LIGHT POWERS THIS LIQUID SEMICONDUCTOR—see p.31

OCTOBER-NOVEMBER 75¢

# Science and Electronics

and

# Radio-TV EXPERIMENTER

**WHITE'S RADIO LOG**
- AM Stations
- Worldwide SW
- Police/Emergency

Shutterbug special

## S/E's UNIVERSAL DARKROOM TIMER

- controls enlarger on time
- clocks any tray operation

PLUS

## 4 BUDGET BUILD-ITS

- 97-cent Hard-Rock Fuzz Box
- Sn/Fe Moving-Vane Ammeter
- Perpetual-Motion Freq Standard
- Penny Pincher's Police Convertor


BEGINNING THIS ISSUE

## THE SKIES ABOVE US

S/E's roving report on what's what in outer space

# Dazzle your friends with lightworks.

**Sound n' Color®**

The new dimension to music pleasure. EICO All Electronic Solid-State Audio-Color Organs transform sound waves into moving synchronized color images. Connect easily to speaker leads of hi-fi or radio. From $29.95

**Translators**

The electronics you need to create audio-stimulated light displays to your own imagination. Actuate Light Display Units, Strobe Lites, any lamp configuration (Xmas trees, patio lights, etc.). From $24.95 kit, $39.95 wired.

**Strobe Lites**

High-intensity bursts of white light from Xenon tube flash in cadence with each beat of audio. From $24.95 kit, $39.95 wired.

# Build the Stereo Kits praised by experts.

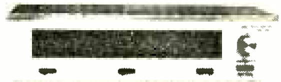
All amplifier power ratings according to IHF standards. Cortina® designed and manufactured in U.S.A. and guaranteed by EICO.

70-Watt AM/FM Stereo Receiver including cabinet. Cortina 3770, $189.95 kit, $279.95 wired.

70-Watt FM Stereo Receiver including cabinet. Cortina 3570, $169.95 kit, $259.95 wired.

150-Watt Silicon Solid-State Stereo Amplifier including cabinet. For the audio perfectionist. Cortina 3150, $149.95 kit, $225 wired.

70-Watt Silicon Solid-State Stereo Amplifier including cabinet. Cortina 3070, $99.95 kit, $139.95 wired.



FM Stereo Tuner including cabinet. Cortina 3200, $99.95 kit, $139.95 wired.

[illegible] MIKE [illegible]

# Build for fun and use with Eicocraft® jiffy project kits.

The newest excitement in kits. 100% solid-state and professional. Expandable, interchangeable. Excellent as introductions to electronics. No technical experience needed. Finest parts, pre-drilled etched printed circuit boards, step-by-step instructions. 36 kits to select from, $2.50 to $9.95. Just released: EC-2600 Super Snoop $8.95, EC 2700 Police & Fire Converter

(lo band) $7.95, EC-2800 Aircraft Converter $7.95, EC 2900 Police & Fire Converter (hi band) $7.95, EC-3100 2-Station Intercom (with cases) $10.95, EC-3200 Do-It-Yourself PC Etching Kit $4.95, EC 2300 Audio Preamplifier $8.95, EC-2400 Bullhorn $8.95, EC-2500 Fuzzbox $8.95

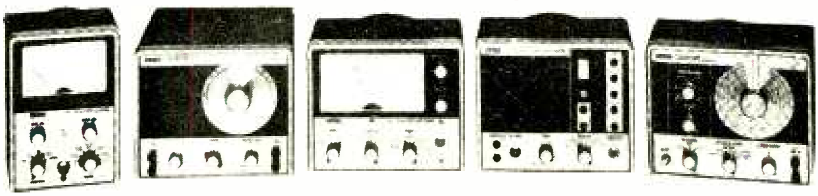
EC-[illegible] TREASURE FINDER $9.95

## Shape up your own car/boat with EICO Engine Analyzer

For all 6V/12V systems; 4, 6, 8 cyl. engines. Now you can keep your car or boat engine in tip-top shape with this solid-state portable self-powered universal engine analyzer. Completely tests your total ignition/electrical system. Complete with comprehensive Tune-up & Troubleshooting Manual. EICO 888, $49.95 kit, $69.95 wired.

## Be a technocrat with EICO® solid-state test equipment

Only EICO brings you laboratory precision and long life at lowest cost.



EICO 240 Solid-State FET-TVOM $49.95 kit, $69.95 wired

EICO 379 Solid-State Sine/Square Wave Generator $54.95 kit, $74.95 wired

EICO 242 Solid-State Deluxe FET-TVOM $59.95 kit, $79.95 wired

EICO 150 Solid-State Signal Tracer $49.95 kit, $69.95 wired

EICO 330 Solid-State RF Signal Generator $59.95 kit, $79.95 wired

**You save up to 50% with EICO Kits. Since 1945, Best Buys in Electronics. Over 3 Million EICO Instruments Now in Use.**

**FREE 1969 CATALOG**

Send me FREE catalog describing the full EICO line of 200 best buys, and name of nearest dealer.

**EICO**

**EICO Electronic Instrument Co., Inc.**
283 Malta Street, Brooklyn, N.Y. 112[illegible]

**EICO Canada Ltd.**
20 Millwick Drive, Weston, Ontario

Name

Address

City State Zip

October/November 1969

# Science and Electronics



★ Cover Highlights

Cover illustration by Len Goldberg

**Science and Electronics**

**JULIAN M. SIENKIEWICZ, WA2CQL**
*Editor-in-Chief*

**RICHARD A. FLANAGAN, KQD2566**
*Managing Editor*

**CHARLES S. HARRIS**
*Technical Editor*

**HELEN PARKER, KQD7967**
*News Editor*

**JIM MEDLER**
*Art Editor and Associate Art Director*

**ARTHUR S. COOKFAIR; ERNEST A. KEHR; MARSHALL LINCOLN, K9KTL/W7DQS; ROY K. MARSHALL, PH.D.; JACK SCHMIDT**
*Contributing Editors*

•

**JOSEPH A. D'AMATO,** *Art Director*
**IRVING BERNSTEIN,** *Cover Art Director*
**MARGARET R. GOTTLIEB,** *Art Associate*
**JIM CAPPELLO,** *Advertising Director*
**CARL BARTEE,** *Production Director*
**GERTRUD BORCHARDT,** *Production Manager*
**MARILYN VARGAS,** *Assistant Production Manager*
**WILFRED M. BROWN,** *Instruments Division Manager*

•

**B.G. DAVIS,** *Chairman of the Board*
**JOEL DAVIS,** *President and Publisher*
**LEONARD F. PINTO,**
*Vice-President and General Manager*
**VICTOR C. STABILE, KBPØ681,**
*Vice-President and Treasurer*
**ROGER G. CAVANAGH,**
*Circulation and Marketing Director*

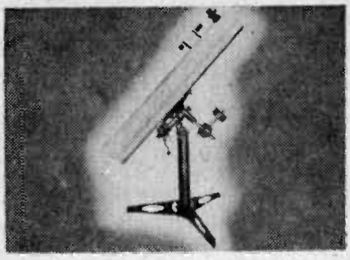
SCIENCE AND ELECTRONICS and RADIO-TV EXPERIMENTER (Vol. 27, No. 2) is published bi-monthly by Science & Mechanics Publishing Co., a subsidiary of Davis Publications, Inc. Editorial, business, and subscription offices: 229 Park Avenue South, New York, N.Y. 10003. One-year subscription (six issues)—$4.00; two-year subscription (12 issues)—$7.00; and three-year subscription (18 issues)—$10.00. Add $1.00 per year for postage outside the U.S.A. and Canada. Advertising offices: New York, 229 Park Avenue South, 212-OR 3-1300; Chicago; 520 N. Michigan Ave., 312-527-0330; Los Angeles: J. E. Publishers Rep. Co., 8380 Melrose Ave., 213-653-5841; Atlanta: Pirnie & Brown, 3108 Piedmont Rd., N.E.; 404-233-6729; Long Island: Len Osten, 9 Garden Street, Great Neck, N.Y., 516-487-3305; Southwestern advertising representative: Jim Wright, 4 N. 8th. St., St. Louis, 314-CH-1-1965.

EDITORIAL CONTRIBUTIONS must be accompanied by return postage and will be handled with reasonable care; however, publisher assumes no responsibility for return or safety of manuscripts, art work, or photographs. All contributions should be addressed to the Editor. SCIENCE AND ELECTRONICS and RADIO-TV EXPERIMENTER, 229 Park Avenue South, New York, N.Y. 10003.

Second class postage paid at New York, New York and at additional mailing office. 

KEEP PACE WITH SPACE AGE! SEE MOON SHOTS—LANDINGS, SPACE FLIGHTS, CLOSE-UP!

# AMAZING SCIENCE BUYS
## for FUN, STUDY or PROFIT



### SUPER 6" SPACE CONQUEROR

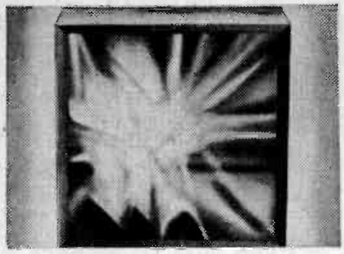
Superb Astronomical Reflector—Up to 576X. Capable of revealing faint stars of nearly 13th magnitude, split double stars separated by less than 1 sec. of arc. Features aluminized & overcoated 6" f/8 ground and polished pyrex parabolic mirror accurate to ¼ wave. 48 F.L. 6X achromatic finder scope. 4 eyepieces—48X Kellner, ½" 96X & ¼" 192X Ramsdens, Barlow to double or triple power—rack & pinion focusing mount. 47¾" aluminum tube. Electric clock drive w/manual slow-motion control. Setting circles. Heavy-duty equatorial mount. Pedestal base. Compares to $295–$350 models.

Stock No. 85,086HP ........ $239.50 F.O.B.

3" REFLECTOR TELESCOPE

Stock No. 85,050HP ........ $29.95 Ppd.

Stock No. 85,105HP 4¼" .... $96.50 F.O.B.



### A COOL ADVENTURE . . . WITH LIGHT!

The almost hypnotic spell of ever changing firelight has been captured in a cool-light display box! With the liquid motions of a rising and cascading fountain blowing in the wind, psychedelic colors appear, intermingle and vanish to rise again in new patterns and drift away. This soothing light show housed in a handsome 11½" square by 7" deep, walnut finished lumia light box is an effective addition to any room—your living room, bedroom, rec-room, doctor's office. Especially effective among a wall picture group. Modern as tomorrow—available today!

Stock No. 71,180HP
Lumia Light Box ............ $29.95 Ppd.


### SEE MUSIC IN DAZZLING ACTION

MusicVision Dramatic Breakthrough in Audio-Visual Enjoyment

Actually see favorite musical selections translated into fantastic patterns of beautiful color—each individual note creating its own unique twisting, radiating shape . . . each shape dancing and prancing, whirling and swirling in perfect time with the music. Easily attached to stereo, radio, tape recorder. Send 25¢ in coin for 16-page booklet #9096HP.

Walnut Cabinet Model
No. 85,181HP .............. $99.50 F.O.B.

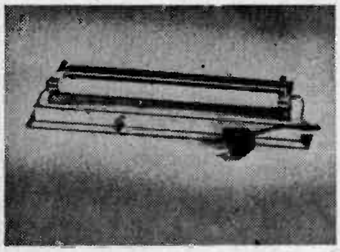
8" Set—No. 71,030HP ....... $45.00 Ppd.

8" Do-It-Yourself Kit
No. 71009HP ............... $22.50 Ppd.


### 'BRIGHT IDEAS' IN UNIQUE LIGHTING

Big, new 100-page handbook packed with facts, loaded with illustrations. All latest developments, applications, equipment. Covers strobes, sources, black light, projectors, crystal and organic slides, color organs, mirrors, polarized color, screens, light boxes, MusicVision, etc. Rare find for business, home, hobby. Ideal for display houses, combos, experimenters, hobbyists. 8½" x 11" looseleaf paper punched to fit 3 ring binder . . . add new developments as they happen.

Stock No. 9100HP ............. $3.00 Ppd.

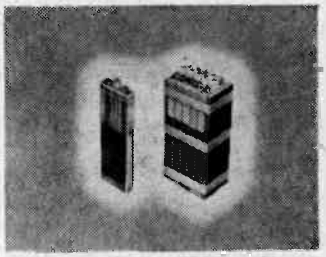


### LONG-WAVE BLACK LIGHT FIXTURE

Extremely versatile, compactly designed, long wave (3200-4000 angstroms) black light (ultraviolet) fixture. Has 6-watt, 110-V lamp with built-in filter—eliminates harmful shorter wave ultraviolet rays. Use to identify minerals, fungi, bacteria—check for surface flaws, oil and gas leakage—perfect for displays with fluorescent paper, paints, chalk, crayons, trace powder. Incl. adjustable aluminum reflector, push-pull switch, connecting plug. Mount vert., horr., or on corner. 10" L., 1½" W., 1¼" H.

Stock No. 70,364HP ........... $12.50 Ppd.

No. 60,124HP (Replacement Bulb) $4.50 Ppd.



### NICKEL-CADMIUM BATTERY BARGAIN!

Terrific values—slightly used gov't surplus. Lightweight 5 cell, 6 volt, 4 Amp-hour battery with almost unlimited life. Extremely high current output. Recharges in 1 hour with Edmund kit. Won't deteriorate when left discharged. Minimum maintenance—few drops of water per year. Rugged, shock-and-vibration resistant nylon case. Delivered partially charged, filled with electrolyte. 3⅛"x2"x6". 2 lb.

Stock No. 70,942HP (battery) ... $15.00 Ppd.

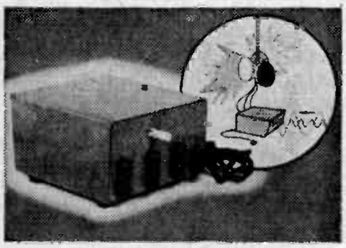
Stock No. 70,807HP (charger kit) . $8.00 Ppd.

Stock No. 41,109EH (cell) ...... $3.95 Ppd.

### ASTRONOMICAL TELESCOPE KITS

Grind your own mirror for powerful telescope. Kit contains fine annealed pyrex mirror blank, tool, abrasives, diagonal mirror and eyepiece lenses. You build instrument valued from $75.00 up.

| Stock No. | Diam. | Thickness | Price |
|---|---|---|---|
| 70,003HP | 4¼" | ¾" | $9.75 Ppd. |
| 70,004HP | 6" | 1" | 13.95 Ppd. |
| 70,005HP | 8" | 1⅜" | 21.00 Ppd. |
| 70,006HP | 10" | 1¾" | 34.25 F.O.B. |
| 70,007HP | 12½" | 2⅛" | 65.85 F.O.B. |



### NEW! LOW-COST COLOR ORGAN

Create tremendous variety of unusual and beautiful effects. Simply plug in 3 diff. sets of colored lights and place near audio source. Notes picked up by interior "mike" determine which colored lights go on—loudness determines intensity. Surprising number of commercial, display and home uses—control lighting in pools and fountains, window and holiday decorations, great for parties. Tough, compact unit with light intensity control. 4-9/16" x 2¼" x 4½". 1 lb. 6 oz.

Stock No. 1900HP ............. $39.95 Ppd.

4 Channel De Luxe 2,000 Watt
Stock No. 71,103HP .......... $195.00 Ppd.

### GIANT FREE CATALOG

**148 PAGES! MORE THAN 4,000 UNUSUAL BARGAINS!**


Completely new 1969 edition. New items, categories, illustrations. Dozens of electrical and electromagnetic parts, accessories. Enormous selection of Astronomical Telescopes, Microscopes, Binoculars, Magnifiers, Magnets, Lenses, Prisms. Many war surplus items: for hobbyists, experimenters, workshop, factory. Mail coupon for catalog "HP." EDMUND SCIENTIFIC CO., 300 EDSCORP BUILDING, BARRINGTON, N.J. 08007

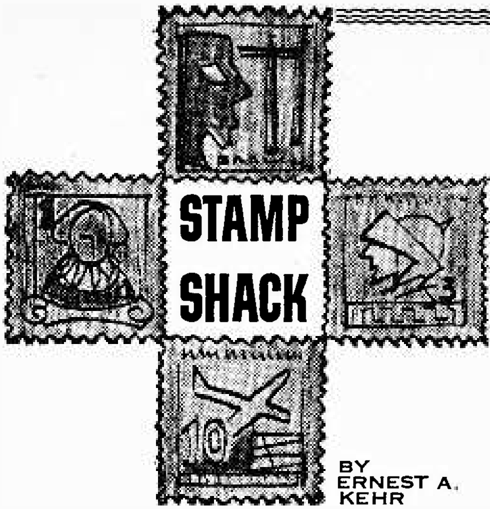
Name ____________________

Address ____________________

City __________ State ______ Zip ______

ORDER BY STOCK NUMBER • SEND CHECK OR MONEY ORDER • MONEY-BACK GUARANTEE

**EDMUND SCIENTIFIC CO.** 300 EDSCORP BUILDING
BARRINGTON, NEW JERSEY 08007



# STAMP SHACK

BY ERNEST A. KEHR

● ● The multi-color, 50-lire stamp issued by Italy on Nov. 25, 1968, is simply inscribed, "Centro Telespaziale del Fucino." But the intercontinental communications progress it commemorates is vastly more impressive. It was released to mark the opening of expanded facilities built by the Italian Government to take advantage of satellites for the intercontinental transmission and reception of private messages, radio and TV programs. The design shows the Fucino installations, with one of two Space antennae, each about 30 feet in diameter, in the foreground.

● Once the United States and the Soviet Union rocketed sophisticated hardware into outer Space, and proved satellites could be kept orbiting under meticulous control from ground stations, this new communications technique was adapted to commercial use to serve mankind.

In Washington, the initial efforts were culminated by the organization of INTELSAT, in February of 1965, to harness spacecraft potentials on a private basis. The peculiar ability of sending messages across vast distances not only relieved pressure on overloaded cables beneath the seas; it enabled broadcasters to transmit instantaneous news events in a manner impossible through existing terrestrial equipment.

● ITALCABLE and RAI, Italy's two organizations concerned with private and commercial message transmission, and radio-TV productions respectively, appreciated the potentials of INTELSAT. And almost as soon as its formation was announced, arrangements were made to link themselves into the American satellite program. They created "Telespazio" exclusively for this purpose under the aegis of the Italian Ministry of Posts and Telecommunications.


*Italy 1968 Fucino Installation*

● By June, 1965, Telespazio was ready to make use of the first Early Bird facilities. Equipment which already is outmoded, was installed in a brand new, specifically designed center at Fucino, two miles from Avezzano, in Aquila Province, and once an important source of water in the days of Caesar and Claudius.

● As early as October of that year, Italian TV viewers witnessed the arrival and all-day visit of Pope Paul VI to the UN, in New York via satellite.

● As this communications medium was developed, Telespazio kept pace by acquiring and installing the costly equipment as it came from the manufacturers here. And while the new antennae now are in operation, still more recent equipment already is in the process of being built, including a more sophisticated antenna that is 27.40 meters (90 feet) in diameter.

● ● On Aug. 1, 1928, the Broadcasting Corporation of China was established in Nanking, to provide the populace with early radio news and entertainment programs. To mark the 40th anniversary of that noteworthy event, the Chinese Postal Administration released a pair of special postage stamps produced by the government's engraving plant in Taipeh.

● The $1 value features a map of Asia with concentric circles spreading all over the mainland from Formosa. All during World War II, BCC fostered morale of both the armed forces


*China (Taiwan) 1968 Postal 40th Anni.*

and the populace; it linked government agents in occupied areas, and conveyed China's voice to allied nations. After it moved to Taiwan in 1949, its facilities are being used to transmit programs to the mainland of China, to keep the Chinese there constantly aware of what is happening on Formosa.

● The $4 shows a small microphone from which an interesting pattern of red circles and (Continued on page 105)

# POSITIVE FEEDBACK


Julian M. Sienkiewicz
EDITOR-IN-CHIEF


**Don't look now,** but our new name—SCIENCE AND ELECTRONICS—appears on top of our old one . . . and in larger type, too! Yep, we've made the switch. From here on in we can only go to bigger and better coverage of the exciting worlds of science and electronics. However, we can't do the job alone. We need help from you! Look carefully at this issue and let us know what you think of it. Then, in a short letter, let us know exactly what you *like* and what you *dislike*. Tell us, too, what's missing so we can make our coverage more interesting and more complete.

It's as difficult for an editor to judge his magazine as it is for an artist to judge his paintings. (Could this explain why there are many starving artists and editors?) So you see, by writing you can get a better magazine and maybe make the Editor rich simultaneously *(Whee!)*. Please address all your remarks to The Editor, SCIENCE AND ELECTRONICS, 229 Park Avenue So., New York, N.Y. 10003.

**Plot!** Programming a computer requires translation of word or picture directions into a numerical language understood by the computer's electronic circuits. Now, a new computer *accessory* simplifies this translation by making many programming tasks as easy as tracing lines on a blueprint or photograph. The *accessory*, a three-axis reversible scaler, was developed by The MicroMetric Corporation, Berkeley, Calif., a member of The Grass Valley Group, Inc. Designed for a wide range of industrial and scientific applications, the new scaler will free programmers, now in short supply, from routine production and laboratory work, allowing them to concentrate on more profitable assignments.

Programming a computer to control a machine tool, for example, can be accomplished merely by tracing a blueprint of the desired part with the plotting cross hairs of a MicroMetric two axis "digitizer," as the combination of the new scaler and its plotting table is called.

*(Continued on page 102)*

# Heathkit®—Your Best Buy In Electronics

## NEW Heathkit Solid-State Auto Tune-Up Meter . . . Measures Dwell, RPM And DC Voltage

The new Heathkit ID-29 is most versatile . . . really three automotive test instruments in one . . . and its low price makes it even a better value. Measures Dwell on all 4-cycle 3, 4, 6, or 8 cylinder engines . . . measures RPM in two ranges 0-1500 and 0-4500 . . . measures DC voltage from 0 to 15 volts. And no batteries are needed . . . running engine provides both signal and power. Easy to use . . . on both 6 and 12 volt system without changing leads. It's lightweight, easy to carry . . . comes equipped with black polypropylene case that has a built-in lead storage compartment and is resistant to virtually everything. Fast, simple assembly . . . takes just one evening. The perfect accessory for the handyman who wants to do his own car tune-up, emergency road service personnel, or shop mechanics . . . order your ID-29 now. 4 lbs.

**NEW**
**Kit ID-29**
**$29⁹⁵***

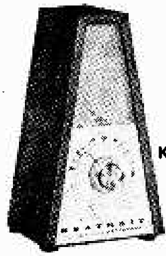
## NEW Heathkit GD-48 Solid-State Metal Locator

A low cost, versatile, professional metal detector at one-third the cost of comparable detectors. Packed with features for long life, rugged reliability, and dozens of uses. Completely portable, battery operated and weighs only 3 lbs. The GD-48 is highly sensitive, probes to 6 feet, and has an adjustable sensitivity control. Its built-in speaker signals presence of metal; front panel meter gives visual indication. Other features include built-in headphone jack, telescoping shaft for height adjustment, smartly styled and smartly designed for easy in-hand use and easy assembly. Whether you're an amateur weekend hobbyist or a professional treasure hunter the GD-48 is for you . . . also a great help to contractors, surveyors, Gas, Electric, Telephone and other public Utility Companies. 4 lbs. GDA-48-1, 9 Volt Battery $1.30*; GD-396, Headphones, 2000 ohm (Superex) $3.50*

**NEW**
**Kit GD-48**
**$59⁹⁵***

## NEW Heathkit Electronic Metronome

The new Heathkit TD-17 is a low cost, precise performing electronic Metronome. . . . a handy helper for any music student. Battery operated . . . no springs to wind . . . accurate, steady calibration is always maintained . . . from 40 to 210 beats per minute. Instruction label on bottom gives conversion from time signature and tempo to beats per minute. Stylish fruit wood finished cabinet. Easy solid state circuit board construction . . . assembles and calibrates in only 2-3 hours. The new Heathkit TD-17 Electronic Metronome is so low in cost every music student can afford one . . . order yours now. 1 lb.



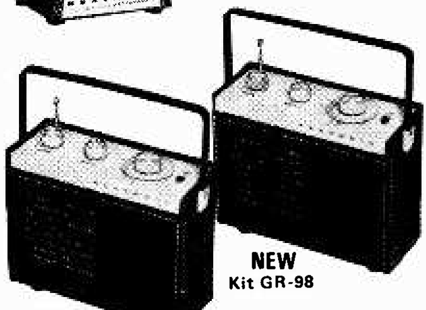
**NEW**
**Kit TD-17**
**$12⁹⁵***

## NEW Heathkit GR-88 Solid-State Portable VHF-FM Monitor Receiver

Tunes both narrow and wide band signals between 152-174 MHz . . . for police, fire, most any emergency service. Exceptional sensitivity and selectivity, will outperform other portable receivers. Features smart compact styling . . . with durable brown leatherette case, fixed station capability with accessory AC power supply, variable tuning or single channel crystal control, collapsible whip antenna, adjustable squelch control and easy circuit board construction. The new GR-88 receiver is an added safety precaution every family should have . . . order yours today. 5 lbs.

## NEW Heathkit GR-98 Solid-State Portable Aircraft Monitor Receiver

Tunes 108 through 136 MHz for monitoring commercial and private aircraft broadcasts, airport control towers, and many other aircraft related signals. Has all the same exceptional, high performance features as the GR-88 above. The perfect receiver for aviation enthusiast . . . or anyone who wants to hear the whole exciting panorama of America in flight. 5 lbs. GRA-88-1, AC Power Supply $7.95



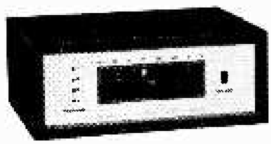
**NEW**
**Kit GR-98**

**NEW**
**Kit GR-88**

**$49⁹⁵***
**each**

## NEW Heathkit GD-28 8-Track Cartridge Tape Player

The new GD-28 is an ideal addition to any home music system. Plays pre-recorded tapes through any system with a Tape Recorder, Tuner or Auxiliary input. Just push in the 8-track stereo cartridge . . . it starts and changes tracks automatically . . . even shows which track is playing. Changes tracks instantly with the front panel switch too. Goes together quickly on one circuit board, and the famous Motorola® tape playing mechanism is preassembled & adjusted. Attractive wood-grained polyurethane cabinet included. Order yours now. 10 lbs.



**NEW**
**Kit GD-28**
**$59⁹⁵***

### FREE! Heathkit Catalog

**Now with more kits, more color. Fully describes these along with over 300 kits for stereo/hi-fi, color TV, electronic organs, guitar amplifiers, amateur radio, marine, educational, CB, home & hobby. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.**

HEATHKIT
*a Schlumberger subsidiary*

**HEATH COMPANY, Dept. 19-67**
Benton Harbor, Michigan 49022

☐ Enclosed is $____________________, plus shipping.

Please send model (s)______________________________
☐ Please send FREE Heathkit Catalog. ☐ Please send Credit Application.

Name________________________________________

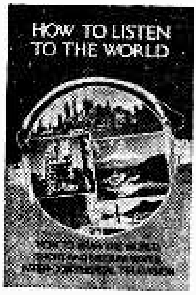
Address______________________________________

City______________ State______________ Zip________

*Mail order prices; F.O.B. factory. Prices & specifications subject to change without notice. CL-360

# BOOKMARK
BY BOOKWORM

**Here's How!** Don't take a back seat to any one when it comes to shortwave and medium-wave DXing. The fifth edition of *How To Listen To The World* is now available and raising eyebrows of shortwave novices and pros alike. One of the main purposes of this book is to enable the listener (and TV viewer) to obtain the greatest benefit from the world of radio through his receiver. Radio world listening nowadays is no longer a purely shortwave matter. Over the last few years, there has been an ever increasing interest in world listening on medium waves. Therefore, such Table of Content titles as "Im-

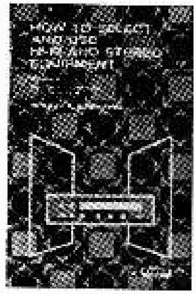



**Soft cover**
**211 pages**
**$3.95**

proving medium-wave reception," "Medium-wave propagation," and "Medium-wave DXing from Australia" offer a guide to the locked-in shortwave DXer who wants to switch to the lower frequencies. *How To Listen To The World* is edited by J. M. Frost and includes articles from qualified authors, radio broadcast organizations and DX-club officials. Get your copy today direct from Gilfer Associates, Inc., Box 239, Park Ridge, N. J. 07656.

**Takes Two for Stereo.** How does the prospective buyer of hi-fi and stereo equipment spot those features which add up to the best possible equipment in a particular price range and avoid those which are well packaged, but low in quality? And how can the owner of a system improve his rig to gain increased listening pleasure? These are a few of the many questions answered in a practical two-volume paperback set by the noted author Murray P. Rosenthal. The volumes are titled *How To Select and Use Hi-Fi and Stereo Equipment*.

Volume I, which concentrates on the basic hi-fi and stereo equipment, opens with a brief but very thorough discussion of acoustics. Written clearly, concisely, it gives the reader an excellent background, including the often overlooked relationship between enclosure, speaker and listening area. Criteria are given for selecting the various types of speakers. Cutting through the confusing array of enclosure types and sub-types the book tells just how different kinds of enclosures affect sound, and which kinds are particularly effective in given situations. Headphones, preamplifiers, amplifiers, tuners and receivers are then discussed, showing




**Volume I**
**Soft cover**
**114 pages**
**$3.25**

**Volume II**
**Soft cover**
**104 pages**
**$3.25**

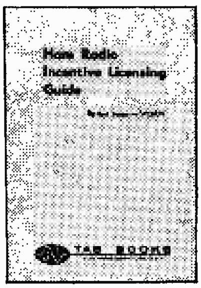
a sampling of control features, connection possibilities, and a comparison of the advantages and disadvantages of tube vs transistorized equipment.

Volume II fully discusses record players and tape recorders, components which may be added to the basic hi-fi or stereo rig at any time. It shows how different kinds of construction in these components can affect performance. Covering phono arms, pick-up types, styli, etc., it gives concrete reasons why certain kinds of equipment should be selected or avoided. A particularly valuable feature of Volume II is a thorough troubleshooting guide. Here are 38 pages of tips on solid-state devices, tools, testing, for those listeners who want to keep their equipment in top working order.

So pick up your copies of *How to Select and Use Hi-Fi and Stereo Equipment* and get with good sound. Available at many electronic parts stores or direct from the publisher, Hayden Book Company, Inc., 116 West 14th Street, New York, N. Y. 10011.

**Ham Fact Dept.** In the United States, anyone can get an amateur license—no prior electronics experience is necessary, and for the Novice Class ticket, age is no barrier. Many youngsters under ten already have theirs, as well as a host of young-at-heart enthusiasts who have begun to climb the ladder toward that General, Advanced, or Extra Class License. To pass the Novice Class exam only a "speaking acquaintance" is required—the basic rules and code. In effect now are new FCC rules intended to encourage present radio amateurs toward achievement of higher class licenses with reserved operating privileges and to stimulate interest among outsiders.

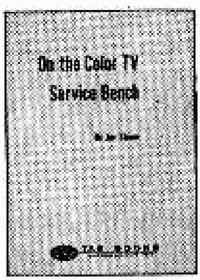
A new book, *Ham Radio Incentive Licensing Guide,* tells how to begin, or to advance, to each succeeding license class, in clear, concise, and easy-to-understand terms. For many, the most formidable obstacle is learning the code. Here the reader will find proven methods of learning and developing proficiency with International Morse Code. An entire Chapter is devoted to each license class, eliminating the necessity of wading through material irrelevant for the reader's immediate goal, and if he is shooting for a higher class ticket, he can simply skip to the appropriate Chapter. The Incentive Licensing Guide, prepared with the aid of the




**Soft cover**
**160 pages**
**$3.95**

FCC, includes actual test material, substantially as it appears on official exam forms, and it covers *every* question which may be encountered in each test, from Novice to Extra Class. Naturally, the text is authorized by a ham, Bert Simon, W2UUN. To get your copy write to the publisher, Tab Books, Blue Ridge Summit, Pa. 17214. ∎

**Color Bench Rainbow.** Here's a handy benchmate for practicing color TV technicians and B&W experts who want to break into color TV servicing. It's *On the Color TV Service Bench,*




**Soft cover**
**192 pages**
**$4.95**

a brand-new troubleshooting guidebook written by a real pro, Jay F. Shane, an expert who cut his teeth on the first TV circuits 20 years ago. The text describes causes and cures for

*(Continued on page 105)*


## Sun of a Gun!

This new movie light unit from Sylvania is named the Sun Gun, is designed for 8 and 16 mm movie cameras, and operates on 9 nickel cadmium energy sources in a separate power pack that weighs only 3 lb. Each energy source has a running time of 10 minutes or approximately two 50-ft. rolls of movie film when batteries are fully charged. The energy power packs can be fully recharged in 60 minutes with a separate recharger. The Sun Gun features a beam selector in the back of the light head so you can regulate the light beam from spot to flood even when shooting. The total light output on the spot position is 15,000 center beam candle power and 7,000 center beam candle power at the flood position. The light

*Sylvania Sun Gun Movie Light Unit*

source is a 150-watt tungsten-halogen lamp with an average rated life of 30 hours when operated in the Sun Gun system. The total Sun Gun unit will have a price of $119.95, including a custom-made carrying case. For more information write to Sylvania Electric Products Inc., 730 Third Ave., New York, N.Y. 10017.

## Beep-Beep! Beep-Beep!

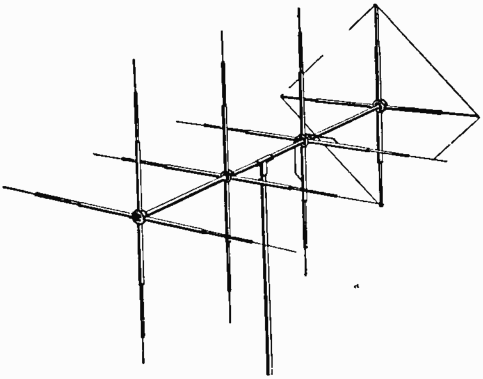
Do the kids bug you on road trips? Bell & Howell has devised the Road Runner cassette tape player kit to keep them off your back. Besides the Road Runner cassette, six batteries and earphone, the kit contains two original tapes with stories, travel facts, behavior tips, sing-along songs and games, all set to original music. There's also a travel booklet and a spe-


*Bell & Howell Road Runner Cassette Kit*

cial prerecorded cassette tape bonus offer. The package comes in a sturdy travel carton with handle and sells for $38.88. If you bought the elements separately they would come to $45.00. The Road Runner cassette features touch control for fast forward, play or stop, easy drop-in cassette loading, and a rugged case. You can, of course, use all standard cassette tapes in the Road Runner. At your local dealer or write to Bell & Howell, Video and Audio Products Div., 7235 N. Linder Ave., Skokie, Ill. 60076.

## CB Base Station Antenna

Avanti has a new CB base station antenna designed along the lines of antennas used to pinpoint signals on "moon bounce." Therefore, they have called it the Moonraker, and it combines ½-wave cross dipole elements with Avanti's PDL design reflector. They include a switch box so you can have either horizontal or vertical operation. Moonraker's shorter boom length (15 ft.) helps keep weight and turning radius to a minimum and lets you use a standard inexpensive TV-type antenna rotor system. Also a plus from the shorter boom length is better signal excitation for greater true gain—14.5 dB. Impedance is 50 ohms,

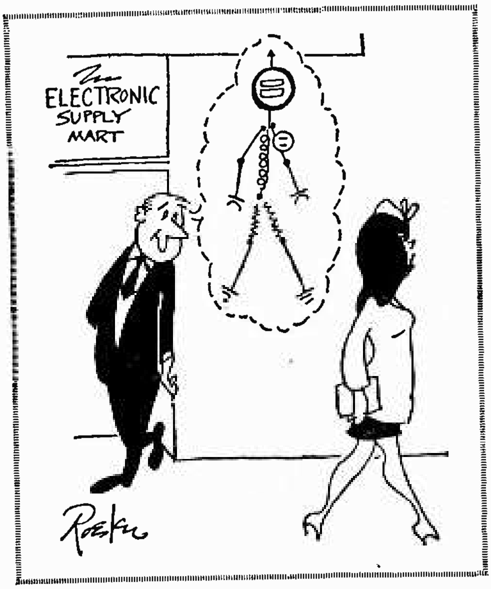


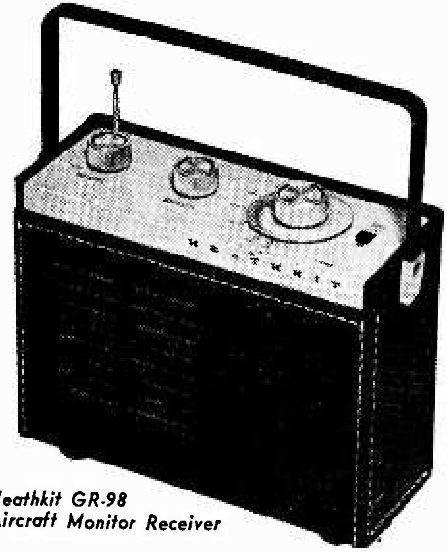
*Avanti Moonraker CB Base Station Antenna*

power handling 1000 watts. Wind survival is 90 mph, the weight of the Moonraker is 24 lb., and the price is $129.95 with a one-year guarantee. Write to Avanti Research & Development, Inc., 33-35 W. Fullerton Ave., Addison, Ill. 60101.

## Skywatch by Ear

Heath Company has a new portable aircraft monitor receiver, the GR-98, which tunes from 108-136 MHz. With it you can hear commercial and private aircraft, airport control towers, air control conversations, and many other aircraft-related signals. There's a six-to-one vernier tuning control, a built-in whip antenna, 40-kHz selectivity and 1.5-$u$V sensitivity for a 10 dB signal-to-noise ratio. Another feature is adjustable squelch control, and, for those



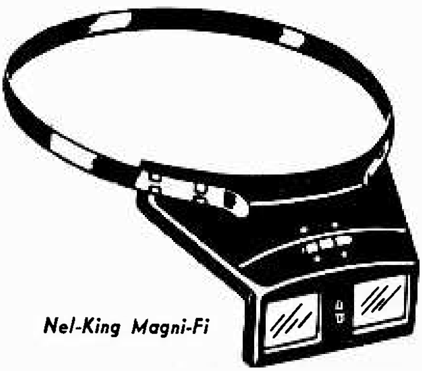


*Heathkit GR-98*
*Aircraft Monitor Receiver*

who want to monitor one station almost continuously, the GR-98 has crystal control of one-channel—just plug in the crystal of your choice, tune to the approximate frequency and flip the front panel switch to the *Xtal* position and you're on frequency immediately. GR-98 weighs less than 4 lb. with six C cells installed, and measures 7¼ x 8½ x 3½-in. For fixed station use, the carrying handle converts into a tilt stand and an external antenna jack is provided. The tuner portion is factory assembled and aligned; the rest goes together on a single circuit board. Price: $49.95. For more details write Heath Co., Benton Harbor, Mich. 49022.

## Hobbyists, Stop Squinting!

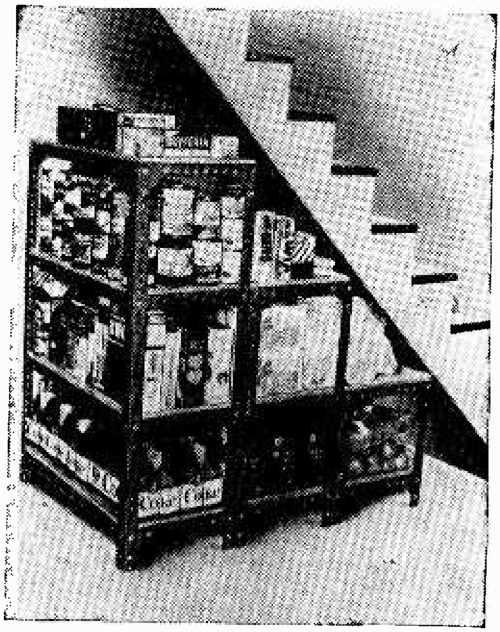
Having trouble making out details on those printed circuits? The Magni-Fi has a headband that adjusts to any head size and a precision 2½ diopter lens. It not only leaves your hands free to work, but the hinged lens swings up and out of the way when you don't need it. You can wear Magni-Fi without or with glasses. And one of the nicer features of the Magni-Fi is its very low price: $7.95. If desired, a 3-diopter lens is available for $2.98. Magni-Fi is available by mail (35¢ postage) from Nel-King Products, Inc., 811 Wyandotte St., Kansas City, Mo. 64105.



*Nel-King Magni-Fi*

## Grownup Erector Set

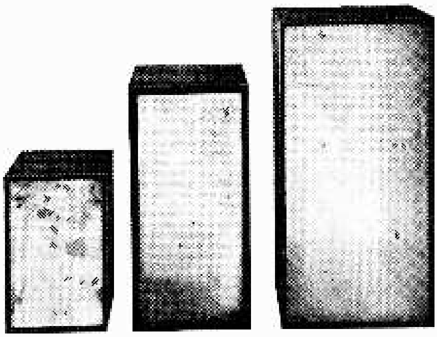
Dexion Inc.'s slotted steel angle is now available at your local lumber yards, hardware, and department stores. Framework for workbenches, machine stands, shelving, soap box racers, and lots of other items can be assembled just like you did with your Erector set. All you need is a wrench and a hacksaw. Dexion angle is made of cold rolled steel with a baked enamel finish. It's packaged in bundles of 8 five-foot lengths with nuts, bolts and corner braces included. This is called the Dexion 100 kit and its price is $12.65. Write for their Idea Pamphlet, which illustrates 21 do-it-yourself projects—from storage units to pet stands and puppet theatres. For a free copy send to Dexion Inc., 39-27 59th St., Woodside, N.Y. 11377.



*Dexion Slotted Steel Angle*

## New Sound 'N Color Family

A whole new dimension for your music—color! EICO has three new models in their Sound 'N Color line which use special low-voltage, high-intensity lights to achieve their startling effects. The light boxes come in three and four channel models—each channel responding to a different portion of the audio spectrum. Every combination of musical in-



*Model 3440* *Model 3445* *Model 3450*

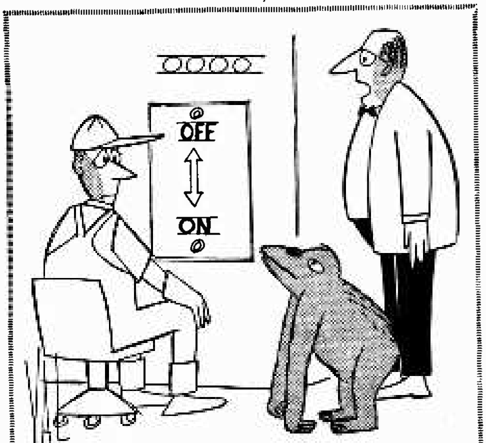
*EICO Sound 'N Color Organs*

struments produces its own distinct multi-color pattern. Shown are Model 3440, 3-channel, 15 x 10 x 6-in., in kit form $49.95, wired $79.95. Next is Model 3445, 4-channel, 24 x 12 x 10-in., kit $64.95, wired $99.95. The one on the right is the jumbo model, 3450, 4 channels, 30 x 15 x 11-in., kit $79.95, wired $109.95. For more info, write EICO Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N.Y. 11207.

## Clear the Tracks for Stereo!

The new Heathkit GD-28 is a stereo tape player kit designed to play back prerecorded 8-track stereo tape cartridges through any home music system. Unit is completely automatic; the user just plugs in the cartridge of his choice. A metal tape splice switches the play-head from one track to the next automatically, or you can select the track you want by pushing the slide-switch on the front panel. Pilot lamps indicate which track is playing. The tape player mechanism is preassembled and adjusted, and the 6-transistor, 2-diode preamplifier circuit goes together in a trice on one small circuit board.

*(Continued on page 106)*



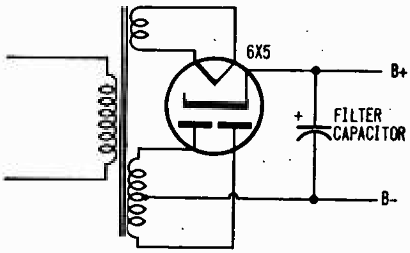

"Sorry, Higgins, you're being replaced but not exactly by a computer."


## It's Zapped!

*Everytime my amplifier is turned on, the 6X5 rectifier tube burns out. What gives?*

—*R. L. F., Middletown, N. Y.*

Undoubtedly the input filter capacitor (see diagram) is shorted. Replace it with one of the same value in microfarads. The same trouble




occurs in solid-state diode rectifier circuits only there's a very low ohmic resistor between the diode and the filter capacitor that overheats and pops. Replace filter, capacitor, resistor and diode.

## Never!!

*Can you give me a schematic of a solid-state phono preamplifier?*

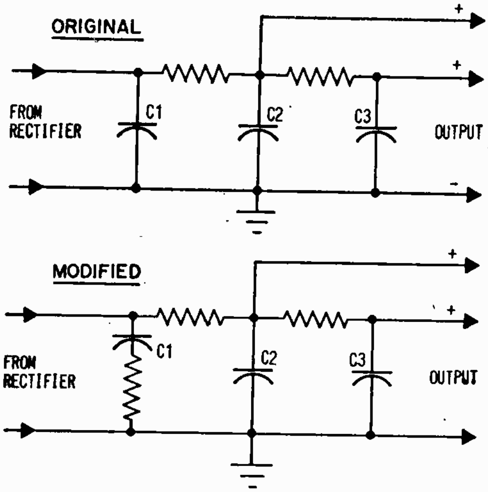
—*C. R. B., Amityville, N. Y.*

Why? There are several good wired units available on printed circuit boards and modules that are a heck of a lot cheaper than the parts needed to make one. Look through the catalogs of Lafayette Radio, Allied Radio, and Radio Shack for some good buys.

## Show Some Resistance

*I am having trouble getting the right voltage out of a DC power supply. When I use a capacitor input circuit, the voltage is too high. When I disconnect the input filter capacitor, the voltage is too low. Do I have to add an AC input voltage control?*

—*A. M., Santa Barbara, Calif.*




Try a resistor in series with input capacitor C1. Try various values until the output voltage is correct. The resistor will probably have to be a wire wound type rated at 10 watts or more.

## Old Waves

*What was the first broadcasting station in the U.S.? Both KDKA in Pittsburgh and WWJ in Detroit claim the title. Also, was it 1920 or 1921?*

—*D. H., Metairie, La.*

The way we heard it, it was KQW in San Jose in 1913. Before that DeForest broadcast live opera in New York. And before that it was just ghosts in the attic.

## Point of Information

In reply to *E. E. C., Jr.*, of New Bern, N. C. on where to obtain the light emitting diode for the "Talk on an Infrared Light Beam," they are obtainable from Cleveland Service District, Lamp Division, General Electric Co., 12910 Taft Avenue, Cleveland, Ohio 44108. Request an SSL-4 solid state lamp. The cost is under $10.00. (Our thanks go to G. H. of Dickinson, N. D. for the info.)

## DX for UX199

*I have an old RCA Radiola 20 which uses type UX199 tubes. Where can I get replacement tubes? Our local stores don't have them.*

—*L. J. E., Everett, Wash.*

Get information on the phone by dialing 206-MA 4-2341 or order direct by mail from Seattle Radio Supply, 2117 Second Avenue, Seattle, Wash. 98121. The Company advertises that they have lots of old tubes (199, 12A, 483, etc.) and sell them at $3.00 each.

## Achtung!

*I have seen a relatively new Grundig radio in a local drug store. The owner got it out-of-state from a fellow who needed the money. Whom can I contact to obtain Grundig sales information? I am interested in AM and FM stereo plus short wave reception.*

*—R. B. V., Montgomery, Ala.*

Write to Grundig Electronic Sales, 355 Lexington Avenue, New York City.

## Going Abroad

*In recent months I have obtained quite a few 2S transistors. I have found no reference to such types in magazines or books and would like to know if they are interchangeable with (or the same as) 2Ns. If not, please give me some information on them.*

*—D. S., Liberty, Mo.*

Get a copy of the Datadex Transistor Reference Book for $3.95 from IRC, Inc., 401 N. Broad St., Philadelphia, Pa. 19108. It lists 2S numbers and their 2N or other equivalents.

## Amateur Juvenile

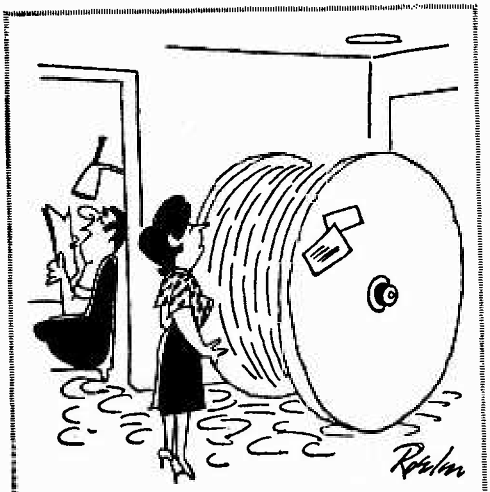
*I am not old enough to have a CB license. But I have heard that it does not matter what your age is for ham license. Is this true?*

*—D. L. S., Brookfield, Mo.*

Wish I had your problem. Yes, it's true. *If* you can pass the test. Start studying.

## Back to School

*I know next to nothing about radio or electronics, but would like to learn. I saw an ad in your magazine on kits. Would I be able to gain enough basic knowledge from assembling these*




"A cable from Uncle Willie? I didn't know he went abroad!"

*kits to go on to more advanced projects, or would I be better off to start out some other way?*

—*S. G. K., Wichita, Kansas*

Building kits is a good way to get some practical experience. But, take a home-study course or go to a resident school to learn theory and to get guidance. There's nothing like school for learning.

## Museum Piece

*I recently acquired an old Burndept SW/BCB receiver and a set of 26 plug-in coils. It will cover 11.8 to 520 meters, but it uses three Burndept Super-Valves in place of tubes. I wonder if you could tell me its age and approximate value. It works and is in fairly good condition.*

—*F. W., Kamloops, B.C.*

The Super-Valves are undoubtedly tubes with a glamorous name. Vintage should be around 1929; value about one buck. The Edison Museum in Greenfield Village, Dearborn, Michigan, would probably like to have it.

## Way Out

*I need some advice about protecting my short-wave antenna from lightning. I have been told to use a lightning arrestor. I have also been told not to use one, because it could very well attract lightning. What should I do?*

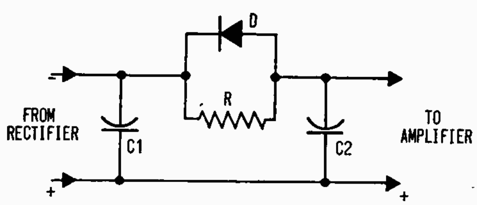
—*C. L., Fredericksburg, Va.*

Use a lightning arrestor. But install it properly, or you'll be exactly where you started, with no protection at all.

## Do Hum In

*Between musical passages there is an annoying hum in the speaker which is fed by a transistorized amplifier employing a Class B output stage. I don't notice the hum when music is played. How can I stop the hum?*

—*D. E. R., Holywood, Calif.*




You might try adding additional power supply filtering by adding capacitor C2, diode D and resistor R, as shown in the diagram. Capacitor C1 is the existing output filter capacitor. When there is no audio signal going through the amplifier, power supply current is low, the diode does not conduct, and filter section R/C2 reduces power supply ripple. When power supply current rises, the diode conducts, shorting R, and allowing heavy current to flow with a voltage drop of less than a volt across the diode.

Connect a DC voltmeter across D and try various values of R (during no-signal condition) so that the diode will not be forward-biased and therefore conduct. For C2, use a high value electrolytic. If ungrounded output is positive instead of negative, reverse the polarity of the diode and of C2.

## Socket to Me

*I read somewhere that it is possible to pep up a receiver by replacing the RF amplifier with a tube of higher gain. I decided to do this with my Lafayette HA-63. I replaced the 6BA6 with a 6GM6 (making all socket changes). Now my "S" meter no longer works, there's no increase in sensitivity, but there is some distortion. Can you tell me what I did wrong and possibly how to correct it.*

—*P. A. J., Maspeth, N.Y.*

The two tubes have somewhat different characteristics. Make sure you wired socket terminals 2 and 7 together! In general, it's better not to tamper with a receiver. The man who designed it obviously had good reasons for selecting the tubes he did; there is only a small difference in price between these two types. Gain is usually dependent on overall circuit design and the parameters given in tube manuals should not be taken too literally.

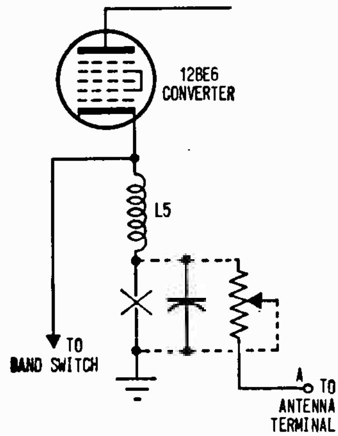
## Long Story on Long Wire

*I am using a Hallicrafters S-120 to listen to the BCB. Sensitivity on the BCB is good with just the ferrite bar antenna. However, being a DX hound, I would like to use a better an-*


"I rather fight than switch!"

*tenna like the 75-foot long wire in my attic which I use for SW. This is my problem. How do I go about coupling the antenna to the S-120? I've tried connecting it to the antenna terminal on the back, but the results were very poor. The antenna boosted signals, but I got hets, a high-pitched tone, and strong locals all over the band. Also, when I tune in a strong local (on the right frequency) the audio is very distorted. Connecting the antenna to the ferrite bar antenna netted me the same results. How can I couple the antenna to the S-120 so that it works for BCB? Also, how can I eliminate the ferrite bar antenna completely, and just use the antenna?*

—*W. W., Chicago, Ill.*




Your receiver's schematic diagram shows that when an external antenna is connected to the antenna terminal the long wire ant signal is fed to a tap on the internal ferrite antenna, which is as it should be. In Chicago, in the proximity of lots of high power radio signals, you can expect the problems you encountered. There's just too much signal being pumped into the receiver input. You could try adding a manual RF gain/level control, as shown in the simplified diagram. Break the circuit at "X" and connect a 5000-ohm pot and an 0.1 μF capacitor as shown by dotted lines.

## He Gets the Image

*My small, portable eight-transistor radio picks up CW signals on 930 kHz and at about 690 kHz when I'm at Newport Beach. With my communications receiver operating in the 200-400 kHz band, I hear CW signals exactly the same as on the BCB except that they are much stronger. Could you please explain this?*

—*L. C. Tucson, Ariz.*

It could be that the signals from the CW station are being heterodyned with a signal from a strong BCB station. For example, if a CW signal on 290 kHz beats with a BCB station on 640 kHz their sum frequency would be 930 kHz. You would hear the CW signal as an *audio* tone since the sum frequency and the carrier of the BCB station on 930 kHz would not be exactly the same. Also, the 290-kHz signal beating with a 980-kHz BCB signal would produce a beat at 690 kHz.

These may no be the actual conditions that existed when you heard the CW signals, but the principles are the same. The CW signals could have come from a beacon, Naval, or commercial shore station, or from a nearby ship.

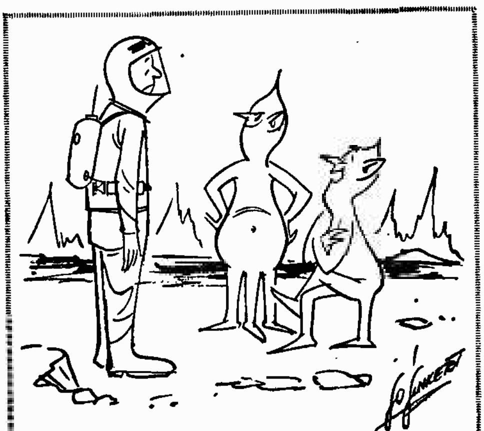
These signals will produce a beat if the first stage of your receiver is non-linear—which would be the case if it has no RF stage ahead of it. If it has one, the RF stage could be overloading or be biased improperly for linear operation.

### Cheapy Q Checker

*The only test equipment I have is a VOM. How can I test the transistors in my radio with it?*

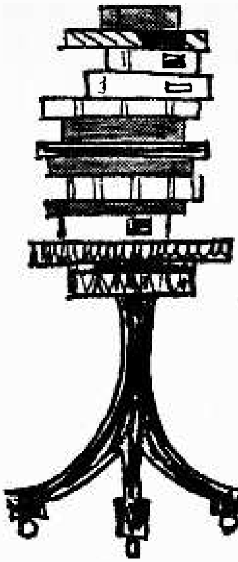
—*T. J., Duluth, Minn.*

Connect the negative lead of the VOM (set to measure DC volts) to the collector of a pnp transistor and the positive lead to its emitter. If it is an npn transistor, the VOM leads should be just the reverse. Finally, use a clip lead and short the base to the emitter. If the voltage increases, the transistor is active and you're in business. But, let's be honest—you need a transistor tester.



"Actually it's very practical!"

# LITERATURE



## ELECTRONIC PARTS

★**2.** Now, get the all-new 512-page, fully illustrated *Lafayette Radio* 1969 catalog. Discover the latest in CB gear, test equipment, ham gear, tools, books, hi-fi components and gifts. Do it now!

★**5.** *Edmund Scientific's* new catalog contains over 4000 products that embrace many interests and fields. It's a 148-page buyers' guide for Science Fair fans.

★**4.** *Olson's* catalog is a multi-colored newspaper that's packed with more bargains than a phone book has names. Don't believe us? Get a copy.

★**1.** *Allied's* catalog is so widely used as a reference book that it's regarded as a standard by people in the electronics industry. Don't *you* have the 1969 *Allied Radio* catalog? The surprising thing is that it's free!

★**7.** Before you build from scratch, check the *Fair Radio Sales* latest catalog for electronic gear that can be modified to your needs. *Fair* way to save cash.

**8.** Get it now! *John Meshna, Jr.'s* new 96-page catalog is jam packed with surplus buys—surplus radios, new parts, computer parts, etc.

★**140.** How cheap is cheap? Well, take a gander at *Cornell Electronics'* latest catalog. It's packed with bargains like 6W4, 12AX7, 5U4, etc., tubes for only 33¢. You've got to see this one to believe it!

★**135.** Get with ICs! *RCA's* new integrated Circuit Experimenter's Kit KD2112 is the first of its kind and should be a part of your next project. Get all the facts direct from *RCA*. Circle 135.

**106.** With 70 million TV and 240 million radios somebody somewhere will need a vacuum tube replacement at the rate of one a second! Get *Universal Tube Co.'s* Troubleshooting Chart and facts on their $1.50 flat rate per tube.

**10.** *Burstein-Applebee* offers a new giant catalog containing 100s of big pages crammed with savings including hundreds of bargains on hi-fi kits, power tools, tubes, and parts.

★**11.** Now available from *EDI (Electronic Distributors, Inc.):* a catalog containing hundreds of electronic items. *EDI* will be happy to place you on their mailing list.

★**6.** Bargains galore, that's what's in store! *Poly-Paks Co.* will send you their latest 8-page flyer chock-full of *Poly-Paks'* new $1.00 electronic and scientific "blis-dor" paks and equipment.

**23.** No electronics bargain hunter should be caught without the 1969 copy of *Radio Shack's* catalog. Some equipment and kit offers are so low, they look like misprints. Buying is believing.

## CB—AMATEUR RADIO SHORTWAVE RADIO

**102.** No never mind what brand your CB set is. *Sentry* has the crystal you need. Same goes for ham rigs. Seeing is believing, so get *Sentry's* catalog today. Circle 102.

**146.** It may be the *first—Gilfer's* speciality catalog catering to the SWL. Books, rigs, what-nots—everything you need for your listening post. Go *Gilfer*, circle 146!

**100.** You can get increased CB range and clarity using the "Cobra-23" transceiver with speech compressor—receiver sensitivity is excellent. Catalog sheet will be mailed by *B&K Division of Dynascan Corporation.*

**141.** Newly-designed CB antenna catalog by *Antenna Specialists* has been sectionalized to facilitate the picking of an antenna or accessory from a handy index system. Man, *Antenna Specialists* makes the pickin' easy.

**130.** Bone up on the CB with the latest *Sams* books. Titles range from "ABC's of CB Radio" to "99 Ways to Improve your CB Radio." So Circle 130 and get the facts from *Sams.*

**107.** Want a deluxe CB base station? Then get the specs on *Tram's* all new Titan II—it's the SSB/AM rig you've been waiting for!

**96.** Get your copy of *E. F. Johnson's* new booklet, "Can *Johnson* 2-Way Radio Help Me?" Aimed for business use, the booklet is useful to everyone.

**129.** Boy, oh boy—if you want to read about a flock of CB winners, get your hands on *Lafayette's* new 1969 catalog. *Lafayette* has CB sets for all pocketbooks.

**46.** Pick up *Hallicrafters'* new four-page illustrated brochure describing Hallicrafters' line of monitor receivers —police, fire, ambulance, emergency, weather, business radio, all yours at the flip of a dial.

**116.** Pep-up your CB rig's performance with *Turner's* M+2 mobile microphone. Get complete spec sheets and data on other *Turner* mikes.

**48.** *Hy-Gain's* new CB antenna catalog is packed full of useful information and product data that every CBer should know. Get a copy.

**111.** Get the scoop on *Versa-Tronics'* Versa-Tenna with instant magnetic mounting. Antenna models available for CBers, hams and mobile units from 27 MHz to 1000 MHz.

**45.** CBers, Hams, SWLs—get your copy of *World Radio Labs'* 1969 catalog. If you're a wireless nut or experimenter, you'll take to this catalog.

★**101.** If it's a CB product, chances are *International Crystal* has it listed in their colorful catalog. Whether kit or wired, accessory or test gear, this CB-oriented company can be relied on to fill the bill.

**103.** *Squires-Sanders* would like you to know about their CB transceivers, the "23'er" and the new "SS5." Also, CB accessories that add versatility to their 5-watters.

## TOOLS

★**78.** *Xcelite's* midget hex socket screwdrivers in *Xcelite's* PS-89 set let you make delicate adjustments easier. "Piggyback" handle adds grip, reach, and power needed for other jobs.

**118.** Secure coax cables, speaker wires, phone wires, etc., with *Arrow* staple gun tackers. 3 models for wires and cables from 3/16" to 1/2" dia. Get fact-full Arrow literature.

## ELECTRONIC PRODUCTS

**143.** Bring new life to your hobby. Exciting plans for new projects—let Electronics Hobby Shop give you the dope. Circle 143, now.

★**44.** Kit builder? Like wired products? *EICO's* 1969 catalog takes care of both breeds of buyers. 32 pages full of hi-fi, test, CB, ham, SWL, automotive and hobby kits and products —do you have a copy?

★**42.** Here's colorful 116 page catalog containing a wide assortment of electronic kits. You'll find something for any interest, any budget. And *Heath Co.* will happily send you a copy.

**144.** Hear today the organ with the "Sound-of-Tomorrow," the Melo-Sonic by *Whippany Electronics.* It's portable—take it anywhere. Send for pics and descriptive literature.

**12.** *C. B. Hanson* new Automatic Control records both sides of a telephone call automatically—turns off automatically, too! Get all the details —today!

**126.** Did you dig *Delta's* new literature package chucked full of pics and

# LIBRARY...

★ Starred items indicate advertisers in this issue. Consult their ads for additional information and specifications.

specs on such goodies as an FET-VOM, SCR ignition system, computerized auto tach, hi-voltage analyzer, etc.? Man, then let *Delta* know you're alive! Circle 126 now!

**109.** *Seco* offers a line of specialized and standard test equipment that's ideal for the home experimenter and pro. Get specs and prices today.

**9.** Troubleshooting without test gear? Get with it—let Accurate Instrument clue you in on some great buys. Why do without?

**145.** *Alco Electronic Products* has 28 circuit ideas using their remote control relay. Get 100-and-one odd jobs done at home without calling an electrician. Get all the facts today!

### SCHOOLS AND EDUCATIONAL

**★136.** You can become an electrical engineer *only* if you take the first step. Circle 136 and *ICS* will send you their free illustrated catalog describing 17 special programs. *ICS* also has practical electrical courses that'll increase your income.

**★74.** Get two free books—"How to Get a Commercial FCC License" and "How to Succeed in Electronics"—from *Cleveland Institute of Electronics.* Begin your future today!

**★3.** Get all the facts on *Progressive Edu-Kits* Home Radio Course. Build 20 radios and electronic circuits; parts, tools and instructions come with course.

**142.** *Radio-Television Training of America* prepares you for a career—not a job. 16 big kits help you learn as you build. 120 lessons. Get all the facts today!

**114.** Prepare for tomorrow by studying at home with *Technical Training International.* Get the facts today on how you can step up in your present job.

**137.** For success in communications, broadcasting and electronics get your First Class FCC license and *Grantham School of Electronics* will show you how. Interesting booklets are yours for the asking.

### HI-FI/AUDIO

**104.** You can't hear FM stereo unless your FM antenna can pull 'em in. Learn more and discover what's available from *Finco's* 6-pages "Third Dimensional Sound."

**119.** *Kenwood* puts it right on the line. The all-new *Kenwood* FM-stereo receivers are described in a colorful 16-page booklet complete with easy-to-read-and-compare spec data. Get your copy today!

**30.** *Shure's* business is hi-fi — cartridges, tone arms, and headphone amps. Make it your business to know *Shure!*

**17.** Mikes, speakers, amps, receivers—you name it, *Electro-Voice* makes it and makes it good. Get the straight poop from *E-V* today.

**99.** Get the inside info on why *Koss/Acoustech's* solid-state amplifiers are the rage of the experts. Colorful brochure answers all your questions.

**26.** The all new, lavishly-illustrated, full-color brochure, "At Home With Stereo" clues you in on *H.H. Scott's* 1969 stereo consoles. Discover how to pick a hi-fi console for your living room.

### TAPE RECORDERS AND TAPE

**14.** You just gotta get *Craig's* new pocket-size, full-color folder illustrating what's new in home tape recorders—reel-to-reel, cartridge and cassette, you name it! It looks like a who's who for the tape industry.

**123.** Yours for the asking—*Elpa's* new "The Tape Recording Omnibook." 16 jam-packed pages on facts and tips you should know about before you buy a tape recorder.

**31.** All the facts about *Concord Electronics Corp.* tape recorders are yours for the asking in a free booklet. Portable, battery operated to four-track, fully transistorized stereos cover every recording need.

**34.** "All the Best from *Sony*" is an 8-page booklet describing *Sony-Superscope* products—tape recorders, microphones, tape and accessories. Get a copy today before you buy!

**35.** If you are a serious tape audiophile, you will be interested in the all new *Viking/Telex* line of quality tape recorders.

### TELEVISION

**70.** Need a new TV set? Then assemble a *Heath* TV kit. *Heath* has all sizes. B&W and color, portable and fixed. Why not build the next TV you watch?

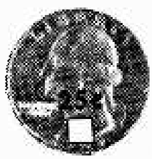
**127.** *National Schools* will help you learn all about color TV as you assemble their 25-in. color TV kit. Just one of *National's* many exciting and rewarding courses.

---

**SCIENCE AND ELECTRONICS**
**Department 1169**
**229 Park Avenue South**
**New York, N.Y. 10003**

Please arrange to have the literature whose numbers I have circled at right sent to me as soon as possible. I am enclosing 25¢ to cover handling. (No stamps, please.)

Sorry, only 20 circled items maximum.




☐ **Indicate total number of booklets requested**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 14 | 17 | 23 | 26 | 30 | 31 | 34 | 35 |
| 42 | 44 | 45 | 46 | 48 | 70 | 74 | 78 | 96 | 99 |
| 100 | 101 | 102 | 103 | 104 | 106 | 107 | 109 | 111 | 114 |
| 116 | 118 | 119 | 123 | 126 | 127 | 129 | 130 | 135 | 136 |
| 137 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | | |

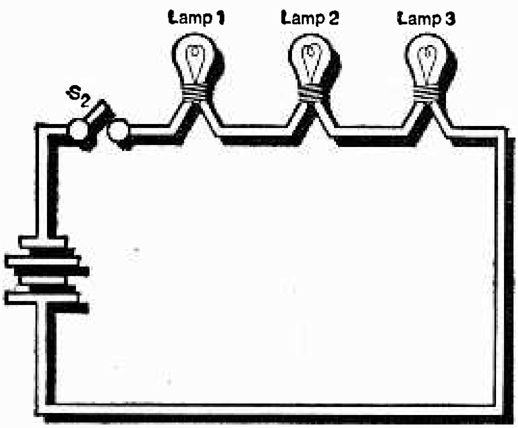
NAME____________________________

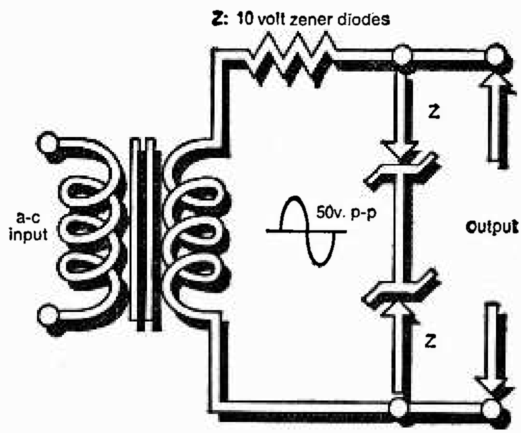
ADDRESS_________________________

CITY_____________________________

STATE________________ZIP________

# Can you solve these two basic problems in electronics?




This one is relatively simple:

**When Switch $S_2$ is closed, which lamp bulbs light up?**

Note: If you had completed only the first lesson of any of the RCA Institutes Home Study programs, you could have solved this problem.

