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THE NEW! Amateur **73** Radio Today

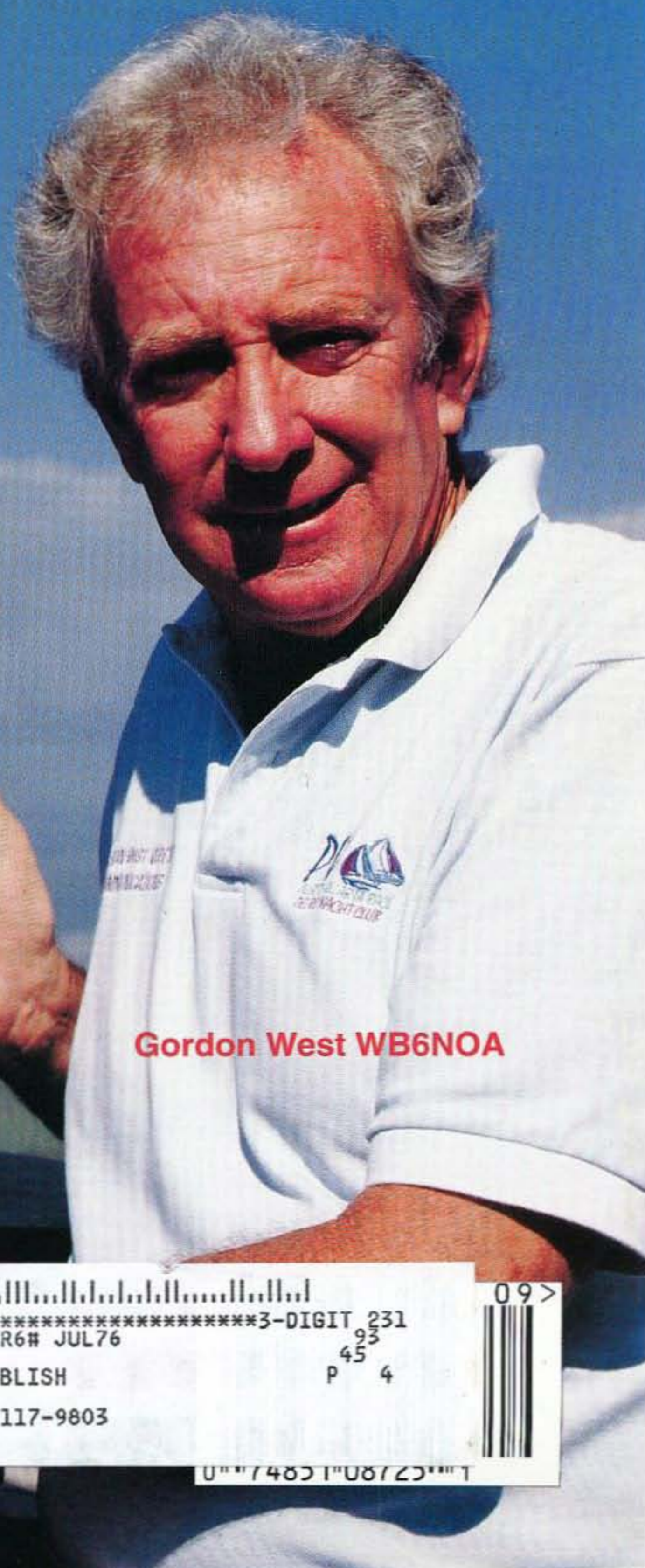
Spreading the Ham Virus

- Ham Ambassadors
- How to Infect
Grade Schoolers

Digital TV Tuners

SSB Generation


136 kHz Ham Band Loop



Gordon West WB6NOA

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THE NEW! 73 Amateur Radio Today

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REVIEW

- 37 Up on a Down Under Kit — W4QBU**
The DSE K-7204 ESR/low ohms meter measures well on the 73 review-o-meter.

QRX . . .

Industry and ARRL Meet in Dallas

The second meeting of the ham industry with the ARRL took place at the Dallas Ham Com convention on Thursday evening, June 8th. We have this report:

If the ham industry meeting a few months ago in Milwaukee was a lovefest, then the meeting in Dallas on June 8th might best be characterized as a

newlywed couple having their first spat. And while nobody is willing to talk on-the-record, the problem appears to be at the level of the retail dealers rather than higher up the ham radio distribution chain.

Simply, retailers are looking for two things. With business far from good, first and foremost they are looking for a way to eke out enough profit so as to pay the mortgage on their home, put food on the

Continued on page 6

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

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SWITCHING POWER SUPPLIES...



MODEL SS-10TK



MODEL SS-12IF

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- HIGH EFFICIENCY SWITCHING TECHNOLOGY SPECIFICALLY FILTERED FOR USE WITH COMMUNICATIONS EQUIPMENT, FOR ALL FREQUENCIES INCLUDING HF
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- EMI FILTER
- MEETS FCC CLASS B

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MODEL SS-18

DESKTOP SWITCHING POWER SUPPLIES

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SS-10	7	10	1 1/2 x 6 x 9	3.2
SS-12	10	12	1 1/2 x 6 x 9	3.4
SS-18	15	18	1 1/2 x 6 x 9	3.6
SS-25	20	25	2 1/4 x 7 x 9 1/2	4.2
SS-30	25	30	3 x 7 x 9 1/2	5.0



MODEL SS-25M

DESKTOP SWITCHING POWER SUPPLIES WITH VOLT AND AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SS-25M*	20	25	2 1/4 x 7 x 9 1/2	4.2
SS-30M*	25	30	3 x 7 x 9 1/2	5.0



MODEL SRM-30

RACKMOUNT SWITCHING POWER SUPPLIES

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25	20	25	3 1/2 x 19 x 9 1/2	6.5
SRM-30	25	30	3 1/2 x 19 x 9 1/2	7.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M	20	25	3 1/2 x 19 x 9 1/2	6.5
SRM-30M	25	30	3 1/2 x 19 x 9 1/2	7.0



MODEL SRM-30M-2

2 ea SWITCHING POWER SUPPLIES ON ONE RACK PANEL

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25-2	20	25	3 1/2 x 19 x 9 1/2	10.5
SRM-30-2	25	30	3 1/2 x 19 x 9 1/2	11.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M-2	20	25	3 1/2 x 19 x 9 1/2	10.5
SRM-30M-2	25	30	3 1/2 x 19 x 9 1/2	11.0



MODEL SS-12SM/GTX



MODEL SS-10EFJ-98

CUSTOM POWER SUPPLIES FOR RADIOS BELOW

- EF JOHNSON AVENGER GX-MC41
- EF JOHNSON AVENGER GX-MC42
- EF JOHNSON GT-ML81
- EF JOHNSON GT-ML83
- EF JOHNSON 9800 SERIES
- GE MARC SERIES
- GE MONOGRAM SERIES & MAXON SM-4000 SERIES
- ICOM IC-F11020 & IC-F2020
- KENWOOD TK760, 762, 840, 860, 940, 941
- KENWOOD TK760H, 762H
- MOTOROLA LOW POWER SM50, SM120, & GTX
- MOTOROLA HIGH POWER SM50, SM120, & GTX
- MOTOROLA RADIUS & GM 300
- MOTOROLA RADIUS & GM 300
- MOTOROLA RADIUS & GM 300
- UNIDEN SMH1525, SMU4525
- VERTEX — FTL-1011, FT-1011, FT-2011, FT-7011

NEW SWITCHING MODELS

- SS-10GX, SS-12GX
- SS-18GX
- SS-12EFJ
- SS-18EFJ
- SS-10-EFJ-98, SS-12-EFJ-98, SS-18-EFJ-98
- SS-12MC
- SS-10MG, SS-12MG
- SS-101F, SS-121F
- SS-10TK
- SS-12TK OR SS-18TK
- SS-10SM/GTX
- SS-10SM/GTX, SS-12SM/GTX, SS-18SM/GTX
- SS-10RA
- SS-12RA
- SS-18RA
- SS-10SMU, SS-12SMU, SS-18SMU
- SS-10V, SS-12V, SS-18V

RAMSEY

Doppler Direction Finder

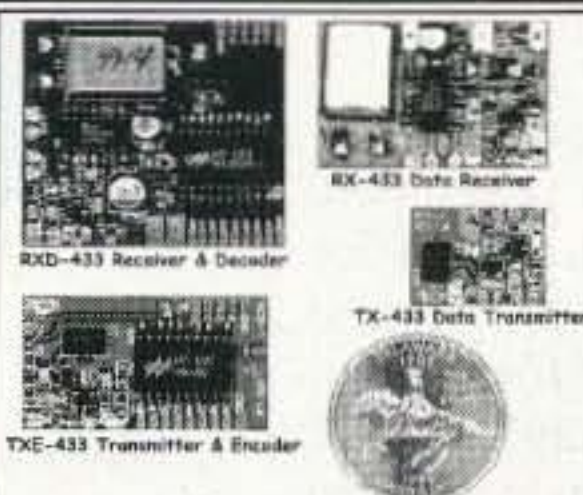
Track down jammers and hidden transmitters with ease! This is the famous WA2EBY DF'er featured in April 99 QST. Shows direct bearing to transmitter on compass style LED display, easy to hook up to any FM receiver. The transmitter - the object of your DF'ing - need not be FM, it can be AM, FM or CW. Easily connects to receiver's speaker jack and antenna, unit runs on 12 VDC. We even include 4 handy home-brew "mag mount" antennas and cable for quick set up and operation! Whips can be cut and optimized for any frequency from 130-1000 MHz. Track down that jammer, win that fox hunt, zero in on that downed Cessna - this is an easy to build, reliable kit that compares most favorably to commercial units costing upwards of \$1000.00! This is a neat kit!

DDF-1, Doppler Direction Finder Kit \$149.95

Wireless RF Data Link Modules

RF link boards are perfect for any wireless control application; alarms, data transmission, electronic monitoring...you name it. Very stable SAW resonator transmitter, crystal controlled receiver - no frequency drift! Range up to 600 feet, license free 433 MHz band. Encoder/decoder units have 12 bit Holtek HT-12 series chips allowing multiple units all individually addressable, see web site for full details. Super small size - that's a quarter in the picture! Run on 3-12 VDC. Fully wired and tested, ready to go and easy to use!

RX-433 Data Receiver..... \$16.95 TX-433 Data Transmitter..... \$14.95
RXD-433 Receiver/Decoder..... \$21.95 TXE-433 Transmitter/Encoder..... \$19.95



World's Smallest TV Transmitters



We call them the 'Cubes'.... Perfect video transmission from a transmitter you can hide under a quarter and only as thick as a stack of four pennies - that's a nickel in the picture! Transmits color or B&W with fantastic quality - almost like a direct wired connection to any TV tuned to cable channel 59. Crystal controlled for no frequency

drift with performance that equals models that cost hundreds more! Basic 20 mW model transmits up to 300' while the high power 100 mW unit goes up to 1/4 mile. Their very light weight and size make them ideal for balloon and rocket launches, R/C models, robots - you name it! Units run on 9 volts and hook-up to most any CCD camera or standard video source. In fact, all of our cameras have been tested to mate perfectly with our Cubes and work great. Fully assembled - just hook-up power and you're on the air! One customer even put one on his dog!

C-2000, Basic Video Transmitter..... \$89.95 C-2001, High Power Video Transmitter... \$179.95

CCD Video Cameras



Top quality Japanese Class 'A' CCD array, over 440 line line resolution, not the off-spec arrays that are found on many other cameras. Don't be fooled by the cheap CMOS single chip cameras which have 1/2 the resolution, 1/4 the light sensitivity and draw over twice the current! The black & white models are also super IR (Infra-Red) sensitive. Add our invisible to the eye, IR-1 illuminator kit to see in the dark! Color camera has Auto gain, white balance, Back Light Compensation and DSP! Available with Wide-angle (80°) or super slim Pin-hole style lens. Run on 9 VDC, standard 1 volt p-p video. Use our transmitters for wireless transmission to TV set, or add our IB-1 Interface board kit for super easy direct wire hook-up to any Video monitor, VCR or TV with A/V input. Fully assembled, with pre-wired connector.

CCDWA-2, B&W CCD Camera, wide-angle lens \$69.95
CCDPH-2, B&W CCD Camera, slim fit pin-hole lens. . \$69.95
CCDCC-1, Color CCD Camera, wide-angle lens \$129.95
IR-1, IR Illuminator Kit for B&W cameras \$24.95
IB-1, Interface Board Kit \$14.95

AM Radio Transmitter



Operates in standard AM broadcast band. Pro version, AM-25, is synthesized for stable, no-drift frequency and is settable for high power output where regulations allow, typical range of 1-2 miles. Entry-level AM-1 is tunable, runs FCC maximum 100 mW, range 1/4 mile. Both accept line-level inputs from tape decks, CD players or mike mixers, run on 12 volts DC. Pro AM-25 includes AC power adapter, matching case and bottom loaded wire antenna. Entry-level AM-1 has an available matching case and knob set that dresses up the unit. Great sound, easy to build - you can be on the air in an evening!

AM-25, Professional AM Transmitter Kit. \$129.95
AM-1, Entry level AM Radio Transmitter Kit. . . \$29.95
CAM, Matching Case Set for AM-1..... \$14.95

Mini Radio Receivers



Imagine the fun of tuning into aircraft a hundred miles away, the local police/fire department, ham operators, or how about Radio Moscow or the BBC in London? Now imagine doing this on a little radio you built yourself - in just an evening! These popular little receivers are the nuts for catching all the action on the local ham, aircraft, standard FM broadcast radio, shortwave or WWV National Time Standard radio bands. Pick the receiver of your choice, each easy to build, sensitive receiver has plenty of crystal clear audio to drive any speaker or earphone. Easy one evening assembly, run on 9 volt battery, all have squelch except for shortwave and FM broadcast receiver which has subcarrier output for hook-up to our SCA adapter. The SCA-1 will tune in commercial-free music and other 'hidden' special services when connected to FM receiver. Add our snazzy matching case and knob set for that smart finished look!

AR-1, Airband 108-136 MHz Kit..... \$29.95 FR-6, 6 Meter FM Ham Band Kit \$34.95
HFRC-1, WWV 10 MHz (crystal controlled) Kit \$34.95 FR-10, 10 Meter FM Ham Band Kit..... \$34.95
FR-1, FM Broadcast Band 88-108 MHz Kit \$24.95 FR-146, 2 Meter FM Ham Band Kit..... \$34.95
SR-1, Shortwave 4-11 MHz Band Kit \$29.95 FR-220, 220 MHz FM Ham Band Kit..... \$34.95
SCA-1 SCA Subcarrier Adapter kit for FM radio... \$27.95 Matching Case Set (specify for which kit) ... \$14.95

PIC-Pro Pic Chip Programmer



Easy to use programmer for the PIC16C84, 16F84, 16F83 microcontrollers by Microchip. All software - editor, assembler, run and program - as well as free updates available on Ramsey download site! This is the popular unit designed by Michael Covington and featured in Electronics Now, September 1998. Connects to your parallel port and includes the great looking matching case, knob set and AC power supply. Start programming those really neat microcontrollers now...order your PICPRO today!

PIC-1, PICPRO PIC Chip Programmer Kit \$59.95

1 GHz RF Signal Generator



A super price on a full featured RF signal generator! Covers 100 KHz to 999.99999 MHz in 10 Hz steps. Tons of features; calibrated AM and FM modulation, 90 front panel memories, built-in RS-232 interface, +10 to -130 dBm output and more! Fast and easy to use, its

big bright vacuum florescent display can be read from anywhere on the bench and the handy 'smart-knob' has great analog feel and is intelligently enabled when entering or changing parameters in any field - a real time saver! All functions can be continuously varied without the need for a shift or second function key. In short, this is the generator you'll want on your bench, you won't find a harder working RF signal generator - and you'll save almost \$3,000 over competitive units!

RSG-1000B RF Signal Generator \$1995.00

Super Pro FM Stereo Transmitter



Professional synthesized FM Stereo station in easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set freq with Up/Down buttons, big LED display. Input low pass filter gives great sound (no more squeals or swishing from cheap CD inputs!) Limiters for max 'punch' in audio - without over mod. LED meters to easily set audio levels, built-in mixer with mike, line level inputs. Churches, drive-ins, schools, colleges find the FM-100 the answer to their transmitting needs, you will too. Great features, great price! Kit includes cabinet, whip antenna, 120 VAC supply. We also offer a high power export version of the FM-100 fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped if accompanied by a signed statement that the unit will be exported.

FM-100, Pro FM Stereo Transmitter Kit \$249.95
FM-100WT, Fully Wired High Power FM-100..... \$399.95

FM Stereo Radio Transmitters



No drift, microprocessor synthesized! Great audio quality, connect to CD player, tape deck or mike mixer and you're on-the-air. Strapable for high or low power! Runs on 12 VDC or 120 VAC. Kit includes snazzy case, whip antenna, 120 VAC power adapter - easy one evening assembly.

FM-25, Synthesized Stereo Transmitter Kit \$129.95

Lower cost alternative to our high performance transmitters. Great value, easily tunable, fun to build. Manual goes into great detail about antennas, range and FCC rules. Handy for sending music thru house and yard, ideal for school projects too - you'll be amazed at the exceptional audio quality! Runs on 9V battery or 5 to 15 VDC. Add matching case and whip antenna set for nice 'pro' look.

FM-10A, Tunable FM Stereo Transmitter Kit..... \$34.95
CFM, Matching Case and Antenna Set \$14.95
FMAC, 12 Volt DC Wall Plug Adapter..... \$9.95

RF Power Booster



Add muscle to your signal, boost power up to 1 watt over a freq range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM transmitters, providing radio service through an entire town. Runs on 12 VDC. For a neat finished look, add the nice matching case set. Outdoor unit attaches right at the antenna for best signal - receiving or transmitting, weatherproof, too!

LPA-1, Power Booster Amplifier Kit \$39.95
CLPA, Matching Case Set for LPA-1 Kit \$14.95
LPA-1WT, Fully Wired LPA-1 with Case \$99.95
FMBA-1, Outdoor Mast Mount Version of LPA-1 \$59.95

FM Station Antennas



For maximum performance, a good antenna is needed. Choose our very popular dipole kit or the Comet, a factory made 5/8 wave colinear model with 3.4 dB gain. Both work great with any FM receiver or transmitter.

TM-100, FM Antenna Kit \$39.95
FMA-200, Vertical Antenna \$114.95

Order Toll-free: 800-446-2295

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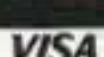
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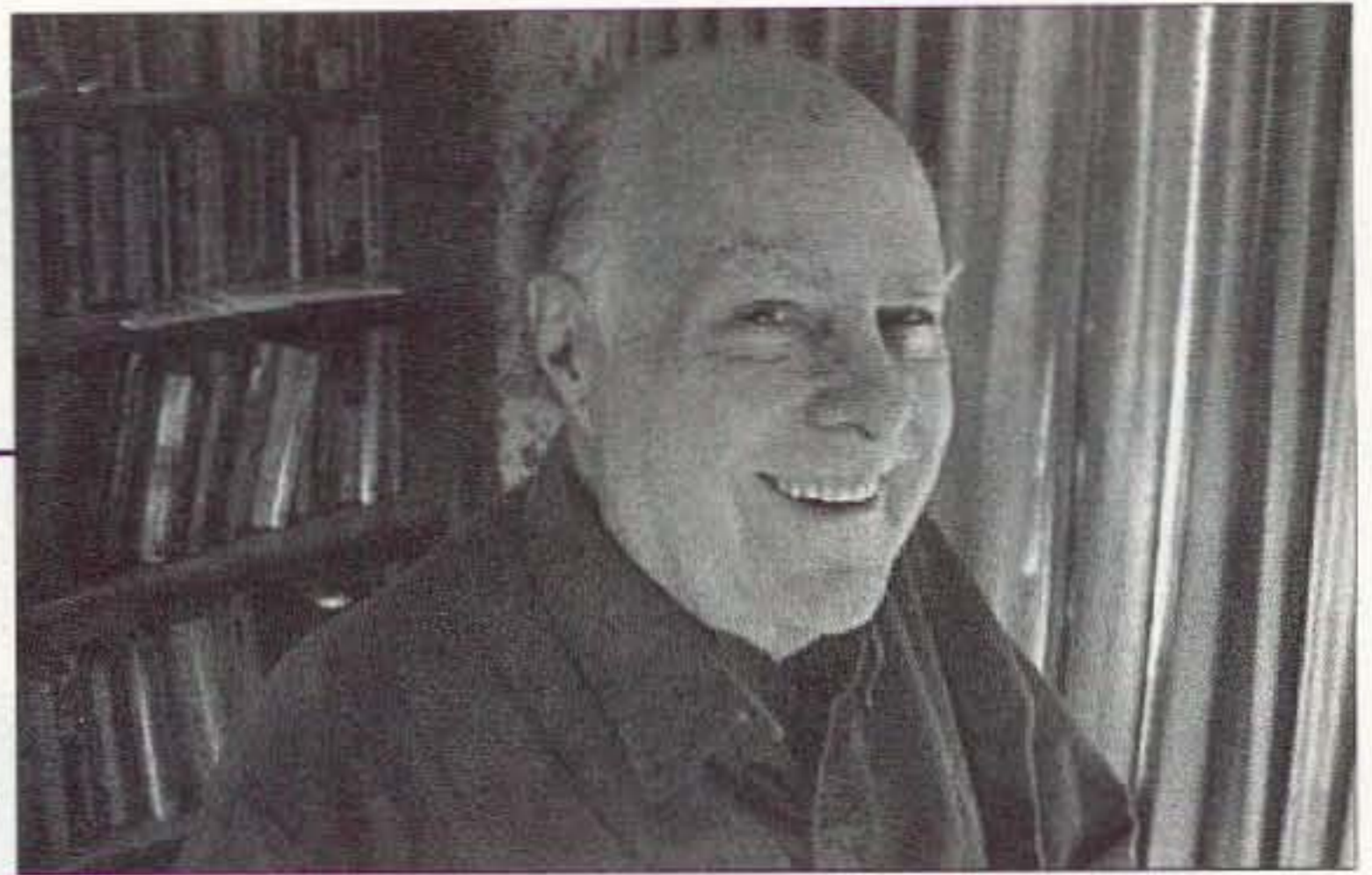


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NEVER SAY DIE

Wayne Green W2NSD/1

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A Birthday Present

My 78th birthday is September third and I'm asking you for a birthday present. Stop cringing, it isn't going to cost you anything.

Few magazines last ten years, much less forty, so when I started 73 back in 1960, it never really dawned on me that I'd signed up for a lifetime job. Mind you, I'm not complaining. What better way to spend a life time than working in a field that's your major hobby — something you are personally interested in and enjoy? Indeed, this is just what I preach in my *Secret Guide to Wealth*. Build your career in a field that's fun for you instead of seeming like work. And what, for a dyed-in-the-wool ham, could possibly be more fun than publishing a ham magazine?

The first issue of 73 was the October issue, and came out in September 1960, 40 years ago.

Well, 1960 was quite a year for me. In 1959 I volunteered for a free trip around the world on "Operation World Wide," where Bill Leonard W2SKE and I had a fantastic time making 20m SSB contacts as we flew around the world in an old unpressurized Air Force C-54 (which had been used for the famed Berlin Airlift), visiting the hams in 23 countries.

At the time I was the editor of *CQ*, but I had my work done so far ahead that taking off for a couple of months wasn't any problem. Later that year the State Department asked me if I would represent amateur radio on the US team at the International Telecommunications Union conference in Geneva. That's a long and interesting story.

When I got back from these two trips and got busy contacting authors for articles for the magazine I began hearing from

very unhappy authors and columnists. They hadn't been paid in ages. So I went to the office one weekend to look at the books — and found that while I'd been away most of the magazine's money had been spent buying the publisher a luxury yacht, and that my authors and columnists hadn't been paid for almost a year. To keep things going I paid many of them out of my own pocket, with the publisher's and the bookkeeper's promises that I'd be repaid. When they got to where they owed me a full year's pay I was fired. That was in January 1960 — starting off the year in great shape.

No, I've never gotten a nickel of that money back from *CQ*.

I tried working for an ad agency for a few months, but it wasn't any fun. What I really enjoyed was editing a ham magazine and helping to pioneer stuff like SSB, RTTY, and NBFM.

When *CQ* stopped publishing construction articles and went almost 100% to columns, I knew hams loved to build, so I decided to start 73 and push the fun of home building as hard as I could. Well, that was the change I made in *CQ* when I started as the editor in January 1955. And that formula took the magazine from losing about \$50,000 a month in today's dollarettes into the black within a few months. By 1959 it was making millions — most of which went into the publisher's yacht. He made it a company "expense" by inviting the staff for a cruise one day a year.

I sold off most of my toys — my sea plane, my Porsche, my boat — and got together just barely enough money to print the first issue of the magazine. And it's still around!

1960 was a really busy year. I helped the ARRL's Hudson Division Convention sell booth space, founded and was the first secretary of American Mensa, was president of the Porsche Club and put on several rallies that no one who participated in will ever forget, and stuff like that.

What You Can Do

So here we are, forty years later. Here we are with over 677,000 licensed hams, 75% of which don't subscribe to *any* ham magazine. Now, that's a shame! I can understand the hams who entered the hobby through the no-code Tech ticket considering the League to be the enemy, and thus refusing to subscribe to *QST*. Hey, that's 57% of us right there! And I can understand where many hams might not be very interested in contests, and thus pass up *CQ*. Hmm, that leaves 73!

As a birthday present for me please get on the air and tell the Techs on the repeaters about 73. Then get on the HF bands and tell the new Generals what they're missing. If you can convince just one more subscriber, that will be a wonderful birthday present. The magazine will help make their hobby a lot more fun. They'll have a ball trying the antennas we publish, and my editorials will give them a lot more to talk about than the weather.

Six meters is hotter'n a pistol, with contacts all around Europe and even Australia.

I'll keep leaving the contest news to *CQ*, and the operating news to *QST*. I want to help every ham to have fun with our ham satellites, with the red hot HF bands during this sun spot

peak, and to try RTTY, SSTV, and packet. Maybe I can even get some of you to go on a DXpedition. I guarantee that you'll never forget one minute of such a trip for the rest of your life.

Amateur radio offers a lifetime of excitement and adventure, but only if you grab the opportunities. Like I have. And still do.

Oh, Canada!

Maybe you saw the TV exposé on seniors taking bus trips to Canada to buy their medications? The same drugs are available there at one half to one third their US prices, so it makes sense for people in our northern tier states to go to Canada every month or so and stock up on their medications.

All of which gives you a hint of how thoroughly the pharmaceutical companies are screwing us on drug prices. Why, they're almost making as much profit as the illegal drug sellers!

Of course, if I could get these people to read my health guide and change their lifestyles a bit, they wouldn't have any need for prescription drugs. But since my discoveries would gut the whole medical industry, it isn't going to happen — at least not soon.

Did you read where American kids are now going to Canadian universities, where our kids are getting a higher quality education at a fraction of US university prices? How about \$7,200 at McGill University in Montreal?

A few years ago, when I was researching our university system, I had to visit Waterloo

Continued on page 8

Big Savings on Radio Scanners

COMMUNICATIONS ELECTRONICS INC.

Order on-line and get big savings

Take advantage of Communications Electronics special savings when you enter your order directly on the internet. Visit CEI at <http://www.usascan.com>, and click on "CEI News" to get your big CEI E-Value savings. Resellers, get extra special pricing when you fax your sales tax license to CEI at +1-734-663-8888.

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Mfg. suggested list price \$515.00/Special \$299.95

Looking for a great hand-held two-way transceiver? Fire departments depend on the RELM MPV32 transceiver for direct two-way communications with their fire or police department, civil defense agency or ham radio repeater. The MPV32 is our most popular programmable frequency agile five watt, 32 channel handheld transceiver that has built-in CTCSS. This feature may be programmed for any 50 standard EIA tones. Frequency range 136.000 to 174.000 MHz. The full function, DTMF compatible keypad also allows for DTMF Encode/Decode and programmable ANI. Weighing only 15.5 oz., it features programmable synthesized frequencies either simplex or half duplex in 2.5 KHz. increments. Other features include PC programming and cloning capabilities, scan list, priority channel, selectable scan delay, selectable 5 watt/1 watt power levels, liquid crystal display, time-out timer and much more. When you order the MPV32 from CEI, you'll get a complete package deal including antenna, 700 ma battery (add \$20.00 to substitute a 1000 ma battery), battery charger, belt clip and user operating instructions. Other useful accessories are available. A heavy duty leather carrying case with swivel belt loop part #LCMP is \$49.95; rapid charge battery charger, part #BCMP is \$69.95; speaker/microphone, part #SMMP is \$54.95; extra high capacity 1000 ma. ni-cad battery pack, part #BPMP1 is \$79.95; extra 700 ma. ni-cad battery pack, part #BPMP7 is \$59.95; cloning cable part #CCMP is \$34.95; PC programming kit, part #PKIT030 is \$224.95. A UHF version with a frequency range of 450-480 MHz. part #MPU32 is on special for \$299.95. Your RELM radio transceiver is ideal for many different applications since it can be programmed with just a screwdriver and programming instructions in less than 10 minutes. Programming is even faster with the optional PC kit. The programming instructions part #PIMPV is \$19.00. Call 1-800-USA-SCAN to order for RELM radios.

Bearcat®895XLT-A1 Radio Scanner
Mfg. suggested list price \$729.95/Special \$194.95
300 Channels • 10 banks • Built-in CTCSS • S Meter
Size: 10-1/2" Wide x 7-1/2" Deep x 3-3/8" High
Frequency Coverage: 29.000-54.000 MHz., 108.000-174 MHz., 216.000-512.000 MHz., 806.000-823.995 MHz., 849.0125-868.995 MHz., 894.0125-956.000 MHz.

The Bearcat 895XLT is superb for intercepting trunked communications transmissions with features like TurboScan™ to search VHF channels at 100 steps per second. This base and mobile scanner is also ideal for intelligence professionals because it has a Signal Strength Meter, RS232C Port to allow computer-control of your scanner via optional hardware and 30 trunking channel indicator annunciators to show you real-time trunking activity for an entire trunking system. Other features include **Auto Store** - Automatically stores all active frequencies within the specified bank(s). **Auto Recording** - This feature lets you record channel activity from the scanner onto a tape recorder. **CTCSS Tone Board** (Continuous Tone Control Squelch System) which allows the squelch to be broken during scanning only when a correct CTCSS tone is received. For maximum scanning enjoyment, order the following optional accessories: **PS001** Cigarette lighter power cord \$14.95; **PS002** DC power cord - enables permanent operation from your vehicle's fuse box \$14.95; **MB001** Mobile mounting bracket \$14.95; **EX711** External speaker with mounting bracket & ten feet of cable with plug attached \$19.95. The BC895XLT comes with AC adapter, telescopic antenna, owner's manual and one year limited Uniden factory warranty. Not compatible with AGEIS, ASTRO, EDACS, ESAS or LTR systems. Call 1-800-USA-SCAN.

TrunkTracking Radio

DISTRIBUTOR'S COUPON EXPIRES 10/30/00 #00077Z

SAVE \$75 on one BC245XLT

Save \$75 when you purchase your Bearcat 245XLT handheld scanner directly from Communications Electronics Inc., PO Box 1045, Ann Arbor MI 48106 USA. Telephone orders accepted. Call 1-800-USA-SCAN. Mention offer CE12. TERMS: Good only in USA & Canada. Only one coupon is redeemable per purchase and only on specified product.

Bearcat®245XLT-A TrunkTracker

Mfg. suggested list price \$429.95/CEI price \$269.95

300 Channels • 10 banks • Trunk Scan and Scan Lists

Trunk Lockout • Trunk Delay • Cloning Capability

10 Priority Channels • Programmed Service Search

Size: 2-1/2" Wide x 1-3/4" Deep x 6" High

Frequency Coverage:

29.000-54.000 MHz., 108-174 MHz., 406-512 MHz., 806-823.995 MHz., 849.0125-868.995 MHz., 894.0125-956.000 MHz.

Our new Bearcat TrunkTracker BC245XLT, is the world's first scanner designed to track Motorola Type I, Type II, Hybrid, SMARTNET, PRIVACY PLUS and EDACS® analog trunking systems on any band. Now, follow UHF High Band, UHF 800/900 MHz trunked public safety and public service systems just as if conventional two-way communications were used. Our scanner offers many new benefits such as **Multi-Track** - Track more than one trunking system at a time and scan conventional and trunked systems at the same time. **300 Channels** - Program one frequency into each channel. **12 Bands, 10 Banks** - Includes 12 bands, with Aircraft and 800 MHz. 10 banks with 30 channels each are useful for storing similar frequencies to maintain faster scanning cycles or for storing all the frequencies of a trunked system. **Smart Scanner** - Automatically program your BC245XLT with all the frequencies and trunking talk groups for your local area by accessing the Bearcat national database with your PC. If you do not have a PC simply use an external modem. **Turbo Search** - Increases the search speed to 300 steps per second when monitoring frequency bands with 5 KHz. steps. **10 Priority Channels** - You can assign one priority channel in each bank. Assigning a priority channel allows you to keep track of activity on your most important channels while monitoring other channels for transmissions. **Preprogrammed Service (SVC) Search** - Allows you to toggle through preprogrammed police, fire/emergency, railroad, aircraft, marine, and weather frequencies. **Unique Data Skip** - Allows your scanner to skip unwanted data transmissions and reduces unwanted birdies. **Memory Backup** - If the battery completely discharges or if power is disconnected, the frequencies programmed in your scanner are retained in memory. **Manual Channel Access** - Go directly to any channel. **LCD Back Light** - An LCD light remains on for 15 seconds when the back light key is pressed. **Autolight** - Automatically turns the backlight on when your scanner stops on a transmission. **Battery Save** - In manual mode, the BC245XLT automatically reduces its power requirements to extend the battery's charge. **Attenuator** - Reduces the signal strength to help prevent signal overload. The BC245XLT also works as a conventional scanner. Now it's easy to continuously monitor many radio conversations even though the message is switching frequencies. The BC245XLT comes with AC adapter, one rechargeable long life ni-cad battery pack, belt clip, flexible rubber antenna, earphone, RS232C cable, Trunk Tracker frequency guide, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO, ESAS or LTR systems. Hear more action on your radio scanner today. Call CEI today at 1-800-USA-SCAN to order your BC245XLT radio scanner.



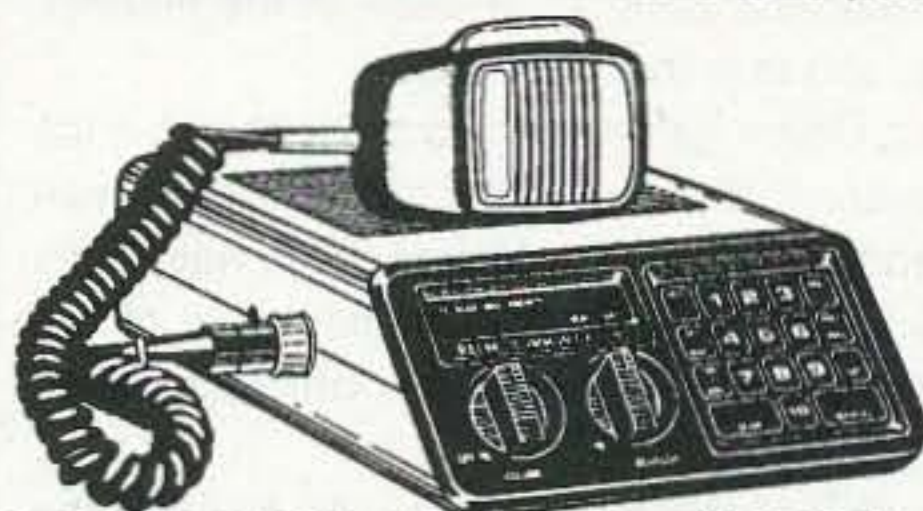
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Sangean ATS909-A shortwave receiver \$229.95
Sangean ATS818CS-A shortwave receiver \$199.95
Sangean ATS404-A shortwave receiver \$79.95

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RELM®RH256N-A Transceiver/SPECIAL

Mfg. suggested list price \$460.00/Special \$284.95

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Frequency Coverage: 144.000-174.000 MHz.

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Continued from page 1

table, and send the kids through college. Some probably came to the Dallas conclave expecting to find some instant solution to their business worries, and were put off when nothing really new was offered.

The dealers also appear to have another problem, that of finding something in common with the rest of the ham radio industry. They see themselves as being on the frontline, having to battle for their very survival, while distributors, importers, magazines, and even the ARRL have some level of insulation from the problems that they have to face. Finding some common bond between the dealers and the rest of the industry will become a paramount issue in the months, years, and meetings to come.

This Dallas gathering also brought with it the realization that there is a big difference between the wants, needs, and desires of the ham radio retail community and the political arm of the hobby (as represented by the American Radio Relay League).

Several of those we spoke with say that the retailers were less than enthusiastic about having the League as a player. But at the upper levels in the ham radio supply chain it is understood that only by working together can all in ham radio — and this includes radio amateurs like you and me — hope to prosper. Also, that this prosperity will eventually reach the retail level if the dealers can show a bit more patience and wait for restructuring to take root. Once it does, ham radio should once again begin to grow, and everyone will benefit.

The Dallas meeting was hosted by Evelyn Garrison WS7A, 73 Ad Sales Manager, and Gordon West WB6NOA. These are two names well known inside and outside the ham radio industry. ARRL President Jim Haynie W5JBP, along with Rosalie White WA1STO and Jennifer Hagy N1DTY, represented the League.

Thanks to Newsline, Bill Pasternak WA6ITF, editor.

Restructuring: It Seems To Be Working

While it's too soon to know for sure, initial numbers on restructuring seem to bode well for ham radio.

After the first seven weeks following the implementation of changes in the United States Amateur Radio service, statistics compiled by Fred Maia of the *W5YI Report* are very encouraging. According to *W5YI* there are now 7,490 more General class license holders than there were on May 31st of 1999. This is most likely due to pre March 1987 Technician Class hams taking advantage of a no-test upgrade.

But the big surprise is the number of people

who have gone to Extra from the various other license classes. That number is up by an amazing 7,051; or a little over 9%.

Not surprising is the small amount of change in the area of code-free Technician class hams. They still remain the single largest group in ham radio at 206,854. That's 30% of all hams holding an FCC license. But from May 31, 1999, to May 31st of 2000 their ranks only grew by 1,873.

It's still too early to even conjecture as to whether or not this means the codeless entry into ham radio has lost its appeal. Some believe there will be another wave of code-free newcomers as soon as the initial changes brought about by restructuring begin to settle down.

While it is very early on in the streamlining process, the figures accumulated between the April 15th implementation of restructuring and the May 31st cutoff date of Fred's report do seem to show some small but perceptible positive change. If the trend continues, the year 2000 could be the beginning of a good growth period for amateur radio here in the USA.

Thanks to Bill Burnett KT4SB, via Newsline, Bill Pasternak WA6ITF, editor.

Ham Stats: The World of Amateur Radio

More good news about the number of people enjoying ham radio. The International Amateur Radio Union says that things appear to be looking up.

How many ham radio operators are there in the world? According to the International Amateur Radio Union Web site, the actual number of licensed radio amateurs reached just a few short of three million in 1999. That's right: We said three million, with Japan still leading the way with more than 1,296,000 station licenses issued. We in the United States rank number two at 679,864 individual license holders, followed by Thailand at 141,241, the Republic of Korea at 130,000, and Germany at 80,336.

And the good news continues. This as IARU figures show that the number of amateur license holders continues to grow. The IARU says that the number of amateur operators worldwide passed the half million mark back in 1969. That doubled in the ten years between 1970 and 1980, and again in the decade and a half between 1980 and 1995.

But there is a downside to all of this. According to the IARU, membership of national amateur societies shows a quite different trend. It says that most radio amateurs do not belong to their respective national societies and overall support of these groups continues to decline.

Thanks to David Black KB4KCH, via Newsline, Bill Pasternak WA6ITF.

Scientists Break Speed of Light

Has *Star Trek* come true? Can warp speeds be achieved? Warp speeds exceed the speed of light. Science now says it has happened.

Particle physicists have shown that light pulses can be accelerated to up to 300 times their normal velocity of 186,000 miles per second. And the implications, like the speed, are mind-boggling. (*Actually, further explanation has speculated that some subatomic particles may have traveled at superlumina speed, but that the entire entities of which they might have been part might have remained sublumina — thus saving Einstein's as-pects. — ed.*)

One interpretation: Light will arrive at its destination almost before it has started its journey. In effect, it is leaping forward in time.

Exact details of the findings remain confidential because they have been submitted to *Nature*, the international scientific journal, for review prior to possible publication. (*Of course, the results may have been available before the experiments took place, in which case ... oh, never mind. — ed.*)

The research is already causing controversy among physicists. What bothers them is that if light could travel forward in time it could carry information. This would breach one of the basic principles in physics — causality, which says that a cause must come before an effect.

It would also shatter Einstein's theory of relativity since it depends in part on the speed of light being unbreachable.

Thanks to Graham Kemp VK4BB, via Newsline, Bill Pasternak WA6ITF, editor.

Kids' Words of Wisdom

- Never trust a dog to watch your food. Patrick, age 10.
- When you want something expensive, ask your grandparents. Matthew, 12.
- Never smart off to a teacher whose eyes and ears are twitching. Andrew, 9.
- Wear a hat when feeding sea gulls. Rocky, 9.
- Sleep in your clothes so you'll be dressed in the morning. Stephanie, 8.
- Never try to hide a piece of broccoli in a glass of milk. Rosemary, 7.
- Don't flush the john when our dad's in the shower. Lamar, 10.
- Never ask for anything that costs more than five dollars when your parents are doing taxes. Carrol, 9.
- Never bug a pregnant mom. Nicholas, 11.
- Don't ever be too full for dessert. Kelly, 10.

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MFJ TUNERS

MFJ-989C Legal Limit Antenna Tuner

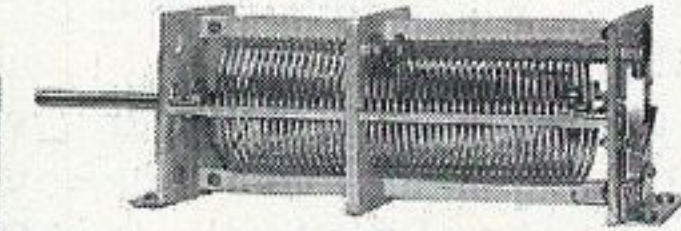
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You get everything you've ever wanted in a high power, full featured antenna tuner -- widest matching range, lighted Cross-

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\$359⁹⁵

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Two knob tuning (differential capacitor and AirCore™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. 10 3/4"Wx4 1/2"Hx15 in.

MFJ-962D compact Tuner for Amps



A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! AirCore™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. 10 3/4"Wx4 1/2"Hx10 7/8 in.

MFJ-969 300W Roller Inductor Tuner



Superb AirCore™ Roller Inductor tuning. Covers 6 Meters thru 160 Meters! 300 Watts PEP SSB. Active true peak reading lighted Cross-Needle SWR Wattmeter, QRM-Free PreTune™, antenna switch, dummy load, 4:1 balun, Lexan front panel. 3 1/2"Hx10 1/2"Wx9 1/2"D inches.

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MFJ-941E super value Tuner

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MFJ-945E HF+6 Meter mobile Tuner

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. Lighted Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz and 6 Meters. 300 Watts PEP. MFJ-20, \$4.95, mobile mount.

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Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x6 1/2x2 1/2 inches.

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MFJ-901B
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NEVER SAY DIE

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University (near Toronto) to find a university that was using personal computers productively.

At McGill the freshmen live on campus, but the upper classes mostly live in town. It's like that at Rensselaer, my alma mater, where they have a large freshmen dorm quadrangle and much smaller upper class dorms nearby for the geeks. The rest of the frosh are pledged to the fraternities, which have their fraternity houses all around town. There are the Greeks and the Geeks. My fraternity, Sigma Chi, bought the old governor's mansion in the posh section of town. I helped find the mansion when we decided to move from an old brownstone downtown near the railroad tracks to a more upscale area.

