73® Amateur Radio Today

OCTOBER 1998
ISSUE #457
US $3.95
CANADA $4.95

International Edition

Reviews:

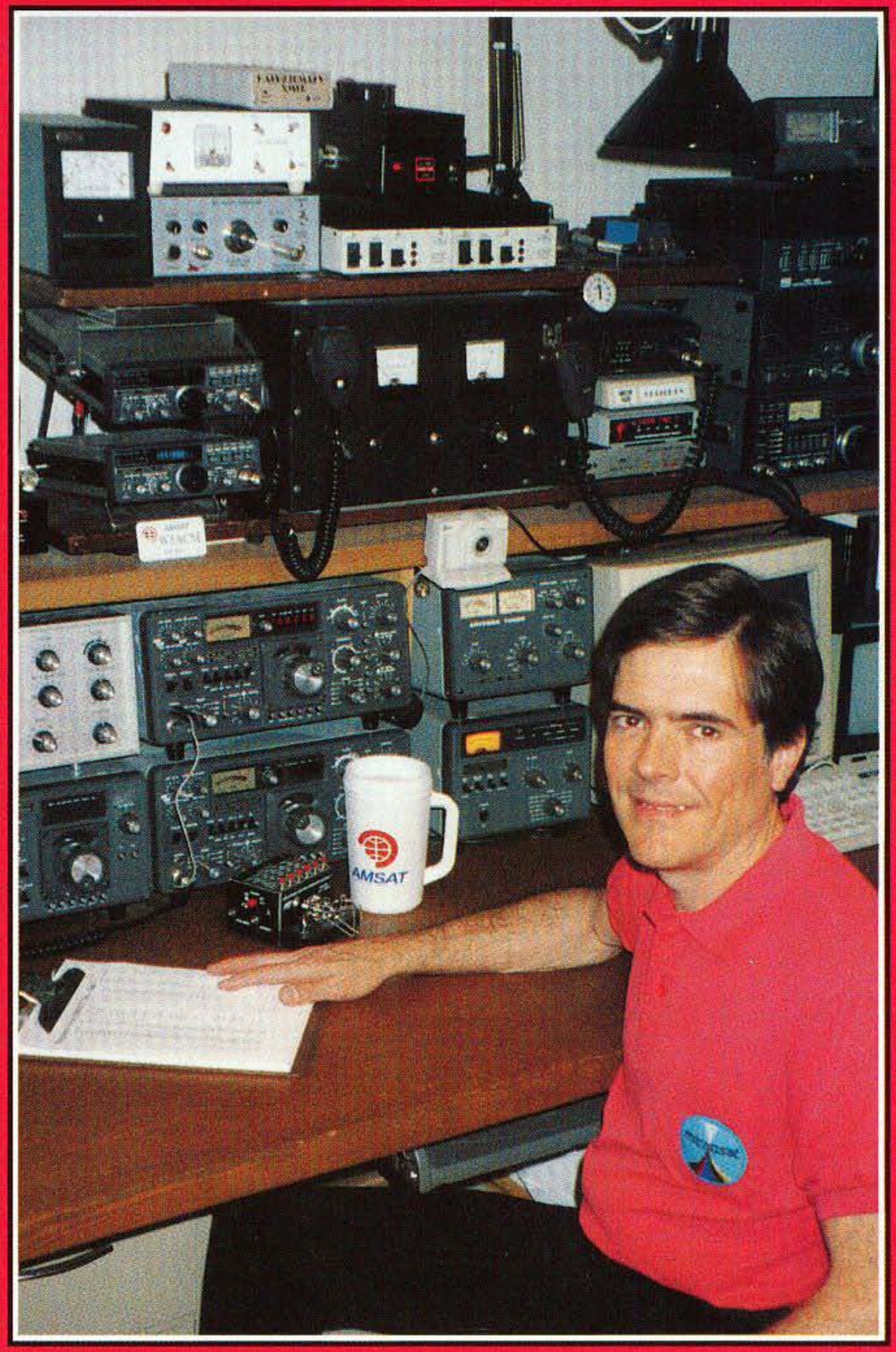
MFJ's Linear Protector

Scratch That Itch With The Embedded TiCK

Theory:

Matching Networks

Superhets Exposed



Andy MacAllister W5ACM

The VK-ZL All-Ham RV Tour

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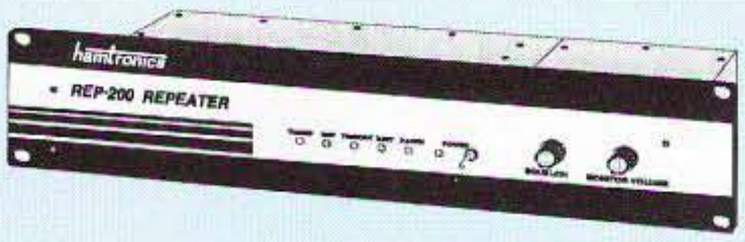
0 74851 08725 1

Get more features for your dollar with our

REP-200 REPEATER

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



- ***kit still only $1095***
- ***factory assembled still only $1295***

50-54, 143-174, 213-233, 420-475 MHz. (902-928 MHz slightly higher.)

☞ **FCC type accepted** for commercial service in 150 & 450 MHz bands.

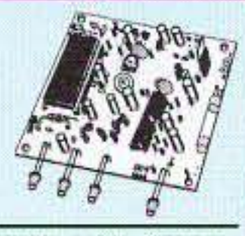
Digital Voice Recorder Option. Allows message up to 20 sec. to be remotely recorded off the air. Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!** ..... **only $100.**

REP-200C Economy Repeater. Real-voice ID, no dtmf or autopatch. ..... Kit only $795, w&t $1195.

REP-200N Repeater. Without controller so you can use your own. ..... **Kit only $695, w&t $995.**

You'll KICK Yourself
If You Build a Repeater
Without Checking Out Our Catalog First!

Hamtronics has the world's most complete line of modules for making repeaters. In addition to exciters, pa's, and receivers, we offer the following controllers.



COR-3. Inexpensive, flexible COR module with timers, courtesy beep, audio mixer. ..... **only $49/kit, $79 w/t.**

CWID. Traditional diode matrix ID'er. ..... **kit only $59.**

CWID-2. Eprom-controlled ID'er. ..... **only $54/kit, $79 w/t.**

DVR-1. Record your own voice up to 20 sec. For voice id or playing club announcements. ..... **$59/kit, $99 w/t.**

COR-4. Complete COR and CWID all on one board. ID in eprom. Low power CMOS. ..... **only $99/kit, $149 w/t.**

COR-6. COR with real-voice id. Low power CMOS, non-volatile memory. ..... **kit only $99, w/t only $149.**

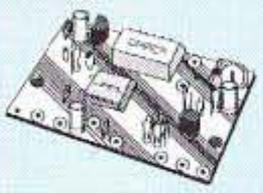
COR-5. µP controller with autopatch, reverse ap, phone remote control, lots of DTMF control functions, all on one board, as used in REP-200 Repeater. ..... **$379 w/t.**

AP-3. Repeater autopatch, reverse autopatch, phone line remote control. Use with TD-2. ..... **kit $89.**

TD-2. Four-digit DTMF decoder/controller. Five latching on-off functions, toll call restrictor. ..... **kit $79.**

TD-4. DTMF controller as above except one on-off function and no toll call restrictor. Can also use for selective calling; mute speaker until someone pages you. ..... **kit $49.**

SUBAUDIBLE TONE ENCODER/DECODER



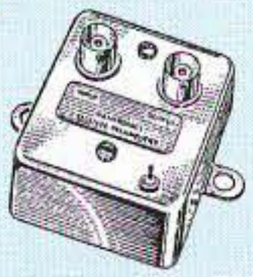
Access all your favorite closed repeaters!

- **Encodes** all standard CTCSS tones with crystal accuracy and convenient DIP switch selection.
- Comprehensive manual also shows how you can set up a front panel switch to select tones for several repeaters.
- **Decoder** can be used to mute receive audio and is optimized for installation in repeaters to provide closed access. High pass filter gets rid of annoying buzz in receiver. ☺ **New low prices!**
- **TD-5** CTCSS Encoder/Decoder Kit ..... now only **$29**
- **TD-5** CTCSS Encoder/Decoder Wired/tested **$49**

LOW NOISE RECEIVER PREAMPS

LNG-( ) GaAs FET PREAMP

STILL ONLY $59, wired/tested



- Make your friends sick with envy! Work stations they don't even know are there.
- Install one at the antenna and overcome coax losses.
- *Available for 28-30, 46-56, 137-152, 152-172, 210-230, 400-470, and 800-960 MHz bands.*

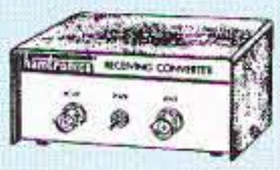
LNW-( ) ECONOMY PREAMP

ONLY $24/kit

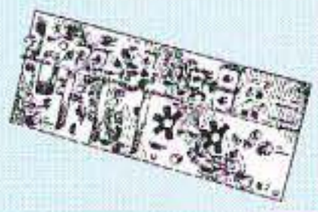
- Miniature MOSFET Preamp
- Solder terminals allow easy connection inside radios.
- *Available for 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, and 400-500 MHz bands.*

TRANSMITTING & RECEIVING CONVERTERS

No need to spend thousands on new transceivers for each band!



- Convert vhf and uhf signals to & from 10M.
- Even if you don't have a 10M rig, you can pick up very good used xmtrs & rcvrs for next to nothing.
- Receiving converters (shown above) available for various segments of 6M, 2M, 220, and 432 MHz.
- Rcvg Conv Kits from $49, wired/tested units only $99.



- Transmitting converters for 2M, 432 MHz.
- Kits only $89 vhf or $99 uhf.
- Power amplifiers up to 50W output.

WEATHER ALERT RECEIVER

A sensitive and selective professional grade receiver to monitor critical NOAA weather broadcasts. Good reception even at distances of 70 miles or more with suitable antenna. No comparison with ordinary consumer radios!

Automatic mode provides storm watch, alerting you by unmuting receiver and providing an output to trip remote equipment when an alert tone is broadcast. Crystal controlled for accuracy; **all 7 channels** (162.40 to 162.55).

Buy just the receiver pcb module in kit form or buy the kit with an attractive metal cabinet, AC power adapter, and built-in speaker. Also available factory wired and tested.

RWX Rcvr kit, PCB only $79

RWX Rcvr kit with cabinet, speaker, & AC adapter $99

RWX Rcvr wired/tested in cabinet with speaker & adapter $139

WEATHER FAX RECEIVER

Join the fun. Get striking images directly from the weather satellites!

A very sensitive wideband fm receiver **optimized for NOAA** APT & Russian Meteor **weather fax** on the 137MHz band.

Designed from the start for optimum satellite reception; not just an off-the-shelf scanner with a shorted-out IF filter!

Covers all 5 satellite channels. Scanner circuit & recorder control allow you to automatically capture signals as satellites pass overhead, even while away from home.

- **R139 Receiver Kit** less case $159
- **R139 Receiver Kit** with case and AC power adapter $189
- **R139 Receiver w/t** in case with AC power adapter ...$239
- Internal PC Demodulator Board & Imaging Software $289
- Turnstile Antenna $119
- Weather Satellite Handbook $20

SYNTHESIZED FM EXCITER & RECEIVER MODULES

NEW

We recently introduced new vhf fm exciters and receivers which do not require channel crystals.
NOW... uhf modules are also available!

Exciters and Receivers provide high quality nbfm and fsk operation. Features include:

- ***Dip switch frequency selection.***
- ***Exceptional modulation for voice and ctcss.***
- ***Very low noise synthesizer for repeater service.***
- ***Direct fm for data up to 9600 baud.***
- ***TCXO for tight frequency accuracy in wide range of environmental conditions.***
- ***Next day shipping. No wait for crystals.***

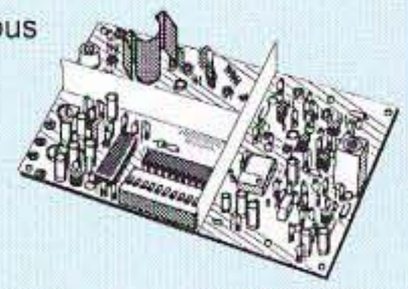
EXCITERS:

Rated for continuous duty, 2-3W output.

T301 VHF Exciter: for various bands 139-174MHz*, 216-226 MHz.

- Kit (ham bands only) ...**$109** (TCXO option $40)
- Wired/tested, incl TCXO...**$189**

T304 UHF Exciter: various bands 400-470 MHz*.



- Kit (440-450 ham band only) incl TCXO ...**$149**
- Wired/tested...**$189**

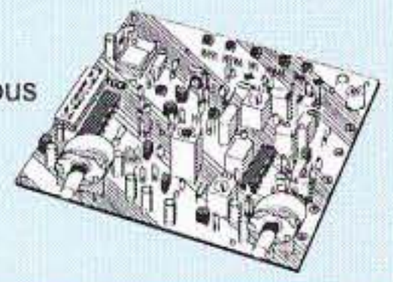
* for gov't & export use.

RECEIVERS:

R301 VHF Receiver: various bands 139-174MHz*, 216-226 MHz.

- **Kit** (ham bands only) ...**only $139** (TCXO option $40)
- **Wired/tested** ...**$209** (includes TCXO)

R304 UHF Receiver: various bands 400-470 MHz*.



- Kit (440-450 ham band only) incl TCXO ...**$179**
- Wired/tested...**$209**

TRADITIONAL CRYSTAL-CONTROLLED VHF & UHF FM EXCITERS & RECEIVERS

FM EXCITERS: 2W output, continuous duty.

- **TA51:** for 6M, 2M, 220 MHz ..... **kit $99, w/t $169**
- **TA451:** for 420-475 MHz. ..... **kit $99, w/t $169**
- **TA901:** for 902-928 MHz, (0.5W out) ..... **w/t $169**

VHF & UHF POWER AMPLIFIERS.

Output levels from 10W to 100W..... **Starting at $99**

FM RECEIVERS:

Very sensitive – 0.15µV. **Superb selectivity,** >100 dB down at ±12 kHz, best available anywhere, flutter-proof squelch. For 46-54, 72-76, 140-175, or 216-225 MHz. ... **kit $129, w/t $189**

- **R144 RCVR.** Like R100, for 2M, with helical resonator in front end..... **kit $159, w/t $219**
- **R451 FM RCVR,** for 420-475 MHz. Similar to R100 above. kit $129, w/t $189.
- **R901 FM RCVR,** 902-928MHz ..... **$159, w/t $219**

WWV RECEIVER

Get time & frequency checks without buying multiband hf rcvr. Hear solar activity reports affecting radio propagation. **Very sensitive and selective** crystal controlled superhet, dedicated to listening to WWV on 10 MHz. Performance rivals the most expensive rcvrs.

- **RWWV Rcvr** kit, PCB only $59
- **RWWV Rcvr** kit with cabt, spkr, & 12Vdc adapter $89
- **RWWV Rcvr** w/t in cabt with spkr & adapter $129

Buy at low, factory-direct net prices and save!
For complete info, call or write for complete catalog.
Order by mail, fax, email, or phone (9-12, 1-5 eastern time).
Min. $6 S&H charge for 1st lb. plus add'l weight & insurance.
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Our 36th Year

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Phone 716-392-9430 (fax -9420)

RAMSEY

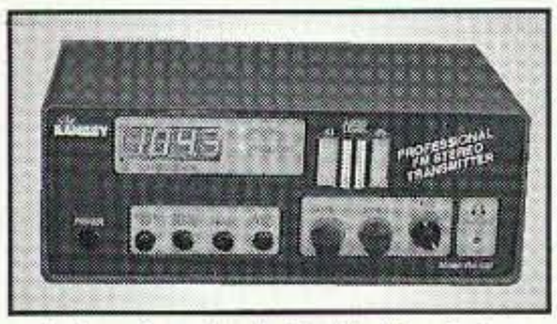
World's Smallest TV Transmitters

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 law enforcement 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. Audio units include sound using a sensitive built-in mike that will hear a whisper 15 feet away! Units run on 9 volts and hook-up to most any CCD camera. Any 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!

C-2000, Basic Video Transmitter Cube.....$89.95
C-3000, Basic Video and Audio Transmitter Cube.....$149.95
C-2001, High Power Video Transmitter Cube.....$179.95
C-3001, High Power Video and Audio Transmitter Cube.....$229.95

Super Pro FM Stereo Radio Transmitter

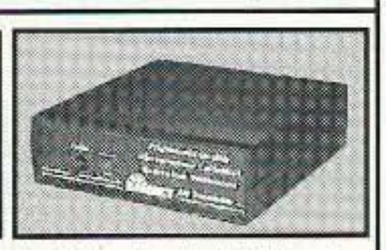


A truly professional frequency synthesized FM Stereo transmitter station in one easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set frequency easily with the Up/Down freq buttons and the big LED digital display. Plus there's input low pass filtering that gives great sound no matter what the source (no more squeals or swishing sounds from cheap CD player inputs!) Peak limiters for maximum 'punch' in your audio - without over modulation, LED bargraph meters for easy setting of audio levels and a built-in mixer with mike and line level inputs. Churches, drive-ins, schools and colleges find the FM-100 to be the answer to their transmitting needs, you will too. No one offers all these features at this price! Kit includes cabinet, whip antenna and 120 VAC supply.

We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.

FM-100, Professional FM Stereo Transmitter Kit.....$299.95
FM-100WT, Fully Wired High Power FM Transmitter.....$429.95

AM Band Radio Transmitter

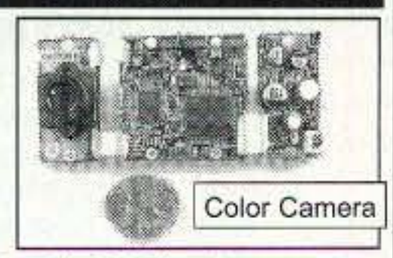


Ramsey AM radio transmitters operate in the standard AM broadcast band and are easily set to any clear channel in your area. Our AM-25, 'pro' version, fully synthesized transmitter features easy frequency setting DIP switches for stable, no-drift frequency control, while being jumper setable for higher power output where regulations allow. The entry-level AM-1 uses a tunable transmit oscillator and runs the maximum 100 milliwatts of power. No FCC license is required, expected range is up to 1/4 mile depending upon antenna and conditions. Transmitters accept standard line-level inputs from tape decks, CD players or mike mixers, and run on 12 volts DC. The Pro AM-25 comes complete with AC power adapter, matching case set and bottom loaded wire antenna. Our entry-level AM-1 has an available matching case and knob set for a finished, professional look.

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

CCD Video Cameras

B&W Camera



Color Camera

If you're looking for a good quality CCD board camera, stop right here! Our cameras use top quality Japanese Class 'A' CCD arrays with over 440 line line resolution, not the off-spec arrays that are found on many other cameras. You see, the Japanese suppliers grade the CCDs at manufacture and some manufacturers end up with the off-grade chips due to either cost constraints or lack of buying 'clout'. Also, a new strain of CMOS single chip cameras are entering the market, those units have about 1/2 the resolution and draw over twice the current that these cameras do - don't be fooled! Our cameras have nice clean fields and excellent light sensitivity, you'll really see the difference, and if you want to see in the dark, the black & white models are super IR (Infra-Red) sensitive. Our IR-1 Illuminator kit is invisible to the human eye, but lights the scene like a flashlight at night! Color camera has Auto White Balance, Auto Gain, Back Light Compensation and DSP! Available with Wide-angle (80º) or super slim Pin-hole style lens. They run on 9 VDC and produce standard 1 volt p-p video. Add one of our transmitter units for wireless transmission to any TV set, or add our IB-1 Interface board for audio sound pick-up and super easy direct wire hook-up connection to any Video monitor, VCR or TV with video/audio input jacks. Cameras fully assembled, including pre-wired connector.

CCDWA-2, B&W CCD Camera, wide-angle lens.....$99.95
CCDPH-2, B&W CCD Camera, slim fit pin-hole len.....$99.95
CCDPH-2, Color CCD Camera, wide-angle lens.....$149.95
IR-1, IR Illuminator Kit for B&W cameras.....$24.95
IB-1, Interface Board Kit.....$24.95

FM Stereo Radio Transmitters

Microprocessor controlled for easy frequency programming using DIP switches, no drift, your signal is rock solid all the time - just like the commercial stations. Audio quality is excellent, connect to the line output of any CD player, tape deck or mike mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability of the FM-25; many Caribbean folks use a single FM-25 to cover the whole island! New, improved, clean and hum-free runs on either 12 VDC or 120 VAC. Kit comes complete with case set, whip antenna, 120 VAC power adapter - easy one evening assembly.

FM-25, Synthesized FM Stereo Transmitter Kit.....$129.95

A lower cost alternative to our high performance transmitters. Offers great value, tunable over the 88-108 MHz FM broadcast band, plenty of power and our manual goes into great detail outlining aspects of antennas, transmitting range and the FCC rules and regulations. Connects to any cassette deck, CD player or mixer and you're on-the-air, you'll be amazed at the exceptional audio quality! Runs on internal 9V battery or external power from 5 to 15 VDC. Add our matching case and whip antenna set for a nice finished look.

FM-10A, Tunable FM Stereo Transmitter Kit.....$34.95
CFM, Matching Case and Antenna Set.....$14.95
AC12-5, 12 Volt DC Wall Plug Adapter.....$9.95

RF Power Booster

Add some serious muscle to your signal, boost power up to 1 watt over a frequency 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 Stereo transmitters, providing radio service through an entire town. Runs on 12 VDC. For a neat, professionally finished look, add the optional matching case set.

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

Treasure Finder Kit

Search for buried treasure at the beach, backyard or park. This professional quality kit can detect metal at a depth of up to 6 inches. Easy to use, just listen for the change in tone as you 'sweep' the unit across the surface - the larger the tone change - the larger the object. Has built-in speaker or earphone connection, runs on standard 9 volt battery. Complete kit includes handsome case, rugged PVC handle assembly that 'breaks down' for easy transportation and shielded Faraday search coil. Easy one evening assembly. This nifty kit will literally pay for itself! That guy in the picture looks like he found something - what do you think it is - gold, silver, Rogaine, Viagra? You'll have fun with this kit.

TF-1, Treasure Finder Kit.....$39.95

Binocular Special

We came across these nice binoculars in an importers close-out deal. Not some cheap in-line lens jobs, these beauties have roof prisms, a super nice rubber armored housing over light weight aluminum. 10 x 25 power with fully coated optics. Includes lens cleaner cloth, neck lanyard and nice carry case. For extra demanding use in bright sun, choose the EX module with ruby coated Objective lens. First quality at a close-out price! We've seen the exact same units with the 'Bushnell' name on them being sold for $30 more!

BNO-1, Binoculars and case.....$24.95
BNO-1EX, Ruby Coated Lens Binoculars and case.....$29.95

Speech Descrambler

Decode all that gibberish! This is the popular descrambler / scrambler that you've read about in all the Scanner and Electronic magazines. Speech inversion technology is used, which is compatible with most cordless phones and many police department systems, hook it up to your scanner speaker terminals and you're in business. Easily configured for any use: mike, line level and speaker output/inputs are provided. Also communicate in total privacy over telephone or radio, full duplex operation - scramble and unscramble at the same time. Easy to build, all complex circuitry contained in new custom ASIC chip for clear, clean audio. Runs on 9 to 15VDC. Our matching case set adds a professional look to your kit.

SS-70A, Speech Descrambler/Scrambler Kit.....$39.95
CSS, Custom Matching Case and Knob Set.....$14.95
SS-70AWT, Fully Wired SS-70A with Case.....$79.95
AC12-5, 12 Volt DC Wall Plug Adapter.....$9.95

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Sorry, no tech info, order status at this number

Technical Info, Order Status
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Fax: 716-924-4555

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ORDERING INFO: Satisfaction Guaranteed. Examine for 10 days, if not pleased, return in original form for refund. Add $6.95 for shipping, handling and insurance. Orders under $20, add $3.00. NY residents add 7% sales tax. Sorry, no CODs. Foreign orders, add 20% for surface mail or use credit card and specify shipping method.

ASTRON CORPORATION
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Irvine, CA 92618
(949) 458-7277 • Fax (949) 458-0826 www.astroncorp.com

SWITCHING POWER SUPPLIES

	CONT.	ICS	WT.(LBS)
SS-10	7	10	3.2
SS-12	10	12	3.4
SS-18	15	18	3.6
SS-25	20	25	4.2
SS-30	25	30	5.0

SS-25M With volt & amp meters
SS-30M With volt & amp meters

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

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

SL SERIES

• LOW PROFILE POWER SUPPLY

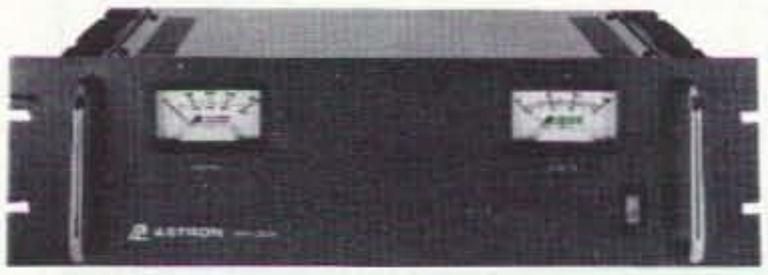
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

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

RM SERIES



MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

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

RS-A SERIES

MODEL RS-7A

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

RS-M SERIES

MODEL RS-35M

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

VS-M AND VRM-M SERIES

MODEL VS-35M

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

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shippin Wt. (lbs
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
VS-70M	67	34	16	70	6 x 13¾ x 12⅛	48
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

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

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

CIRCLE 16 ON READER SERVICE C

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OCTOBER 1998
ISSUE #457

73 Amateur Radio Today

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DEPARTMENTS

On the cover: Andy MacAllister W5ACM (ex-WA5ZIB) has been writing our Hamsats column for over 10 years. He is currently a member of the board of directors of AMSAT, the Radio Amateur Satellite Corp., and also serves as their vice president of User Services. His ham radio activities got their start when his father brought home the December 1966 issue of *73 Magazine* while they were living in Tehran, Iran. Licensed since high school, he holds an amateur Extra Class ticket and is an electronics design engineer and professional writer. His radio interests range from VLF to microwaves and CW to high-speed digital, but tend to focus on modes and activities via satellite. Photo by his XYL, Heather MacAllister.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

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Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Nothing To Say

If you believe that, I've got a zero-point energy device to sell you. I'm talking (well, writing) about the ARRL board's restructuring proposals. Jeez, they've actually come down from the 20 WPM code requirement for the Extra Class license. Well, Class A, they want to call it. I'm old enough so I used to *be* a Class A licensee. Old? You bet! I was making CW contacts on 40m in 1938. Lordy, that's 60 years ago! And I was on 160m phone, too. By 1941 I was able to win the Sweepstakes contest for my division. To prove it, I've got a medal that the ARRL sent me at the time pinned to my hamfest hat.

For you young squirts, back befo de wo we had three license classes: A, B, and C. Around 90% of us were Class B, which permitted CW on all bands and phone (it was 100% AM in them thar days) on 160m and 10m. Ten was like a VHF band and peopled by pioneers. Yeah, there was a little bit doing on 5m and 2-1/2m, but not much. So naturally I was attracted to 2-1/2 meters. Indeed, when I got my ticket, I made my first contact with Dexter W2MCV with my 2-1/2m walkie-talkie.

Most of my activity was on 160m phone, which went from 1800–2050 kc in those days.

Class A provided phone privileges on 75m and 20m. 100 kc on each band, so with AM carriers filling 10 kc, that allowed around nine roundtables. Period. Naturally the nine channels were dominated by nine kilowatt stations. When Irving Vermillia W1ZE, Cape Cod, came on, with his walloping signal and his ticking clock up near the mike, you knew who it was immediately.

That was then, and now is now.

My response to the League's timid approach to restructuring is restrained applause. It's better than doing nothing and watching the hobby go down the toilet due to the League's neglect. I think I'll still hear the toilet flushing — just not as loudly. Too little, and maybe even too late.

They've proposed to lower the code requirement for General from 13 per to 5. Using my sneaky (but legal) secret system, almost anyone should be able to ace the 5 WPM test with one hour of training. And that's for the slo-o-ow learners. Most people can be ready in about 20 minutes. Heck, I learned the Greek alphabet in 10 minutes when I was being hazed for my college fraternity initiation. It was either that or get my butt seriously whacked. And I still can rattle it off.

I learned the code one night while I was getting into my Boy Scout uniform. I'd put it off until a half hour before the meeting. I still know most of the code.

I won't rehash my judgment that the ARRL's 1963 incentive licensing scheme was not just a failure, but provoked the greatest disaster the hobby has ever experienced.

Look, you ARRL director guys (and gal), the future of the hobby is in your hands. It's time to make some major changes, not just patch up the leaks.

It was nice to see them propose widening the phone bands. Well, considering the withering away of CW activity, it's about time to reallocate frequencies. Heck, when I started, 40m went from 7000–7300 and was wall-to-wall CW, from top to bottom. 80m, from 3500–3900 was packed solid at night with CW. Now I hear a few chirps around the bottom of the band.

Motivation

Harry Lewis W7JWJ was kind enough to send me a long and fascinating letter. I might even have published it, but he asked me not to. I'll bet he was worried about his reputation being tarnished by being associated with weird Wayne Green.

Harry has a certificate for copying code at 79 WPM. He's offered $1,000 to anyone who could beat him at copying the code. He's taught thousands of people to copy the code. He points out that it has been taking longer and longer for people to learn to copy the code at 13 WPM. In the 1930s, it took an average of 12.5 hours of practice. By 1944, it was taking about 28 hours. By 1970, it was averaging 70 hours. It is now averaging 110 hours!

Harry is convinced that diet is a big part of the problem. Well, I agree with him that the American diet has gone to hell in a handbasket. Sugar, chocolate, white flour, meat laced with hormones and antibiotics, and so on. Smoking, beer and other poisons aren't speeding up our brains any, either.

Sure, our schools are part of the reason SAT scores have been plummeting, but so is the great American diet of hamburgers and fries, which provides virtually no usable nutrition for our bodies — or brains. We wash down the hamburgers and fries with a coke or a glutinous shake — both poison.

If you or your children want to be able to think and be healthy, you've got to shop a different part of the supermarket. Over there in that tiny organic food section, buying fruit and vegetables, instead of in the meat section.

Motivation helps, too. Harry noticed that when military ops had the choice of learning to copy code at 40 WPM in two weeks and getting a cushy safe job with good pay *vs.* going to an active battalion, they had a 100% success rate. Makes sense.

I've found that concentrating on building a new skill makes it easy and fun to learn. The old never-say-die approach. When the Advertising Club of New York had a horseback riding outing I remembered how much fun I'd had as a kid in Washington (DC) riding in Rock Creek Park, so I decided to take lessons. I found a superb professional and took lessons several times a week — until I got very good at it. I read every book I could find, got an Arabian, and started training him. I rode horses everywhere I went — on the beaches and hills of California, the forests of Germany, the beaches and hills of Caribbean islands, the parks of Paris.

When the head trainer at the Ringling Brothers stables in Sarasota saw me riding one of their horses he asked me to exercise his top show horse, Starlit Night. Wow! Now that was fun! I put the horse through all the *dressage* gaits. The horse was amazingly responsive to my every signal, no matter how slight.

Outside of my usual bragging, what I'm saying is that you can accomplish just about any skill you want to if you make it your business to do it. It takes motivation and determination. Never Say Die! With

that, a good diet, and plenty of exercise, you can beat Harry at the code — if you really want to. You can certainly yawn through the stupid 20 WPM test. And you can learn *any* skill you want to.

I'd like to see our schools devote more effort to teaching kids skills — like swimming, diving, bowling, bicycle riding, driving, flying, archery, etc. I've published a list of skills in the past, so I won't do it again. But how about you? Can you keep up with me on skis? Have you learned how to hot air balloon? Stunt kite flying? Juggling? How about parachuting? I'm game, if you are. Scuba diving? Let's see if you can use less air than I do. I guarantee you can't.

In what skills or fields are you an expert? Have you learned anything you could write about and sell your teaching? That can be a nice home business. I've become an expert on nutrition and my book *The Secret Guide to Health* is selling like crazy. As one of the founders and first secretary of American Mensa, I wrote *The Secret Guide to Wisdom*, which has sold thousands of copies. And, with a Ph.D. in entrepreneurial science, plus a lifetime of experience, my book *The Secret Guide to Wealth* is also a best-seller. So what have you done or learned that you can write about? Get busy with your word processor.

Oh, yes — please stop whining about the crummy code and just *do* it.

Stub-bor-en

Why are you so stubborn? My patience is over 17% exhausted just trying to get you out of the endless maze in which you've been trapped all your life. Despite everything I've been preaching, you have been stubbornly refusing to even consider starting your own business. What does it take to blast you out of the sand trap of a nine-to-five? Have you got iron-poor blood?

Sure, I got sucked into going to college so that I could work for other people all my life. It wasn't until I was 28 that I managed to wake up. That's when I started my first real business — manufacturing loudspeaker enclosures. I set up a desk in one end of my bedroom in Brooklyn (NY) and hired Jordan Polly K2AZL as my first employee. The manufacturing was contracted out and one end of the cellar was set up as a shipping department. Next to the coal bin and laundry tubs. My ham shack filled the rest of the cellar. This grew within three years to about a $20 million business, but by then I'd had to rent outside offices and a warehouse.

My grandfather had run his brake lining business from the same house twenty years earlier. He'd made millions inventing things, helping what is now known as Citgo get started with his college buddy Henry L. Dougherty. Dougherty put the profits from manufacturing my grandfather's inventions into oil. Then came the stock market crash and a million dollars in City Service stock dropped to being worth about $3,500. And my grandfather (Pop) went from being a millionaire to needing to find something to do to get by.

He first took over the management of Continental Can and rescued it from bankruptcy. Then his uncle called, explaining that he'd invented a new and better brake lining. Pop drove out to East Brady, Pennsylvania, to see what this was all about, and signed up to handle the eastern part of the country for Rex Hide brake lining. Customers loved it because the stuff didn't wear out every few thousand miles like the regular lining. Soon the cellar was filled with inventory and trucks were picking up shipments every day. The lining was molded out of carbon and rubber to fit brake drums, so when WWII came along and rubber was scarce, the factory was closed down. And that was the end of Rex Hide.

Pop, who smoked a pipe and cigars, died of pneumonia in his early 50s. Smoking had ruined his lungs.

Where am I heading with all this? I'm trying to get you to start thinking in terms of starting a small business in some field that will be real fun for you and run it out of your home until it gets too big to handle.

I started *73 Magazine* out of a small apartment in Brooklyn and ran it for two years before I moved everything to New Hampshire — into my new home in Peterborough. And I ran it, plus *Byte*, *Microcomputing*, *80-Micro*, *Desktop Computing*, *InCider*, *Run*, and some other publications from there until I sold everything to IDG in 1983. Well, I did have to buy the house and barn next door for more magazine offices, a 24-room motel for software development, a house and barn in northern Peterborough for the book division, a house in West Peterborough for shipping, and so on. I gobbled up just about every available building. I probably shouldn't have let the growth get away from me like that.

The nice thing about a mail order business is that you can run it from anywhere, and you can start small. PC Connection started out in a farmhouse in Marlow (NH) and now they've taken over an entire shopping mall in Merrimack for their offices.

Look, you're never going to make much money working for someone else. The key to freedom is owning your own business. So find some innovative product and get started with an office at home like I did. In addition to running *73*, my products these days are books, which I write, print, and put together at home. Well, this is the information age, but the problem is that there is so much information that everyone is on overload. So I do my research and simplify the information, making it all available in one book.

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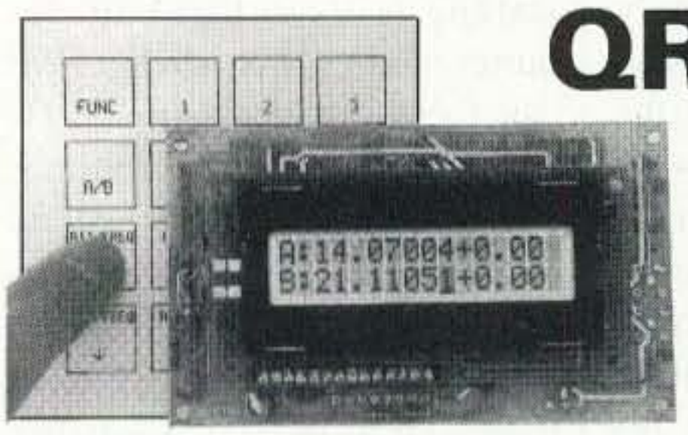

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CIRCLE 335 ON READER SERVICE CARD

LETTERS

From the Ham Shack

James Alderman KF5WT. How can we revive, or save, amateur radio? Some hams have suggested that in order to maintain our viability we must work more at providing emergency communications. I have another theory.

As one who works in the radio communications industry, I can tell you that modern public safety radio systems are built with multiple levels of redundancy to avoid outages. For instance, in case power goes out, the systems my company builds will run on battery backup power for a few minutes until emergency generators come up. If the entire tower facility is destroyed, most radio systems have a whole separate backup tower site.

If dispatch consoles, or the phone lines that connect them to the tower site, happen to go down, dispatchers can simply use standard mobile radios to dispatch radio calls. In short, the chance of hams having to supply police and fire departments with emergency radio communications is getting less likely all the time since old style public safety repeaters are being replaced by 800 MHz trunked or digital radio systems.

However, hams can provide a valuable service to relief agencies such as the Red Cross and Salvation Army. These organizations provide direct relief in times of disaster and rarely have funds to spend on radios. If hams have emergency communications resources, such as multiple repeaters with wide coverage and backup power, well-trained operators who can quickly set up communications, the ability to operate both voice and packet in simple portable setups, and even portable repeaters to deploy in areas where relief operations are underway, we can provide a valuable service like no other radio service can.

But although hams can provide a service to the public in these times of disaster, there is one area where I believe we can provide an even greater service—and I further believe it's our only hope for ensuring the survival of our hobby.

We should focus on the educational benefits of amateur radio. Let me explain. In the two-way radio industry, it used to be that most new employees came up through the ham ranks. That is, kids who grew up tinkering with ham radio often went to work in the radio and electronics industry. This is no longer the case. So few young hams are coming up these days, our company (located in Dallas) often has to recruit out of state to even find radio installers. (Installing is a job that only requires minimal knowledge.) We can forget about finding a 21-year-old who knows anything about radio communications and can actually work on repeater sites. Ham radio is no longer a training ground for a high-tech work force. Of all my present coworkers, I would say only about one in 10 is a ham.

Ham radio can provide tremendous educational opportunities for young people. Here are a few possibilities that require minimal work on the part of clubs:

• Amateur radio day at local schools. Hams could set up two-meter stations in selected elementary or middle school classrooms (maybe five or six). Students in each class could prepare a short speech outlining what material has been studied over the past weeks, and select a spokesman to deliver the address over ham radio to all the other classrooms. Then other classrooms could ask questions. The benefit would be that all classes get the benefit of knowledge that was previously confined to only one classroom. Further, students would learn about speech writing, public speaking, passing information over two-way radio, and they might even pick up some interviewing skills.

• Amateur balloon launches. Hams could launch, and track with DF equipment, a helium balloon package to carry student experiments to the edge of space. The easiest payload is a 35 mm film camera rigged to snap photos every so many minutes. Or a crossband repeater, or "satellite," could be flown aloft to allow schools 100 miles apart to link up and share knowledge. A club sponsored project like this could provide an activity involving many areas of interest as well as opportunities for student involvement. There is a wealth of information about amateur balloon launches on the Internet.

• Amateur television. In many larger cities, amateurs transmit live coverage of shuttle missions on ATV. Since practically all schools already have cable-ready TV sets, a simple outside antenna is all that's required to pull in 440 MHz ATV pictures, provided the transmit site is within a reasonable distance of the school. This live coverage is available on the NASA Select Network which can be picked up on a standard C-band home satellite receiver. NASA makes many resources available to schools free of charge, including curriculum material for all grade levels that coincides with each shuttle mission.

These are only three of many ways that clubs, or just groups of amateurs, could have an impact on their communities. I've been working recently in my rural Texas hometown to try and implement some of these ideas, but I must tell you it has been a hard row to hoe. To start with, there is only a handful of active hams in the area any more, and there really aren't any young hams coming up through the ranks. From what I hear, this is the situation all over the country.

In order to get younger hams in our ranks, I believe we must be a fraternity that people would be excited to join. In fact, I believe that ham radio in general is in such a slump that the only way we can survive is to GIVE our way out of it. That is, we must begin to serve our communities and our local schools by providing a service that nobody else can. We must use our skills to educate kids, get them interested in science and technology, and provide an exciting and wholesome activity that the whole family can participate in. If we do this, our ranks will surely grow and amateur radio will have a bright future.

Gerald Wagman K2EWA, East Brunswick NJ. I enjoy reading "Never Say Die" though I am often in disagreement with what you say, sometimes vehemently, but I must admit much of it is thought-provoking in any event. And there some items I do agree with. I found the "We're At War," item in the July '98 column to be of particular interest, especially relating to the comments on studying the art of war. I spent many years in middle management in basic research in the pharmaceutical industry, and one of the best little books I've come across is titled *Leadership Secrets of Attila the Hun* by Wes Roberts, Ph.D. (Warner Books, 1985). This book can serve as a model in areas other than just management; it's a primer in leadership and Dr. Roberts has dissected Attila's role in life, generally thought of as that of a tyrant and a barbaric and ruthless pillager, by extracting the clever leadership principles that he used. It demonstrates that the techniques which Attila devised are readily applicable to our management leadership of today and I think that all of these young theoretically-oriented management

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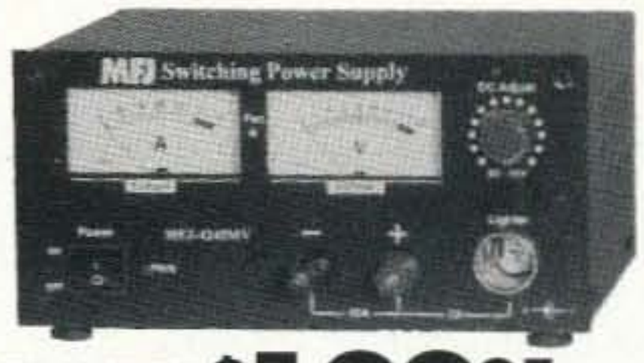

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QRUBZ?

