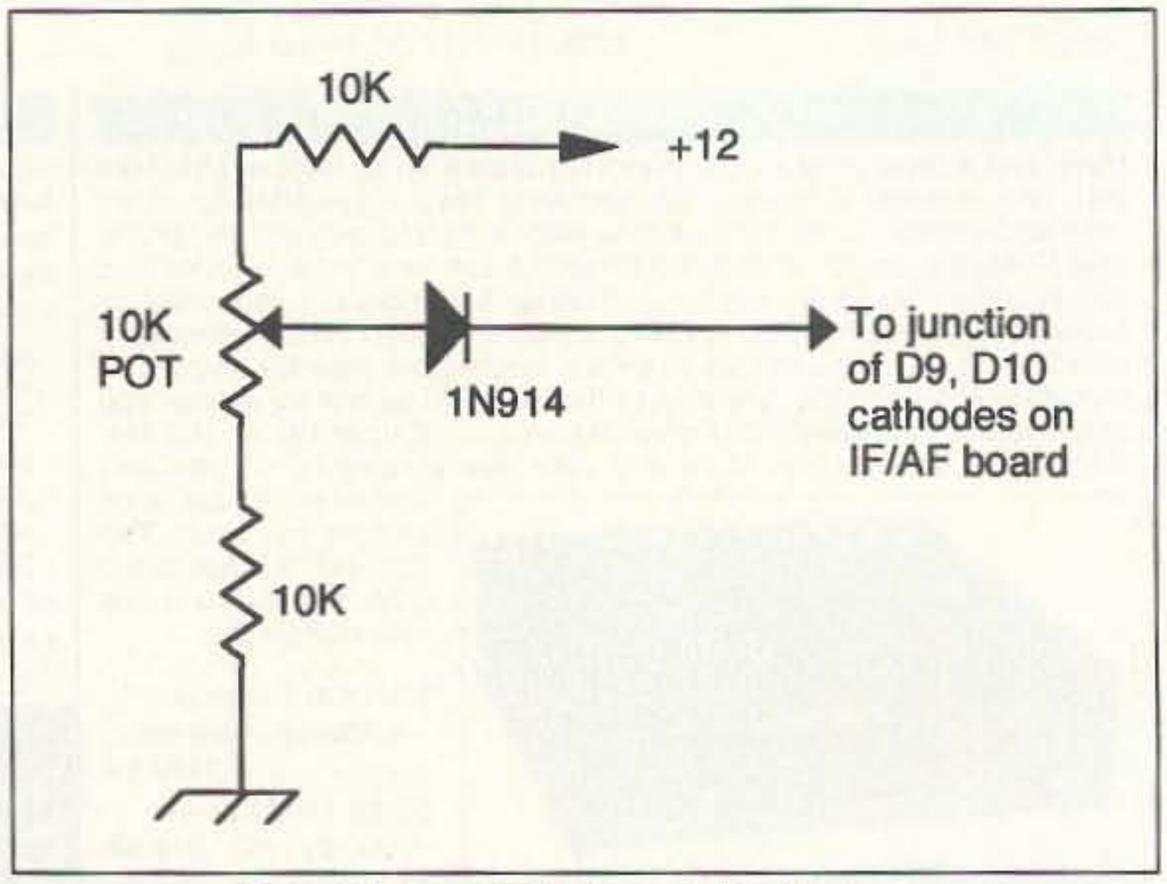

Figure 3. Improved RF gain control for the Argosy.

it—even the rear apron is getting kinda busy. A small toggle switch might fit if you do some forward thinking before you start drilling.

If you have not installed the RF gain control you can pass on turning off the AGC. But by wiring the noise blanker on all the time you can use the blanker's switch to select between two time constants. Again, you don't want to turn off the AGC unless you have installed the RF gain control.

Improved Noise Floor

This modification came from Cornell Drentea in his *Ham Radio* article. It's so simple I had to include it in this column.

The original Argosy has a very high noise floor. It's enough to make weak signals impossible to hear. The noise came from the BFO sidebands spilling over to the high gain audio amplifier. This "hiss" obscured signals below S3. The fix is simple: Change C34 from 0.01 to 0.1. This change will reduce the hiss to a point you'll easily hear without test equipment! Capacitor C34 is located on the IF/AF board.

Reduced Hum Pickup

This has always been a problem with Ten-Tec rigs. The power switch runs 110 AC through the main chassis. High gain stages can pick up any stray AC and pass it from one stage to the other. There are two fixes. Run the rig from a battery supply. Or, you can disconnect the AC control line from the power supply (internally, so the power switch inside the rig is dead) and use the main power switch on the supply to turn the rig on and off.

You might want to try shielding the power line inside the Argosy with aluminum foil. Copper mesh screen would be ideal, but that stuff is almost impossible to find anymore. Be sure you ground the shielding in several places to avoid ground loops.

"Before you start digging inside your Argosy, be sure you know what you're doing!"

Internal Keyer

If you don't have the T/R control board inside your Argosy you can use that space to install your favorite electronic keyer. All you need to do is add the proper three-wire jack for the key paddles, and of course the keyer speed control. The popular Curtis keyer on a chip would be ideal. Several PC boards have been designed using this chip. Check available QRP books for suggested Curtis keyer PC boards.

Several of the modifications for the Argosy require the use of a dual concentric pot. Mouser electronics carries some of the more common values. Digi-Key also carries some dual pots. The only problem is finding a set of matching knobs. You can use a set of knobs from Ten-Tec. They used dual controls on both the Corsair and the Argonaut II, but they won't match the ones used on the Argosy. Since Ten-Tec makes their own knobs, along with other stamped out pieces parts, you'll never find an exact match that fits.

Standby Current

A higher-than-normal receive current may be traced to an improperly adjusted final PA bias. Although it's an adjustment that should not be touched, it's relatively painless to reset. All you need is an ammeter in series with the VCC line to the PA. Adjust trimmer R1 on the PA board until the current is 30 mA. The trimmer is kinda hard to reach, so measure the receive current first before you attempt this adjustment. More than likely, you'll find the receive current to be within specifications. If not, look at the bias adjustment.

A Word of Caution

Before you start digging inside your Argosy, be sure you know what you're doing! Some of the modifications presented here and in the *Ham Radio* article require the complete teardown of the rig. If you don't feel secure about such projects, then it's best to pass them by. If you want to try some of these modifications, install only one at a time. Test the rig for proper operation before you start on the second modification. Test again and then move on until you're done modifying the rig. I can't say if all the modifications presented here work—I haven't done too many of them on my Argosy II.

Better-Sounding Argonaut II Audio

I found that you can really make the Argonaut II sound much better just by using an external speaker. The one inside the rig is way too tinny-sounding for me. I use a Minus speaker from Radio Shack. The black metal one is just about the right height and style to match the Argonaut II. It's too bad Ten-Tec did not offer an external speaker for the Argonaut II/Delta II. 73

Number 14 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
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Using the "Spectra Plus" Spectrum Analyzer Software

A spectrum analyzer is a device that will permit you to look at a signal in terms of amplitude vs. frequency, rather than the normal oscilloscope amplitude vs. time presentation. All signals can be depicted as a fundamental sine wave, plus a number of additive sine and cosine harmonics. The particular shape of any given signal is set by the particular harmonics and phases present. It is possible to analyze the general spectrum by looking at the waveform, but for particular and accurate information you need to use a spectrum analyzer.

Professional spectrum analyzer instruments are costly, and beyond the financial capabilities of most amateur radio operators. Some people have been successful in building their own spectrum analyzers, but even these instruments get pricey when capability goes up (especially frequency resolution and accuracy of the frequency display).

Now you can use IBM-compatible computers to do audio spectrum analysis of signals, including signals received off the air . . . if you have a sound board compatible with at least the 8-bit SoundBlaster board. The sound board serves as an analog-to-digital converter to translate the analog audio signal into a series of digital data that can be digested by the computer.

The spectrum analysis software is "Spectra Plus Ver. 2.0" by Pioneer Hill Software, 24460 Mason Road, Poulsbo WA 98370; (206) 697-3472. Hardware requirements are rather modest by today's standards: a 386 or later IBM-compatible machine with 2 Mbyte of memory minimum, or 4 Mbytes for recording; a VGA monitor capable of at least 16 colors (which is about all of them, except for monochrome), 1 Mbyte (plus space for audio files, which can be large) hard disk space available; Windows software; a sound card (16-bit recommended, but 8-bit will work); and a mouse or trackball.

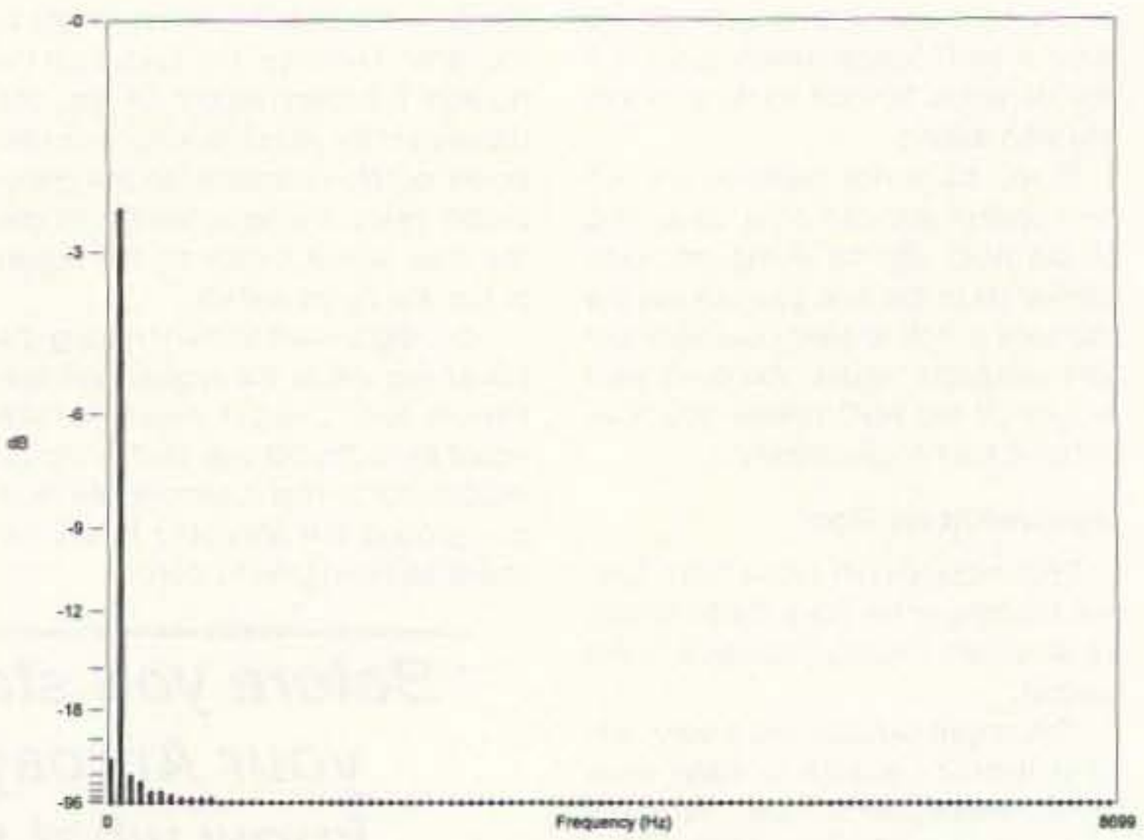

Figure 1. 100 Hz sine wave.

There are three modes and four functions: Real-Time, Recorder and Post-Processing. The Real-Time mode accepts digitized audio directly from the sound card, and then analyzes the waveform and displays the results. Although the program can be run indefinitely, the raw audio data cannot be saved in a disk file.

The Recorder mode digitizes the input audio signal, and stores it on the hard drive in a .WAV file (the standard audio file format). These files can later be analyzed in the Post-Processing mode or played back through an audio system. My wife is a musical composition student; she can use the SoundBlaster card in our computer to digitize sounds and use them as a synthesizer. The "Spectra Plus" can control the process, as well as analyze the spectra of the waveform.

The Post-Processing mode processes recorded audio data, whether from the record mode above or from other sources. It looks for a .WAV file. More of the functions of the software work with this mode than with Recorder or Real-Time.

The functions of "Spectra Plus" include Time Series, Spectrum, Spectrogram, and 3-D Surface Plot. The time series is the ordinary amplitude vs. time display that one sees on an oscilloscope. In this mode, the digitized audio is seen in the Volts/Time display on the computer screen, and it can be printed.

The Spectrum function analyzes the audio signal, and then produces an amplitude (volts) vs. frequency display (examples given below).

The Spectrogram produces a display that has frequency spectrum along the vertical axis, and time along the horizontal axis. This type of display is useful for seeing the time history of the spectrum, i.e. how the frequency content of a waveform changes over time. This mode can be used for analysis of "Whistlers," i.e. those low frequency ELF radio signals emitted by distant lightning strikes. Note well, however, that this mode works well on the screen, and prints well on a color printer, but its printout on my Laserjet III is pukey.

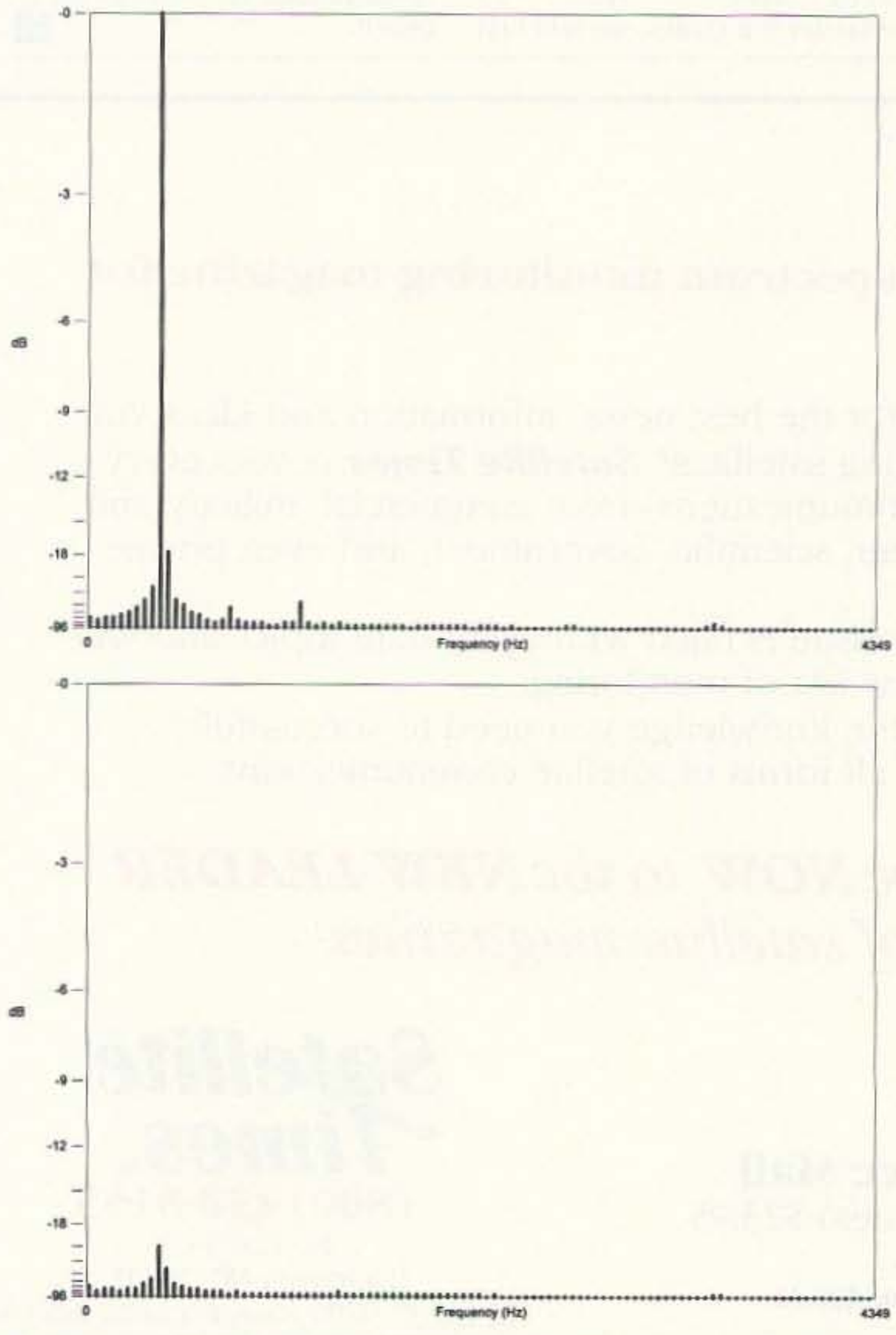

Figure 2. A) CW station emitting dashes. B) Apparently, a CW backwave as it appeared between transmissions.

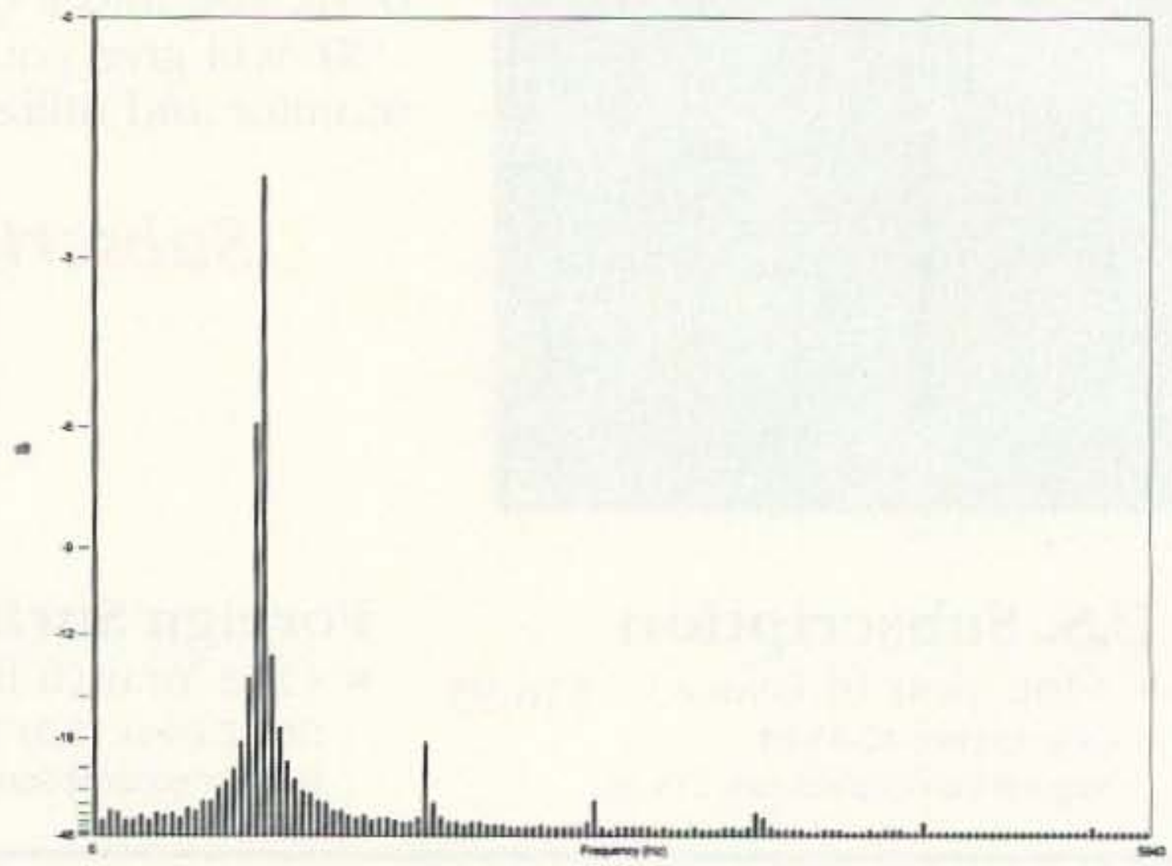

Figure 3. AM signal modulated with 1000 Hz.

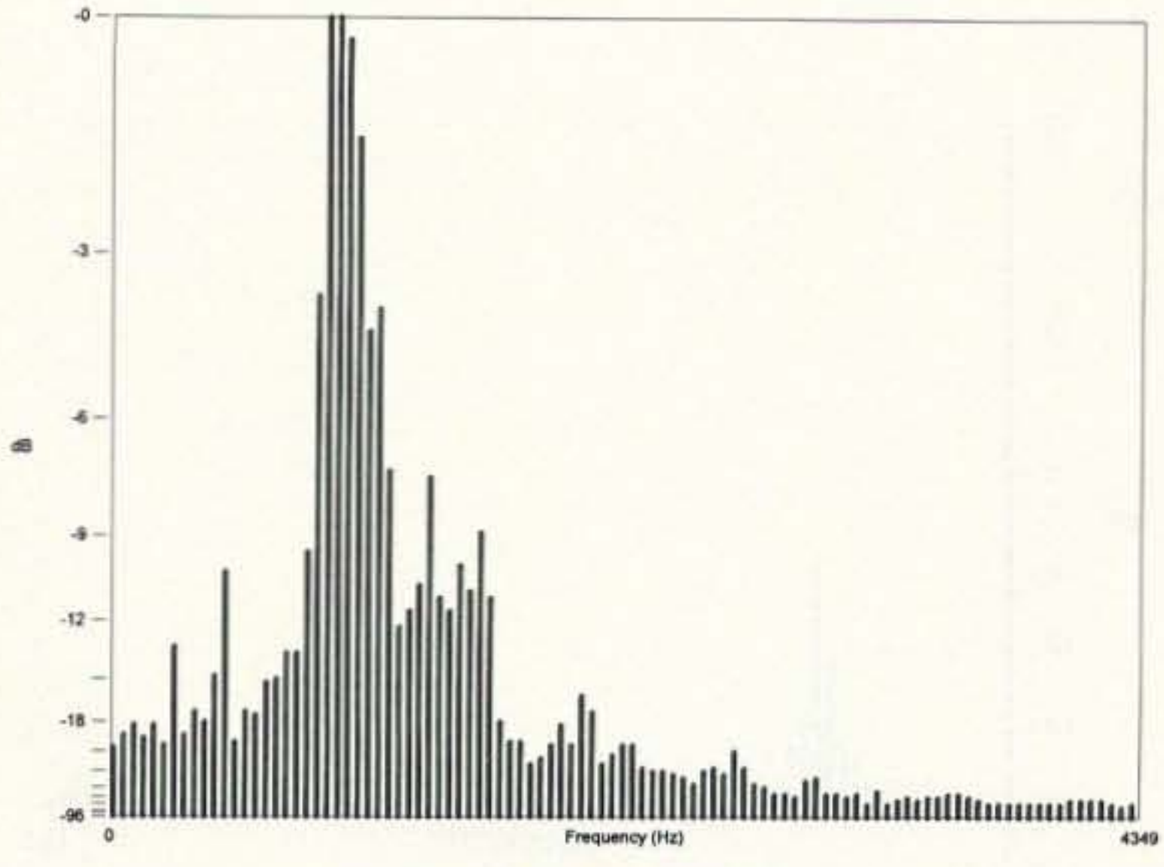

Figure 4. 40m SSB motor-mouth signal.

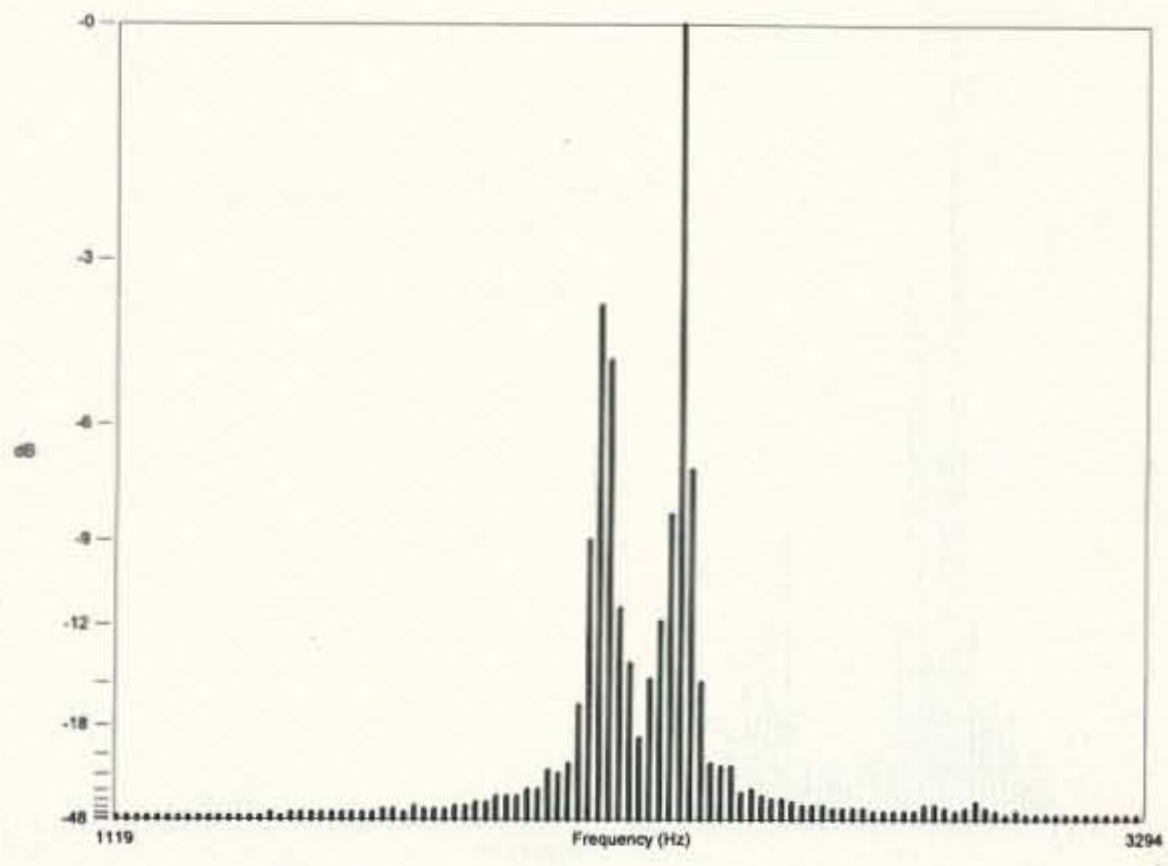

Figure 5. RTTY signal with 200 Hz spacing.