Okay, how come the same drugs are a fraction of US prices in Canada? How come Canadian universities are able to operate at a fraction of US universities? The drug situation

comes from the far more than cozy FDA-pharmaceutical-insurance company relationship. We're being screwed, my friends. Systematically fleeced by three big industries which have bought the power to screw us via their bribery of our congressmen. So we pay up or take a bus to Canada — or read my *Secret Guide to Health*.

If you want to know more about how far American universities have skidded in recent years, please read George Roche's *The Fall of the Ivory Tower*, which is reviewed in my *Secret Guide to Wisdom* (p. 9). Of course, if your youngsters or grandchildren have learned to read and to actually understand what they're reading, my \$5 *Secret Guide to Wealth* may save them from wasting four (or more years) and tens of thousands of your dough, going to college.

Music, Music

One thing we all enjoy is music. It's fun and relaxing. It's a great stress reducer.

It's also, for babies, a great

brain developer. It significantly increases their IQ, providing them with a brain boost which will benefit them all the rest of their lives. And this boost starts a lot earlier than you may think — during pregnancy. The downside of all this is that the kid will be a lot smarter than you, and always be one step ahead of you.

What kind of music should you play for little Ickey during his/her nine months of residency? In view of the research done with both plants and animals, where Mozart produced better growth for plants and more cooperation for animals, vs. stunted plant growth and animals that kill each other when exposed to rock music, I'd go for classical. Like Strauss (Johann Jr, rather than Richard), Joplin, Beethoven, Tchaikovsky's ballets, and Mendelssohn. Yeah, Mozart is okay. His last four symphonies and *Eine Kleine Nachtmusik*, are good bets.

Right here in Peterborough we have Kindermusik classes for newborn babies to age 7, where they teach kids to play

instruments, and the older kids learn to read and compose music.

Babies are like sponges in that the more things you expose them to, the faster and more powerful their brains grow. Putting them into play pens, shut off from exploring and learning, permanently limits their IQ development. There are no second chances when it comes to building baby's brain connections. With music, babies and youngsters are exposed to a new and fun bunch of things to learn.

It's the same with language. During the 1-3 year ages babies brains are in the language learning phase. Researchers have shown that babies can learn to speak dozens of languages at this age, and to be able to think in each of them without confusing them, and to speak them without any accent. This is a brain development skill that can never be done later on. This business of trying to teach foreign languages in high school goes against nature

Continued on page 61

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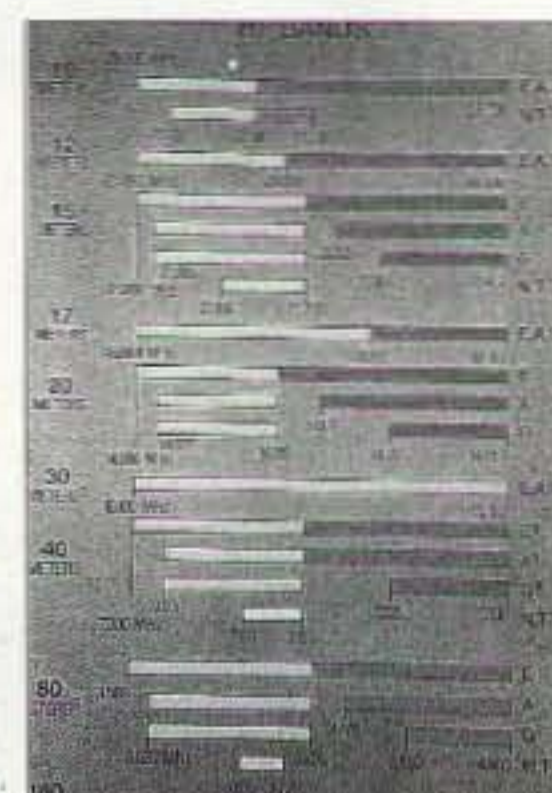
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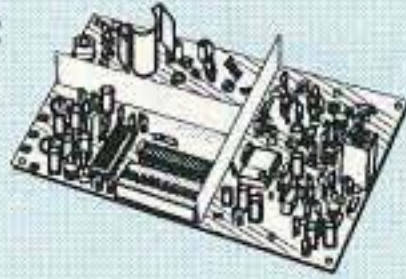
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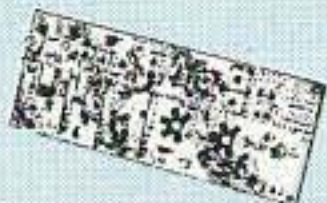
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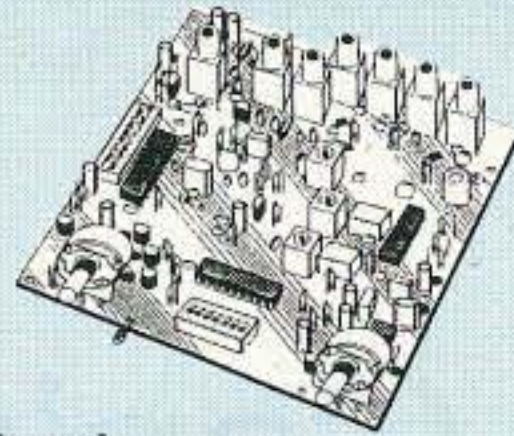
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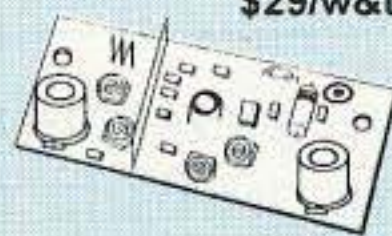
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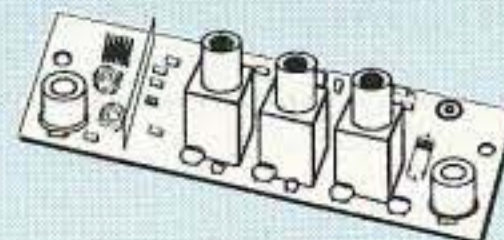
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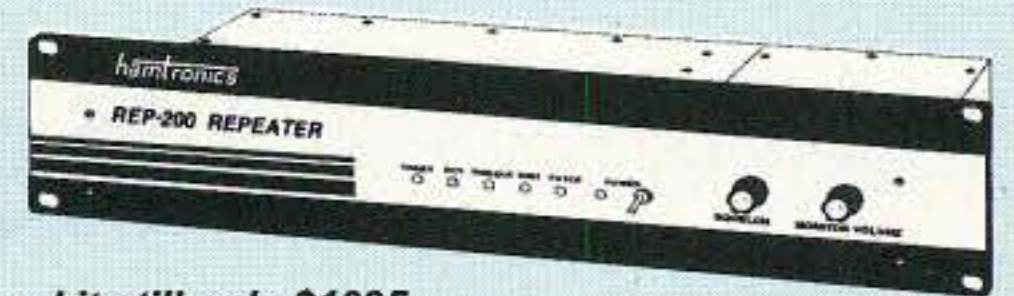
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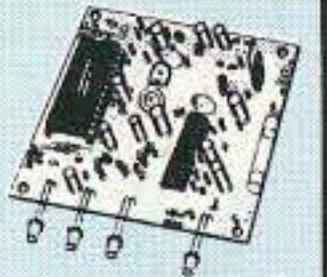
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The Cap'n Crunch LOWFER Loop

This lightweight longwave antenna could become a classic.

Many readers may ask, "Why a special loop receiving antenna covering just 65 kHz in the LF spectrum, where there is nothing to hear anyway?" Well, there is a vast amount of activity in the band 130 kHz–195 kHz (2308–1538 meters). It is just 65 kHz wide, but looking at that in good old-fashioned meters, the segment is 770 meters wide!

Why "lightweight"? Well, most LF loops use a stout and heavy timber frame, plus a large amount of copper wire. The result is *heavy*. In this design, a lightweight cardboard frame is used, which is nearly weightless in itself. It is simple, cheap, and quick to construct. The one heavy item is a reel of copper wire 100 meters (333 feet) long.

What is there to be heard?

You might be amazed at the amount of activity to be heard between 130 kHz and 195 kHz, plus periodic spasms of atmospheric QRM — also

QRM. It is quite a different ball game than listening on the HF bands. The following is some of that activity:

1. The 136 kHz amateur radio band (135.5–137.8 kHz), which originated in Europe and is gradually spreading worldwide.

2. Between 130 kHz and 160 kHz, there are many largely unidentified strange-sounding repetitive signals, many of which are, no doubt, navigational aids. Some enthusiasts specialize in investigating and identifying these signals.

3. The USA-originated 1750 meter LOWFER band (160–190 kHz). LOWFER stands for Low Frequency Experimental Radio stations.

4. A bonus is some of the various European longwave high-power AM broadcast stations. It has been possible to list at least nine stations between 150 and 195 kHz, of which all but two share the same band as the USA-originated LOWFER band. These stations provide possible DX listening for the North American-based listeners, and others outside Europe. Conversely, it means that for European listeners, they swamp the very low power LOWFER stations in the USA and elsewhere.

Summarizing: Wherever you live on Planet Earth, there is always something heard between 130 kHz and 195 kHz.

A good receiver is required to get the best results, plus a sensitive loop antenna with excellent nulling to remove or greatly reduce the fiendish atmospheric noise and other QRM that often occurs. Also, believe it or not, you can often experience QRM between stations. The "Cap'n Crunch" loop goes a long way towards providing the necessary antenna facilities.

The schematic

Fig. 1 illustrates the somewhat unusual schematic and unusual circuitry.

A multiturn loop (L) is resonated in a balanced circuit by a 2-gang x 500 + 500 pF variable capacitor, with the addition of C1 across the winding. C1 is a 130 pF capacitor, across which is wired a small padding capacitor to make final adjustment to get the loop into the 130/195 kHz spectrum (see text). These capacitors can be ceramic disc, silver mica, or mica, and the voltage rating is not important, making it possible for most to find them in the junk box. The coaxial feedline is

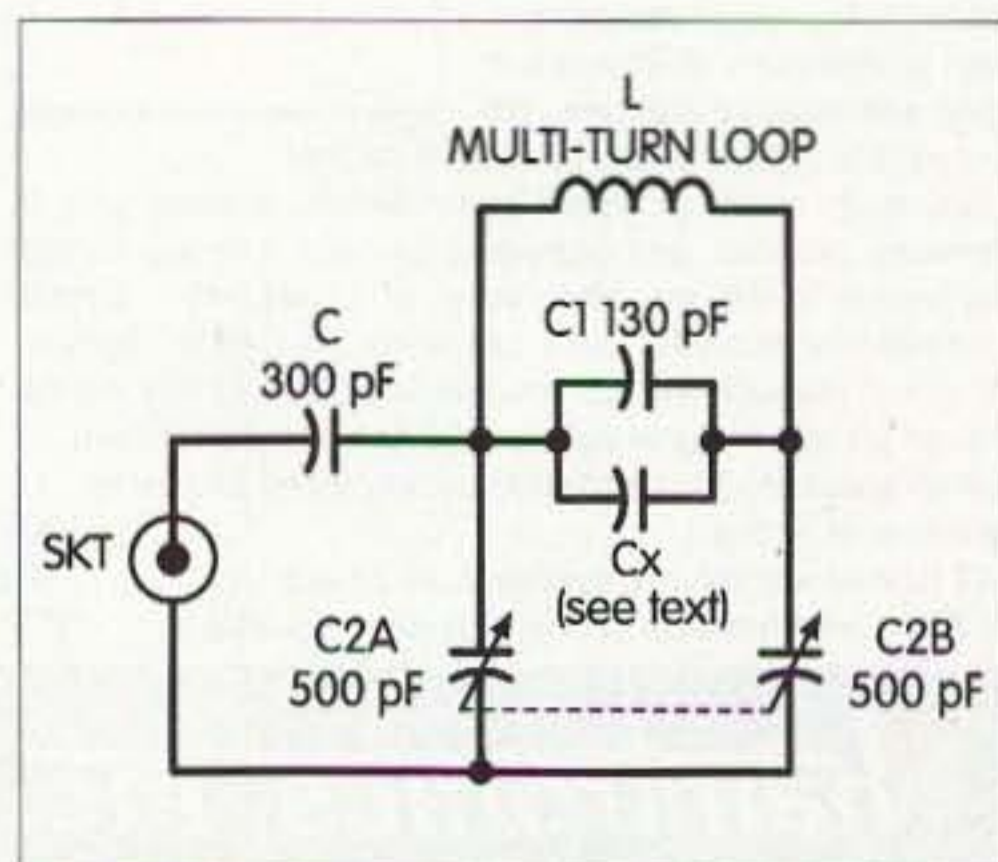


Fig. 1. Schematic.

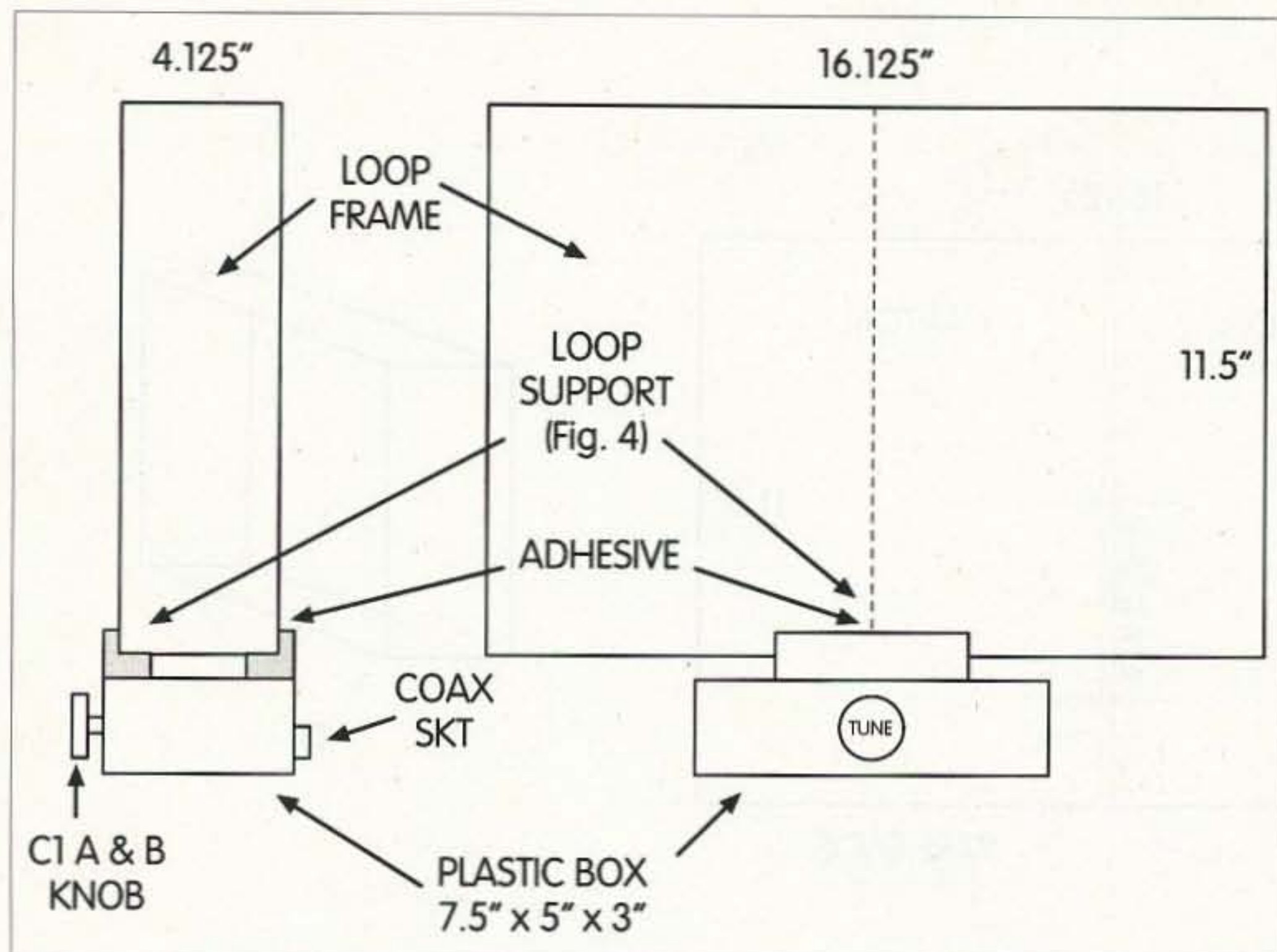


Fig. 2. The assembly.

coupled to the loop with capacitor C1, which is a 300 pF that can also be found in the junk box. SKT is a coaxial socket of a convenient type.

Profile

Fig. 2 shows the profile of the final loop assembly. It consists of a box frame (Fig. 3), onto which is wound loop "L". The frame is mounted on an inverted plastic box/base containing the variable capacitor C2A+B, on the

front, and the coaxial socket at the rear.

Loop frame winding

The frame used on the prototype was of negligible-weight thin cardboard construction, made from two breakfast cereal (hence the Cap'n Crunch) cartons glued together side by side, as shown in Fig. 3. Each carton was the popular size of approximately 11-1/2" x 8" x 4-1/8". After gluing them together,

wind two layers of wide masking tape around the circumference. The final dimensions are 16-1/8" x 11-1/2" x 4-1/8". At this stage, you can apply a coat of emulsion paint to the faces of the box frame, to cover the advertising and logos.

The winding consists of a 100-meter (333-foot) reel of PVC-covered hook-up wire, single core 1/0.6 mm (22 AWG) sheathed PVC to an overall diameter of 1.2 mm. The closewound winding should be started about 1/4" from the frame edge, and conveniently fills the width to about 1/4" from the other edge. The whole reel of wire is used. At the center bottom, 8"-long leads should be left for cutting back and soldering later. The use of PVC wire effectively spaces the wire turns.

Around the outside of the winding, wind a layer of PVC insulating tape.

An alternative thin cardboard frame could be made by cutting down larger cartons, or from cardboard sheets, with the aid of scissors, a scalpel, a stapler, sticky tape, and a tube of adhesive.

For those who prefer a wood frame, a simple design is shown in Fig. 3(b). Using this will, of course, multiply the overall weight of the final assembly by several times.

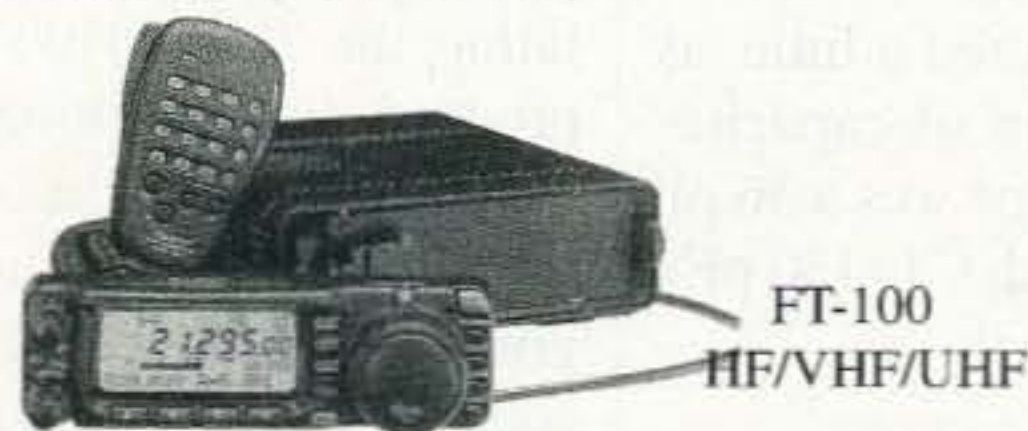
The box/base unit

The plastic box I used was a mi-

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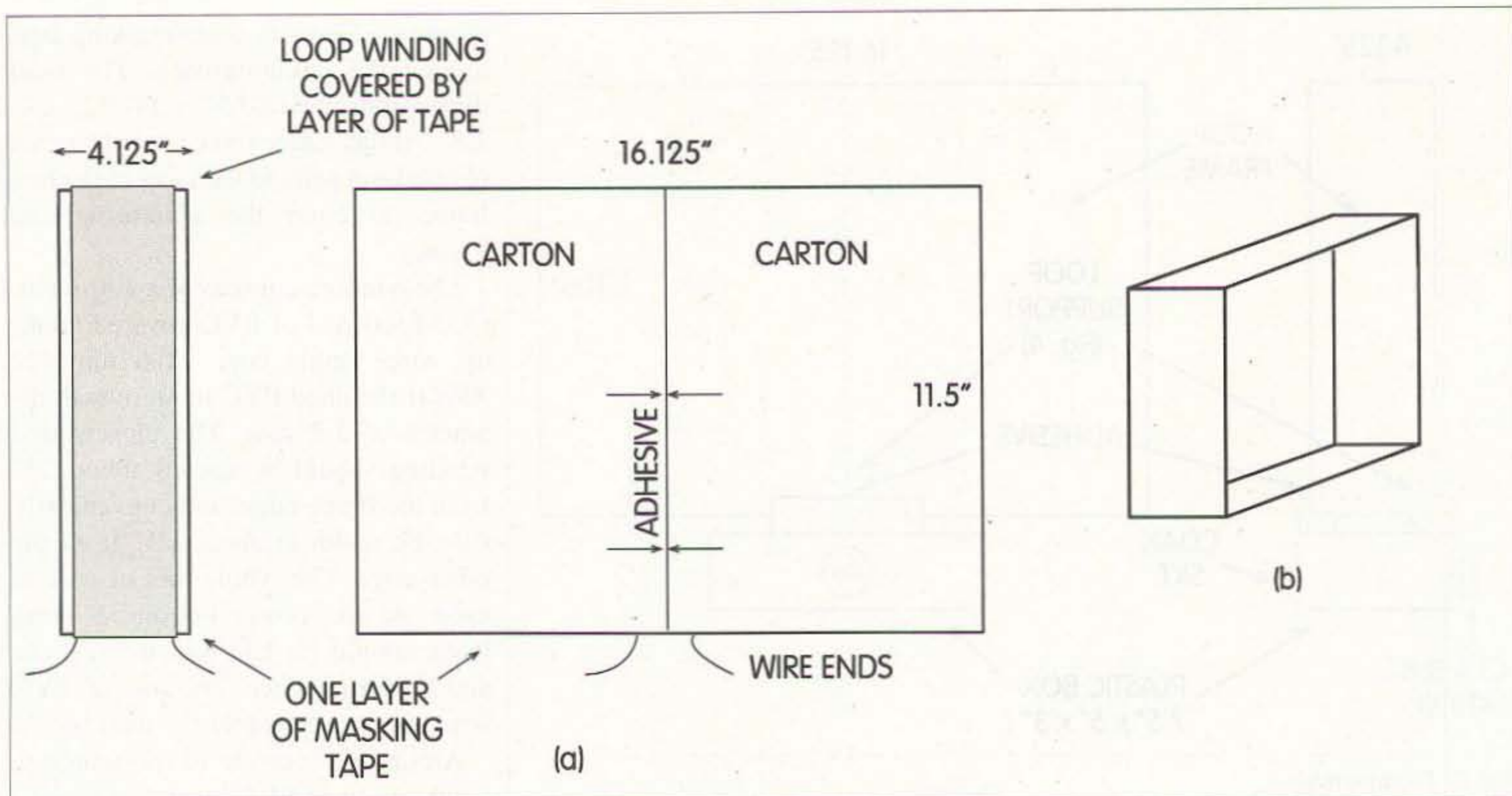


Fig. 3. (a) Loop frame and winding. (b) Alternative wooden frame.

crowave/freezer box 7-1/2" x 5" x 3" (Fig. 2). Any similar size of plastic box would do. The variable capacitor C2A+B is mounted at the front. A rigid 500 + 500 pF air-spaced type should be used. The coaxial socket (SKT) is mounted in the center of the rear. The box is inverted so that the original push-on top now forms the base.

Final assembly

Two simple loop supports are required, made of wood (see Fig. 4). Screw these to the base unit as shown, so that the loop frame/winding is a snug fit.

Pierce two holes in the top of the box/base, then pass the 8" ends of the loop winding through the holes. The box frame is held in position by a small spot of adhesive, as shown in Fig. 2.

The loop ends are cut back and connected to the tuning capacitor (Fig. 1). The other wiring should be completed using 18- or 20-gauge tinned copper wire. All connections should be securely soldered. No mechanical joints should be used.

NOTE: Cx is not connected at this stage.

Testing and operation

The loop should be connected, with a short length of coaxial feedline, to a good receiver covering the required frequency range. Stand the loop on a nonmetal surface. Next, check the loop frequency range. You will find that the LF end is a few kHz higher than required. This can be lowered a little, as required, by the addition of capacitor Cx, which on the prototype was a 56 pF silver mica in parallel with C1 (130 pF).

This produces the frequency range required—130–195 kHz.

The tuning capacitor is quoted as 500 + 500 pF, but in practice this is the manufacturer's nominal value, which may vary by as much as ± 20 pF from manufacturer to manufacturer. It may be necessary to experiment with the value of Cx to compensate for this factor; with the adjacent values to 56 pF (Cx) \pm . For example, unlike on HF frequencies, the addition of, say, 20 pF has only a minimal effect on the low frequency end of the tuning range.

Next, check the nulling on a suitable carrier (BFO On) around 140 kHz. The loop, rotated edge-on to this station, will produce maximum signal strength. Rotating the loop to 90 degrees should produce 100% nulling, except on the strongest local signal. Similarly, rotation of the loop should eliminate or greatly reduce QRN of the atmospheric and man-made types, which can on occasion be quite devilish.

The loop is remarkably sensitive for its small size. At my QTH, with a very sensitive receiver, a preamplifier is not necessary. In fact, it produces intermodulation! With less sensitive receivers, a preamplifier may be needed

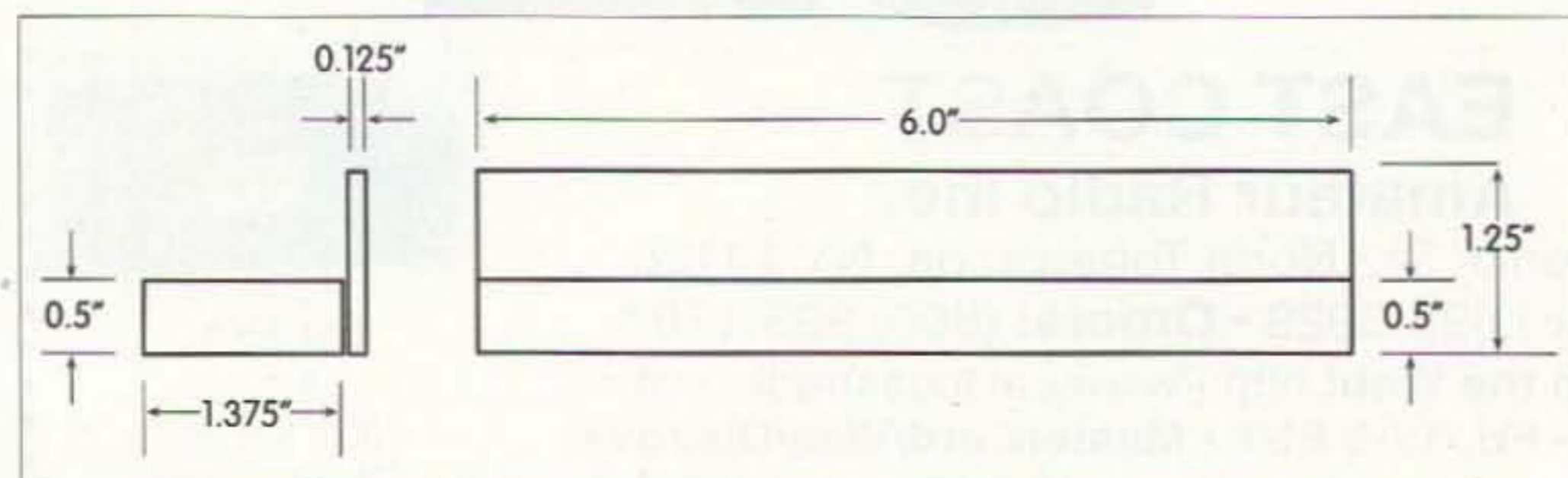


Fig. 4. Loop support.

Continued on page 58

Generating SSB

Use this tutorial to better understand — or better build — your next project.

Generating a single sideband (SSB) signal or, more accurately, a single sideband suppressed carrier (SSB/SC) signal, became necessary when SSB became the dominant communications mode in the HF bands. The battle between AM and SSB was won when the congestion on the bands became intolerable. While SSB has many advantages over AM, simplicity is not one of them.

SSB requires only half the bandwidth of AM and doesn't require the transmission of a carrier. Using only half the bandwidth theoretically doubles the number of transmissions that can exist in a band, and eliminating the carrier got rid of a great potential for producing heterodynes and interference in the receiver. Eliminating the carrier also reduced the power demands of the transmitter. Eliminating the carrier was good riddance.

Generating an SSB signal is now commonplace, even though it's complex. The home-brewer must face these complexities and make trade-offs in implementation, cost, and parts availability to accommodate his particular situation.

The chief disadvantage in generating an SSB signal has been the need for special, and usually expensive, components such as crystal filters or 90° audio phase shifting networks. The initial cost and availability weigh heavily against the filtering method of generating SSB. Audio phase shift methods require precision parts for good phase shift control and sideband suppression. A side issue of the phase shift method

is the bandwidth that can be achieved with a particular implementation. The bandwidth for communications is relatively broad, about 300 Hz to 3000 Hz, or 10:1.

Generating a single sideband by filtering is the most straightforward method. It usually starts by generating a double sideband suppressed carrier (DSBSC) signal with a balanced modulator that produces just the upper and lower sidebands — the carrier f_c is

suppressed. If the modulating frequency is restricted to 300 Hz to 3000 Hz, the output of the balanced mixer is two bands of frequencies, f_c+300 Hz to f_c+3000 Hz and f_c-300 Hz to f_c-3000 Hz. Therefore, to select one sideband requires a filter that cuts off in the interval between f_c+300 Hz and f_c-300 Hz; that is, an interval that is twice the lowest modulating frequency.

When the carrier f_c is even moderately high, the filter requires extremely

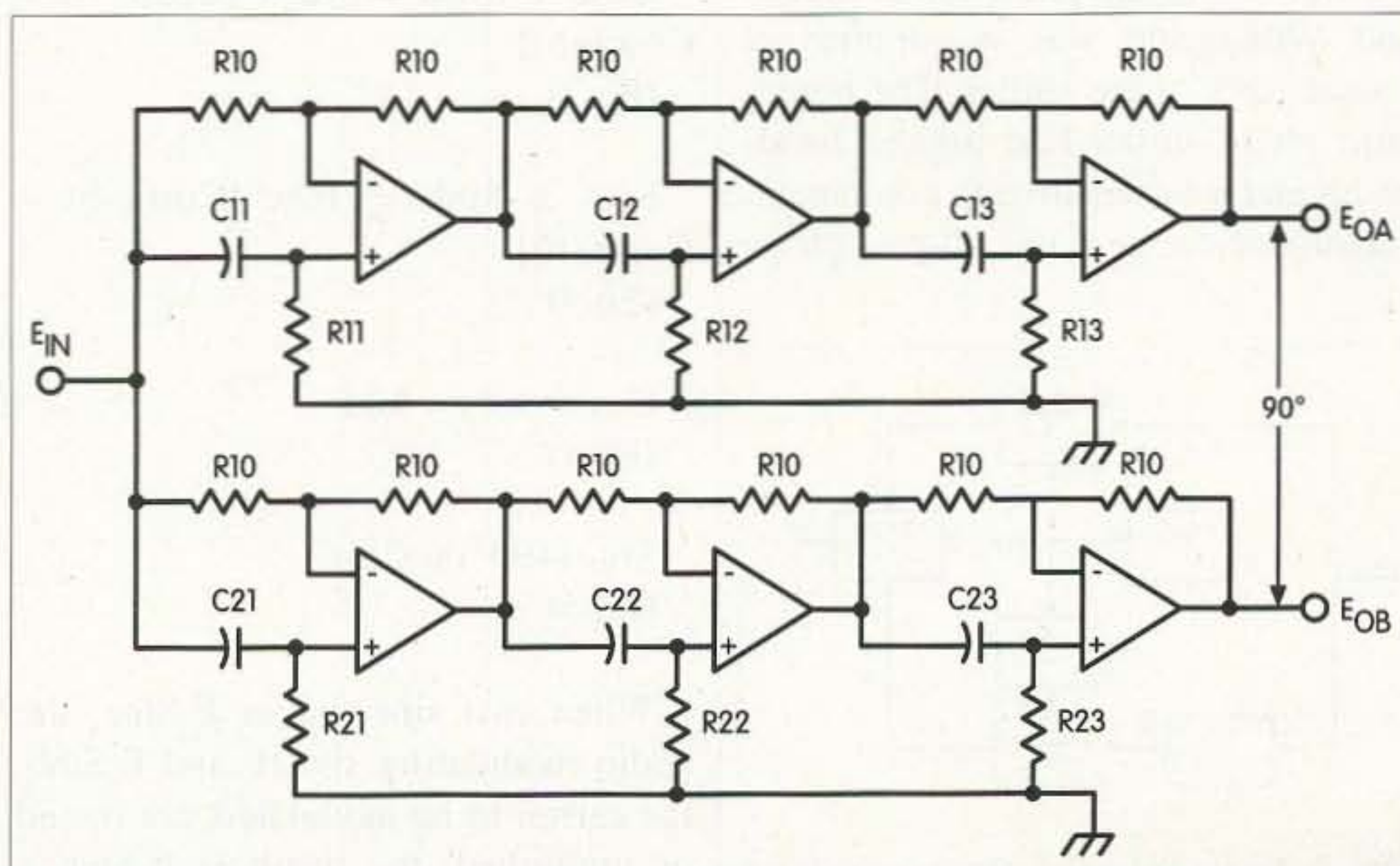


Fig. 1. An active phase shifter produces $90 \pm 0.1^\circ$ of relative phase shift.

Name	Computed Value	Standard Value	Mfr. P/N
C11, 12, 21	1000 pF	1000 pF*	Xicon PF1H 102G
C13, 22, 23	0.01 μF	0.01 μF*	Xicon PF1H 103G
R11	16.09 k	16.2 k**	RN55D 1622F
R12	118.3 k	118 k**	RN55D 1183F
R13	510.5 k	511 k**	RN55D 5113F
R21	55.14 k	54.9 k**	RN55D 5429F
R22	23.79 k	23.7 k**	RN55D 2372F
R23	174.9 k	174 k**	RN55D 1743F

* = ±2%. ** = ±1%.

Table 1. Parts list.

high Qs that can only be achieved with crystals or mechanical filters. Crystal filters typically operate at several MHz while mechanical filters usually operate below 500 kHz. These filters are moderately expensive and operate at a fixed frequency. Of course, the fixed filter frequency can be moved to the desired frequency in another mixing step.

The home-brewer usually opts for the phase shift method of generating SSB even though generating the audio 90° phase shift is not a simple process.

Early on, an RC lattice network was used to obtain the phase shift. Barker and Williamson was a commercial source for a phase shifter. The home-built phase shifter had limited bandwidth and was sensitive to component variation. Now, an active all-pass phase

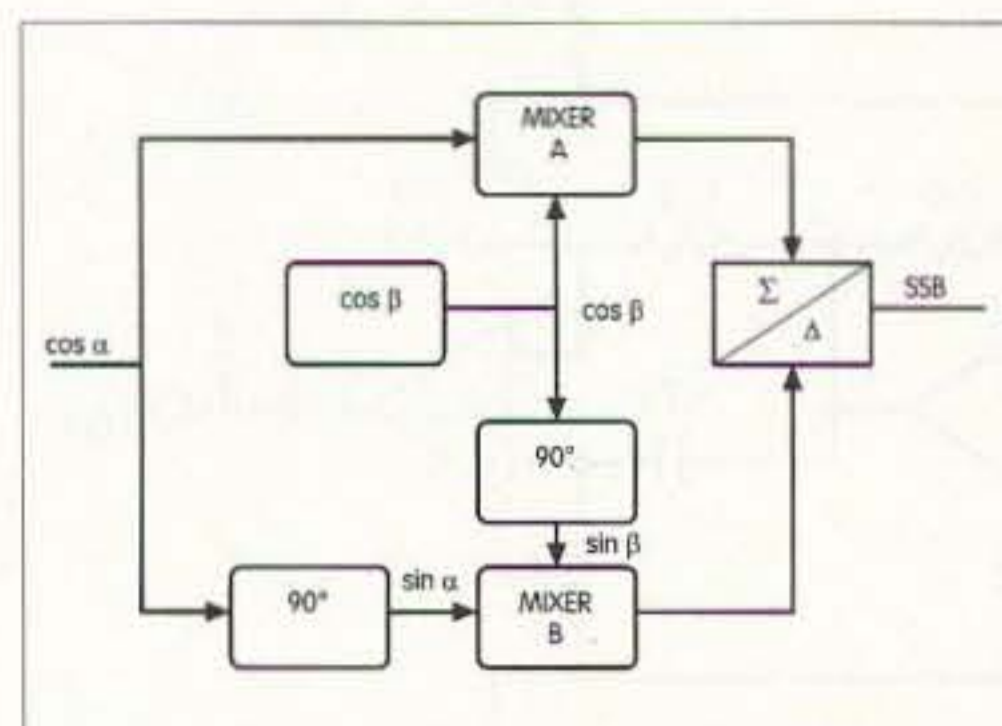


Fig. 2. Single sideband can be generated by phase shifting.

shifter is a better solution, even though it is still sensitive to component variation.

In the *Electronic Filter Design Handbook* by Williams, active all-pass sections are shown that can produce 90±0.1° of phase shift over a 10:1 bandwidth. A six-section filter with 90±0.1° phase shift, which translates into about 55 dB of sideband suppression, is shown in Fig. 1. The parts list is given in Table 1.

In the phasing method of generating an SSB signal, shown in Fig. 2, the audio signal is split into two equal amplitude channels separated by 90° and mixed with quadrature local oscillators. The mixer outputs are added to produce just the lower sideband or subtracted to produce just the upper sideband. The 90° phase shifts and amplitude equality are critical in that they determine the sideband suppression.

The sideband suppression is approximately 20 x log(tand/2) where d is the total deviation from 90° of both the audio and the local carrier. A total error of about 1.1° is required for 40 dB of sideband suppression. Of course, the amplitudes of both channels must also be equal.

The trig identities used in describing the various processes are:

$$\text{Cosa} \times \text{Sinb} = 1/2 \times [\text{Sin}(a-b) + \text{Sin}(a+b)] \quad (\text{Eq 1})$$

$$\text{Cosa} \times \text{Cosb} = 1/2 \times [\text{Cos}(a-b) + \text{Cos}(a+b)] \quad (\text{Eq 2})$$

$$\text{Sina} \times \text{Sinb} = 1/2 \times [\text{Cos}(a-b) - \text{Cos}(a+b)] \quad (\text{Eq 3})$$

$$\text{Cos}(f+90^\circ) = \text{Sinf} \quad (\text{Eq 4})$$

$$\text{Sin}(f+90^\circ) = \text{Cosf} \quad (\text{Eq 5})$$

When two sine waves $E_a \text{Sina}$, the audio modulating signal, and $E_b \text{Sinb}$, the carrier to be modulated, are mixed or multiplied, the result is $E_a \text{Sina} \times E_b \text{Sinb}$. Trigonometric identities show

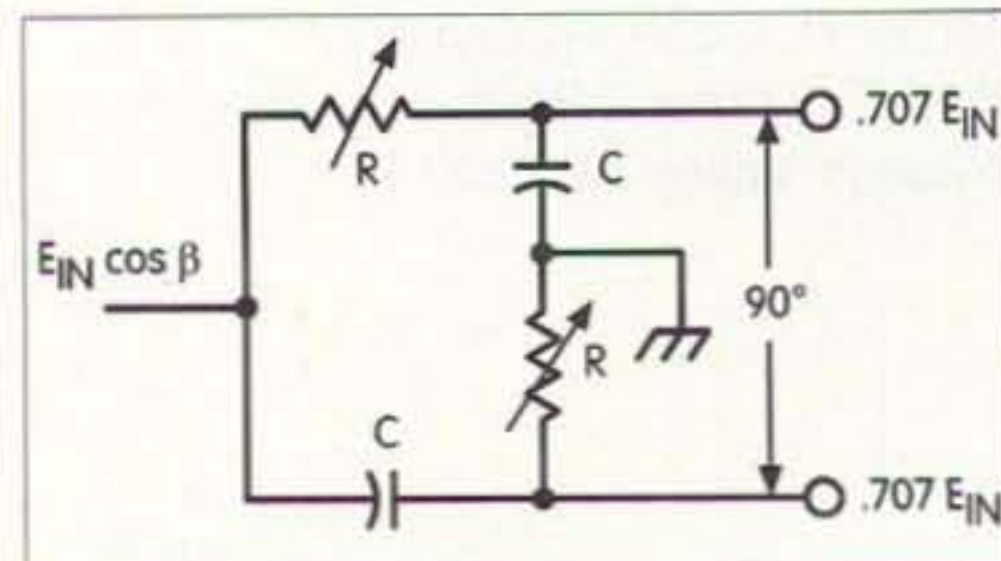


Fig. 3. 90° of phase shift for a single frequency is almost trivial.

the product $E_a \text{Sina} \times E_b \text{Sinb}$, equation 3, to be equal to:

$$E_o = E_a E_b \times 1/2([\text{Cos}(a-b) - \text{Cos}(a+b)])$$

The term $\text{Cos}(a-b)$ is the difference frequency or lower sideband, and the term $\text{Cos}(a+b)$, is the sum frequency or upper sideband. The amplitudes of both the sum and difference components are proportional to the term $E_a E_b / 2$ and have no influence on the frequencies or the phase produced. Therefore, the amplitudes are not identified in the following descriptions.

In the phasing method of SSB generation, the modulating signal Cosa is split into two channels. One channel is shifted 90° to become Sina (eq 4). The local oscillator Cosb is also split into two branches of Sinb and Cosb . The Cosa signal is mixed with the local oscillator Cosb in mixer A to produce an output of $\text{Cosa} \times \text{Cosb}$ (eq 2). The Sina signal is mixed with local oscillator Sinb in mixer B to produce an output of $\text{Sina} \times \text{Sinb}$ (eq 3).

From the trigonometric identities equations 2 and 3, the outputs of the two mixers are seen to be:

$$\text{A channel} = \text{Cosa} \times \text{Cosb} = \text{Cos}(a-b) + \text{Cos}(a+b)$$

$$\text{B channel} = \text{Sina} \times \text{Sinb} = \text{Cos}(a-b) - \text{Cos}(a+b)$$

When the outputs of the two mixers are summed, the result is $\text{Cos}(a-b)$, the lower sideband, and the upper sideband cancels. When the outputs are subtracted, only the upper sideband, $\text{Cos}(a+b)$, remains.

Continued on page 16

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Perfectly tune critical HF mobile antennas in seconds for super DX -- without subjecting your transceiver to high SWR.

Measure your antenna's 2:1 SWR bandwidth on one band, or analyze multiband performance over the entire spectrum 1.8-170 MHz!

Check SWR outside the ham bands without violating FCC rules.