This one's a little more difficult:

**What is the output voltage (p–p)?**

Note: If you had completed the first lesson in the new courses in Solid State Electronics, you could have easily solved this problem.

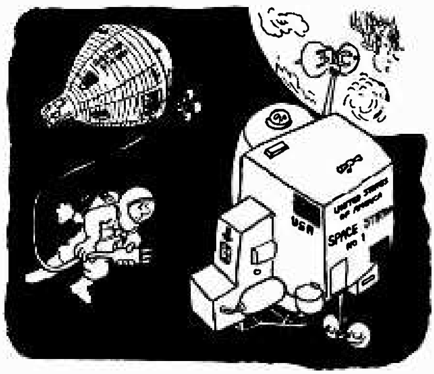
These new courses include the latest findings and techniques in this field. *Information you must have if you are to service today's expanding multitude of solid state instruments and devices used in Television, Digital, and Communications Equipment.*

**If you had completed an entire RCA Institutes Home Study Course in Semiconductor Electronics, Digital Electronics, or Solid State Electronics, you should now be qualified for a good paying position in the field you choose. Send for complete information. Take that first essential step now by mailing the attached card.**

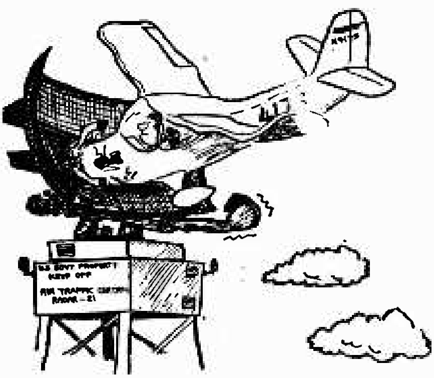
ANSWERS: Problem 1—they all light up
Problem 2—20 Volts (p–p)

# the PRECISION APPROACH

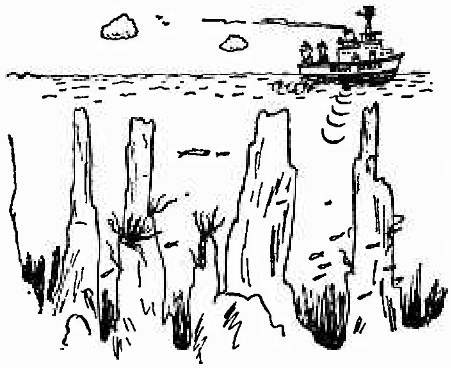
by Jack Schmidt

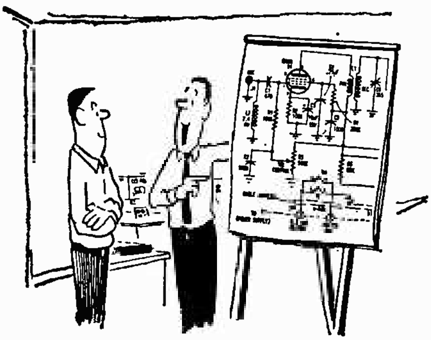



"Roger, 4175, it is confirmed . . .
. . . . we have you in radar contact!"

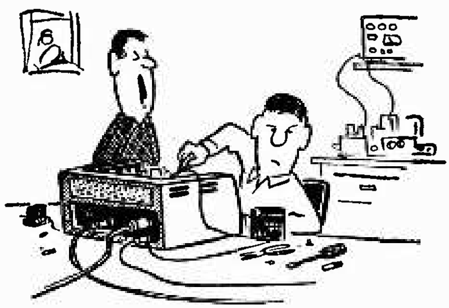



"Our pulsing sonar shows it to be over 80 feet deep along here."





". . . thereby turning off the light when the closet door is closed!"



". . . adjust to 3147.42 kHz, or give the chassis a rap with a hammer!"

Science and Electronics
OCTOBER-NOVEMBER 1969

# LIGHT POWERS THIS LIQUID SEMICONDUCTOR!

**Some copper, some lead, some water, a spoonful of chemical, and you've made a PHOTOCELL!**

FOR THE PAST few years, solid state electronics have become commonplace. However, back in the Roaring 20s, before the transistor, pioneers in electronics experimented with many unusual devices. One of the most interesting devices of this period was the liquid photocell, an inexpensive, easily made photovoltaic cell housed in a glass jar containing copper and

by Charles Green, W6FFQ

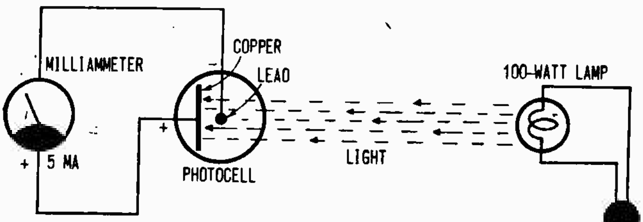
# Liquid Semiconductor

lead electrodes and a liquid electrolyte, lead nitrate.

A thin coating of copper oxide on the copper electrode acts as the photosensitive element. You can experiment with the liquid photocell by building this liquid semiconductor described in the article and in the accompanying drawing and photos. Also included are plans for a variable sensitivity meter module that can be used to test DC current output of the liquid photocell.

**How It Works.** When radiant energy, in the form of visible light, strikes a suitably prepared metallic substance, electrons are emitted. In the absence of light, the copper and lead electrodes of this photocell have a small potential difference, as does an electrochemical battery with no load applied. When a load is connected to the electrodes, a small DC current flows from the photocell. The amount of DC current is determined by the internal resistance between the copper and lead electrodes through the electrolyte.

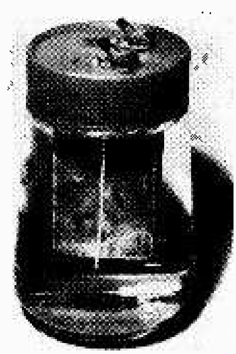
This internal resistance varies with the condition of the copper oxide coating on the copper electrode, which is the photoelectric sensitive surface. When light strikes the copper oxide, electrons are emitted, and the internal resistance of the photocell is changed. This causes a larger DC current to flow out of the photocell into the load. The amount of light controls the DC current output; the more light, the more current output from the photocell.

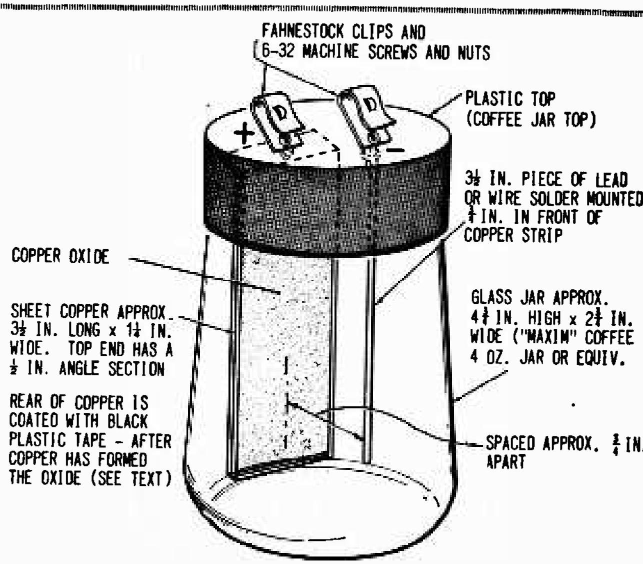


LIQUID PHOTOCELL OPERATION

**Liquid photocell produces output of several milliamperes proportional to intensity of light shining on it (the more light, the more current). Cell can be rejuvenated by renewing cuprous oxide on the copper surface.**

**Construction.** You will need sheet copper, a strip of lead or lead solder, and a glass jar approximately 4¾-in. high with a 2¾-in. diameter (we used a "Maxim" instant coffee 4-oz. jar). The size of the jar





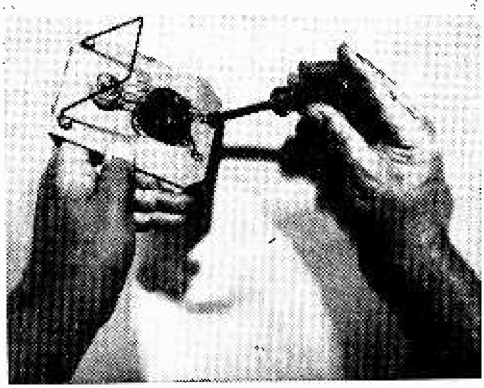

**Details of cell's construction appear in drawing (right) and photo (above). We used plastic cap supplied with Maxim coffee jar to insulate electrodes. Be sure to cover rear of copper electrode with plastic tape after oxide forms.**

is not critical, but the jar must be made of clear glass and should have a plastic lid, or you will have to make a wooden or plastic lid to fit. The copper sheet may be difficult to obtain. We cut and flattened a length of ½-in. copper tubing for our model.

Begin construction by cutting a 4-in. x 1¼-in. piece of sheet copper. Bend one end to form a right angle ½-in. wide, and drill a hole to clear a 6-32 machine screw in the center, as shown in the drawing. Before the copper strip can be used, a coating of cuprous oxide must be formed on it to serve as the sensitive surface. Hold the sheet by the ½-in. angled section with a large pair of pliers and heat the copper strip evenly in the flame of a gas stove or a torch. Hold the strip well inside the flame, so it does not become covered with soot. Heat the copper until it becomes uniformly dark, then remove the strip from the flame and allow it to cool. Do not let the surface touch anything.

The black surface of the copper strip is cupric oxide. Just below the cupric oxide is a thin layer of cuprous oxide—actually the photosensitive oxide. After the copper strip has cooled, place it in a jar filled with pure household ammonia. Cap the jar and allow the copper strip to soak until most of the black oxide is off. Cuprous oxide has a red color, but because the layer is so thin it may be difficult to see. Also, the ammonia develops a bluish tint from the dissolved copper oxide; therefore, don't wait until all of the black oxide is off, as the inner layer of cuprous oxide may also start to dissolve. Remove the copper from the ammonia and wash it in water to remove the ammonia. (Hold it by the angle.)

While the copper strip is soaking, drill the plastic cap of the jar and mount a length of wire solder (preferably not cored) or a thin strip of pure lead to a Fahnestock clip fastened to the lid as shown in the drawing. Cut the lead electrode to a length of 3½-in. After the copper strip has been washed,



**Both meter and shunt potentiometer are mounted on fiberboard panel. Supporting bracket is formed from wire coat hanger.**


**Completed meter panel rests at convenient angle on supporting bracket. Pair of Fahnestock clips mounted at top serve as terminals.**

**BILL OF MATERIALS FOR LIQUID SEMICONDUCTOR**

J1, J2—Fahnestock clips (Lafayette 32T7601 or equiv.)
R1—1500-ohm potentiometer
1—4 x 5-in. sheet of fiberboard
1—Glass jar (see text)
1—1¼ x 3½-in. sheet of copper (see text)
1—3½-in.-long piece of lead solder or lead strip (see text)
1—0-1 mA milliameter (Lafayette 99T5052 or equiv.) or 0-5 mA milliameter (Lafayette 99T5053 or equiv.)
Misc.—Screws and nuts, black plastic tape, wire coathanger, hookup wire, etc.

**Bill of Materials above specifies either 0-1 or 0-5 mA milliammeter, since actual value isn't critical. Idea here is to let you use whatever is most readily available. As explained in text, 100-watt lamp is required to calibrate meter.**

# Liquid Semiconductor

mount it approximately ¾-in. away from the solder as shown in the drawing. Do not touch the photosensitive surface with your fingers.

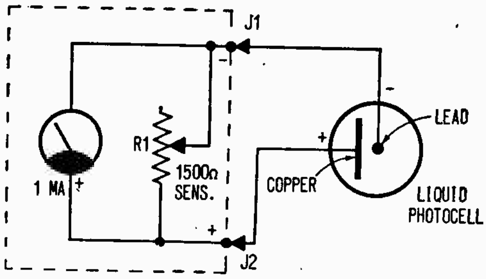
Cover the rear of the copper strip with black plastic tape so that light will strike only the surface facing the lead electrode and the light source.

Fill the jar with water to just below the plastic top, making certain that the water level is below the end of the machine screws holding the electrodes to the jar cover. Dissolve one teaspoon of lead nitrate in the water. Note: all lead compounds are poisonous, therefore thoroughly wash your hands and all items that were in contact with the lead nitrate. Lead nitrate can be obtained from a chemical supply or student science store. After the lead nitrate is dissolved, screw on the plastic cap and electrode assembly. The water should be clear. If, because of chemical treatment of your local water, it does not remain clear after adding the lead nitrate, you may have to use distilled water to mix with the lead nitrate electrolyte.

**The Photocell Meter.** The liquid photocell has a low impedance output; therefore, it requires a low resistance meter for accurate readings. A 5-mA milliammeter should be used to indicate the change in the DC current output. A VOM with an equivalent 5-mA range usually has a higher internal resistance and will not indicate as well as the individual meter.

Our meter module unit contains a 1-mA meter movement with a variable sensitivity control connected in parallel with the meter (see the drawing). We built our module on a 4 x 5-in. piece of fiberboard. Coathanger wire is bent into a support bracket and is bolted to the bottom of the fiberboard as shown in the photo.

Connect a 5-mA milliammeter or the meter module, to the photocell terminals as shown in the drawing. The copper electrode is connected to the meter plus terminal and the lead one is connected to the meter negative terminal. There may be a high current output from the photocell momentarily. If so, short out the photocell terminals (or turn the meter module sensitivity control to minimum resistance) until this output current drops.



METER ASSY. WITH R1 SENSITIVITY CONTROL

**Potentiometer R1 is shunt to adjust range of 0-1 mA meter. It is best viewed as a sensitivity control allowing a wide range of readings.**

The photocell has to be aged with the meter connected, until the dark current (DC current output with no light) is from 0.3 to 0.5 mA. This aging may take anywhere from several minutes to an hour, depending upon the quality of the cuprous oxide layer on the copper electrode.

**Testing the Photocell.** Place a 100-watt lamp near the photocell on the side near the lead electrode. Turn the lamp on and observe that the photocell DC current output increases. Adjust the meter module sensitivity control as necessary for an indication. The amount of current increase will depend on the quality of the cuprous oxide layer formed on the copper electrode. Our unit had a 2 mA increase.

Experiment with various lamps of different wattages, as well as with fluorescent lamps. Also test the photocell in sunlight. Make a chart of the photocell DC output current readings obtained with the lamp at different distances from the cell.

The liquid photocell has a definite life span. As it is used, you will notice that the copper electrode becomes darker and the DC current output from the light source diminishes gradually. This occurs because lead is gradually being deposited on the copper strip through internal electrochemical activity.

When the DC current output becomes too low, remove the copper electrode from the photocell, clean the surface with sandpaper, and then reheat the copper strip to form a new oxide coating, as previously described in the construction of the photocell. Remove the oxide from the copper with ammonia, wash and replace the copper electrode in the photocell. In this way the photocell will have an indefinite life just by renewing the coating on the copper strip. ■

COVER STORY


Now! Control exposure time, development time, any darkroom function with our

# UNIVERSAL DARKROOM TIMER

by Ron Michaels

In addition to the purest of chemicals and water, what's the most important factor influencing photographic processes—whether involving films or prints and most decidedly in the case of color? Timing, of course! Accurate, repeatable timing is a must in the darkroom if you want to produce consistently good work.

Our Universal Darkroom Timer provides both accuracy and repeatability over a wide range. This solid-state timer can control exposure time as well as development time at the flick of a switch. In addition to calling

# Universal Darkroom Timer

it a *Universal Timer,* we should also refer to it as a *Custom Designed Timer.* Reason is that with the exchange of just a few critical components the timing cycle ranges can be tailored to fit your particular darkroom needs.

For example, we prefer never to expose print paper for more than seven seconds when using the enlarger—that's the maximum exposure time in the process we use. Also, we never keep negatives in their developing solutions for more than seven minutes. Since these two ranges represent the maximum timing cycles we use, we selected the components that produce these ranges for our timer. The Timing Table included with this article gives the proper values of the key components for several other timing ranges.

**How It Works.** A full-wave silicon controlled rectifier (SCR) switching circuit is the heart of our timer. When the SCR turns *on* (allows current flow to pass through), AC current can flow through the bridge rectifier (Q2) and the load, or whatever is plugged into the output sockets. When the SCR is turned *off* the bridge acts like an open switch and no current flows through the load. The balance of the circuit is an unique biasing arrangement that adapts the switching circuit to function as two different timers.

Key point to remember in the following circuit description is that the SCR remains

### TIMING TABLE

**A—For enlarger timing of 0-7 seconds and process timing of 0-7 minutes**

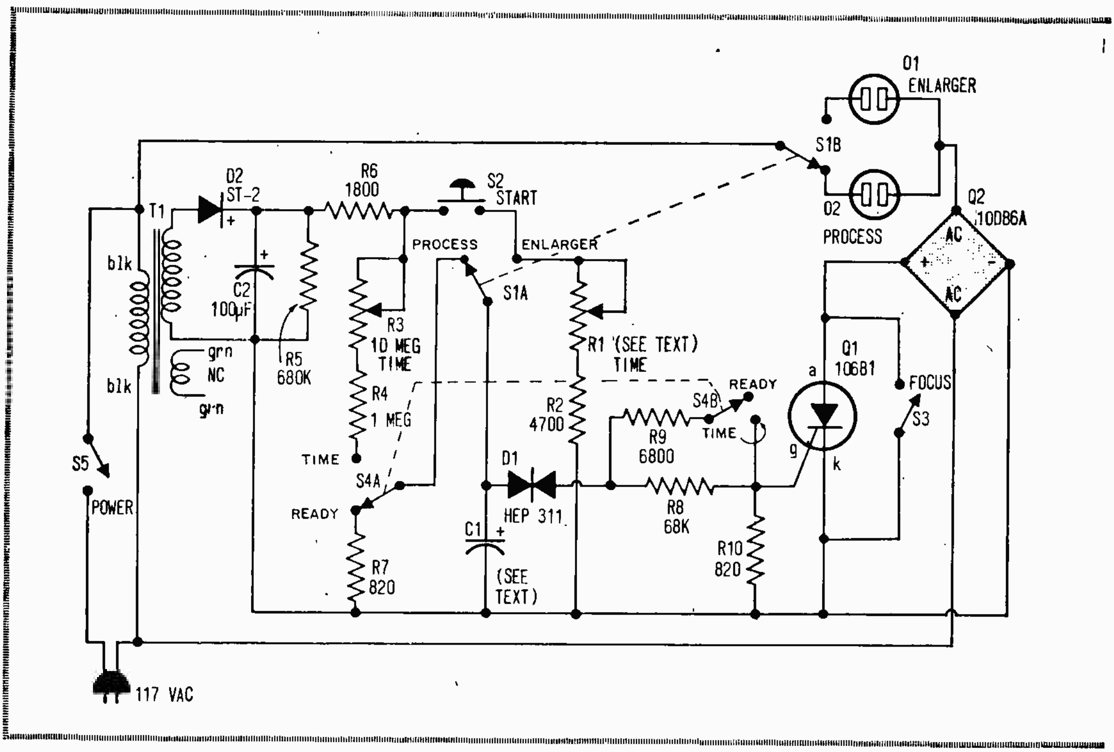
R1—50,000-ohm potentiometer
R3—10-megohm potentiometer
C1—200-uF, 350-V electrolytic capacitor

**B—For enlarger timing of 0-10 seconds and process timing of 0-10 minutes**

R1—50,000-ohm potentiometer
R3—10-megohm potentiometer
C1—300-uF, 350-V electrolytic capacitor

**C—For enlarger timing of 0-15 seconds and process timing of 0-15 minutes**

R1—100,000-ohm potentiometer
R3—10-megohm potentiometer
C1—400-uF, 350-V electrolytic capacitor

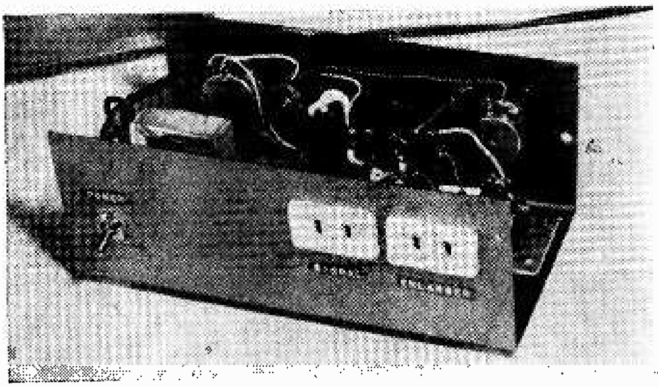


*on* (and the bridge conducts) whenever a current of more than 200 microamps (1/5 of a milliamp) is fed into the *gate* terminal.

**The Enlarger Timer.** The desired operation is that the enlarger lamp will turn *on* at the touch of a button, remain *on* for a present time period, then will turn *off* automatically. The desired time period is selected by an adjustable control (R1). When function switch S1 is placed in the ENLARGER position, the timing circuitry for this function is actuated. This is a very straightforward operation.

When pushbutton switch S2 is depressed, timing capacitor C1 is charged to approximately 200 VDC. Instantly this voltage sends a substantial amount of current into the *gate* terminal of the SCR, turning it *on* and thus permitting rectifier bridge current to flow through the load. Switch S1 is a double pole unit; one section is used to select one of the two convenience outlets to be connected to the timer switching circuit. When S1 is placed in the ENLARGER position, outlet "O1", labeled ENLARGER, is connected. This is the outlet the Enlarger's power cord is plugged into.

The SCR remains *on* as long as the gate



Rear view of timer assembly showing locations of two outlets where power cords for audible indicator for both process timer and enlarger are plugged in. Right-hand outlet is connected to short duration timing circuit for enlarging; left-hand outlet is connected to long duration timing circuit for processing. Bell or buzzer is powered through latter outlet.

## PARTS LIST FOR UNIVERSAL DARKROOM TIMER

C1—Electrolytic capacitor, 350 volt rating, 200 uF (for 0-7 sec timing) (Cornell Dubilier BR200-350 or equiv.); 300 uF (for 0-10 sec. timing) (Cornell Dubilier BR300-350 or equiv.); 400 uF (for 0-15 sec. timing) (Cornell Dubilier BR400-350 or equiv.)
C2—100 uF, 250 volt electrolytic capacitor (Cornell Dubilier BR100-250 or equiv.)
D1—Silicon, bilateral trigger diode (Motorola HEP 311)
D2—Diac trigger diode (GE ST-2)
O1, O2—Panel mounting AC socket (Allied 47F0830 or equiv.)
Q1—Silicon controlled rectifier (SCR) (GE 106B1)
Q2—Bridge rectifier (International Rectifier 10DB6A)
R1—Potentiometer, 50,000 ohm for 0-7 sec. and 0-10 sec. timing (Allied 46E5314 or equiv.); 100,000 ohm for 0-15 sec. timing (Allied 46E5317 or equiv.)
R2—4700-ohm, ½-watt resistor
R3—10-megohm potentiometer (IRC-CTS D106 with shaft 18 or equiv.)
R4—1-megohm, ½-watt resistor
R5—680,000-ohm, ½-watt resistor
R6—1,800-ohm, ½-watt resistor
R7—820-ohm, ½-watt resistor
R8—68,000-ohm, ½-watt resistor
R9—6,800-ohm, ½-watt resistor
R10—820-ohm, ½-watt resistor
S1, S4—Dpdt toggle switch (Allied 56F3867 or equiv.)
S2—Spst, normally open pushbutton switch (Allied 56F4947 or equiv.)
S3, S5—Spst toggle switch (56F3869 or equiv.)
T1—Power transformer, 117 volt pri.; 125 volt, 0.15 mA sec. and 6.3 volt, 1 amp. sec. (not used) (Allied 54F4163 or equiv.)
1—8 x 5 x 3-in. sloping-front cabinet (Allied 42F8686 or equiv.)
1—Terminal tie strip (Allied 47F2917 or equiv.)
Misc.—Hardware, wire, solder, cement, fiberglass tape, labels, etc.

Schematic detailing Universal Darkroom Timer. Note that text and schematic refer to a position of S4 as "Ready" whereas in the photo this position is marked "Reset." These designations are interchangeable, so mark your timer as you want.

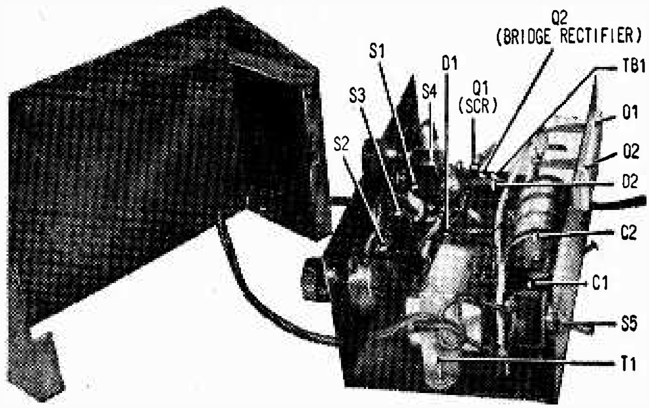
# Universal Darkroom Timer

current flow continues. However, the combined current drain of the SCR and the adjustable shunt resistance, consisting of R1 in series with R2, rapidly discharges timing capacitor C1. The exact time of discharge is dependent on the setting of R1. Within a few seconds C1's voltage falls below the breakdown voltage of trigger diode D1

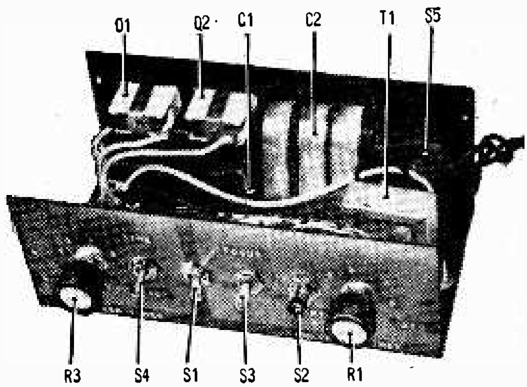
it into wall outlet. When S3 is placed in FOCUS position, the enlarger lamp is turned *on* and remains *on* until S3 is placed in the *off* position, where it must remain whenever using the timer to time an operation.

**The Process Timer.** For this function the timing cycle is of much longer duration (several minutes), and the timer should sound a signal at the end of the present timing interval. When S1 is placed in the PROCESS position, a biasing circuit is activated that is virtually the opposite of the circuit for the ENLARGER timing just described.

The PROCESS timing operation is controlled by toggle switch S4. With S4 in the




**Timer assembly with cover of cabinet removed to show mounting of components on "U" shaped section of cabinet. This becomes front panel, bottom, and rear panel of timer cabinet assembly. All controls except for power switch S5 are mounted on front panel (power switch was placed on rear panel to simplify wiring). Even if timer should inadvertently be left turned on for long periods of time no harm will result. Nor will your power bill zoom, as timer requires little power.**




**View shows front panel and interior layout of timer assembly. Notice how C1 and C2 are taped together and cemented in position on rear panel. With exception of variable resistors, all semiconductors and resistors are placed on an insulated tie strip, to which tie strip terminals have been staked. Strip is mounted adjacent to power transformer on bottom of cabinet and raised by spacers to prevent shorting out circuitry.**

(about 30 V) and the diode blocks any further flow of current into the gate of the SCR.

Pushing S2 a second time recharges C1 and recycles the timing circuit. Toggle switch S3 has been added as a bypass switch to enable focusing the enlarger without having to disconnect it from the timer and plug

READY position, capacitor C1 is kept fully discharged and the SCR is kept turned *off*. Therefore, no current can flow through the load (in this case some type of 117-volt operated signal device—a bell, horn, or buzzer). When S4 is switched to its TIME position, capacitor C1 is connected to the 200-volt DC supply through a high value resistance chain composed of potentiometer R3 in series with R4.

Because of its high capacity, and this resistance chain, C1 charges very slowly, and, after several minutes (the exact time is dependent on the setting of R3), the voltage across capacitor C1 reaches the breakdown voltage of diode D1. Instantly the capacitor begins to discharge through the SCR gate, turning the SCR *on* and allowing current to flow through the load, which in this operation is the signaling device.

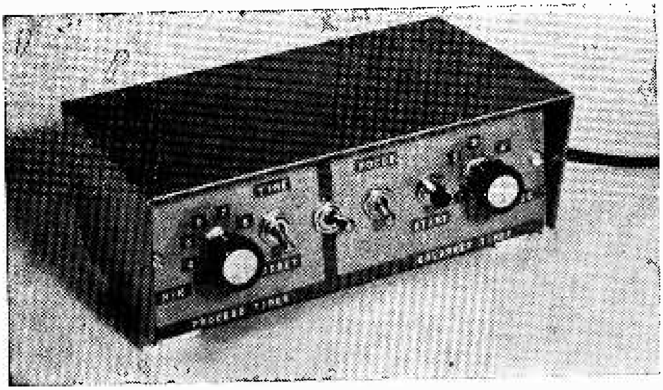
With S1 in the PROCESS position, outlet "O2" is activated through the timer. However, after about 5 seconds, C1's voltage falls below the critical diode breakdown potential, current flow stops, the SCR is turned *off,* and the signaling device stops sounding. The capacitor then again begins building up to the breakdown potential, at which point the signal device would again be activated. However, the person using the timer would normally interrupt the cycle as soon as the signal is first sounded. Used in this manner our circuit behaves in much the same way as an electrical or mechanically driven clock.

**Building the Timer.** We housed our timer in an aluminum cabinet having a cowl front. Our reason for using this type of cabinet is that the overhang, or cowl avoids accidental operation of the controls in the darkroom. The unit has been well designed and packs a lot of circuitry into a small space. Even so, there is ample room to easily wire the components if you follow our layout as shown in the photos.

All of the resistors, the bridge rectifier, the SCR, and diode D1 are mounted on a phenolic board containing staked terminals, which, in turn, is mounted in the center of the cabinet's base next to the power transformer. All other controls except for power switch S5 are mounted on the front panel. The two convenience outlets and the power switch are mounted on the rear of the cabinet.

The two electrolytic capacitors, C1 and C2, are first taped together with fiberglass binding tape and then cemented to the inside surface of the rear of the cabinet. Before fastening the tie strip to the cabinet base, mount all of the components mentioned above to it.

The timer draws so little current in standby condition that no harm would result from leaving the power *on* when the unit was not being used. Therefore, to facilitate the parts layout and the wiring, the power switch was mounted on the rear panel.



**Finished product is very professional looking timing device that is of inestimable value in any darkroom, be it for professional or amateur photographers. It combines facilities to time development of film and/or paper as well as exposure timing for the enlarger. Incorporating silicon controlled rectifier and sophisticated timing approach, unit provides two different timing ranges economically by sharing common components.**

**Calibrating the Timer.** Once the proper timing ranges have been chosen, and the components specified in the Timing Table have been wired in the circuit, calibration points can be marked on the panel adjacent to the knobs for R1 and R3. The exact locations of the marks are determined by checking the timing of *on* status with a stopwatch at each of the timing periods desired to meet your particular darkroom process.

Because many of the components in the circuitry are common to both timing operations there is some interaction between the two adjustable controls. For this reason it is important that S4 be kept in the READY position whenever using the unit as an enlarger timer.

Our Universal Timer has an advantage over commercial units. Should you change your photo processing procedures, which may require a change in timing, this can be easily done by exchanging a few parts. ■

# Did you know that...

. . . clouds of nitrogen dioxide were recently studied remotely by a team of Canadian scientists? Working under an HEW contract and using a unique, telescopic, gas-analyzing spectrometer, Toronto's Barringer Research Inc. was able to perform quantitative chemical analyses of polluted air over the Los Angeles basin without making physical contact with the material under study.

. . . new ICs help put market transactions on brokers' desks? Developed by Trans-Lux Corporation, the new Vidi-Quote records current stock-exchange information in binary code, then converts it to alpha-numeric characters which are displayed on a compact TV monitor. Its ICs are by Texas Instruments.

. . . FM radios alert emergency personnel in an unusual use of a CATV system? Cablevision of Virginia, the firm responsible for the community-minded hookup, speeds emergency squad members to disaster scenes by sending distress calls over its CATV system. A Jerrold-operated company, Cablevision devised the hookup to supplement the klaxon atop the courthouse in Clifton Forge, Va. Results are swifter and surer rescues.

# PENNY PINCHER'S POLICE CONVERTOR

**New adventures in fuzz snooping for six bucks! !**

by Allen James

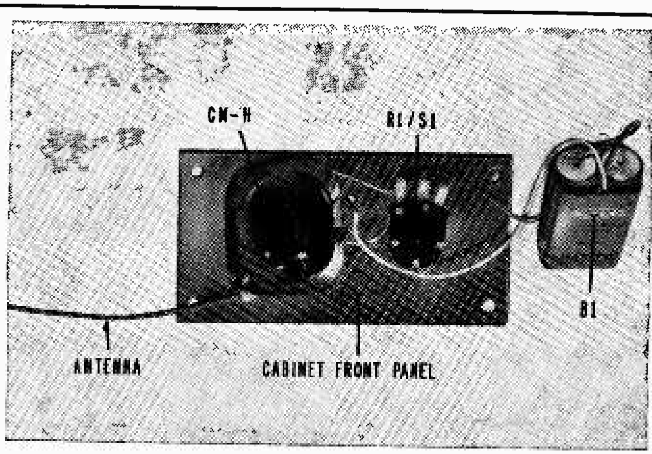
**If you don't live** so far away from a police or fire transmitter that a strong wind is needed to blow the signal out to you, you can throw together a six-buck vhf converter for listening to these calls in less time than it takes a soldering iron to heat up. By the time the iron is hot you'll have all the parts mounted and ready for final soldering.

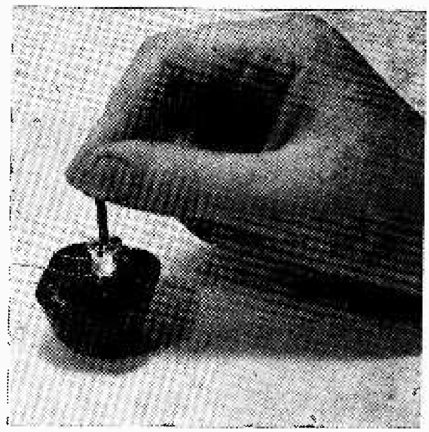
The six-buck converter uses very few parts: a 9-volt battery, a small 5-k pot with a switch and a Cordover CM-H FM Converter Module. The parts can be mounted in just about any type of housing—they can

# POLICE CONVERTOR

even be wired together without a housing. If you want to go the deluxe route, you can build the unit in a small utility box for approximately one more dollar, and include a battery connector instead of directly-wired/ soldered battery connections.

**Works With FM.** Unlike the more commonly used converters that are operated in conjunction with an AM radio as the basic module's internal oscillator to 52 MHz, the 52 MHz oscillator signal will beat with the 152 MHz received signal and will produce new signals equal to the sum and difference of the oscillator and received signals. (152 MHz + 52MHz = 204 MHz and, 152 MHz − 52 MHz = 100 MHz). These new signals appear at the module's output along with the original 152 MHz and 52 MHz signals for a total of at least four frequencies: 204 MHz, 152 MHz, 100 MHz and 52 MHz. Since the FM radio is tuned to 100 MHz, only the 100 MHz signal will be received by the FM radio and the audio output of the receiver, and since vhf police and fire signals are FM, if the CM-H converter module is used with an FM radio you will get better sensitivity.

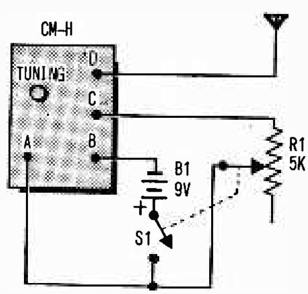


Practically any mounting arrangement will work for Police Converter, but it's best to keep leads from R1 to module as short as possible. Module (at right) is roughly size of ice cube.

Even though it's possible to receive FM signals on an AM radio by using slope detection and by tuning the AM set to the sideband of the received signal, since police and fire FM signals are narrow band FM (actually split channel), by the time these signals have passed through the slope detector there would not be much modulation left.

**How It Works.** The converter module works on the *heterodyne principle,* similar to that used in a standard BC radio. Within the module is an adjustable oscillator whose frequency is approximately 88-108 MHz removed from the frequency of the desired signal. To illustrate, let's assume the desired frequency is 152 MHz, and we want the 152 MHz signal to be received when the FM radio is tuned to 100 MHz. If we adjust the




Schematic of Penny Pincher's Police Converter is simplicity in itself. What unit lacks in sensitivity it makes up in ease of assembly and low cost.

**PARTS LIST FOR PENNY PINCHER'S POLICE CONVERTER**

B1—9-V battery (Lafayette 99T6021 or equiv.)

1—CM-H Cordover vhf police and fire converter module (Lafayette 19T5528 or equiv.)

R1—5000-ohm potentiometer with spst switch (S1) (Lafayette 32T7363 or equiv.)

Misc.—Plastic box (Lafayette 99T8078 or equiv.), hardware, hook-up wire, battery terminal (Lafayette 99T6287), metal strap to hold battery, solder, etc.

radio will be the modulation of the 152 MHz signal.

To provide for reception of various police and fire vhf channels and to ensure that the signal can be heterodyned to a quiet spot of the FM band, the internal oscillator of the module is adjustable over a very wide range, covering reception of the total 150-164 MHz band, which can be positioned on just about any part of the FM band.

Certainly for $6 one doesn't expect to obtain the most sensitive of converters. The unit we assembled was effective up to five miles away from base stations of police and fire transmitters, and reception from mobile units was limited to one or two miles, depending on the terrain.

By feeding output of the converter to an FM radio, the signal is detected by an FM detector and maximum modulation is extracted from the signal. The converter module uses a single 24-in. wire lead both as the receiving antenna and the radio coupling. The lead is clipped or connected to the antenna of the FM radio. The antenna serves both as the antenna for the module and the converter/radio coupling.

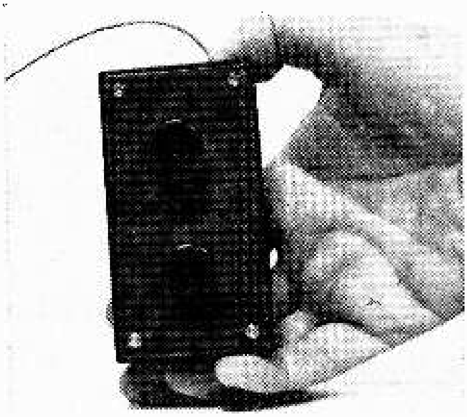
**Building the Converter.** Our converter is built on the front panel of a 4 x 2⅛ x 1⅝-in. utility case. The converter module is mounted on the front panel by pushing the module's mounting clip through a 27/64-in. or a 13/32-in. hole. Adjustment control R1/S1 should be mounted as close as possible to the module. Connections should be made directly to the module's leads; do not attempt to use terminal strips between the module's connecting leads and the external connections. Make certain all leads are kept away from the metal panel; use sleeving to make certain the splices can't touch the panel.

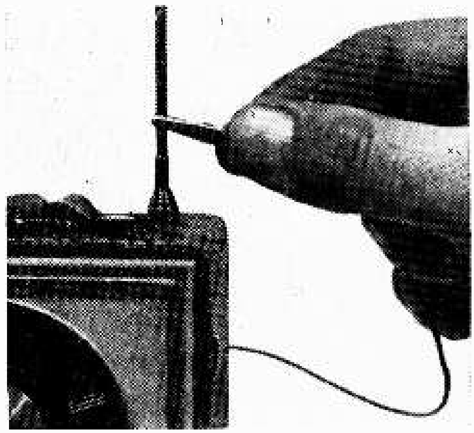
Drill a ⅛-in. hole through the top of the plastic case for the connecting lead from the module to the FM radio (24-in. length of stranded insulated wire). Pass the wire through this hole and then secure the front panel with the screws supplied. Finally, attach a small alligator clip to the radio-connecting wire.

**Aligning Converter.** Extend the whip antenna of the FM radio and clip the converter wire to any part of the FM antenna. Tune the radio to a dead spot on the band—preferably between 90 and 100 MHz. Turn on the converter by rotating R1's knob, and then very slowly, advance R1 until the background noise heard in the radio reaches a usable volume. If R1 is advanced too far the radio will block up. It will go quiet and you may hear several different FM commercial radio stations as R1 is adjusted. The correct R1 adjustment is maximum noise just before "blocking." As a double check, when R1 is correctly adjusted you will hear clicks as you touch the FM antenna.

If possible, borrow a friend's vhf FM police and fire receiver and tune in the local police or fire frequencies. When you hear a transmission in this receiver, adjust the tuning slug of the converter module until you hear the same station. If you can't borrow a receiver, you'll just have to be patient

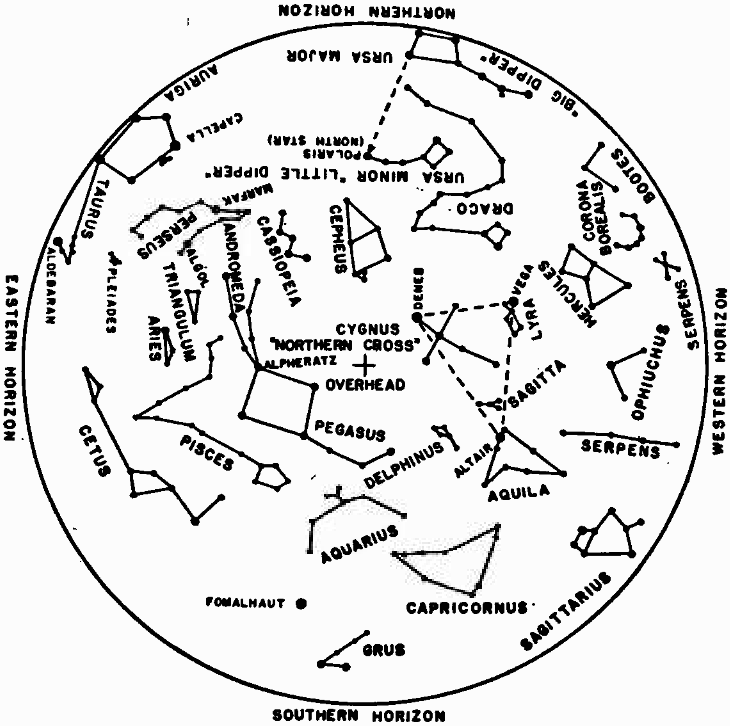
*(Continued on page 109)*





**Completed Converter mounted in plastic box sports symmetrically placed tuning and adjust controls. Converter's antenna lead is ideally clipped to whip antenna on associated FM set.**

# The Skies Above Us




by Dr. Roy K. Marshall

## The Night Sky in October

★★ A pair of 7x50 binoculars or a monocular of that size and power can be very useful in prowling along the Milky Way. (The 7 indicates the magnifying power, in diameters; the 50 tells the diameter of the front lens, in millimeters.) About November 1, the most distant object in the sky that can be seen without optical aid might be picked up with such a glass, as a smudgy, slightly elongated haze, then looked for without the glass, just so you can say that you saw light that is 2,200,000 years old!

The great galaxy in Andromeda stands almost exactly overhead at 10 p.m. on the date suggested above. It consists of about 150 billion stars arranged in a great spiral form that is so distant that light from it arriving here now left there more than two million years ago. And light, remember, travels at a speed of 186,300 miles per second.

Our sun is one of the stars in a similar galaxy, our own, whose flattened spiral shape is responsible for the appearance of the Milky Way.

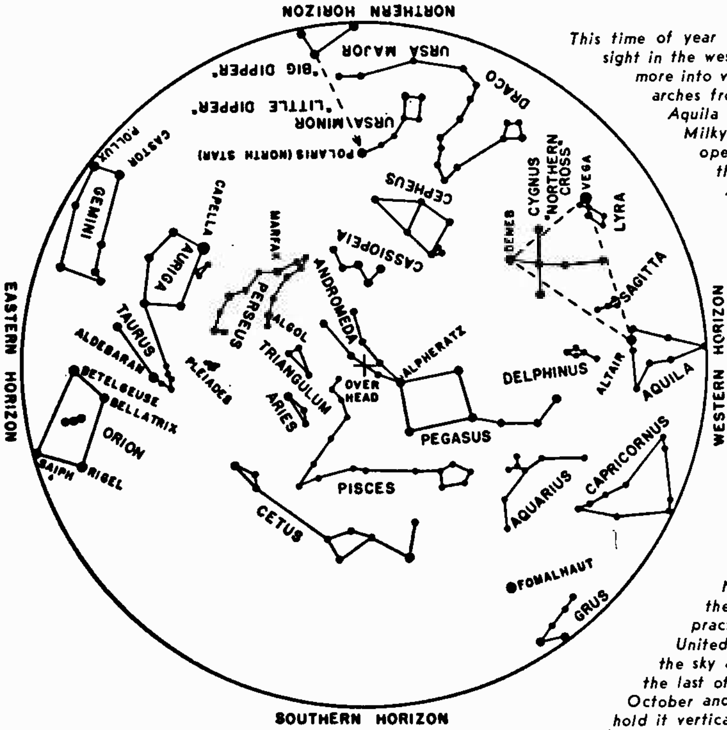
★ The galaxies are interestingly detailed objects as photographed through large telescopes, but disappointing as seen with the eye through the same instruments, because the eye takes only snapshots, while the photograph can be exposed as long as we wish, to build up the strength of the image and reveal the structural details.

Another object that is disappointing visually but shows intricate filamentary structure in photographs has recently come into astronomical news in connection with the strange, periodically pulsing sources of radio signals called "pulsars." The gaseous nebula itself has been known since 1731, when the astronomer Bevis ran across it; in a large telescope it is a hazy, elongated faint patch of light. It has been called the "Crab Nebula," from a fancied resemblance to that animal.

The gas cloud, first seen by Bevis in 1731, lies in Taurus, in our eastern sky on Nov. 1, closely south of the "A" in Taurus on our map for Nov. 1 at 10 p.m.

★ A close friend of mine among astronomers, Dr. John Charles Duncan, examined many photographs of the Crab Nebula, taken over decades at the Mount Wilson Observatory, and found that before 1926, the Crab Nebula had been expanding at such a rate that, about 900 years earlier, this cloud of gas had been all at one point.

With the cooperation of a scholar in the University of California, he discovered that, in the year 1054, Chinese and Korean as-




*This time of year sees the summer stars slipping out of sight in the west and those of the winter coming once more into view in the east. The summer Milky Way arches from the southwest, through Sagittarius, Aquila and Cygnus, then thins into the winter Milky Way and passes into Cepheus, Cassiopeia, Perseus, and finally through Auriga in the northeast. The "summer triangle" of Altair in Aquila, the Eagle, Vega in Lyra, the Lyre, and Deneb in the tail of Cygnus, the Swan, is still displayed in the west, while the Pleiades glitter above ruddy Aldebaran in the east. The golden planet Jupiter which glorifies our sky most of the summer is now lost in the sun's glare, but the other giant of the sun's family, the ringed Saturn, is now closest to us (673,000,000 miles) and is about midway between the two triangles of Cetus and Aries. Red Mars is low in the southwest, in Sagittarius. The almost first quarter moon passes south of Mars on October 17 and again on November 15, while the full moon passes north of Saturn on October 25 and again on November 21. ☆☆☆ The maps show the principal stars and planets which are above the horizon at latitude 34° North at about 9 p.m. standard time at the middle of the month. These maps are practical star location guides anywhere in the United States throughout the month showing the sky at 10 p.m. on the first and at 8 p.m. on the last of the month. To look at the night sky in October and November, select the proper map and hold it vertically. Then turn the map so that the point of the compass toward which you are facing shows at the bottom of the map. ☆☆☆ Our special thanks go to the Griffith Observatory in Los Angeles, California.*

## The Night Sky in November

tronomers had noted a very bright star in the very spot where the Crab Nebula stands today—a "guest star," which today we call a nova, or new star, which we know today is not really a new star, but one which newly calls our attention to it.

A nova is a star which generates energy so strongly that the overlying layers of the star can't hold it in, so the star literally explodes. For a few days or weeks or even months, the star may be the brightest object in the sky, until it subsides to the obscurity from which it erupted. We have records in both early and later times of many such exploding stars.

What we see when we observe the Crab Nebula in Taurus is the gaseous debris of the colossal explosion when a star literally "blew its top." The gigantic explosion occurred about 3050 years B.C., because modern measures show that the object's distance is 4100 light-years. Now, after a lapse of almost 5000 years, the Crab Nebula may be telling us something of a new state of matter.

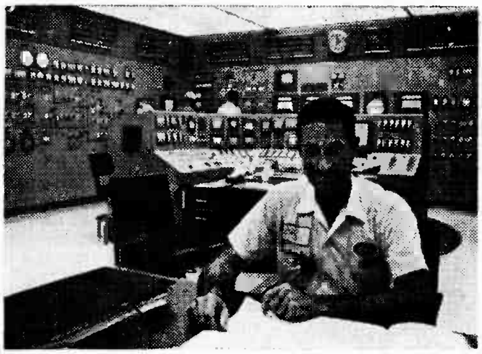
★ The great radio telescopes have been telling us that something in or near the Crab Nebula is sending us radio "beeps" at intervals of one-thirtieth of a second.

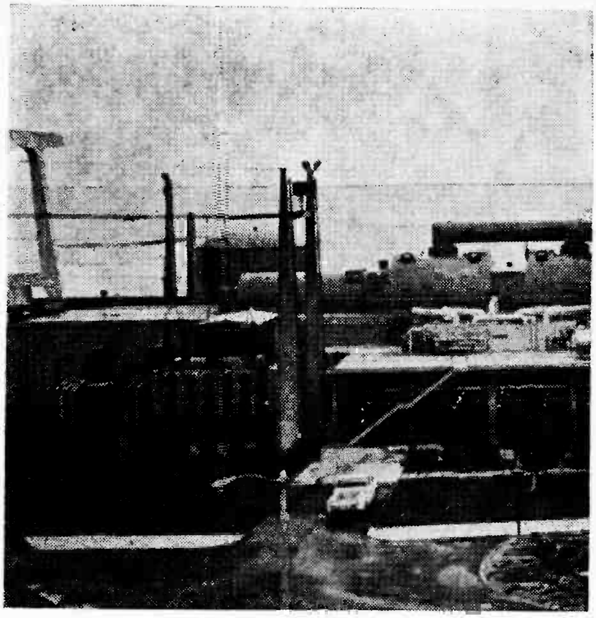
*(Continued on page 110)*

### Our new columnist Dr. Roy K. Marshall

You wouldn't think the man looking so directly at you has spent most of his life gazing at stars . . . but that's his story. From a doctorate in astrophysics at the University of Michigan through stints at various planetariums (planetaria?), Dr. Roy K. Marshall has perhaps not as many qualifications as there are stars, but enough. Dr. Marshall has been associated with the Adler Planetarium, Chicago; the Yerkes Observatory, University of Chicago; the Harvard Observatory; the Fels Planetarium, Philadelphia; Morehead Planetarium, Chapel Hill, N.C.; Odessa College Planetarium, Odessa, Texas and is currently Director of the Gibbes Planetarium, Columbia Museum of Science, Columbia, S.C. Dr. Marshall is the author of "The Nature of Things," "Sun, Moon and Planets," "Star Maps for Beginners" and "Sundials." A man for all media, Roy Marshall has been education director for the Philadelphia Inquirer radio and TV stations, science editor of the Philadelphia Evening Bulletin, columnist for SKY AND TELESCOPE magazine, and now astronomy columnist for SCIENCE AND ELECTRONICS. He is the recipient of an honorary degree from the Philadelphia College of Pharmacy and Science "for propagating the knowledge of science via writings, lecturing, planetarium work, radio and television." Let him welcome you aboard on a fascinating trip to the heavens! ■

by James Robert Squires



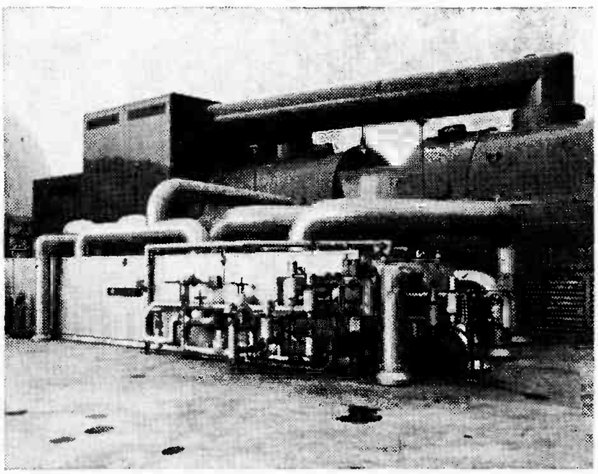


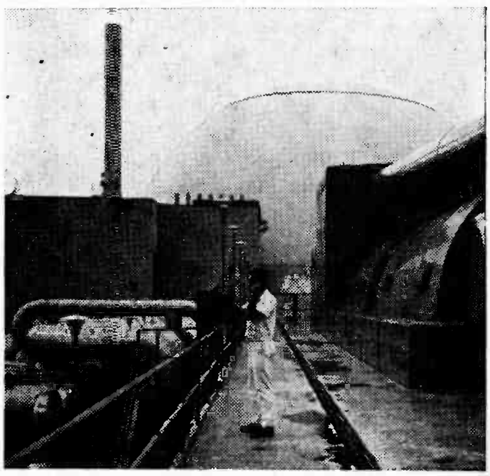
One of San Onofre's five watch engineers, Pat Riley is empowered with making go/no-go decisions in event of trouble. His job: to make sure that everything remains AOK.

# SAN ONOFRE'S

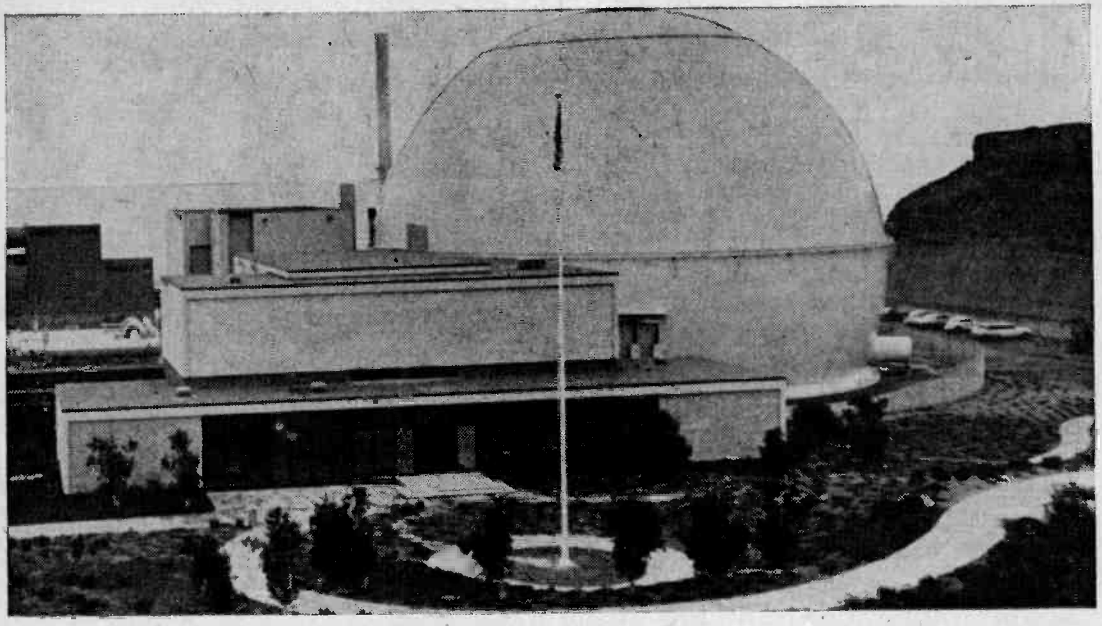
☐ Set beside the Pacific Ocean in a man-made cavity 90 ft. below the cliffs, the San Onofre nuclear-powered generating station is located roughly 60 miles south of Los Angeles. In operation since January of last year, the station is capable of generating 450 megawatts of electrical power, 80% of which is used by the Southern California Edison Company and 20% by the San Diego Gas and Electric Company, co-owners of the project.

The generating station, which is of the





Twin flash evaporators (left), powered by steam from secondary system, convert sea water into distilled water at rate of 120 gallons per minute. Water is stored in huge tanks for later use; any excess is pumped to reservoir high on cliffs for supplying domestic water needs.

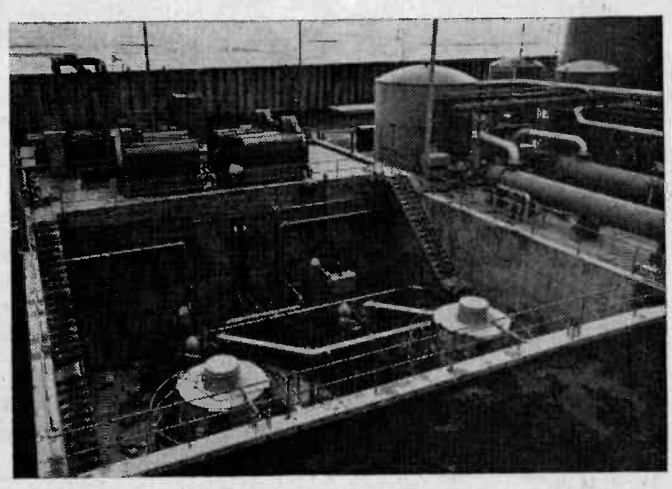


# FABULOUS 450

Overall view of San Onofre. Large sphere at right houses nuclear reactor and its associated steam generators; sphere is vented to relieve pressure in event of mishap.

pressurized water type similar to that used by nuclear submarines and surface vessels typified by the aircraft carrier *Enterprise*, has its nuclear reactor located at the bottom of the big sphere (see our photos).

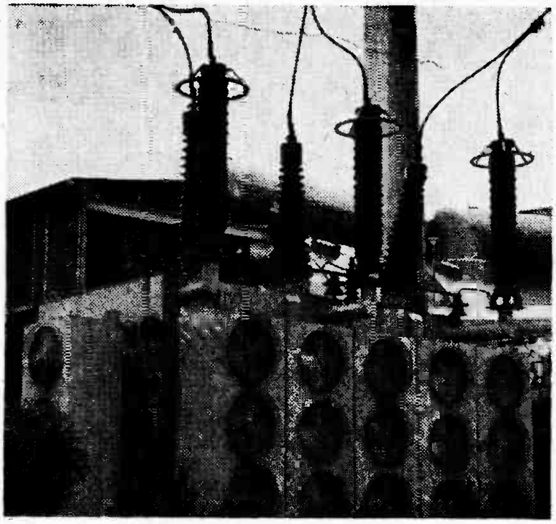
To understand how the station works, remember that whenever the pressure on a quantity of water is raised above 14.7 pounds per square inch (psi), the water will no longer boil at 212 F. Because of the 2000 psi pressure within the reactor's primary system, water doesn't even boil at the

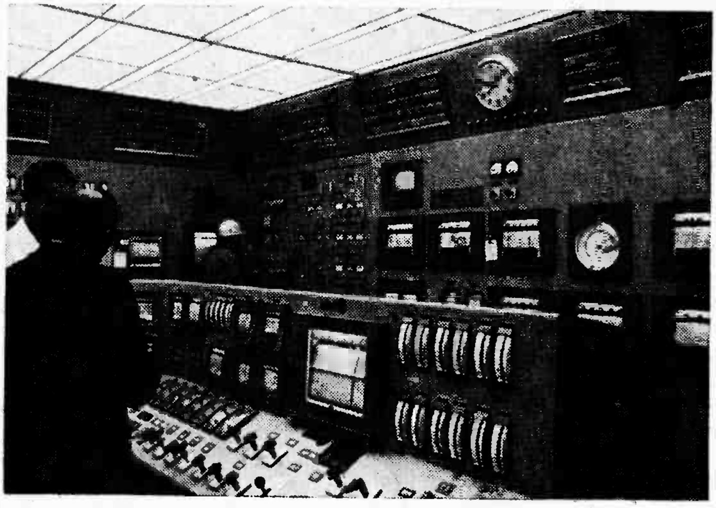


Steam generators and turbine generator (left) form secondary portion of generating setup. Though heated by nuclear energy, pressurized water serves only as means of conducting energy between reactor and steam generators. Right, sea intake and outflow pump pit.

system operating temperature of 575 F —hence the term, pressurized water reactor.

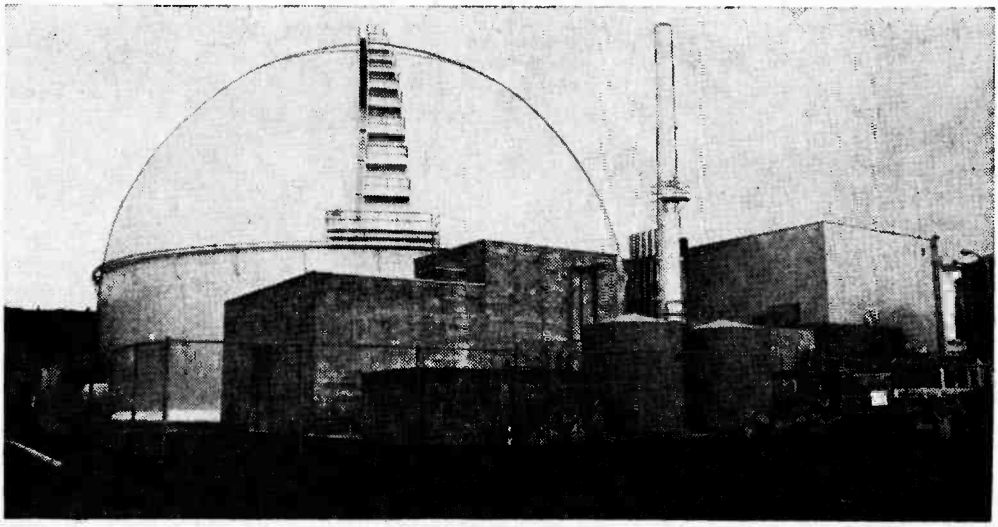
In operation, distilled water in the primary system circulates around the nuclear reactor and in doing so absorbs tremendous energies in the form of heat. This pressurized water is then forced to one of three steam generators located with the reactor inside the sphere. Steam produced by these generators is used to drive the plant's turbine-generator, thus producing electrical energy in the same manner as conventional, fossil-fueled stations. ■



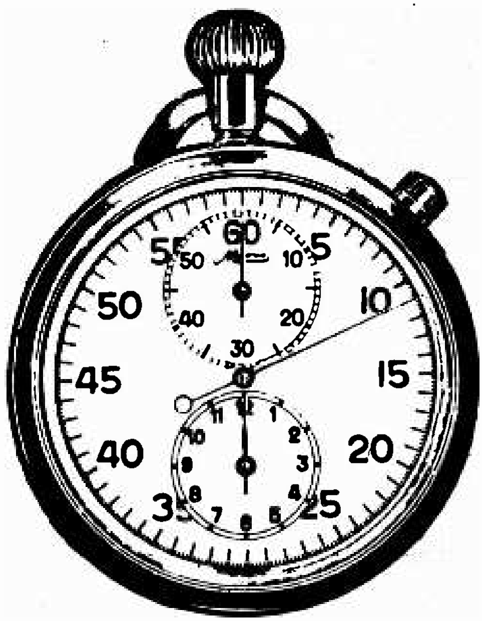


**Above, output transformer at San Onofre; below, master control room. Indicator panels continuously flash status of instruments and equipment to engineer in charge; levers control position of rods in core.**

**Structure immediately in front of sphere is waste collection building. Here, radioactive substances which cannot be otherwise disposed of are baled and pressed into cement containers.**



by Don Jensen



# Their Time Is Your Time

*A multi-million-dollar effort by many nations of the world converts your shortwave receiver into an electronic Timex!*

☐ Regularly as clockwork, the shortwave time stations split the hours into tiny fragments with their incessant electronic pulses. No music, no personalities, no entertainment, not even a newscast to break the monotony. Their programming is a bomb—a *time* bomb!

On the whole, their ticks, tones, and tech data are of interest mostly to scientific sorts who rely on their specialized services. Still, these "clock radios" offer some interesting DX to shortwave listeners.

Mention standard time stations, and most SWLs figure you're talking about the 46-year-old WWV, the National Bureau of Standards' operation at Ft. Collins, Colorado. For, truth to tell, WWV has been ticking away since 1923 (originally from Greenbelt, Maryland) on 2.5, 5, 10, 15, 20, and 25 MHz. And the more hip also know its Hawaiian counterpart, WWVH, at Puunene on Maui Island, which joined in on 5, 10, and 15 MHz in 1948. Still others are familiar with Canada's CHU, widely heard on 3.330, 7.335, and 14.670 MHz.

*(turn page)*

# Their Time Is Your Time

But there are scores of other shortwave time stations operating around the globe. They are run by astronomical observatories, private and government labs, and military commands.

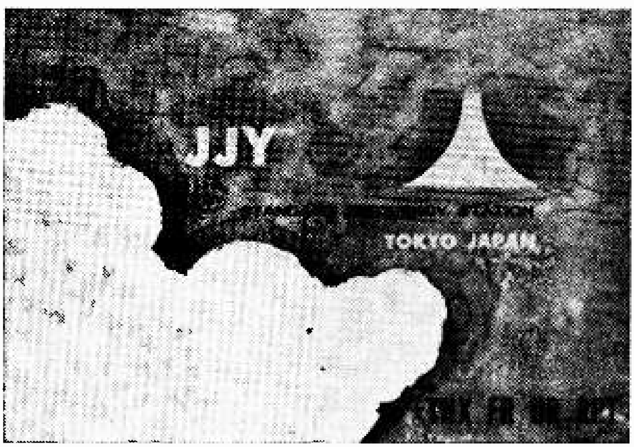
**Little-Known DX.** There are several reasons why many SWLs don't realize the DX potential of these services. Some share the standard frequencies with WWV and WWVH, which usually dominate the channels. Others have mini-skeds, transmitting just a few minutes each week. Then, too, some use off-beat wavelengths, which makes them tough to tune unless you know when and where to listen.

But when conditions are right, the foreign time-tickers can be logged during the WWV/WWVH silent periods—quarter to and quarter past the hour, respectively—or during brief pauses in their voice announcements. Sometimes, unexpectedly, alien ticking can be heard right through the U.S. time stations.

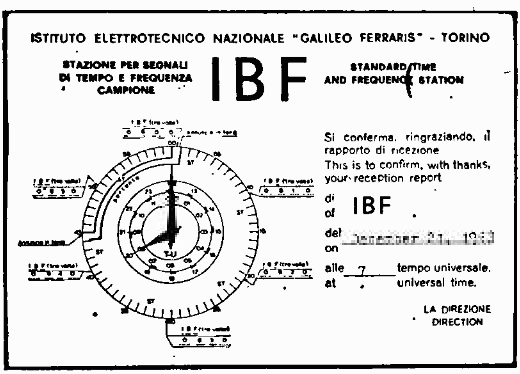
Some identify only in International Morse Code, causing problems for SWLs who can't read CW. Way to get around this is to tape the signals, then play them back at half-speed to decipher the individual di-dah combinations.

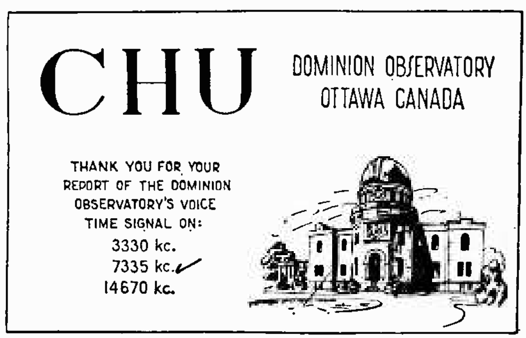
**Three On Five.** For openers, stake out 5 MHz during the early evening hours, when WWV will no doubt be pounding in. However, during the voice announcement just before each quarter hour, you may hear a CW signal in the background, tapping out the call ZUO three times. This station, one of the most frequently heard overseas standard time services, belongs to South Africa's Republic Observatory in Johannesburg. Its transmitter at Olifantsfontein sometimes puts in a surprisingly good signal for just 4 kW.

A few hours later, between 0645 and 0700 GMT, the same 5-MHz frequency has been offering the electronic time signals of IBF, the Instituto Elettrotecnico Nazionale station at Turin, Italy. At times it manages




**Putting together a QSL collection can be interesting when cards are grouped by topics—stamp collectors do this. A topical collection of time stations on six continents and Oceania set up in a nice display. For once it will be possible td show your friends the interesting world of shortwave listening. The chart at the top of the facing page tells you what will be needed in effort to get a complete set. Some of the nicer QSLs are shown on these pages — JJY-Japan, IBF-Italy, CHU-Canada, VNG-Australia. Get yours today!**



## STANDARD TIME STATIONS AROUND THE WORLD

| Country | Station | Address | Frequency (MHz) | When to Tune (GMT) |
|---|---|---|---|---|
| ARGENTINA | LOL | Observatorio Naval, Buenos Aires, Avenida Costanera Sur 2099 | 5.000 | 0000-0100 |
| AUSTRALIA | VNG | Australian Post Office, Postmaster General's Dept., 57 Bourke St., Melbourne 3000 | 7.515 | 1200-1300 |
| BRAZIL | PPE | Observatorio Nacional, Rua Gen. Bruce 586, Rio de Janeiro, GB ZC-08 | 8.721 | 0025-0030 |
| CANAL ZONE | NBA | U.S. Naval Observatory, Balboa | 5.870 | 0155-0200 |
| CEYLON | 4PB | Colombo Radio, Colombo | 8.742 | 1325-1330 |
| CHILE | CCV | Instituto Hidrografico, Casilla 324, Valparaiso | 8.205 | 0055-0100 |
| CHINA | XSG | Zikawei Observatory, Shanghai | 8.333 | 0855-0905 |
| CZECHOSLOVAKIA | OMA | Standard Frequency Station, Budecska 6, Praha 2, Vinohrady | 3.170 | Evenings |
| ENGLAND | MSF | National Physical Lab, Teddington, Middlesex | 5.000 | Evenings |
| GERMANY, EAST | DIZ | German Geodetic Institute, DDR15, Potsdam | 4.525 | Evenings |
| GUAM | NPN | U.S. Naval Observatory | 5.448.5 | 1155-1200 |
| ITALY | IBF | Instituto Elettrotecnico Nazionale, Corso Massimo d'Azeglio 42, Torino | 5.000 | 0645-0700 |
| JAPAN | JJY | Radio Research Laboratories, Koganei, Tokyo | 15.000 | 2200-2300 |
| PERU | OBC | Comunicaciones Navales Radio, Callao | 12.307 | 0055-0100 |
| SOUTH AFRICA | ZUO | Republic Observatory, Johannesburg | 5.000 | 0200-0400 |

to bull its way through the WWV transmissions, identifying both by CW and voice—in Italian, naturally.