The 3-D surface plot displays a three-dimensional perspective of the spectrum over time. It appears to contain amplitude information, frequency information and time information.

"Spectra Plus" Display Examples

Figure 1 shows a spectrum of a sine wave from a signal generator. Note the single frequency spike (which you would expect from a pure sine wave), plus some noise along the baseline. This sample was a 100 Hz sine wave digitized in 16-bit mode at a rate of 44 kHz using my SoundBlaster Pro-16 sound card. The signal source was my bench function generator. Note that the amplitude scale along the vertical axis is normalized to make the large spike 0 dB, and all other features as negative dB. The frequency calibration along the horizontal axis is printed out to nearly 8,700 Hz, and shows no additional harmonics.

Figure 2A shows a CW station transmitting a series of dashes. This signal was recorded off the air using a communications receiver with an 2.7 kHz SSB filter. Note that the main signal is a large spike (as expected, with a series of sidelobes along the baseline, plus what appear to be harmonics. Note that the signal does not have zero bandwidth, which explains why a filter with 100 or 250 Hz (or so) is used for CW. Figure 2B shows the same station a few moments later with the carrier turned off. It appears that it is emitting a rather serious backwave, i.e. a signal that passes through the final amplifier even when the rig is ostensibly not transmitting. That would be good info to know if my interpretation of the waveform is correct.

The display shown in Figure 3 is an AM signal from my signal generator. The sig-gen was tuned to an AM BCB frequency, and was modulated with its internal 1,000 Hz sine wave oscillator (which is a tad distorted). Note that the sidebands extend out quite a distance. I suspect the distance the sidebands extend from the carrier is a result of the clipped positive peak I've noted on the modulated signal, and also on the raw modulating 1,000 Hz sine wave.

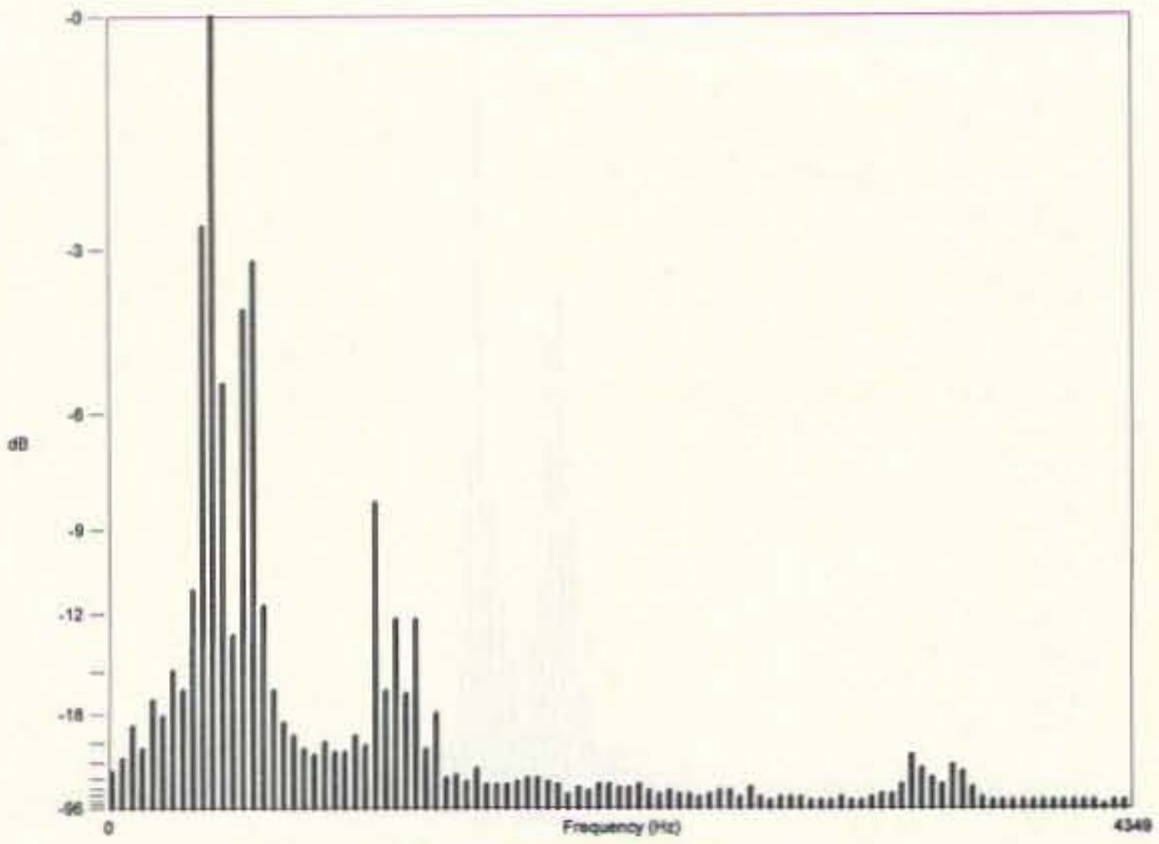

Figure 6. AMTOR signal.

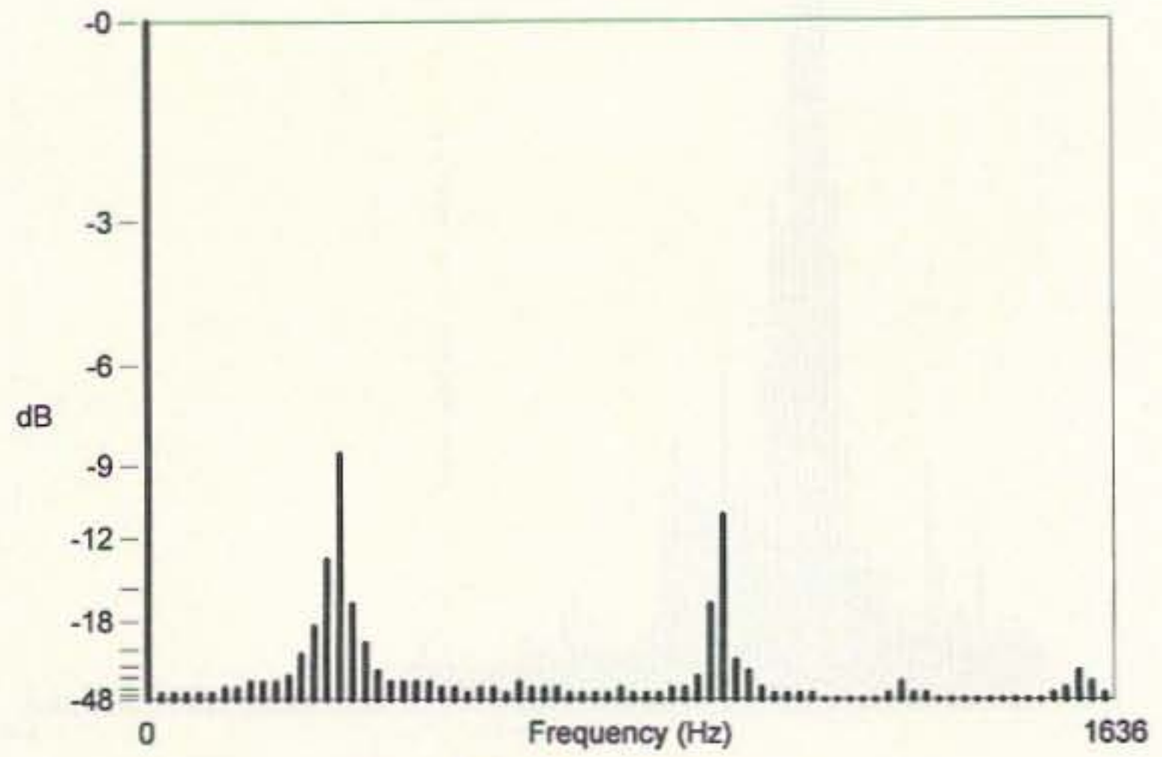

Figure 7. Space telemetry signal.

Figure 4 is a signal I wish I hadn't heard. It's a 40m SSB signal, along with other stuff that was interfering with the signal. The reason why I wish I hadn't heard it is that the source was one of those jerks who argue with everybody, are mean-spirited, and use foul language that was once illegal on the air. The QSO was a real food fight amongst adult juveniles who need to be gotten off the air.

Figure 5 is from a sample .WAV file supplied with the software. It is of a radioteletype (RTTY) signal with 200 Hz mark-space separation. Note the two-spiked appearance of the waveform, and that both spikes have their own sidelobes.

Figure 6 is the spectrum of an AMTOR signal that I recorded off the 20m band, while Figure 7 is a space telemetry signal that is among the "Spectra Plus" samples.

The "Spectra Plus Ver. 2.00" software is a useful adjunct to ham radio operations for those who have a Windows-compatible computer. It's also a useful thing for shortwave listeners to have available as it will, with a little experience, help them identify some of the non-voice, non-CW signals that are frequently heard on the air.

Low-Noise Preamplifiers

A lot of readers responded to my offer of the MAR-1 RF preamplifier kit. The MAR-1 kit is spec'd from near-DC to 1,000 MHz, with gain of 15 to 18 dB, 50 ohm input and output impedances, and a noise factor of 5 dB. That kit sells for $10 postpaid. I now have the same printed circuit board, plus a MAR-6 device and two chip capacitors for $14.95. The MAR-6 is spec'd at near-DC to 2,000 MHz, gains from 11 to 20 dB (depending on frequency), and a noise figure of 2.8. Anyone wanting one of these kits can contact me at P.O. Box 1099, Falls Church VA 22041. 73

Mini-Joystick Scanning

Shift your tuning into high gear!

by Shane P. Brady WB2WPM

Contesting has become very predominant in the WB2WPM shack in the past few years. While never going for the win, I usually try to spend at least 12 to 15 hours on a major contest. My modest station is composed of a Kenwood TS-440 interfaced with my PC.

There are two predominant programs I use during contests: KE1A's CT, and N3EQF's LOG-EQF. Both of these admirable programs now support the Kenwood radios—finally! While this allowed me to jump bands and have the programs follow along, giving me exact frequencies on my logs, I still had to manually tune the radio. Not having stacked monobanders on each band and a kW output, I had to rely on the search-and-pounce mode of operation. Trying to control a frequency with 100 watts and the ever-sought-after rare "WB2" prefix is difficult, to say the least, in most circumstances.

At the end of the contests I found myself with severe "contester's elbow." This dreaded ailment is caused by entering calls on the keyboard, then reaching up and tuning the radio for a new station. As I would reach up for the tuning knob my elbow would hit the operating table. While not a problem for day-to-day activities, over a contest's duration this may result in hundreds upon hundreds of impacts. I have operated with an elbow pad which has helped a little.

The Joystick

What I needed was a method of tuning that would not require my hands to ever leave the keyboard. From my Commodore days I remembered a small self-stick mini-joystick designed for use with the GEOS programs. Made by Suncom, this Icontroller design is small and is made to mount directly to a keyboard. With one of these mounted on my keyboard I should be able to tune up and down without reaching for the radio.

Looking at the Kenwood manual, the mike connector has output for up-and-down tuning, and of course keying the transmitter. I located a source (Tenex Computer Express, P.O. Box 6578, South Bend IN 46660-6578; 1-800-786-6781; $17.95 plus S&H) for the joystick and ordered one.

Having seen them before, I knew it came with a small coiled cord that would not be long enough to reach the rig; I was going to need an extension cord. The joystick comes with the same 9-pin connector used by all those long-forgotten Atri joysticks. While waiting for my purchase to arrive I bought an original Atri joystick for 25 cents at a hamfest. If you are unable to find an old joystick to scavenge the cord and connector from, Radio Shack sells them.

The Connections

After I received the new joystick, the next step was to determine which wires went to what joystick action. I cut the old Atri control stick off and discarded it. With the remaining wire I stripped back the insulation and plugged my extension cord into the new mini-joystick. From the *Commodore Users' Guide* I located the pinouts for the connector; pin 8 is ground. Using an ohmmeter made it quick to determine the other wires needed. The joystick was going to be mounted upside down from its intended use. Keeping this in mind, on my particular cable the wire colors were as follows in relationship to joystick movement:

Ground	Black
Right	Green
Left	Brown
Up	Blue
Down	White
Fire	Orange

In the shack I use a boom mike and foot

Continued on page 67

Photo A. WB2WPM's joystick-controlled contesting station.

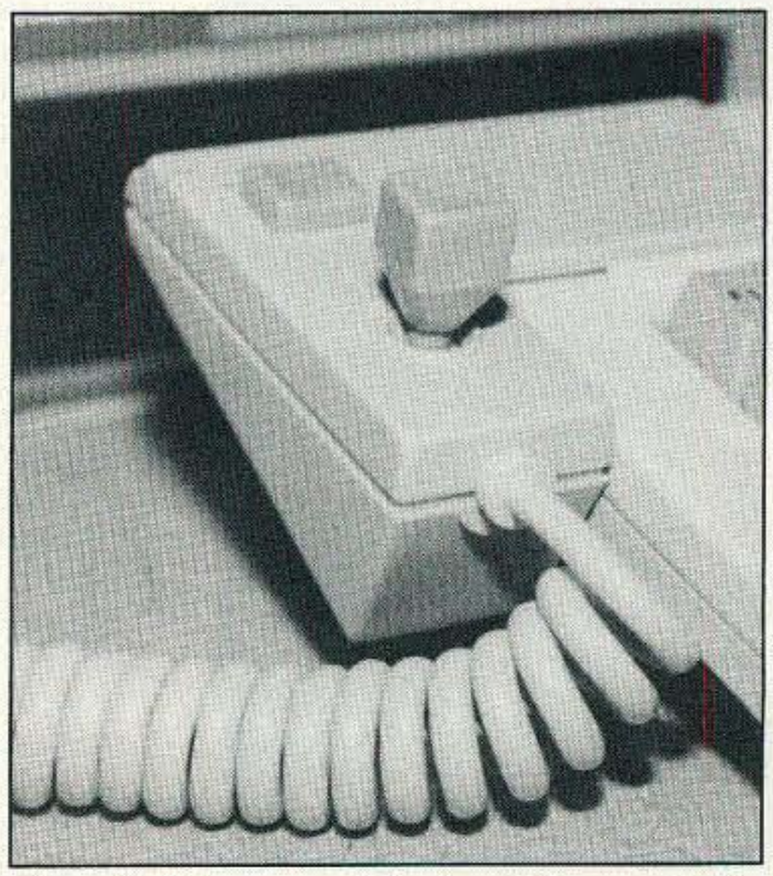

Photo B. Close-up of the joystick, mounted to the keyboard.

Number 16 on your Feedback card

HAMS WITH CLASS

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Instructor's Workshop

Sadly, this was the first time in eight years that I was forced to miss going to the Dayton Hamvention. Two weeks prior to the weekend that I look forward to all year, I found out that I had to undergo back surgery to alleviate the excruciating pain of a herniated disc and a sciatic nerve problem. After months of preparation for the two forums that I do at Dayton each year, I was devastated. Of course, it's at times like this that you learn how wonderful it is to be able to rely on good friends to come to the rescue.

Bill Pasternak WA6ITF is an editor of *Westlink Report*, and has been a dear friend of mine for many years. He immediately sprang into action, along with forums director Ron Moorefield W8ILC, to take care of my forums and to make me feel as though I were still participating in the weekend. No small task, but they pulled it off!

The very talented Bob Grove WA4PYQ, publisher of *Monitoring Times*, agreed to co-moderate the Instructor's Workshop with Bill. With these two very capable men running the forum and with the excellent speakers I had lined up, I knew it had to be a big success.

Photo A. Bob Grove WA4PYQ, co-moderator of the Instructor's Forum.

Bill had dispatched Henry Feinberg K2SSQ from AT&T to my home a few days before my surgery in order to videotape my introduction to my forums. On Friday, April 29, the Instructor's Workshop opened with a taped greeting from me. Since the entire event was being videotaped to send to me by Joe Eisenberg WAØWRI, I can't tell you what a thrill it was for me to watch this later at home. This forum is an important one to me because the audience consists of very special people. These are the folks who are using amateur radio in the classroom, teaching radio license courses, or who come to hear new ideas for recruiting people. It's the group that helps to keep amateur radio growing.

Bob Grove spoke first. He announced that he'd be publishing a new magazine called *Satellite Times*. It will include all aspects of satellite information, including amateur radio, weather, TV communications, and lots more. Bob spoke about using shortwave in the classroom. This eloquent speaker had been a high school science teacher for 16 years and is well aware of the advantages of bringing scanners and other radios into the classroom. He pointed out that many hams first got exposed to radio by listening to radio demonstrations in school. He explained the differences between broadcast and utilities and defined how they can both enhance and enrich classroom activities.

In foreign language studies, students can hear the actual language being spoken. A social studies lesson can come to life as the class listens to cultural programs on the radio which project an image of a specific country to the rest of the world. These programs describe the history, government, present state, arts, music and news from various countries in the world. Bob described how interesting it can be to listen to programs like the BBC which announces news as it is breaking. He referred to Radio Moscow and made note that propaganda can be fascinating to listen to in a classroom setting.

Using VHF/UHF scanners with kids helps them learn about what is going on around them. Listening to police calls, ambulance runs, and emergency teams of all kinds rendering medical assistance to victims can provide tremendous insight to students. Imagine the lessons that could have been taught with the use of a radio in a classroom during the L.A. earthquakes and the clean-up and rescues that followed.

Bob ended his excellent presentation by projecting that we're at a crossroads in communications and about to take an enormous leap skyward in the next few decades. A whole new world of satellite communications is about to open. Just think of the possibilities in a classroom!

My co-net control on the CQ All Schools Net, Gordon West WB6NOA, was next up to speak. Gordon's Radio School has been producing license materials and study guides for many years. Gordon is a good example of how an enthusiastic instructor is the key to the success of a radio program in a school setting. He stressed the importance of handing out lots of "stuff" for the kids to touch and look at. Having the class identify a bag filled with various electronics components is a good idea.

Gordon ended with his famous "glowing pickle" demonstration. Even though he cautioned that safety is always the first consideration, I could see on the videotape that the entire first row cleared out as he plugged into 110V to start the current going through the soon-to-be-exploding pickle. Be sure to join Gordon and the rest of our nationwide school net this fall for more good ideas to use in the classroom. We'll start out on 28.303 MHz at 12:30 EST on Tuesdays and Thursdays. If nothing is heard, we'll QSY to 21.303 MHz.

My other net control on the school net is Jim Wilmerding N4MDC who discussed SAREX in the classroom. Jim gets a special thank you from me for converting the tapes of both my forums to VHS format. His presentation was superb, as usual. As a school administrator himself, he addressed the popular topic of how to talk to administrators when you want to get a school radio program started. He wisely stressed the importance of going in prepared, making an exciting presentation, and telling the principal what the children and the school will gain from the radio class.

As hams and as educators we all know the value of ham radio in the classroom, but be sure that the school administrator knows how it will enhance the existing school curricula. He also described his experience with the SAREX program at his school. Jim emphasized the importance of being flexible and having patience when you get involved with making space shuttle contacts. Of course, those of us who have done it all agree it's worth the effort. Jim will be assuming a new administrative position in Rockland, Maine, this fall. You'll be hearing more about him and his good works with radio and education in my columns.

Vicki Gigante KA3PVS is in charge of shuttle retransmissions at the Goddard Space Flight Center. Vicki made the point that today we only see the shuttle on TV when there's a problem or perhaps when there is a spacewalk taking place. She goes into schools to give kids the opportunity of sharing in the excitement of the space program via amateur radio. The amateur radio club at Goddard gives out scanners to schools so they can put it on the PA system for a launch or landing.

She accomplishes two things by

Photo B. Jim Wilmerding N4MDC (left) and Bill Pasternak WA6ITF (right).

going into different schools. First, she gets to demonstrate amateur radio to the children. Astronaut Ron Parise WA4SIR is a member of the Goddard ARC. He sometimes joins Vicki in the demo part of her visit and speaks with the students on the radio. Second, she is exposing kids to some of the more fascinating aspects of space travel and communications. The frequencies for retransmission are 3860 kHz, 7185, 14295, 21395, 28650 and on 2 meters 147.45 in the local area.

Bill WA6ITF described how he conceived of the idea of the Young Ham of The Year Award in 1986 for children under the age of 18. Burt Hicks, publisher of the *Westlink Report*, and Chip Margelli from Yaesu both support the effort and co-sponsor the award every year. Bill stressed that the qualifications they're looking for have nothing to do with how young a child is when he or she got licensed. They're interested in children who use amateur radio to make a contribution to the hobby, to the community, or to their school.

In 1990, the young lady who won the award was Mary Alestra KB2IGG, a 12-year-old from my ham radio program. Mary is everything we'd like a ham radio operator to be. I was so excited when she won the award! At Dayton, Bill showed the video of Mary accepting the award four years ago, highlighting her incredible speech. Be sure to nominate a deserving youngster, if you know one, for 1995.

Bill then introduced Cathy Gilliland KBØFDU, age 16, who is the narrator of a new video, "This Is Amateur Radio," being produced for young teens. Cathy takes you on an on-screen guide to amateur radio, as seen through the eyes of a teen-ager. Bill hopes to distribute the video to public schools across the country.

Cynthia Wall KB7ITT was the last speaker at the forum. She is the author of a series of adventure books seen through the eyes of youngsters. The Great Northwest is featured in her books, along with amateur radio. These books make a wonderful addition to any classroom, or to any child's collection.

Cynthia is very concerned about making children aware of safety in the wilderness. She goes into schools and talks about the difference that possession of a radio would make during disasters such as the Mt. Hood incident. The books are all problem-solving books which teach kids how to think for themselves. The heroes solve their own problems. We can look forward to a new book coming out in August about the great whales.

I'll always be grateful to Bill and Bob for doing such a professional job with the Instructor's forum. Anyone who missed it this year really missed some exceptional presentations. I hope we can all meet there next year at Dayton. 73

Mini-Joystick Scanning

Continued from page 65

switch. On the Kenwood mike connector I only had the audio going into the connector. This left lots of room to route my new cable into the connector. I wanted to be able to disconnect the joystick from the radio without disconnecting my boom mike, so I wired a 5-pin DIN plug right at the connector.

There were only three functions I needed to connect up to the radio: scan up, scan down, and the PTT. (After all, why let that "fire" button on the joystick go to waste?) In wiring the connector, I decided that the up and right (blue and green) would be the joystick motion for scanning up. These both went to pin 4 of the mike connector. The down and left action (white and brown) would control the scan down function; these were soldiered to pin 3 of the mike connector. The last two connections were the ground (black) going to pin 8, and the fire/PTT being connected to pin 2.

After double-checking all wiring with an ohmmeter to assure myself I had the proper orientation of joystick movement, it was time to test it out. As you can see from Photo B, I have actually mounted the joystick upside down on the upper-left side of the keyboard. There is just enough room on my board to position the joystick with its self-stick backing.

Results

Everything worked out better than expected. On the TS-440 the scan rate is a bit on the slow side, just right for contesting! I have found that I have good control over tuning with just a little pressure from my little finger on the stick. And, if I'm so inclined to, I can use the fire button to key up the transmitter.

The last contest went off flawlessly, and I didn't succumb to the dreaded contester's elbow. This has worked out so well, I might pick up some more of these joysticks, just to have on hand for projects down the road. After all, it is a strain to reach up for that rotor control . . . ! 73

Number 17 on your Feedback card

PACKET & COMPUTERS

Digital Amateur Radio

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SMTP—The Right Way to do Mail

For the past several months this column has focused on TCP/IP in general and JNOS in particular. For those just tuning in, TCP/IP means Transport Control Protocol/Internet Protocol. That mouthful is a suite of applications that handle communications for the Internet—you know, the "Information Superhighway." [As an aside, there is no such thing as the "Information Superhighway." The term is a political invention, and it makes me slightly ill just to hear people talk about it. It's more like a few interstates, some county roads, and a whole lot of side streets and driveways. This is not to imply that the Internet is without value; it is very valuable. The idea of the Information Superhighway is just political nonsense—the reality is much more complex. Well, enough editorial, let's get back to the real world.]

The Internet was developed by ARPA (Advanced Projects Research Agency—now DARPA, with the D for defense), in cooperation with academe and industry, as a way to promote cooperation in research and on government projects. The Internet project was not just the construction of the physical network to carry the signals, but also the development of the TCP/IP protocol suite. To simplify what is going on there: The TCP portion takes care of moving the data around; the IP portion takes care of packaging the data so it is useful and understood.

SMTP (Simple Mail Transfer Protocol) is the way the electronic mail is sent in the IP world. It is really a simple protocol; in fact, it uses English to send commands back and forth. You can actually send mail as if you were an SMTP server by using telnet (the IP remote login program) to connect to port 25 (IP services are associated with ports, also called sockets; each port provides a different service), and issue a few commands:

```
:telnet host.com 25
Trying...
Connected to host.com.
Escape character is '^]'.
220 host.com — Server ESMTP
(PMDF V4.3-7 #6563)
help
214- Available
214-
214- DATA, EHLO, EXPN, HE-
LO, HELP, MAIL FROM
214- NOOP, QUIT, RCPT TO,
RSET, SAML FROM
214- SEND FROM, SOML FROM,
TICK, VERB, VRFY
214- XADR, XSTA
214
```

You can see here that I connected to a host and issued the "help" command. Notice the numbers that preceed each line: The text is for humans, and the numbers (220, 214) let automated SMTP servers understand the messages with ambiguity.