When you live in rural Maine, shopping invariably means getting into your truck and driving anywhere from 50 to 250 miles on mostly deserted roads. There is very little to do. The radio provides only acid rock as an excuse for music, some screechy soprano on the PBS station or some hell-and-brimstone preacher who's determined to save me even if it means killing me. My two-meter rig was stolen on my last trip to the big city and even if I still had it, there are generally no repeaters or stations in range.

It was on just such a trip last week that my idle mind began to think about "Q" signs. The more I thought about them, the more silly they seemed. For example, QSL means, "Can you acknowledge receipt?" or "I am acknowledging receipt." What has that got to do with "SL"? It should be "QAR" and you should send a "QAR" card.

The more I thought about it, the more examples I kept coming up with. "QSY" means "change," either frequency or type of emission. What does "SY" have to do with change? It should be "QC," and if you want to be more specific, "QCF" for "change frequency" and "QCM" for "change mode."

"QRP" must mean "really poor," and can't afford a rig that puts out more than five watts. If it's "low power," call it that: "QLP."

"QRN" means "troubled by static," and "QRM" means "being interfered with." Therefore, "QTS" and "QTI" (troubled by an idiot).

"QRZ!" You are wearing something with a "rusty zipper" on it and should exercise extreme care when near RF. Basically, it means, "Who's calling?", so it should be "QWC."

"QTH." Well I guess you could say "the house." But what about all those people who live in apartments or condos? Too bad: You have no QTH, so no "QAR" card for you! Since it really means, "what is your position (location)?", or "my position (location) is," call it that, "QPL." I will send my QAR card direct to your QPL.

How about "QRL"? I am busy being chased by a roaring lion, or are you busy being chased by a roaring lion? It means I am busy/are you busy—do not interfere. So a simple "QB"—or for the purists who insist on three-letter signs, "QBZ."

"QSB." Now there is a good one. How about my "solder broke" and I am off the air. Or, not a mobile, stationary broadcast (there are several others, but propriety will not let me say them). It means signal strength is going up and down, ergo, "QUD."

Fortunately, for the reader, this was only a short drive (60 miles to the nearest Radio Shack) and it is time for me to return to reality (though there are those who would say that I have long since left that far behind). So 73, gb, gl, gldx, es cusn my QAR card is sure via buro.

TNX Dr. Hal Goodman W3UWH.

What to Do About Your Technician Accent

On FM, there is little need to repeat your callsign several times. "N3SZW listening," is sufficient. However, it may be necessary to repeat if the person you're trying to contact has his HT in scanner mode.

"Negative contact," and "clear" are also unnecessary if no one answers your call.

"N3SZW for ID" is superfluous. It's understood that you are identifying yourself.

Listen before you transmit. PTT (push to talk) on your microphone should be labeled RTL (release to listen).

Speak in plain, everyday language.

Q codes are meant for CW, not on repeaters.

When words must be spelled, they should be spelled phonetically. Cute nonstandard phonetics are questionable at best. However, "November Three Solid Zirconium Wire" might help someone remember your call.

Avoid endless signoffs. A simple "N3SZW clear," is sufficient to end your communication.

Excerpted by Bill Smith N3SZW, with permission from the ARRL, from *Your Technician Accent ....And What to Do About It!* by James Craswell WØVNE, *QST*, Vol. 82, No. 4, p. 88, and adapted here from *The Ham Arundel News*, Mar. 4, 1998.

Military to Help Save 70 cm

The ARRL has called out the United States Navy to help save the 70 cm band from being forced into a sharing agreement with land mobile users or possible reallocation to their exclusive use. Speaking at the Rochester Hamfest, ARRL First Vice President Steve Mendelsohn W2ML explained how it all came about.

"It occurred to me after talking to somebody at Dayton that we don't own the 440 spectrum. Most of you should be aware we are merely secondary users. And I wondered if the primary user was aware. So the League contacted the NTIA (National Telecommunications Information Agency), which is the government FCC, and in turn NTIA contacted the real user, the Navy. The Navy has just spent some 75 billion dollars—billion with a B, on a little thing called the Combat Engagement System. CES operates in that 400 meg band. So the Navy was real unhappy about the idea of sharing the band with anybody. And, of course, with the Navy, they have their idea of jammer hunting that is significantly different from ours. They have the hardware to enforce what they desire."

The fact that the Navy is siding with ham radio does not mean that the fight to save the 70 cm band is over. Congress wants more military spectrum turned over to the private sector for commercial use and the FCC is under pressure to accede to these demands. As such, ham radio operators cannot afford to become complacent. The battle is not over yet.

From *Amateur Radio Newsline*, via *The LCARA Patch*, July 1998, Tim Culek KQ8TC, editor.

Florida Ham Radio Hotline Has New Area Code

The amateur radio information telephone message system has a new area code. Pinellas County's (Florida) new area code is 727. Anyone interested in Clearwater, Largo, or St. Petersburg area ham radio clubs can call (727) 531-8135 for information. New hams, visiting amateur radio operators, and the public are invited to call the "Ham Hotline" as a quick way to get updates on local events, meetings, and testing sessions.

Located on Florida's west coast, on the west side of Tampa Bay, Pinellas County has about 3000 licensed hams. Pinellas County has an active APRS network, ground-breaking SkyWarn operations, 12 amateur radio clubs, and a growing ARES group. Any of these topics, or others, could be featured on the hotline's weekly message. These messages are not intended for radio rebroadcast.

TNX Amateur Radio Public Information Office, Pinellas County FL, news release, William Holcomb, editor.

The Code that Really Counts

The radio amateur is:

•Considerate — Never knowingly operates in such a way as to lessen the pleasure of others.

•Loyal — Offers loyalty, encouragement and support to other amateurs, local clubs, through which amateur radio in the United States is represented nationally and internationally.

•Progressive — With the knowledge abreast of science, a well-built and efficient station and operation above reproach.

•Friendly — Slow and patient operating when requested; friendly advice and counsel to the

beginner; kindly assistance, cooperation and consideration for the interests of others. These are the hallmarks of the amateur spirit.

•Balanced — Radio is an avocation, never interfering with the duties owed to family, job, school, or community.

•Patriotic — Station and skill always ready for service to country and community.

The original "Amateur's Code" was written by Paul M. Segal W9EEA, in 1928.

From the Spring 1998 newsletter of Voice of Idaho ARC, Steve Wade KF7YC, editor.

My Neighbor and Me

After being a Tech Plus for 19 years I decided that it was a good time to upgrade. I was nearing the time when I intended to retire, and I would really have time to pursue the hobby.

I ordered some code study tapes from *73 Magazine.* Every day I practiced receiving the code and before very long I was ready to take the 13 WPM test. I only needed to take the code test, and not the written test, because I was licensed prior to 1977.

I went down to the library in Delaware, just over the Pennsylvania line, where a group of local hams administered amateur examinations on the third Saturday of every month. Not only did I pass the 13 WPM test, but to my surprise I passed the 20 WPM test also. The VE recommended that I try the Advanced test. I did—and failed, but three months later I had my Extra class license, and set out to talk to the world.

I invested in an Alinco HF transceiver, a power supply, and a R7000 antenna. On the air, I was having a great time making contacts all over the world. There were times that I could have used more than the 10-watt output my transceiver provided ... so I decided to invest in an amplifier. I chose the Ameritron AL811, eagerly hooked up, and started to broadcast.

Things were going great until that day when my next-door neighbor came pounding on my door. I opened it to face a very upset man.

"Knock it off," yelled Mike. "I can't listen to my hi-fi! You're interfering with my music and I'm going to report you to the FCC!"

I tried to apologize but it was clear that Mike was not in any mood to listen. I decided to let some time go by and try to reason with him later.

The next day I knocked on his door and invited him to stop by and see my radio equipment. I apologized for the problems, but explained that I was entirely legal, and offered to work with him to eliminate the problem with his hi-fi. I demonstrated my radio and let him make a couple of contacts on 40 meters. He really took to it—in fact, he asked if I could help him get an amateur license!

We studied together for three months. Mike went down to the library, took the test, and is now the holder of a General class license—and is totally addicted to amateur radio. He spends every night chasing DX.

I just ordered cable TV. Since my neighbor got his license, I haven't been able to watch a clear TV picture!

TNX Jim Giunta WB3HDA.

Why Do You Get Upset When a Ham Erects a Radio Tower?

It doesn't
•Squeal its tires
•Screech its brakes
•Blow its horn
•Rev its motor
•Slam its doors at unGodly hours
•Shine its headlights in your bedroom window
•Backfire
•Bite you
•Bark or meow or howl
•Leave deposits on your property
•Dig up your garden
•Scratch on your door
•Widdle on your trees
•Scatter your garbage
•Drop leaves that you have to clean up
•Grow branches over your house
•Drop fruit or nuts which clog your rain gutters
•Block your view like a tree or building
•Grow roots that damage your walk, driveway, or drains
•Have rowdy parties
•Play loud music
•Or ride bikes across your lawn

From Marvin Wilson VE7BJ, originally in the *Ontario Amateur.* We adapted it in a rather cavalier way from the *Badger State Smoke Signals*, June 1998, Jim Romelfanger K9ZZ, acting editor. 73

Radio Bookshop

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Code Tapes

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73T06 **The Stickler 6 wpm code tape** This is the practice tape for those who survived the 5 wpm tape and it is also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and spaced at 5 wpm $5.00

73T13 **Back Breaker 13 wpm code tape** Code groups again at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per. $5.00

73T20 **Courageous 20+ wpm code tape** Go for theExtra class license. $5.00

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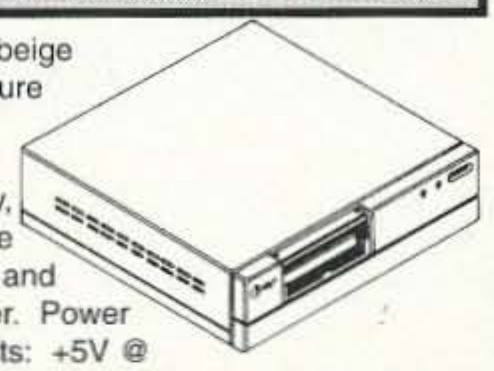

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The Ins and Outs of Surface-Mount

Everything you need to know to get started — or get better.

Homer L. Davidson
1517 1st Avenue North
Fort Dodge IA 50501-4237

Today surface-mounted devices (SMD) are found in many consumer electronics products such as TVs, VCRs, camcorders, and compact disc and cassette players. The surface-mounted part has opened up a whole new area of electronic construction. These tiny components are now available to the electronics hobbyist to miniaturize his or her favorite project (**Photo A**).

Now you can build SMD electronic circuits and projects like the big boys. In fact, they are a lot of fun to build. Of course, you must have a steady hand and a great deal of patience.

Because many surface-mounted devices have similar shapes and sizes, sometimes it is difficult to identify them on the chassis. The commercial resistors might appear as round, flat, leadless devices. The ceramic capacitor is a flat solid part with the terminal connections at the outside, tinned ends. The resistor might have several numbers for identification with lines at the ends, while the ceramic capacitor has a line at the top with a letter of the alphabet and numbers. Transistors and diodes are often identified with two letters. The SMD component terminals are found at each end, except on transistors and IC chips.

The commercial surface-mounted transistor might appear in a chip form with flat contacts at one side, top and bottom, or on both sides. You might find more than one transistor inside one chip. The same applies to fixed diodes and LED SMD parts. Two or more diodes might be found in one component. Remember, you can test these transistors and diodes like the big brother, or standard, components. The SMD part is mounted directly on the PC wiring.

Those tiny components

The SMD part available for electronic construction is marked and mounted somewhat like the commercial SMD component. These SMD components are miniature in size and must be handled with care. Since these parts are so tiny, they can easily be lost or flipped out of sight. For surface-mounted resistors and capacitors, select the physically largest, with the highest wattage and highest working voltage. Choose SMD electrolytic capacitors with at least a 16-volt rating for small nine-volt electronic projects. Select thick film chip resistors with a 1/8th watt size. Most ceramic chip SMD capacitors have a 50-volt working voltage. These surface-mounted parts are ideal for building the small electronic project (**Photo B**).

Identifying SMD parts

Within the latest TV chassis, surface-mounted parts are soldered directly to the board wiring, while standard components are mounted on top of the PC chassis. The electronics project PC board can be etched so that the SMD parts are mounted on top of the wiring. The most common SMD components available for electronic projects are capacitors, resistors, transistors, ICs, LEDs, diodes, and inductors.

The SMD parts found on the electronics chassis might look like tiny brown, black and gray specks. The fixed resistor might be marked with white numbers upon a black chip. A ceramic capacitor chip might have a letter with a number alongside to identify the value. Some bypass and coupling SMD chip capacitors are not marked at all. The

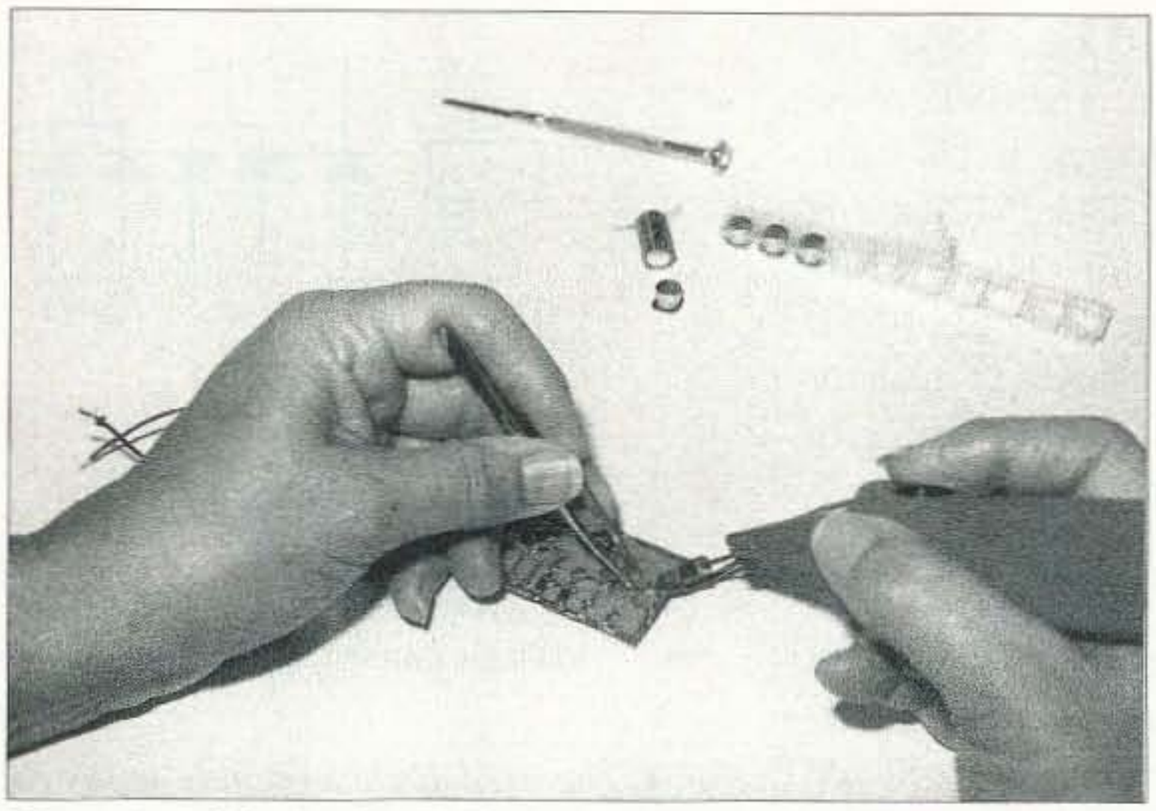

Photo A. *Soldering the SMD component into the PC wiring with a battery iron.*

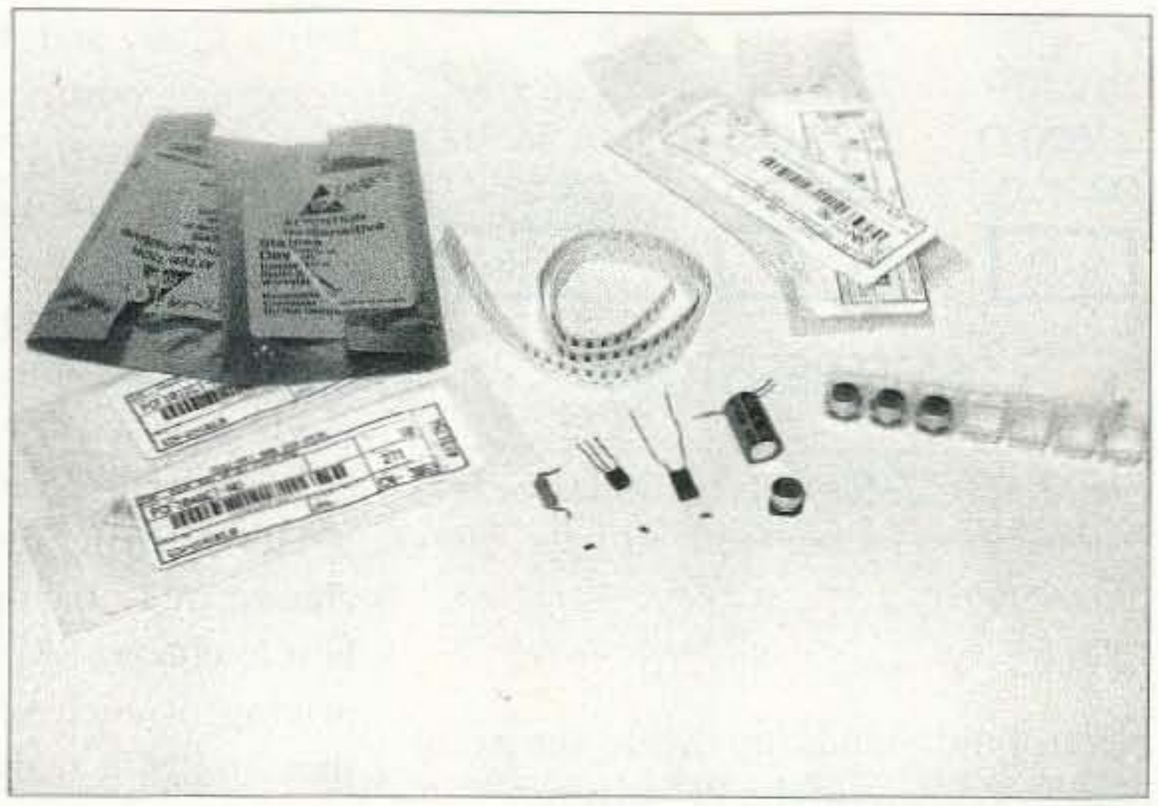

Photo C. *Four tiny SMD chips are dwarfed by their common equivalents. From left: resistor, transistor, fixed cap, electrolytic.*

electrolytic capacitor chip can be identified with a white line at one end, indicating the positive terminal, while the aluminum electrolytic has a black line or area, which is the negative or ground terminal. Besides the polarity marking, the SMD chip electrolytic capacitor might have the capacity value and working voltage stamped on the top side.

The SMD transistor has three terminals, with two on one side and one on the other side. The terminals might be marked 1, 2, and 3. The ceramic IC chip has many terminals on each side, while some microprocessors have gullwing-type terminals. The SMD transistor or IC might have the part marked on top or no markings at all. Some transistors are marked with a number and letter on the top side. Of course, you must have a magnifying glass under a strong light to identify the small numbers and letters on the tiny SMD component.

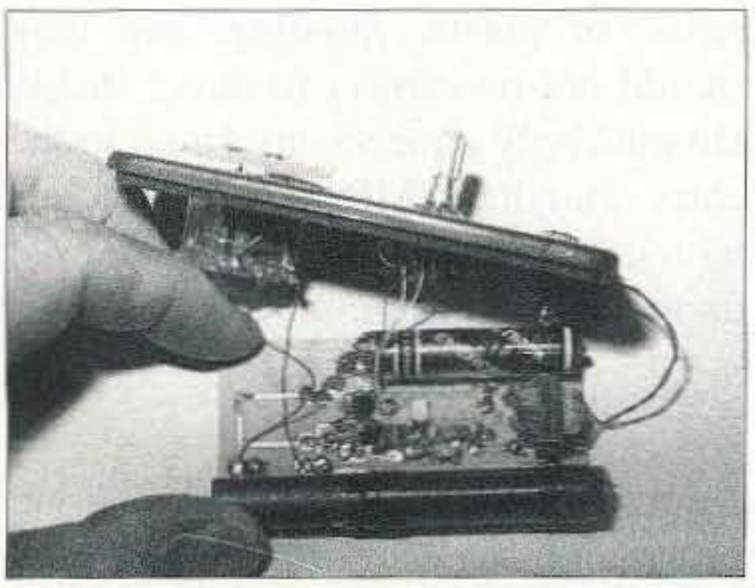

Photo B. *A small AM radio made up of SMD components.*

SMD capacitor chips

The SMD ceramic capacitor chip might be available in three or four different case sizes: 1210, 1206, 0805, and 0603. I prefer working with the 1210 and 1206 case sizes, since they are physically the largest chips to work with. For instance, the SMD 1210 case is 3.05 mm in length, 2.54 mm in width, and 1.27 mm thick, while the 1206 is the same length (3.05 mm), 1.52 mm wide, and 1.27 mm thick. Naturally, the smaller the capacity in picofarads (pF), the smaller the case size of the capacitor (**Photo C**).

Most ceramic chip capacitors are available with a 50 volt working voltage. The capacity can range from 0.5 pF to 0.068 µF. These ceramic chip capacitors are available from some mail order firms in a single (1), 10, 100, 500, or 1000 lot price. It's best to purchase parts at a 10-lot price. The ceramic chip capacitor is used in bypass and coupling electronic circuits.

The surface-mounted chip and dipped mica capacitors are selected for RF, radio, microwave, and resonator circuits. The working voltage might be 100 and 500 volts from 1 to 1000 pF capacitance. These SMD mica capacitors are quite expensive compared to other SMD capacitors.

Remember, the ceramic chip capacitor is a nonpolarized capacitor. You can solder any end into the PC wiring circuit without any problems. The ceramic chip capacitor might have a letter and number stamped on the top indicating the actual capacitor value, while in other chips there are no markings and only end connections. Always keep those SMD parts inside marked plastic envelopes so they will not get lost or mixed up.

The SMD aluminum electrolytic capacitors are polarized and should have a 16, 25, 35, or 50 V working voltage. Do not use a 10 volt or less working voltage SMD electrolytic in a nine-volt battery circuit, as they have a tendency to break down.

Often the voltage and capacity are stamped on top of the electrolytic capacitor (**Fig. 1**).

The top black marked area indicates the ground terminal. Observe the correct polarity of electrolytic capacitors; if installed backwards, they can run warm, overheat, and blow up in your face. They are available from 0.15 to 1000 microfarads (µF). The SMD aluminum

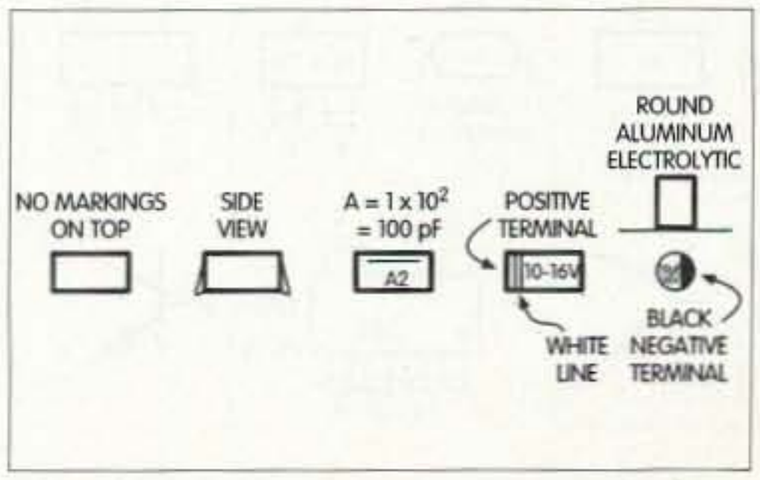

Fig. 1. *The ceramic capacitor might have a letter and number on the top side to identify the chip and value.*

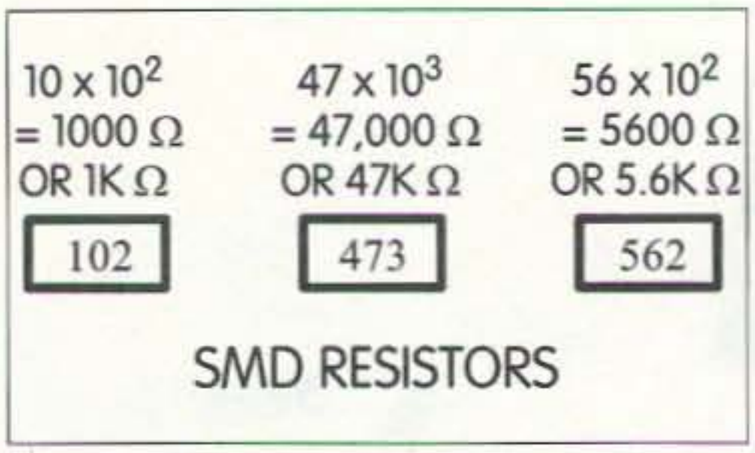

Fig. 2. *The SMD chip resistor has several numbers on top to identify the value of resistance.*

electrolytic stands up while the solid chip lies down on the PC wiring.

The tantalum electrolytic chip capacitors are found in a smaller capacity and can be purchased in 16, 20, 25, and 35 working voltages. The black polarity bar on the top side is the positive terminal. Most standard electrolytic capacitors have a black line that indicates a negative or ground terminal. These SMD electrolytic capacitors have the reverse, a positive (+) polarity with a black bar at one end. Place the SMD black line at the positive voltage connection.

The tantalum electrolytic are available from 0.47 to 47 microfarads (µF). The SMD aluminum electrolytic capacitor is used in B+, decoupling, and power supply circuits, while the lower-capacity tantalum capacitors might be found in coupling and bypass circuits.

SMD resistors

The SMD resistor can be identified by numbers stamped on the top side of the chip. These SMD resistors appear in thick film chips of 0805, 1206, 1210, and 2512 case styles. Choose the

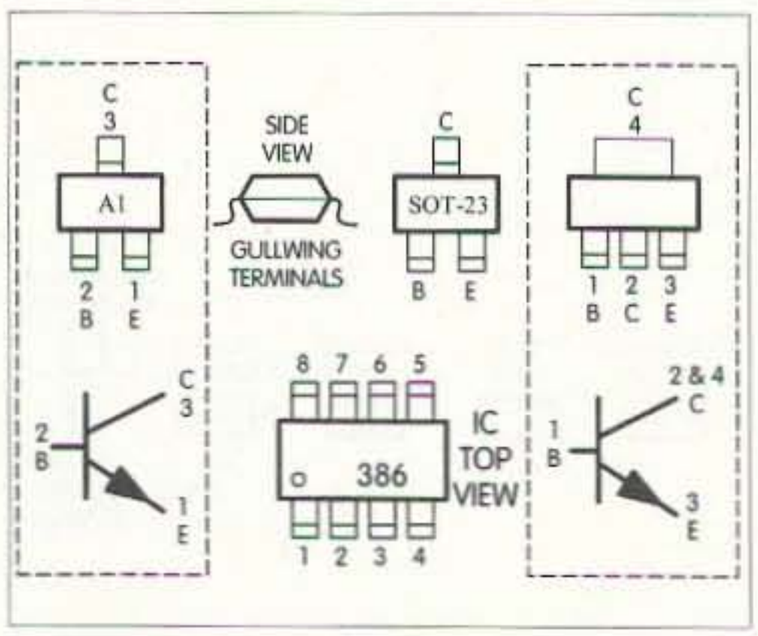

Fig. 3. *The SOT-23 general purpose transistor might have a number and letter on the top side.*

0805, 1206, and 1210 case styles for electronic construction. The 0805 resistor is 1/10 watt; 1206 style is 1/8 watt; and 1210 is 1/4 watt. The 2512 case is a 1 watt SMD resistor. These SMD fixed resistors appear in 0 Ω, 10 Ω, and 1.0 megohms. The 0 Ω resistor might be used as a feedthrough or to tie two circuits together.

These SMD resistors can be purchased in 1, 10, or 100 lot prices. It's best to choose SMD resistors in a 10-lot pricing of each value. Remember, either end of a resistor can be soldered into the circuit with the resistance value at the top. For instance, the SMD resistor might have 102 stamped on top, where the first two numbers equal the amount and the last number indicates zeros to add. The numbers 1 and 0 thus would equal 10, and two zeros at the end would then mean a 1000 ohm or 1 k resistor or (**Fig. 2**).

SMD transistors (SMT)

The surface-mounted transistor might appear as a chip with flat contacts at one side, top and bottom, or both sides. You might find more than one transistor inside one chip. The standard or conventional SMD transistor has an SOT-23 package outline, while the one watt power transistor has an SOT-89 outline with a heat sink. The SOT-89 and SOT-223 might consist of two transistors in one chip or in a Darlington arrangement.

The conventional transistor (SOT-23) is a general purpose transistor that you would find in electronic projects. Digi-Key uses part numbers such as FMMT3904CT-ND for the 2N3904 NPN transistor and FMMT3906CT-ND for the 2N3906 PNP type. The Mouser Electronics listings for the same type of transistors have part numbers of MMBT3904 and MMBT3906. The conventional 2N2222 general switching transistor in the SMT types is listed as MMST2222 at Mouser and FMMT2222ACT-ND (NPN) at Digi-Key Corporation.

The SOT-23 general purpose transistor has the collector terminal on one side (at the top), with the base to the left and emitter terminal to the right at the bottom side of package outline. Some have flat or gullwing-type terminals.

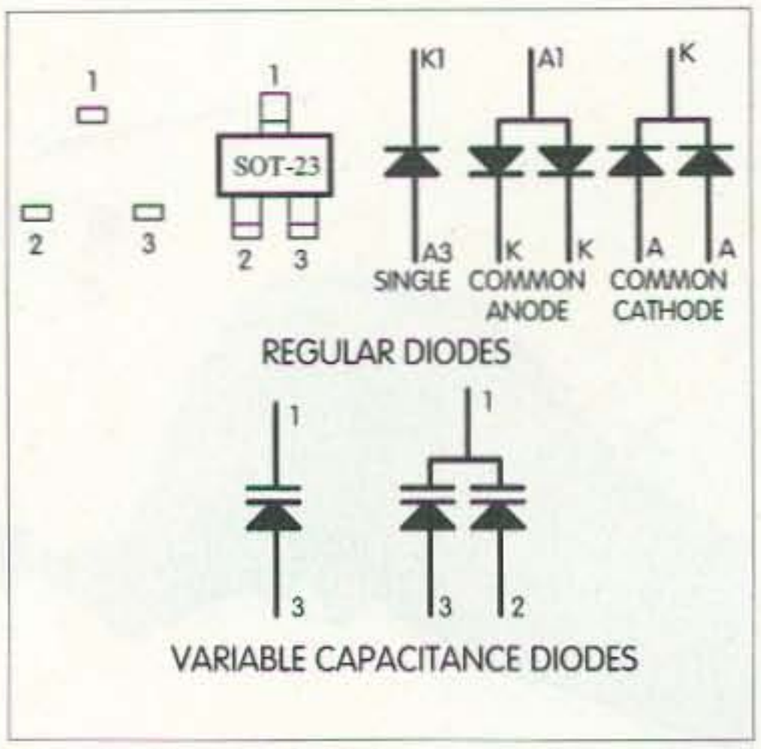

Fig. 4. *The fixed diode terminals are listed as numbers and more than one diode may be found in one chip.*

These transistors can be tested with the transistor tester or with the diode test of the digital-multimeter (DMM).

You can identify the SOT-23 general purpose FMM3906CT by a 2A stamped on top, and the FMMT3904CT by a 1A. The CMPT2222A switching transistor has a C1P on its top (body) (**Fig. 3**).

IC chips

The SMD IC chip is constructed somewhat like the standard IC with gullwing terminals. Usually these static-sensitive devices arrive in dark static-sensitive bags. Terminal 1 is identified by a U or indentation circle on top and is found at the bottom left hand corner, looking down upon the chip. For instance, the linear LM386 low power amp IC is an SMT p/n LM386-1-ND at Digi-Key and has an SO-8 outline. The 386 numbers are stamped on top with an indented circle at terminal 1.

IC chip devices are neither heatproof nor shockproof. They are made of ceramic or plastic molding, and they should not be subject to direct shock. Do not apply unnecessary stress to the chip. Handle SMD semiconductors with extreme care. Install the chip flat upon the printed circuit board.

SMD diodes

The leadless, fixed, Schottky barrier, zener, and variable capacitance diodes appear in SOT-23 packages. These diodes might look like three-legged

transistors. The SMD diode can be identified by two alphabet letters or numbers. You might find one or two fixed diodes in one chip (**Fig. 4**). Only two terminals are used with one fixed diode, while all three terminals are used with two diodes in one SOT-23 chip. These diodes can be purchased in one (1), 10, and 100 lot pricing.

There are several different packages the SMD diode may appear in. The SMD signal diode SD914 or MMBD914 might appear in an SOT-23 package, while an SMD S1 signal diode appears in a round LL-34 chip. The SMD zener diode might be found in a flat round chip, or in an SOT-23 package. The case and power rating of a 3.6 V zener diode rated at 200 mW, 300 mW, and 400 mW are found in an SOT-23 package. The LL-34 case zener diode is rated at 500 mW in a round package. The SMD one-watt zener diode appears in a round (SM-1) or PSM flat chip. All SMD diodes can be tested with the diode test of the DMM.

Which side is up?

Mount the SMD resistor with the numbers on top and black side upward. The bypass or coupling chip capacitor, which might not have any markings on the body, should be mounted with the contact points downward on the end pads. Mount the small chip electrolytic capacitors with the capacity and voltage listed on top with contacts at the bottom. Make sure the white line on the top side of SMD capacitor connects to the positive voltage. The top black edge of the aluminum electrolytic capacitor is connected to ground.

The transistor is mounted with the number and letter (example: 1A) upward with the terminals over the three PC pads. Place the indented dot of the SMD IC at terminal one on the PC wiring. Make sure all terminals line up with the PC pads and connections.

Mounting SMD components

Fixed SMD capacitors and resistors are constructed so that solder is applied to each end, which then lies upon a solder pad of the PC wiring. If the resistor or capacitor lies over a piece of PC wiring, I like to place a thin piece

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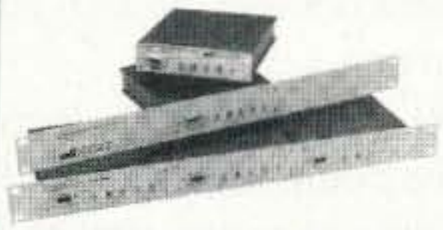

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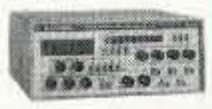

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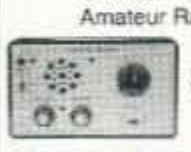

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of cellophane tape over the wiring before the part is mounted. This method prevents any part from shorting between wiring and component.

First, I prefer to mount all fixed capacitors, then resistors, and then semiconductors last. Take one part out of the package at a time. Remove the part from the strip by sliding a razor or knife blade under the piece of cellophane, and then place the SMD part on a sheet of white paper. Seal the remaining parts on the cut tape strip with a piece of tape. Return all parts back to the original package or bag. Seal up with tape or staple the plastic packet so parts will not spill out.

Before installation, test each resistor for correct resistance and fixed capacitors for possible leakage. Measure for correct resistance and capacity leakage with the 2 k Ω range of your ohmmeter. Carefully place the meter test probes at each end of the component for a correct test. Likewise, check each SMD transistor or diode on the diode test of a digital multimeter (DMM), if one is available. Double check the polarity of diodes and electrolytic capacitors before and after installation.

Grasp the tiny component with a pair of small tweezers and hold the ends to be soldered over the correct set of pads. Make sure the wiring pads are tinned with solder. Choose the smallest diameter of rosin solder for those tiny connections. Tack one end in with the soldering iron. A dab of solder will do. Then go to the opposite end and apply enough solder to make a clean soldered joint. You are soldering the ends of the SMD part to the PC wiring pads. Go back and resolder the tacked-in side. A good soldered bond on the end of the SMD component will have a bright, clean connection.

Choose a 30-watt (or less) soldering iron with a fine point. A battery soldering iron is ideal and makes tiny bright connections. Do not leave the iron on the joint too long; it will damage the SMD part or lift the PC pad and wiring. Double-check the soldered connection with the magnifying glass. After installation, check for correct resistance across the fixed resistor and leakage across the capacitor.

The semiconductors are the most difficult SMD components to solder into the circuits. They have such tiny connections. Try to center the three transistor terminals over the right soldered pads or tabs with the small tweezers. Tack in one terminal to hold it into position. Then carefully solder up all three terminals with the fine point of the soldering iron. Be very careful not to apply too much heat from the iron and destroy the transistor.

Check for the indentation or dot on top of IC that indicates terminal 1. Make sure terminal 1 is at the right pad. Double-check to see if all IC terminals are over each PC wiring pad. Tack in one terminal on each side of the IC so it will stay in position. Now solder up all IC terminal connections to the PC wiring. Inspect each connection with the magnifying glass.

Test between each IC element or terminal with the 200-Ω range of the DMM for leakage. Sometimes too much solder will lap over and cause leakage between the two terminals. Make an in-circuit diode-transistor test of each diode and transistor. You want to make sure the transistor or IC is not damaged and has good clean soldered connections.

The resistance and diode tests of resistors, capacitors, transistors, and ICs ensure that no parts are damaged, the correct part is in the right position, and good soldered connections are made. This increases the likelihood that the electronics project will perform after all parts are mounted. When it's fired up for the first time, and it works, there are no greater rewards.

Testing components

Test each SMD component after it's mounted and soldered. Inspect each soldered connection with a magnifying glass. Check the resistance of each SMD resistor. Check each capacitor for leakage. Take a low-ohm continuity measurement across coils and inductors.

You will note that when a resistance measurement is made across the electrolytic capacitors, the meter hand will charge up or the DMM numbers will rise and fall as the capacitor discharges. Reverse the test probes and the capacitor will charge up again according to the amount of capacity of the electrolytic. The charge is very small on a 10 µF electrolytic capacitor when compared to a 100 µF one. The charge and discharge of the electrolytic indicates a good connection, normal capacitor, and no shorts or leakage.