Also noted on 5 MHz from time to time is LOL, the Argentine Naval Observatory station at Buenos Aires. It's identified by its thrice-repeated Morse call letters. Unfortunately, while the station's staff claims it wants reception reports, DXers complain that QSLs are few and far between.

Most of the stations, though, are good verifiers. One of the best—with a sharp QSL to boot—is Japan's JJY. Recently, this service of Radio Research Laboratories in Tokyo has been heard through WWV on 15 MHz during our late afternoons.

**Off-Beat Frequencies.** If you don't want to fight the QRM on the standard frequencies, switch to the time stations that use the far-out frequencies. For example, there's the German Geodetic Institute's DIZ in the East Berlin suburb of Potsdam. (Its 5-kW transmitter, on 4.525 MHz, is actually located in nearby Nauen.) No identifications here, but on this frequency it is unmistakable, particularly during the later afternoon and around midnight in the U.S.

Halfway around the world is VNG, the time station of the Australian post office in Melbourne. It identifies by voice—and in English, happily enough—on the hour only.

*(Continued on page 109)*

# You get more for your money from NRI—

## America's oldest and largest Electronic, Radio-Television home-study school

Compare. You'll find — as have so many thousands of others — NRI training can't be beat. From the delivery of your first lessons in the remarkable, new Achievement Kit, to "bite size," easily-read texts and carefully designed training equipment . . . NRI gives you more value.

Shown below is a dramatic, pictorial example of training materials in *just one* NRI Course. Everything you see below is included in low-cost NRI training. Other major NRI courses are equally complete. Text for text, kit for kit, dollar for dollar—your best home-study buy is NRI.

**APPROVED UNDER NEW GI BILL** If you served since January 31, 1955, or are in service, check GI line in postage-free card.

## GET A FASTER START WITH NRI'S NEW EXCLUSIVE ACHIEVEMENT KIT

The day your enrollment is received your Achievement Kit will be on its way to you. It contains everything you need to make an easy, fast start in the Electronics training of your choice. This attractive, new starter kit is an outstanding, logical way to introduce you to home-study the way NRI teaches it . . . backed by a dedicated staff and the personal attention you should expect of a home-study school. It is your first special training aid . . . designed to make your adventure into Electronics absorbing, meaningful. Your Achievement Kit contains your first group of lesson texts; rich vinyl desk folder to hold study material; the industry's most complete Radio-TV Electronics Dictionary; valuable reference texts; lesson answer sheets; envelopes; pencils, pen; engineer's ruler—even postage. No other school has anything like it.

## LEARNING BECOMES AN ABSORBING ADVENTURE WITH NRI TRAINING KITS

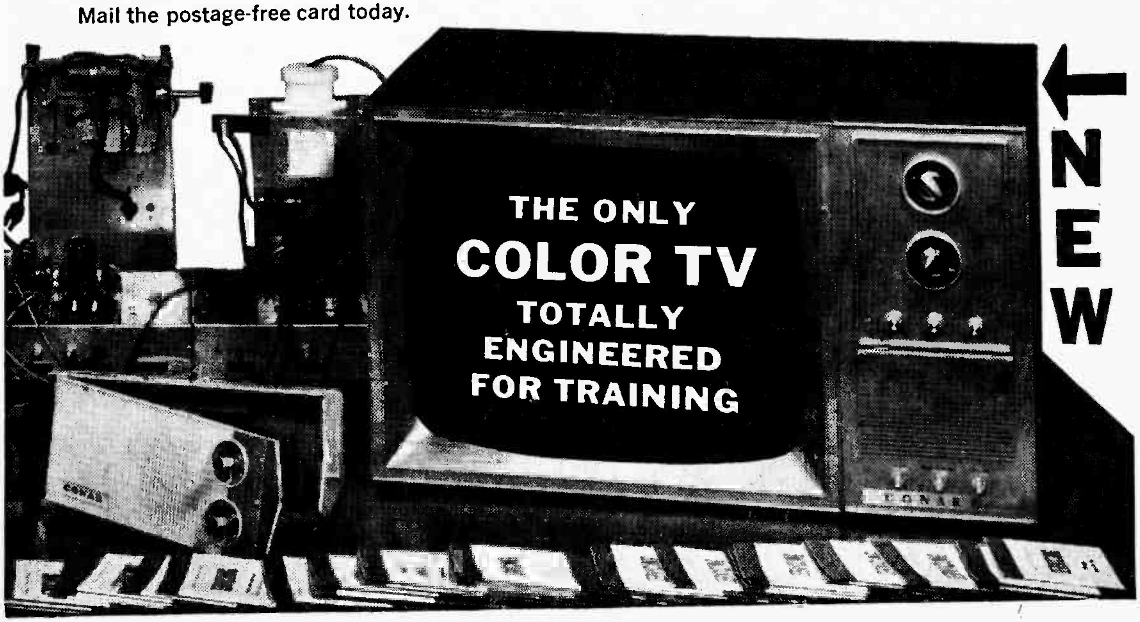
What better way to learn than by doing? NRI pioneered and perfected the "home lab" technique of learning at home in your spare time. You get your hands on actual parts and use them to build, experiment, explore, discover. Electronics come alive! NRI invites comparison with training equipment offered by any other school. Begin NOW this exciting, practical program. It's the best way to understand the skills of the finest technicians—and make their techniques your own. Whatever your reason for wanting to increase your knowledge of Electronics . . . whatever your field of interest . . . whatever your education . . . there's an NRI instruction plan for you, at low tuition rates to fit your budget. Get all the facts about NRI training plans, NRI training equipment. Fill in and mail the attached postage-free card today.

NATIONAL RADIO INSTITUTE, Washington, D.C. 20016.

OVER 50 YEARS LEADERSHIP IN ELECTRONICS TRAINING

Accredited by the Accrediting Commission of the National Home Study Council

**BUILD-TEST-EXPLORE-DISCOVER.** All this is yours — from Achievement Kit to the only Color TV specifically designed for training — when you enroll for NRI's TV-Radio Servicing course. Other courses are equally complete. But NRI training is more than kits and "bite-size" texts. It's also personal services which have made NRI a 50 year leader in the home-study field. Mail the postage-free card today.



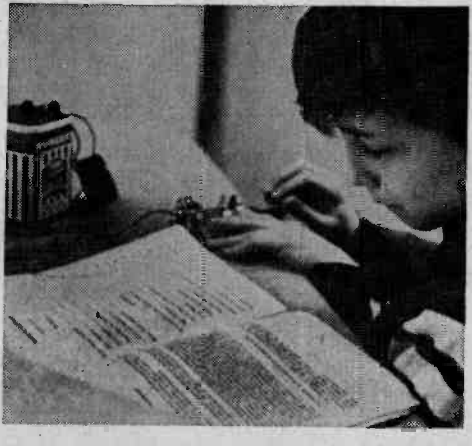
**Code practice occupies sizable portion of Saturday morning sessions. Informal gatherings normally begin with Joe tapping telegrapher's key while boys jot down letters they hear. To earn FCC Novice license, boys must pass test showing they can send and receive code at 5 wpm.**

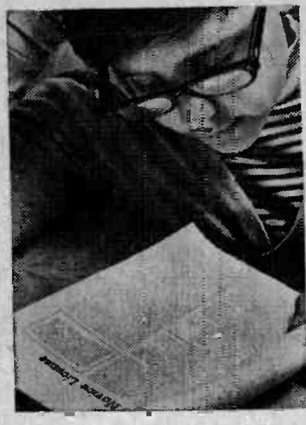
# Saturday Morning

**Keen ears pick out coded letters as slow but steady di-dahs issue from oscillator. Once code has been memorized, boys begin pounding out their own messages (photos at right).**

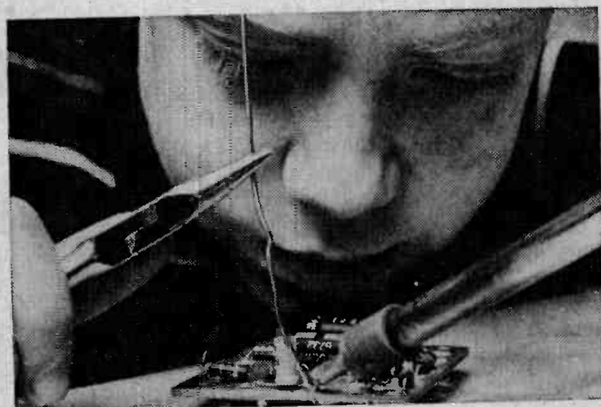
☐ This is the world of diodes . . . transistors . . . toroids. It's a maze of tiny electronic components . . . of wire and perf boards . . . of telegraphers' keys . . . 9-volt batteries and soldering guns.

This is Joseph R. Wasserman's 90-minute Saturday morning world spent with a dozen or more (depending on the vagaries of weather, homework, and colds) wide-eyed





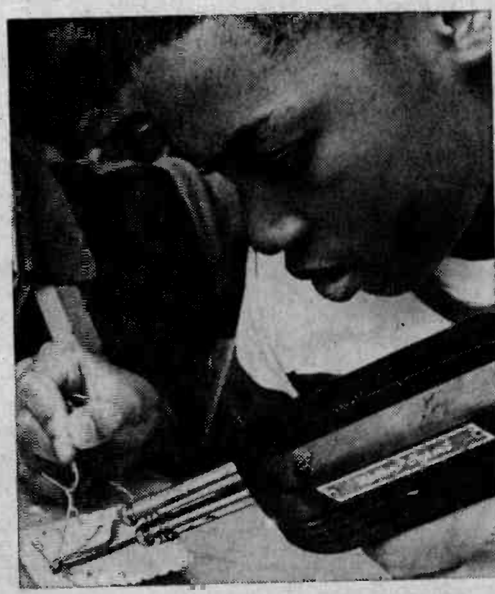
Concentration is a must when it comes to absorbing cold facts. Boy at left is poring over ARRL's License Manual which lists 50 sample questions and answers would-be Novice may face during his exam.



# Ham-in

and quick-to-learn kids from suburban Philadelphia. It's a 90-minute world that has a way of stopping the clock, for those 90 minutes more often than not somehow stretch into two or more hours.

Joe is a school psychologist (Monday to Friday) with the Upper Darby School System (adjacent in Delaware County, Pa.) and a ham radio buff of long standing. And



Soldering is yet another skill successfully acquired by members of Joe's Saturday Morning Ham-in. Friendly word from Joe encourages do-it-yourselfer to develop sure, light touch.

# Saturday Morning Ham-in

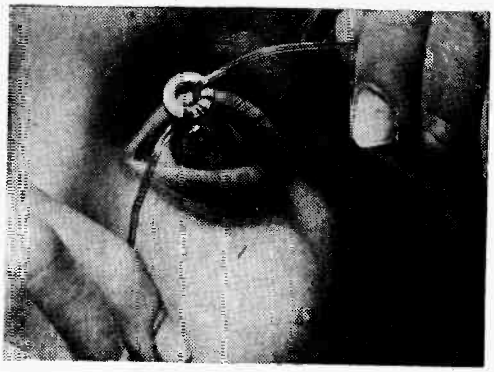
he has some provocative theories about education as well as a mutual love for his hobby and "his boys."

"These kids," he says, "are 10, 11, and 12. Just look at what they can learn about electronics, about circuitry and radio theory once a week in this room. I believe we can teach children more detailed, more difficult, and certainly more useful material of all kinds at earlier ages."

The LaMott Community Center in Cheltenham Township, Montgomery County, Pa., began sponsoring Joe's class last fall. The youngsters learn the International Morse Code, prepare to take the Federal Communications Commission's Novice License test, and are building their own transistorized receivers.

Just to keep spirits high and to show his Saturday morning Marconis what they may strive to achieve, Joe brings his own transmitter and receiver. The boys have listened in while ham operators around the world have carried on contacts across the poles and over the seas.

The talk from Texas, California, Alaska, the U.S.S.R., England, even Nairobi is frequently technical. But Joe's boys understand. Not all, to be sure. But more and more each week. —*Joe Gronk*



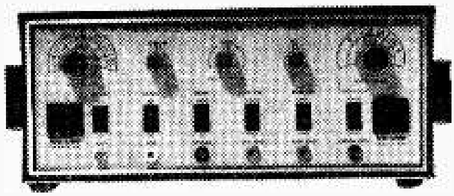
**Two toroids are required for receivers boys are building, and they wind them themselves. Below, boy samples signals from Joe's rig.**

**Thrilled with romance of communicating with earth's four corners, boys cluster around Joe's transmitter and receiver. Often, they too manage to take part in exciting world of DX action.**

# Science and Electronics LAB CHECK

## HEATHKIT MODEL IG-28

## All-IC Color Bar and Dot Generator



☐ Just as with one of the airlines' claims, there's a "something extra" with the Heathkit Color Bar and Dot Generator. In this instance that something is extra features hung on a standard color generator. What they do is make it a lot easier to align a TV for darn good color quality; you might say they're akin to the fine tuning adjustments common to lab-grade service equipment.

The IG-28 is all solid-state, using the latest in computer type design to obtain the necessary waveforms. Thing is, the step counters and adjustable dividers generally associated with color generators normally require at least an oscilloscope for proper generator alignment. With the IG-28, however, integrated circuit flip-flops and gates mean that you build it and it works.

Except for the non-critical circuits, such as the RF oscillators and modulator, the IG-28 is all-IC, with printed circuits for everything except the front-panel controls. Since the ICs are essentially direct coupled through the printed foils, should any problems arise you simply plug in a new IC (all ICs use sockets).

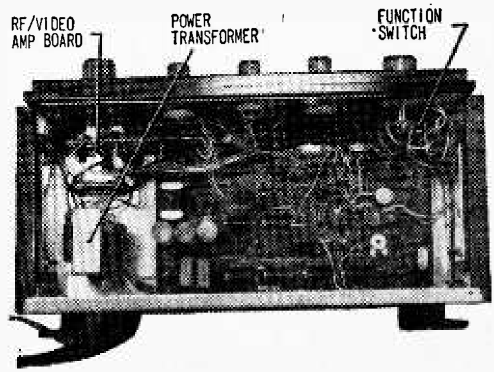
Even the RF oscillator is made trouble-free through use of a printed "tank coil." Rather than rely on the usual type of wire coil, which can be damaged, the IG-28's oscillator coil is part of the printed foil on the RF printed circuit board. And though it appears to be a "wavy foil," it's actually a coil.

**Features, Features.** The IG-28 provides the usual color generator patterns: dots, cross hatch, horizontal lines, vertical lines, and color bar. What's more, it also provides for purity adjustment, a "plaid" gray scale, and a 3x3 divide for the vertical and horizontal lines.

In addition to the tunable RF output covering channels 2 through 6 (with an associated level control), there is a video signal output with level control, a 4.5-MHz sound carrier output, a sync take-off on the front panel, and the usual "gun killer" switches. Since some of these features are totally new to some of you we'll take time out to explain.

If you look at a color bar pattern on a black-and-white TV, or a color receiver with the color turned *off*, the color bars appear as shades of gray. Now picture many of these shades of gray running both vertically and horizontally so they form a "plaid" pattern of gray scale covering the entire CRT.

When a color set is properly adjusted (using the test procedure given in the Heath manual), the color gun levels are such that no color tinting occurs on the "plaid" pattern. In short, it makes it easy to adjust the TV so black and white reproduces as black




**Large printed-circuit board in IG-28 contains all electronics except RF oscillator and video output amplifier. All pulse circuits are IC self-locking flip-flops or gates, and all ICs plug into sockets for quick and easy servicing.**

and white—not B & W with a smidgen of color.

A 3x3 divider does what it says—it divides the number of vertical and horizontal lines by three, so that only three H and V lines (rather than 8 to 10) appear on the CRT. The intersection of the two center lines represents "dead center" on the CRT, and the reduced number of lines is often much easier to use for centering linearity, and dynamic convergence adjustments.

**Attached gun killer cables have insulation-piercing alligator clips that stab through insulation, making contact but not injuring wires to CRT color grids.**

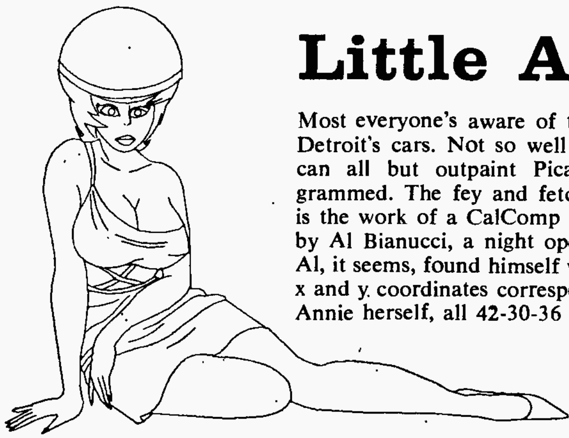
A 4.5-MHz sound carrier is also just what it says—a sound carrier for adjustment of sound traps. It also aids in correct frequency adjustment of the color bar generator. The sound carrier beats with the color carrier in the TV set to produce a herringbone pattern in the color bars. When the receiver is properly tuned to the generator, or vice versa, the herringbone pattern disappears, indicating correct tuning. If the pattern does not disappear it means the receiver's sound carrier trap must be adjusted. (All you do is adjust the trap until the pattern disappears.)

**Assembling The Kit.** In addition to the panel controls, for which a wiring harness is supplied, the IG-28 kit has two PC boards: a large one for the color generator and a small board for the RF oscillator and video output amplifier. Much of the assembly involves nothing more than plugging in the correct component and soldering.

If you're careful and make no mistakes in selecting the components, the IG-28 will work right off the bat, giving you horizontal lines and an RF output. Then, using the supplied alignment tool, you adjust the RF oscillator trimmer capacitor so the IG-28's tuning corresponds to the channel selected on the TV. Two quick adjustments bring in the vertical lines, and the IG-28 is ready for use.

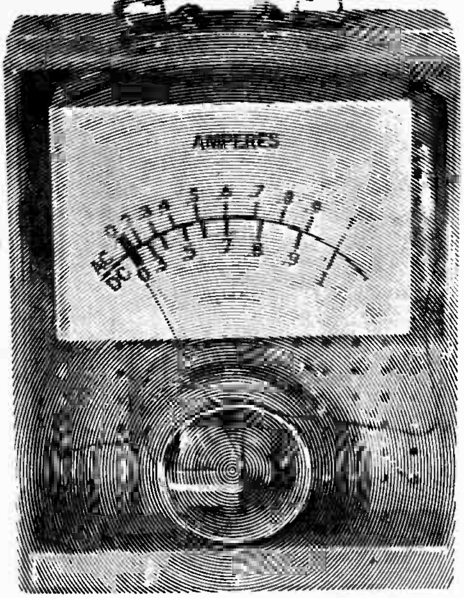
A notable feature of the IG-28, by the way, is the assembly/instruction manual, with perhaps the best written, illustrated, and thorough color adjustment procedure we have seen to date.

The Heathkit IG-28 Color Bar and Dot Generator is priced at $79.95; a wired version is available for $114.95. For additional information write to the Heath Co., Dept. 19, Benton Harbor, Mich. 49022. ■



# Little Annie Fanny

Most everyone's aware of the role computers play in the design of Detroit's cars. Not so well known is the fact that some computers can all but outpaint Picasso—if, that is, they're properly programmed. The fey and fetching Little Annie Fanny you see at left is the work of a CalComp 563 plotter, programmed in this instance by Al Bianucci, a night operator at Chicago's H. W. Lockner, Inc. Al, it seems, found himself with next to nothing to do, so he digitized x and y coordinates corresponding to Annie's fanny et al. Result was Annie herself, all 42-30-36 of her. ■




# Sn/Fe MOVING VANE AMMETER

## Easy to build—works on AC and DC

by Charles Green, W6FFQ

**When the first** electric indicator was made by Hans Öersted in 1819 out of a magnetic compass and some wire, he could not have imagined that millions of meters that are its direct descendants would be in use wherever a low-cost rugged indicator is required. For example: as an ammeter in an automobile.

The iron vane electrical meter (ammeter or voltmeter as it's called today) is made in two general types: the polarized vane type—a magnet or an iron vane moving in a magnetic field, or, the repulsion vane type—two iron vanes repelling each other in an induced magnetic field created by the current flow being measured.

Our project uses the repulsion vane principle in an easy-to-build iron vane ammeter. This project will provide the reader the opportunity to combine education with the fun of building. This simple ammeter indicates from 0 to 1 ampere, AC or DC. A solenoid, two sections of a tin can, and a rubber band (in lieu of the conventional metal pivot and spiral spring) are the essential meter components housed in a plastic "P" box. Included in this article are experiments to help you better understand the repulsion vane action of this type of meter.

**Vane Repulsion Experiments.** Fig. 1 shows the components used in one experiment that can be performed to show how iron vanes move by magnetic repulsion. In our experimental hookup shown in the photo, the coil is made by random winding 200 turns of #22 enameled magnet wire on a 1¼-in. diameter cardboard coil form, about 1-in. long. This cardboard form can be made by cementing cardboard wound around a bottle having 1¼-in. diameter. Use plastic tape to hold the wire in place and leave 10-in. leads coming out of the coil. Remove about 1 in. of the enamel from the end of each lead.

Next, cut up a clean tin can to make two 1½ x ½-in. pieces. These will become the iron vanes in this experiment. Make sure the tin can is made from sheet iron and not from aluminum. Bend each iron piece about ½-in. from one end into a right angle.

# MOVING VANE AMMETER

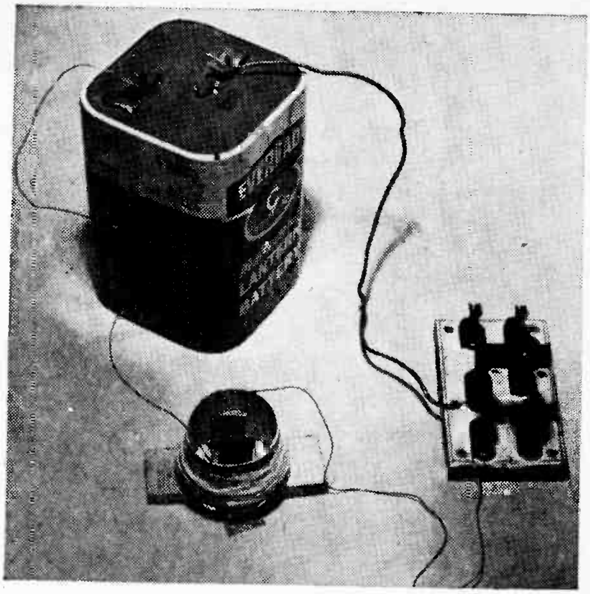


**Fig. 1. Vane repulsion experiments demonstrate basic operation of moving-vane ammeter. Circuit works with 6-V battery or filament transformer.**

Then make two 1 x 1 x ¼-in. wood blocks, and place them under the coil form about ¾ in. apart, as shown in the photo. Place the two sheet iron vanes inside the center of the coil, with the longer ends upright, and about ⅛-in. apart. Make sure they do not touch the wood blocks. The small ½-in. bends should be in the clear space between the blocks.

Connect the coil leads to a knife switch, and a 6-volt battery. Polarity isn't important, as the coil will work with the battery connected either way. See Fig. 2.

Close the switch and note that the two iron vanes repel each other. This is because the magnetic field of the coil magnetizes each iron vane with the same magnetic polarity; both north ends of the vanes are adjacent to one another, as well as both south ends. This is the reason why they repel one another. Fig. 3 explains this action.

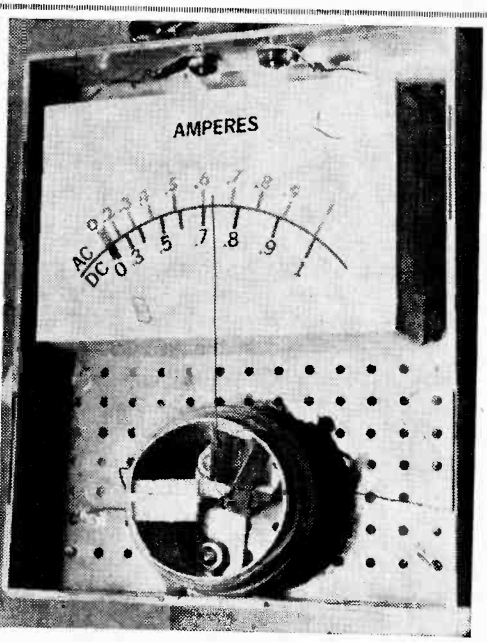
Repeat the experiment, but hold one of the vanes with a wood pencil (or other non-magnetic item) so that it does not move. Observe that the free vane is still repelled by the fixed vane. It is this action, with one fixed, and one moving vane, that is used in iron vane meters.

Disconnect the battery, and replace it with a 6.3-V transformer (as in Fig. 2). Repeat the previous experiments with the transformer replacing the battery in the circuit, and observe that the iron vane is repelled in the same manner with AC as it is with DC. Even though the AC changes its direction of flow, the magnetic fields still magnetize the iron vanes in a similar manner.

**Building the Meter.** The iron vane ammeter is built into a 4⅝ x 3⅝ x 1½-in. plastic box supplied with a clear plastic lid. Use the same coil wound for the vane experiments for this meter unit (see the ammeter assembly drawing).

Start construction by making the vane bracket out of 0.05-in. or heavier sheet aluminum. Make the iron vanes from tin can sheet metal as indicated in Fig. 4. Use a rubber band that fits snugly over the bracket as shown, but not too tightly. It should be able to be twisted and then spring back easily. Mount the moving vane on the rubber band about ½-in. down from the top of the bracket, by bending a ⅛-in. lap of the bracket end around the rubber band.

Mount the bracket and the fixed vane in the bottom of the plastic box as shown in Fig. 5. Before tightening the mounting




**Basic structure of moving-vane ammeter is shown in photo above and in detail drawing at right. Text describes how unit is calibrated for both AC and DC readings.**

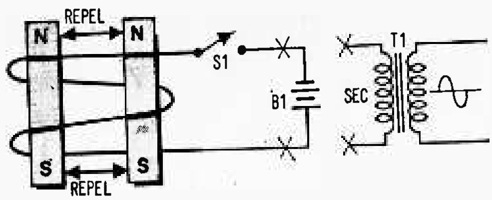



Fig. 2. Because of nature of hookup, iron vanes will always repel one another regardless of battery polarity. If desired; 6.3-V filament transformer (T1) can replace B1.

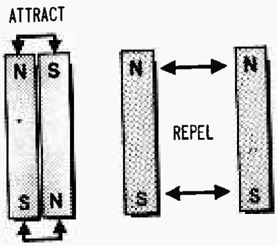



Fig. 3. Vanes can attract one another only when polarities differ. Here, polarities are always same, so vanes repel.

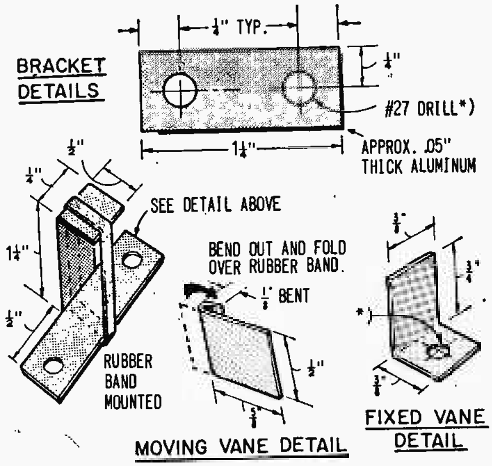
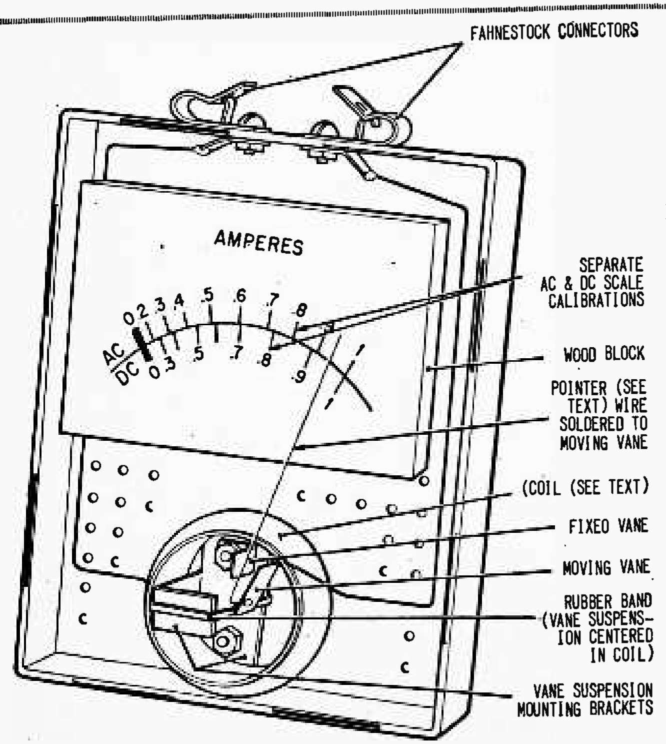



Fig. 4. Details of bracket, moving vane, and fixed vane. Bracket is made of 0.05-in. aluminum strip, vanes from tin can.

screws, shift the rubber band so that the top of the moving vane is even with the top of the fixed vane. Make sure that the rubber band is in the center of the bracket. Notch out the bottom of the left side of the coil form so that it will fit over the bracket base, and cement the coil form to the bottom of the box. Position it as shown in the drawing of Fig. 5.

Install Fahnestock clips on the plastic box as shown and connect them to the coil leads. Dress the coil leads to the sides of the box and hold the leads in place with a drop of cement. *(Continued overleaf)*




### PARTS LIST FOR SN/FE MOVING VANE AMMETER

3—6-V batteries
1—Cardboard tube, 1¼-in. diam., 1-in. long (or cardboard sheet to make tube—see text)
¼ lb.—#22 enameled copper wire
2—Fahnestock clips
1—"P" plastic box, 4⅝ x 3⅝ x 1½-in. with clear plastic lid (Radio Shack 270-105 or equiv.)
1—Heavy rubber band for vane suspension (see text)
R1—200-ohm wirewound potentiometer (Mallory MR-200F with MR-1250 shaft, or equiv.)
T1—Filament transformer, 6.3-V, 1-A
1—3 x 2 x 1-in. wood block
Misc.—Tin can (iron only—see text), 0.05-in. or heavier aluminum strip, DC ammeter (0-1A), AC ammeter (0-1A), rubber feet, hardware, solder, etc.

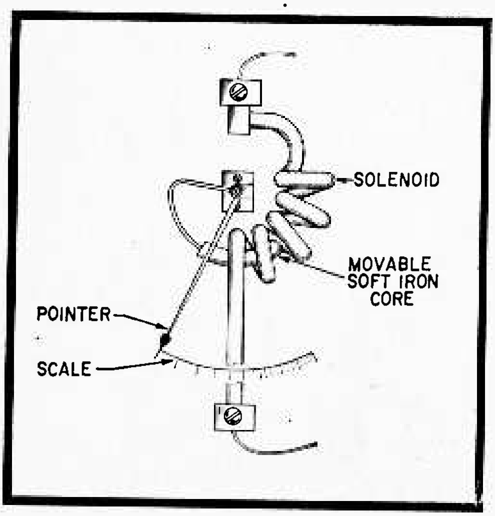
# MOVING VANE AMMETER

Cement the scale, drawn on a sheet of paper, to a block of wood, 3 x 2 x 1-in. The wood block is bolted to the box bottom with two sheet metal or wood screws, positioned as shown in the drawing. Screw small rubber feet on each corner of the box.

Make a pointer for the meter from a straightened length of #22 enameled magnet wire, and solder one end to the moving vane as shown in the photo and drawing. Do not use too much heat as heat can damage the rubber band. Bend the wire to make a pointer for the meter scale and cut off the excess wire. The pointer is about 2¾-in. long. Place a small drop of cement inside the coil form to act as a vane stop and prevent the pointer from hitting the side of the box cover. Make sure that the pointer and vane swings freely and returns to a zero point.

**Calibrating the Meter.** You will need both a DC and an AC meter having 1-ampere ranges; a 200-ohm, wire-wound rheostat; and AC and DC power sources. Three 6-V batteries will serve as the DC source and a 6.3-V, 1-ampere filament transformer will do for the AC source.

Before calibrating, draw an arc on the meter scale and establish a zero point. The meter will have separate AC and DC calibrations as shown in the photo and drawing. If necessary, reposition the meter




**Commercial moving-vane ammeters of yester-year were much like water meters. Note that device was accurate only if vertical.**

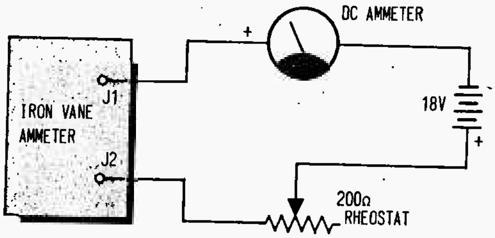



**Fig. 6. Hookup for calibrating moving-vane ammeter for DC. See text for details.**

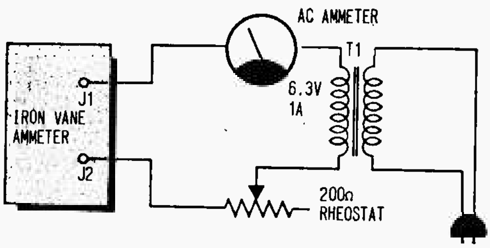



**Fig. 7. Filament transformer and AC ammeter are required for easy AC calibration.**

pointer by bending the top of the bracket.

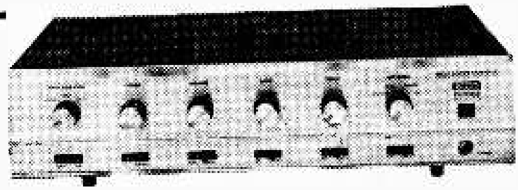
Adjust the rheostat to maximum resistance and connect it in series with the calibrated DC ammeter, 18-volt battery and the iron vane meter as shown in the circuit of Fig. 6. Adjust the rheostat and calibrate the iron vane meter according to the DC ammeter readings. Note that the iron vane meter will not respond near the zero position. Calibration of our unit was started at the 0.3 ampere position and was marked at every 0.1 ampere position to 1 ampere. Now connect the AC ammeter and filament transformer as shown in the circuit of Fig. 7 for the AC calibration. Be sure to set the rheostat to maximum resistance before beginning calibration. We started calibration of our unit at the 0.2 ampere point and continued as in the DC calibration. We used rub-on lettering to make the scale for the best appearance.

**Operation.** The use of a rubber band instead of the more conventional metal pivot and spiral spring makes for easier construction. But temperature changes and sagging and aging rubber may cause the meter indications to vary. The meter will still work as a good indicator for approximate current readings.

Try using the ammeter to check the current of household light bulbs. The ammeter, together with the vane repulsion experiments, will also make a good science fair project. ■

# Science and Electronics LAB CHECK

## EICO CORTINA
## Model 3150
## Integrated Stereo Amplifier



☐ When the original EICO *Cortina* amplifier was introduced a year or so ago, just about nothing else was available that delivered comparable performance at such a low price. But the original *Cortina* unfortunately lacked the punch needed to drive low-efficiency speakers to high volume levels. Now, a new, high-power *Cortina*, Model 3150, overcomes that limitation with 150 watts (IHF) of stereo power output—a lot more than needed by any speaker system. (For those who don't need the extra power the original 70-watt *Cortina* is still available.)

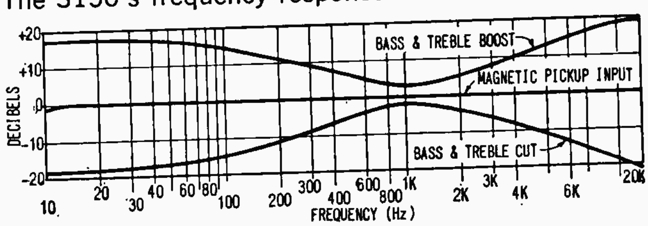
In addition to packing more punch, the 3150 *Cortina* also utilizes the latest in high-power solid-state technology for rock-bottom distortion. The new *Cortina* offers four inputs: a selector switch handles magnetic phono, tuner, and auxiliary; a tape-monitor switch provides the tape-recorder input. Outputs include main speaker, remote speaker, headphones, and tape recorder.

**Other Controls.** Volume and tone controls are ganged, which means that what you do to one channel you automatically do to the other. A balance control is provided for equalizing the stereo volume; a speaker selector selects either headphones, main speakers, remote speakers, or all speakers.

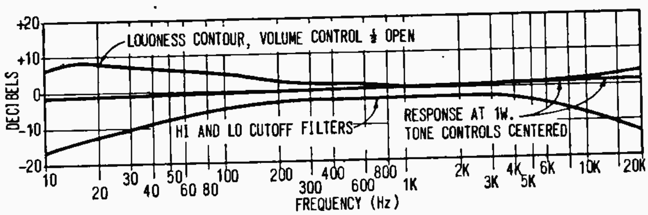
Panel switches provide for loudness contour, mono/stereo, lo-cut, hi-cut, and power; the rear apron contains both switched and non-switched AC outlets.

Though the circuitry is fairly conventional, the mono/stereo switch is somewhat unusual. Reason is that the mono connection is made by parallel-connecting the signal inputs together, rather than the preamplifier outputs. This method avoids the

The 3150's frequency response and the effect of its controls




**RIAA equalization on 3150 was ruler flat from 20 to 20,000 Hz. Bass and treble controls had fulcrum around 1-kHz point, with maximum boost and cut of some 20 dB.**



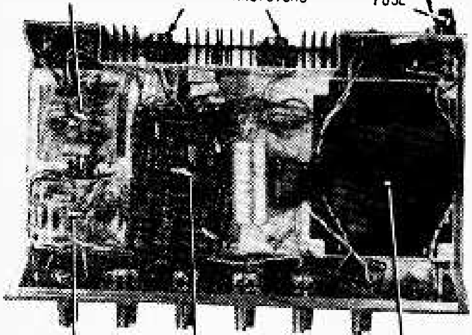

**Response at 1-watt output with tone controls centered was also pretty much ruler flat. High filter was effective, though low filter proved somewhat broad.**

# LAB CHECK

crossloading of the amplifiers which often results in increased distortion. (We could not determine any deleterious effects, including increased noise level, caused by the EICO-type connection.)

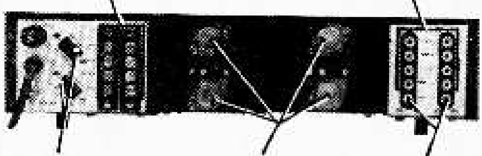
The 3150, available wired ($225.00) or kit ($149.95), complete with wood finish cabinet, uses modular construction; each individual section—preamp, driver, etc.—is on a separate printed-circuit board, and each channel has its own boards. There appear to be no assembly problems other than the usual tedium of plugging many components into matching holes.

**Performance.** Typical of the most modern solid-state designs, the EICO *Cortina*




**Each side of chassis contains printed circuit modules for single amplifier channel (this is upper side of completed amplifier). Topside also contains power-supply filter, shown to left of husky power transformer. Even chassis is assembled in modular form: front (with controls), back, and amplifier base.**

amplifier is absolutely ruler flat from 20 Hz to 20 kHz at normal listening levels of 1 watt, and almost ruler flat at the rated power output of 40 rms watts (sine-waveform) per channel into an 8-ohm load. As with most solid-state amplifiers, power output varies somewhat with load impedance. For the *Cortina*, the rated power output per channel is 50 watts into 4 ohms and 25 watts into 16 ohms. (Under no circumstances should the total per channel speaker load be less than 4 ohms. Reason is that the 3150, like most solid-state amplifiers, will attempt to deliver a tremendous amount of power into anything even remotely resembling a short circuit. And, unfortunately, any load offering an impedance of less than 4 ohms is going to look too much like a short circuit for comfort.)




**Output transistors are recessed in heat sinks, which are themselves recessed to provide flat, non-protruding rear apron. Both main and remote speaker terminals (at left) have their own common (ground) connections.**

Distortion is about as low as can be measured with standard lab-grade instruments. Total harmonic distortion (THD) at the threshold of clipping was 0.1% at 20 Hz, 0.08% at 1 kHz, and 0.18% at 20 kHz.

As shown in our curves, tone-control range is very wide, with almost 20 dB cut and boost at the extreme ends of the listening spectrum. The loudness switch adds about 7 dB boost at 20 Hz.

Our curves also show high-frequency cut to be good: only 3 dB down at 7 kHz. The low-frequency cut, however, is a little more broad than usual. This means that a listener would likely notice a slight loss of bass when the lo-cut is used to reduce turntable rumble (though we can't see why anyone would connect anything other than a quality turntable to this amplifier).

The magnetic input equalization is absolutely ruler flat, with a sensitivity of 0.0015 V (rms) for rated power output. Hum and noise measured better than 80 dB down, which is absolutely dead quiet at any volume-control setting.

**How It Sounds.** The EICO 3150 is easily identified as having "transistor sound." Its output is exceptionally clean and transparent, noticeably so at the higher frequencies where the amplifier can deliver some 5% more than the rated power before clipping. In fact, it is quite something to listen to a soprano's high C at full power output; few other amplifiers can handle it as well as the 3150.

For additional information on the 3150 *Cortina*, write EICO, Dept. T, 283 Malta St., Brooklyn, N.Y. 11207. ■

# 97-cent Hard-Rock Fuzz Box


## Add "Fuzz" to your guitar amp for mere pennies

by Herb Friedman, W2ZLF/KBI9457

**For just 97¢** you can modify the amplifier of your practice, or budget, guitar by adding the hottest sound going with the hard-rock combos—*fuzz*. For those too square to know what fuzz is, we'll explain.

Fuzz is distortion, out-and-out distortion of the original guitar sound. Unlike random distortion, most fuzz effects are accomplished by squaring the waveform of the guitar pickup, thereby obtaining a husky sound quality akin to that of a saxophone.

Most new guitar amplifiers have the fuzz built in, the technical terms for fuzz being harmonic modifier, overtone, or something

# Hard-Rock Fuzz Box

similar. Whatever it's called, it's still fuzz. If the amplifier doesn't have built-in fuzz, the fuzz sound can be added through the use of a fuzz box—an adapter connected between the guitar pickup and amplifier input. Though fuzz boxes provide the conveniences of adjustable fuzz quality and a foot switch, the price range of $12 to $40 often puts it well outside the budget, particularly for units considered practice or budget units that originally cost less than the commercial fuzz box. Well, for you budget-minded people, we offer the *97¢ Fuzz Box*, actually a fuzzing circuit that is built directly into the amplifier (see Fig. 1).

**What Is Fuzz.** As shown in the schematic, the fuzz circuit is nothing more than a diode clipper (D1 and D2), a switch to turn it *on* and *off* (S1), and a depth control (R1) that sets the degree of fuzz effect. The *on-off* switch can be combined with the control, and if you use the recommended source for parts the whole bit will cost 97¢. If you want to build a super-deluxe version having a separate *on-off* switch it may run about $2. When a separate switch is used the setting of the depth control is not affected as the fuzz is switched in and out.

**How It Works.** Diodes D1 and D2 are the silicon type, requiring approximately 0.5 to 0.7 volt before they conduct. The fuzz circuit is connected into the amplifier at a

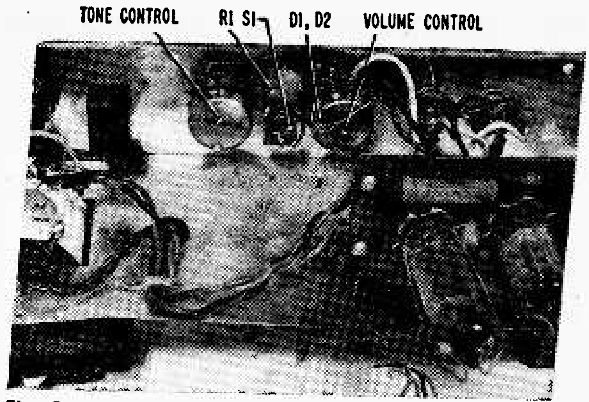
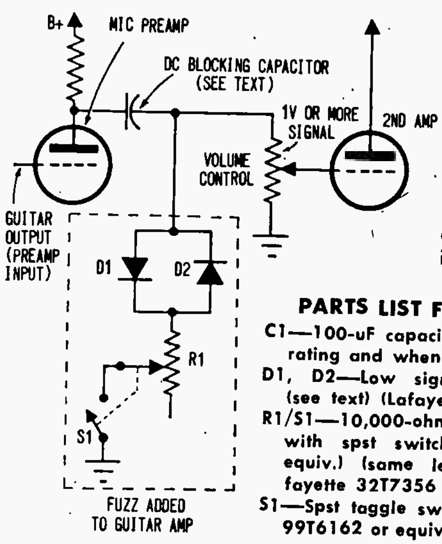



**Fig. 1. Parts for fuzz circuit mounted on amplifier panel surrounding existing controls.**

point, usually across the volume control, where the guitar signal is approximately 1 to 3 volts. Therefore, the diodes will clip that part of the signal waveform that exceeds 0.5 to 0.7 volt. R1 increases the conduction voltage, allowing the user to set the clipping level anywhere from just peaks of the waveform (slight fuzz) to the husky sound obtained when the diodes are returned directly to ground. The photographs clearly indicate the effect of the fuzz circuit. Fig. 2 shows a sine-waveform simulating the guitar sound with *no* fuzz—S1 open. Fig. 3 is the fuzz circuit *cut-in*, with R1 at almost full resistance (note that the waveform is just slightly distorted). Fig. 4 shows the high degree of distortion obtained when R1 is set to zero resistance—*full* fuzz.

The scope pictures have been adjusted to be almost equal in size for clarity of illustration. Actually, as you would expect, the fuzz circuit causes a loss in sound level of up to 6 dB, depending on the degree of fuzz. This is generally no problem since most guitar amplifiers have much more than 6 dB reserve gain.

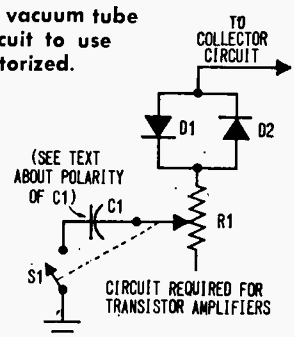
When fuzz is added to transistor ampli-




**Left, fuzz circuit added to vacuum tube amplifier. Right, fuzz circuit to use if your amplifier is transistorized.**

**PARTS LIST FOR 97¢ FUZZ BOX**

**C1—100-uF capacitor (see text about voltage rating and when required)**
**D1, D2—Low signal voltage silicon diode (see text) (Lafayette 19T6001 or equiv.)**
**R1/S1—10,000-ohm miniature potentiometer with spst switch (Lafayette 32T7364 or equiv.) (same less switch—see text—Lafayette 32T7356 or equiv.)**
**S1—Spst toggle switch (Lafayette 34T3301 or 99T6162 or equiv.—see text)**



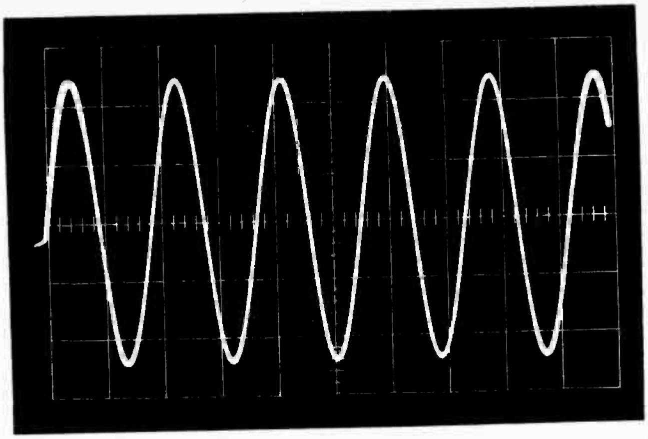


Fig. 2. Undistorted sine wave output of guitar amplifier simulating guitar sound with no fuzz added.

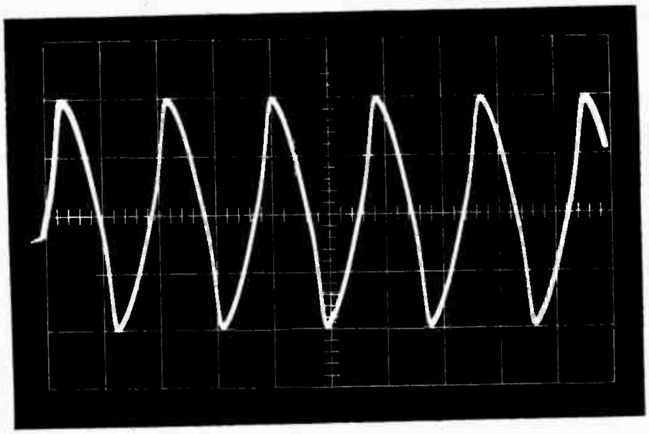


Fig. 3. Output of guitar amplifier with fuzz in, R1 at nearly full resistance. Note waveform slightly distorted.

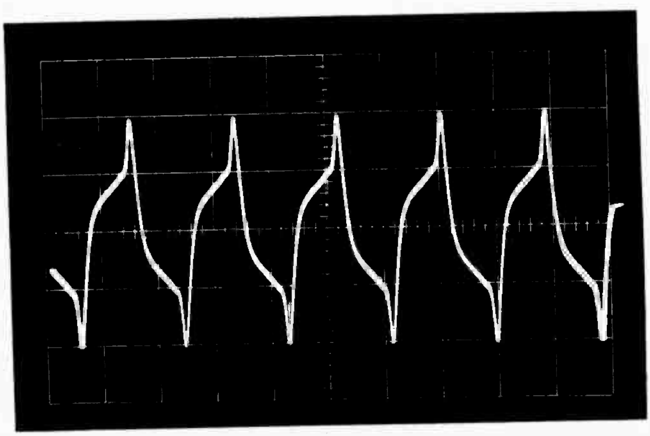


Fig. 4. Output of guitar amplifier with maximum fuzz, R1 set to 0 resistance. Note high degree of distortion.

fiers the circuit must be modified slightly by inserting a 100-$\mu$F capacitor (C1) in series with the arm of R1, as shown in the schematic. Voltage rating of C1 should be equal, at least, to the voltage to which D1 and D2 connect. Polarity connections of C1 are determined by the amplifier circuit voltage at D1-D2 (usually + for npn and − for pnp transistors). When the voltage is positive, C1's positive lead is connected to the arm of R1, or, if the voltage is negative, C1's negative lead is connected to it.

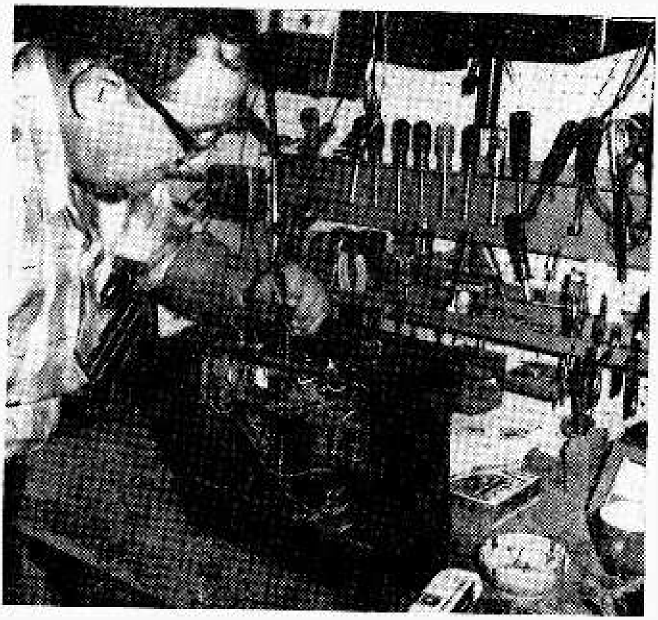
**Where to Connect.** The fuzz circuit must be connected into the amplifier at some point where the signal level exceeds 1 V. This is normally after the microphone preamplifier, across the volume control. (If tone controls are also connected across the volume control they are ignored.) If the volume control is in the circuit before the microphone preamplifier rather than after it (which would not be normal), or if it follows a second amplifier stage, connect the fuzz after the first amplifier, following the plate DC blocking capacitor. Do not connect the fuzz to the wiper arm of the volume control as this will disable the volume control, causing the volume control to affect only the degree of fuzz. Similarly, don't try to get more fuzz by connecting to the grid of the output tube as this will sharply reduce the overall amplifier gain, and the volume control again will affect only the degree of fuzz. The best location for the fuzz circuit is at the point where the signal voltage just exceeds 1 V, usually after the microphone preamplifier.

In transistor amplifiers you

# Hard-Rock Fuzz Box

will most likely find the 1-V signal level point is the collector of the second transistor. Connect the transistor-version fuzz (with C1) to the collector of this transistor.

**Placing the Parts.** Try to keep the fuzz circuit away from power leads because it is a relatively low level circuit, and is prone to hum pickup. It is better to locate it as close as possible to the volume control or associated circuit. A typical installation is shown in the photographs. A miniature potentiometer (R1) is used to squeeze in between existing components.



**Using a center punch to mark panel before drilling prevents possibility of bit slipping and inadvertently scratching panel.**

First step is to drill the holes in the panel. To avoid shaking the amplifier to pieces with an electric drill, leave the amplifier mounted in its case for support and center punch the panel (so the drill doesn't walk into other components). Then drill the mounting hole(s), preferably with a slow speed drill. The slower the speed the lower the vibration.

Whether you use a separate *on-off* switch, or one mounted on the back of R1, try to connect the ground end to the low level amplifier ground. There usually is a ground wire connecting the ground lug of the volume control to the input jack ground. If the volume control is grounded to the chassis through its mounting bushing (no ground bus wire), connect the fuzz ground from S1 to the volume control ground *at the volume control*—do not ground the fuzz just any old place on the chassis. Nine times out of ten it doesn't matter where the fuzz is grounded, but yours might be the tenth case.

**Using the Fuzz.** When S1 is open (fuzz *off*) the amplifier will function normally. With S1 closed (fuzz *on*) the fuzz effect can be varied from full *on* to fuzz *off*, as determined by R1's setting; full resistance is little or no fuzz, while zero resistance is maximum fuzz. Do not expect the rough, harsh fuzz associated with add-on fuzz boxes. The 97¢ Fuzz simply cannot generate that much distortion. You'll get a definite husky sound, quite different from the normal guitar sound, but not quite the rough effect of an add-on commercial unit.

Since the fuzz sound is really harmonics created by distorting the original waveform, the amplifier must be capable of passing the harmonic frequencies, for if the harmonics are reduced, or filtered out completely, the final sound won't be much different from the normal guitar sound. Therefore, when using the fuzz make certain the amplifier's tone control—which is usually of the highcut type—is wide open to pass all of the high frequencies. After a little practice, of course, you can use the tone control to get subtle shading of fuzz tone quality.

**About the Parts.** D1 and D2 are the cheapest small-signal silicon type; usually sold in packages of 10 for about 90 cents. R1 is a "dime size" transistor potentiometer of 10,000 ohms, available with a switch (Lafayette 32T2405, 79¢) or without a switch (Lafayette 32T7356, 59¢). If you use a separate *on-off* switch for S1 you can buy a standard size toggle type (Lafayette 34T3301, about 50¢) or a subminiature type (Lafayette 99T6162, price around $1.50) if space is at a premium. ■

# Science and Electronics LAB CHECK

## UNIVOX Super-Fuzz Guitar Fuzzbox

☐ Imagine, if you can, a guitar sound so *with it*, so *now*, so *far out*, that it can't be put on a record! That's just what you get with a Univox *Super-Fuzz*—the ultimate in a guitar fuzzbox.

Unlike conventional fuzzboxes, the Univox *Super-Fuzz* neither distorts the waveform by clipping signal peaks, nor generates a slight kickback oscillation that causes a peak burst of distortion. Instead, this unusual unit generates almost completely new sound waveforms which are triggered by the basic guitar waveforms. And the sound no longer resembles that of a guitar. Rather, it can simulate many new ethereal instruments depending on the setting of the Univox's controls.

**V For Vibrato.** For example, with a guitar, *vibrato*—a rapid variation in pitch—can only be obtained by changing the tension on the guitar strings; this is normally accomplished by physical movement of a guitar's vibrato arm which is mechanically connected to the guitar strings. The closest you can get electronically is *wah-wah*, a simple system whereby a foot control causes an oscillator to trigger *on* guitar waveforms in a manner that simulates a frequency shift.

On the other hand, the Univox can be set to automatically trigger a slight frequency shift at the beginning of each note that creates a continuous "blue note" sound. End result sounds as though the vibrato handle had actually been moved at the beginning of each note!

And that's only one effect. The Univox can generate everything from standard fuzz effect to impulse waveforms that can be handled by only the finest of amplifier equipment—waveforms so steep they couldn't be traced by a phono stylus even if they could be cut on disc.

**Picture Gallery.** Some typical effects that can be obtained are shown in our waveform photographs. These were made using a sine-waveform test signal. Since guitar sounds aren't necessarily sine-waveform, the actual effects obtained surpass those shown in our photos.

Fig. 1 is our 600-Hz reference, a pure sine-waveform. In Fig. 2, the Univox No. 1 fuzz has been slightly opened, distorting the basic waveform as in a typical fuzzbox and also adding some second harmonic (note 6

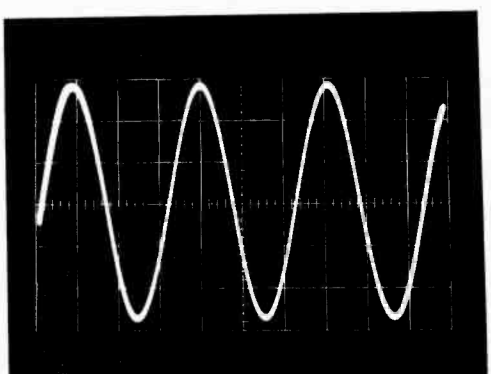


**Fig. 1. Pure, 600-Hz sine-waveform.**

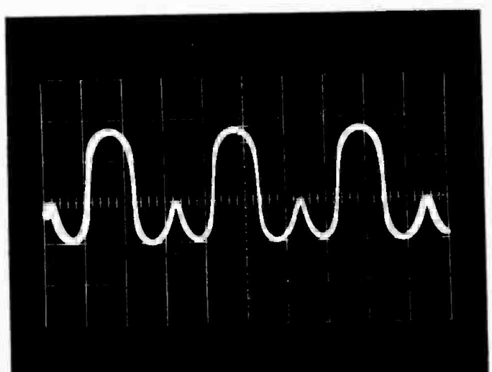


**Fig. 2. With No. 1 fuzz slightly open.**

# LAB CHECK

cycles rather than 3). Increasing the No. 1 fuzz effect gives distorted second harmonic as shown in Fig. 3; and even more No. 1 fuzz gives a severely distorted second harmonic, producing a high order harmonic fuzz tone (Fig. 4). These are all the effects which give the so-called saxophone guitar sounds.

Fig. 5 is a slight amount of No. 2 fuzz, which virtually destroys the guitar's normal sound and makes it multiple harmonics and some basic original frequency. Fig. 6 shows even more No. 2 fuzz with multiple harmonics, distorted basic tone, and impulses at slightly lower than the second harmonic frequency. The sound here is unbelievably weird. And it is at the point where the impulses are generated that the slide tone effect is obtained as the impulse starts at a slightly lower frequency and slides up about ¼ to ½ tone.

Fig. 7 is maximum No. 2 fuzz. Note that the waveform is not blurred because of poor scope sync. Rather, the sound is harmonics, added to harmonics, creating more harmonics, on top of the distorted basic frequency, with impulses added. It's an unbelievable effect somewhere west of Pepperland!

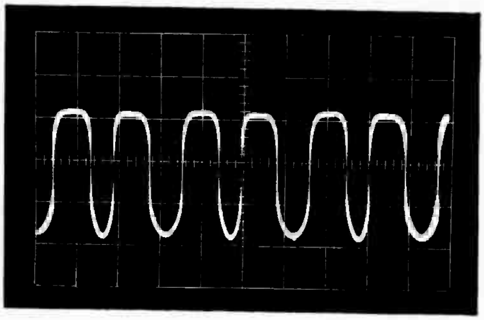


**Fig. 3. With No. 1 fuzz more open.**

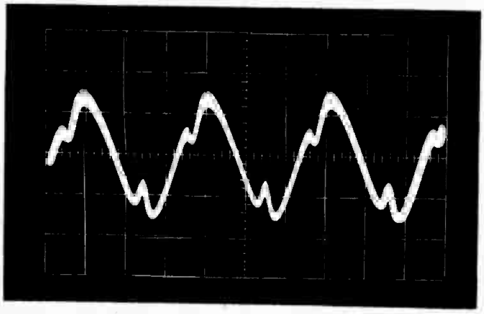


**Fig. 4. With No. 1 fuzz fully open.**

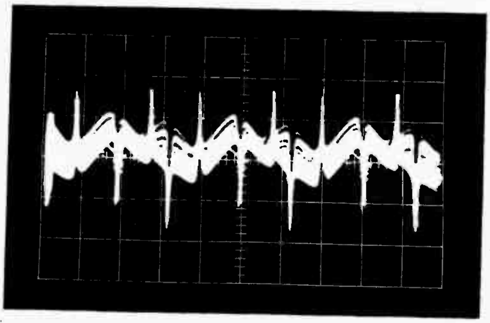


**Fig. 5. With No. 2 fuzz slightly open.**

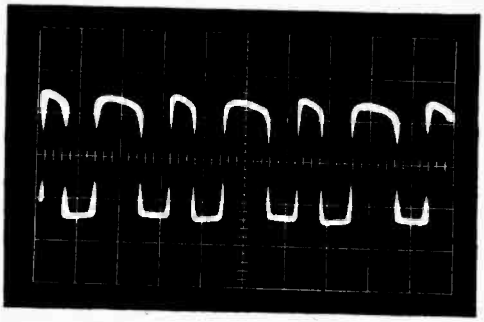


**Fig. 6. With No. 2 fuzz more open.**

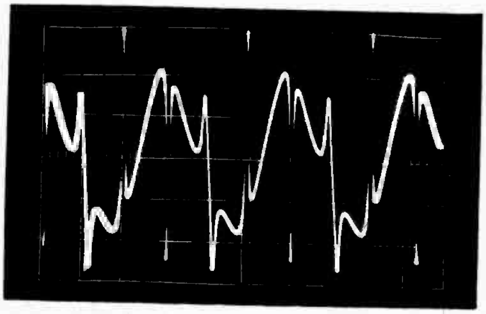


**Fig. 7. With No. 2 fuzz fully open.**

As shown, the Univox *Super-Fuzz* gets its myriad effects from only two of three controls, for one is a BALANCE control and contributes nothing to the effects.

The FOOTSWITCH on the top cuts the superfuzz in and out. The BALANCE control sets the superfuzz level so that the amplifier's output sound level is the same with or without fuzz. The EXPANDER control carries the power switch and provides the desired fuzz depth; the more it is advanced the greater the degree of fuzz effect.

*(Continued on page 107)*

# TALLEST TOWER

Facts and photos courtesy Communications News

Tallest self-supporting antenna tower in the U.S. was recently erected by the Monroe County Electric Co-op just north of Waterloo, Illinois.

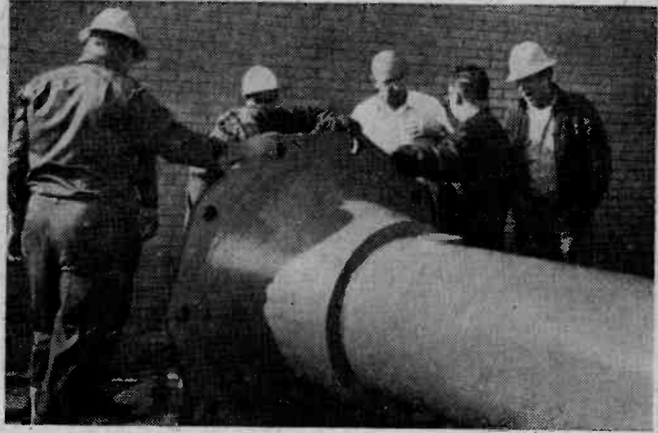
Interestingly enough, the Union Metal Manufacturing Company in Canton, Ohio has fabricated a series of monotube self-supporting antenna poles from 25 feet through 200 feet since 1941. But the 225-ft antenna pole in our photos is the first to be manufactured in this series and the first one erected in the U.S.

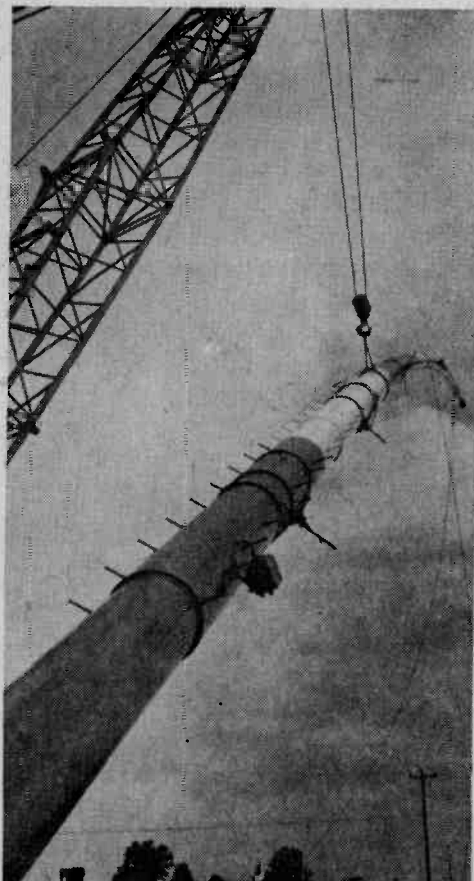
L.V. Hard, manager of the Cooperative, said this pole was ordered to complete his excellent communications hookup. His system consists of a Motorola base station and six Motorola mobile units, broadcasting on 158.78 MHz and covering three counties with a range of 35 miles.

Prior to its erection, the antenna

# TALLEST TOWER

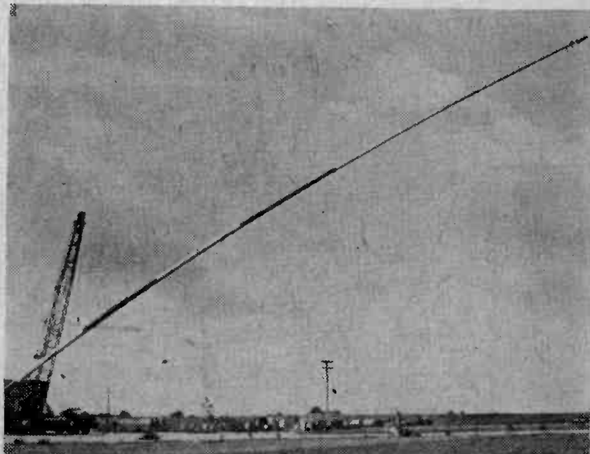
Below, left, ten 80-in. anchor rods made up pole's anchorage. Below, right, Alois Luhr (no hat) checks pole's 16-ft-deep foundation.





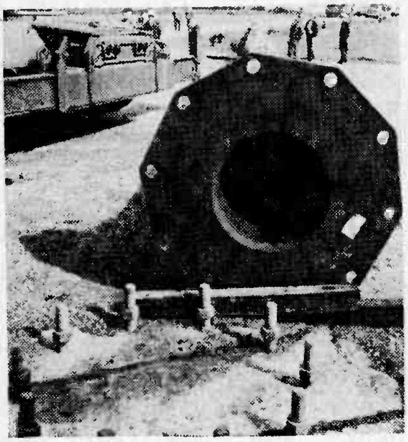
pole was assembled and painted, and the aircraft warning lights installed and wired. The three lower sections had the wire rope slings in place with the come-a-longs (coffin hoists) in tension. Before raising the pole into position, a tag line was fastened at the top of the pole and another one about halfway down. Taking care to protect the aircraft warning light at the top of the pole, workers fastened the wire sling at the balance point of the pole.

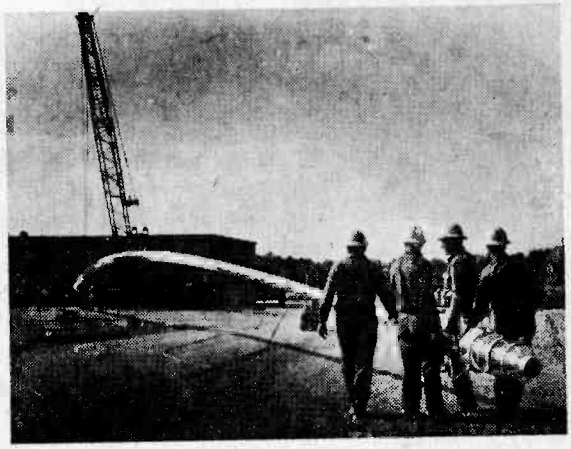
Not entirely self-supporting, the antenna pole is comprised of 13 tapered tubular sections telescoped together to a total length of 225 ft. The butt tubular section is 24-in.