OK, so why is SMTP so good? Let's take a look at how it works if you let your system do the work. First, how does "normal" packet mail work? I want to send a message to my friend Mike AA9FP, so I take these steps:

1. I connect to my local PBBS. Depending upon your QTH, this may be easier said than done. As we have discussed before, the LANs (Local Area Networks) in the packet world are generally (mostly) completely unmanaged. Hidden transmitters are everywhere, causing interference and often making staying connected a hit or miss proposition.

I should also point out that my beautiful new 486 machine is now doing the work of a dumb terminal, and probably talking to one of the 386SX machines so often seen as PBBSs. Something is wrong when your $3,500 hot rod is doing the work of a wheelbarrow.

2. While fervently hoping that I will not be disconnected, or make a typo, or get a phone call, or (you get the idea), I type my message. Generally the text reflects my anxiety about the situation (i.e.: it ain't no masterpiece.)

3. I go have a cold drink, and hope that I never have a desire to talk to Mike again.

OK, OK, so I am being dramatic. The point is, the current system causes a huge quantity of unnecessary traffic. It wastes the power of the local computers—even if they are just XTs or 286s, and it is not much fun.

With SMTP the digital ham radio hobby is much more relaxing. Here's how that same message gets sent:

1. I login (locally on my own machine) to my own mailbox.

JNOS (the TCP/IP program we have talked about in this column) provides a full-fledged PBBS which can be used as a personal mailbox or a full-blown PBBS with mail forwarding of the traditional kind. The login process is easy:

```
Trying 127.0.0.1:telnet...
Telnet session 1 connected to
Local BBS
JNOS (n1ewo-9)
Welcome to N1EWO [44.48.70.22]
login: n1ewo
Password:
[JNOS-1.10c-IHM$]
You have 1 message - 0 new.
Area: n1ewo Current msg# 1.
?,A,B,C,CONV,D,E,F,H,I,IH,IP,J,K,L,
M,N,NR,O,P,PI,R,S,T,U,V,W,X,Z >
```

2. The steps from here are very much like being connected to a "normal" PBBS, just much more relaxing.

One thing that I notice right away is how quickly the machine reacts (I am connected to my own machine and *not* over the air). I also cannot be dumped because of interfering stations. Another difference is addressing. Instead of the normal sort of AA9FP@WJ9U.#CIN.IN, I type:

```
Area: n1ewo >
sp Mike
Subject:
Hello!
```

Enter message. End with /EX or ^Z in first column (^A aborts):

Notice that I called him "Mike." This is because I have a file of aliases that allow me to use names that I understand and remember easily—just a nice convenience. The real difference, though, comes when I finish.

The delivery of SMTP mail is the revolutionary aspect. With the current system, mail is collected by a centralized PBBS then delivered as packages to various distribution points. It finds its way through the system to the destination PBBS and waits for the recipient to connect and check it. (It has become more common for individuals to run similar packages and get their mail directly.)

With SMTP, delivery can go one of two ways. If the recipient is local, the SMTP server (on your machine) will connect directly to the SMTP server on his machine and make the transfer—no third parties involved. It will do this in the background while you do other things, and will keep trying 'til you stop it. It is fun to send your first SMTP mail message and watch the process.

The second possibility is that an SMTP gateway would be used. If the recipient is too far from you to talk directly, a machine locally can be used as a gateway, and the mail will be routed to the destination. This can occur in a batch like the current system or one at a time. A gateway today would very likely resort to the current packet network for the hop in between, and an SMTP gateway on the other end would do the delivery.

Notice that there is no requirement for the recipient to connect anywhere but his own mailbox. This system has a flaw, though. It requires that the recipient's machine be available at all times, ready to receive mail. Not all of us can do that.

POP Goes the Email

The answer to this problem is POP (Post Office Protocol). With POP there is a server in a local area which receives mail for a particular ham—like a PBBS does today. But, instead of connecting to the PBBS and reading the messages, POP is a background batch process. When I start up my station, it checks the POP server for mail and transfers any it finds. All automagically—pretty neat.

OK, fine, but how do I do this?

Well, the first step is to get a copy of NOS (Network Operating System) or a variant. We have been using JNOS—my favorite. It is written by Johann (WG7J) and has reached its final "official" release version 1.10c. Johann is working on a Windows version which should be spectacular. You can get the latest version on the Internet by anonymous FTP to:

```
ftp.ece.orst.edu
in the directory:
/pub/ham/wg7j
the file is:
110exe.zip
```

It should also be available on many ham-radio-related BBSs. You may find earlier versions—these will get you started, but 1.10c has several new features worth having. You may also see releases with later numbers. These are the result of the large following of JNOS users who continue to improve the source code and add features (and bugs, sometimes).

Reprints of this column's discussion of running JNOS are available—call the magazine. We'll discuss more about JNOS in future months. 73 de N1EWO. 73

HOMING IN

Number 18 on your Feedback card

Radio Direction Finding

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Testing the Ramsey SlyFox

I love building electronic gear. Long ago, I lost count of the number of kits I have put together. It's too bad that today's new hams cannot learn electronics by equipping their stations and test benches with ambitious kits by Heath, Eico, and Realistic. Most of today's kits seem to be the "jingling bag of parts" variety, consisting of just a small circuit board and components, without enclosure.

Simple kits are still a good, inexpensive way to learn about electronics and construction techniques. If you need an unusual product that doesn't have enough mass appeal to justify an offshore production line, a kit may provide the most economical way to buy it.

Ramsey Electronics (793 Canning Parkway, Victor NY 14564) provides many such "niche market" items. Last year, the company began touting a series of kits for fans of VHF radio direction finding (RDF). The long-promised Ramsey SlyFox 2 meter transmitter is now available to RDF contesters. (We call ourselves foxhunters or T-hunters, hence the name.)

It's Unique

The SlyFox (Model FHT-1, $129.95) is a complete 2 meter transmitter with a built-in microprocessor-based timer and CW identifier. Hook it to a DC power source and antenna, select the mode and timing, and it's ready to serve as a target for your club's next hidden transmitter hunt. An optional voice memory module (Model FHID-1, $29.95) is also available.

I have spent the last several weeks evaluating the SlyFox. I constructed a kit and got it working. I also tested a SlyFox that was built and tuned up at the factory. The manual for both was revision 1.2, dated October 1993.

"Homing In" has previously described and reviewed a number of timer/ID "foxboxes" that connect to your existing VHF-FM transmitter or transceiver to make it into a hidden T. Ramsey is the first and only company to offer a complete one-box transmitter-IDer kit. The idea is good, because most handhelds and mobile rigs are not intended for the continuous-duty full-power transmitting mode demanded by long-distance T-hunts.

On the other hand, the FHT-1 does not have a frequency synthesizer. Changing the hunt frequency means replacing a soldered-in crystal. There is no provision for bringing out audio and push-to-talk control to drive an external transmitter, say, for a hunt on the 50 or 222 MHz bands.

The SlyFox comes with a crystal for 146.52 MHz. That frequency is not commonly used for T-hunting anywhere, to my knowledge. Putting a three-hour T-hunt on the national simplex frequency would not be met favorably in most cities. A better choice would have been 146.565 or 146.43 MHz. Several areas of the USA use one or the other of these channels for T-hunts.

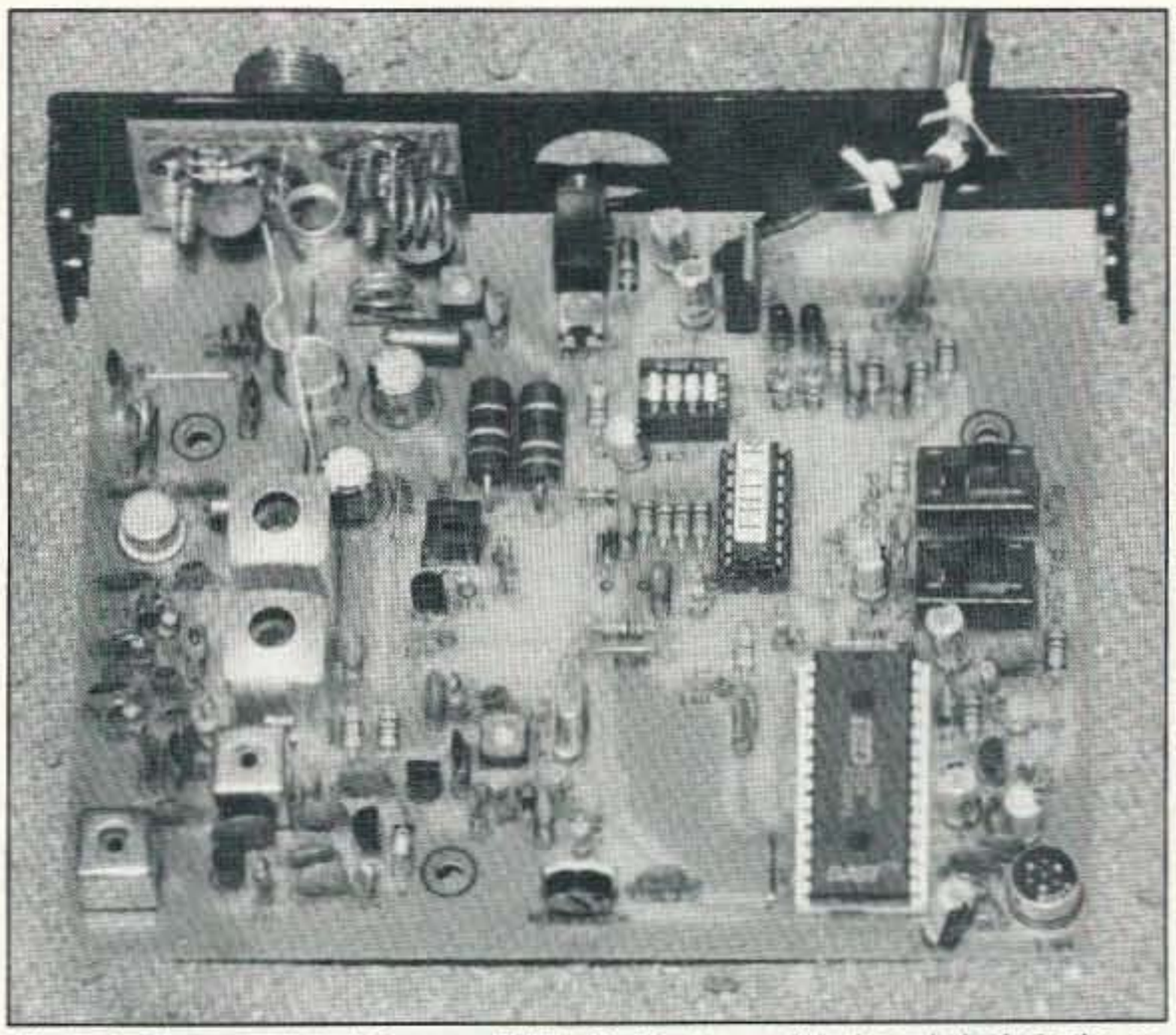

Photo A. The completed Ramsey FHT-1 SlyFox transmitter boards include the enclosure's end plate, which is mounted to the coax connector during assembly. Components for the optional FHID-1 voice ID kit are in the lower right corner of the main board. The three-conductor ribbon cable at upper right connects to paddles to program the CW IDer.

The crystal is a common parallel-resonant type for nine-times multiplication. Ramsey provides a complete description of its requirements. I ordered a rock for 146.565 MHz from a local supplier and it works fine.

The SlyFox has the same RF circuit as the Ramsey FT-146 2 meter transmitter. The crystal oscillator drives two tripler stages, a driver, and the final. The manual promises 5 to 6 watts RF output with a 13 to 14 volt DC supply, and at least 4 watts at 12.0 volts.

Ramsey's technician told me to expect 5.5 watts at 13.8 volts and over 4.5 watts at 12.0 volts from the factory-wired unit. But in my tests with two well-calibrated Bird Electronic Corporation Model 4431 wattmeters and a UHF dummy load, the most I measured was 4.6 watts at 13.8 volts and 3.45 watts at 12.0 volts. In the low-power mode, output was 920 milliwatts at 13.8 volts.

Not for Beginners

A VHF transmitter is not the best choice for one's first kit-building experience. Ramsey recognizes this, and states in the manual, "To be honest, we'd like to see first-time builders start out with an easier kit . . . but we are confident that you can construct the FHT-1 successfully if you follow this manual carefully and patiently."

Legend has it that in its heyday the Heath company hired men and women "off the street" to test-build Heathkits before they were released. If a non-technical person couldn't make the product work, it wasn't ready to sell. Such testing is not economically feasible today, so it is not surprising to see minor discrepancies in kit manuals. SlyFox had a few. For example, DIP switch positions in the mode tables are reversed from the switch configuration and the paddle dot-dash terminals are reversed in the pictorial. Soldering the center conductor of the coax connector is not called out until this terminal is in a corner and surrounded by other parts, making the task awkward.

But all in all, the assembly instructions are good. Many steps include information on the function of the part being installed, to help you understand how the unit works. Color code and other part identification data is given in every step.

Most parts fit on the 4-1/2" x 5-1/2" main circuit board (Photo A). There is tin-plated etch on one side, and the other side is clearly marked with component designators to aid assembly. The main board also has etch and markings for the optional voice unit parts.

The voice ID area of the board is shaded out in the Parts Finder drawing that you use to assemble the basic FHT-1, resulting in a couple of errors. One jumper needed in the basic FHT-1 is covered up in the drawing. On the other hand, the pictorial shows resistor R11, which is not used unless you add the FHID-1. This could confuse some builders.

A separate 1" x 1-3/4" circuit board holds the SO-239 output connector and a two-section output low-pass filter. Parts on the filter board mount to the etch side, surface-mount style. This board "stands up" at the edge of the main board, held in place with one capacitor lead and two small wires (Photo B). Once constructed, the two-board assembly is very tricky to re-

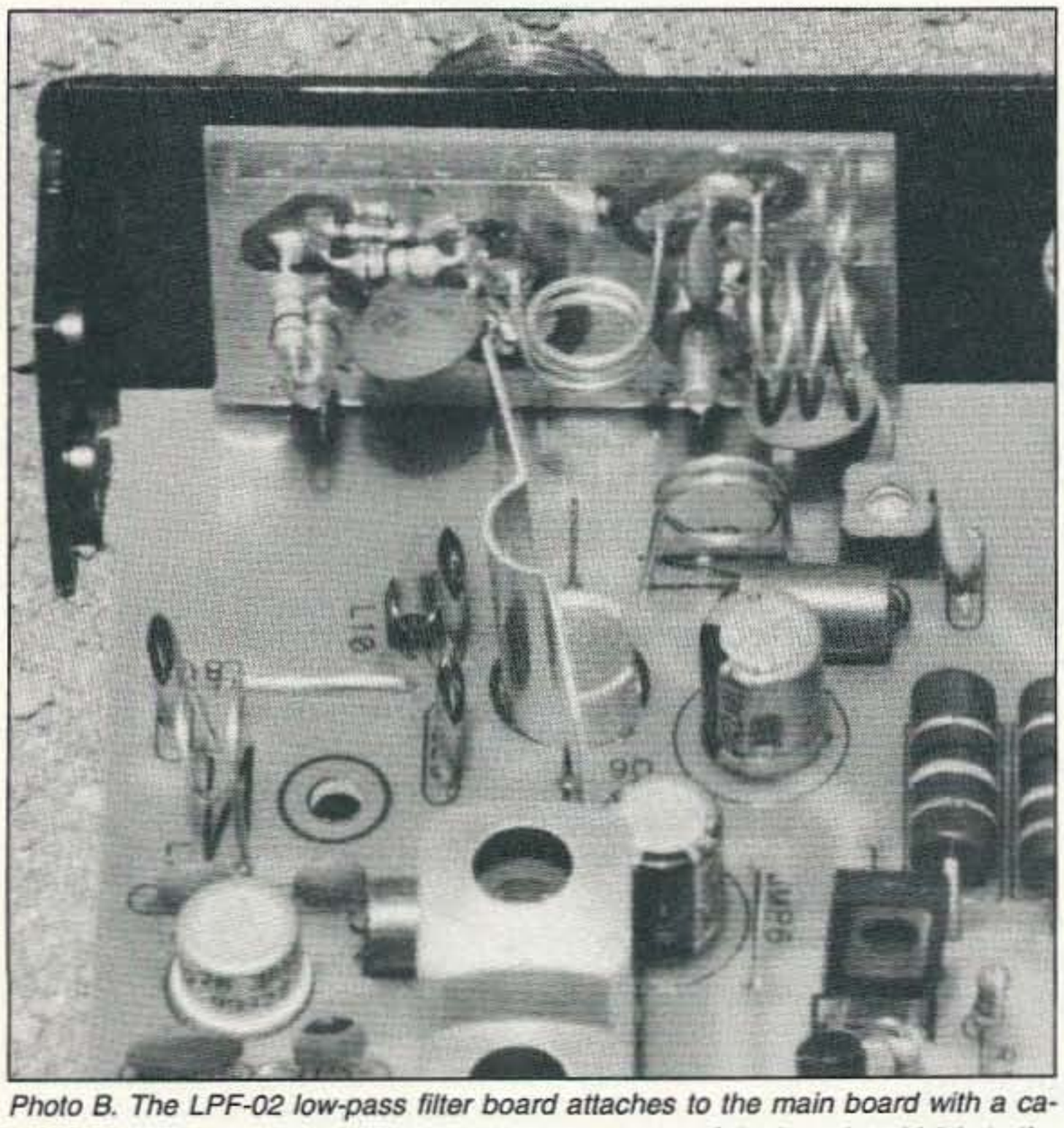

Photo B. The LPF-02 low-pass filter board attaches to the main board with a capacitor lead and two ground wires. L4 is in the center of the board and L3 is to the right.

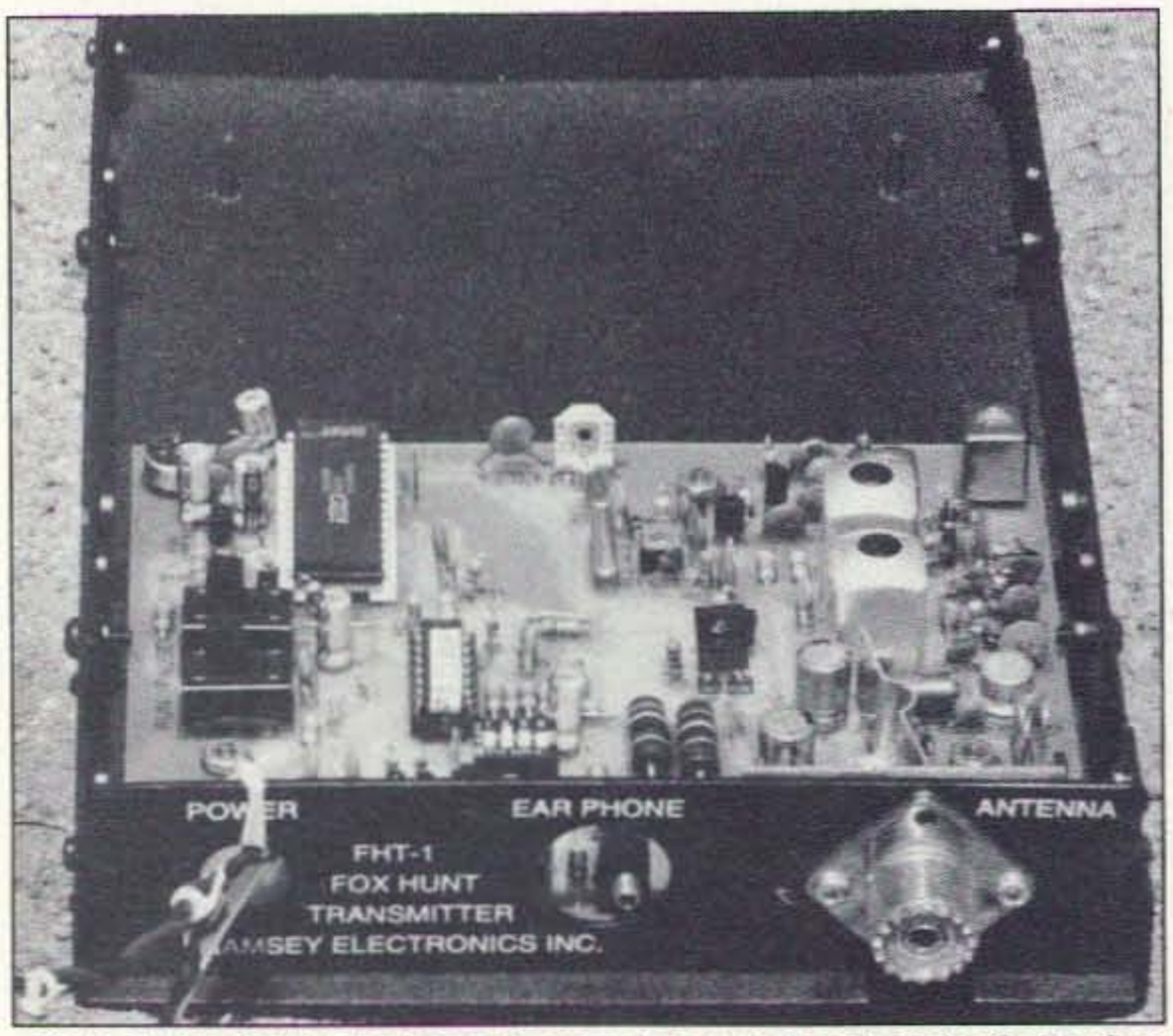

Photo C. The CFHT steel case is rugged enough to protect the SlyFox from abuse in the field. There is plenty of room for a set of C-size batteries.

move for servicing and troubleshooting, because there is no sturdy mechanical attachment of the boards. You can't solder them directly together because the filter board sits on the non-etch side of the main board.

If you plan to provide your own enclosure for the rig, I suggest you have the boards handy when you pick out or fabricate your box so you can be sure to arrange the proper fit. You cannot complete the filter board assembly first because the end plate of your case must be bolted to the coax connector and filter board before soldering the connector center pin.

Ramsey sells a matching enclosure, Model CFHT, for $29.95 (Photo C). Top and bottom are made of steel for ruggedness. It holds the filter board and connector perfectly in place. At 6" x 9-3/4" x 1-1/2", it is almost twice as large as it needs to be. There is room for batteries or another circuit board.

The inductance of air-core coils in VHF circuits is a function of the diameter and spacing of the turns. Ramsey engineers have a clever method for helping you make the four air-core coils properly. You are instructed to wind them on the threads of a 5/16 x 20 bolt, then "unscrew" them to get perfect 5/16" diameter and 1/20" spacing.

Other VHF transmitter kits I have built use a myriad of tiny variable capacitors for tune-up, but this rig has only one to resonate the final tank and one to tweak the crystal oscillator to the exact channel frequency.

Tuning Trials and Tribulations

Any home-built transmitter, whether from scratch or a kit, must be tuned up properly. Spurious and harmonic emissions must be within FCC's stringent limits at high and low power level into any antenna. Final transistor power dissipation must be kept low for long life.

Ramsey realizes that most hams don't own a spectrum analyzer and many have not yet acquired a VHF wattmeter and a good dummy load. So, the instruction manual suggests several flashlight bulbs that can be used to load the SlyFox and indicate power output. Except for some brief experimentation, I used a wattmeter and a UHF load, and I'm glad I did, as you will see.

The first step in tuneup of the SlyFox kit is to verify the output of the first tripler stage using the supplied non-metallic hexagonal tuning tool. Hey, where's the tool? It's the only missing part in this kit. No problem—I have built enough Heathkits to have lots of them on hand.

Despite careful tuning of the triplers' RF coils, I got zero volts at the first tripler test point. Probing with a DC voltmeter, I found very low voltage on the emitter of the oscillator stage. C23, the coupling capacitor between oscillator and tripler, was shorted.

Unfortunately, the manual doesn't provide any troubleshooting help for this condition. There are no voltage or resistance charts, either. A skilled RF experimenter would have no trouble tracking this defective part, but the task would have been quite difficult for a beginner.

After finding and installing a replacement for the defective C23, I followed the instructions and tuned the tripler, driver, and final stages for maximum output. However, the tripler test point voltages were well below the minimum expected values in the manual. The most output power I could get with careful tweaking was only 2.7 watts. I checked the rig's output on a

Number 19 on your Feedback card

HAM HELP

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. (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 1 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.

I am in desperate need of a Digital Display Board X-54-15-4000 for a KENWOOD TS-830.S. You can call me collect at (718) 919-6072 after 6 PM EST; or write to me, *Juan Mosoller, PAPA INDIA INT'L, P.O. Box 210-417, Brooklyn NY 11221-007.*

I need to get in touch with a technician who is familiar with a ROBOT 800-C Terminal Unit and who would be willing and able to identify and correct a problem within the unit. Also, does anyone know whether the Robot Manufacturing Co. is still in business? I need their address. I would appreciate any and all assistance. *Herman H. Franks WD4IFN/TU4EV, AmEmbassy Abidjan (FMC), Dept. of State, Washington DC 20521-2010.*

WANTED: Software-hardware info for HEATHKIT H-101-20. Computer ham programs are my main interest. *Jerry Weihrauch K0HZI, 475 E. Minnehaha #3, St. Paul MN 55101.*

spectrum analyzer and found that the level of the second harmonic was only 16 dB below that of the fundamental, much higher than allowed by the FCC. In addition, the output transistor got very hot after only a few seconds of operation.