Test each transistor with the diode-test of the DMM. Place the red probe (positive) of an NPN transistor at the base (B) terminal and black probe (negative) at the collector (C) terminal (**Fig. 5**). Note the normal diode-junction test resistance. Leave the red probe (+) at the base (B) terminal and place the black probe (-) at the emitter terminal. Notice that the two different

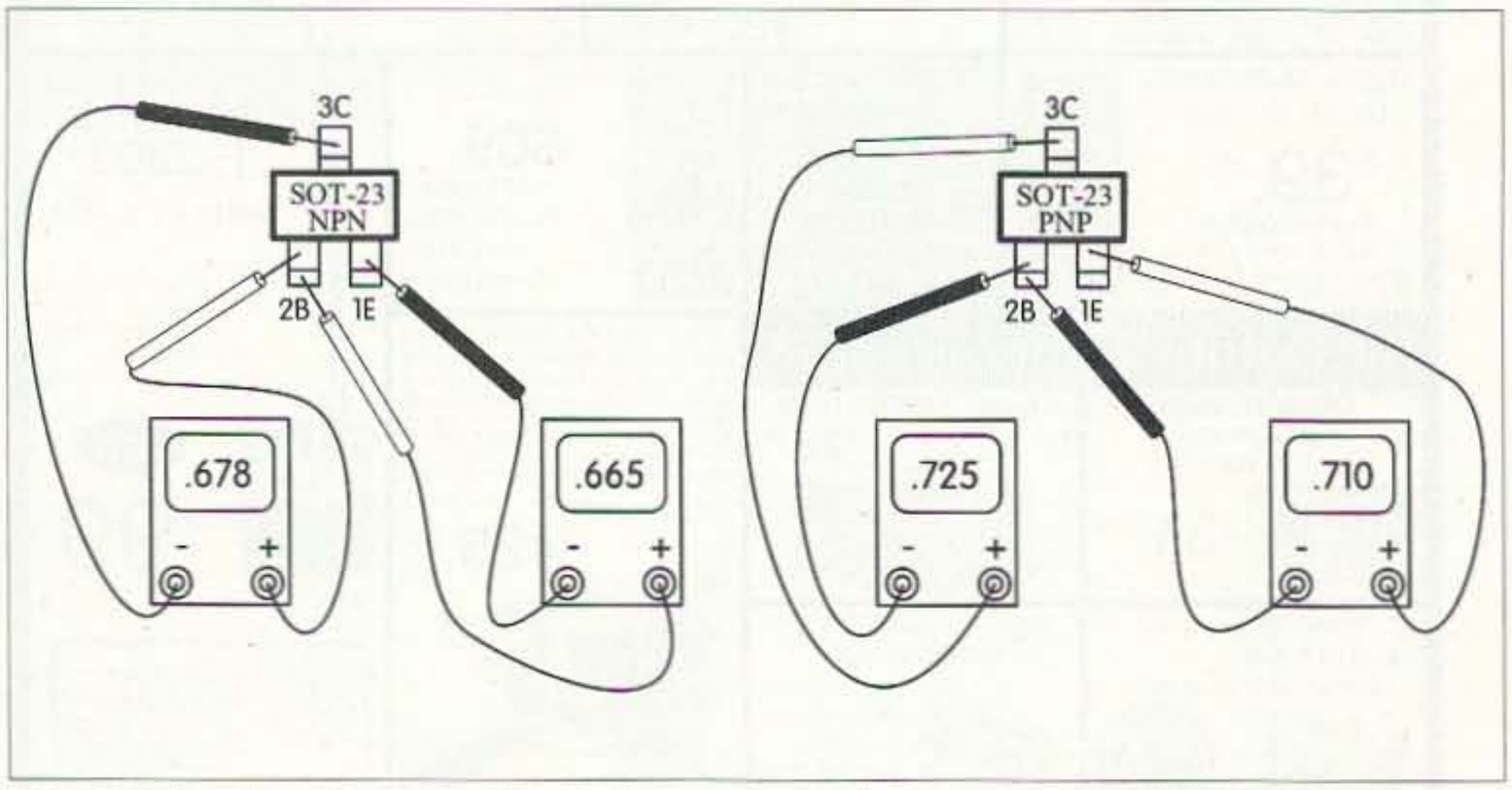
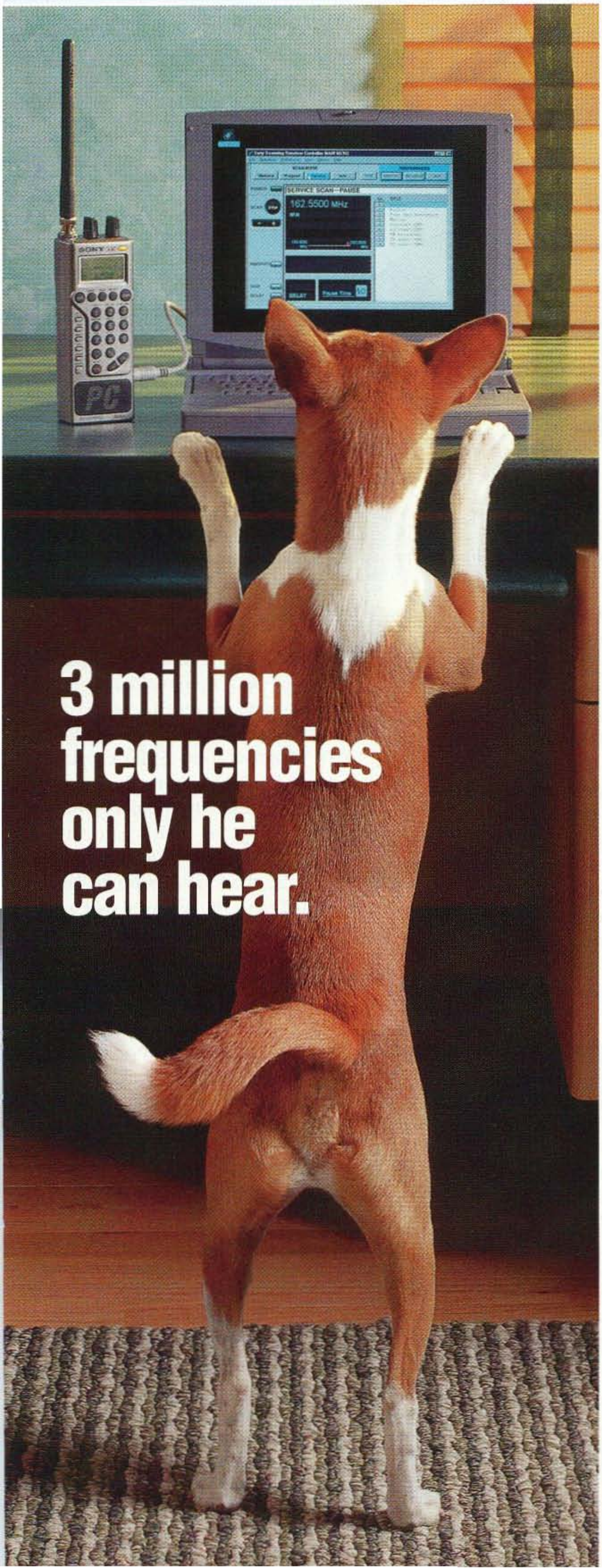


Fig. 5. Checking the normal transistor with a diode-test of the DMM. This diagram shows the forward bias test only. All junctions should show a very high resistance in the reverse bias configuration.



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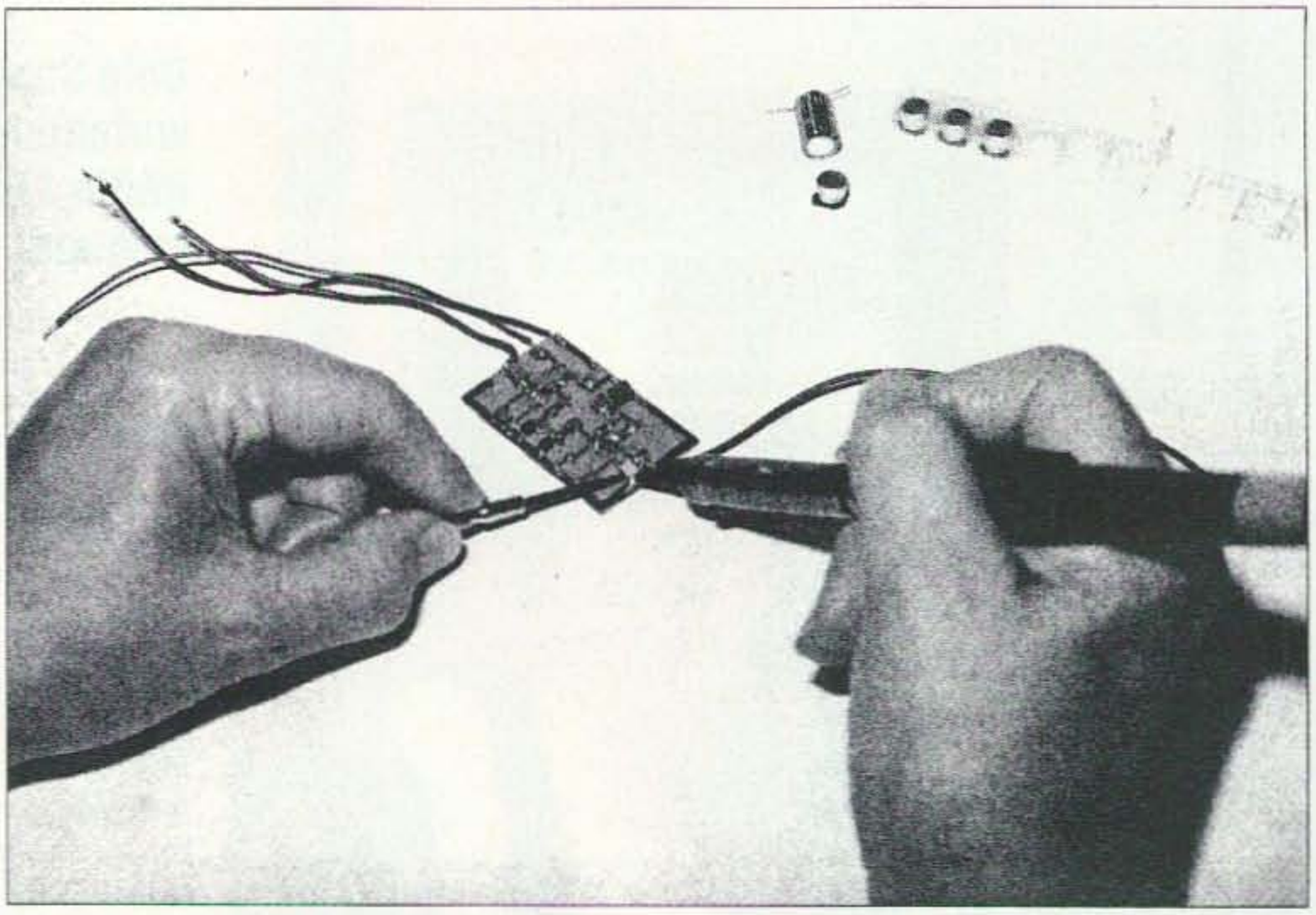

Photo D. Apply heat from the iron and pry up on chip to remove it from soldering pads.

resistance measurements are quite close with a normal transistor.

Now reverse the test leads. An infinite reading indicates a good or normal transistor. If a low resistance measurement is found below 100 Ω, in both directions, the transistor is leaky. The transistor is shorted between two elements if the reading is below 5 Ω. The leaky or shorted transistor will have a low ohm measurement with reverse test leads in both directions. Often, the defective transistor becomes leaky between collector and emitter terminals.

Removing SMD components

If you have placed the SMD part in the wrong spot or have damaged the tiny parts with too much heat, the component must be removed from the PCB. Remove fixed SMD capacitors and resistors by applying the iron first at one end and then quickly to the other. Pry up the SMD part with a small screwdriver. By quickly heating both ends, the small chip can be removed. Throw the removed part away. Do not try to reuse it.

Heat each individual terminal of the transistor and pry up each terminal with a pocket knife or small screwdriver (**Photo D**). Do the same with each gullwing terminal of the damaged IC until all terminals are removed. Touch up the soldering pads with solderwick and soldering iron. Lift the excess solder from the PC pads and wiring.

Where to locate SMD parts

Most SMD components for electronics projects can be ordered through electronics mail-order firms. You may have to shop around to acquire special SMD parts. Digi-Key and Mouser Electronics handle most SMD components, while other mail order firms might handle only capacitors and resistors. You can identify SMD parts with a typical case mounting, diamond markings, or SMD listings in the parts catalog. 73

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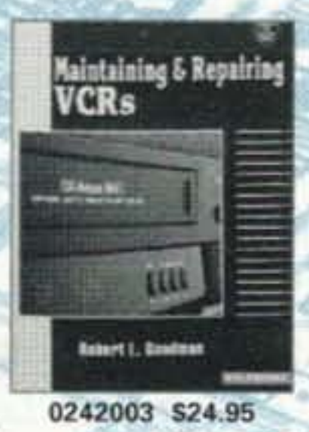

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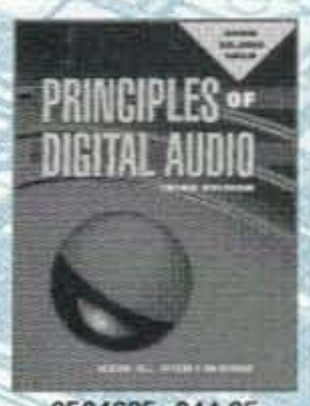

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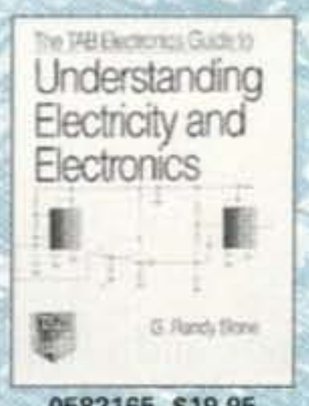

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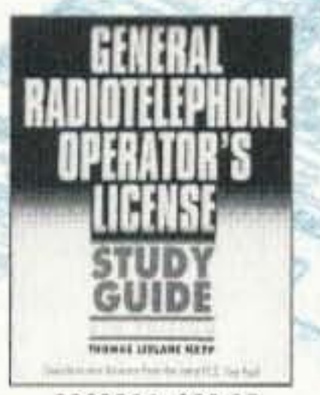

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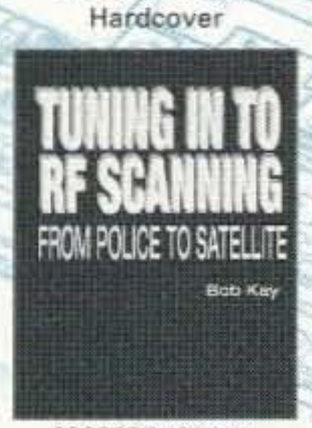

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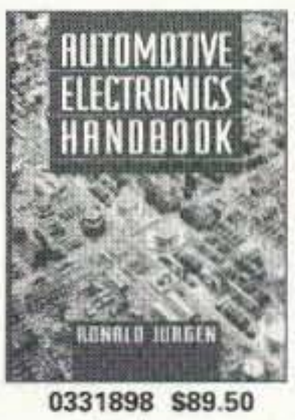

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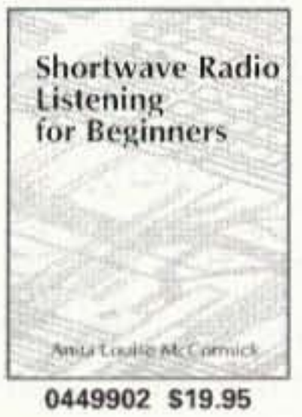

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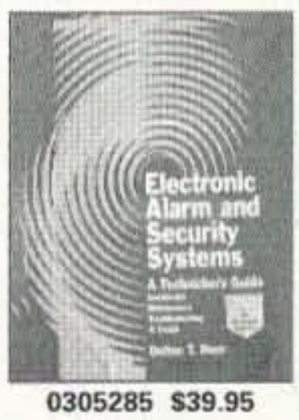

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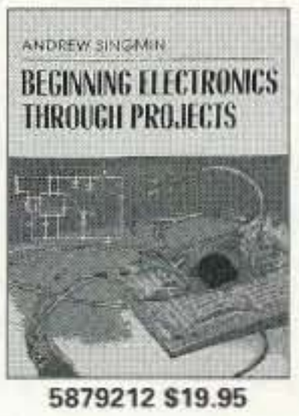

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STAR1098

What is a Linear Amplifier Saver?

Why, it's the MFJ-214, of course!

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Niles IL 60714-3108
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Linear amplifiers made for intermittent amateur HF SSB service aren't meant to be operated at full key-down power ... at least not for more than a very few seconds (and when the manufacturers say a few seconds, they usually mean it!). The power supplies used in amateur-grade amplifiers, the ratings on the tube(s) themselves, and the cooling systems employed are usually designed for voice-waveform, single-sideband, intermittent duty *only*, and any attempt by the operator to ignore these warnings is usually met with shortened component life or even immediate failure.

To make matters worse, in order to ensure correct tuning and best linearity, a linear amplifier should be tuned up at full PEP (peak envelope power)! Given these restrictions, how in the world can you properly tune up an amateur-grade HF linear amplifier ... if it can't be run at full output long enough to see when it is in tune?

The MFJ-214 Linear Amplifier Saver has been designed to solve this seeming paradox.

Here's what it does

The MFJ-214 is basically an audio square-wave pulse generator, coupled with a switching transistor driver. It's connected to your transceiver's CW key jack and it keys the transceiver on and off at a fairly rapid rate. This allows the linear amp to reach full output power many times each second, but for only a short period of time within the framework of any one of those on/off cycles in any second. This allows the amplifier to reach full *peak* power for a portion of each second, but keeps the *average* power at about half of that peak. That's a whole lot easier on your amp than flat-out, continuous, key-down tuning.

Here's how it does it

The square-wave generator in the MFJ-214 is a single NE555 dual-comparator IC, running as an oscillator instead of a comparator, followed by a 2N7000 FET which is used as a solid-state switch. The FET transistor switch keys the host transceiver's positive keying line via the transceiver's CW key jack (usually located on the rear apron of the host transceiver). The MFJ-214's circuitry will handle 50 volts open circuit and 100 mA of keying current. It can also be used with negative voltage keying lines if certain precautions are followed as outlined in MFJ's well-written accompanying manual.

Once connected to the host transceiver's CW key jack, and with the transceiver itself feeding into a dummy load, the '214 is ready to go.

First, a couple of definitions just in case you're not familiar with these terms. When you see the word "exciter" in quotation marks in the MFJ manual, it simply means the amateur "transceiver" that you're using, and the term "PA" means the final "power amplifier" stage in either your transceiver or linear amplifier. These are terms that were more commonly used in the past than in the single transceiver-oriented amateur radio world of today.

The nitty-gritty

The MFJ-214 has two (screwdriver-adjustable) internal controls: the pulse repetition rate control (which controls the frequency at which the NE555 is running), and the pulse duty cycle control (which controls how much of one cycle is occupied by each pulse, i.e., the pulse's width).

If you're not familiar with the concept of duty cycle, here's basically what it means: If you picture the time between two fixed points as the length of time of one cycle (at a given frequency), the duty cycle is how much of that time is actually occupied by the pulse maximum. **Fig. 1** shows the concept for three different pulse widths and their resultant duty cycles (usually expressed as a percentage), and **Fig. 2** shows how those pulses would key an

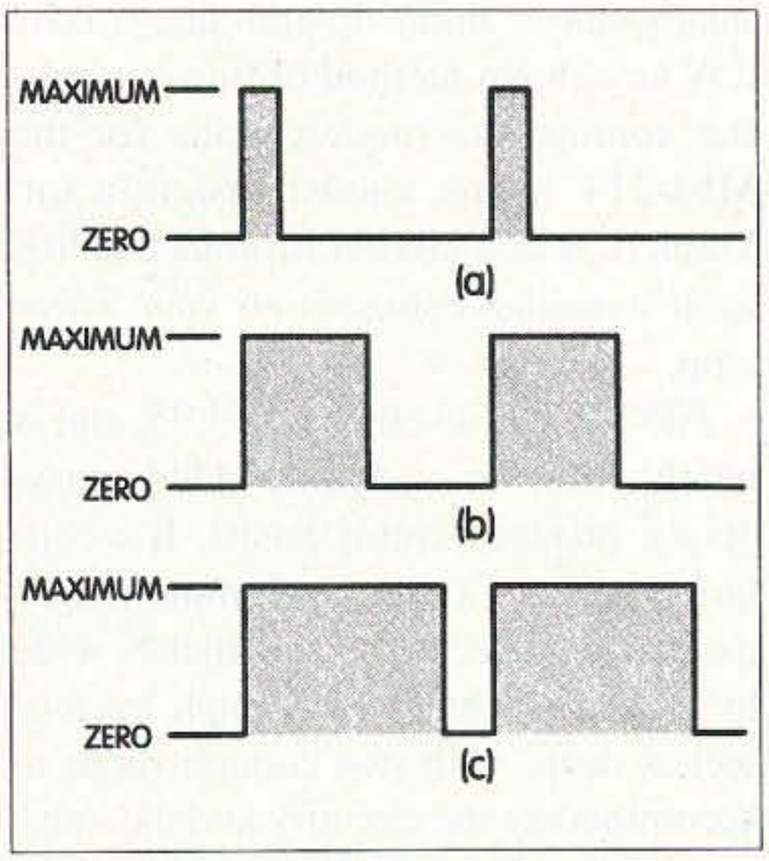

Fig. 1. *Examples of two cycles of a square wave of the same frequency, each having different duty cycles. (a) 20% duty cycle: 20% of the time the output is at maximum, 80% of the time, it's off. (b) 50% duty cycle. (c) 80% duty cycle.*

HF transceiver's CW keying line (and how they would appear on an RF monitor scope).

Simply put, duty cycle is the ratio of time on duty to time off duty, just as the name might imply. The MFJ-214's repetition rate (frequency) is adjustable from between 16 Hz and 41 Hz. The duty cycle can then be adjusted between about 30% on-time to about 70% on-time when the repetition rate is set at 25 Hz (or mid-range). Interestingly, the duty cycle range varies with the repetition rate, being greatest at the highest repetition rates. These conclusions are from measurements that I made on my own '214.

There are just two external switches on the MFJ-214: an alternate-action power on/off switch (labeled "Pulse Tune") that connects and disconnects the nine-volt battery power source, and a momentary "Carrier Tune" switch that allows the operator to momentarily switch to a steady CW carrier for comparison purposes as described later.

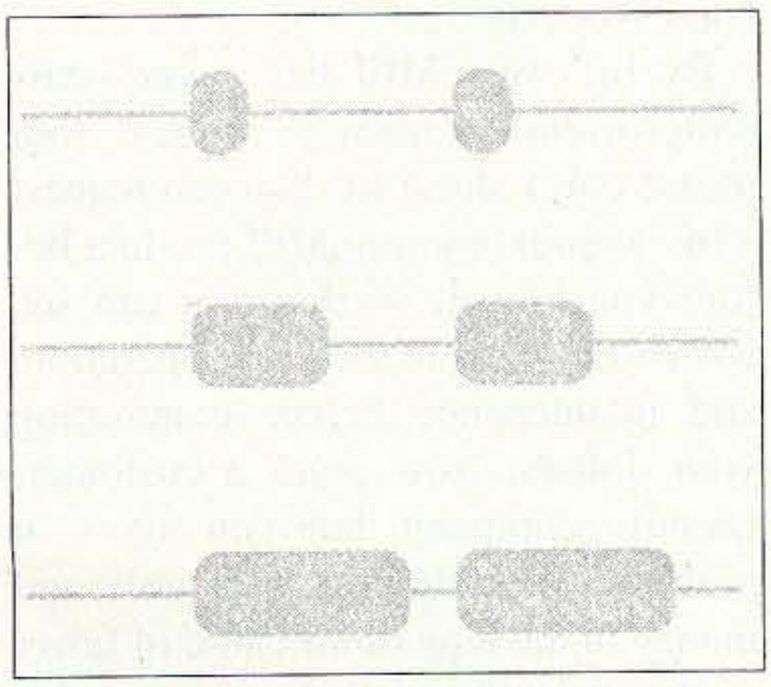

Fig. 2. *Same as* ***Fig. 1****, as duty cycles would appear on an RF monitor scope when keying an HF transceiver.*

The docs

The manual for the MFJ-214 is very clearly written (although maybe it's somewhat technical for newcomers at times) and describes typical "real world" speech duty cycle like this: "Unprocessed speech usually has an average power between 1% and 10% of peak envelope power. Sustained speech, such as a long 'hello,' produces average power levels that typically range from 10 to 30% of PEP. Heavy speech processing increases the average power, pushing the short-term average power of normal speech to 30% or more."

All of this makes more sense if you've ever looked at an amplifier's RF waveform on a monitor scope. Unprocessed human speech produces very "spiky" waveforms. As speech processing is added (or words are exaggerated), the waveforms look less and less spiky. This increases the average power in the speech waveforms, but as we've all heard, it also changes the overall quality of the sound.

Any processed speech must sound somewhat different from unprocessed speech because the two waveforms are different. The MFJ manual goes on to say: "Proper amplifier or transmitter tuning requires adjustments at maximum peak power, generally with maximum available drive from the exciter. A continuous tone or carrier is generally used during adjustment, and the amplifier is generally tuned for maximum output. The continuous single tone carrier ... will raise heat significantly. The MFJ-214 Linear Amplifier Saver allows proper tuning while driving the PA with a low duty cycle waveform." And so it does.

The manual also describes how to adjust both the pulse repetition rate and the duty cycle controls properly. It cautions that: "If the pulse rate is too fast and/or the duty cycle too long, the pulses will blur into one long steady signal." This, of course, would result in the operator being no better off than before, and the amplifier being tuned would quickly overheat. The manual goes into why the pulse duty cycle out of the MFJ-214 may not exactly match the duty cycle of the amplifier's RF envelope (it has to do with delays within the transceiver's CW wave shaping circuitry). It also cautions that if the duty cycle is too low, full peak envelope power may not be reached.

The manual further touches upon the problem of wattmeters, both averaging and peak-reading ... not all peak-reading meters are truly peak-reading! Your peak-reading wattmeter should read the same as an average reading

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wattmeter when the MFJ-214 is in the Carrier Tune mode. When in the Pulse Tune mode, however, a true peak-reading meter may read a somewhat higher amplifier output wattage. This is due to both ALC foldback and power supply voltage sag during full-power output operation of your SSB linear.

MFJ suggests that the ideal position for the pulse rate and the duty cycle controls is achieved when an accurate peak meter reads maximum output, and then the controls are moved just a tad beyond that point (presumably to allow for some variation in battery voltage within the '214). Though the manual misses this point, all of this can be done with the linear amplifier in the standby mode, using only the transceiver's "barefoot" output power (generally 100 watts for most current HF transceivers). Once these controls have been set, then the linear amp can be placed in the "operating" mode and safely tuned with the reduced average power.

I found that with my station setup, the pulse repetition rate control runs at about mid-range, and the duty cycle control just a bit clockwise of mid-range. This gives me a reading of 50 watts on my averaging inline wattmeter, and 100 watts on my peak-reading wattmeter, with my HF transceiver operating "barefoot" into a 52-ohm dummy load ... just what I want. I can then switch my linear inline and take my time tuning it up, confident that the linear is pretty much "loafing along."

At the 25 Hz (or so) pulse repetition rate, my averaging meters show very little bounce. If you find that yours bounce too much at these settings, increase the pulse repetition rate and lower the duty cycle somewhat until your averaging meter shows about one-half of your transceiver's full CW power output. Then you should be all set.

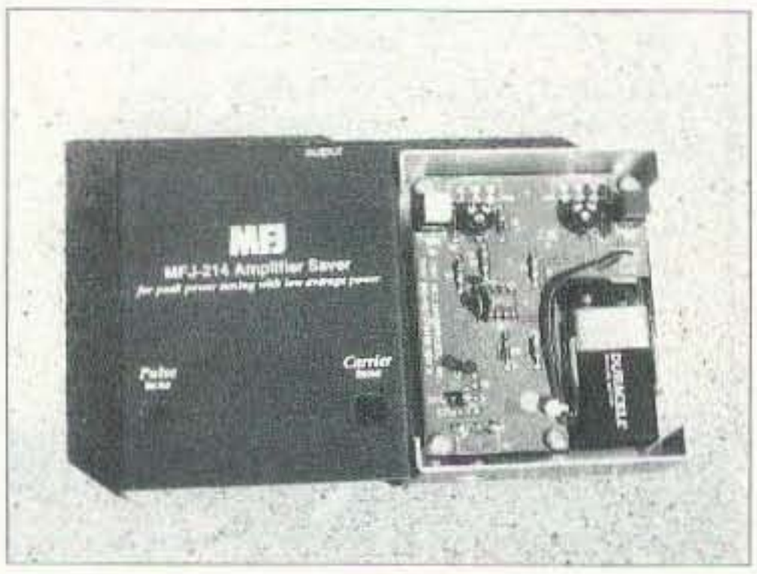

Photo A. *The MFJ-214 Amplifier Saver.*

Watch the words "average" and "peak." The whole idea behind using the MFJ-214 is to keep the average power low, while allowing the linear amplifier being tuned to reach full peak power ... but only for part of the cycle. That's also the whole idea behind balancing the pulse repetition rate and the duty cycle controls. What we want to do is to get the amplifier to go to its peak output for a long enough period so that we can read the meters, but also for a short enough period so that the amplifier is running at about half power as far as the adverse heating effects are concerned. That's the bottom line: keeping the average heating power to one-half or so, while pushing the amp to peak power part of the time.

The manual also stresses that a peak-reading wattmeter is not needed to adjust your linear amplifier correctly using the MFJ-214 Amplifier Saver. As they put it: "When the amplifier is tuned to produce maximum average power, when driven with a constant rate and duty cycle pulse, it is almost certainly tuned for maximum peak power." The manual also states that: "The least damaging and cleanest PA tuning condition generally occurs when the PA is peaked slightly beyond maximum output, in a direction that OPENS or UNMESHES the loading capacitor..."

It also warns about not having enough of the amplifier's "loading" capacitor in the circuit before applying full exciter power. Undercoupling an amplifier's tank circuit can cause the plate tank voltages to rise beyond the ratings of some of the components normally used in an amateur-grade PA tank circuit and thus can result in arc-over or other high-voltage induced problems.

That pretty much covers both the operation of the MFJ-214 Amplifier Saver accessory and the guidance on its use provided by the accompanying MFJ manual. When you factor in the current price of tubes and other components that can be stressed beyond their limits by using the old-fashioned, steady-state, "hurry-up-and-tune-it-fast" CW key-down method of linear amplifier tuning, the modest price for the MFJ-214 seems almost insignificant. Think of it as a kind of insurance policy against needless stresses on your linear amp.

The MFJ-214 sells for $49.95, and is neatly built on a double-sided glass-epoxy printed circuit board. It's contained inside a black aluminum box measuring three and a half inches wide by one and a half inches high by four inches deep, with just enough room to accommodate the circuitry and the internal nine-volt battery. It draws about 10 mA from the battery while in operation.

The only shortcoming that I found with the '214 was the lack of an on/off power indicator. It's a little too easy to leave the unit turned on, forgetting that the internal battery is wasting away unnecessarily. Sacrificing a couple of more mA by including a flashing LED power-on indicator would have been a good addition at the factory, but it's also one that can easily be added by the buyer should it prove to be needed at a later date.

How to get one

MFJ products are carried by most ham dealers nationwide, or you can contact MFJ Enterprises directly by calling (601) 323-0549 or (601) 323-5869. You can send a FAX to them at (601) 323-6551 or send an E-mail to: [techinfo@mfjenterprises.com]. MFJ also has a nicely done Web site at [http://www.mfjenterprises.com/] with downloadable information online as well as links to other amateur radio-related Web pages.

By the way, MFJ has a very customer-friendly manual policy (but please don't abuse it). You can request a free manual for any MFJ product before you buy it, so that you can see what's involved in its setup, operation, and maintenance before committing your dollars. Now *that's* a customer-friendly company, but you know, it probably saves them time, trouble, and money in the long run because of fewer returns from dissatisfied customers. It's smart business practice and others may be well advised to imitate it. 73

The Ideal Log?

This computer-style card file may be for you.

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One of life's little challenges: When contacting a station you are sure you have worked before, what was … the operator's name? Station's QTH? Date last worked? QSL situation?

Do these questions ring a bell? Of course, if you keep no log there is not much that can be done about these questions except to delve back into your super-duper memory. The simplest solution for normal folks would be to keep a card-file log.

When first receiving General or Novice licenses, usually one of the first goals of amateurs is to talk to as many high-frequency DX stations as possible around the world. For many of us this mild form of madness in making only DX contacts wears thin. After a while it is found to be more satisfying to intersperse our DXing with talking about a variety of interesting amateur radio or other topics with amateurs on the air by phone, CW, and so forth—to "rag-chew" with them. Eventually, those 10- or 15-second DX contacts may even be given up entirely over the years.

The logging method described here is somewhat the same as logging with a computer, except that no computer is required. It is good not only for DXers, but also is really great for rag-chewers on all of our MF, HF, VHF, UHF, and SHF bands. When you learn to enjoy rag-chewing, you will find it helpful to keep a log of pertinent items of information about operators who have been worked before. Unfortunately, if you use a common logbook, it may take a lot of leafing back through many logsheets, or even logbooks, to find a "worked-before" station's callsign and to determine what previous notes can tell you about that other operator. If you have some items about the other person's activities readily available in your log, you can develop a much more enjoyable and worthwhile second, third, or even more frequent QSO.

Leafing back through a logbook for information about a previously worked station can waste a lot of time, especially if you haven't worked that station in several years. The best way to beat the leafing back is to use a card file, with one card for each station, no matter how many times it is worked. I have used a card-file log for more than 25 years. It is possible to put about 20 QSO entries for a station on one file card if both sides are used. When rag-chewing on any band, many stations will be worked several times and you get to really know the other operators.

A card file is interesting to use. Other operators with whom no contact has been made in some time may be astounded when they are addressed by name, are asked if they are still in the same QTH (which is named), are asked if they are using the same rig (which is also named), and are told how long it has been since the last QSO—in '85, '91, '97, or whenever!

Many amateurs have tried card-file logs, but given up after a while, because they went about it in the wrong way. I know I did. Then, after many years of using regular logbooks again, I felt there had to be a better way to keep track of stations worked. So I went back to file cards again, but this time I devised a better method—one that really works.

One difficulty with file-card logging is not being able to determine what stations were worked yesterday, or last week, or last month. There is no way to do this with file cards alone. However, there is a very simple fix for this. Use a little four-by-six-inch spiral-bound

notebook. Jot down the day's date on the first free line and after that, the callsign of each station as it is worked that day. With such a little notebook, a quick review of all stations worked recently is readily available. Full information about these stations will be on their file cards. Other uses for such a notebook might be to log the calls of stations checking onto regular nets, times/frequencies/results of tests made, and callsigns/time/bands/mode/etc., when contesting.

The secret of the successful use of a file-card system is the file cards used. It is possible to buy three-by-five-inch file cards, of course, but they are rather thick and are expensive. More important, because they are thick, not many will fit into any reasonably-sized filebox. What is the best alternative? Simple. With a paper cutter, cut two or three pieces of standard-size (eight and a half by 11 inches) 20- or 16-lb. typing or computer paper (cut down the middle, vertically) into strips 11 inches long by four and a quarter inches wide. Cut these strips horizontally into four "cards," each four and a quarter inches by two and three quarters inches. You can fit about 500 cards this thin into each two inches of storage box length. The 12-inch-long box suggested below will hold about 3000 cards and leave enough room between cards to allow adequate fingering space. If you have no paper cutter, a local printer can cut half a ream of paper to the correct dimensions. Make sure all cards are *exactly* the same height! The width dimension of file cards is not too critical, but the height of all cards must be the same or there will be trouble trying to finger through them when they are filed. It might be better to cut them to a two and one-eighths-inch height so they will be uniform in height. Variations in the 11-inch paper height seem to be more or less common when paper is purchased from different manufacturers.

A suitable file-card box is easily constructed. Glue and nail together an open-top box out of 3/16- or 1/4-inch plywood pieces. Cut them to produce a box with internal dimensions of four and three-eighths inches wide, ±12 inches long, and two and a half inches deep. If you work with metal, it should be simple to fold and solder or bolt together such a box. Probably even a heavy cardboard might be glued together. File your cards in this box by their station callsigns. It is handy to fashion a holder for the four-by-six-inch spiral-ring notebook and glue it to one side of the file box.

QTH	OP'S NAME	CALL
Address	Spouse's Name	Year Licensed
E-Mail Address		Work/Retired?
		Background, etc.
Rig/Power	Antenna	CW Speed

date/start time/end time/other RST/my RST/freq./mode/special info from QSO/hobbies/health/age, etc.
date/start time/end time/other RST/my RST/freq./follow-up on notes from last QSO, etc.
date/start time/end time/other RST/my RST/freq./follow-up, etc.

Fig. 1. *One layout pattern that has proved successful for the author.*

If you are not experienced in keeping a card file of amateur stations, a recommended method is to file first by the station's district number and then alphabetically by the first, then second, and then third letters following the number. When there are number-letter duplicates, file these alphabetically by the letters preceding the number.

Let's check some examples. Here are some calls of stations that might have been worked:

W2NSD/1
W6ECU
K4NO
KL7RQ
W6BOB
K1AVG
K6ECU
N6ECU
K7NP
XE3MN
W4NO
WA6ECU
VE2ALU

These cards should be filed by their numbers first, then by letters that follow the numbers, and *then* by letters that precede the numbers. Any foreign station callsigns that start with numbers and then have letters can be filed separately, either before or after calls starting with letters. Can you put these in the correct order? (Answer at end.)

To separate the different district-number cards, use heavier but similar height and width separator cards. Glue small labels or tabs on them that project up above the separator card tops about one-quarter inch. (Standard three-by-five cards can be cut to this shape and work well.) On the tab, print with a black felt pen the 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0 district numbers for the callsign cards which will be filed behind them. The K1AVG card in our examples would be filed behind the separator card labeled "1." The VE2ALU card would be filed after the "2" separator card, and so on.

Since I live in the very large W6 district, I follow my sixth district separator card with 26 similar separator cards, except that these are alphabetically labeled with "A," "B," "C," etc. All of the many sixth district cards are filed alphabetically by the letters following the district number and behind the sixth district separator card. Since I am surrounded by several nearby seventh district states, I also use alphabetical separators with these cards.

If possible, it is best to fill out the file card for any CW, SSB, RTTY, etc., contacts while the other station is transmitting. For CW QSOs, this requires an ability to copy in your head. If copy is made on paper, the card can be made out at the end of the QSO. Don't wait until sometime later to do it, or you may get into trouble. As soon

as a CQ is heard, or when entering into a QSO, if you called the CQ, check the file to see if the other station has been worked before. It is OK to send "QRX min" to allow checking. If this is not done, you may waste time making out a second card for a station worked previously. At the end of the QSO, when all of the information wanted is entered on the file card, enter the station's callsign in the notebook, file the card, make out a QSL if this is desired, and you are ready for the next QSO.

You can enter information on the file cards using various schemes. One layout system that has been found successful goes like this: In the top left-hand corner, write the station's QTH; below that, the address if wanted; and below that, the E-mail address if wanted. Middle top, two lines: op's name, then spouse's name. Top right, four lines: callsign; year licensed; op's work, or retired?; and background/other info. See **Fig. 1**.

Next, three entries lined up straight across: station's rig/power at left; antenna info in middle; and CW speed to use at right.

Then we begin our QSO entries, starting at the far left and continuing across the card, using as many lines as necessary. Each entry looks like this: date/start time/end time/other RST/my RST/freq./mode/any special info from the QSO, e.g., hobbies, surgery, new car, age, etc.

The next entry would be the same, except that "special info" might include follow-up on the previous entry.

The difference between the start time and the end time can indicate what kind of a rag-chew it was. A 10-minute or less QSO indicates that there was not much of an interchange of interesting information. A QSO with a 20- to 60-minute difference says that a lot of information, probably quite interesting, was exchanged and that here is a good rag-chewer. Circling the "age" number, if one is given, may help to determine what subjects might be used during any upcoming QSO. The last-worked date is helpful. Working the same station too often may not be a good idea. For short DX contacts, a call, starting time, frequency, and

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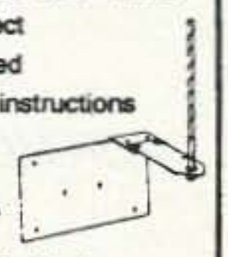

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perhaps S-meter report in the notebook may be all that is needed, using no file card at all.

When a CQ is heard, check the files to see if that station has been worked before and to see if it seems desirable to do it again. Unrewarding QSOs can be red inked around the callsign so that you may not bother to answer that station's CQ again. For example, if a CW operator has a poor fist, won't slow down for you, uses inappropriate language, is unfriendly, or doesn't want to carry on a conversation, a red line around the callsign on the card might be warranted. Conversely, blue-ribbon QSOs might be indicated with a blue line around the callsign.

QSO times can be kept in UTC, although local 2400-hour time has its advantages. First, it requires no mental gymnastics to tell what part of the day the QSOs on a file card took place. Also, if a QSL is to be sent, it tells the other operator what time of day it was at your location when the path was good, without having to figure it out. When making out a QSL to a foreign station who only uses UTC, since you know the difference in hours between your local time and UTC, just add that number of hours to your local time to give the QSO time in UTC.

Over the years you might need to double the size of the filebox, or you may want to keep DX file cards in a separate box. Any second similar box can be glued or soldered to the side of the first one.

It is handy to be able to slide the file-card box under the rig to provide a clear operating position on the desk or tabletop. To do this, the transmitting/receiving equipment can be placed on top of an inverted-U-shaped one-inch-thick wooden shelf. It should be five or six inches high, at least two feet wide, and 16 inches deep. Make sure the upright support boards under the shelf are screwed together securely with a wooden backboard to give the shelving adequate lateral strength. The card-file box will slide under this shelf, making it readily accessible but out of the way. Your key or keys may be mounted in, or will slide into, this off-the-operating-position area, as will a hand-held microphone, preferably onto a small pad. Equipment controls may be more easily seen and operated if the equipment is mounted five inches or so above the tabletop. Small loudspeakers mounted in the back of this area will project received signal sounds directly at the operator, usually making earphones unnecessary.

After a decade or so of card filing, it may be wise each January to go through all nearby district cards and remove those showing no contacts in the last 10 years. The number of file cards should increase only slightly each year from then on if this weeding-out process is used. If more filing space is required, cards from slightly more remote states may be weeded out, or another box may be added. Nearby states' silent-key licenses can be checked each month to keep the file up to date.

When first starting a card file, the box will have mostly open spaces, of course. Go back through the last couple of log pages and make out some file cards to see how things work out. If you have half a ream of paper cut to card size (4000 cards), use some of these to fill the empty box space behind the filed cards. If you do your own blank-card cutting, find a friend with a table saw if you have none, and cut some two-and-a-half-by-four-inch pieces of one- or two-inch scrap lumber and use these as spacer blocks to fill the empty spaces in your box. As the box becomes filled with filed cards, remove the spacer blocks. Always keep a few blank cards just ahead of the first district separator card to provide easy access to blank cards.

To indicate something is special about certain cards, rub a red felt-tip pen across the right-hand top edge of the card. This provides easy identity when it is filed. If you have two or three categories of cards you want to be able to identify, you can mark the top edges with different colored inks or mark different portions of the top edges of the cards.

Glue some "gliders" to the bottom of your card-file box so that the desktop will not be scratched as the box is pushed around the operating position.

Nothing fancy is required. Four round pieces of cardboard or felt, perhaps three quarters of an inch in diameter, will work nicely. Position the sliders about an inch in from each corner of the box bottom.

This logging method will enhance QSOs not only for you, but also for the other amateurs you contact. The most interesting QSOs usually occur when you ask questions about what the other person has done, is doing, or is expecting to do, or how their surgery went, or something else you picked up from the last QSO. Experience will tell what kind of questions to ask other amateurs to produce the most interesting responses and what to note on file cards. Asking questions always starts the other person talking, a good beginning for rag-chewing. A file-card log can also provide a fast check for DX stations, whether you want to work them again, whether they sent you a card or not, and so on.