Breathtaking part of 20-minute erection time came as 225-ft pole was progressively raised higher and higher toward true vertical. As safety precaution, steel cable was placed around pole near base and held taut by winch truck. Erection crew found plenty of opportunity to put their two-way radios to good use during course of actually raising 26,850-lb. tower.

Wire rope slings with come-alongs and heavy copper wire around joints were in place at start. At first lift, entire antenna pole was carefully checked. Crew of Monroe Coop took special care to guard aircraft warning beacon at top of pole.

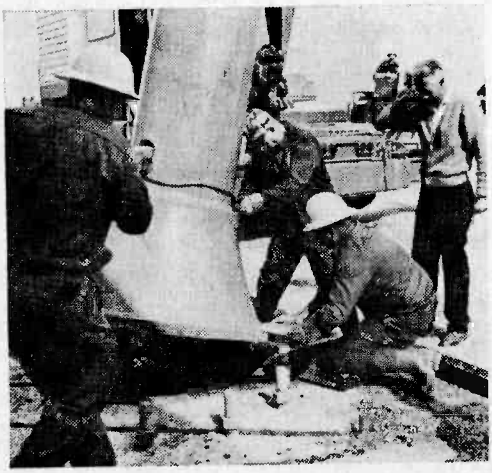


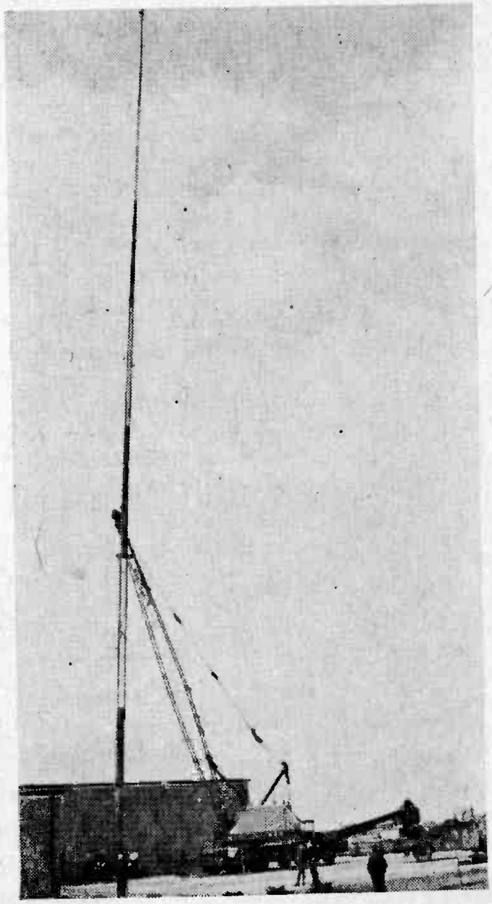


in diameter, while the very top is a mere 3.8-in. in diameter.

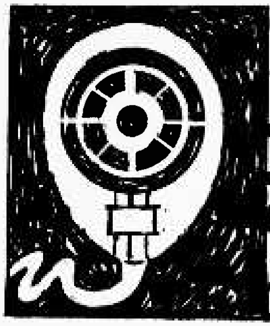
L. E. Dechant of Dechant Electric Service in Belleville, Ill., supervised installation of the coaxial cable and antenna at the top of the pole. Equipped with Motorola two-way radios to talk to the ground, one of Dechant's men and a member of the Cooperative's crew climbed the pole to attach the antenna and coaxial cable. Addition of the antenna gave the pole/antenna combo an overall height of 247 ft.

The Motorola base station was moved from its former location in Waterloo and on the air by 4:30 p.m. of the same day. ■





Coop engineer Wiley Jones (sweater) checks pole position over anchor bolts before pole is lowered into final position. Once pole had been seated on anchor bolts, workmen then adjusted first leveling nuts, then anchor nuts to ensure that entire 247-ft-high structure was both adequately secure and accurately locked in true 90-degree-from-horizontal position.



# HAM TRAFFIC DE W7DQS

by MARSHALL LINCOLN

## Watch Not, Have Not

☐ SWLing generally is thought of as being completely separate from ham radio. Separate it is, though there's a form of this activity that has become very important to hams. The SWLs in question are hams who're active in a specialized form of SWLing. They perform a vital service for all of us.,

Though these SWLs scan the ham bands, they're mainly interested in finding non-hams! They're not looking for bootleggers in the usual sense—but they are looking for radio stations which don't belong on our frequencies.

These SWL-hams are officially known as members of the Intruder Watch. This is a ham activity which is little known, but vitally important to all of us. It was organized about five years ago by the ARRL to provide a systematic, effective way of spotting commercial stations which operate illegally on ham frequencies. It also provides a means to get these intruders moved with FCC help.

The Intruder Watch corps has grown to include several dozen dedicated hams who spend a few hours each week tuning across the ham bands searching for signals, mostly from foreign broadcast stations, that have moved in and set up shop. Once these are located, their frequencies must be determined and the stations identified. Then a written report is made to ARRL headquarters.

These reports from Intruder Watchers all over the country are dovetailed together and forwarded regularly to the FCC. Then, either the FCC or the State Department makes official contact with the offending stations or with their government authorities. From this procedure, which is unavoidably slow and cumbersome at times, has come considerable relief from foreign broadcasters who have created undue interference on the ham bands.

**Among the hams who help guard our precious frequencies against commercial stations moving in are two Intruder Watch listeners, Dr. William W. McGrannahan, KØORB, Kansas City, Mo. (right) and Elmer P. Fruhardt, Jr. W9GFF (left), Chicago, Ill. They are among the dozens of hams over the country who regularly submit reports of commercial stations they've heard interfering with legal ham operations. It is through this group's actions that it is possible for our government to take action that will stop this infringement on overcrowded ham frequencies.**

It's important that such complaints be processed against these intruders. If their intrusion on ham frequencies goes unchallenged, these broadcasters can claim in the future that no one objected to their use of ham frequencies and that they therefore should be allowed to continue to use them legally!

This can happen because of a loophole in the international ham regulations: some frequencies are reserved world-wide for ham use, but other portions of our bands are *shared* with various commercial users in other parts of the world. If there is no official complaint that these commercial stations interfered with legal ham operations, then the commercial boys can legally continue to use ham frequencies. That would be a sneaky way to steal some of our frequencies!

**Bandits In Our Brotherhood.** The FCC has confirmed its agreement in principle with the concern expressed in this column some time ago regarding the guttersnipe behavior of a growing number of ham radio operators.

In a recent report of its own activities, the FCC had this to say: "The past year has shown a significant trend toward increased on-the-air feuding and use of questionable language in a radio service which historically has prided itself on cooperative self-regulation. Limited manpower has prevented attention to any but the most flagrant cases. Approximately 2800 violation and advisory notices were issued to licensees during the year."

If some of us tend to shrug this off, it should be emphasized this is a pretty serious condemnation of the behavior of some of our brother operators. Never before has the FCC had to make such a criticism of the Amateur Radio Service.

Generally, it has been complimentary about our actions and our service. But now, the federal rule makers are beginning to frown at what some of those in our midst are beginning to do to the once-proud world of amateur radio.

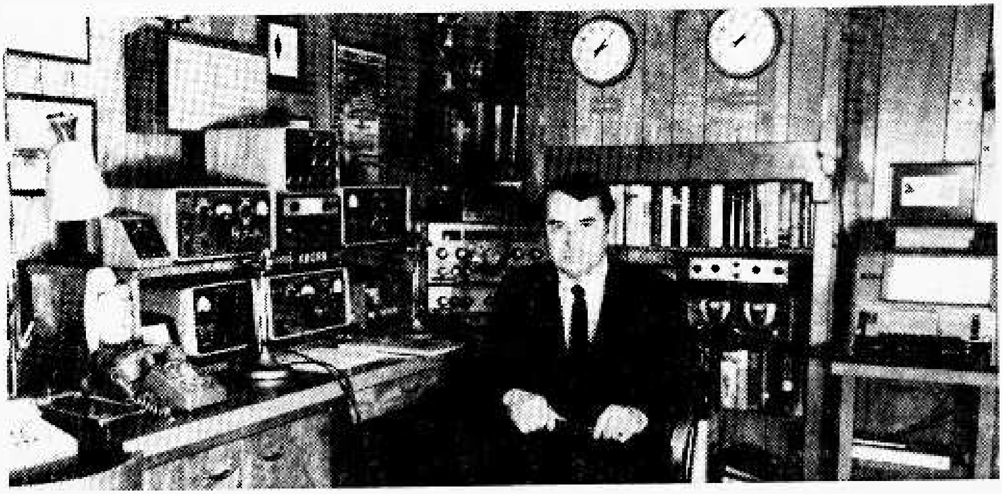
Anyone who has done much listening in recent years can only marvel that the FCC hasn't complained about this before. But now the handwriting is on the wall. The "criminal element" in our midst—the fellows who carry on with dirty language and roughhouse manners—consists of more than just a few scattered cases. Fact is, they've become numerous enough to deserve official condemnation by the government agency that writes the rules we're supposed to live by.

Formerly hams were noted for doing a good job of policing their own bands. As a result, FCC enforcement could be at a minimum and still our bands could be pretty clean in terms of individual behavior. But now sterner measures may become necessary unless hams can clean their own house. There's no room in our wonderful hobby for those who have no respect for one another or for decent public conduct.

Remember, even in the privacy of your home, you're on public display every time you key up the transmitter and talk into the mike. Anyone can be listening just as if you were down at the courthouse square on a soap box.

To protect our hobby and our future op-

*(Continued on page 108)*



By ARTHUR S. COOKFAIR

# FAMOUS PATENTS

## No. 763,772
## THE FOUR-CIRCUIT TUNING PATENT

**In the year 1901,** accepted scientific theory said that wireless communication must be limited to about 165 miles. When Guglielmo Marconi announced his plan to transmit signals across the Atlantic, the greatest scientific minds in the world said *it couldn't be done!*

But the 26-year-old engineer went ahead and invented a better "wireless" system and, on Dec. 13, 1901, used it in the first transatlantic transmission. He had done the thing that *couldn't be done.*

The irony of it is that *40 years later* the Supreme Court of the United States found his claim to that accomplishment invalid.

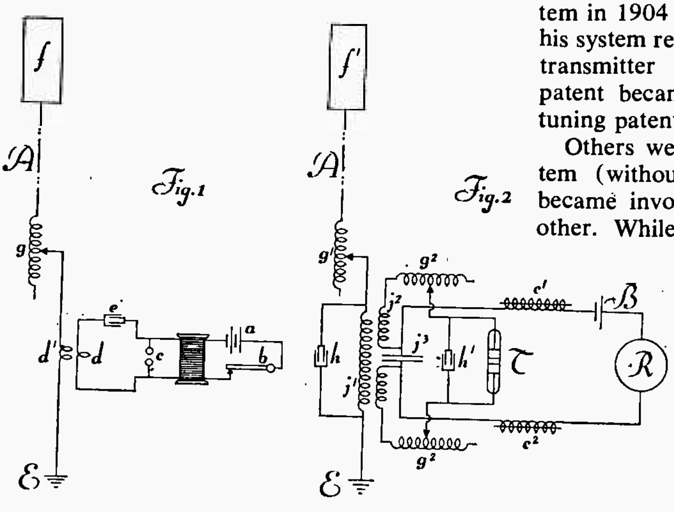
The pessimistic predictions of the turn-of-the-century scientists were based on the *line-of-sight theory*. According to that theory, radio waves, which travel in a straight line, would *not* follow the curve of the earth, but would go off into space. Despite the gloomy forecasts of failure, Marconi succeeded in sending radio waves across the Atlantic Ocean. Explanations were quick to follow. The following year Sir Oliver Heaviside and Arthur Kennelly showed that radio waves are bounced back to earth by an ionized layer in the stratosphere (the "Heaviside-Kennelly layer").

Marconi's achievement was acclaimed by the scientific world. But it's one thing to convince a group of scientists and quite another to convince a group of lawyers and judges. In the legal world, the young Italian's troubles were just beginning.

Marconi patented his improved radio system in 1904 (Patent No. 763,772.) Because his system required two tuning circuits in the transmitter and two in the receiver, the patent became known as the "four-circuit tuning patent."

Others were quick to use Marconi's system (without permission) and the patent became involved in one law suit after another. While the rest of the world acknowledged the inventor's accomplishment, lawyers and judges continued to argue about it.

*(Continued on page 109)*

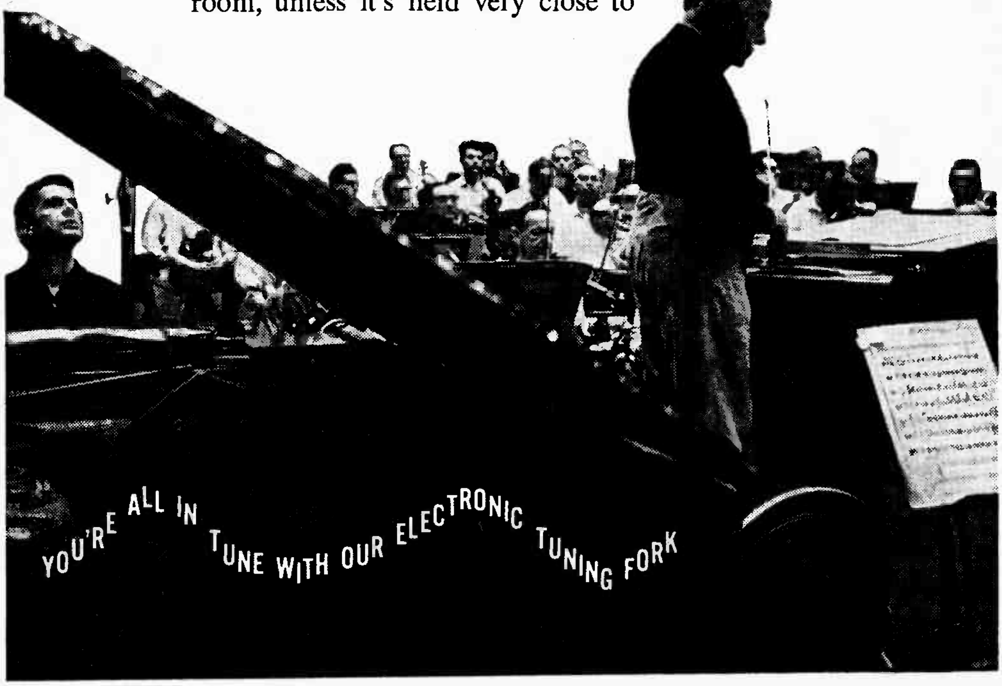



**Marconi's four-circuit tuning patent filed on June 28, 1904 illustrated circuits for both his transmitter (Fig. 1) and his long-wave receiver (Fig. 2).**

# PERPETUAL MOTION FREQ STANDARD

by Ron Michaels

**Bach or Rock . . .** no matter what kind of music you make, you'll make it better if the instrument you play is in tune. Obviously, if this statement is true for one instrument—and who will dispute it—it's unquestionably true for an instrumental group. Trouble is, tuning up an assembly of different instruments can be a problem: none of the standard assortment of tuning aids (pitch pipes, whistles, etc.) is really very accurate. On the other hand, the tuning fork, a universal standard for musical tone, produces a very low-level output that's hard to work with in a large room, unless it's held very close to

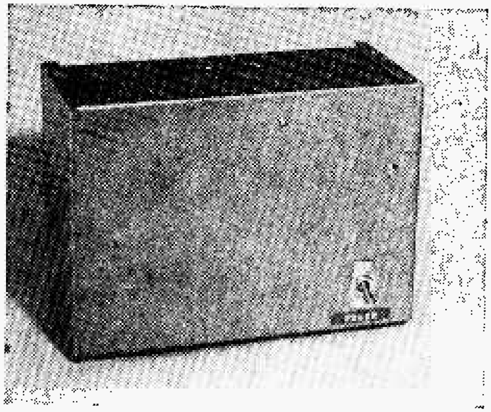


# FREQ STANDARD

your ear. For this reason the fork must be passed from player to player—a time-consuming job.

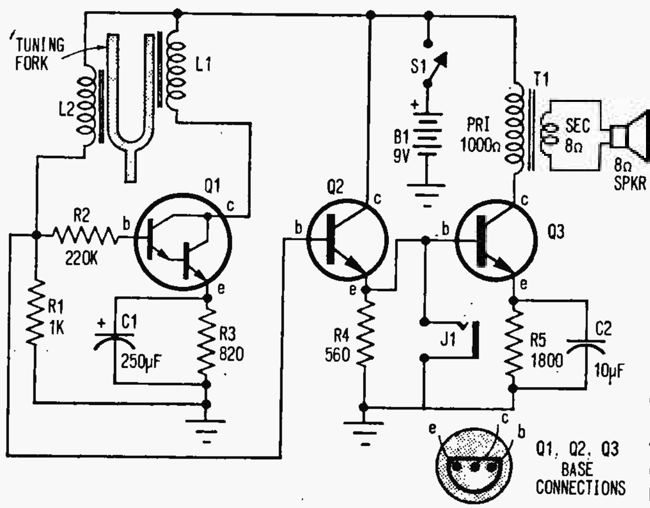
Our amplified electronic tuning fork oscillator will lick this problem. The heart of this unit is a conventional tuning fork, that produces a pure sine wave output that is absolutely accurate. Its electronic circuitry is arranged so that the tone output is continuous and at sufficient volume from the built-in loudspeaker for most group applications. It's not necessary to repeat striking it during tune-up-time.

**How It Works:** Q1, a Darlington amplifier, is connected as an oscillator that, suspiciously, looks like any conventional feedback oscillator configuration. And so it is—with one major difference: the collector and base inductors (coils L1 and L2) are coupled together via the tuning fork. In essence, this circuit can be compared to a dog chasing its own tail.



**Completed perpetual motion Freq Standard. That's on/off switch S1 at lower right, only control to be found anywhere on unit.**

The tuning fork vibrations induce a sinusoidal current flow in coil L2, connected to the base of Q1, which is amplified by the transistor and fed through collector coil L1. This produces a magnetic field around L1 that is sinusoidal, forcing the tuning fork to vibrate. Because the fork vibrates at this




**Schematic reveals Freq Standard's simple but highly accurate circuit. Mechanical tuning fork controls Q1's frequency of oscillation; audio tone appearing at Q1's base is then amplified and fed to either J1 (for further amplification) or direct to Freq Standard's speaker.**

**PARTS LIST FOR PERPETUAL MOTION FREQ STANDARD**

- **B1—9-V battery (Eveready 266 or equiv.)**
- **C1—250-uF, 12-V electrolytic capacitor**
- **C2—10-uF, 12-V electrolytic capacitor**
- **J1—Open-circuit phone jack**
- **L1, L2—See text**
- **Q1—2N5306 Darlington Amplifier (GE)**
- **Q2, Q3—2N5172 transistor (GE)**
- **R1—1000-ohm, ½-watt resistor**
- **R2—220,000-ohm, ½-watt resistor**
- **R3—820-ohm, ½-watt resistor**
- **R4—560-ohm, ½-watt resistor**
- **R5—1800-ohm, ½-watt resistor**
- **S1—Spst toggle switch**
- **T1—Output transformer: 1000-ohm pri.; 8-ohm sec. (Lafayette 33T8550 or equiv.)**
- **1—Tuning fork (see text)**
- **1—2½-in., 8-ohm speaker (Lafayette 99T6038 or equiv.)**
- **Misc.—Aluminum minibox, ¼-round wood molding, epoxy cement, battery strap, tie strip (4 lug), perfboard and push-in terminals, wire, solder, hardware, etc.**

fundamental resonant frequency, the output frequency is stable and accurate.

What starts the fork vibrating in the first place? Random electrical noise. The minute you turn *on* the power switch, Q1 amplifies this noise which, in turn, starts the fork vibrating. In a few seconds (typically 5 to 10) the fork stabilizes at its resonant frequency.

Transistors Q2 and Q3 form a straightforward audio amplifier circuit that drives the built-in speaker. The signal to be amplified is taken from the base of Q1, its input, rather than its output, because the sine wave is purer at this point. The trip through the Darlington amplifier tends to distort the waveform.

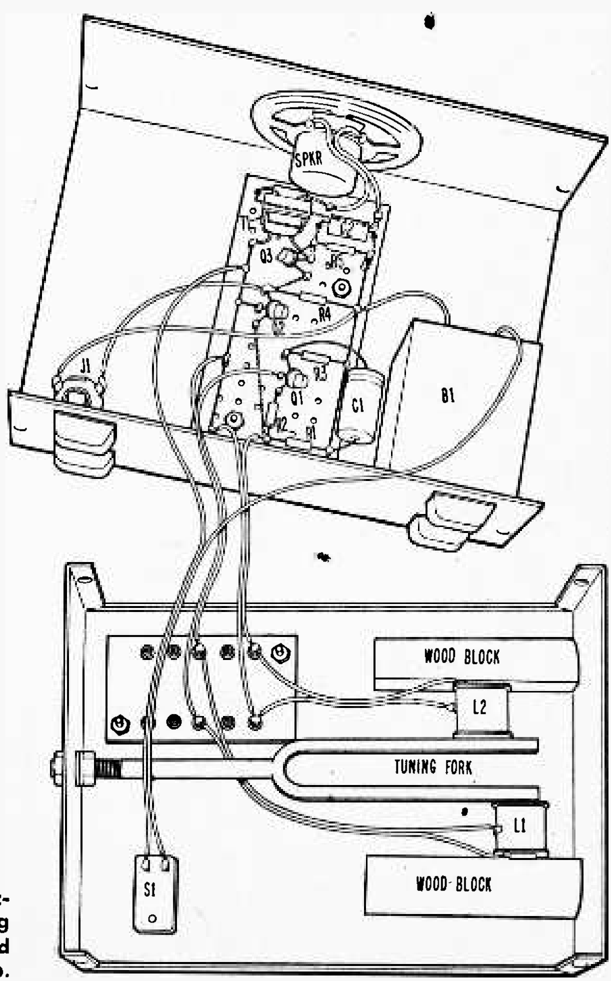
If you desire greater output volume, the oscillator output can be fed from J1 to any external audio amplifier.

**Building It.** You must use a steel tuning fork, so be sure that the one you buy is not aluminum. A magnet tells all. Your local music supply shop will have (or will be able to order) steel forks in a wide range of fundamental frequencies. The fork we use vibrates at 440 Hz (standard *A*). However, you do not have to stick with a 440-Hz fork as any other frequency will work in the device.

Thread the end of the fork's stem with a steel threading die. The fork will, in all probability, have a stem diameter of ¼-in., so that a ¼-20 NC die is perfect. This threading enables mounting the fork securely with ¼-20 nuts to the aluminum minibox that serves as the chassis/cabinet (as shown in photo). A secure mount is necessary for proper operation since the fork must be firmly held in place between the two coils.

**From Phones To Oscillator.** L1 and L2 are coils obtained from a Trim 2000-ohm impedance headphone. Each coil has an impedance of 1000 ohms—the two coils are wired in series in the headphone case to total the 2000 ohms of the unit. To remove the coils, first unscrew the hard rubber cap and lift off the thin metal diaphragm (it is held in place by magnetic attraction). Remove the two bolts that hold the horseshoe magnet to the coil assemblies (each coil assembly consists of a coil of wire mounted on a right angled pole piece to facilitate its mounting to the magnet). Carefully cut the very thin copper wires that join the coils together and also the wires from each coil to its respective output terminal of the headphone.

Firmly fasten coils L1 and L2, each to a separate wooden block, made from ¼-round wood molding approximately 2-in. long, by means of a wood screw through the hole in their pole piece/mounting support



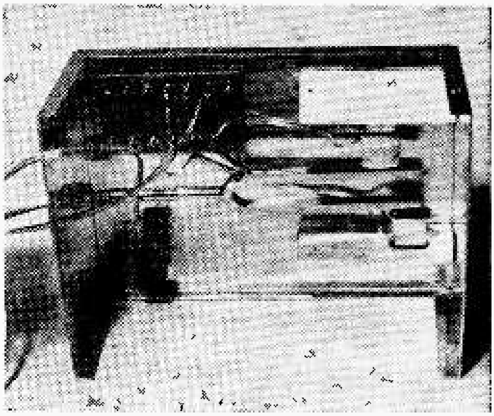

Freq Standard's mechanical construction is simplified by placing tuning fork in bottom of minibox, perfboard and most related components in top.

# FREQ STANDARD

into the wood block. Using epoxy cement, cement the wooden blocks to the base of the minibox, as shown in the photograph. The blocks should be positioned so that the space between a tuning fork tine and the pole piece of a coil is 1/16-in. L2 should be mounted so that it is placed about a coil's length further down the length of its respective tine than coil L1 is down its tine (see photo). This positioning will improve signal linearity.

Carefully solder flexible, insulated wire extensions to the fine wires of each coil, of sufficient length to dress them away from the fork and long enough to reach a tie strip. The wire from the coils is very fine and enameled. Be careful in removing the enamel when preparing the fine wire for soldering to the extension leads. Make sure all the enamel has been removed and the copper is bright and clean. Handle the fine wires with the care you would give a delicate piece of china; they are fragile, and can be easily broken at the coil bobbin.

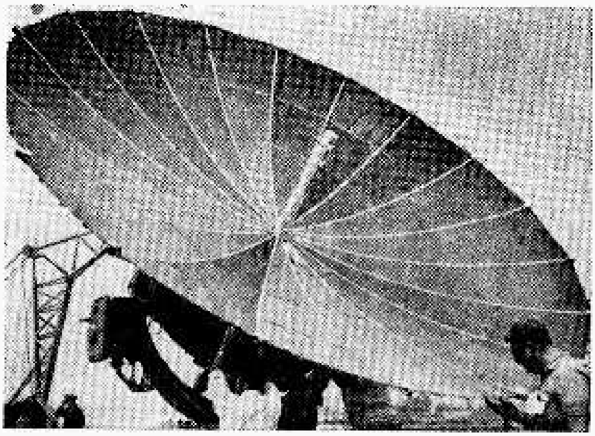
The balance of the components are mounted and wired on a piece of perfboard, using push-in terminals as soldering points.

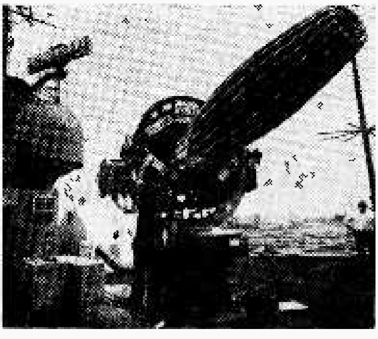


**View of bottom portion of Freq Standard, showing tuning fork, coils L1 and L2, and wooden blocks which hold them. See text for recommendations re placement of coils.**

Since AC hum pickup (from adjacent power lines) is a potential problem, keep all interconnecting leads as short as possible. Another reason to keep them short is to ensure that they will not droop onto the tuning fork when the minibox is closed. This will affect the fork's output. Note: The phasing of the two coils is important. If you get no tone from the unit after checking out your wiring job, reverse the connections to either one of the coils, but not both. ■

# TV's long, long way to Tipperary





**It's a long, long way from the Apollo 11's Pacific splashdown point to Tipperary, but Tipperary TV viewers enjoyed live coverage nevertheless. Reason was an unusual furled parabolic reflector antenna which Western Union International used to beam the event to a Comstat communications satellite and thence to TV stations in some 49 countries around the world. The 15-ft antenna was mounted on gyro-stabilized platform on deck of U.S.S. Hornet and maintained unerring aim on satellite regardless of motion of ship.**

# WHITE'S RADIO LOG

An up-to-date Directory of North American AM, FM, and TV Stations, including special sections on World-Wide Shortwave Stations and Emergency Stations for Selected Areas

## WHITE'S RADIO LOG CONTENTS FOR 1969*



* If you save six consecutive issues of Radio-TV Experimenter and Science and Electronics, you will have a complete White's Radio Log. If you have missed an issue, you may be able to get a copy by writing directly to the publisher stating which issue you wish and enclosing $1.00 for each issue.

WHITE'S RADIO LOG

# U. S. AM Stations by Call Letters

| Call | Location | kHz |
|---|---|---|
| KAAA | Kingman, Ariz. | 1230 |
| KAAY | Little Rock, Ark. | 1090 |
| KABC | Los Angeles, Calif. | 790 |
| KABH | Midland, Tex. | 1510 |
| KABI | Abilene, Kans. | 1560 |
| KABL | Oakland, Calif. | 960 |
| KABQ | Albuquerque, N.M. | 1350 |
| KABR | Aberdeen, S.Dak. | 1420 |
| KACE | Riverside, Calif. | 1570 |
| KACI | The Dalles, Oreg. | 1300 |
| KACL | Santa Barbara, Cal. | 1290 |
| KACT | Andrews, Tex. | 1360 |
| KACY | Port Hueneme, Calif. | 1520 |
| KADA | Ada, Okla. | 1230 |
| KADL | Pine Bluff, Ark. | 1270 |
| KADO | Marshall, Tex. | 1410 |
| KAFE | Sante Fe, N.M. | 810 |
| KAFF | Flagstaff, Ariz. | 930 |
| KAFY | Bakersfield, Calif. | 550 |
| KAGE | Winona, Minn. | 1380 |
| KAGH | Crossett, Ark. | 800 |
| KAGI | Grants Pass, Oreg. | 930 |
| KAGO | Klamath Falls, Oreg. | 1150 |
| KAGT | Anacortes, Wash. | 1340 |
| KAHI | Auburn, Calif. | 950 |
| KAHU | Waipahu, Hawaii | 940 |
| KAIM | Honolulu, Hawaii | 870 |
| KAIN | Nampa, Ida. | 1340 |
| KAIR | Tucson, Ariz. | 1490 |
| KAJO | Grants Pass, Oreg. | 1270 |
| KAKC | Tulsa, Okla. | 970 |
| KAKE | Wichita, Kan. | 1240 |
| KALB | Alexandria, La. | 580 |
| KALE | Richland, Wash. | 960 |
| KALF | Mesa, Ariz. | 1510 |
| KALG | Alamogordo, N.Mex. | 1230 |
| KALI | San Gabriel, Cal. | 1430 |
| KALL | Salt Lake City, Utah | 910 |
| KALM | Thayer, Mo. | 1290 |
| KALN | Iola, Kan. | 1370 |
| KALO | Little Rock, Ark. | 1250 |
| KALT | Atlanta, Tex. | 900 |
| KALV | Alva, Okla. | 1430 |
| KAMD | Camden, Ark. | 910 |
| KAMI | Cozad, Neb. | 1580 |
| KAML | Kenedy-Karnes City, Tex. | 990 |
| KAMO | Rogers, Ark. | 1390 |
| KAMP | El Centro, Calif. | 1430 |
| KANA | Anaconda, Mont. | 580 |
| KAND | Corsicana, Tex. | 1340 |
| KANE | New Iberia, La. | 1240 |
| KANI | Wharton, Tex. | 1500 |
| KANN | Ogden, Utah | 1090 |
| KANO | Anoka, Minn. | 1470 |
| KANS | Larned, Kan. | 1510 |
| KAOH | Duluth, Minn. | 1390 |
| KAOK | Lake Charles, La. | 1400 |
| KAOL | Carrollton, Mo. | 1430 |
| KAOR | Oroville, Calif. | 1340 |
| KAPA | Raymond, Wash. | 1340 |
| KAPB | Marksville, La. | 1370 |
| KAPE | San Antonio, Tex. | 1480 |
| KAPI | Pueblo, Colo. | 690 |
| KAPR | Douglas, Ariz. | 930 |
| KAPS | Mt. Vernon, Wash. | 1470 |
| KAPT | Salem, Ore. | 1220 |
| KAPY | Port Angeles, Wash. | 1290 |
| KARE | Atchison, Kan. | 1470 |
| KARI | Blaine, Wash. | 550 |
| KARK | Little Rock, Ark. | 920 |
| KARM | Fresno, Calif. | 1430 |
| KARR | Great Falls, Mont. | 1400 |
| KARS | Belen, N.M. | 860 |
| KART | Jerome, Idaho | 1400 |
| KARV | Russellville, Ark. | 1490 |
| KARY | Prosser, Wash. | 1310 |
| KASA | Phoenix, Ariz. | 1540 |
| KASH | Eugene, Ore. | 1590 |
| KASI | Ames, Iowa | 1430 |
| KASL | Newcastle, Wyo. | 1240 |
| KASM | Albany, Minn. | 1150 |
| KASO | Minden, La. | 1240 |
| KAST | Astoria, Ore. | 1370 |
| KASY | Auburn, Wash. | 1220 |
| KATA | Arcata, Calif. | 1340 |
| KATE | Albert Lea, Minn. | 1450 |
| KATI | Casper, Wyo. | 1400 |
| KATL | Miles City, Mont. | 1340 |
| KATN | Boise, Ida. | 950 |
| KATO | Safford, Ariz. | 1230 |
| KATQ | Texarkana, Tex. | 940 |
| KATR | Eugene, Ore. | 1320 |
| KATY | San Luis Obispo, Cal. | 1340 |
| KATZ | St. Louis, Mo. | 1600 |
| KAUS | Austin, Minn. | 1480 |
| KAVA | Burney, Cal. | 1450 |
| KAVE | Carlsbad, N.Mex. | 1240 |
| KAVI | Rocky Ford, Colo. | 1320 |
| KAVL | Lancaster, Calif. | 610 |
| KAVR | Apple Valley, Calif. | 960 |
| KAWA | Waco-Marlin, Tex. | 1010 |
| KAWL | York, Neb. | 1370 |
| KAWT | Douglas, Ariz. | 1450 |
| KAWW | Heber Springs, Ark. | 1370 |
| KAYC | Beaumont, Tex. | 1450 |
| KAYE | Puyallup, Wash. | 1450 |
| KAYG | Lakewood, Wash. | 1480 |
| KAYL | Storm Lake, Iowa | 990 |
| KAYO | Seattle, Wash. | 1150 |
| KAYS | Hays, Kans. | 1400 |
| KAYT | Rupert, Idaho | 970 |
| KAZA | Gilroy, Cal. | 1290 |
| KBAB | Indianola, Iowa | 1490 |
| KBAD | Carlsbad, N.M. | 740 |
| KBAL | San Saba, Tex. | 1410 |
| KBAM | Longview, Wash. | 1270 |
| KBAN | Bowie, Tex. | 1410 |
| KBAR | Burley, Idaho | 1230 |
| KBAT | San Antonio, Tex. | 680 |
| KBBA | Benton, Ark. | 690 |
| KBBB | Borger, Tex. | 1600 |
| KBBC | Centerville, Utah | 1600 |
| KBBO | Yakima, Wash. | 1390 |
| KBBQ | Burbank, Cal. | 1500 |
| KBBR | North Bend, Oreg. | 1340 |
| KBBS | Buffalo, Wyo. | 1450 |
| KBCH | Oceanlake, Oreg. | 1380 |
| KBCL | Shreveport, La. | 1220 |
| KBEA | Mission, Kans. | 1480 |
| KBEC | Waxahachie, Tex. | 1390 |
| KBEE | Modesto, Calif. | 970 |
| KBEK | Elk City, Okla. | 1240 |
| KBEL | Idabel, Okla. | 1240 |
| KBEN | Carrizo Sprgs., Tex. | 1450 |
| KBER | San Antonio, Tex. | 1150 |
| KBEW | Blue Earth, Minn. | 1560 |
| KBFS | Belle Fourche, S.Dak. | 1450 |
| KBFW | Bellingham, Wash. | 930 |
| KBGH | Memphis, Tex. | 1130 |
| KBGN | Caldwell, Idaho | 910 |
| KBGO | Waco, Tex. | 1580 |
| KBHB | Sturgis, S. D. | 810 |
| KBHC | Nashville, Ark. | 1260 |
| KBHM | Branson, Mo. | 1220 |
| KBHS | Hot Springs, Ark. | 590 |
| KBIB | Monette, Ark. | 1560 |
| KBIF | Fresno, Calif. | 900 |
| KBIG | Avalon, Cal. | 740 |
| KBIL | Liberty, Mo. | 1140 |
| KBIM | Roswell, N.Mex. | 910 |
| KBIS | Bakersfield, Calif. | 970 |
| KBIX | Muskogee, Okla. | 1490 |
| KBJM | Lemmon, S.D. | 1400 |
| KBJS | Sallisaw, Okla. | 1510 |
| KBIZ | Ottuwa, Iowa | 1240 |
| KBJT | Fordyce, Ark. | 1570 |
| KBKR | Baker, Oreg. | 1490 |
| KBKW | Aberdeen, Wash. | 1450 |
| KBLC | Lakeport, Cal. | 1270 |
| KBLE | Seattle, Wash. | 1050 |
| KBLF | Red Bluff, Calif. | 1490 |
| KBLI | Blackfoot, Idaho | 690 |
| KBLL | Helena, Mont. | 1240 |
| KBLR | Bolivar, Mo. | 1130 |
| KBLT | Big Lake, Tex. | 1290 |
| KBLU | Yuma, Ariz. | 1320 |
| KBLW | Logan, Utah | 1390 |
| KBLY | Gold Beach, Oreg. | 1220 |
| KBMI | Henderson, Nev. | 1400 |
| KBMN | Bozeman, Mont. | 1230 |
| KBMO | Benson, Minn. | 1290 |
| KBMR | Bismarck, N. D. | 1350 |
| KBMW | Wahpeton, N.D.-Breckenridge, Minn. | 1450 |
| KBMY | Billings, Mont. | 1240 |
| KBND | Bend, Oreg. | 1110 |
| KBOA | Kennett, Mo. | 830 |
| KBOE | Oskaloosa, Iowa | 740 |
| KBOI | Boise, Ida. | 670 |
| KBOK | Malvern, Ark. | 1310 |
| KBOL | Boulder, Colo. | 1490 |
| KBOM | Bismark-Mandan, N.Dak. | 1270 |
| KBON | Omaha, Nebr. | 1490 |
| KBOP | Pleasanton, Tex. | 1380 |
| KBOR | Brownsville, Tex. | 1600 |
| KBOW | Butte, Mont. | 550 |
| KBOX | Dallas, Tex. | 1480 |
| KBOY | Medford, Oreg. | 730 |
| KBPS | Portland, Oreg. | 1450 |
| KBRB | Ainsworth, Neb. | 1400 |
| KBRC | Mt. Vernon, Wash. | 1430 |
| KBRF | Fergus Falls, Minn. | 1250 |
| KBRI | Brinkley, Ark. | 1570 |
| KBRK | Brookings, S.Dak. | 1430 |
| KBRL | McCook, Nebr. | 1300 |
| KBRN | Brighton, Colo. | 800 |
| KBRO | Bremerton, Wash. | 1490 |
| KBRR | Leadville, Colo. | 1230 |
| KBRS | Springdale, Ark. | 1340 |
| KBRV | Soda Springs, Ida. | 790 |
| KBRX | O'Neill, Nebr. | 1350 |
| KBRZ | Freeport, Texas | 1460 |
| KBSF | Springhill, La. | 1460 |
| KBSN | Crane, Tex. | 970 |
| KBST | Big Spring, Tex. | 1490 |
| KBTA | Batesville, Ark. | 1340 |
| KBTC | Houston, Mo. | 1250 |
| KBTM | Jonesboro, Ark. | 1230 |
| KBTN | Neosho, Mo. | 1420 |
| KBTO | El Dorado, Kans. | 1360 |
| KBTR | Denver, Colo. | 710 |
| KBUB | Sparks, Nev. | 1270 |
| KBUC | San Antonio, Tex. | 1310 |
| KBUD | Athens, Tex. | 1410 |
| KBUH | Brigham City, Utah | 800 |
| KBUN | Bemidji, Minn. | 1450 |
| KBUR | Burlington, Iowa | 1490 |
| KBUS | Mexia, Tex. | 1590 |
| KBUY | Ft. Worth, Tex. | 1540 |
| KBUZ | Mesa, Ariz. | 1310 |
| KBVM | Lancaster, Calif. | 1380 |
| KBWD | Brownwood, Tex. | 1380 |
| KBXM | Kennett, Mo. | 1540 |
| KBYE | Okla. City, Okla. | 890 |
| KBYG | Big Spring, Tex. | 1400 |
| KBYP | Shamrock, Tex. | 1580 |
| KBYR | Anchorage, Alaska | 1270 |
| KBZB | Odessa, Tex. | 920 |
| KBZY | Salem, Oreg. | 1490 |
| KBZZ | LaJunta, Colo. | 1400 |
| KCAB | Dardanelle, Ark. | 980 |
| KCAC | Phoenix, Ariz. | 1010 |
| KCAD | Abilene, Tex. | 1560 |
| KCAL | Redlands, Calif. | 1410 |
| KCAM | Glennallen, Alaska | 790 |
| KCAN | Canyon, Tex. | 1550 |
| KCAP | Helena, Mont. | 1340 |
| KCAR | Clarksville, Tex. | 1350 |
| KCAS | Slaton, Tex. | 1050 |
| KCAT | Pine Bluff, Ark. | 1530 |
| KCAW | Port Arthur, Tex. | 1510 |
| KCBC | Des Moines, Iowa | 1390 |
| KCBD | Lubbock, Tex. | 1590 |
| KCBN | Reno, Nev. | 1230 |
| KCBQ | San Diego, Calif. | 1170 |
| KCBS | San Fran., Calif. | 740 |
| KCCB | Corning, Ark. | 1260 |
| KCCC | Carlsbad, N.M. | 930 |
| KCCL | Paris, Ark. | 1460 |
| KCCN | Honolulu, Hawaii | 1420 |
| KCCO | Lawton, Okla. | 1050 |
| KCCR | Pierre, S. D. | 1240 |
| KCCT | Corpus Christi, Tex. | 1150 |
| KCCV | Independence, Mo. | 1510 |
| KCEE | Tucson, Ariz. | 790 |
| KCEY | Tunlock, Calif. | 1390 |
| KCFA | Spokane, Wash. | 1330 |
| KCFH | Cuero, Tex. | 1600 |
| KCFI | Cedar Falls, Iowa | 1250 |
| KCGO | Cheyenne, Wyo. | 1590 |
| KCHA | Charles City, Iowa | 1580 |
| KCHE | Cherokee, Iowa | 1440 |
| KCHI | Chillicothe, Mo. | 1010 |
| KCHJ | Delano, Calif. | 1010 |
| KCHR | Charleston, Mo. | 1350 |
| KCHS | Truth or Consequences, New Mexico | 1400 |
| KCHV | Coachella, Calif. | 970 |
| KCID | Caldwell, Idaho | 1490 |
| KCII | Washington, Iowa | 1380 |
| KCIJ | Shreveport, La. | 980 |
| KCIM | Carroll, Iowa | 1380 |
| KCIN | Victorville, Calif. | 1590 |
| KCJB | Minot, N.Dak. | 910 |
| KCKC | San Bernardino, Cal. | 1350 |
| KCKN | Kansas City, Kans. | 1340 |
| KCKW | Jena, La. | 1480 |
| KCKY | Coolidge, Ariz. | 1150 |
| KCLA | Pine Bluff, Ark. | 1400 |
| KCLE | Cleburne, Tex. | 1120 |
| KCLM | Redding, Cal. | 1330 |
| KCLN | Clinton, Iowa | 1390 |
| KCLO | Leavenworth, Kans. | 1410 |
| KCLR | Ralls, Tex. | 1530 |
| KCLS | Flagstaff, Ariz. | 600 |
| KCLU | Rolla, Mo. | 1590 |
| KCLV | Clovis, N.Mex. | 1240 |
| KCLW | Hamilton, Tex. | 900 |
| KCLX | Colfax, Wash. | 1450 |
| KCMC | Texarkana, Tex. | 1230 |
| KCMJ | Palm Sprgs., Calif. | 1010 |
| KCMO | Kansas City, Mo. | 810 |
| KCMS | Manitou Sprgs., Colo. | 1490 |
| KCNI | Broken Bow, Nebr. | 1280 |
| KCNO | Alturas, Calif. | 570 |
| KCNW | Tulsa, Okla. | 1300 |
| KPNW | Eugene, Ore. | 1120 |
| KCNY | San Marcos, Tex. | 1470 |
| KCOB | Newton, Iowa | 1280 |
| KCOG | Centerville, Iowa | 1400 |
| KCOH | Houston, Tex. | 1430 |
| KCOK | Tulare, Calif. | 1270 |
| KCOL | Ft. Collins, Colo. | 1410 |
| KCOM | Comanche, Tex. | 1550 |
| KCON | Conway, Ark. | 1230 |
| KCOR | San Antonio, Tex. | 1350 |
| KCOW | Alliance, Nebr. | 1400 |
| KCOY | Santa Maria, Cal. | 1440 |
| KCPX | Salt Lake City, Utah | 1320 |
| KCRA | Sacramento, Calif. | 1320 |
| KCRB | Chanute, Kans. | 1460 |
| KCRC | Enid, Okla. | 1390 |
| KCRG | Cedar Rapids, Iowa | 1600 |
| KCRL | Reno, Nev. | 780 |
| KCRM | Crane, Tex. | 1380 |
| KCRS | Midland, Tex. | 550 |
| KCRT | Trinidad, Colo. | 1240 |
| KCRV | Caruthersville, Mo. | 1370 |
| KCSJ | Pueblo, Colo. | 590 |
| KCSR | Chadron, Nebr. | 610 |
| KCTA | Corpus Christi, Tex. | 1030 |
| KCTI | Gonzales, Tex. | 1450 |
| KCTO | Columbia, La. | 1540 |
| KCTY | Salinas, Calif. | 980 |
| KCTX | Childress, Tex. | 1510 |
| KCUB | Tucson, Ariz. | 1290 |
| KCUE | Red Wing, Minn. | 1250 |
| KCUZ | Clifton, Ariz. | 1490 |
| KCVL | Colville, Wash. | 1270 |
| KCVR | Lodi, Calif. | 1570 |
| KCYL | Lampasas, Tex. | 1450 |
| KCYN | Williams, Ariz. | 1240 |
| KDAC | Ft. Bragg, Calif. | 1230 |
| KDAK | Carrington, N.D. | 1600 |
| KDAL | Duluth, Minn. | 610 |
| KDAV | Lubbock, Tex. | 580 |
| KDAY | Santa Monica, Calif. | 1580 |
| KDB | Santa Barbara, Calif. | 1490 |
| KDBM | Dillon, Mont. | 800 |
| KDBS | Alexandria, La. | 1410 |
| KDCE | Espanola, N.M. | 970 |
| KDDA | Dumas, Ark. | 1560 |
| KDDD | Dumas, Tex. | 800 |
| KDEC | Decorah, Iowa | 1240 |
| KDEF | Albuquerque, N.Mex. | 1150 |
| KDEN | Denver, Colo. | 1340 |
| KDEO | El Cajon, Calif. | 910 |
| KDES | Palm Sprgs., Calif. | 920 |
| KDET | Center, Tex. | 930 |
| KDEW | DeWitt, Ark. | 1470 |
| KDEX | Dexter, Mo. | 1590 |
| KDFL | Sumner, Wash. | 1560 |
| KDFN | Doniphan, Mo. | 1500 |
| KDGO | Durango, Colo. | 1240 |
| KDHI | Twenty-nine Palms, California | 1250 |
| KDHL | Faribault, Minn. | 920 |
| KDHN | Dimmitt, Tex. | 1470 |
| KDIA | Oakland, Calif. | 1310 |
| KDIO | Ortonville, Minn. | 1350 |
| KDIX | Dickinson, N.Dak. | 1230 |
| KDJI | Holbrook, Ariz. | 1270 |
| KDJW | Amarillo, Tex. | 1010 |
| KDKA | Pittsburgh, Pa. | 1020 |
| KDKD | Clinton, Mo. | 1280 |
| KDKO | Littleton, Colo. | 1510 |
| KDLA | DeRidder, La. | 1010 |
| KDLK | Del Rio, Tex. | 1230 |
| KDLM | Detroit Lakes, Minn. | 1340 |
| KDLR | Devils Lake, N.Dak. | 1240 |
| KDLS | Perry, Iowa | 1310 |
| KDMA | Montevideo, Minn. | 1450 |
| KDMO | Carthage, Mo. | 1490 |
| KDMS | El Dorado, Ark. | 1290 |
| KDNC | Spokane, Wash. | 1440 |
| KDNT | Denton, Tex. | 1440 |
| KDOK | Tyler, Tex. | 1490 |
| KDOL | Mojave, Calif. | 1340 |
| KDOM | Windom, Minn. | 1580 |
| KOON | Salinas, Calif. | 1460 |
| KDOT | Scottsdale, Ariz. | 1440 |
| KDOV | Medford, Oreg. | 1300 |
| KDOX | Marshall, Tex. | 1410 |
| KDQN | DeQueen, Ark. | 1390 |
| KDRG | Deer Lodge, Mont. | 1400 |
| KDRO | Sedalia, Mo. | 1490 |
| KDRS | Paragould, Ark. | 1490 |
| KDRY | Alamo Hts., Tex. | 1110 |
| KDSJ | Deadwood, S.Dak. | 980 |
| KDSN | Denison, Ia. | 1530 |
| KDSX | Denison-Sherman, Tex. | 950 |
| KDTA | Delta, Colo. | 1400 |
| KDTH | Dubuque, Iowa | 1370 |
| KDUZ | Hutchinson, Minn. | 1260 |
| KDWA | Hastings, Minn. | 1460 |
| KDWB | St. Paul, Minn. | 630 |
| KDWT | Stamford, Tex. | 1400 |
| KDXE | No. Little Rock, Ark. | 1380 |
| KDXI | Mansfield, La. | 1360 |
| KDXU | St. George, Utah | 1430 |
| KDYL | Tooele, Utah | 990 |
| KDZA | Pueblo, Colo. | 1230 |
| KEAN | Brownwood, Tex. | 1240 |
| KEAP | Fresno, Calif. | 980 |
| KEBE | Jacksonville, Tex. | 1400 |
| KECH | Ketchikan, Alaska | 620 |
| KEDA | San Antonio, Tex. | 1540 |
| KEDD | Dodge City, Kans. | 1550 |
| KEDO | Longview, Wash. | 1400 |
| KEED | Eugene, Ore. | 1450 |
| KEEE | Nacogdoches, Tex. | 1230 |
| KEEL | Shreveport, La. | 710 |
| KEEN | San Jose, Calif. | 1370 |
| KEEP | Twin Falls, Idaho | 1450 |
| KEES | Gladewater, Tex. | 1430 |
| KEGG | Daingerfield, Tex. | 1560 |
| KEHG | Fosston, Minn. | 1480 |
| KELA | Centralia-Chekalis, Wash. | 1470 |

| Call | Location | kHz |
|---|---|---|
| KELD | El Dorado, Ark. | 1400 |
| KELI | Tulsa, Okla. | 1430 |
| KELK | Elko, Nev. | 1240 |
| KELO | Sioux Falls, S.Dak. | 1320 |
| KELP | El Paso, Tex. | 920 |
| KELR | El Reno, Okla. | 1460 |
| KELY | Ely, Nev. | 1230 |
| KENA | Mena, Ark. | 1450 |
| KENE | Toppenish, Wash. | 1490 |
| KENI | Anchorage, Alaska | 550 |
| KENM | Portales, N.Mex. | 1450 |
| KENN | Farmington, N.M. | 1390 |
| KENO | Las Vegas, Nev. | 1460 |
| KENR | Houston, Tex. | 1070 |
| KENT | Prescott, Ariz. | 1340 |
| KEOR | Atoka, Okla. | 1110 |
| KEOS | Flagstaff, Ariz. | 690 |
| KEPR | Kennewick-Richland-Pasco, Wash. | 610 |
| KEPS | Eagle Pass, Tex. | 1270 |
| KERB | Kermit, Tex. | 600 |
| KERC | Eastland, Tex. | 1590 |
| KERG | Eugene, Oreg. | 1280 |
| KERN | Bakersfield, Calif. | 1410 |
| KERV | Kerrville, Tex. | 1230 |
| KESM | Eldorado Springs, Mo. | 1580 |
| KEST | Boise, Idaho | 790 |
| KETX | Livingston, Tex. | 1440 |
| KEUN | Eunice, La. | 1490 |
| KEVA | Evanston, Wyo. | 1240 |
| KEVL | White Castle, La. | 1590 |
| KEVT | Tucson, Ariz. | 690 |
| KEWE | Ft. Collins, Colo. | 600 |
| KEWI | Topeka, Kans. | 1440 |
| KEWQ | Paradise, Cal. | 930 |
| KEX | Portland, Oreg. | 1190 |
| KEXO | Grand Junc., Colo. | 1230 |
| KEXS | Excelsior Springs, Mo. | 1090 |
| KEYD | Oakes, N.Dak. | 1220 |
| KEYE | Perryton, Tex. | 1400 |
| KEYJ | Jamestown, N.Dak. | 1400 |
| KEYL | Long Prairie, Minn. | 1400 |
| KEYN | Wichita, Kan. | 900 |
| KEYR | Terrytown, Nebr. | 690 |
| KEYS | Corpus Christi, Tex. | 1440 |
| KEYY | Provo, Utah | 1450 |
| KEYZ | Williston, N.Dak. | 1360 |
| KEZU | Rapid City, S.Dak. | 920 |
| KEZY | Anaheim, Calif. | 1190 |
| KFAB | Omaha, Nebr. | 1110 |
| KFAC | Los Angeles, Calif. | 1330 |
| KFAH | Lakewood Center, Wash. | 1480 |
| KFAL | Fulton, Mo. | 900 |
| KFAM | St. Cloud, Minn. | 1450 |
| KFAR | Fairbanks, Alaska | 660 |
| KFAX | San Francisco, Calif. | 1100 |
| KFAY | Fayetteville, Ark. | 1250 |
| KFBC | Cheyenne, Wyo. | 1240 |
| KFBD | Waynesville, Mo. | 1270 |
| KFBK | Sacramento, Calif. | 1530 |
| KFBR | Nogales, Ariz. | 1340 |
| KFCB | Redfield, S. Dak. | 1380 |
| KFDF | Van Buren, Ark. | 1580 |
| KFDI | Wichita, Kansas | 1070 |
| KFDR | Grand Coulee, Wash. | 1360 |
| KFEL | Pueblo, Colo. | 970 |
| KFEQ | St. Joseph, Mo. | 680 |
| KFFA | Helena, Ark. | 1360 |
| KFGO | Fargo, N.D. | 790 |
| KFGQ | Boone, Iowa | 1260 |
| KFH | Wichita, Kans. | 1330 |
| KFI | Los Angeles, Calif. | 640 |
| KFIL | Preston, Minn. | 1060 |
| KFIR | Sweet Home, Ore. | 1370 |
| KFIV | Modesto, Calif. | 1360 |
| KFIZ | Fond du Lac, Wis. | 1450 |
| KFJB | Marshalltown, Iowa | 1230 |
| KFJM | Grand Forks, N.Dak | 1370 |
| KFJZ | Ft. Worth, Tex. | 1270 |
| KFKA | Greeley, Colo. | 1310 |
| KFKF | Bellevue, Wash. | 1540 |
| KFKU | Lawrence, Kans. | 1250 |
| KFLA | Scott City, Kans. | 1310 |
| KFLD | Floydada, Tex. | 900 |
| KFLI | Mountain Home, Ida. | 1240 |
| KFLJ | Walsenburg, Colo. | 1380 |
| KFLN | Baker, Mont. | 960 |
| KFLW | Klamath Falls, Oreg. | 1450 |
| KFLY | Corvallis, Oreg. | 1240 |
| KFMB | San Diego, Cal. | 760 |
| KFMJ | Tulsa, Okla. | 1050 |
| KFML | Denver, Colo. | 1390 |
| KFMO | Flat River, Mo. | 1240 |
| KFNV | Ferriday, La. | 1600 |
| KFNW | Fargo, N.Dak. | 900 |
| KFOR | Lincoln, Nebr. | 1240 |
| KFOX | Long Beach, Calif. | 1280 |
| KFPW | Ft. Smith, Ark. | 1230 |
| KFQD | Anchorage, Alaska | 750 |
| KFRA | Franklin, La. | 1390 |
| KFRB | Fairbanks, Alaska | 900 |
| KFRC | San Francisco, Calif. | 610 |
| KFRD | Rosenberg-Richmond, Tex. | 980 |
| KFRE | Fresno, Calif. | 940 |
| KFRM | Salina, Kan. | 550 |
| KFRO | Longview, Tex. | 1370 |
| KFRU | Columbia, Mo. | 1400 |
| KFSA | Ft. Smith, Ark. | 950 |
| KFSB | Joplin, Mo. | 1310 |
| KFSC | Denver, Colo. | 1220 |
| KFST | Ft. Stockton, Tex. | 860 |
| KFTM | Ft. Morgan, Colo. | 1400 |
| KFTW | Fredericktown, Mo. | 1450 |
| KFUN | Las Vegas, N.Mex. | 1230 |
| KFUO | Clayton, Mo. | 850 |
| KFVS | Cape Girardeau, Mo. | 960 |
| KFWB | Los Angeles, Calif. | 980 |
| KFXD | Nampa, Idaho | 580 |
| KFXM | San Bernardino, Calif. | 590 |
| KFYN | Bonham, Tex. | 1420 |
| KFYO | Lubbock, Tex. | 790 |
| KFYR | Bismarck, N.Dak. | 550 |
| KGA | Spokane, Wash. | 1510 |
| KGAF | Gainesville, Tex. | 1580 |
| KGAK | Gallup, N.Mex. | 1330 |
| KGAL | Lebanon, Oreg. | 920 |
| KGAR | Vancouver, Wash. | 1550 |
| KGAS | Carthage, Tex. | 1590 |
| KGAY | Salem, Oreg. | 1430 |
| KGB | San Diego, Calif. | 1360 |
| KGBC | Galveston, Tex. | 1540 |
| KGBS | Los Angeles, Calif. | 1020 |
| KGBT | Harlingen, Tex. | 1530 |
| KGBX | Springfield, Mo. | 1260 |
| KGCA | Rugby, N.D. | 1450 |
| KGCL | East Prairie, Mo. | 1080 |
| KGCX | Sidney, Mont. | 1480 |
| KGDN | Edmonds, Wash. | 630 |
| KGEE | Bakersfield, Calif. | 1230 |
| KGEK | Sterling, Colo. | 1230 |
| KGEM | Boise, Idaho | 1140 |
| KGEN | Tulare, Calif. | 1370 |
| KGER | Long Beach, Calif. | 1390 |
| KGEZ | Kalispell, Mont. | 600 |
| KGFF | Shawnee, Okla. | 1450 |
| KGFJ | Los Angeles, Calif. | 1230 |
| KGFL | Roswell, N.M. | 1430 |
| KGFW | Kearney, Nebr. | 1340 |
| KGFX | Pierre, S.D. | 1060 |
| KGGF | Coffeyville, Kans. | 690 |
| KGGM | Albuquerque, N.Mex. | 610 |
| KGHL | Billings, Mont. | 790 |
| KGHM | Brookfield, Mo. | 1470 |
| KGHO | Hoquiam, Wash. | 1560 |
| KGHS | International Falls, Minn. | 1230 |
| KGIL | San Fernando, Calif. | 1260 |
| KGIW | Alamosa, Colo. | 1450 |
| KGKL | San Angelo, Tex. | 960 |
| KGKO | Benton, Ark. | 850 |
| KGLA | Gretna, La. | 1540 |
| KGLC | Miami, Okla. | 910 |
| KGLE | Glendive, Mont. | 590 |
| KGLM | Avalon, Calif. | 740 |
| KGLN | Glenwood Sprgs., Colo. | 980 |
| KGLO | Mason City, Iowa | 1300 |
| KGLU | Safford, Ariz. | 1480 |
| KGMB | Honolulu, Hawaii | 590 |
| KGMC | Englewood, Colo. | 1150 |
| KGMI | Bellingham, Wash. | 790 |
| KGMO | Cape Girardeau, Mo. | 1220 |
| KGMR | Jacksonville, Ark. | 1500 |
| KGMS | Sacramento, Calif. | 1380 |
| KGMT | Fairbury, Nebr. | 1310 |
| KGMY | Missoula, Mont. | 1450 |
| KGNB | New Braunfels, Tex. | 1420 |
| KGNC | Amarillo, Tex. | 710 |
| KGNO | Dodge City, Kans. | 1370 |
| KGNS | Laredo, Tex. | 1300 |
| KGNU | Santa Clara, Cal. | 1430 |
| KGO | San Francisco, Calif. | 810 |
| KGOL | Palm Desert, Cal. | 1270 |
| KGOS | Torrington, Wyo. | 1490 |
| KGPC | Grafton, N.Dak. | 1340 |
| KGRB | West Loma, Cal. | 900 |
| KGRI | Henderson, Tex. | 1000 |
| KGRL | Bend, Oreg. | 940 |
| KGRN | Grinnell, Iowa | 1410 |
| KGRO | Pampa, Tex. | 1230 |
| KGRS | Pasco, Wash. | 1340 |
| KGRT | Las Cruces, N.Mex. | 570 |
| KGST | Fresno, Calif. | 1600 |
| KGTN | Georgetown, Tex. | 1530 |
| KGU | Honolulu, Hawaii | 760 |
| KGUC | Gunnison, Colo. | 1490 |
| KGUD | Santa Barbara, Calif. | 990 |
| KGUL | Port Lavaca, Tex. | 1560 |
| KGVL | Greenville, Tex. | 1400 |
| KGVO | Missoula, Mont. | 1290 |
| KGVW | Belgrade, Mont. | 630 |
| KGW | Portland, Oreg. | 620 |
| KGWA | Enid, Okla. | 960 |
| KGY | Olympia, Wash. | 1240 |
| KGYN | Guymon, Okla. | 1210 |
| KHAC | Window Rock, Ariz. | 1300 |
| KHAD | DeSoto, Mo. | 1190 |
| KHAI | Honolulu, Hawaii | 1090 |
| KHAK | Cedar Rapids, Iowa | 1360 |
| KHAL | Homer, La. | 1320 |
| KHAP | Aztec, N.M. | 1340 |
| KHAR | Anchorage, Alaska | 590 |
| KHAS | Hastings, Nebr. | 1230 |
| KHAT | Phoenix, Ariz. | 1480 |
| KHBM | Monticello, Ark. | 1430 |
| KHBR | Hillsboro, Tex. | 1560 |
| KHDN | Hardin, Mont. | 1230 |
| KHEM | Big Springs, Tex. | 1270 |
| KHEN | Henryetta, Okla. | 1590 |
| KHEP | Phoenix, Ariz. | 1280 |
| KHEY | El Paso, Tex. | 690 |
| KHFH | Sierra Vista, Ariz. | 1420 |
| KHFI | Austin, Tex. | 970 |
| KHHH | Pampa, Tex. | 1230 |
| KHIL | Willcox, Ariz. | 1250 |
| KHIT | Walla Walla, Wash. | 1320 |
| KHJ | Los Angeles, Calif. | 930 |
| KHLO | Hilo, Hawaii | 850 |
| KHMO | Hannibal, Mo. | 1070 |
| KHOB | Hobbs, N.Mex. | 1390 |
| KHOG | Fayetteville, Ark. | 1440 |
| KHOS | Tucson, Ariz. | 940 |
| KHOT | Madera, Calif. | 1250 |
| KHOW | Denver, Colo. | 630 |
| KHOZ | Harrison, Ark. | 900 |
| KHQ | Spokane, Wash. | 590 |
| KHRB | Lockhart, Tex. | 1060 |
| KHRT | Minot, N. D. | 1320 |
| KHSJ | Hemet, Calif. | 1320 |
| KHSL | Chico, Calif. | 1290 |
| KHUB | Fremont, Nebr. | 1340 |
| KHUZ | Borger, Tex. | 1490 |
| KHVH | Honolulu, Hawaii | 1040 |
| KHYT | Tucson, Ariz. | 1330 |
| KIBE | Palo Alto, Calif. | 1220 |
| KIBH | Seward, Alaska | 950 |
| KIBL | Beeville, Tex. | 1490 |
| KIBS | Bishop, Calif. | 1230 |
| KICA | Clovis, N.M. | 980 |
| KICD | Spencer, Iowa | 1240 |
| KICK | Springfield, Mo. | 1340 |
| KICO | Calexico, Calif. | 1490 |
| KICS | Hastings, Neb. | 1550 |
| KICX | McCook, Neb. | 1360 |
| KICY | Nome, Alaska | 850 |
| KID | Idaho Falls, Idaho | 590 |
| KIDD | Monterey, Calif. | 630 |
| KIDO | Boise, Idaho | 630 |
| KIEV | Glendale, Calif. | 870 |
| KIFG | Iowa Falls, Ia. | 1510 |
| KIFN | Phoenix, Ariz. | 860 |
| KIFW | Sitka, Alaska | 1230 |
| KIGO | St. Anthony, Ida. | 1400 |
| KIHN | Hugo, Okla. | 1340 |
| KIHR | Hood River, Oreg. | 1340 |
| KIJV | Huron, S.Dak. | 1340 |
| KIKI | Honolulu, Hawaii | 830 |
| KIKK | Pasadena, Tex. | 650 |
| KIKO | Miami, Ariz. | 1340 |
| KIKS | Sulphur, La. | 1310 |
| KIKX | Tucson, Ariz. | 580 |
| KIKZ | Seminole, Tex. | 1250 |
| KILE | Galveston, Tex. | 1400 |
| KILO | Grand Forks, S.Dak. | 1440 |
| KILR | Estherville, Ia. | 1070 |
| KILT | Houston, Tex. | 610 |
| KIMA | Yakima, Wash. | 1460 |
| KIMB | Kimball, Nebr. | 1260 |
| KIML | Gillette, Wyo. | 1270 |
| KIMM | Rapid City, S.D. | 1150 |
| KIMN | Denver, Colo. | 950 |
| KIMP | Mt. Pleasant, Tex. | 960 |
| KINO | Independence, Kans. | 1010 |
| KINE | Kingsville, Tex. | 1330 |
| KING | Seattle, Wash. | 1090 |
| KINN | Alamagordo, N. M. | 1270 |
| KINO | Winslow, Ariz. | 1230 |
| KINS | Eureka, Calif | 980 |
| KINT | El Paso, Tex. | 1590 |
| KINY | Juneau, Alaska | 800 |
| KIOA | Des Moines, Iowa | 940 |
| KIOT | Barstow, Calif. | 1310 |
| KIOX | Bay City, Tex. | 1270 |
| KIQS | Willows, Calif. | 1560 |
| KIRL | St. Charles, Mo. | 1460 |
| KIRO | Seattle, Wash. | 710 |
| KIRT | Mission, Tex. | 1580 |
| KIRV | Fresno, Cal. | 1510 |
| KIRX | Kirksville, Mo. | 1450 |
| KISD | Sioux Falls, S.Dak. | 1230 |
| KISN | Vancouver, Wash. | 910 |
| KIST | Santa Barbara, Calif. | 1340 |
| KIT | Yakima, Wash. | 1280 |
| KITE | San Antonio, Tex. | 930 |
| KITI | Chehalis-Centralia, Wash. | 1420 |
| KITN | Olympia, Wash. | 920 |
| KIUL | Garden City, Kans. | 1240 |
| KIUN | Pecos, Tex. | 1400 |
| KIUP | Durango, Colo. | 930 |
| KIVY | Crockett, Tex. | 1290 |
| KIWA | Sheldon, Iowa | 1550 |
| KIXF | Fortuna, Cal. | 1090 |
| KIXI | Seattle, Wash. | 910 |
| KIXL | Dallas, Tex. | 1040 |
| KIXX | Provo, Utah | 1400 |
| KIXZ | Amarillo, Tex. | 940 |
| KIZZ | El Paso, Tex. | 1150 |
| KJAM | Madison, S.Dak. | 1390 |
| KJAN | Atlantic, Iowa | 1220 |
| KJAX | Santa Rosa, Calif. | 1150 |
| KJAY | Sacramento, Calif. | 1430 |
| KJBC | Midland, Tex. | 1150 |
| KJCF | Festus, Mo. | 1400 |
| KJCK | Junction City, Kans. | 1420 |
| KJDY | John Day, Ore. | 1400 |
| KJEF | Jennings, La. | 1290 |
| KJEM | Oklahoma City, Okla. | 800 |
| KJET | Beaumont, Tex. | 1380 |
| KJFJ | Webster City, Iowa | 1570 |
| KJIM | Ft. Worth, Tex. | 870 |
| KJIN | Houma, La. | 1490 |
| KJLT | North Platte, Nebr. | 970 |
| KJNO | Juneau, Alaska | 630 |
| KJNP | North Pole, Alaska | 1170 |
| KJOE | Shreveport, La. | 1480 |
| KJOY | Stockton, Calif. | 1280 |
| KJPW | Waynesville, Mo. | 1390 |
| KJR | Seattle, Wash. | 950 |
| KJRB | Spokane, Wash. | 790 |
| KJRG | Newton, Kans. | 950 |
| KJSK | Columbus, Nebr. | 900 |
| KJST | Joshua Tree, Cal. | 1420 |
| KJWE | Burien, Wash. | 800 |
| KJWH | Camden, Ark. | 1450 |
| KKAL | Denver City, Tex. | 1580 |
| KKAM | Pueblo, Colo. | 1350 |
| KKAN | Phillipsburg, Kans. | 1490 |
| KKAR | Pomona, Calif. | 1220 |
| KKAS | Silsbee, Tex. | 1300 |
| KKAT | Roswell, N.M. | 1430 |
| KKDA | Grand Prairie, Tex. | 730 |
| KKEP | Estes Park, Colo. | 1470 |
| KKEY | Portland, Ore. | 1150 |
| KKGF | Great Falls, Mont. | 1310 |
| KKHI | San Francisco, Calif. | 1550 |
| KKIN | Aitkin, Minn. | 930 |
| KKIS | Pittsburg, Calif. | 990 |
| KKIT | Taos, N.Mex. | 1340 |
| KKJO | St. Joseph, Mo. | 1550 |
| KKOK | Lompoc, Calif. | 1410 |
| KKUA | Honolulu, Hawaii | 690 |
| KKUB | Brownfield, Tex. | 1300 |
| KLAC | Los Angeles, Calif. | 570 |
| KLAD | Klamath Falls, Oreg. | 960 |
| KLAK | Lakewood, Colo. | 1600 |
| KLAM | Cordova, Alaska | 1450 |
| KLAN | Lemoore, Calif. | 1320 |
| KLAV | Las Vegas, Nev. | 1230 |
| KLBK | Lubbock, Tex. | 1340 |
| KLBM | La Grande, Oreg. | 1450 |
| KLBS | Los Banos, Calif. | 1330 |
| KLCB | Libby, Mont. | 1230 |
| KLCN | Blytheville, Ark. | 910 |
| KLCO | Poteau, Okla. | 1280 |
| KLEA | Lovington, N.Mex. | 630 |
| KLEB | Golden Meadow, La. | 1600 |
| KLEE | Ottumwa, Iowa | 1480 |
| KLEI | Kailua, Hawaii | 1130 |
| KLEM | LeMars, Iowa | 1410 |
| KLEN | Killeen, Tex. | 1050 |
| KLEO | Wichita, Kans. | 1480 |
| KLER | Orofino, Idaho | 950 |
| KLEX | Lexington, Mo. | 1570 |
| KLEY | Wellington, Kan. | 1130 |
| KLFB | Lubbock, Tex. | 1420 |
| KLFD | Litchfield, Minn. | 1410 |
| KLGA | Algona, Iowa | 1600 |
| KLGR | Redwood Falls, Minn. | 1490 |
| KLIB | Liberal, Kans. | 1470 |
| KLIC | Monroe, La. | 1230 |
| KLID | Poplar Bluff, Mo. | 1340 |
| KLIF | Dallas, Tex. | 1190 |
| KLIK | Jefferson City, Mo. | 950 |
| KLIN | Lincoln, Nebr. | 1400 |