Suddenly, there was a pop and output power went to zero. I thought at first that the final transistor had burned up, but it turned out that Q4, the second tripler, had shorted. This part is in a three-terminal pill-sized case with thin flat leads. It is not available in most local electronics stores, but I found an electrical replacement with four thicker leads, too large to fit in the board holes. I cut off one of the two collector leads and soldered the transistor on the rear side of the board, surface-mount style. I held my breath and powered it up again. Good news—it worked. Bad news—output and harmonics were exactly the same as before.

I spent many hours probing the two tripler stages, assuming that they were not peaking on the proper multiples. That seemed to be the most logical cause for this combination of low test point voltages, low output, and high harmonics. I also compared my kit unit with Ramsey's wired unit. All DC voltages and currents were normal, and the tuned circuits appeared to be OK. So I turned my attention to the final stage.

I noticed that the factory-wired unit's output inductor L2 and filter inductor L4 had much wider spacing than called for in the kit instructions. The manual does not specify any adjustments to the spacing of these coils after assembly. But when I spread the turns on the kit unit to match the factory's unit and retuned the final capacitor, power output increased dramatically.

With back-and-forth adjustments of the output capacitor and all four air-wound coils, I was able to get the kit to match the output power of the Ramsey-wired unit. The second, third, and fourth harmonics of the kit now measure -70, -50, and -70 dB respectively, easily satisfying FCC requirements. All spurious emissions are better than 54 dB below the carrier, and the final transistor runs much cooler than before. The tripler test point voltages are still well below manual minimums, but it doesn't seem to matter.

So if you observe low output when tuning up the FHT-1, try spreading the turns on all air-wound coils to 1/8" apart instead of the 1/20" spacing you get with the winding-form bolt.

My experience clearly proves the need to use good RF test equipment for tuning up this kit. It may be OK to do your initial "smoke checks" with a flashlight bulb load, but I urge you not to put on any T-hunts with this rig until you verify the output power and final stage tuning with a good wattmeter and 50-ohm VHF load. A spectrum analyzer check would be a good idea, too.

An incandescent lamp is not an adequate indicator of power output and signal purity at VHF. If I had trusted only a bulb in my initial tests and not checked further, my SlyFox would still be putting out half power and excessive harmonics. Furthermore, the output capacitor's set point for a 50-ohm load is not the same as for an inductive incandescent bulb. So make friends with a ham who owns a VHF wattmeter. Perhaps your local ham club has one to loan out.

Cycling and ID Options

The SlyFox CW IDer works like an electronic keyer. You will need a set of dot-dash paddles to program in your call. The manual states that the memory holds 10 to 15 characters, but I found that it will take only a total of 32 dots, dashes, and letter spaces. There is enough memory for any US callsign, but not for a long call with a suffix such as KD6ZBB/2.

The internal keyer's clock starts when you send the first dit or dah and continues at a fixed rate until the memory is full. Don't hesitate when sending, or the memory will fill up with spaces. You cannot change the rate of programming or playback of the ID, which is about 13 WPM. The 68HC705 microcontroller automatically sends "DE" before the callsign when playing back the CW ID.

Every transmission starts with identification. You can program the unit to follow the ID with silent carrier, a continuous tone, or to unkey for the remainder of the 60-second cycle. Then the unit executes an OFF period of zero to 60 minutes before keying up again. You can program the power to be high or low, or to alternate between high and low power transmissions.

You can choose only increments of four minutes for the OFF cycle, which limits your duty cycle options. You can get continuous transmission (60 seconds on, zero OFF) or 10 seconds on, 45 off. You can also get 10 or 60 seconds on and increments of four minutes off, but you cannot select such combinations as 10 seconds on and 10 seconds off, or one minute on followed by one minute off, or any combination thereof.

The CW ID memory is volatile, requiring you to install an alkaline or lithium battery to hold your callsign, timing, and tone selection when power is removed. The voice ID add-on does not require a backup battery for voice memory, but one is still needed to hold tone frequency and timing cycle data in the user-programmable mode.

When you add the voice ID option, the CW IDer is disabled, and you won't need the paddles. The voice message lasts 20 seconds, but it is truncated to 10 seconds if you do not select the 60-seconds-on mode. 73

Number 20 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

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San Diego CA 92119

10 GHz Operation & Loran: A Poor Man's Grid Square Location System

This month will be a very busy one with both the first weekend of the ARRL 10 GHz contest and the ARRL convention taking place in San Diego. Both events should produce a flurry of activity, consuming lots of time, setting up for either event. I am looking forward to the convention because of all the activities and eyeball QSOs. In addition to getting ready for the convention, we are trying to give our microwave equipment a good shakedown test starting in early May to ensure proper contest-time operation. New items that have been added are given a real stress test for field operations to make sure they won't fail in portable operations.

It seems that most of the time I do not give my equipment the time needed to put it into top shape due to the many different constraints put upon the time I have available for hobby activities. I don't want to put a strain on family activities and the hobby must remain as just that, a hobby. I recommend starting much earlier on equipment checks, leaving lots of time for family activities. I've just got to start earlier next year (as I always say).

This month I will put into practice some of the methods and practices that our San Diego Microwave Group uses to facilitate microwave contacts. Some of the devices we bring into play are very simple and inexpensive, while other items can be a little more complex and costly. In this light I would like to start with a few simple devices that can be put into operation for little cost; then I will cover a surplus Loran receiver system that is used for position control.

10 GHz Contest Preparations

A little background information on our systems might be in order first. In our operations, both high power (10 watts) and low power systems (50 to 100 mW) are used for SSB operations and both produce very good results. While the low power systems are not as "loud" as the high power systems, they are quite readable and log just as many contacts as high power systems. First Rule: High power is nice, but not necessary if conditions are reasonable. First choice: Don't go for power, but improve your receiver noise figure.

MMICs for Receiver Preamps

A good investment in your SSB system would be to make performance improvements in the receiver system, particularly the preamplifier gain and noise figure. If your system operates in the 10 dB or so noise figure range, a tremendous improvement can be made with lower noise figures. If you lower your noise figure from 10 dB to something near 3 dB you will be surprised at the overall performance improvements. It's like having the transmitter at the other end of the path double or quadruple its power output.

What kind of amplifier should I build to attain a low noise figure? Well, there are many devices that are suitable, all of them having GaAsFET-type construction. The basic types are HEMPT-type FETs, which require a stripline design for proper operation at the design frequency of interest. The stripline PC board must be designed to match the device to the specific frequency of interest. Another type to use is the MMIC. This MMIC is a Microwave Module Integrated Circuit and all circuit parameters are matched to 50 ohms on both the input and output of the device. Specific design requirements are not necessary, as in the GaAsFET-type amplifier, making amplifier design quite easy. Most normal MMICs that I am familiar with are good for something up to 2 to 3 GHz at best. While there are MMICs that operate at much higher frequencies, their prices are prohibitive.

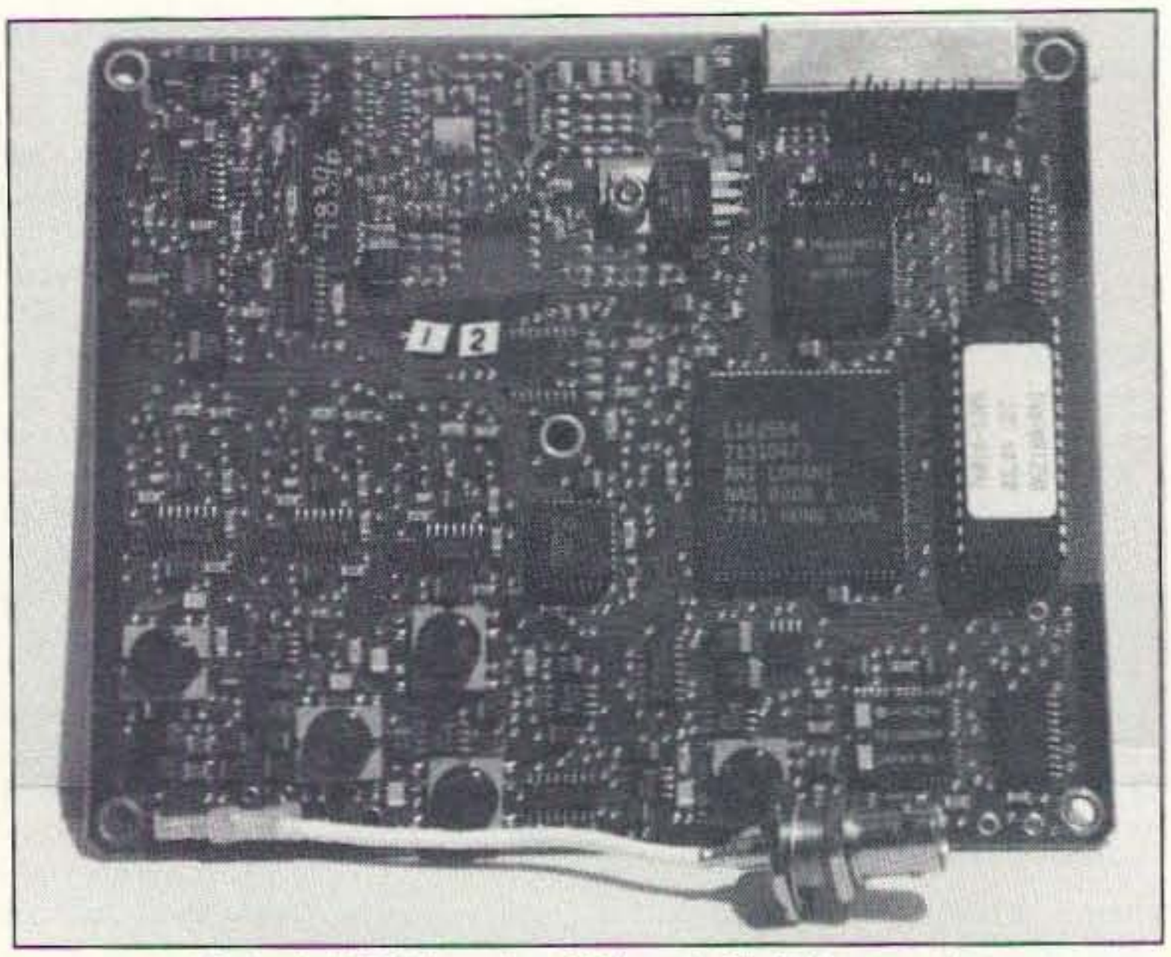

Photo A. LORAN receiver PC board with BNC connector.

However, all that has changed with Hewlett Packard's new MMIC, the MGA-86576 MMIC. The frequency response of this device is good from a low frequency limit of 1 GHz to just over 10 GHz. This device sports about 20 dB of gain over the 1-to-10-GHz range, and noise figures under 3 dB. Now the best part: These devices cost about $8 each in single quantity from Hewlett Packard Distributors. Kerry N6IZW made a circuit test using one of these devices using a 10 GHz stripline PC board that was originally made for a Mgf-1402 GaAsFET, and cut off the tuning tabs leaving only the bias lines and 50 ohm stripline. Usable gain as measured at 10 GHz was 13 dB, and the noise figure was not measured but observed very near the 3 dB estimated. See Figure 1, the MMIC circuit diagram.

I plan to do more testing on this device and have ordered several more devices to experiment with. I will report on further tests as they develop. From the first test runs, this Motorola MMIC device has us very impressed due to the very inexpensive nature and wide frequency band of operation. Add this device to your system and you should see quite an improvement in receiver operations.

Microwave Dish Alignment

The next simple item that can be useful is dish pointing and alignment, specifically vertical dish alignment. When you know where the proper vertical alignment is, its not a problem. However, when you need a calibration marker this is a difficult calibration. How do you construct a calibration device for this purpose? This problem can be easily solved by adding an old meter movement to your dish tripod. This meter movement can be a defective meter from surplus. Mount the meter upside down on your dish, with the center of the meter movement pointing downward. This meter will now serve as an indicator of your dish antenna—use the indicator as calibration marks to reference the vertical angle or incline your dish is now aimed at.

Basic calibration is accomplished by adjusting the meter needle to a reference point when copying a remote beacon or station. First copy a beacon whose position is known; that will give you a good horizontal compass reference. Then, rock your dish in the vertical position for best signal strength and set the meter to its reference. Now you can rock the dish in other test inclines and try for that faraway shot, knowing (without guesswork) a good position (which should be near the correct position) for your dish. This allows you to return to a calibration point without guesswork. It's basically an incline meter from a very unusual source. It doesn't even matter if the meter is any good, just that the meter movement swings free with gravity. You must remove the meter movement spring from the meter for free movement of the indicator on the meter.

The next point is distance alignment, your horizontal compass heading. In this category you need to know where you are and have some method of accurately pointing your dish antenna at the other station. Needless to say, the other station has to know where he is located. A six-figure grid square location is sufficient for this heading. Up on big rock candy mountain near the cutoff, "about 30 miles from wherever" just doesn't cut it. Trying to use locations like that would be like swatting flies blindfolded. It can be

Photo B. One of our "secret" surplus yards being observed by Kerry N6IZW. Note the large CRUSHER on the right, (not a space alien or relative of Dr. Crusher of STAR TREK fame). Surplus electronic items are saved from this and other similar junkyard tools of destruction.

accomplished with maps and other references, but trying to find an unfamiliar location this way takes lots of time away from microwave operation. A big help with map use is to draw out compass directions to popular spots, giving forward and reverse compass bearings. Plan ahead! Know where the other fellow is going to operate from and determine the compass heading in advance. If you have big bucks, obtain a GPS receiver—it will give your location and tell you if you are in the end zone or eating popcorn in the first row. The cost of these devices range from $500 up, mostly *up*. An alternative to this system is LORAN. It's still a toy for me in this application, but an inexpensive toy.

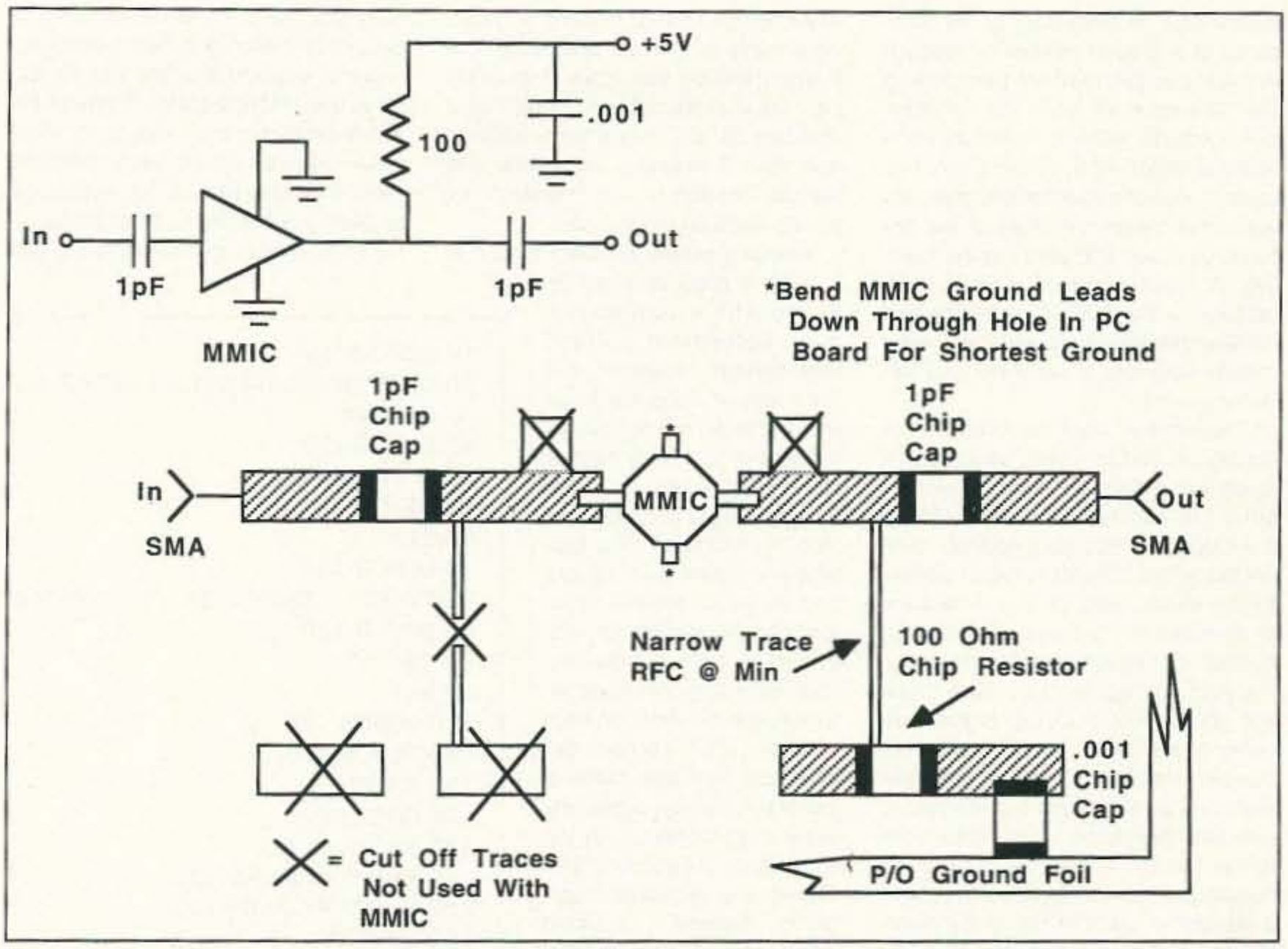

Figure 1. A modified 10 GHz amplifier board, featuring the Motorola MGA-86576 microwave MMIC. Gate bias circuit for FET is not required using MMIC. Circuit produced 20 dB gain at 1 GHz, and 13 dB gain at 10 GHz. Approximate noise figure was 3 dB.

LORAN Location System

Loran was in operation before GPS, and it can give very usable location data. It is not as accurate as GPS but it can tell position with accuracy to about a third of a mile. Its accuracy depends on how well it can receive its location transmitters and it can give results to about to about 2,000 feet or so. In actual practice, Kerry and I have observed the readout accuracy to be about 0.34 mile.

Why use Loran when GPS is available and provides much more accuracy? Price. We located a receiver in surplus and gave it a try. We became so excited by the results that we picked up the whole batch of receivers before they could be lost forever (see Photo A).

Putting the receiver into operation was not difficult. All that is required to put the board into operation is an IBM or compatible PC running BASIC, and a single com port (RS-232). A simple one-chip interface device (Maxim 232 chip) is needed to interface the Loran PC board and the RS-232 port on the computer. See Figure 2, a computer interface adaptor schematic using this Maxim chip.

As you can see from Figure 2, only the Maxim chip and a few capacitors and voltage regulators are required. Minimum connections are necessary to your RS-232 port as only the serial receive and transmit lines are required, making this adaptor easy to duplicate. When your adaptor is constructed, a simple checkout is all that is needed. I blew my adaptor up by not being careful—I had reversed the +5 and +15 volt lines. Don't you make the same error—check your work over before applying power. You can check three times, but you can only apply power wrong *once*! Repairing my wiring error and replacing the chip solved the circuit problem.

Check it out with a voltmeter. You should have about +10 volts on pin 2, and -10 volts on pin 6 of the Max-232 chip. Current draw is 250 mA at 5 volts and 100 mA at 15 volts. You will need to heat-sink the 5 volt regulator to keep it cool at this current. See Figure 2 for interface pinouts on the LORAN PC board. Only a few pins are actually used. Pin 1 is +15 volts, pin 2 is +5 volts, pins 3 and 5 are grounded. Pins 10 and 12 are the communication ports on the LORAN PC board, with pin 10 a receive command line and pin 12 the transmit line. The schematic diagram also includes a pinout for those computers that use a 9-pin connector for the RS-232 port, like my Tandy 1400 LT.

The computer used was running DOS 3.3 and GWBASIC. The BASIC program sends a data message to the PC board via the RS-232 port instructing the Loran receiver to do a task. The command is: Send the capital letter "A" "carriage return" "line feed" and the receiver will respond with data on position in respect to latitude/longitude, and a certainty factor in decimal on what accuracy or error distance the program calculation has determined to be the maximum error. Kerry put this format into a BASIC program; the listing for this program is shown in Figure 3.

The additional steps at the end of the program are part of a routine to read the Loran receiver oscillator and

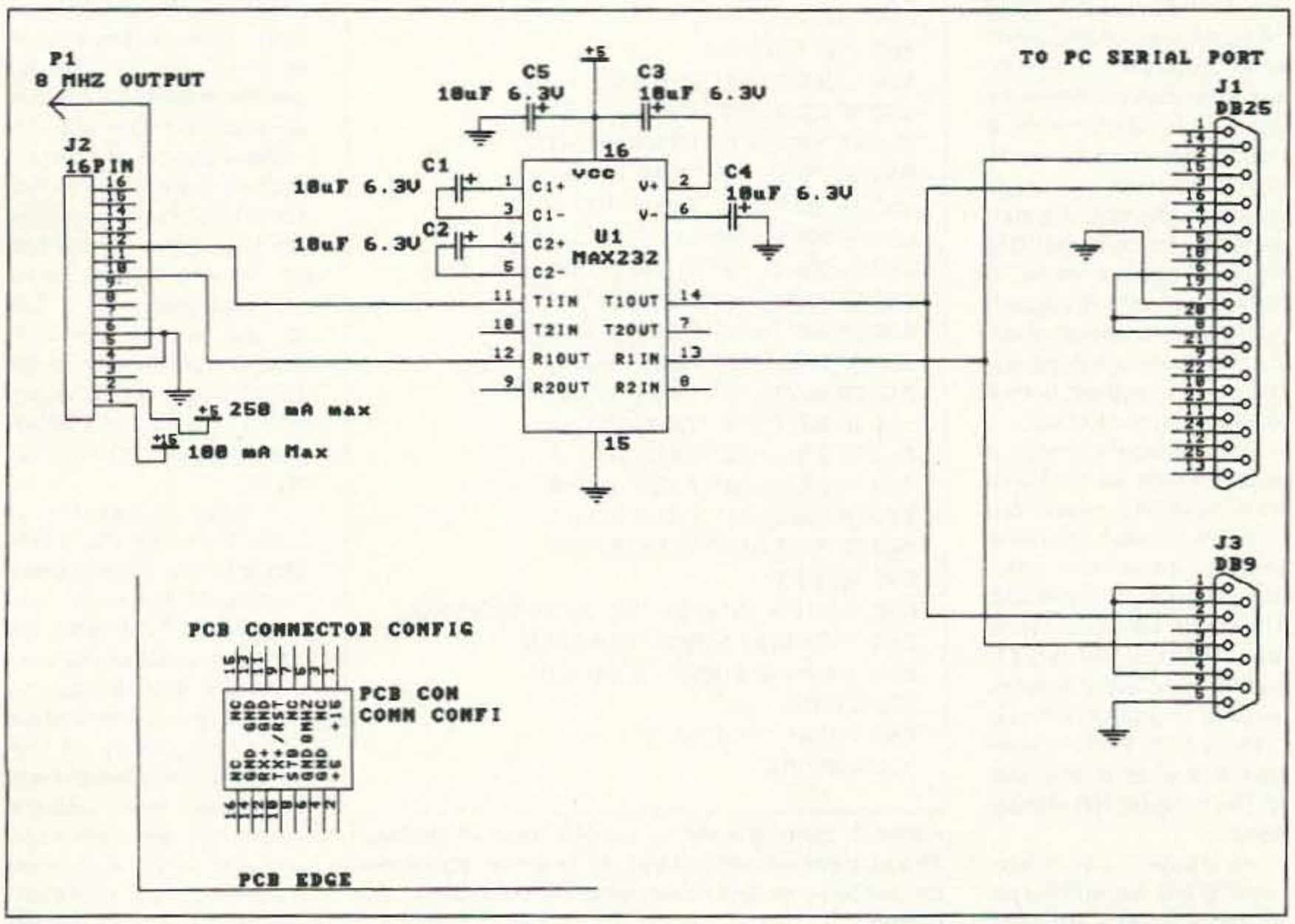

Figure 2. Schematic for Maxim-232 RS-232 PC-LORAN adaptor.

report what its frequency is, as compared to a precise cesium or ribidium oscillator at the LORAN transmitting site. The error will be in the transmission medium, which is minimum compared to WWV HF 5, 10 MHz, etc. The Loran receiver's internal program will report the frequency offset of the onboard oscillator and print out the reading. We can connect a frequency counter to the LORAN receiver and monitor this frequency and use it as a transfer standard to calibrate your frequency counter.

The receiver must be receiving Loran signals and be locked up in normal mode. For example, if the program reports the oscillator frequency to be 8.00000234 MHz, your counter connected to the LORAN receiver oscillator pin should read the same frequency to make them agree. Adjust your counter calibration oscillator to make the readings agree. It's a little touch and go, but when LORAN signals are being copied well it gives an excellent transfer standard. Loran master frequency standards are maintained to very near perfection, a few parts in ten to the twelfth. At present there is no reason you cannot obtain calibration to a number of parts in ten to the ninth. We are working on refinements to this step to obtain better frequency transfer results and will report on future findings as they happen.