As I mentioned before, a computer can be used to do essentially the same thing as a file-card system. I find it much simpler to use file cards than to boot up and get into a computer logging program, which also ties up my one and only computer. Any filing system is most handy when right in front of the operator. Computers are usually off to the side of the radio operating position. A file-card system can be a lot handier and more readily available. Rag-chewing and other QSOs will be made much more interesting if file-card logging is used.

Finally, a reminder that any filing system is only as good as its filer. Did you get your cards filed correctly? They should be:

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VE2ALU
W2NSD/1
XE3MN
K4NO
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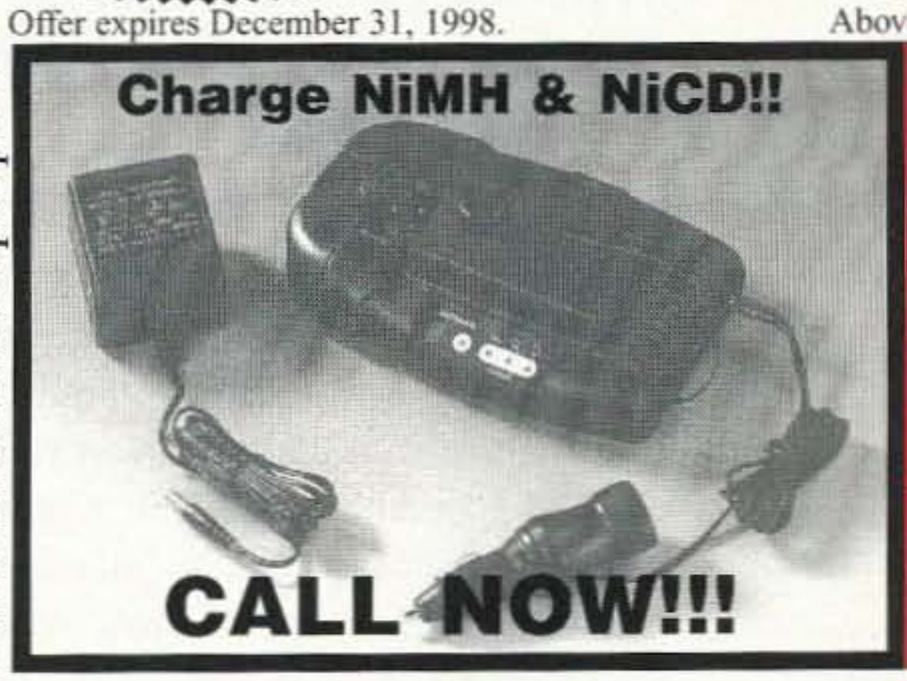

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Intro to Superhets

Part 3: Accessories and conclusion.

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

The addition of accessory circuits allows the superhet receiver to be used in many applications that might otherwise be avoided. An accessory circuit in any receiver is any circuit, other than the power supply, that makes the receiver more useful to the user and does not take part in receiving the signal. Circuits falling into that category are AVC, AGC, AFC, noise limiter, S-meter, tuning meter, squelch, and BFO. Each circuit contributes to the comfort and convenience of the user.

AVC-AGC

AVC and AGC circuits are essentially the same and are used for the same purpose, that is, to reduce the gain of controlled stages based upon the level of an incoming signal. AVC stands for Automatic Volume Control; it was used to control receiver gain in AM radios as shown in **Fig. 1**. The objective was to provide a means for adjusting the signal level at the detector in order to provide a fairly constant audio level recovery as various stations were tuned and when the signal amplitude of a selected station varied due to propagation changes. The AVC voltage was developed at the AM detector as the rectified output from the received signal which made the voltage proportional to the amplitude of the received signal.

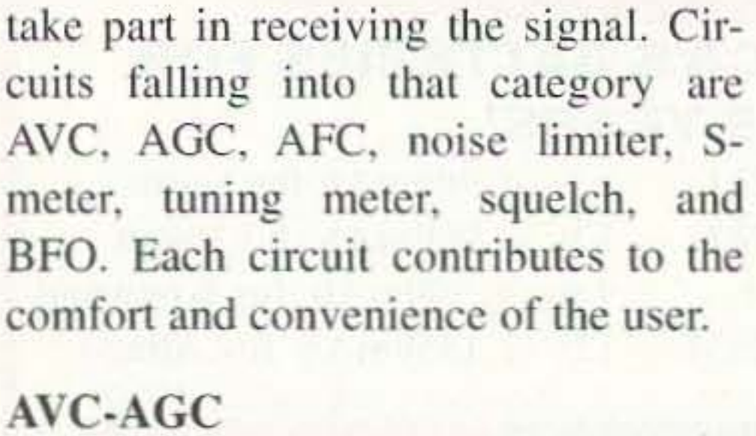

***Fig. 1.** AVC-AGC voltage derived from the detector and used to control the gain of the RF and IF stages.*

When television came into being, a concern for controlling the picture contrast developed. AVC was then used in TV sets for controlling the contrast, but now audio "volume" was not of concern so the name was changed to AGC for Automatic Gain Control. The AGC function is now used in many applications beyond those required in receivers.

Because the AVC-AGC voltage is developed at the detector, it contains all of the modulation products as well as represents the received signal amplitude. All of the modulation products must be removed before the voltage can be used for gain control, and an RC filter having a long time constant is utilized.

AFC

AFC is Automatic Frequency Control, used to counteract the oscillator drift in tunable receivers. One of many available AFC circuits is shown in **Fig. 2**. AFC in an FM receiver is essentially in the same form as the steering voltage function used in a PLL circuit. When an AFC circuit is connected to a tunable oscillator, the frequency of the oscillator can be varied by changing the tuning voltage applied to it. The receiver's oscillator can be kept tuned to a given station or signal by applying a DC voltage to the AFC circuit that was derived from the FM detector. The polarity of the derived voltage determines in which direction the oscillator is to be moved, and the amplitude determines how far.

S-meter

An S-meter used in older receivers was an analog function utilizing a milliammeter which was connected into

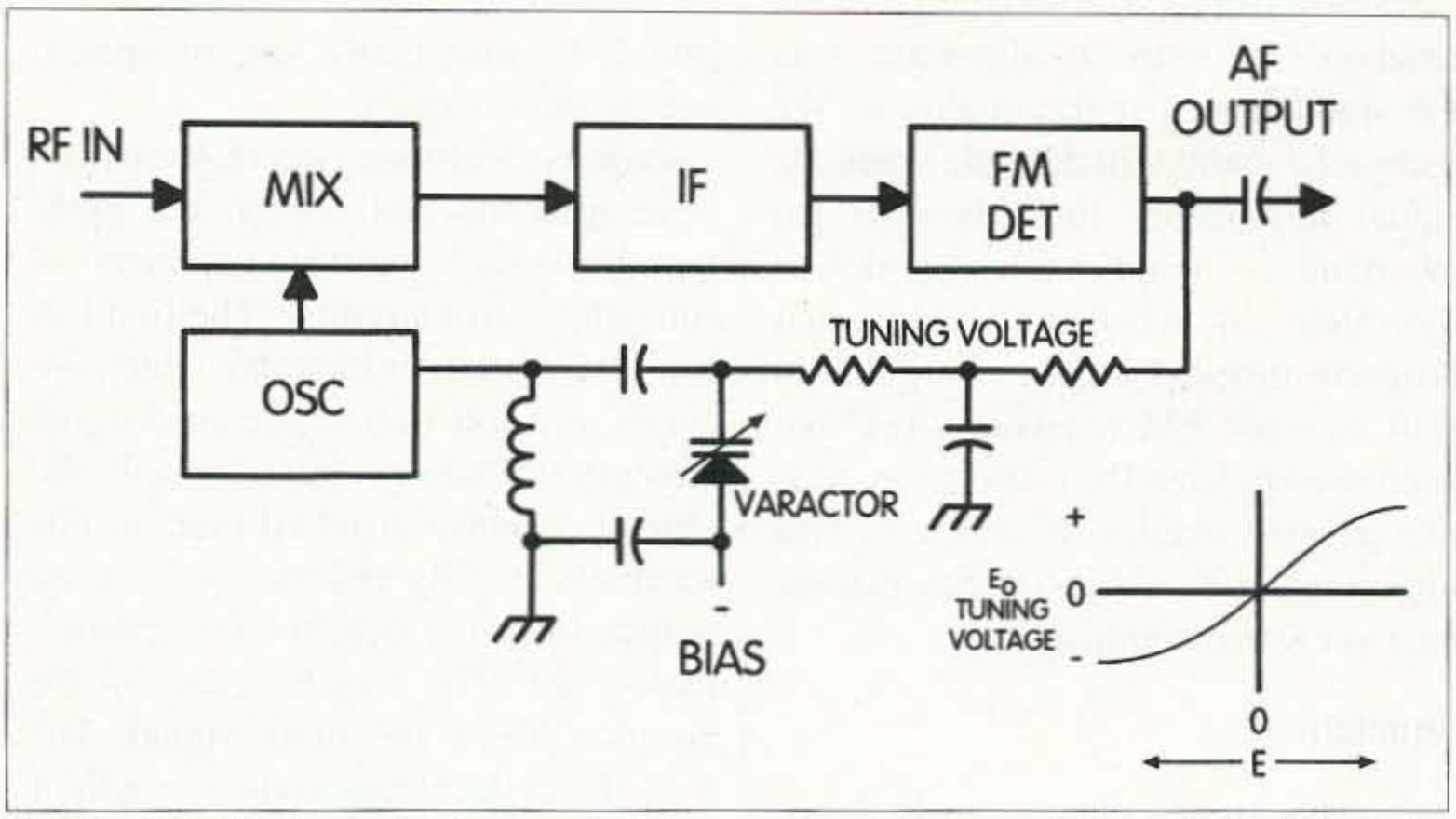

***Fig. 2.** An AFC circuit implemented with a varactor. Tuning voltage is derived from the FM detector.*

the receiver's circuit to measure the relative signal strength of an incoming signal. The meter provided a visual indication of signal strength. Modern receivers use an LCD/LED bar for the same purpose. At one time, electron-ray tubes, sometimes called cat's-eye tubes, were used. They provided a soft green glow in a somewhat round configuration where a dark pie-shaped wedge existed on one side. The wedge would get narrower as the signal strength increased, and provided the user with an indication of tuning. The wedge provided little in the way of a relative signal strength between stations unless the strength differences were significant.

Signal strength indications are relative and not absolute because of the many involved variables that affect the meter indication. In the past, S-meters had a scale calibrated in S-units from 0 to 9 and decibel graduations above 9. Each S-unit was equal to 6 dB of signal voltage change at the antenna terminals, providing a signal strength indication (0 to 9) from 0–54 dB. Signal strength above S9 was indicated directly in decibels.

The circuit for an S-meter is similar to that of a basic voltmeter having an amplifier driver, and receives its signal voltage level from any circuit in the receiver that provides a relatively proportional response to the amplitude of an incoming signal. **Fig. 3** shows one of the many techniques for implementing an S-meter, in which the incoming signal is sampled and rectified, with the resulting DC voltage applied to a meter within a bridge circuit. The transistor is biased to obtain a "zero" indication on the meter in the absence of an incoming signal. The rectified voltage, which is essentially proportional to the strength of the incoming signal, will drive the meter up scale, providing the user with an indication of relative signal strength.

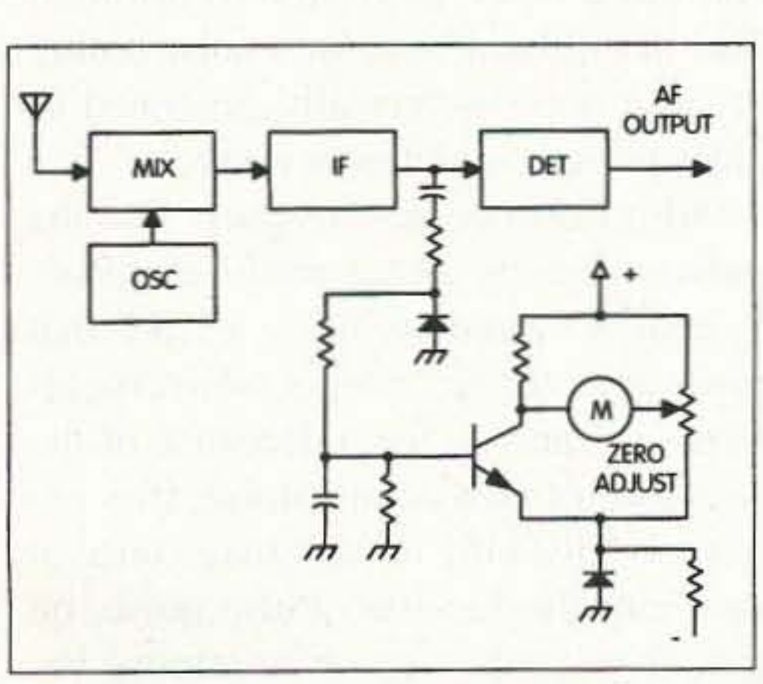

***Fig. 3.** S-meter circuit. The signal output from the IF is sampled, rectified and filtered. The rectified voltage amplitude is essentially proportional to signal amplitude.*

Tuning meter

A tuning meter follows the same circuit design concept as the S-meter, except that the meter is a center-zero device. For the tuning meter to function, the detector must be capable of producing a DC output voltage relative to the incoming signal's position within the receiver's passband. A circuit

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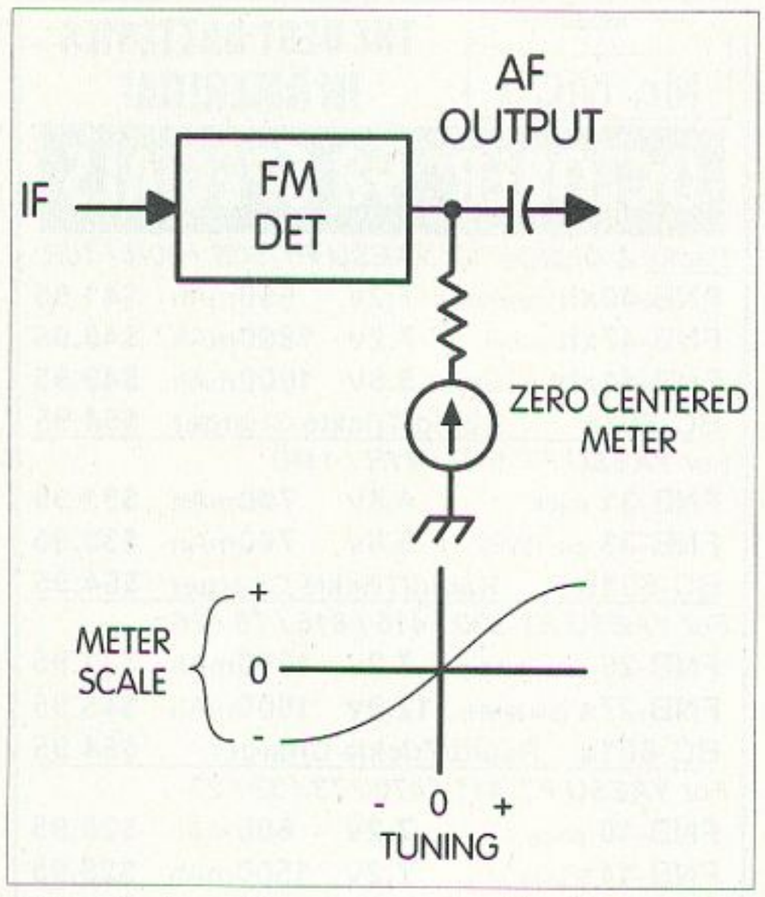

Fig. 4. A tuning meter used with an FM detector capable of producing a DC voltage that is relative in amplitude to the position of a received signal within a receiver's passband.

configuration for a tuning meter is shown in **Fig. 4**. The meter obtains its control voltage from an FM detector, where the voltage amplitude and polarity follow the position of the received signal relative to the center of the receiver's passband. As long as the received signal is in the center of the passband, the meter will indicate zero, but as the signal moves to either side, the meter will indicate the change by moving to one side or the other as well.

Having an FM signal centered in the receiver's passband is important from the standpoint that the quality of the recovered audio will degrade when the signal approaches the edges of the passband. A tuning meter provides an indication of when the receiver is properly tuned. Because of oscillator drift in some FM receivers, AFC has been used to keep the receiver tuned to the selected station. In this case, the tuning meter would just verify that the receiver remains tuned.

Squelch

Constant noise from a receiver becomes bothersome for people having to listen for many hours per day. This noise is the random noise that the receiver detects during the time stations are off the air. A squelch circuit will quiet the receiver's audio circuit during a no-signal period by applying a control voltage to a gated audio amplifier.

Many methods have been devised to squelch a receiver. They have ranged from mechanical to electronic, with an electronic version shown in **Fig. 5**. Early squelch circuits used a relay to short out the audio amplifier input terminals when a signal was not present. Relays had a slow response, in addition to a reaction differential (hysteresis) which caused them to remain closed should the received signal amplitude be marginally low, or open if not set tight enough.

Various electronic circuits have been developed that get around the problem. In essence, there are two forms of squelch control circuitry. The first follows the pattern of the relay which operates as a function of received signal strength (signal strength operated); the other is a noise-operated system. FM receivers amplify and rectify the noise output from the detector (at approximately 20 kHz) which occurs in the absence of an incoming signal. The noise level decreases as the strength of the received signal rises. Using the noise detection approach makes the squelch action faster and more reliable. Once detected, the noise-derived voltage is used to control the passage of audio from the detector to the audio amplifier through a gated audio path. In **Fig. 5**, an FET is used to clamp the audio channel, significantly reducing the audio voltage level presented to the audio amplifier.

Squelch circuits in modern receivers are implemented within the IF/detector IC in most cases. However, it's possible to implement a squelch function using discrete parts should it become desirable to add the function to an "already designed" receiver.

Noise limiters

Noise in receivers is always a problem. Since noise is characteristically an amplitude voltage function, it affects AM receivers the most. The purpose of the noise limiter is to discriminate between sounds made by noise sources and those received from a transmitter. This is a difficult task for a noise limiter because noise is typically generated as pulse noise or continuous noise.

Pulse noise comes in spurts like the pulses made by an automobile ignition system. Continuous noise is like that made by electric motors, shavers, alternators, and so forth. Because of the structure of continuous noise, it is extremely difficult to eliminate once it gets into the receiver. Pulse noise, on the other hand, is easier to remove because pulses are widely spaced, allowing a limiter circuit time to react and reduce the effects of the noise pulse.

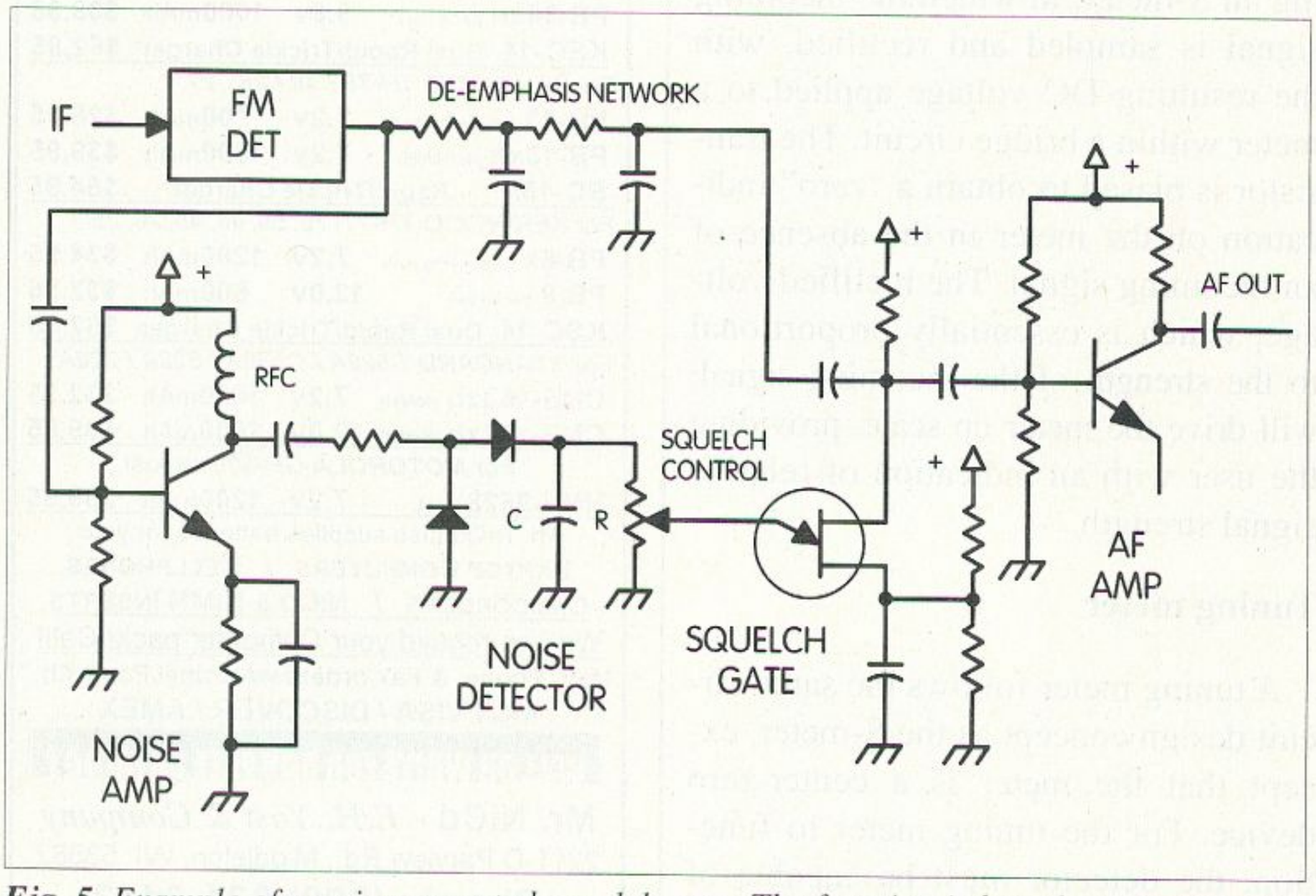

Fig. 5. Example of a noise-operated squelch gate. The function is based on the presence of white noise in the signal channel during the absence of an incoming signal. Values of C and R establish a time constant for opening and closing the squelch gate.

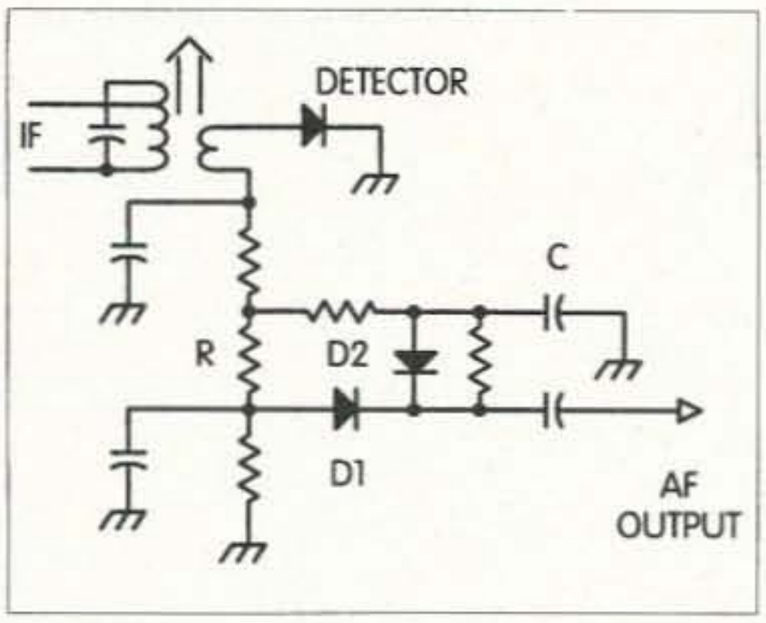

Fig. 6. *Series-shunt diode noise limiter used with an AM detector. Capacitor C establishes a long time constant to hold the switch threshold during a noise pulse.*

Perhaps the simplest and most effective noise limiter is a series-shunt limiter as shown in **Fig. 6**. Signal and noise voltages are developed across the resistor network and would normally be transferred to the audio stage. However, very little of the noise pulse is allowed to pass through the circuit onto the audio stage as the noise pulse itself is used as the trigger to close the noise gate.

The voltage across resistor R will increase during a noise pulse, causing diodes D1 and D2 to react. The noise pulse has a steep wavefront and a high amplitude that drives the shunt diode D2 into conduction during the duration of the pulse. During conduction, D2 shorts the audio path to ground through the low reactance of capacitor C.

Simultaneously, diode D1 will be reverse biased, essentially disconnecting the audio path between the detector and the audio amplifier. Some of the noise pulse will pass through because the diodes are not perfect switches, but the offending high amplitude portion of the pulse is removed. The circuit is self-adjusting in terms of signal amplitude, such that an incoming signal at any fairly constant amplitude will charge capacitor C to a threshold voltage value and the signal amplitude at that level will not be treated as noise, unless it also exhibits a steep wavefront. Noise limiters are quite effective for the communication of voice with minimal distortion, but the rapid level changes contained in music will cause a noise limiter to clip and distort the audio

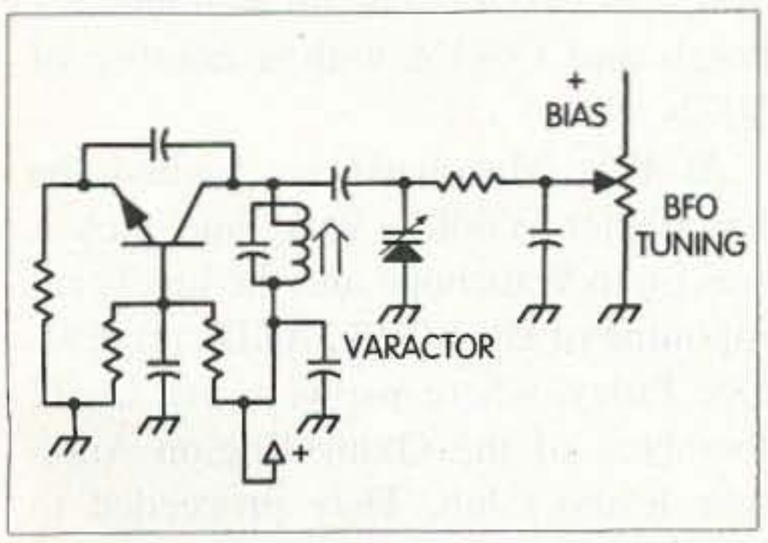

Fig. 7. *A variable frequency BFO implemented with a Colpitts oscillator. A varactor is utilized for frequency control.*

BFO

When a continuous wave (CW) signal or a single sideband (SSB) signal is to be received, it is necessary for the receiver to beat (mix) a local signal against the incoming signal. The beat note created when listening to a CW signal must be audible; otherwise, the operator hears only noise popping in the receiver. The typical beat note produced is usually between 400 and 1200 Hz and is selected for ease of copying. A BFO can be implemented by using either a fixed or variable frequency oscillator. A variable one is shown in **Fig. 7**.

For SSB operation, the BFO is used for carrier reinsertion where the oscillator is heterodyned against the incoming signal to become the carrier that was removed at the transmitter. To provide proper recovery of audio, the BFO's frequency must be in the same relationship position to the sideband as was the original carrier. If the BFO was operating at any other frequency, the audio would tend to sound unnatural.

Final notes

The superheterodyne receiver concept was developed in 1932 and has existed with little change over these many years. The development of integrated circuits has made the assembly and design of a receiver much simpler, with results far exceeding those of the original design. With the evolution of receivers, the number of conversion steps and the narrowing of the signal passband have brought forth some very interesting designs.

Perhaps one of the simpler design versions is the direct conversion superheterodyne, which converts directly from RF to audio. It embodies the principles of the superheterodyne without the complications of the IF amplifier. In other words, the detector is preceded by a mixer-oscillator providing a direct frequency conversion from a selected radio frequency to an audio signal. Because of the close frequency proximity between the RF and oscillator, the trick is to prevent the local oscillator from masking the incoming signal. 73

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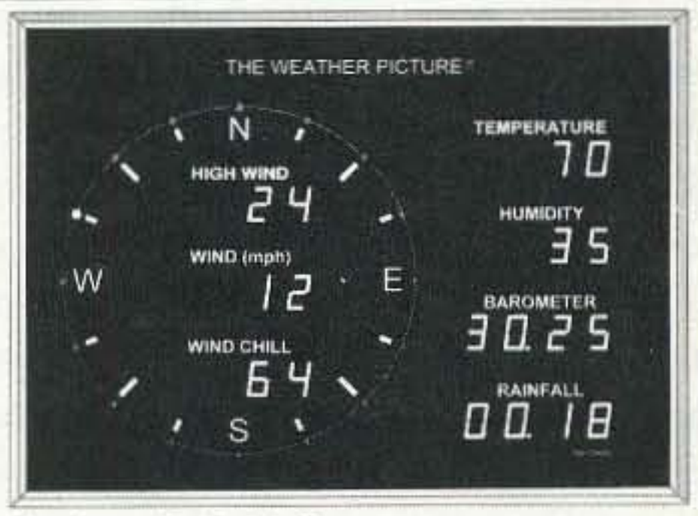

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Jack McKenzie N5MFG
Rt. 3 Box 177-B
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[n5mfg@juno.com]

Recently, 20 hams and their XYLs (most of whom are also hams) completed a tour of the eastern coast of Australia, from Sydney to Brisbane, and both the North and South Islands of New Zealand. The reception that we received from local hams in both countries was overwhelming. Our arrival and our itinerary were both broadcast far and wide over amateur radio, and resulted in local hams greeting us at almost every stop.

The tour was organized by Dick W4AOP and Meredith Glover W4AMK, who visited both countries two years ago as the only hams among 20 other couples. They enjoyed meeting local hams so much at that time that they thought it would be great to put together another tour made up of *all* hams.

Australia

We arrived in Sydney at the unholy hour of 6:00 a.m. and were greeted by officials of the Wireless Institute of Australia (New South Wales Division): Eric Fossey VK2EFY, director, and Geoff McGrorey-Clark VK2EO, division president. They then presented each of us with an elegant scroll conveying honorary membership in their organization. Later, after we had picked up the little camper vans that were to be our constant companions for the next month, Eric led a group of us through the maze of roads that is downtown Sydney to the offices of the Australian Communications Authority, where we became instant VK2s.

Actually, we learned to drive on what they call the "correct" side of the road without too much difficulty. I made a sign for my back window which read "STUDENT DRIVER from the USA" and everyone was very nice, deferring to me because they realized I didn't know what I was doing!

While in Sydney, we enjoyed the tourist bit in visiting their unbelievably beautiful and stately Opera House, and enjoying a harbor cruise that included lunch aboard a replica of the *HMS Bounty*. But the real reason that we came was to visit with Down Under hams.

The next day, while on the way to our next destination of Port Macquarie, we accepted an invitation from Eric to visit and participate in the New South Wales Division's weekly 10:00 a.m. Sunday broadcast from VK2WI, their extensive station located in Dural. There, high on a hill in a brick building, was the VK2WI station complex, composed of more than a dozen individual stations that broadcast on 13 different bands simultaneously! Although approaching its 40th anniversary at this location—and with somewhat dated tube-type equipment, at that—it is an effective and impressive station, complete with soundproof announcing and engineering booths. Of course, we were a topic of that week's broadcast, which was followed by "Call Backs," in which hams from all over Australia (and the world) can call in on any band from 160 meters to 2.3 cm and have a QSO with VK2WI. That day, one of our group, Harry WB2SFZ, took over an announcer's booth and QSO'd with a number of VK2s.

At Port Macquarie we visited the Kingfisher Wildlife Park, and then it was on to Wauchope and the lovely rural home of David VK2AYD and XYL Dee Pilley, where we were met by 32 members of the Oxley Region Amateur Radio Club. They proceeded to put on a real Aussie barbecue—steaks, chicken, sausages, you name it. David and Dee and our leaders, Dick and

Meredith, have been long-time friends, having met when Dick pulled David out of a snowdrift in Bucks County, Pennsylvania, many years ago.

David was responsible for getting the word out about us all over the South Pacific and alerting the clubs and associations in both Australia and New Zealand of our plans. He also cooked us 72 porterhouse steaks! We were overwhelmed by the friendliness of all the local hams and the welcome that we received.

Anyone want to send E-mail? Well, yes, Bill Stofmeel VK2WST sent one for me to my family and ham friends back in the States. After I got home, I discovered that Bill had added to my message, "Hello from Bill and Tony. We just got back from the barbecue and they all had a great time—Cheers to you all ... VK2WST." This handling of E-mail for us continued at nearly every stop. After visits to Woombah and Brisbane, it was finally time to turn in our RVs and fly to New Zealand.

Photo A. *Would you let this group into* your *country? (Photos by author.)*

South Island, New Zealand

We arrived in Christchurch, picked up new little camper vans, and settled in for the night at a van park. Our arrival was announced on their National System along with our itinerary, and plans were made throughout both islands to greet and meet us. Their National System is a series of 13 dedicated, linked high-quality repeaters on the 70 cm band. When a station accesses one of these repeaters, the signal is relayed to all other repeaters in the system and can be heard simultaneously up and down the country. For example, a station in Wellington can talk via the system to a station in Auckland as if he or she were in the local region.

In New Zealand, our US licenses were good for 30 days of operation on VHF. We merely added /NZ to our callsign. No fees and no paperwork! Leaving Christchurch, we headed for Lake Tekapo, Dunedin, Te Anau, Queenstown, the West Coast, and Picton. At Lake Tekapo, about half our group took an hour-long flight over and around Mount Cook (12,306 feet) and the Southern Alps. Personally, I got a lot closer to Mount Cook than I ever wanted to!

At every stop, the local hams would come out to meet us. In Dunedin, a couple dozen came, including Stan ZL4MB and XYL Sadie (who sent E-mail for many of us and also brought us copies of *The Christchurch Press*, which contained an article about our caravan and a large picture). Don ZL4TGR brought grapes for all of us, which we thoroughly enjoyed. We visited a rookery of yellow-eyed penguins and the only mainland nesting colony of royal albatrosses in the world (these birds have a wingspan of 15 feet!).

We drove south, surrounded by snow-covered mountains, iridescent lakes, and rolling fields of thousands upon thousands of grazing sheep. We will also remember this area as the land of the one-way bridges, including two, believe it or not, that we shared with a train! The highway would suddenly curve over to the train track and we would straddle the rails with our little camper vans. Across the train trestle we would go. That evening one of the local hams told us, "Not to worry, mate, there's only two trains a day on that line!"

On the west coast of South Island, among the glaciers and fjords, we enjoyed a spectacular cruise on Milford Sound, a fjord said to be the deepest in the world. Considering that it is one of the wettest places on Earth, we were blessed to have clear, sunny weather.

As we departed the town of Fox Glacier, heading toward Greymouth, a distance of some 122 miles, we commenced hearing Bob ZL3ADH calling

Photo B. *Reportedly there were no shrimp on the barbie at the lovely home of David VK2AYD and Dee Pilley in Australia, but plenty of other goodies kept everyone happy.*

Photo C. *Guess what you run into—or stop for—on New Zealand's South Island?*

us on 146.55 simplex, our caravan traveling frequency. He said he was in Greymouth. One of our bunch, Dave KI5OJ, worked him with an ICOM IC-W32A half-watt HT into a home-brew J-pole lashed to his rearview mirror with duct tape! Dick W4AOP talked with him using a mag-mount antenna stuck to the top of the kitchen stove inside his camper van. Some of our group had stayed to tour the glaciers by helicopter, so Bill WB8AMD worked him with his HT "helicopter mobile."

That night we had a big bonfire on the beach. All the local hams, including Bob Boote ZL3ADH and his XYL Val, were there, and Bob explained that he had used a Kenwood TS-711A into a linear amplifier which fed 80 watts into a 16-element collinear antenna array. But we were still amazed at two-meter simplex at that distance.

North Island, New Zealand

We loaded our little vans on a ferry for the three-and-a-half hour crossing to Wellington and the beginning of our tour of North Island. Hams on South Island had told us that they had one-fourth the population and three-fourths of the beauty of the country. But I'm not so sure: North Island is certainly scenic—and the hams are just as friendly!

Traveling north, we came to the seaside village of Te Awanga, which is near Napier and Hastings. We learned that their amateur radio clubs are set up as branches of the New Zealand Amateur Radio Transmitters, which is the same as our own ARRL. While in the area, we were visited by hams from the Napier Branch, including Les Reid ZL2LR, section leader of the Amateur Radio Emergency Corps, and XYL Betty. The Hastings Havelock North Branch was represented by Branch Chairman Dave ZL3DK and XYL Irene. They arranged a delightful dinner for us attended by 20 or more local hams, all of whom brought QSL cards to exchange with us. And while there, we visited the Art Deco city of Napier as well as took a chartered bus to view the gannet seabird colony at Cape Kidnappers. This included a wild ride over perilous back sheep country in getting there. We also enjoyed joining in on their morning "Cornflake Net" on 146.700.

We continued on to Rotorua in the north central part of North Island and through an area of intense geothermal activity. Many of us visited the Ohaaki geothermal power station and walked through an area of bubbling mud and volcanic craters. Our van park had huge hot tubs, fed from thermal springs, that we weary travelers enjoyed shortly after we arrived. While we looked at craters others fished, Lake Taupo being right on our route. Cecil N5UUR and Paul WB8TTQ, together with XYLs Trudy and Martha, caught five huge trout that they cooked and which fed most of our group. That evening, Ted Bretherton ZL1MG, president of the Rotorua Amateur Radio Club Branch #33 and XYL Margaret ZL1TYA, along with at least a dozen other members, came to our park and brought food and drink. The welcome that we enjoyed at every stop was just fantastic, and Rotorua was certainly no exception.

The weather was superb for traveling. Murray ZL1BPU told us, "New Zealand is a rainy place, but recently it has been sunny and warm with less than the usual rain. There is no sign of approaching winter except for the first appearance of fall colors on trees and a distinct coolness in the air. In our part of New Zealand, there is no snow and very rarely a frost."

We wrapped up our tour of North Island with a full-day bus trip to the northernmost point of the country, called Cape Reinga. Here is where two oceans meet, the Tasman Sea and the Pacific Ocean, and you can see very clearly the actual line of demarcation between the two. To get there, our bus actually drove for 45 miles in the surf along what they call "90-Mile Beach," happily hydroplaning this way and that, throwing out a twin roostertail behind!

All things must come to an end, and so did our caravan Down Under. We toured Auckland, and then had a final banquet attended by hams from several clubs in the Auckland area. This included Peter Smith ZL1ARB, president of North Shore Branch #29; Irving ZL1MO, secretary of Rodney Branch #71; and John Bell ZL1FB, chairman of Hibiscus Coast Branch #80—along with many members from each of their branches.

We hope that our little caravan helped promote amateur radio in both Australia and New Zealand. I know that we created a lot of publicity. Articles

Continued on page 56

Photo D. *One good flock leads to another—this time, of ham RVs waiting in NZ for the ferry to cross from South Island to North Island.*

Number 33 on your Feedback card

Just the TiCK Kit

Embedded Research's memory keyer is now available with beacon mode.

Breckinridge S. Smith K4CHE
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I sit there at the kitchen table, keying the paddles and getting responses from the tiny board lying in front of me. As my wife eyes the scene, you can sense that she is not too pleased with the shrill dits and dahs from the piezo element that are bouncing off the walls of the kitchen.

I admit the setup was a little strange; I had the TiCK with its wires going to a nine-volt battery, and three wires going to my home-brew paddles. The little keyer board was just floating around the table supported by its wires.

Finally, she asks, "What is that?"

I respond, "It's a TiCK."

"Have you been in the woods?"

"No."

"Then why the tick thing?"

"It's a keyer—TiCK stands for Tiny CMOS Keyer. I'm testing it for an article."

"Why do you have to test everything?"

"I like to test things to see how they work. Right now I'm trying to figure out how to play back my message."

She says, "Why don't you read the manual? I bet you haven't read it …"

I stop keying for a second, trying to compose a response. "I will, but first I just want to play with the thing …"

"Wouldn't you save time by reading the manual?"

I have to admit my wife is a little strange—or at least I think so, which may say something about me instead. She even reads the manual for the microwave. But I continued to play with the TiCK®, mastering the commands, and it stayed on the kitchen table … every time I passed it I would have to sit down and play with the thing.

I had "TiCK fever."

I had sent for the TiCK 2B and had received the package in five days. The one-inch by one and a half-inch board was well marked and had good instructions, complete with the usual beginner's cautions about solder bridges and parts placement.

The heart of the project is an eight-pin PIC® chip that has been programmed as a memory keyer by its creators, Brad Mitchell WB8YGG and Gary Diana N2JGU. Brad and Gary have created several versions of the TiCK, but version 2B had a beacon feature that attracted me because it could have many applications—as a keyer, as a UHF beacon, and even as a tiny foxbox IDer. I had visited Brad and Gary's booth at Dayton, where you could sense their excitement and enthusiasm for their creations.

Building the kit

I built the kit in about an hour. You have the option of using an onboard five-volt regulator or powering the board from a regulated three-to-five-volt source. The audio output can be either via an input to your radio audio chain (which will require some experimenting) or through a piezo element which is supplied with the kit. If you are new to kit building, I recommend that you use the onboard regulator and an external nine-volt battery. Use the supplied piezo element to monitor the audio and to keeps things simple as recommended by the manual, until you get familiar with the TiCK.

When you apply power, if everything is all right the little TiCK talks to you immediately with its identifier message. For the TiCK 2B, it sends the Morse letter "B". Each member of the TiCK family has its own separate power-on identifier.

I was not familiar with any of the earlier versions of the TiCK, so it was a learning experience to set up the different features of the keyer. First, there is not a conglomeration of controls and buttons to activate and there are really no special setup commands that are needed to use the keyer as a basic keyer. It's simple and it works. All of the additional feature commands are given either by input from your keying paddles and or by using a single push-button, which is supplied.