**Are your home-town AM stations** listed correctly in *White's Radio Log?* If you believe there is a correction called for in *White's* listings, please check first with your local station. For each callsign obtain the correct city location, frequency, and power. (Remember, even though your local paper may list a station as a "home-town" station, it may be officially licensed by the FCC for operation in the next city.) Get all the facts on a piece of paper (be very brief), include your name and address, and mail to *White's Radio Log*, RADIO-TV EXPERIMENTER, 229 Park Avenue South, New York, N. Y. 10003. Your help in contributing to the accuracy and completeness of *White's Radio Log* will be sincerely appreciated. See page 96. —*Editor*

# WHITE'S RADIO LOG

| Call | Location | kHz |
|---|---|---|
| KLIP | Fowler, Calif. | 1220 |
| KLIQ | Portland, Oreg. | 1290 |
| KLIR | Denver, Colo. | 990 |
| KLIV | San Jose, Cal. | 1590 |
| KLIX | Twin Falls, Idaho | 1310 |
| KLIZ | Brainerd, Minn. | 1380 |
| KLKC | Parsons, Kans. | 1540 |
| KLLA | Leesville, La. | 1570 |
| KLLL | Lubbock, Tex. | 1460 |
| KLME | Laramie, Wyo. | 1490 |
| KLMO | Longmont, Colo. | 1060 |
| KLMR | Lamar, Colo. | 920 |
| KLMS | Lincoln, Nebr. | 1480 |
| KLMX | Clayton, N.Mex. | 1450 |
| KLO | Ogden, Utah | 1430 |
| KLOA | Ridgecrest, Calif | 1240 |
| KLOC | Ceres, Calif. | 920 |
| KLOE | Goodland, Kans. | 730 |
| KLOG | Kelso, Wash. | 1490 |
| KLOH | Pipestone, Minn. | 1050 |
| KLOK | San Jose, Calif. | 1170 |
| KLOL | Lincoln, Neb. | 1530 |
| KLOM | Lompoc, Calif. | 1330 |
| KLOO | Corvallis, Ore. | 1340 |
| KLOU | Lake Charles, La. | 1580 |
| KLOW | Loveland, Colo. | 1570 |
| KLPL | Lake Providence, La. | 1050 |
| KLPM | Minot, N.Dak. | 1390 |
| KLPR | Okla. City, Okla. | 1140 |
| KLPW | Union, Mo. | 1220 |
| KLRA | Little Rock, Ark. | 1010 |
| KLRS | Mountain Grove, Mo. | 1360 |
| KLSI | Salina, Kan. | 910 |
| KLTF | Little Falls, Minn. | 960 |
| KLTI | Macon, Mo. | 1560 |
| KLTR | Blackwell, Okla. | 1580 |
| KLTZ | Glasgow, Mont. | 1240 |
| KLUB | Salt Lake City, Utah | 570 |
| KLUC | Las Vegas, Nev. | 1140 |
| KLUE | Longview, Tex. | 1280 |
| KLUV | Haynesville, La. | 1580 |
| KLVI | Beaumont, Tex. | 560 |
| KLVL | Pasadena, Tex. | 1480 |
| KLVT | Levelland, Tex. | 1230 |
| KLWN | Lawrence, Kans. | 1320 |
| KLWT | Lebanon, Mo. | 1230 |
| KLWW | Cedar Rapids, Iowa | 1450 |
| KLYD | Bakersfield, Calif. | 1350 |
| KLYQ | Hamilton, Mont. | 980 |
| KLYR | Clarksville, Ark. | 1360 |
| KLZ | Denver, Colo. | 560 |
| KMA | Shenandoah, Iowa | 960 |
| KMAC | San Antonio, Tex. | 630 |
| KMAD | Madill, Okla. | 1550 |
| KMAK | Fresno, Calif. | 1340 |
| KMAM | Butler, Mo. | 1530 |
| KMAN | Manhattan, Kans. | 1350 |
| KMAQ | Maquoketa, Iowa | 1320 |
| KMAR | Winnsboro, La. | 1570 |
| KMAS | Shelton, Wash. | 1280 |
| KMAV | Mayville, N.D. | 1520 |
| KMBL | Junction, Tex. | 1450 |
| KMBY | Monterey, Calif. | 1240 |
| KMBZ | Kansas City, Mo. | 980 |
| KMCD | Fairfield, Iowa | 1570 |
| KMCL | McCall, Ida. | 1240 |
| KMCM | McMinnville, Oreg. | 1260 |
| KMCO | Conroe, Tex. | 900 |
| KMCW | Augusta, Ark. | 1190 |
| KMDO | Ft. Scott, Kans. | 1600 |
| KMED | Medford, Oreg. | 1440 |
| KMEL | Wenatchee, Wash. | 1340 |
| KMEN | San Bernardino, Cal. | 1290 |
| KMEO | Phoenix, Ariz. | 740 |
| KMER | Kemmerer, Wyo. | 950 |
| KMFB | Mendocino, Cal. | 1300 |
| KMHL | Marshall, Minn. | 1400 |
| KMHT | Marshall, Tex. | 1450 |
| KMIL | Cameron, Tex. | 1330 |
| KMIN | Grants, N.M. | 980 |
| KMIS | Portageville, Mo. | 1050 |
| KMJ | Fresno, Calif. | 580 |
| KMLB | Monroe, La. | 1440 |
| KMLO | Vista, Cal. | 1000 |
| KMMJ | Grand Island, Nebr. | 750 |
| KMMO | Marshall, Mo. | 1300 |
| KMNS | Sioux City, Iowa | 620 |
| KMO | Tacoma, Wash. | 1360 |
| KMON | Great Falls, Mont. | 560 |
| KMOR | Murray, Utah | 1230 |
| KMOX | St. Louis, Mo. | 1120 |
| KMPC | Los Angeles, Calif. | 710 |
| KMPG | Hollister, Cal. | 1540 |
| KMPL | Sikeston, Mo. | 1520 |
| KMRC | Morgan City, La. | 1430 |
| KMRE | Anderson, Cal. | 1580 |
| KMRS | Morris, Minn. | 1230 |
| KMUL | Muleshoe, Tex. | 1380 |
| KMUS | Muskogee, Okla. | 1380 |
| KMVI | Wailuku, Hawaii | 550 |

| Call | Location | kHz |
|---|---|---|
| KMYC | Marysville, Calif. | 1410 |
| KMYO | Little Rock, Ark. | 1050 |
| KNAB | Burlington, Colo. | 1140 |
| KNAF | Fredericksburg, Tex. | 910 |
| KNAK | Salt Lake City, Utah | 1280 |
| KNAL | Victoria, Tex. | 1410 |
| KNBA | Vallejo, Calif. | 1190 |
| KNBI | Norton, Kan. | 1530 |
| KNBR | San Francisco, Cal. | 680 |
| KNBY | Newport, Ark. | 1280 |
| KNCB | Vivian, La. | 1600 |
| KNCK | Concordia, Kans. | 1390 |
| KNCY | Nebraska City, Nebr. | 1600 |
| KNDC | Hettinger, N.Dak. | 1490 |
| KNDI | Honolulu, Hawaii | 1270 |
| KNDK | Langdon, N. D. | 1080 |
| KNDY | Marysville, Kans. | 1570 |
| KNEA | Jonesboro, Ark. | 970 |
| KNEB | Scottsbluff, Nebr. | 960 |
| KNED | McAlester, Okla. | 1150 |
| KNEI | Waukon, Ia. | 1140 |
| KNEL | Brady, Tex. | 1490 |
| KNEM | Nevada, Mo. | 1240 |
| KNET | Palestine, Tex. | 1450 |
| KNEW | Oakland, Cal. | 910 |
| KNEX | McPherson, Kans. | 1540 |
| KNEZ | Lompoc, Calif. | 960 |
| KNFT | Bayard, N.M. | 950 |
| KNGS | Hanford, Calif. | 620 |
| KNIA | Knoxville, Iowa | 1320 |
| KNIC | Winfield, Kan. | 1550 |
| KNIM | Maryville, Mo. | 1580 |
| KNIN | Wichita Falls, Tex. | 990 |
| KNIR | New Iberia, La. | 1360 |
| KNIT | Abilene, Tex. | 1280 |
| KNLV | Ord, Neb. | 1060 |
| KNND | Cottage Grove, Oreg. | 1400 |
| KNNN | Friona, Tex. | 1070 |
| KNOC | Natchitoches, La. | 1450 |
| KNOE | Monroe, La. | 540 |
| KNOK | Ft. Worth, Tex. | 970 |
| KNOP | N. Platte, Nebr. | 1410 |
| KNOR | Norman, Okla. | 1400 |
| KNOT | Prescott, Ariz. | 1450 |
| KNOW | Austin, Tex. | 1490 |
| KNOX | Grand Forks, N.Dak. | 1310 |
| KNPT | Newport, Ore. | 1310 |
| KNUI | Makawao, Hawaii | 1310 |
| KNUJ | New Ulm, Minn. | 860 |
| KNUZ | Houston, Tex. | 1230 |
| KNWC | Sioux Falls, S.D. | 1270 |
| KNWS | Waterloo, Iowa | 1090 |
| KNX | Los Angeles, Calif. | 1070 |
| KOA | Denver, Colo. | 850 |
| KOAC | Corvallis, Oreg. | 550 |
| KOAD | Lemoore, Calif. | 1240 |
| KOAG | Arroyo Grande, Cal. | 1280 |
| KOAK | Red Oak, Ia. | 1080 |
| KOAL | Price, Utah | 1230 |
| KOAM | Pittsburg, Kans. | 860 |
| KOB | Albuquerque, N.Mex. | 770 |
| KOBE | Las Cruces, N.Mex. | 1450 |
| KOBH | Hot Springs, S.Dak. | 580 |
| KOBY | Reno, Nev. | 1550 |
| KOCA | Kilgore, Tex. | 1240 |
| KOCY | Oklahoma City, Okla. | 1340 |
| KODA | Houston, Tex. | 1010 |
| KODE | Joplin, Mo. | 1230 |
| KODI | Cody, Wyo. | 1400 |
| KODL | The Dalles, Oreg. | 1440 |
| KODY | North Platte, Nebr. | 1240 |
| KOEL | Oelwein, Iowa | 950 |
| KOFE | St. Maries, Idaho | 1480 |
| KOFI | Kalispell, Mont. | 1180 |
| KOFO | Ottawa, Kans. | 1220 |
| KOFY | San Mateo, Calif. | 1050 |
| KOGA | Ogallala, Nebr. | 930 |
| KOGO | San Diego, Calif. | 600 |
| KOGT | Orange, Tex. | 1600 |
| KOH | Reno, Nev. | 630 |
| KOHI | St. Helens, Ore. | 1600 |
| KOHO | Honolulu, Hawaii | 1170 |
| KOHU | Hermiston, Oreg. | 1570 |
| KOIL | Omaha, Nebr. | 1290 |
| KOIN | Portland, Oreg. | 970 |
| KOJM | Havre, Mont. | 610 |
| KOKA | Shreveport, La. | 1550 |
| KOKE | Austin, Tex. | 1370 |
| KOKL | Okmulgee, Okla. | 1240 |
| KOKO | Warrensburg, Mo. | 1450 |
| KOKX | Keokuk, Iowa | 1310 |
| KOKY | Little Rock, Ark. | 1440 |
| KOL | Seattle, Wash. | 1300 |
| KOLD | Tucson, Ariz. | 1450 |
| KOLE | Port Arthur, Tex. | 1340 |
| KOLI | Coalinga, Cal. | 1050 |
| KOLJ | Quanah, Tex. | 1150 |
| KOLM | Rochester, Minn. | 1520 |
| KOLO | Reno, Nev. | 920 |
| KOLS | Pryor, Okla. | 1570 |
| KOLT | Scottsbluff, Nebr. | 1320 |
| KOLY | Mobridge, S.Dak. | 1300 |
| KOMA | Okla. City, Okla. | 1520 |
| KOMO | Seattle, Wash. | 1000 |
| KOMW | Omak, Wash. | 680 |
| KOMY | Watsonville, Calif. | 1340 |
| KONE | Reno, Nev. | 1450 |
| KONG | Visalia, Calif. | 1400 |
| KONI | Spanish Fork, Utah | 1480 |
| KONO | San Antonio, Tex. | 860 |
| KONP | Port Angeles, Wash. | 1450 |
| KOOD | Lakewood Center, Wash. | 1480 |

| Call | Location | kHz |
|---|---|---|
| KOOK | Billings, Mont. | 970 |
| KOOL | Phoenix, Ariz. | 960 |
| KOOO | Omaha, Nebr. | 1420 |
| KOOS | Coos Bay, Oreg. | 1230 |
| KOPR | Butte, Mont. | 550 |
| KOPY | Alice, Tex. | 1070 |
| KOQT | Bellingham, Wash. | 1550 |
| KORA | Bryan, Tex. | 1240 |
| KORC | Mineral Wells, Tex. | 1140 |
| KORD | Pasco, Wash. | 910 |
| KORE | Springfield-Eugene, Ore. | 1050 |
| KORK | Las Vegas, Nev. | 920 |
| KORL | Honolulu, Hawaii | 650 |
| KORN | Mitchell, S.Dak. | 1490 |
| KORT | Grangeville, Idaho | 1230 |
| KOSE | Osceola, Ark. | 860 |
| KOSG | Panshuska, Okla. | 1500 |
| KOSI | Aurora, Colo. | 1430 |
| KOSY | Texarkana, Ark. | 790 |
| KOTA | Rapid City, S.Dak. | 1380 |
| KOTN | Pine Bluff, Ark. | 1490 |
| KOTS | Deming, N.M. | 1230 |
| KOUR | Independence, Iowa | 1220 |
| KOVC | Valley City, N.Dak. | 1490 |
| KOVE | Lander, Wyo. | 1330 |
| KOVO | Provo, Utah | 960 |
| KOWB | Laramie, Wyo. | 1290 |
| KOWL | South Lake Tahoe, Cal. | 1490 |
| KOWN | Escondido, Calif. | 1450 |
| KOXR | Oxnard, Calif. | 910 |
| KOY | Phoenix, Ariz. | 550 |
| KOYL | Odessa, Tex. | 1310 |
| KOYN | Billings, Mont. | 910 |
| KOZA | Odessa, Tex. | 1230 |
| KOZE | Lewiston, Idaho | 1300 |
| KOZI | Chelan, Wash. | 1220 |
| KOZN | Omaha, Neb. | 660 |
| KOZY | Grand Rapids, Minn. | 1490 |
| KPAC | Port Arthur, Tex. | 1250 |
| KPAL | Palm Springs, Calif. | 1450 |
| KPAM | Portland, Oreg. | 1410 |
| KPAN | Hereford, Tex. | 860 |
| KPAR | Albuquerque, N.M. | 1190 |
| KPAS | Banning, Calif. | 1490 |
| KPAT | Berkeley, Calif. | 1400 |
| KPAY | Chico, Calif. | 1060 |
| KPBA | Pine Bluff, Ark. | 1590 |
| KPBC | Port Sulphur, La. | 1510 |
| KPCA | Marked Tree, Ark. | 1580 |
| KPCO | Quincy, Cal. | 1370 |
| KPCR | Bowling Green, Mo. | 1530 |
| KPDN | Pampa, Tex. | 1340 |
| KPDQ | Portland, Oreg. | 800 |
| KPEG | Spokane, Wash. | 1380 |
| KPEL | Lafayette, La. | 1420 |
| KPEP | San Angelo, Tex. | 1420 |
| KPET | Lamesa, Tex. | 690 |
| KPGE | Page, Ariz. | 1340 |
| KPHO | Phoenix, Ariz. | 910 |
| KPIK | Colorado Sprgs., Colo. | 1580 |
| KPIN | Casa Grande, Ariz. | 1260 |
| KPLC | Lake Charles, La. | 1470 |
| KPLT | Paris, Tex. | 1490 |
| KPLY | Crescent City, Calif. | 1240 |
| KPMC | Bakersfield, Calif. | 1560 |
| KPNG | Port Neches, Tex. | 1150 |
| KPNW | Eugene, Ore. | 1120 |
| KPOC | Pocahontas, Ark. | 1420 |
| KPOD | Crescent City, Calif. | 1310 |
| KPOF | Denver, Colo. | 910 |
| KPOI | Honolulu, Hawaii | 1380 |
| KPOJ | Portland, Oreg. | 1330 |
| KPOL | Los Angeles, Calif. | 1540 |
| KPOP | Roseville, Cal. | 1110 |
| KPOR | Quincy, Wash. | 1370 |
| KPOS | Post, Tex. | 1370 |
| KPOW | Powell, Wyo. | 1260 |
| KPPC | Pasadena, Calif. | 1240 |
| KPQ | Wenatchee, Wash. | 560 |
| KPRB | Redmond, Oreg. | 1240 |
| KPRC | Houston, Tex. | 950 |
| KPRE | Paris, Tex. | 1250 |
| KPRK | Livingston, Mont. | 1340 |
| KPRL | Paso Robles, Calif. | 1230 |
| KPRM | Park Rapids, Minn. | 1240 |
| KPRO | Riverside, Calif. | 1440 |
| KPRS | Kansas City, Mo. | 1590 |
| KPSO | Falfurrias, Tex. | 1260 |
| KPST | Preston, Idaho | 1340 |
| KPTN | Central Point, Ore. | 1400 |
| KPUA | Hilo, Hawaii | 970 |
| KPUB | Pueblo, Colo. | 1480 |
| KPUG | Bellingham, Wash. | 1170 |
| KPUL | Pullman, Wash. | 1150 |
| KPUR | Amarillo, Tex. | 1440 |
| KPWB | Piedmont, Mo. | 1140 |
| KPXE | Liberty, Tex. | 1050 |
| KQAQ | Austin, Minn. | 970 |
| KQEN | Roseburg, Ore. | 1240 |
| KQEO | Albuquerque, N.Mex. | 920 |
| KQIK | Lakeview, Oreg. | 1230 |
| KQIL | Grand Junction, Col. | 1340 |
| KQIQ | Santa Paula, Cal. | 1400 |
| KQMS | Redding, Calif. | 1400 |
| KQOT | Yakima, Wash. | 930 |
| KQRS | Golden Valley, Minn. | 1440 |
| KQV | Pittsburgh, Pa. | 1410 |
| KQWB | Fargo, N. D. | 1550 |
| KQXI | Arvada, Colo. | 1550 |
| KQYX | Joplin, Mo. | 1560 |

| Call | Location | kHz |
|---|---|---|
| KRAD | E. Grand Forks, Minn. | 1590 |
| KRAE | Cheyenne, Wyo. | 1480 |
| KRAF | Reedsport, Ore. | 1470 |
| KRAI | Craig, Colo. | 550 |
| KRAK | Sacramento, Cal. | 1140 |
| KRAL | Rawlins, Wyo. | 1240 |
| KRAM | Las Vegas, Nev. | 920 |
| KRAN | Morton, Tex. | 1280 |
| KRAY | Amarillo, Tex. | 1360 |
| KRBA | Lufkin, Tex. | 1340 |
| KRBC | Abilene, Tex. | 1470 |
| KRBI | St. Peter, Minn. | 1310 |
| KRBN | Red Lodge, Mont. | 1450 |
| KRCB | Council Bluffs, Ia. | 1560 |
| KRCK | Ridgecrest, Calif. | 1360 |
| KRCO | Prineville, Oreg. | 690 |
| KRDD | Roswell, N. M. | 1320 |
| KRDG | Redding, Calif. | 1230 |
| KRDO | Colo. Springs, Colo. | 1240 |
| KRDR | Gresham, Ore. | 1230 |
| KRDS | Tolleson, Ariz. | 1190 |
| KRDU | Dinuba, Calif. | 1240 |
| KRED | Eureka, Cal. | 1480 |
| KREH | Oakdale, La. | 900 |
| KREI | Farmington, Mo. | 800 |
| KREK | Sapulpa, Okla. | 1550 |
| KREL | Corona, Cal. | 1370 |
| KREM | Spokane, Wash. | 970 |
| KREN | Renton, Wash. | 1420 |
| KREO | Indio, Calif. | 1400 |
| KREW | Sunnyside, Wash. | 1230 |
| KREX | Grand Junction, Colo. | 1100 |
| KRFO | Owatonna, Minn. | 1390 |
| KRFS | Superior, Nebr. | 1600 |
| KRGI | Grand Island, Neb. | 1430 |
| KRGO | Salt Lake City, Utah | 1550 |
| KRGV | Weslasco, Tex. | 1290 |
| KRHD | Duncan, Okla. | 1350 |
| KRIB | Mason City, Iowa | 1490 |
| KRIG | Odessa, Tex. | 1410 |
| KRIH | Rayville, La. | 990 |
| KRIO | McAllen, Tex. | 910 |
| KRIZ | Phoenix, Ariz. | 1230 |
| KRKC | King City, Calif. | 1490 |
| KRKD | Los Angeles, Calif. | 1150 |
| KRKO | Everett, Wash. | 1380 |
| KRKT | Albany, Ore. | 990 |
| KRLA | Pasadena, Calif. | 1110 |
| KRLC | Lewiston, Ida. Clarkston, Wash. | 1350 |
| KRLD | Dallas, Tex. | 1080 |
| KRLN | Canon City, Colo. | 1400 |
| KRLW | Walnut Ridge, Ark. | 1320 |
| KRMD | Shreveport, La. | 1340 |
| KRME | Hondo, Tex. | 1460 |
| KRMG | Tulsa, Okla. | 740 |
| KRML | Carmel, Calif. | 1410 |
| KRMO | Monett, Mo. | 990 |
| KRMS | Osage Beach, Mo. | 1150 |
| KRNO | San Bernardino, Calif. | 1240 |
| KRNR | Roseburg, Oreg. | 1490 |
| KRNS | Burns, Oreg. | 1230 |
| KRNT | Des Moines, Iowa | 1350 |
| KRNY | Kearney, Nebr. | 1460 |
| KROB | Robstown, Tex. | 1510 |
| KROC | Rochester, Minn. | 1340 |
| KROD | El Paso, Tex. | 600 |
| KROE | Sheridan, Wyo. | 930 |
| KROF | Abbeville, La. | 960 |
| KROP | Brawley, Calif. | 1300 |
| KROS | Clinton, Iowa | 1340 |
| KROW | Dallas, Ore. | 1460 |
| KROX | Crookston, Minn. | 1260 |
| KROY | Sacramento, Calif. | 1240 |
| KRPL | Moscow, Idaho | 1400 |
| KRRR | Ruidoso, N.Mex. | 1340 |
| KRRV | Sherman, Tex. | 910 |
| KRSA | Alisal, Calif. | 1570 |
| KRSC | Othello, Wash. | 1400 |
| KRSD | Rapid City, S.Dak. | 1340 |
| KRSI | St. Louis Park, Minn. | 950 |
| KRSL | Russell, Kans. | 990 |
| KRSN | Los Alamos, N.Mex. | 1490 |
| KRSP | Salt Lake City, Utah | 1060 |
| KRSY | Roswell, N.Mex. | 1230 |
| KRTN | Raton, N.Mex. | 1490 |
| KRTR | Thermopolis, Wyo. | 1490 |
| KRUN | Ballinger, Tex. | 1400 |
| KRUS | Ruston, La. | 1490 |
| KRUX | Glendale, Ariz. | 1360 |
| KRVC | Ashland, Oreg. | 1350 |
| KRVN | Lexington, Neb. | 880 |
| KRWB | Roseau, Minn. | 1410 |
| KRWL | Carson City, Nev. | 1300 |
| KRXK | Rexburg, Idaho | 1230 |
| KRYS | Corpus Christi, Tex. | 1360 |
| KRYT | Colo. Springs, Colo. | 1530 |
| KRZE | Farmington, N.M. | 1280 |
| KRZY | Albuquerque, N.M. | 1450 |
| KSAC | Manhattan, Kans. | 580 |
| KSAL | Salina, Kans. | 1150 |
| KSAM | Huntsville, Tex. | 1490 |
| KSAY | San Francisco, Calif. | 1010 |
| KSCB | Liberal, Kans. | 600 |
| KSCJ | Sioux City, Iowa | 1360 |
| KSCO | Santa Cruz, Calif. | 1080 |
| KSD | St. Louis, Mo. | 550 |
| KSDN | Aberdeen, S.Dak. | 930 |
| KSDO | San Diego, Calif. | 1130 |
| KSDR | Waterton, S.Dak. | 1480 |
| KSEE | Santa Maria, Calif. | 1480 |
| KSEI | Pocatello, Idaho | 930 |

| Call | Location | kHz |
|---|---|---|
| KSEK | Pittsburg, Kans. | 1340 |
| KSEL | Lubbock, Tex. | 950 |
| KSEM | Moses Lake, Wash. | 1470 |
| KSEN | Shelby, Mont. | 1150 |
| KSEO | Durant, Okla. | 750 |
| KSET | El Paso, Tex. | 1340 |
| KSEW | Sitka, Alaska | 1400 |
| KSEY | Seymour, Tex. | 1230 |
| KSFA | Nacogdoches, Tex. | 860 |
| KSFE | Needles, Calif. | 1340 |
| KSFO | San Francisco, Calif. | 560 |
| KSGM | Ste. Genevieve, Mo. | 1340 |
| KSGT | Jackson, Wyo. | 1340 |
| KSHA | Medford, Ore. | 860 |
| KSIB | Creston, Iowa | 1520 |
| KSID | Sidney, Nebr. | 1340 |
| KSIG | Crowley, La. | 1450 |
| KSIL | Silver City, N.Mex. | 1340 |
| KSIM | Sikeston, Mo. | 1400 |
| KSIS | Sedalia, Mo. | 1050 |
| KSIW | Woodward, Okla. | 1450 |
| KSIX | Corpus Christi, Tex. | 1230 |
| KSJB | Jamestown, N.Dak. | 600 |
| KSKI | Sun Valley, Idaho | 1340 |
| KSKY | Dallas, Tex. | 660 |
| KSL | Salt Lake City, Utah | 1160 |
| KSLM | Salem, Oreg. | 1390 |
| KSLO | Opelousas, La. | 1230 |
| KSLV | Monte Vista, Colo. | 1240 |
| KSLY | San Luis Obispo, Cal. | 1400 |
| KSMA | Santa Maria, Calif. | 1240 |
| KSMK | Kennewick, Wash. | 1340 |
| KSMM | Shakopee, Minn. | 1530 |
| KSMN | Mason City, Iowa | 1010 |
| KSMO | Salem, Mo. | 1340 |
| KSND | Seattle, Wash. | 1590 |
| KSNN | Pocatello, Ida. | 1290 |
| KSNO | Aspen, Colo. | 1260 |
| KSNY | Snyder, Tex. | 1450 |
| KSO | Des Moines, Iowa | 1460 |
| KSOA | Ava, Mo. | 1430 |
| KSOK | Arkansas City, Kans. | 1280 |
| KSOL | San Francisco, Cal. | 1450 |
| KSOM | Ontario, Cal. | 1510 |
| KSON | San Diego, Calif. | 1240 |
| KSOO | Sioux Falls, S.Dak. | 1140 |
| KSOP | Salt Lake City, Utah | 1370 |
| KSOX | Raymondville, Tex. | 1240 |
| KSPI | Stillwater, Okla. | 780 |
| KSPL | Diboll, Tex. | 1260 |
| KSPO | Spokane, Wash. | 1230 |
| KSPR | Springdale, Ark. | 1590 |
| KSPT | Sandpoint, Idaho | 1400 |
| KSRA | Salmon, Idaho | 960 |
| KSRC | Socorro, N.Mex. | 1290 |
| KSRM | Soldatna, Alaska | 920 |
| KSRO | Santa Rosa, Calif. | 1350 |
| KSRV | Ontario, Oreg. | 1380 |
| KSSS | Colorado Springs, Colo. | 740 |
| KSST | Sulphur Springs, Tex. | 1230 |
| KSTA | Coleman, Tex. | 1000 |
| KSTB | Breckenridge, Tex. | 1430 |
| KSTL | St. Louis, Mo. | 690 |
| KSTN | Stockton, Calif. | 1420 |
| KSTP | St. Paul, Minn. | 1500 |
| KSTR | Grand Junction, Colo. | 620 |
| KSTT | Davenport, Iowa | 1170 |
| KSTV | Stephenville, Tex. | 1510 |
| KSUB | Cedar City, Utah | 590 |
| KSUD | W. Memphis, Ark. | 730 |
| KSUE | Susanville, Calif. | 1240 |
| KSUM | Fairmont, Minn. | 1370 |
| KSUN | Bisbee, Ariz. | 1230 |
| KSVC | Richfield, Utah | 980 |
| KSVN | Ogden, Utah | 730 |
| KSVP | Artesia, N.Mex. | 990 |
| KSWA | Graham, Tex. | 1330 |
| KSWB | Seaside, Ore. | 930 |
| KSWM | Aurora, Mo. | 940 |
| KSWO | Lawton, Okla. | 1380 |
| KSWS | Roswell, N. M. | 1020 |
| KSWW | Wickenburg, Ariz. | 1250 |
| KSXX | Salt Lake City, Utah | 630 |
| KSYC | Yreka, Calif. | 1490 |
| KSYL | Alexandria, La. | 970 |
| KSYX | Santa Rosa, N.Mex. | 1420 |
| KTAC | Tacoma, Wash. | 850 |
| KTAE | Taylor, Tex. | 1260 |
| KTAR | Phoenix, Ariz. | 620 |
| KTAT | Frederick, Okla. | 1570 |
| KTBB | Tyler, Tex. | 600 |
| KTBC | Austin, Tex. | 590 |
| KTCB | Malden, Mo. | 1470 |
| KTCH | Wayne, Neb. | 1590 |
| KTCR | Minneapolis, Minn. | 690 |
| KTCS | Fort Smith, Ark. | 1410 |
| KTOL | Farmersville, La. | 1470 |
| KTDO | Toledo, Oreg. | 1230 |
| KTEE | Idaho Falls, Idaho | 1260 |
| KTEL | Walla Walla, Wash. | 1490 |
| KTEM | Temple, Tex. | 1400 |
| KTEO | San Angelo, Tex. | 1340 |
| KTER | Terrell, Tex. | 1570 |
| KTFI | Twin Falls, Idaho | 1270 |
| KTFS | Texarkana, Tex. | 1400 |
| KTGO | Tioga, N. D. | 1090 |
| KTGR | Columbia, Mo. | 1580 |
| KTHE | Thermopolis, Wyo. | 1240 |
| KTHO | South Lake Tahoe, Cal. | 590 |
| KTHS | Berryville, Ark. | 1480 |
| KTHT | Houston, Tex. | 790 |
| KTIB | Thibodaux, La. | 630 |
| KTIL | Tillamook, Oreg. | 1590 |
| KTIM | San Rafael, Calif. | 1510 |
| KTIP | Porterville, Calif. | 1450 |
| KTIS | Minneapolis, Minn. | 900 |
| KTIX | Pendleton, Ore. | 1240 |
| KTKN | Ketchikan, Alaska | 930 |
| KTKR | Taft, Calif. | 1310 |
| KTKT | Tucson, Ariz. | 990 |
| KTLD | Tullulah, La. | 1360 |
| KTLN | Denver, Colo. | 1280 |
| KTLO | Mountain Home, Ark. | 1240 |
| KTLQ | Tahlequah, Okla. | 1350 |
| KTLU | Rusk, Tex. | 1580 |
| KTLW | Texas City, Tex. | 920 |
| KTMC | McAlester, Okla. | 1400 |
| KTMF | New Prague, Minn. | 1350 |
| KTMN | Trumann, Ark. | 1530 |
| KTMS | Santa Barbara, Calif. | 1250 |
| KTNC | Falls City, Nebr. | 1230 |
| KTNM | Tucumcari, N.Mex. | 1400 |
| KTNT | Tacoma, Wash. | 1400 |
| KTOB | Petaluma, Cal. | 1490 |
| KTOC | Jonesboro, La. | 920 |
| KTOD | Sinton, Tex. | 1590 |
| KTOE | Mankato, Minn. | 1420 |
| KTOH | Lihue, Hawaii | 1350 |
| KTOK | Oklahoma City, Okla. | 1000 |
| KTOM | Salinas, Cal. | 1380 |
| KTON | Belton, Tex. | 940 |
| KTOO | Henderson, Nev. | 1280 |
| KTOP | Topeka, Kans. | 1490 |
| KTOT | Big Bear Lake, Cal. | 1050 |
| KTOW | Sand Spring, Okla. | 1340 |
| KTPA | Prescott, Ark. | 1370 |
| KTRB | Modesto, Calif. | 860 |
| KTRC | Santa Fe, N.Mex. | 1400 |
| KTRE | Lufkin, Tex. | 1420 |
| KTRF | Thief River Falls, Minn. | 1230 |
| KTRG | Honolulu, Hawaii | 990 |
| KTRH | Houston, Tex. | 740 |
| KTRI | Sioux City, Iowa | 1470 |
| KTRM | Beaumont, Tex. | 990 |
| KTRN | Wichita Falls, Tex. | 1290 |
| KTRT | Truckee, Cal. | 1400 |
| KTRY | Bastrop, La. | 730 |
| KTSA | San Antonio, Tex. | 550 |
| KTSL | Burnett, Tex. | 1340 |
| KTSM | El Paso, Tex. | 1380 |
| KTTN | Trenton, Mo. | 1600 |
| KTTR | Rolla, Mo. | 1490 |
| KTTS | Springfield, Mo. | 1400 |
| KTTT | Columbus, Nebr. | 1510 |
| KTUC | Tucson, Ariz. | 1400 |
| KTUE | Tulia, Tex. | 1260 |
| KTUF | Tempe, Ariz. | 1580 |
| KTUI | Sullivan, Mo. | 1560 |
| KTW | Seattle, Wash. | 1250 |
| KTWO | Casper, Wyo. | 1030 |
| KTXJ | Jasper, Tex. | 1350 |
| KTXO | Sherman, Tex. | 1500 |
| KTYM | Inglewood, Calif. | 1460 |
| KTYN | Minot, N.D. | 1430 |
| KUAD | Windsor, Colo. | 1170 |
| KUAI | Eleele, Kanai, Hawaii | 720 |
| KUAM | Agana, Guam | 610 |
| KUAT | Tucson, Ariz. | 1550 |
| KUBA | Yuba City, Calif. | 1600 |
| KUBC | Montrose, Colo. | 580 |
| KUDE | Oceanside, Calif. | 1320 |
| KUDI | Great Falls, Mont. | 1450 |
| KUDL | Fairway, Kan. | 1380 |
| KUDU | Ventura, Calif. | 1590 |
| KUDY | Spokane, Wash. | 1280 |
| KUEN | Wenatchee, Wash. | 900 |
| KUGN | Eugene, Oreg. | 590 |
| KUIK | Hillsboro, Oreg. | 1360 |
| KUJ | Walla Walla, Wash. | 1420 |
| KUKA | San Antonio, Tex. | 1250 |
| KUKI | Ukiah, Calif. | 1400 |
| KUKU | Willow Springs, Mo. | 1330 |
| KULA | Honolulu, Hawaii | 690 |
| KULE | Ephrata, Wash. | 730 |
| KULP | El Campo, Tex. | 1390 |
| KULY | Ulysses, Kan. | 1420 |
| KUMA | Pendleton, Oreg. | 1290 |
| KUMU | Honolulu, Hawaii | 1500 |
| KUNO | Corpus Christi, Tex. | 1400 |
| KUOA | Siloam Springs, Ark. | 1290 |
| KUOM | Minneapolis, Minn. | 770 |
| KUPD | Tempe, Ariz. | 1060 |
| KUPI | Idaho Falls, Idaho | 980 |
| KUPK | Garden City, Kan. | 1050 |
| KURA | Moab, Utah | 1450 |
| KURB | Mountlake Terrace, Wash. | 1510 |
| KURL | Billings, Mont. | 730 |
| KURV | Edinburg, Tex. | 710 |
| KURY | Brookings, Oreg. | 910 |
| KUSD | Vermillion, S.Dak. | 690 |
| KUSH | Cushing, Okla. | 1600 |
| KUSN | St. Joseph, Mo. | 1270 |
| KUTA | Blanding, Utah | 790 |
| KUTI | Yakima, Wash. | 980 |
| KUTY | Palmdale, Calif. | 1470 |
| KUVR | Holdredge, Nebr. | 1380 |
| KUXL | Golden Valley, Minn. | 1570 |
| KUZN | W. Monroe, La. | 1310 |
| KUZZ | Bakersfield, Calif. | 800 |
| KVAC | Forks, Wash. | 1490 |
| KVAL | Sauk Rapids, Minn. | 800 |
| KVAN | Vancouver, Wash. | 1480 |
| KVAS | Astoria, Ore. | 1230 |
| KVBR | Brainerd, Minn. | 1340 |
| KVCK | Wolf Point, Nebr. | 1450 |
| KVCL | Winnfield, La. | 1270 |
| KVCV | Redding, Calif. | 600 |
| KVDB | Sioux City, Iowa | 1090 |
| KVEC | San Luis Obispo, Calif. | 920 |
| KVEE | Conway, Ark. | 1330 |
| KVEG | Las Vegas, Nev. | 970 |
| KVEL | Vernal, Utah | 920 |
| KVEN | Ventura, Calif. | 1450 |
| KVET | Austin, Tex. | 1300 |
| KVFC | Cortez, Colo. | 740 |
| KVFD | Ft. Dodge, Iowa | 1400 |
| KVGB | Great Bend, Kans. | 1590 |
| KVI | Seattle, Wash. | 570 |
| KVIC | Victoria, Tex. | 1340 |
| KVIL | Highland Park, Tex. | 1150 |
| KVIN | Vinita, Okla. | 1470 |
| KVIO | Cottonwood, Ariz. | 1600 |
| KVIP | Redding, Calif. | 540 |
| KVKM | Monahans, Tex. | 1330 |
| KVLB | Cleveland, Tex. | 1410 |
| KVLF | Alpine, Tex. | 1240 |
| KVLG | LaGrange, Tex. | 1570 |
| KVLH | Pauls Valley, Okla. | 1470 |
| KVLL | Woodville, Tex. | 1220 |
| KVLV | Fallon, Nev. | 980 |
| KVMA | Magnolia, Ark | 630 |
| KVMC | Colorado City, Tex. | 1320 |
| KVML | Sonora, Calif. | 1450 |
| KVNC | Winslow, Ariz. | 1010 |
| KVNI | Coeur d'Alene, Idaho | 1240 |
| KVNU | Logan, Utah | 610 |
| KVDB | Bastrop, La. | 1340 |
| KVOC | Casper, Wyo. | 1230 |
| KVOD | Albuquerque, N. Mex. | 730 |
| KVOE | Emporia, Kans. | 1400 |
| KVOG | Ogden, Utah | 1490 |
| KVOL | Lafayette, La. | 1330 |
| KVOM | Morrilton, Ark. | 800 |
| KVON | Napa, Calif. | 1440 |
| KVOO | Tulsa, Okla. | 1170 |
| KVOP | Plainview, Tex. | 1400 |
| KVOR | Colo. Springs, Colo. | 1300 |
| KVOU | Uvalde, Tex. | 1400 |
| KVOW | Riverton, Wyo. | 1450 |
| KVOX | Moorhead, Minn. | 1280 |
| KVOY | Yuma, Ariz. | 1400 |
| KVOZ | Laredo, Tex. | 1490 |
| KVPI | Ville Platte, La. | 1050 |
| KVRA | Vermillion, S. D. | 1570 |
| KVRC | Arkadelphia, Ark. | 1240 |
| KVRD | Cottonwood, Ariz. | 1240 |
| KVRE | Santa Rosa, Calif. | 1460 |
| KVRH | Salida, Colo. | 1340 |
| KVRS | Rock Springs, Wyo. | 1360 |
| KVSA | McGehee, Ark. | 1220 |
| KVSF | Santa Fe, N.Mex. | 1260 |
| KVSH | Valentine, Nebr. | 940 |
| KVSI | Montpelier, Ida. | 1450 |
| KVSL | Show Low, Ariz. | 1450 |
| KVSO | Ardmore, Okla. | 1240 |
| KVWC | Vernon, Tex. | 1490 |
| KVWG | Pearsall, Tex. | 1280 |
| KVWM | Show Low, Ariz. | 970 |
| KVWO | Cheyenne, Wyo. | 1370 |
| KVYL | Holdenville, Okla. | 1370 |
| KWAC | Bakersfield, Calif. | 1490 |
| KWAO | Wadena, Minn. | 920 |
| KWAK | Stuttgart, Ark. | 1240 |
| KWAL | Wallace, Idaho | 620 |
| KWAM | Memphis, Tenn. | 990 |
| KWAT | Watertown, S.Dak. | 950 |
| KWBA | Baytown, Tex. | 1360 |
| KWBB | Wichita, Kans. | 1410 |
| KWBC | Navasota, Tex. | 1550 |
| KWBE | Beatrice, Nebr. | 1450 |
| KWBG | Boone, Iowa | 1590 |
| KWBW | Hutchinson, Kans. | 1450 |
| KWCB | Searey, Ark. | 1300 |
| KWCL | Oak Grove, La. | 1280 |
| KWCO | Chickasha, Okla. | 1560 |
| KWDR | Del Rio, Tex. | 810 |
| KWEB | Rochester, Minn. | 1270 |
| KWED | Seguin, Tex. | 1580 |
| KWEI | Weiser, Idaho | 1260 |
| KWEL | Midland, Tex. | 1440 |
| KWEW | Hobbs, N.Mex. | 1480 |
| KWFA | Merkle, Tex. | 1500 |
| KWFR | San Angelo, Tex. | 1260 |
| KWFT | Wichita Falls, Tex. | 620 |
| KWG | Stockton, Calif. | 1230 |
| KWHI | Brenham, Tex. | 1280 |
| KWHK | Hutchinson, Kans. | 1260 |
| KWHN | Fort Smith, Ark. | 1320 |
| KWHO | Salt Lake City, Utah | 860 |
| KWHW | Altus, Okla. | 1450 |
| KWIK | Pocatello, Idaho | 1240 |
| KWIL | Albany, Oreg. | 790 |
| KWIN | Ashland, Oreg. | 580 |
| KWIP | Merced, Calif. | 1580 |
| KWIQ | Moses Lake, Wash. | 1260 |
| KWIV | Douglas, Wyo. | 1050 |
| KWIX | Moberly, Mo. | 1230 |
| KWIZ | Santa Ana, Calif. | 1480 |
| KWJJ | Portland, Oreg. | 1080 |
| KWK | St. Louis, Mo. | 1380 |
| KWKC | Abilene, Tex. | 1340 |
| KWKH | Shreveport, La. | 1130 |
| KWKW | Pasadena, Calif. | 1300 |
| KWKY | Des Moines, Iowa | 1150 |
| KWLA | Many, La. | 1530 |
| KWLC | Decorah, Iowa | 1240 |
| KWLG | Wagoner, Okla. | 1530 |
| KWLM | Willmar, Minn. | 1340 |
| KWMC | Del Rio, Tex. | 1490 |
| KWMT | Ft. Dodge, Iowa | 540 |
| KWNA | Winnemucca, Nev. | 1400 |
| KWNO | Winona, Minn. | 1230 |
| KWNS | Pratt, Kans. | 1290 |
| KWNT | Davenport, Iowa | 1580 |
| KWOA | Worthington, Minn. | 730 |
| KWOC | Poplar Bluff, Mo. | 930 |
| KWOE | Clinton, Okla. | 1320 |
| KWON | Bartlesville, Okla. | 1400 |
| KWOR | Worland, Wyo. | 1340 |
| KWOS | Jefferson City, Mo. | 1240 |
| KWOW | Pomona, Calif. | 1600 |
| KWPC | Muscatine, Iowa | 860 |
| KWPM | West Plains, Mo. | 1450 |
| KWPR | Claremore, Okla. | 1270 |
| KWRC | Woodburn, Ore. | 940 |
| KWRD | Henderson, Tex. | 1470 |
| KWRE | Warrenton, Mo. | 730 |
| KWRF | Warren, Ark. | 860 |
| KWRG | New Roods, La. | 1500 |
| KWRO | Coquille, Oreg. | 630 |
| KWRT | Boonville, Mo. | 1370 |
| KWRW | Guthrie, Okla. | 1490 |
| KWSD | Mt. Shasta, Calif. | 620 |
| KWSH | Wewoka-Seminole, Oklahoma | 1260 |
| KWSO | Wasco, Calif. | 1050 |
| KWSR | Rifle, Colo. | 810 |
| KWSU | Pullman, Wash. | 1250 |
| KWTC | Barstow, Calif. | 1230 |
| KWTO | Springfield, Mo. | 560 |
| KWTX | Waco, Tex. | 1230 |
| KWUN | Concord, Cal. | 1480 |
| KWVR | Enterprise, Oreg. | 1340 |
| KWVY | Waverly, Iowa | 1470 |
| KWWL | Waterloo, Iowa | 1330 |
| KWXY | Cathedral City, Cal. | 1340 |
| KWYK | Farmington, N.Mex. | 960 |
| KWYN | Wynne, Ark. | 1400 |
| KWYO | Sheridan, Wyo. | 1410 |
| KWYR | Winner, S.Dak. | 1260 |
| KWYS | W. Yellowstone, Mont. | 920 |
| KWYZ | Everett, Wash. | 1230 |
| KXA | Seattle, Wash. | 770 |
| KXAR | Hope, Ark. | 1490 |
| KXEL | Waterloo, Iowa | 1540 |
| KXEN | Festus-St. Louis, Mo. | 1010 |
| KXEO | Mexico, Mo. | 1340 |
| KXEW | Tucson, Ariz. | 1600 |
| KXEX | Fresno, Calif. | 1550 |
| KXGI | Ft. Madison, Iowa | 1360 |
| KXGN | Glendive, Mont. | 1400 |
| KXIC | Iowa City, Iowa | 800 |
| KXIT | Dalhart, Tex. | 1410 |
| KXIV | Phoenix, Ariz. | 1400 |
| KXJK | Forrest City, Ark. | 950 |
| KXKW | Lafayette, La. | 1520 |
| KXL | Portland, Oreg. | 750 |
| KXLE | Ellensburg, Wash. | 1240 |
| KXLF | Butte, Mont. | 1370 |
| KXLJ | Helena, Mont. | 1240 |
| KXLO | Lewiston, Mont. | 1230 |
| KXLR | Little Rock, Ark. | 1150 |
| KXLW | Clayton, Mo. | 1320 |
| KXLY | Spokane, Wash. | 920 |
| KXO | El Centro, Calif. | 1230 |
| KXOA | Sacramento, Calif. | 1470 |
| KXOK | St. Louis, Mo. | 630 |
| KXOL | Ft. Worth, Tex. | 1360 |
| KXOW | Hot Springs, Ark. | 1420 |
| KXOX | Sweetwater, Tex. | 1240 |
| KXRA | Alexandria, Minn. | 1490 |
| KXRB | Sioux Falls, S.D. | 1000 |
| KXRO | Aberdeen, Wash. | 1320 |
| KXRX | San Jose, Calif. | 1500 |
| KXTO | Sherman, Tex. | 1500 |
| KXXL | Bozeman, Mont. | 1450 |
| KXXX | Colby, Kans. | 790 |
| KXYZ | Houston, Tex. | 1320 |
| KYA | San Francisco, Calif. | 1260 |
| KYAC | Kirkland, Wash. | 1460 |
| KYAK | Anchorage, Alaska | 630 |
| KYAL | McKinney, Tex. | 1600 |
| KYCA | Prescott, Ariz. | 1490 |
| KYCN | Wheatland, Wyo. | 1340 |
| KYES | Roseburg, Oreg. | 950 |
| KYET | Payette, Idaho | 1450 |
| KYJC | Medford, Oreg. | 1230 |
| KYLT | Missoula, Mont. | 1340 |
| KYME | Boise, Idaho | 740 |
| KYMN | Northfield, Minn | 1080 |
| KYND | Burlington, Ia. | 1150 |
| KYNG | Coos Bay, Oreg. | 1420 |
| KYNO | Fresno, Calif. | 1300 |
| KYNT | Yankton, S.Dak. | 1450 |
| KYOK | Houston, Tex. | 1590 |
| KYOR | Blythe, Calif. | 1450 |
| KYOS | Merced, Calif. | 1480 |
| KYOU | Greeley, Colo. | 1450 |
| KYRO | Potosi, Mo. | 1280 |
| KYSM | Mankato, Minn. | 1230 |
| KYSN | Colorado Sprgs., Colo. | 1460 |
| KYSS | Missoula, Mont. | 930 |
| KYUM | Yuma, Ariz. | 560 |
| KYVA | Gallup, N.Mex. | 1230 |
| KYW | Philadelphia, Pa. | 1060 |
| KYXI | Oregon City, Ore. | 1520 |
| KZAK | Tyler, Tex. | 1330 |
| KZEE | Weatherford, Tex. | 1220 |
| KZEL | Eugene, Ore. | 1540 |

# WHITE'S RADIO LOG

| Call | Location | kHz |
|---|---|---|
| KZEY | Tyler, Tex. | 690 |
| KZIA | Albuquerque, N.M. | 1580 |
| KZIN | Yuba City, Cal. | 1450 |
| KZIP | Amarillo, Tex. | 1310 |
| KZNG | Hot Springs, Ark. | 1340 |
| KZOE | Princeton, Ill. | 1490 |
| KZOL | Farwell, Tex. | 1570 |
| KZUN | Santa Maria, Cal. | 1600 |
| KZOO | Honolulu, Hawaii | 1210 |
| KZOT | Marianna, Ark. | 1460 |
| KZOW | Globe, Ariz. | 1240 |
| KZRK | Ozark, Ark. | 1540 |
| KZUN | Opportunity, Wash. | 630 |
| KZYX | Weatherford, Okla. | 1590 |
| KZYM | Cape Girardeau, Mo. | 1220 |
| KZZN | Littlefield, Tex. | 1490 |
| VOUS | Argentia, Nfld. | 1480 |
| WAAA | Winston-Salem, N.C. | 980 |
| WAAB | Worcester, Mass. | 1440 |
| WAAC | Terre Haute, Ind. | 1300 |
| WAAF | Chicago, Ill. | 950 |
| WAAG | Adel, Ga. | 1470 |
| WAAK | Dallas, N.C. | 960 |
| WAAM | Ann Arbor, Mich. | 1600 |
| WAAO | Andalusia, Ala. | 1530 |
| WAAT | Trenton, N.J. | 1300 |
| WAAX | Gadsden, Ala. | 570 |
| WAAY | Huntsville, Ala. | 1550 |
| WABA | Aguadilla, P.Rico | 850 |
| WABB | Mobile, Ala. | 1480 |
| WABC | New York, N.Y. | 770 |
| WABD | Ft. Campbell, Ky. | 1370 |
| WABF | Fairhope, Ala. | 1220 |
| WABG | Greenwood, Miss. | 960 |
| WABH | Deerfield, Va. | 1150 |
| WABI | Bangor, Maine | 910 |
| WABJ | Adrian, Mich. | 1490 |
| WABK | Gardiner, Me. | 1280 |
| WABL | Amite, La. | 1570 |
| WABO | Waynesboro, Miss. | 990 |
| WABQ | Cleveland, Ohio | 1540 |
| WABR | Winter Park, Fla. | 1440 |
| WABT | Tuskegee, Ala. | 580 |
| WABV | Abbeville, S.C. | 1590 |
| WABY | Albany, N.Y. | 1400 |
| WABZ | Albemarle, N.C. | 1010 |
| WACA | Camden, S.C. | 1590 |
| WACB | Kittanning, Pa. | 1380 |
| WACE | Chicopee, Mass. | 730 |
| WACI | The Dalles, Ore. | 1300 |
| WACK | Newark, N.Y. | 1420 |
| WACL | Waycross, Ga. | 570 |
| WACO | Waco, Tex. | 1460 |
| WACR | Columbus, Miss. | 1050 |
| WACT | Tuscaloosa, Ala. | 1420 |
| WACX | Austell, Ga. | 1600 |
| WACY | Kissimmee, Fla. | 1220 |
| WADA | Shelby, N.C. | 1390 |
| WADE | Wadesboro, N.C. | 1210 |
| WADK | Newport, R.I. | 1540 |
| WADM | Decatur, Ind. | 1540 |
| WADO | New York, N.Y. | 1280 |
| WADR | Remsen, N. Y. | 1480 |
| WADS | Ansonia, Conn. | 690 |
| WAEB | Allentown, Pa. | 790 |
| WAEL | Mayaguez, P.Rico | 600 |
| WAEW | Crossville, Tenn. | 1330 |
| WAFC | Staunton, Va. | 900 |
| WAFI | Middlesboro, Ky. | 1560 |
| WAFT | Grand Rapids, Mich. | 1480 |
| WAGC | Centre, Ala. | 1550 |
| WAGE | Leesburg, Va. | 1290 |
| WAGF | Dothan, Ala. | 1320 |
| WAGG | Franklin, Tenn. | 950 |
| WAGL | Lancaster, S. C. | 1560 |
| WAGM | Presque Isle, Maine | 950 |
| WAGN | Menominee, Mich. | 1340 |
| WAGO | Oshkosh, Wis. | 690 |
| WAGR | Lumberton, N.C. | 580 |
| WAGS | Bishopville, S.C. | 1380 |
| WAGY | Forest City, N.C. | 1320 |
| WAHT | Annville-Cleona, Pa. | 1510 |
| WAIK | Galesburg, Ill. | 1590 |
| WAIL | Baton Rouge, La. | 1260 |
| WAIM | Anderson, S.C. | 1230 |
| WAIN | Columbia, Ky. | 1270 |
| WAIR | Winston-Salem, N.C. | 1340 |
| WAIT | Chicago, Ill. | 820 |
| WAJF | Decatur, Ala. | 1490 |
| WAJR | Morgantown, W.Va. | 1440 |
| WAKE | Valparaiso, Ind. | 1500 |
| WAKI | McMinnville, Tenn. | 1230 |
| WAKN | Aiken, S.C. | 990 |
| WAKO | Lawrenceville, Ill. | 910 |
| WAKR | Akron, Ohio | 1590 |
| WAKS | Fuquay-Varina, N.C. | 1460 |
| WAKX | Superior, Wisc. | 1320 |
| WAKY | Louisville, Ky. | 790 |
| WALD | Walterboro, S.C. | 1060 |
| WALE | Fall River, Mass. | 1400 |
| WALG | Albany, Ga. | 1590 |
| WALK | Patchogue, N.Y. | 1370 |
| WALL | Middletown, N.Y. | 1340 |
| WALM | Albion, Mich. | 1260 |
| WALO | Humacao, P.R. | 1240 |
| WALT | Tampa, Fla. | 1110 |
| WALY | Herkimer, N.Y. | 1420 |
| WAMA | Selma, Ala | 1340 |
| WAMB | Donelson, Tenn. | 1190 |
| WAMD | Aberdeen, Md. | 970 |
| WAME | Miami, Fla. | 1260 |
| WAMG | Gallatin, Tenn. | 1130 |
| WAMI | Opp, Ala. | 860 |
| WAML | Laurel, Miss. | 1340 |
| WAMM | Flint, Mich. | 1420 |
| WAMO | Homestead, Pa. | 860 |
| WAMR | Venice, Fla. | 1320 |
| WAMS | Wilmington, Del. | 1380 |
| WAMW | Washington, Ind. | 1580 |
| WAMY | Amory, Miss. | 1580 |
| WANA | Anniston, Ala. | 1490 |
| WANB | Waynesburg, Pa. | 1580 |
| WANL | Lineville, Ala. | 1540 |
| WANN | Annapolis, Md. | 1190 |
| WANO | Pineville, Ky. | 1230 |
| WANS | Anderson, S.C. | 1280 |
| WANT | Richmond, Va. | 990 |
| WANV | Waynesboro, Va. | 970 |
| WANY | Albany, Ky. | 1390 |
| WAOA | Opelika, Ala. | 1520 |
| WAOK | Atlanta, Ga. | 1380 |
| WAOP | Ostego, Mich. | 980 |
| WAOV | Vincennes, Ind. | 1450 |
| WAPA | San Juan, P.R. | 680 |
| WAPC | Riverhead, N.Y. | 1570 |
| WAPE | Jacksonville, Fla. | 690 |
| WAPF | McComb, Miss. | 980 |
| WAPG | Arcadia, Fla. | 1480 |
| WAPI | Birmingham, Ala. | 1070 |
| WAPL | Appleton, Wis. | 1570 |
| WAPX | Montgomery, Ala. | 1600 |
| WAQI | Ashtabula, Ohio | 1600 |
| WAQY | Birmingham, Ala. | 1220 |
| WARA | Attleboro, Mass. | 1320 |
| WARB | Covington, La. | 730 |
| WARD | Johnstown, Pa. | 1490 |
| WARE | Ware, Mass. | 1250 |
| WARF | Jasper, Ala. | 1240 |
| WARI | Abbeville, Ala. | 1480 |
| WARK | Hagerstown, Md. | 1490 |
| WARM | Scranton, Pa. | 590 |
| WARN | Ft. Pierce, Fla. | 1330 |
| WARO | Canonsburg, Pa. | 540 |
| WART | Moulton, Ala. | 1530 |
| WARU | Peru, Ind. | 1600 |
| WARV | Warwick-E. Greenwich, R.I. | 1590 |
| WASA | Havre de Grace, Md. | 1330 |
| WASC | Spartanburg, S.C. | 1530 |
| WASK | Lafayette, Ind. | 1450 |
| WASP | Brownsville, Pa. | 1130 |
| WATA | Boone, N.C. | 1450 |
| WATC | Gaylord, Mich. | 900 |
| WATE | Knoxville, Tenn. | 620 |
| WATH | Athens, Ohio | 970 |
| WATI | Indianapolis, Ind. | 810 |
| WATK | Antigo, Wis. | 900 |
| WATM | Atmore, Ala. | 1590 |
| WATN | Watertown, N.Y. | 1240 |
| WATO | Oak Ridge, Tenn. | 1290 |
| WATP | Marion, S.C. | 1430 |
| WATR | Waterbury, Conn. | 1320 |
| WATS | Sayre, Pa. | 960 |
| WATT | Cadillac, Mich. | 1240 |
| WATV | Birmingham, Ala. | 900 |
| WATW | Ashland, Wis. | 1400 |
| WATZ | Alpena, Mich. | 1450 |
| WAUB | Auburn, N.Y. | 1590 |
| WAUC | Wauchula, Fla. | 1310 |
| WAUD | Auburn, Ala. | 1230 |
| WAUG | Augusta, Ga. | 1050 |
| WAUK | Waukesha, Wis. | 1510 |
| WAVA | Arlington, Va. | 780 |
| WAVC | Warner Robins, Ga. | 1350 |
| WAVE | Louisville, Ky. | 970 |
| WAVI | Dayton, Ohio | 1210 |
| WAVL | Apollo, Pa. | 910 |
| WAVN | Stillwater, Minn. | 1220 |
| WAVO | Avondale Estates, Ga. | 1420 |
| WAVP | Avon Park, Fla. | 1390 |
| WAVU | Albertville, Ala. | 630 |
| WAVZ | New Haven, Conn. | 1300 |
| WAWA | West Allis, Wis. | 1590 |
| WAWK | Kendallville, Ind. | 1140 |
| WAWZ | Zarephath, N.J. | 1380 |
| WAXE | Vero Beach, Fla. | 1370 |
| WAXK | Superior, Wis. | 1320 |
| WAXU | Georgetown, Ky. | 1580 |
| WAXX | Chippewa Falls, Wis. | 1150 |
| WAYB | Waynesboro, Va. | 1490 |
| WAYD | Ozark, Ala. | 1190 |
| WAYE | Baltimore, Md. | 860 |
| WAYN | Rockingham, N.C. | 900 |
| WAYR | Orange Park, Fla. | 550 |
| WAYS | Charlotte, N.C. | 610 |
| WAYX | Waycross, Ga. | 1230 |
| WAYZ | Waynesboro, Pa. | 1380 |
| WAZA | Bainbridge, Ga. | 1360 |
| WAZE | Clearwater, Fla. | 860 |
| WAZF | Yazoo City, Miss. | 1230 |
| WAZL | Hazelton, Pa. | 1490 |
| WAZS | Summerville, S. C. | 980 |
| WAZY | Lafayette, Ind. | 1410 |
| WBAA | West Lafayette, Ind. | 920 |
| WBAB | Babylon, N.Y. | 1440 |
| WBAC | Cleveland, Tenn. | 1340 |
| WBAF | Barnesville, Ga. | 1090 |
| WBAG | Burlington, N.C. | 1150 |
| WBAL | Baltimore, Md. | 1090 |
| WBAM | Montgomery, Ala. | 740 |
| WBAP | Fort Worth, Tex. | 570 & 820 |
| WBAR | Bartow, Fla. | 1460 |
| WBAT | Marion, Ind. | 1400 |
| WBAW | Barnwell, S.C. | 740 |
| WBAX | Wilkes-Barre, Pa. | 1240 |
| WBAY | Green Bay, Wis. | 1360 |
| WBAZ | Kingston, N.Y. | 1550 |
| WBBA | Pittsfield, Ill. | 1580 |
| WBBB | Burlington-Graham, N.C. | 920 |
| WBBF | Rochester, N.Y. | 950 |
| WBBI | Abingdon, Va. | 1230 |
| WBBK | Blakely, Ga. | 1260 |
| WBBL | Richmond, Va. | 1480 |
| WBBM | Chicago, Ill. | 780 |
| WBBO | Forest City, N.C. | 780 |
| WBBQ | Augusta, Ga. | 1340 |
| WBBR | Travelers Rest, S.C. | 1580 |
| WBBS | Jacksonville, N.C. | 1290 |
| WBBT | Lyons, Ga. | 1340 |
| WBBW | Youngstown, Ohio | 1240 |
| WBBX | Portsmouth, N.H. | 1380 |
| WBBZ | Ponca City, Okla. | 1230 |
| WBCA | Bay Minette, Ala. | 1150 |
| WBCB | Levittown, Pa. | 1490 |
| WBCH | Hastings, Mich. | 1220 |
| WBCI | Williamsburg, Va. | 740 |
| WBCK | Battle Creek, Mich. | 930 |
| WBCM | Bay City, Mich. | 1440 |
| WBCO | Bucyrus, Ohio | 1540 |
| WBCU | Union, S.C. | 1460 |
| WBEC | Pittsfield, Mass. | 1420 |
| WBEE | Harvey, Ill. | 1570 |
| WBEJ | Elizabethton, Tenn. | 1240 |
| WBEL | So. Beloit, Ill. | 1380 |
| WBEN | Buffalo, N.Y. | 930 |
| WBER | Moncks Corner, S. C. | 950 |
| WBET | Brockton, Mass. | 1460 |
| WBEU | Beaufort, S.C. | 960 |
| WBEV | Beaver Dam, Wis. | 1430 |
| WBEX | Chillicothe, Ohio | 1490 |
| WBFD | Bedford, Pa. | 1310 |
| WBFJ | Woodbury, Tenn. | 1540 |
| WBFN | Quitman, Miss. | 1500 |
| WBGC | Chipley, Fla. | 1240 |
| WBGN | Bowling Green, Ky. | 1340 |
| WBGS | Slidell, La. | 1560 |
| WBHB | Fitzgerald, Ga. | 1240 |
| WBHC | Hampton, S.C. | 1270 |
| WBHF | Cartersville, Ga. | 1450 |
| WBHM | Birmingham, Ala. | 1550 |
| WBHN | Bryson City, N. C. | 1590 |
| WBHP | Huntsville, Ala. | 1230 |
| WBHT | Brownsville, Tenn. | 1520 |
| WBIA | Augusta, Ga. | 1230 |
| WBIB | Centreville, Ala. | 1110 |
| WBIE | Marietta, Ga. | 1080 |
| WBIG | Greensboro, N.C. | 1470 |
| WBIP | Booneville, Miss. | 1400 |
| WBIR | Knoxville, Tenn. | 1240 |
| WBIS | Bristol, Conn. | 1440 |
| WBIW | Bedford, Ind. | 1340 |
| WBIX | Jacksonville Beach, Fla. | 1010 |
| WBIZ | Eau Claire, Wis. | 1400 |
| WBJM | Lemmon, S. D. | 1400 |
| WBKC | Chardon, O. | 1560 |
| WBKH | Hattiesburg, Miss. | 950 |
| WBKN | Newton, Miss. | 1410 |
| WBKV | West Bend, Wis. | 1470 |
| WBLA | Elizabethtown, N.C. | 1440 |
| WBLC | Lenoir City, Tenn. | 1360 |
| WBLE | Batesville, Miss. | 1290 |
| WBLF | Bellefonte, Pa. | 1330 |
| WBLG | Lexington, Ky. | 1300 |
| WBLJ | Dalton, Ga. | 1230 |
| WBLO | Evergreen, Ala. | 1470 |
| WBLR | Batesburg, S.C. | 1430 |
| WBLT | Bedford, Va. | 1350 |
| WBLU | Salem, Va. | 1480 |
| WBLY | Springfield, Ohio | 1600 |
| WBMA | Beaufort, N.C. | 1400 |
| WBMC | McMinnville, Tenn. | 960 |
| WBMD | Baltimore, Md. | 750 |
| WBME | Belfast, Me. | 1230 |
| WBMJ | San Juan, P. R. | 1190 |
| WBMK | West Point, Ga. | 1310 |
| WBML | Macon, Ga. | 1240 |
| WBMS | Black Mountain, N.C. | 1350 |
| WBNB | Charlotte Amalie, Virgin Islands | 1000 |
| WBNC | Conway, N.H. | 1050 |
| WBNL | Boonville, Ind. | 1540 |
| WBNO | Bryan, Ohio | 1520 |
| WBNR | Beacon, N.Y. | 1260 |
| WBNS | Columbus, Ohio | 1460 |
| WBNT | Oneida, Tenn. | 1310 |
| WBNX | New York, N.Y. | 1380 |
| WBOB | Galax, Va. | 1360 |
| WBOC | Salisbury, Md. | 960 |
| WBOK | New Orleans, La. | 1230 |
| WBOL | Bolivar, Tenn. | 1560 |
| WBOM | Jacksonville, Fla. | 970 |
| WBOO | Baraboo, Wis. | 740 |
| WBOP | Pensacola, Fla. | 980 |
| WBOW | Terre Haute, Ind. | 1230 |
| WBOX | Bogalusa, La. | 920 |
| WBOY | Clarksburg, W.Va. | 1400 |
| WBPZ | Lock Haven, Pa. | 1230 |
| WBRB | Mt. Clemens, Mich. | 1430 |
| WBRC | Birmingham, Ala. | 960 |
| WBRD | Bradenton, Fla. | 1420 |
| WBRE | Wilkes-Barre, Pa. | 1340 |
| WBRG | Lynchburg, Va. | 1050 |
| WBRI | Indianapolis, Ind. | 1500 |
| WBRJ | Marietta, O. | 910 |
| WBRK | Pittsfield, Mass. | 1340 |
| WBRL | Berlin, N.H. | 1400 |
| WBRM | Marion, N.C. | 1250 |
| WBRN | Big Rapids, Mich. | 1460 |
| WBRT | Bardstown, Ky. | 1320 |
| WBRO | Waynesboro, Ga. | 1310 |
| WBRV | Boonville, N.Y. | 900 |
| WBRX | Berwick, Pa. | 1280 |
| WBSA | Boaz, Ala. | 1300 |
| WBSC | Bennettsville, S.C. | 1550 |
| WBSG | Blackshear, Ga. | 1350 |
| WBSM | New Bedford, Mass. | 1420 |
| WBSR | Pensacola, Fla. | 1450 |
| WBT | Charlotte, N.C. | 1110 |
| WBTA | Batavia, N.Y. | 1490 |
| WBTC | Uhrichsville, O. | 1540 |
| WBTH | Williamson, W.Va. | 1400 |
| WBTM | Danville, Va. | 1330 |
| WBTN | Bennington, Vt. | 1370 |
| WBTO | Linton, Ind. | 1600 |
| WBTS | Bridgeport, Ala. | 1480 |
| WBUC | Buckhannon, W.Va. | 1460 |
| WBUD | Trenton, N.J. | 1260 |
| WBUG | Ridgeland, S.C. | 1430 |
| WBUT | Butler, Pa. | 1050 |
| WBUX | Doylestown, Pa. | 1570 |
| WBUY | Lexington, N.C. | 1440 |
| WBUZ | Fredonia, N.Y. | 1570 |
| WBVM | Utica, N.Y. | 1550 |
| WBVP | Beaver Falls, Pa. | 1230 |
| WBYB | St. Pauls, N.C. | 1060 |
| WBYE | Calera, Ala. | 1370 |
| WBYG | Savannah, Ga. | 1450 |
| WBYS | Canton, Ill. | 1560 |
| WBZ | Boston, Mass. | 1030 |
| WBZA | Glens Falls, N.Y. | 1410 |
| WBZE | Wheeling, W. Va. | 1470 |
| WBZY | New Castle, Pa. | 1140 |
| WCAB | Rutherfordton, N.C. | 590 |
| WCAI | Fort Myers, Fla. | 1350 |
| WCAL | Northfield, Minn. | 770 |
| WCAM | Camden, N.J. | 1310 |
| WCAO | Baltimore, Md. | 600 |
| WCAP | Lowell, Mass. | 980 |
| WCAR | Detroit, Mich. | 1130 |
| WCAS | Cambridge, Mass. | 740 |
| WCAT | Orange, Mass. | 1390 |
| WCAU | Philadelphia, Pa. | 1210 |
| WCAW | Charleston, W.Va. | 680 |
| WCAY | Cayce, S.C. | 620 |
| WCAZ | Carthage, Ill. | 990 |
| WCBA | Corning, N.Y. | 1350 |
| WCBG | Chambersburg, Pa. | 1590 |
| WCBI | Columbus, Miss. | 550 |
| WCBK | Martinsville, Ind. | 1540 |
| WCBL | Benton, Ky. | 1290 |
| WCBM | Baltimore, Md. | 680 |
| WCBS | New York, N.Y. | 880 |
| WCBT | Roanoke Rapids, N.C. | 1230 |
| WCBY | Cheboygan, Mich. | 1240 |
| WCCC | Hartford, Conn. | 1290 |
| WCCF | Punta Gorda, Fla. | 1580 |
| WCCM | Lawrence, Mass. | 800 |
| WCCN | Neillsville, Wis. | 1370 |
| WCCO | Minneapolis-St. Paul, Minn. | 830 |
| WCCR | Urbana, Ill. | 1580 |
| WCCW | Traverse City, Mich. | 1310 |
| WCDJ | Edenton, N.C. | 1260 |
| WCDL | Carbondale, Pa. | 1440 |
| WCDQ | Hamden, Conn. | 1220 |
| WCDS | Glasgow, Ky. | 1440 |
| WCDT | Winchester, Tenn. | 1340 |
| WCEC | Rocky Mount, N.C. | 810 |
| WCED | DuBois, Pa. | 1420 |
| WCEF | Parkersburg, W.Va. | 1050 |
| WCEH | Hawkinsville, Ga. | 610 |
| WCEM | Cambridge, Md. | 1240 |
| WCEN | Mt. Pleasant, Mich. | 1150 |
| WCER | Charlotte, Mich. | 1390 |
| WCFL | Chicago, Ill. | 1000 |
| WCFR | Springfield, Vt. | 1480 |
| WCFV | Clifton Forge, Va. | 1230 |
| WCGA | Calhoun, Ga. | 900 |
| WCGB | Pastillo, P. R. | 1050 |
| WCGC | Belmont, N.C. | 1270 |
| WCGO | Chicago Hghts., Ill. | 1600 |
| WCGR | Canandaigua, N.Y. | 1550 |
| WCHA | Chambersburg, Pa. | 800 |
| WCHB | Inkster, Mich. | 1440 |
| WCHE | Westchester, Pa. | 1520 |
| WCHI | Chillicothe, Ohio | 1350 |
| WCHJ | Brookhaven, Miss. | 1470 |
| WCHK | Canton, Ga. | 1290 |
| WCHL | Chapel Hill, N.C. | 1360 |
| WCHN | Norwich, N.Y. | 970 |
| WCHO | Washington Court House, Ohio | 1250 |
| WCHS | Charleston, W.Va. | 580 |
| WCHV | Charlottesville, Va. | 1260 |
| WCIK | Gordon, Ga. | 1560 |
| WCIL | Carbondale, Ill. | 1020 |
| WCIN | Cincinnati, Ohio | 1480 |