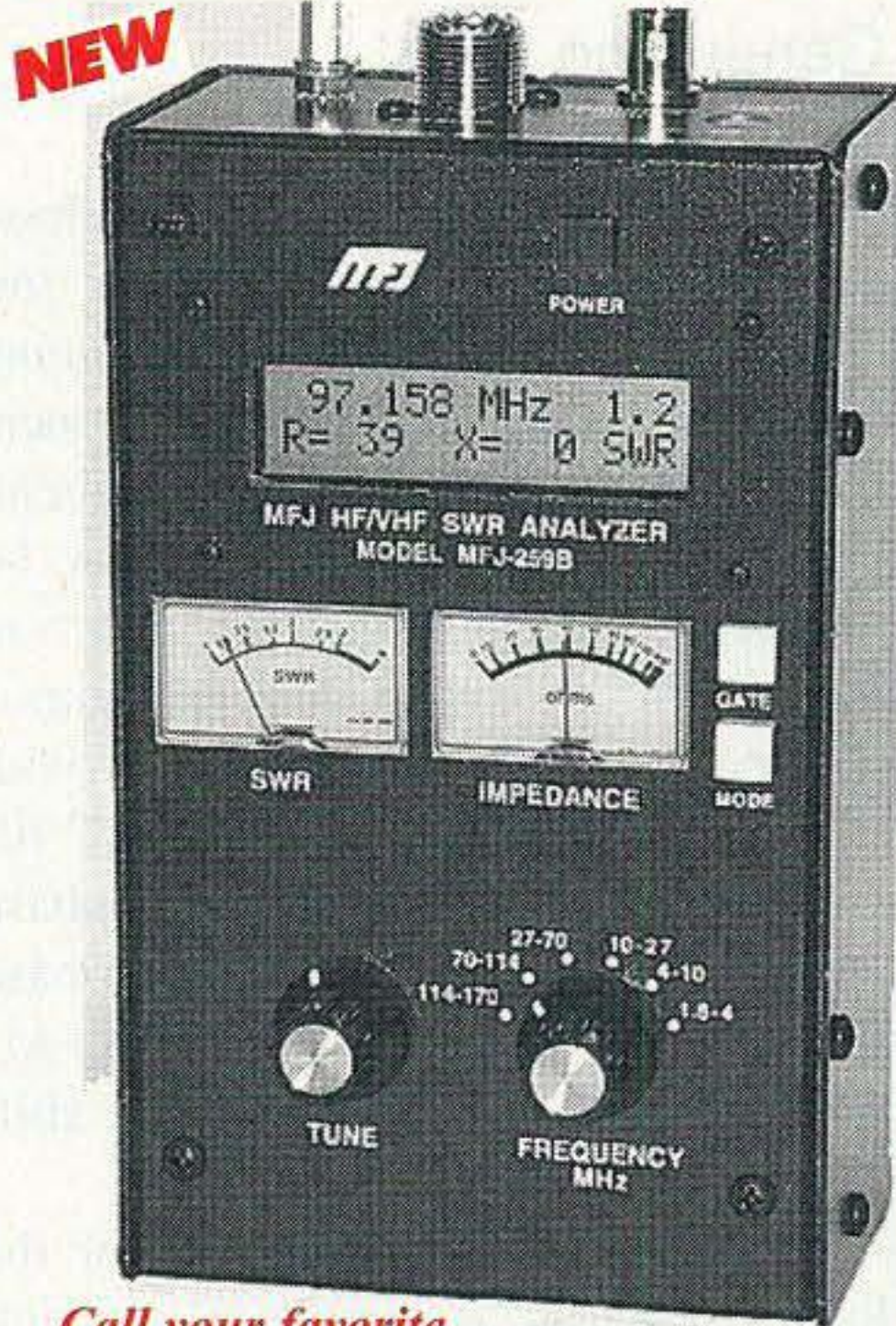
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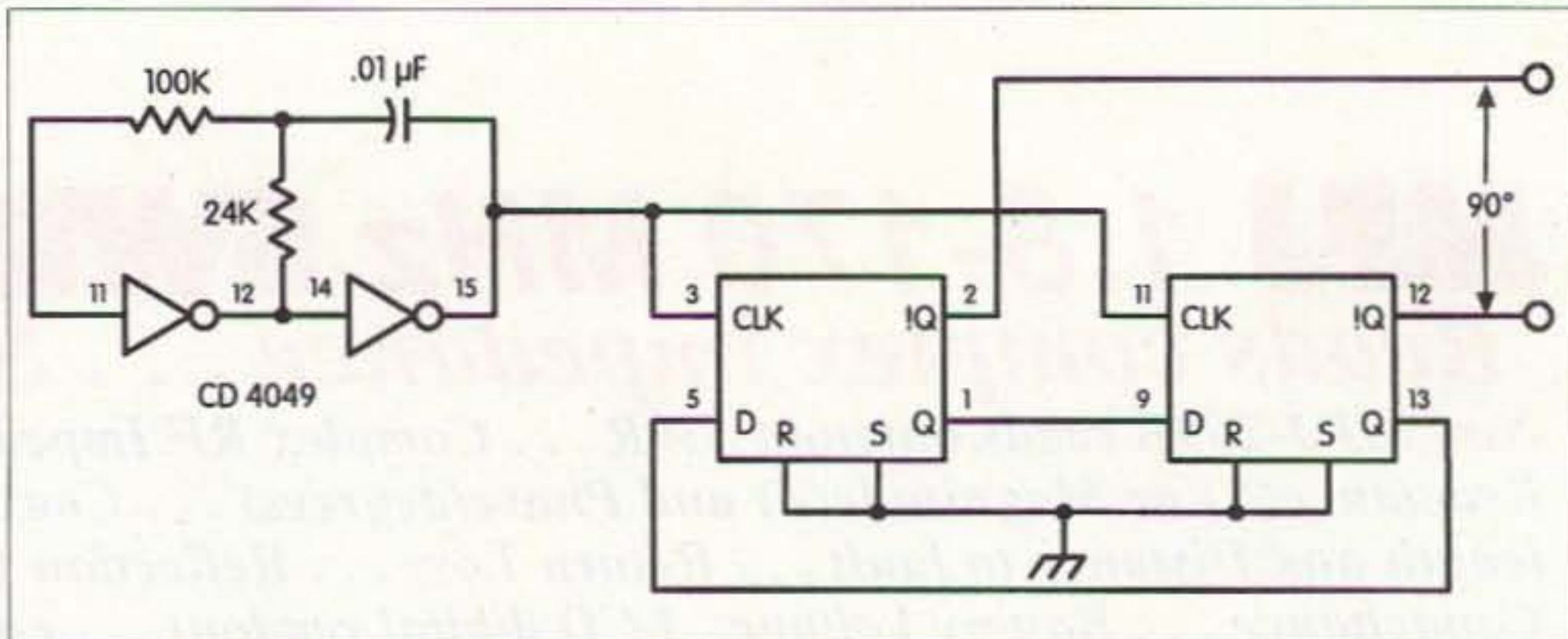


Fig. 4. Exactly 90° of phase shift can be produced digitally.

Generating SSB

continued from page 14

Obtaining an approximate 90° phase shift for a fixed local oscillator frequency is straightforward, but obtaining exactly 90° requires a bit of component adjustment and accurate measurement. Quadrature local oscillators can be produced with Rs and Cs as shown in Fig. 3. For example, plus and minus 45° phase shifts are obtained with simple low-pass and high-pass RC filters. The low-pass filter has a phase shift of -45° when $R = X_c$. The phase shift for the high-pass filter is +45° when $R = X_c$. The relative phase shift then is 90°.

While the RC phase shifter for the local oscillators is simple in concept, the devil is in the details. The output voltage of each filter is $0.707 \times E_{in} \angle \pm 45^\circ$ only when X_c is exactly equal to R. Unfortunately the tolerances of the R and C aren't zero, and 5% parts can produce a phase error as great as $\pm 3^\circ$, which limits the sideband suppression to some 30 dB even when the audio phase shift is exactly 90°. Therefore, R must be adjusted to make $R = X_c$ and $E_{out} = 0.707 \times E_{in}$.

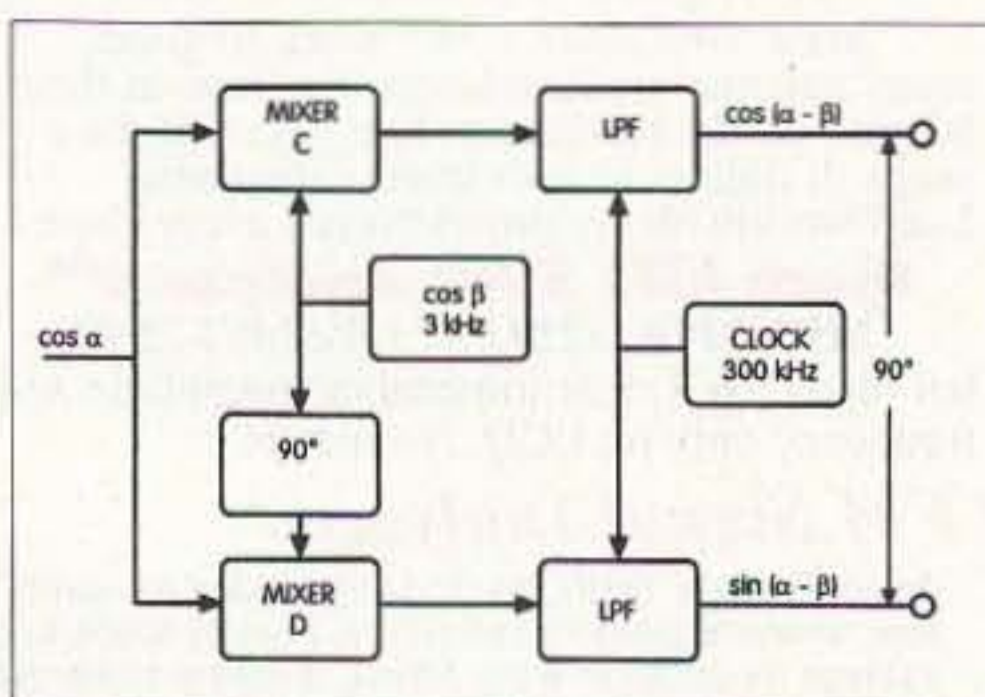


Fig. 5. Wideband phase shift can be produced by mixing.

An exact 90° phase shift for the local oscillators can be obtained digitally with a dual D flip-flop as shown in Fig. 4. In the D flip-flop, the data on the D input is transferred to the Q output on the transition of the clock. Therefore, quadrature signals are produced when both flip-flops are clocked simultaneously and the not-Q output of one is fed to the D input of the other. The two Q outputs are separated by exactly 90°, but in the process the clock is divided by four.

The maximum clock frequency depends on the flip-flops used. For example, the CD4013 CMOS ICs can be clocked up to 3.5 MHz when operated from 5 V, or 12 MHz when operated from 15 V. When operated with a 12 V supply, quadrature local oscillators up to 3 MHz can be produced. The digital scheme is essentially independent of frequency and is dead-on 90°. The fact that the output is a square wave has no influence on the mixing, but does determine the harmonics and their amplitudes present in the output.

An active audio phase shifter with its close tolerance parts can be avoided by the mixing scheme shown in Fig. 5. The audio signal $\cos \alpha$ is applied simultaneously to two mixers C and D which mix the audio with quadrature local oscillators $\sin \beta$ and $\cos \beta$. From the trigonometric identities of equations 1 and 2, the outputs of mixer C and D are:

$$C \text{ mixer} = \cos \alpha \times \cos \beta = \cos(\alpha + \beta) + \cos(\alpha - \beta)$$

$$D \text{ mixer} = \sin \alpha \times \cos \beta = \sin(\alpha + \beta) + \sin(\alpha - \beta)$$

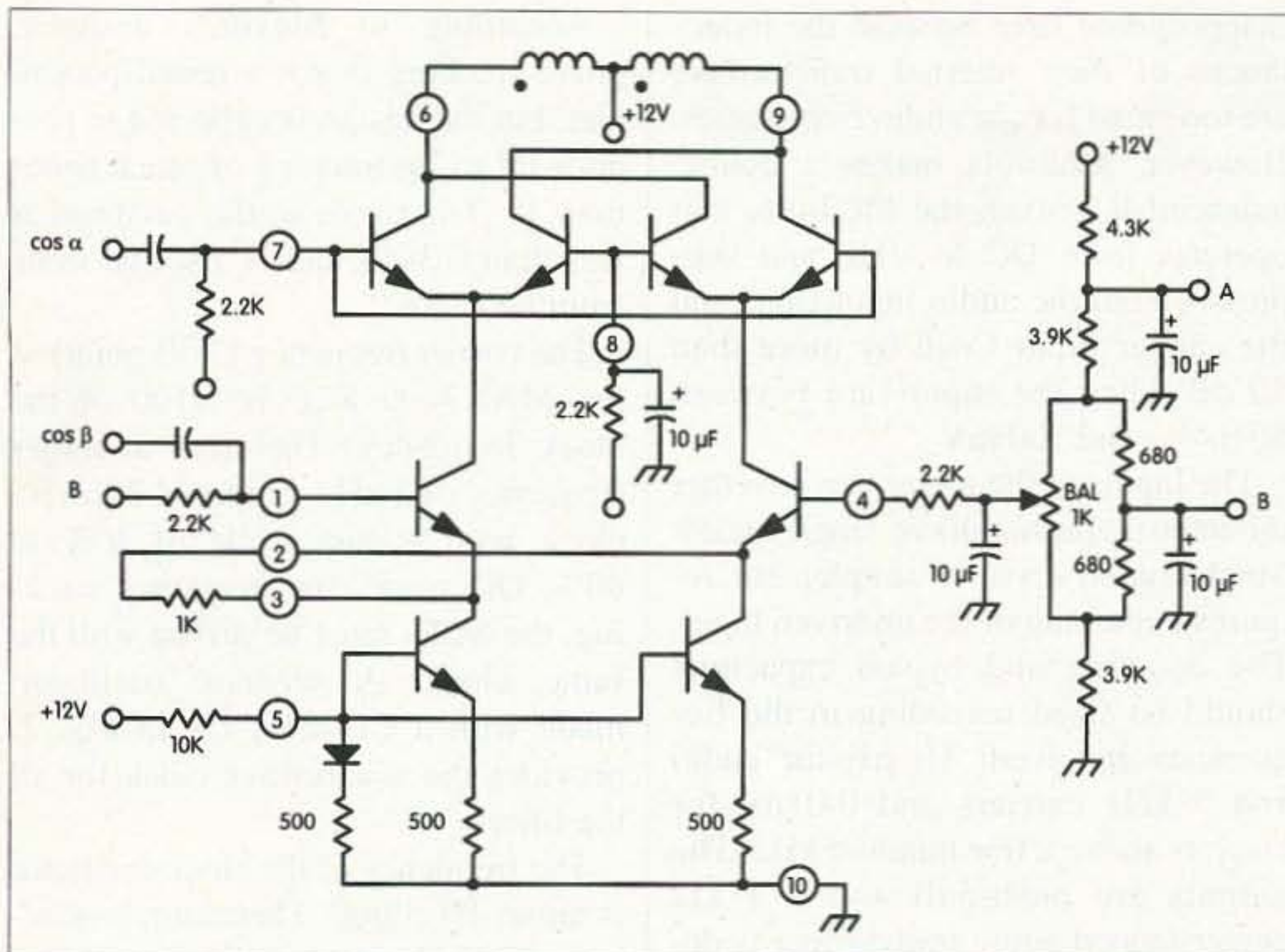


Fig. 6. An MC1496 mixer can operate from DC to VHF.

The outputs are in quadrature. $\sin(a-\beta)$ and $\cos(a-\beta)$ can be used in the phase shift method of generating single sideband shown in Fig. 2.

When the difference outputs of mixers C and D are applied to mixers A and B of Fig. 2 and mixed with quadrature local oscillators $\cos w_c$ and $\sin w_c$, the outputs of mixers A and B are:

$$\begin{aligned} \text{A mixer} &= \cos(a-\beta) \times \cos w_c = \\ &= \cos(a-\beta-w_c) + \cos(a-\beta+w_c) \end{aligned}$$

$$\begin{aligned} \text{B mixer} &= \sin(a-\beta) \times \sin w_c = \\ &= \cos(a-\beta-w_c) - \cos(a-\beta+w_c) \end{aligned}$$

Adding the outputs of mixer A and mixer B results in $\cos(a-\beta-w_c)$, with $\cos(a-\beta+w_c)$ suppressed. Recall that

Continued on page 18

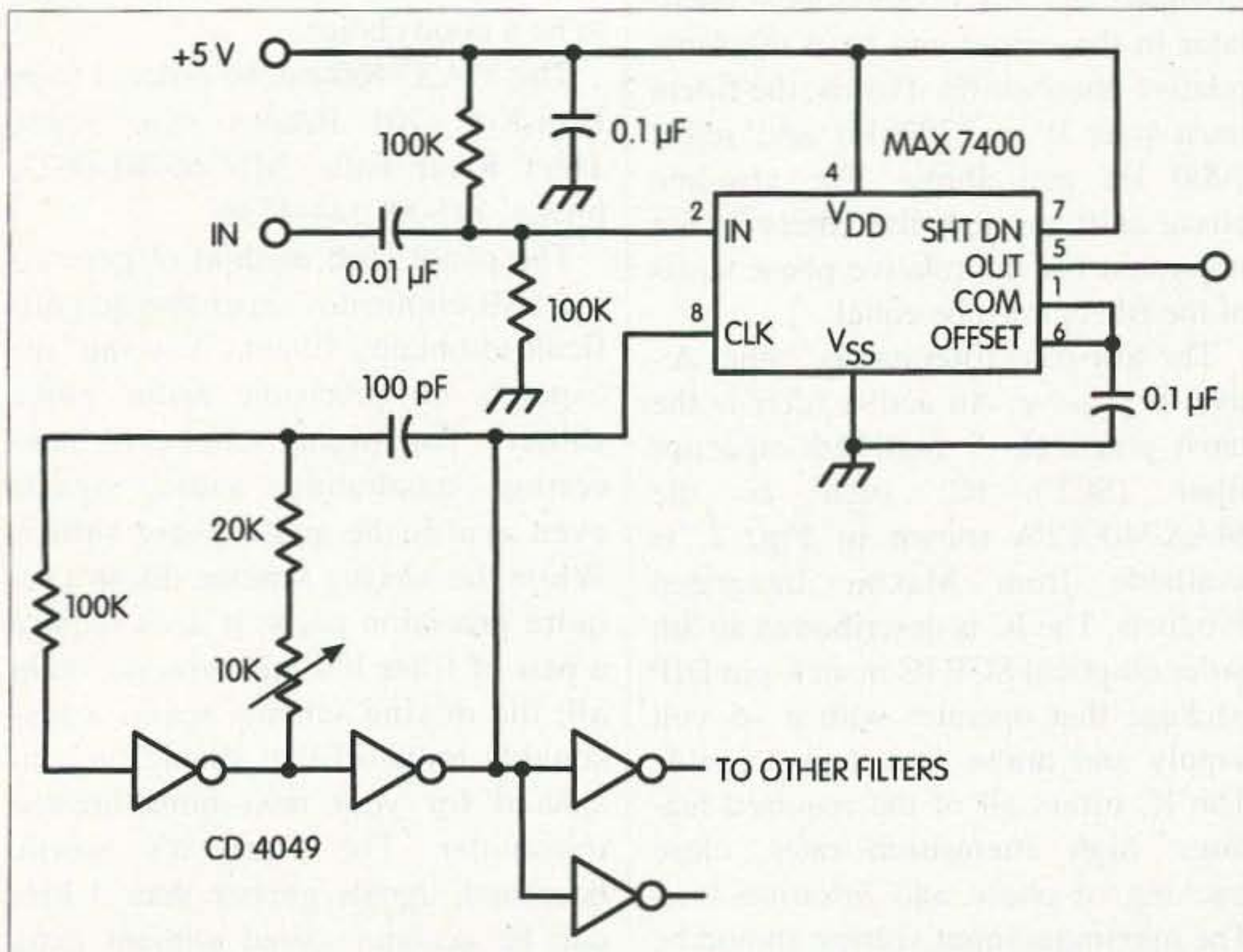
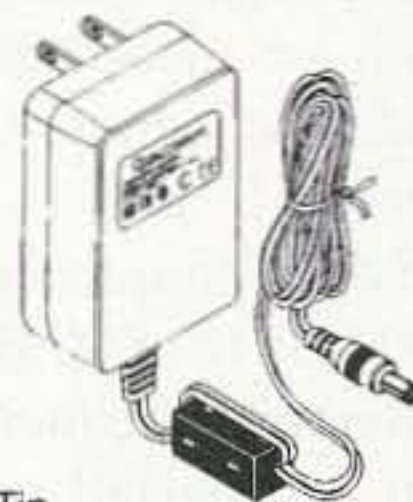


Fig. 7. The SCF is driven with a CMOS clock oscillator.

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Generating SSB

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$a-\beta$ is the lower sideband of the mixers C and D.

There is no restriction on the frequency of a , β , or w_c . However, from a practical standpoint β should be as low as possible to simplify filtering. To that end, the local oscillators $\text{Cos}\beta$ and $\text{Sin}\beta$ are made equal to the maximum audio frequency, 3 kHz. The outputs of mixers C and D then are each two bands of frequencies 0 to 2700 Hz and 3300 Hz to 6000 Hz in quadrature. The difference frequency, 0 to 2700 Hz, can be selected with a low-pass filter for use in the phase shift method of SSB generation.

To ease the filter requirements, mixers C and D should have outputs that are free of the inputs a and β . Eliminating these inputs is critical because they have frequency components that are the same as the desired (difference) output and cannot be removed by filtering. A solution is at hand: a double balanced mixer has an output that is free of the two inputs a and β .

Double balanced mixers such as Mini-Circuit's used at IF and RF are

inappropriate here because the inductances of their internal transformers are too small for the audio frequencies. However, Motorola makes a double balanced IC mixer, the MC1496, that operates from DC to VHF and suppresses both the audio input Cosa and the carrier input $\text{Cos}\beta$ by more than 50 dB when the inputs are between 60 mV_{rms} and 500 mV_{rms}.

The inputs to the mixer can be either differential (push-pull) or single-ended. Single-ended drive is simpler but requires bypassing of the undriven input. The coupling and bypass capacitors should be sized according to the frequencies involved: 10 μF for audio and 3 kHz carriers and 0.01 μF for carriers above a few hundred kHz. The outputs are push-pull and a 1 k Ω center-tapped audio transformer is desired for the low frequency mixers. The mixers A and B operate at RF, and an RF transformer is required. Single-ended drive with a single +12 volt supply is shown in Fig. 6.

The mixer is available in either a 10-pin 603 case, similar to a TO-5, or a 14-pin DIP. The pin numbers shown in the drawing are for an MC1496G metal case. The pinouts for the MC1496P 14-pin DIP and MC1496G metal can are different.

The low-pass filters on the output of mixers C and D must reject the upper sideband and any residual local oscillator in the output and have the same relative phase shifts. That is, the filters must pass 0 to 2700 Hz and reject 3000 Hz and above. The absolute phase shift through the filters is not important but the relative phase shifts of the filters must be equal.

The low-pass filter can be either active or passive. An active filter is the most practical. A switched capacitor filter (SCF) IC, such as the MAX7400CPA shown in Fig. 7, is available from Maxim Integrated Products. The IC is described as an 8th order elliptical SCF IC in an 8-pin DIP package that operates with a +5 volt supply and draws less than 3.5 mA. The IC offers all of the required features: high attenuation rates, close tracking of phase and insertion loss. The maximum input voltage should be restricted to about 4 V_{pp}.

According to Maxim's designer, phase tracking is not a tested parameter, but the design is expected to produce lot-to-lot tracking of much better than 1°. The ripple in the passband is less than 0.3 dB and is also the same from lot to lot.

The corner frequency (3 dB point) of the MAX7400 SCF is 1/100 of the clock frequency. Therefore a corner frequency of 3 kHz requires a 300 kHz clock with a duty cycle of 40% to 60%. Of course, for frequency tracking, the SCFs must be driven with the same clock. A separate oscillator, made with a CD4049, U1 in Fig. 7, provides the squarewave clock for all the filters.

The frequency of the clock oscillator is about 1/1.39RC. Therefore, producing a 300 kHz clock requires an RC of 2.4×10^{-6} . A 100 $\pm 5\%$ pF capacitor and a 10k pot in series with a 20k $\pm 5\%$ fixed resistance can set the clock for exactly 300 kHz.

While the maximum audio frequency is assumed to be 3 kHz, it is not guaranteed. A filter located between the microphone and the modulator can ensure that there are no frequencies above 3 kHz. This need to restrict the bandwidth is applicable to any method of SSB generation. The input filter need not be exotic — it can be passive or active — but the MAX7400 seems to be a good choice.

The MAX7400 can be ordered from Digi-Key, 701 Brooks Ave. South, Thief River Falls, MN 65701-0677; phone: 1 (800) 344-4539.

The phase shift method of generating SSB eliminates expensive and difficult-to-obtain filters, but at the expense of precision audio phase shifters. The mixing scheme for generating quadrature audio signals even avoids the audio phase shifter. While the mixing scheme doesn't require precision parts, it does require a pair of filter ICs and mixers. All in all, the mixing scheme seems a reasonable trade-off that should be considered for your next home-brewed transmitter. For what it's worth, baseband signals greater than 3 kHz can be accommodated without extra effort.

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We are losing more than the few who make it! Need more proof? Consider this — estimate the number of *Now You're Talking* ARRL books sold to prospective hams, and add in the thousands of books Technician class Element 2 sold at over 7,000 Radio Shack stores in the country. Now add in all of the combined books sold at dealer and distributor levels, and then factor in all of the entry-level computer courses sold to prospective hams.

Now look at licensing figures, and chances are for every 20 or 30 entry-level books sold, only one new ham emerges. Ever wonder where the other 29 went?

"So I start reading the new Element 2 Technician class book, and I decide it might be fun to learn more about ham radio activities. I go into the local ham radio store, and the salesman is busy on the phone and directs me to go look on the bulletin board for a ham club," comments a retired medical doctor, wishing to add ham radio as a new hobby for when he and his wife go RVing.

"There is no phone number for the club nearby, so I show up at their meeting unannounced, and I never really made contact with a ham club

member who might give me some enthusiasm for ham radio in an RV," adds the doctor. Ultimately, he calls an 800 VEC listing and locates the phone number of a nearby accredited volunteer examiner.

"I called the volunteer examiner, and she couldn't have been nicer — she went out of her way to double-check that I had the right study materials,

knew where the examination was to be given, and what to bring to the exam location. She really made me feel I was important during my first steps of getting the ham license," adds the doctor.

I call these outgoing positive first contact men and women "*Ham Ambassadors*." Almost every club has one, and almost every VE team has one, and anyone spending a lot of their



Photo A. Manufacturers offer free band charts and world maps to instructors teaching ham classes.



Photo B. Manufacturers all indicate they are happy to support Ham Ambassador instructors and examiners.

own personal time teaching a ham class for free has definitely qualified themselves as a *Ham Ambassador*. These men and women have the skill to see new prospective hams find a local radio club, feel welcome within the club, see them to the exam session, and finally watch them make their first transmission over the airwaves.

The American Radio Relay League has the largest database of active instructors. These instructors are teaching

classes in schools, clubs, at the Red Cross, and are sometimes renting facilities on their own. They may receive a distinctive ARRL instructor's name badge, and receive the instructor's newsletter that comes out several times a year. They might also be on an E-mail connection to the League.

The W5YI Group has found many of its accredited volunteer examiners are also instructors, and they offer an instructor patch for those who request it.

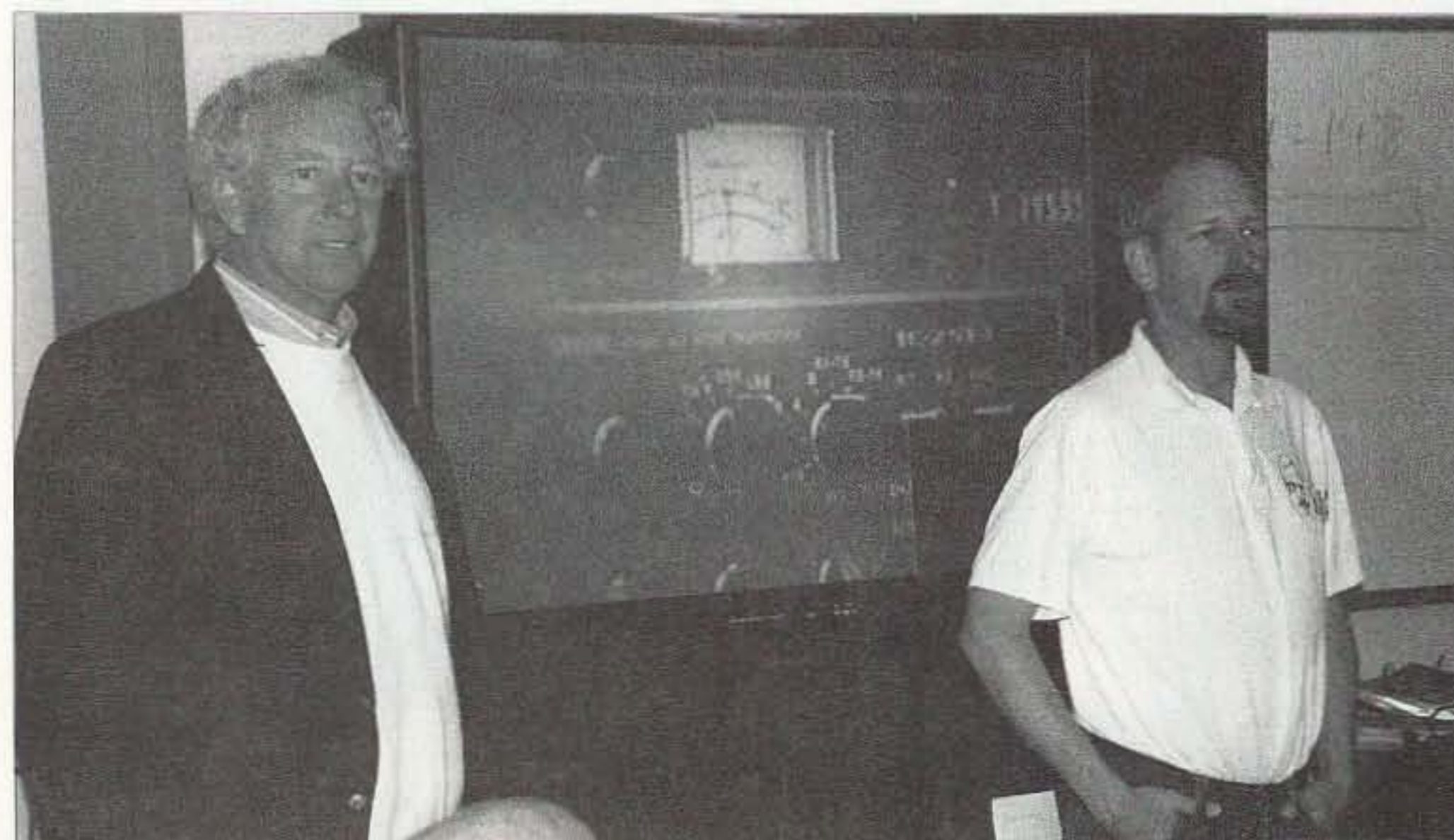


Photo C. Author West (L), training a new instructor Ham Ambassador at a first-ever video conference ham class.

Both the League as well as W5YI may also offer instructors a small discount on books and computer programs.

We are not doing enough for our Ham Ambassadors!

Manufacturers like ICOM America, Kenwood Corporation, Yaesu, ADI, Alinco, and several other amateur radio manufacturers all indicate they want to do more for the *Ham Ambassador* who is making our amateur radio service grow.

"Every year we produce thousands of dollars of band charts, log books, wall maps, pens and pencils, grid square maps, and license holders to be given out free to licensed hams and prospective students," comments an industry representative at a recent meeting in Dallas, Texas.

"Getting these materials into the hands of the *Ham Ambassador* is a problem — how do we know at a hamfest who is teaching a class for 100 students, or who is looking for 100 wall maps to paper the inside of their shack," adds the industry representative. "And how many times have we been asked to donate or sell at a steep discount equipment for use in the classroom, only to find out the class never occurred and the equipment was never returned," comments another industry representative.

"As an industry, we have materials and deals available for those that are making the amateur service grow. What we need is a single point of contact to qualify and reward those volunteer *Ham Ambassadors* who are really producing results," adds yet another industry rep.

Equipment and accessory manufacturers don't have the time to coordinate this program, but they *do* have in place equipment programs to offer discounts to those in the business of amateur radio. Manufacturers will offer dealer employee discounts beyond normal dealer discounts. They may also authorize dealers to sell a piece of equipment at dealer cost and spiff that dealer for the accommodation sale to someone special in the industry. And that someone special would be you, the elmer, instructor, VE, or *Ham Ambassador*

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On the back side of each page are lines for code copy. Just lines — and plenty of them. On the Gordon West 6-tape code course, we make it clear that the code copy should be kept in a continuous page-by-page book. This will allow the students to see their CW progress, and it also allows for the instructor to see exactly where the students are on the code tapes.

The students write down their practice on the back side of each home study page. This way the code will not get lost as part of the overall pre-study homework book. When the students come to class, everything is in one nice, neat package.

Soon there will be the additional page-by-page *demonstration guide* paralleling every page of the Gordon West textbook. Instructors who teach one sub-element an evening will see exactly what items they may wish to bring to class to better describe the components found in that sub-element. There will also be a resource guide on how to contact the ARRL for instructor color 35mm slides, ARRL overhead transparencies, and a list of ARRL video tapes for instructor loan.

The instructor's guide will also contain information on where to order additional reference materials for the students to purchase. This could include the *ARRL Antenna Book*, the *ARTSCI Repeater Map Book*, *ARRL RF Exposure* book, Master Publishing *Basic Electronics* book, and for those students planning on going for Extra class, the *West GROL Licensing Guide*.

The instructor guide will also recommend specific class sessions to give out some of the free manufacturer frequency guides, band plan guides, and world charts. This way you give out your classroom materials in order of their appearance in the text.

who is helping our amateur radio service grow.

But again, the industry comes back with the statement, "But who will handle the program to get these free training materials and equipment discounts to the people really contributing to the growth of our hobby?"

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Photo D. Author West working with handi hams and recruiting more Ham Ambassadors.

may be assured those VE team members will be well taken care of because they are helping our service grow," adds another southeast store manager.

The plan

Step 1 in the *Ham Ambassador* program is to identify those active hams who are making things happen in their area. We could then identify their "territory" and begin passing leads to them that we might get from, let's say, a small ad in an RV, an aviation, a camping, or marine publication. This *Ham Ambassador* would also receive a list

of free manufacturer training materials that they could bring in for their upcoming class. A single \$3.20 priority mail stamp could handle up to 2 pounds of training aids. A collection of these materials from many manufacturers would be available on a single order form, so getting maps, log books, frequency charts, and VHF band plans is like one-stop shopping — the only cost is a single priority mail stamp.

Instructor *Ham Ambassadors* could also bring in textbooks at up to 40 percent off, or the textbook supplier could forward the name and call sign of the



Photo E. Motorcycle mobile ham is a great class demo! This system has full APRS capability.

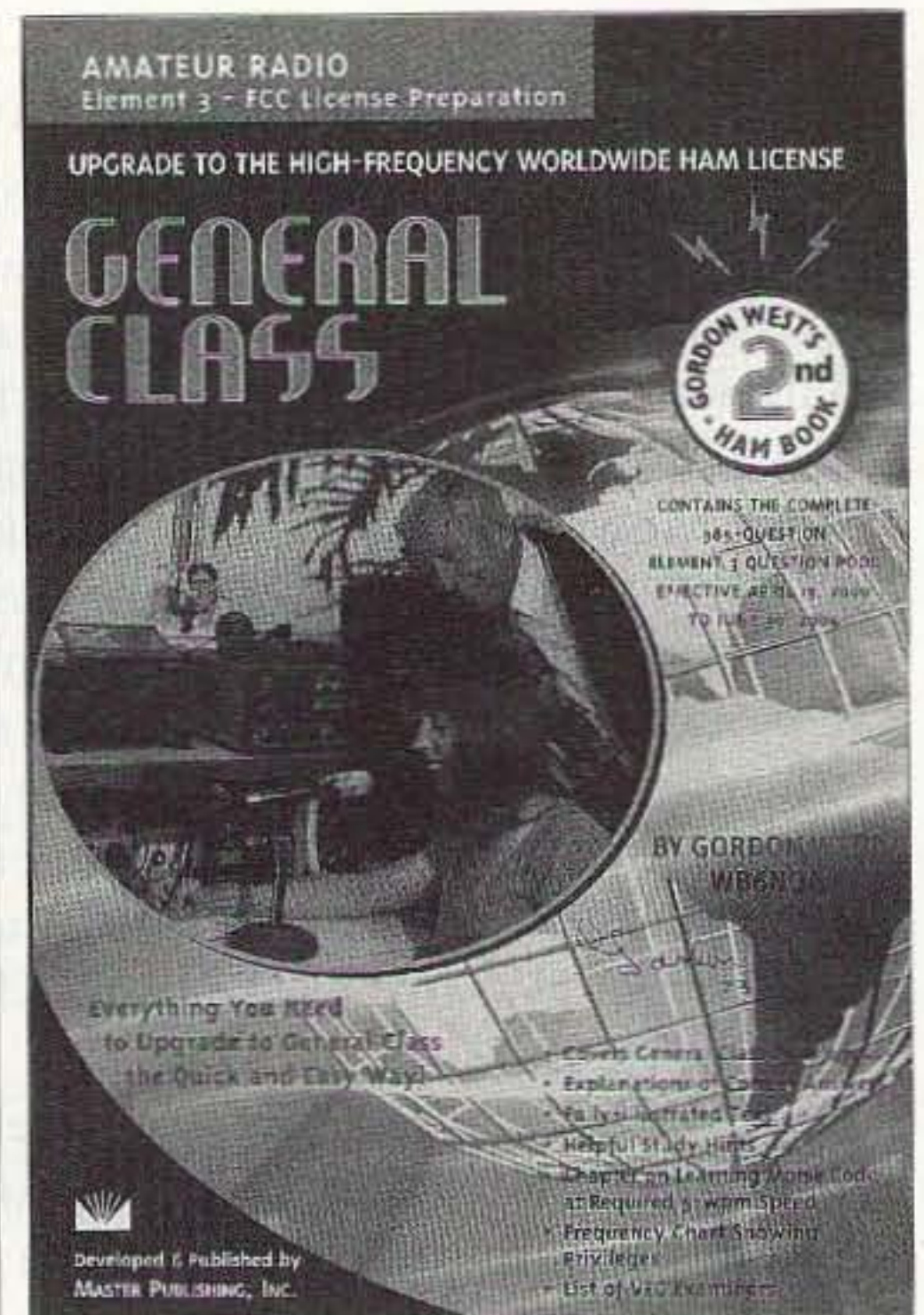


Photo F. Gordon West's Study Guide for General Class. One of the three books in Gordon's series.

instructor on to a local dealer and work the discount through the dealer. Most dealers would see the value of supplying textbooks to students discounted through the instructor by knowing the instructor is going to refer those students back to the dealer when it comes time to buy the equipment. If dealers take good care of the instructor's needs, including classroom demo equipment, many of the equipment sales will probably come back to that same dealer because of his or her support. The savvy dealer would also include their company brochure in each book sold to the instructor.

At the VE level, colorful, large, band-plan charts showing frequency allocations may soon be in high demand. This author has formally recommended to the National Council of Volunteer Exam Coordinators (NCVEC) that they expand what is now available at the test location for reference during the actual exam. Did you know that NCVEC approved the use of the Ohms Law circle on written exams? Why not include one of the manufacturer's band plan charts to allow the students to look up frequency segments during test taking? This would allow instructors to spend more time on showing students how to use these band plan



Photo G. Kids and CW are a perfect match — West issues an Element 1 CSCE.

charts as opposed to simply rote memorizing the frequency limits. These charts would especially be helpful on those questions dealing with “gentlemen’s agreement” that may not be found in Part 97. Since many accredited volunteer examiners are also amateur instructors, these charts and tables would certainly be of use in the classroom, if not the exam session.

The well-structured *Ham Ambassador* program may seem an impossible task to organize, yet the amateur radio service needs it more than ever. We need to up the number of sales we are presently getting from leads, and a

strong program will seal in the gaps when people get the book and don’t follow through on obtaining the license.

If you are teaching or testing in the amateur service, or if you are just one of those club good guys that everyone is turning new prospective hams onto, let me hear from you so I can immediately begin sending you my big collection of manufacturer free coupons, charts, band plans, and VHF/UHF grid square guides. Describe your activities, name your “selling territory,” and let’s see what I can do to get you the materials to make your efforts even *more powerful* than they are right now. 73



Photo H. Hams who help teach Red Cross classes could become Ham Ambassadors.

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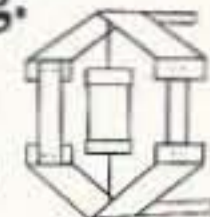
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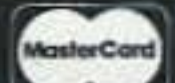
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School's In!

Go on a "lecture circuit" to the local school — and promote your favorite technical hobby.

This article tells of a presentation I gave to my daughter's grade school class. The topic? My favorite, of course — weather satellites! We all remember that twinge you get in your stomach when you have to speak in front of the class, but this time it was different! I had this burning desire to tell these kids about an exciting hobby, while at the same time not boring them to death; hopefully, I would be teaching them something and ultimately getting them genuinely interested in doing more research on their own.

My presentation was done using my semiportable, home-made 4-foot dish, downconverter, VHF scanner, and PC. I digitized several pictures live, and showed them some pictures I had taken previously.

The plan

Preparation is the most important part. You must have a very well ordered

outline of what you want to cover and how to present it. At the same time, you must be able to hold the attention of the class. I spent 10 to 15 minutes at a time over several days deciding what would be interesting and important to discuss. My outline is shown in **Sidebar A**.

Notice that there are times shown for each section. Estimate how much time

each section of your presentation will take, then total up the times. Limit the amount of time for the total presentation based on the age group you'll be addressing. Younger children have a shorter attention span, and the topics should have a high "wow" factor. Older children have longer attention spans, so you can delve deeper into each topic. After you have the outline finished, contact the teacher and ask if they would be interested in having you do a presentation on your special topic. If the answer is "no," I'll be very surprised! Everyone needs a little break in their routine workday — including teachers. After you get a "go ahead," give the teacher a copy of your outline. Then ask the teacher if there are any suggestions or changes to your outline. Tell the teacher that you will need to check out your equipment before they ever mention to the students that tomorrow (next week, etc.) they will be having a presentation on your special topic. You don't want to tell the class that something will happen and then have to back out because of interference, etc.! Such things as high-powered radio services near the school, noisy power lines, etc., can

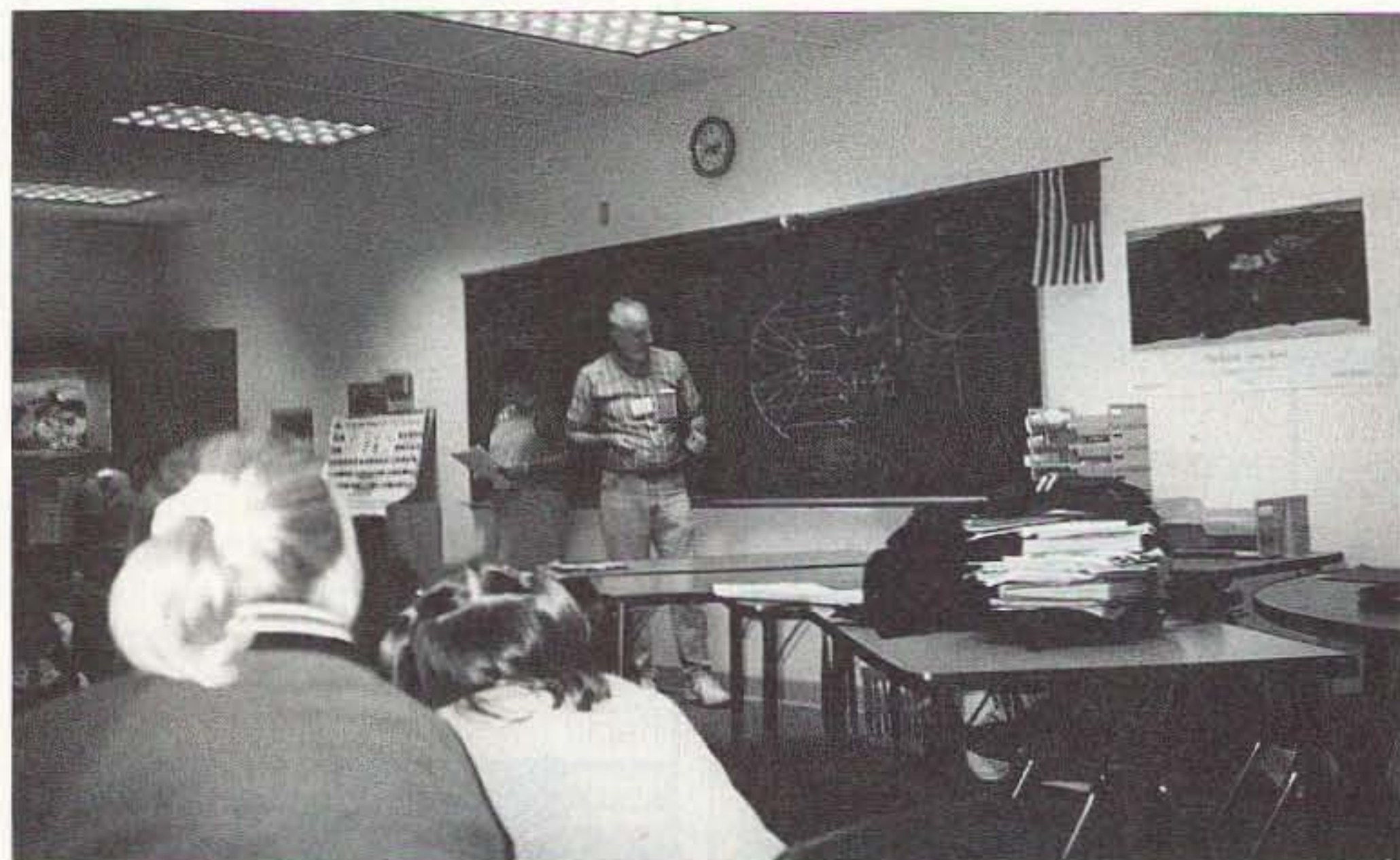


Photo A. Here, the author explains a diagram of how the waves bounce off the dish surface and focus into the feedhorn. To the right, on the board, is the formula for a parabolic, and a plot of the formula. (Both photos by author's wife, Yvonne.)