In the instructions, Brad and Gary describe a control system that they have developed. They named it the "Single Button Interface" or SBI. As

described in their extensive instruction sheet, holding down the SBI will allow the user access to the various TiCK functions which are announced by some Morse code abbreviations via the piezo audio output.

The function commands are arranged in a two-tiered system. The first tier is very easily accessed and contains often-used commands such as Speed, Tune, and Memory Play. The second tier of commands is found by entering through the "A" or "Admin" mode, which is on the first tier but allows you second tier access. The A mode's operation is a little more difficult to get the feel for. Once you have arrived in the sequence where you want to be, you quickly release the SBI (button). If you are new to Morse code, you can slow the whole process down with the Speed command, which will make it easier to identify the modes.

The following menu of commands and functions is available on the first tier: Speed, Tune, Memory Play, "A" or "Admin" mode, and "K" ("keyer"). During your experimenting with the board and while roaming throughout the first tier of functions, if you make a mistake or can't figure out what to do, then just stop on the K function. The K mode reverts to normal keyer operation and nothing will change. The second tier of commands and functions contains Memory Input, Paddle Select, Audio On/Off, Straight Key, Iambic mode, and Beacon mode. Again, you have to access the second tier of commands by first selecting the A or "Admin" mode in the first tier. Just build the keyer. You'll figure it out.

The Paddle Select is neat and allows the user to select which paddle is going to be the dit and dah one. The Audio On/Off is useful for those late midnight stealth operations. The Iambic mode can be toggled off, but is by power on default in the on mode. Don't ask me to explain Iambic mode operation, but CW professionals and code fanatics swear by it.

Once you have everything set up, just key when you want. If you want your message played, just push the single button. Great for contesting or just sending a short CQ. Speed change is very easy and has some built-in safeguards. For instance, as you are increasing your speed, you can increase it almost to the speed of light. But to keep from going into never-never-speedland, the keyer will only go so fast before it then retreats from the high-speed end and reverts to the beginning of the lowest speed scale to start over. The genius of this is that if the TiCK remained in the extremely fast area, it would be very difficult to use the menu, as the menu is in Morse code and for some of us it is hard to read code at 50 words a minute. The default speed when you power up is approximate 12 words per minute.

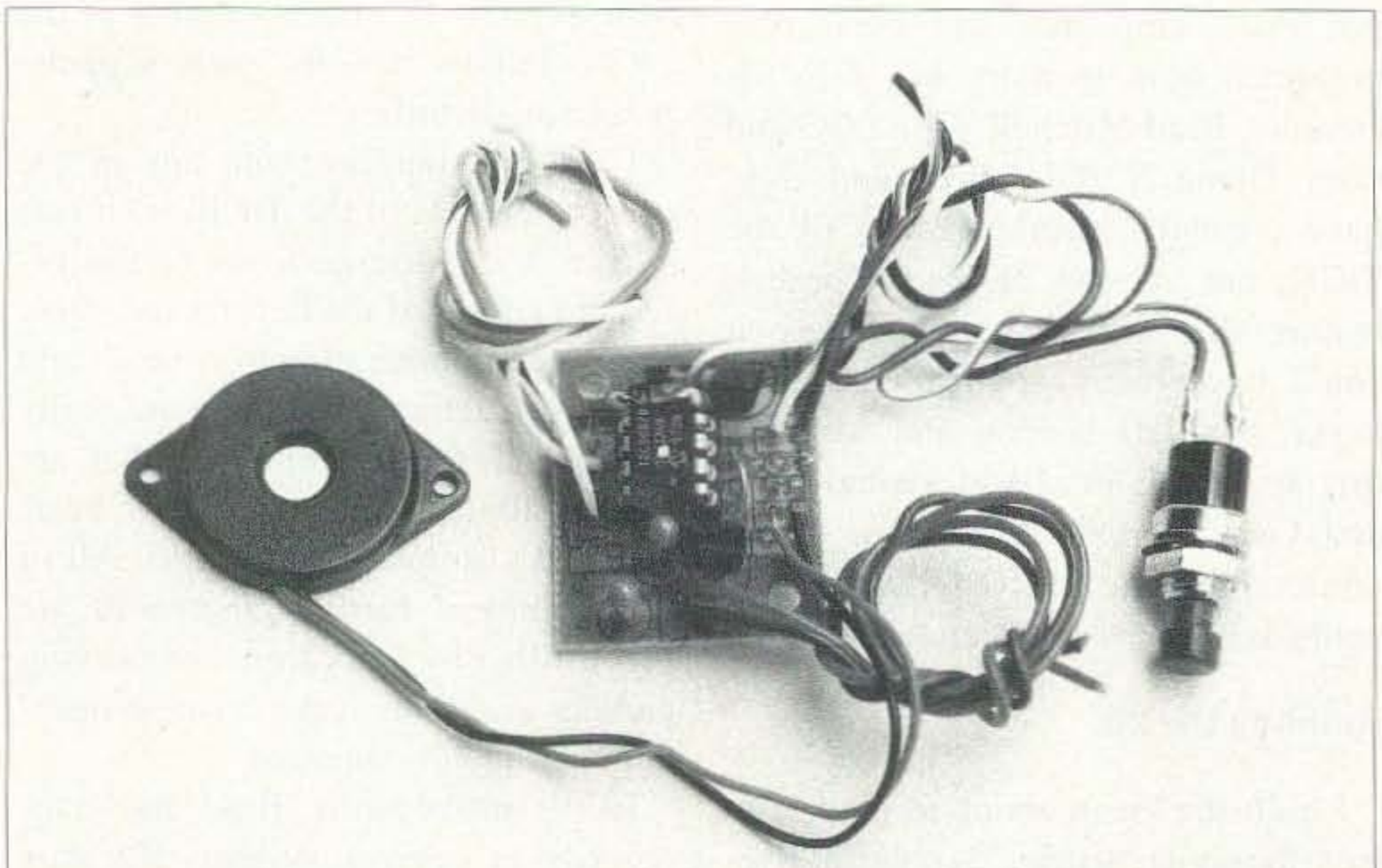

Photo A. *The TiCK from Embedded Research. Photo by Emeigh Associates.*

The message memory holds a sentence approximately five words long with spaces. When you load the memory, if you pause for a single space, or a series of spaces, the TiCK will pick this up and load the delay space period. The loading of this space period could be useful for foxbox beacons when you have continuous beacon keying and you want your call followed by a silent time period.

Beacon mode

I played quite a bit with the beacon and found the instructions to be a little confusing—probably because I hadn't completely read them in the first place. You have to "toggle" the Beacon mode on with the paddle (either one); to exit the Beacon mode, you have to get back in the menu in the "B" mode and then toggle it off again using the paddle. Once you have toggled the beacon mode on, just hit the single push-button for the beacon to start.

Now, what is neat is that while you are sending the beacon, you can stop it by keying with the paddles and again start it with the push-button. The beacon can be used for those marathon 20-minute CQ sessions without breaking to listen. Some new hams like to do this when they are trying to get everyone's attention or they haven't learned how to receive yet. Again, in normal memory play mode, if you just push the button your message will be played one time. To repeat the message, you will have to push the button again. In "beacon" mode, the message will go on forever until interrupted by the paddles.

Bench testing

During bench testing my unit, I could barely hear very weak harmonics of the internal 4 MHz oscillator up in the 20 meter band near 14.155 MHz and 14.265 while I was keying, and as soon as I released the key the weak signal would disappear. I could not detect any signals on the other HF bands, and used a spectrum analyzer to check the HF segments.

The 4 MHz oscillator is only used when you're keying and does not oscillate when you are not keying. Actually,

when you are not keying the unit goes into a "sleep" mode and draws very little current. Using the onboard 78L05 regulator, I measured less than one milliamp; if one milliamp is too much for you, the instructions suggest using another regulator type for even less power consumption.

When mounting your TiCK in a metal box, you might consider using bypass capacitors on the leads entering and exiting the box and/or using type 43 ferrite material on the leads. This is just a suggestion.

I didn't have any problems keying a 50-watt HF rig and a QRP rig during my tests. Most of the time I was playing with this little board it roamed around my bench or the kitchen table. I really did not handle it very carefully during this month of abuse. The board was not mounted in any enclosure, just supported by its wires. It survived.

When power is interrupted to the TiCK, you will lose your stored information, such as speed, paddle selection, keying modes, and message memory. If you get lost in the menu of commands, you can always disconnect the battery and start over. I experimented with powering the TiCK with a small three-volt lithium battery and used it to power the unit via pin 1 (VCC) of the chip. However, due to the leakage of the supplied onboard regulator, you will have to cut the land on the board from the output of the 78L05 and just let the three-volt battery power the TiCK.

You can diode isolate the output of the 78L05 by installing a diode across the land that you just cut with the cathode end of the diode feeding pin 1 (VCC). With the TiCK running on just the three-volt battery, the current was very low—in the 1 to 2 µA range—so the three-volt battery will last forever in the "sleep" mode.

After I did the diode trick, I discovered on Embedded Research's Web page that they make another TiCK model that has the battery option. That would be the TiCK-EMB kit. This kit has the battery option, the low-current 5 V regulator, and support for enhanced RF immunity, static discharge, and so forth. I don't do a lot of Web page stuff, but go look at the Embedded Research page for full details on the TiCK family at [www.frontiernet.net/~embres/]. The page is well organized, very professional, and updated on a regular basis.

The TiCK unit keys your transmitter with a 2N2222 transistor, which should handle most of the newer radios and certainly most of the QRP units that are being sold. If you are using older vacuum tube radios, then let the 2N2222 bias a larger transistor on and off for keying. The keying was sharp and no transients were noted.

Overall evaluation

Overall, I recommend the TiCK-2B as a first-time project for new hams. It will familiarize you with circuit board construction and soldering. The TiCK is also an excellent project for new hams and old-timers alike with which to familiarize themselves with the new "PIC" technology and at the same time complete a compact memory/beacon keyer that can stand alone or fit in any radio. With thousands of satisfied customers in more than 25 countries, I predict that pretty soon you will see a new bumper sticker: "I love my TiCK."

The complete TiCK 2B kit (catalog number TK2B-DK), consisting of circuit board, parts, and manual, is available for $23, postage paid, from Embedded Research, P.O. Box 92492, Rochester NY 14692. For further information on other kit versions of the TiCK and other products, as well as an order form, see their Web page cited above. 73

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SPECIAL EVENTS

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

OCT 2–3

SPRINGDALE, AR NWAARC HAMFEST '98 will be held at the Jones Center For Families, corner of Hwy. 265 and E. Emma Ave. (north of the airport). General public admitted Fri., 7 p.m.–9 p.m., Sat., 8 a.m.–2 p.m. Setup both days. Admission $5. Tables $6. Tailgate $4. Free parking. Venders, traders, forums. VE exams by pre-registration. For info or reservations, write to *Northwest Arkansas ARC, P.O. Box 24, Farmington AR 72730*; *or call Sherri Hyde N5UXI* at *(501) 524-4797*. Talk-in on 146.70(-) or 146.76(-).

OCT 3

SYRACUSE, NY The Radio Amateurs of Greater Syracuse will host their 42nd Hamfest Sat., Oct. 3rd, 8 a.m.–2 p.m. at the Pompey Hills Fire Department in the beautiful Pompey Hills suburb of Syracuse, just off Route 20. Admission $5 (16 and older). Indoor flea market $10 with table, or $3 BYO/table. Tables only with advance reservations—no extra tables will be available on site. Outside flea market $3.00. Setup Fri. at 4 p.m., and Sat. at 6 a.m. Tailgaters $3 10 x 20 ft. space, plus admission. Features: breakfast and lunch by the Pompey Hills Fire Dept. Auxiliary; served 7 a.m.–2 p.m. Forums, ARRL, awards, VE exams. Contact *Vivian Douglas WA2PUU, (315) 469-0590* for info; or write *RAGS, Box 88, Liverpool NY 13088;* or check the Web site at *[www.pagesz.net/~rags]*. Talk-in on 147.90/30 MHz.

WILLOW GROVE, PA The Mt. Airy VHF Radio Club ("Packrats") will present the 1998 Mid-Atlantic States VHF Conference at the Hampton Inn, 1500 Easton Rd. (Rt. 611 one quarter mile below the Willow Grove Exit #27 of the PA Turnpike). For room reservations, call (215) 659-3535. Registration is $24 per person at the door. This includes an admission ticket for "Hamarama" being held the following day. Doors are open Sat. Oct. 3rd, 9 a.m.–9 p.m. For additional info, contact *John Sortor KB3XG, 1214 N Trooper Rd., Norristown PA 19403*; or E-mail at *[johnkb3xg@aol.com.]*. *Tel. (610) 878-5674.*

OCT 4

BEDFORD, IN The Hoosier Hills Ham Club will host its 37th annual Hamfest Sun., Oct. 4th, at the Lawrence County 4-H Fairgrounds located southwest of Bedford IN, on US 50, 1/2 mi. west of the junction of US 50 and State Rd. 37. Talk-in will be on the W9QYQ rptr. 146.730(-) PL 107.2. The gates will open at 5 a.m. EST. Tickets are $6 per person. Dealer setup starts Sat., Oct. 3rd, at 10 a.m. There will be a free chili supper with the purchase of a hamfest ticket on Sat. evening at 6 p.m. There will also be a two-meter foxhunt on Sat. at 3 p.m. on the fairgrounds. Overnight camping available Sat. evening at $8 per vehicle. VE exams at noon on Sun. Please register before noon if you wish to test. More info can be obtained on the Web at *[http://dmrtc.net/~jscheiwe/hamfest.html]*. *E-mail [jscheiwe@dmrtc.net]* or call *John Scheiwe KB9LTI at (812) 279-0050.*

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Corona Park, 47-01 111th St., Queens NY. Doors open for vendors to set up at 7:30 a.m., buyers admitted at 9 a.m. Free parking. Admission by donation, buyers $5, sellers $10 per space. Talk-in on 444.200 rptr. PL 136.5. For further info call, nights only, *Stephen Greenbaum WB2KDG, (718) 898-5599; or E-mail [WB2KDG@bigfoot.com].*

WARRINGTON, PA The Mt. Airy VHF Radio Club ("Packrats") will hold its annual "Hamarama" on Sun., Oct. 4th, at the Bucks County Drive In, Rt. 611 (4 miles north above the Willow Grove Exit #27 of the PA Turnpike) between County Line Rd. and Street Rd. Doors open to vendors at 6 a.m. for outdoor tailgating; spaces $8 ea. plus general admission charge. Sellers of new and used amateur radio equipment, electronic components, and computer hardware/software vendors are invited to participate. Open to the public at 7 a.m. for a $5 donation. Talk-in on 146.52 simplex. For more info, contact *Mark Schreiner NK8Q, 662 Cafferty Rd., Ottsville PA 18942. E-mail [nk8q@amsat.org] or call (215) 497-1414.*

OCT 10

BREMERTON, WA The North Kitsap ARC will sponsor a Hamfest in President's Hall at Kitsap County Fairgrounds, NW corner of Fairgrounds Rd. at Nels Nelson Rd. Admission $4 for 12 and over, under 12 free. New and used equipment. Tables $15 ea. (and 1 free admission) until 9/30/98; $20 ea. afterwards. Commercial spaces $30. Contact *Susan Johnson AB7MD, P.O. Box 1226, Poulsbo WA 98370, packet [AB7MD@N7WE.#WWA.USA.NOAM]; or E-mail [sujohnso@linknet.kitsap.lib.wa.us].*

EVANS, GA The Augusta Hamfest, sponsored by the ARC of Augusta, will be held at Evans Middle School 9 a.m.–4 p.m. Setup Fri. 6 p.m.–9 p.m. and Sat. 6 a.m.–9 a.m. VE exams start at noon. Contact *Frank at [ks4oc@bellsouth.net], or Terry at (706) 796-7635*. Write to P.O. Box 3072, Augusta GA 30914.

TEANECK, NJ On Oct. 10th, the Bergen ARA will hold its annual "Fall Hamfest" at Fairleigh Dickinson University. Buyer admission is $5, with XYLs and harmonics free. Seller admission $10. VE exams will be featured. Take Rte. 4 east/west to the River Rd. exit. Follow the signs into the hamfest area. Talk-in on 146.790 (-600). For further info call *Jim Joyce K2ZO at (201) 664-6725 before 10 p.m.* Please, no calls after 10 p.m.

OCT 10–11

MEMPHIS, TN The Greater Memphis Amateur Radio and Computer Show, "MemFest '98" will be held at 2585 N. Hollywood at I-240 in Memphis, Oct. 10th and 11th. The event is open on Sat. 8:30 a.m.–4 p.m., and Sun. 8:30 a.m.–2 p.m. Admission $5 at the door. Non-ham activities, ladies' activities and VE exams (both days) will be featured. Flea market tables are $25 each; dealer booths are $55 each. Talk-in on 146.22/.82. Send correspondence to *MemFest '98, P.O. Box 751841, Memphis TN 38175-1841*. The event is sponsored by the Greater Memphis Amateur Radio Operators. For general info, contact *Lee Bowers KA4KVW, (901) 867-3461, or Ben Troughton KU4AW, (901) 372-8031.*

TAMPA, FL The Egypt Temple ARA will host their 2nd annual Hamfest and Computer Show in the Unit Building located at 4050 Dana Shores Drive, Tampa FL. There will be 60 tables available at $15 each for the two-day event, 18 of which will be against the wall with standing room behind and aisle space in front. Each table will have two chairs. Admission tickets required by all except children under 10 years of age. Electricity will be available but customers must supply their own cable. Table reservations and tickets can be obtained from *J.F. Strom K9BSL, 233-34th Avenue North, St. Petersburg FL 33704-2241. Tel. (813) 822-9107.* No food or drink allowed except that being sold by Egypt Temple members.

OCT 11

MASON, MI The LCDRA and CMARC Hamfair Swap & Shop will be held 8 a.m.–1 p.m. at the heated Community Center in the NW corner of the Ingham County Fairgrounds in Mason MI. This building is easily accessible to the physically challenged and has ample handicapped parking. From I-96, take Exit 106 (US 127) south to the Kipp Rd. Exit. You can follow the signs in from Kipp or use the talk-in at 145.390. Alternate directions: Take 127 to the Cedar St. exit for Mason. Head south on Cedar to the 2nd light, which is M-36. Turn left (east) and travel through downtown area,

past the courthouse. Continue east on M-36, just outside of town to the fairgrounds. The main gate will have a sign and personnel to guide you in from there. Admission $5 per person. Tables $10, trunk sales $6. Overnight camping available. Vendor setup 6 a.m. Contact *Don WB8NUS at (517) 321-2004, or LCDRA, P.O. Box 80106, Lansing MI 48908.*

WALLINGFORD, CT The Nutmeg Hamfest and Computer Show, featuring the ARRL Connecticut State Convention, will be held 9 a.m.–3 p.m., rain or shine, at the fabulous "Mountainside Special Event Facility." KJI Electronics, Lentini Comm. and other major vendor displays. VE exams. Register in advance by calling *Joel Curneal N1JEO, (203) 235-6932.* Free parking. Inside selling space includes one 10 x 10 ft. booth, one 8 ft. table, one chair (two free vendor passes per booth), $20. Outside, one tailgate 30 ft. space, $15. General admission $6 (children under 12, $3). Make checks payable to *Nutmeg Hamfest* and send to *Gordon Barker K1BIY, 9 Edge Wood Rd., Portland CT 06480. Tel. (860) 342-3258.*

OCT 18

CAMBRIDGE, MA A tailgate electronics, computer and amateur radio Flea Market will be held Sun., Oct. 18th, 9 a.m.–2 p.m. at Albany and Main St., Cambridge MA. Admission $4. Free off-street parking for 1000 buyers. Fully handicapped accessible. Tailgate room for 600 sellers. Sellers $10 per space at the gate, $9 in advance—includes one admission. Setup at 7 a.m. For space reservations or further info, call *(617) 253-3776.* Mail advance reservations before Oct. 5th to *W1GSL, P.O. Box 397082 MIT BR., Cambridge MA 02139-7082.* Rain or shine! Covered tailgate area available for all sellers. Talk-in on 146.52 and 449.725/444.725 PL 2A, W1XM rptr. Sponsored by the MIT Radio Society and the Harvard Wireless Club.

KALAMAZOO, MI The 16th Annual Kalamazoo Hamfest will be held at the Kalamazoo County Fairgrounds. Free parking. The Kalamazoo ARC and the SW Michigan AR Team are co-hosting this event. Vendor setup is at 6 a.m. Doors open to the public at 8 a.m. Advance tickets $3, $4 at the door. Trunk sales $5. Tables $1.50 per ft., 4 ft. minimum. Electrical hookup $5. For tickets/tables, send SASE to *Gary Hazelton N8GH, 75075 M-40, Lawton MI 49065.* For contact or info see the Web site at *[www.net-link.net/wmat].* E-mail inquiries to *[ka8blo@net-link.net].* Talk-in on 147.040 K8KZO rptr.

SELLERSVILLE, PA The RH Hill ARC will host their Hamfest at the newly rebuilt Sellersville Fire House, on Rt. 152, 5 mi. south of Quakertown and 8 mi. north of Montgomeryville. Admission is $5. VE exams 10 a.m.–1 p.m. for all classes. Bring documents. Indoor flea market spaces $12, table included. Outdoor spaces $6, bring tables. Contact *Linda Erdman, 2220 Hill Rd., Perkiomenville PA 18074;* or call her at the *Hamfest Hotline, (215) 679-5764.* The club maintains a Web site at *[http://www.rfhill.ampr.org].*

OCT 24

GRANDVIEW, MO "Octoberfest '98" will be held by the Southside ARC Sat., Oct. 24th, 8 a.m.–2 p.m. at Grandview Middle School (East Junior High), 12650 Manchester, in Grandview MO. VE exams start at 10 a.m.; you must be pre-registered! Code test 10 a.m.–11:20 a.m. Written test 12 noon–1 p.m. Mail your completed 610 to *Exam Registration, P.O. Box 12757, North Kansas City MO 64116.* Tickets are 4 for $5 in advance, 3 for $5 at the door. Single tickets $3. Tables are $15 each, includes one ticket. For tickets, tables, or info, contact *Donna Quick KBØYJN, (816) 537-7464, E-mail [kbØyjn@juno.com]; or Mark Sevy KBØVWD, (816) 331-8948, E-mail [kbØvwd@juno.com],* or write to *SSARC, P.O. Box 701, Grandview MO 64030.*

RICKREALL, OR The Mid-Valley ARES will present its 4th Annual "Swap-Toberfest," Amateur Radio Emergency Services Convention, Sat. Oct. 24th, at the Polk County Fairgrounds in Rickreall OR. Doors open for the convention from 9 a.m. to 3:30 p.m. the day of the event. Swap table setup will be 6 p.m.–9 p.m. Fri. night, Oct. 23rd, and on Sat. morning, Oct. 24th, at 7 a.m. Features include swap tables, commercial dealers, meetings, and seminars. Emergency Communications Vehicles will be on display from Marion and Polk County Emergency Management, Civil Air Patrol, American Red Cross, the Oregon State Police, and others as available. Self-contained RV spaces are available. For more information, contact *Bob Boswell W7LOU, (503) 623-2513,* or E-mail to *[w7lou@goldcom.com].* To download a copy of the flyer and pre-registration form, surf the net for *[http://www.teleport.com/~n7ifj/swaptobe.htm].* Handicapped hams who have pre-registered may enter Swap-Toberfest at 8 a.m. through the East Door. One pre-registered assistant per handicapped ham may accompany to offer a helping hand.

SUMTER, SC The Sumter ARA's 12th Annual Hamfest and Computer Fair will be held 8 a.m.–4 p.m. at the Sumter County Exhibition Center, 700 W. Liberty St., Sumter SC. Advance tickets are $5, $6 at the door. For advance tickets send check and SASE to *SARA, P.O. Box 193, Sumter SC 29151-0193.* Advance ticket requests received after Oct. 17th will be held at the door. For dealer packages or more info, contact *Steve Heriot KC4ZLB, 115 S. Washington St., Sumter SC 29150-5127. Tel. (803) 773-2282; E-mail [sheriot@ftc-i.net];* or contact *Greg Czerniak W4GRC, 2220 Highway 261 S., Wedgefield SC 29168. Tel. (803) 494-5565; E-mail [grcljc@ftc-i.net].* Talk-in on 147.015.

OCT 24–25

EL PASO, TX The 1998 International Hamfiesta and Computer Show will be held at the Ysleta Independent School District's Cultural Arts Center, 9600 Sims St., El Paso TX, Sat. 8 a.m.–5 p.m., Sun. 9 a.m.–2 p.m. Pre-registration $5. At the door, $6. Swap tables $10 with Fri. setup. Tables $12 at the door. Computer upgrading. VE exams both days. There will be forums on ARRL, packet radio, Internet communications, QSL verification, and satellite tracking. RV overnight hookups nearby. QCWA breakfast. Contact *Clay Emert K5TRW, P.O. Box 971072, El Paso TX 79997. Tel. (915) 859-5502. E-mail [cemert@dzn.com].*

NOV 1

CANTON, OH The Massillon ARC will sponsor "Hamfest 98," Sun., Nov. 1st, at the Stark County Fairgrounds, 305 Wertz Ave. NW, Canton OH. Vendor setup at 6 a.m. Doors open to the public at 8 a.m. General admission $5, $4 in advance. Tables are $10 each. Info and reservations to *MARC, P.O. Box 73, Massillon OH 44648.* Include an SASE. An auction begins at 10 a.m. Talk-in on 147.18(+) rptr. E-mail to *[marc.hamclub@juno.com],* or call *Terry Russ (330) 837-3091 before 10 p.m.*

DES MOINES, IA The Tikva Tracers ARC "Hamfest Iowa '98" will be held at the 4H Building, Iowa State Fairgrounds, in Des Moines. Setup Sat. 6 p.m.–9 p.m.,

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and 6 a.m. Sun. Doors open at 8 a.m. Seminars and "Ask the Experts" will be among the featured goodies. Talk-in on 146.22/.82. Admission $5, first table $10, each additional $8, electric $8. VE exams at 9:30 a.m. Contact *Randal Lees NØLMS, 1575 Northwest 78th St., Clive IA 50325-1255. Tel. (515) 279-4241; E-mail [rclees@raccoon.com].*

NOV 7

ENID, OK The Enid Hamfest Group will hold the Enid Hamfest at Oxford & 4th Streets, at the Garfield County Fairgrounds (Hoover Bldg.), 8 a.m.–5 p.m. Admission $2, tables $1 each. Special features: Free doughnuts and coffee in the morning, free hotdogs and soda at noon. VE exams at 1 p.m. Contact *Tom Worth N5LWT, (580) 233-8473, E-mail [N5LWT@HOTMAIL.COM]*; or *Fred Selfridge N5QJX, (580) 242-3551; E-mail [FREDNNEL@IONET.NET]*. Talk-in on 147.15(+) or 444.400(+)

SORRENTO, FL A Hamfest, Computer Show and Electronic Expo will be hosted by the Lake ARA, Nov. 7th at the East Chamber of the Commerce Building in Sorrento FL. Admission $5; vendor cost is $10 (includes one admission). Setup Fri., Nov. 6th, at 3:30 p.m.–6 p.m.; Sat., Nov. 7th, at 6 a.m.–8 a.m. VE exams (walk-ins only) at 10 a.m. For info and table reservations, contact *Chuck Crittendon KA4EXM, P.O. Box 615, Altoona FL 32705. Tel. (352) 669-2075.*

WAUKESHA, WI The Milwaukee Repeater Club will sponsor the 14th annual "6.91 Friendly Fest" on Sat., Nov. 7th, 8 a.m.–1 p.m. at Waukesha County Expo Center Arena Forum, N1 W24848 Northview Rd., Waukesha WI (I-94 to County J, south to FT, west to Expo). Sellers admitted at 5:30 a.m. Tickets $5. 4 ft. tables $5 each. Please call *Mike KB9PHA at (414) 258-4435.* Send an SASE with payment to The *Milwaukee Repeater Club, P.O. Box 2123, Milwaukee WI 53201.* There will be VE exams on-site. Talk-in on 146.91(-) (The Friendly Repeater), and on 146.52. Visit the Club's Web site at *[http://www.execpc.com/~mrc/friendlyfest.htm].*

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NOV 8

KAUKAUNA, WI The Fox Cities ARC will present its annual Hamfest at the Starlite Club, corners of Hwy. 55 and Cnty. Rd. JJ. You must buy an admission ticket if you pre-register. Advance admission tickets $4 ea., 8 ft. long tables $8 ea. Send check or money order payable to *FCARC, 1912 Russett Ct., Appleton WI 54914, Attn: Chad Pennings N9PRC, Hamfest Chairman, tel. (920) 993-0485.* Registration for VE exams is 8 a.m.–9 a.m., no walk-ins after 9 a.m. Bring original license plus two copies, and a photo ID. For more exam info contact *Larry Siebers KD9IA, (920) 757-1167.* Talk-in on 146.52 simplex.

SPECIAL EVENT STATIONS

OCT 3

LAWRENCEVILLE, GA Gwinnett ARS will operate Station W4G 1400Z–2200Z on Oct. 3rd, in conjunction with the "Air Fair & Fall Classic Biplane Fly-in" being sponsored by the Experimental Aircraft Assn. (EEA) Chapter 690. Operation will be in the General portions of 40, 20, 15, and 28.450 on 10 meters. For a certificate, QSL to *GARS, P.O. Box 88, Lilburn GA 30048.*

OCT 3–4

HILTON, NY The Brockport ARK will operate a special event station to celebrate the 18th annual Apple Festival from Hilton NY. K2BRK will operate in the General class portion of the HF bands as well as 2m and 70 cm, from the festival site in Monroe County, grid square FN13. BARK will acknowledge contacts with either a postcard QSL or an 8.5- x 11-inch certificate to all verified stations that send an SASE. The QSL manager for this event is *John D. Hysell KF2XC, 381 Fiesta Rd., Rochester NY 14626-3843.* Visit the BARK Web site at *[www.frontiernet.net/~n2tuk]* for more details and updates.

OCT 4

PITTSBURGH, PA The *USS Requin* ARC will operate NY3EC from the submarine *U.S.S. Requin,* docked at the Carnegie Science Center of Pittsburgh. They will be on the air 1400Z–2100Z Oct. 4th. The station will operate vintage CW equipment in the 40 meter Novice band, and in the Novice portions of the 10 and 15 meter bands, if conditions permit. Phone operation will be in the General class segment of 20m and 40m. For a certificate and QSL card, send QSL and an 8-1/2- x 11-inch SASE to *Jack Buzon KA3HPM, 47 Grubbs Rd., Cheswick PA 15024-9648.*

OCT 11–NOV 7

MINNEAPOLIS, MN The 1998 Plenipot Meeting, being held Oct. 12th–Nov. 7th, will be accompanied Oct. 11th–Nov. 7th by special event station W98ITU, operating from Minneapolis MN. QSL cards are available from *W98ITU, P.O. Box 131415, St. Paul MN 55113.* Remember to send an SASE. DX cards will be handled directly or through the W9 bureau. Operation will be on all HF bands, CW, phone and RTTY. Novice band operations are also being planned.

OCT 17

WILMINGTON, NC The Azalea Coast ARC will operate AC4RC 10 a.m. EST–3 p.m. EST from the original radio room of the Battleship *USS North Carolina BB 55.* Connect with them on 7.250, 14.250, 21.35, 28.400. QSL *AC4RC, P.O. Box 4044, Wilmington NC 28406.* The club will also be hosting a JOTA event from the Battleship Park gazebo 10 a.m.–3 p.m.

OCT 17–18

JACKSONVILLE, IL The Jacksonville ARS will operate K9JX Oct. 17th and 18th, to mark the club's 40th Anniversary. Operation will be in the General portion of 10–80 meters. For a certificate send an SASE and contact info to *K9JX, 773 E. College Ave., Jacksonville IL 62650.* 73

LETTERS

continued from page 6

graduates ought to read it. It's only 110 pages long and has more meat in it than most of the courses they take. I tend to agree with you that your quote "the marketplace is the battlefield" is not far from the truth.

Jim Parker ABØEZ. Thanks for publishing my letter to *73* in the April 1998 issue. To date, I have received a grand total of *one* response via my E-mail address ... and that chap agreed with me! I thought that my letter might provoke a bunch of angry, hairy-chested, macho ham responses defending the ARRL and CW. It appears that I was wrong. Perhaps I have just been dismissed as a kook or a troublemaker not worth the time it takes to respond. Or perhaps we should all just be quiet, pay our League dues, and follow the leader like a good bunch of sheep!

Let me share with you a brief synopsis from a local club meeting I attended where an ARRL representative spoke. This gentleman first stood up and shared with us how the League was going to ensure that the CW requirement for HF operation would remain in place. Indeed, our trusty League official spoke of how it was our collective moral duty to ensure that this tradition (hazing) stayed in place.

Then the conversation shifted to the VHF and above area. Our elected official then informed us that it was time to think about junking our antiquated analog repeaters and handie-talkies (which are already in place, relatively cheap, and work!) for digitally encoded trunking systems! When asked, the main reason given for the encouraged change was "for efficient spectrum use." This is pure baloney! Wayne, we don't even use 10% of the frequencies we as hams have allotted above 29 MHz. Just try and buy a piece of commercial ham equipment for use

HAMS WITH CLASS

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

School demos—a great experience!

In the enlightened times of the 1990s, most hams have come to realize the importance of encouraging young people to become involved in the hobby and service of amateur radio. There are lots of exciting approaches and opportunities to expose children to the fun and challenges of becoming a radio operator if only we are prepared and use a little creativity in our thinking.

We've all read about the efforts of resourceful clubs, dedicated parents and teachers, and individual hams who have introduced many youngsters to our hobby by inviting them to observe and participate in Field Days, fundraisers, community events, and other club activities. As a teacher myself, I've always tried to take advantage of invitations to speak at PTA meetings, to conduct teacher workshops, and above all, to do live demonstrations in different classrooms in other schools.

Last June I was visiting with some non-ham friends on Long Island, New York. There were two very bright, articulate little boys in the family who were telling me about all the many activities they're involved in, both in school and in the afternoons and evenings. Bradley is in the first grade in the Franklin School in Hewlett. Zachary is in kindergarten in the same school.

Even though there is a heavy emphasis on sports in the Parker family, both parents and a doting uncle are all educators who encourage the boys to be well-rounded in their interests. They are all open-minded and totally committed to the children's educational experiences.

Could I ask for a better opportunity? As soon as I volunteered to come to the school and do a ham radio demonstration, Larry Parker contacted his son's school to get permission for me to come there. Having done school demos for the past 20 years, I know the importance of being prepared. Many of my "Hams With Class" columns have been devoted to the absolutely necessary step of good preparation. At least 50% of the letters that I receive deal with the question of how to approach school administrators to get permission to come into a school to demonstrate ham radio. *Good preparation* is the key to success with anything, in my opinion—especially when going before busy administrators, parent groups, and classroom teachers.

Once we were in agreement on the date, I prepared a package of information for the teacher, Mrs. Fenton. The more aware the classroom teacher is of what to expect during your visit, the better the presentation will be. There are lots of classroom materials available from the ARRL for teachers. Simply contact the educational activities department at 225 Main Street, Newington CT 06111, and tell them of your plans.

My next step was to contact my good friend, Rob Todaro N2JIX, who is the president of the LIMARC radio club on Long Island. He immediately put me in touch with several ham radio operators who were local to the Hewlett school. Plans were made for both simplex and repeater contacts. A good piece of advice is to always have a backup plan in case you encounter problems.

***Photo A.** Carole WB2MGP puts Bradley Parker on the air.*

Upon my arrival at the Franklin School, I was greeted by Ms. Joyce McGinn, the principal. I was delighted to learn that her brother had been a ham as a young boy, so she was somewhat familiar with the positive points of amateur radio. She was impressed with the concept of using the radio in the classroom to teach school curricula. I was so pleased when she came into Mrs. Fenton's room to observe the demonstration lesson I gave to two first-grade classes.

I showed the children a rolled-out plastic QSL card holder, containing colorful cards from contacts from all over the world, that I had taken from the wall of my own classroom. I showed them my two-meter rig and let Bradley Parker make the first contact on the air (**Photo A**). I knew enough to vary the activities at a rapid rate due to

Continued on page 40

***Photo B.** Mrs. Fenton, Carole WB2MGP, and a roomful of eager first graders.*

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on the 900 MHz band other than a scanner! Even if you could buy a ham transceiver for 900 MHz, what would you hear? Silence! Yeah, and we really use the daylights out of 1.2 GHz, too ... *NOT!*

How many 1.2 GHz repeater systems are there in your home town? We have two in the Denver area and they are almost always silent, except for a computer-generated identification. Boy, I can really see the need for a trunking system on that band! Let's see, keep a 100-year-old communication method as a requirement for worldwide communications (no matter if you intend to use that method or not!) but junk existing and working communications systems for something new? I think not on both counts.

If this is the thinking from the top down via the ARRL, then amateur radio as a whole in America is in serious trouble, even worse than I had thought before. We obviously need to get some new blood elected into the ranks of the ARRL in a desperate way! Before I get bashed, let me say, once again, that I personally love CW, am a VE, am an ARRL member, and would like to see amateur radio survive until I am one of the Old-Timers! 73

HAMSATS

Amateur Radio Via Satellites

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On July 10, two new hamsats achieved orbit, thanks to a *Zenit-2* launch vehicle from the Baykonur cosmodrome. *TMSAT-1* and *Gurwin-II Techsat* made it to space without mishap, and are functional. The orbit is about 820 km (500 miles) high and inclined 98.8 degrees. The satellites travel over the poles and come within view about the same time every day due to the sun-synchronous orbit. Their primary amateur radio activity will be digital 9600-baud store-and-forward communications.

The launch

The primary payload on the Russian *Zenit-2* launcher was the *Resurs-01 No. 4* satellite. It is a Russian civil remote sensing satellite similar to a US Landsat, but based on the Russian Meteor weather satellites. It was built by VNII Elektromekhaniki and some sources have reported that it may later be labeled as *Resurs-02 No. 1*. An integral part of the *Resurs* spacecraft is the Belgian LLMS (Little Leo Messaging System). It is to be used as part of the IRIS communications system.

There were four secondary satellites onboard. The two non-ham spacecraft included *FASat-Bravo*, a 50-kg test satellite built for the Chilean Air Force by Surrey Satellite Technology, Ltd. (SSTL) in England and *Safir-2*, a 60-kg relay satellite built by OHB in Bremen for the German Space Agency.

TMSAT-1

Built at the University of Surrey, *TMSAT-1* (Thai Micro SATellite) is almost identical in appearance to the Chilean *FASat-Bravo*. *TMSAT-1* was built in a cooperative agreement between SSTL and the Thai Micro Satellite Company, Ltd. (TMSC) of Bangkok, Thailand. TMSC was created by the Mahanakorn University of Technology (MUT) and Thai Satellite Communication (TSC). The satellite carries a number of experiments and systems. The Earth observation camera and data communication payload are the primary focus of amateur radio interest.

***Photo A.** The SSTL team in Moscow during spacecraft integration with* FASat-Bravo *on the left and* TMSAT-1 *on the right. Chris Jackson G7UPN in the center. (SSTL photo)*

The imaging system includes one wide-angle camera and three narrow-angle units (infrared, red, and green). The wide-angle camera has a field of view of 1500 x 1500 km, producing an image 576 x 576 pixels. The narrow-angle unit sees a 100 x 100 km area and provides a 1024 x 1024 pixel image. Pictures that are taken by the cameras will be available via the 9600-baud amateur downlink.

The communications system includes three two-meter uplink frequencies coupled to one of two 70-cm downlink frequencies. The primary downlink frequency is 436.925 MHz. In addition to the 9600-baud downlink, the satellite has an onboard digital signal processing (DSP) system that can allow real-time voice communications, experimental digital modems, a digital voice broadcaster, and other as-yet unspecified activities. The *TMSAT* home page on the Internet can be found at the Universal Resource Locator (URL) of: [http://www.ee.surrey.ac.uk/CSER/UOSAT/missions/tmsat/index.html].

Gurwin-II Techsat

The Techsat project to study satellite systems began seven years ago as a senior project for

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HAMS WITH CLASS

continued from page 39

the short attention span of first graders.

I observed wide grins as I showed a few minutes' worth of a video taken of the students in my class talking on the radio in our classroom ham shack to a one-room schoolhouse class on an island off the coast of Maine. And they all were enthralled with the footage of our SAREX ATV contact with the space shuttle *Challenger* in 1985.

I brought photo albums and colorful posters from some of our more memorable contacts to show the children. I showed them photos and a box filled with souvenirs from the Navajo Indian School in Sun Valley, Arizona, that we've been speaking to through the years.

Next, I showed them QSL cards and video footage of some of the very young children who made presentations at my youth forum at the 1998 Dayton Hamvention. It's an important point to make that children always enjoy watching other children having a good time in a classroom setting and doing unusual things.

The time went by so quickly that before we knew it, the hour was up and I barely had enough time to answer their questions and give out souvenir Kenwood caps and ICOM magnets.

It was such a kick for me to watch a class of first graders, lined up to go on the school bus, all wearing ham radio caps and yelling "88s!" to me as they hurried onboard the bus to tell the other kids about the exciting lesson they had just had.

The teacher has already invited me to return next term and address new classes. Many of the parents gave very positive feedback about how excited their children were when they got home from school that day.

The best way to prepare for speaking to the elementary level classes is to have a multimedia presentation, keep the topics brief and exciting, and have lots of visuals.

It will always be a big hit if you distribute nice souvenirs to the children when you leave. Also, make sure the teacher whose class you've been visiting is left with information sheets containing a number where you can be reached for further information.