| Call | Location | kHz |
|---|---|---|
| WCIR | Beckley, W. Va. | 1060 |
| WCIS | Moss Point, Miss. | 1460 |
| WCIT | Lima, Ohio | 940 |
| WCJU | Columbia, Miss. | 1450 |
| WCKB | Dunn, N.C. | 780 |
| WCKD | Ishpenning, Mich. | 970 |
| WCKI | Greer, S.C. | 1300 |
| WCKL | Catskill, N.Y. | 560 |
| WCKM | Winnsboro, S.C. | 1250 |
| WCKY | Cincinnati, Ohio | 1530 |
| WCLA | Claxton, Ga. | 1470 |
| WCLB | Camilla, Ga. | 1220 |
| WCLC | Jamestown, Tenn. | 1260 |
| WCLD | Cleveland, Miss. | 1490 |
| WCLE | Cleveland, Tenn. | 1570 |
| WCLG | Morgantown, W.Va. | 1300 |
| WCLI | Corning, N.Y. | 1450 |
| WCLO | Janesville, Wis. | 1230 |
| WCLR | Crystal Lake, Ill. | 850 |
| WCLS | Columbus, Ga. | 1580 |
| WCLT | Newark, Ohio | 1430 |
| WCLU | Covington, Ky. | 1320 |
| WCLW | Mansfield, O. | 1140 |
| WCMA | Corinth, Miss. | 1230 |
| WCMB | Harrisburg, Pa. | 1460 |
| WCMC | Wildwood, N.J. | 1230 |
| WCME | Brunswick, Maine | 900 |
| WCMI | Ashland, Ky. | 1340 |
| WCMN | Arecibo, P.R. | 1280 |
| WCMP | Pine City, Minn. | 1350 |
| WCMR | Elkhart, Ind. | 1270 |
| WCMS | Norfolk, Va. | 1050 |
| WCMT | Martin, Tenn. | 1410 |
| WCMY | Ottawa, Ill. | 1430 |
| WCNB | Connersville, Ind. | 1580 |
| WCNC | Elizabeth City, N.C. | 1240 |
| WCND | Shelbyville, Ky. | 940 |
| WCNH | Quincy, Fla. | 1230 |
| WCNL | Newport, N. H. | 1010 |
| WCNR | Bloomsburg, Pa. | 930 |
| WCNU | Crestview, Fla. | 1010 |
| WCNW | Fairfield, O. | 1560 |
| WCNX | Middletown, Conn. | 1150 |
| WCOA | Pensacola, Fla. | 1370 |
| WCOC | Meridian, Miss. | 910 |
| WCOF | Immokalee, Fla. | 1490 |
| WCOG | Greensboro, N.C. | 1320 |
| WCOH | Newnan, Ga. | 1400 |
| WCOJ | Coatesville, Pa. | 1420 |
| WCOK | Sparta, N. C. | 1060 |
| WCOL | Columbus, Ohio | 1230 |
| WCON | Cornelia, Ga. | 1450 |
| WCOP | Boston, Mass. | 1150 |
| WCOR | Lebanon, Tenn. | 900 |
| WCOS | Columbia, S.C. | 1400 |
| WCOU | Lewiston, Maine | 1240 |
| WCOV | Montgomery, Ala. | 1170 |
| WCOW | Sparta, Wis. | 1290 |
| WCOX | Camden, Ala. | 1540 |
| WCOY | Columbia, Pa. | 1580 |
| WCPA | Clearfield, Pa. | 900 |
| WCPC | Houston, Miss. | 940 |
| WCPH | Etowah, Tenn. | 1220 |
| WCPK | Chesapeake, Va. | 1600 |
| WCPM | Cumberland, Ky. | 1280 |
| WCPR | Coamo, P. R. | 1450 |
| WCPS | Tarboro, N.C. | 760 |
| WCRA | Effingham, Ill. | 1090 |
| WCRB | Waltham, Mass. | 1330 |
| WCRE | Cheraw, S.C. | 1420 |
| WCRI | Scottsboro, Ala. | 1050 |
| WCRK | Morristown, Tenn. | 1150 |
| WCRL | Oneonta, Ala. | 1570 |
| WCRM | Clare, Mich. | 990 |
| WCRO | Johnstown, Pa. | 1230 |
| WCRS | Greenwood, S.C. | 1450 |
| WCRT | Birmingham, Ala. | 1260 |
| WCRV | Washington, N.J. | 1580 |
| WCRW | Chicago, Ill. | 1240 |
| WCRY | Macon, Ga. | 900 |
| WCSA | Ripley, Mass. | 1260 |
| WCSC | Charleston, S.C. | 1390 |
| WCSH | Portland, Maine | 970 |
| WCSI | Columbus, Ind. | 1010 |
| WCSJ | Morris, Ill. | 1550 |
| WCSL | Cherryville, N. C. | 1590 |
| WCSM | Celina, Ohio | 1350 |
| WCSR | Hillsdale, Mich. | 1340 |
| WCSS | Amsterdam, N.Y. | 1490 |
| WCST | Berkeley Springs, W.Va. | 1010 |
| WCSV | Crossville, Tenn. | 1520 |
| WCSW | Shell Lake, Wis. | 940 |
| WCTA | Andalusia, Ala. | 920 |
| WCTC | New Brunswick, N.J. | 1450 |
| WCTR | Chestertown, Md. | 1530 |
| WCTT | Corbin, Ky. | 680 |
| WCTW | New Castle, Ind. | 1550 |
| WCUB | Manitowoc, Wis. | 980 |
| WCUE | Cuyahoga Falls, Ohio | 1150 |
| WCUM | Cumberland, Md. | 1230 |
| WCVA | Culpeper, Va. | 1490 |
| WCVI | Connellsville, Pa. | 1340 |
| WCVL | Crawfordsville, Ind. | 1550 |
| WCVP | Murphy, N.C. | 600 |
| WCVR | Randolph, Vt. | 1320 |
| WCVS | Springfield, Ill. | 1450 |
| WCVU | Portsmouth, Va. | 1350 |
| WCWA | Toledo, O. | 1230 |
| WCWC | Ripon, Wis. | 1600 |
| WCWR | Tarpon Springs, Fla. | 1470 |
| WCYB | Bristol, Va. | 690 |
| WCYN | Cynthiana, Ky. | 1400 |
| WDAD | Indiana, Pa. | 1450 |
| WDAE | Tampa, Fla. | 1250 |
| WDAF | Kansas City, Mo. | 610 |
| WDAK | Columbus, Ga. | 540 |
| WDAL | Meridian, Miss. | 1330 |
| WDAN | Danville, Ill. | 1490 |
| WDAR | Darlington, S.C. | 1350 |
| WDAS | Philadelphia, Pa. | 1480 |
| WDAT | Ormond Beach, Fla. | 1380 |
| WDAX | McRae, Ga. | 1410 |
| WDAY | Fargo, N. Dak. | 970 |
| WDBC | Escanaba, Mich. | 680 |
| WDBF | Delray Beach, Fla. | 1420 |
| WDBJ | Roanoke, Va. | 960 |
| WDBL | Springfield, Tenn. | 1590 |
| WDBM | Statesville, N.C. | 550 |
| WDBO | Orlando, Fla. | 580 |
| WDBQ | Dubuque, Iowa | 1490 |
| WDCF | Dade City, Fla. | 1350 |
| WDCJ | Arlington, Fla. | 1220 |
| WDCR | Hanover, N.H. | 1340 |
| WDDT | Greenville, Miss. | 900 |
| WDDY | Gloucester, Va. | 1420 |
| WDEA | Ellsworth, Me. | 1370 |
| WDEB | Jamestown, Tenn. | 1500 |
| WDEC | Americus, Ga. | 1290 |
| WDEF | Chattanooga, Tenn. | 1370 |
| WDEH | Sweetwater, Tenn. | 800 |
| WDEL | Wilmington, Del. | 1150 |
| WDEN | Macon, Ga. | 1500 |
| WDEV | Waterbury, Vt. | 550 |
| WDEW | Westfield, Mass. | 1570 |
| WDGL | Douglasville, Ga. | 1520 |
| WDGY | Minneapolis, Minn. | 1130 |
| WDIA | Memphis, Tenn. | 1070 |
| WDIC | Clinchco, Va. | 1430 |
| WDIG | Dothan, Ala. | 1450 |
| WDIX | Orangeburg, S.C. | 1150 |
| WDJS | Mt. Olive, N.C. | 1430 |
| WDJZ | Bridgeport, Conn. | 1530 |
| WDKD | Kingstree, S. C. | 1310 |
| WDKN | Dickson, Tenn. | 1260 |
| WDLA | Walton, N.Y. | 1270 |
| WDLB | Marshfield, Wis. | 1450 |
| WDLC | Port Jervis, N.Y. | 1490 |
| WDLR | Delaware, Ohio | 1550 |
| WDLM | E. Moline, Ill. | 960 |
| WDLP | Panama City, Fla. | 590 |
| WDLT | Indianola, Miss. | 1380 |
| WDME | Dover-Foxcraft, Me. | 1340 |
| WDMG | Douglas, Ga. | 860 |
| WDMJ | Marquette, Mich. | 1320 |
| WDMP | Dodgeville, Wis. | 810 |
| WDMV | Pocomoke City, Md. | 540 |
| WDNC | Durham, N.C. | 620 |
| WDNE | Elkins, W.Va. | 1240 |
| WDNG | Anniston, Ala. | 1450 |
| WDNL | Warren, O. | 1570 |
| WDNT | Dayton, Tenn. | 1280 |
| WDOB | Canton, Miss. | 1370 |
| WDOC | Prestonsburg, Ky. | 1310 |
| WDOD | Chattanooga, Tenn. | 1310 |
| WDOE | Dunkirk, N.Y. | 1410 |
| WDOG | Allendale, S. C. | 1300 |
| WDOL | Athens, Ga. | 1470 |
| WDON | Wheaton, Md. | 1540 |
| WDOR | Sturgeon Bay, Wis. | 910 |
| WDOS | Oneonta, N.Y. | 730 |
| WDOT | Burlington, Va. | 1400 |
| WDOV | Dover, Del. | 1410 |
| WDOW | Dowagiac, Mich. | 1440 |
| WDQN | DuQuoin, Ill. | 1580 |
| WDRC | Hartford, Conn. | 1360 |
| WDSC | Dillon, S.C. | 800 |
| WDSG | Dyersburg, Tenn. | 1450 |
| WDSK | Cleveland, Miss. | 1410 |
| WDSL | Mocksville, N. C. | 1520 |
| WDSM | Superior, Wis. | 710 |
| WDSP | DeFuniak Springs, Fla. | 1280 |
| WDSR | Lake City, Fla. | 1340 |
| WDSU | New Orleans, La. | 1280 |
| WDTM | Selmer, Tenn. | 1130 |
| WDUN | Gainesville, Ga. | 1240 |
| WDUX | Waupaca, Wis. | 800 |
| WDUZ | Green Bay, Wis. | 1400 |
| WDVA | Danville, Va. | 1250 |
| WDVH | Gainesville, Fla. | 980 |
| WDVL | Vineland, N.J. | 1270 |
| WDWD | Dawson, Ga. | 990 |
| WDWS | Champaign, Ill. | 1400 |
| WDXB | Chattanooga, Tenn. | 1490 |
| WDXE | Lawrenceburg, Tenn. | 1370 |
| WDXI | Jackson, Tenn. | 1310 |
| WDXL | Lexington, Tenn. | 1490 |
| WDXN | Clarksville, Tenn. | 540 |
| WDXR | Paducah, Ky. | 1560 |
| WDXY | Sumter, S.C. | 1240 |
| WDYZ | Buford, Ga. | 1460 |
| WDZ | Decatur, Ill. | 1050 |
| WEAB | Greer, S.C. | 800 |
| WEAC | Gaffney, S. C. | 1500 |
| WEAD | College Park, Ga. | 1570 |
| WEAG | Alcoa, Tenn. | 1470 |
| WEAL | Greensboro, N. C. | 1510 |
| WEAM | Arlington, Va. | 1390 |
| WEAN | Providence, R.I. | 790 |
| WEAQ | Eau Claire, Wis. | 790 |
| WEAS | Savannah, Ga. | 900 |
| WEAT | W. Palm Beach, Fla. | 850 |
| WEAV | Plattsburg, N.Y. | 960 |
| WEAW | Evanston, Ill. | 1330 |
| WEBB | Baltimore, Md. | 1360 |
| WEBC | Duluth, Minn. | 560 |
| WEBJ | Brewton, Ala. | 1240 |
| WEBO | Owego, N.Y. | 1330 |
| WEBQ | Harrisburg, Ill. | 1240 |
| WEBR | Buffalo, N.Y. | 970 |
| WEBS | Calhoun, Ga. | 1110 |
| WEBY | Milton, Fla. | 1330 |
| WECL | Eau Claire, Wis. | 1050 |
| WECP | Carthage, Miss. | 1480 |
| WEDC | Chicago, Ill. | 1240 |
| WEDO | McKeesport, Pa. | 810 |
| WEEB | Southern Pines, N.C. | 990 |
| WEED | Rocky Mount, N.C. | 1390 |
| WEEE | Rensselaer, N.Y. | 1300 |
| WEEF | Highland Park, Ill. | 1430 |
| WEEI | Boston, Mass. | 590 |
| WEEL | Fairfax, Va. | 1310 |
| WEEN | Lafayette, Tenn. | 1460 |
| WEEP | Pittsburgh, Pa. | 1080 |
| WEER | Warrenton, Va. | 1250 |
| WEET | Richmond, Va. | 1320 |
| WEEU | Reading, Pa. | 850 |
| WEEW | Washington, N.C. | 1320 |
| WEEX | Easton, Pa. | 1230 |
| WEEZ | Chester, Pa. | 1590 |
| WEGO | Concord, N.C. | 1410 |
| WEGP | Presque Isle, Maine | 1390 |
| WEHH | Elmira Heights-Horseheads, N.Y. | 1590 |
| WEHW | Windsor, Conn. | 1480 |
| WEIC | Charleston, Ill. | 1270 |
| WEIF | Moundsville, W. Va. | 1370 |
| WEIM | Fitchburg, Mass. | 1280 |
| WEIR | Weirton, W.Va. | 1430 |
| WEIS | Centre, Ala. | 990 |
| WEJL | Scranton, Pa. | 630 |
| WEKG | Jackson, Ky. | 810 |
| WEKR | Fayetteville, Tenn. | 1240 |
| WEKY | Richmond, Ky. | 1340 |
| WEKZ | Monroe, Wis. | 1260 |
| WELA | Elizabeth, N.J. | 1530 |
| WELB | Elba, Ala. | 1350 |
| WELC | Welch, W.Va. | 1150 |
| WELD | Fisher, W.Va. | 690 |
| WELE | S. Daytona, Fla. | 1590 |
| WELF | Tomahawk, Wis. | 810 |
| WELI | New Haven, Conn. | 960 |
| WELK | Charlottesville, Va. | 1010 |
| WELM | Elmira, N.Y. | 1410 |
| WELO | Tupelo, Miss. | 580 |
| WELP | Easley, S.C. | 1360 |
| WELR | Roanoke, Ala. | 1360 |
| WELS | Kinston, N.C. | 1010 |
| WELV | Ellenville, N. Y. | 1370 |
| WELW | Willoughby, O. | 1330 |
| WELX | Xenia, O. | 1110 |
| WELY | Ely, Minn. | 1450 |
| WELZ | Belzoni, Miss. | 1460 |
| WEMB | Erwin, Tenn. | 1420 |
| WEMD | Easton, Md. | 1460 |
| WEMJ | Laconia, N.H. | 1490 |
| WEMP | Milwaukee, Wis. | 1250 |
| WENC | Whiteville, N.C. | 1220 |
| WEND | Ebensburg, Pa. | 1580 |
| WENE | Endicott, N.Y. | 1430 |
| WENG | Englewood, Fla. | 1530 |
| WENK | Union City, Tenn. | 1240 |
| WENN | Birmingham, Ala. | 1320 |
| WENO | Madison, Tenn. | 1430 |
| WENR | Englewood, Tenn. | 1090 |
| WENT | Gloversville, N.Y. | 1340 |
| WENY | Elmira, N.Y. | 1230 |
| WENZ | Highland Springs, Va. | 1450 |
| WEOK | Poughkeepsie, N.Y. | 1390 |
| WEOL | Elyria, Ohio | 930 |
| WEPG | S. Pittsburgh, Tenn. | 910 |
| WEPM | Martinsburg, W.Va. | 1340 |
| WERA | Plainfield, N.J. | 1590 |
| WERD | Atlanta, Ga. | 860 |
| WERE | Cleveland, Ohio | 1300 |
| WERH | Hamilton, Ala. | 970 |
| WERI | Westerly, R.I. | 1230 |
| WERK | Muncie, Ind. | 990 |
| WERL | Eagle River, Wis. | 950 |
| WERT | Van Wert, Ohio | 1220 |
| WERX | Wyoming, Mich. | 1530 |
| WESA | Charleroi, Pa. | 940 |
| WESB | Bradford, Pa. | 1490 |
| WESC | Greenville, S.C. | 660 |
| WESO | Southbridge, Mass. | 970 |
| WESR | Tasley, Va. | 1330 |
| WEST | Easton, Pa. | 1400 |
| WESX | Salem, Mass. | 1230 |
| WESY | Leland, Miss. | 1580 |
| WETB | Johnson City, Tenn. | 790 |
| WETC | Wendell-Zebulon, N.C. | 540 |
| WETH | St. Augustine, Fla. | 1420 |
| WETT | Ocean City, Md. | 1590 |
| WETU | Wetumpka, Ala. | 1250 |
| WETZ | New Martinsville, West Virginia | 1330 |
| WEUC | Ponce, P.R. | 1420 |
| WEUP | Huntsville, Ala. | 1600 |
| WEVA | Emporia, Va. | 860 |
| WEVD | New York, N.Y. | 1330 |
| WEVE | Eveleth, Minn. | 1340 |
| WEVR | River Falls, Wis. | 1550 |
| WEW | St. Louis, Mo. | 770 |
| WEWO | Laurinburg, N.C. | 1080 |
| WEXL | Royal Oak, Mich. | 1340 |
| WEXT | W. Hartford, Conn. | 1550 |
| WEYE | Sanford, N.C. | 1290 |
| WEYY | Talladega, Ala. | 1580 |
| WEZE | Boston, Mass. | 1260 |
| WEZJ | Williamsburg, Ky. | 1440 |
| WEZQ | Winfield, Ala. | 1300 |
| WEZY | Cocoa, Fla. | 1350 |
| WFAA | Dallas, Tex. | 570 & 820 |
| WFAB | Miami, Fla. | 990 |
| WFAD | Middlebury, Vt. | 1490 |
| WFAG | Farmville, N.C. | 1250 |
| WFAH | Alliance, Ohio | 1310 |
| WFAI | Fayetteville, N.C. | 1230 |
| WFAR | Farrell, Pa. | 1470 |
| WFAS | White Plains, N.Y. | 1230 |
| WFAU | Augusta, Me. | 1340 |
| WFAW | Ft. Atkinson, Wis. | 940 |
| WFAX | Falls Church, Va. | 1220 |
| WFBA | San Sebastion, P.R. | 1460 |
| WFBC | Greenville, S.C. | 1330 |
| WFBF | Fernandina Beach, Fla. | 1570 |
| WFBG | Altoona, Pa. | 1290 |
| WFBL | Syracuse, N.Y. | 1390 |
| WFBM | Indianapolis, Ind. | 1260 |
| WFBR | Baltimore, Md. | 1300 |
| WFBS | Spring Lake, N. C. | 1450 |
| WFCG | Franklinton, La. | 1110 |
| WFCM | Winston-Salem, N. C. | 1550 |
| WFDF | Flint, Mich. | 910 |
| WFDR | Manchester, Ga. | 1370 |
| WFEA | Manchester, N.H. | 1370 |
| WFEB | Sylacauga, Ala. | 1340 |
| WFEC | Harrisburg, Pa. | 1400 |
| WFFF | Columbia, Miss. | 1360 |
| WFFG | Marathon, Fla. | 1300 |
| WFGL | Fitchburg, Mass. | 960 |
| WFGN | Gaffney, S.C. | 1570 |
| WFGW | Black Mountains, N.C. | 1010 |
| WFHG | Bristol, Va. | 980 |
| WFHK | Pell City, Ala. | 1430 |
| WFHR | Wis. Rapids, Wis. | 1320 |
| WFIA | Louisville, Ky. | 900 |
| WFIF | Milford, Conn. | 1500 |
| WFIG | Sumter, S.C. | 1290 |
| WFIL | Philadelphia, Pa. | 560 |
| WFIN | Findlay, Ohio | 1330 |
| WFIS | Fountain Inn, S.C. | 1600 |
| WFIV | Kissimmee, Fla. | 1080 |
| WFIW | Fairfield, Ill. | 1390 |
| WFIX | Huntsville, Ala. | 1450 |
| WFKN | Franklin, Ky. | 1220 |
| WFKY | Frankfort, Ky. | 1490 |
| WFLA | Tampa, Fla. | 970 |
| WFLB | Fayetteville, N.C. | 1490 |
| WFLI | Lookout Mtn., Tenn. | 1070 |
| WFLN | Philadelphia, Pa. | 900 |
| WFLO | Farmville, Va. | 870 |
| WFLR | Dundee, N.Y. | 1570 |
| WFLS | Fredericksburg, Va. | 1350 |
| WFLW | Monticello, Ky. | 1360 |
| WFMC | Goldsboro, N.C. | 730 |
| WFMD | Frederick, Md. | 930 |
| WFMH | Cullman, Ala. | 1460 |
| WFMJ | Youngstown, Ohio | 1390 |
| WFMO | Fairmont, N.C. | 860 |
| WFMW | Madisonville, Ky. | 730 |
| WFNC | Fayetteville, N.C. | 940 |
| WFNL | No. Augusta, S.C. | 1600 |
| WFOB | Fostoria, Ohio | 1430 |
| WFOM | Marietta, Ga. | 1230 |
| WFOR | Hattiesburg, Miss. | 1400 |
| WFOY | St. Augustine, Fla. | 1240 |
| WFPA | Fort Payne, Ala. | 1400 |
| WFPG | Atlantic City, N.J. | 1450 |
| WFPM | Fort Valley, Ga. | 1150 |
| WFPR | Hammond, La. | 1400 |
| WFRA | Franklin, Pa. | 1450 |
| WFRB | Frostburg, Md. | 560 |
| WFRC | Reidsville, N.C. | 1600 |
| WFRM | Coudersport, Pa. | 600 |
| WFRO | Fremont, Ohio | 900 |
| WFRX | West Frankfort, Ill. | 1300 |
| WFSC | Franklin, N.C. | 1050 |
| WFSG | Boca Raton, Fla. | 740 |
| WFSH | Valparaiso, Fla. | 1340 |
| WFSO | Pinellas, Fla. | 570 |
| WFSP | Kingwood, W. Va. | 1560 |
| WFSR | Bath, N.Y. | 1380 |
| WFST | Caribou, Maine | 600 |
| WFTC | Kinston, N.C. | 960 |
| WFTG | London, Ky. | 1400 |
| WFTL | Ft. Lauderdale, Fla. | 1400 |
| WFTM | Maysville, Ky. | 1240 |
| WFTN | Franklin, N.H. | 1240 |
| WFTO | Fulton, Miss. | 1330 |
| WFTR | Front Royal, Va. | 1450 |
| WFTW | Ft. Walton Beach, Fla. | 1260 |
| WFUL | Fulton, Ky. | 1270 |
| WFUN | Miami, Fla. | 790 |
| WFUR | Grand Rapids, Mich. | 1570 |
| WFVA | Fredericksburg, Va. | 1230 |
| WFWL | Camden, Tenn. | 1220 |
| WFWR | Ft. Wayne, Ind. | 1090 |
| WFYC | Alma, Mich. | 1280 |
| WGAA | Cedartown, Ga. | 1340 |
| WGAC | Augusta, Ga. | 580 |
| WGAD | Gadsden, Ala. | 1350 |
| WGAF | Valdosta, Ga. | 910 |
| WGAI | Elizabeth City, N.C. | 560 |
| WGAL | Lancaster, Pa. | 1490 |
| WGAN | Portland, Maine | 560 |

# WHITE'S RADIO LOG

| Call | Location | kHz |
|---|---|---|
| WGAP | Maryville, Tenn. | 1400 |
| WGAR | Cleveland, Ohio | 1220 |
| WGAS | S. Gastonia, N.C. | 1420 |
| WGAT | Gate City, Va. | 1050 |
| WGAU | Athens, Ga. | 1340 |
| WGAW | Gardner, Mass. | 1340 |
| WGBB | Freeport, N.Y. | 1240 |
| WGBC | Chipley, Fla. | 1240 |
| WGBF | Evansville, Ind. | 1280 |
| WGBG | Greensboro, N.C. | 1400 |
| WGBI | Scranton, Pa. | 910 |
| WGBR | Goldsboro, N. C. | 1150 |
| WGBS | Miami, Fla. | 710 |
| WGCB | Red Lion, Pa. | 1440 |
| WGCD | Chester, S.C. | 1490 |
| WGCH | Greenwich, Conn. | 1490 |
| WGCM | Gulfport, Miss. | 1240 |
| WGEA | Geneva, Ala. | 1150 |
| WGEE | Indianapolis, Ind. | 1590 |
| WGEN | Geneseo, Ill. | 1500 |
| WGEM | Quincy, Ill. | 1440 |
| WGEN | Genesco, Ill. | 1500 |
| WGET | Gettysburg, Pa. | 1320 |
| WGEZ | Beloit, Wis. | 1490 |
| WGFA | Watseka, Ill. | 1360 |
| WGFS | Covington, Ga. | 1430 |
| WGGA | Gainesville, Ga. | 550 |
| WGGG | Gainesville, Fla. | 1230 |
| WGGH | Marion, Ill. | 1150 |
| WGGO | Salamanca, N.Y. | 1590 |
| WGH | Newport News, Va. | 1310 |
| WGHC | Clayton, Ga. | 1570 |
| WGHM | Skowegan, Maine | 1150 |
| WGHN | Grd. Haven, Mich. | 1370 |
| WGHQ | Kingston, N.Y. | 920 |
| WGIC | Xenia, O. | 1500 |
| WGIG | Brunswick, Ga. | 1440 |
| WGIL | Galesburg, Ill. | 1400 |
| WGIR | Manchester, N.H. | 610 |
| WGIV | Charlotte, N.C. | 1600 |
| WGKA | Atlanta, Ga. | 1190 |
| WGKR | Perry, Fla. | 1310 |
| WGL | Fort Wayne, Ind. | 1250 |
| WGLB | Port Wash., Wis. | 1560 |
| WGLC | Mendota, Ill. | 1090 |
| WGLI | Babylon, N.Y. | 1290 |
| WGMA | Hollywood, Fla. | 1320 |
| WGMF | Watkins Glen, N.Y. | 1500 |
| WGML | Hinesville, Ga. | 990 |
| WGMS | Bethesda, Md. | 570 |
| WGN | Chicago, Ill. | 720 |
| WGNC | Gastonia, N.C. | 1450 |
| WGNE | Panama City Beach, Fla. | 1480 |
| WGNI | Wilmington, N.C. | 1450 |
| WGNP | Indian Rocks Beach, Fla. | 1520 |
| WGNS | Murfreesboro, Tenn. | 1450 |
| WGNU | Granite City, Ill. | 920 |
| WGNY | Newburgh, N.Y. | 1220 |
| WGOC | Kingsport, Tenn. | 1090 |
| WGOE | Richmond, Va. | 1590 |
| WGOG | Walhalla, S. C. | 1000 |
| WGOH | Grayson, Ky. | 1370 |
| WGOK | Mobile, Ala. | 900 |
| WGOL | Goldsboro, N.C. | 1300 |
| WGON | Munising, Mich. | 1400 |
| WGOV | Valdosta, Ga. | 950 |
| WGOW | Chattanooga, Tenn. | 1150 |
| WGPA | Bethlehem, Pa. | 1100 |
| WGPC | Albany, Ga. | 1450 |
| WGR | Buffalo, N.Y. | 550 |
| WGRA | Cairo, Ga. | 790 |
| WGRD | Grand Rapids, Mich. | 1410 |
| WGRI | Griffin, Ga. | 1410 |
| WGRM | Greenwood, Miss. | 1240 |
| WGRO | Lake City, Fla. | 960 |
| WGRP | Greenville, Pa. | 940 |
| WGRT | Chicago, Ill. | 950 |
| WGRV | Greeneville, Tenn. | 1340 |
| WGSA | Ephrata, Pa. | 1310 |
| WGSB | Geneva, Ill. | 1480 |
| WGSM | Huntington, N.Y. | 740 |
| WGSR | Millen, Ga. | 1570 |
| WGST | Atlanta, Ga. | 920 |
| WGSV | Guntersville, Ala. | 1270 |
| WGSW | Greenwood, S.C. | 1350 |
| WGTA | Summerville, Ga. | 950 |
| WGTC | Greenville, N.C. | 1590 |
| WGTL | Kannapolis, N.C. | 870 |
| WGTM | Wilson, N.C. | 590 |
| WGTN | Georgetown, S.C. | 1400 |
| WGTO | Cypress Gardens, Fla. | 540 |
| WGTR | Natick, Mass. | 1060 |
| WGUL | New Port Richey, Fla. | 1500 |
| WGUN | Atlanta-Decatur, Ga. | 1010 |
| WGUS | North Augusta, S.C. | 1380 |
| WGUY | Bangor, Maine | 1250 |
| WGVA | Geneva, N.Y. | 1240 |
| WGVM | Greenville, Miss. | 1260 |
| WGWC | Selma, Ala. | 1340 |
| WGWR | Asheboro, N.C. | 1260 |
| WGY | Schenectady, N.Y. | 810 |
| WGYV | Greenville, Ala. | 1380 |
| WHA | Madison, Wis. | 970 |
| WHAG | Halfway, Md. | 1410 |
| WHAI | Greenfield, Mass. | 1240 |
| WHAK | Rogers City, Mich. | 960 |
| WHAL | Shelbyville, Tenn. | 1400 |
| WHAM | Rochester, N.Y. | 1180 |
| WHAN | Haines City, Fla. | 930 |
| WHAP | Hopewell, Va. | 1340 |
| WHAR | Clarksburg, W.Va. | 1340 |
| WHAS | Louisville, Ky. | 840 |
| WHAT | Philadelphia, Pa. | 1340 |
| WHAV | Haverhill, Mass. | 1490 |
| WHAW | Weston, W.Va. | 980 |
| WHAZ | Troy, N.Y. | 1330 |
| WHB | Kansas City, Mo. | 710 |
| WHBB | Selma, Ala. | 1490 |
| WHBC | Canton, Ohio | 1480 |
| WHBF | Rock Island, Ill. | 1270 |
| WHBG | Harrisonburg, Va. | 1360 |
| WHBL | Sheboygan, Wis. | 1330 |
| WHBN | Harrodsburg, Ky. | 1420 |
| WHBO | Tampa, Fla. | 1050 |
| WHBQ | Memphis, Tenn. | 560 |
| WHBT | Harriman, Tenn. | 1600 |
| WHBU | Anderson, Ind. | 1240 |
| WHBY | Appleton, Wis. | 1230 |
| WHCC | Waynesville, N.C. | 1400 |
| WHCO | Sparta, Ill. | 1230 |
| WHCQ | Spartanburg, S.C. | 1400 |
| WHCU | Ithaca, N.Y. | 870 |
| WHDF | Houghton, Mich. | 1400 |
| WHDH | Boston, Mass. | 850 |
| WHDL | Olean, N.Y. | 1450 |
| WHDM | McKenzie, Tenn. | 1440 |
| WHEB | Portsmouth, N.H. | 750 |
| WHEC | Rochester, N.Y. | 1460 |
| WHEE | Martinsville, Va. | 1370 |
| WHEL | New Albany, Ind. | 1570 |
| WHEN | Syracuse, N.Y. | 620 |
| WHEO | Stuart, Va. | 1270 |
| WHEP | Foley, Ala. | 1310 |
| WHER | Memphis, Tenn. | 1430 |
| WHFB | Benton Harbor-St. Joseph, Mich. | 1060 |
| WHGR | Houghton L., Mich. | 1290 |
| WHHH | Warren, Ohio | 1440 |
| WHHM | Henderson, Tenn. | 1580 |
| WHHO | Hornell, N.Y. | 1320 |
| WHHV | Hillsville, Va. | 1400 |
| WHHY | Montgomery, Ala. | 1440 |
| WHIC | Hardinsburg, Ky. | 1520 |
| WHIE | Griffin, Ga. | 1320 |
| WHIH | Portsmouth, Va. | 1400 |
| WHIL | Medford, Mass. | 1430 |
| WHIM | Providence, R.I. | 1110 |
| WHIN | Gallatin, Tenn. | 1010 |
| WHIO | Dayton, Ohio | 1290 |
| WHIP | Mooresville, N.C. | 1350 |
| WHIR | Danville, Ky. | 1230 |
| WHIS | Bluefield, W.Va. | 1440 |
| WHIT | New Bern, N.C. | 1450 |
| WHIZ | Zanesville, Ohio | 1240 |
| WHJB | Greensburg, Pa. | 620 |
| WHJC | Matawan, W.Va. | 1360 |
| WHK | Cleveland, Ohio | 1420 |
| WHKP | Hendersonville, N.C. | 1450 |
| WHKY | Hickory, N.C. | 1290 |
| WHLB | Virginia, Minn. | 1400 |
| WHLD | Niagara Falls, N.Y. | 1270 |
| WHLF | South Boston, Va. | 1400 |
| WHLI | Hempstead, N.Y. | 1100 |
| WHLL | Wheeling, W.Va. | 1600 |
| WHLM | Bloomsburg, Pa. | 550 |
| WHLN | Harlan, Ky. | 1410 |
| WHLO | Akron, Ohio | 640 |
| WHLP | Centerville, Tenn. | 1570 |
| WHLS | Port Huron, Mich. | 1450 |
| WHLT | Huntington, Ind. | 1300 |
| WHMA | Anniston, Ala. | 1390 |
| WHMC | Gaithersburg, Md. | 1150 |
| WHMI | Howell, Mich. | 1350 |
| WHMP | Northampton, Mass. | 1400 |
| WHN | New York, N.Y. | 1050 |
| WHNC | Henderson, N.C. | 890 |
| WHNY | McComb, Miss. | 1250 |
| WHO | Des Moines, Iowa | 1040 |
| WHOA | San Juan, P.R. | 870 |
| WHOC | Philadelphia, Miss. | 1490 |
| WHOD | Jackson, Ala. | 1290 |
| WHOK | Lancaster, Ohio | 1320 |
| WHOL | Allentown, Pa. | 1600 |
| WHOM | New York, N.Y. | 1480 |
| WHON | Centerville, Ind. | 930 |
| WHOO | Orlando, Fla. | 990 |
| WHOP | Hopkinsville, Ky. | 1230 |
| WHOS | Decatur, Ala. | 800 |
| WHOT | Campbell, Ohio | 1330 |
| WHOU | Houlton, Maine | 1340 |
| WHOW | Clinton, Ill. | 1520 |
| WHOY | Salinas, P. R. | 1210 |
| WHP | Harrisburg, Pa. | 580 |
| WHPB | Belton, S.C. | 1390 |
| WHPE | High Point, N.C. | 1070 |
| WHPL | Winchester, Va. | 610 |
| WHRF | Riverhead, N.Y. | 1570 |
| WHRN | Herendon, Va. | 1440 |
| WHRT | Hartselle, Ala. | 860 |
| WHRY | Elizabethtown, Pa. | 1600 |
| WHSC | Hartsville, S.C. | 1450 |
| WHSL | Wilmington, N.C. | 1490 |
| WHSM | Hayward, Wis. | 910 |
| WHSY | Hattiesburg, Miss. | 1230 |
| WHTC | Holland, Mich. | 1450 |
| WHTG | Eatontown, N.J. | 1410 |
| WHUB | Cookeville, Tenn. | 1400 |
| WHUC | Hudson, N.Y. | 1230 |
| WHUM | Reading, Pa. | 1240 |
| WHUN | Huntington, Pa. | 1150 |
| WHUT | Anderson, Ind. | 1470 |
| WHVL | Hendersonville, N.C. | 1600 |
| WHVR | Hanover, Pa. | 1280 |
| WHVW | Hyde Park, N.Y. | 950 |
| WHWB | Rutland, Vt. | 1000 |
| WHWH | Princeton, N.J. | 1850 |
| WHYD | Columbus, Ga. | 1270 |
| WHYL | Carlisle, Pa. | 960 |
| WHYN | Springfield, Mass. | 560 |
| WHYP | North East, Pa. | 1530 |
| WHYZ | Greenville, S. C. | 1070 |
| WIAC | San Juan, P.R. | 740 |
| WIAM | Williamston, N.C. | 900 |
| WIBA | Madison, Wis. | 1310 |
| WIBB | Macon, Ga. | 1280 |
| WIBC | Indianapolis, Ind. | 1070 |
| WIBG | Philadelphia, Pa. | 990 |
| WIBM | Jackson, Mich. | 1450 |
| WIBR | Baton Rouge, La. | 1300 |
| WIBU | Poynette, Wis. | 1240 |
| WIBV | Belleville, Ill. | 1260 |
| WIBW | Topeka, Kans. | 580 |
| WIBX | Utica, N.Y. | 950 |
| WICC | Bridgeport, Conn. | 600 |
| WICE | Providence, R.I. | 1290 |
| WICH | Norwich, Conn. | 1310 |
| WICK | Scranton, Pa. | 1400 |
| WICO | Salisbury, Md. | 1320 |
| WICY | Malone, N.Y. | 1490 |
| WIDE | Biddeford, Maine | 1400 |
| WIDO | Elizabethton, Tenn. | 1520 |
| WIDG | St. Ignace, Mich. | 940 |
| WIDU | Fayetteville, N.C. | 1600 |
| WIEL | Elizabethtown, Ky. | 1400 |
| WIFE | Indianapolis, Ind. | 1310 |
| WIFF | Auburn, Ind. | 1150 |
| WIFM | Elkin, N.C. | 1540 |
| WIGG | Wiggins, Miss. | 1420 |
| WIGM | Medford, Wis. | 1490 |
| WIGO | Atlanta, Ga. | 1340 |
| WIGS | Gouverneur, N.Y. | 1230 |
| WIII | Homestead, Fla. | 1430 |
| WIIN | Atlanta, Ga. | 970 |
| WIKB | Iron River, Mich. | 1230 |
| WIKC | Bogalusa, La. | 1490 |
| WIKE | Newport, Vt. | 1490 |
| WIKI | Chester, Va. | 1410 |
| WIKY | Evansville, Ind. | 820 |
| WIL | St. Louis, Mo. | 1430 |
| WILA | Danville, Va. | 1580 |
| WILD | Boston, Mass. | 1090 |
| WILE | Cambridge, Ohio | 1270 |
| WILI | Willimantic, Conn. | 1400 |
| WILK | Wilkes-Barre, Pa. | 980 |
| WILL | Urbana, Ill. | 580 |
| WILM | Wilmington, Del. | 1450 |
| WILO | Frankfort, Ind. | 1570 |
| WILS | Lansing, Mich. | 1320 |
| WILY | Centralia, Ill. | 1210 |
| WILZ | St. Petersburg Beach, Fla. | 1590 |
| WIMA | Lima, Ohio | 1150 |
| WIMO | Winder, Ga. | 1300 |
| WIMS | Michigan City, Ind. | 1420 |
| WINA | Charlottesville, Va. | 1070 |
| WINC | Winchester, Va. | 1400 |
| WIND | Chicago, Ill. | 560 |
| WINE | Brookfield, Conn. | 940 |
| WINF | Manchester, Conn. | 1230 |
| WING | Dayton, Ohio | 1410 |
| WINH | Georgetown, S. C. | 1470 |
| WINI | Murphysboro, Ill. | 1420 |
| WINK | Fort Myers, Fla. | 1240 |
| WINN | Louisville, Ky. | 1240 |
| WINQ | Tampa, Fla. | 1010 |
| WINR | Binghamton, N.Y. | 680 |
| WINS | New York, N.Y. | 1010 |
| WINT | Winter Haven, Fla. | 1360 |
| WINU | Highland Park, Ill. | 1510 |
| WINW | Canton, O. | 1520 |
| WINX | Rockville, Md. | 1600 |
| WINY | Putnam, Conn. | 1350 |
| WINZ | Miami, Fla. | 940 |
| WINU | Highland, Ill. | 1510 |
| WINW | Canton, Ohio | 1520 |
| WIOD | Miami, Fla. | 610 |
| WIOI | New Boston, Ohio | 1010 |
| WIOK | Normal, Ill. | 1440 |
| WION | Ionia, Mich. | 1430 |
| WIOO | Carlisle, Pa. | 1000 |
| WIOS | Tawas City-East Tawas, Mich | 1480 |
| WIOU | Kokomo, Ind. | 1350 |
| WIP | Philadelphia, Pa. | 610 |
| WIPC | Lake Wales, Fla. | 1280 |
| WIPR | San Juan, P.R. | 940 |
| WIPS | Ticonderoga, N.Y. | 1250 |
| WIQT | Horseheads, N. Y. | 1000 |
| WIRA | Ft. Pierce, Fla. | 1400 |
| WIRB | Enterprise, Ala. | 600 |
| WIRC | Hickory, N.C. | 630 |
| WIRD | Lake Placid, N.Y. | 920 |
| WIRE | Indianapolis, Ind. | 1430 |
| WIRJ | Humboldt, Tenn. | 740 |
| WIRK | W. Palm Beach, Fla. | 1290 |
| WIRL | Peoria, Ill. | 1290 |
| WIRO | Ironton, Ohio | 1230 |
| WIRV | Irvine, Ky. | 1550 |
| WIRY | Plattsburg, N.Y. | 1340 |
| WIS | Columbia, S.C. | 560 |
| WISA | Isabella, P.R. | 1390 |
| WISE | Asheville, N.C. | 1310 |
| WISK | Americus, Ga. | 1390 |
| WISL | Shamokin, Pa. | 1480 |
| WISM | Madison, Wis. | 1480 |
| WISN | Milwaukee, Wis. | 1130 |
| WISO | Ponce, P.R. | 1260 |
| WISP | Kinston, N.C. | 1230 |
| WISR | Butler, Pa. | 680 |
| WISS | Berlin, Wis. | 1090 |
| WIST | Charlotte, N.C. | 1240 |
| WISV | Viroqua, Wis. | 1360 |
| WISZ | Glen Burnie, Md. | 1590 |
| WITA | San Juan, P.R. | 1140 |
| WITH | Baltimore, Md. | 1230 |
| WITL | Lansing, Mich. | 1010 |
| WITN | Washington, N.C. | 930 |
| WITY | Danville, Ill. | 980 |
| WITZ | Jasper, Ind. | 990 |
| WIVE | Ashland, Va. | 1480 |
| WIVK | Knoxville, Tenn. | 850 |
| WIVV | Vieques, P.R. | 1370 |
| WIVY | Jacksonville, Fla. | 1050 |
| WIXE | Monroe, N.C. | 1190 |
| WIXI | Lancaster, Ky. | 1280 |
| WIXK | New Richmond, Wis. | 1590 |
| WIXN | Dixon, Ill. | 1460 |
| WIXX | Oakland Park, Fla. | 1520 |
| WIXY | Cleveland, O. | 1260 |
| WIXZ | McKeesport, Pa. | 1360 |
| WIYN | Rome, Ga. | 1360 |
| WIZE | Springfield, Ohio | 1340 |
| WIZO | Franklin, Tenn. | 1380 |
| WIZR | Johnstown, N. Y. | 930 |
| WIZS | Henderson, N.C. | 1450 |
| WIZZ | Streator, Ill. | 1250 |
| WJAB | Westbrook, Me. | 1440 |
| WJAC | Johnstown, Pa. | 850 |
| WJAG | Norfolk, Nebr. | 780 |
| WJAK | Jackson, Tenn. | 1460 |
| WJAM | Marion, Ala. | 1310 |
| WJAR | Providence, R.I. | 920 |
| WJAS | Pittsburgh, Pa. | 1320 |
| WJAT | Swainsboro, Ga. | 800 |
| WJAX | Jacksonville, Fla. | 930 |
| WJAY | Mullins, S.C. | 1280 |
| WJAZ | Albany, Ga. | 960 |
| WJBB | Haleyville, Ala. | 1230 |
| WJBC | Bloomington, Ill. | 1230 |
| WJBD | Salem, Ill. | 1350 |
| WJBE | Knoxville, Tenn. | 1430 |
| WJBK | Detroit, Mich. | 1500 |
| WJBL | Holland, Mich. | 1260 |
| WJBM | Jerseyville, Ill. | 1480 |
| WJBO | Baton Rouge, La. | 1150 |
| WJBS | DeLand, Fla. | 1490 |
| WJBY | Gadsden, Ala. | 930 |
| WJCD | Seymour, Ind. | 1390 |
| WJCM | Sebring, Fla. | 960 |
| WJCO | Jackson, Mich | 1510 |
| WJCW | Johnson City, Tenn. | 910 |
| WJDA | Quincy, Mass. | 1300 |
| WJDB | Thomasville, Ala. | 630 |
| WJDX | Jackson, Miss. | 620 |
| WJDY | Salisbury, Md. | 1470 |
| WJEF | Grand Rapids, Mich. | 1230 |
| WJEH | Gallipolis, Ohio | 990 |
| WJEJ | Hagerstown, Md. | 1240 |
| WJEM | Valdosta, Ga. | 1150 |
| WJER | Dover, Ohio | 1450 |
| WJES | Johnston, S.C. | 1570 |
| WJET | Erie, Pa. | 1400 |
| WJFC | Jefferson City, Tenn. | 1480 |
| WJGA | Jackson, Ga. | 1540 |
| WJHO | Opelika, Ala. | 1400 |
| WJIC | Salem, N. J. | 1510 |
| WJIG | Tullahoma, Tenn. | 740 |
| WJIL | Jacksonville, Ill. | 1550 |
| WJIM | Lansing, Mich. | 1240 |
| WJJC | Commerce, Ga. | 1270 |
| WJJD | Chicago, Ill. | 1160 |
| WJJJ | Christiansburg, Va. | 1260 |
| WJJL | Niagara Falls, N.Y. | 1440 |
| WJJM | Lewisburg, Tenn. | 1490 |
| WJJZ | Mt. Holly, N. J. | 1460 |
| WJKM | Hartsville, Tenn. | 1090 |
| WJKY | Jamestown, Ky. | 1060 |
| WJLB | Detroit, Mich. | 1400 |
| WJLD | Homewood, Ala. | 1400 |
| WJLE | Smithville, Tenn. | 1480 |
| WJLK | Asbury Park, N. J. | 1310 |
| WJLS | Beckley, W.Va. | 560 |
| WJMA | Orange, Va. | 1340 |
| WJMB | Brookhaven, Miss. | 1340 |
| WJMC | Rice Lake, Wis. | 1240 |
| WJML | Petoskey, Mich. | 1110 |
| WJMO | Cleveland Hgts., Ohio | 1490 |
| WJMR | New Orleans, La. | 990 |
| WJMS | Ironwood, Mich. | 590 |
| WJMW | Athens, Ala. | 730 |
| WJMX | Florence, S.C. | 970 |
| WJNC | Jacksonville, N.C. | 1240 |
| WJND | W. Palm Beach, Fla. | 1230 |
| WJOB | Hammond, Ind. | 1230 |
| WJOE | Port St. Joe, Fla. | 1080 |
| WJOI | Florence, Ala. | 1340 |

| Call | Location | kHz |
|---|---|---|
| WJOL | Joliet, Ill. | 1340 |
| WJON | St. Cloud, Minn. | 1240 |
| WJOR | South Haven, Mich. | 940 |
| WJOT | Lake City, S.C. | 1260 |
| WJDY | Burlington, Vt. | 1230 |
| WJPA | Washington, Pa. | 1450 |
| WJPD | Ishpeming, Mich. | 1240 |
| WJPF | Herrin, Ill. | 1340 |
| WJPR | Greenville, Miss. | 1330 |
| WJPS | Evansville, Ind. | 1330 |
| WJPW | Rockford, Mich. | 810 |
| WJQS | Jackson, Miss. | 1400 |
| WJR | Detroit, Mich. | 760 |
| WJRC | Joliet, Ill. | 1510 |
| WJRD | Tuscaloosa, Ala. | 1150 |
| WJRI | Lenoir, N.C. | 1340 |
| WJRL | Calhoun City, Miss. | 1530 |
| WJRM | Troy, N.C. | 1390 |
| WJRZ | Hackensack, N.J. | 970 |
| WJSB | Crestview, Fla. | 1050 |
| WJSM | Martinsburg, Pa. | 1110 |
| WJSO | Jonesboro, Tenn. | 1590 |
| WJSW | Maplewood, Minn. | 1010 |
| WJTN | Jamestown, N.Y. | 1240 |
| WJTO | Bath, Me. | 730 |
| WJTS | Jupiter, Fla. | 1000 |
| WJUN | Mexico, Pa. | 1220 |
| WJVA | South Bend, Ind. | 1580 |
| WJW | Cleveland, Ohio | 850 |
| WJWL | Georgetown, Del. | 900 |
| WJWS | South Hill, Va. | 1370 |
| WJXN | Jackson, Miss. | 1450 |
| WJZM | Clarksville, Tenn. | 1400 |
| WKAC | Athens, Ala. | 1080 |
| WKAI | Macomb, Ill. | 1510 |
| WKAJ | Saratoga Springs, N.Y. | 900 |
| WKAL | Rome, N.Y. | 1450 |
| WKAM | Goshen, Ind. | 1460 |
| WKAN | Kankakee, Ill. | 1320 |
| WKAP | Allentown, Pa. | 1320 |
| WKAQ | San Juan, P.R. | 580 |
| WKAR | East Lansing, Mich. | 870 |
| WKAT | Miami Beach, Fla. | 1360 |
| WKAU | Kaukanna, Wis. | 1050 |
| WKAY | Glasgow, Ky. | 1490 |
| WKAZ | Charleston, W.Va. | 950 |
| WKBA | Vinton, Va. | 1550 |
| WKBC | N. Wilkesboro, N.C. | 810 |
| WKBH | La Crosse, Wis. | 1410 |
| WKBJ | Milan, Tenn. | 1600 |
| WKBK | Keene, N.H. | 1220 |
| WKBL | Covington, Tenn. | 1250 |
| WKBN | Youngstown, Ohio | 570 |
| WKBO | Harrisburg, Pa. | 1230 |
| WKBQ | Garner, N.C. | 1000 |
| WKBR | Manchester, N.H. | 1250 |
| WKBV | Richmond, Ind. | 1490 |
| WKBW | Buffalo, N.Y. | 1520 |
| WKBX | Winston-Salem, N.C. | 1500 |
| WKBY | Chatham, Va. | 1080 |
| WKBZ | Muskegon, Mich. | 850 |
| WKCT | Bowling Green, Ky. | 930 |
| WKCU | Corinth, Miss. | 1350 |
| WKCW | Warrenton, Va. | 1420 |
| WKCY | Harrisonburg, Va. | 1300 |
| WKDA | Nashville, Tenn. | 1240 |
| WKDE | Altavista, Va. | 1000 |
| WKDK | Newberry, S.C. | 1240 |
| WKDL | Clarksdale, Miss. | 1600 |
| WKDO | Liberty, Ky. | 1560 |
| WKDR | Plattsburgh, N.Y. | 1070 |
| WKDX | Hamlet, N.C. | 1250 |
| WKDZ | Cadiz, Ky. | 1110 |
| WKEE | Huntington, W.Va. | 800 |
| WKEI | Kewanee, Ill. | 1450 |
| WKEN | Dover, Del. | 1600 |
| WKER | Pompton Lakes, N.J. | 1500 |
| WKEU | Griffin, Ga. | 1450 |
| WKEX | Blackburg, Va. | 1430 |
| WKEY | Covington, Va. | 1340 |
| WKFD | Wickford, R.I. | 1370 |
| WKFE | Yauco, P.R. | 1550 |
| WKFR | Battle Creek, Mich. | 1400 |
| WKGN | Knoxville, Tenn. | 1340 |
| WKGX | Lenoir, N.C. | 1080 |
| WKHM | Jackson, Mich. | 970 |
| WKIC | Hazard, Ky. | 1390 |
| WKIG | Glenville, Ga. | 1580 |
| WKIK | Leonardtown, Md. | 1370 |
| WKIN | Kingsport, Tenn. | 1320 |
| WKIP | Poughkeepsie, N.Y. | 1450 |
| WKIS | Orlando, Fla. | 740 |
| WKIX | Raleigh, N.C. | 850 |
| WKIZ | Key West, Fla. | 1500 |
| WKJB | Mayaguez, P.R. | 710 |
| WKJG | Fort Wayne, Ind. | 1380 |
| WKJK | Granite Falls, N.C. | 900 |
| WKJR | Muskegon, Mich. | 1520 |
| WKKD | Aurora, Ill. | 1580 |
| WKKO | Cocoa, Fla. | 860 |
| WKKR | Pickens, S.C. | 1540 |
| WKKS | Vanceburg, Ky. | 1570 |
| WKLA | Ludington, Mich. | 1450 |
| WKLC | St. Albans, W.Va. | 1300 |
| WKLF | Clanton, Ala. | 980 |
| WKLK | Cloquet, Minn. | 1230 |
| WKLM | Wilmington, N.C. | 980 |
| WKLO | Louisville, Ky. | 1080 |
| WKLP | Keyser, W.Va. | 1390 |
| WKLV | Blackstone, Va. | 1440 |
| WKLY | Hartwell, Ga. | 980 |
| WKMC | Roaring Sprgs., Pa. | 1370 |
| WKMF | Flint, Mich. | 1470 |
| WKMK | Blountstown, Fla. | 1000 |
| WKMT | Kings Mtn., N.C. | 1220 |
| WKNE | Keene, N.H. | 1290 |
| WKMG | Newberry, S.C. | 1520 |
| WKNR | Dearborn, Mich. | 1310 |
| WKNT | Kent, Ohio | 1520 |
| WKNX | Saginaw, Mich. | 1210 |
| WKNY | Kingston, N.Y. | 1490 |
| WKOA | Hopkinsville, Ky. | 1480 |
| WKOK | Sunbury, Pa. | 1070 |
| WKOL | Amsterdam, N.Y. | 1570 |
| WKOP | Binghamton, N.Y. | 1360 |
| WKOR | Starkville, Miss. | 980 |
| WKOV | Wellston, Ohio | 1330 |
| WKOW | Madison, Wis. | 1070 |
| WKOX | Framingham, Mass. | 1190 |
| WKOY | Bluefield, W.Va. | 1240 |
| WKOZ | Kosciusko, Miss. | 1340 |
| WKPA | New Kensington, Pa. | 1150 |
| WKPM | Princeton, Minn. | 1300 |
| WKPO | Prentiss, Miss. | 1510 |
| WKPR | Kalamazoo, Mich. | 1420 |
| WKPT | Kingsport, Tenn. | 1400 |
| WKQH | Chiefland, Fla. | 940 |
| WKQV | Sullivan, Ind. | 1550 |
| WKQW | Spring Valley, N.Y. | 1300 |
| WKRA | Holly Springs, Miss. | 1110 |
| WKRC | Cincinnati, Ohio | 550 |
| WKRG | Mobile, Ala. | 710 |
| WKRK | Murphy, N.C. | 1320 |
| WKRM | Columbia, Tenn. | 1340 |
| WKRO | Cairo, Ill. | 1490 |
| WKRS | Waukegan, Ill. | 1220 |
| WKRT | Cortland, N.Y. | 920 |
| WKRW | Cartersville, Ga. | |
| WKRZ | Oil City, Pa. | 1340 |
| WKSC | Kershaw, S.C. | 1300 |
| WKSK | W. Jefferson, N.C. | 1600 |
| WKSN | Jamestown, N.Y. | 1340 |
| WKSP | Kingstree, S.C. | 1090 |
| WKSR | Pulaski, Tenn. | 1420 |
| WKST | New Castle, Pa. | 1280 |
| WKTC | Charlotte, N.C. | 1310 |
| WKTE | King, N.C. | 1090 |
| WKTG | Thomasville, Ga. | 730 |
| WKTJ | Farmington, Maine | 1380 |
| WKTQ | South Paris, Maine | 1450 |
| WKTS | Sheboygan, Wis. | 950 |
| WKTX | Atlantic Beach, Fla. | 1600 |
| WKTY | LaCrosse, Wis. | 580 |
| WKUL | Cullman, Ala. | 1340 |
| WKVA | Lewistown, Pa. | 920 |
| WKVM | San Juan, P.R. | 810 |
| WKVO | Havelock, N.C. | 1330 |
| WKVT | Brattleboro, Vt. | 1490 |
| WKWF | Key West, Fla. | 1600 |
| WKWK | Wheeling, W.Va. | 1400 |
| WKWS | Rocky Mount, Va. | 1290 |
| WKXL | Concord, N.H. | 1450 |
| WKXR | Exeter, N.H. | 1540 |
| WKXV | Knoxville, Tenn. | 900 |
| WKXY | Sarasota, Fla. | 930 |
| WKY | Oklahoma City, Okla. | 930 |
| WKYB | Hemingway, S.C. | 1000 |
| WKYC | Cleveland, Ohio | 1100 |
| WKYE | Bristol, Tenn. | 1550 |
| WKYK | Burnsville, N.C. | 1540 |
| WKYO | Caro, Mich. | 1360 |
| WKYX | Paducah, Ky. | 570 |
| WKYZ | Madisonville, Tenn. | 1250 |
| WKZA | Kane, Pa. | 960 |
| WKZI | Casey, Ill. | 800 |
| WKZO | Kalamazoo, Mich. | 590 |
| WLAC | Nashville, Tenn. | 1510 |
| WLAD | Danbury, Conn. | 800 |
| WLAF | LaFollette, Tenn. | 1450 |
| WLAG | La Grange, Ga. | 1240 |
| WLAK | Lakeland, Fla. | 1430 |
| WLAM | Lewiston, Maine | 1470 |
| WLAN | Lancaster, Pa. | 1390 |
| WLAP | Lexington, Ky. | 630 |
| WLAQ | Rome, Ga. | 1410 |
| WLAR | Athens, Tenn. | 1450 |
| WLAS | Jacksonville, N.C. | 910 |
| WLAT | Conway, S.C. | 1330 |
| WLAU | Laurel, Miss. | 1430 |
| WLAV | Grand Rapids, Mich. | 1340 |
| WLAW | Lawrenceville, Ga. | 1360 |
| WLAY | Muscle Shoals, Ala. | 1450 |
| WLBB | Carrollton, Ga. | 1100 |
| WLBC | Muncie, Ind. | 1340 |
| WLBE | Leesburg, Fla. | 790 |
| WLBG | Laurens, S.C. | 860 |
| WLBH | Mattoon, Ill. | 1170 |
| WLBI | Denham Springs, La. | 1220 |
| WLBJ | Bowling Green, Ky. | 1410 |
| WLBK | DeKalb, Ill. | 1360 |
| WLBL | Auburndale, Wis. | 930 |
| WLBN | Lebanon, Ky. | 1590 |
| WLBR | Lebanon, Pa. | 1270 |
| WLBS | Centreville, Miss. | 1580 |
| WLBZ | Bangor, Maine | 620 |
| WLCB | Moulton, Ala. | 1530 |
| WLCK | Scottsville, Ky. | 1250 |
| WLCM | Lancaster, S.C. | 1360 |
| WLCN | Laurensburg, N.C. | 1500 |
| WLCO | Eustis, Fla. | 1240 |
| WLCS | Baton Rouge, La. | 910 |
| WLCX | LaCrosse, Wis. | 1490 |
| WLCY | St. Petersburg, Fla. | 1380 |
| WLDB | Atlantic City, N.J. | 1490 |
| WLDS | Jacksonville, Ill. | 1180 |
| WLDY | Ladysmith, Wis. | 1340 |
| WLEA | Hornell, N.Y. | 1480 |
| WLEC | Sandusky, Ohio | 1450 |
| WLEE | Richmond, Va. | 1480 |
| WLEF | Greenwood, Miss. | 1540 |
| WLEH | Lehigh Acres, Fla. | 1440 |
| WLEM | Emporium, Pa. | 1240 |
| WLES | Lawrenceville, Va. | 580 |
| WLET | Toccoa, Ga. | 1420 |
| WLEW | Bad Axe, Mich. | 1340 |
| WLEY | Cayey, P.R. | 1080 |
| WLFA | Lafayette, Ga. | 1590 |
| WLFH | Little Falls, N.Y. | 1230 |
| WLGM | Lynchburg, Va. | 1320 |
| WLGN | Logan, O. | 1510 |
| WLIB | New York, N.Y. | 1190 |
| WLIJ | Shelbyville, Tenn. | 1580 |
| WLIK | Newport, Tenn. | 1270 |
| WLIL | Lenoir City, Tenn. | 730 |
| WLIP | Kenosha, Wis. | 1050 |
| WLIQ | Mobile, Ala. | 1360 |
| WLIS | Old Saybrook, Conn. | 1420 |
| WLIV | Livingston, Tenn. | 920 |
| WLIX | Islip, N.Y. | 540 |
| WLIZ | Lake Worth, Fla. | 1380 |
| WLKE | Waupun, Wis. | 1170 |
| WLKM | Three Rivers, Mich. | 1510 |
| WLKN | Lincoln, Me. | 1450 |
| WLKR | Norwalk, O. | 1510 |
| WLKS | W. Liberty, Ky. | 1450 |
| WLKW | Providence, R.I. | 990 |
| WLLE | Raleigh, N.C. | 570 |
| WLLH | Lowell, Mass. | 1400 |
| WLLL | Lynchburg, Va. | 930 |
| WLLS | Hartford, Ky. | 1600 |
| WLLY | Wilson, N.C. | 1350 |
| WLMD | Laurel, Md. | 900 |
| WLMS | Leominster, Mass. | 1000 |
| WLNC | Laurinburg, N.C. | 1300 |
| WLMJ | Jackson, Ohio | 1280 |
| WLNA | Peekskill, N.Y. | 1420 |
| WLNC | Laurinburg, N.C. | 1300 |
| WLNG | Sag Harbor, N.Y. | 1600 |
| WLNH | Laconia, N.H. | 1350 |
| WLOA | Braddock, Pa. | 1550 |
| WLOB | Portland, Maine | 1310 |
| WLOC | Munfordville, Ky. | 1150 |
| WLOD | Pompano Beach, Fla. | 980 |
| WLOE | Leaksville, N.C. | 1490 |
| WLOF | Orlando, Fla. | 950 |
| WLOG | Logan, W.Va. | 1230 |
| WLOH | Princeton, W.Va. | 1490 |
| WLOI | LaPorte, Ind. | 1540 |
| WLOK | Memphis, Tenn. | 1340 |
| WLOL | Minneapolis, Minn. | 1330 |
| WLON | Lincolnton, N.C. | 1050 |
| WLOP | Jesup, Ga. | 1370 |
| WLOR | Thomasville, Ga. | 730 |
| WLOS | Asheville, N.C. | 1380 |
| WLOT | Marinette, Wis. | 1300 |
| WLOU | Louisville, Ky. | 1350 |
| WLOV | Washington, Ga. | 1370 |
| WLOW | Aiken, S.C. | 1300 |
| WLOX | Biloxi, Miss. | 1490 |
| WLPH | Irondale, Ala. | 1480 |
| WLPM | Suffolk, Va. | 1450 |
| WLPO | LaSalle, Ill. | 1220 |
| WLPS | Lehighton, Pa. | 1150 |
| WLQH | Chiefland, Fla. | 940 |
| WLRC | Whitehall, Mich. | 1490 |
| WLS | Chicago, Ill. | 890 |
| WLSB | Copper Hill, Tenn. | 1400 |
| WLSC | Loris, S.C. | 1570 |
| WLSD | Big Stone Gap, Va. | 1220 |
| WLSE | Wallace, N.C. | 1400 |
| WLSH | Lansford, Pa. | 1410 |
| WLSI | Pikeville, Ky. | 900 |
| WLSM | Louisville, Miss. | 1270 |
| WLST | Escanaba, Mich. | 600 |
| WLSV | Wellsville, N.Y. | 790 |
| WLTC | Gastonia, N.C. | 1370 |
| WLTH | Gary, Ind. | 1370 |
| WLTN | Littleton, N.H. | 1400 |
| WLTO | Miami, Fla. | 1220 |
| WLUV | Loves Park, Ill. | 1520 |
| WLUX | Baton Rouge, La. | 1550 |
| WLUZ | Bayamon, P.R. | 1600 |
| WLVA | Lynchburg, Va. | 590 |
| WLW | Cincinnati, Ohio | 700 |
| WLWO | (V.O.A.) Marathon, Fla. | 1180 |
| WLYB | Albany, Ga. | 1250 |
| WLYC | Williamsport, Pa. | 1050 |
| WLYN | Lynn, Mass. | 1360 |
| WLYO | New Orleans, La. | 940 |
| WLYV | Ft. Wayne, Ind. | 1450 |
| WMAB | Munising, Mich. | 1400 |
| WMAC | Metter, Ga. | 1360 |
| WMAD | Madison, Wis. | 1550 |
| WMAF | Madison, Fla. | 1230 |
| WMAG | Forest, Miss. | 860 |
| WMAJ | State College, Pa. | 1450 |
| WMAK | Nashville, Tenn. | 1300 |
| WMAL | Washington, D.C. | 630 |
| WMAM | Marinette, Wis. | 570 |
| WMAN | Mansfield, Ohio | 1400 |
| WMAP | Monroe, N.C. | 1060 |
| WMAQ | Chicago, Ill. | 670 |
| WMAS | Springfield, Mass. | 1450 |
| WMAT | Lansing, Mich. | 1010 |
| WMAY | Springfield, Ill. | 970 |
| WMAZ | Macon, Ga. | 940 |
| WMBA | Ambridge, Pa. | 1460 |
| WMBD | Peoria, Ill. | 1470 |
| WMBH | Joplin, Mo. | 1450 |
| WMBI | Chicago, Ill. | 1110 |
| WMBL | Morehead City, N.C. | 740 |
| WMBM | Miami Beach, Fla. | 1490 |
| WMBN | Petoskey, Mich. | 1340 |
| WMBO | Auburn, N.Y. | 1340 |
| WMBR | Jacksonville, Fla. | 1460 |
| WMBS | Uniontown, Pa. | 590 |
| WMBT | Shenandoah, Pa. | 1530 |
| WMC | Memphis, Tenn. | 790 |
| WMCA | New York, N.Y. | 570 |
| WMCH | Church Hill, Tenn. | 1260 |
| WMCL | McLeansboro, Ill. | 1060 |
| WMCP | Columbia, Tenn. | 1280 |
| WMCR | Oneida, N.Y. | 1600 |
| WMCS | Machias, Me. | 1400 |
| WMCT | Mountain City, Tenn. | 1390 |
| WMCW | Harvard, Ill. | 1600 |
| WMDC | Hazlehurst, Miss. | 1220 |
| WMDD | Fajardo, P.R. | 1480 |
| WMDN | Midland, Mich. | 1490 |
| WMEG | Eau Gallie, Fla. | 920 |
| WMEK | Chase City, Va. | 980 |
| WMEL | Pensacola, Fla. | 610 |
| WMEN | Tallahassee, Fla. | 1330 |
| WMEV | Marion, Va. | 1010 |
| WMEX | Boston, Mass. | 1510 |
| WMFC | Monroeville, Ala. | 1360 |
| WMFD | Wilmington, N.C. | 630 |
| WMFG | Hibbing, Minn. | 1240 |
| WMFJ | Daytona Beach, Fla. | 1450 |
| WMFR | High Point, N.C. | 1230 |
| WMGA | Moultrie, Ga. | 1130 |
| WMGR | Bainbridge, Ga. | 930 |
| WMGS | Bowling Green, Ohio | 730 |
| WMGW | Meadville, Pa. | 1490 |
| WMGY | Montgomery, Ala. | 800 |
| WMIA | Arecibo, P.R. | 1070 |
| WMIC | Sandusky, Mich. | 1560 |
| WMID | Atlantic City, N.J. | 1340 |
| WMIK | Middlesboro, Ky. | 560 |
| WMIL | Milwaukee, Wis. | 1290 |
| WMIM | Mt. Carmel, Pa. | 1590 |
| WMIN | Mpls.-St. Paul, Minn. | 1400 |
| WMIQ | Iron Mountain, Mich. | 1450 |
| WMIR | Lake Geneva, Wis. | 1550 |
| WMIS | Natchez, Miss. | 1240 |
| WMIX | Mt. Vernon, Ill. | 940 |
| WMJL | Marion, Ky. | 1010 |
| WMJM | Cordele, Ga. | 1490 |
| WMKR | Millinocket, Me. | 1240 |
| WMKT | S. St. Paul, Minn. | 1370 |
| WMLO | Beverly, Mass. | 1570 |
| WMLP | Milton, Pa. | 1380 |
| WMLS | Sylacauga, Ala. | 1290 |
| WMLT | Dublin, Ga. | 1330 |
| WMMB | Melbourne, Fla. | 1240 |
| WMMH | Marshall, N.C. | 1460 |
| WMMJ | Lancaster, N.Y. | 1300 |
| WMMM | Westport, Conn. | 1260 |
| WMMN | Fairmont, W.Va. | 920 |
| WMMW | Meriden, Conn. | 1470 |
| WMNA | Gretna, Va. | 730 |
| WMNB | No. Adams, Mass. | 1230 |
| WMNC | Morganton, N.C. | 1430 |
| WMNE | Menomonie, Wis. | 1360 |
| WMNI | Columbus, Ohio | 920 |
| WMNS | Olean, N.Y. | 1360 |
| WMNT | Manati, P.R. | 1500 |
| WMNZ | Montezuma, Ga. | 1050 |
| WMOA | Marietta, Ohio | 1490 |
| WMOB | Mobile, Ala. | 840 |
| WMOC | Chattanooga, Tenn. | 1450 |
| WMOG | Brunswick, Ga. | 1490 |
| WMOH | Hamilton, Ohio | 1450 |
| WMOK | Metropolis, Ill. | 920 |
| WMON | Montgomery, W.Va. | 1340 |
| WMOO | Mobile, Ala. | 1550 |
| WMOP | Ocala, Fla. | 900 |
| WMOR | Morehead, Ky. | 1330 |
| WMOU | Berlin, N.H. | 1230 |
| WMOV | Ravenswood, W.Va. | 1360 |
| WMOX | Meridian, Miss. | 1240 |
| WMOZ | Mobile, Ala. | 960 |
| WMPA | Aberdeen, Miss. | 1240 |
| WMPC | Lapeer, Mich. | 1230 |
| WMPL | Hancock, Mich. | 920 |
| WMPM | Smithfield, N.C. | 1270 |
| WMPO | Middleport-Pomeroy, Ohio | 1390 |
| WMPP | Chicago Heights, Ill. | 1470 |
| WMPS | Memphis, Tenn. | 680 |
| WMPT | So. Williamsport, Pa. | 1450 |
| WMQM | Memphis, Tenn. | 1480 |
| WMRB | Greenville, S.C. | 1490 |
| WMRC | Milford, Mass. | 1490 |
| WMRE | Monroe, Ga. | 1490 |
| WMRF | Lewistown, Pa. | 1490 |
| WMRI | Marion, Ind. | 860 |
| WMRN | Marion, Ohio | 1490 |
| WMRO | Aurora, Ill. | 1280 |
| WMRP | Flint, Mich. | 1570 |
| WMSA | Massena, N.Y. | 1340 |
| WMSG | Oakland, Md. | 1050 |
| WMSJ | Sylva, N.C. | 1480 |
| WMSK | Morganfield, Ky. | 1550 |
| WMSL | Decatur, Ala. | 1400 |
| WMSR | Manchester, Tenn. | 1320 |
| WMST | Mt. Sterling, Ky. | 1150 |
| WMT | Cedar Rapids, Iowa | 600 |
| WMTA | Central City, Ky. | 1380 |