Sidebar A: Presentation Outline

1. Do one picture to start out. Demonstrate what signal/picture "sounds" like. Introduction — 10 minutes.
2. Has been one of my favorite hobbies for 15 years. Info from books, magazines, Internet.
3. Pictures are free — no scrambling.
4. Satellite types/orbits/names/launching countries. Why do the satellites stay up there? — 10 minutes.
 - a. Geosynchronous — orbit time is exactly 24 hours, so it appears to stand still, straight above equator; size is about 10 feet in diameter and 6 feet high. Speed of orbit is 7,000 mph, is in a parking space about 300 miles on a side, fuel to reposition, cost is \$80 million each. Can't fix if fuel runs out since it is so far out even the Space Shuttle can't go that far.
 - b. Orbit forces — gravity = centrifugal force.
 - c. How an image is scanned: one line every 1/4 of a second x 240 seconds (4 minutes per picture).
 - d. Use globe and small object to show relative size of orbit and Earth, 22,500 miles up vs. 450 miles up.
 - e. Polar orbiting — go over North and South Poles, much faster orbit, every 140 minutes, much closer, much better view plus can view poles when geosynchronous cannot. Size is about 10 feet long and 3 feet square. Speed of orbit is 15,000 mph.
 - f. Polar orbiters also do SAR (Search and Rescue) data collection, plane crash search.
 - g. Countries launching weather satellites are US (GOES), Russia (GOMS), Europe (Metoosat), Japan (GMS), China (Feng Yun).
5. Computer software — free, person wrote it for the fun of it. Show how it works, scroll, zoom — 3 minutes.
6. Image types — 10 minutes.
 - a. Water vapor — shows humidity and dry areas of atmosphere — can see equally well at night or in daylight.
 - b. Visible — limited information.
 - c. Infrared — temperature of land, water, clouds — temperature of clouds indicates how high up and how severe the weather is below them. Can see equally well at night or in daylight.
 - d. Maps showing isobars, air temperatures, winds.
 - e. Polar-orbiting relay — since geosynchronous can't see poles, NOAA relays pictures from polar satellites to geosynchronous satellites.
 - f. Resolution: About 2.4 miles is best available.
 - g. Show schedule of picture types: "TV Guide of Weather Satellites."
 - h. Samples of each type: water vapor, 4 km US; Northern Hemisphere, whole disk, infrared — Northern Hemisphere, whole disk, polar-relayed of Australia.
7. Who uses the pictures from the satellites? — 5 minutes.
 - a. The Weather Channel on TV — you and I.
 - b. Farmers — temperatures, humidity, cloudy/clear areas.
 - c. Ships — water temperature, winds.
 - d. Military — if fighting a war, must know weather for soldiers, planes, ships.
 - e. Fishing industry — water temperature — some fish go deep if water is too hot/cold.
 - f. Airlines — need to know wind direction to get best fuel economy.
 - g. Hurricane tracking — direction it is moving and if it is getting stronger/weaker.
8. Satellites cannot predict the weather — we need humans for that!
9. Equipment, books, articles — 5 minutes.
 - a. Dish — home-made design, used math to get curve, how it works, article, \$25 for parts.
 - b. Feedhorn — 2-lb. coffee can, show inside probe, gathers signal by focusing the signal into the feedhorn.
 - c. LNA — kit from HP.
 - d. Downconverter — designed and built own.
 - e. Filter — designed and built own; article.
 - f. Police scanner.
 - g. Quad helix — same shape as on satellite — \$10.
 - h. Books — *Weather Satellite Handbook*; *Satellite Experimenter's Handbook*
 - i. Software for computer is free.
10. Hand out pictures of satellites.

Sidebar B: Equipment checklist:

PC, Keyboard
Mouse
Monitor
Interface cable, scanner to sound card
Type N connector cables
Type BNC cables
VHF scanner and power cube
Operational downconverter
BNC barrel adapters
VHF Quadrifilar helix antenna
BNC EZ-hooks
Outlet strip
Extension power cords
Stand for dish
Dish
Feedhorn
Rope — to transport dish on car roof
Globe
Weather Satellite Handbook
Magazine articles
Satellite Experimenter's Handbook
"TV Guide of Weather Satellites"
Listing of sample pictures
Old boards — filters, downconverter

really ruin an otherwise great presentation. Remember a guy named Murphy? He's alive, well, and watching you — and ready to trip you up. Take one step at a time and he'll stay out of your way!

I enlisted the help of the school's computer teacher and asked for the largest monitor available so that the class could see the images clearly from the back of the room. My monitor is a 14-inch hamfest special. The computer teacher supplied me with a 29-inch SVGA monitor — my pictures never looked so good! (By the way, I brought along my own monitor just in case there was a problem with the big one.) The teacher also kindly helped me with the setup and teardown of the equipment.

Be sure to do a site survey in person, noting where you can place your equipment [including antenna(s)], route cables, obtain power, etc. Make a list of everything you'll need to do the demo. Then go over it again and again and again, making sure you haven't forgotten anything. See my list in **Sidebar B**. Bring extra coax, power extension cords, and coax connectors so that you can string long pieces together to be sure that you can reach as far as needed.

Bring handouts, pictures, old PC boards of your hardware, books, etc., to make your presentation more than a lecture. After the demo, I brought my dish inside, let them look at it closely, and passed around the feedhorn. The downconverter that I used to do the live pictures was mounted in a metal chassis that had a clear plastic lid —

this protected the delicate circuitry from fingers, but allowed them to see all the components. (By the way, the feedhorn is made from an old 2-lb. coffee can. I stressed this point to show them that this hobby is not necessarily expensive.) I used a little humor too: I have an NOAA listing showing the time each type of image is broadcast (infrared, water vapor, visible, etc.). I called it the "TV Guide of Weather Satellites."

Be sure to invite the head-of-school/principal to your presentation. Ours didn't show up, and I'm not sure why. At least make the invitation. If they do choose to watch, they can see that the students are learning something practical.

What happened at class ...

First of all, the presentation went very well! I planned on 35 minutes and it turned into 60 minutes, with five to six hands up still wanting to ask questions at the end of the allotted time! If you REALLY know your topic, I promise you that you won't be nervous. I didn't even notice the time. Word of my presentation spread quickly — I thought I was to make a presentation in front of my daughter's class of 25 students and two teachers. At lecture time, I found out that they had invited all of grades 4 through 8! The 25 students were now 85, and the two teachers were now six!

The presentation began with my daughter's teacher introducing me: "I'd like to introduce Julie's dad, Jim. He's going to talk to us today about weather satellites." I started out by digitizing a live picture, describing it as it was forming the image on the screen. I interspersed my presentation with frequent interruptions for questions from the kids. I also repeated each question so that ALL could hear the question AND the answer. (Have you ever been to a lecture and couldn't hear the question? This makes the answer totally senseless sometimes.) Also, when a student asked a question I looked them in the eye with a smile — showing undivided attention and a genuine interest in their question. Don't be afraid to admit you can't answer a question — "I don't know" is a perfectly



Photo B. This is after the presentation, showing the kids the curvature of the dish.

good answer, but be sure to offer to find out and get back to them. Here's a sampling of the questions they asked:

1. Why don't satellites crash into each other? Answer: All space objects are tracked very carefully, and new satellites are put into orbits where they stay far enough away from all other objects, like other satellites, space junk, etc.

2. Can satellites be repaired? Answer: Yes, some can be repaired. If they have enough fuel to push them low enough to be "grabbed" by the Space Shuttle, they can be repaired then relaunched, either from the Shuttle or from another vehicle.

3. How did you get interested? Answer: I read a two-part article by Dr. Ralph Taggart WB8DQT and Clayton Abrams K6AEP in the November and December 1984 issues of *73 Magazine*. After I saw their pictures from the weather satellites, I said I wanted to be able to do that more than anything else!

4. How many articles have you written? Answer: Over the past six years I've written six articles on weather satellites and related equipment.

5. Are the satellites affected by Y2K (remember that?) or meteor showers? Answer: The satellites probably won't be affected by Y2K (my presentation was given in late November 1999 — so the topic was really getting a lot of press). Yes, meteors can affect satellites, but there have only been a few satellites damaged by meteors in the last 30 years.

Two of the images I showed them were picked for effect. One image was a few weeks old and showed hurricane Floyd (it did a lot of damage to the East Coast, especially North Carolina). The other image was a live shot of an approaching storm front. I predicted that the rain would reach our location at about 3 p.m. — and it did, too! Murphy isn't always around!

I stressed the fact that I used math to find the required curvature of my dish. The math involved was simple algebraic manipulation of the parabolic curve equation — a topic that the 8th graders had already covered in their math class. This showed that there really is a

use for the math they learn, beyond passing an exam. I told them that without the formula, I could not get weather satellite pictures. I also drew a ray diagram on the board to show how all the incoming waves bounce off the surface of the dish and focus into the feedhorn of the dish.

I displayed an example of each image type (items 6a through 6e in the outline — **Sidebar A**) and told as much as possible about each image.

I ended my presentation when the teacher interrupted to say that the students had to get ready to go home. I thanked them for being so interested and for asking so many good questions. A brief round of applause followed, and then they spent about five more minutes looking over my dish, feedhorn, and downconverter.

One mistake I made was to hand out the pictures of the satellites while I was talking. If one of the students was looking at the pictures, then they weren't listening. I suggest any hand-outs should be done at the end of the lecture.

Where to from here?

I plan on doing a demo of ham radio next. There are a lot of details to work out. I don't want to call CQ endlessly with no answers, only to lose their interest. Also, I don't want any

"language" problems that still do appear on the air from time to time. (Thanks to Riley Hollingsworth, the bands are MUCH better than they were just a few months ago!) You and I know that real life is not "Leave It to Beaver," so I'm going to pick my QSO very carefully — probably using a pre-arranged time and frequency to talk to a ham that I know. Also, I will make sure that the band chosen will be open and that there isn't any chance of a thunderstorm, interference from nearby equipment, etc.

Summary

It was fun and very refreshing to see hands constantly going up to ask good, well-thought-out questions. If I inspired even one of the students to learn more about weather, satellites, or the math that is involved, it was well worth the time and effort! My main goal was to inspire them to find an interesting hobby or topic and to learn all about it. I took one half-day of my vacation time from work to do the checkout and another half-day to do the actual presentation, and I must say that I'm very glad I did! It was VERY rewarding.

If you decide to do a presentation at a school on any topic, please write me and let me know all about it — I'd be very interested in hearing from you. 73

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Adopt a School

More good tips on introducing the ARS.

Over the years, friends of mine often have attempted to bring ham radio into a school classroom. Just as often, their attempts have been unsuccessful. Why did this happen, when I have enjoyed a small but steady success with my own attempts to introduce technology into the classroom via radio? Please take a moment and let me share with you my experiences here in Alaska, as well as past successes in Las Vegas NV.

First, what does it take to be successful? Now that many schools have connected to the Internet, what can you bring to the classroom? Many hams, in trying to bring amateur radio into the classroom, start by assuming a level of understanding far beyond that of the teacher or the class.

The second problem is often not meeting the needs of the class or teacher. Far too often, the helpful ham tries to push the hobby itself — not the opportunity the hobby represents. The fact that you can talk to someone in Madagascar or China or Lower Spit (UK), sometimes, just does not impress most children brought up on instant Internet communications and worldwide SATCOM. To make matters worse, most hams won't let the kids touch the equipment. What can you do to ensure your success?

Success comes from two main ideas: One, work with the teaching staff to fulfill *their* needs. Two, use shortwave listening (SWL) as a beginning. Both of these statements need a bit of explanation — let me give you an example or two.

I find a school near where I live, preferably one that children I personally

know attend. I approach a teacher on the staff and offer to add some excitement to a music, geography, or science class. A date and time is set. I then bring in a small shortwave receiver and tune in an English-language program appropriate for the class. *The focus is on the content of the broadcast, not the radio set itself.*

This type of effort has almost always been a hit. The bonus is that you will now have an advocate on

***The Focus is on the content
of the broadcast, not the
radio set itself.***

the school staff, and more visits are sure to follow.

In Las Vegas, I placed an old military receiver (R-390) in a fifth-grade classroom, provided training to the teacher on how to use the equipment, and left very simple, written operating instructions as a guide for the set. The teacher purchased a copy of *Popular Communications* magazine to have a short and current guide to what was on the air. The equipment was wildly

successful. Teachers fought over putting the set in their classroom.

More importantly, they told their friends about this radio. Phone calls soon followed. By the time I had transferred out of the area, over 15 radio sets had been placed in local school classrooms, and lectures had been given at area teacher in-service training at the University of Nevada—Las Vegas (UNLV) several times.

The local Las Vegas hams were very supportive of this effort. They donated older equipment, which I tuned or repaired as needed. Once up to speed, the equipment went to schools and operations and safety training were provided to the staff. The use was left up to the school. Lesson learned?

Once the opportunity is present, the students find a million things to use the equipment for — to fill their own needs. I give suggestions and technical advice on a regular basis to help, but just that: advice only. Here in Anchorage, a local middle school successfully applied for and received several thousand dollars in grants for a complete ham station — HF to SATCOM. I was able to assist in the grant writing, adding technical details with a focus on safety.

Why use shortwave radio broadcasts? Well, no license is needed, safety concerns are at a minimum, and the receivers are relatively inexpensive. The wide variety of programming is tailor-made to fill just about any needs, from those of K through high school.

Remember, it is the content, not the radio, that is important. But don't worry — several teachers have asked for and received training to get their tickets.

What else can you do? I just finished a lecture at an area high school about shortwave radio, but the emphasis was on technology and language training. High school physics and science classes can use HF and SATCOM signals as a low-cost adjunct to class lessons. Prior to this, a demonstration of packet radio operations set the local school LAN/E-mail crowd a-buzz.

More? How about jobs? I have talked to several classes about the employment opportunities presented by being a trained ham radio operator, and having the electronic knowledge gained in studying for the license. Each student will view this information with different levels of enthusiasm; don't be too disappointed if someone falls asleep in class. Key on the school staff, at first — they are the most in touch with the needs of the students and the curriculum.

Anyway, back to the local high school staff. Once a solid staff constituency is in place, the local junior high schools feeding into this high school should be brought on-line with technology programs of their own. The final product can then be cloned into other schools with ease. So now an entire generation of local students will have the chance to know and use radios as part of their basic education.

Can you do this at your local schools? I believe so. All it will take is a commitment on your part to work with a school on a regular, long-term basis. You will have to do some homework, but basically the secret lies in finding what needs you can fill.

The equipment brought into the school should be *safe!* This means complete cabinets, grounded, and short, amplified

indoor antennas. Training the teachers and putting together short, simple instruction guides for the staff and students is part of equipment placement. Older tube-type sets are fine, and donated sets can be solicited over the air. Once the program is in place, students may raise their own money — just be prepared to offer advice on the purchase.

Two schools I worked with in Las Vegas did just that. The students, on their own initiative, raised the money to buy used gear at local hamfests. We all had fun in the search and in haggling with the hams selling the radios.

So, do your homework and adopt a school. The future of US technology leadership is riding on your involvement! 73

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Part 4 of good stuff from The Hertzian Herald.

Requiem for vacuum tubes, That's wrong!, Resisting temptation, and The lowly light bulb — the trivia wizard is on a roll.

There is a new (to me) TS-930 on my operating bench, and my venerable TS-820, with its spare 12BY7 driver and pair of 6146 finals, is stored in the closet. This marks the first time that I've had a shack with absolutely no vacuum tubes in it, and it seems fitting to speak a brief eulogy at the passing of these last representatives of an extinct race.

Vacuum tubes shared much of the warmth and weakness of our human species. The graceful outlines and egglike fragility of body — neither of us was likely to survive a fall down a flight of steps. The transparency — looking into a tube was like looking into the eyes of a human being — and neither of us was able to conceal for long if it was doing something spurious.

The little foibles — everyone knew that the 6146 had a delicate grid, and you didn't want to drive it too hard; and that the screen of an 807 was liable to melt if you tried to coax more power out of it that way; rather like we knew

about Uncle Chet's bad leg, and that you didn't want to mention the accident Aunt Lil had with the Buick.

Yes, tubes were like people, with names and personalities you could remember. The 6L6 was the little hard-working tough guy. He seemed to be everywhere, could do everything, and never gave up, even though his work came dirt cheap. We used him for oscillator, RF amp, modulator, and AF output. The 6V6 lost his job when the 6L6 showed up.

The tube complement of your receiver or transmitter were like members of your family — you knew all their names, jobs, and personalities. The 12AX7 speech-amp twins. The 6SK7 and 6AU6 — straight-arrow types; IF amps, they were. The big, brawny 5U4 rectifier — not a signal in his head, but boy, could he pump out the milliamps. And his little brother, the 5Y3 — always trying to be a 5U4, but never able to handle the current.

Many were the cold winter mornings when I would come into the lab with my hands wrapped around a hot cup of coffee, and huddle closer to the big Tek 551 oscilloscope for warmth. The tubes in there were happy to share

their body heat. And they achieved a splendid racial harmony — the blue mercury vapors; the orange regulators; the dark metal octals; the glass tubes, transparent with silver smears of "getter"; the green of the CRT trace.

Vacuum tubes were mortal — like us humans. Oh, you could run their filaments at double voltage for a minute or so to rejuvenate them into emitting electrons for a few more months — although there was always a risk of death inherent in such surgery — but you took them out of their sockets and put them through the tube tester with your own hands, and you knew that they would not be with you forever. And if a tube died a violent death, it screamed: It turned red in the plates, and choked blue with gas, and threw sparks, and pleaded for mercy.

A transistor, when it checks out, doesn't even drop off the key. It just leaves. No noise, no smoke, no smell — just gone. And if you drop a transistor down a flight of steps, the problem isn't breaking it — the problem is finding it. But you seldom make personal contact with an individual transistor or IC. They're all soldered in, and there isn't a "Transistors Tested Free" sign

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in the window of the local drug store, like there was for tubes in earlier days.

And even if they were in sockets, could you pull out and test all the ICs in your Pentium Byte Cruncher 8000? They're lined up in there in their hundreds, each one looking just like the next one, in chilling replication of the beetle helmets at a Nazi Nuremberg rally.

No, I can't let it happen. The semiconductor tyranny is not to be endured. A small band of partisans known as the AWA (Antique Wireless Association) is planning a strike in the 3,560 to 3,580 area on the last weekend in November [1998 — ed.], using 1929-vintage transmitters. I shall join the resistance movement. My pine breadboard, copper-strap coil, and CX-350 triode are hidden in my shack. On the appointed day, I shall assemble them into a Hartley oscillator, and a chirping signal generated by a single vacuum tube shall be heard calling CQ CQ de K8JWR. (See photos. — ed.)

That's wrong!

Teachers have a reputation for being notorious prigs, forever correcting the utterances of folks who were perfectly happy before they came along. This time, I intend to live up to my reputation by correcting some common abuses of technical language. Most of the following comes from IEC (International Electrotechnical Commission) publications, or the IEEE Dictionary of Terms.

Condensed. The thing formed of two metal plates separated by an insulator is now properly called a capacitor. The old word condenser is reserved for what you find on the back of a refrigerator. Automotive and electrician types may still use "condenser" for a while, but those days are numbered. And a capacitor has capacitance, not capacity. Capacity is the proper term for the ampere-hour rating of a battery. Finally, really small values of capacitance are expressed in picofarads (pF). Pico has the sound in peek, not the sound in pike.

Play a gig or dance a jig. The official pronunciation of the prefix for 1000 million is giga, with the soft G of

"jig." However, popular usage is so heavily in favor of the hard G (as in giggle) that we'll let you by on this one either way. We must insist that the prefix for 1,000 is abbreviated k (lower case), not K. The capital K is for the Kelvin, the metric temperature unit — and it is simply K: not °K or degree K. Note that computerists often use K to mean 1024, as in "300 Kbyte file." This is not recognized by the IEC, but is widely accepted.

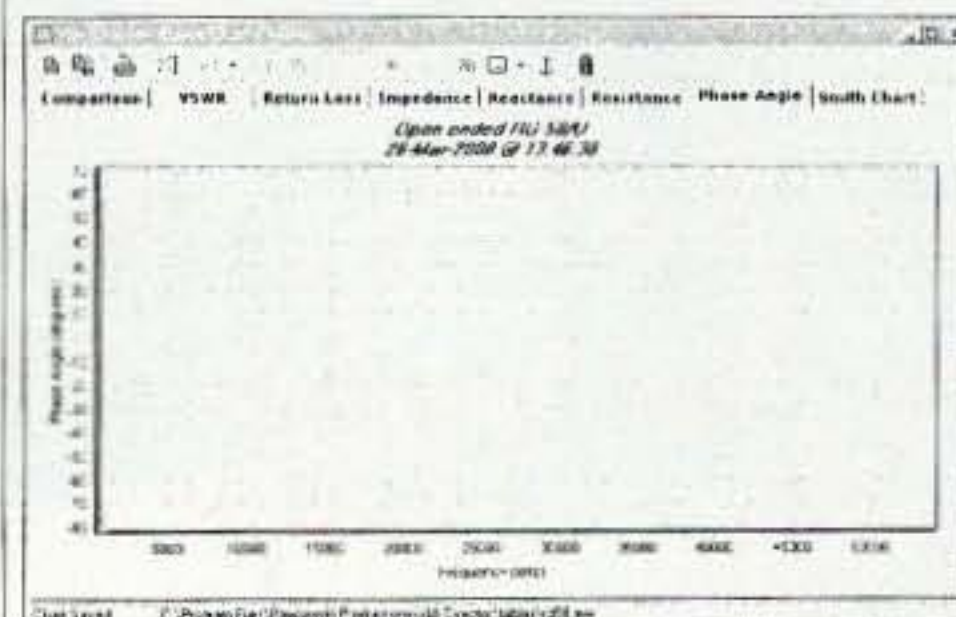
Tongue twisters. The loopy pattern on an oscilloscope that shows frequency and phase relationships is a lissajous figure — pronounced lee-sah-joo, with no syllable accented. A crystal uses the piezoelectric effect — say pea-AY-zoh. Chassis is pronounced to rhyme with classy — the third S is silent.

Mystic symbols. The schematic symbol that looks like a garden rake represents a chassis or common connection; earth ground is the symbol that looks like an upside down Christmas tree, according to the IEC. So many people use the Christmas tree for chassis ground that we will have to wink at this one also. In schematics, wires crossing but not connected just simply cross — use no loops or humps to "jump" the wire. Where wires cross and connect, you should offset half of the vertical wire right or left a bit, and use two solder dots to show where the two vertical ends connect to the horizontal wire.

Grab bag. (1) ASCII stands for American Standard Code for Information Interchange, and is pronounced ASK-ee. The two letters I are not a roman numeral 2 — there is no two to it. (2) "Electronic" means "operated by currents flowing in a vacuum tube or semiconductor." "Electronics" means "having to do with electronic devices." Advertisers for an "electronic technician" are not looking for a human being, but a machine. (3) The letters dB have the character of a unit (like ampere, A) not a quantity (like current, I). Do not write dB = 20, but instead, with G for gain, write G = 20 dB. (4) We speak of a high-voltage device, but never of a high-amperage device; it is a high-current device. (5) Finally, my

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Photo A. The receiver at K8JWR consists of a type-27 triode regenerative detector and 27 audio amp. The transmitter uses a 27 Hartley oscillator and 27 neutralized amp at 4 watts output. The power supply uses a type-80 rectifier and VR-150 regulator. It's all built on pine boards with aluminum front panels.

personal pet peeve: Never talk of the "voltage going" to a device. Voltage causes current to go, but voltage does not go, flow, run, or move at all. Voltage "appears" or "exists" or "is measured." Say that it "goes" and I'll make you write on the blackboard 500 times, "Voltage doesn't go."

Resisting temptation

Every ham knows that $I = E / R$, but why call current I? Why not C? Well, I

hooked up with a French engineer on 40 meters a few nights ago, and he told me the French have two words for current. One is courant (if I copied it right) and the other is intensité. This is not strange — we have three words for E: electromotive force, potential difference, and voltage.

By the way, my Christmas [1998] stocking contained a copy of an 1871 text entitled *Modern Practice of the Electric Telegraph*, and Ohm's Law is given there as $C = E / R$. The Ohm at

that time was defined as the resistance of 1/16 mile of no. 9 galvanized iron wire, the standard in telegraph circuits. Incredibly, current and voltage were given no units at all throughout the 160-page text. The Ohm's Law problems start out, "Let the main batteries have an EMF of 1,000 ..." and end with, "... the strength of the current will be 15.4." These are obviously not volts and amps, but just arbitrary units.

Galvanometers were mentioned for comparing currents, but I don't think they had calibrated ammeters or voltmeters in 1871. It was not until the 1890s that the American Institute of Electrical Engineers and the International Electrical Congress got around to standardizing the units and terms that now — 100 years later — seem so familiar: volt, ohm, ampere, henry, farad, milli, kilo, and the lot.

Old-timers among us remember that hertz replaced cycle in our vocabulary about 1966, and that pico was stated micromicro or mickeymike until even later. And who could suppress a chuckle upon hearing that the unit of conductance (reciprocal resistance) was the mho (ohm spelled backwards) and that its symbol was an upside down "horseshoe" ohms sign (omega)? Now, alas, it is simply siemens, symbol S. Political correctness has driven out our sense of humor.

I consider it unfortunate that resistance was given substance with a unit before voltage and current, because resistance is the only one of the three that has no independent existence. Imagine that you get in a time machine and, going back to 1755, present Ben Franklin with a tiny cylinder with brown-black-red stripes on it. Could he call it a 1000-ohm resistor? No, it would only be a useless bit of carbon to him, because Volta would not invent the first source of continuous current until 1800, and Oersted would not give us the beginnings of a current indicator until 1820.

Current has its own meaning as a flow of charge, and voltage has meaning as the "force" that moves the charge, but resistance has meaning only as a voltage/current ratio. As an analogy, what would it mean if you



Photo B. K8JWR at the controls of his 1929-style station. Dan has now worked 36 states on 80 CW with this setup. (No, the frequency counter in the middle is not 1929 vintage.)

presented a Honda Civic to Robinson Crusoe and told him it got 40 miles to the gallon? Miles are real things, and gallons are real things, but fuel economy exists only as the ratio of these two things. With no gasoline and no roads, the term is meaningless. Without voltage and current, the term resistance is likewise, meaningless.

Notice that a Honda Civic is not 40 mpg; it is a machine that maintains a ratio of 40 miles to one gallon. Likewise, the brown-black-red thing is not 1000 ohms; it is a device that maintains a ratio of 1,000 volts per amp (or 1,000 mV per mA, to choose safer numbers). This conception of resistance as a voltage/current ratio becomes important when you have resistance without a physical device (antenna resistance, for example), and when the same device presents different resistance to DC than to AC — as transistors, diodes, and even simple coil wire are prone to do.

The lowly light bulb

Surely, in this age of high technology, there can't be much that we don't all know about a light bulb — or can there?

Thomas Edison invented the screw-in base, and almost everything else about the modern light bulb except the filament material. He used carbonized thread, then carbonized splinters of bamboo. It was left to others to draw tungsten metal into a fine enough filament to be useful. A typical incandescent lamp operates with a filament temperature of 2,000 °C, where most metals would melt.

The resistance of a 100 W, 120 V lamp, by Ohm's Law, is $R = V^2/P = 120^2/100 = 144$, or about 150 ohms.

The resistance of metals increases with temperature, however, so a cold 100 W lamp will show a resistance of about one tenth that, or 15 ohms.

The steady-state current for the 100 W bulb will be 120 V/150 ohms, or 0.8 amps, but the inrush current, when you first turn it on and it hasn't had a chance to warm up, will be $I = 120 V/15 \text{ ohms} = 8 \text{ amps!}$

This inrush current will settle down to within 300% of the steady-state

current in about 20 ms, and to 150% in 60 ms. Now, an ordinary fuse can withstand a 300% load current for about 0.5 seconds; a slow-blow type, for about 7 seconds. But fast-acting "instrument" fuses and certain types of magnetically operated circuit breakers may blow in as little as 10 milliseconds, so you can see that incandescent lamps in fused systems can get you into trouble.

Incandescent lamps may also draw huge current spikes upon burnout. You have probably seen the brilliant flash of light when you turn on a lamp and the filament parts. This is caused by ionization of the few gas molecules remaining in the bulb. Current through the ionized gas can exceed 100 A, and can last for several milliseconds. It can trip breakers and ruin diodes or triacs in the lamp's control circuits. A series resistor, calculated to drop about 5% of the line voltage, will limit ionization current to safe values.

It has been found that incandescent lamp light output varies as the 3.5 power of voltage, whereas lamp life varies as the 12th power of voltage. Using the y-to-the-x-power function of a scientific calculator, we see that dropping the voltage of a 120 V, 100 W lamp by 5% (to 114 V) will decrease the light output to 84%, but will give the lamp 1.8 times the life expectancy it has at 120 V.

Everyone knows that incandescent lamps put out heat as well as light, but what's the split? Sadly, only about 2% of the electrical energy delivered to an incandescent lamp appears as visible

light. The other 98% is given off as waste heat — not too bad in February, when rooms need to be heated anyway. But in July, 1,000 W of incandescent lamps will require 3,600 BTU of air conditioning to remove waste heat.

Fluorescent lamps typically give 10% of their output as visible light, and only 90% as waste heat. This means you can use 200 W of fluorescent lighting to get the same brightness as 1,000 W of incandescent; you spend less on your lighting and on your air conditioning. High-pressure sodium lamps, used in street lights, give as much as 20% efficiency — still poor stuff for hams who are used to converting as much as 50% of their electrical energy to RF in their transmitters. **73**

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Try This Tube-Type FM Transmitter

That's FM as in broadcast radio.

Once upon a time, when AM radio was king and TV and hi-fi were only dreams, a gadget called a wireless microphone was popular. You could use it to surprise the kids by telling them over the radio where their birthday presents were hidden, or to shake up a party with a bogus police call alarm for one of the guests.

But the most common application was for playing records through a radio without making connections to it. Times have changed. FM radio and hi-fi have made AM wireless mikes look like toys. The transmission range of AM mikes was limited, their signal was subject to interference, audio response was a joke, and they were frequency unstable. So, why not a wireless mike for FM radios, with all the familiar advantages of FM? Well, there's no reason at all why not!

Right up with the best-quality FM broadcast transmitters is this license-free FM transmitter. With the exception of its low power output, its measured performance figures read like the spec sheet of a good professional FM transmitter. The quality of its transmission easily will match the capabilities of the best hi-fi system. By using temperature-compensating capacitors for C22, C23, C19, and C18, I found that transmitter drift was undetectable over a period of several days. With a sensitive FM tuner, its range is about 500 feet, and this is legal, too. Just look at what you can do with it:

- Wireless PA. Put a mike and the transmitter on a speaker's podium and

broadcast to an FM tuner connected to a remotely located PA amplifier to save yourself the trouble of stringing microphone wires. Overflow audiences in nearby rooms can hear the speech on an FM receiver or radio.

- Play records through FM receivers at different locations in your home.
- Use it as a baby sitter ("monitor") when visiting a neighbor.
- Use it as a low-power broadcast station at a school dormitory or at camp.
- Providing you really know how to use it and know how to service FM tuners, it's a good signal source for peaking the IFs of an FM tuner or radio.
- Use it to monitor communications of a communication radio at a remote location.
- Use its two-vacuum-tube design for experimentation.

As you can see, this preamp and FM transmitter has many uses, and a lot of features. There are high and low level input jacks which, in conjunction with selector switch S2, permit the use of a variety of program sources.

With S2 in the PHONO position, a magnetic cartridge with 2 mV output, connected to the low level input J1, will produce 100% modulation.

The AUX position of S2 provides R.I.A.A. equalization, which is accurate to within one percent from 20 Hz to 20 kHz.

When S2 is set to MIC, equalization is switched out, and J1's input impedance is changed from 47,000 ohms to 100,000 ohms. The 2 mV sensitivity is more than enough for a high impedance, low output mike. This 2 mV sensitivity is also sufficient for low impedance mikes, but a matching transformer should be used.

Connect high-output crystal mikes to high level input J2. At J2, the input impedance is 500,000 ohms, and there is a 20 dB attenuation. Program sources such as a preamp, or the preamp output of a tape recorder, also should be plugged into J2, and then S2 should be switched to the AUX position.

The audio frequency response of the FM transmitter is flat to within 1 dB from 50 Hz to 14 kHz. The transmitter signal incorporates the standard 70 μ S pre-emphasis.

In order to meet legal requirements for this type of transmitter, *you must use the parts values specified and must not make any circuit changes.* All parts were selected for physical size and electrical characteristics to

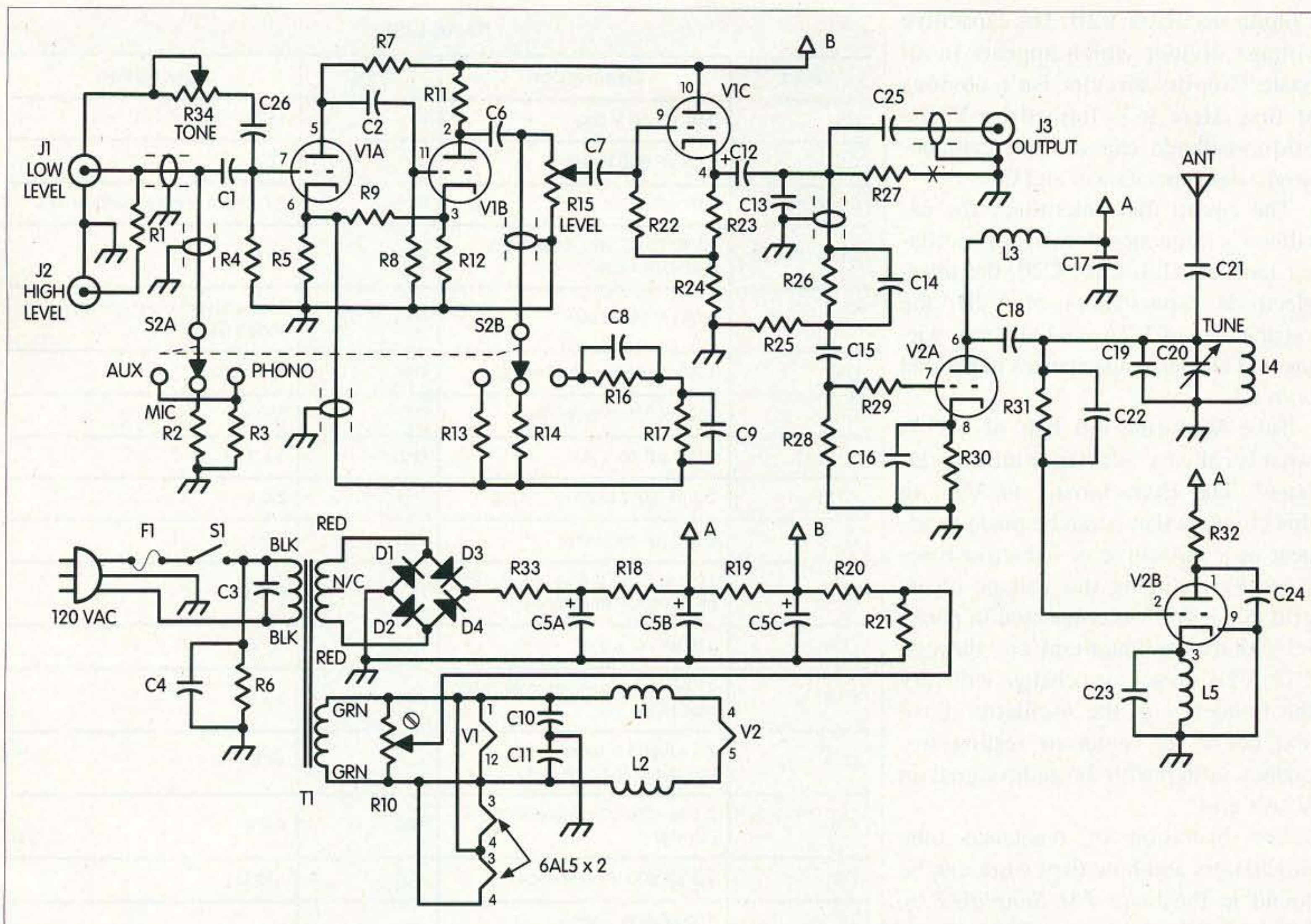


Fig. 1. Schematic.

ensure optimum performance, frequency stability, and legal output power. Where specified, temperature compensating or silver mica capacitors must be used: A ceramic disc will not do. Install all parts with particular care around V2, the modulator/oscillator tube. All leads must be kept as short as possible.

Oscillator tank coil L4 is made with 5.5 turns of #16 enameled or formvar coated wire, wound on a 1/4" diameter rod spaced at 3/8" long. It is mounted on tuning capacitor C20, C19.

Use shielded cable, if possible, for the tube filaments. Run two cables, one for each side of the tube filaments, and ground both outside shields of the two cables. Do not use the chassis for one side of the filament circuit. Also note that the shield at one end only of each shielded lead (RG-174/U coax) is grounded.

After you're satisfied that all wiring is correct, turn on the transmitter, allow it to warm up for a few minutes, and attach a 7" piece of stiff wire to the antenna. The antenna must not be any longer than 7" (otherwise the radiated power will exceed the legal limits), and the transmitter frequency may be lower than 88 MHz. Adjust C20 so that its plates are half meshed. Tune an FM receiver or tuner between 88 and 90 MHz to find the transmitter signal. If

you can't pick up the signal, spread or compress L4 slightly until the signal comes in. Adjust R10 for lowest hum at the receiver.

On average program material, level control R15 should be set so that the meter indicates between 30% and 40%. A higher indication will cause distortion, because on audio peaks the bandwidth of the transmitted signal will exceed the bandwidth of the receiver.

Transmitter operation

V1A, V1B make up the audio preamp. Positive feedback from the cathode of V1A increases the audio gain. Negative feedback from the plate of V1B via C6 and S2B to the cathode of V1A reduces distortion and determines equalization. Switch S2A establishes input impedance.

Tube V1C drives the optional meter and modulator. The modulator/oscillator of the transmitter is a modified

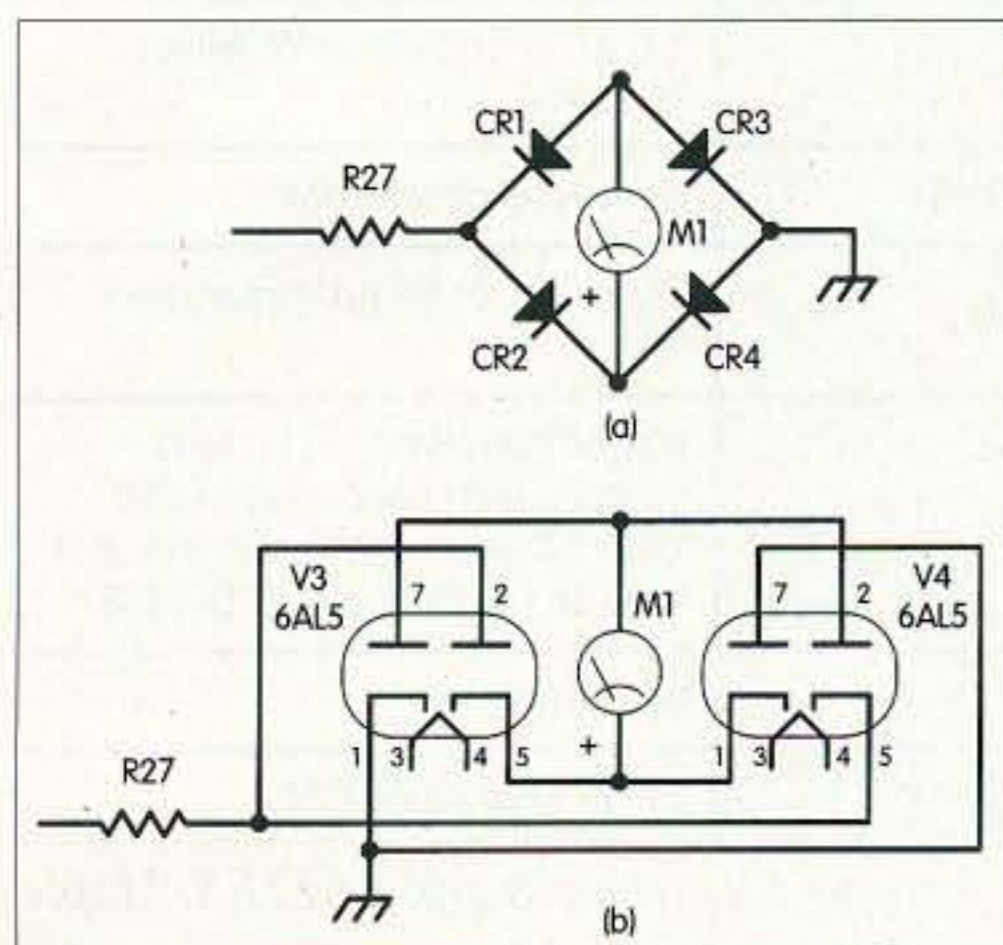


Fig. 2. VU/level meter options. See Fig. 1 for location of R27. For solid-state version in (a), use 100µA meter for M1.

Colpitts oscillator V2B. The capacitive voltage divider which appears in all basic Colpitts circuits isn't obvious at first. Here it is formed by V2B's grid-to-cathode capacitance, cathode-to-ground capacitance, and C23.

The circuit that determines the oscillator's frequency consists of oscillator tank coil L4, C19, C20, the inter-electrode capacitances of V2B, the capacitance of V2A, and all stray wiring and antenna capacitances in parallel with L4.

Tube V2A (the left half of V2) is what is called a "reactance tube modulator." The characteristic of V2A in this circuit is that it can be made to appear as a capacitive or inductive reactance by changing the voltage on its grid. Since V2A is connected in parallel with the oscillator tank coil through C18, V2A's reactance change will vary the frequency of the oscillator above and below its center or resting frequency in step with the audio signal on V2A's grid.