Let's get back to horizontal dish position and where you are in respect to your horizontal horizon. The LORAN receiver receives a complex signal from a string of stations on 100 kHz and uses the timing and coding pulses to enable the receiver to determine where it is located. This data is part of the serial data that is displayed on the PC computer as the latitude/longitude information for your location. This data could be inserted into one of several grid square programs to allow you to calculate just where you are situated and display the latitude/longitude information as a six-figure grid square location, like DM12LT. The grid square program would have to be modified to accept the data directly from the LORAN receiver. This has not been done at present, but it is a future project. For the time being, operation will have to be manual. Perhaps someone reading this column will incorporate this feature and report back.

The information from the LORAN receiver can be of great benefit to a rover who is working fast-paced contacts to a series of fixed microwave stations operating in contests similar to the ARRL 10 GHz contest. After a set of contacts is made, the rover packs up and moves on to another location 10 miles farther down the road. All equipment and antennas are mobile-mounted, making setup fast. The benefit LORAN would present is determining, with good accuracy, when you are positioned in the area you think you are. For most locations this data can be confirmed by simple map interpolations compared to your surroundings. But when the distance between any distinguishable feature is great, uncertainly is the real answer. Errors in your position can make dish pointing critical at best. Considering that a standard 30" dish has a beam width of less than 3 degrees, horizontal and vertical location is very important for fast contacts on microwave.

Knowing where the fixed station is located is great and can be set up with a compass to good agreement towards that station. However, the fixed station does not know with certainty where you are in respect to a very narrow dish's beam width (less than 3 degrees). If you can provide your location to a specific six-figure grid square and be accurate, this problem can be eliminated with accurate dish positioning and setup. In most cases antennas can be aimed at each other and initial contacts can be made even over paths of several hundred miles. By eliminating wobble from the wheels of frequency and aiming, you will leave uncertainty behind. Knowing where you are and on what frequency provides nearly armchair-quality performance. It's almost like shooting fish in a barrel.

One question remains, I suppose, and that is: How do you take a 100 kHz antenna into the field and make it portable? Well, these systems are made to operate on very short active antennas that have a high-gain preamplifier connected to a short receive antenna for mobile use. An active antenna could be home-brew constructed as its circuitry is not too difficult to reproduce. Power for the active antenna is a normal provision from the LORAN receiver and is furnished on the antenna connector center conductor that feeds the active antenna. In this case 15 volts is supplied up the coax for this purpose. Usually these preamps will operate on anything from 8 to 15 volts at 5 mA or so.

A commercially-produced antenna can be obtained from MAXRAD (available through some ham radio dealers), an antenna products company, for under $50. The basic active antenna model MXLB-100 is $27, and the simplest of antenna mounts (magnetic) model GBN is $15. Performance quoted is -5 dB to unity gain for this compact 100 kHz antenna.

As always, I am experimenting and am working on an active antenna and want to incorporate a ferrite element to give frequency immunity to out-of-band signals that seem to interfere with the basic active antenna circuit. Some of the active antennas are broadband wide-open circuits and as such could receive 60 cycles as well. To prevent this problem I would like to try a simple filter to eliminate out-of-band signals having the antenna resonate at about 100 kHz. A similar problem happened while trying to receive WWVB on 60 kHz. I used a longwire antenna and had so much interference it was not copyable. Placing a filter at 60 kHz in the antenna lead made a marked improvement in performance. I plan to attempt the same thing with the Loran antenna in addition to gain in the circuit. This is still speculative, but some further experimentation will prove or disprove the worth of this plan.

```
10 DIM X$(40)
20 OPEN "com1:1200,N,8,1,RS"AS #1
30 C$="0D"
40 GOSUB 130
50 GOSUB 180
60 C$="A"
65 S=0
70 GOSUB 130
75 PRINT"   LAT   LONG   ST POSER MODE"
80 GOSUB 180
90 C$="B"
95 S=1
100 GOSUB 130
110 GOSUB 180
115 PRINT
120 GOTO 60
130 PRINT #1,C$;
140 PRINT #1,CHR$(13);
150 PRINT #1,CHR$(10);
160 RETURN
170 GOSUB 180
180 D=0
190 X$(D)=INPUT$(1,#1)
195 IF S=1 THEN 210
200 PRINT X$(D);
210 FOR I=1 TO 100
220 NEXT I
230 V= EOF(1)
240 IF V=-1 THEN 280
250 D=D+1
260 GOTO 190
270 END
280 PRINT
281 IF S=1 THEN GOSUB 400
290 RETURN
400 FOR I=2 TO 5
410 IF X$(I)="F" THEN H(I)=15
420 IF X$(I)="E" THEN H(I)=14
430 IF X$(I)="D" THEN H(I)=13
440 IF X$(I)="C" THEN H(I)=12
450 IF X$(I)="B" THEN H(I)=11
460 IF X$(I)="A" THEN H(I)=10
470 IF X$(I)="9" THEN H(I)=9
480 IF X$(I)="8" THEN H(I)=8
490 IF X$(I)="7" THEN H(I)=7
500 IF X$(I)="6" THEN H(I)=6
510 IF X$(I)="5" THEN H(I)=5
511 IF X$(I)="4" THEN H(I)=4
512 IF X$(I)="3" THEN H(I)=3
520 IF X$(I)="2" THEN H(I)=2
530 IF X$(I)="1" THEN H(I)=1
540 IF X$(I)="0" THEN H(I)=0
545 NEXT I
550 T=H(5)+16*H(4)+256*H(3)+4096*H(2)
560 IF T>8000 THEN T=T-65536!
570 OSC#= 8*T/256 +8000000#
575 PRINT
580 PRINT OSC#;" MHz"
710 RETURN
```

Figure 3. Basic program of LORAN receiver operation. This program will print out latitude, longitude, status monitor, position error and Loran mode that the receiver is reporting.

The receiver must be receiving Loran signals and be locked up in normal mode. For example, if the program reports the oscillator frequency to be 8.00000234 MHz, your counter connected to the LORAN receiver oscillator pin should read the same frequency to make them agree. Adjust your counter calibration oscillator to make the readings agree. It's a little touch and go, but when LORAN signals are being copied well it gives an excellent transfer standard. Loran master frequency standards are maintained to very near perfection, a few parts in ten to the twelfth. At present there is no reason you cannot obtain calibration to a number of parts in ten to the ninth. We are working on refinements to this step to obtain better frequency transfer results and will report on future findings as they happen.

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Both Kerry and I have noticed severe interference to the LORAN receiver in tests where the unpackaged receiver was placed on top of or near the computer terminal that was running the BASIC program. Moving the unshielded PC board away from the computer some two feet seemed to cure the problem of the receiver not receiving the LORAN signals. The computer was radiating energy, blocking the receiver. The receiver was connected for these tests on the workbench without benefit of a shielded box or feedthrough capacitors for the DC or computer port connections. This, like anything else, is not a finished product, but it is a starting point, and it provides the fun of picking through surplus material for toys to play with. (See Photo B.)

Well that's it for this month. I hope that the information provided here will assist you with microwave operations in remote locations. Whether you choose to use Loran or GPS for position accuracy is a matter of choice. We have operated without benefit of systems such as this and had a good time. However, it's another toy to put into the toy box for fun, and it offers operation improvement. I hope to have enough time to be able to report further on the LORAN receiver active antenna project and LORAN operation in general next month.

I have a quantity of LORAN receiver PC boards and will make them available for amateur purposes. Tested LORAN PC boards are $25 each postpaid, to U.S./Canadian destinations only (contact me at the address at the beginning of this column). As always, I will be glad to answer questions about this and other related VHF, UHF, microwave subjects. 73 WB6IGP Chuck. 73

Number 21 on your Feedback card

ASK KABOOM

Your Tech Answer Man

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Peterborough NH 03458

Intermittents!

Last month, we were discussing clipping, and I promised to go over its effects in the digital realm. So, let's finish that up before we get to this month's topic.

Playing the Numbers

Digital signals can be created in two ways: from digital information, such as that coming from a microprocessor, or from analog information, after passing it through an analog-to-digital (A/D) converter. With digitally-originating signals, parameters are well defined; You always know the makeup of the signal. After all, there are just so many codes to go around, given the number of bits for which the circuit is designed.

Analog information, however, has no such tidy rules. If you're going to convert a changing voltage into a representative series of bits, you must set some limits. How do you know how big the analog signal will be? You don't, at least not exactly. Sure, you can scale it to some approximate level, using amplifiers for gain and resistors for loss. But, there's no way to ensure it'll be *exactly* the optimum size, which is whatever will use up all the available digital codes without trying to go past the highest one. So, what's to prevent your making the signal a little too small, just to be sure it doesn't overdrive the A/D converter? Well, nothing, but you'll be wasting some bits, due to their never getting turned on.

Stop!

In effect, though, an A/D converter is self-limiting. As the input signal reaches the level beyond which the converter cannot generate a higher number, it just keeps outputting the highest number it can until the signal drops below the limit. The result is a digital signal which represents clipping much like the kind you get with an overdriven analog amplifier.

But it's not exactly the same. In theory, it should be. In a real analog circuit, though, clipping doesn't occur instantaneously. Rather, the circuit's gain begins to get non-linear as the signal approaches the acceptable limits, and then full clipping occurs soon after. The result is what you might call "soft clipping." An A/D converter, however, stays completely linear up to its limits, and then it clips completely. So, the resulting square waves have very steep sides, making for a particularly ugly kind of distortion called "hard clipping."

So, if you clip an A/D converter, the resulting bits will represent a highly distorted version of the input signal. It's important to remember, though, that those bits themselves are perfectly fine, and the rest of the digital system can process them with no trouble; they just don't represent what you wanted.

Can you clip a digital-to-analog (D/A) converter? No. Bits come in, and whatever they represent comes back out as analog. Bits themselves can't clip. Of course, if they represent a distorted signal, that's what you'll get. But you can't fault the bits or the D/A converter.

Well, I think that about does it for clipping. Now, let's get to something else.

A Bad Night's Sleep

Wanna give a technician headaches and nightmares? Just sneak up and whisper the word "intermittent." That ought to do it! Nothing in the wonderful, wacky world of electronics is more frustrating. Why does something work, then not work, and then work again?

Plenty of things can cause intermittent operation, but by far the number one cause is a bad connection. Big deal, right? A few minutes with a magnifying glass and a soldering iron and all will be fixed. Well, think again. Sometimes, finding the problem can be easy, but often it is very difficult, and now and then it's just plain impossible. Let's take a look at the different kinds of bad connections you can run into and how you might smoke them out.

Leaves Me Cold

When is hot cold? When it's a cold solder joint! Many intermittents are caused by bad joints. Sometimes you can see the darned things, while other times they look perfectly normal. If you see dull, crumbly looking solder, chances are you've got a bad joint. Especially if you can see the component lead sticking out, with obvious cracks or space between it and the solder around it, you can be sure that joint's cold. How do solder joints get that way? Most are born that way; not enough heat was used to make the joint. Remember, solder isn't just globbed on; it's supposed to make a molecular bond. It takes significant heat to do that, and, if the temperature doesn't go high enough during the soldering process, the bond won't form. Typically, though, the joint will work for awhile—at least long enough for the unit to pass quality inspection and be shipped out to you. In your home, of course, it starts to die fast. Sometimes it's not so fast. I've seen cold joints which worked fine for years and then suddenly went bad.

But, you say, most devices aren't

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Number 23 on your Feedback card

UPDATES

HI-PER Audio Filter

With regard to the above mentioned project, which appeared in the May, 1994 issue of *73*, page 10, please note the following: The PC board component placement overlay (Figure 3) shows the polarity for the DC input in reverse. To see this more clearly, please refer to the schematic (Figure 2) where C16 is correctly polarized across the DC input.

The Parts List and overlay call for C17, but C17 does not appear on the schematic. The schematic should show C17 parallel to C3, going to ground. This was omitted on the schematic—it is correct on the overlay.

C1, 3, 14, and 16 are 100 µF 16V electrolytics according to the Parts List, but on the schematic C1 and 14 are called 10 µF caps. Either value will work well; the values are not critical here.

Fast Charger

Refer to the above article in the May issue of *73*, page 22. The article recommends a TK4355 inductor for L1, but that part is no longer available.

A suitable replacement can be found at Radio Shack, with a slight modification. The RS part #273-102 is a 100 µH coil. "Fast Charger" requires a 47 µH coil for L1. To modify the RS part, simply unwind half the windings, scrape off the protective enamel coating from the end and resolder. 73

hand-soldered anymore. How can a wave-soldered board have this problem when the entire board has been dipped in a molten solder bath? Actually, most cold joint problems I've encountered have been on wave-soldered boards. Apparently, the heat sometimes just isn't turned up high enough. The small parts come out fine, but the larger ones sink enough of the heat that their leads don't get hot enough to form the proper bond. That results in the classic "lead sticking out from hole in the solder" syndrome. In fact, this problem is so common I recommend checking the leads of big components first, particularly on wave-soldered boards. On the other hand, I haven't seen too much trouble with surface-mounted devices (SMDs), probably because they're so small that they get plenty hot enough for proper bonding. Also, special low-temperature solders are used with those parts.

Gets Me Hot

Operating heat sometimes can create cold joints. I've seen anode caps on transmitting tubes actually lose the solder where the caps joined their wires. I don't mean that the solder melted—it actually disappeared altogether! The cause? The heat of the tubes. Or perhaps it was the high voltage; I don't know. It's also possible for power transistors and resistors to fry their joints, although the solder usually doesn't disappear, it just gets dull and crumbly.

Wiggle It

A great way to find cold joints is to gently wiggle the board, taking care not to get shocked or cause unwanted signals to enter the circuit through your finger. The best way is with an insulated tool of some kind. For small boards, I like to use a cotton swab stick with one end cut off. I hold the cotton end and use the stick to press on the board, pushing on various spots until I can localize the reaction. For bigger assemblies, I use the insulated end of a small screwdriver.

Does it work? Sometimes. But often, I think I've found the right spot, only to discover much later on that the real trouble was nowhere near where I was pressing. Unfortunately, the effect of leverage sometimes can cause greater movement somewhere across the board than where I pushed. I've had some tremendously frustrating times with that sort of thing.

"A great way to find cold joints is to gently wiggle the board, taking care not to get shocked or cause unwanted signals to enter the circuit through your finger."

Cracked Up

Not all intermittents are caused by bad solder joints. Tiny cracks in PC boards used to be big offenders, but I haven't seen much of that kind of trouble in awhile. I suspect that improved board-making techniques have reduced the problem. Still, if an intermittent rig has been dropped, and you can't find bad joints, suspect a board crack. With reasonably sized, single or double-sided boards, fixing cracks isn't hard. But, with multilayer boards or the very fine lines you are likely to find in a modern HT, you may be looking at a disaster.

Going To Extremes

Some intermittents are caused or exacerbated by thermal changes. With cold solder joints, changes in temperature can result in a connection's going on and off again. Also, some damaged semiconductors can exhibit the same behavior. If the rig works at first and then goes wacky (the usual scenario), get some coolant spray and start spraying parts around the suspect areas. When you hit the right one, you'll know it, because the circuit will start working again, at least for a few minutes. If, however, the radio misbehaves at first and then settles into normal operation, use the coolant spray to make it screw up.

In some cases, you can also make great use of a hair dryer. If you already have one, it's cheaper to use it than to buy coolant spray. Also, heat will sometimes uncover a problem that the spray will miss. Usually, the added heat will make a circuit go bad, unless the problem is one of those unusual, reverse types which gets better when hot. Just remember that you don't have the same kind of pinpoint control, and you don't want to start melting anything, which is a real possibility with a hair dryer. *Never* use an industrial heat gun—they're just too hot.

So, what makes parts heat-sensitive? With transistors, cracks in the semiconductor substrate or partially disconnected internal connecting wires can do it. With IF coils and such, it's usually a bad solder joint inside, where the tiny coil wires join the form's leads. Now and then an actual break in the wire can do it, because the ends touch. It's rare, though. Resistors and potentiometers can have tiny cracks, and they can be very hard to find, because they react both thermally and physically when you flex the board.

Finally, always check switches and relay contacts for intermittents. Any time you pass a signal through a mechanical, unsoldered connection, you're looking for trouble. Relays are big offenders.

Well, I hope you don't have nightmares from thinking about intermittents! I know I've had plenty of them. Now, let's look at a letter:

Dear Kaboom,

I have a big junk box with lots of different kinds of parts from old radios, TVs and even a radar detector. Unfortunately, many of these potentially useful goodies don't have standard markings like 2N or 2SC. Are there any publications which could cross-reference the odd numbers? Also, are there any books of technical data for transistors and ICs?

Signed,
Electron Wanderer

Dear Electron,

Many of your parts probably have "standard" numbers you don't recognize. There are various systems in use throughout the world, and some don't show up here in the USA enough for us to become familiar with them. Check with an electronics supply house, either locally or via catalog, and you should be able to get some cross-reference books. But beware: Some parts are marked only with "house numbers," which are made up by manufacturers for their internal use. There's no book which can help with that. As for technical data books, Motorola, TI and all the other big manufacturers sell them, and having a few is an absolute must for serious experimentation or troubleshooting.

Until next time, 73 de KB1UM. 73

Number 24 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

The June ARRL VHF/UHF contest was held last weekend (June 4-5). This has become one of the fun ham weekends in the Keene, New Hampshire, area through the years. We try to come up with a respectable score with our limited efforts: 6m, 2m, and 70cm (SSB and CW) and 223.5 MHz FM. Even though this year's totals were down from past years, we had a good time.

VHF/UHF contests can be a lot of fun even if you only have one band. We heard many operators operating FM simplex from hilltops or mountaintops with just their mobile radios and antennas. Plus, many of those operators operated for just a few hours to give others a point or two. It was also amazing just how far you can hear an FM simplex signal if good locations are available. One that I remember was on 223.5 MHz from the New Jersey area to us in New Hampshire, and we were using an omni antenna, no beam, and an IC-37A, no amplifier.

Don't let lack of equipment keep you from giving it a try.

Another fun ham weekend takes place every June, namely Field Day—which this year took place on June 25-26. This is another kind of event for which you don't need a lot of sophisticated equipment to have a good time. You can even operate from your own QTH if you don't want to get involved with emergency power. I know of many who feel it is the most enjoyable event of the year, taking their low-power HF rig, a wire dipole, and car battery, and making a family camping weekend out of it. As you can imagine, many other campers show up to ask what the ham is doing; some stick around to find out about ham radio, others just walk away shaking their heads.

However you do it, Field Day can be a great amount of fun with a bunch of your friends.

I received a great letter today from Gerard Paquette VE2AW, with an enclosed QSL card confirming an FM contact with a high-altitude weather balloon repeater launched from Hawkesbury, Ontario, Canada, on 30 October 1993. Mine was just one of approximately 500 two-way contacts made to Gerry by radio amateurs in the United States and Canada.

This contact was made with a radio with an output of about 15 watts into a 14-element horizontal beam. If you consider that the balloon repeater was probably using a vertically-polarized antenna, I feel very lucky that it even heard my horizontal signal.

If you have any questions to ask of Gerry, or maybe even some monetary support to offer, contact him at: A/S Gerard Paquette VE2AW, 890 rue Hudson, McMasterville, QC J3G 5C3.

Until next month, 73 de Arnie N1BAC.

Roundup

England *[Information from Ted Melinosky K1BV, The K1BV Directory of DX Awards, HCR 10-Box 837A, Spofford NH 03462]* From Fred Handscombe G4BWP: "I am happy to inform you of my appointment as Radio Society of Great Britain (RSGB) HF Awards manager. All applications for RSGB Awards (except IOTA) should now be sent to me. Some very old information exists and several award managers still receive mail. I hope the RSGB programme will now enter a period of stability in its management!

"I also act as the National QSL checkpoint for UK applications for overseas awards, where this is an acceptable method."

An information package of the latest RSGB HF Awards is available from Fred Handscombe G4BWP for £1.50, $3.00, or 5 IRCs to cover airmail postage. Fred's address is: Fred Handscombe G4BWP, RSGB HF Awards Manager, Sandholm, Heath Farm Road, Red Lodge, Bury St. Edmunds, Suffolk, IP28 8LG, England.

Switzerland *From the International Telecommunication Union Press:* The ITU Council adopted unanimously on May 10, 1994, a resolution authorizing the Government of National Unity of South Africa to resume its full participation in the conferences, meetings, and activities of the Union with immediate effect. The Chairman of the Council, Mr. Souleymane Mbaye (Senegal), informed the entire membership of the Union the same day.

The Council is the management body which meets once a year and acts on behalf of the Plenipotentiary Conference when the latter is not in session.

The ITU Plenipotentiary Conferences had successively adopted resolutions in 1973, 1982, and 1989, which excluded the Government of the Republic of South Africa from the Plenipotentiary Conference and from all other conferences and meetings of the Union. Resolution 12 adopted in 1989 by the Nice Plenipotentiary Conference had provided for the continued exclusion of the Government of the Republic of South Africa until the elimination of the apartheid policies.

The most recent developments in South Africa, culminating in the holding of the first free democratic elections, led the Council to consider that the apartheid policies had ended and hence to decide to repeal Resolution 12.

The next Plenipotentiary Conference will be held in Kyoto, Japan, September-October 1994. For further information, write to: International Telecommunication Union, Place des Nations, CH-1211 Geneve 20, Switzerland. Telephone: National (022) 730 5111; International + 41 22 730 5111; Telefax +41 22 733 7256.

Taiwan *Letter from Bolon Lin BV5AF:* Some information for your reference: BVIØSAT—May 15-22, For Taiwan AMateur SATellite Association (TAMSAT): QTH Changhua 500, Mid-Taiwan area; QSL via BV5AF, P.O. Box 39, Changhua 500, Taiwan.

BVØRI—June 12-15 for Rotary International 1994 Convention; QTH Taipei, Taiwan; QSL via CTARL Bureau, P.O. Box 73, Taipei 100, Taiwan and/or P.O. Box 93, Taipei 100, Taiwan.

BV5EV, Handler/Operator: Linda Lai, YL student; QTH Changhua 500, Taiwan; QSL via Ctarl Bureau, P.O. Box 73, Taipei 100, Taiwan. *Bolon Lin, BV5AF, P.O. Box 93, Taipei 100, Taiwan.*

Turkish Republic of Northern Cyprus/USA *Letter from Igor Zdorov KUOJ:* The Turkish Republic of North Cyprus (TRNC) celebrated its 10th anniversary in 1993. In 1992, after a law authorizing ham radio there was passed, the Telecommunications Administration of TRNC issued the first license to 1B1NCC, Northern Cyprus Club. After that, four permanent licenses to local hams, 1B1AA, AB, AC, and AD, were issued. Unfortunately, 1B1AC passed away in the summer of 1993. Nevertheless, ham radio in TRNC is gaining its momentum. In 1993, 1B/DK7ZZ was on the air for two weeks, followed by my almost-three-weeks-long operation as 1B/KUØJ in December. Because both 1B1AA and 1B1AB were overseas on business at that time, and 1B1AD was using mostly phone, I put my emphasis on CW and made about 10,000 QSOs on all HF bands 10 through 160, including WARC. Over 50% of my contacts were with state-side hams.

In March-April of 1994, Baldur

1B/DJ6SI was on the air for a while, and I provided Eric N1CYA with the info on getting 1B license procedure, his 1B/N1CYA operation pending in April. By the way, I would not recommend trying a 1B operation without a license. I surely was glad I had mine when the local police came and asked about my antenna.

Upon my return home, I read that Cliff KR4M had tabled his petition in favor of TRNC recognition by DXCC, as I found out later, for very unfortunate personal reasons. After discussing this matter with Cliff, I filed my own petition, which was received by DXAC on 2-2-94.

Recently I made presentations to DX Associations of six different states (TX, OK, KS, MO, IA, MN), at which I showed the slides of my 1B operation and discussed my petition. The reaction was overwhelmingly positive; a few questions were asked, but no opposition was encountered. I do acknowledge, however, the existence of some opposition among hams against TRNC recognition by DXCC and I will keep addressing their arguments as soon as I become aware of such.

I am glad to see that even the opposition agrees that DXCC criteria, like " . . . society united together, occupying a definite territory and having a definite population, politically organized and controlled under one exclusive regime, maintaining a standing army, customs, currency and stamps" are met. The following is my response to the arguments I have come across lately:

•Authorized Use of ITU-assigned Call Sign Prefixes: After declaring its independence, TRNC was left without ITU-assigned prefixes, since the Republic of Cyprus (South) kept total control over their usage. When, almost 10 years after TRNC declaration, a law authorizing amateur radio in TRNC was passed, the Telecommunication Administration of TRNC, to avoid any additional problems with their southern neighbor, adopted 1B as a prefix, not used by or assigned to any country. Several cases set a prerogative for this, such as 1AØ, 1S, SØ, FS, all of which are, by the way, recognized by DXCC as separate countries.

•The ability of "engaging in foreign relations—including capacity to carry out its obligations under international law and applicable international agreements." TRNC is actively repaying its foreign aid loans (annual payments balance rise is about 14%), and has trade relations with more than 60 countries, including U.S.A., Japan, and UK. It stimulates foreign trade by liberal tax concessions, establishing a free port zone in Famagusta, free exchange of foreign currency/stock, and controls foreign investment policy. It provides (and pays for) postal service to any country, telephone and other communications all over the world, and is an observer member of International Islamic Association.

•Low level of diplomatic recognition is the result of failure of the U.N.'s inconsistent attempts to resolve the Cyprus problem in more than three decades, and should not be held against TRNC. Despite the official diplomatic recognition by Turkey only, acting as a responsible member of the international community, TRNC supports representations in 10 countries, including Western Europe, Japan, and the U.S.A., where it has two consulates, one of which is accredited to the U.N. in New York. From the DXCC's standpoint, the fact that North Korea is, out of the whole Western Bloc, recognized by Sweden only, did not make it ineligible. Other examples may be given.