Above all, remember that the enthusiasm *you* have for the hobby is what will get transmitted to the students. This is what ultimately will get them interested and eager to learn more. 73

Photo B. *Chris Jackson G7UPN and* TMSAT-1, *with the main payload* Resurs-01 #4, *during spacecraft integration in Moscow in April. (SSTL photo)*

aerospace engineering students at the Technion Israel Institute of Technology in Haifa, Israel, under the guidance of Professor Haim Eshed. Later, the program was expanded to develop and launch a series of satellites designed and built at the Technion. Work on the program was organized by Professor Giora Shaviv, the head of the Asher Space Institute (ASI). The first satellite, *Techsat-I*, was destroyed (along with the first hamsat from Mexico) when the launcher, a converted Russian ICBM, malfunctioned in 1995.

The second satellite in the Techsat series, *Gurwin-II Techsat*, represents not only a replacement for *Techsat-I*, but also offers more experiments and capabilities. The satellite is named after the distinguished American Society for Technion (AST) leader Joseph Gurwin and the late Rosalind Gurwin.

In addition to an imaging system and the amateur radio communications package, *Gurwin-II Techsat* has a number of interesting experiments. The satellite carries a UV photometer operating in the 0.24–0.30 mm spectral region to investigate ozone concentrations over the Middle East and to test the capabilities of a small, low-power system for use in space. Another experiment is a charged-particle detector to measure protons and heavy ions in space that cause single-event upsets in electronic devices. There is also a superconductivity experiment that will be used to see if such a device can survive launch and how long it can operate unattended in a space environment. A small X-ray detector has been incorporated into the satellite as a step toward later development of a simple X-ray telescope. An array of reflectors is attached to the outside of the 48 kg satellite to allow the use of Satellite Laser Ranging (SLR) techniques. An Earth-based laser is used to measure the trip time for laser pulses sent from the ground. Distance measurements can achieve an accuracy of five to

Photo C. *Commissioning the* TMSAT-1 *Bangkok control station HSØAM. From left to right: Chatpetch, Pavinee, Chris Jackson G7UPN, and Withaya HSØECQ.*

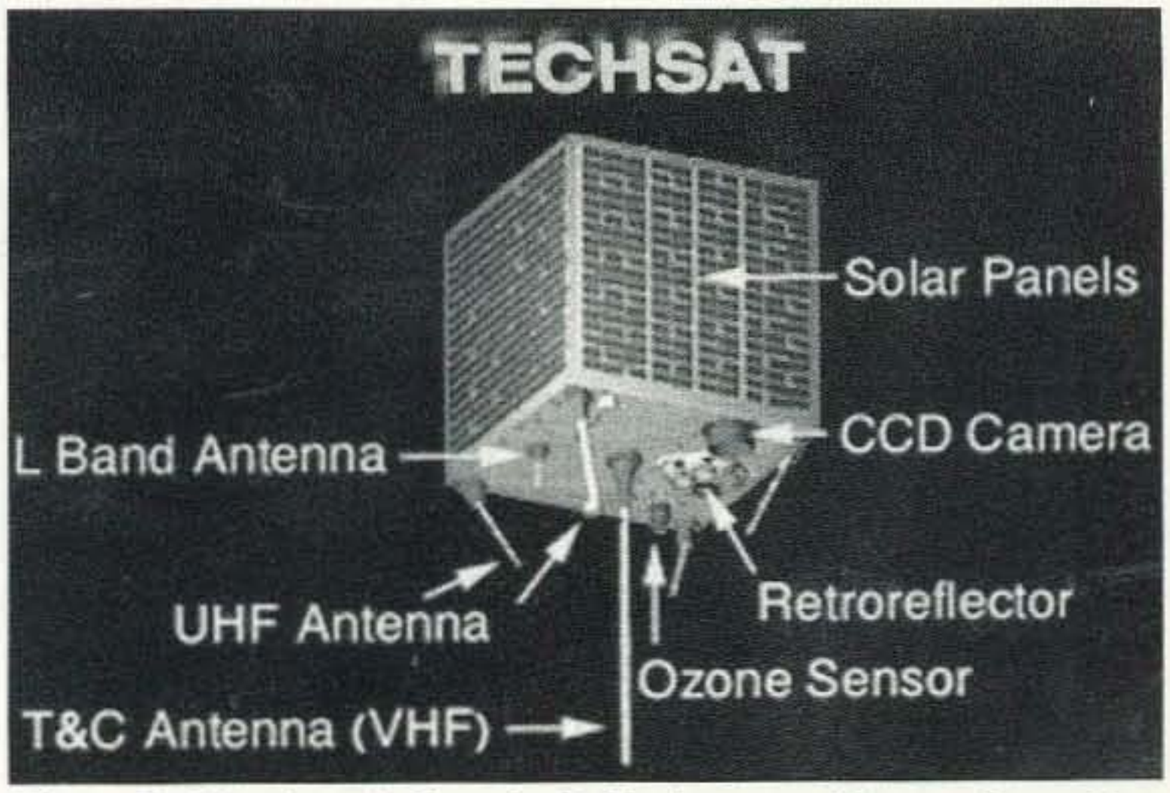

Photo D. *The Israeli* Gurwin-II Techsat *satellite configuration. (Technion Israel Institute of Technology)*

10 centimeters (two to four inches).

The imaging system on *Gurwin-II Techsat* is simpler than that on *TMSAT-1*, but still represents a unique opportunity for hams to view pictures taken from orbit. It uses a CCD (Charge Coupled Device) video camera in conjunction with an image processing and control card. When commanded from the ground, the camera can capture an image, digitize it, compress it, and store it for later transmission.

The amateur radio package is similar to other satellite based store-and-forward systems, but with one significant difference. The three uplink frequencies are in the 23-cm band, just below 1270 MHz. A single downlink is provided on 70 cm at 435.325 MHz. The system is capable of operation at either 1200 baud or 9600 baud. After initial tests are complete, the 9600-baud downlink/uplink will become standard. The *Gurwin-II Techsat* home page can be found on the Internet at the URL: [http://techsat.internet-zahav.net/].

Both new hamsats represent significant additions to the growing fleet of digital resources in orbit, and point out the global cooperation now in place among like-minded satellite enthusiasts. Who would have believed that a Thai hamsat built in England and an Israeli hamsat from Haifa would go to orbit together, on a Russian rocket?

Field Day 1998

Once again the low-Earth-orbit hamsats like *Fuji-OSCAR-20*, *Fuji-OSCAR-29*, *RS-12*, *RS-15*, and *AMRAD-OSCAR-27* were called upon to carry a large part of the 1998 Field Day communications. There was, however, a big surprise that few expected. *AMSAT-OSCAR-10*, now 15 years old, was online and working great. In the months prior to Field Day (always the 4th weekend in June), communications through *A-O-10* had been difficult. The satellite's onboard computer has been dead for more than 10 years, but when the spacecraft is oriented with good solar cell illumination, the Mode B (70 cm up and

Photo E. *Picture of Neve-Shaanan in Israel taken by a Techsat satellite during tests. The* Techsat-II *satellite will take pictures of the Earth from orbit. (Technion photo)*

Photo F. *Field Day can get hot in central Texas. The K5DX hamsat team had a cool time with K5BXX's RV.*

Photo H. *The author, Andy W5ACM, listens for more satellite contacts during Field Day 1998 at the K5DX site.*

two meters down) analog transponder works reasonably well. For Field Day, the illumination was almost perfect and the satellite's orbit made a very favorable pass over North America. From its apogee, or orbital high point, signals were a bit difficult, and deep fades were a problem, but when the satellite was closer in (less than 25,000 km), signals were good and the fades less noticeable. The bulk of the analog Field Day contacts were made through this satellite that just won't give up. Operators were surprised and delighted.

The digital satellites, especially those capable of 9600-baud operation, were very busy during Field Day. Field Day greeting messages were logged from around the world. *KITSAT-OSCAR-23* carried the most, with *KITSAT-OSCAR-25* and *UOSAT-OSCAR-22* close behind. *AMSAT-OSCAR-16* and *LUSAT-OSCAR-19* were also active at 1200 baud.

Unlike the American Radio Relay League Field Day rules that consider "satellite" a single band, the AMSAT (Radio Amateur Satellite Corporation) rules state that each satellite is a separate band. This encourages operators to chase all the satellites, and not just the easiest one. The AMSAT rules also encourage the use of the digital satellites for Field Day message forwarding and message collecting. Under the AMSAT rules, it is actually possible to get a decent score without ever transmitting, just by receiving Field Day greeting messages broadcast from the digital satellites. Foreign operators are also encouraged to participate on an even basis with American and Canadian stations.

The Houston AMSAT Group teamed up with the Texas DX Society (TDXS) for a weekend of hot weather, air-conditioned motor homes, BBQ and lots of HF and hamsat contacts. A new Yaesu FT-847 was used for all of the satellite activity. All of those who tried their hand at the new rig from Yaesu enjoyed it, and found it easy to use. Although we didn't have the wiring correct to uplink messages to the digital satellites, we did manage a large number of downloads and made mostly voice and CW contacts via *A-O-10* and the other analog satellites. It was a Field Day to remember.

Photo G. *Mike WA5TWT arranges the coax feeds to the VHF and UHF satellite antennas at the K5DX Field Day site.*

The AMSAT Annual Meeting and Space Symposium

It's time again for the AMSAT-NA Space Symposium and Annual Meeting. This year, it will be held at the Battlefield Inn (formerly the Park Inn) in Vicksburg, Mississippi, from October 16th through the 18th. Compared to other conventions and events, the rates for AMSAT gatherings are extremely reasonable.

Registration is $30.00, the Saturday night banquet is $20.00, and a Sunday morning field trip to the US Army Engineer Waterways Experiment Station is $10.00. To register, call AMSAT at (301) 589-6062.

Room rates are $52.00 for a single and $62.00 for a double per night. A complimentary breakfast buffet is included. For reservations at the Battlefield Inn call 1 (800) 359-9363 and mention the AMSAT Conference.

Southwest Airlines is the official airline of the AMSAT Conference and will provide a 10% discount on airfares. To make airline reservations, call 1 (800) 433-5368 and reference K3308. Flights go into the Jackson (Mississippi) airport. A shuttle service is available for $9.00 each way.

You can check all this out on the Internet via the URL: [http://pages.prodigy.com/DXHF93A]. The talk-in frequency at the conference is on the 147.27 MHz repeater (100 Hz PL). Some family activities will be provided, and Vicksburg has many interesting sites to tour, including Civil War battle scenes and antebellum mansions. From casinos to campgrounds, they have it all. I'll see you in Mississippi! 73

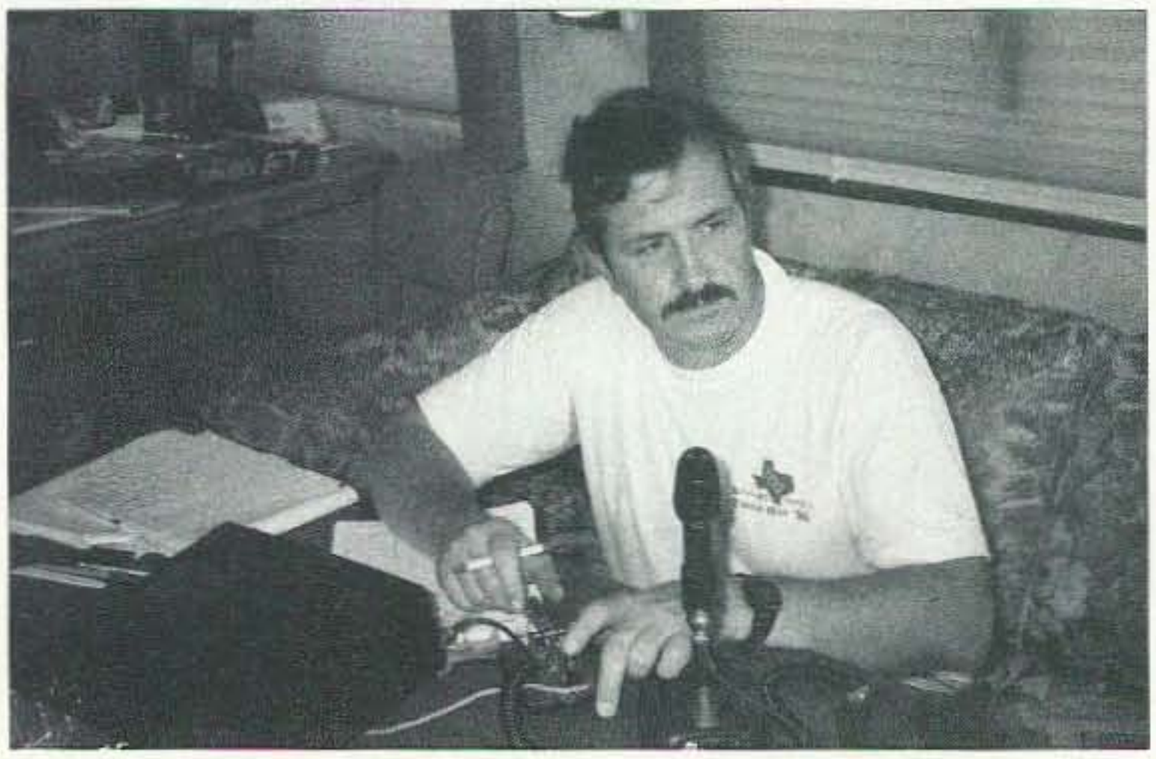

Photo I. *Doug WB5TKI collects a few more CW contacts via A-O-10 during the 1998 Field Day operation.*

Number 43 on your Feedback card

On the Go

Mobile, Portable and Emergency Operation

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Over the past few months, I've noticed quite a few more mobile HF stations on the air. I attribute this to our improving sunspot cycle. With better propagation, I can hear (and work) more stations of all types, including mobiles. On the other hand, I sense that more hams are adding HF mobile capability because of the improved propagation. People are more interested in investing time and effort into selecting and installing new mobile rigs when the chances are good that they will be able to work interesting and DX stations. To all of you who have either added HF or are thinking of adding it—Welcome!

I'm still operating my trusty Kenwood TS-130S, and though its features are modest, I'm able to operate it almost entirely by touch with only the occasional glance at the control panel. However, I do find many of the new rigs absolutely fascinating, with features including memories and expanded coverage from 80 meters to VHF. Regardless of the type of rig, though, successful HF mobiling depends to a great extent on how attentive one is to details, especially when installing the rig. A couple of extra hours' work in the beginning will pay off in big performance benefits.

Years ago we learned that a good electrical connection starts with a good mechanical connection. In mobile operations, this is especially good advice. In the event of an accident, a good mechanical connection between the rig and the vehicle will minimize the chance that the rig will become a missile ricocheting around the passenger compartment. An object in motion (your radio) tends to remain in motion (even if the car in which it is installed has abruptly stopped) until another force (hitting something or somebody) overcomes it. As they say, physics isn't just a good idea—it's the law (... sorry about that).

Most rigs have the chassis and/or case at the same potential as the car chassis or body—normally negative. The car uses the body as the negative lead for most circuits, as do most radios. The radio also may use the chassis to connect to the braid of the antenna lead. Even though many radio mounting brackets provide no electrical connection to the car, I believe this is important. The radio may be mounted within rubberized clamps, but this is more for vibration protection than electrical isolation. I try to mount my HF rig to the car body with metal brackets that provide both a mechanical and electrical connection. Also, this may improve your insurance coverage on your rig. Some policies pay a higher amount for theft of a permanently-installed piece of equipment than for a temporary installation. Check your policy to see if this applies to you.

Power connections can sometimes get a good discussion going among hams. With my UHF and VHF equipment I try to have a good connection for power, but I do keep a power cord available that will let me plug the radio into a cigarette lighter in an emergency. This is not appropriate for HF installations, and a connection directly to the battery is recommended. First, HF rigs tend to run around 100 watts, while a VHF or UHF transceiver usually will be between five and 50 watts. Second, VHF and UHF mobile operations tend to use FM as the mode of choice, and FM is inherently less sensitive to noise. HF operations use one of the sidebands of an AM signal, and electrical noise is much more of a factor.

When it comes to actually wiring the power cord, some swear to the benefit of fusing only the positive lead. Others believe that both leads should be fused. I admit to being guilty of blowing both fuses (in my much younger days, of course), so I subscribe to the two-fuse theory. Remember that a point in a circuit is positive or negative in relation to some reference point, so a negative lead in relation to the positive lead may in fact be positive in relation to some other reference, and if they touch, you may wish you had that second fuse.

Many of the panels in an automobile are not connected together in an optimal manner, and this produces a lot of noise. While noise blankers do a marvelous job, they are merely an attempt to treat a symptom of a larger problem. Remember that "signal-to-noise ratio" really means (signal + noise)/(noise). If all of the body panels can be better connected, overall noise may be reduced. This can be done in a few hours by ensuring that all the panels are mechanically and electrically connected. A noncorroding sheet-metal screw can be used to connect panels which do not move, and wire, braid or metal straps can be used to bridge panels which do. While there are problems associated with attaching dissimilar metals, I believe that the expected life of the automobile is usually short enough that this is not an issue. I try to keep any connections away from severe weather and corrosives such as salt.

Speaking of signals and noise—I find it helpful to remember this when listening to the radio. I adjust the RF gain so that when tuned to a frequency with no signal I hear little or nothing. I then use the AF gain to adjust the audio level. While I may lose some volume, this can be more than made up for by using an external speaker aimed at the operator rather than the built-in speaker aimed down at the floor or up under the dashboard.

I really enjoy talking with a DX station while driving alone up and down the interstate. Sometimes I can work a fellow mobile station at the other end of the country, which can be quite satisfying. If you're thinking about adding this aspect of the hobby to your palette, I hope that this column will help you decide to join the group—and that these ideas will be of help. Drop me a line to let me know how your experiences are working out, and what suggestions or experiences you've had.

Told-you-so department

During the recent fires in Florida, hams in the Brevard, Flagler and Volusia County areas were quite busy for extended periods. Good job, everyone. While you were busy, you might have missed television reporters asking people to not use their cellular or standard telephones. Seems there was so much telephone activity that not only was the cellular system not working properly, but even the landline system was overloaded. Those emergency personnel who were relying on cellular did not get the results they expected. In the meantime, what I heard on two meters indicated that the hams held things together. Even in this day of high technology, we hams fill a need that can't quite be covered by other options. 73

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QRP

Low Power Operation

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Last month I talked about the NorCal 38 Special. This month, we'll take a closer look at this rig.

The one that I have sitting on my workbench is rather dead. There's not much audio and no receive at all. The transmitter is *kaput* as well. To make matters worse, if that's possible, I did not assemble the kit. So, to begin the troubleshooting, I had to basically rebuild the kit one step at a time. This did not mean I had to resolder every joint, but rather that I had to follow the instructions step by step to ensure that the kit was put together correctly.

I found no misplaced parts or incorrectly installed components. I checked very carefully for missed solder joints and of course the ever present solder bridges. I found none. All in all, the person who assembled this 38 Special did a pretty nice job. Unfortunately, it still didn't work.

Simple tests

In a rig like this, the best place to start is by checking the main power bus. In the NorCal 38 Special, there is one main voltage regulator. It's a standard 78XX series regulator. Checking its operation is simple. There should be 12 volts on the input and eight volts on the output. A quick check with the calibrated fingertip should tell you if the regulator is pulling too much current. It should be warm to the touch, but not hot enough to leave a layer of skin on the metal tab!

After you have verified that the regulator is working, check each Vcc pin for the correct voltage. On the NE602s, Vcc is found on pin 8. You'll find Vcc on pin 14 of the CD4066 and on pin 8 for the NE5532. You'll need to probe pin 20 on the 74HC240 to check Vcc. While you're at it, check each Gnd pin. These all should in fact be grounded, but if you find a pin that has some voltage floating on it, suspect a missed solder connection or a solder connection with a resin bead in the middle.

Since the 38 Special uses a variable voltage to warp the frequency of a crystal, check to see if the voltage is actually there. In the 38 Special, probe the junction of R4 and L1. As you move the tuning control through its range, the voltage at this junction should move. Voltage tests are the foremost line of tracking down trouble in the 38 Special. Paul NA5N has provided a voltage chart which I am happy to share with you here (**Table 1**). Paul's help came in quite handy while I was looking for the problem in this 38 Special.

Diagnostic voltage measurements for the 38 Special

Voltage measurements are VDC unless otherwise indicated, using a DVM or voltmeter in both receive and transmit modes. Due to variations in voltmeters and Vcc, voltages shown are ±0.25 V. The 38 Special measured has a five-watt amplifier, but *no* RIT or keyer mod. For transmit voltages, make sure you are connected to a dummy load.

AC voltages

Most of the AC voltages in the 38S are too small to register on a DVM/voltmeter, except as follows: HC240 RF output at U4-12,14,16 = 0.14 VAC on transmit (approx.). On a scope, however, you should see about a 7–8 Vpp signal on both the input and output pins of the HC240 PA stage drivers.

The NE5532 audio output at U5-1 registers at about 0.05 VAC on Xmit and about 0.03 VAC on Rcv with a moderately strong signal. This is a 50–150 mVpp signal on a scope.

This chart has appeared on the QRPL reflector and in the NorCal publications. If you E-mail me, I'll send you an electronic copy that prints out quite nicely. My E-mail address is at the top of the column.

Problem found, somewhat

My patient had all the correct DC voltages. It was when I checked the RF voltages that things seemed to be way out of whack. I discovered that if you threw in a whopper of a signal, you could hear it in the headphone. And if the band was really up, you could every now and then make out a signal. I decided the problem must be in the front end. Something must be shorting the signal to ground, or the input transformer was not wound correctly.

So I rewound the input transformer, T1, several times, with no improvement. I also checked for proper placement of D1, D2 and C2 and C4. All seemed to be correct. At that time, I E-mailed Paul my observations. He suggested I scope out pin 7 of U1. That's the receive mixer. With scope probe in hand, I observed that the output of pin 7 was in no way close to the 1.2 Vpp that was supposed to be there. I had only millivolts instead of volts. I suspected a bad NE602, and a new one was installed. That did not fix the problem. By using a counter, I knew that the crystal was on frequency, and I could move the frequency

U1 NE602 RCV Mixer			U2 CD4066 Switch			U4 HC240 Drivers, PA and Sidetone Osc			Diodes (A = Anode; K = Cathode/Banded End)			
	RCV	XMIT		RCV	XMIT		RCV	XMIT			XMIT	
U1-1	1.4	1.7	U2-1	7.8	7.8	U4-1	5.7	0		RCV	300mW	5W
U1-2	1.4	2.2	U2-2	7.8	0	U4-2	0	4.2	D1-A	4.8	7.6	8.1
U1-3	0	0	U2-3	7.8	0	U4-3	0	4.0	D1-K	5.4	7.8	7.4
U1-4	6.7	4.7	U2-4	0	0	U4-4	0	4.3	D2-A	4.8	7.6	8.1
U1.5	6.7	4.7	U2-5	0	7.6	U4-5	7.8	3.8	D2-K	5.4	7.8	7.3
U1-6	7.4	7.4	U2-6	0	7.6	U4-6	0	4.4	D4-A	5.7	0	0
U1-7	6.6	6.5	U2-7	0	0	U4-7	0	7.6	D4-K	5.7	0	0
U1-8	7.8	7.8	U2-8	0	6.6	U4-8	0	4.4	D5-A	5.7	0	0
U3 NE602 TX Mixer/ Prod Detector			U2-9	6.6	6.6	U4-9	0	4.4	D5-K	5.7	0	0
			U2-10	6.6	6.6	U4-10	0	0			XMIT	
	RCV	XMIT	U2-11	6.6	6.6	U4-11	7.8	3.5		RCV	Either Power	
U3-1	1.4	1.4	U2-12	5.6	0	U4-12	0	3.6	D6-A	6.1	0.5	
U3-2	1.4	1.4	U2-13	5.6	0	U4-13	5.7	0	D6-K	5.8	0.1	
U3-3	0	0	U2-14	7.8	7.8	U4-14	0	3.6	D7-A	0.6	1.5	
U3-4	6.7	6.7	U5 NE5532 Audio Filter/Amp			U4-15	0.6	3.8	D7-K	0.1	7.6	
U3-5	6.7	6.7				U4-16	0	3.6	D8-A	0.6	4.0	
U3-6	7.7	7.7		RCV	XMIT	U4-17	7.8	3.8	D8-K	0.1	7.7	
U3-7	7.0	7.0	U5-1	3.9	3.9	U4-18	0	3.6				
U3-8	7.8	7.8	U5-2	3.9	3.9	U4-19	0	0				
Q1 2N3904 RF Driver & Bi-phase Franistan			U5-3	3.9	3.9	U4-20	7.8	7.8				
			U5-4	0	0							
	RCV	XMIT	U5-5	3.9	3.9		D3-A: 0-8V, depending on setting of TUNE pot					
Q1-E	0	0.9	U5-6	3.9	3.9		D3-K: 0V (ground)					
Q1-B	0.6	1.5	U5-7	3.9	3.9							
Q1-C	7.8	3.5	U5-8	7.8	7.8							

Table 1. *Diagnostic voltage measurements for the 38 Special. Note: U1-3 = U1, pin 3.*

THE DIGITAL PORT

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This month's column varies a bit from the norm, as it is written while traveling across the USA. We are in the middle of a trip to visit family, mostly offspring, who are scattered from one end of the country to the other. This gives several opportunities to observe the activities of other hams as well as to master the away-from-home E-mail dilemma. The latter part consumed more time than I like to admit.

Another E-mail challenge

Due to the extended time (more than three weeks) on the road, it was necessary to find a way to access my E-mail away from the local phone number provided by my Internet Service Provider (ISP). This was a nearly-traumatic experience that, for a time, appeared unmanageable—so I thought some of you could benefit from my experience.

The ISP I use covers a relatively small area, so I contacted them for help. I considered calling in with the AT&T card, which runs 30 cents a minute when away from the home phone, and felt that wouldn't hurt too badly if I used a little discretion. They informed me they had numbers I could use in about 900 cities across the country for an additional monthly fee. Also, they were contemplating a toll-free number charged by the minutes of access. Lots of options.

When I got to a small city in Idaho, I experimented with the calling card. Using the Windows95™ dial-up accessory and following the seemingly straightforward instructions didn't work (systems normal). I attempted to use the calling card to make a voice call to the ISP, and experienced another complication.

The complexity of the keypad entries when using the card involved 34 digits, but the audible tones, when pressing the keys, disappeared at about 30 digits. After calling AT&T, plus the local phone system, and being assured neither of their systems had such a limitation, it was time to press a little logic into the equation.

The helpful voice at AT&T had explained that some pay phones had this limitation. This meant to me that the problem was likely in the phone set I was using. Another phone on the same line worked perfectly when using the offending dialing sequence. The conclusion? Probably the redial function on the first phone would only hold a certain number of characters. This has probably happened to others who read this column, but it was a revelation to me about the not-so-well-known shortcomings of modern appliances. The technician at the local phone company considered this idea for a few moments and said he felt I was on to something.

The next problem emerged when I got the real skinny on using the calling card with Windows95's dial-up system. The suggestion (instructions) from the senior technician at my ISP was to enter all the numbers in the "number to be dialed" space in the dialer, and separate them with commas, to achieve the proper wait time between sequences. The number of commas was to be determined by experimentation.

I love a challenge; that is part of why I am a ham. After entering the vast array of numbers, with an initial guess at commas, and clicking enter, it actually dialed the number and made the connection! However, that was apparently some strange quirk of fate that I would never repeat. Subsequent dialings and comma-adjustments seemed to result in a problem similar to that which occurred when I dialed the phone card sequence. Hmmm …

Luckily, the day was saved when the sales rep from the ISP called and gave me their new toll-free 888 number to call (which I am to understand costs less than half what the calling card would cost). The tech rep had assured me the 888 number was not in service as yet, but then what would the tech department know? I'll take what works. It connects like a champ.

You would think all the problems would be behind us, but wait, there's more. We were traveling in our roll-your-own van conversion (another story), staying in RV parks. Not many RV park owners are attuned to the idea that their guests may have need for E-mail access. Generally, the parks priced at the top end of the scale are accommodating; but there are many park owners who still consider E-mail and Internet to be voodoo and, therefore, to be avoided.

If my powers of observation, being tilted by experience, serve me correctly, I will make a prediction. The cost and stability of using a cell phone for these purposes will come into line one day. That simple prediction is based on such things as the years-past phenomenon of the microwave oven that could not be produced and marketed for

---

around via the tuning control, so the VXO seemed to be working. There's just nothing coming out of the mixer. No mixer, no receiver, and no transmit.

I worked on and off with this problem for a week or so at a time. I'd dig in the rig and then put it away to let me work on the problem in my head. I decided that the problem must be a zapped crystal, so I ordered a new one from Mouser Electronics and installed it. Much to my dismay, the new crystal did not correct the problem.

Digging deeper

It occurred to me that if the output of the first mixer were so low, perhaps the output itself was being loaded down. The output of the first mixer is routed to an analog switch, a CD4066, and then passed through to the product detector/TX mixer. I had a CD4066 lying about, so I installed a new one at U2's location. I also replaced the coupling capacitor, C11. Neither fixed the problem of low first mixer output. I went so far as to replace C8, thinking if it were leaky, the output would be pulled to ground. Again, the problem remained and I still did not have enough output from the first mixer.

Strange things were happening

I began to notice that every time I hooked up the scope to the output of the mixer, I had a signal. It just looked awful! I then noticed that by moving my finger near the three wires going to the main tuning control, the output would change. Not slightly, but by a wide margin. It moved so much, you could see a frequency change if you coupled the output to a counter.

And this is where we have to stop. Out of space again. As I work on this column, I am still working on the 38 Special. No, I haven't got it working, but I have learned a lot about the little rig. Right now, I can't say for sure if there will be a happy ending—but you'll never know unless you tune in again next month! 73

under $500 (decreed by those in the know at the time) or the current example of the laptop with CD drive and color monitor on which I am typing ever becoming an affordable reality. Or ... how about some of the ham gear available these days that is such a bargain when compared to the commercial versions?

User demand and simple competition makes many things possible. The magic arts of marketing answer the needs of the sales department until no longer necessary; then another trend develops that cuts prices to the bone and the manufacturer continues to pay the same dividends to the shareholders. Some part of that activity is quicker than the eye. Anyway, watch the cost of using cell phones in the next few years. You heard it here first.

The elusive chip

Several times in the past I mentioned the shortage of the TCM-3105 chip needed to build a clone for the BayCom 1200b modem. A word from Gene WB2NVI brings news that JDR Microdevices has a supply and that Gene recently purchased two of the elusive little chips at $11.99 each. Although I am currently far from my notes, JDR has a familiar ring. I believe it is mentioned in the LDG Electronics literature as a source. Their Web address is [www.jdr.com]. LDG is the manufacturer of the BayCom clone I mentioned in the July column and their URL is [www.ldgelectronics.com].

Mobile laptop power

One of the modern wonders of the world is the convenience of the laptop to keep us from being tied down to the desktop. The mobility is wonderful, but there is a problem that is difficult to address without throwing large wads of money at it. The useful charge of the battery seems to wane about 20 minutes after the word processor or other program of the minute is in place. The high-buck cure for this is lots of batteries and a fancy desktop charger. If you charge enough batteries to fill a wheeled carry-on bag, you can work with your laptop 'til you drop.

I am not sure where being practical overlaps being poverty-stricken, but those two phrases come to mind when I am operating away from a wall outlet. The wall outlet is where the power supply/charger plugs in for anything but the quickest on-off operations of this portable little computer.

My cure for this has been in place and working for over a year now and that is a wall outlet in the van with a Radio Shack™ 300 watt inverter semi-permanently wired in to the auxiliary battery system. At this moment, I am writing with this lash-up and it is a dependable solution.

Even when parked for an extended period, the deep cycle RV battery provides adequate voltage to operate the computer and other accessories. The battery is rigged to charge from the vehicle alternator and is easily disconnected from the parallel connection to the vehicle battery by a manually switched solenoid.

The RV folks recommend a slight variation in circuitry so the auxiliary battery is charged any time the engine runs. I chose the manual switch so the engine can be started in the event of failure of the regular battery. It paid off last winter when the regular battery died in the cold weather. Just a flip of the switch, and the auxiliary battery provides the juice to the starter with its own set of full-sized cables. However, the system does require thinking. I have to remember to flip that switch at the appropriate times.

After this system was in place, I became aware of an adapter made specifically for the IBM™ laptop that plugs into a cigarette lighter. It sells for about $90 and is distributed by an outfit just up the road from me in Reno. I don't have one of their fliers with me so I will not attempt to mislead you with the wrong name, but will gladly furnish it if you want to contact me.

The inverter solution is good for other purposes. I recharge my razor, power an electric tooth cleaner, and run a printer as well as other homey conveniences while away from home. Too bad I will have to break down and carry a generator for some of the more important things one of these days, such as an air conditioner or the wife's hair dryer.

I am carrying the LDG packet modem with me on the trip. It is only a minor difficulty to find a local ham packet PBBS in an unfamiliar setting. I usually manually dial around 145.100 and listen for audible packet bursts. The "proper" method would be to set the receiver to scan a segment of the band most generally populated by PBBSs and watch for action.

Whatever method I use to find the frequency, it is then necessary to watch for an identification string from the node or pick up on the callsign by observing connections in progress. From that point it is a simple process to log on to the system. You will sometimes be surprised to learn different PBBS software comes in a variation of formats, yet will all offer similar functions. If they did not, we could not expect the entire system to pass information as well as it does throughout the world.

Next month

I didn't bring the Web address chart template with me, so the ever-growing chart will not be in the column until next month. That is the best way to preserve accuracy. Since I began using the copy-and-paste method for the chart, I can't recall a complaint, so I don't want to stir the waters.

Next month, I will endeavor to bring you the results of a new project, but I have learned not to commit to some of the stuff that just doesn't work out. It is too easy to make a challenge into a disaster by simply setting a deadline.

If you have questions or comments about this column, E-mail me at either of the addresses at the top. I will gladly share what I know or find a resource for you. On packet, my current PBBS address is shutting down. If your packet mail comes back or is not answered, that is the reason. I am searching for a new address. For now, 73, Jack KB7NO. 73

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Meeting Your Match

The fine points of understanding matching networks.

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When we connect a load to a source, be it an antenna or an amplifier stage, we expect power to be delivered to the load. Whether the power delivered is the maximum available from the generator (source) or not depends on the resistance of the load relative to the internal resistance of the generator.

The maximum power is delivered to a conjugate matched load. A conjugate matched load has the same magnitude as the generator's internal impedance, but with the opposite phase angle. The reactive component of the load is then in resonance with the reactance of the generator. When the load impedance has the same magnitude and phase angle as the generator, the load is said to be matched on an image impedance basis. The term "image" arises from the fact that impedances on the two sides of the output terminals are images of each other. Only when the load and generator are purely resistive are the image match and the conjugate match the same.

In a voltage amplifier, say in a receiver IF, voltage is the important concern, not power. Therefore, the amplifier load impedance is maximized at the expense of power output. Under these conditions, matching is not important. However, in a transmitter amplifier chain, power usually is critical and the amplifiers matched for maximum power output.

It's all well and good to say the maximum available power from a generator is obtained when the load is a conjugate match to the generator. If you designed the amplifier, you know what the impedance should be, but what is the output impedance of an unknown generator? The internal impedance of a generator can be found with a couple of measurements and some calculation. **Fig. 1** shows a generator with an unknown impedance. R_g is the generator's open circuit voltage divided by the short circuit current, that is, $R_g = E_g/I_g$. When the generator cannot be safely operated unloaded or shorted, the internal resistance can be calculated by noting the voltage across two different values of load. The reactance, either inductive or capacitive, is tuned out when the voltage across an arbitrary load is maximum. The voltage across the load is measured, the load is changed, and the voltage across the second load resistance is measured. The two different loads and load voltages produce two equations with two unknowns, E_g and R_g, which can be solved simultaneously.

For example, if the voltage across a 400 Ω load is 30 V and the voltage across a 200 Ω load is 20 V, the two equations for E_g are:

$$E_g = \frac{(E_{L1} + E_{L1}R_g)}{R_{L1}}$$

$$= \frac{(E_{L2} + E_{L2}R_g)}{R_{L2}}$$

Solving for R_g produces:

$$R_g = \frac{R_{L1}R_{L2}(E_{L1} - E_{L2})}{(E_{L1}R_{L2} - E_{L2}R_{L1})}$$

For the values of the loads and load voltages in the example, $R_g = 400\ \Omega$ and $E_g = 60$ V.

Continued on page 50

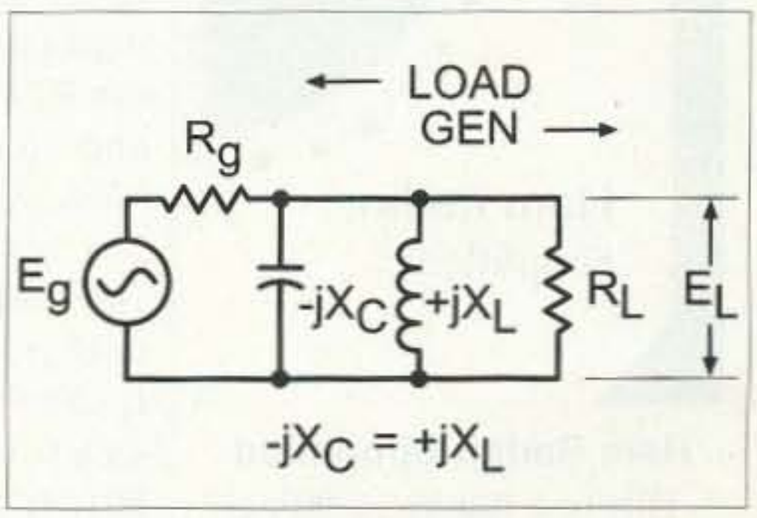

Fig. 1. *The generator impedance can be calculated when the generator's reactance is "tuned out."*

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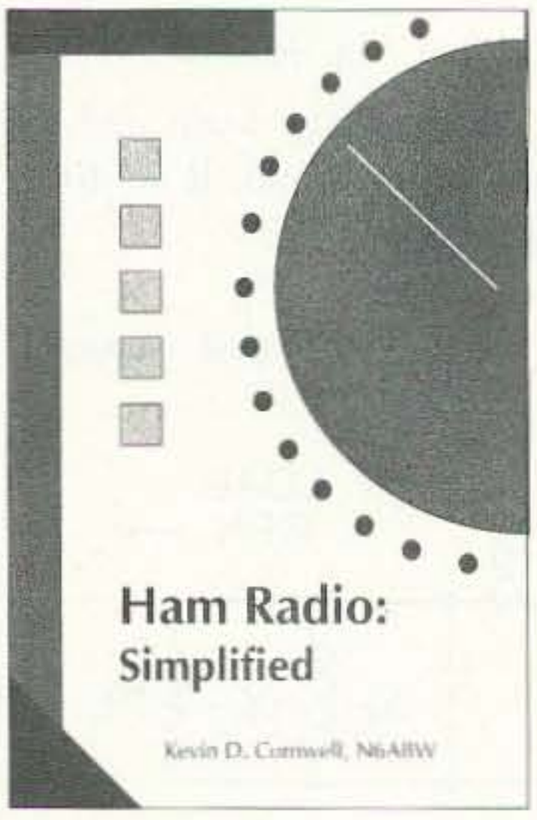

Ham Radio: Simplified

This new illustrated 90-page book by Kevin Cornwell N6ABW provides an excellent entry to ham radio. It explains all the fundamentals of the hobby in simple language. It discusses what equipment to get; how to use it; which bands are good for what; the different kinds of antennas; how to operate without seeming like a dweeb; and how to run RTTY, slow scan, packet, and so on. This is a great book to give to anyone who has made the mistake of showing an interest in the hobby. It'll help set the hook. It's $8.95 plus the usual $1.95 s&h from PhotograFix, 2139 Hilt Road, Hornbrook CA 96044; phone (800) 934-9368 or FAX (530) 475-0916.

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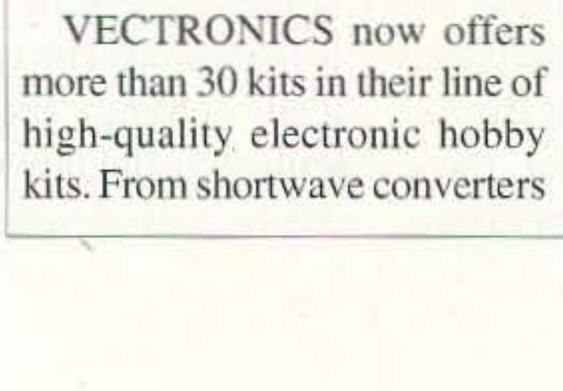

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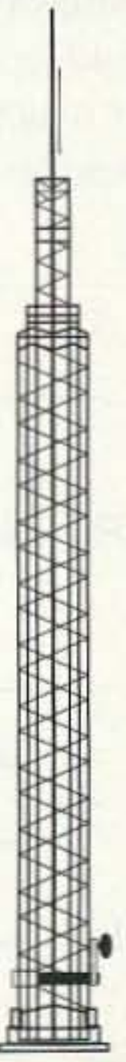

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Meeting Your Match

continued from page 47

The relationship between load impedance, generator impedance, output voltage, and output power is shown in "Impedance and Power." As seen in **Table 1**, the maximum power is delivered to the load when $R_L = R_g$ and maximum voltage across the load occurs when the load impedance is maximum. To realize the desired load resistance requires an impedance transformer.

Transforming the load impedance can be accomplished with wound transformers or with suitable reactive networks. At low frequencies, the reactances required are not practical, and the shortcomings of wound transformers must be accepted. At RF, reactive matching networks are the norm. The impedance transformation of a wound transformer is fixed and determined by its construction—primarily the turns ratio. Therefore, wound transformers just transform the magnitude of the load impedance and seldom provide an image match or conjugate match.