The operation of reactance tube modulators and how they work can be found in the book *FM Simplified* by Milton S. Kiver. Also see *Principles of Frequency Modulation* by B.S. Camies, published by John F. Rider Publications. 73

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Parts List

Part	Description	Part	Description
C1	0.01 μ F 50 V disc	R7	150 k
C2, 7	0.02 μ F 500 V disc	R9, 31	22 k
C3, 4, 15, 17	0.01 μ F 500 V disc	R10	250 Ω pot with screwdriver slot
C5A, 5B, 5C	40/40/80 μ F 350 V electro or individual caps	R13	68 k
C6	0.05 μ F 500 V disc	R15	1 meg audio taper pot with switch S1 (SPST)
C8	1000 pF 500 V silver mica	R16	4.7 megs
C9	220 pF 500 V silver mica	R17	330 k
C10, 11	0.001 μ F 50 V disc	R18	1 k 1 W
C12	2.2 μ F 50 V electro	R19	2.2 k
C13	0.002 μ F 500 V disc	R21	3.9 k
C14	1600 pF 500 V silver mica (1500 pF & 100 pF in parallel)	R23	680 Ω
C16	470 pF 50 V disc	R24	10 k
C18	47 pF 600 V temp compensation type N750	R25	6.2 k
C19	2.2 pF 600 V temp compensation type NPO	R26	47 k
C20	2.3 to 15 pF miniature variable (tuning)	R27	4.7 k
C21	2.2 pF 500 V silver mica	R30	470 Ω
C22	100 pF 600 V temp compensation type N750	R32	18 k 1 W
C23	10 pF 600 V temp compensation type N750	R33	47 Ω
C24	470 pF 500 V disc	R34	250 k pot
C25	0.047 μ F 50 V mylar	F1	1/2 A 3AG fuse and holder
C26	0.015 μ F	S1	SPST switch on R15
CR1-4	1N34A or 1N60 germanium signal	S2	2P3T rotary switch
D1-4	1N4005 or bridge rectifier	L1-3	3.3 μ H RF choke (J.W. Miller #70F336A1)
All resistors 1/2 W 5% unless otherwise noted.		L4	Tank coil (see text)
R1, 14	470 k	L5	1.5 μ F RF choke (J.W. Miller 70F156A1)
R2, 11	100 k	J1-3	RCA-type phone jack
R3, 20	47 k	M1	VU meter or 50 μ A meter (see text)
R4, R8, R22	1.2 megs	T1	Power transformer 117 VAC primary, with secondaries 250 VAC CT (not used) at 25 mA, 6.3 VAC at 1 A (Stancor #PS-8416)
R5, 12, 29	1 k	V1	6C10 tube
R6, 28	1 meg	V2	6AQ8 tube or ECC85

Table 1. Parts list. Parts can be obtained from Antique Electronic Supply, 6221 S. Maple Ave., Tempe AZ 85283.

Many people quit looking for work when they find a job.

Up on a Down Under Kit

The DSE K-7204 ESR/low ohms meter measures well on the 73 review-o-meter.

ESR stands for Equivalent Series Resistance and refers to the internal resistance in a capacitor. This becomes important when an electrolytic cap is used in a switch-mode power supply, a computer monitor, or similar equipment. As an electrolytic ages and perhaps dries out a bit, this resistance increases and the effectiveness of the capacitor decreases. Symptoms can vary from complete shutdown to overvoltage, and loss of signal quality. Just measuring the microfarads with a capacitance meter does not detect the problem.

For some time, I have been looking for a convenient way to check the ESR of capacitors. Basically, we need to measure the impedance using an AC voltage. One way of doing this would be to place the cap on the output of a signal generator and measure the voltage across it. This could then be compared to a known good capacitor of the same size, if one were available.

Or, we could calculate the impedance of a "perfect" capacitor at that frequency, then calculate the voltage that should appear across it when connected to the signal generator, and compare that with the voltage measured across the one being tested. Very time consuming and frustrating when troubleshooting a piece of equipment.

The best solution would be an AC ohmmeter able to measure down to hundredths of an ohm. That is what the Dick Smith Electronics K-7204 ESR meter is and does. And because it uses a very low voltage, it does not turn on semiconductor junctions, so the measurement can be made with the capacitor still in the circuit.

I have seen ESR meters advertised in the electronic magazines, but the prices were not inviting for the occasional

user like myself. So when I visited the AnaTek Corporation's Web site and saw the Dick Smith ESR kit for only \$50, I decided to order one. I am glad I did. If you go to the Web site [www.anatekcorp.com], be sure to look at the Classified and Flea Market ads. There you will find the same item at a 10% discount.

The K-7204 kit is well designed and engineered. The circuit uses a programmed Zilog microcontroller along with 13 transistors and a TV crystal. A 4094 CMOS shift register drives two 7-segment 1/2" LED readouts. Ranging is done automatically from 0.01 to 99 ohms. Power is supplied by a 9 V battery, with a 78L05 regulator. Silk-screened on the panel is a table of the maximum acceptable ESR values. These values decrease with increasing capacitor size, and dip down and back up with increasing voltage rating. So the table is a convenient and necessary reference.

The 5-page assembly manual, although complete, is not a detailed step-by-step guide, like the old Heathkit manuals. It begins with a clear explanation of ESR and its causes, describes the meter and its operation, and then guides the builder in the wiring and

calibration of the meter. A 16-page *Guide to Kit Construction* offers the beginner proper techniques for construction and

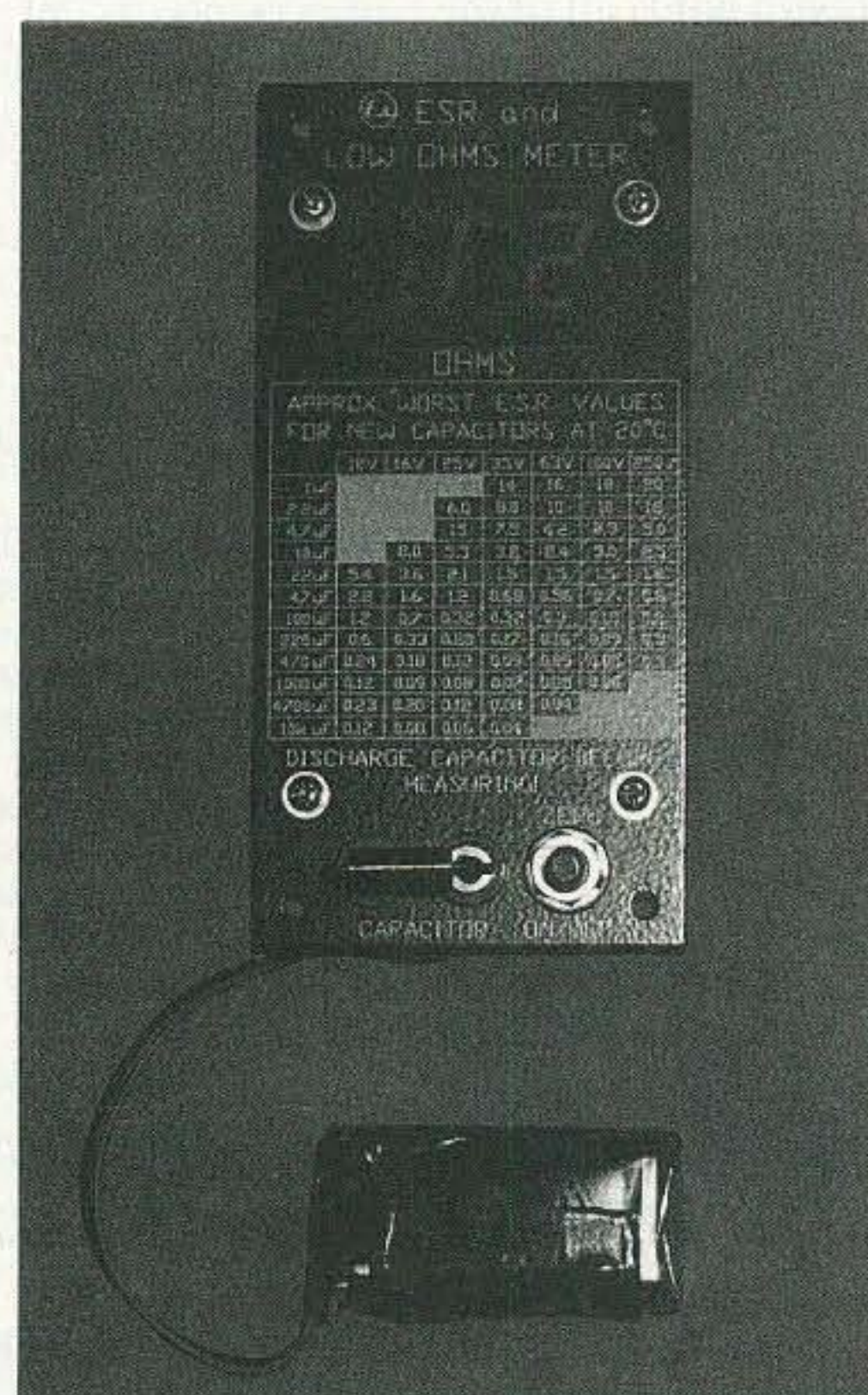


Photo A. The ESR meter accurately measures a low value resistor of 12 ohms. Silk-screened on the front panel is a table of maximum ESR values for electrolytic capacitors, for easy comparison with the meter reading.

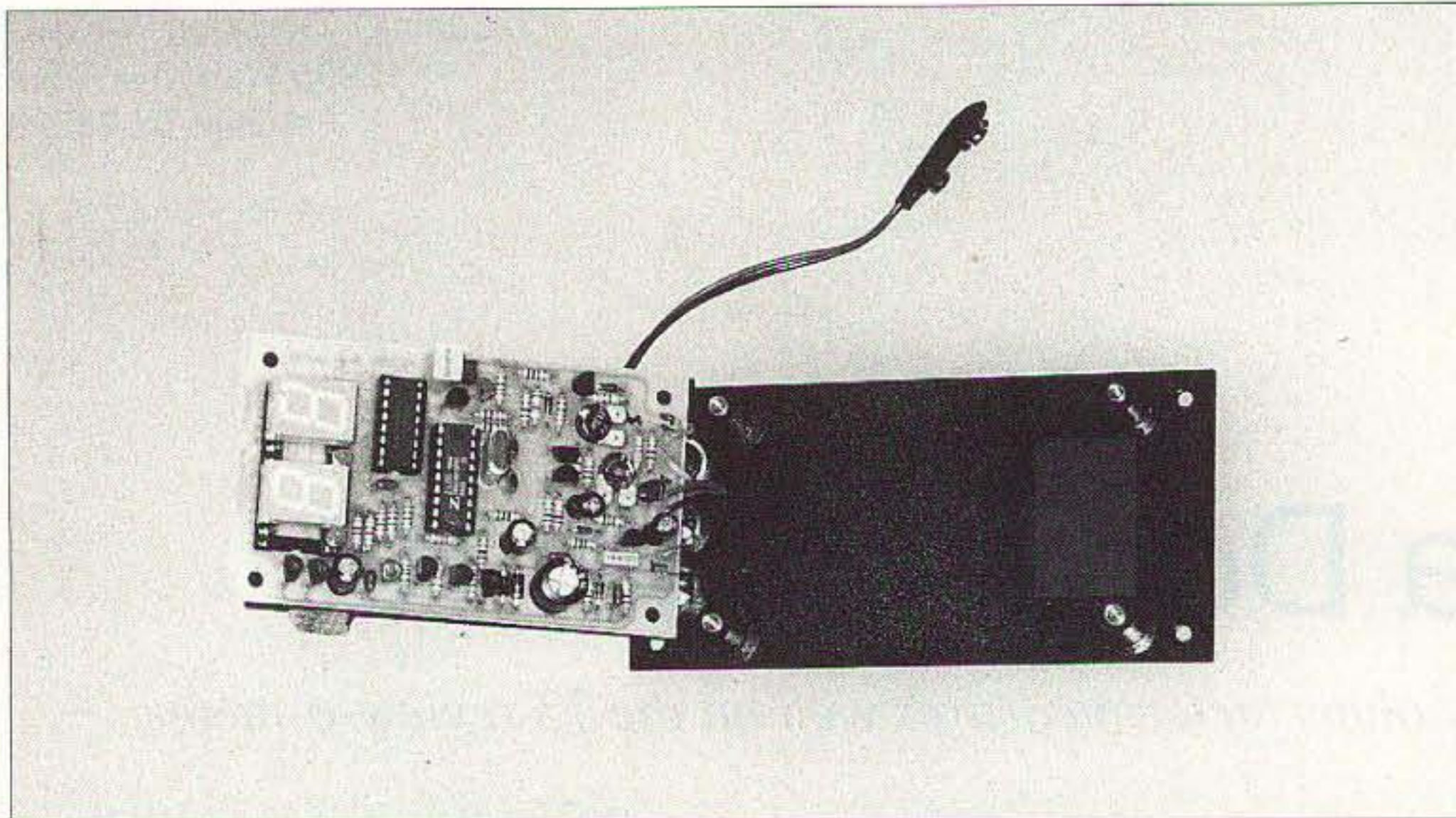


Photo B. The completed ESR meter ready for mounting in its case. The Zilog microprocessor appears in the middle of the PC board, next to the crystal. All components mount on this single-sided board except the 9-volt battery, switch, and test lead jacks.

component identification. Even so, I would not recommend this kit for a first-time project unless some supervision is available. My construction time was about two evenings from opening the box to the finished meter.

The quality of the kit and components is excellent. No parts were missing. Even the solder is included. A pre-tinned fiberglass printed circuit board holds all of the components except the test jacks and the on/off button. The finished board mounts on a pre-punched,

painted, and silk-screened metal front panel. Calibration is quickly accomplished using supplied 1% resistors, after which the meter and 9 volt battery are housed in a black plastic case 1-5/8 x 2-5/8 x 5-1/4 inches. The case is included, not an extra-cost item. Included also are a pair of regular test leads, plus a pair of banana plugs and alligator clips to make a set of clip-on test leads.

Operation is simplicity itself: Just one push-button controls everything. Pushed once to turn on, the display

flashes "EA" and then shows a minus sign. Next, short the meter leads together and press the push-button again to cancel out their resistance. Put the leads on the capacitor, and the ESR is displayed in ohms. Push the button again to turn it off (or if not used for a few minutes, the ESR meter turns itself off). When the battery drops to 7 volts, a flashing "b" warns of the need for replacement. Besides measuring the ESR of capacitors, the low ohms ability of the meter makes it ideal for checking printed circuit traces and contacts. But keep in mind that the meter current is RF, so it will display the impedance rather than the DC resistance of wirewound resistors and coils.

I have not yet checked all of my electrolytics, but a number of those checked had to be discarded. I have also checked the in-circuit caps on a couple of computer monitors and several switching power supplies. A 47 μ F capacitor in a nonworking power supply read 23 ohms ESR. Replacing it brought the supply back to life. My initial impression is that the smaller-size caps of 10 μ F and down are more prone to increased ESR.

The only real improvement I would suggest regarding this kit would be to have the parts values silk-screened on the PC board. This would speed construction and avoid parts placement errors. The addition of four rubber feet to the bottom of the case would help to keep the meter from sliding off the workbench. I added them shortly after picking up my 7204 from the floor of the workshop. The "drop test" confirmed that the meter is both lightweight and rugged. All in all, I recommend the K-7204 ESR meter both as an enjoyable construction project and as a practical troubleshooting tool — well worth the price. If you don't like to swing a soldering iron, a wired and tested version of the kit is available for \$99. But if you don't like to solder, you probably would not have much use for the ESR meter anyway.

For further information about the ESR/low ohms meter, contact Dick Smith Electronics, CNR Lane Cove & Waterloo Roads, North Ryde NSW 2113, Australia. In the USA, contact AnaTek Corporation, P.O. Box 1200, Amherst NH 03031; E-mail: [sales@anatekcorp.com].

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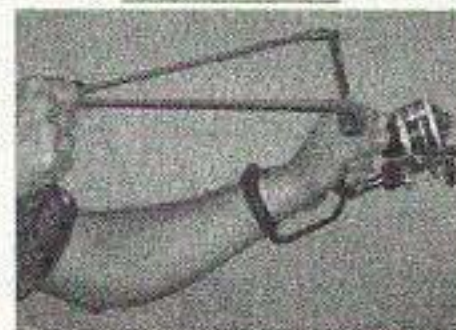
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DXpeditioning - Behind the Scenes, A smashing good book for DXers

Rare is the occasion when I encounter a ham-related text that is worthy of a cover-to-cover reading. A new book that has come out of the UK DX community is just that. DXpeditioning - Behind the Scenes, edited by veteran DXers Neville Cheadle G3NUG, and Steve Telenius-Lowe G4JVG, is a comprehensive reference for any would-be DXpeditioner that has not yet earned his or her stripes as one who goes wanting of that rare opportunity to "put a new one on" for the folks back home.

To better introduce the scope and intent of this book, here are Neville's own words to me in a letter that accompanied my copy of the text:

"We learned so much from the Spratly Island (9MØC) and other DXpeditions that we wanted to share these experiences with the worldwide DX community. The result is this wide-ranging manual which has been written by members of the 9MØC Spratly team. It is not only written for the DXpeditioner, there is also a great deal to interest all DXers. There is much in this book about operating standards. It also gives some idea of what is involved in providing several band-country slots on several modes from a rare location ... A wide range of topics is covered, including: Project Planning, Marketing and Public Relations, Licensing and Permits, Sponsorship, Preliminary Site Survey, Team and Management Structure, Equipment, Logistics, RF Matters, Technology, Propagation, Specialist Areas (RTTY, LF, 6 meters), DXpedition Manual, The Operation, Life Support and Environmental Considerations, Finance, After the Event, and QSLing. We believe that this book is a real "must" for all those interested in DXing. It has been published by RadioActive Publications of the UK and is available from Nevada Communications, Unit 1, Fitzherbert Spur, Farlington, Portsmouth, PO6 1TT, UK [www.nevada.co.uk].

Wayne Mills N7NG in his review commented "The well-crafted *DXpeditioning - Behind the Scenes*, offers a comprehensive view of virtually all aspects of a major expedition for the traveler and the DXer alike.

From early planning through QSLing, this book offers a variety of thoughts and suggestions on every facet of the DXpedition. It is by far, the most complete 'how-to' reference available.

We are forming a new DXpeditioning organization, the 'Five Star DXers Association' to take over the assets of the Spratly team. All the surpluses from sales of this book will flow to this new organization and will be used as part of the funding for a major DXpedition, probably to the Central Pacific in March 2001."

When I read through the biographical sketches of the contributors in the appendix (don't you all read back-to-front like I do?), I thought that this opus might be too UK-specific. But as I read on, it became clear to me that this book provides a systematic approach to DX project planning and resource management that may be applied to nearly every jurisdiction on the planet. I was also impressed with the way the 9MØC story is interwoven into the instructional material, providing some entertainment value for anyone who might find themselves tarrying among the pages. The pictures are cool, too.

Now maybe it's because my MBA is in project management, but I really appreciate the way Neville and Steve have not only given us a logical flow of planning and resource management, but have also provided some clues as to the true "critical path" in putting on a DXpedition on foreign soil. The context is, as Neville points out above, the lessons and experiences gained from 9MØC. Not only is the reader provided with

cogent explanations and clear examples, but excellent visual material as well. For example, Neville's figure on the page here shows detailed diagramming of just what needs to happen to get a DXpedition off the ground. Can you spell PERT?

Neville and Steve, modest gentlemen that they are, attempt to inform us that they merely acted as editors in the preparation of the material. While that may be true to a certain extent, the text bears evidence that they also developed a considerable amount of original material of their own. What remains apart from their own contributions is a collection of essays from various subject

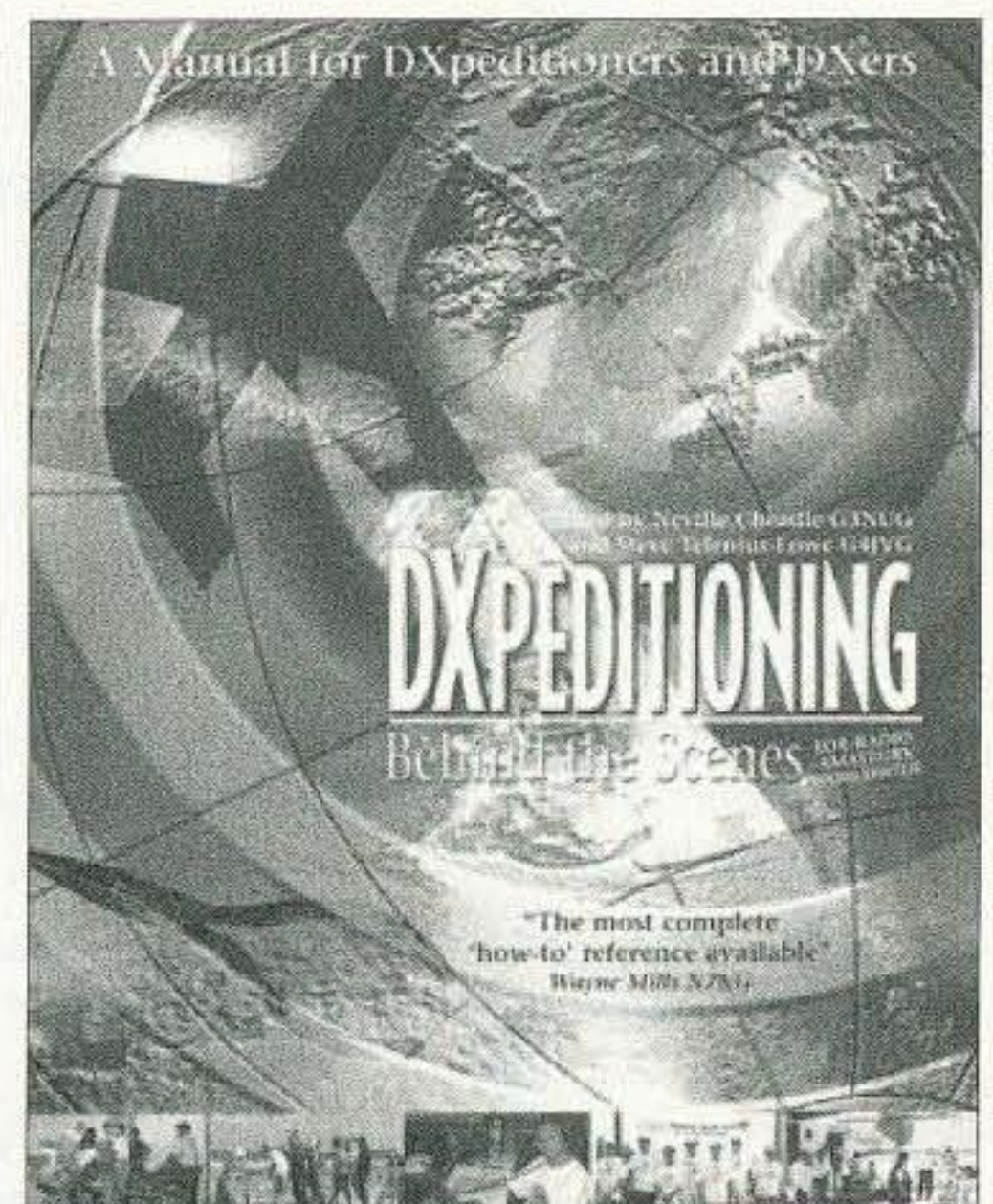


Photo A. Cover shot of *DXpeditioning - Behind the Scenes*, by Neville Cheadle G3NUG and Steve Telenius-Lowe G4JVG.

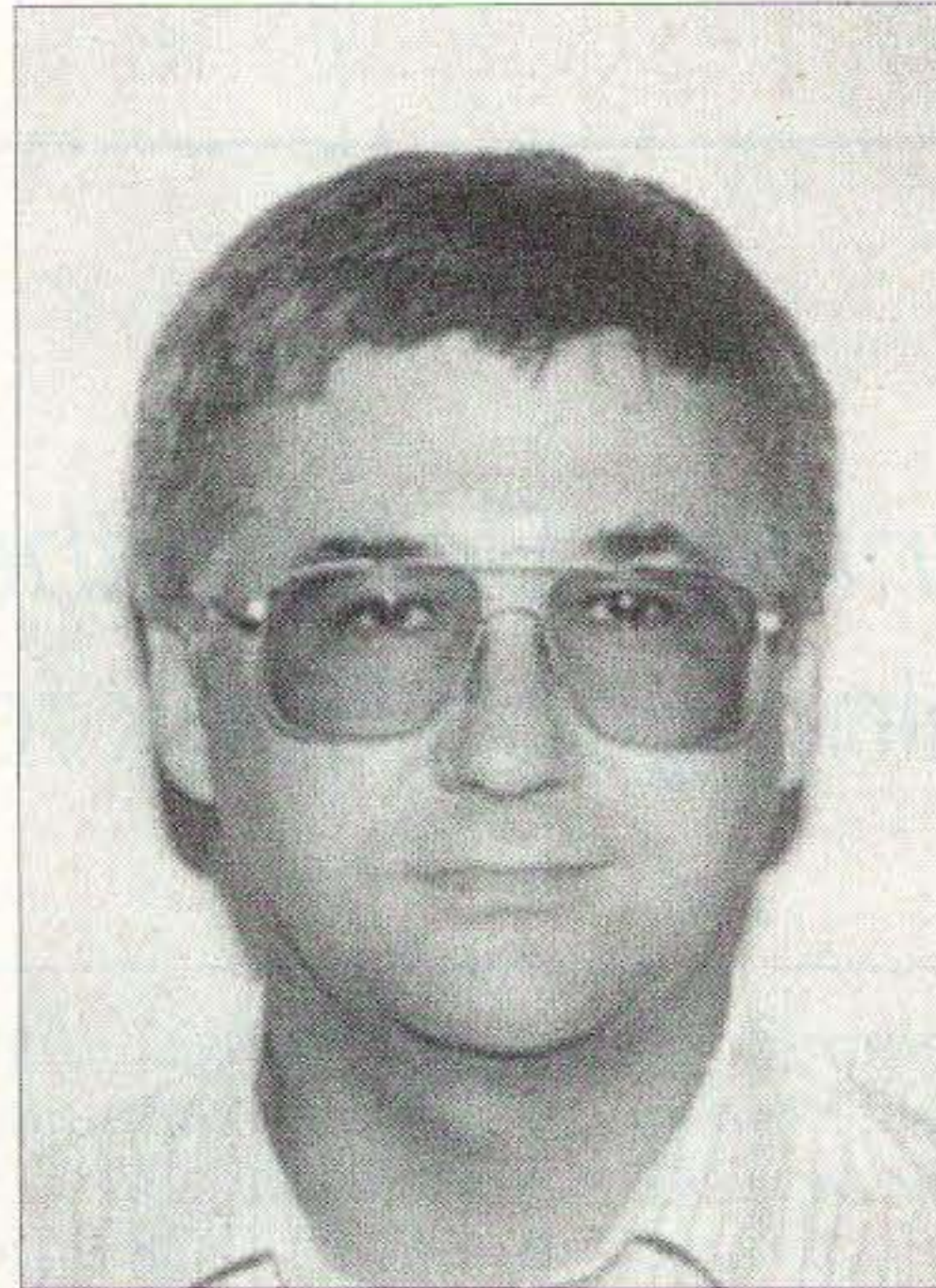


Photo B. Here are the two editors: Neville on the left, and Steve on the right.

matter experts in the UK DX community. Here is the list of chapter headings and authors included in the text:

- 1: INTRODUCTION - Steve Telenius-Lowe G4JVG
- 2: PROJECT PLAN - Neville Cheadle G3NUG
- 3: MARKETING AND PUBLIC RELATIONS - Ron Field G3XTT
- 4: LICENSING AND PERMITS - G4JVG
- 5: SPONSORSHIP - G3NUG and G4JVG

- 6: PRELIMINARY SITE SURVEY - G3NUG
- 7: TEAM AND MANAGEMENT STRUCTURE - G3NUG
- 8: EQUIPMENT - Don Beattie G3OZF
- 9: LOGISTICS - G3NUG
- 10: RF MATTERS - Tony Canning GØOPB
- 11: TECHNOLOGY - John Linford G3WGV
- 12: PROPAGATION - G4JVG
- 13: SPECIALIST AREAS - G3XTT and Mike Devereux G3SED
- 14: DXPEDITION MANUAL - G3WGV

- 15: THE OPERATION - G3NUG
- 16: LIFE SUPPORT AND ENVIRONMENTAL CONSIDERATIONS - G3NUG
- 17: FINANCE - G3WGV
- 18: AFTER THE EVENT - G3NUG
- 19: QSLING - Phil Whitchurch G3SWH
- 20: THE SPRATLY ISLAND DXPEDITION STORY - 9MØC - G3NUG

I should also add some kudos to the publisher, Radio Active Publications. I am very impressed with production of this book. The graphics are excellent and very clear. The general presentation is professional, and their employment of half tones and colors is superb as well. It is very refreshing to settle back with a publication in hand that is the antithesis of that which so often festoons the bookracks at the local radio store. Yes indeed, the publisher has done well by Neville and Steve.

I highly recommend this book to the readers of 73, and hope that it will find a permanent place in your libraries. Once again, here is where you may currently obtain a copy.

RadioActive Publications
Nevada Communications
Unit 1, Fitzherbert Spur
Farlington, Portsmouth
PO6 1TT, UK

[<http://www.nevada.co.uk/book-dx.html>].

I expect that it will soon be available locally. Cheers and a hearty well done, gents!

Fig 2.1: Typical outline planning network

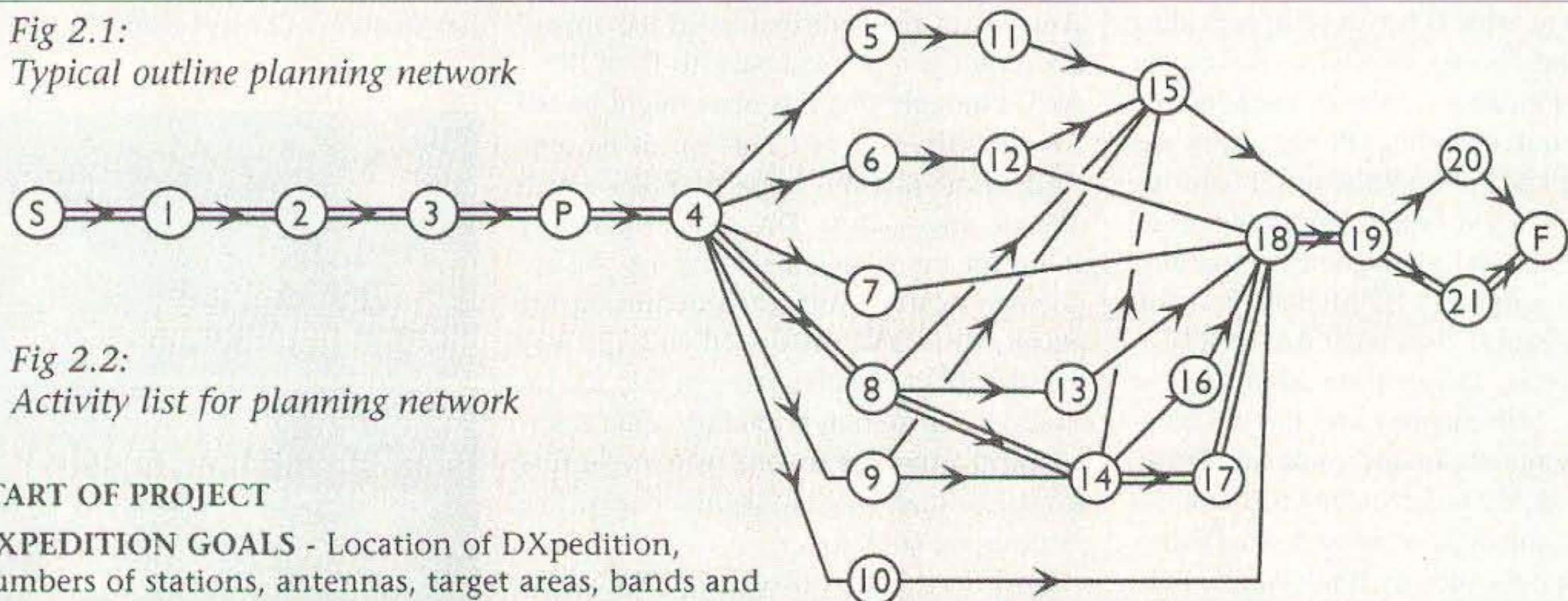


Fig 2.2: Activity list for planning network

- S START OF PROJECT
- 1 DXPEDITION GOALS - Location of DXpedition, numbers of stations, antennas, target areas, bands and modes (Chapter 2).
- 2 SIZE AND SHAPE OF TEAM - Numbers of operators, RF and technology support, experience and selection of core team (Chapter 7).
- 3 OUTLINE BUDGET - Costs and income required from team members, sponsorships and QSL cards (Chapter 17)
- 4 LICENSING AND PERMITS - G4JVG
- 5 SPONSORSHIP - Initial sponsorship discussions with clubs, foundations, manufacturers and non-amateur sources (Chapter 5).
- 6 PRELIMINARY SITE SURVEY - G3NUG
- 7 TEAM AND MANAGEMENT STRUCTURE - G3NUG
- 8 EQUIPMENT - Don Beattie G3OZF
- 9 LOGISTICS: OPERATORS - Detached planning, travel in and out, accommodation, time on site (Chapter 9).
- 10 RF MATTERS - Tony Canning GØOPB
- 11 SPONSORSHIP - Initial sponsorship discussions with clubs, foundations, manufacturers and non-amateur sources (Chapter 5).
- 12 LOGISTICS: OPERATORS - Detached planning, travel in and out, accommodation, time on site (Chapter 9).
- 13 LIFE SUPPORT - Review all life support issues and
- 14 DXPEDITION MANUAL - G3WGV
- 15 THE OPERATION - G3NUG
- 16 LIFE SUPPORT AND ENVIRONMENTAL CONSIDERATIONS - G3NUG
- 17 FINANCE - G3WGV
- 18 AFTER THE EVENT - G3NUG
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- 20 THE SPRATLY ISLAND DXPEDITION STORY - 9MØC - G3NUG
- 21 THE SPRATLY ISLAND DXPEDITION STORY - 9MØC - G3NUG
- F FINISH

Fig. 1. Here is a snapshot of some of the graphical details contained in the book (from page 7). (a) Typical outline planning network. (b) Example of activity list for planning network.

Central Arizona DX Association



N7KJ - 6545 East Montgomery Rd
Cave Creek, Arizona 85331

Photo C. Logo of the Central Arizona DX Association.

The Central Arizona DX Association Charter Member Reunion, Second Notice

Here is a quick reminder to all of the "Diaspora" members of the Central Arizona DX Association. You may remember that I included a small feature on the 25th anniversary reunion of the charter membership of the CADXA in the July installment of the DX Forum. Well, the meeting is about to commence, so if you forgot, it's time to hit Pricewatch.com and book your tickets to Phoenix. The 25th Anniversary Reunion meeting will be conducted as part of the regular meeting of the Central Arizona DX Association on September 7th of this year. For those of you who are familiar with the area, it will be held at the PARA Club in Tempe. Anyone interested in attending, please contact Bob Davies K7BHM, CADXA Historian, at (480)839-3728, or via E-mail at [bdavies@sfamipec.com]. Don't miss this very special event.

Kingman and Palmyra 2000

I just received this from Steve KF2TI a couple of days ago. Read on, this is important stuff.

Kingman Reef And Palmyra Atoll October 2000

The Kingman Reef/Palmyra DX Group will operate from Kingman Reef in early October 2000. We need your financial support to make this very needed entity available to all DXers worldwide. Kingman Reef is number 16 overall and number 2 in EUROPE on the most recent ARRL DXCC "Most Wanted" list.

Our team is international in make up and highly experienced in operations from locations such as this, and their experience will enhance your chances of increasing not only your total count and but also many

band/mode totals. Current team members are NI6T, N4XP, N4BQW, KH7U, NH6UY, K4UEE, WB4JTT, K3VN, DJ9ZB, AA7A, OH2BU, WA1S, and RA3AUU. Additional team members will be added for a total of 16 operators. Several of the operators have already operated from both Kingman Reef and Palmyra Atoll.

Operation will run for approximately 12 days in early October and will include 2 full weekends. Planned are 6 stations with amplifiers and yagis on higher bands, and a Titanex and Battle Creek Special on low bands. We will also operate 6 meters, RTTY and SAT. A web site will operate and N1DG is the web master.

KR/PDXG team members have been operating from Palmyra Atoll since early May as we assist The Natures Conservancy in

establishing a base camp while the Conservancy completes the final stages of its purchase of Palmyra Atoll from its private owners. Operation from Palmyra will also occur as we stage and transit the atoll during the primary operation on Kingman Reef.

Donations are being solicited to offset the high cost of this type of operation. Please assist us in making this operation a success by donating any amount you can. If your donation is in the form of a check or money order, please make it out to "Kingman Reef/Palmyra DX Group" and mail it to Tom

Continued on page 58

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Grunge Busters II — Intermod Patrol

Whether it's for exposing jammers, locating stations in distress, tracking endangered wildlife, promoting international radiosports or holding a friendly club competition, radio direction finding (RDF) is becoming popular among hams around the country. I've given talks about it to ten radio clubs so far this year, and there was lots of enthusiasm and interest among the members every time.

As I wait my turn to speak at these meetings, the "old business" topics often include members' complaints of noise and garbles on the club's repeater, followed by reports of the Technical Committee's efforts to find the cause. RDF is an important tool when the interference comes from a distant source, such as a spur-plagued pager transmitter, leaky cable TV coax, or faulty medical telemetry device. Two of last year's most popular "Homing In" columns were in the March and June issues, where the repeater grunge-busting efforts of RDF enthusiasts in New Jersey and California were described.

Sometimes, no one else is to blame because the grunge originates right at the repeater site. The culprit might be inside the transmitter final stage, inside the receiver front end, or somewhere else close by. You might think these problems would be easier to solve than distant spurs, but the presence of the strong repeater signal can actually make it much harder. In such cases, RDF can help put the pieces of the puzzle together, as this month's tale illustrates.

Aerospace agony

Over a hundred big-gun DXers and VHF-FM enthusiasts coexisted peacefully at the southern California engineering facility where I worked fifteen years ago. In addition to a world-class HF station with a Collins 13-element log-periodic beam for 40 through 10 meters on a 90-foot tower, the shack housed the first two-meter repeater to be put on the air by an aerospace industry ham club.

Shortly after the club installed a higher repeater antenna, a problem arose. Every evening, the repeater would begin transmitting a howling sound and some muffled

scratching noises. Sometimes the noise would just break in and out intermittently. At other times, it was so severe that it would hold up the repeater until it timed out. As soon as someone keyed up the repeater again, the cycle would begin anew. Heavy rain would make the problem go away for a day or so, but then it would come right back.

Carrier access for open repeaters was the norm in southern California at that time. No one considered putting full-time subaudible tone access on their machines. Besides, that would only have covered up the problem. The grunge would still have QRMed weak signals.

Audio howl and lockup of the repeater were clues that intermodulation was involved. This phenomenon, usually called "intermod" for short, occurs when two or more signals on different frequencies interact to produce signals on additional frequencies that are related mathematically to the original signals.

This interaction happens normally inside receivers. For instance, when you listen to an FM broadcast station on 91.5 MHz, a local oscillator in your radio is generating an unmodulated signal on 102.2 MHz, from which the 91.5 MHz signal is subtracted to produce the 10.7 MHz intermediate frequency. The subtraction takes place in a non-linear stage called a mixer. In a good receiver, all other mixing products (such as the 91.5 + 102.2 MHz sum) are filtered out. The mixer is the only non-linear stage in the set.

If mixing takes place where it shouldn't, unwanted intermodulation interference occurs. Transmitter finals and receiver inputs are supposed to be linear, but sometimes improper tuning or incorrect device bias conditions will introduce non-linearities.

The result can be very serious. An example is the case in Ohio some years ago in which a strong signal from a TV broadcast transmitter went down the coax into the final stage of an FM broadcast transmitter at the same site. Intermodulation products were created and amplified in the FM transmitter, then radiated to cause widespread interference.

When nonlinearity produces harmonics as well as sum/difference products, many more unwanted frequencies can be generated. For instance, here's what could happen if repeaters on 146.79(-) and 147.39(+) shared the same site and severe intermod occurred:

$$\begin{aligned}(2 \times 146.79) - 147.39 &= 146.19 \text{ MHz} \\ (2 \times 147.39) - 146.79 &= 147.99 \text{ MHz} \\ (3 \times 146.79) - (2 \times 147.39) &= 145.59 \\ &\text{MHz} \\ (3 \times 147.39) - (2 \times 146.79) &= 148.59 \\ &\text{MHz}\end{aligned}$$

...and so forth

Any of these products could cause unwanted QRM if radiated. Even at very low level, the 146.19 product would lock up or severely desensitize the 146.79 repeater.

Now back to the aerospace story: From the audio howl and lock up of the repeater, it was clear that our transmitter output was mixing with another signal (or signals) to create a spur on the input frequency. But what other transmitters were involved? Where was the mixing taking place? Usually when two signals mix in this manner, you can hear the audio of both at the same time, so why not in this case?

Our club's repeater was on 146.97(-). A few minutes with a calculator showed that signals or harmonics of signals on 147.57, 146.67, 147.27 and some out-of-band VHF

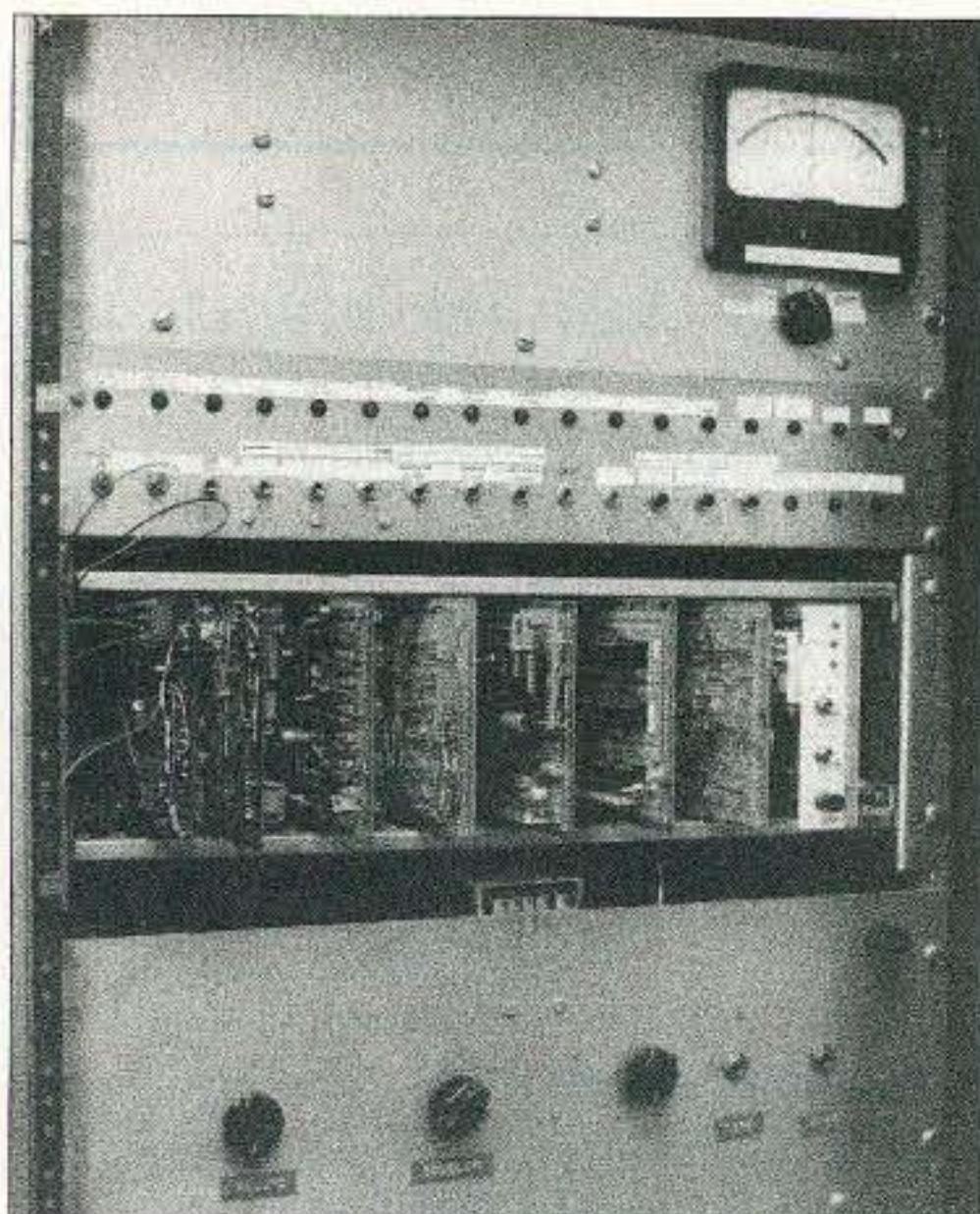


Photo A. This two-meter repeater was built from the ground up by aerospace hams about 25 years ago. The receiver S-meter tap connects to the panel meter at upper right.

frequencies could mix with the fundamental or harmonics of 146.97 to produce a signal on the input. But signals on these frequencies weren't strong, weren't continuous, and weren't dead carriers.