# WHITE'S RADIO LOG

| Call | Location | kHz |
|---|---|---|
| WMTC | Vancleve, Ky. | 730 |
| WMTD | Hinton, W. Va. | 1380 |
| WMTE | Manistee, Mich. | 1340 |
| WMTL | Leitchfield, Ky. | 1580 |
| WMTM | Moultrie, Ga. | 1300 |
| WMTN | Morristown, Tenn. | 1300 |
| WMTR | Morristown, N.J. | 1250 |
| WMTS | Murfreesboro, Tenn. | 810 |
| WMUS | Muskegon, Mich. | 1090 |
| WMUU | Greenville, S.C. | 1260 |
| WMVA | Martinsville, Va. | 1450 |
| WMVB | Millville, N.J. | 1440 |
| WMVG | Milledgeville, Ga. | 1450 |
| WMVO | Mt. Vernon, Ohio | 1300 |
| WMVR | Sidney, Ohio | 1080 |
| WMWM | Wilmington, O. | 1090 |
| WMYB | Myrtle Beach, S.C. | 1450 |
| WMYN | Mayodan, N.C. | 1420 |
| WMYR | Ft. Myers, Fla. | 1410 |
| WNAB | Bridgeport, Conn. | 1450 |
| WNAD | Norman, Okla. | 640 |
| WNAE | Warren, Pa. | 1310 |
| WNAG | Grenada, Miss. | 1400 |
| WNAH | Nashville, Tenn. | 1360 |
| WNAK | Nanticoke, Pa. | 730 |
| WNAL | Nelsonville, O. | 940 |
| WNAM | Neenah, Wis. | 1280 |
| WNAR | Norristown, Pa. | 1110 |
| WNAU | New Albany, Miss. | 1470 |
| WNAV | Annapolis, Md. | 1430 |
| WNAX | Yankton, S.Dak. | 570 |
| WNBC | New York, N.Y. | 660 |
| WNBF | Binghamton, N.Y. | 1290 |
| WNBH | New Bedford, Mass. | 1340 |
| WNBI | Park Falls, Wis. | 980 |
| WNBP | Newburyport, Mass. | 1470 |
| WNBS | Murray, Ky. | 1340 |
| WNBT | Wellsboro, Pa. | 1490 |
| WNBY | Newberry, Mich. | 1450 |
| WNBZ | Saranac Lake, N.Y. | 1240 |
| WNCA | Siler City, N.C. | 1570 |
| WNCC | Barnesboro, Pa. | 950 |
| WNCG | N. Charleston, S.C. | 910 |
| WNCO | Ashland, Ohio | 1340 |
| WNCT | Greenville, N.C. | 1070 |
| WNDB | Daytona Beach, Fla. | 1150 |
| WNDR | Syracuse, N.Y. | 1260 |
| WNDU | South Bend, Ind. | 1490 |
| WNEB | Worcester, Mass. | 1230 |
| WNEG | Taccoa, Ga. | 630 |
| WNEL | Caguas, P. R. | 1430 |
| WNER | Live Oak, Fla. | 1250 |
| WNES | Central City, Ky. | 1050 |
| WNEW | New York, N.Y. | 1130 |
| WNEX | Macon, Ga. | 1400 |
| WNFL | Green Bay, Wis. | 1440 |
| WNGA | Nashville, Ga. | 1600 |
| WNGO | Mayfield, Ky. | 1320 |
| WNHC | New Haven, Conn. | 1340 |
| WNHV | White River Jct., Vt. | 910 |
| WNIA | Cheektowaga, N.Y. | 1230 |
| WNIK | Arecibo, P.R. | 1230 |
| WNIL | Niles, Mich. | 1290 |
| WNIO | Niles, Ohio | 1540 |
| WNJH | Hammonton, N.J. | 1580 |
| WNKY | Neon, Ky. | 1480 |
| WNLC | New London, Conn. | 1510 |
| WNLK | Norwalk, Conn. | 1350 |
| WNMP | Evanston, Ill. | 1590 |
| WNMT | Garden City, Ga. | 1520 |
| WNNC | Newton, N.C. | 1230 |
| WNNJ | Newton, N.J. | 1360 |
| WNNT | Warsaw, Va. | 690 |
| WNOG | Naples, Fla. | 1270 |
| WNOK | Columbia, S.C. | 1230 |
| WNOO | Chattanooga, Tenn. | 1260 |
| WNOP | Newport, Ky. | 740 |
| WNOR | Norfolk, Va. | 1230 |
| WNOS | High Point, N.C. | 1590 |
| WNOV | Milwaukee, Wis. | 860 |
| WNOW | York, Pa. | 1250 |
| WNOX | Knoxville, Tenn. | 990 |
| WNPS | New Orleans, La. | 1450 |
| WNPT | Tuscaloosa, Ala. | 1280 |
| WNPV | Lansdale, Pa. | 1440 |
| WNRG | Grundy, Va. | 940 |
| WNRI | Woonsocket, R.I. | 1380 |
| WNRJ | Gainsville, Ga. | 1580 |
| WNRK | Newark, Del. | 1260 |
| WNRV | Narrows-Pearisburg, Va. | 990 |
| WNSL | Laurel, Miss. | 1260 |
| WNTN | Newton, Mass. | 1550 |
| WNTT | Tazewell, Tenn. | 1250 |
| WNTY | Southington, Conn. | 990 |
| WNUE | Ft. Walton Bch., Fla. | 1400 |
| WNUS | Chicago, Ill. | 1390 |
| WNUZ | Talladega, Ala. | 1230 |
| WNVA | Norton, Va. | 1350 |
| WNVL | Nicholasville, Ky. | 1250 |
| WNVY | Pensacola, Fla. | 1230 |
| WNWI | Valparaiso, Ind. | 1080 |
| WNXT | Portsmouth, Ohio | 1260 |
| WNYC | New York, N.Y. | 830 |
| WNYN | Canton, O. | 900 |
| WNYR | Rochester, N.Y. | 680 |
| WOAI | San Antonio, Tex. | 1200 |
| WOAP | Owosso, Mich. | 1080 |
| WOAY | Oak Hill, W.Va. | 860 |
| WOBS | Jacksonville, Fla. | 1360 |
| WOBT | Rhinelander, Wis. | 1240 |
| WOC | Davenport, Iowa | 1420 |
| WOCB | W. Yarmouth, Mass. | 1240 |
| WOCH | North Vernon, Ind. | 1460 |
| WOCN | Miami, Fla. | 1450 |
| WOCO | Oconto, Wis. | 1260 |
| WODI | Brookneal, Va. | 1230 |
| WODY | Bassett, Va. | 900 |
| WOGA | Sylvester, Ga. | 1540 |
| WOGO | New Smyrna Beach, Fla. | 1550 |
| WOHI | E. Liverpool, Ohio | 1490 |
| WOHO | Toledo, Ohio | 1470 |
| WOHS | Shelby, N.C. | 730 |
| WOI | Ames, Iowa | 640 |
| WOIB | Saline, Mich. | 1290 |
| WOIC | Columbia, S.C. | 1320 |
| WOIO | Canton, O. | 1060 |
| WOKA | Douglas, Ga. | 1310 |
| WOKB | Winter Garden, Fla | 1600 |
| WOKC | Okeechobee, Fla. | 1570 |
| WOKE | Charleston, S.C. | 1340 |
| WOKJ | Jackson, Miss. | 1550 |
| WOKK | Meridian, Miss. | 1450 |
| WOKL | Eau Claire, Wis. | 1050 |
| WOKO | Albany, N.Y. | 1460 |
| WOKS | Columbus, Ga. | 1340 |
| WOKW | Brockton, Mass. | 1410 |
| WOKY | Milwaukee, Wis. | 920 |
| WOKZ | Alton, Ill. | 1570 |
| WOL | Washington, D.C. | 1450 |
| WOLD | Marion, Va. | 1330 |
| WOLF | Syracuse, N.Y. | 1490 |
| WOLS | Florence, S. C. | 1230 |
| WOMI | Owensboro, Ky. | 1490 |
| WOMN | Decatur, Ga. | 1310 |
| WOMP | Bellaire, Ohio | 1290 |
| WOMT | Manitowoc, Wis. | 1240 |
| WONA | Winona, Miss. | 1570 |
| WONO | Pleasantville, N.J. | 1400 |
| WONE | Dayton, Ohio | 980 |
| WONN | Lakeland, Fla. | 1230 |
| WONS | Tallahassee, Fla. | 1410 |
| WONW | Defiance, Ohio | 1280 |
| WOOD | Grand Rapids, Mich. | 1300 |
| WOOF | Dothan, Ala. | 560 |
| WOOK | Washington, D.C. | 1340 |
| WOOO | Deland, Fla. | 1310 |
| WOOW | Greenville, N.C. | 1340 |
| WOPA | Oak Park, Ill. | 1490 |
| WOPI | Bristol, Tenn. | 1490 |
| WOR | New York, N.Y. | 710 |
| WORA | Mayaguez, P.R. | 760 |
| WORC | Worcester, Mass. | 1310 |
| WORD | Spartanburg, S.C. | 910 |
| WORG | Orangeburg, S.C. | 1580 |
| WORJ | Orlando, Fla. | 1270 |
| WORK | York, Pa. | 1350 |
| WORM | Savannah, Tenn. | 1010 |
| WORV | Hattiesburg, Miss. | 1580 |
| WORX | Madison, Ind. | 1270 |
| WOSC | Fulton, N.Y. | 1300 |
| WOSH | Oshkosh, Wis. | 1490 |
| WOSU | Columbus, Ohio | 820 |
| WOTR | Corry, Pa. | 1370 |
| WOTT | Watertown, N.Y. | 1410 |
| WOTW | Nashua, N.H. | 900 |
| WOUB | Athens, Ohio | 1340 |
| WOVE | Welch, W.Va. | 1340 |
| WOW | Omaha, Nebr. | 590 |
| WOWL | Florence, Ala. | 1240 |
| WOWO | Ft. Wayne, Ind. | 1190 |
| WOWW | Naugatuck, Conn. | 1380 |
| WOWY | Clewiston, Fla. | 1590 |
| WOXF | Oxford, N.C. | 1340 |
| WOZK | Ozark, Ala. | 900 |
| WPAB | Ponce, P.R. | 550 |
| WPAC | Patchogue, N.Y. | 1580 |
| WPAD | Paducah, Ky. | 1450 |
| WPAG | Ann Arbor, Mich. | 1050 |
| WPAL | Charleston, S.C. | 730 |
| WPAM | Pottsville, Pa. | 1450 |
| WPAQ | Mount Airy, N.C. | 740 |
| WPAR | Parkersburg, W.Va. | 1450 |
| WPAS | Zephyrhills, Fla. | 1400 |
| WPAT | Paterson, N.J. | 930 |
| WPAW | E. Syracuse, N.Y. | 1540 |
| WPAX | Thomasville, Ga. | 1240 |
| WPAY | Portsmouth, Ohio | 1400 |
| WPAZ | Pottstown, Pa. | 1370 |
| WPBC | Richfield, Minn. | 980 |
| WPCC | Clinton, S.C. | 1400 |
| WPCF | Panama City, Fla. | 1430 |
| WPCO | Mt. Vernon, Ind. | 1590 |
| WPOE | Paris, Ky. | 1440 |
| WPDF | Corydon, Ind. | 1550 |
| WPDM | Potsdam, N.Y. | 1470 |
| WPDQ | Jacksonville, Fla. | 600 |
| WPDR | Portage, Wis. | 1350 |
| WPDX | Clarksburg, W.Va. | 750 |
| WPED | Crozet, Va. | 810 |
| WPEH | Louisville, Ga. | 1420 |
| WPEL | Montrose, Pa. | 1250 |
| WPEN | Philadelphia, Pa. | 950 |
| WPEO | Peoria, Ill. | 1020 |
| WPEP | Taunton, Mass. | 1570 |
| WPET | Greensboro, N.C. | 950 |
| WPFA | Pensacola, Fla. | 790 |
| WPFB | Middletown, Ohio | 910 |
| WPGA | Perry, Ga. | 980 |
| WPGC | Bradbury Hghts., Md. | 1580 |
| WPGF | Burgaw, N. C. | 1470 |
| WPGM | Danville, Pa. | 1570 |
| WPGW | Portland, Ind. | 1440 |
| WPHB | Philipsburg, Pa. | 1260 |
| WPHC | Waverly, Tenn. | 1060 |
| WPHM | Port Huron, Mich. | 1380 |
| WPIC | Sharon, Pa. | 790 |
| WPIO | Piedmont, Ala. | 1280 |
| WPIK | Alexandria, Va. | 730 |
| WPIP | Collierville, Tenn. | 1590 |
| WPIT | Pittsburgh, Pa. | 730 |
| WPKE | Pikeville, Ky. | 1240 |
| WPKO | Waverly, Ohio | 1380 |
| WPKY | Princeton, Ky. | 1580 |
| WPLA | Plant City, Fla. | 910 |
| WPLB | Greenville, Mich. | 1380 |
| WPLK | Rockmart, Ga. | 1220 |
| WPLM | Plymouth, Mass. | 1390 |
| WPLO | Atlanta, Ga. | 590 |
| WPLY | Plymouth, Wis. | 1420 |
| WPMB | Vandalia, Ill. | 1500 |
| WPME | Punxsutawney, Pa. | 1540 |
| WPMH | Portsmouth, Va. | 1010 |
| WPMP | Pascagoula, Miss. | 1580 |
| WPNC | Plymouth, N.C. | 1470 |
| WPNF | Brevard, N.C. | 1240 |
| WPNH | Plymouth, N. H. | 1300 |
| WPNO | Auburn, Me. | 1530 |
| WPNX | Columbus, Ga. | 1460 |
| WPOK | Pontiac, Ill. | 1080 |
| WPON | Pontiac, Mich. | 1460 |
| WPOP | Hartford, Conn. | 1410 |
| WPOR | Portland, Maine | 1490 |
| WPOW | New York, N.Y. | 1330 |
| WPPA | Pottsville, Pa. | 1360 |
| WPRA | Mayaguez, P.R. | 990 |
| WPRC | Lincoln, Ill. | 1370 |
| WPRE | Prairie Du Chien, Wis. | 980 |
| WPRJ | Parsippany-Troy Hills, N.J. | 1310 |
| WPRN | Butler, Ala. | 1240 |
| WPRO | Providence, R.I. | 630 |
| WPRP | Ponce, P.R. | 910 |
| WPRS | Paris, Ill. | 1440 |
| WPRT | Prestonsburg, Ky. | 960 |
| WPRV | Wauchula, Fla. | 1600 |
| WPRW | Manassas, Va. | 1460 |
| WPRY | Perry, Fla. | 1400 |
| WPSL | Monroeville, Pa. | 1510 |
| WPTF | Raleigh, N.C. | 680 |
| WPTL | Canton, N.C. | 920 |
| WPTN | Cookeville, Tenn. | 1500 |
| WPTR | Albany, N.Y. | 1540 |
| WPTS | Pittston, Pa. | 1540 |
| WPTW | Piqua, Ohio | 1570 |
| WPTX | Lexington Pk., Md. | 920 |
| WPUL | Bartow, Fla. | 1130 |
| WPUT | Brewster, N.Y. | 1510 |
| WPUV | Pulaski, Va. | 1580 |
| WPVA | Colonial Hghts., Va. | 1290 |
| WPVL | Painesville, Ohio | 1460 |
| WPXC | Prattville, Ala. | 1410 |
| WPXE | Starke, Fla. | 1490 |
| WPXI | Roanoke, Va. | 910 |
| WPXY | Greenville, N. C. | 1550 |
| WPYB | Benson, N.C. | 1130 |
| WQAM | Miami, Fla. | 560 |
| WQBA | Miami Fla. | 1140 |
| WQBC | Vicksburg, Miss. | 1420 |
| WQBS | San Juan, P.R. | 650 |
| WQDY | Calais, Maine | 1230 |
| WQIC | Meridian, Miss. | 1390 |
| WQIK | Jacksonville, Fla. | 1090 |
| WQIZ | St. George, S.C. | 810 |
| WQMR | Silver Spring, Md. | 1050 |
| WQOK | Greenville, S.C. | 1440 |
| WQSN | Charleston, S.C. | 1450 |
| WQTC | Two Rivers, Wis. | 1590 |
| WQTE | Monroe, Mich. | 560 |
| WQTW | Latrobe, Pa. | 1570 |
| WQTY | Montgomery, Ala. | 1500 |
| WQUA | Moline, Ill. | 1230 |
| WQVA | Quantico, Va. | 1530 |
| WQXI | Atlanta, Ga. | 790 |
| WQXL | Columbia, S.C. | 1320 |
| WQXQ | Ormond Bch., Fla. | 1380 |
| WQXR | New York, N.Y. | 1560 |
| WQXT | Palm Beach, Fla. | 1340 |
| WRAA | Luray, Va. | 1330 |
| WRAB | Arab, Ala. | 1380 |
| WRAC | Racine, Wis. | 1460 |
| WRAD | Radford, Va. | 1460 |
| WRAG | Carrollton, Ala. | 590 |
| WRAI | San Juan, P.R. | 1520 |
| WRAJ | Anna, Ill. | 1440 |
| WRAK | Williamsport, Pa. | 1400 |
| WRAM | Monmouth, Ill. | 1330 |
| WRAN | Dover, N.J. | 1510 |
| WRAP | Norfolk, Va. | 850 |
| WRAW | Reading, Pa. | 1340 |
| WRAY | Princeton, Ind. | 1250 |
| WRBC | Jackson, Miss. | 1300 |
| WRBD | Pampano Beach, Fla. | 1470 |
| WRBE | Lucedale, Miss. | 1440 |
| WRBJ | St. Johns, Mich. | 1580 |
| WRBL | Columbus, Ga. | 1420 |
| WRBN | Warner Robins, Ga. | 1600 |
| WRC | Washington, D.C. | 980 |
| WRCD | Dalton, Ga. | 1430 |
| WRCH | New Britain, Conn. | 910 |
| WRCK | Tuscumbia, Ala. | 1410 |
| WRCO | Richland Center, Wis. | 1450 |
| WRCP | Philadelphia, Pa. | 1540 |
| WRCS | Ahoskie, N.C. | 970 |
| WRDB | Reedsburg, Wis. | 1400 |
| WRDN | Durand, Wis. | 1430 |
| WRDO | Augusta, Maine | 1400 |
| WRDS | S. Charleston, W.Va. | 1410 |
| WRDW | Augusta, Ga. | 1480 |
| WREB | Holyoke, Mass. | 930 |
| WREC | Memphis, Tenn. | 600 |
| WREL | Lexington, Va. | 1450 |
| WREN | Topeka, Kans. | 1250 |
| WREO | Ashtabula, Ohio | 970 |
| WREV | Reidsville, N.C. | 1220 |
| WREX | Grand Junction, Colo. | 920 |
| WREY | New Albany, Ind. | 1290 |
| WRFC | Athens, Ga. | 960 |
| WRFD | Worthington, Ohio | 880 |
| WRFS | Alexander City, Ala. | 1050 |
| WRGA | Rome, Ga. | 1470 |
| WRGM | Richmond, Va. | 1540 |
| WRGS | Rogersville, Tenn. | 1370 |
| WRHC | Jacksonville, Fla. | 1400 |
| WRHI | Rock Hill, S.C. | 1340 |
| WRHL | Rochelle, Ill. | 1060 |
| WRIB | Providence, R.I. | 1220 |
| WRIC | Richlands, Va. | 540 |
| WRIE | Erie, Pa. | 1330 |
| WRIG | Wausau, Wis. | 1400 |
| WRIM | Pahokee, Fla. | 1250 |
| WRIN | Rensselaer, Ind. | 1560 |
| WRIP | Rossville, Ga. | 980 |
| WRIS | Roanoke, Va. | 1410 |
| WRIT | Milwaukee, Wis. | 1340 |
| WRIV | Riverhead, N.Y. | 1390 |
| WRIZ | Coral Gables, Fla. | 1550 |
| WRJC | Mauston, Wis. | 1270 |
| WRJN | Racine, Wis. | 1400 |
| WRJS | San German, P. R. | 1060 |
| WRJW | Picayune, Miss. | 1320 |
| WRKB | Kannapolis, N.C. | 1460 |
| WRKD | Rockland, Maine | 1450 |
| WRKH | Rockwood, Tenn. | 580 |
| WRKL | New City, N. Y. | 910 |
| WRKM | Carthage, Tenn. | 1350 |
| WRKN | Brandon, Miss. | 970 |
| WRKO | Boston, Mass. | 680 |
| WRKT | Cocoa Beach, Fla. | 1300 |
| WRKV | Rockville, Conn. | 800 |
| WRLD | Lanett, Ala., W. Point, Ga. | 1490 |
| WRMA | Montgomery, Ala. | 950 |
| WRMF | Titusville, Fla. | 1050 |
| WRMG | Red Bay, Ala. | 1430 |
| WRMN | Elgin, Ill. | 1410 |
| WRMS | Beardstown, Ill. | 790 |
| WRMT | Rocky Mount, N.C. | 1490 |
| WRNB | New Bern, N.C. | 1490 |
| WRNC | Raleigh, N.C. | 1240 |
| WRNG | N. Atlanta, Ga. | 680 |
| WRNL | Richmond, Va. | 910 |
| WRNY | Rome, N.Y. | 1350 |
| WROA | Gulfport, Miss. | 1390 |
| WROB | West Point, Miss. | 1450 |
| WROC | Rochester, N.Y. | 1280 |
| WROD | Daytona Beach, Fla. | 1340 |
| WROK | Rockford, Ill. | 1440 |
| WROL | Fountain City, Tenn. | 1490 |
| WROM | Rome, Ga. | 710 |
| WRON | Ronceverte, W.Va. | 1400 |
| WROS | Scottsboro, Ala. | 1330 |
| WROV | Roanoke, Va. | 1240 |
| WROW | Albany, N.Y. | 590 |
| WROX | Clarksdale, Miss. | 1450 |
| WROY | Carmi, Ill. | 1460 |
| WROZ | Evansville, Ind. | 1400 |
| WRPL | Charlotte, N.C. | 1540 |
| WRPM | Poplarville, Miss. | 1530 |
| WRR | Dallas, Tex. | 1310 |
| WRRR | Rockford, Ill. | 1330 |
| WRRZ | Clinton, N.C. | 880 |
| WRSA | Saratoga Sprgs., N.Y. | 1280 |
| WRSC | State College, Pa. | 1390 |
| WRSJ | Bayamon, P. R. | 1560 |
| WRSL | Stanford, Ky. | 1520 |
| WRSW | Warsaw, Ind. | 1480 |
| WRTA | Altoona, Pa. | 1240 |
| WRTH | Wood River, Ill. | 590 |
| WRTL | Rantoul, Ill. | 250d |
| WRUF | Gainesville, Fla. | 850 |
| WRUM | Rumford, Maine | 790 |
| WRUN | Utica, N.Y. | 1150 |
| WRUS | Russellville, Ky. | 610 |
| WRVA | Richmond, Va. | 1140 |
| WRVK | Mt. Vernon, Ky. | 1460 |
| WRWD | Augusta, Ga. | 1480 |
| WRWH | Cleveland, Ga. | 1380 |
| WRXO | Roxboro, N.C. | 1430 |
| WRYM | New Britain, Conn. | 840 |
| WRYT | Boston, Mass. | 950 |
| WSAC | Fort Knox, Ky. | 1470 |
| WSAF | Sarasota, Fla. | 1220 |
| WSAI | Cincinnati, Ohio | 1360 |
| WSAJ | Grove City, Pa. | 1340 |
| WSAL | Logansport, Ind. | 1230 |
| WSAM | Saginaw, Mich. | 1400 |

| Call | Location | kHz |
|---|---|---|
| WSAN | Allentown, Pa. | 1470 |
| WSAO | Senatobia, Miss. | 1550 |
| WSAR | Fall River, Mass. | 1480 |
| WSAT | nr. Salisbury, N.C. | 1280 |
| WSAU | Wausau, Wis. | 550 |
| WSAV | Savannah, Ga. | 630 |
| WSAY | Rochester, N.Y. | 1370 |
| WSAZ | Huntington, W.Va. | 930 |
| WSB | Atlanta, Ga. | 750 |
| WSBA | York, Pa. | 910 |
| WSBB | New Smyrna Beach, Fla. | 1230 |
| WSBC | Chicago, Ill. | 1240 |
| WSBR | Boca Raton, Fla. | 740 |
| WSBS | Gt. Barrington, Mass. | 860 |
| WSBT | South Bend, Ind. | 960 |
| WSBP | Chattahoochee, Fla. | 1580 |
| WSCM | Panama City Beach, Fla. | 1290 |
| WSCO | Taylorsville, Miss. | 1280 |
| WSCR | Scranton, Pa. | 1320 |
| WSCV | Peterborough, N.H. | 1050 |
| WSDR | Sterling, Ill. | 1240 |
| WSDS | Ypsilanti, Mich. | 1480 |
| WSEB | Sebring, Fla. | 1340 |
| WSEL | Pontotoc, Miss. | 1440 |
| WSEM | Donaldsonville, Ga. | 1500 |
| WSEN | Baldwinsville, N.Y. | 1050 |
| WSER | Elkton, Md. | 1550 |
| WSET | Glen Falls, N.Y. | 1410 |
| WSEV | Sevierville, Tenn. | 930 |
| WSEW | Selingsgrove, Pa. | 1240 |
| WSFB | Quitman, Ga. | 1490 |
| WSFC | Somerset, Ky. | 1240 |
| WSFR | Sanford, Fla. | 1300 |
| WSFT | Thomaston, Ga. | 1220 |
| WSFW | Seneca Falls, N.Y. | 1110 |
| WSGA | Savannah, Ga. | 1400 |
| WSGB | Sutton, W.Va. | 1490 |
| WSGC | Elberton, Ga. | 1400 |
| WSGN | Birmingham, Ala. | 610 |
| WSGO | Oswego, N.Y. | 1440 |
| WSGW | Saginaw, Mich. | 790 |
| WSHB | Raeford N.C. | 1400 |
| WSHF | Sheffield, Ala. | 1290 |
| WSHN | Fremont, Mich. | 1550 |
| WSHO | New Orleans, La. | 1230 |
| WSHP | Shippenburg, Pa. | 1480 |
| WSIB | Beaufort, S.C. | 1490 |
| WSIC | Statesville, N.C. | 1400 |
| WSID | Baltimore, Md. | 1010 |
| WSIG | Mount Jackson, Va. | 790 |
| WSIP | Paintsville, Ky. | 1490 |
| WSIR | Winter Haven, Fla. | 1490 |
| WSIV | Pekin, Ill. | 1140 |
| WSIX | Nashville, Tenn. | 980 |
| WSJC | Magee, Miss. | 810 |
| WSJM | St. Joseph, Mich. | 1400 |
| WSJR | Modawaska, Me. | 1230 |
| WSJS | Winston-Salem, N.C. | 600 |
| WSJW | Woodruff, S.C. | 1510 |
| WSKE | Everett, Pa. | 1050 |
| WSKI | Montpelier-Barre, Vt. | 1240 |
| WSKT | Knoxville, Tenn. | 1580 |
| WSKY | Asheville, N.C. | 1230 |
| WSLB | Ogdensburg, N.Y. | 1400 |
| WSLC | Clermont, Fla. | 1340 |
| WSLG | Donaldsonville, La. | 1090 |
| WSLI | Jackson, Miss. | 930 |
| WSMA | Marine City, Mich. | 1590 |
| WSLM | Salem, Ind. | 1220 |
| WSLR | Akron, Ohio | 1350 |
| WSLS | Roanoke, Va. | 610 |
| WSLT | Ocean City-Somers Pt., N.J. | 1520 |
| WSLV | Ardmore, Tenn. | 1520 |
| WSM | Nashville, Tenn. | 650 |
| WSMB | New Orleans, La. | 1350 |
| WSMD | La Plata, Md. | 1560 |
| WSME | Sanford, Maine | 1220 |
| WSMG | Greeneville, Tenn. | 1450 |
| WSMI | Litchfield, Ill. | 1540 |
| WSML | Graham, N.C. | 1190 |
| WSMN | Nashua, N.H. | 1590 |
| WSMT | Sparta, Tenn. | 1050 |
| WSMY | Weldon, N. C. | 1400 |
| WSNE | Cumming, Ga. | 1410 |
| WSNJ | nr. Bridgeton, N.J. | 1240 |
| WSNO | Barre, Vt. | 1450 |
| WSNT | Sandersville, Ga. | 1490 |
| WSNW | Seneca, S. C. | 1150 |
| WSNY | Schenectady, N.Y. | 1240 |
| WSOC | Charlotte, N.C. | 930 |
| WSOK | Savannah, Ga. | 1230 |
| WSOL | Tampa, Fla. | 1300 |
| WSOM | Salem, Ohio | 600 |
| WSON | Henderson, Ky. | 860 |
| WSOO | Slt. Ste. Marie, Mich. | 1230 |
| WSOQ | No. Syracuse, N.Y. | 1220 |
| WSOY | Decatur, Ill. | 1340 |
| WSPA | Spartanburg, S.C. | 950 |
| WSPB | Sarasota, Fla. | 1450 |
| WSPD | Toledo, Ohio | 1370 |
| WSPF | Hickory, N.C. | 1000 |
| WSPR | Springfield, Mass. | 1270 |
| WSPT | Stevens Pt., Wis. | 1010 |
| WSRA | Milton, Fla. | 1490 |
| WSRC | Durham, N.C. | 1410 |
| WSRF | Ft. Lauderdale, Fla. | 1580 |
| WSRO | Marlborough, Mass. | 1470 |
| WSRW | Hillsboro, Ohio | 1590 |
| WSSA | College Park, Ga. | 1570 |

| Call | Location | kHz |
|---|---|---|
| WSSB | Durham, N.C. | 1490 |
| WSSC | Sumter, S.C. | 1340 |
| WSSO | Starkville, Miss. | 1230 |
| WSSV | Petersburg, Va. | 1240 |
| WSTC | Stamford, Conn. | 1400 |
| WSTH | Taylorsville, N.C. | 860 |
| WSTK | Woodstock, Va. | 1230 |
| WSTL | Eminence, Ky. | 1600 |
| WSTP | Salisbury, N.C. | 1490 |
| WSTR | Sturgis, Mich. | 1230 |
| WSTU | Stuart, Fla. | 1450 |
| WSTV | Steubenville, Ohio | 1340 |
| WSTX | Christiansted, V.I. | 970 |
| WSUB | Groton, Conn. | 980 |
| WSUH | Oxford, Miss. | 1420 |
| WSUI | Iowa City, Iowa | 910 |
| WSUN | St. Petersburg, Fla. | 620 |
| WSUX | Seaford, Del. | 1280 |
| WSUZ | Palatka, Fla. | 800 |
| WSVA | Harrisonburg, Va. | 550 |
| WSVL | Shelbyville, Ind. | 1520 |
| WSVN | Valdese, N.C. | 1490 |
| WSVM | Valdese, N.C. | 1490 |
| WSVP | West Warwick, R.I. | 1450 |
| WSVS | Crewe, Va. | 800 |
| WSWN | Belle Glade, Fla. | 900 |
| WSWV | Pennington Gap, Va. | 1570 |
| WSWW | Platteville, Wis. | 1590 |
| WSYB | Rutland, Vt. | 1380 |
| WSYD | Mt. Airy, N.C. | 1300 |
| WSYL | Sylvania, Ga. | 1490 |
| WSYR | Syracuse, N.Y. | 570 |
| WTAB | Tabor City, N.C. | 1370 |
| WTAC | Flint, Mich. | 600 |
| WTAD | Quincy, Ill. | 930 |
| WTAE | Pittsburgh, Pa. | 1250 |
| WTAG | Worcester, Mass. | 580 |
| WTAI | Eau Gallie, Fla. | 1560 |
| WTAK | Garden City, Mich. | 1090 |
| WTAL | Tallahassee, Fla. | 1450 |
| WTAN | Clearwater, Fla. | 1340 |
| WTAP | Parkersburg, W.Va. | 1230 |
| WTAQ | LaGrange, Ill. | 1300 |
| WTAR | Norfolk, Va. | 790 |
| WTAW | Bryan, Tex. | 1150 |
| WTAX | Springfield, Ill. | 1240 |
| WTAY | Robinson, Ill. | 1570 |
| WTBC | Tuscaloosa, Ala. | 1230 |
| WTBF | Troy, Ala. | 970 |
| WTBO | Cumberland, Md. | 1450 |
| WTBY | Waterbury, Conn. | 1590 |
| WTCA | Plymouth, Ind. | 1050 |
| WTCB | Flomaton, Ala. | 990 |
| WTCH | Shawano, Wis. | 960 |
| WTCJ | Tell City, Ind. | 1230 |
| WTCM | Traverse City, Mich. | 1400 |
| WTCO | Campbellsville, Ky. | 1450 |
| WTCR | Ashland, Ky. | 1420 |
| WTCS | Fairmont, W.Va. | 1490 |
| WTCW | Whitesburg, Ky. | 920 |
| WTEL | Philadelphia, Pa. | 860 |
| WTGA | Thomaston, Ga. | 1590 |
| WTGR | Myrtle Beach, S. C. | 1520 |
| WTHB | Augusta, Ga. | 1550 |
| WTHD | Milford, Del. | 930 |
| WTHE | Mineola, N.Y. | 1520 |
| WTHI | Terre Haute, Ind. | 1480 |
| WTHM | Lapeer, Mich. | 1530 |
| WTHN | Thomaston, Ga. | 1500 |
| WTHT | Hazleton, Pa. | 1300 |
| WTHU | Thurmont, Md. | 1450 |
| WTIC | Hartford, Conn. | 1080 |
| WTID | Newport News, Va. | 1270 |
| WTIF | Tifton, Ga. | 1340 |
| WTIG | Massillon, Ohio | 990 |
| WTIK | Durham, N.C. | 1310 |
| WTIL | Mayaguez, P.R. | 1300 |
| WTIM | Taylorville, Ill. | 1410 |
| WTIP | Charleston, W.Va. | 1240 |
| WTIQ | Manistique, Mich. | 1490 |
| WTIV | Titusville, Pa. | 1230 |
| WTIX | New Orleans, La. | 690 |
| WTJH | East Point, Ga. | 1260 |
| WTJS | Jackson, Tenn. | 1390 |
| WTKM | Hartford, Wis. | 1540 |
| WTKO | Ithaca N.Y. | 1470 |
| WTKY | Tompkinsville, Ky. | 1370 |
| WTLB | Utica, N.Y. | 1310 |
| WTLK | Taylorsville, N.C. | 1570 |
| WTLN | Apopka, Fla. | 1520 |
| WTLO | Somerset, Ky. | 1480 |
| WTLS | Tallasee, Ala. | 1300 |
| WTMA | Charleston, S.C | 1250 |
| WTMB | Wisconsin Rapids, Wis. | 1460 |
| WTMC | Ocala, Fla. | 1290 |
| WTNE | Trenton, Tenn. | 1500 |
| WTMJ | Milwaukee, Wis. | 620 |
| WTMP | Tampa Fla. | 1150 |
| WTMR | Camden, N.J. | 800 |
| WTMT | Louisville, Ky. | 620 |
| WTNC | Thomasville, N.C. | 790 |
| WTND | Orangeburg, S.C. | 920 |
| WTNN | Millington, Tenn. | 1380 |
| WTNS | Coshocton, Ohio | 1560 |
| WTNT | Tallahassee, Fla. | 1270 |
| WTOB | Winston-Salem, N.C. | 1380 |
| WTOC | Savannah, Ga. | 1290 |
| WTOD | Toledo, Ohio | 1560 |
| WTOE | Spruce Pine, N.C. | 1470 |
| WTON | Staunton, Va. | 1240 |
| WTOO | Bellefontaine, O. | 1390 |
| WTOP | Washington, D.C. | 1500 |

| Call | Location | kHz |
|---|---|---|
| WTOR | Torrington, Conn. | 610 |
| WTOT | Marianna, Fla. | 980 |
| WTOW | Towson, Md. | 1580 |
| WTPR | Paris, Tenn. | 710 |
| WTPS | Portage, Mich. | 1560 |
| WTOW | Towson, Md. | 1570 |
| WTOX | Selma, Ala. | 1570 |
| WTOY | Roanoke, Va. | 910 |
| WTRA | Latrobe, Pa. | 1480 |
| WTRB | Ripley, Tenn. | 1570 |
| WTRC | Elkhart, Ind. | 1340 |
| WTRE | Greensburg, Ind. | 1330 |
| WTRI | Brunswick, Md. | 1520 |
| WTRL | Bradenton, Fla. | 1490 |
| WTRN | Tyrone, Pa. | 1340 |
| WTRO | Dyersburg, Tenn. | 1330 |
| WTRP | LaGrange, Ga. | 620 |
| WTRR | Sanford, Fla. | 1400 |
| WTRU | Muskegon, Mich. | 1600 |
| WTRX | Flint, Mich. | 1330 |
| WTRY | Troy, N.Y. | 980 |
| WTSA | Brattleboro, Vt. | 1450 |
| WTSB | Lumberton, N.C. | 1340 |
| WTSL | Hanover-Lebanon, New Hampshire | 1400 |
| WTSN | Dover, N.H. | 1270 |
| WTSV | Claremont, N.H. | 1230 |
| WTTB | Vero Beach, Fla. | 1490 |
| WTTC | Towanda, Pa. | 1550 |
| WTTF | Tiffin, Ohio | 1600 |
| WTTI | Dalton, Ga. | 1530 |
| WTTL | Madisonville, Ky. | 1310 |
| WTTM | Trenton, N.J. | 920 |
| WTTN | Watertown, Wis. | 1580 |
| WTTO | Toledo, Ohio | 1520 |
| WTTR | Westminster, Md. | 1470 |
| WTTS | Bloomington, Ind. | 1370 |
| WTTT | Amherst, Mass. | 1430 |
| WTUG | Tuscaloosa, Ala. | 790 |
| WTUP | Tupelo, Miss. | 1490 |
| WTUX | Wilmington, Del. | 1290 |
| WTVB | Coldwater, Mich. | 1590 |
| WTVL | Waterville, Maine | 1490 |
| WTVN | Columbus, Ohio | 610 |
| WTVR | Richmond, Va. | 1380 |
| WTWA | Thomson, Ga. | 1240 |
| WTWB | Auburndale, Fla. | 1570 |
| WTWN | St. Johnsbury, Vt. | 1340 |
| WTXL | W. Spgfd., Mass. | 1490 |
| WTYC | Rock Hill, S.C. | 1150 |
| WTYL | Tylertown, Miss. | 1290 |
| WTYM | East Longmeadow, Mass. | 1600 |
| WTYN | Tryon, N.C. | 1550 |
| WTYS | Marianna, Fla. | 1340 |
| WTZE | Tazewell, Va. | 1470 |
| WUBE | Cincinnati, O. | 1230 |
| WUDO | Lewisburg, Pa. | 1010 |
| WUFE | Baxley, Ga. | 1260 |
| WUFF | Eastman, Ga. | 710 |
| WUFO | Amherst, N.Y. | 1080 |
| WULA | Eufaula, Ala. | 1240 |
| WULF | Alma, Ga. | 1400 |
| WUMU | Gainesville, Fla. | 1390 |
| WUNA | Aquadilla, P. R. | 1340 |
| WUNE | Baton Rouge, La. | 1550 |
| WUNI | Mobile, Ala. | 1410 |
| WUNN | Mason, Mich. | 1110 |
| WUNO | Rio Piedras, P.R. | 1320 |
| WUNR | Brookline, Mass. | 1600 |
| WUOK | Cumberland, Md. | 1270 |
| WUPR | Utado, P.R. | 1530 |
| WUSJ | Lockport, N.Y. | 1340 |
| WUST | Bethesda, Md. | 1120 |
| WUWU | Gainsville, Fla. | 1390 |
| WVAB | Virginia Bch., Va. | 1550 |
| WVAK | Paoli, Ind. | 1560 |
| WVAL | Sauk Rapids, Minn. | 800 |
| WVAM | Altoona, Pa. | 1430 |
| WVAP | Burnettown, S.C. | 1510 |
| WVAR | Richwood, W. Va. | 600 |
| WVCB | Shallotte, N. C. | 1410 |
| WVCF | Windermere, Fla. | 1480 |
| WVCG | Coral Gables, Fla. | 1080 |
| WVCH | Chester, Pa. | 740 |
| WVEC | Hampton, Va. | 1490 |
| WVGT | Mt. Dora, Fla. | 1580 |
| WVIC | E. Lansing, Mich. | 730 |
| WVIM | Vicksburg, Miss. | 1490 |
| WVIP | Mt. Kisco, N.Y. | 1310 |
| WVJP | Caguas, P.R. | 1110 |
| WVJS | Owensboro, Ky. | 1420 |
| WVKO | Columbus, Ohio | 1580 |
| WVLD | Valdosta, Ga. | 1450 |
| WVLK | Lexington, Ky. | 590 |
| WVLN | Olney, Ill. | 740 |
| WVLY | Water Valley, Miss. | 1320 |
| WVMC | Mt. Carmel, Ill. | 1360 |
| WVMG | Cochran, Ga. | 1440 |
| WVMI | Biloxi, Miss. | 570 |
| WVMT | Burlington, Vt. | 620 |
| WVNA | Tuscumbia, Ala. | 1590 |
| WVNJ | Newark, N.J. | 620 |
| WVOB | Bel Air, Md. | 1520 |
| WVOC | Battle Creek, Mich. | 1500 |
| WVOE | Chadburn, N.C. | 1590 |
| WVOH | Hazelhurst, Ga. | 920 |
| WVOJ | Jacksonville, Fla. | 1320 |
| WVOK | Birmingham, Ala. | 690 |
| WVOL | Berry Hill, Tenn. | 1470 |
| WVOM | Iuka, Miss. | 1270 |
| WVON | Cicero, Ill. | 1450 |
| WVOP | Vidalia, Ga. | 970 |

| Call | Location | kHz |
|---|---|---|
| WVOS | Liberty, N.Y. | 1240 |
| WVOT | Wilson, N.C. | 1420 |
| WVOV | Huntsville, Ala. | 1000 |
| WVOW | Logan, W.Va. | 1290 |
| WVOX | New Rochelle, N.Y. | 1460 |
| WVOZ | Carolina, P.R. | 1400 |
| WVPO | Stroudsburg, Pa. | 840 |
| WVRC | Spencer, W. Va. | 1400 |
| WVSA | Vernon, Ala. | 1380 |
| WVSC | Somerset, Pa. | 990 |
| WVSM | Rainsville, Ala. | 1500 |
| WVVW | Grafton, W.Va. | 1260 |
| WWAB | Lakeland, Fla. | 1330 |
| WWAM | Cadillac, Mich. | 1370 |
| WWBA | St. Petersburg, Fla. | 680 |
| WWBC | Cocoa, Fla. | 1510 |
| WWBD | Bamberg-Denmark, S.C. | 790 |
| WWBR | Windber, Pa. | 1350 |
| WWBZ | Vineland, N.J. | 1360 |
| WWCA | Gary, Ind. | 1270 |
| WWCC | Bremen, Ga. | 1440 |
| WWCH | Clarion, Pa. | 1300 |
| WWCM | Brazil, Ind. | 1380 |
| WWCO | Waterbury Conn | 1240 |
| WWDA | Wisconsin Dells, Wis. | 990 |
| WWDC | Washington, D.C. | 1260 |
| WWDR | Murfreesboro, N. C. | 1080 |
| WWGM | Nashville, Tenn. | 1560 |
| WWGO | Erie, Pa. | 1450 |
| WWGP | Sanford, N.C. | 1050 |
| WWGS | Tifton, Ga. | 1430 |
| WWHG | Hornell, N.Y. | 1320 |
| WWHY | Huntington, W.Va. | 1470 |
| WWIN | Baltimore, Md. | 1400 |
| WWIS | Black River Falls, Wis. | 1260 |
| WWIT | Canton, N.C | 970 |
| WWJ | Detroit, Mich. | 950 |
| WWJB | Brooksville Fla. | 1450 |
| WWJC | Superior, Wis. | 1270 |
| WWKE | Ocala, Fla. | 1370 |
| WWKO | Fair Bluff, N.C. | 1480 |
| WWKY | Winchester, Ky. | 1380 |
| WWL | New Orleans, La. | 870 |
| WWLE | Cornwall, N.Y. | 1170 |
| WWML | Portage, Pa. | 1470 |
| WWNC | Asheville, N.C. | 570 |
| WWNH | Rochester, N.H. | 930 |
| WWNR | Beckley, W.Va. | 620 |
| WWNS | Statesboro, Ga. | 1240 |
| WWNY | Watertown, N.Y. | 790 |
| WWOD | Lynchburg, Va. | 1390 |
| WWOK | Charlotte, N.C. | 1480 |
| WWOL | Buffalo, N.Y. | 1120 |
| WWOM | New Orleans, La. | 600 |
| WWON | Woonsocket, R.I. | 1240 |
| WWOW | Conneaut, Ohio | 1360 |
| WWPA | Williamsport, Pa. | 1340 |
| WWPF | Palatka, Fla. | 1260 |
| WWRL | New York, N.Y. | 1600 |
| WWSC | Glens Falls, N.Y. | 1450 |
| WWSD | Monticello, Fla. | 1090 |
| WWSF | Loretto, Pa. | 1400 |
| WWSR | St. Albans, Vt. | 1420 |
| WWST | Wooster, Ohio | 960 |
| WWSW | Pittsburgh, Pa. | 970 |
| WWTC | Minneapolis, Minn. | 1280 |
| WWUN | Jackson, Miss. | 1590 |
| WWVA | Wheeling, W.Va. | 1170 |
| WWWB | Jasper, Ala. | 1360 |
| WWWF | Fayette, Ala. | 990 |
| WWWR | Russellville, Ala. | 920 |
| WWXL | Manchester, Ky. | 1450 |
| WWYN | Erie, Pa. | 1260 |
| WWYO | Pineville, W.Va. | 970 |
| WXAL | Demopolis, Ala. | 1400 |
| WXCL | Peoria, Ill. | 1350 |
| WXCO | Wausau, Wis. | 1230 |
| WXGI | Richmond, Va. | 950 |
| WXIT | Charleston, W.Va. | 1490 |
| WXKW | Troy, N. Y. | 1600 |
| WXLI | Dublin, Ga. | 1230 |
| WXLL | Big Delta, Alaska | 980 |
| WXLW | Indianapolis, Ind. | 950 |
| WXOK | Baton Rouge, La. | 1460 |
| WXOX | Bay City, Mich. | 1250 |
| WXPQ | Eatonton, Ga. | 1520 |
| WXMT | Merrill, Wis. | 730 |
| WXRF | Guayama, P.R. | 1590 |
| WXTN | Lexington, Miss. | 1000 |
| WXTR | Pawtucket, R.I. | 550 |
| WXUR | Media, Pa. | 690 |
| WXVA | Charles Town, W.Va. | 1550 |
| WXVI | Riviera Bch, Fla. | 1600 |
| WXVW | Jeffersonville, Ind. | 1450 |
| WXXX | Hattiesburg, Miss. | 1310 |
| WXYC | Ft. Myers, Fla. | 1350 |
| WXYZ | Detroit, Mich. | 1270 |
| WYAL | Scotland Neck, N.C. | 1280 |
| WYAM | Bessemer, Ala. | 1450 |
| WYBG | Massena, N. Y. | 1050 |
| WYCL | York, S.C. | 980 |
| WYDE | Birmingham, Ala. | 850 |
| WYDK | Yadkinville, N.C. | 1480 |
| WYFE | Rockford, Ill. | 1150 |
| WYGO | Corbin, Ky. | 1330 |
| WYHE | Bristol, Tenn. | 1550 |
| WYLD | New Orleans, La. | 940 |
| WYLO | Jackson, Wis. | 540 |
| WYMB | Manning, S.C. | 1410 |
| WYNA | Raleigh, N. C. | 1550 |
| WYND | Sarasota, Fla. | 1280 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| WYNK | Baton Rouge, La. | 1380 | WYRU | Red Springs, N.C. | 1510 | WYZE | Atlanta, Ga. | 1480 |
| WYNN | Florence, S.C. | 540 | WYSE | Inverness, Fla. | 1560 | WZAM | Prichard, Ala. | 1270 |
| WYNR | Brunswick, Ga. | 790 | WYSH | Clinton, Tenn. | 1380 | WZBN | Zion, Ill. | 1500 |
| WYNS | Leighton, Pa. | 1150 | WYSL | Buffalo, N.Y. | 1400 | WZEP | DeFuniak Sprgs., Fla. | 1460 |
| WYNX | Smyrna, Ga. | 1550 | WYSR | Franklin, Va. | 1250 | WZIP | Cincinnati, Ohio | 1050 |
| WYNZ | Ypsilanti, Mich. | 1520 | WYTH | Madison, Ga. | 1250 | WZKY | Albemarle, N.C. | 1580 |
| WYOQ | Wyoming, Mich. | 1530 | WYTI | Rocky Mount, Va. | 1570 | WZOB | Ft. Payne, Ala. | 1250 |
| WYOU | Tampa, Fla. | 1550 | WYVE | Wytheville, Va. | 1280 | WZOE | Princeton, Ill. | 1490 |
| WYPR | Danville, Va. | 970 | WYWY | Barbourville, Ky. | 950 | WZST | Leesburg, Fla. | 1410 |
| WYRE | Annapolis, Md. | 810 | WYXI | Athens, Tenn. | 1390 | WZUM | Carnegie, Pa. | 1590 |
| WYRN | Louisburg, N.C. | 1480 | WYYY | Kalamazoo, Mich. | 1470 | WZYX | Cowan, Tenn. | 1440 |

## A THANK YOU NOTE FROM THE EDITORS

**Thank you!** The Editors of SCIENCE AND ELECTRONICS would like to thank all readers who offered information on station changes, additions, and deletions during the past few months. Though many of the letters overlapped, each aided us considerably in the task of making *White's Radio Log* as current as possible at press time. If we left your name out, please forgive us!

Donald A. Blesse, Rumson, N.J.
Elmer C. Carlson, Cocoa, Fla.
Charles Ekstrom, Chicago, Ill.
John Garofano, Framingham, Mass.
WWR. Garrett, Augusta, Ga.
Tom Kneitel, Commack, N.Y.
David Moore, Jr., Little Rock, Ark.
Lars Nielsen, Dundas, Ontario
Sydney Osgood, Suncock, N.H.
A. Pace, Toronto, Ontario
R.L.A. New England, Sharon, Mass.
John N. Ramsey, W. Hartford, Conn.
Jerry Robertson, Croswell, Mich.
Gladys Sienkiewicz, Brooklyn, N.Y.
Mark Wirtz, Evansville, Ind.
Jerry Yacuzzi, W. Hartford, Conn.

## White's World-Wide Shortwave Stations

**Many of you** who read White's Radio Log's Shortwave Listings have written to ask for further information on the stations you hear which do not fit into the categories of either broadcasting or amateur stations. They include ships, aircraft, military, police, fire, etc.

To DXers, such stations are generally classified as *utility stations* and they constitute a fascinating aspect of the hobby; so interesting in fact, that a great many DXers specialize in logging and QSLing them.

While very few utilities stations have their own printed QSL cards, many will gladly complete and return to you a prepared card for this purpose. Just enclose the card with your reception report and ask them to sign it and return it—include on the card spaces for the station to fill in their power, antenna type, and any other data of interest.

If you would like to take a whack at this off-beat DX fare, all you have to do is tune your communications receiver around to their favorite nesting places. Look between 2 and 3.5 MHz, from 4 to 4.8 MHz, from 5.1 to 5.9 MHz, from 6.2 to 7 MHz, from 7.3 to 9 MHz, from 10 to 11.5 MHz, from 12 to 14 MHz and you'll hear them pouring in from all over the world. For police and fire monitoring, you'll need a special receiver covering the 30 to 50, or 150 to 174 MHz bands—these are readily available at a wide range of prices from most dealers.

If you like, send in some of your reception results to us here at White's, and we'll probably run them.

**Propagation Forecast.** The noise level will now start to fall off sharply as cooler weather arrives. This means not only improved reception (except from south of the Tropic of Capricorn) on the lower SW bands like 60 and 90 Meters, but also on the medium wave BCB—535 to 1605 kHz. No broadcast DXer should neglect the latter in his quest for new countries. Here, depending upon your receiver, patience, and luck, you can log such stations as ZNS at Nassau, Bahamas (1540 kHz) ZBM1 Pembroke (1235) and ZFB1 St. George's, (960), Bermuda, R. Jamaica (720 and 770 kHz), R. Barbados and ZBV1 Tortola, British Virgin Islands (both currently on 780). None of these countries have SWBC stations and all, with the possible exception of Bermuda, will be best when ionospheric disturbances knock out upper latitude QRM.

By the way, and contrary to what some old timers may try to tell you, the noise level is the only real DX factor (between .3 and 30 MHz) that tropospheric weather conditions will affect.