The power output of a transformer or reactive network ideally is equal to the input power. Actually, the output power is a little less than the input power because of losses in the resistance of the windings and core losses. The equations for matching networks which follow assume lossless inductors and capacitors.

Matching networks made with discrete reactive components in the form of an "L", "π", or "T", or their combinations, are commonly used at RF. An "L" network is a "π" or "T" with one element reduced to zero or infinity. **Fig. 2a** shows a generic "π" network that matches the load R_o to the generator R_1. Usually the series arms and shunt arms have opposite signs. When the reactance Z_b in the "π" of **Fig. 2a** is infinite, the resulting network is an "L" as shown in **Fig. 2b**. **Fig. 2c** shows a "T" network. When the reactance Z_a in the "T" is zero, the resulting network is also an "L" as shown in **Fig. 2d**. Both the transformation ratio and phase shift through the network can both be selected in either a "π" or "T". In the "L", the phase shift is determined by the load resistance R_o and the series arm. The phase shift ß through the "L" is $\tan^{-1}(Z_c/R_o)$, the angle whose tangent is Z_c/R_o.

The equations for the lossless reactances in an image matching "L" network are:

$$Z_1 = R_1\sqrt{[R_o / (R_1 - R_o)]}$$

(input shunt arm)

[Equation 1]

and

$$Z_2 = \sqrt{[R_o\,(R_1 - R_o)]}$$

(series arm)

[Equation 2]

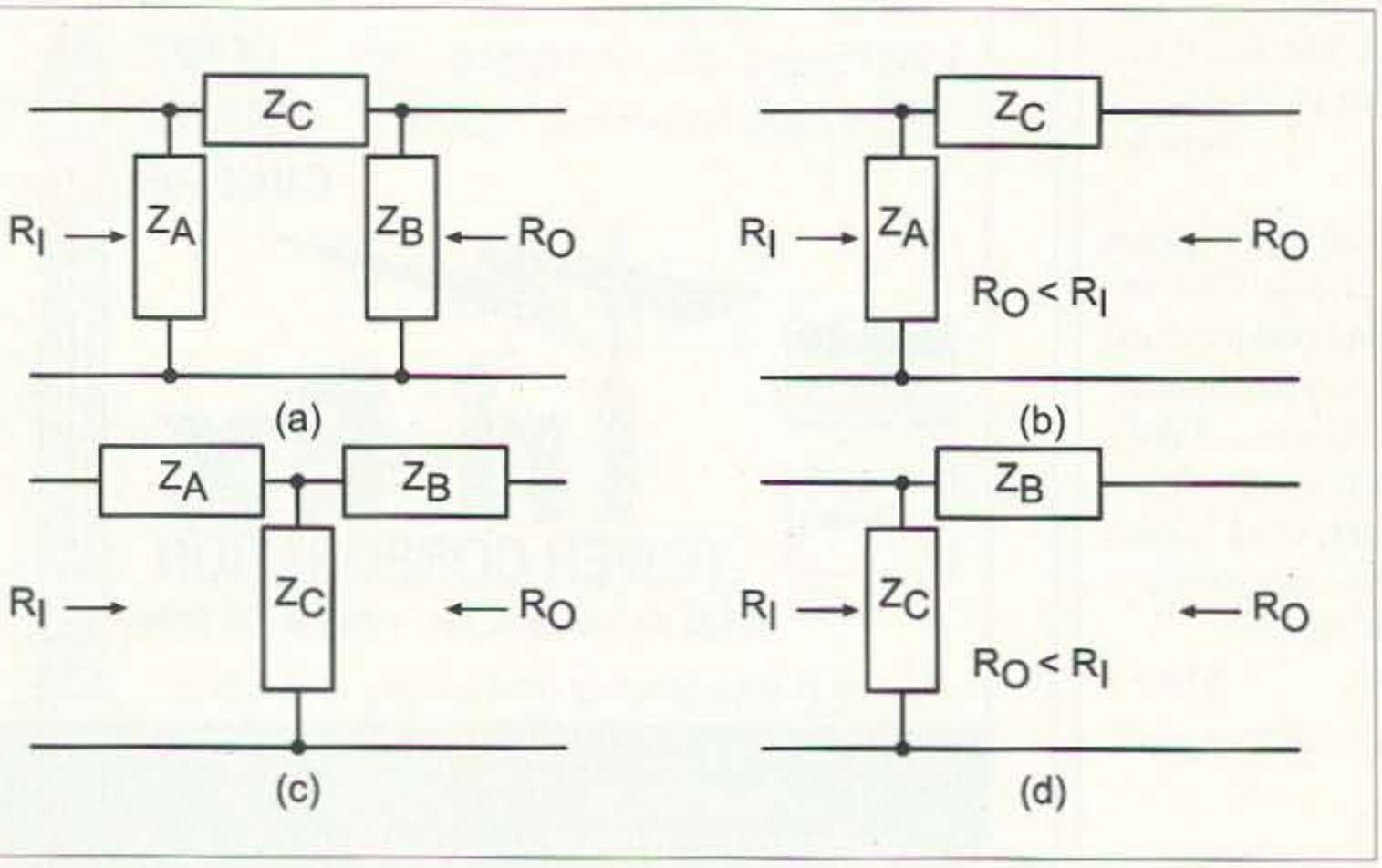

Fig. 2. There are many forms of matching networks. (a) A "π" network. (b) An "L" network derived from the "π." (c) A "T" network. (d) An "L" derived from the "T."

The generator can feed either R_1 or R_o, but R_o must be less than R_1.

In most impedance matching applications phase shift through the network is not important and the "L" network is satisfactory. But where phase shift is important, a full "π" or "T" may be required. The design equations for the "π" are:

$$Z_a = \frac{jR_1R_2\mathrm{Sin}\beta}{[R_2\mathrm{Cos}\beta - \sqrt{(R_1R_2)}]}$$

$$Z_b = \frac{jR_1R_2\mathrm{Sin}\beta}{[R_1\mathrm{Cos}\beta - \sqrt{(R_1R_2)}]}$$

$$Z_c = j\mathrm{Sin}\beta\sqrt{(R_1R_2)}$$

where ß is the phase shift through the network. When ß is 90°, Sinß = 1 and Cosß = 0, and the equations for the low-pass configuration reduce to

$$Z_a = -j\sqrt{(R_1R_2)}$$

$$Z_b = -j\sqrt{(R_1R_2)}$$

and

$$Z_c = j\sqrt{(R_1R_2)}.$$

The network behaves like a quarter-wave transmission line transformer.

The design equations for the "T" are:

$$Z_a = \frac{-j[R_1\mathrm{Cos}\beta - \sqrt{(R_1R_2)}]}{\mathrm{Sin}\beta}$$

$$Z_b = \frac{-j[R_2\mathrm{Cos}\beta - \sqrt{(R_1R_2)}]}{\mathrm{Sin}\beta}$$

$$Z_c = \frac{j\sqrt{(R_1R_2)}}{\mathrm{Sin}\beta}$$

where ß is the phase shift through the network.

When ß is 90°, Cosß = 0, and Sinß = 1, the equations reduce to:

$$Z_a = -j\sqrt{(R_1R_2)}$$

$$Z_b = -j\sqrt{(R_1R_2)}$$

and

$$Z_c = +j\sqrt{(R_1R_2)}.$$

Again, the network behaves as a quarter-wave transmission line.

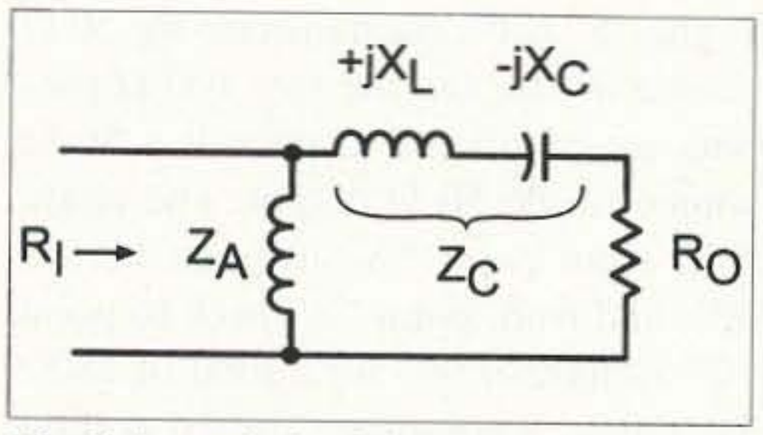

Fig. 3. A tuned circuit increases selectivity.

For an "L" to produce a resistance when looking into Z_a requires Z_a and Z_c to have opposite signs. Most often Z_c is a capacitor and Z_a an inductor, so that DC is blocked from the load and Z_a provides a series DC feedpath for the generator (plate or collector of an amplifier). Unfortunately, when Z_c is a capacitor, the "L" is a high-pass filter and there is no attenuation of harmonics. If harmonics must be suppressed, Z_c can be a series-tuned circuit operated off-resonance to provide the appropriate total reactance for Z_c.

The 3 dB bandwidth of a tuned circuit can be expressed as:

$$BW_{3dB} = \frac{F_o}{Q}$$

where

F_o = center frequency

and

$$Q = \frac{X_L}{R} = \frac{1}{2\pi F_o C R_o}.$$

Making Z_c a series-tuned LC circuit as shown in **Fig. 3** can produce a narrow bandpass response and suppress harmonics. The net value for Z_c is $jX_L - jX_c$. The voltage across capacitor is equal to the current in the load times $-jX_c$. The current in the load I_L is

$$\sqrt{\frac{P_o}{R_o}}.$$

Even with moderate power, the voltage across X_c can be surprisingly high.

For example, when you desire to transform 50 Ω to 800 Ω with a high pass "L", equations 1 and 2 show a series arm Z_c of –j194 and a shunt input arm of +j207. When you want to reduce the second harmonic, a series-tuned circuit operating below its resonant frequency has a capacitive reactance which can replace Z_c.

The response of a single tuned circuit falls 6 dB for every doubling of bandwidth. To achieve about 20 dB of harmonic suppression requires a Q slightly greater than 10. The reactance X_L then must be about j500 and the reactance X_c must be -j694 to produce the net reactance of -j194 required for the impedance transformation. When the power output is 200 W into 50 Ω, the current in the load and the series arm of the "L" is 2 A_{rms} or 2.828 A_{pk} while the voltage across the capacitor is 1.96 kV.

The network equations given in equations 1 and 2 produce a resistive input impedance, but a conjugate match will probably require an additional reactive component to tune out the generator's reactance. When the generator output has a capacitor to ground, a conjugate match requires an inductance in parallel to resonate the generator's capacitance. That additional inductance can be incorporated into Z_a.

For example, when the value of Z_a needed is j207 and the generator has a shunt capacity whose reactance is –j1000, the generator must be paralleled with +j1000 to tune out the generator's reactance. For +j1000 in parallel with $+jZ_a$ to be +j207 requires jZ_a to be +j261.

The "L" network is the simplest circuit for matching a load to a generator, and when the generator is a tube or transistor, the "L" can also provide DC

Continued on page 52

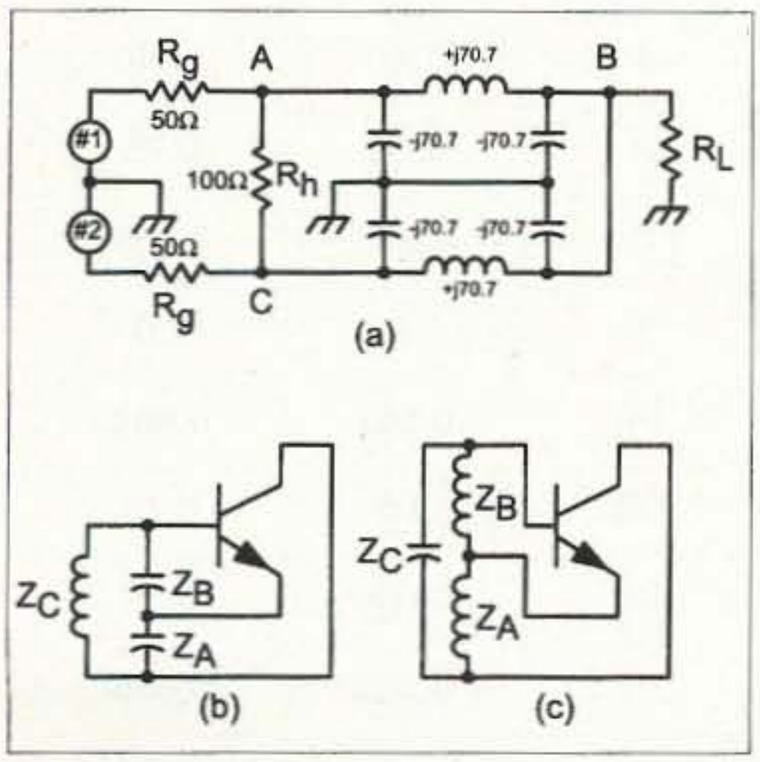

Fig. 4. Phase shift and impedance transformation are important in (a) a Wilkenson hybrid; (b) a Colpitts oscillator; and (c) a Hartley oscillator.

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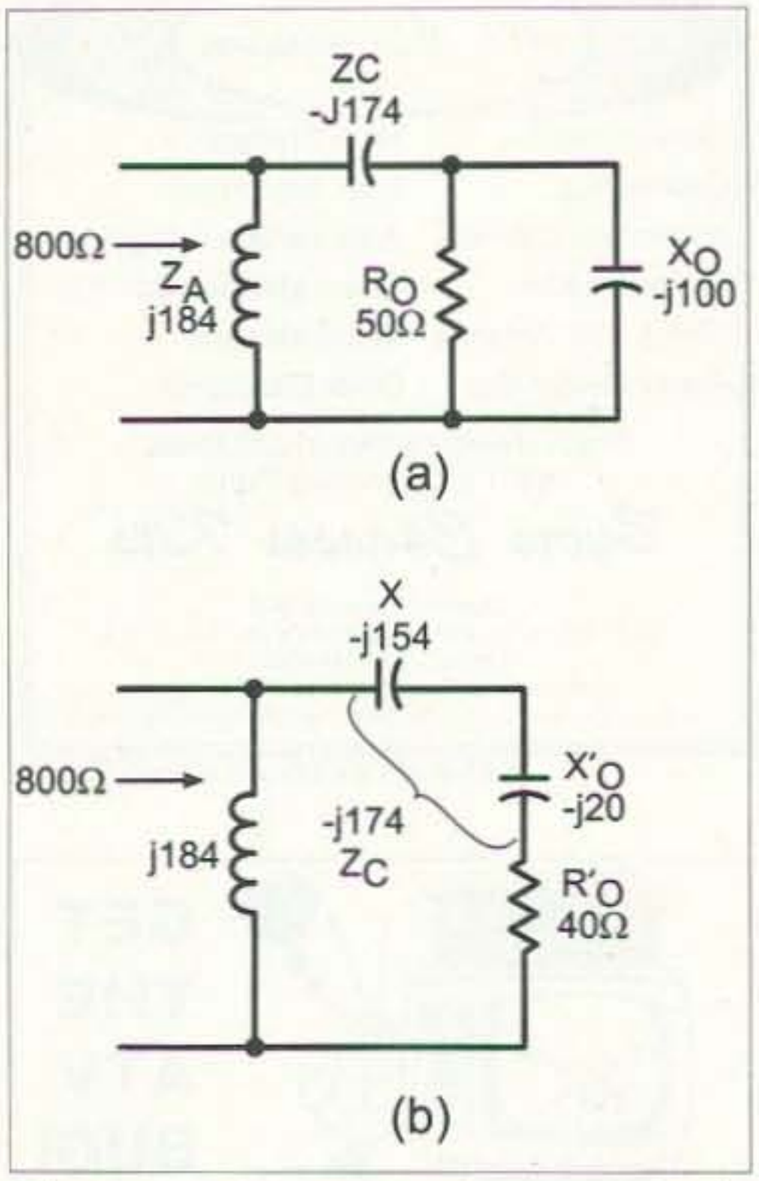

Fig. 5. An "L" can match reactive loads. (a) A load with a shunting capacitor. (b) The equivalent series circuit.

Meeting Your Match

continued from page 51

blocking to the load and a DC feedpath to the amplifier.

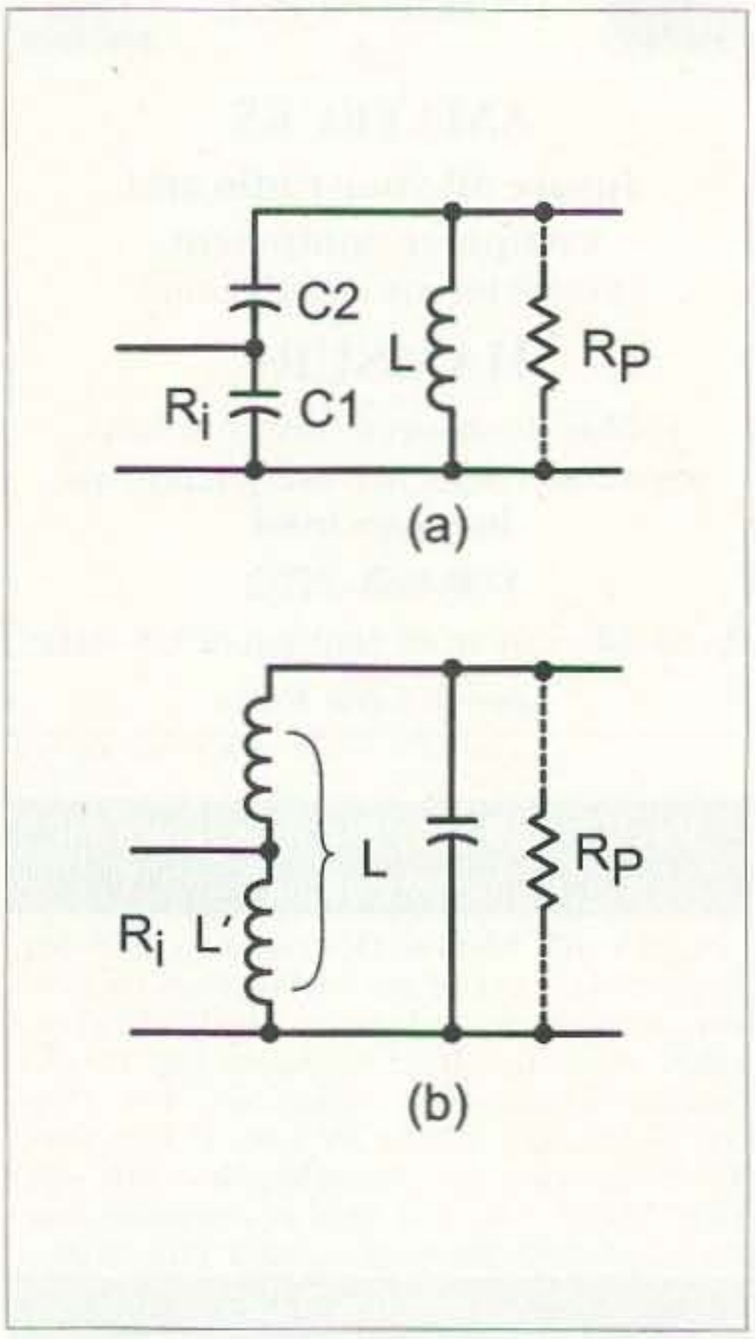

Fig. 6. (a) Tapped capacitors transform resistances. (b) Tapped inductors or an autotransformer can transform resistances.

The "π" matching network shown in **Fig. 2a** is commonly found as the plate or collector load of an amplifier. Z_b is often called the "loading" capacitor and Z_a the "tuning" capacitor. As in the "L", here the selectivity can be increased by using a series-tuned circuit for Z_c.

Occasionally both the phase shift and impedance transformation are important characteristics of the matching network as in the Wilkenson hybrid shown in **Fig. 4**. Like any hybrid, the Wilkenson combines two inputs into one output and isolates the inputs from each other. Isolation means that input #1 does not appear at input #2 and vice versa. Without isolation, some of the signal #1 at point A will appear at point C and may modulate or pull signal source #2.

The "π" networks transform the 50 Ω source to 100 Ω. The two 100 Ω outputs are paralleled to present a 50 Ω source to the 50 Ω output. The phase shift from point "A" to point "B" is 90°, and from point "B" back to point "C" is another 90° for a total of 180°. Therefore, a non-phase shifted portion of input #1 applied to input #2 through R_b cancels #1's signal coming back from the output. The two output capacitors can be combined into one with a reactance of 35.35.

In passing, the resonator of the Colpitts oscillator can be viewed as a "π" with 180° of phase shift. **Fig. 4b** shows the RF circuit of the Colpitts; the DC circuit is not shown. The input to the "π" is fed from the output of the amplifier and the output of the "π" is shifted 180° to drive the input of the

Impedance and Power

Fig. 7 shows the equivalent circuit of a generator and load. When the load is a resistor R_L, the power dissipated in the load is $I_L^2R_L$ or E_L^2/R_L, where I_L is the current in the load and E_L is the voltage across the load. The generator is matched when R_L equals R_g, and the voltage across a matched load is $E_g/2$. When the load is an impedance Z_L, the voltage across the load is:

$$E_L = \frac{E_g Z_L}{(Z_L + R_g)}$$

but only the real (resistive) part of Z_L dissipates power; the reactive part stores energy, then gives it back. The resistive part of an impedance Z_L is:

$$R = Z_L \cos\theta$$

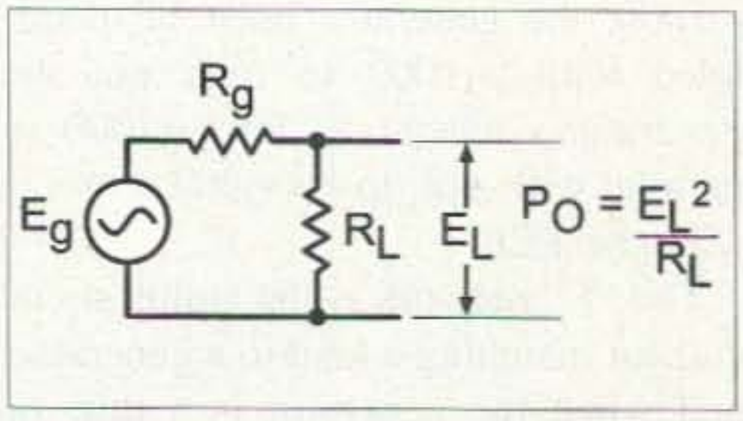

Fig. 7. The power output available from a generator depends on the load resistance compared to the generator.

The relationship of power in the load to the generator's internal resistance is given in **Table 1**. From the values in the table, you can see that maximum power is obtained when the load resistance is equal to the generator resistance.

R_L / R_g	E_L	P_L
6	1.714	0.490
5	1.666	0.555
4	1.60	0.640
3	1.50	0.75
2	1.333	0.888
1	1	1.0
1/2	0.667	0.888
1/3	0.5	0.75
1/4	0.400	0.64
1/5	0.333	0.555
1/6	0.284	0.490

Table 1. Relationship of power in the load to the generator's internal resistance.

amplifier. If the shunt arms of the "π" are inductors and the series arm a capacitor, the oscillator is seen to be the Hartley oscillator shown in **Fig. 4c**.

When the load R_o is in parallel with a capacitive reactance $-jX_o$, as shown in **Fig. 5a**, the equivalent series circuit is shown in **Fig. 5b**. X_o and R_o are transformed to their equivalent series components X_o' and R_o'. 50 Ω in parallel with –j100 is equivalent to 40 Ω in series with –j20.

"Conversions" describes the process of converting parallel and series Rs and jXs to their series equivalents. These calculations are rather time-consuming with a four-function calculator, but tolerable with a "scientific" calculator that has trig functions, squares, and square roots. A calculator that can compute polar and rectangular coordinates makes the calculations a snap.

For example, when $R_o = 50$ and $X_o = -j100$, the equivalent series circuit shown in **Fig. 5b** is $R_o' = 40$ and $X_o' = -j20$. The "L" network that transforms 40 Ω to 800 Ω is found with equations 1 and 2 to have $Z_c = -j174$ and $Z_A = +j184$. Since X_o' will be part of Z_c, the series arm of the network Z_c is:

$$Z_c = -jX_1 - jX_o' = -j174$$

When $-jX_o'$ is –j20, then $-jX_1 = -j154$. The final "L" has $Z_c = -j154$ and $Z_a = +j184$.

Fig. 6a is **Fig. 5** redrawn as the tapped capacitor tuned circuit often used in receivers to match the antenna to the input and reduce the loading on the input circuit. R_i is the input resistance, the antenna resistance, and R_p the transformed output resistance. Near resonance, the effect is to make the impedance offered to the input terminals less in magnitude than the parallel impedance of the entire circuit without changing the character of the impedance curve as far as shape or equivalent Q is concerned. Tapping a parallel resonant circuit accordingly offers a means of adjusting the magnitude of impedance obtained without changing the characteristics of the circuit itself. The ratio of impedance offered by the input R_i to the parallel impedance of the circuit R_p is:

$$\frac{R_i}{R_p} = [\frac{C_1}{(C_1 + C_2)}]^2$$

For example, if R_i is 50 and X_1 is –j5, then their equivalent series values are $R_1' = 0.49$ and $X_1' = j4.9$. If X_2 is –j50, then the total capacitive reactance across L is –j55. The equivalent Q is:

$$Q = \frac{X}{R} = \frac{55}{0.49} \approx 112$$

A tapped inductor follows the same procedure as the tapped capacitor network when there is no mutual coupling between the inductors. But, when there is mutual coupling as shown in **Fig. 6b**, $R_i/R_p = (M_{eq}/L)^2$, where M_{eq} is the total equivalent mutual impedance between L' and the entire coil L, including both common and inductive coupling.

Continued on page 56

Conversions

The impedance of the series circuit shown in **Fig. 8** is the vector sum of a resistance R and a reactance jX. The voltage across a resistor is in phase with the current in it and is shown on the horizontal axis. The voltage across a reactance is 90° out of phase with the current in it and is shown on the vertical axis. In an inductor, the voltage leads the current by 90°, and in a capacitor the voltage lags the current by 90°. The voltage across an inductor is expressed as jX_L, while the voltage across a capacitor is $-jX_c$. The factor j rotates a vector 90° in a counterclockwise direction. **Fig. 9** shows the vector sum of R and +jX. The resistive voltage is on the horizontal axis and the reactive voltage on the vertical axis. Their sum Z is the vector addition of R and +jX. From the Pythagorean theorem,

$$Z = \sqrt{(R^2 + X^2)}$$

and from trigonometry, the angle θ is the angle whose tangent is X/R ($Tan^{-1}X/R$). Also from trigonometry, $X = Z\sin\theta$ and $R = Z\cos\theta$.

The horizontal axis represents the real component, resistance R or conductance G ($G = 1/R$), while the vertical axis represents the imaginary component, the reactance X or susceptance ß ($-j\beta = 1/jX$).

$R_1 + jX_1$ can be added to $R_2 + jX_2$. Reals are added to reals and imaginaries added to imaginaries: $(R_1 + R_2) + (jX_1 + jX_2)$. Of course, $R_1 + jX_1$ can be multiplied with $R_2 + jX_2$, but it's much easier to do so in polar form:

$$Z_1\angle\theta(Z_2\angle\phi) = Z_1Z_2\angle(\theta + \phi)$$

Treat the angles as exponents.

Dividing rectangular forms is also much easier in polar form:

$$\frac{Z_1\angle\theta}{Z_2\angle\phi} = (\frac{Z_1}{Z_2})\angle(\theta - \phi)$$

Again, treat the angles as exponents.

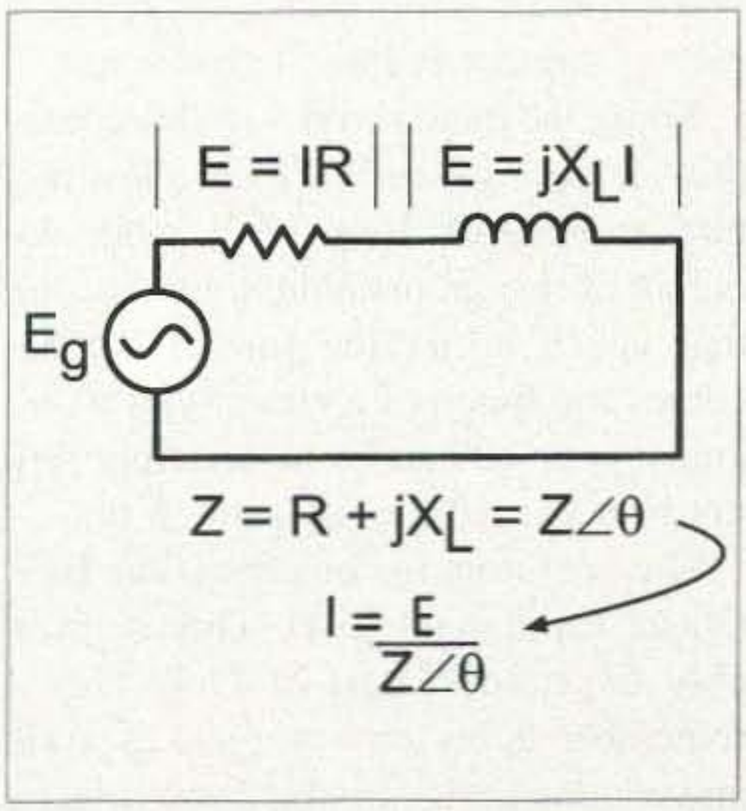

Fig. 8. A resistor and inductor in series add vectorially.

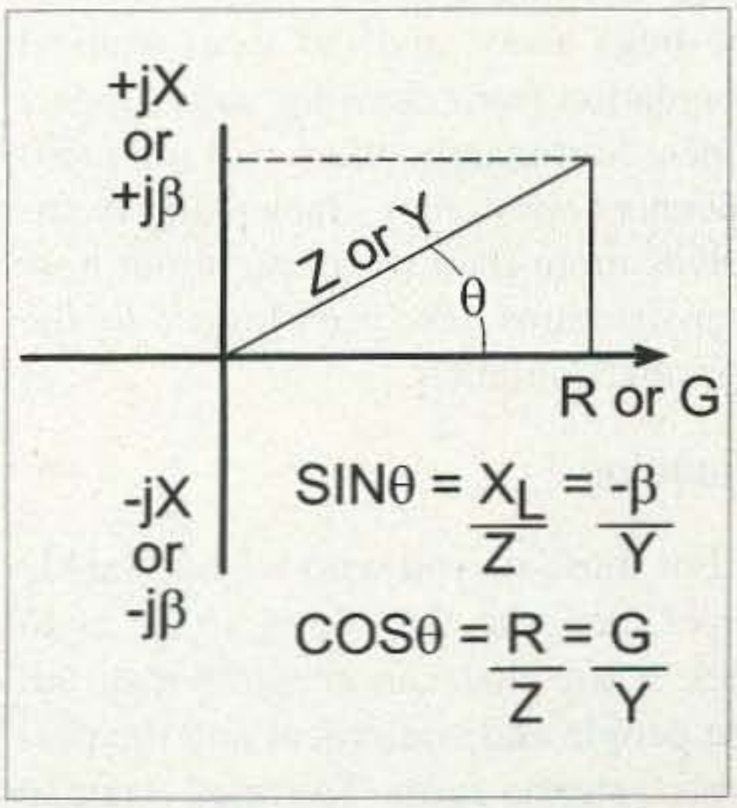

Fig. 9. A circuit containing R and X is depicted as a right triangle.

The Perfect Field Day

Did everybody have fun?

Joseph Molter N8IDA
Cuyahoga County ARES/RACES
Coordinator
3842 Monte Vista
Cleveland Heights OH 44121

Field Day and the SET (Simulated Emergency Test) used to be great times for camaraderie and testing your skills as an emergency communications responder, but unfortunately our two great times in the field have turned more into contests about the number of contacts we can make. A great Field Day was a tent, an old beat-up Coleman® generator to run a rig and a couple of lights, and tossing up a couple of wire antennas into a tree. The real challenges were keeping the generator running, the bugs away, and the local squirrel population from chewing your support ropes. Fortunately, there still are radio operators who enjoy challenging themselves more than worrying about how many stations have been logged on the portable computer.

Planning

For those of you who wish to tackle Field Day, the first thing to do is to pick a site that can accommodate all the people and equipment and the portable antenna farm. You may want to consider a site that can also generate some positive media coverage for amateur radio. Local parks, zoos, lake- or oceanfront areas, or maybe even the odd amusement park.

Make sure that all necessary permissions and signed agreements are in place, even if FD is out on the back 40 of your Uncle Ned's farm. It is best to have stated in writing what is going to be done, what local facilities you will need (e.g., rest rooms, showers, water source), and the time frame you and your group will be there. Make doubly sure that the place is cleaner than when you arrived and any damages are taken care of, no matter how insignificant.

Notify the media with a well-prepared press release and maybe even a few pictures in advance. Remember, while doing all of this preparation, to make sure that you'll be having fun. If FD becomes too much of a chore, you won't enjoy yourself, and you certainly will not be successful, contesting or not.

The next item to consider is the BEL (Basic Equipment List). This is probably the hardest part of Field Day. I remember going on vacations as a kid and coming back with that extra suitcase my mother packed—which I never even opened *once*.

The BEL can be broken down into several sections: amateur radio gear (rigs, antennas, feedlines, accessories); living accommodations (tent, sleeping bag, cooking equipment); personal needs (food, clothing, first aid supplies, hygiene needs); power supply (generator, batteries, solar). Make sure that the list is as complete as possible. Go over it with several amateurs—don't let just one guy do it because he was in the Marine Corps and is supposed to know these things.

It is always important to remember the sunscreen and bug repellent; more outings have been ruined by sunburns and mosquito bites than any of us cares to remember. You might even consider setting up and having a run-through to make sure that everything you need is there. And don't let things get so out of hand that you discover you'll need to rent a truck to move your supplies to Field Day!

Decisions must be made as to the bands and modes you wish to operate. This decision will also affect your selection of gear to take. Plenty of pens, pencils, and logbooks are also needed. Leave the computer at home—log

your contacts the old-fashioned way. Stick with the bands and modes you and your friends or amateur radio group are familiar with. I personally like to log onto homemade sheets for this type of event. Use a pencil—it is easier to correct any errors and can be transposed later onto more formal log sheets. Don't forget a copy of the rules if you wish to score your Field Day for points and competition. (No! I am not against contests!)

Field Day has arrived

The first thing to do on Field Day morning is remind yourself: This is going to be fun, *this is going to be fun* … sure! Second, pack all those helpful things like toilet paper, bug spray, sunscreen, aspirin, soda pop, lots of coffee, and the ever-popular Oreos®. Now we can worry about the equipment and everything else.

Get things packed and time your arrival to take full advantage of the setup time before the actual event. (The rules for Field Day operation and classes of competition are always published in *QST*.)

During your planning phase, everyone on the team should have been assigned a job. The initial setup should consist of antennas and power systems. These will occupy most of the time. Power sources need to be adjusted for proper voltage and current. If you are using a gas- or wind-powered generator, you also want to make sure that you are producing the correct frequency (60 Hz at 110 to 120 volts). Antennas should be adjusted to SWR and carefully checked for any possibility of a short during the following 24 hours. Follow the same guidelines for putting up temporary antennas as you would use for a permanent installation. This is especially true around power lines.

The next items on the list are operating facilities and sleeping quarters. Believe it or not, there are always a few people who are determined to get some sleep during Field Day. Keep sleeping quarters (tents) away from the operating facilities. If you plan to have an eating area, this should be set up close to the operating tent. Run any power cables into the tents if necessary. Make sure all cables are properly labeled and flagged, so nobody will accidentally trip over them or be electrocuted.

Finally, the rigs can be set up and testing can commence. Beforehand, all accessories and radio cables should have been labeled for easy installation. Watch for obvious problems, such as intermod and too much load on the generator.

You're finally ready to start Field Day operations. Make sure there are lots of paper and pencils for logging and any note taking. Sometimes an inexpensive cassette recorder is handy to take verbal notes during operations on such things as addresses given over the air, problems that may arise and can be forestalled or avoided next year, and notes on changes or suggestions for improvement. This is also very handy for any debriefing session you may decide

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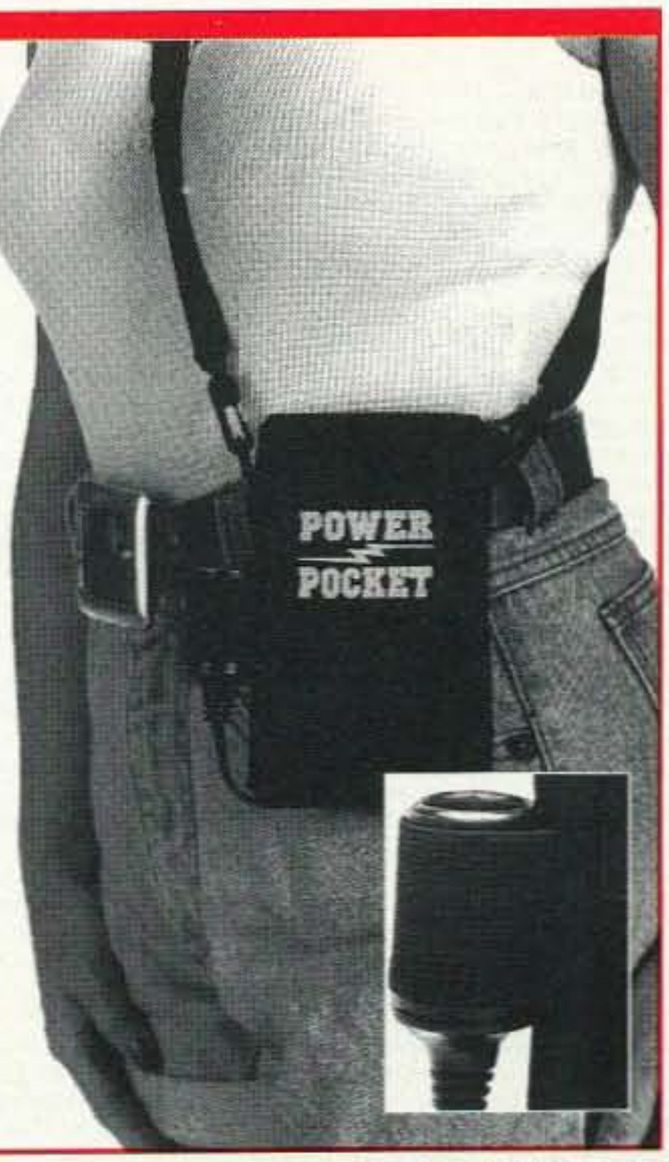

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to have immediately following Field Day exercises.

Are we still having fun?

Ready, set, operate! During that actual part of Field Day, make sure all operators work in shifts. Some folks seem to think they can go nonstop—they end up losing their voices after four or five hours. People should work in two-hour shifts, especially on voice. Trade off with the person who is logging other operators. Let people rest their voices.

This is also true for people doing CW. Most of us are fairly casual radio operators and are not ready to run a radio marathon. Hands can cramp up from keys or bugs.

Headphones are a good addition, both for the operator and logger. This helps cut down on background noise and makes logging a lot easier. It is fairly easy to wire up two headphones to a single jack. Some people find it easier to log directly into a computer. Make sure the computer has a good "clean" source of power. Remember, above all: This is not Operation Desert Storm! Have fun and don't make yourself miserable!

During the next 24 hours, make sure that all personnel get plenty of food and water. Some parts of the country can be quite hot in June and heatstroke is a real possibility. Even the best-trained athletes and soldiers can suffer from heat exhaustion and sunstroke.

Make sure that a source of good clean water is available. During hot weather, it is easy for someone to consume eight to 12 liters of water in a 24-hour period. Sports drinks are also a good supplement to water, in that they supply necessary salts, minerals, and carbohydrates. If anyone does exhibit signs of heat exhaustion, get him somewhere cooler and get fluid into him. Watch for signs of shock. It is a good idea to have someone available who has first aid training, and no one should be hesitant about calling for additional help.

Finally, even if people don't want to sleep, make sure that they do get at least some rest away from the operations areas.

Taking it all back home

Once Field Day is over, start packing up and dismantling the camp. Keep notes on those items that were never used or items that you wish you'd had. Carefully relabel cables and accessories. Safely store any fuels and allow the generator to cool down before moving it. Make sure you leave the area that you used for camp cleaner than you found it.

If you are competing in the contest part of Field Day, make sure that all logs are filled out correctly and ready to send in. Have several people review the logs before sending them in.

Arrange to have a debriefing session after Field Day to check any problems or deficiencies. Gather your notes and that tape recorder I mentioned earlier and talk over with the whole crew your present success and possible improvements for next year.

Modify your Basic Equipment List if necessary. What bands didn't work well for your location? Which radio is not very user-friendly during a fast-paced contest or emergency situation? How does your Field Day experience relate to an actual disaster situation with field communications and remote power sources? Do you want to go back to the same area or try someplace different? The month of October is not too soon to start planning for next year. 73

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G'Day, OM!

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describing our tour—and ham radio in general—appeared in many newspapers, including those in Narrabeen, Port Macquarie, Dunedin, Hastings and Te Awanga. Many included photos.