•"Continued talks about reunification" between Greek and Turkish Cypriots are purely symbolic. These talks, conducted through the U.N., have not brought any progress since 1975, and are not expected to bring any progress in the future. This opinion is shared by TRNC Consulate in Washington, D.C. The talks are basically deadlocked because the U.N., on one hand, recognizes the existence of TRNC and the rights of Turkish Cypriots, but on the other hand, treats the Republic of Cyprus (Greek South) Government, as the sole government of the island, which, in turn, fails to acknowledge the rights of Turkish Cypriots. Talks on reunification of Germany took close to 40 years. DXCC did, however, count German Democratic Republic as a separate for over 17 years prior to reunification, while the talks were going on. The important difference is that the division of Germany was not based on ethnic differences and was not initiated by any group of German people on either side. The chances of the reunification of the two ethnic communities of Cyprus, which have lived separately on the island for many centuries, are way less than the chances of reunification of Bosnia and Serbia.

And, last but never least, I would like to stress that, after my recent visit to TRNC, I strongly feel that this country does deserve DXCC recognition. *[Igor Zdorov KUØJ, 5980 Anna Ave. #308, Minneapolis MN 55432]*

AUSTRALIA

David Horsfall VK2KFU
PO Box 257
Wahroonga NSW 2076
Australia

In my last news from Australia, I mentioned how the Spectrum Management Authority (SMA) was overhauling the licensing scheme (for all classes—business, Amateur, and CB) in Australia. Combined with the long-awaited changes to the Amateur Regulations scheduled for the end of this year, we can look forward to some interesting times (remember that Chinese curse?).

The new Amateur regulations, foreshadowed almost two years ago and delayed for one reason or another, will mean greater deregulation for Australian Amateurs, and amongst other things will allow Novices to use packet radio (currently they cannot), permit the codeless "Limited" Amateur to use 10m FM, and create a "Codeless Novice" class of licence. These changes are expected to create an influx of people into the Amateur Radio Service, which is languishing for lack of numbers; youngsters these days are more interested in playing with their computers than talking to the other side of the world.

With these changes comes greater responsibility, and there are moves afoot to make the Amateur responsible for resolving all cases of interference; a spectrally-pure signal will no longer be a defence, and as Australia has comparatively lax EMI standards, it has become a dumping ground for the rest of the world.

I also mentioned in the last column the madness that seems to have infected the VK2 Division of the Wireless Institute of Australia (WIA). Sanity was expected to have returned at the Annual General meeting, but no—the election outcome was successfully challenged on the grounds that it was not conducted according to the Articles of Association; the Returning Officer was not permitted to conduct the ballot, proxies were not authenticated, and several dubious Reports to Members and "How to Vote" guides were circulated. At the time of writing, an amicable solution to this crisis is being sought; one that does not involve going to court and subsequent legal bills. A fresh election, conducted by a neutral third party, would appear to be the preferred option. In the meantime, it would appear that the only person who has any authority within the VK2 Division is the paid Administrative Secretary, as it is generally agreed that a new Council was not elected after all.

Cheers for now. Those with access to packet or Internet can contact me as "VK2KFU @ VK2AAB.SYD.NSW.AUS.OC" and "dave@esi.COM.AU" respectively. I'm not sure whether all messages are being delivered to my packet address, so if you don't get a reply, it means that I didn't see it. 73

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*Advertisers who have contributed to the National Advisory Committee (NIAC).

NEVER SAY DIE

Continued from page 4

me into amateur radio was *QST* magazine. Our school library had a subscription, so when I wanted to know more about amateur radio I went to the library and started reading. It sounded like fun, so I joined the school radio club, where I was able to get on the air. The club station was W2ANU on 160 meters. Well, that was about the only voice band Class B amateurs could use, and most of us were Class B back then. This was in 1937.

Will today's youngsters be able to go to their school or public library and find out what's happening in amateur radio? That's what got me going, so check it out and see if your local school libraries have subscriptions to *73* and *Radio Fun*. They probably don't unless you've donated the subscriptions. So I'll tell you what, if you'll do your bit to help interest youngsters in amateur radio by springing for a combo subscription for *73* and *Radio Fun* for your local school and your local public library, I'll go part way with you. You might even want to come off as Daddy Warbucks by giving subscriptions for your radio club library too. Subscriptions to the two publications would normally cost $33, but if you send me $25 we'll send the libraries you select a subscription to both magazines with your compliments.

Here's your chance to help amateur radio recruit new hams. Your $25 can do a whole lot of good. Send your subscriptions to: Library Special, *73* Magazine, Peterborough NH 03458-1107. Cash, check, or credit card. Or call us at 603-924-0058.

Book Bargain

If you ever find yourself short of things to talk about on the air, you could do worse than get a copy of kindly old Uncle Wayne's *Declare War* book. It's time to put the few copies we've got left in the warehouse on sale.

Book? Okay, in case you are either a newcomer to *73* or have advanced brain rot, here's what happened. Coming on to three years ago, when the recession was at its worst, the governor of New Hampshire, unable to think of anything much to do about the situation, got the Legislature to authorize an Economic Development Commission to help him cope with the disaster. Yes, he appointed me to the Commission, even though I warned him that I would be at the least a royal pain by insisting that we accomplish something.

It didn't take me long to discover that most of the very important businessmen and even more important politicians on the Commission were too busy with other things to devote much time or thought to the job. So, for over a year, I attended Commission meetings and endless subcommittee meetings. I sent reports to the Commission members of what I was finding as far as our problems were concerned, and then I suggested inexpensive solutions. A few members were enthusiastic about my reports. The rest I didn't hear from. When I saw them or called them and asked what they thought they said that, well, ahem, they hadn't had time to read them yet.

So I reprinted my reports in book form and sent it to the Legislature, most of whom didn't read it either. I wasn't set up to handle national distribution, so I settled for getting the book into New Hampshire bookstores. It sold well and brought me many compliments. No negatives from anyone yet. I've advertised it in *73* and sold several hundred copies, again getting many nice letters commenting on my approach to solving our more serious national problems.

Now I'd like to clean out the copies that are left, so instead of the $13 published price (plus $3 shipping and handling), I'll send it to you for $10 postpaid.

So what's in the book? Well, there's a wealth of entrepreneurial ideas. When I took a look at the major problems facing New Hampshire and America, I looked for creative solutions. Not having seen socialism succeed anywhere in the world in history, I've tended to avoid calling on the government for intelligence or answers.

What kind of problems? Well, little things like our high crime rate and how to tackle it. The high cost of prisons and shortage of prison space—the welfare mess—our rotten school system—the high cost of a college education—how we can cut the bloated government bureaucracy in half in three years—how we can cut taxes and get rid of the deficit—solving the drug problem—building a high-tech workforce—ending poverty—making Congress honest. Things like that.

Sure, I've written about some of these things in my editorials, but the book has 360 pages of my findings and ideas. You may find this difficult to believe, but I even express some opinions—and I'm well known for being almost totally unopinionated. I think you'll like my proposal which will provide unlimited prison space for a fraction of what we're paying now and result in re-educated and motivated ex-prisoners. I think you'll like my college plan which will provide free tuition and a three-year degree.

Send or call in your order (603-588-2105) to Uncle Wayne's Bookshelf, Peterborough NH 03458-1107. This book is so good I can almost guarantee you'll like it so much you'll be reading it over the air. If you paid the full bore I would guarantee it.

One Million Dollars?

One result of my offering advice in my business publications such as *Music Marketing, Music Retailing, Ham Radio Marketing, Microcomputer Marketing,* plus articles in *Folio, Inc.*, and so on, has been a series of consulting gigs. While there are as many problems as there are businesses, I found some that almost all businesses had several in common.

The three almost universal problems are (a) lousy PR, (b) lousy advertising, and (c) lousy direct mail follow-up on advertising and promotion. Why the owner and CEO of a company would go to all the expense and trouble of developing a really good product, only to kill it with lousy marketing, is difficult to understand. I guess it comes down to either remarkable stupidity, or else a lousy education in the fundamentals of business.

What's more basic to selling a product than advertising? Yet there are few schools teaching the subject. Worse, all too many of the big ad agencies don't seem to have anyone around who's ever studied the fundamentals. When you consider that a good ad can easily sell 10 times as much product as a crummy ad, this is not something you want to trust to a high-school dropout. That's like a manufacturer letting a rig be designed by a Novice.

"A simple new product release in a magazine will, on the average, result in about the same increase in sales of a product as a full-page ad."

Since there already are books and courses available for anyone interested in learning about advertising, and I'm not interested in writing something that is already available elsewhere, I haven't yet written an advertising primer. Maybe one of these days.

When I started my first business, manufacturing loudspeakers, I quickly discovered that I couldn't depend on agencies for anything beyond doing the mechanicals for my ads. I'd have to design and write them. I bought some books, which were OK, but not great. One of the best moves of my life was to sign up for a course in advertising with the Advertising Club of New York. Their lecture series was superb. They not only covered how to design and write ads, but how to handle ads in magazines, newspapers, radio, TV, billboards, posters, and even matchbook covers. Changed my life.

Promotion!

The easiest way for any company to generate more sales without a lot of expense is to go the promotion route. There's a lot to learn about this. There are obviously some sneaky tricks the professionals use to make sure their material gets before the public. As a publisher of some of the larger magazines in the country, I knew that not more than a handful of experts had even an inkling of how to get new products releases or product reviews published.

From my viewpoint, most companies are throwing away sales. A simple new product release in a magazine will, on the average, result in about the same increase in sales of a product as a full-page ad. A good product review will sell as much as four full pages of ads.

If you use the normal magazine guideline, an ad, if it is any good, and is in a magazine reaching good potential buyers, should sell at least 10 times the cost of the ad in product. Thus, if a page ad in a magazine costs $8,000, an advertiser would expect to get at least $80,000 in sales as a result. Now, if we figure that a company has at least four new products a year and thus is able to get four new products releases printed in a magazine, plus maybe two product reviews, that should provide the same sales as running a dozen full-page ads—so we're talking about an additional $1 million in sales, all from absolutely free advertising!

In the ham radio field, where ads are more like $1,500 a page, that's still an added $180,000 in sales—if you know how to write the new products releases and get them published.

To help business people take advantage of the power of promotion I made a one-hour video explaining exactly how to do it—giving away some secrets that have made a few other publishers furious. I've been selling the video for $100 with a money-back guarantee. No one's asked for their money back yet, and I've sold several hundred of them. They're even being used by a couple of colleges as part of their advertising courses.

Now I'd like to make this video available to interested *73* readers at a big discount. How about $40 plus $3 shipping? That's my $1 Million Video. Send a check or your credit card number to Uncle Wayne's Bookshelf, Peterborough NH 03458-1107.

It really doesn't make much difference what kind of a business you are in—PR is an inexpensive and very effective way to generate sales. But, you know, not one company in a thousand knows how to get all this free advertising. Maybe one in ten thousand. And that includes some very large, but not too brilliantly run, companies.

Is it worth $40 to you to generate a few thousand dollars in extra sales? Probably not. Too much trouble. Yawn.

With some encouragement I'll do a video on how to double your business with a better follow-up on reader's service cards. Or at least I'll write a book. A video would be better so I could show you how stupid some manufacturers are in preparing their literature. You won't believe it if I don't show you.

Chicken Little

When one of the non-publishing WGI divisions managed, through spectacularly poor management, to rack up unexpected losses, I knew I'd be able to count on at least one Chicken Little to blow this out of proportion. I was not disappointed. Fred W5YI, who seems unable to keep himself from avoiding any such opportunity, stepped right in with his appropriately-colored pink sheet.

The only way I'm able to "run" so

many different businesses without being tied down 24 hours a day is to pick the best managers I can and give them the authority to run them. Most of the time this works out fine, but now and then one screws up—and then of course covers up. In this case it was with the IMPS Manufacturing Division.

This is the Independent Music Producers Syndicate, which has been brokering the manufacture of compact discs for over a thousand independent record companies. The team running it managed to lose a bundle through loose credit policies.

Yes, I should pay more attention, but I had no reason not to trust the creative financial reports I was getting, and I was spending most of my time researching and writing—work which resulted in my *Declare War* book, and a soon-to-be-finished *Declare War II*, or *Son of Declare War*. Plus I was also writing editorials for *73*, *Radio Fun*, *"Cold Fusion"*, *Music Retailing*, and *IMPS Journal*. Getting *"Cold Fusion"* started took extra time too, what with my having to bone up on the latest fundamentals of physics, chemistry, atomic theory, quantum mechanics, and even chaos theory. So I got blind-sided. Hey, I'm only one guy, and I'm old. Say, where'd I put my walker?

Despite Fred's enthusiastic Chicken Little alarums, *73* is doing just fine, thank you, and it's no more for sale than it's ever been. When I found out what was really going on I dumped the CD brokerage business and concentrated our efforts on the cold fusion field, which I'm convinced is going to have more of an impact on the world than any other development in the 20th century. That left me with a warehouse full of CDs to sell to clean up our debts. Fortunately they're all superb music, so we'll be providing some incredible music bargains for anyone who likes music. And if you don't like music, you're a very disturbed person and have no business reading my editorials.

When you break an egg, make an omelet, right? So we're arranging through a liquidator to make this great music available for anyone looking for merchandise to sell at flea markets. Would you believe full-length digitally recorded CD music collections available as low as $2.65 each in quantity? Tests in New Hampshire flea markets saw these CDs selling like hot cakes at $4.50, with many entrepreneurs cleaning up $200-$300 on a Saturday. For more information on that, check with Buys Inc., Box 184, Antrim NH 03440-0184, 603-588-2105 days, an answering machine at night—or fax 588-3205.

Tesla Symposium, July 21-24

It's in Colorado Springs and there'll be a bunch of hams there, just like last year. I was there and had a great time. I learned a lot and met some wonderfully interesting people. Even better, I bought a ton of great books—many of which I've been reviewing and recommending to you.

The Symposium is at the Sheraton Hotel South, in Colorado Springs. Give the Tesla Society a call for details: 719-475-0918. Say Wayne sent you. I told you all about this last year, you just didn't pay any attention. If you're interested in weird science, don't miss this one.

And if you find that the Symposium doesn't keep you busy both day and night, you could do worse than drive up to nearby Boulder in the evenings and enjoy the ragtime festival. That's what Sherry and I did every night last year. If we can make it this year, we'll be doing the same. Scott Kirby will be there performing. Say hello to him and be enchanted by his artistry. He's incredible. You'll also enjoy Frank French, another superb performer. Call 303-499-9150 for details.

If Sherry and I can make it all the way from New Hampshire, what's holding you back? Have some fun. And if you can't make it, at least say hello on 14,297 via KC2Q.

Bad Science

The current scientist put-downs of cold fusion remind me of the early days of radio. As you're aware, we started out with spark transmitters. Well, I've donated several early radio books to the Wireless Museum which say that voice could never be transmitted because damped waves could not be modulated. These were, of course, published well after Nicola Tesla had demonstrated voice transmissions. History is packed with such wrong-headed scientific pontifications.

Maybe you've read about the early scientific controversy over the existence of ether. Well, light waves and radio waves had to travel through some kind of a medium, right? Just as sound waves travel through air. But when no one was able to detect the ether, they dismissed it, and moved light through space in photon packets. I guess radio goes in RF packets? Well, somehow it gets there, as do waves of a wide variety of other wavelengths.

So do magnetism and gravity. Gravitrons? So now some scientists are relooking at the ether concept. Maybe "space" isn't nothing after all. And I don't mean the few atoms or molecules of stuff that's floating around out in "empty space."

Are the researchers who are generating "excess" energy somehow tapping into the ether? Well, there are a growing number of scientists who are starting to think more seriously about this. They're calling it "zero point" energy. Everything has to have a name.

Perhaps the mysterious excess energy cold fusion researchers are tapping can be explained in this way. Or maybe there are two possible electron orbits for hydrogen and the excess energy is resulting from changing this orbit. Or who knows?

We know a lot about electricity now. We can measure it, generate it, transport it, store it, and use it. About the only thing we don't know yet is what it is. We can measure gravity, but we don't know much more about it. We don't even know for sure how fast a "gravity wave" propagates. Speed of light? Instantaneous? We can measure inertia, but what causes it?

So don't tell me about how far along we are in science. And don't tell me what is or isn't possible. And that goes for our most revered and lettered scientists.

I'm hoping that *Nova* will broadcast either the March BBC or the April CBC documentaries on cold fusion. These programs have embarrassed the hell out of some very important scientists, making them look like idiots. I enjoyed the juxtaposition of the Department of Energy head saying cold fusion is the fiasco of the century against Dr. Fleischmann holding a reactor a little larger than a thermos bottle in his hands which he claims has been generating over 20,000 watts of power continuously. We could use a few more such fiascos.

The AMA Sucks

When I read about one therapy after another which has been proven in practice, but of which the AMA "doesn't approve," I almost get angry. It seems like almost every branch of science has the same problem.

In recent months I've learned a bunch about the problems that dental amalgam and nickel inlays can cause. If you have any amalgam fillings, I guarantee you'll be healthier if you get 'em replaced. You want to read *It's All In Your Head* by Hal Huggins. Those fillings, which the ADA still supports, are dumping poisonous silver and mercury into your body.

Then there's the way we're doing a job on ourselves by preventing ultraviolet light from getting into our eyeballs. Read *Health And Light* by John Ott, *Light, Medicine of the Future*, by Jacob Liberman, and *Into The Light* by W.C. Douglass. It's incredible what even just a little ultraviolet light can do for your health.

There also is a long history of curing a wide variety of illnesses by exposing a small amount of a person's blood to ultraviolet light and then putting it back. Illnesses like cancer.

Are low-powered magnetic fields helping to make you and your family sick? You bet they are. You can read more about this in *The Body Electric* by Robert Becker, *Cross Currents*, also by Becker, *The Electricity Around You May Be Hazardous To Your Health* by Ellen Sugarman, *Currents of Death* by Paul Brodeur, and *The Great Power-Line Cover-Up*, also by Brodeur.

You'll also want to read *Magnetism and Its Effects on the Living System* by Davis & Rawls.

And if that isn't enough, you're going to love *Hydrogen Peroxide Medical Miracle* by William Douglass. If you know anyone with cancer, colds, flu, artery plaque, heart disease, shingles, gum disease, etc., you should get them to read the book.

K4VSC sent me a brochure from the Jungle Aviation and Radio Service (JAARS) about a snakebite zapper. It does about the same as zapping a snakebite with a wire from the spark plug of a car or boat, the way the Peruvian Indians do. JAARS is making small hand-operated generators for jungle use (no batteries to die). They claim that the treatment also works on scorpion stings. I'd say we need more research. I'll bet a similar approach would work on jellyfish, stingray, scorpion fish, and fire coral stings. It might work fine for bee and wasp stings, and even mosquitos and other insect bites. Imagine what a business you could have with a little gadget which instantly stopped the itching of bug bites. It would have a small ring you'd put around the bite and an electrode to touch the middle of the bite. Zap, and no more pain.

There are more than a few reasons to suspect that something like this might also help with some skin or breast cancers. I've a letter from a reader citing the Swedish use of 12 volts to get rid of breast cancers.

Alas, there is very little funding available for research into non-pharmeceutical approaches to sickness repair, and it has been claimed by many people in the field that the FDA is controlled by the pharmeceutical industry. Tough combo to fight, no matter how good the therapy.

Now we read that in the last 50 years male sperm counts have been cut in half. What we haven't yet read is what whatever is doing this is also doing to the surviving half of our sperm. If whatever it is is killing half, imagine how sick or damaged the other half must be! Pesticides are suspected. They've been used so extravagantly that now they're into just about everything we eat and much of what we drink. They're into our farm lands and our water supplies. We eat them, drink them, and breathe them.

So what can we do about this mess we've gotten ourselves into? You can do the same thing I'm doing. You can read and get the facts. You can give talks at your local Chambers of Commerce, Rotary, Lions clubs. You can get on talk radio and pass the word. You can raise hell and put a brick under it.

I'm not talking ecoscams with little or no scientific basis like the ridiculous Alar scare, the owls, nuclear winter, acid rain, greenhouse summer, the snail darter, or the blessed ozone hole. And by the way, there are some fine books on all these media-hyped scares. The two I recommend as the best are *Evironmental Overkill* by Dixie Lee Ray, and *Ecoscam* by Ronald Bailey.

Your alternative is to keep quiet and shrug off your responsibility to do your best to fight for a healthier life for your children . . . and theirs. And, as you are shrugging, try to remember that the main reason democracy has failed so disasterously in America is the refusal of most people to assume any responsibility, thus leaving much of the change in the hands of nut cases who do go out and scream and carry on.

The bottom line: Do your homework and then make yourself heard.

73

Number 25 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.*

AUG 1

DOYLESTOWN, PA The Wyndmoor AR Rptr. Club of Doylestown will meet at the Doylestown Twnshp. Bldg. Comm. Room on Wells Rd., at 7:30 PM. Interested persons may call *Bob Agans, (215) 348-7966*. The Club features speakers and videotapes on topics concerning amateur radio. They also get together for license tests and weekend excursions.

AUG 1-30

PITTSBURGH, PA For details regarding a Hamfest/Computer Show/Flea Market, contact *Catherine Crnhovich, Queen Roberta College, 3343 Webster Ave., Pittsburgh PA 15219.*

AUG 5-7

VERNON, BC, CANADA The 3rd annual Sky High Hamfest will be held by the North Okanagan RAC, at Silver Star Mt. Resort. Flea Market. Dinner & Dance. HF Station. More. Contact *North Okanagan ARC, P.O. Box 1706, Vernon BC V1T 8C3, Canada.* For hotel reservations, call *1-800-663-4431.*

AUG 6

CARLINVILLE, IL The Macoupin County ARC, Inc., will hold "Hamfest '94" at the Macoupin County Fairgrounds, 1/2 mile north of Carlinville, on Route 4. Doors open at 8 AM. VE Exams, all classes, pre-registration required. Talk-in on 146.82 and 443.400 (103.5 PL). For registration and info, call *(217) 854-8261.*

GOSHEN, IN The Elkhart County Hamfest will be held at the 4-H Fair Grounds located on CR 34. Talk-in on 145.430(-), 224.90(-), 443.325(+), PL 131.8. VE Exams. Contact *Jocelyne WZ9M, 20284 CR 36, Goshen IN 46526. Tel. (219) 533-7632.*

INDIANAPOLIS, IN The annual WA9SNT Hamfest will be held at ITT Tech. Inst., 9511 Angola Ct., from 8 AM-3 PM. Set-up at 6 AM. This event is sponsored by the ITT Radio Club. Talk-in on 145.25(-). Contact *Dave Johnston K9HDQ, (317) 875-8640.*

VALPARAISO, IN The Porter County Hamfest/Computer Show, sponsored by the Porter County ARC in co-operation with The Porter County Tourism Bureau, will be held at Porter County Expo Center. Doors open at 8 AM (set-up at 6 AM). VE Exams 9 AM-12 Noon. Talk-in on 146.775/-6kc 131.8 PL and 146.520 simplex. Contact *Rich N9QLQ, (219) 762-8701;* or send SASE to *PCARC HamFest, P.O. Box 1782, Valparaiso IN 46384-1782.*

AUG 7

CROOKED LAKE, ANGOLA, IN The Annual Land of Lakes Angola Hamfest, sponsored by the Land of Lakes ARC, will be held 6 AM-2 PM at Steuben County 4-H Fairgrounds, corner of 200W & 200 N. VE Exams for all classes. Talk-in on 147.180, 145.090 packet, 444.350 131.8 tone, 444.900/.100, 224.94, 53.050. Contact *Sharon Brown WD9DSP, 905 W Pkwy. Dr., Pleasant Lake IN 46779. Tel. (219) 475-5897.*

MARSHFIELD, WI The Marshfield Area ARS will hold their 3rd annual Picnic, in Wildwood Pk., beginning around 11 AM. This is a Potluck/Swapfest. Talk-in on 147.180. Contact *Guy A. Boucher KB9GPJ, 107 West Third St., Marshfield WI 54449. Tel. (715) 384-4323. PACKETT:KB9GPJ @ W9IHW.WI.USA.NA.*

NEW KENSINGTON, PA The Skyview Radio Soc. will sponsor its annual Swap-n-Shop Hamfest from 8 AM-3 PM at the Club grounds on Turkey Ridge Rd. Talk-in on 146.64-. Contact *Michael Peltz N3MRU, 11 Manorfield Dr., Delmont PA 15626. Tel. (412) 468-8699.*

PEOTONE, IL The 60th annual Hamfest/Computer Festival, sponsored by Hamfesters RC, Inc., will be held at Will County Fairgrounds 6 AM-3 PM. Flea Market. Set-up Sat. Aug. 6th at 6 PM-12 midnight. Talk-in on 146.52 simplex, 146.64(-) (courtesy of STARS); 146.94 (-) (courtesy of KARS). For info, call *(708) 535-AHAM.* For advance tickets, send SASE and check by July 20th to *David F. Brasel NF9N, 6933 W. 110 St., Worth IL 60482. Tel. (708) 448-0580.*

UPPER MARLBORO, MD The 4th annual Southern Patuxent Hamfest will be held from 7 AM-2 PM at the Show Place Arena. Set-up from noon to 8 PM on Sat., Aug. 6th. Talk-in on 147.150(+). Contact *SPARC Hamfest, P.O. Box 399, St. Leonard MD 20685. Tel. (410) 586-2177.* Sponsored by The Southern Patuxent ARC.