Careful checks with a dummy load and spectrum analyzer showed that there were no spurs from the transmitter on or near 146.37 MHz. The receiver antenna had to be picking it up from an external source. Perhaps RDF could be used to detect and locate the mix signal. With the transmitter locked on and the repeater howling away, I drove slowly through all parking lots of the 300-acre facility, trying in vain to pick up a signal on the input with my 4-element RDF quad. No luck.

Schmoozing the guards

Apparently, I needed to get the RDF gear closer to the repeater. A visit to the Security office and some fast talking produced a letter of permission to bring my vehicle inside the facility gates. Nobody told the Security officers, however. As I drove up and stopped right in front of the gate in my car bristling with antennas, I think it was instinct that made the guard's hand move toward his weapon.

After some more fast talking, I got the car and gear inside, where the grunge remained elusive. Using a sideband detector¹ for maximum RDF system sensitivity, I found that the only traces of 146.37 signal were coming from the direction of the ham club's station on a building rooftop. The signal got slightly stronger as I drove to the

side of the building under those antennas. But was that weak carrier really the grunge signal, or was it just a birdie in my receiver caused by the very close and strong signal on the output?

My conclusion from the RDF experiment was that the grunge was coming from something in the club's hamshack or its antenna system. Unlike the hilltop communication sites occupied by many ham repeaters, our radio room was quite "clean" at the time. The only system in 24-hour operation was the repeater. The company's two-way equipment and the club's packet cluster station hadn't been added to the room yet. The rooftop had only the repeater antenna mast and the large log-periodic HF antenna on its tower.

I stopped the howling lockup temporarily by putting a 10 dB RF attenuator between the duplexer and the receiver input. For a few days I ruminated about the "scratchy" characteristics of the grunge and how it seemed to change suddenly (for better or worse), around sunrise and sunset each day. Maybe the spur was not made up of mixed narrowband FM signals.

If one signal were FM broadcast, the wideband modulation (± 75 kHz deviation) might sound like that on a narrowband (± 5 kHz) FM receiver. I took out the RF attenuation, opened the receiver squelch, and strained my ears to try to get some intelligence out of the scratchy grunge. Hmm, this isn't music. It sounds like somebody talking, and talking, and talking.

In those pre-Rush days, there was only one talk-radio station in the Los Angeles market. It was an AM station on 790 kHz. Could that be it? I couldn't imagine how a 790 kHz signal could lock up a two-meter repeater with intermodulation.

How could I clearly copy AM signals coming through a narrowband FM repeater receiver? I could tap the IF and feed it to an AM receiver tuned to the IF frequency, but I didn't have a suitable receiver for that. So I tried something more crude. The repeater receiver had an S-meter output, consisting of a diode detector on a second-IF stage, wired to a meter on the system panel (**Photo A**).

That diode ought to be a rudimentary AM detector. I hooked an audio amplifier and speaker to the S-meter output. Voilà! The sound of not just one, but two AM broadcast stations came plainly from the speaker. Quick comparisons with a pocket transistor radio verified that one was on 790 kHz and the other was on 1390 kHz.

Now the mix equation was obvious:

$$146.97 - 1.39 + 0.79 = 146.37 \text{ MHz}$$

It was also evident why the grunge made sudden changes at sunrise and sunset. That's when many AM broadcast stations daily change their directional antenna pattern and/or power output. But it still didn't explain where the mix was taking place and why

Continued on page 59

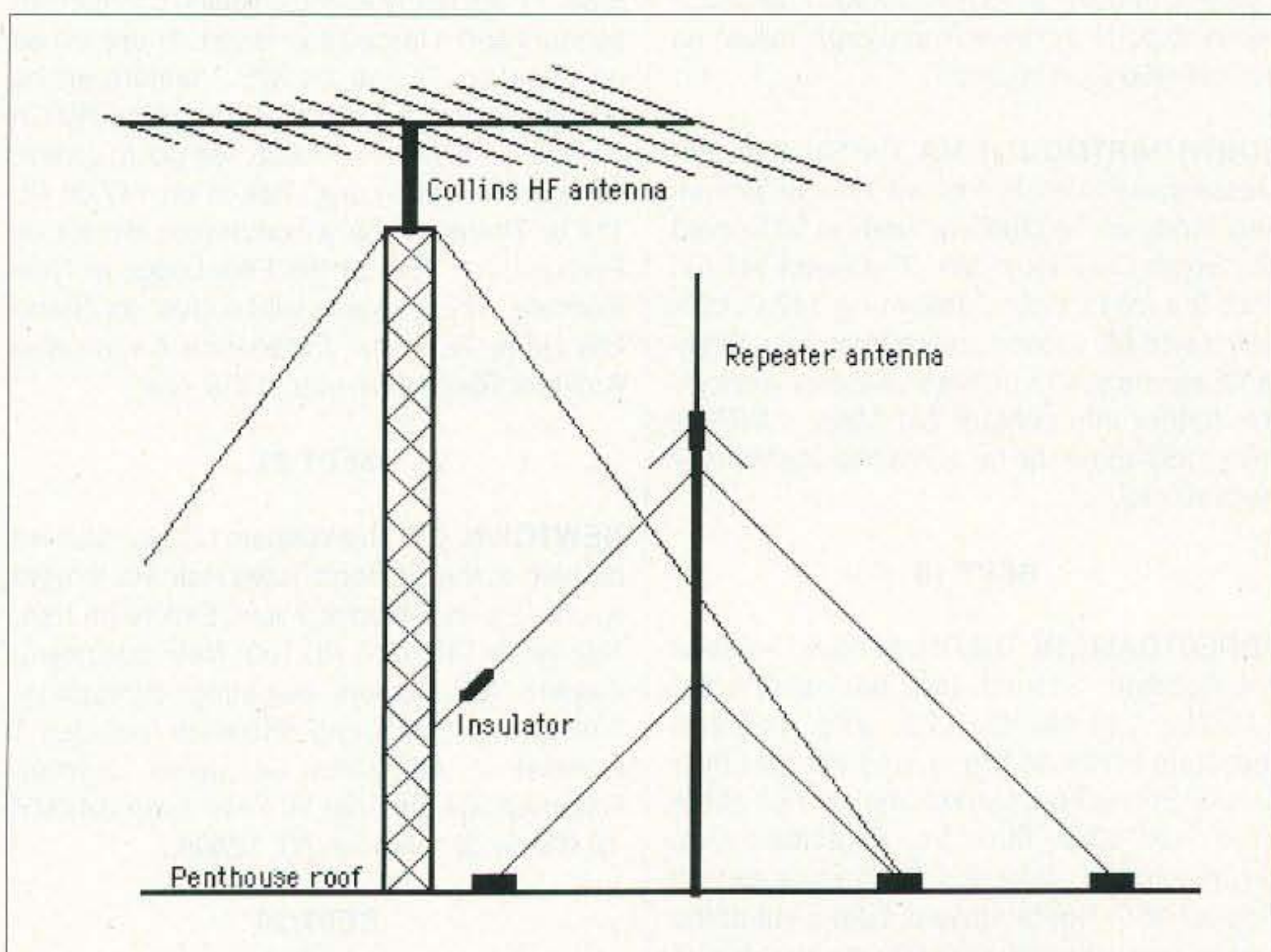


Fig. 1. The tall HF antenna tower and repeater antenna masts were quite close and they used some of the same guy anchor points. Adding an insulator in one guy wire solved a pesky intermod problem, as the text explains.

CALENDAR EVENTS

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the December issue, we should receive it by September 30. Provide a clear, concise summary of the essential details about your Calendar Event.

SEPT 8-9

QUEEN WILHELMINA STATE PARK, AR The 31st annual Mena Hamfest will be sponsored by the Queen Wilhelmina Hamfest Assn. at Queen Wilhelmina State Park near Mena AR. The location is 13 miles west of Mena AR on Hwy. 88. Talk-in on the Quachita ARA rptr., N4EJZ, 146.79 100 Hz tone, or 146.49 simplex. For flea market spaces, contact *Charlotte KC5DOR* at (870) 642-7656, or E-mail [blee@ipa.net]. This family oriented state park features a zoo, miniature golf, scenic railroad, and snack bar. RV and tent camping as well as lodge. No entrance fee, but \$2 registration guarantees next year's flyer.

SEPT 10

BETHPAGE, NY The Long Island Hamfair & Electronics Flea Market will be sponsored by LIMARC, Sunday, Sept. 10th, 8:30 a.m.-2 p.m., rain or shine, at Briarcliffe College, 1055 Stewart Ave., in Bethpage NY. Amateur radio equipment, shortwave radios, scanners, CB equipment, power supplies, accessories, ARRL info, and the all new 50/50. Tailgate spaces \$15. General admission \$6, children under 12 free. For more info, call the 24-hour LIMARC info line at (516) 520-9311, or check the Web page at [www.limarc.org]. Talk-in on the 146.850 PL-136.5 rptr.

SOUTH DARTMOUTH, MA The Southeastern Massachusetts ARA, Inc. will hold its annual fleamarket on the club's grounds at 54 Donald St., South Dartmouth MA. The event will run from 9 a.m. to 1 p.m. Talk-in on 147.00/.60. Admission \$2, spouse and children free. Walk-in VE exams at 10 a.m. Free space for vendors. For further info contact *Bill Miller K1IBR* at (508) 996-2969; or by E-mail to [billmiller@netzero.net].

SEPT 16

FORESTDALE, RI The Rhode Island Amateur FM Repeater Service, Inc., will operate the 146.76, 146.94, 223.76, and 447.425 repeaters in Rhode Island, and will hold their annual Spring Flea Market and Auction at the VFW Post 6342, Main St., Forestdale (No. Smithfield), RI. Take the Forestdale exit off Route 146 in No. Smithfield, take a left at the end of the ramp and go six tenths of a mile to the Post on your right just before the Village Haven Restaurant. Please observe parking instructions. Flea market opens about 8 a.m.

Spaces are \$5 each. Some spaces are available under the pavilion on a first-come first-served basis. An auction will be held from 11 a.m. until about 3 p.m. Talk-in on 146.76. For further info contact *Rick Fairweather K1KYI*, 106 Chaplin St., Pawtucket RI 02861. Tel. (401) 725-7507 between 7 and 8 p.m. only. E-mail to [k1kyi@arrl.net].

SANTA ROSA, CA The Sonoma County Radio Amateurs, Inc. Annual Hamfest and VE exams will be held at Lewis Adult Education Center, corner of Lewis Road & Lomitas Ave. Vendors admitted at 6:30 a.m., buyers 7:30 a.m. Double parking spaces for vendors at \$10 each, buyers free. VE exams 9 a.m.-12 noon. For info and directions call *Rick Reiner K6ZWB* at (707) 575-4455, or go to the Web site at [http://www.cds1.net/scra/]; or write to SCRA, P.O. Box 116, Santa Rosa CA 95402.

WHITE PLAINS, NY The Hudson Division Convention, sponsored by the Westchester Emergency Communications Assn., will be held at the Westchester County Center in White Plains NY. Directions: Interstate I-287 in Westchester to Exit 5, east on Route 119 to the County Center on left. Doors open 8 a.m.-2 p.m. Features include forums, VE exams from 8:30-11:30, many ARRL officials, commercial vendors and a large flea market. There will be no tailgating. Tables are \$25. Vendors will be admitted at 6 a.m. For more info call the *WECA hotline* at (914) 741-6606; or go to [www.hudsonconvention.org]. Talk-in on 147.06 PL 114.8. There will be a convention dinner on Friday, Sept. 15th at the Elks Lodge in New Rochelle. Three awards will be given for Grand Ole Ham, Technical Excellence Award, and Amateur Radio Operator of the Year.

SEPT 21

NEWTOWN, CT The Western CT Hamfest will be held at the Edmond Town Hall, Rt. 6, from 9 a.m.-2 p.m. Setup at 7 a.m. Exit 10 on I-84. Talk-in on 146.67(-) PL 100. New equipment dealers, flea market, tailgating, computers. Tables \$10. Tailgating \$6 (each includes 1 admission). Admission \$4 (under 12 free). Reservations and info to *Seab Lyon AA1MY*, 12 Willow St., Beacon NY 12508.

SEPT 23

BENTONVILLE, AR The Benton County Radio Operators will host a hamfest at the National Guard Armory from 8 a.m. to 1 p.m.

Talk-in on 145.290 rptr. Contact *Shirley KC5RDU* on the 147.030 rptr. for further info; or E-mail [SRHarris@ipa.net].

SEPT 24

NEW PORT RICHEY, FL The 10th Pasco County Hamfest will be held 9 a.m.-3 p.m. at New Port Richey Recreational Center, 6630 Van Buren Rd., New Port Richey FL. The event will be inside and air conditioned. Admission \$5, XYLS and under 12 admitted free. Tables \$15 each; electricity \$5. Tailgate spaces \$3 each. Contact *Ron Wright N9EE*, 8849 Gum Tree Ave., New Port Richey FL 34653. Tel. (727) 376-6575; or E-mail [n9ee@akos.net].

YONKERS, NY The Metro 70cm Network will hold a Computer and Electronic Fleamarket at Lincoln High School, Kneeland Ave., Yonkers NY. Doors open for vendors at 7 a.m. and buyers at 9 a.m. Free parking. Admittance \$6; under 12 years free. Talk-in on 440.425 PL 156.7; 146.910 PL 114. Vendors should call *N2VQP* after 7 p.m. at (914) 969-7888; or E-mail [Ceve914@aol.com] to register.

OCT 8

MEDINA, OH Join the M2M Group for the all new 2000 Medina County Hamfest, Sunday, Oct. 8th, at the Medina County National Guard Armory, 920 W. Lafayette Rd., 1/2 mile west of the fairgrounds. Vendor setup at 6:30 a.m. Open to the public 8 a.m.-2 p.m. Talk-in on 147.030(+). Computer equipment, new and used ham gear, VE exams, contact *Fred* at (440) 236-3477. Walk-ins always welcome. Indoor tables. Limited outdoor flea market spots available on a first-come first-served basis. General admission \$5 per person at the door or \$4 in advance. Vendors \$9 in advance, \$10 per table on the day of the event. For more information about tickets and registration, please call *Mike* at (330) 273-1519.

WALLINGFORD, CT The 8th Nutmeg Hamfest & Computer Show, and the ARRL Connecticut State Convention, will be held Sunday, Oct. 8th, 9 a.m.-3 p.m. at the Mountainside Special Event Facility, High Hill Rd., Wallingford CT. Exit 15 Rte 91 (North or South). Follow signs. Vendor setup starts at 6 a.m. Some of the features of this event are: Indoor and outdoor vendors and private "tailgating" sales, seminars, lectures,

Continued on page 59

The Joy of HTs and Other Transceivers for VHF/UHF

I have had so much fun over the years using and carrying HTs for various bands, starting with an early two-channel FM crystal-controlled HT many years ago. Back then, this was quite a jump in technology, as it replaced a single-channel crystal-controlled hand-held unit that had a suitcase handle on top of the unit to carry this transceiver. (It was a converted surplus Motorola business-band FM transceiver.) We paid quite a bit for premium multichannel (usually two channels) crystal radios in those days.

Well, it took quite a few years until the Icom IC-2AT came upon the HT scene, and what a development that was. As far as I was concerned, this was a marvel in technology, sporting a synthesizer and CTCSS tones and touchtone for phone patch use — all off the HT touchtone pad. You can't imagine what a commotion it caused when it was introduced.

I don't have the old IC-2AT now, as it was passed off to a good friend. I've added many other fine HTs to the test-and-use grist mill over all these years. They include HTs for bands from 144 MHz, 220 MHz, and 440 MHz.

The 2AT has been upgraded to an IC-02, and added to this collection which includes an IC-03 and an IC-04 to cover all bands from 2 meters to 450 MHz. I even have an HT (Santec LS-202) that sports SSB and FM all rolled into one compact unit. The Santec has proven to be quite a valuable HT, especially when my interests include microwave portable operation. It beats carrying a base station multimode radio for field operation in the ARRL 10 GHz and Up contest each year. It just depends on your style in setting up at a remote location, be it a secluded spot or a more comfortable one that permits much larger installations. If you have to back-pack or work on a limited-weight-to-carry operation, the Santec LS-202 for SSB operation is most necessary, and weighs in at only about a pound, batteries included.

You might ask yourself, "Why so many radios?" Well, It started out being an evaluation to find the best devices to be able to modify and turn into usable microwave

converter "IF" strips for converters. In the beginning, I picked up what I could find in the used market, and from there it just developed into what it is today. Still, it's a collection amassed hit-or-miss, but still remaining in operating condition, attesting to a very good workbench and maintenance routine for those who needed it. The rest of the units have stood the test of time and still function without anything except a good dusting off once in a while.

What, then, makes a very good base station for microwave converter operation? Popular applications demand a multimode radio for CW, SSB, and narrowband FM. My multimode collection, amassed over the years in trying to find the best possible microwave converter radio, includes the Kenwood TS-700, the Icom-202, Icom-211, Icom-245, Icom-260, and my main base station, an Icom-820. All these radios are capable of multimode operation, with the exception of the Icom-202, which is SSB only. All are desirable for microwave converter IF usage in either the 2 meter or 3/4 meter frequency range. In the used marketplace, all except the Icom-820 are in the \$100 to \$200 swap meet price range. The Icom-820 would be a great find, but is still too new a radio to be found at swap meets or the used market at a lower range bargain price.

If you're interested in a multimode radio for VHF / UHF work or microwave converter usage, pick up what you can. If you pass up a bargain-priced radio, waiting for the ideal radio to come along, you might have a long wait. My recommendation is to

pick up what you can locate and start operating, getting your feet wet in this fascinating part of the hobby, be it SSB or converter usage. Still, keep an eye open for your best choice, and upgrade later should you find a better multimode radio.

Most of the HTs in my collection are Icom radios. It just happened that way and has worked out well, proving rugged construction and quality give little trouble over many years of use. In retrospect, I was swept off my feet with that first 2-channel 2 meter FM HT so many years ago. With the first synthesized 2 meter radio — the Icom 2AT — it happened again! A great technological advancement that could not be passed up. Recently, it happened again with my latest acquisition.

Now, I don't go out and purchase every model of radio that comes along, but sooner or later there is a device that comes along that really catches my eye. This HT that caught my eye is also an Icom radio, and sports a four-band transmit and six-band receiver. As an amateur transceiver, the IC-T81A produces 5 watts output on 50 MHz, 144 MHz, and 450 MHz, and 1 watt on 1296 MHz. Its mode of operation is all narrowband FM, except for the VHF aircraft band on 118 to 135.995 MHz which is AM for this receive application. Wideband FM is put into play for receive frequencies of 76 to 107.995 MHz.

All other operation is on the four amateur bands, narrowband FM 50-54 MHz, 144-148 MHz, 430-450 MHz, and 1240-1300 MHz. Wide receiver coverage extends operation from 74 to 174 MHz on VHF, 400

to 470 MHz on UHF, and 1240 to 1300 MHz on the UHF microwave band. Operation is from either a cable to external source of 12 volts DC, or an internal NiMH 9.6 volt 680 mA internal battery pack.

The Icom-T81A sports a single rubber ducky antenna suitable for use on all of the four transmit frequencies, 50 MHz to 1300 MHz. Icom updated its antenna connector to a miniature SMA microwave connector instead of the BNC connector on earlier radios. This change to the SMA connector represents a great improvement that is more sturdy regarding external connection or antenna movement. This has been a problem with most HTs equipped with BNC connectors, with movement of the antenna stressing the chassis-mounted BNC connector. The addition of this SMA microwave connector makes great sense for operation in a miniature microwave connector. It's great having such a small connector on the end of the mobile cable, instead of the PL-259-to-BNC adapters that are mandated in other units.

I have been so impressed with the Icom-T81A HT that I have many plans for its use in my main interest of microwave converter usage. One drawback for microwave converters and IF radios for 2 meters is that your image frequency can still have some influence in your converter's output, as it is only 150 some MHz away from the carrier. Realizing that, microwave filters for 5 GHz or 10 GHz can have a usable passband of a few hundred MHz, allowing the image of the 2 meter radio to still have some degradation of system performance.

The easy way around this problem is to

use a higher IF frequency, pushing the image over the filter's passband rejection slope and solving this problem (by using 1296 MHz or some other frequency in the 1240 to 1300 MHz range of operation available with the Icom T81A). This would be all narrowband FM of course — wish it could be SSB also, maybe in some future model!

In its operation, the Icom T81A is just a breath of fresh air, it is so easy to use. I find in Icom's advertisement that you don't need the manual to remember all of the functions, as it's quite easy with the joystick button and simpler keypad operation. I have to agree with Icom that this HT is quite easy to operate. I find that while I don't do the correct option key stroke function every time from memory, it is usually thought out in a few seconds and then correctly implemented. On other HTs, I have struggled without the instruction manual and find this T-81A is so much improved that I can't shout loud enough about how great an improvement it is.

In brief, it's just much easier than other HT's I have tried, eliminating the struggle to remember the functions of the keypad and trying to remember the correct programming options. As with everything, nothing is perfect, and the only problem I find is the front panel joystick button going into SET MODE. It functions well for four of its five functions, so it's not a great liability, just a minor annoyance.

The joystick button is a multifunction button that normally works very well for four functions — the up, down, left, and right selections. It's quite easy to remember what function is what, as it displays the selection process on the LCD display, somewhat eliminating carrying a pocket cheat card. The fifth function is "SET MODE", accessed by pushing straight down on the joy button for a 1 second duration. I find you have to attempt this function a few times before entering the SET MODE. What you get sometimes is one of the other four functions coming up vs. the desired SET MODE. A minor inconvenience. Just use this button with a sensitive touch and the problem seems to go away. If you persist in being heavy-handed, it will give you some difficulty.

Now, don't take my comments about this as a major fault. I find the entire package of the Icom-T81A to have so many positive attributes that I tend to forget about this SET MODE problem. A simple fix for those who might want to load up quite a few repeaters and tone functions is to obtain the PC-programmable software and the connecting cable and do all programming of memory and options using the software. For spur-of-the-

moment programming, it just takes a small amount of trying to accomplish the SET MODE programming desired. As I mentioned earlier, if you don't know what repeater tones are required, the T81A has a tone scan mode that is easily accessed. When the unknown tone is decoded, the SET MODE contents are programmed with the desired decoded tone frequency. Quite a nice internal tool.

For those who plan travel with an HT, I recommend the PC Windows program and computer interface cable that allows you to program in spreadsheet fashion and then upload to your T-81A. In this way, you can save files for different parts of the country and options that are functional for different regions you plan to visit. You could set up repeaters for the Dayton area for use there and when you return home you could upload your local systems, returning the programming from a saved PC file of your local systems. This makes the T-81A very versatile and quite easy to use.

Other options available include auto shutdown, saving battery power when not used; LCD backlight lighting; beep tones for keyboard control; auto repeater duplex or simplex frequency controls; DTMF dialing speed; and LCD contrast controls. Standard "SET MODE" contents include CTCSS tone use for squelch operation; repeater tone frequency setting; tuning steps for frequency tuning; repeater offset frequency desired; scan resume conditions; and a toggle to enable or disable "RIT/VXO" frequency function on the 1200 MHz band only. Other operations using the Icom-T81A include AM operation on the commercial aircraft band, and wideband FM in the 88 to 108 MHz band.

All the features rolled into one very small package that fits nicely in the palm of your hand. Ergonomically speaking, Icom has designed a great HT into a very small package — battery included, with a four-frequency antenna. I especially like the size and power-to-weight ratio for power output of 5 watts in high power mode, making it very nice in mobile use. That's where I get the best enjoyment from the T-81A, as I park my truck in the downtown area of San Diego and do not want to have an underdash or other radio showing to tempt someone to break into my vehicle. I figure it's easier to eliminate the problem by not displaying some candy in the open for a potential problem. That's of course my preference, to use HTs for mobile use to eliminate the auto break-in side of the problem.

Accessories in my operation include a

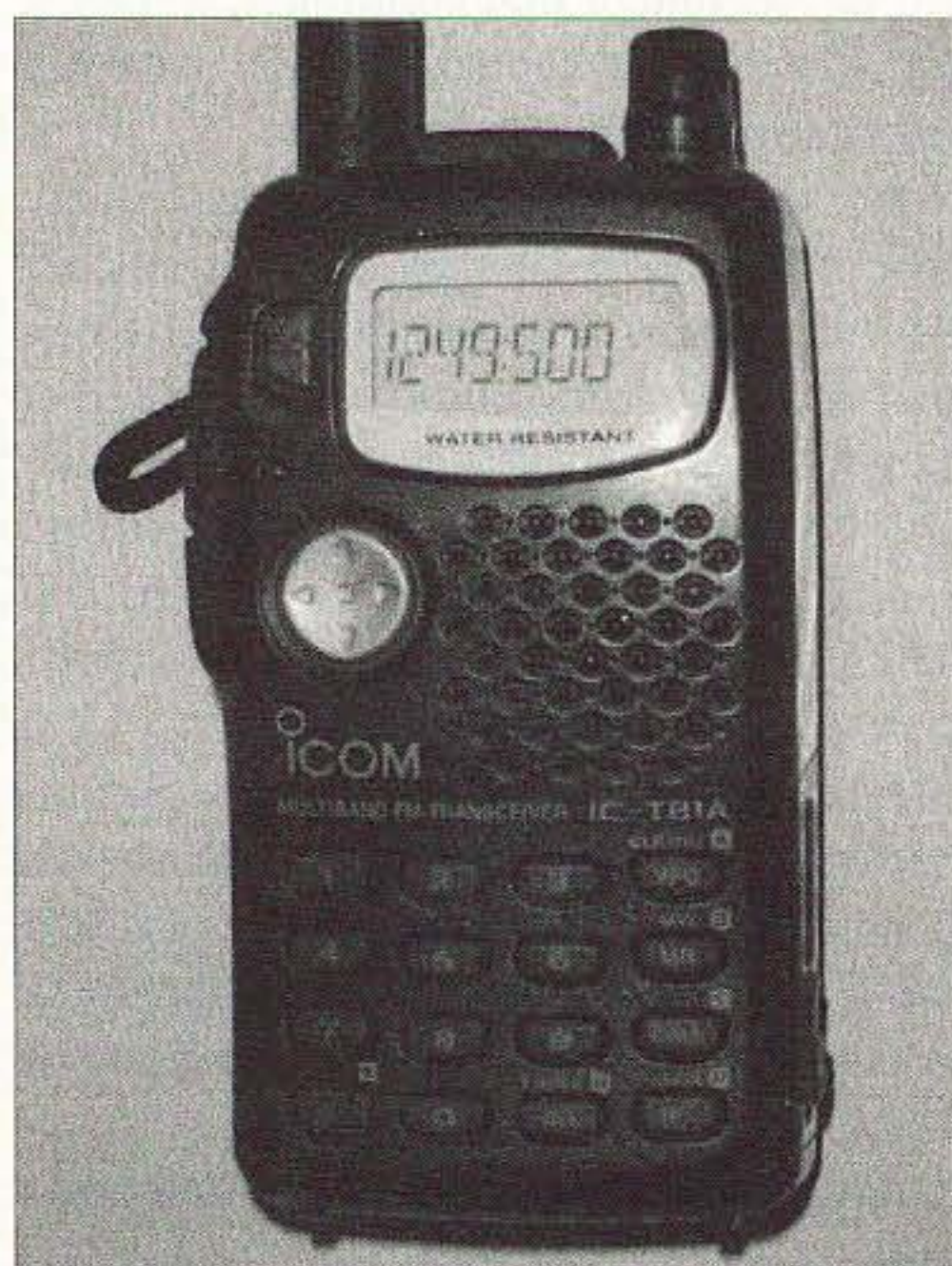


Photo A. The Icom IC-T81A four-band HT for 6 meters, 2 meters, 3/4 meter, and 23cm.

Continued on page 59

Justifying Our Existence

Far too many of us are old enough to remember Walt Kelly's comic strip, "Pogo." In one famous episode, a character parodied Commodore Oliver Hazard Perry's report of victory ("We have met the enemy and they are ours"). In the comic strip, the character stated, "We have met the enemy and they is us."

At times, this is a far too accurate statement about some of the practitioners of ham radio. Many times, when we are doing good things, some hams seem bent on ensuring that we do not get the credit we are due. These folks are so intent on enforcing the letter of the law that they are oblivious to the spirit of the law and totally unaware of the spirit of the hobby.

In the past few months, hams have done yeoman duty helping out in wildfires in the southeast, southwest, and northwest. They have provided key communications for a young man who was injured when his family's boat was attacked in the Caribbean. Hams have been the communications for public service events; through SkyWarn, the eyes and ears of the Weather Service; and the link for local emergency relief efforts. They routinely provide all kinds of support for their communities.

In some respects, we do not expect to receive credit for the work we do, but in others that credit is a critical component of our existence. Bluntly put, how can we possibly justify the existence of a hobby that has access to broad expanses of the radio spectrum? Why do regulations such as PRB-1 exist? Why does the FCC invest its time and effort into maintaining our existence? The reason is simple — we currently offer a value to the community that is greater than the cost we represent to the government. However, merely representing a great value to our community and our nation is not sufficient — we must also make key people aware of what we do represent.

Value is one of those concepts that we think we understand, but about which we may be hazy. There's an old saying that a cynic knows the price of everything but the value of nothing. Unfortunately, there appears to be more than a few cynics within the ham radio community.

What would it cost to assemble a group of experienced radio operators on short notice, equip each of them with one or more radios, and dispatch them to the scene of a disaster? If this had to be done by a local government agency through normal channels, you would see at least the following:

1. Radio equipment, \$200–\$1000
2. Radio operator, \$10–\$15 per hour
3. Benefits, 20%–40% of hourly rate

In a relatively small operation involving five radio operators for a single eight-hour day, we would be talking about the following:

1. Radio equipment (minimum), \$200 times five operators = \$1000
2. Salaries and benefits (minimum), \$10 per hour times eight hours times five operators = \$400, plus 20% for minimum benefits = \$480

Of course, to maintain a team of professional communicators would require additional costs. In the hospital where I work, an individual who is not guaranteed a certain amount of hours each week is paid a premium rate when they are needed. In addition, those who are subject to being called in to work on short notice receive a small hourly amount just to be available. There might be some type of additional pay for being sent to a disaster area, and of course any time over eight hours would be paid at time and a half for overtime. So, no matter how you slice it, five amateur radio operators who volunteer their time and equipment for public service represent hundreds if not thousands of dollars in value.

Unfortunately, we hams sometimes forget how much we contribute to the common good and how this must, and in fact does, represent a value to the community. Now, to get a real feel for how extensive this is, remember that during any given week there are hams providing support for hundreds of

locations throughout the country. For argument's sake, let's figure that there are one hundred events at which ham radio is active.

1. 100 events which utilize five amateurs for a total of eight hours = \$48,000
2. Equipment for five amateurs at each of the one hundred events = \$100,000

If we look at one year's activity, assuming that we have only one hundred events per week, which use only five hams for one full day, the value of the labor is \$2,496,000 and the equipment value is \$5,200,000. In reality, the number of hours hams provide is probably much, much higher for real events without counting various drills, emergency nets, support of MARS, etc. If that is the value of the service we provide, what is the cost?

- Zero.
- Nothing.
- Nada.

On the surface, this looks like one heck of a deal for the government, but on the other hand, it explains why the government is willing to give us our frequencies and tolerate our towers, etc. This is a good deal both for us as hams and for the government — the proverbial win-win arrangement.

Why have I bored you with these calculations? Recently I read some E-mail regarding a public service exercise in which Ron Wetjen WD4AHZ used the format from the ARRL *Public Activity Service Report* (FSD-157) to indicate the value of service which amateurs had provided. Since he had assigned a dollar value to the service provided, several folks responded as to how this was in violation of Part 97. In fact, no money ever changed hands, so there was neither a violation nor any impropriety. On the other

Continued on page 61

Y2K Field Day Report

The ARRL (American Radio Relay League) Field Day competition offers an opportunity to test emergency preparedness communications and, for the satellite enthusiast, the challenge of making hamsat contacts from a remote location. Field Day is always the fourth weekend in June, and Field Day 2000 was great.

The object of the competition is to work as many stations as possible on any and all amateur bands. This includes HF, VHF, UHF and the microwave bands, with the exception of 30, 17 and 12 meters. There are also a number of activities that an individual or group can pursue to collect bonus points. One of them is 100 extra points for a satellite contact.

While most clubs just want a single 100-point satellite QSO, there is an alternative Field Day competition that shares many ARRL rules, but is separate and focuses only on satellite operation. It is run by AMSAT, the Radio Amateur Satellite Corporation. The goal is to make as many satellite contacts as possible on any and all hamsats. Any mode that will work via satellite is encouraged and each satellite is considered a separate band.

Unlike normal shortwave operation in a remote location, more preparation is needed for satellite work. The communications equipment and antennas must be checked for even minor problems, since the received

signals are very often weak and transponder loading is at its peak during the contest. If the Field Day site is far from home, orbital predictions must be recalculated for a different location, especially if beams are used.

Field Day 2000 via satellite

Last year AMSAT-OSCAR-10 was surprisingly good and this year was nearly the same, but this 17-year-old hamsat can be quite unpredictable since the onboard computer gave out over a decade ago. AO-10 provided many voice and CW contacts for those who pursued it, and with its high elliptical orbit, AO-10 is still a great resource in the sky. It is simply an uncontrolled, but functional Mode "B" (70 cm up and two meters down), transponder in space.

The Fuji satellites F-O-20 and F-O-29 were both in analog (voice and CW) mode for Field Day. Contacts were plentiful for those who were prepared for the exceptional Doppler shift associated with satellites

with a UHF downlink. The 70-cm downlink signals can drift as much as 20 kHz in the course of an overhead pass. Satellite newcomers had problems keeping up.

The Russian RS-13 hamsat did well, but operation via this VHF/HF hamsat was confusing. RS-13 is currently in Mode KA. This means that it receives on two meters and 15 meters simultaneously and downlinks on 10 meters. Due to the great band conditions on 15 meters, numerous stations that were simply working terrestrial 15-meter Field Day, were heard through the transponder. While this was entertaining, it made it very hard to tell the difference between satellite stations and those that were inadvertently being heard through the satellite.

Operation via AMSAT-OSCAR-27 and UoSAT-OSCAR-14 was as expected, super crowded! These single-channel FM Mode "J" (2 meters up and 70 cm down) repeaters in the sky were working well even though it sounded like hundreds of stations

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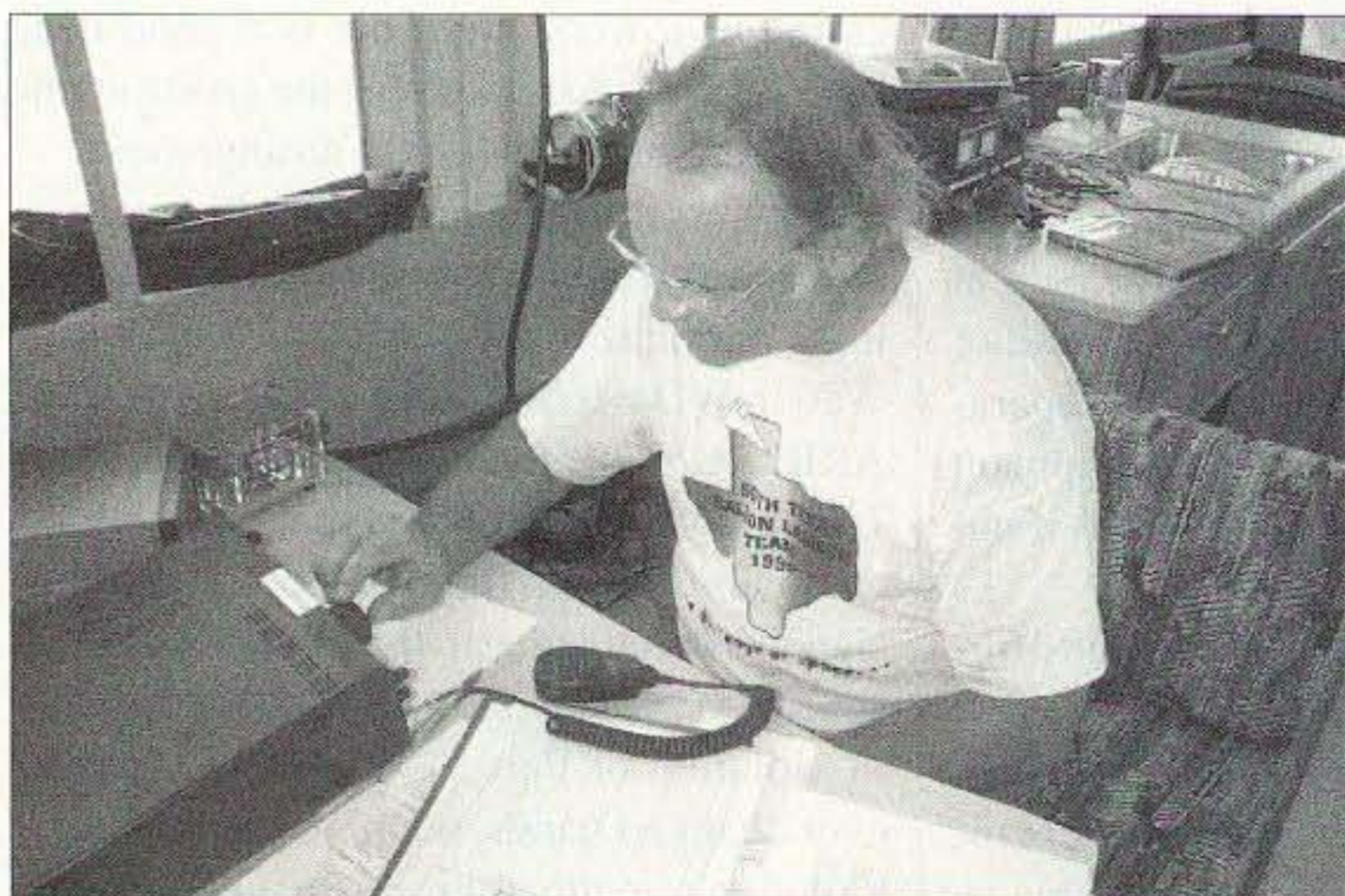


Photo A. Mike WA5TWT gets serious with AO-10 during Field Day 2000 at W5ACM in South Texas, on the Sparks Ranch west of Houston.



Photo B. Yaesu FT-847s were used for both HF and satellite use during Field Day at W5ACM.

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Photo C. Borrowed satellite antennas and tower, from Doug WB5TKI, worked well for all of the VHF/UHF hamsats during Field Day 2000.

HAMSATS

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were trying to access the satellite simultaneously. Perhaps the mass of signals is like that heard by shuttle astronauts when they operated SAREX (the Shuttle Amateur Radio EXperiment). The result is that only a few contacts are made, usually by the stations with the biggest antennas and the strongest transmitters. It was wild, but at least it was only temporary. Unfortunately there were a number of stations trying to get their 100-point ARRL Field Day bonus using HTs and small beams. Most were disappointed, but what can you expect from a repeater with an altitude of several hundred miles, when everyone within range is trying to talk at the same time?

While SUNSAT-OSCAR-35 was not

available for Field Day last year, it was on for some passes over the U.S. this time. During one pass over North America it was operating like a 1200-baud packet digipeater on Mode B (70 cm up and two meters down). On another pass, SO-35 came over in FM voice mode. It was fantastic. Very few Field Day participants expected SO-35 to even be on the air for Field Day due to satellite overheating problems caused by excessive sun exposure. For those who were checking the two-meter downlink frequency on each pass, it was a delightful surprise to get some digital and FM voice activity for the competition. The FM downlink on 145.825 MHz is always easy copy, even on a small scanner or HT.

The digital hamsats were doing reasonably well this year. Three 9600-baud birds were the most popular; UoSAT-OSCAR-22, KITSAT-OSCAR-23 and KITSAT-OSCAR-25. Downloading and uploading Field Day greeting messages is an accepted activity in the AMSAT Field Day rules. Recent rule changes also allowed digital contacts that use the amateur-radio satellites as flying digipeaters.

Several stations tried out the 9600-baud satellites using the Kenwood TMD-700A this year. Results with this new, rather amazing mobile transceiver were mixed at our site. We had a few too many cables and connectors between the radio and the antennas, thus only a few Field Day messages were downloaded, due to low received signal levels. Communication with the TNC (Terminal Node Controller) in the TMD-700A was easy to set up and use, but next year we will do a few tests before heading to the field with a new system.

Field Day 2000 - terrestrial

Our group of satellite chasers had provided the hamsat station for the Texas DX

Society for a number of years. This year TDXS decided not to do Field Day, so we were on our own. Our primary HF Field Day antenna, a three-element triband Yagi, had been collecting dust in an attic. Fortunately the elements and hardware had been carefully packed and labeled. Assembly was easy, and the large beam with rotator was actually lighter than the satellite array with its tower sections.

Two Yaesu FT-847s were used for all SSB voice and CW contacts at the main station, an air-conditioned pop-up camper. One rig was used for satellite and the other for HF. The radios did both tasks quite well. With emphasis on satellite work, the HF station was simply for fun, and if necessary, to provide backup gear for the satellite system. After fighting for contacts via AO-10 and its deep, long signal fades, 20-meter phone seemed loud and easy, but extremely crowded. The old beam did a great job though, and was also quite useful for the RS-13 downlink passband on 10 meters.

Six meters was a surprising delight this year. Coverage was very similar to ten meters and signals were very good on the MFJ transceiver and small three-element beam at 12 feet. Most of our contacts from south Texas were into the northeast around Tennessee, although a few got as far north as Canada, and south to Florida. The station was set up in the open, and the Texas mosquitos were fierce after dark.