In one of the many E-mail messages handled for us, Peter Smith ZL1ARB, of Orewa, New Zealand, added to one of my messages, "... and we have enjoyed having them with us—they have all been wonderful ambassadors for America!" And, indeed, we did try to be good ambassadors for both the United States of America and for the wonderful world of amateur radio. 73

Meeting Your Match

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However, if a tapped coil is wound on a ferrite core so that the mutual coupling is high, the two coils behave like an ideal transformer with predictable results (the impedance is transformed by the turns ratio squared). With air-cored coils, the coupling coefficient is small and the ideal transformer approximation does not hold in all cases. However, if $R_p/w_oL \geq 10$, and $R_i \geq w_oL$, the circuit still behaves like an ideal transformer at the resonant frequency. In passing, I should mention that you should be aware that when the turns ratio is large and the secondary is a few at the end of the primary, the coupling may be low, even with a core. To achieve tighter coupling, distribute the secondary over the entire primary; the distributed capacity will increase slightly but the coupling will be much tighter.

Matching networks can be used to match an arbitrary load to an arbitrary generator for maximum power output, maximum voltage, or a particular phase shift. Calculating the values of reactances for a match may seem intimidating, but it will give you a better feel for what the parts do than using nomographs or charts. Matching networks made with discrete reactive elements are flexible and can be adjustable—and that's something wound transformers can't easily offer. 73

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
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Niles IL 60714-3108
[dmiller14@juno.com]

Moderator's note: Roger and Ron Block of PolyPhaser Corporation have put together a well-written series of tips and suggestions on how we can effectively protect our ham radio stations from the effects of a lightning strike. The series began in the January of this year, and Part 9 appeared last month. Here is Part 10, the final installment of "Lightning protection — what your mother never told you!"

Worth repeating

Mother Nature will see to it that nothing we place in the soil will last forever. But we can do our part to design a grounding system that lasts a reasonable period of time. First, always use compatible (similar) metals in your grounding system. If copper is used, don't mix it with tinplated copper wire.

On all mechanical compression joints, copper joint compound should be used to cover the hardware. This will prevent corrosion which can cause a loss of the compression strength and increase joint resistance over time. The joint compound, a petroleum-based product with conductive copper flakes, displaces water, oxygen, acids and salts.

Exothermic connections (when used) should be allowed to cool slowly to prevent stress corrosion. As explained earlier, an exothermic weld is created with a graphite mold for the desired connection, into which copper oxide and aluminum powders are placed. An additional starter powder ignites the exothermic process. The resultant molten copper is deposited into the lower mold cavity where it burns away any oxides and creates a larger fused connection. This larger cross-sectional bond decreases resistance and increases the surface area which reduces the inductance of the joint. Since the materials are similar, the connection lasts as long as the remaining grounding material.

A grounding system should be tested annually. It should also be checked annually for excessive corrosion. Yes, it requires some effort, but anything less is leaving too much to chance (the very thing that we're trying to avoid).

Know your soil's pH. If it's too acidic, either correct it to neutral (using gardener's lime) or your ground system will suffer the consequences of excessive corrosion.

Selecting a protector

Coax protection: Both 50 and 75 ohm protectors are available. Most amateur applications will be for 50 ohms.

Speed: Is the measure of protection for lightning only, or lightning and NEMP (Nuclear Electromagnetic Pulse) threats? Most of the protectors do well for both, but for some critical applications, higher-speed protection may be necessary.

Frequency range: There are broad-coverage units (DC to 1.5 GHz specials) to single-frequency filtered models. Today it's possible to make units to 20 GHz. Most of lightning's energy is concentrated in the lower frequency ranges of DC to 1.0 MHz. The further away from this range, the less the amount of energy that will get through to the equipment (throughput energy). Always choose the lowest throughput energy for the desired frequency range.

Transmit (Xmit), Transceive (Xcv) or *Receive Only (RO):* The number of Xmit signals is important (if ham repeaters are sharing a common antenna). Protectors are voltage sensitive and multi-Xmit signals are voltage additive, not power additive. Two 100 watt Xmit signals combined equal 200 watts of treating power, but the additive voltages have peaks of 200 V, which equate to a single 400 watt signal. Because of this, multichannel, simultaneous Xmit systems must have a higher turn-on voltage and be designed to handle the peak instantaneous RF currents that can normally be reached. These are generally known as "combiner protectors."

Transmit Power: Each model that can support a 10 watt or higher level signal is categorized by its power level capability. Generally speaking, as the frequency is increased, the power handling rating is reduced. This is done for many reasons, the most important of which is to be sure the protector will turn off after a lightning or EMP firing, and not be "kept alive" in a glow state by the presence of the normal transmit energy. The turn-on voltage (as mentioned before) is tied in with power handling. In units that do not support DC continuity, little protection is lost by going to a higher turn-on voltage unit, especially if Xmit combining is planned in the future.

Presence of AC or DC Power With the RF Signals: This is usually relevant for "receive only" situations, such as tower-top-mounted preamps. However, there are special units for the higher UHF range, and into the microwave region, for the higher current requirements of tower-top transmit amplifiers. Units are also available for DC injector/pickoff and for protecting already injected coax lines.

Mounting: Bulkhead panels are recommended. Flange styles may be mounted on a bus bar or on a single-point ground panel. A ground strap larger than the total sum of all the circumferences of the coax shields should be used to connect to a low inductance ground system.

Connector Type and Gender: UHF style connectors are poor at the UHF frequencies (300–3000 MHz). Wattmeters that use these connectors will give misleading readings even when using type-N adapters at the UHF bands. Type-N connectors are recommended even though they have limited center pin lightning current handling capability when compared with UHF connectors. BNC, SMA and F male and female are also commonly found on stock protectors.

Data/Phone Line Protection: For lightning, twisted pair cable bundles will mutually couple surge energy to all other pairs in the cable. Unused pairs should be grounded (if allowed). Protectors are available for use on 66-type punch-down blocks with an appropriate grounding bus. For 6 pairs or fewer, more energy will be present per pair, so a hybrid protector that can handle energy levels that would normally vaporize standard 24 AWG wire pairs should be used. Selection of data/phone line protectors depends on the presence of either -48V battery and/or ringing voltages. The line impedance and total allowable loop resistance (as well as the highest frequency or bit rate), will determine the insertion loss from the protector's I/O line resistance/inductance and capacitance.

Power Line Protection: For lightning and EMP, shunt-type protectors will limit the voltages to a safe level for most non-electronic equipment. Inline-type protectors are mandatory for electronic equipment survival. These inline units should be mounted/grounded close to the equipment being protected. For mainframe computers and high-power RF equipment, inline power mains protectors are produced which provide single or polyphase protection with EMI/RFI filtering. They'll often have

front panel status lights and local/remote alarm contacts as standard equipment.

For power line protector selection, the peak voltage, number of phases, configuration, and inline current usage will pinpoint the unit best suited for a particular application. Voltages to 480 VAC are readily available for single- to three-phase applications. Replacement modules and breakers are usually available separately for most models.

The Big Bertha lightning simulator

Our quest for knowledge has taken us to the point of actually making a lightning simulator that couldn't be purchased. We lovingly call it "Big Bertha." It consists of ten 200 microfarad capacitors, which have a total weight of three quarters of a ton! Not your typical tabletop high-voltage insulation tester! The simulator is set up as a "Marx Generator," which means that the capacitors are charged in parallel and then connected in series for the discharge phase. This is the most straightforward way to get 100,000 volts delivery with 62 kA and 100,000 Joules of energy.

Delivery to what?, you may ask. An antenna, of course.

To start with, we thought that we needed to know more about the effects upon and the output from an antenna when it gets hit by the real thing, lightning. We'd already tested transmission lines and knew how they share strike current with the tower, but we had no idea what effect the different antenna designs would have on the current waveform. Some of the questions that we needed answered were:

1) Would the antenna ring, and if so, for how long?

2) What voltages would it reach?

3) What effect does bandwidth have?

4) How much energy is coupled to a side-mounted antenna when the tower is hit?

5) What are the effects and pickup patterns from nearby strikes?

It's an ongoing project, and we hope to have some results of tests from donated commercial antennas shortly. The aim is to provide commercial antenna manufacturers with real-life survivability data, with the goal in mind of permitting them to build better antennas from a lightning survivability standpoint (and not just an RF transmission one). It would also be advantageous to the industry to have a standardized lightning survivability testing scheme, so that the end customer can factor an antenna's lightning resistance into the purchasing formula. Perhaps the realization of this goal may yet come out of our research.

If funds permit, we will also be working, together with the University of Nevada (and Big Bertha), on testing and learning more about the glassification of ground rods and on arcing in and out of the earth/rock interface. This knowledge will be helpful for developing even better grounding systems for use in poor soil conditions and for rock-encrusted mountaintop sites ... and so the research continues.

We hope that you've enjoyed learning from this series of columns on lightning and its effects on nearby electronic equipment, and that you've gained some valuable information on how you can protect your own home ham station (or repeater station) from lightning-originated damage. From the information this month and in previous columns, you can see that effective lightning protection isn't as simple as just a ground rod and a spark-gap arrestor. For state-of-the-art protection, a well planned and mechanically sound lightning diversion system is essential for maximum survivability of your equipment. We recommend that you go back over the previous columns since the January 1998 issue and refresh your memory from time to time. It can take a while to become adept at thinking in lightning protection terms with regard to everything you do with your antenna and station ground construction and maintenance, but once you do, it can pay very big dividends. Please let us know if you enjoyed the series.

Moderator's note: If you missed any installments of this series by Roger and Ron Block, you can contact PolyPhaser Corporation by telephone at (702) 782-2511, at [http://www.polyphaser.com/] on the Web, or at (702) 782-6728 for access to their telephone BBS. Ask for a reprint of their special bulletin, "Protection to Keep You Communicating." This month's treatment concludes the series by Roger and Ron ... we sincerely thank them for their generosity in the sharing of this hard-won information with us via the pages of 73 Amateur Radio Today. *This concludes the series "Lightning protection — what your mother never told you!"*

Murphy's Corollary: In crisis situations that force us to choose among alternative courses of action, most will lead us on an entirely wrong course!

As we begin the fourth consecutive year of the Ham To Ham column in *73 Magazine*, we offer a very special thanks to this month's contributor:

Roger Block, President
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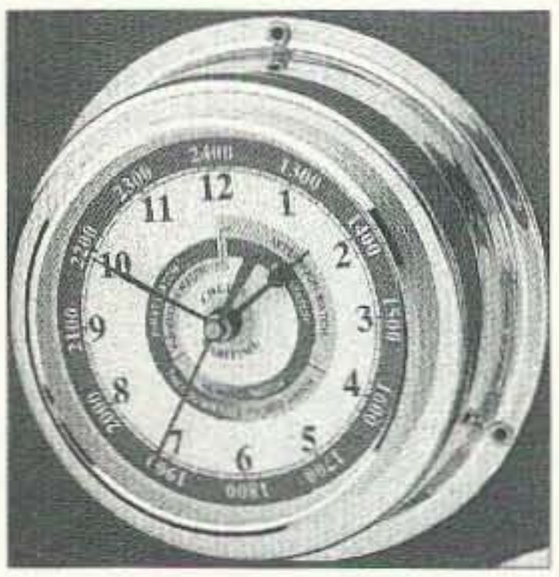
2225 Park Place
P.O. Box 9000
Minden NV 89423-9000

If you're missing any past columns, you can probably find them at *73*'s Ham To Ham column home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at: [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas that you would like to see included in this column to the moderator at the address at top. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions, on any particular tip, to the originator of the idea, not to this column's moderator nor to *73 Magazine*. 73



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NEVER SAY DIE

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Like in the health field. You can spend a fortune reading the endless books and newsletters, 99% of which are a waste of time. So I read 'em all, talk it over with people I've learned to trust, and then make truly dependable information available. Like this, for instance.

If you have a product that people need it won't make any difference, at least for long, if the banking system fails, if the government collapses, or whatever.

My wife Sherry discovered that there was a need for how-to-dance video lessons. She's running a nice business selling them from our farm. She has a whole room full of video duplicators running day and night, a barn full of the packaging, and so on.

So what are you using your living room for, watching TV? Our living room has two computer systems in addition to the TV. The study has a computerized video editing setup, and so on.

Hey, are you still just sitting there? Why are you so stubborn? America really can be the land of the free (except for the freedoms we have gradually ceded to the government), so start untying your bonds.

Skilled Workers

Did you watch the PBS program about the schools in China? China's aim, like ours, is to provide their country with skilled workers, and their schools are leaving ours in the dust. Countries compete with each other by exporting products. And that means either by making products cheaper than competitors can, or better. Or both.

The big money in exports obviously lies in high volume sales, which in turn means they are being made by big companies. It is these big companies which need skilled workers, so it makes sense from an international business viewpoint for a country to train as many skilled workers as possible. Remember, business *is* war today, as I've discussed recently.

Our public schools, as I've also pointed out before, were first started by our church leaders as a way to ensure them a steady supply of compliant churchgoers (and resulting revenues). Then the industrial revolution came along, bringing a need for skilled workers for our factories. Our public schools had the aim of taking a diverse supply of young children and turning them into as nearly identical workers as possible for our giant industries. Workers who would do as they were told without asking questions so as not to stop our production lines.

Well, that's a good competitive strategy for a country, but it means that everyone will have to settle for about the same pay and a similar life style.

I went through that mill, just like you did. And no one ever blew the whistle and said, Hey, wake up, being just one more bee in the hive isn't your only alternative. One more skilled ant worker in the anthill. When WWII came along, I was another warrior ant. I was a skilled worker ant at the General Electric Company, testing radio transmitters. I was a skilled worker ant at Airborne Instrument Laboratories as an engineer.

Then, when I was 28, I finally wised up and started my own company. Since then I've been the editor and publisher of a bunch of high-tech magazines in the ham radio, computer and digital audio fields. I've manufactured audio and computer products, started and run a chain of retail stores, imported and exported high tech products, and so on. But you know, virtually none of the skilled worker education I went through in public school and college has ever been of any use to me.

I watched the Chinese children all doing well in trig and spherical trig. I've never needed any of that. Nor has the torture of "learning" calculus ever paid off for me, despite the wide variety of businesses I've run. Torture is not an exaggeration. I struggled through two years of calculus before I went into the navy in 1942. Then, when I went back to school four years later, I hadn't any memory whatever of the calculus I'd supposedly "learned" before the war — so I had to relearn it all again. I've never needed any of it.

So I'm preaching revolution. The next time you come out of the anthill, take a look around. You really don't have to live like that — in an apartment and commuting to work. What kind of quality of life is that?

Our country may want you to shut up and apply your working skills for a large corporation, but the route to freedom lies outside the anthill or hive. And it also lies outside of the few skills they're forcing you to acquire in our public schools.

Reading and writing are good skills, but as John Taylor Gatto, the prize-winning teacher, has explained, they can be learned by almost anyone in 100 hours. A couple of weeks. Arithmetic and algebra I've also found very useful. I remember learning about poetry along about the third grade, but I don't recall ever being encouraged to write it. A fourth-grade course in the fundamentals of art also has been helpful for me — first as a TV cameraman and director, and then as a magazine editor. But I wish I'd been encouraged to develop my art potential.

They taught me to read music in the third grade, but never to write it. The reading part came in handy when I became a chorister at St. Paul's Church, and then went on to sing in several first rate choruses. But I wish I'd been encouraged to write music.

My Brooklyn public school had a weekly class for the whole school in classical music. That helped get me interested in hi-fi, which led to my first manufacturing company making loudspeaker enclosures. It also helped get me interested in listening to classical music all through my life.

As far as I know, our public schools have stopped all that poetry, art and music nonsense in the lower grades. Hey, how many art museums have you visited? Have you ever tried sculpting, painting, writing poems or music?

Most of the skills needed to be successful with your own business aren't being taught — because that's not in the interest of the big businesses which are pretty much calling the tune. It's their money that gets politicians elected, not yours, and not that of entrepreneurs. It's their money that's controlling Congress.

It's too late for you, but how about your children or grandchildren? Do you want them to be skilled workers or entrepreneurs? Do you want them to be wage slaves or free persons?

Oh, yes, one more thing. These days it takes the work of two wage slaves to maintain an acceptable standard of living, but only one of a free person to do many times better.

FCC Sells Out

The FCC, long a champion of freedom of the airwaves, seems to have been bought and paid for by the cellular telephone industry. I wonder at what level money changed hands? Did the pressure to further curb our freedoms come from our easily-bribed Congress? Or have the FCC commissioners gotten in on the action?

We are losing our freedoms slice by slice while you are too busy watching TV and rag-chewing on the local repeater to be bothered to do anything about it. I'm not normally much one for flag waving, but this is getting my goat. One of the reasons I spent four damned years in the navy fighting WWII on a submarine was supposedly defending our liberty ... our freedom. And now Americans are sitting there on their fat asses, pissing away what millions of us fought for. And a lot died for.

I got a letter from a guy who is in prison. He says the police broke into his house and planted some drugs. Then they confiscated his home, car,

and bank account, and put him in prison. What can he do, he asked. We've been losing our freedoms to the DEA, the FBI, the IRS, and down through the alphabet, nibbled away one at a time. Now we can be arrested and fined for listening to the wrong frequencies on our radios — or even being able to!

So the FCC wants manufacturers to pot any circuits which could be modified to tune in cellular phone channels. In this way the cellular phone companies can tell their customers that their phone conversations will be private and won't be compromised. Of course, anyone really interested in listening to this stuff can use an old scanner or even an old TV tuner.

The hams in the surveillance business tell me that all this is eyewash, that *any* phone conversation can be monitored by someone who knows what he's doing.

Nostalgia

Okay, all you old-timers, time to test your memory. At what time did Amos and Andy come on every night? Which series had "Poor Butterfly" for its theme song? Who said, "Wanna buy a duck?" How about, "Okay, Colonel." What was The Singing Lady's name? Who was Ukelele Ike? Vic and who? Who wrote the radio play *The Loblies*? What was the theme song for Chandu the Magician? Who was the warden at Sing Sing? What was the theme song? And who was Your Host? What product sponsored the Sherlock Holmes program? What product sponsored Orphan Annie? How about Jack Armstrong's sponsor? The Little Theater just off where? Who always said, "And so long until tomorrow?" H.V. who? Floyd who? Myrt and who? Who was Hairbreadth Harry's girlfriend? Who said "Fap"? How about "Gloriosky, Zero"? Remember Joe Bftsplk? Hans and Fritz? What fairy godfather said "Cushlamacree" and used a stogie for a magic wand? Buck Rogers' sponsor? What "hit the spot, 12 full ounces, that's a lot"? How much were 12 Marlin blades? What song had "fooderyackasaki" in it? Who played the bazooka? What was the title of the Popeye cartoon? The Maggie and Jiggs cartoon? Skeezix cartoon? What poisonous food product sponsored The Lone Ranger? How about Singin' Sam? What product did he promote ("no brush, no lather, no rub in")? Whose cabbage patch? What was Buster Brown's dog's name?

There, that ought to hold you old buzzards.

Okay, one more. How many of you turkeys went to Saturday matinees where, for a dime, you got two feature films, a full-length western, two serials, seven cartoons, plus a drawing for prizes?

Pulser

Many *73* readers have built the Bioelectrifier. Several have actually even used it. Every few days I get letters attributing miraculous cures to its use. A few entrepreneurs are supplying the electronic klutz market with ready-to-use units for from $150 to $250 and up.

I've been asked endlessly where people can get the magnetic pulse units Bob Beck devised to knock the HIV virus out of the lymph glands back into the blood, so it can be eliminated with a Bioelectrifier. The pulse unit is so simple to make that there hasn't been much commercial interest in providing them. And that's an opportunity for an entrepreneur.

The pulse unit generates a very short 20,000 gauss pulse via a coil of wire which is held next to the lymph glands. Beck says to use about 150 turns of #14 wire wound on a spool taken out of a VCR tape cassette. This is then wired in series with the flash bulb in an electronic photo strobe unit. Old flash units can be found at flea markets for a buck or two, and you can install a jack to plug in the coil.

Someone interested in making the units commercially should locate an inexpensive source of flash guns, rechargeable batteries, and chargers. It took me less than five minutes to locate several sources of these in the current Hong Kong Trade Development Council catalog. Check [www.tdc.org.hk] for information. Or you can make a trip to Asia this month (October) and catch the huge electronic trade shows in Japan, Korea, Taiwan, and Hong Kong, which are back to back over a two week period every year at this time. For several years I led groups of 200–250 for Commerce Tours [(415) 433-3072]. The tours were very well organized and were a terrific bargain.

If you're interested in supplying pulse units I can put you together with a distributor. Aim for a wholesale price around $50.

What's the market for them? Well, with the explosion of hepatitis C, for which the medical industry has no cure, in addition to the AIDS market, there could be quite a demand. Then, if a few of you baldies will see if you can replicate Beck's regrowth of his male pattern baldness hair using the pulse unit, the lid could be off, with a demand for millions of units. That's a nice market to be in on first.

Beck says he sprayed silver colloid solution on his head and then used the pulse unit a dozen times around his head several times a day. The result was a full head of hair on what had been a desert. Build a unit, give it a serious try, and let me know the results, positive or negative. If it works as Beck says, there are a zillion baldies out there who would give anything to recreate something to comb instead of polish.

How might a few thousand 20,000 gauss blasts affect the brain? With some people I know it can't possibly hurt. Beck doesn't seem to be changed. He's as reclusive and paranoiac as ever. Just hairier. Oh, by the way, Beck is the chap with the basic patents for electronic flash guns.

Creativity

Back in 1960, when I was starting *73*, I tried LSD. I'm very glad I did, for it gave me some valuable insights into life. It was an awesome experience. One of the concepts that came to me at the time was that in a way I was selling part of my soul to my readers, and also that I was stepping on a treadmill which would be inescapable from then on, with a new magazine issue due out every month.

So here I am 38 years later, still on the treadmill, still sharing with you my thoughts and interests — sharing part of my soul with you. Sharing it openly and honestly. Helping those who will let me to live happier, healthier, wealthier and more productive lives. At 76, that's half of my life.

Of course publishing *73* led to my publishing a repeater magazine and books, then to computer magazines and books, then to compact disc magazines and discs. I love the idea of helping new technologies develop. It's exciting and fun.

It really isn't difficult to start a new magazine, once you know the ropes. There are five basic requirements, all of which are obvious, once you think about it. Alas, somewhere around 90% of the people who start new magazines don't think about it. Rule #1: Find a niche market where there is no existing publication. You don't need to compete head to head with an established magazine, like a remora, trying to exist on the scraps left over from a host. Rule #2: Pick a niche where there are a lot of people who will be willing to pay to read articles about their interest. Rule #3: Have an available continuing source of articles that these readers will want to read. Rule #4: Make sure there are businesses that will want to reach this select group of readers and have no other easy way to reach them. Rule #5: Have an editor who lives and breathes the subject.

The other day I picked up *The Granite Server*, a free tabloid, at the local supermarket. The subhead read, "The Technology & Informa-

tion Source for New Hampshire." Hmm. Inside I found nontechnical articles of general uninterest.

The economics of publishing dictate that the revenues are normally split 50-50, with half from circulation and half from advertising. Free or controlled circulation publications have to charge double for advertising, which means that they have to be pretty careful about whom they have for readers. These readers are going to have to spend twice as much with the advertisers as do those of paid circulation publications.

The *Server* seemed to have no circulation discrimination, nor any discernible editorial niche. It also didn't have much advertising. That seemed like a recipe for disaster, so I called the editor and got together with the editor and publisher for lunch at my favorite Chinese buffet. They had not been able to sell many ads, and their few advertisers were complaining about a lack of results. They were (wisely) considering ceasing publication.

I brainstormed with them for a few minutes and was able to come up with a niche for them to fill which fit my five rules. Yes, they've stopped wasting money on the *Server*.

If you keep your eyes, ears and mind open, there are endless niches for new publications — and, for that matter, for new businesses. For instance, with the growing number of dire millennial predictions, how about a magazine devoted to survival technology and strategies? If any of the mass extinction prophecies come about, the people who have made some survival plans will be in a better position to be around to pick up the pieces. They'll want to know about maintaining a pure water supply, what food to store and how, how to prepare to grow new food later, emergency power generation, building and living underground, and so on.

We've been threatened with comets, asteroids, massive solar flares, alien invasions, a third world war, a polar shift, a new ice age, nuclear or biological terrorism, a melting of the ice caps that would destroy most of our major cities, massive earthquakes, and so on.

Can *all* of the doom and gloomers be wrong? Some of them have disturbingly good records for their past predictions. There could be a growing market for survival-oriented products and information.

Then there's the growing dissatisfaction with our worst-in-the-developed-world school system. This is going to mean an interest in alternatives, as well as a magazine reviewing alternative products. Everything that's being "taught" in schools today, plus that which should be being taught, could be produced using top-notch performers and graphics on video. This would not only simplify home schooling, it would allow anyone anywhere to learn about anything that interests them.

A good teacher will know what questions the students will have, and incorporate the answers to those questions in the course. One of the reasons Sherry's how-to-dance videos are so enormously popular is that Kathy Blake, her instructor, has been teaching people for years, so she knows where people normally have problems. Thus, while the famous dancing names have managed to bring out two or three titles on video, Sherry has produced almost a hundred dance videos and they're selling very well. Once someone tries a Kathy Blake video and compares it to anything else on the market, they keep coming back for more.

I believe that within 25 years most education will be delivered via video, with courses being available for any imaginable subject, from grade one to doctorate-level college courses, plus a whole raft of business-oriented courses. The opportunity is there for you to be in this soon-to-grow field either as a supplier or as an information source.

But there are similar opportunities at every turn. If I had the time, I'd love to do a magazine on new building technologies. It would cover new materials such as plastic concrete and foam concrete, underground buildings, new heating technologies, and so on. This would be of interest to architects, building contractors, and people wanting to build homes or business buildings. It would also spur the development of new products and services by making it easy to promote them.

Another coming huge business will be a replacement for the chemical companies which are making us sick. These are the companies which are selling the fertilizers and pesticides our farmers are using to get their crops to grow on mineral-depleted land. The lack of minerals has forced farmers to pour on the NPK (nitrogen, phosphorus, potassium). The resulting sickly crops then require pesticides to kill off the insects which attack sick plants. And we get the benefit of all this in fruits and vegetables which lack the minerals our bodies need to be healthy, plus we get the pesticide residues.

All this can be replaced by new plant growing technologies. I recently cited a dozen of 'em that should be promoted with new products and information sources. Just using already developed new growing technologies, it's possible to grow plants seven times larger than current models, complete with all the missing minerals and no need for pesticides. By the time researchers get through, I expect we'll be seeing ten and even twenty times the size of fruits and vegetables. Right now, using a couple of new technologies, people are growing 400-pound pumpkins and huge, juicy and fabulous tasting tomatoes. Yes, a magazine devoted to plant growing technology is needed.

Well, I could go on and on about new technologies and niches for products and publications. Maybe I ought to hold a seminar. Well, if some hamfests will invite me to speak, and that's what people want to hear about, I'm ready. It would, I suspect, probably be over the ARRL's dead body.

Unfortunately the reality is that you are probably so deeply mesmerized by the "system" that you are going to continue to work for someone else, complete with commuting to work every day, and that you're just irritated by my efforts to upset your beliefs.

Surviving

With the crescendo of millennial doom prophecy books, unless you're living in a coastal city you're giving some thought to at least being a little prepared in case even one of the prophets is right. If you're living in a coastal city no amount of preparation will, I expect, be of much value. For that matter, if you're a ham, what on earth are you doing living in a city anyway? You need some room to grow your antenna farm, particularly now that the HF bands are opening.

As soon as I could after starting *73* in New York City, I moved to New Hampshire where I could put up all the towers and beams I wanted. And did. But now, with the unusual weather confirming many of the dire predictions by prophets, I'm getting more interested in thinking about survival plans.

I'm not sure which doom prediction will pan out (if any), but most of 'em seem reasonably based, so why not have an edge of safety? Between Y2K, the Asian meltdown, the threat from North Korea, ditto Pakistan/India, increasing government corruption, black budgets, nuclear or biological terrorist attacks, polar shifts, a new Ice Age, melting polar ice, killer solar flares, errant comets and asteroids, rapidly increasing numbers of earthquakes and volcanoes, and the weather going berserk, it may be worthwhile to invest a few bucks in survival books.

By the way, when all else fails with communications, we hams will be doing our best to keep people in touch with each other.

Bill Yatchman sent me a copy of his *Bad Times, Good*

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NEVER SAY DIE

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News, A Practical Guide to Preparedness and Survival. It's a $10 117-page paperback and can be had from Greentree, 2756 W. Hwy. 89A, Sedona AZ 86336; [(602) 282-6601]. Add $3 for s/h.

Another nifty book on the subject is *The Complete Book of Survival* by Stahlberg. It's subtitled, "How to protect yourself against revolution, riots, hurricanes, famine and other natural and man-made disasters." This 1998 288-page large format book is published by Barricade, 150 Fifth Ave. #700, NYC NY 10011.

Magnassager

My thanks to Alan Christian WW6B for a newspaper clipping about a combination magnet and vibrator which is used for massaging. There are a couple of excellent books on magnetism and living things reviewed in my *Guide to Books*. A strong magnetic field seems to ease pain quickly and promote remarkably fast healing of wounds — at the least. Again, we're into an area where the giant pharmaceutical companies that run the medical industry can't get patents, so there's been little funding available for research. Like almost none.

If you know any doctors who might be interested in doing some research, you, being a known electrical genius, might enlist their help in testing the healing power of both electromagnets and strong permanent magnets which are vibrated. I'd test both DC and AC electromagnets to see if the 60 Hz has any effect on the healing, positive or negative. Oh, yes, don't get the magnet near your watch. Or computer discs. Anywhere near.

My friend Don Lorimer has developed a permanent magnet with a major wallop which has been helping veterinarians heal animals after operations in a fraction of the normal time. Since so much of our body works by electrical currents, it's not remarkable that magnets might be helpful in a wide range of ailments. We need a lot more research.

I've had several readers (and Art Bell program listeners) send me information about the Nikken magnets. I suspect these are essentially the same magnets that are being used to hold ads on fridge doors, wrapped in cloth and multi-level marketed with the usual whopping markup. You should be able to get magnets like that from a sign-making supply company and cut them to whatever size and shape you want.

Or you can do like everyone else does and tell Opportunity to get the hell away from your door and stop all that damned racket.

Lobbying

A Texas reader sent me a clipping listing the 1997 lobbyist payments (what they report, anyway). The top player was the AMA, which invested $17.1 million in preserving their $1.5 trillion gravy boat. That's your money, of course, which they are spending. The companies spending millions to lobby feel that they are getting their money's worth or they wouldn't continue to spend (invest). And what does the AMA get for their $17 mil? They buy a government which helps them suppress any inexpensive remedies and doesn't ask questions about why America has the most expensive medical system in the world, along with third-world-class results as compared with most other developed countries.

Right up there in the top lobbying spenders were Pfizer, the Committee to Preserve Medicare, Blue Cross, the American Hospital Association, and pharmaceutical manufacturers. How much protection from Congress did their $54-plus million buy them? Keep that in mind when you read the newspapers. As I said, if it wasn't paying off for them, the money would dry up.

The second biggest buyer of privilege was Philip Morris. Wow, is *that* a surprise! Just in case there was any question in your mind about what happened to the recent attempt at tobacco legislation that sank into quiet oblivion. PM invested $5.8 million, thus helping them to save billions.

Fluoride Update

As Dr. Robert Carlton, a US EPA scientist put it, "Fluoridation is the greatest case of scientific fraud of this century — if not of all time."

With over half of the US municipal water supplies being fluoridated, the chances that you and your family are being poisoned by this stuff is high. Poisoned? Recent studies have linked fluorides with osteoporosis and osteoarthritis, backache, and has been projected to cripple over 10% of people over 60.

For the young married couples, it has been shown in two large Chinese studies to lower children's IQ. This influence can start during pregnancy, when the brain is developing the fastest, and has been confirmed by studies of the brains of aborted fetuses. Oh, yes, there's a much higher rate of miscarriages in areas with artificial fluoridation of the water.

Fluoride damages the central nervous system, causing hyperactivity and learning disabilities in children.

One study showed that the greater the fluoride concentration in the water, the lower the fertility rate for women.

Other studies have shown fluoride to cause neural degeneration and it also seems to enhance the flow of aluminum to the brain, resulting in Alzheimer's symptoms.

So, are you and your family still drinking and bathing in municipal water laced with fluorides? It's okay for flushing your toilet, but it's bad news when taken internally.

Isn't it about time to start either distilling your drinking water, or getting a reverse osmosis filter? Or don't you worry about next week? Or care at all about giving your kids a break in life? Life is tough enough when you give your kids every break you can without permanently dumbing them down right from the beginning.

You know, I keep hearing people wondering why kids today are so out of control — why some kids grab a gun and start shooting classmates. Then I read about the effects of fluorides, sugar, aspartame, fluorescent lights, and other poisons on kids and I wonder why the situation isn't worse.

Drug Deaths

You probably read about the 100,000 deaths a recent study reported in the *Journal of the American Medical Association* that were attributed to bad reactions to prescription drugs. So much for putting trust in your doctor, eh? No, this isn't a new problem and I've written about it before.

In this one-size-fits-all world sometimes our doctors forget that each one of us is different. We look different and our body chemistries are all different. So a drug that may be wonderful for one person can kill another. And does. But other than the 100,000 or so families affected, few people seem to care much about this unnecessary loss of life. But, wow, was there hell to pay when 58,000 Americans were killed over a several year period in Vietnam.

I'm not sure how many of the hundred thou are included in the Ralph Nader study which showed that 180,000 people are killed by negligence in our hospitals every year.

Hospitals are full of sick, and often contagious, people, and their germs and viruses often are distributed on air currents for some remarkable distances, according to some other research reports.

Well, gee, you whine, we all have to go to the hospital now and then. Oh, baloney! I've done a lot of research on this and I'm convinced, as you should know by now, that most of the 11% of the GDP we spend on sickness care is totally unnecessary. Most of us are working determinedly, every day, to make ourselves sick — to make sure we get as little of that Social Secu-

Number 63 on your Feedback card

PROPAGATION

Jim Gray W1XU/7
210 E Chateau
Payson AZ 85541
[jimpeg@netzone.com]

October 1998						
SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G-F	3 F-P
4 P	5 P	6 P-F	7 F	8 F	9 F-G	10 G
11 G	12 G	13 G	14 G	15 G	16 G-VG	17 VG
18 VG-G	19 G	20 G	21 G	22 G-F	23 F-P	24 P
25 P-VP	26 VP	27 VP-P	28 P-F	29 F-P	30 P	31 P

The best days for DX are likely to occur between the 10th and 21st ... 11 or 12 excellent days for your operating pleasure and solid QSOs. The worst days are fewer in number, but are anticipated to take place on the 4th and 5th, and again during the last week of the month, with the 26th and 27th being particularly disturbed. On these dates, look for other geophysical upsets as well, and keep a low profile! The remaining days should trend around F (Fair) conditions.

10–12 meters

Fairly good transequatorial DX should occur during local afternoons. Also, some F2-layer openings on east-west paths to Africa and the South Pacific may be possible in the morning. Short skip out to 2,000 miles or so ought to be available in the afternoon.

15–17 meters

Reasonably good DX to all areas of the world, especially to Africa, South America and South Pacific during daylight hours and peaking in the afternoon. Short-skip openings to distances greater than 1,000 miles should be common.

20 meters

Expect openings to all areas of the world from morning to evening (see band-time-country chart), peaking locally an hour or so after sunrise and again during the afternoon. Short skip beyond 750 miles should be good during the day.

30–40 meters

Fairly good worldwide DX openings may be expected from early evening through sunrise; short skip from 100 to 1,000 miles during the day, and beyond during darkness hours. As always, QRN can be a problem, but should be abating this month.

80–160 meters

On 80 meters, you may find fairly good DX openings to the southern hemisphere during hours of darkness and sunrise; short skip to about 350 miles during the day, and out to between 500 and 2,000 miles at night. On 160 meters, look for DX during the hours of darkness and just before dawn. Short skip should be available from 1,500 to 2,300 miles at night.

Check the bands above and below the suggested ones for possible DX surprises. It's often a good idea to park your receiver on a seemingly unused frequency and just wait. A DX station is very likely to pop up before any one else hears him, and you can snag a good catch. Smart operators don't try to bust pileups unless they have super antennas and kilowatt rigs. Be smart and wily ... like a fox ... and make your play before the pileup starts. Listen, listen, and listen. 73, W1XU/7. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20					20	20				15
ARGENTINA	20	20	40	40						10	10	15
AUSTRALIA	15		20			40	20	20				15
CANAL ZONE	15	20	40	40	40		20	20	20	10	10	15
ENGLAND	40	40	40	40			20	15	10	10	20	20
HAWAII	15	20	20	40	40	40	20	20			10	10/15
INDIA							20	20				
JAPAN	15	20					20	20				15
MEXICO	15	20	40	40	40		20	20	20	10	10	15
PHILIPPINES							20	20				
PUERTO RICO	15	20	40	40	40		20	20	20	10	10	15
RUSSIA (C.I.S.)	40	40						15	15	20		
SOUTH AFRICA	20								15	15	10	20
WEST COAST	40	80						20	20	20	15	40

CENTRAL UNITED STATES TO:

ALASKA	15											15
ARGENTINA	15	20	20	40	40						10	15
AUSTRALIA	15	20	20	20		40	80					15
CANAL ZONE	15	20	20	40	40			15	15	10	10	15
ENGLAND		40/80	40/80			15/20	15	15	20	20	20	
HAWAII	15	20	20	40	40	40	80	20			10	15
INDIA								20				
JAPAN	15											15
MEXICO	15	20	20	40	40			15	15	10	10	15
PHILIPPINES	15	20						20				
PUERTO RICO	15	20	20	40	40			15	15	10	10	15
RUSSIA (C.I.S.)								20	15	20		
SOUTH AFRICA	20									15	15	20

WESTERN UNITED STATES TO:

ALASKA	10/15	15	15	20	20	20	40	40				15
ARGENTINA	10/15	20	20	40							15	10/15
AUSTRALIA	10	15	15	20	20	40	40	40	20	20	15/20	15
CANAL ZONE	20	20	40/20	40/20	40			20	15	15	10	10
ENGLAND										15/20	15-20	
HAWAII	10	15	20/15	40	40	40	40	40		20	20	20
INDIA	15/20	15/20							20			
JAPAN	10/15	15	15	20	20	20	40	40				15
MEXICO	20	20	40/20	40/20	40			20	15	15	10	10
PHILIPPINES	15/20	15/20		20		40	40		20	20		15
PUERTO RICO	20	20	40/20	40/20	40			20	15	15	10	10
RUSSIA (C.I.S.)									20			
SOUTH AFRICA	20	20								15	15	20/15
EAST COAST	40	80						20	20	20	15	40

rity pittance as possible, and as much as we can of Medicare and our sickness insurance. We do it when we eat cooked disorganic food and when we dump poisons into our bodies. We do it with stress and EMFs. Yes, I'm repeating myself and you aren't going to change your habits one whit.

Brrrr

A letter from geologist reader Jack Sauers cites several published reports that the glaciers in Greenland, Antarctica, Norway, Sweden, and the Bering Sea are strongly increasing in mass. The Douglas fir trees have declined in elevation by 1000 feet in the past 650 years.

Botanists are rushing to develop grain crops that can better stand the cold and the fungi that the colder climate will bring. The colder weather has been decimating the wheat crop and raising hell with potatoes. The potato industry estimates that it lost $7 billion this year to the potato blight.

With the temperatures along the northwestern states down about 9° F since 1950, and headed down to over 10° lower by 2007, we could be heading for a serious food

Number 64 on your Feedback card

Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, 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 Rt. 202N, Peterborough NH 03458 and get set for the phone calls. The deadline for the January 1999 classified ad section is November 10, 1998.

MAHLON LOOMIS, INVENTOR OF RADIO, by Thomas Appleby (copyright 1967). Second printing available from **JOHAN K.V. SVANHOLM N3RF**, SVANHOLM RESEARCH LABORATORIES, P.O. Box 81, Washington DC 20044. Please send $25.00 donation with $5.00 for S&H. BNB420

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FREE: Scanner collector's methods and secrets. Learn how to buy, sell, trade and USE scanners in the most efficient manner. Enclose $2.00 for postage and handling to: P.O. Box 402, Decatur TX 76234. BNB523

METHOD TO LEARN MORSE CODE FAST AND WITHOUT HANGUPS Johan N3RF. Send $1.00 & SASE. SVANHOLM RESEARCH LABORATORIES, P.O. Box 81, Washington DC 20044 USA. BNB421

HEATH COMPANY is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. **Phone:** (616) 925-5899, 8–4 ET. BNB964

WANTED: High capacity 12 volt solar panels for repeater. [**kk4ww@ fairs.org**] or (540) 763-2321. BNB2630

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Tormet's Electronics Bench Reference has over 100 pages of circuits, design information, large radio section, parts sources, etc. See details at [www.ohio.net/~rtormet/index.htm], or send check or money order for $19.95+ $2.50 postage and handling to **RMT Engineering**, 6863 Buffham Rd., Seville OH 44273. BNB 529

WANTED: NYE VIKING STATION MONITOR RFM-003, RFM-005. Paying $600. Randy Ballard N5WV, **(903) 687-3002**; [TMT@Prysm.net]. BNB5001

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supply shortage. The weather change has taken tropical rains to higher latitudes, increasing glacier growth in the north and bringing drought to Texas and Oklahoma.

With the world consuming 26 billion barrels of oil annually, but finding only 6 billion barrels, we'd better start leaning on our cold fusion researchers to start coming up with some practical products. The price for oil can only go up and the need for heating oil only increase.

I think it's time for me to seriously consider getting a wood stove. Just in case. We sure could have used one last winter when the worst ice storm in history hit the Northeast. Our power was out for five days. 73

The New Approach to HF Radio!

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The Kachina 505DSP Computer Controlled Transceiver

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12 200 MEMORIES • Memory capacity of 200 channels, each of which store frequency, mode, AGC and bandwidth.

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15 HEAVY-DUTY POWER SUPPLY • Built-in switching power supply with "silent" cooling system designed for continuous transmission at maximim output.

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