WELLESLEY, MA The Wellesley ARS and the Babson Wireless Club will cosponsor a Ham Flea Market from 9 AM-2 PM at Trim Hall, Babson College. VE Exams at 11:30 AM (register by 11 AM). Bring exam fee of $5.75 (checks made out to ARRL/VEC), an original and a copy of your license, an original and a copy of any CSCEs held, a calculator and a pen. To reserve tables, contact *Barbara Holdridge N1ICQ, 107 Church St., Westwood MA 02090. Tel. (617) 329-2628.* VE Exams Contact: *Gerry Driscoll NV1T, 107 Church St., Westwood MA 02090. Tel. (617) 444-2686.*

AUG 13

QUINCY, IL The Western IL ARC will hold the 1st Post-Flood Ham Radio/Computer Swapfest at Eagles Alps Lodge, 3737 N. 5th St. VE Exams (NA9Q-Reservations *(217) 224-8526).* Talk-in on 146.63/.03. For info, contact *Rod Simon N9MCX, c/o WIARC, P.O. Box 3132, Quincy IL 62305-3132. Tel. (217) 223-8739.*

TACOMA, WA The Radio Club of Tacoma will have its annual Flea Market at Charles Wright Academy, 7723 Cham-

bers Creek Rd. W., from 9 AM-3 PM. VE Exams at 10 AM. Commercial and non-commercial venders MUST pre-register for tables. Talk-in on 148.28. Contact *Alan Allen N7EAY, P.O. Box 11188, Tacoma, WA 98411. Tel. (206) 475-7413.*

AUG 13-14

CHARLOTTE, VT The BARC 42nd Internat'l Hamfest will be held by the Burlington ARC at The Old Lantern campgrounds on Greenbush Rd. Talk-in on 146.61/.01, 146.94/.34, and simplex 146.52. Flea Market. VE Exams. Demonstrations. Contact *Duane Waller N1BBR, (802) 877-2819.*

SHREVEPORT, LA The Shreveport ARA "ARK-LA-TEX" Hamfest will be held at Bossier City Civic Center, Benton Rd., Bossier City LA. Time: Sat. 8:30 AM-4:30 PM; Sun. 8:30 AM-1 PM. VE Exams. Forums. Banquet. Talk-in on 147.03. Contact *Alice B. Prudhomme KG5ZZ, Rt. 1 Box 410, Mansfield LA 71052. Tel. (318) 872-5988 after 6 PM.*

AUG 14

CHARLOTTE, NC Roll-A-Round Skate Center, 8830 East Harris Blvd., will be the location for the Charlotte ARC Hamfest/Computer Fair. Time: 8 AM-4 PM. Flea Market spaces are limited and must be pre-registered. Talk-in on 147.06(-), 444.85(+).For more info, call *(704) 522-4971, Ext. 3330.* Make checks payable to *Charlotte ARC*, and send with SASE (before Aug. 1st) to *Charlotte ARC, P.O. Box 33582, Charlotte NC 28233-3582.*

EASTON, PA The Delaware-Lehigh ARC, Inc. will hold its annual Hamfest/Computer event at the Career Inst. of Tech., 5335 Kesslersville Rd., starting at 8 AM. Set-up at 6 AM. Talk-in will be on 146.10/.70 MHz, W3OK Rptr. Contact *Bill Goodman K3ANS, (610) 253-2745 or (610) 258-5060.* You may also call the *DLARC answering service at (610) 820-9110.*

NAZARETH, PA A Hamfest/Computer Show will be held by the Delaware-Lehigh ARC, Inc. at the Career Institute of Tech., Easton PA, starting at 8 AM. Set-up at 6 AM. VE Exams. Demo Ham Station. Electronics Test Bench, and more. Talk-in on 146.10/.70 W3OK Rptr. Contact *Bill Goodman K3ANS, (610) 253-2745 or (610) 258-5060.* Also call *DLARC Answering Service at (610) 820-9110.* Make checks payable to *Delaware-Lehigh ARC, Inc.*, and mail to *The Delaware-Lehigh ARC, Inc., RR 4 Greystone Bldg., Nazareth PA 18064-9211.*

AUG 20

ALBUQUERQUE, NM The Duke City Hamfest is scheduled to be held at the New Mexico Army Nat'l. Guard Armory, 600 Wyoming Blvd., N.E. Hours: 7 AM MDT-5 PM MDT. Set-up Aug. 19th after 6 PM. For details about VE Exams, please call *Bob Witter at (505) 292-3218.* Flea Market spaces by pre-registration only. For info call *KC5FT or KB5SF at (505) 821-2771.* Make checks payable to *The Duke City Hamfest*, and mail with SASE prior to Aug. 11th to *Duke City Hamfest, P.O. Box 6552, Albuquerque NM 87197-6552.* Talk-in on 147.10 (+600 kHz) with back up on 147.15 MHz (+600 kHz). No one under the age of 15 admitted without parent or guardian.

LONGVIEW, WA The Lower Columbia ARA will host their 3rd annual Ham Radio/Computer/Electronic Equip. Swap Meet from 9 AM-3 PM at Cowlitz County Fairgrounds. Set-up Aug. 19th 5 PM-9 PM; Aug. 20th, 6 AM-8:45 AM. Talk-in on 147.26(+) K7ZVV Rptr. For info, call *(206) 425-6076, (206) 425-9184, or (206) 425-1866.* Make checks payable to *LCARA*, and mail to *LCARA Swap Tables, P.O. Box 906, Longview WA 98632.*

AUG 20-21

HUNTSVILLE, AL The 1994 Huntsville Hamfest will be held at the Von Braun Civic Center. Doors open to the public at 9 AM on both days. Dealer Show/Flea Market. Tech. Forums. Banquets, and more. The nearby Huntsville Hilton Hotel is participating by offering special Hamfest rates. Talk-in by K4BFT on 146.34/.94 MHz. For info, call *(205) 534-7175*, or write to *Huntsville Hamfest, P.O. Box 12534, Huntsville AL 35815.*

AUG 21

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club will hold a Flea Market from 9 AM-2 PM at Albany and Main St. For details call *(617) 253-3776.* Mail advance reservations before Aug. 5th to *W1GSL, P.O. Box 82 MIT BR., Cambridge MA 02139.* Talk-in on 146.52 and 449.725/ 444.725 PL 2A W1XM Rptr.

MARYSVILLE, OH The 18th Annual HamFest of the Union County ARC will be held at the Union County Fairgrounds near Columbus OH. Radio equip./Computer products. Flea Market. Contact *Gene Moore N8YRF, 24461 Claibourne Rd., Marysville OH 43040. Tel. (513) 246-5943.*

AUG 26-28

SAN DIEGO, CA The 1994 ARRL Southwestern Div. Convention will be hosted by the San Diego AR Council, Inc. at the Town and Country Convention Center off of I-8 in San Diego. Times: Fri. 3 PM; Sat. 9 AM-4 PM; Sun. 9 AM-Noon. Harbor Dinner Cruise Fri. night. Banquet Sat. eve. featuring Steve Roberts N4VRE and Behemoth. VE Exams. There will also be an ARRL ceremony for Wouff Hong. Talk-in on 145.320 - 107.2 PL. For info call *(619) 278-4284.* To pre-register, contact *Bob Boehme, 10340 Everell Place, Santee CA 92071.*

AUG 27

BRIDGEWATER, NJ The Somerset County ARS Inc. will hold their annual Hamfest at the Somerset County 4H Center on Milltown Rd., just off of Route 202. Time: 8 AM-1 PM. Set-up at 6 AM. Talk-in on 448.175(-). Contact *Donna, or George N2RQH, (908) 369-4533.* Or write to *SCARS, P.O. Box 742, Manville NJ 08835.*

CHAFFEE, NY The Arcade Kiwanis will sponsor the Pioneer Radio Operators' Soc. 3rd annual Chaffee Hamfest/Computer Show from 7 AM-3 PM at Manion Pk. Talk-in on 145.390 and 444.175. Ad-

vance registration tickets $3 each (Flea Market set-up included). Make checks payable to *Mike Wrona, 139 Greenmeadow Dr., West Seneca NY 14224.* Please include an SASE.

CHANUTE, KS The Chanute Area ARC Hamfest will be held 9 AM-2 PM at the Nat'l Guard Armory, South Santa Fe St. VE Exams; registration at 9:30 AM. Testing at 10 AM. Bring originals and copies of license and all certificates, and a picture ID. Flea Market set-up 7 AM-9 AM. Talk-in on 146.745-. Contact *Paul N0NBD or Sarah N0TKO, Rt. 1, Box 208, Humboldt KS 66748. Tel. (316) 473-2873.*

RHINELANDER, WI The Northwoods ARC, ARES, Rhinelander and Tomahawk Rptr. Assns. will co-sponsor the Northwoods Swapfest. Doors open 8 AM-2 PM at Sugar Camp Town Hall, 13 miles north of Rhinelander, on Hwy. 17. VE Exams: Registration 10:30 AM, testing at 11 AM. Contact *Mary Berger NS9Q, 367 Lois St., Rhinelander WI 54501. Tel. (715) 362-9296.*

ROSEAU, MN Lake of the Woods Rptr. Assn., Inc. will hold their 8th annual Ham Fest at Roseau High School Gym, Hwy #11 E. VE Exams. Flea Market. Banquet with program. More. Talk-in on 147.69/.09 and 146.40/147.00. Contact *David Landby KB0HAP, Rte. 3, Box 10, Warroad MN 56763. Tel. (218) 386-1092.*

AUG 28

LEBANON, TN A Hamfest will be held at Cedars of Lebanon State Pk., U.S. Hwy. 231, 7 mi. south of I-40. The Short Mountain Rptr. Club will host this event 7 AM-3 PM. Talk-in on 146.91. Contact *Mary Alice Fanning KA4GSB, 4936 Danby Dr., Nashville TN 37211. Tel. (615) 832-3215.*

MATAMORAS, PA The ARRL sanctioned Tri-State ARC Hamfest will be held at Hunts Best Western Pavillion, RT. 84 Exit 11 (where PA, NY and NJ meet). Flea Market. ARRL Booth. Contact *Paul KD3L, (717) 491-4808 after 1 PM; Ray WY2D, (914) 856-1733 after 6 PM;* or *Bob N3NPT, (717) 296-4551.*

ST. CHARLES, MO The St. Charles ARC will host "Hamfest94" at the Blanchette Park from 6:30 AM-2:30 PM. Vendor area open 9 AM. Talk-in on 146.07/.67. Contact *Scott Schultz N0UVM, 241 Burning Leaf Dr., St. Peters MO 63376. Tel. (314) 928-7267.* To pre-register for VE Exams, call *(314) 524-3254.*

WOODSTOCK, IL The Tri-County Radio Group, Inc. will hold its Hamfest/Computer Show at the McHenry County Fairgrounds located just off Route 14 on Route 47, beginning at 6:30 AM for Fleamarket, and 8 AM for exhibitors. (Set-up Sat. by appointment, or 6:30 AM on Sun.) Talk-in on 146.52 simplex. Reservation deadline is Aug. 10th. Write to *T.C.R.G., P.O. Box 3107, Skokie IL 60076-6107*; or call *Robert N9KXG, (708) 658-1678.*

YONKERS, NY A Hamfest/Computerfest, sponsored by the Yonkers ARC, will be held 9 AM-3 PM at the Yonkers Municipal Parking Garage on Main St. Talk-in on 146.865, 440.150 MHz. Preregistration is $10 per space. Make checks payable to the *Yonkers ARC* and send your order with an SASE to *Y.A.R.C., P.O. Box 378, Centuck Sta., Yonkers NY 10710-0378.*

SEPT 2-3

NEW ORLEANS, LA The New Orleans Internat'l DX Convention will be held at Royal Sonesta Hotel on Bourbon St. Times: Fri., Sept. 2, 1 PM-11 PM; Sat., Sept 3, 8 AM-Midnight.
Registration deadline is Aug. 15th. For more info, call *(504) 283-4143 days only; FAX (504) 524-2129.* Send checks or money orders payable to: *New Orleans Internat'l DX Convention, c/o Michael Mayer W5ZPA, 5836 Marcia Ave., New Orleans LA 70124.*

SEPT 17

SCOTTSDALE, AZ The Family AR Event will hold its 2nd annual event at Rawhide Western Town, 23023 N. Scottsdale Rd. RC airplane demo. Weathersat forums. Emergency Ham Radio. Activities for children. Swap meet area opens at 6 AM. Exhibit hall opens at 9 AM. Contact *Len Winkler KB7LPW, P.O. Box 9219, Phoenix AZ 85068. Tel. (602) 861-0303.*

SPECIAL EVENT STATIONS

AUG 5-7

MACUNGIE, PA Local hams will operate W3TEB on the General 80, 40 and 20 meter phone subbands and 146.55, in conjunction with the 31st annual Das Awkscht Fescht (PA Dutch for "August Festival" - A Festival and Antique Car Show). For a certificate, send QSL and SASE to *Henry Buchin W3TEB, 21 East Main St., Macungie PA 18062-1308.*

AUG 6-7

BARNEGAT LIGHT, NJ The Old Barney ARC will operate W2OB from "OLD BARNEY," the Barnegat Lighthouse (Long Beach Is. IOTA NA-111), to commemorate Nat'l Lighthouse Day. Time: 3000 UTC-0000 UTC each day. Freq.: Look in the lower 25 kHz of the General phone bands; 40, 20, 15, and 10 meters, plus 146.52 simplex, 146.835 Rptr., and other local Rptrs. For a special QSL, send a 9" x 12" SASE with 2 units of postage, via NU2F. For more info, contact *QSL W2OB via NU2F, Joe Fleishinger Sr., 75 Joshua Dr., Manahawkin NJ 08050 USA.*

WELLSBORO, PA The Tioga County ARC will operate WO3C 1300Z Aug. 6-1800Z Aug 7, from Leonard Harrison State Pk, to celebrate the 50th Anniversary of Smokey Bear. Operation will be in the 80, 40, 20 and 15 meter General phone subbands, and in the Novice 10 meter phone subband. For a certificate, send QSL and a 9" x 12" SASE to *Darlene Rahn WO3C, R.D. #6 Box 200, Wellsboro PA 16901.*

AUG 7-13

POTTSVILLE, PA The Schuylkill ARA will operate N3ILC Aug. 7th-Aug. 13th, to celebrate the Schuylkill County Fair. Operation will be both CW and phone on the General and Novice subbands. For a certificate, send QSL and SASE to *Ed Brennan N3ILC, 520 Spring Garden St., Pottsville PA 17901-1651.*

AUG 12-13

MIDDLEBOURNE, WV The Tyler County ARO will operate KA8GOH 1500Z-2200Z Aug. 12th and 13th to celebrate the 32nd annual Tyler County Fair. Operation will be in the lower portion of the General 40 and 20 meter phone bands, and the 146.385/R. For a certificate, send QSL and 9" x 12" SASE to *TCARO, P.O. Box 287, Middlebourne WV 26149.*

AUG 12-16

WEST ISLAND, MONTREAL, CANADA Members of the West Island ARC are planning the club's 3rd expedition to St. Paul Island (off the northern tip of Nova Scotia). IOTA NA-94. The group plans to operate CW, SSB, and RTTY, using the call CY9CWI. Operation will be on 40, 80, and 160 meters. Operations will start at 0000Z on Aug. 12th and continue through Aug. 16th. Freq.: (MHz) 1.830-50, 3.505-15, 3.780-3.800, 7.040-7.060, 7.250, 10.110, 14.040, 14.195, 18.080, 18.120, 21.040, 21.320, 24.940, 28.120, 28.495, RS-12: Tx 21.220, Rx 29.420, RTTY 7.090, 14.090. Listen for operators Reg. VE2AYU, Coos. VE2GTI, Jean VE2JCX, Jean VE2TBH, Lowell VY2OX, Fred VE2SEI, Andrew VE2WHO, Helen VE2YAK, and Margaret VE2ZOO. VE2YAK and VE2ZOO will be especially looking for ops trying for YL DXCC. Address QSLs to *West Island ARC Inc., P.O. Box 884, Pointe-Claire/Dorval QC, Canada H9R 4Z6.* For more info, contact *Fred Archibald VE2SEI, 130 Embleton Cres., Pointe Claire QC, Canada H9R 3N2.*

AUG 13

BARNESBORO, PA The Dividing Ridge ARC will operate KE3DR 1500Z-2300Z to commemorate Barnesboro's Centennial. Operation will be in the lower General 40 and 20 meter phone subbands and the Novice phone portion on 10 meters. For a certificate, send QSL and SASE to *Dividing Ridge ARC, RD#1 Box 503-A, Barnesboro PA 15714.*

CENTERVILLE, GA The employees of Georgia Power Co. (Plant Scherer) and friends will operate Station AD4FC to commemorate the company's dedication to the environment and the community. The event will begin at 1200 UTC and end at 2400 UTC. Operation will be in the lower 25 kHz of 80, 40, 20, and 15 meter General class phone subbands, and in the 10 meter Novice class phone subband. For a certificate, send a 9" x 12" SASE to *Don Hall AD4FC, 262 Valencia Cir., Centerville GA 31028.* There will also be VE Exams and a Tailgate Swapfest.

LAKE WINNIPESAUKEE, NH The Central NH ARC will operate W1JY from the deck of the 235 ft. M/S Mt. Washington. Operation will be 1200Z-1900Z on 28,333, 21,333 and 14,333 +/- 3mh. Listen on 10 meters on the hour, 15 meters at 20 minutes after the hour, and 20 meters at 40 minutes after the hour. For a certificate, send 9" x 12" SASE and QSL to *CNHARC, Box 1112, Laconia NH 03247-1112.*

AUG 13-14

FALL RIVER, MA Station W1ACT will operate from aboard the tall ship "H.M.S. Bounty" as part of the annual "Fall River Celebrates America" Festival. Operations will be on 2, 6 and 10 through 160 meters, using CW, SSB, and FM. The Station will operate 1400Z Aug. 13th-1400Z Aug. 14th. To get a QSL card, please QSL via *Ed Walsh WV1L, 798 Second St., Fall River MA 02721.*

MILFORD, MI The Milford ARC will operate W8YDK 1500Z-2300Z both days, to celebrate the Milford Memories Summer Festival in commemoration of the discovery and founding of Milford MI. Operation will be in the lower portions of the General and Novice 40, 20 and 10 meter subbands. For a QSL card, send SASE and QSL to *Joe Kaminsky N8PGF, MARC, P.O. Box 301, Highland MI 48357.* 73

BARTER 'N' BUY

Number 26 on your Feedback card

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and junebe you can help make a ham sure it still works right and junebe 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 September classified ad section is July 14, 1994.

ALL ABOUT CRYSTAL SETS. Theory and construction of crystal set radios. $9.95 each, ppd USA. Send to: **ALLABOUT BOOKS**, Dept. S, P.O. Box 22366, San Diego CA 92192. BNB200

CUSTOM MADE-HAND TOOLED leather products with your initials, name, call letters. Photo's & estimates available. Key rings, wallets, belts, purses, hanging signs, specialty items. GREAT GIFT. **LEATHER & WEST,** 67 Causeway Rd., West Swanzey NH 03469. (603)352-6256. 9-4 pm. M-F ET. BNB215

SUPERFAST MORSE CODE SUPEREASY. Subliminal cassette, $12. LEARN MORSE CODE IN 1 HOUR. Amazing supereasy technique, $12; both $20. Moneyback guarantee. Free Catalog: SASE **BAHR-T4,** 150 Greenfield, Bloomingdale IL 60108. BNB221

OVER 500 TAILGATE SPACES THIS YEAR. Suncoast Amateur Radio and Computer Convention. November 19 & 20, 1994. Florida State Fairgrounds. Write: **FGCARC,** P.O. Box 2423, Clearwater FL 34617-2423. BNB265

WANTED: AUDIO EQUIPMENT. Tube, Solid State, McIntosh, Marantz, Tannoy, EV-Patricians, Western Electric, Nakamichi preferred. John, (410)465-2699. BNB268

QSL SAMPLES- 50 cents. **SAMCARDS,** 48 Monte Carlo Dr., Pittsburgh PA 15239. BNB275

MOTOROLA EQUIPMENT. Two 450Mhz MOCOM 35 Transceivers with 110v power supplies, one Alert Monitor 450Mhz Base receiver, new with manuals, $600.00 takes all. Two 450Mhz Duplexers, $200.00. Tony Sperduti, WB2MPZ, 710 Central Park Blvd., Port Orange FL 32127, (904)756-7763. BNB288

ATTENTION HAMS! Subscribe to *6-50 Worldwide for Six Meter Enthusiasts*, *DX Digest for DX Chasers*, or *The Novice/Tech Report*. Call (817)694-4047 or FAX (817)694-2522. BNB292

COMMODORE 64 REPAIR. Fast turn around. **SOUTHERN TECHNOLOGIES AMATEUR RADIO,** 10715 SW 190th Street #9, Miami FL 33157. (305)238-3327. BNB295

KIT BUILDERS— NEW, SYNTHESIZED qrp Transmitter/Transceiver, the ARK4. Full Transceiver Kit w/case only $199.95. One board, no wiring, top quality components & PCB. GUARANTEED TO WORK. For info send SASE; Call/Write to order: **S & S ENGINEERING**, 14102 Brown Road, Smithsburg MD 21783; (301)416-0661. BNB304

WANTED: Electron Tubes, ICS, Semiconductors. **ASTRAL,** P.O. Box 707ST, Linden NJ 07036. Call (800)666-8467. BNB307

KENWOOD AUTHORIZED REPAIR. Also ICOM, Yaesu. **GROTON ELECTRONICS,** Box 379, Groton MA 01450. (508)448-3322. BNB310

PROGRAMMABLE COUNTER - Works with ANY VFO Rig! Get a digital display for your rig, 100 Hz resolution. You can read the tuned frequency directly, no need to calculate offsets. Counts to 40 Mhz, up OR down. Counter Kit, $69.95; Kit w/case, $99.95; Assembled w/case, $139.95. GUARANTEED TO WORK. For info send SASE: Call/write to order: **S & S ENGINEERING,** 14102 Brown Rd., Smithsburg MD 21783; (301)416-0661. BNB334

RCI-2950 OWNERS: New modification manual including Power increase. Clarifier modification. Modulation increase. Operating hints, and more. Parts included. Only $20.00 ppd in U.S. (Missouri residents add $1.15 tax). **SCOTT**, P.O. Box 510408, St., Louis MO 63151-0408. (314)846-0252. Money Orders or C.O.D. BNB340

Continued on page 91

Number 27 on your Feedback card

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW

ICOM

Icom has announced the IC-820H high performance all-mode dual-band base station transceiver for 2 meter and 440 MHz operation. The IC-820H is compact and lightweight, making it ideal for mobile, fixed, or field operation. Yet, this new transceiver is packed with top performance features, including a newly designed DDS capable of resolving 1 Hz tuning steps for fine-tuning.

Built-in satellite functions include normal and reverse tracking, independent uplink/downlink control for Doppler shift compensation and separate satellite VFO. Ten satellite memories allow you to quickly switch from normal to satellite operation.

Independent controls and indicators for each band make the IC-820H easy to operate. Additional features include IF shift, memory allocation, AF speech compressor, auto repeater and one-touch repeater, built-in high stability crystal unit, RIT, CW semi break-in, and side tone.

The suggested retail price is $1,999. For more information, visit your favorite dealer or contact *Icom America, Inc., 2380-116th Avenue N.E., Bellevue, WA 98004; (206) 454-8155.* Or circle Reader Service No. 201.

AMATEUR RADIO EXCELLENCE

Amateur Radio Excellence Products has introduced the ARE "Classic" Clock for the ultimate ham shack. Ham operators everywhere will appreciate the Classic's beautiful, original artwork dial, capturing the essence of the Golden Age of radio. The classic represents the finest value available today in a custom-made clock for radio amateurs.

The ARE Classic features a 12- and 24-hour dial, quartz accuracy, and a fully laminated artwork face with the call letters of your choice custom-printed with the art. These beauties are 100% crafted in the USA. The clock frame measures approximately 9" square by 2" deep, and is suitable for desktop display or wall mounting.

The ARE Classic is powered by one AA battery (included), and is gift-boxed

in fine tissue. The dial face is dark brown on light beige; frames are available in simulated light oak, walnut, or black (shown) finishes. Please specify frame and call letters when ordering.

The price is $39.99 plus $4.50 shipping in the USA. (Foreign addresses add shipping FPO NH, USA.) For more information or to order contact *Amateur Radio Excellence, P.O. Box 1551, Dept. 73, Manchester, NH 03105.*

AUTEK RESEARCH

Autek Research has introduced the pocket-sized RF Analyst, designed to check and adjust antennas, feedlines, and RF networks. It includes a microprocessor, A/D converters, and a low-distortion leveled sine wave generator with four-digit readout. This device is continuously adjustable from 1.2 to 35 MHz in five bands. Measurements include RF impedance (0 to 2,000 ohms), SWR (1 to 15:1), C (0 to 9,999 pF), and L (<.04 to 300 µH). This range of digital readout information is unique in this price range.

The instrument connects to any antenna or feedline for instant readouts. L and C are measured at the frequency of interest, showing the true RF value of these components. Basic accuracy

is 2.5% to 5% over most of its range. The instrument fits into a shirt pocket and runs on a 9 volt battery.

The Autek Research RF Analyst is priced at $129.95 plus $6 S&H (US). For more information or to order contact *Autek Research, 4143 W. Waters Ave., #120, Tampa, FL 33614; (813) 871-3805.* Or circle Reader Service No. 205.

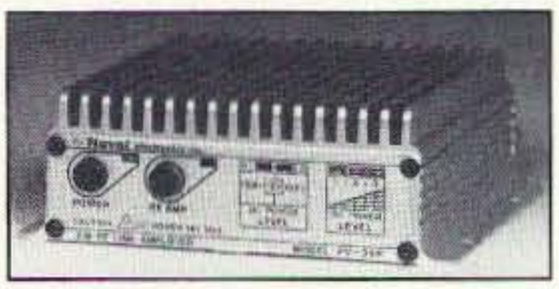
GORDON WEST RADIO SCHOOL

The amateur radio General Class Element 3B question pool has been revised as of July 1, 1994. The new question pool will be valid for four years, and will reflect the exact 288 questions and answers now found on amateur radio General Class tests. All of the Gordon West Radio School books and cassettes have been updated to coincide with this change.