Field Day 2001

While there are no guarantees that AO-10 will still be on the air for Field Day next year, there are also no promises about HF propagation. We hope that both will be in good shape. We are also hoping for a fully commissioned Phase-3D satellite to be online for the event. Will you be ready? **73**

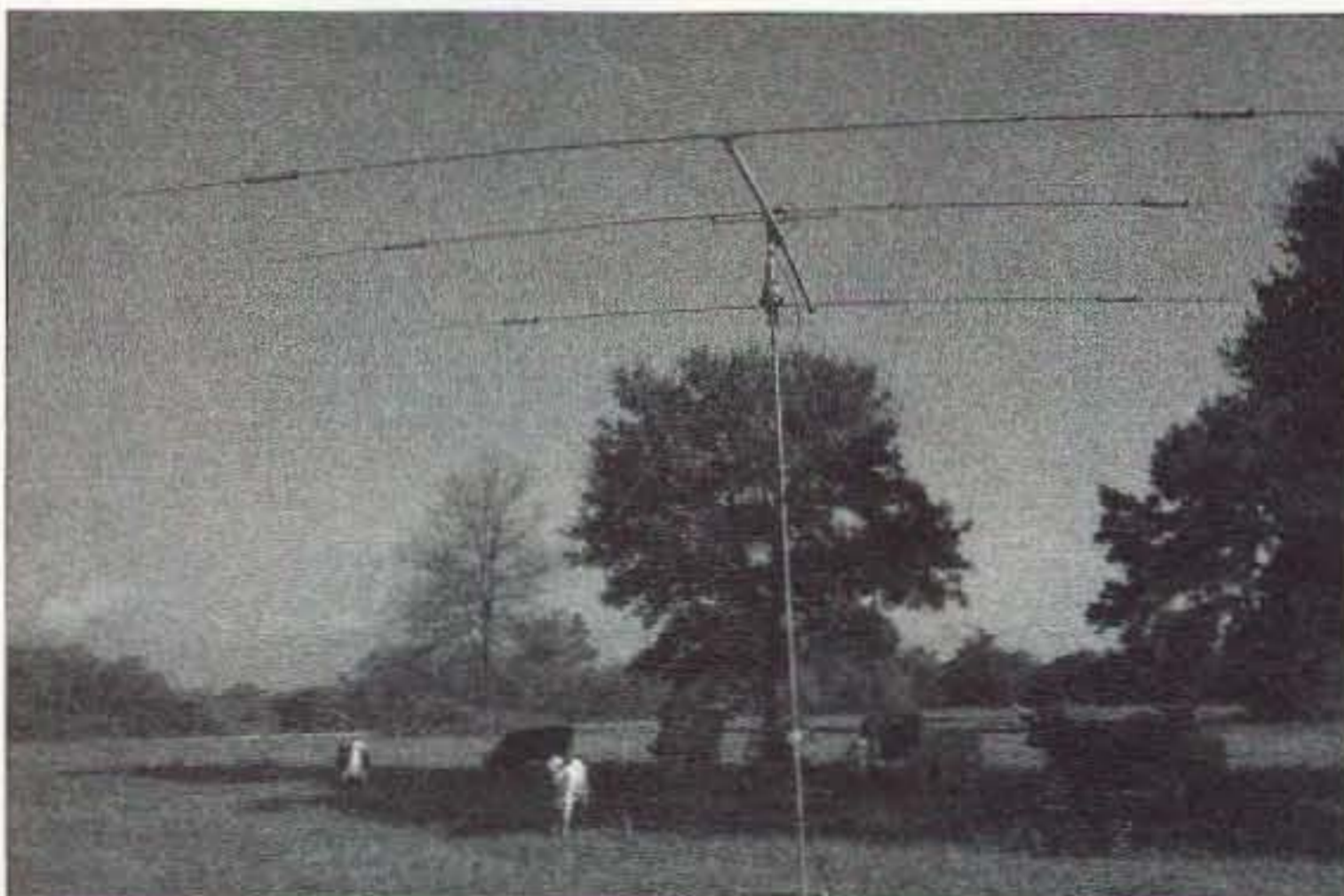


Photo D. A typical Texas Field Day site — cows check out the HF antenna installation.



Photo E. Ed KD5ELB ran the six-meter outdoor station at W5ACM during Field Day.

DigiPan is as easy as PSK31 gets

You may wonder why DigiPan appears to dominate the new as well as the serious PSK users as their choice software. There are several good reasons. I went back to the web site (See Table 1) and downloaded Version 1.2 to upgrade Version 1 that I tried some months ago, and discovered why so many hams are hooked.

First — It is easy. Easy to get (download it free). Easy to install — I haven't heard a ham say it took more than a few minutes after the download until the program displayed on their monitor.

Configuration is a snap — The pull-down menu under "Configure" includes a simple three-entry box for your callsign, name and QTH. If you are using a PTT switch, click on the serial port option under "Configure" and define your port and the pin you are using in the port connector. The author recommends to use a PTT switch and gives the simple circuit in the help file. It is the standard circuit I use — it works.

Instructions for cables — The help file will lead you step-by-step to "wiring" the audio from your radio to your computer soundcard. The only extra information you will need will be about the pins on the connectors of your radio. This can be found in your owner's manual.

Set the audio level — I got a pleasant surprise when I clicked "Spectrum drive" and "Transmitter drive" buttons under "Configure." When you do this, the "Volume control" panel comes up automatically for your soundcard. With other programs, I have always had to wrestle the volume control panel up from the Windows™ Control Panel, and devise a procedure to keep the volume controls displayed while putting the program in the transmit mode. This all works so easily with DigiPan, it seems too good to be true.

The bottom line — I didn't have to stop to make any cables because the same cables work for most of the soundcard programs (now that DigiPan allows the use of the DTR pin in the serial port for PTT). DigiPan macros are partially defined for you so you can easily make contacts without typing in callsigns. Attempting to remember the other

ham's call does slow you down on the typing end.

Macros are in place for you to call CQ, call another station who was calling CQ, initiate an exchange ([his call] de [your call]), turn it back to him (BTU, etc.), and sign off. There is an added plus to pre-defined macros. You can see what is written already and the editing becomes a cinch. In other words, I like to send three lines with a CQ. All I had to do was right-click the macro button for CQ and add what I wanted, which included the instruction to go back to receive.

I did a little experimenting to see what would happen if I double-clicked a call sign in the receive field. Sure enough, it copied the callsign into the "Call" box above the field. The same thing worked with "Name" (for the other ham) and "Report" received. Using this little bit of knowledge, I was able to make the first contact with the upgraded software within 15 minutes of the download. That spells *easy* to me.

Afterward, I spent a little more time browsing the help menu and found instructions to automatically place information in the remaining boxes from the receive field. See **Fig. 1**.

Also, in the Help file, there are instructions to alter the frequency markings above the tuning field. The program comes with some generic numbers which you can alter through the configure process to read very close to the actual frequency you are tuned to. With a little practice, you will be able to speak in Hz instead of meters. Small revision to our methods, but some of us like to be a bit more precise.

The program is equipped with an easy to use log. Clicking the "Save" button at the upper right of the screen saves the information in the cells. There are help file

instructions for printing and exporting, plus you can search and view on the screen for previous contacts.

This version of DigiPan is the third release. I don't know if there is another release immediately in the works, but there isn't much left to fix. The authors, Nick UT2UZ and Skip KH6TY have added features and removed bugs until this is a very complete package.

Incidentally, Nick is the author of the MixW multi-mode shareware program that provides a choice of tuning methods and does RTTY and packet. Additionally, it contains two new modes, MTTY and FSK31, that you will be hearing more about as time moves on. However, if you want a program to join in the fun of PSK31 and presently have no intentions of working other digital modes, you can't lose with DigiPan. It just simply works and is as easy as it can be made. Plus, once you have the DigiPan working the way you want, the same cable setup will work for MixW, as well as quite a few other pieces of digital software.

If you haven't tried this mode, you can make a few sound cables (to get the audio back and forth between the computer and your rig), for \$10 to \$20 at the high end. It is not necessary to build the PTT circuit in the beginning. You can put the program in transmit mode and manually toggle the transceiver. It is a few extra strokes, but quite a few of us have started that way with great success. The quality of the signal is the same and most PSK hams know to wait a bit after a turnover ... just because.

The popularity of PSK

I was noticing the other evening, about supper time, how busy the PSK portion of 20 meters was. Usually I can call a station and they hear me and we can have a decent

rag-chew. This particular evening there was such an abundance of activity that we were all victims of each other's QRM. This does not happen every evening, but it is a sign of the times. This mode has really caught on.

Other new modes

Along that same line of thought, I see several new modes coming along that may share and add to the impact. There is another factor I have noticed that is something to be thankful for; that is the influx of licensed hams into the HF spectrum since the middle of April.

Back to the new modes. We have used or heard of MT63 and Hellschreiber, though I still think of the latter as a novelty. There are some new offerings that are just getting going due to the fact there are so few hams with the necessary software. Nick's MixW now includes the FSK31 and the MTTY.

Both modes carry the claim of narrower spectrum use and added stability. I haven't

been in the right place at the right time as of this writing, but it will be very interesting to use these modes and get real feedback from other users. I believe the MTTY can be narrowed to less than 50 Hz between the tones. I am not sure if the FSK can get much narrower than the PSK's 31 Hz. Time will tell how well these modes are accepted.

There is one more, and I have only heard the results of an initial test QSO that was successful between Europe and Australia. The mode is named Piccolo and is authored by Nino, the author of the popular soundcard programs, Hellschreiber and MT63. It is reasonable to believe that by the time this hits print, there will be advances in all these three new offerings.

TrueTTY update

A while back, I wrote a piece about a nice shareware package by Sergei UA9OSV, and mentioned there were some changes he was working on. Well folks, Sergei has been

busy. The one change I was looking for was the one to make my typing look better, the over-the-air backspace. He did it. I just got the recent update and, sure enough, that little item is included along with quite a few others.

TrueTTY does PSK31 and RTTY. In addition to the backspace for PSK31, Sergei has included quite a few improvements to the operation of the entire program. He has made it easier to set the UTC time as it relates to local time.

He has also improved the editing capability of the macros, which can now be edited from an "edit macros" menu as opposed to editing a page containing all macros, such as with a text editor. There are many other improvements to the program that, if you haven't looked in for a while, you will be surprised at what you see.

Printers are getting better and different — I recently got one of the HP color printers that prints near-photo-quality images. I checked first to see if there were ink refills available as there were for the old printer. There are and they are also available for the color cartridges. What a deal, I thought.

There is a little surprise I should tell you about when refill time comes. The aftermarket ink package comes with a humongous paper clip, with instructions to clamp it on the cartridge early in the refill process and to take it off when finished. They also have some dialogue concerning leaks.

There is a definite connection. The clamp (and this is not explained) is to squeeze in the sides of the cartridge being filled and sealed so there will be a minute vacuum after the fill hole is plugged and the clamp removed. They mention the amount of ink may be more than is needed. Sure enough, I got a leak from the discharge area.

This is probably adding up to you as you read this. I think next time I will squeeze the sides a bit more aggressively and not fill the cartridge absolutely full. It looks to be education by the seat of the pants. The cost savings is substantial, so I will continue to do this, but it is a learning experience. If yours leaks, put it over a container and let it leak. Wipe it occasionally so the ink doesn't dry. My first one took the better part of an hour before it looked safe to install, but it works great.

Then I discovered something about the complaint on Internet Explorer — I have used Netscape from day one and just recently purchased a little accounting package from Microsoft™ to help me communicate with my accountant. Installation did not go well.

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/my_ham_soft.htm http://users.nais.com/~jaffejim/mixwpage.htm
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Site with links to PSK31 and Logger 7. Also Zakanaka and scope program	www.chroniclenetworks.com/~dwm/Logger.htm
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
Digipan — PSK31 — easy to use — new version 1.2	http://members.home.com/hteller/digipan/
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BayCom 1.5 and Manual.zip in English	www.cs.wvu.edu/~acm/gopher/Software/baycom/
N1RCT site — excellent RTTY ref.	http://www.megalink.net/~n1rct/
Int'l Visual Communication Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Creative Services Software	www.cssincorp.com
Hellschreiber & MT63	www.freeweb.org/varie/ninopo/iz8bly/index.htm

Table 1. The chart from Hell(er) — your guide to good things on the Web.

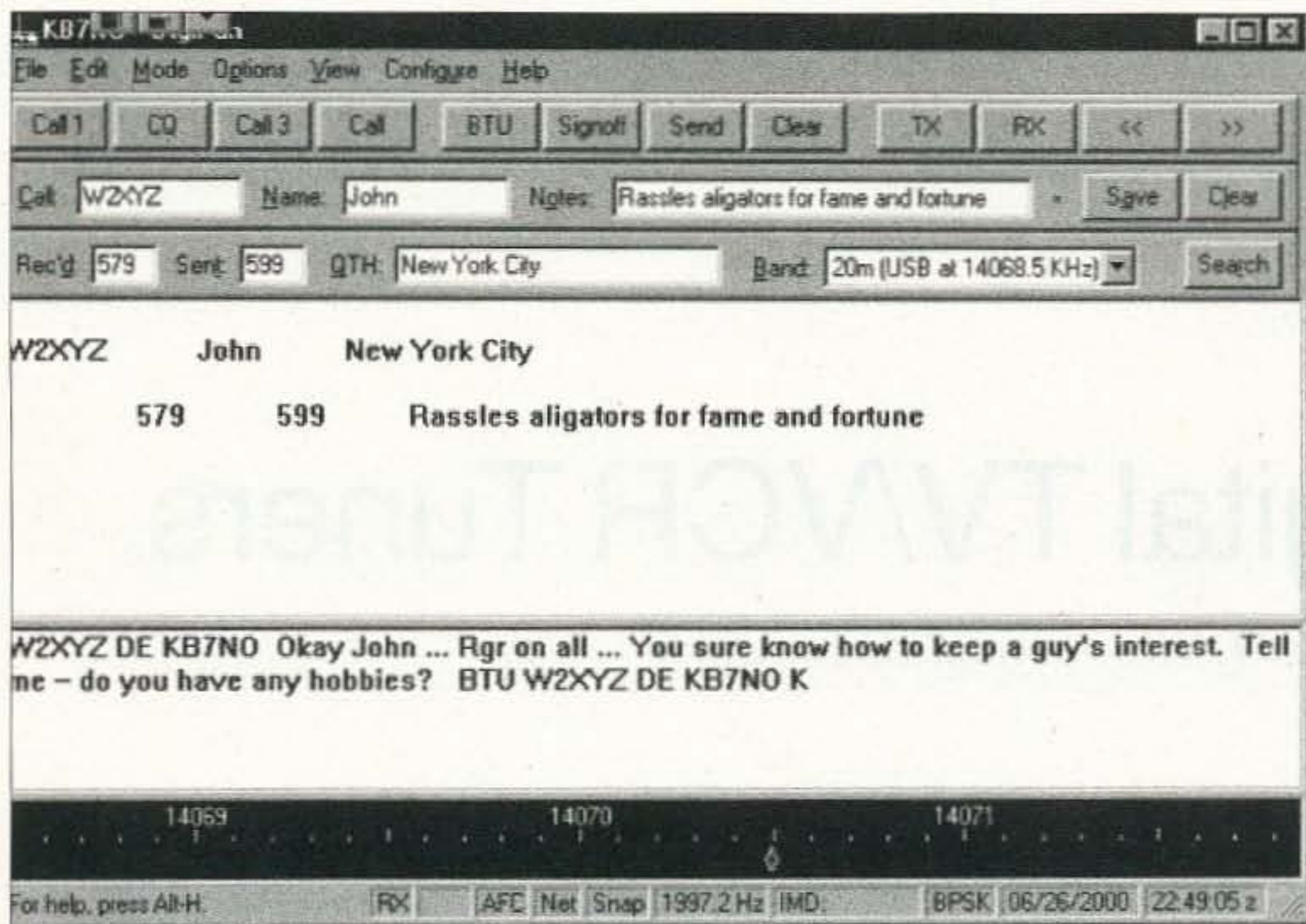


Fig. 1. Screenshot — Here is a shot of the program “everybody is using,” Version 1.2 of DigiPan. The macro buttons at the top can either be clicked with a mouse, or you can use function keys to activate the macro. As a demo, I typed the bits of info in the receive field, then double clicked the callsign which was copied into the “Call” cell. The same was done with the John and the 579. For the other entries, it was necessary to select, click and drag per the help file info. In the transmit field, the two callsign exchanges were entered by using the pre-defined macros. The position of the diamond in the tuning screen at the bottom can show the frequency in use if you tune your radio to the frequency in the “Band” cell at the top. Hidden behind the “always on top” icons (from unrelated software) at the top, is your station callsign; as soon as you configure the free DigiPan software.

The package included the Internet Explorer browser and it was required, otherwise the little 20 to 30 megabyte accounting package would not play. To install the whole shebang required 175 Megs! I rebelled. Actually, the computer wasn't in the correct mode. The drive is partitioned and the major part of the program had to be installed where I had the least room — or else. A call to Microsoft didn't offer a cure, only confirmed the waste of space was part of the process. I decided to scrap the software from the world leader and go buy something from a slightly less egotistical organization. No wonder all the accusations and court proceedings. Hard to believe until you see it first hand. Not much ham software would be sold if programmers used such tactics. There would never have been a PSK31 revolution.

Another look at an intense programming effort for computer control of your transceiver and attendant accessories may offer some interest to you. Some time back, I was made aware of [http://www.trx-manager.com/], which displays a shareware program for control of most popular transceivers. The first time I accessed the URL I happened on the French version and didn't fare well.

The other day I gave it another stab, and there is an English version that the above URL takes you to. If you are curious and would like to see such a program work in your shack, you can download a full working version with a limited trial period. I gave it a try. It worked on my new rig, which indicates they are keeping the software updated. I haven't formed an opinion of its true value to me, but it is worth a look if you have a computer and a transceiver. They give a lot of help and hints for what to do when things don't work, so you should be able to make it do its stuff.

If you have questions or comments about this column, E-mail me [jheller@sierra.net]. I will gladly share what I

know, or find a resource for you. For now, 73, Jack KB7NO. 73

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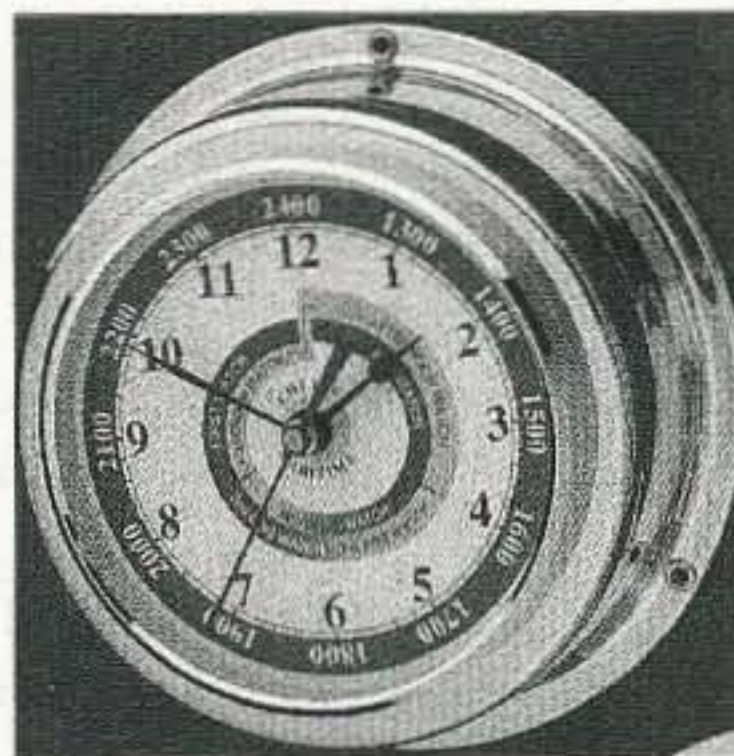
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Inside Digital TV/VCR Tuners

Part 1: How to make them work.

TV tuners have been around for a long time and have really helped hams with numerous projects. The early TV tuners used tuning capacitors and/or variable inductors for channel selection and were later replaced by detent and switchable tuners. Although these tuners worked well in ham projects, the real breakthrough came with the varactor tuners that opened up a whole new world for ham exploration.

The more recent introduction (about 1995) of digital tuners changed the way tuners performed in both TV and VCR applications by increasing tuning stability. Digital tuners are now beginning to find their way to curbside trash bins, where hams are encountering them for perhaps the first time. My introduction to digital tuners began when Pete Haas N8PIF, sent me a tuner and requested information on how to use it. Unfortunately, at the time I knew perhaps less than anyone about them. However, having the tuner in-hand was very compelling, and the information provided in this series on tuners is the result of my study.

While we're on the subject of giving credit to those who have made this

study possible, David Shalita W6MIK followed along very closely with me as the study moved forward. David built up a data test set similar to mine, which will be described later, so that we could work essentially in parallel. Having David work with me was similar to having help pulling up on one's own boot straps. But with help, of course, you gain ground, and we did, as you'll see reported here.

My thanks goes out to both Pete and David for their support in bringing this digital tuner project to an experimenter's beginning. With the digital tuner door opened, only experimentation will tell us how far we might go. If you have an interest in tuners, then please follow along, as this is an exciting technical adventure. It was a tremendous learning experience for me. As you'll see, I'm NOT a digitally oriented person, but I've gained a new perspective on the field.

Digital tuners

There are essentially two types of digital tuners at this point, classed as 3-wire and as 2-wire. Digital tuners, as shown in **Fig. 1**, look very similar to the more common varactor tuner. I'll

describe the 2-wire first so that we'll be able to spend the rest of the time on the 3-wire tuner.

The 2-wire tuner is the latest entry into the tuner stable, and because of the technology used, it will most likely be around for a long time. Control of the tuner is via separate data and clock lines, and follows an adopted computer protocol (reference Philips Semiconductor's application note AN 036) called I2C, which is a two-way, two-line communication bus between a microprocessor and peripheral ICs. In the case of a 2-wire digital TV/VCR tuner, the internal synthesizer has a unique address, and when addressed by a microprocessor/controller, the synthesizer will acknowledge and then be enabled to receive data via the data bus. From that point on, the tuner provides all of the normal tuner activities such as receiving a signal at a given frequency, and then generates an output signal that is passed along to the rest of the receiver.

The 3-wire bus system used in TV/VCR tuners is the subject of information to be provided in this series. Although the 3-wire tuners are compatible for I2C control via the CLOCK

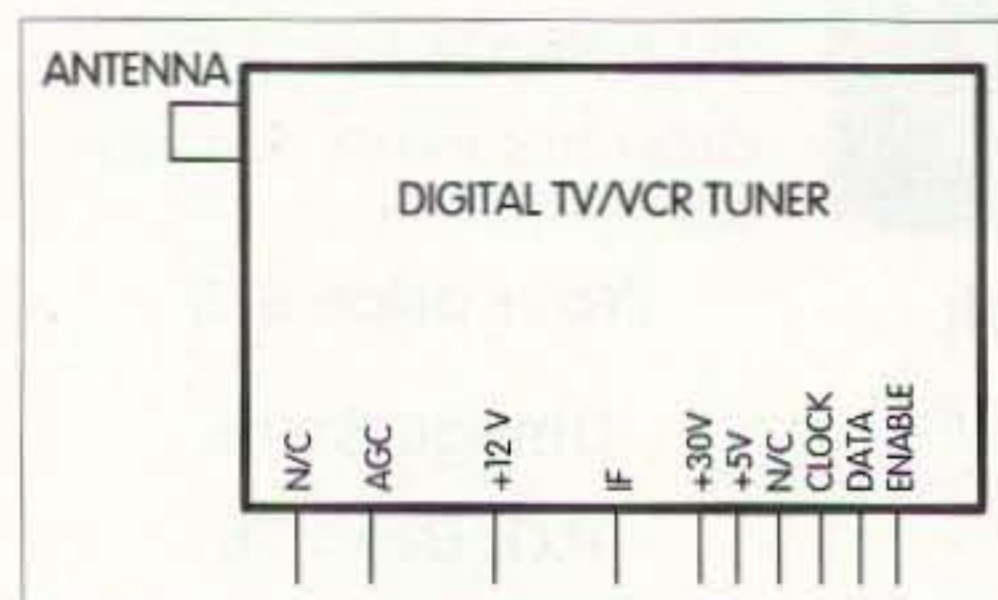


Fig. 1. Typical 3-wire digital tuner is shown. A 2-wire tuner appears to be similar but minus the enable input.

and DATA bus, the ENABLE bus must be kept separate because the 3-wire tuner does not have a unique internal address.

3-wire data requirements

Those 3-wire tuners that I've encountered to date require that 18/19 bits of data be clocked serially into the internal register of a synthesizer IC. For the register to recognize and prepare for the receipt of data, an ENABLE line must be raised before and during and then dropped at the completion of the data transfer as shown in Fig. 2. Following the first falling edge of the clock pulse after the drop of the ENABLE line, data will be transferred from the receiving register to the appropriate functions within the tuner.

The first four bits clocked into the register are band bits, which are essentially pass-through data that is used to enable the internal tuner band selectors (diode switches). Following the band bits in sequence are 14 or 15 frequency-select bits that are used to set up the synthesizer divider chain. These bits are in binary order with the MSD (most significant digit) bit being the first clocked in and the LSD (least significant digit) bit being the last. Some synthesizer registers will transfer the frequency data following the 19th clock bit should there be a data overrun. However, other tuners will fail to realize that the data has been overrun, and will ignore the entire entry. When an 18-bit count is used, many synthesizers will reset the first MSD (bit 15) frequency bit to zero while a 19-bit clock keeps bit 15 active. Any clock speed below 100 kHz is accepted by the synthesizer register, making it easy for manual data entry.

Data bits in the serial bit stream are given a binary weight, with bit 15 being equal to 16,384, bit 14 equal to 8,192, etc., down to bit 1, which is equal to one.

Voltage requirements for digital tuners appear to be quite uniform for all of those that I've encountered — including the I2C variety. The voltages are as follows: +12 V, +5 V, and +30 V. Maximum tuner sensitivity occurs with an AGC voltage between (+)6 V and 9 V.

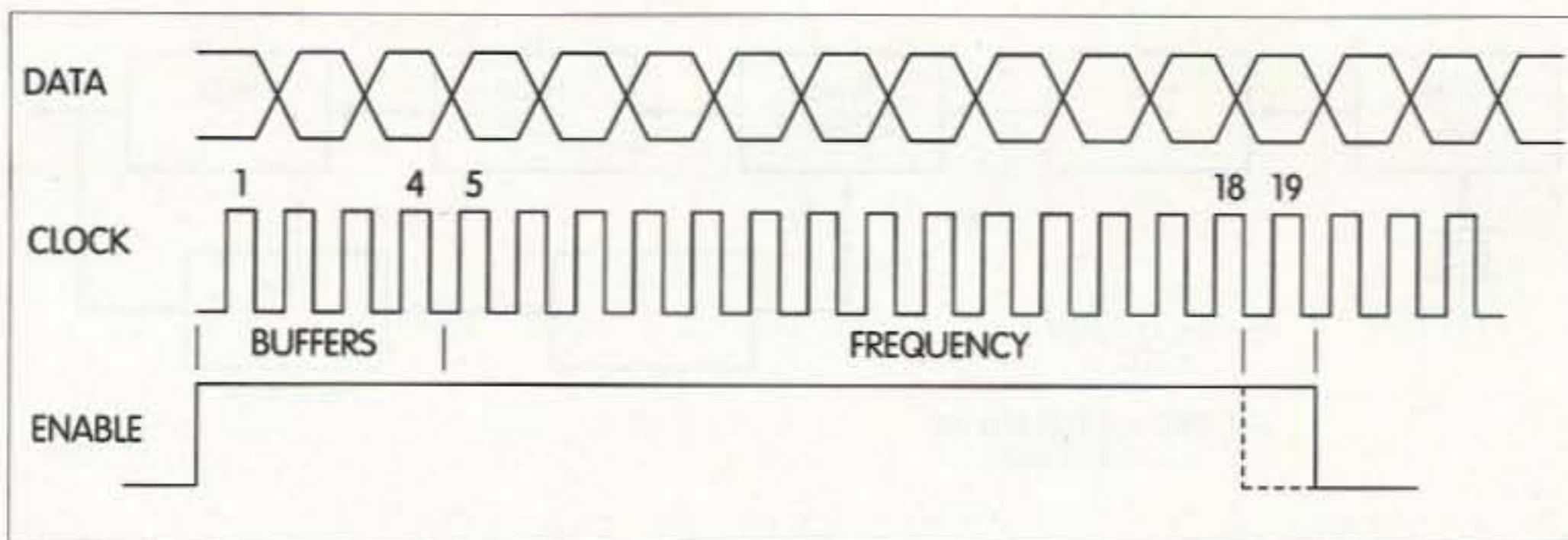


Fig. 2. 18/19-bit bus timing diagram for a 3-wire digital tuner.

Controlling the tuner is a matter of generating a serial bit stream that will select the desired frequency band within the tuner and then set up the synthesizer divider to the proper count. Determining the divider count is fairly straightforward and can be done with a pencil and paper, a calculator, or a computer. I've worked up a BASIC program to do the counting following the entry of a desired frequency. The BASIC program will be discussed later on, for those interested in using such a tool. I'll also show you how to easily work out the binary coding using the pencil and paper method.

After going through all of the above information, you may wonder why anyone would bother with a digital tuner. That's a good question that can be answered only by each individual. For me, the challenge of making the digital tuner operate was my reason for proceeding. Now that the digital tuner is operating, it has many of the same applications of the earlier varactor tuner.

Perhaps the best feature of the digital tuner is the frequency stability of the local oscillator (VCO). Being phase-locked, the local oscillator is as stable as the 4 MHz crystal that's used within the synthesizer. Defining all of the

possible uses for the tuner is a little difficult at this point, because only time and experimentation will provide the answer. However, the positive features involve frequency stability while monitoring a received signal, the input frequency is a "known" because of synthesizer control, and the tuner should make a useful and very stable synthesized signal source.

The front end design of the digital tuner incorporates a dual-gate FET, which allows it to have perhaps the best possible input sensitivity. During my tests, the input sensitivity has been as good as the receiver that followed the tuner. In some cases, the tuner provided an increase in input sensitivity. As an example, if the basic receiver exhibited an input sensitivity of 1 μ V, the use of the tuner allowed the sensitivity to remain at 1 μ V, and in some cases it improved to almost 0.5 μ V.

Perhaps, on the negative side, the digital tuner might not be a good candidate as the front end of a spectrum analyzer project because of the synthesizer step frequency. Unlike an analog varactor tuned tuner, which can be tuned smoothly from one frequency to another, a synthesized tuner will step

Continued on page 56

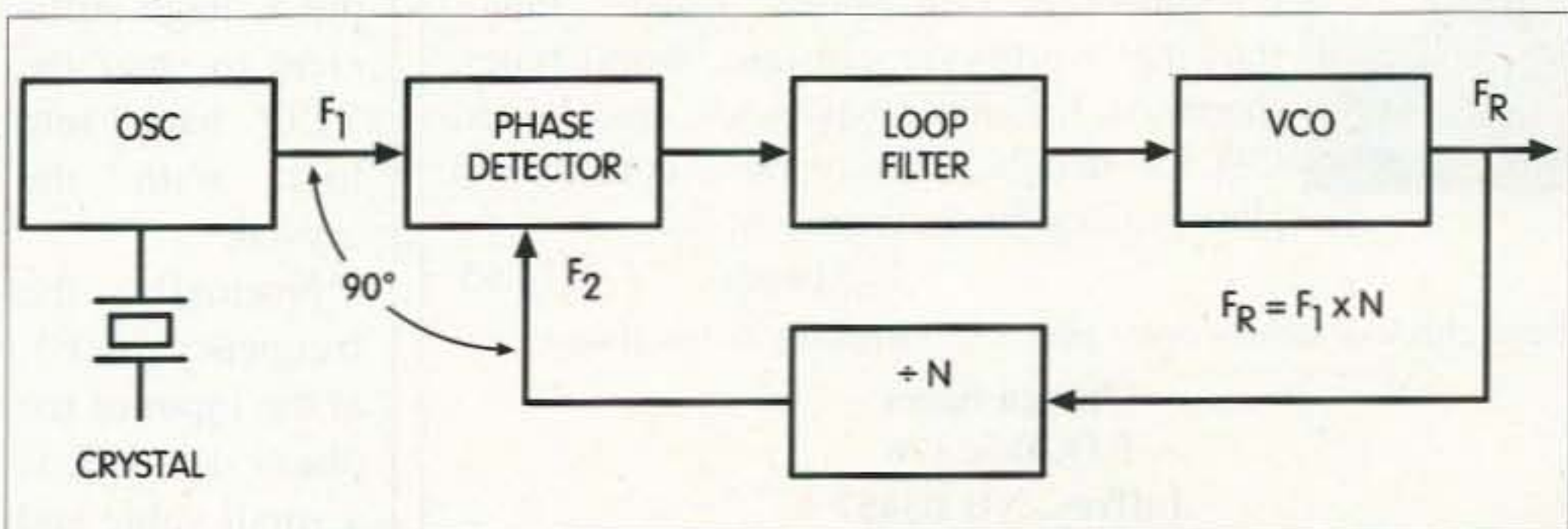


Fig. 3. Block diagram of a basic phase-locked loop synthesizer.

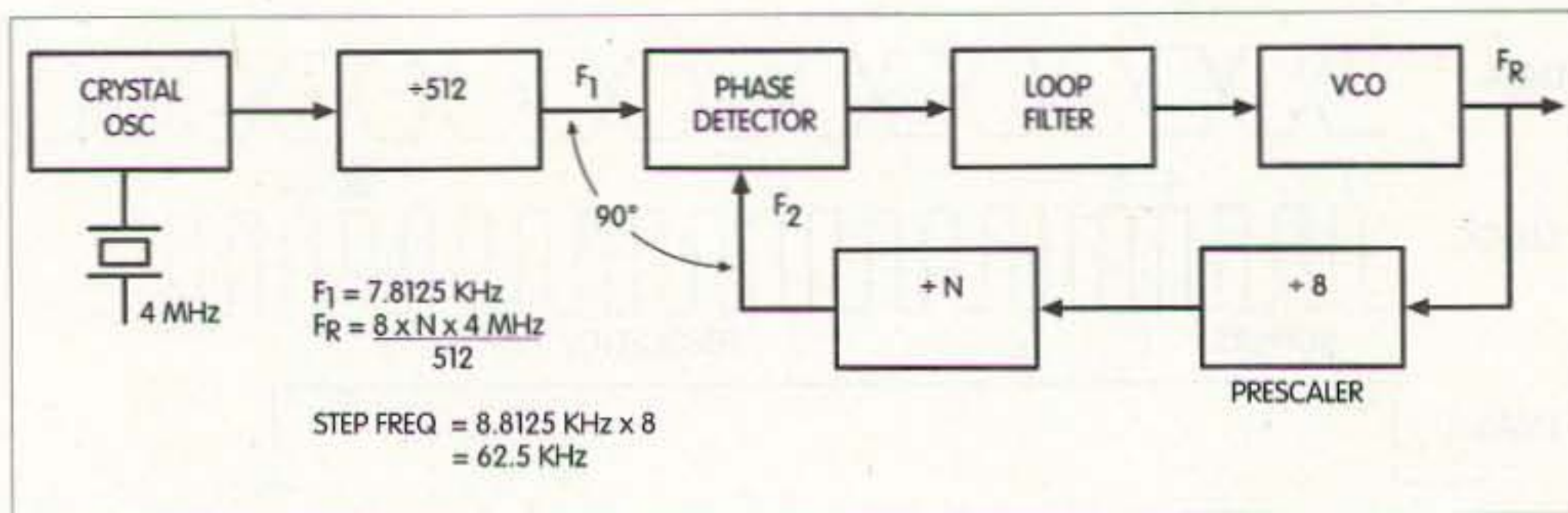


Fig. 4. Typical TV/VCR digital tuner synthesizer. Tuner step frequency is 62.5 kHz.

Inside Digital TV/VCR Tuners

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from one frequency to the next as the tuner moves across a frequency band.

Synthesizer theory

Before getting into the details of how the digital tuner is controlled, it is desirable to review how synthesizers operate, because that's the basis upon which a digital tuner operates. The objective is to understand how a synthesizer is used to control the local

oscillator (VCO) within the tuner through the use of a numerical divider.

Frequency synthesizers get their name from being able to generate a great number of discrete frequencies with the same stability as that of a quartz crystal, while utilizing only one crystal. Fig. 3 shows the basic elements of a phase-locked synthesizer where the VCO is locked to the stability of the crystal, but can operate at any frequency that can be locked by the loop. When the VCO is "locked," the two input signals to the phase detector are

equal in frequency, but operating in quadrature (90 degrees apart).

As long as the phase angle remains, the system operates OK, but if the phase shift changes between F1 and F2, then the VCO begins to move until either phase lock is again achieved or the VCO falls to a low preset out-of-lock frequency. In most cases, the phase detector will develop a DC output voltage sufficient to steer the VCO back into lock with the crystal.

Normally, the frequency of F1, at the input of the phase detector, is a small value and determines the

step frequency of the synthesizer. It is also used to calculate Fr (VCO output) when the loop divider is known. As an example, if F1 = 1 MHz and the divider is 10, then Fr = 10 MHz. A loop filter is used to reduce the VCO's rate of change so that "hunting" is eliminated.

A digital TV/VCR tuner synthesizer, as shown in Fig. 4, follows the theory described, but has two additional divider elements that modify the calculation. A prescaler (divide-by-8) is typically used between the VCO and the synthesizer divider. The purpose of the prescaler is to reduce the input frequency to the main divider because of the divider's low frequency response and the limited divide ratio that's available. The prescaler's fixed divide ratio has a direct effect on the final synthesizer step frequency.


Between the crystal oscillator and the phase detector is an additional divider that reduces the crystal frequency to a low value. As shown, the divider has a divide ratio of 512, which reduces the 4 MHz crystal frequency to 7.8125 kHz (F1). With both fixed dividers in place, the equation for determining the step frequency is $7.8125 \text{ kHz} \times 8 = 62.5 \text{ kHz}$.

When stepping across the TV spectrum, a step frequency of 62.5 kHz is quite logical, but the step is pretty drastic for some ham applications. However, the wide step doesn't daunt a ham experimenter, because tuning across the tuner's IF output band with a receiver resolves the issue.

What's to follow


This is the first in a series of seven discussions on digital TV/VCR tuners. In this first section, we've discussed the different types of digital tuners and the frequency synthesizers used in the tuners, and have provided some insight into the calculations needed for digital tuner control.

The second part in the series will discuss the data transmitter that may be used for tuner control. Additional sections will include a data receiver, testing of the digital tuner, a BASIC program for generating the binary code, and a discussion on making printed circuit boards for a digital tuner project.



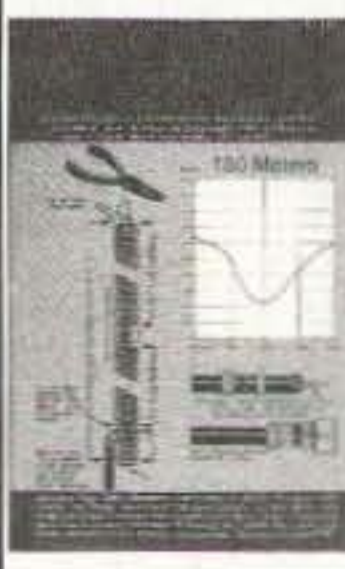
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Windshield Auto-Wiper

This gadget provides an interesting approach to an old challenge.

Auto-Wiper, an off-on device intermittent windshield-wiper controller, evolved as a solution to the shortcomings of conventional controllers. Built around the ubiquitous 555 timer/oscillator chip and a handful of discrete components, it offers some unusual features not found in most commercial units.

Conventional SCR controllers use the wiper motor internal cam switch to commute (turn off) the SCR as the wiper motor cam rotates out of its detent. The electrical power to complete the wipe cycle flows through the cam park switch and the wiper switch until the cam once more rotates into detent, interrupting the power source to the motor. After a pause, the SCR is again pulsed “on” to repeat its single cycle again. This approach to control is called open-loop (no feedback), single-cycle operation.

In most SCR wiper controllers, the system continues to operate as long as the wiper switch is turned on and power is applied to the circuit. And although most can be slowed down (for a very light rain), many cannot be made to automatically perform one “pass” and then “pause” for any appreciable amount of time. To create such a pause requires operation of the wiper switch. This may mean that the wipers stop at any place along the wiper arc and at the park position (where they do not hinder the driver’s vision) only fortuitously.

Most modern wiper control systems use dynamic braking to stop the wipers

at the park position. To interface to these systems, the SCR controllers usually require additional relay switching or the dismantling of the dynamic braking feature — both are undesirable alternatives.

Auto-Wiper is designed to work with a modern wiper system through a simple interface. MOSFET power transistors eliminate the SCR device and its need for external commutation,

while providing the dynamic braking essential for proper wiper action. By means of a pulse generated by the cam switch once each cycle, synchronization between Auto-Wiper and the windshield wipers is maintained. Furthermore, these feedback pulses allow varying the number of wipes between

Continued on page 58

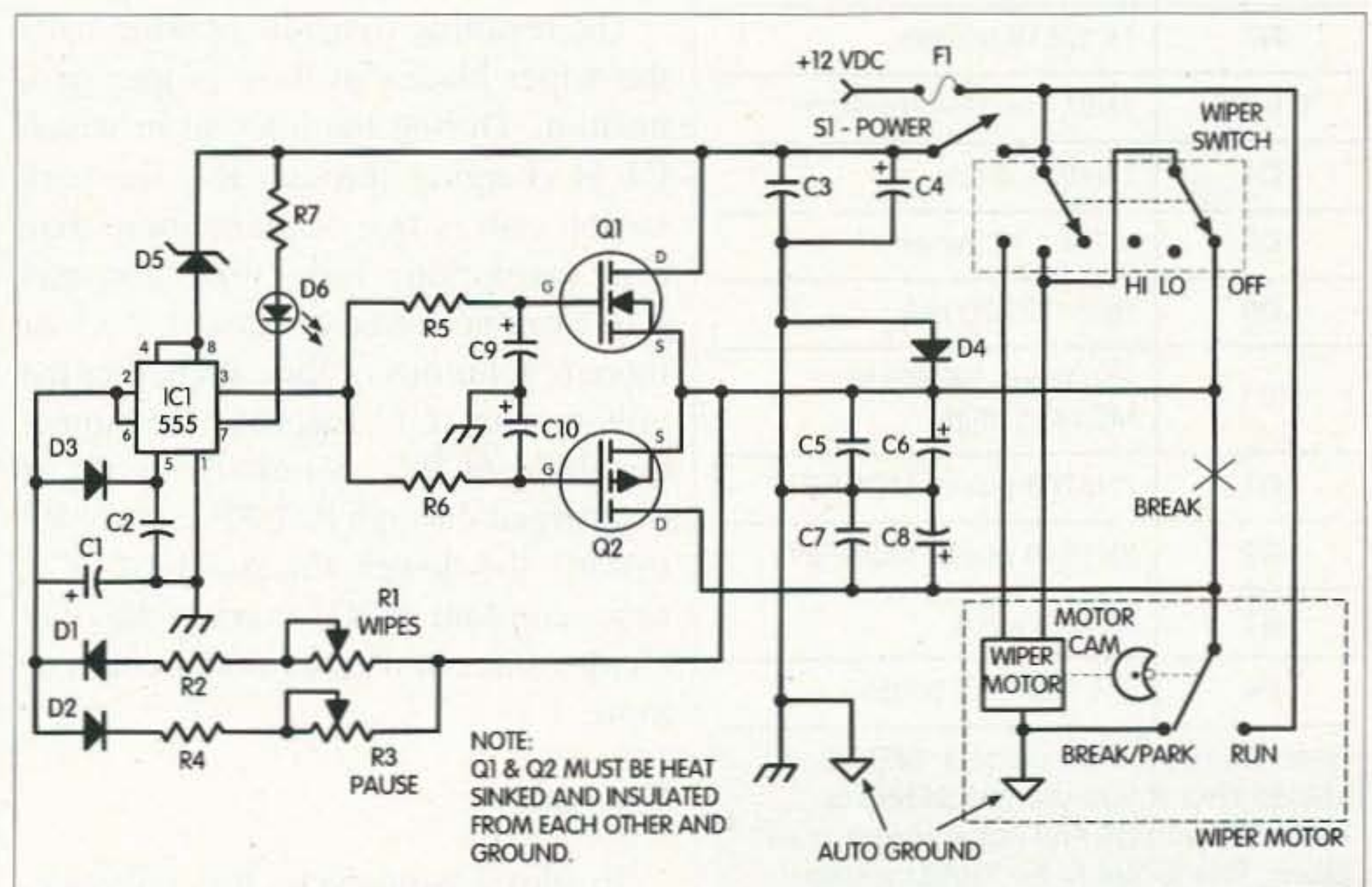


Fig. 1. Car windshield wiper controller schematic.

Windshield Auto-Wiper

continued from page 57

pauses to one, two, three, or more without resetting the pause control.

How it works

As shown in the schematic, the 555 timer IC1 (configured as a gated astable pulse generator with independently adjustable ON and OFF times) derives its feedback from the voltage across the wiper motor. This voltage governed by the park switch pulses in synchronization with the wiper blades. Hence the timer is controlled by the wipers themselves in addition to its

ON (WIPES, R1) and OFF (PAUSE, R3) time constants.

When S1 (part of R1) is first closed, low voltage on pin 2 of IC1 triggers the timer into its ON state. MOSFET power transistor Q2 is cut off but Q1 is turned on, allowing power to flow to the wiper motor. Power is also supplied to the motor through the internal diode of Q2 as the park switch cam rotates out of detent. The feedback voltage across the motor charges C1 through WIPES control R1 until the voltage across C1 is clamped by D3 just above the upper threshold of IC1.