"Only the General Class Element 3B question pool was changed last July," says Gordon West WB6NOA. "All other amateur radio question pools remain exactly the same, and the Advanced Class pool is next for revision in about nine months," adds West.

The new General Class audio cassettes also cover all the new General Class questions. They have been completely updated in stereo to make learning convenient and fun, whether while exercising at home or while driving in the car.

The updated books and cassettes are available at your favorite dealer, or you can order the autographed set direct for $19.95 plus $3 S&H. For more information or to order contact *Gordon West Radio School Inc., 2414 College Drive, Costa Mesa, CA 92626; (714) 549-5000 (Hot Line 10-4 p.m.); (714) 434-0666 (Info Line 24 hrs.).* Or circle Reader Service No. 202.



NAVAL ELECTRONICS, INC.

Naval Electronics has introduced their new all-mode PV-35R VHF Linear Amplifier incorporating a GaAsFET preamp as well as RF power and supply voltage indicators. The unit provides a maximum output of 35 watts (30 out for 3 in). LEDs show output levels of 10, 20, and 30 watts and, at the same time, power supply variations from 10.5 to 13.8 VDC. This amp works in the FM, CW, AM, and SSB modes.

For more information contact *Naval Electronics, Inc., 5417 Jetview Circle, Tampa, FL 33634; (813) 885-6091, FAX (813) 885-3789.* Or circle Reader Service No. 203.

ELECTROSOFT

Electrosoft has introduced a program to control the Yaesu FT-990 transceiver. The program works on any PC or compatible equipped with a serial port and requires the FIF-232c interface circuit supplied by Yaesu.

The Electrosoft program reads the frequency, bandwidth, and mode for both VFOs and for 90 memory channels, then stores the data in a computer file. You can store an unlimited number of channel files. The program can read any previously saved file and reset the frequencies, bandwidths, modes, and scanning information quickly and easily.

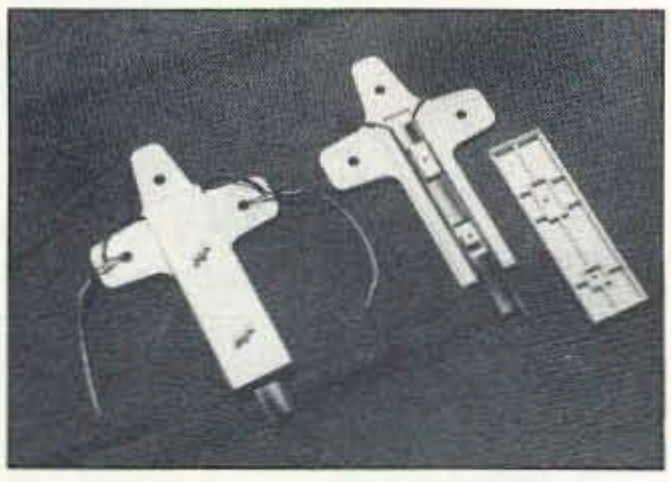
The bottom line on the screen shows the command keys used to

edit and the highlighted fields in the four top windows. The program is backed by a money back guarantee and is priced at $100. For more information or to order contact *Electrosoft, P.O. Box 1462, Loveland, CO 80539.* Or circle Reader Service No. 204.

WA1FFL

Wire antenna enthusiasts will be interested in a new center support device, the WA1FFL Ladder-Loc for 450 ohm ladder-line antennas. The device is constructed of calcium-reinforced polypropylene and features a built-in strain relief to take the weight off the wire joints at the feed point. It has overlapped construction to keep water out of the sides and is very sturdy.

The Ladder-Loc goes together quickly with two wing nuts; adding a touch of sealant will make it completely weatherproof. The product is priced at



$11.95 plus shipping. For more information or to order contact *Radioware, P.O. Box 1478, Westford, MA 01886; (800) 950-9273.* Or circle Reader Service Number 206.

Continued from page 89

OLD - NEW ELECTRON TUBES FOR SALE, large inventory of old receiving tubes, 2600 in cartons, 200 loose and not cartoned, loose and uncarton are free! Please call for inventory list. Donald Ouellette, 68 East Main St., Fort Kent ME 04743, (207)834-5742 or (207)834-2188 EST. BNB349

HR2510, RCI2950, CONNEX 3300, COBRA 148, GALAXY SATURN, plus many more kits to increase your modulation, $19.95. **(800)536-0109.** BNB350

KIT BUILDERS! Complete list of 165+ kit vendors. #10 SASE + $3.00 USD to: **RUTENBER ENGINEERING,** 38045 10th St. E. #H75-AR, Palmdale CA 93550. BNB365

QSL CARDS — Standard and custom. Your ideas or ours. Excellent quality. Foil stamping available. Many designs and type styles. Catalog and samples $1.00 refundable. **WILKINS**, Dept. A, Box 787, Atascadero CA 93423. BNB370

CALLSIGN WRISTWATCH - Free details, send SASE. **TLC,** Dept HWA, 9438 Broadway, Temple City CA 91780. BNB379

MANUALS KW940 Owner and Shop manual with schematic, $20.00; also Heathkit SB220-1 manual and schematic, $20.00; also NEW 3-500Z, $85.00. (210)435-6190. BNB381

NEW NN1G CW SUPER-HET SINGLE BAND TRANSCEIVER KIT. Available in 20M, 30M, 40M, 80M. $59.95 plus $3.75 S/H. (Catalog-2 Stamps). **DAN'S SMALL PARTS & KITS,** 1935 South 3rd West #1, Missoula MT 59801. BNB385

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SERVICE . . . . . MONITORS . . . . . WANTED . . . .
Any late model . . . . . Test Equipment. . . . . Call, (408)241-7376. BNB390

CW'ers, USN FLAMEPROOF KEY, new, packed 1955, $59 (shipping included). Collectors, 15 pages, mostly telegraphic, refundable $2.00 plus 2 Stamps. Joseph Jacobs, 60 Seaview Terr., Northport NY 11768. BNB393

IT'S BACK! The return of the HW-8 Handbook! Second printing. Modifications for the Heath QRP rigs. First class mail $11. DX add $4 for air mail shipping. **Mike Bryce, WB8VGE,** 2225 Mayflower NW, Massillon OH 44647. BNB404

MAHLON LOOMIS, INVENTOR OF RADIO; (patented 1872) by Thomas Appleby. (Copyright 1967). Available from **JOHAN K.V. SVANHOLM, N3RF, SVANHOLM RESEARCH LABORATORIES,** P.O. Box 81, Washington DC 20044. Please send $25.00 donation with $5.00 for S&H. BNB420

BROWNIES QSL CARDS SINCE 1939. Catalog & samples $1 (refundable with order). 3035 Lehigh Street, Allentown PA 18103. BNB430

BUTTERNUT ANTENNAS, NEW—in box. (2)HF6-VX, $125.00; (2)HF5B, $200.00; (2)HF2V, $110.00; (1)HF7VX, $150.00. (210)435-6190. BNB435

RADIO DOCTOR VIDEOS for Repair and Alignment of HF Transceivers. Reviewed by Gordon West, January—*73 Magazine*. Videos for popular KENWOOD, YAESU, and ICOM. ORDERS: **(800)788-1416** MC/VISA. **Catalog: SASE** (2 stamps): **RADIO DOCTOR**, 710 Teague Dr., Kennesaw GA 30144. BNB442

FREE . . . Ham Radio **Gospel Tracts:** DX Contact and Christian Helps, SASE: N1GDP, RAR-OFC, P.O. Box 8, Harmony ME 04942. BNB443

ROSS' $$$$ NEW AUGUST (ONLY) SPECIALS. SAVE TIME AND MONEY HAVE MODEL NUMBER AND MANUFACTURER READY WHEN YOU CALL OR WRITE. KENWOOD, IF-10A, $69.50; PB-12, $50.00; TH-41BT, $220.00; TH-205AT, $250.00; MFJ 1228, $44.90; 1229, $129.90; 840, $16.00; 815B, $50.00; ALINCO CALL; YAESU CALL; ICOM AG-35, $130.00; 707, $800.00; AG-1, $80.00; BC-50,$35.00; 04AT, $250.00; BP-70, $52.00; CALLBOOK OUT DATED, $15.00; SUPPLEMENT, $4.50; BENCHER CALL; BUTTERNUT CALL; CUSHCRAFT R-7, $342.50; CALL FOR MORE; TELEX HY-GAIN, T2X, $360.00; CD-45II, $225.00; RF CONCEPTS CALL; MIRAGE CALL; LARSEN CALL. LIMITED TIME OFFERS. LOOKING FOR SOMETHING NOT LISTED OR HARD TO FIND? CALL OR WRITE. OVER 9000 ham-related items in stock for immediate shipment. Mention ad. Prices cash, F.O.B. Preston. HOURS TUESDAY-FRIDAY 9:00 TO 6:00, 9:00-2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. **ROSS DISTRIBUTING COMPANY,** 78 SOUTH STATE, PRESTON ID 83263. (208)852-0830. BNB707

ELECTRON TUBES: All types and sizes. Transmitting, receiving, microwave . . . Large inventory = same day shipping. **DAILY ELECTRONICS,** 10914 NE 39th ST. Suite B-6, Vancouver, WA 98682. (800)346-6667 or (206)896-8856. BNB719

MINIATURE POLICE RADAR TRANSMITTER One mile range, $41 assembled, $31.00 kit. 9025 Coldwater Rd. Bldg. 100A, Fort Wayne IN 46825. BNB725

HAM RADIO REPAIR—Prompt service. **ROBERT HALL ELECTRONICS,** 1660 McKee Rd., Suite A, San Jose CA 95116. (408)729-8200. BNB751

GET YOUR "FCC COMMERCIAL GENERAL RADIOTELEPHONE LICENSE". Electronics Home Study. Fast, inexpensive! "Free" details. **COMMAND PRODUCTIONS,** D-174, Box 2824, San Francisco CA 94126-2824. BNB761

WANTED: HAM EQUIPMENT AND OTHER PROPERTY. The Radio Club of Junior High School 22 NYC, Inc. is not only the Big Apple's largest Ham club but also the nation's only full time, non-profit organization, working to get Ham Radio into schools around the country as a theme for teaching using our EDUCOM-Education Thru Communication-program. Send your radio to school. Your donated amateur or related property, which will be picked up or shipping arranged, means a tax deduction to the full extent of the law for you as we are an IRS 501 (c) (3) charity in our fourteenth year of service. Your help will also mean a whole new world of educational opportunity for children around the country. Radios you can write off, kids you can't. Enjoy the coming fall season by helping someone else and yourself. Please, write-phone-or FAX the WB2JKJ "22 Crew" today: The RC of JHS 22, P.O. Box 1052, New York NY 10002. Telephone (516)674-4072 or FAX (516)674-9600. Young people, nationwide, can get high on Ham Radio with your help. Meet us on the WB2JKJ CLASSROOM NET: 7.238 MHz. 1100-1230 UTC and 21.395 MHz. 1300-1900 daily. BNB762

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Number 28 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Another Ham Scam

The history of amateur radio has been frequently marked with people trying to make a buck. I'm not talking about legitimate businesses that sell products or services to the ham community. I'm talking about the periodic attempt by some less-than-legitimate characters to take advantage of hams. The most recent to come to my attention is interesting only because of who is behind it.

I received a fax from an amateur in Texas that contained the contents of a mailing he received from The W5YI Group. The outside envelope was enblazoned with all kinds of large and alarming messages like "Urgent Alert!" and "Your Amateur Radio License Is About To Expire!" Inside was a Form 610 with the instructions removed, a separate sheet of instructions and a letter/order form warning of the eminent expiration of the recipient's amateur radio license. Fred Maia W5YI explains in this letter that he is such a nice guy that he just thought he'd remind you of the upcoming expiration of your license and give you the chance to renew it through his company for a measly $5.

Wait a minute. I thought there was no fee involved with an amateur radio license. Oh, I see. Buried within the instruction sheet that comes in the mailing is the notice that "The FCC does not charge a fee to renew your license. The $5.00 fee is to reimburse The W5YI Group for the administrative costs involved in operating a notification and renewal service." The instructions then go on to mimic the FCC instructions that somehow became separated from the 610 before being inserted into the envelope, and conclude with a large and boldfaced reminder to "Return this letter, FCC Form 610 application, and copy of your license along with the $5.00 fee in the enclosed envelope today!"

As the skunk said, "Is it me, or is it starting to stink in here?"

When you consider the average age of an amateur radio operator and realize that many of these packages will be received by elderly people, it is more than deplorable. If you are about to write me a letter about how the above-quoted disclaimer makes it all OK, save it. I don't care how many carefully-worded phrases The W5YI Group puts into the letter, the purpose of this package is to get $5 from as many hams as possible. The W5YI Group is a business, and like any business they have the right to make a fair profit from their efforts. This particular effort is sleazy. How many elderly hams will receive this package and send out the $5, thinking they narrowly escaped losing something that brings joy and companionship into their lives? Fred, you should be ashamed of yourself.

Is this $5 license renewal scheme illegal? No, probably not. After all, that disclaimer *is* in there. It's enough to save any investigation from the bunko squad. There is a very large difference between what is legal and what is moral. What is legal is defined by law. What is moral is defined by your own heart. We all have to make our own decision as to what defines our values and ethics. We all decide what our integrity and character are worth. Is the integrity of The W5YI Group worth about five bucks?

If you are confused as to how to complete an FCC Form 610, ask for help from someone on your local repeater or at your next ham club meeting. If you are friends with a ham who might be taken in by this kind of a scheme, ask them when their license expires and help them to get it renewed. If they can't produce a copy of their license and don't know when it expires, help them to find out.

When obtained from a legitimate source, the FCC Form 610 includes sufficient instructions to renew your license. Anyone who could manage to pass an amateur radio exam (or, for that matter, anyone who had enough brains to figure out how to obtain a license *without* taking the test) can certainly figure out how to write their own name and address and check the appropriate boxes. One thing the FCC Form 610 also includes that somehow was omitted from The W5YI Group's package is the address of the FCC, which is the only place any of you need to be sending a license renewal. 73

"When obtained from a legitimate source, the FCC Form 610 includes sufficient instructions to renew your license."

Number 29 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

August has middle-of-summer type propagation conditions, and you can't expect a particularly good month for HF DX. The Solar Flux continues to decline and the usual summer "blahs" are upon us, along with hot weather throughout most of the Northern Hemisphere.

The *worst* days are expected to occur on the 1st, 12th-14th, and again on the 28th-31st. The *best* days are expected to be 5th-8th, and 18th-24th. Other days, as indicated, will be Fair or trending between Fair and Good or Poor. It looks like we may expect some severe geophysical conditions surrounding the 28th for a day or two either way. The 1st will see us emerging from some severe conditions on or near the last two days of July. As you know from following these reports over the years, we can miss by a day or two from the predicted dates in either direction, but be particularly alert on the first few and last few days of the month, keeping an ear tuned to WWV and to your local weather stations.

10 and 12 Meter Bands

Sporadic E during daylight hours on many Good days (G), with strong skip signals from 500 to 1,500 miles, and with abrupt termination of contact as the ion cloud moves out of range.

15 and 17 Meter Bands

Good sporadic E contacts between 300 and 1,300 miles on most Good (G) days. Also, you may find trans-equatorial skip into the Southern Hemisphere, with decent but not outstanding signal strength.

20 Meter Band

Consistent DX to most parts of the world on Good (G) days during daylight hours, and on particularly favorable days, often until midnight local time. This band will be your DX workhorse.

30 and 40 Meter Bands

Nighttime DX between local sunset and sunrise ought to be good-to-excellent on days marked Good (G) on the chart, and often on Fair (F) days. Thunderstorm activity usually abates several hours after sunset, but QRN will obscure weak signals. Day and night short skip will occur on many days, with daytime skip averaging up to 1,000 miles and nighttime skip up to 2,000 miles. Beware of high absorption levels around local noon.

80 and 160 Meter Bands

Forget any daytime activity, but when conditions are Good (G) you may well discover occasional DX at night, especially when QRN from thunderstorms isn't present. There will be few, if any, really good DX contacts on 160 or 80 during July. Short skip at night, however, can be pretty good out to about 1,000 miles or so.

Always listen to WWV and the propagation forecasts at 18 minutes after any hour, when up-to-date reports of Boulder K and A indexes are given along with solar flux readings. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
AGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40[1]	40		15	15	15	10	10
ENGLAND			40[1]	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40[1]	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40[1]	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U.S.S.R.							20	20		20		
WESTCOAST	20	40	40	40[1]	40[1]	40						20

CENTRAL UNITED STATES TO:

ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40[1]	40		20			20	
CANAL ZONE	15	20	20	20	40[1]	40	20	20	15	15	15*	10
ENGLAND	20	40					20	20		20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
U.S.S.R.								20			20	

WESTERN UNITED STATES TO:

ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40[1]	40[1]		20		15	15
CANAL ZONE	15	15	20	20[1]	40[1]	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20[1]	40[1]	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U.S.S.R.									20			
EAST COAST	20	40	40	40[1]	40[1]	40						20

1 = Possible 80 meter openings * = Check next higher band G = Good F = Fair P = Poor

AUGUST 1994

SUN	MON	TUE	WED	THU	FRI	SAT
	1 P	2 P-F	3 F	4 F-G	5 G	6 G
7 G	8 G-F	9 F	10 F-P	11 F-P	12 P	13 P
14 P	15 P-F	16 F	17 F-G	18 G	19 G	20 G
21 G	22 G	23 G	24 G	25 G-F	26 F	27 F-P
28 P	29 P	30 P	31 P			

FT-11R/41R
2m/70cm Handhelds

- **Frequency Coverage:**
  Wide Receiver Coverage:
  FT-11: 110-180 MHz RX,
  144-148 MHz TX
  FT-41: 430-450 MHz RX/TX
- Selectable Alpha Numeric Display
- New Compact Battery Design
  4.8V produces 1.5 Watts
  9.6V produces Full 5 Watts*
- 150 Memory Channels
  (75 when Alpha Numeric)
- AM "Aircraft" Receive
  (110-136 MHz)
- Small Compact Size w/ Easy Operation (measures only:
  4"H x 2¼"W x 1"D)
- Rx/Tx Battery Savers
- High-efficiency MOS FET Power Module
- Large Back-Lit Keypad and Display
- Up/Down Volume/Squelch Controls
- Built-in DTMF Paging/Coded Squelch
- Automatic Power Off (APO)
- **Accessories:**
  FNB-31 4.8V, 600 mAh Battery
  FNB-33 4.8V, 1200 mAh Battery
  FNB-38 9.6V, 600 mAh Battery
  FBA-14 6 AA Size Battery Case
  FTS-26 CTCSS Decode Unit
  NC-50 Dual Slot 1-Hour Desk Charger
  CA-10 Charge Adapter (required w/ NC-50)

*FT-11 Only.
FT-41, 3.5 Watts

"Look, alphanumeric display and a 4.8V battery. Terrific!"

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NEW!

NEW Alphanumeric Display
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NEW Up/Down Thumb Control
with Volume and Squelch Bar Graph. No other radio has this. Back lit, too!

NEW Compact Battery Design
4.8V gets you 1.5 Watts. A first for amateur radio.

5 Watt Version Available Now!

Get a grip on this!

World's smallest size HT with a full sized keypad
Measures only: 4"H x 2¼"W x 1"D

"Small" is relative, isn't it? It could mean size – which in this case it does. And, it could mean "reduced", which it doesn't! Nothing missing from the hot new FT-11R HT from Yaesu except bulk! You're going to wonder just how all the features of this full-function radio fit in. Until you remember Yaesu pioneered 2-way radio micro technology.

To see what this really means to you, check out all the new features. Like the alphanumeric display. This Yaesu HT first, lets you tag your favorite frequency by name, call sign or number. Or, the new "voltage stingy" battery. It's an industry first for amateur radio. Smaller and compact, the 4.8V battery gives you 1.5 watts on TX. And, if that's not enough, there's an optional drop in, dash mount battery charger.

You see it's not a small time performer. Just small sized. The FT-11R. Another small example of Yaesu superiority. See your dealer today!

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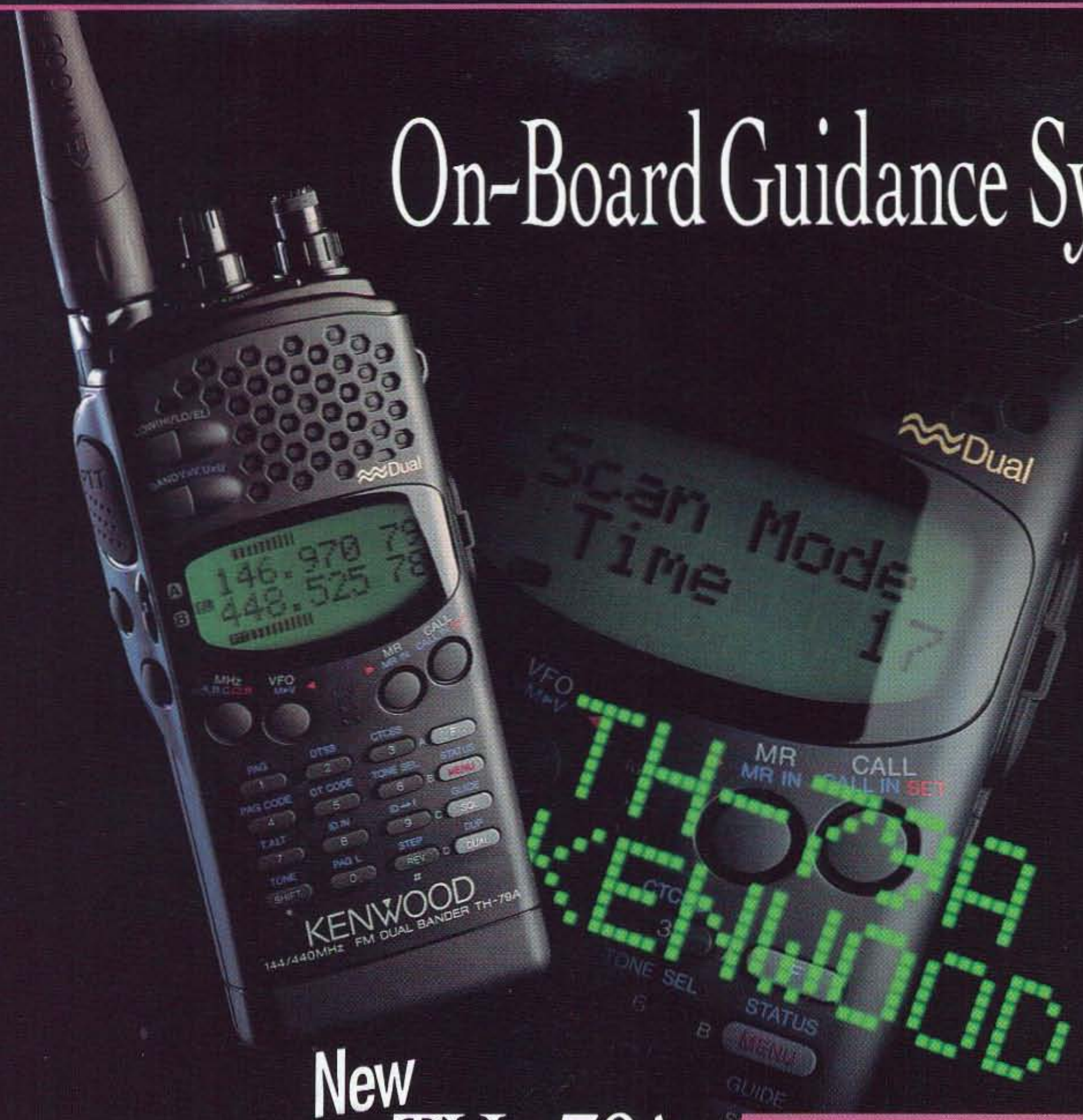
On-Board Guidance System



New TH-79A

FM DUAL BANDER

Information at your fingertips. Everything you need to know about operating the new TH-79A FM dual-bander (144MHz/440MHz) can be viewed in its unique dot-matrix LCD with alphanumeric display. No need for the manual. In addition to this innovative guide function, the TH-79A sports a user-friendly menu system, providing easy access to the many powerful features of this slim-line handheld transceiver. Such as 82 non-volatile memory channels with ID, DTSS and page functions, and a DTMF memory function for auto-dial operation. Full-crossband duplex operation is available, as is the ability to receive two frequencies on the same band (VHF+VHF or UHF+UHF) simultaneously. And thanks to the FET power module, long hours of operation are possible on one charge. With the TH-79A, transceiver technology enters the 21st century.

Features

- 2.7W approx. output (144MHz), 2W approx. output (440MHz) from MOS FET power module and supplied 6V battery; 5W approx. output using optional PB-34
- Dot-matrix LCD with menu/guide system
- 82 non-volatile memory channels with ID
- DTMF keypad with memory function
- DTSS (Dual-Tone Squelch System) with page
- Built-in CTCSS tone encoder/decoder
- Automatic band change ▮ Power-on call sign display
- Auto repeater offset (VHF) ▮ Input overvoltage warning
- 3-position output power control
- Auto power-off and battery save function ▮ Time-out timer
- Multiple scan modes ▮ Cross-band repeater function
- Page answer-back function ▮ Channel display function
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- Modifiable for MARS/CAP use**

*Specifications guaranteed for Amateur bands only.
**Permits required. Specifications guaranteed for Amateur bands only.

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