As the voltage on C1 rises above the upper threshold of IC1, the timer turns OFF turning Q2 on while cutting off Q1. The wiper motor, still powered through the internal diode of Q2, continues to operate until the park switch cam once more rotates into detent. The result is that the feedback voltage remains HIGH, thus preventing the discharge of C1 until the cam rotates into detent.

When this occurs, C1 is freed to discharge through PAUSE control R3 toward the zero feedback voltage across the wiper motor. The voltage on C1 falls until it crosses the lower threshold of IC1, triggering it ON to start the cycle over again. Also, as the cam rotates into detent, the wiper motor's windings are shorted to ground through the wiper switch and Q2.

The resulting dynamic braking halts the wiper blades in their proper park position. During the interval in which C1 is charging through R1, the park switch cam is free to make more than one revolution; thus time constant R1C1 can be varied to allow 1, 2, 3, or more revolutions of the cam before the voltage on C1 reaches the upper threshold of IC1. Similarly, as C1 is discharged through PAUSE control R3 toward the lower threshold of IC1, time constant R3C1 varies the discharge time from zero to 60 seconds or more.

Operation

To start a wipe cycle, it is only necessary to pulse Q1 long enough for the park switch cam to rotate out of detent.

Therefore, it is only necessary to advance the WIPES control clockwise until the desired number of wipes are reliably swept. Erratic operation may occur if the control is turned beyond this optimum point. When decreasing the number of wipes, always retard the WIPES control to less than the number of wipes you want, and then advance it as above.

Any desired pause of up to 60 seconds is simply set by the PAUSE control. When first turned on, the initial wipe duration will be somewhat longer than set by the WIPES control. This is caused by C1 charging from zero volts rather than from the lower threshold voltage of IC1 as in subsequent cycles. A useful purpose is served, however, in that the windshield is sure to be wiped clean at the start. The original wiper switch is normally not used, but can at any time override Auto-Wiper. 73

Parts List	
Part	Description
C1	8.2 μ F 50 V 10% solid tantalum capacitor (Sprague Q-Line #QDT1-61)
C2	0.01 μ F 50 V disc
C3, C5, C7	0.1 μ F 50 V disc
C4, C6, C8-C10	10 μ F 25 V electro
R1	1 meg linear pot
R2	33k 1/4 W resistor
R3	10 meg linear pot
R4	1k 1/4 W resistor
R5, R6	120 ohms 1/4 W resistor
R7	1k 1/2 W resistor
D1-D3	1N914 or 1N4148 diode
D4	1N4001 diode
D5	4.7 V 1 W zener
D6	Red LED 20 mA
IC1	555 timer: SE555 or MC1455 chip
Q1	2N6788 power MOSFET
Q2	2N6849 power MOSFET
S1	SPST switch
F1	6 A fuse and holder

Note: D5 is used with regular NE555 or LM555 chip. If you use the SE555 or MC1455, omit D5 and put a jumper in its place. This is due to the higher voltage rating of these parts.

Table 1. Parts list.

The Cap'n Crunch LOWFER Loop

continued from page 12

between the loop and the receiver. There are many published designs of simple-to-construct, low-cost preamplifiers of the wideband type. Commercial types are available from suppliers at a moderate cost.

Final note: Remember that the Rx will have to be operated with "BFO On," except when you are listening to the AM broadcast stations. 73

THE DX FORUM

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Harrell, 2011 New High Shoals Road, Watkinsville GA 30677.

Questions can be forwarded to Tom N4XP, at [n4xp@juno.com] or Garry NI6T, at [ni6t@intuitive.com].

73, Steve KF2TI

Iron Chef DX - Total Master of DX Stadium 10 years running Many challenges, no defeats. Landing, NJ"

Back to Bhutan

This is also hot off the presses. It was provided via the Internet, and is contained in

the *Ohio/Penn DX Bulletin* #470. I am re-printing it here for the benefit of those who do not have access to the Internet. If you missed the previous A5 operations, you don't want to miss this.

"A5, BHUTAN. Gerard F2VX, President of the Clipperton DX Club (CDXC), reports that their project is now "on the road." They will fly from Paris to Bangkok/Timphu on September 1st and return on the 15th. The team consists of: Alain F6ANA, Denise F6HWU (YL), Alain F5LMJ, Vincent F5MBO/GØLMX, Christian FH/TU5AX, and Gerard F2VX. They will travel with five transceivers: 2 Kenwood TS50, 2 Icom IC706 and 1 Yaesu FT757. They have the authorization of the MOC to use one of the A52A antennas (a Cushcraft triband A3S). Also, they will have verticals and dipoles for the other bands and the WARC's. Power is still limited to 100 watts. They ask the DX community to help them with their project. Since the past 20 years, the CDXC has sponsored many international DXpeditions, for other DX Clubs from all around the world. They hope some clubs or associations could help them. The cost for this 'A5' activity with travel, staying in A5, and license, is around 23,000 F (or \$3400 USD) for each operator! The QSL manager will be F8RZ (Jean). All the team's members are members of both the Clipperton DX Club and REF-Union."

Many thanks to the folks at the *Ohio/Penn DX Bulletin* for condensing and relaying this great news item.

VK9C - Cocos Keeling DXpedition

I was recently informed that the DXpedition planned by VK6KZ and VK6HK is still on for October 21st through November 4th of this year. They are rumored to be focused on 6 meters, but will also be equipped to operate on 40 through 10 meters if the conditions on 6 are nothing to write home about. If anyone has more current information, please pass it on.

Pulling the big switch

So much for this month's offering. I look forward to hearing from all of you very soon, so ...

73 and good DX!

HOMING IN

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broadcast-band signals were trouncing a tight VHF receiver input.

Back to the roof

For RDF in the broadcast band, I used the pocket transistor radio and its ferrite rod antenna. Such sets are very directional when the rod is oriented horizontally. There are sharp signal nulls off the ends of the rod and broad peaks off the side. As I "sniffed" on the penthouse rooftop with the radio tuned to either 790 or 1390, the strongest signal wasn't coming from the direction of the radio stations' towers, but from the heavy guy wires of the giant Collins tower supporting the HF antenna.

The five guy wires coming down to the roof from the 50-foot mast holding the repeater antenna had very little AM-band RF on them. A sixth guy went from the top of the repeater mast to a spot about 10 feet up on the Collins tower (Fig. 1). What if that guy coupled RF between antenna supports? As an experiment, I disconnected it at the big tower attachment point, inserted an insulator, and re-installed it. The grunge was gone. It never came back.

A grunge hunt is often just like a hidden transmitter hunt, because you never know where you'll end up and you never know what you'll find. In this case, the two broadcast stations were not super-power (only 5 kW each) and not close (14 and 27 miles away). Nevertheless, long guy wires with AM-band resonances and a corroded connection or two were all that it took to create enough unintentional QRM to render a repeater nearly unusable. A similar situation could occur at your club's communication site. Prepare your gear and practice your RDF techniques so you'll be ready.

Have you used RDF to solve an interference problem on your repeater, either accidental or malicious? I'd like to hear about it. I also welcome stories and photos of your local hidden transmitter hunts, on foot or in cars. The E-mail and postal mail addresses are above.

Note

1. As described on pages 158-161 of *Transmitter Hunting—Radio Direction Finding Simplified* by Moell and Curlee, published by TAB/McGraw-Hill, ISBN number 007-1560068.

CALENDAR EVENTS

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demonstrations, VE exams. For VE info call N1JEO at (203) 235-6932. General admission is \$6, children under 12 \$3. This year the special guest speaker will be Wayne Green

W2NSD speaking on "The Day Kruschev Saved Amateur Radio." ARRL speakers include Betsy Doane K1EIC, CT Section Manager; and Tom Frenaye K1KI, New England ARRL Director. Information is available on the Web at [www.qsl.net/nutmeghamfest]. E-mail [nutmeghamfest@qsl.net]. Proceeds from the event will help support public service, scholarship and civic activities.

SPECIAL EVENTS, ETC.

SEPT 2-3

PLATTEVILLE, WI The Hidden Valleys ARC will operate as K9S (Canine Sheep) during the 15th annual national points Platteville Sheepdog Trial. The station will be on the air from 1500Z-2200Z Sept. 2nd and 3rd. Suggested frequencies are the General class portions of phone and CW bands, plus VHF. For a certificate, send a 9 x 12 SASE to HVARC, P.O. Box 112, Platteville WI 53818-0112.

SEPT 16

SLIDELL, LA In celebration of 36 years of community service and ham radio fun, the Ozone ARC will operate W5SLA Sept. 16th, 1300-2200 UTC. Frequencies: 14.250 ± QRM and 7.240 ± QRM. Contact Michael White, 404 Holmes Dr., Slidell LA 70460.

OCT 9-15

ATLANTIC CITY, NJ The Southern Counties ARA will operate K2BR from Oct. 9th at 1400 UTC to Oct. 15th at 0400 UTC, from the Miss America Pageant in Atlantic City NJ. Atlantic City is located on Absecon Island, which is IOTA NA111. Suggested frequencies for 10, 15, 20 and 40 meters: Phone — 28.325, 21.325, 14.250, and 7.250. CW — 28.030, 21.050, 14.050 and 7.050. QSL with a #10 SASE to SCARA, P.O. Box 121, Linwood NJ 08221.

ABOVE & BEYOND

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hand mic, and with the T-81A being four-band it was an antenna problem initially till I figured out that the multiband duplexers and triplexers will work in either direction. I could just as well have provided a rotary coax switch to feed a single 6 meter antenna on one switch position. The second position would be the high gain 2 meter and 3/4 meter gain antenna. Position three would be a 1.2 GHz antenna. Either way, be it a switch or triplexer, either will give you options that can be easily handled, especially with the

Continued on page 61

Check the Days After

The exact peak of any sunspot cycle cannot be accurately forecast, it can only be "postcast." Although we may be close to the peak of Cycle 23, the actual peak may be ahead of us or it may have already passed. Only careful measurements taken over a period of several months will be able to tell.

September is likely to show an improvement in HF radio propagation compared with the summer "doldrums" of June, July, and August, but September 10th through 20th are expected to be days during which the Earth's magnetic field (hence ionosphere) will be upset to active ... most likely due to solar flares and other activity on the sun.

Frequently, however, the days following the worst disturbances can often prove to

be among the best, so be sure to carefully check the 7th, 13th, and 19th, which may be such days.

General band-by-band forecast

10 and 12 meters

Fairly regular DX may be expected on Good (G) days to Europe and the East before noon, and to Africa shortly after noon.

most areas of the world, peaking to Europe before noon and to most other areas of the world during the afternoon; daytime short skip beyond 1,000 miles will be frequent.

20 meters

Excellent DX openings to most areas of the world are expected on Good (G) days from local sunrise until long after sunset. Peak conditions should occur an hour or two after sunrise and again in the late afternoon. On Good (G) days, DX into the southern hemisphere can be worked during the hours of darkness as well. Short skip from 500 to over 2,000 miles is anticipated on most days.

30 and 40 meters

These may be your best DX bands from local sunset until sunrise, when you can expect frequent openings and often strong signals into the southern hemisphere. Daytime short skip to about 1,000 miles is expected, and beyond 750 miles after dark.

80 and 160 meters

Worldwide DX can be expected from local sunset through the darkness hours on

Also, you may find good band openings to South America, the Pacific, and the southern hemisphere during the afternoon. Short skip between 1,000 and 2,000 miles during the day is anticipated for most days.

15 and 17 meters

You can look for excellent daytime DX to the southern hemisphere and to

EASTERN UNITED STATES TO:												
GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/12		20				17/20	20			15/17	10/12
AUSTRALIA	10/12	17/20	20	20	20	30/40	30/40	17/20				10/12
CENTRAL AM.	15/17	17/20	17/20	17/20	17/20	15/17	15/17	10/12	10/12	10/12	17/20	10/12
EUROPE	17/20	30/40	40/80	40/80	30/40			15/17	10/12	15/17	15/17	17/20
FAR EAST	10/12		17/20				17/20	17/20			15/17	10/12
HAWAII	10/12	12/15	17/20	17/20	20/30	20/30	17/20	17/20				10/12
INDIA	17/20	17/20						15/17				
MID-EAST	20	20	20						10/12	10/17	15/17	15/20
RUSSIA/C.I.S.	30/40	30/40	17/20	17/20				10/12	10/12	12/15	17/20	17/20
S.E. ASIA	15/17		17/20	17/20			17/20	15/17	10/12			15/17
SOUTH AFRICA	20/30	40	20/30	20/30					10/12	10/12	12/15	12/15
SOUTH AM.	15/17	15/17	20	30/40	30/40			10/12			12/15	12/15
WEST COAST	20/30	20/30	20/30	30/40	30/40			10/12	10/12	10/12	15/17	17/20
CENTRAL UNITED STATES TO:												
ALASKA	10/12	12/15	17/20	17/20	20		17/20	17/20				10/12
AUSTRALIA	10/12	15/17	15/17		17/20	20/30	30/40	17/20			12/15	10/12
CENTRAL AM.	15/17	15/17	17/20	17/20	20/30			10/12	15/17	10/12	10/12	10/12
EUROPE	30/40	30/40	30/40						12/15	12/15	17/20	17/20
FAR EAST	10/12	12/15	17/20	17/20	17/20		17/20	17/20				10/12
HAWAII	12/15	15/17	15/17	17/20	17/20	20/30	30/40	17/20		10/12	12/15	12/15
INDIA	15/17	17/20						12/15	12/15			
MID-EAST	20	20							15/17	15/17	15/17	
RUSSIA/C.I.S.								12/15	12/15	12/15	17/20	17/20
S.E. ASIA	10/12		15/20	17/20					10/12	10/12		
SOUTH AFRICA			17/20	17/20					12/15	12/15	15/17	17/20
SOUTH AM.	15/17	15/17	20/30	20/30	17/20			10/12			10/12	12/15
WESTERN UNITED STATES TO:												
ALASKA	10/12	10/12	15/17	17/20	17/20	17/20		17/20	17/20			15/17
AUSTRALIA	10/12	12/15	15/17	15/17	17/20	17/20	17/20		17/20			
CENTRAL AM.	10/12	12/15	15/17	17/20	30/40				10/12	10/12	10/12	12/15
EUROPE	17/20	17/20							15/17	15/17	17/20	17/20
FAR EAST	10/12	10/12	12/15	17/20	17/20	17/20			17/20			15/17
HAWAII	10/12	10/12	12/15	15/17	20/30	20/30	30/40		12/15	10/12		
INDIA		15/17	17/20						12/15	15/17		
MID-EAST	20									15/17	15/17	20
RUSSIA/C.I.S.	17/20				17/20			17/20	17/20	20	20	20
S.E. ASIA	10/12	10/12						17/20	15/17	17/20		
SOUTH AFRICA	17/20	20		20						10/12	12/15	12/15
SOUTH AM.	10/12	12/15	15/17	17/20	17/20						10/12	10/12
EAST COAST	20/30	20/30	30/40	30/40	30/40			10/12	12/15	12/15	15/17	17/20

September 2000

SUN	MON	TUE	WED	THU	FRI	SAT
					1 F	2 F
3 F	4 F	5 F-P	6 P	7 P-F	8 F	9 F
10 F-P	11 P	12 P	13 P-F	14 F-P	15 P	16 P
17 P-VP	18 VP-P	19 P-F	20 F-G	21 G	22 G	23 G
24 G	25 G-F	26 F	27 F-G	28 G	29 G	30 G

Good (G) nights, limited of course by thunderstorm static on some paths. Short skip at night will extend between 1,000 and 2,000 miles. 73

ABOVE & BEYOND

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small SMA coaxial connectors being used, making for a miniature installation.

Well, that's it for this month. I hope you have enjoyed my trip through my HT fantasy from early years to present. I highly recommend you take a good look at the Icom IC-T81. You will find it to be a great versatile multiband HT that is usable from 6 meters to 1200 MHz. 73, Chuck WB6IGP [clhough@pacbell.net]. 73

ON THE GO

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hand, state and local agencies are very budget-oriented so explaining our service in terms they can understand makes all the sense in the world. Are we charging for our services (i.e., is there a cost?)? NO! Does this provide a significant benefit (i.e., is there a value?)? ABSOLUTELY! Should we as hams understand this? I certainly think so.

This value is the reason that we get the benefits we do. The federal, state, and local governments need to see the value we are providing in terms that fit their needs. I strongly recommend that we continue to report the value of our services in a form that our supported agencies can understand. Without this, we are just another hobby. Now, if we could just convince some of our brother and sister hams of the logic in this, we'd be much better off. Let's make sure that each of us is an ambassador for amateur radio rather than a destructive critic of it. 73

QRX

continued from page 6

- When your dad is mad and asks you, "Do I look stupid?", don't answer him. Heather, 16.
- Never tell your mom her diet's not working. Michael, 14.
- Don't pick on your sister when she's holding a baseball bat. Joel, 12.
- When you get a bad grade in school, show it to your mom when she's on the phone. Alyesha, 13.
- Never try to baptize a cat. Laura, 13.
- Never spit when on a roller-coaster. Scott, 11.
- Never do pranks at a police station. Sam, 10.

• Beware of cafeteria food when it looks like it's moving. Rob, 10.

• Never tell your little brother that you're not going to do what your mom told you to do. Hank, 12.

• Remember, you're never too old to hold your father's hand. Molly, 11.

• Listen to your brain. It has lots of information. Chelsey, 7.

• Stay away from prunes. Randy, 9.

• Never dare your little brother to paint the family car. Phillip, 13.

• Forget the cake, go for the icing. Cynthia, 8.

• Remember the two places you are always welcome — church and grandma's house. Joanne, 11.

Thanks to A Joke A Day, via ARNS Bulletin, January 1999.

Electromagnetic Fields and Suicide

Researchers from the University of North Carolina report that electric utility workers appear to commit suicide at a higher than average rate. As recounted in the March 15th issue of the *Journal of Occupational and Environmental Medicine*, a study of about 10,000 workers routinely exposed to low frequency electromagnetic fields shows that this group commits suicide twice as often as non-utility workers. The contrast was most evident in younger workers.

While the researchers suspect that electromagnetic radiation affects the production or metabolism of melatonin, that theory is not shared by others — in part, because no other information on other aspects of the physical condition of the study participants was made known.

Thanks to published news reports, via Newsline, Bill Pasternak WA6ITF, editor. 73

NEVER SAY DIE

continued from page 8

and, as you know, you can't fool Mother Nature.

My mother was more enlightened in many ways than others, but she sure messed up on languages. So I had a terrible time in high school struggling to learn enough French so a college would accept me. Well, that was before I knew what a rip off colleges were. And are. My mother fed me right. No sugar, no white bread. No cold cereals. No jam or jellies, no soda pop. It wasn't until I went to church choir camp one summer that I was introduced to white bread and strawberry jam. The result was that I had perfect teeth until I joined the Navy. Three years later I had my first filling.

Play lots of kinds of music for your babies. They particularly enjoy strong rhythmic beats such as you have with Latin music: tango, salsa, cha cha, bolero, beguine, rumba, mambo, samba, lambada, bossa

nova, paso doble, and also the polka, peabody, and waltz. Who knows, with the added brainpower they'll build, and their love of music, you could end up with a musical child prodigy. The world sure could use some of those.

Ka-Boom

We've gotten so used to the stock market continuing its upward movement that the bears are hibernating. I'm going to poke them with a pointed stick.

The standards, for many years, for determining the value of stocks has been the price-to-book-value-ratio, the price-earnings ratio, or the dividend yield. By any of these measures the stock market today is overvalued by about 50%. Any move to return to fundamentals could trigger a disaster.

Today, with over half of American households investing in the market, a big drop in stock prices would quickly trigger the public to cut spending. A 30% drop in the market would make Americans \$5 trillion poorer. And historically that would reduce spending by about \$250 billion, impacting corporate investment, the real estate market, and almost every business.

With many investors buying stock on margin, any significant downward drop in stock prices forces brokers to call their customers for more margin money. Lacking a fast cash response to the margin call, the broker has to sell the stock for whatever he can get for it. This, naturally, speeds a stock's downward plunge. That's what happened in 1929, when many investors had borrowed up to 90% on margin. All it took was a 10% drop in the market and they were wiped out.

What could trigger such a plunge? Well, we're spending about \$30 billion a month more on imports than we're getting back from our exports, so we've been making up the difference by selling American assets, bank CDs, stocks, and Treasury bonds. This is fine as long as the foreign lenders think they'll do better with their investments here. It wouldn't take a lot to have them decide to sell, driving down the value of the dollar. This is what happened in Southeast Asia a couple years ago, and it triggered a deep recession.

If anything happens to burst our growth bubble, the spending boom will end and we'll be in a heap of trouble.

Emancipation

The word means to free from bondage, oppression, or authority. Set free. Liberation.

A little over two hundred years ago the thirteen colonies got fed up with the increasingly lousy deal England was handing them and we had a revolution. Tens of thousands of the colonists gave their lives to gain this freedom from exploitation by the British.

A new kind of country was established. One for the people and by the people. And this worked pretty well for the next hundred

years. But, in the last hundred years we've seen our freedoms gradually taken away and our lives controlled increasingly by a government vastly beyond anything envisioned by the men who established the country. Further, we see this government today being controlled, in turn by secret government agencies and big business.

Ten years ago I was asked by Governor Gregg to serve on an Economic Development Commission, a group which he hoped would help steer New Hampshire out of the worst recession it had experienced in decades. Unfortunately, the Commission was made up of both businessmen and politicians, and the politicians naturally took control of it, making sure that the Commission would not upset any gravy trains.

I refused to be blocked, preparing reports on the problems we'd investigated during a year of subcommittee work and proposing practical solutions to the Commission members. The businessmen members, seeing the political handwriting on the wall, bailed out of the Commission, which eventually disappeared without ever submitting a report to the governor and the Legislature.

I hated to see all that work be wasted, so I reprinted my reports in a 360-page book, *We The People Hereby Declare War on Our Lousy Government*. The 5,000 copies I printed sold out, but with no noticeable effect.

I reported on how seriously flawed our mandatory public school system was, and showed proven ways it could be enormously improved, while costing less than half as much to run. I showed how New Hampshire tourism, our largest industry, could easily be doubled. I showed how we could cut the cost of our prisons by up to 90% and end up with a far more effective prison system. And so on.

So here we are today, in the year 2000, a nation of sheep. We endure taxes of over 60% of our wages. We endure a union-controlled public school system which is teaching our kids less than any other developed country, and which has been purposely designed to make sure we don't have the guts to change it. We endure fluoridation of our water, which is also aimed at making us docile. We endure police forces out of control, government bureaus such as the BTF, which kill protesters. We are under constant surveillance by the NSA, which checks our every phone call, every fax, and every email. We endure the CIA killing heads of state of foreign countries. We know Congress has stolen every dollar of our hard earned Social Security money. Unless we are truly asleep we know that we're being manipulated by the media with one pathetic drama after another (Monica, Elián), none of any great significance to our lives.

If you've bothered to read *any* of the books I've reviewed in my editorials, which I've reprinted in my *Secret Guide to*

Wisdom, you know that our medical industry is crooked clear through.

Crooked? Studies show that there are over 2.4 million unnecessary operations a year, and that about 12,000 people die from these. We know that 400,000 balloon angioplasties were performed last year, though there's no proof whatever that these painful and dangerous operations are more effective than non-surgical therapy. We know that 70% of mammograms are incorrect, and that over 90% of the ultrasounds on pregnant women are not necessary, and worse, can cause permanent damage to the baby. We know that most of the hysterectomies are unnecessary. We know that the drugs used to treat arthritis have little or no effect on the patient, and that 60% of impotence is caused by prescribed drugs and that, despite billions being spent, no progress has been made in dealing with either cancer or heart disease. Please, just read the books I've reviewed on the subject and see what a patsy you and your family have been.

Step one is to break out of your protective shell of ignorance and educate yourself. Step two is to start getting your friends interested in educating themselves. Step three is to stop re-electing your crooks to Congress.

The "system" depends on everyone being a sheep, eating the food from our giant corporations and then going to the doctor when they get sick. We're dutifully and unquestioningly working at jobs with no future, and of little real meaning. We're sacrificing 30 to 60 years of potentially vibrantly healthy life and the freedom to do what we want, when we want. If I said, hey, drop everything and come with me to Chile in a couple of weeks, you'd have to say you couldn't get away from the job, and besides, you couldn't possibly afford it. This is freedom?

I'm calling for emancipation.

Puff-Puff

Just in case you, or someone you know, is still addicted to cigarettes, I thought I'd pass along a report from the British Journal of Neurology linking intellectual impairment in later life with smoking. Smoke and get even dumber, is what they're saying. And the decline in mental powers they measured was not trivial, it was quite significant.

With all the scientific evidence showing the damage smoking does, today it is an act of monumental stupidity for a kid to take up an expensive, life-long drug addiction to smoking cigars or cigarettes. Dumb and dumber.

PC Survivors

In cleaning out my old files I ran across the January 1983 issue of *Time* with the Machine of the Year on the cover. Lordy, that was 17 years ago! They had a nice article on Steve Jobs, but the rest of the cast

is where now? Ed Roberts, who started all this with his Altair 8800, is now a doctor. So, what happened to Jack Tramiel and his Commodore computers? Adam Osborne? Clive Sinclair? David Ahl? Bill Godbout? George Morrow? What ever happened to Gary Killdall and his CPM operating system? Heck, what happened to Wayne Green and *Byte*, *80-Micro*, *Microcomputing*, *Run*, *InCider*, *Hot Cocoa*, and *Desktop Computing*?

Well, the PC has revolutionized everything, far beyond what *Time* predicted, even if most of the pioneers have disappeared into the mist.

Syzygy

That's the time of the new or full Moon, and that's connected with earthquakes.

In case you believe that some people aren't able to accurately predict earthquakes, just because the experts can't, let me enlighten you. For instance, there's Clarisa Bernhardt who, on November 25th, 1974, predicted on a Los Gatos FM station that there would be a 5M quake for the Bay Area on Thanksgiving Day at 3 pm. At 3:01 they had a 5.2M quake in the area, the strongest in the area in five years.

Dogs, cats and other animals seem somehow to be aware that a quake is coming, even if the experts aren't. You've probably read about the guy who noticed that just before a quake there would be a great increase in lost pet ads in the papers.

You can learn a lot more about this field by reading the earthquake newsletter, *Syzygy*. Send a SASE for a sample copy to *Syzygy*, Box 1926, Glen Ellen CA 95442. And check out www.syzygyjob.com. The job stands for James O. Berkland, the editor.

21st Century

All those know-nothings who've been braying about the 21st century starting next year are full of barn dust. They haven't, as usual, done their homework. Well, I have.

Our year numbers didn't even get started until 525 AD, when Dionysius Exiguus estimated Christ's birth, missing it by about seven years. Well, that was before calendars and computers, so he did pretty well. The year 1 AD immediately followed 1 BC. Remember that Roman Numerals have no zero, so there was no year zero. For that matter, there were no centuries until the fifth. This, right now, really is the 21st century. Get used to it.

Band Scan Project

As if we aren't causing the FCC enough aggravation by bickering over the recent rule changes, along come two Texas hams petitioning for more phone spectrum in our ham bands. They want to cut the CW bands by 50%. Well, of course, it's about damned time, in my humble opinion

Continued on page 64

Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

.....Wayne

The Bioelectrifier Handbook: This explains how to build or buy (\$155) a little electrical gadget that can help clean the blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. The circuit can be built for under \$20 from the instructions in the book. \$10 (#01)

The Secret Guide to Wisdom: This is a review of around a hundred books that will help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. \$5 (#02)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. \$5 (#03)

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some difficult lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products. \$5 (#04)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story? If you're near Mobile, please visit the Drum. \$5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories - where I

visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. \$5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. \$5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: \$10 (#22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. \$2 (#24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut its expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy any taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. \$5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. In this book I explain about the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack? I'm getting ready, how about you? \$5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the videos, looked carefully at the photos, read the astronaut's biographies, and talked with some of my readers who worked for NASA. This book cites 25 good reasons I believe the whole Apollo program had to have been faked. \$5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is

what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! \$5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields. \$3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. \$5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

One Hour CW: Using this sneaky booklet even you can learn the Morse Code in one hour and pass that dumb 5wpm HF entry test. \$5 (#40)

Code Tape (T5): This tape will teach you the letters, numbers and punctuation you need to know if you are going on to learn the code at 13 or 20 wpm. \$5 (#41)

Code Tape (T13): Once you know the code for the letters (#41) you can go immediately to copying 13 wpm (using my system). This should only take a couple of days. \$5 (#42)

Code Tape (T20): Or, you can start right out at 20 wpm and master it in a weekend. \$5 (#43)

Wayne Un-Dayton Talk: This is a 90-minute tape of the talk I'd have given at the Dayton, if invited. \$5 (#50)

Wayne Tampa Talk: This is the talk I gave at the Tampa Global Sciences conference—where I cover amateur radio, cold fusion, health, books you should read, and so on. \$5 (#51)

\$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. \$40 (#52)

Reprints of My Editorials from 73. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system, our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

1996 Editorials: 120 pages, 100 choice editorials. \$10 (#72)

1997 Editorials: 148 fun-packed pages, 216 editorials. \$10 (#74)

1998 Editorials: 168 pages that'll give you lots of controversial things to talk about on the air. \$10 (#75)

1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. \$10 (#76)

2000 Editorials: In the works.

Silver Wire: With two 3" pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. \$15 (#80)

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. \$5 (#83)

NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with much better, yet lower cost schools, zero state taxes, far better health care, a more responsive state government, etc. \$1 (#85)

Stuff I didn't write, but you need:
NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. \$25 (#90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs - such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. \$25 (#91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. \$35 (#92)

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Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial!) ads and \$1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham 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: 73 Magazine, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the December 2000 classified ad section is October 10, 2000.

President Clinton probably doesn't have a copy of *Tormet's Electronics Bench Reference* but you should. Check it out at [www.ohio.net/~rtormet/index.htm]
—over 100 pages of circuits, tables, RF design information, sources, etc. BNB530

TELEGRAPH COLLECTOR'S PRICE GUIDE: 250 pictures/prices. \$12 postpaid. **ARTIFAX BOOKS**, Box 88, Maynard MA 01754. Telegraph Museum: [<http://wltp.com>]. BNB113

Great New Reference Manual with over 100 pgs of P/S, transistor, radio, op-amp, antenna designs, coil winding tables, etc. See details at [www.ohio.net/~rtormet/index.htm] or send check or M.O. for \$19.95 + \$2.00 P&H to RMT Engineering, 6863 Buffham Rd., Seville OH 44273. BNB202

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Wanted COLLINS S-LINE Pristine (RE) 32S3-A, 75S3-C, 516F2, 312B4, 30L1, or 30S1 and SM-3. Willing to pay top dollar for the station I have wanted since age 13. 1-512-925-3907 (cell), 1-888-917-9077(home), toll free residential, willbryant@aol.com WA5JUL Bill Bryant. **THIS STATION IS FOR PERSONAL USE, NOT FOR RESALE!** BNB700

ROHN TOWERS HUGE DISCOUNTS CHECK PRICES AT HILLRADIO.NET BNB600

NEVER SAY DIE

continued from page 62

(Wayne, humble? Har-de-har!). Well, if you've been reading my editorials for long you know that I tend to keep my opinions to myself and it takes wild horses to drag them out. There are a lot of wild horses around, apparently.

But, let's not allow any bias on my part, or that of two Texas hams, get involved with this ridiculously long overdue reduction of the CW bands. So, here's what I propose—and you're going to like this because you'll be able to do it while sitting on your (fat?) ass. There I go, getting insulting, just because I was able to de-blind myself 28 years ago I figure anyone should be able to. I was fa-a-at.

Okay, here's the program. I want you to take the time to slowly tune every one of the ham bands at least once a day, counting the number of signals you hear. How many CW. How many phone. How many something else.

Send me your counts, showing the date, time and band you counted, and I'll put the info into my trust iMac and we'll see how well we've apportioned the spectrum for CW vs phone as of 2000. And that'll give the FCC some solid data to work with.

Send your surveys to Ham Band Scan, Box 360, Hancock NH 03449.

"Brick-Wall" Selectivity

Today's elite-class operators demand the best RF weaponry available. Yaesu's exciting new MARK-V FT-1000MP answers the call, with an expanded array of receiver filtering, 200 Watts of power output, and Class-A SSB operation capability for the cleanest signal on the band. Enhanced front-panel ergonomics save you seconds in a pile-up or a contest "run," and Yaesu's HF design and manufacturing know-how ensures that no short-cuts have been taken in our effort to bring you the best HF transceiver money can buy. For more QSOs in your log, and more awards on your wall, there is only one choice: the MARK-V FT-1000MP from Yaesu!

I. IDBT: Interlocked Digital Bandwidth Tracking System

The IDBT feature greatly simplifies operation by matching the bandwidth of the DSP (Digital Signal Processing) system to the net bandwidth of the 8.2 MHz and 455 kHz IF stages. The IDBT system accounts for the settings of the IF WIDTH and SHIFT controls, and automatically sets a DSP bandwidth which matches the analog IF bandwidth.



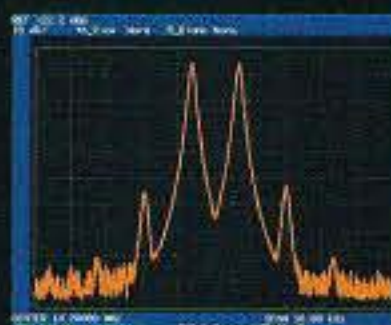
IDBT: A Breakthrough in Selectivity!

II. VRF: Variable RF Front-End Filter

Protecting the MARK-V's receiver components from strong out-of-band signals, the VRF system acts as a high-Q "Preselector," located between the antenna and the main bandpass filter networks, providing additional RF selectivity on the 160-20 meter Amateur bands for multi-operator contest teams, DX-peditions, or for operation near MW/SW broadcast stations.

III. 200 Watts of Transmitter Power Output

Utilizing two Philips® BLF147 Power MOSFETs in a 30-Volt, push-pull configuration, the MARK-V's transmitter puts out up to 200 Watts of clean output power, thanks to the conservative design of the PA section.



Class A 75 W PEP IMD

IV. Class-A SSB Operation

Exclusively available on the MARK-V FT-1000MP, a press of a front-panel button engages Class-A SSB operation of the transmitter, at a power output level of 75 Watts. Class-A operation produces incredibly clean signal quality, with 3rd-order IMD suppressed 50 dB or more, and 5th- and higher-order products typically down 80 dB or more!

V. Multi-Function Shuttle Jog Tuning/Control Ring

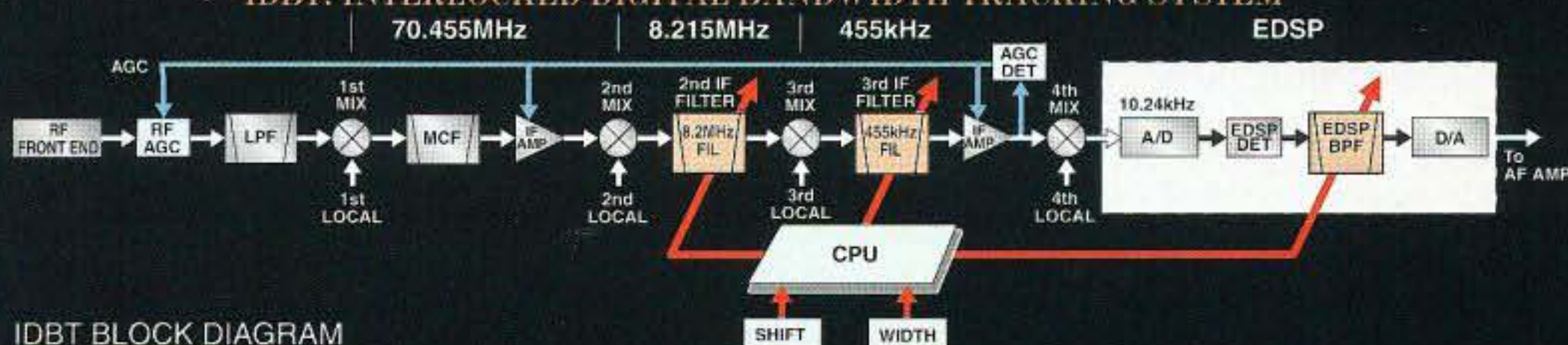
The immensely-popular Shuttle Jog tuning ring, which is concentric with the Main Tuning Knob, has a new look in the MARK-V: it now includes the activation switches for the VRF (left side) and IDBT (right side) features, so you don't have to move your hand position to activate these important circuits during contest or pile-up situations!



HF 200 W All-Mode Transceiver

MARK-V FT-1000MP

IDBT: INTERLOCKED DIGITAL BANDWIDTH TRACKING SYSTEM



IDBT BLOCK DIAGRAM



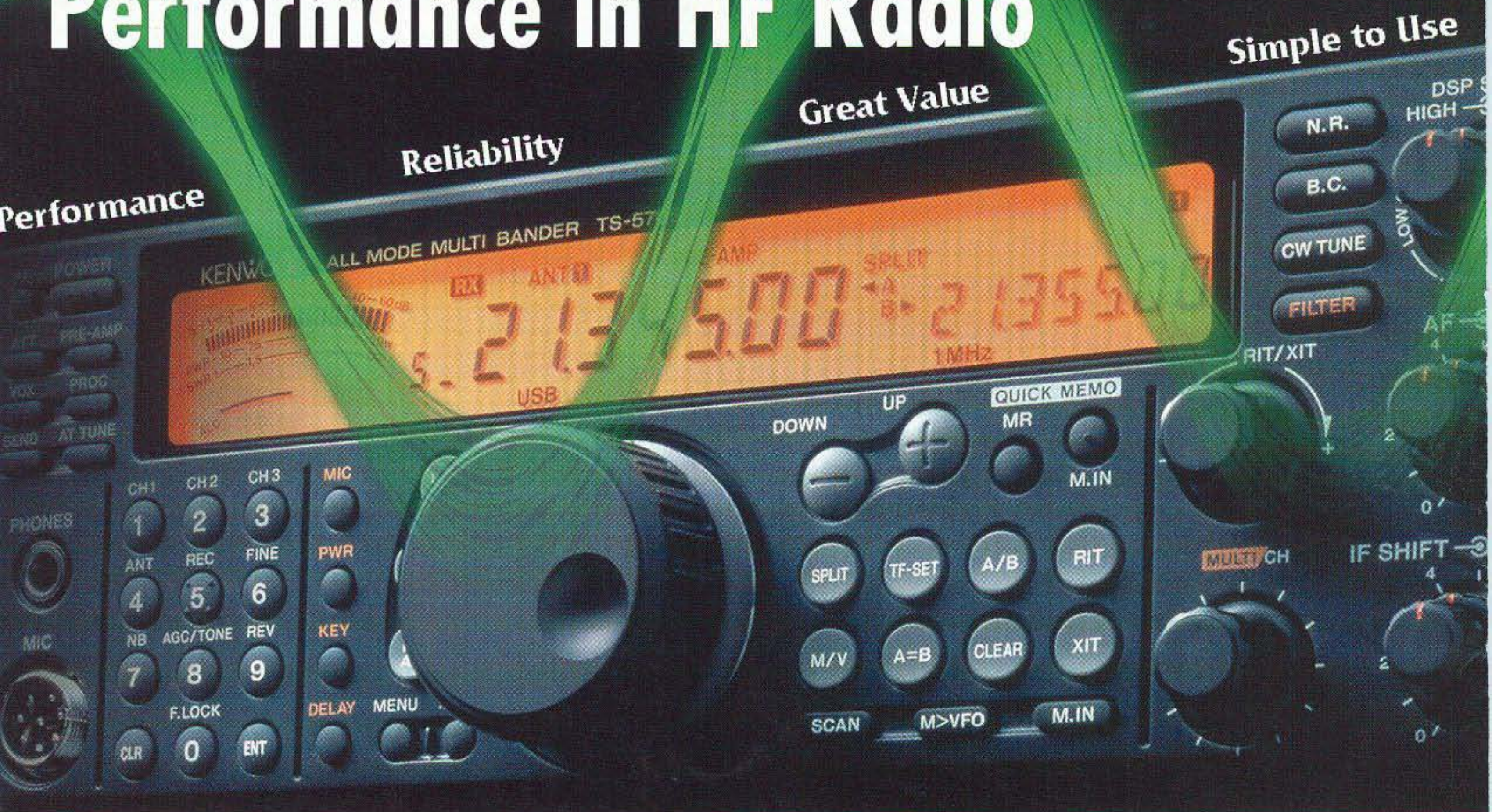
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TS-570D(G) HF TRANSCEIVER/TS-570S(G) HF + 6M TRANSCEIVER

Kenwood has not been standing still since the introduction of the TS-570D/S HF Transceiver last year. Now you can command even more of Kenwood's advanced DSP technology with the G model.

The **DSP** filters and extracts signals with digital technology that is unmatched with standard analog circuits. It provides **CD-class transmit and receive audio quality** that can be shaped to your needs, and two powerful noise reduction systems: **Line Enhancer Method** for SSB/AM modes, and **Speech Processing by Auto Correlation (SPAC)** for CW mode. DSP also enables the **CW-Auto Tune** feature that automatically zero-beats CW signals.

The **Extensive Memory Functions** provide a bank of 100 memory positions split into 90 standard channels for general operation and 10 for programmable VFO, programmable scan and long-term memory. Memory contents can be scrolled, copied or locked out. In addition there are **5 quick memories** for storing frequencies and modes on the fly, perfect for the busy DX contest.

The powerful **Menu System** incorporates **46 menu features** and an **on-line guide** for instant reference. The **large amber backlit LCD display** provides 4 light levels for clear readability under any lighting conditions.

The TS-570D/S has no shortcomings in the construction and performance area. The **continuous-duty 100 watt transmitter** incorporates a large

heavy-duty heat sink with integrated cooling fan for non-stop operation even under extreme environmental conditions. The **wide-band receiver** is rock-stable from 500 kHz through 30 MHz with **dual pre-amps** and **dual bandpass filters** for exceptional selectivity and sensitivity.

With the features and performance of a high-end radio integrated into an affordable mobile-size package, the TS-570D/S is the perfect choice for the field or to build a full station around at home.

- ▶ **FREE operating manual via FTP site**
<ftp://ftp.kenwood.net>
- ▶ Beat cancel
- ▶ 2 position antenna switch
- ▶ CW auto tune adjust (a world's first)
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- ▶ Compact 10-5/8 inch by 3-3/4 inch front panel size for any travel or installation requirement
- ▶ Preset auto antenna tuner with 18 sub-bands
- ▶ Variable electronic keyer (0 and 100 wpm)
- ▶ Packet and FSK features
- ▶ RCP-2 software for PC-based display and memory configurations available via the Internet
- ▶ Full functionality on 6M (TS-570S) including DSP, 100 watts output and preset Auto Antenna Tuner

TS-570D/S (G) new features

- ▶ **TX sound quality monitor** with 9-step monitor volume for absolute control over voice quality
- ▶ **NR1 (SSB)** is operator controllable in 9-step increments, or automatically tracks input signal strength
- ▶ **New CW DSP Filters** (80 Hz, 150 Hz and 500 Hz) give you a total of 11 user-selectable filters
- ▶ **NR1 and NR2 settings** can now re-configure automatically when changing mode groups (SSB/AM/FM to CW/FSK)
- ▶ **Manual weight feature** (with built-in electronic keyer) for adjusting the relative length of dots and dashes in 16 steps between 1:2.5 and 1:4.0
- ▶ **Equalize receive signals**, and use different settings for both TX and RX
- ▶ **"One-touch" DSP filter wide mode** allows 'resurfacing' to check the band conditions when operating in narrow mode
- ▶ **Dual selectable Beat Cancel (BC)** works against intermittent beat interference (except in CW mode)
- ▶ **CW auto tune mode** links only with the RIT frequency without changing the transmit frequency.

Advance Technology Upgrade is available in new production models and for pre-existing TS-570D/S; contact your dealer for details.



**ISO 9001
JQA-1205**

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