Meanwhile it seems that no one knows for certain what the sunspot count will do next but this may be the last really good winter

| Oct./Nov. 1969 LISTENER'S STANDARD TIME | ASIA (except Near East) | EUROPE, NEAR EAST & AFRICA (N. of the Sahara) | AFRICA (S. of the Sahara) | SOUTH PACIFIC | LATIN AMERICA |
|---|---|---|---|---|---|
| 0000-0300 | (19), 25, (31) | 41, 49 | 49, 60e | 31, 41w | 49, 60 |
| 0300-0600 | 31, 41, (49) | (19w), (31) | 19w | 41, 49 | 49, 60 |
| 0600-0900 | 25, 49w | 13, 16, 19 | 19 | 25, 31 | 49 |
| 0900-1200 | 16, 19 | 13, 16, 19 | 19, 25 | 25 | 25, 31 |
| 1200-1500 | 16, 19 | 13, 16, 19 | 19, 25 | (19) | 25, 31 |
| 1500-1800 | 16, 19 | 25, 31, (49) | 31w, 49, 60e | (19) | 31, 49 |
| 1800-2100 | 16, 19 | 31, 49 | 25, 31, (60w) | 16, 19 | (49), 60 |
| 2100-2400 | 16, 19 | 31, 49 | 60 | 16, 19 | (49), 60, 90 |

**To use the table** put your finger on the region you want to hear and log, move your finger down until it is alongside the local standard time at which you will be listening and lift your finger. Underneath your pointing digit will be the shortwave band or bands that will give the best DX results. The time in the above propagation table is given in *standard time* at the listener's location, which effectively compensates for differences in propagation characteristics between the East and West Coasts of North America. Abbreviations: **w**—Western North America and **e**—Eastern North America. When **w** or **e** follow a band listing, it means the band is only good for that part of the continent. The shortwave bands in brackets are suggested as possible second choices. Refer to White's Radio Log for our world-wide Shortwave list.

for 13 Meters. This band is particularly for European and, to a much lesser extent, African propaganda watchers during daylight hours. Major African 13-Meter outlets (South of the Sahara) are the Voice of Nigeria on 21455 kHz and Radio RSA on 21500 and 21535 kHz. The same midday period may also produce improved Latin American prospects as compared with last fall and winter, not because of any significant change in propagation, but due to that increased activity on the international bands.

| *kHz* | *Call* | *Name* | *Location* |
|---|---|---|---|
| 2200 | — | | Fukien, China |
| 2360 | — | R. Parintins | Parintins, Brazil |
| 2410 | 4VU | R. Lumiere | Port au Prince, Haiti |
| 2437 | YDG4 | RRI | Surakarta, Indonesia |
| 2475 | — | | Hangchow, China |
| 2600 | — | | Fukien, China |

## 90-Meter Band—3200 to 3400 kHz

| | | | |
|---|---|---|---|
| 3205 | VUD | All India R. | Lucknow, India |
| 3230 | VRH8 | Fiji BC | Suva, Fiji Is. |
| 3241 | YDR3 | RRI | Ambon, Indonesia |
| 3255 | HIMP | R. Ocoa | Sto. Domingo, Dom. Rep. |
| 3265 | HCMZ6 | V. del Dorado | Pelileo, Ecuador |
| 3285 | — | R. Lubumbashi | Lubumbashi, Congo |
| 3295 | ZYM22 | R. Cultural Sergipe | Sergipe, Brazil |
| 3315 | VUD | All India R. | Bhopal, India |
| 3325 | ZYJ21 | R. Borborema | Campina Grande, Brazil |
| 3335 | ZYR59 | R. Marajoara | Belem, Brazil |
| 3350 | — | R-TV Gabonaise | Franceville, Gabon |
| 3360 | TGVN | V. Nahuala | Solola, Guatemala |
| 3375 | YDK7 | RRI | Djambi, Indonesia |
| 3380 | — | W. Nigerian BC | Ibadan, Nigeria |
| 3391 | YDK7 | RRI | Djambi, Indonesia |
| 3450 | — | R. Peking | Peking, China |
| 3824 | 7PA22 | 7PA22 | Maseru, Lesotho |
| 4055 | — | Gorovit Petropavlovsk | Petropavlovsk, USSR |

| *kHz* | *Call* | *Name* | *Location* |
|---|---|---|---|
| 4273 | — | R. Pyongyang | Pyongyang, N. Korea |
| 4500 | VNG | | Lyndhurst, Australia |
| 4680 | HCWEI | R. Nacional Espejo | Quito, Ecuador |

## 60-Meter Band—4750 to 5060 kHz

| | | | |
|---|---|---|---|
| 4760 | — | Gorovit Dzambul | Dzambul, USSR |
| 4765 | — | R-TV Congolaise | Congo |
| 4775 | — | R. Afghanistan | Kabul, Afghanistan |
| 4785 | — | Gorovit Baku | Baku, USSR |
| 4790 | YVON | Ondenas Portenas | Pt. La Cruz, Venezuela |
| 4800 | HCSV5 | R. Amazonas | Cuenca, Ecuador |
| 4810 | HCLS3 | R. Coro Sta Cecilia | Loja, Ecuador |
| 4820 | OAX7K | R. Puno | Puno, Ecuador |
| 4830 | HSKB | R. Thailand | Bangkok, Thailand |
| 4840 | VUB | All India R. | Bombay, India |
| 4850 | V3USE | Mauritius BC | Forest Side, Mauritius |
| 4860 | — | R. Moscow | Moscow, USSR |
| 4870 | OCX4T | R. Obispado | Peru |
| 4880 | OCX4E | R. Once Sesenta | Lima, Peru |
| 4890 | HRVL | R. Lux | Tegucigalpa, Honduras |
| 4895 | OAZ4T | R. Chanchamayo | Lima, Peru |
| 4908 | — | | Shanghai, China |
| 4915 | CP88 | R. Amboro | La Paz, Bolivia |
| 4923 | HCRQI | R. Quito | Quito, Ecuador |
| 4935 | CR5RE | R. Club de Malanje | Malanje, Angola |
| 4940 | OAZ4R | R. San Juan | San Juan, Peru |
| 4950 | OAX7I | R. Madre de Dios | Lima, Peru |
| 4960 | — | R. Peking | Peking, China |
| 4968 | — | R. Ceylon | Colombo, Ceylon |

# WHITE'S SHORTWAVE STATION LISTINGS

| kHz | Call | Name | Location |
|---|---|---|---|
| 4980 | HIKZ | R. Popular | Santo Domingo, Dom. Rep. |
| 4985 | ZYR89 | R. Aparaceida | Aparaceida, Brazil |
| 4995 | OAZ4C | R. Andina | Andina, Peru |
| 5010 | — | R. Garoua | Garoua, Cameroon |
| 5020 | — | R. Ceylon | Colombo, Ceylon |
| 5025 | ZYK41 | Emis Rural | San Francisco Petrolina, Brazil |
| 5035 | — | Gorovit Alma Ata | Alma Ata, USSR |
| 5041 | — | Emis de Guine | Portuguese Guinea |
| 5055 | CP87 | R. San Rafael | La Paz, Bolivia |
| 5075 | — | R. Peking | Peking, China |
| 5180 | OAX8F | R. Atlantida | Lima, Peru |
| 5535 | — | R. Peking | Peking, China |
| 5860 | — | R. Peking | Peking, China |
| 5925 | — | Gorovit Tashkent | Tashkent, USSR |

## 49-Meter Band—5950 to 6200 kHz

| kHz | Call | Name | Location |
|---|---|---|---|
| 5955 | — | R-TV Francaise | Paris, France |
| | ZYR226 | R. Gazeta | Rio de Janeiro, Brazil |
| 5960 | HRHR | V. de Occidente | Tegucigalpa, Honduras |
| 5970 | — | RFE | Munich, Germany |
| 5975 | ZYT44 | R. Guaraja | Guaraja, Brazil |
| 5980 | BED30 | V. Free China | Taipei, Formosa |
| 5985 | WNYW | R. New York | New York, NY |
| 5995 | — | R. Andorra | Andorra |
| 6000 | — | R. Moscow | Moscow, USSR |
| 6005 | CFCW | CFCW | Montreal, PQ |
| 6010 | CE601 | R. Norte | Santiago, Chile |
| 6020 | — | V. America | Greenville, NC |
| 6025 | CR6RZ | Emis Official | Luanda, Angola |
| 6030 | — | V. America | Greenville, NC |
| 6040 | VUD | All India R. | Delhi, India |
| 6055 | DYH4 | Nat'l Council Churches | Dumaguete City, Phil. |
| 6060 | HCACI | V. de Democracia | Quito, Ecuador |
| 6070 | — | R. Universite | Tananarive, Malagasy Rep. |
| 6075 | DMQ6 | Deutsche Welle | Cologne, W. Germany |
| 6078 | 4VSC | V. de St. Marc | Port au Prince, Haiti |
| 6080 | HRME | R. El Patio | Tegucigalpa, Honduras |
| 6090 | — | BBC | London, England |
| 6095 | HJIW | V. del Centro | Bogota, Colombia |
| 6105 | — | R. Free Europe | Munich, W. Germany |
| 6110 | — | Trans World R. | Bonaire, Neth. Ant. |
| 6115 | XEUDS | R. Univ. de Sonora | Hermosillo, Mex. |
| 6120 | DZF4 | Call of Orient | Manila, Philippines |
| 6125 | HJKE | R. Continental | Bogota, Colombia |
| 6130 | CHNX | CHNX | Halifax, NS |
| 6140 | — | BBC | London, England |
| 6145 | PRL9 | R. Nacional | Rio de Janeiro, Brazil |
| 6155 | OEI21 | Viennese BC | Vienna, Austria |
| | — | Far East Network | Tokyo, Japan |
| 6165 | — | Gorovit Kiev | Kiev, USSR |
| 6170 | — | Army Station | Seoul, S. Korea |
| 6175 | — | R. Malaysia | Kuala Lumpur, Malaysia |
| 6185 | CSA29 | R. Nacional | Lisbon, Portugal |
| 6190 | — | V. America | Greenville, NC |
| 6200 | — | R. Sudamericana | Lima, Peru |
| 6234 | — | R. Budapest | Budapest, Hungary |
| 6330 | — | R. Peking | Peking, China |
| 6480 | — | R. Pyongyang | Pyongyang, N. Korea |
| 6644 | — | R. Peking | Peking, China |
| 7060 | — | R. Peking | Peking, China |

## 41-Meter Band—7100 to 7300 kHz

| kHz | Call | Name | Location |
|---|---|---|---|
| 7155 | — | R. Nationale | Tananarive, Malagasy Rep. |
| 7165 | — | R. Free Europe | Munich, W. Germany |
| 7180 | — | R. Liberty | Spain |
| 7190 | HLK30 | V. Free Korea | Seoul, S. Korea |
| 7200 | — | V. America Relay | Woofferton, England |
| 7230 | — | R. Peking | Peking, China |
| 7260 | VUM | All India R. | Madras, India |
| 7280 | — | R. Moscow | Moscow, USSR |
| 7290 | — | RAI | Rome, Italy |
| 7295 | — | R. Liberty | Spain |
| 7305 | — | R. Peking | Peking, China |
| 7443 | — | UN Radio | Geneva, Switz. |
| 9009 | 4XB31 | Kol Zion | Tel Aviv, Israel |

## 31-Meter Band—9500 to 9775 kHz

| kHz | Call | Name | Location |
|---|---|---|---|
| 9500 | — | R. Peking | Peking, China |
| 9510 | — | R. Bucharest | Bucharest, Rumania |
| 9515 | TAT | R. Ankara | Ankara, Turkey |
| 9525 | PCJ | R. Nederland | Hilversum, Neth. |
| 9530 | — | R. Moscow | Moscow, USSR |
| 9535 | CR6RZ | Emis Official | Luanda, Angola |
| 9545 | HVJ | Vatican R. | Vatican City |
| 9555 | — | V. America Relay | Poro, Philippines |
| 9565 | — | Deutsche Welle Relay | Kigali, Rwanda |
| 9570 | — | BBC Relay | Tebrau, Malaysia |
| 9575 | BED91 | V. Free China | Taipei, Formosa |
| 9585 | — | R. Nacional | Lisbon, Portugal |
| 9590 | — | R. Peking | Peking, China |
| 9595 | — | Swiss BC | Berne, Switz. |
| 9600 | OAX3E | R. Huaraz | Huaraz, Peru |
| 9610 | — | R. Mauritania | Nouakchott, Muretania |
| 9618 | OBX7E | R. El Sol | Lima, Peru |
| 9620 | CXA6 | SODRE | Montevideo, Uruguay |
| 9630 | — | R. Nacional | Lisbon, Portugal |
| 9640 | — | BBC | London, England |
| 9645 | TIFC | Faro del Caribe | San Jose, CR |
| 9655 | — | R. Free Europe | Munich, W. Germany |
| 9660 | BED42 | V. Free China | Taipei, Formosa |
| 9675 | ZYT9 | R. Diario de Manha | Manha, Brazil |
| 9685 | — | R. Moscow | Moscow, USSR |
| 9690 | — | BBC Relay | Limassol, Cyprus |
| 9700 | — | R-TV Francaise | Paris, France |
| 9710 | — | RAI | Rome, Italy |
| 9720 | CR6RZ | Emis Official | Luanda, Angola |
| 9725 | — | V. America | Greenville, NC |
| 9735 | — | Deutsche Welle Relay | Kigali, Rwanda |
| 9745 | BEC62 | Chinese Air Force | Formosa |
| 9755 | PCJ | R. Nederland | Hilversum, Neth. |
| 9760 | — | R. Hanoi | Hanoi, N. Vietnam |
| 9770 | — | BBC | London, England |
| 9912 | VUD | All India R. | Delhi, India |
| 10000 | LOL | (time signals) | Buenos Aires, Arg. |
| 10650 | — | R. Ulan Bator | Ulan Bator, Mongolia |
| 11515 | — | R. Peking | Peking, China |
| 11685 | CR6RR | R. Diamang | Luanda, Angola |

## 25-Meter Band—11700 to 11975 kHz

| kHz | Call | Name | Location |
|---|---|---|---|
| 11700 | — | WIBS | Windward Islands |
| 11710 | — | V. America Relay | Tangiers, Morocco |
| 11720 | — | BBC Relay | Limassol, Cyprus |
| 11730 | — | V. America Relay | Poro, Philippines |
| 11740 | ZAA | R. Tirana | Tirana, Albania |
| 11745 | HJV | Vatican Radio | Vatican City |
| 11755 | — | R. Hanoi | Hanoi, N. Vietnam |
| 11760 | VUD | All India R. | Delhi, India |
| 11775 | ETLF | R. Voice Gospel | Addis Ababa, Ethiopia |
| 11785 | — | Deutsche Welle | Kigali, Rwanda |
| 11790 | WNYW | R. New York | New York, NY |
| 11800 | — | RAI | Rome, Italy |
| 11805 | — | V. America Relay | Poro, Philippines |
| 11815 | VUD | All India R. | Delhi, India |
| 11820 | — | R. Peking | Peking, China |
| 11830 | — | V. America | Greenville, NC |
| 11845 | VUD | All India R. | Delhi, India |
| 11855 | ETLF | R. Voice Gospel | Addis Ababa, Ethiopia |
| 11860 | — | R. Peking | Peking, China |
| 11870 | — | Viennese R. | Vienna, Austria |
| 11875 | DZH6 | National Council Churches | Dumaguete City, Phil. |
| 11880 | LRS | R. Splendid | Buenos Aires, Argentina |
| 11890 | DZE9 | Call of Orient | Manila, Philippines |

### This Issue's Shortwave Contributors

**Randy McTavish,** Clayton Lake, Me., **Bill Frederickson,** Philadelphia, Pa., **Arnie Wuster,** Milwaukee, Wisc., **E. K. Herman,** Kissimmee, Fla., **Edward Trumbull, Sr.,** FPO, San Francisco, Cal., **Willis Rednel,** Sayville, N.Y., **Steven Thorsen,** San Diego, Calif., **Gladys Sienkiewicz,** New York, N.Y., **Stan Levine,** Galveston, Tex., **Ike Iselin,** Portland, Ore., **Arthur J. Chang,** Honolulu, Hawaii, **Alex MacDonald,** Vancouver, B.C., **Sally Esterne,** Atlanta, Ga., **Warren Hallowell,** Little Rock, Ark., **Fred Kleiner,** Circleville, Ohio, **Dick Williams, Jr.,** Des Moines, Iowa, **H. H. Ustmer II,** APO, New York, **Morton Yarmy,** Dover, Del., **Mike O'Dannon,** The Village, Okla., **L. R. Dolinger,** Great Falls, Mont., **Peter Lelange,** St. Agathe, Que., **Red Wilkins,** Chattanooga, Tenn. ■

| kHz | Call | Name | Location |
|---|---|---|---|
| 11905 | ZAA | R. Tirana | Tirana, Albania |
| 11910 | VUD | All India R. | Delhi, India |
| 11920 | ZAA | R. Tirana | Tirana, Albania |
| 11925 | — | BBC | London, England |
| 11935 | — | R. Nacional | Lisbon, Portugal |
| 11945 | — | BBC | London, England |
| 11955 | CR6RZ | Emis Official | Luanda, Angola |
| 11965 | — | R. Japan | Tokyo, Japan |
| 11975 | ELWA | R. Village | Monrovia, Liberia |

## 19-Meter Band—15100 to 15450 kHz

| kHz | Call | Name | Location |
|---|---|---|---|
| 15115 | HCJB | V. Andes | Quito, Ecuador |
| 15130 | ETLF | R. V. Gospel | Addis Ababa, Ethiopia |
| 15140 | — | BBC | London, England |
| 15150 | CE1515 | R. Corporacion | Santiago, Chile |
| 15160 | — | R. Budapest | Budapest, Hungary |
| 15170 | LKV | R. Norway | Oslo, Norway |
| 15180 | — | BBC Relay | Ascension Island |
| 15195 | — | V. America Relay | Monrovia, Liberia |
| 15210 | — | V. America Relay | Poro, Philippines |
| 15225 | — | R. Liberty | Spain |
| 15240 | — | R. Berlin International | Berlin, E. Germany |
| 15250 | VUD | All India R. | Delhi, India |
| 15285 | — | R. Habana | Havana, Cuba |
| 15320 | — | R. Australia | Melbourne, Australia |
| 15385 | DZF3 | Call of Orient | Manila, Philippines |
| 15435 | DMQ15 | Deutsche Welle | Cologne, W. Germany |

## 16-Meter Band—17700 to 17900 kHz

| kHz | Call | Name | Location |
|---|---|---|---|
| 17715 | VUD | All India R. | Delhi, India |
| 17765 | DMQ17 | Deutsche Welle | Cologne, W. Germany |
| 17780 | — | R. Liberty | Greece |
| 17820 | TAV | R. Ankara | Ankara, Turkey |
| 17850 | VUD | All India R. | Delhi, India |
| 17860 | — | BBC | London, England |

## 13-Meter Band—21450 to 21750 kHz

| kHz | Call | Name | Location |
|---|---|---|---|
| 21450 | — | R. Prague | Prague, Czech. |
| 21495 | CSA67 | R. Nacional | Lisbon, Portugal |
| 21540 | — | R. Berlin International | Berlin, E. Germany |
| 21590 | — | BBC | London, England |
| 21615 | — | BBC | London, England |
| 21640 | — | R. Japan | Tokyo, Japan |

# White's Emergency Radio Station Listings for the Philadelphia Area

☐ SCIENCE AND ELECTRONICS and RADIO-TV EXPERIMENTER furnishes this exclusive listing of emergency radio stations as an aid to our many readers now engaged in the fascinating and rapidly growing hobby of monitoring emergency radio communications. We have and will be publishing similar lists devoted to different metropolitan areas in forthcoming issues so that you'll be able to accumulate a sizable array of this difficult-to-obtain data. Refer to the index on page 83 for our 1969 program.

If you desire to obtain similar lists from other areas in the United States that have not or will not be published in this magazine in 1969, then we suggest you write to Communications Research Bureau, Box 56, Commack, N. Y. 11725. They may have a list of emergency radio services that covers your locality. Include a stamped, self-addressed envelope with your request.

### PHILADELPHIA POLICE DEPT.

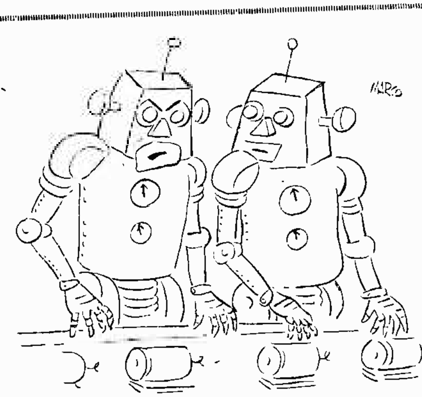
| | |
|---|---|
| KEX220 | 154.65 154.71 |
| KGF587 | 453.15 453.20 453.25 453.30 453.35 453.40 453.55 453.55 453.75 453.80 453.95 |

### PHILADELPHIA FIRE DEPT.

| | |
|---|---|
| KGB476 | 153.95 154.235 170.15 |

### PENNSYLVANIA MUNICIPAL, TOWN, & BORO POLICE/FIRE STATIONS

| Station | Police | | Fire | |
|---|---|---|---|---|
| Abington Twp. | KGA260 | 39.18 | KGC774 | 154.13 |
| | | | KGC368 | 154.13 |
| | | | KGC984 | 33.70 |
| Ardmore | | | KEO364 | 46.42 |
| Aston Twp. | | | KDU489 | 33.94 |
| Bally | | | KBQ387 | 46.10 |
| Bensalem Twp. | KAU696 | 155.37 | | |
| | | 155.55 | | |
| Berwyn | KGF305 | 45.62 | KGB827 | 33.90 |
| Bethel Twp. | | | * | 46.42 |
| Boothwyn | | | * | 46.42 |
| Booths Corner | | | KGE909 | 46.42 |
| Boyertown | | | KGD390 | 33.94 |
| Bridgeport Boro | | | KGE756 | 33.70 |
| Bristol | KFF353 | 155.37 | KGD366 | 46.10 |
| | | 155.55 | KGF733 | 46.10 |
| | KGB960 | 155.37 | | |
| | | 155.55 | | |
| Bristol Twp. | * | 155.37 | KGD367 | 46.10 |
| | | 155.55 | KGH408 | 46.10 |
| Briston | | | KGD829 | 46 10 |
| Brookhaven | | | KGT620 | 46.42 |
| Bryn Mawr | | | KGB861 | 33.70 |
| | | | | 33 90 |
| | | | mobiles | 33.42 |
| Center Point | | | KEU993 | 33 70 |
| Center Square | | | KGD513 | 33.70 |
| Chalfont | | | KGE263 | 46 10 |
| Cheltenham Twp. | * | 155 85 | KGE615 | 154.13 |
| Chester | KFA484 | 154.725 | KGB398 | 154 43 |
| Chester Hts. | | | mobiles | 46 42 |
| Collegeville | | | KGG324 | 33.70 |
| Colmar | | | KGF244 | 154 13 |
| | | | KJD313 | 154 13 |
| Conshohocken | | | KGC902 | 33 70 |
| | | | KGD760 | 33.70 |
| Cornwells | | | KGE437 | 46.10 |
| Cornwells Hts. | | | KBQ387 | 46 10 |
| | | | KGD988 | 46.10 |
| | | | KGE873 | 46.10 |
| | | | KGH700 | 46.10 |
| Croydon | KBH352 | 155.55 | KGE379 | 46.10 |
| | | | | 46 14 |



"I don't care what they say, Marvin—I'm bored!"

# WHITE'S PHILADELPHIA EMERGENCY STATIONS

| Station | Police | | Fire | |
|---|---|---|---|---|
| Doylestown Boro | KGF340 | 155.37 | KGD655 | 46.10 |
| | | 155.43 | KGF318 | 46.10 |
| | * | 155.55 | | 46.14 |
| Dublin | | | KGD774 | 46.10 |
| Eagleville | | | KGE954 | 33.70 |
| E. Coventry Twp. | | | KCT207 | 33.70 |
| | | | | 33.90 |
| E. Greenville | | | KGC818 | 33.70 |
| Eddington | | | KGD831 | 46.10 |
| Edgemont Twp. | | | | 46.42 |
| Elkins Park | KGA404 | 158.85 | KGC240 | 154.13 |
| | | | KGC995 | 154.13 |
| Exton | | | KGE515 | 33.90 |
| Fairless Hills | | | KDX425 | 46.10 |
| Fairview Village | | | KGC900 | 33.98 |
| Fallsington | | | KGD937 | 46.10 |
| Falls Twp. | * | 37.26 | | 46.10 |
| Feasterville | KGE414 | 155.37 | | |
| | | 155.55 | KGC892 | 46.10 |
| Folsom | | | KFT582 | 46.42 |
| Fort Washington | | | KGC299 | 33.70 |
| Garden City | | | KGF810 | 46.42 |
| Gladwyne | KGB325 | 158.73 | | |
| Glenside | | | KGC476 | 154.13 |
| | | | KGE979 | 154.13 |
| Gradyville | | | KDK642 | 46.42 |
| Green Lane | | | KGD336 | 33.70 |
| Green Ridge | | | KFO909 | 46.42 |
| Harmonville | | | KGB857 | 33.70 |
| Hartsville | | | KGF437 | 46.10 |
| Hatboro | | | KGC577 | 154.13 |
| Hatfield | | | KGF309 | 154.13 |
| Haverford Twp. | * | 39.90 | | 46.42 |
| Havertown | KGB239 | 39.90 | KGC512 | 46.42 |
| | | | KGD544 | 46.42 |
| Holmes | | | KEY935 | 46.42 |
| | | | KEY936 | 46.42 |
| | | | KGF717 | 46.42 |
| Horsham | | | KCV398 | 154.13 |
| | | | KGF350 | 154.13 |
| Hulmeville | | | KGD494 | 46.10 |
| Huntington Valley | mobiles | 39.19 | KGC271 | 154.13 |
| Ivyland | | | mobiles | 46.10 |
| Jamison | KDG637 | 155.43 | KFA426 | 46.10 |
| | | | mobiles | 33.70 |
| Jeffersonville | | | KGE477 | 33.70 |
| Jenkintown Boro | mobiles | 39.18 | KGC640 | 154.13 |
| Kennett Square | | | KGE294 | 33.90 |
| Kennett Twp. | | | KGE405 | 33.90 |
| Kimberton | | | KHJ665 | 33.90 |
| King of Prussia | | | KET243 | 33.70 |
| Kulpsville | | | KCR921 | 33.70 |
| Lacey Park | | | KCQ242 | 46.10 |
| Lafayette Hill | | | KGH341 | 33.70 |
| Lahaska | | | KGD477 | 46.10 |
| | | | KDZ403 | 46.14 |
| La Mott | | | KGC995 | 154.13 |
| Langhorne | | | KGD542 | 46.10 |
| Lansdale Boro | KGK647 | 154.755 | KGE438 | 154.13 |


"The machine did it by itself!"

| Station | Police | | Fire | |
|---|---|---|---|---|
| Levittown | mobiles | 155.37 | KEU921 | 46.10 |
| | | 155.55 | KGH406 | 46.10 |
| | | | | 46.14 |
| | | | KGH407 | 46.10 |
| | | | | 46.14 |
| Lima | | | KBE610 | 46.42 |
| Limerick | | | KEO230 | 33.70 |
| Line Lexington | | | KFT248 | 46.10 |
| Linfield | | | KEO362 | 33.70 |
| Linwood | | | KGE581 | 46.42 |
| Lower Makefield Twp. | KFF299 | 155.37 | | |
| Lower Merion Twp. | * | 158.73 | | 33.70 |
| Lower Moreland Twp. | * | 39.18 | | |
| Lower Southampton Twp. | * | 155.37 | | |
| | | 155.55 | | |
| Malvern | | | KGE327 | 33.90 |
| Marcus Hook | | | KGC873 | 46.42 |
| Marshallton | | | KGG344 | 33.90 |
| Media | | | KBK293 | 46.42 |
| Middletown Twp. | KGE363 | 45.22 | KGD321 | 33.90 |
| Milford Square | | | KGD414 | 46.10 |
| Morrisville Boro | mobiles | 37.26 | KDG803 | 46.10 |
| | | 39.06 | KGE827 | 46.10 |
| Morton | | | KGF561 | 46.10 |
| Neshaminy | KGE489 | 155.79 | mobiles | 46.42 |
| Nether Providence Twp. | * | 39.82 | * | 46.42 |
| New Hope | | | | |
| Newportville | | | KGF391 | 46.14 |
| Newtown | | | KGH405 | 46.10 |
| | | | KGF224 | 46.10 |
| | | | | 154.13 |
| Norristown Boro | KCA484 | 37.18 | KGE336 | 154.37 |
| | | | KGF983 | 33.70 |
| Northampton Twp. | * | 155.37 | * | 46.10 |
| | | 155.43 | | |
| North Hills | | | | |
| North Wales | | | KGC298 | 154.13 |
| Nottingham | | | KGC935 | 33.70 |
| Oakmont | | | KGH700 | 46.10 |
| Oaks | | | KBB835 | 46.42 |
| Ogontz | | | mobiles | 33.70 |
| Oreland | | | mobiles | 154.13 |
| Ottsville | | | KGB993 | 154.13 |
| Paoli | | | mobiles | 46.10 |
| Parkland | | | KGC513 | 33.90 |
| Parkside | | | KGD467 | 46.10 |
| Penndel | | | KCN702 | 46.42 |
| Pennsburg | | | KGD512 | 46.10 |
| Penns Park | KDZ425 | 155.37 | KGC549 | 33.70 |
| | | 155.43 | | |
| Perkasie | | | KGD586 | 46.10 |
| Perkiomenville | | | KFY403 | 33.70 |
| Plumsteadville | | | | 33.94 |
| Plymouth Twp. | | | KGD813 | 46.10 |
| Point Pleasant | | | * | 33.70 |
| Pottstown Boro | | | KGE687 | 46.10 |
| Prospect Park | | | KGF392 | 33.70 |
| | | | KGG370 | 46.42 |
| Quakertown Boro | KGE452 | 155.13 | KGD616 | 46.10 |
| Radnor Twp. | KGB330 | 155.37 | | |
| | | 45.50 | | |
| Red Hill | | | | |
| Richboro | KCI715 | 155.37 | KGD272 | 33.70 |
| | | 155.43 | KFZ814 | 46.10 |
| Richlandtown | | | KGE378 | 46.10 |
| Ridley Twp. | | | KDV811 | 46.10 |
| Riegelsville | | | * | 46.42 |
| Ringing Hill | | | KGE754 | 46.10 |
| Rockledge | | | mobiles | 33.70 |
| Roslyn | | | KGC529 | 154 13 |
| | | | KGD226 | 154 07 |
| Royersford | | | | 154 13 |
| Schwenkville | | | KGC999 | 33.70 |
| Sellersville | | | KGD372 | 33.70 |
| Sharon Hill Boro | KGB367 | 45.54 | KGS852 | 46.10 |
| Shinglehouse | | | KGD775 | 46.42 |
| Skippack | | | KFX406 | 46.10 |
| Solebury Twp. | KGF419 | 155.43 | KGG930 | 33.70 |
| Souderton | | | KFF291 | 33.70 |
| Southampton | KDZ451 | 155,37 | KGE802 | 46.10 |
| | | 155.43 | | |
| South Media | | | KGD349 | 46.42 |
| Springfield | | | KBA863 | 46.42 |
| Swarthmore Boro | KGA378 | 39.82 | | |
| Telford | | | KEG833 | 33.70 |
| Tinicum Twp. | mobiles | 45.74 | | |
| Trappe | | | KBX384 | 33.70 |
| Tredyffrin Twp. | * | 45.62 | | |
| Trevose | | | KGE421 | 46.10 |
| | | | | 46.14 |

| Station | | Police | Fire | |
|---|---|---|---|---|
| Trevose Hts. | | | KGE452 | 46.10 |
| | | | | 46.14 |
| | | | KDO246 | 47.46 |
| | | | mobiles | 46.10 |
| Trumbauersville | | | | |
| Tullytown | * | 155.55 | KGE638 | 46.10 |
| | | | | 46.14 |
| Tylersport | | | KEM672 | 33.70 |
| Upper Darby Twp. | KGA853 | 155.09 | KGA346 | 154.19 |
| Upper Moreland Twp. | * | 39.28 | | |
| Upper Pottsgrove | | | KGF463 | 33.70 |
| Upper Southampton Twp. | * | 155.37 | | |
| | | 155.43 | | |
| Valley Forge | | | KBB521 | 33.90 |
| Wallingford | KGD796 | 39.82 | | |
| Warminster Twp. | KDZ470 | 155.37 | KCQ242 | 46.10 |
| | | 155.43 | KGD741 | 46.10 |
| | | | | 46.14 |
| Warrington Twp. | KDA390 | 155.79 | KGD891 | 46.10 |
| | | | KGE910 | 46.10 |
| | | | * | 46.10 |
| Warwick Twp. | * | 155.43 | KGB393 | 33.70 |
| Wayne | | | | 33.90 |
| | | | mobiles | 46.42 |
| West Chester Boro | KGA612 | 45.42 | KGD665 | 33.90 |
| | Call | mHz | Call | mHz |
| West Conshohocken | | | KGD343 | 33.70 |
| West Park | | | KCO285 | 33.70 |
| | | | KJP390 | 33.70 |
| | | | KJD313 | 154.13 |
| West Point | | | * | 154.13 |
| Whitehall Twp. | | | KBS490 | 154.13 |
| Willow Grove | KFR636 | 39.28 | KGC578 | 154.13 |
| | | | mobiles | 33.90 |
| | | | | 46.10 |
| | | | | 46.14 |
| Wrightstown Twp. | * | 155.37 | | |
| | | 155.43 | | |
| Wycombe | | | KGD959 | 46.14 |
| Wyndmoor | | | KGD485 | 154.13 |
| Yeadon Boro | KGB242 | 39.42 | KG1257 | 46.36 |

## N.J. MUNICIPAL, TOWNSHIP, BORO POLICE & FIRE

| | | | | |
|---|---|---|---|---|
| Allentown | | | KDA357 | 154.43 |
| | | | KEH800 | 154.43 |
| Atco | KFR678 | 155.37 | KJB229 | 154.385 |
| | | | | 154.43 |
| Audubon Boro | KEB362 | 155.37 | KEE390 | 46.18 |
| | | | | 154.43 |
| | | | mobiles | 154.385 |
| Barrington Boro | KEF872 | 155.37 | KBT810 | 154.43 |
| Belmar Boro | * | 155.37 | | |
| Bellmawr | KEB473 | 155.37 | KCY548 | 154.43 |
| | | | KEV433 | 154.43 |
| Berlin Boro | KEX298 | 155.37 | | |
| Beverly | KEE941 | 155.49 | KDX508 | 154.385 |
| Blackwood | | | KEI808 | 154.385 |
| | | | | 154.43 |
| Blackwood Terr. | | | KEG955 | 154.43 |
| | | | KFA473 | 154.13 |
| Blawenburg | | | KJK804 | 154.31 |
| | | | mobiles | 154.13 |
| | | | KCQ270 | 154.43 |
| Bridgeport | | | | |
| Burlington Twp. | mobiles | 155.49 | KEG405 | 153.77 |
| Camden | KEB210 | 159.03 | | 154.43 |
| Cherry Hill | KEA395 | 155.52 | KDO312 | 154.43 |
| Chews Landing | | | KJH233 | 154.385 |
| | | | | 154.43 |
| Cinnaminson | KEB418 | 155.49 | KAY257 | 154.13 |
| Clarksboro | | | | |
| Clementon Boro | KEI436 | 155.37 | | |
| Collingswood | KEB356 | 156.21 | | |
| Delanco Twp. | KEE393 | 155.49 | | |
| Delran Twp. | KFG450 | 155.49 | | |
| Deptford Twp. | * | 158.97 | * | 154.13 |
| E. Greenwich Twp. | | | | |
| Edgewater Park Twp. | * | 155.49 | | |
| Ewing Twp. | * | 37.26 | * | 154.43 |
| Gibbstown | KED374 | 158.97 | KFR552 | 154.13 |
| Glendale | KDB419 | 155.37 | KDQ337 | 154.43 |
| Glendora | KEG297 | 155.37 | KEE544 | 154.385 |
| | | | | 154.43 |

| Station | | Police | Fire | |
|---|---|---|---|---|
| Gloucester Twp. | KEA788 | 155.37 | KEH660 | 154.43 |
| | | | * | 154.385 |
| Greenwich Twp. | * | 158.97 | * | 154.13 |
| | | | | 154.385 |
| Groveville | | | KDL820 | 154.43 |
| | | | KED409 | 154.43 |
| | | | * | 154.385 |
| Haddon Twp. | * | 156.21 | | 154.43 |
| Haddonfield | KEB467 | 155.43 | KEC380 | 154.43 |
| Haddon Hts. Boro | KEB374 | 155.37 | KDG375 | 154.43 |
| Hamilton Twp. | * | 37.26 | KEE555 | 154.43 |
| Hamilton Sq. | | | KEA517 | 154.43 |
| Hightstown | | | KDL923 | 154.43 |
| | | | KDL924 | 154.43 |
| | | | KEC839 | 154.43 |
| Hopewell | | | KEB588 | 154.13 |
| Jobstown | | | KB1956 | 154.13 |
| Juliustown | | | KEH309 | 154.13 |
| Lambertville | | | KEF750 | 33.74 |
| Laurel Spgs. Boro | KED296 | 155.37 | KEG971 | 154.385 |
| | | | | 154.43 |
| Lawrence Twp. | * | 37.26 | * | 154.43 |
| Lawrenceville | mobiles | 37.26 | KEF543 | 154.43 |
| Levittown | * | 155.49 | | |
| Lindenwold Boro | KDY440 | 155.37 | | |
| | KED790 | 155.37 | | |
| Magnolia | | | KDA708 | 155.43 |
| Maple Shade Twp. | KEB870 | 155.49 | KBT211 | 154.13 |
| | | | | 154.43 |
| Medford Twp. | KJD335 | 155.49 | KBR240 | 154.13 |
| | | | KDK703 | 154.13 |
| Merchantville Boro | KFD660 | 156.61 | KEG600 | 154.385 |
| | | | | 154.43 |
| | | | KUA762 | 154.385 |
| | | | | 154.43 |
| | | | * | 154.13 |
| Montgomery Twp. | | | | 154.31 |
| Moorestown Twp. | KEB309 | 155.49 | KBR647 | 154.13 |
| Mt. Airy | | | KEE767 | 33.74 |
| Mt. Ephraim Boro | | | KDJ512 | 154.385 |
| | | | | 154.43 |
| | | | KDJ513 | 154.385 |
| | | | | 154.43 |
| | | | KDJ514 | 154.385 |
| | | | | 143.43 |
| Mt. Holly Twp. | KEB452 | 155.49 | KAQ261 | 154.13 |
| Mt. Laurel Twp. | KDK775 | 155.49 | | |
| National Park Boro | KCK314 | 158.97 | | |
| Oaklyn Boro | KEG942 | 156.21 | KEG643 | 154.43 |
| | | | KF1597 | 154.43 |
| Palmyra Boro | KEB346 | 155.49 | | |
| | KEE554 | 155.49 | | |
| Paulsboro Boro | KEB327 | 158.97 | KEJ883 | 154.13 |
| Pemberton | | | KED825 | 154.13 |
| Pennington | | | KED824 | 154.13 |
| | | | KEI930 | 154.13 |
| Pennsauken Twp. | KEB345 | 155.61 | KEE490 | 154.13 |
| | | | KEU999 | 154.13 |
| Princeton Univ. | KDV709 | 155.415 | | |
| Riverside Twp. | KEA415 | 155.49 | | |
| Rocky Hill | | | KIZ210 | 155.31 |

"Say, 'Green cheese.'!"

# WHITE'S PHILADELPHIA EMERGENCY STATIONS

| Station | Police | | Fire | |
|---|---|---|---|---|
| Runnemede Boro | KEC963 | 155.37 | KEF932 | 154.43 |
| | | | KFT567 | 154.43 |
| Sergeantsville | | | KCU294 | 33.74 |
| Sewell | | | KFO890 | 154.13 |
| Somerdale Boro | KED959 | 155.37 | | |
| Springfield Twp. | | | * | 154.13 |
| Stockton | | | KDN919 | 33.74 |
| Tewksbury Twp. | | | * | 33.74 |
| Thorofare | | | KJD911 | 154.13 |
| Titusville | | | KEB973 | 154.13 |
| | | | KGL510 | 154.13 |
| Trenton | KEB276 | 37.26 | KDG330 | 154.43 |
| | KGV253 | 37.26 | KEA739 | 154.43 |
| | | | KED796 | 46.38 |
| | | | KEG274 | 154.43 |
| | | | KEG513 | 154.43 |
| | | | KFK665 | 154.43 |
| | | | KJD337 | 154.43 |
| | | | KJE251 | 155.16 |
| Vincentown | | | KEE921 | 154.13 |
| Voorhees Twp. | * | 155.37 | * | 154.43 |
| Waterford Twp. | * | 155.37 | * | 154.385 |
| W. Amwell Twp. | | | * | 33.74 |
| Westmont | KEB484 | 156.21 | KEE719 | 154.385 |
| | | | | 154.43 |
| Westville Boro | KEE405 | 155.37 | KED463 | 154.43 |
| White Horse | | | KEE593 | 154.43 |
| Willingboro Twp. | KEI693 | 155.49 | | |
| Woodbury | KEA936 | 158.97 | KAQ657 | 154.13 |
| | KEJ871 | 158.97 | | |
| Woodbury Hts. | | | KEG635 | 154.13 |
| Yardville | | | KDL821 | 154.43 |
| | | | KDL822 | 154.43 |

| | | |
|---|---|---|
| Bondentn. Twp. | KDA705 | 154.22 |
| Bordentown | KDN521/KEY873/KJR346 | 154.22 |
| Burlington | KEG961 | 154.22 |
| Burlngtn. Twp. | KDN522 | 154.22 |
| Crosswicks | KDK771 | 154.22 |
| Delanco | KDK631 | 154.22 |
| Levittown | KDB501 | 154.22 |
| Lumberton | KDK740 | 154.22 |
| Maple Shade | KBZ425 | 154.22 |
| Marlton | KF1496 | 154.265 |
| | KFT603 | 154.22 |
| Masonville | KJJ445 | 154.22 |
| Medford | KDK632 | 154.22 |
| Moorestown | KFO815/KJJ446/KJJ447 | 154.22 |
| Palmyra | KBW792/KDZ359 | 154.22 |
| Riverside | KDB499/KDF563/KDX465 | 154.22 |
| Riverton | KDK741 | 154.22 |
| Willingboro | KEP638 | 154.22 |

## DELAWARE RIVER PORT COMMISSION P.D.

| | | |
|---|---|---|
| KEA651 | Camden, N.J. | 158.79 |
| KEF977 | Camden, N.J. | 154.89 |
| KGA518 | Philadelphia, Pa. | 158.79 |
| KGE905 | Philadelphia, Pa. | 154.89 |

## BUCKS COUNTY (Pa.) AGENCIES

| | | |
|---|---|---|
| KC1570 | Doylestown (police) | 155.13 155.37 155.43 155.55* |
| KGF318 | Doylestown (fire) | 46.14 |

* Main channel

## CHESTER COUNTY (Pa.) POLICE/SHERIFF

| | | |
|---|---|---|
| KIZ567 | W. Chester | 154.785 |

## DELAWARE COUNTY (Pa.) AGENCIES

| | | |
|---|---|---|
| KDK667 | Media (fire) | 46.36 46.42 |
| KGA905 | Media (police) | 39.82 |

## MONTGOMERY COUNTY (Pa.) POLICE/SHERIFF

| | | |
|---|---|---|
| KGA243 | Eagleville | 45.26 45.46 |
| KGA243 | Norristown | 45.26 45.46 |

## BURLINGTON COUNTY (N.J.) AGENCIES

| | | |
|---|---|---|
| Police— | | |
| Marlton | KFT545 | 155.49 |
| Mt. Holly | KEE508/KFR662 | 155.49 |
| Riverside | KFR660 | 155.49 |
| Willingboro | KFR661 | 155.49 |
| Fire— | | |
| Beverly | KDG405 | 154.22 |

## CAMDEN COUNTY (N.J.) AGENCIES

| | | |
|---|---|---|
| Police— | | |
| Lakeland | KBM912 | 155.37 |
| Fire— | | |
| Lakeland | KBK523 | 154.265 154.385 154.43 154.43 |
| Runnemede | KEM667 | 154.43 |
| | KEM666 | 154.385 154.43 |
| | KFT567 | 154.43 |

## GLOUCESTER COUNTY (N.J.) AGENCIES

| | | |
|---|---|---|
| KAV708 | Woodbury (fire) | 154.13 154.265 |
| KBC661 | Woodbury (police) | 158.97 |

## PENNSYLVANIA STATE POLICE

| | | |
|---|---|---|
| KDN502 | Philadelphia | 42.62 |
| KFM497 | Trevose | 42.62 |
| KGA990 | Philadelphia | 42.62 |
| KGA992 | Lionville | 42.62 |
| KGA999 | Quakertown | 42.62 |
| KGD352 | Spring City | 45.14 |
| KGD369 | Media | 42.62 |
| KGD370 | Buckingham Mtn. | 42.62 |

Turnpike: 155.67 155.91 159.21

## NEW JERSEY STATE POLICE

| | | |
|---|---|---|
| KEA810 | Voorhees Twp. | 44.62 44.66 44.94 154.68 154.92 |
| KEA814 | Hightstown | 44.62 44.66 44.94 154.68 155.445 |
| KEA818 | Mantua Twp. | 44.62 44.66 44.94 154.68 154.92 |
| KEF823 | S. Hampton Twp. | 44.62 44.66 44.94 154.68 154.92 |
| KEA826 | Edgewater Twp. | 44.62 44.66 44.94 154.68 155.445 |
| KEA832 | Trenton | 44.62 44.66 44.94 154.68 155.445 |
| KEA833 | Woodstown | 44.62 44.66 44.94 154.68 154.92 |
| KEA834 | N. Hanover Twp. | 44.62 44.66 44.94 154.68 155.445 |
| KEC848 | Plainsboro | 44.62 44.66 44.94 154.68 155.445 |
| KEC877 | Bordentown Twp. | 44.62 44.66 44.94 154.68 155.445 |
| KED722 | Washington Twp. | 44.62 44.66 44.94 154.68 154.92 |
| KFX347 | Hopewell | 44.62 44.66 44.94 154.68 155.445 |

(N.J. Turnpike: 154.83 155.19)

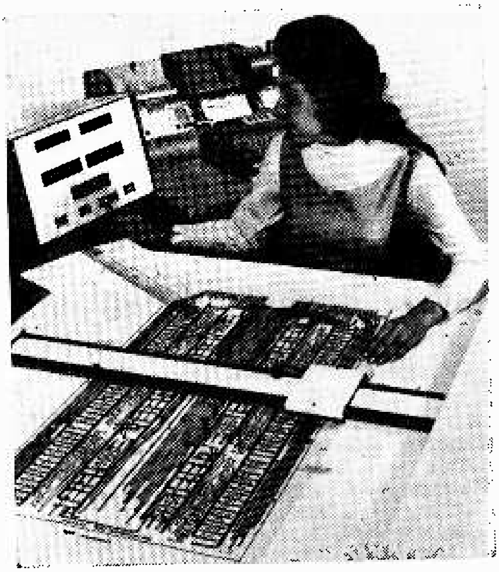
## Positive Feedback

*Continued from page 10*

In the construction field, calculating the amount of concrete needed to resurface a road becomes as simple as tracing an aerial photo of the route, eliminating the extensive ground surveying normally required.

As the operator of the breadbox-size instrument traces the blueprint or photo, 264 of the latest Texas Instruments integrated circuits (ICs) within the unit translate straight and curved movements of the plotting cross hairs into computerized number codes. The numbers are displayed as illuminated digits on the control console and are transmitted to a computer card punch or an incremental tape deck.

"Before the new, low-cost TI integrated cir-



*Converting graphic material like this electronic circuit into computer language is as easy as tracing lines with MicroMetric Corporation's new digitizer system. As the operator traces the drawing on the plotting table, 264 Texas Instruments integrated circuits within the scaler cabinet (left) convert drawing coordinates into digital language for storage on computer cards or tapes. MicroMetric's innovative use of recent TI circuits resulted in a scaler which is 25 percent less expensive, less than a third as heavy and less than a fourth as large as less-capable scaling equipment formerly available.*

cuits were available, a comparable digitizer would have been too expensive, too slow, too large and too unreliable for most users," Mr. Elisher, a spokesman for MicroMetric, said. "The scaler we've developed is 25 percent less expensive, less than a third as heavy and a fourth as large as less-capable two-dimension scalers which preceded it.

"In addition, the higher speed of the new TI transistor-transistor logic (TTL) microcircuits open up a wider range of possible applications," he said. "For example, interferometer systems for measuring large precision-machined metal parts can now count at rates exceeding 300,000 cycles per second.

"Older systems could not count above 50,000 cycles per second. But the high-speed TI circuits easily operate at 5 million cps—well above the requirement for this application. This high speed means greater accuracy and shorter production times for interferometer users.

"There's a common computer practice called 'time sharing'," Mr. Elisher said. "In most instances, it means several companies sharing a single computer whose calculating speed is so great that ownership of the computer could not be justified by one company alone.

"Time-sharing as applied to the MicroMetric scaler, however, refers to the sharing of certain circuits among the three rows of illuminated numericals on the scaler's front panel. The circuitry computes one axis, then the second, then the third, and repeats—all so quickly that to the human eye, the three rows of numerals seem to be changing simultaneously.

"This time-sharing of circuitry gives equipment designers an important new area for cost-saving," he said. In MicroMetric's case, time-sharing cuts many logic circuits by a factor of 17, and failure-prone connections within the system by a factor of three.

**Reader Mail Department.** This Editor receives considerable mail requesting a source for vintage tubes of the pre-war era. (Naturally, I mean World War II.) Well, Arcturus Electronics Corp. has been lucky enough to acquire over 9800 obsolete tubes of 1925-1930 vintage. These tubes have been added to their inventory of other hard-to-obtain types, which, on the evidence, many of our readers would be interested in obtaining. Does Arcturus have the vacuum tube you want? There's only one way to find out —write, requesting a listing of available tubes plus prices. Both appear in their mid-1969 catalog, and it's yours for the asking. Just drop a postcard to Arcturus Electronics Corp., Dept. JS, 502 22nd St., Union City, N.J. 07087. Be sure to say that you read about it in SCIENCE AND ELECTRONICS.

**Oil Down There!** A helicopter-transported oil prospecting device developed by Sinclair Oil's Tulsa Research Center has been used successfully in the muskeg areas of the Arctic North Slope of Canada where conventional methods are both slow and costly. The device, mounted on a quadrapod, is known as the Helicopter Dinoseis system. It is used in locating underground geologic structures which may contain oil or gas.

Resembling moon vehicles in appearance, the Dinoseis quadrapods are sturdily constructed yet light enough to be transported from one shot point to another by helicopter.

The Helicopter Dinoseis system is composed of a 24-inch diameter expandable seismic energy generator chamber suspended between the legs of a quadrapod and resting on the ground. A confined mixture of oxygen and propane is exploded in the chamber by an electrical spark, driving the bottom steel plate against the ground and imparting high-frequency seismic waves into the earth to subsurface rock formations.

Reflected waves were recorded on analog seismic equipment in the Canadian operations, but the same could be recorded on digital seismic gear.

A control module, equipped to serve five exploder units, carries propane and oxygen which fuel the seismic generators, a compressor to provide air used in a recoil system and a generator for power for the control system and radios.

*(Turn page)*

# Positive Feedback

*Continued from previous page*

The eight seismic energy generators are fired simultaneously by radio from the recording unit, and may be pulsed each 10 seconds.

In the Canadian operations, the helicopter moved eight quadrapods and their Dinoseis exploders, two control modules, recording equipment, and personnel one-half mile from one shot point to another in 17 minutes.

"We are extremely gratified by results on these initial operations," F. R. Fisher, head of the Research Center, said. "Mechanical operations were excellent, data quality was comparable and cost was significantly lower than the conventional dynamite and shot-hole method. We are encouraged to believe the Helicopter Dinoseis seismic exploration system will provide the answer to the logistical and economic problems of conducting seismic work in the remote areas of the world."

**"Hi There, Big Boy!"**, said in a sexy voice may mean nothing more to an IBM engineer than the punch card that programmed it. It's all because some IBM engineers developed an experimental device that helps improve the naturalness of synthesized human speech.

The new device—called a formant generator—has application in machine-to-man voice communication devices. Computer-based systems using formant generators could be used to provide stock market quotations, telephone information assistance and satellite commands.

The formant generator is a digitally tunable filter which simulates resonances in the human vocal tracts (formants) during speech. Three of the formant generators, each covering a specific frequency range, are used to simulate the three lowest resonances of the human vocal tract. These devices are also modified and used in the same speech synthesizer to simulate nasal (such as "m" and "n") and fricative (such as "f", "v" and "sh") sounds. (Fricative—that's a word you don't fool with!)

Information on the components of speech is used to design the controls for the formant generators. These are initially fluctuating waveforms—subsequently converted to digital data—which determine the frequencies and amplitude of the sounds produced. One source of such information is sound spectrograms.

This information, after digitizing, is stored by a computer. It is then used to vary the frequencies of the three formant generators in complex combinations to simulate the rapidly shifting formants of human voice. These formants are combined with the output of other speech sound generators and filters—fricative, nasal, hiss and "buzz"—to produce recognizable, "spoken" sounds.

*A member of the IBM Speech Synthesis Laboratory showing a sound spectrogram of the phrase "allow young Willie." The spectrogram illustrates the three lowest formants of speech, indicated by the dark, horizontal bars. The addresses for the three formants are stored by a computer and used to vary the three formant generators required for speech synthesis.*

The formant generators filter the complex waveforms obtained from a broadband source. Each consists of an attenuator between two amplifier-type integrators, plus a feedback circuit. Attenuation, determined by the digital address from a computer, is obtained by turning on different transistors which modify amplifier gain. All frequencies, however, are not attenuated equally, and the frequencies selected vary with the amount of attenuation. The least-attenuated frequencies, returned to the input by the feedback circuit, determine the frequency range of the generated formant.

It'll be a long time before the female operator's voice at the other end of a telephone line is computerized. So dream on, lads, while our dreams may still be real.

**Pure $H_2O$.** A water purification system utilizing ozone has been developed for the millions of homeowners, farmers and small commercial businesses who derive their water from the 15-million wells in America and other private sources. Many of these wells contain undesirable impurities and as time goes by the situation gets worse.

Ozone reportedly oxidizes from water harmful pollutants such as sulphur, bacteria, virus, and many other kinds of impurities. It is also reputed to keep pipes and plumbing free of blackening and damaging corrosion, and it eliminates the tastes and odors of sulphur and other unpleasant substances. Ozonator Corporation of Batavia, N. Y., creators of the system, also maintains that water purified with ozone contains no residual taste or odor that is the case with conventional chlorine or other chemical equipment.

Ozone is an activated oxygen molecule, formed when air is charged by electricity. It is familiar in nature as that fresh smell after a lightning storm. Ozone is unstable, and when bubbled through a household water supply it readily combines with and oxidizes existing impurities.

Ozone's purification properties have been known for hundreds of years. Paris and many other cities in France and Germany have used ozone to purify municipal water since the early 1900s. Until the development of the Ozonator Corporation system, however, ozone was too expensive to produce for application to household water purification.

Ozonator Corporation reports the purifier to be completely automatic and self-regulating. There are no chemicals to add or replace, no backwashing is necessary, and it is unconditionally guaranteed. Since air and electricity are the only raw materials, there is a minimum of maintenance. The Ozonator unit is compact, easy to install, and operates inexpensively from standard household electrical outlets.

This water purification system is fine, if all you need is a glass of water. However, industry needs can only be solved with major sea-water purification plants. ■

## Bookmark

*Continued from page 13*

both the usual everyday color TV troubles, as well as those tough dogs run into once in a blue moon. Here are common sense service bench approaches for solving all sorts of color TV troubleshooting problems, many of them adapted from well-established B&W techniques.

Definitely not a textbook, *On the Color TV Service Bench* tells how to tackle specific problems in a logical, professional way. Moreover, the author clearly explains how the operation of each circuit is affected by specific faulty components. One doesn't have to be an engineer to understand and use the information; it's all boiled down to essentials, including clear-cut facts evolved from numerous case histories. The reader will find the step-by-step alignment instructions—RF, IF, chroma, demodulators, etc.—greatly simplify those mysterious techniques that all too many technicians shy away from. The author shows how to really get that dusty alignment gear to work—even how to use it for troubleshooting purposes.

The book starts right out by unscrambling those tough "brightness" problems, revealing cures for dozens of elusive troubles in a number of familiar chassis. Following the same style of treatment, the content progresses through horizontal deflection systems, horizontal oscillators, high-voltage regulator systems (shunt, feedback, and pulse-controlled), vertical deflection systems, video amplifiers, chroma IF circuits, color sync circuits, color killers and burst amplifiers, and color demodulators. The final chapter describes a number of post-repair techniques which make the difference between simple "patching up" and restoring a receiver to like-new operation. To get your copy, write directly to the publisher. Tab Books, Blue Ridge Summit, Pa. 17214 and tell him the ol' Bookworm sent you. ■

## Stamp Shack

*Continued from page 8*

blue waves emanate to cover the entire area of the vignette. These represent stereo FM, a service that was introduced to China on the anniversary occasion.

*China 40th Anniversary Postal Administration Issue 1968*

● BCC today transmits 556½ hours of radio programs each day, the various ones intended for domestic, international and particularly mainland China reception. This is possible by the use of ten 50-KW transmitters. In addition to the stations in Taipeh, BCC operates facilities in ten other Formosan cities to form what is called "The Mandarin Network."

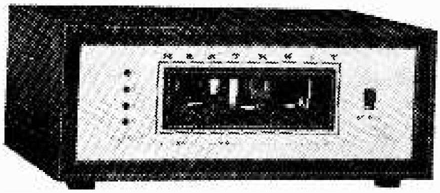
**● ● What's New?**

● The Space City Cover Society, Box 53545, Houston, Tex. 77052, has been preparing and processing commemorative covers in connection with the liftoff and landing of virtually every NASA Spacecraft. Collectors interested in such souvenir covers may write to M. Allen Banks, the society's director, for details.

● One of the more useful books which collectors should own is "Identify Your Stamps," by Ervin J. Felix. It is available from the Whitman Publishing Co., Racine, Wis. 53404, at $2.50. Its 260-pages are packed with answers to questions which constantly confound beginners (and some veterans). ■

# New Products

*Continued from page 17*



*Heathkit GD-28 8-Track Stereo Tape Player*

Heath says it should only take about 6 hours to put together. The GD-28 comes with a walnut-grained polyurethane cabinet and necessary connecting cables and operates from 120 volts. Price in kit form is $59.95 from the Heath Co., Benton Harbor, Mich. 49022.

## Lazy Private Listening

If you're just too tired to get up and cross the room to adjust controls while enjoying your stereo headset, Allied has a unit for you. The Allied Stereo Headphone Remote Control, Model H-879, permits a listener to adjust the volume of one or two headphones from his chair. The unit has an *on-off* switch for speakers, two volume controls and standard ¼-in. headphone jacks. The headphones plug into the remote control which connects with low-priced cable to the amplifier or receiver. Size of Allied's H-879 is 2¾ x 4 x 2 in. and the price is $9.95. A 25-ft. roll of cable costs $1.60. In all Allied stores or by mail from Allied Radio Corp., 100 No. Western Ave., Chicago, Ill. 60680.


*Allied Stereo Headphone Remote Control H-879*

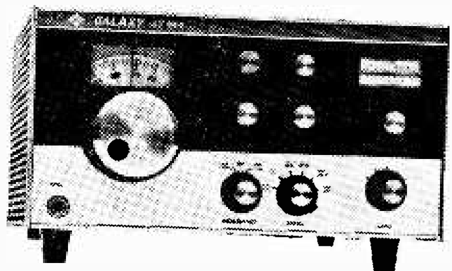
## Just Give Us the FAX

Distributed by Martel Electronics, this is the Rotel 550 AM/FM/Multiplex receiver, which gets a rating of 70 watts IHF. The 550 has front-end tuning, individual bass and treble controls for each channel, loudness control for boosting extreme highs and lows at moderate listening level, and a wide power bandwidth. The tuner is designed for both AM and FM and will lock onto a station even in low reception areas. There is a smoked-glass dial and brushed gold face plate. Price is $299.50 and you can write for further specs to Martel Electronics, 2339 S. Cotner Ave., Los Angeles, Calif. 90064.

*Rotel 550 AM/FM/Multiplex Receiver*

## Pro Transceiver for Hams

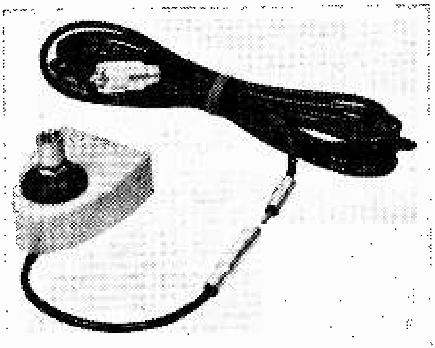
Here is a brand-new transceiver from Galaxy, the GT-550, complete with a line of accessories. The Galaxy GT-550 is a 5-band SSB unit designed for either mobile or fixed station use by amateur radio operators. Really compact, 11¼ x 12⅜ x 6 in., and weighing only 17 lb., it has 550 watts SSB power, 360 watts CW. Price of the GT-550 is $449.00. The Galaxy accessories include: the LA amplifier at $495.00, the RF console at $69.00, the remote VFO at $75.00, and the speaker console at $19.95. Available optional accessories are: AC power supply, mobile power supply, phone patch, CW filter, VOX accessory, calibrator, mobile mounting bracket, and a floor-board adapter. For a brochure with complete specs on the line write Galaxy Electronics, 10 S. 34th St., Council Bluffs, Iowa 51501.



*Galaxy GT-550 Transceiver*

## Antennas, to the Rear!

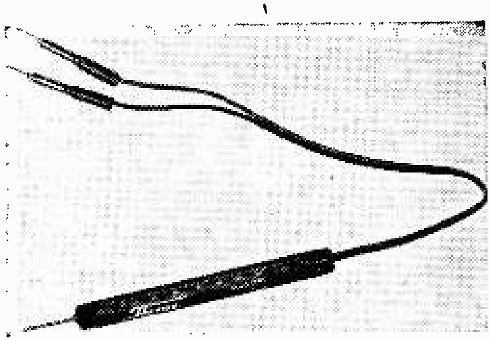
Model TLM is an antenna trunk lip mount which requires neither drilling nor defacing of your vehicle. The clamp and antenna base support are constructed from ⅛-in. carborized plated steel and the mount cover is grey Cycolac plastic. Easily installed in seconds on the rear or side of any automobile trunk lip, TLM will give lowest SWR and minimum noise. The assembly includes New-Tronics' break-cable adaptor with all connections factory soldered plus a special coax cable retainer to protect it when the trunk lid is closed. Model TLM will accommodate a wide selection of antennas with the standard ⅜-in. base. No special tools required. Price is $8.95 and inquiries should be directed to Sales Dept., New-Tronics Corp., 15800 Commerce Park Dr., Brookpark, Ohio 44142.



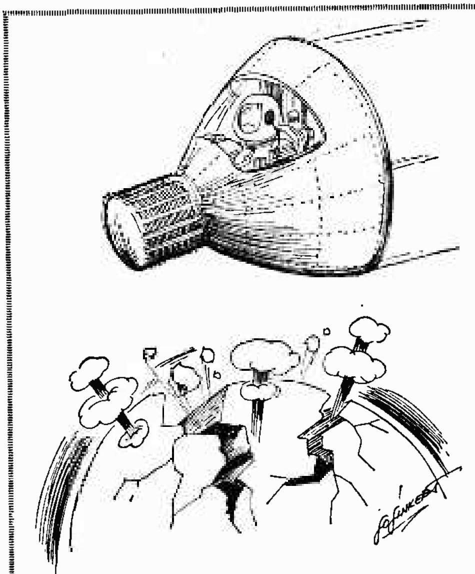
*New-Tronics TLM Trunk Lip Mount*

## Take Your Component's Temp?

Just a mite bigger than a fountain pen, Thermy is a handy new sensing device that quickly gives accurate temperature readings of any solid or liquid with which it is placed in contact. Thermy will electronically measure temperatures from −60°F to 400°F or from −50°C to 200°C, used in conjunction with a quality voltmeter or multitester. You get temperature data beyond the capabilities of ordinary mercury thermometers because its two 40-in. long leads and its 1½-in. long steel probe tip permit entry into heretofore inaccessible areas. A sensitive thermal unit inside the probe increases in resistance as it cools, lowers in resistance as it heats. When you use Thermy with a multitester, hold the probe tip against an object for a quick resistance read-out. A conversion scale is provided to translate ohms to F or C degrees. In a protective case, Thermy is priced at $14.95, and for more info write Mura Corp., 355 Great Neck Rd., Great Neck, N.Y. 11021.



*Mura Corp. Thermy*



"Sorry, the number you have dialed is permanently out of order!"

## Univox Super Fuzz Box

*Continued from page 72*

For example, Fig. 1 is EXPANDER *off*; Fig. 2, about ¼ EXPAND; Fig. 3, ½ EXPAND and Fig. 4, ¾ EXPAND. (Full expansion is bearable only by Martians.) The two-position TONE switch provides either the basic type of fuzz effects such as represented in Figs. 1 to 4, or the impulse effects as in Figs. 5 to 7.

**How It Works.** Since the circuit types and schematic of the Univox is one of the world's best kept secrets, and since we could not crack the circuit in a reasonable time, we must make an educated guess. First off, there is a clipper such as found in all fuzz-boxes. Then there appears to be self-oscillation triggered by positive feedback above a predetermined level, as set by the EXPANDER control. Finally (and this is a far-out guess), a multivibrator triggered by the positive and negative peaks of the basic waveform provides the impulses.

The Univox *Super-Fuzz* is priced at $24.95, including one connecting cable and a 9-V battery. For additional information write Lafayette Radio Electronics Corp., Dept. S, 111 Jericho Tpke., Syosset, N.Y. 11791. ■

## Ham Traffic

*Continued from page 77*

erating privileges, each of us should do a share of getting rid of the hooligan ham who has become noteworthy enough to be mentioned in the FCC's official report. And condemnation on the air won't do it—that's merely stooping to this alley cat trend which we're trying to wipe out. But total ostracism of any ham who doesn't behave himself on the air can be effective. Make a firm resolution to have nothing to do with a fellow whose behavior on the air is open to question. Once he runs out of people to talk to, he will mend his ways.

**Instant Emergency Network.** Some scoffers say that hams no longer can be really effective in providing emergency communications. But an ever-growing group on 40-Meter phone is proving this just isn't so!

These fellows and gals have set up a full-time emergency net that spans the U.S. from coast to coast. And they keep it operating every day of the week and almost around the clock! The beauty of the thing is that the net is organized so it can be strictly an easy-going-type operation. However, it can be instantly switched into a brisk, efficient emergency net when the need arises.

At a time when idle rag chewing seems to be taking over the low phone bands, these operators are showing the world they have a serious interest in using their ham rigs for work, not just for play.

You've read about the West Coast Amateur Radio Service (WCARS) in this column before. That net has been operating since 1963 on 7255 kHz. Its main function has been to provide the system for mobiles encountering traffic accidents, fires, or other emergencies to be able to notify the proper authorities through operators who monitor this frequency at home. Western highways carry a lot of traffic, and sometimes help is quite a ways away in the wide open spaces. Result is that this net has helped a lot of people in trouble over the years.

Last year, the Mid-Western Amateur Radio Service (MWARS) went into operation to serve the same function in the middle of the country. Now this year the East Coast Amateur Radio Service (ECARS) went into operation. All three nets operate on 7255 kHz except when propagation conditions cause them to interfere with each other. Then MWARS moves to 7258 and ECARS moves to 7253.

The practical value of this nation-wide emergency setup was first proved when a mobile in Georgia encountered a serious automobile accident and couldn't raise anyone in his area to call the police. The West Coast group heard his calls, however, and an Arizona station called that state's Highway Patrol, which had hot-line communications with Georgia authorities.

This story brings up the question: why don't hams have more emergency monitoring frequencies set aside for just such occurrences? Actually, this is an old idea which has been tried many times, but it has only been a success over a wide area since these 40-Meter groups got interested.

For many years in the past, the ARRL designated a frequency in each band, both phone and CW, for "National Calling and Emergency Frequencies." For a while, the League's Official Observer corps was requested to send post cards to casual users of these frequencies, notifying them of the voluntary plan to keep these frequencies clear for emergency calls.

However, the idea never really caught on. Everybody agreed it sounded good, but few operators made the effort to make the idea work. Now, though, with the leadership and enthusiasm shown by these three regional emergency nets, the idea of full-time emergency frequencies is gathering momentum again.

Maybe you're interested? If so, listen in on 7255 kHz for a while to learn how they operate. They'll be glad to have you join them. And if you're on a trip with a 40-Meter mobile rig in your car, try monitoring this frequency as you drive along. ■

"High voltage was my problem."

Just about everyone has heard the "tock, tock, tock" of WWV—the big U.S. time station. Tune 'em in and send a report today.

## Their Time Is Your Time

*Continued from page 51*

As with most Down Under stations, listeners will find our early morning hours best. Generally, its 10-kW transmitters on 5.425 and 7.515 MHz are audible after 1200 GMT. Before that, your best bet is 12.005 MHz.

Our list shows a broad cross section of some of the standard time stations now on the air. Some are sure bets; others will really try your skill, patience, and—you guessed it—luck. With the time services you can never be sure what will pop up next. But whatever it is, you're in for a good time! ■

## Famous Patents

*Continued from page 78*

The court battle dragged on for years, finally reaching the Supreme Court in 1943. Nearly 40 years after the patent was granted, the highest court in the land found Marconi's patent claims invalid.

But even the wise old men of the Supreme Court couldn't agree completely. In a split decison, three of the judges strongly disagreed with the majority.

One dissenting judge, Mr. Justice Rutledge, attacked the decision of his colleagues with the statement:

"Before his (Marconi's) invention . . . ether borne communication traveled some eighty miles. He lengthened the arc to 6000. Whether or not this was 'inventive' legally, it was a great and beneficial achievement. Today, forty years after the event, the Court's decision reduces it to an electrical mechanic's application of mere skill . . .

"By present (1943) knowledge it would be no more. School boys and mechanics now could perform what Marconi did in 1901. But before then wizards had tried and failed." ■

Copies of Marconi's Four-Circuit Tuning patent are available for fifty cents each from the U.S. Patent Office, Washington, D.C. 20231. In ordering, give the number of the patent—No. 763,772.

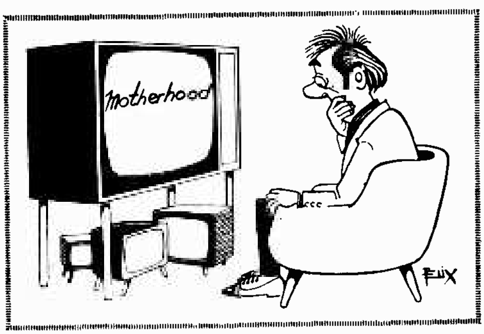
## Police Convertor

*Continued from page 43*

and hunt for the stations—and hope they come on while you're tuning.

Sometimes better reception may be obtained on different parts of the FM band; for example, you may get better reception with the radio tuned to 90 MHz than to any other frequency slot in the band. Once you have the vhf band tuned in, experiment with the radio's tuning and R1's adjustment.

**Using the Converter.** Keep in mind that police and fire calls, are not broadcast continuously as are the broadcasts from AM radio stations. These FM transmissions are of short duration and then the carrier goes off. If you try to adjust the converter during a slack part of the day, it may be minutes or even an hour between calls—for all intents and purposes the band might appear dead. Just because you can't tune in a signal don't assume the converter isn't working. ■



## The Skies Above Us

*Continued from page 45*

Now, astronomers have discovered that a star close to the center of the Crab Nebula is changing in brightness at the rate of once in a thirtieth of a second. This star must be the "villain of the piece." This is the remnant of the star which, about four thousand years ago, "blew its top."

Almost everyone today knows that an atom consists of positively-charged particles (protons) plus an equal number of negatively-charged particles (electrons) to make the atom electrically neutral. If the electrons and the protons are smashed together because of intense gravitational attraction, they make neutrons. These neutrons will not give off visible light but, around them, compressed into a hard ball, may be a few normal atoms.

These "neutron stars" may be much heavier and denser than our sun or any matter we know or can imagine, yet be only 10 miles or so in diameter. Such an unbelievably dense ball may spin on its axis in a fraction of a second and, if one side is brighter than any other part, the flickering of a pulsar may be explained, say the experts.

★ The crux of the matter is: have we found in the faint star near the middle of the Crab Nebula an example of these collapsed, exceedingly-condensed, hypothetical neutron stars?

There were the "quasars," objects which, like the pulsars, were discovered by radio telescopes. Instantly, some astronomers, especially the younger and young middle-aged ones, had instant explanations for these new-found objects, and their "explanations" fell, one-by-one, by the wayside. After several years, we don't yet know whether the quasars are near-by objects of reasonable radiation or enormously distant objects violating all of our previously-derived laws of nature, including impossibly-high emission of energy and impossibly-fast apparent velocities of recession—faster than the velocity of light.

Too many young astronomers and physicists want to get too quickly into the act. We might compare this with what Dr. Thomas Gold, a few years ago, said about the surface of the moon—that it was an ocean of dust, and any man who stepped on it would be drowned and smothered by dust. We have landed many Surveyor probes on the moon, and they have not been swallowed by dust.

★ Why don't the youngsters in astronomy wait, before they rush into print, for at least one second thought—about lunar surface dust, quasars, pulsars, and so on—so they can sacrifice immediate notoriety in favor of possible studiously-studied chance for immortality?

The history of all sciences points up the necessity of plodding along until no "bugs" remain in the theory and its fulfillment. If Isaac Newton could wait more than 20 years before announcing his law of gravitation in 1686, our modern astronomers can wait a year or two before cluttering up our technical journals with fast-judgment pronouncements, later to be demolished.

It was Kepler who demolished, once for all, the Ptolemaic (earth-centered) hypothesis of planetary motions, which had been the law from 1500 years earlier.

There are many mysteries awaiting our explanation in this universe of ours. Let no one think that, from a few miscellaneous observations, he can arrive at a complete explanation, especially when it blithely overthrows reasonably-established physical laws derived from decades or even a lifetime of observations, correlations, and conclusions. How incompetent will seem many would-be geniuses when their snap-judgment rushings into print will be demolished by those who come after. ■

**"The die is cast, the book is written, to be read now or by posterity, I care not which. It can well await its reader. Has not God waited six thousand years for an observer?" The words of John Kepler from his last book.**

# CLASSIFIED Market Place

**FOR BIGGER PROFITS! NEW CAREER OPPORTUNITIES!**
**READ AND REPLY TO THESE CLASSIFIED ADS**

**Classified Ads 65¢ per word, each insertion, minimum 10 words, payable in advance. To be included in the next available issue of SCIENCE & ELECTRONICS (formerly RTV-Exp.) copy must be in our New York Office by Sept. 10th. Address orders to C. D. Wilson, Manager, Classified Advertising, SCIENCE & ELECTRONICS, 229 Park Avenue South, New York, N. Y. 10003.**

## ADDITIONAL INCOME

MONEY—Sparetime Opportunity Panelists At Home Wanted By New York Researcher. Leading research firm seeking people to furnish honest opinions by mail from home. Pays cash for all opinions rendered. Clients' products supplied at no cost. For information write: Research 669, Mineola, N. Y. 11501, Dept. 633-SE.

MAKE Your Classified Ad Pay. Get "How To Write a Classified Ad That Pulls." Includes certificate worth $2.00 toward classified ad. Send $1.25 to C. D. Wilson, Science and Mechanics, 229 Park Avenue South, New York, N. Y. 10003.

## BUSINESS OPPORTUNITIES

I MADE $40,000.00 Year by Mailorder! Helped others make money! Start with $10.00—Free Proof! Torrey, Box 318-T, Ypsilanti, Michigan 48197.

FREE Book "990 Successful, Little-Known Businesses." Fascinating! Work home! Plymouth 311-J, Brooklyn, N. Y. 11218.

1000 GOLD STRIPE Name and Address Labels. 500 SEASONS GREETING LABELS. 500 PERSONALIZED PHONOGRAPH Record Labels $1.00 each or three for $2.89. SPLENDID GIFTS, 15772 NORTHLAWN, Dept. SM-10, DETROIT, MICH. 48238.

## EDUCATION & INSTRUCTION

SCHOOL of Occult Science, P.O. Box 13372, New Orleans, La. 70125.

## ELECTRONIC COMPONENTS

FREE CATALOG Over 80 different solid state electronic products. New Electronic Strobe Kit, $9.95 ppd. See complete line of Bowman solid state products at your local authorized dealer. Bowman Electronics, Inc., 155 East 1st Avenue, Roselle, N. J. 07203.

## GIFTS THAT PLEASE

FREE distinctive gift catalog. Renwell Company, 5305 Wellington, Chicago, Ill. 60641.

## INVENTIONS WANTED

WE either sell your invention or pay cash bonus. Write for details. Universal Inventions, 298-5 Marion, Ohio 43302.

## MISCELLANEOUS

"ADULT" Books, Magazines . . . Free illustrated catalogue! State age. (Send stamp.) Clifton's, Box 1068-M9, Saugus, Calif. 91350.

KNIVES 101 Imported Novelty Knives. Catalogue 50¢. Friedmar Imports, Box 533-EE, Montebello, Calif. 90640.

## MONEYMAKING OPPORTUNITIES

EASY-to-start rubber stamp business home in spare time. Make up to $16.50 an hour without experience. Facts free. Write to: Roberts, 1512 Jarvis, Room CR-105-A, Chicago, Illinois 60626.

COMMERCIAL Chemical Products Formulations. Catalog $1.00 (Refundable). Polychemical, 2411 Northeast 136 Lane, Miami, Fla. 33161.

LEARN Secrets That Make You Rich: $2.00 Book. Guinn, D669, 78 Tubmill, Milford, Delaware 19963.

## PERSONAL

SUBMINIATURE LISTENING DEVICES, low priced, high performance—direct from manufacturer. Dealers Welcome. Audiotronix, RT-8, 156 Fifth Avenue, New York, N.Y. 10010.

ELIMINATE Debts Without Borrowing! Particulars Free. Helper, 10639 Riverside, No. Hollywood, Calif. 91602.

STOP Smoking this Book presents Medical and Psychological Method. Refund Guarantee $2.00. Laury, 41886-A Debra, Elyria, Ohio 44035.

## PRINTING, MIMEOGRAPHING & MULTIGRAPHING

250 EACH—letterheads, statements, envelopes and business cards. Send copy (up to 5 lines) and $17.75 to The Wrightway, 404 East Green, Champaign, Ill. 61820.

## RADIO & TELEVISION

THOUSANDS AND THOUSANDS of types of electronic parts, tubes, transistors, instructions, etc. Send for Free Catalog. Arcturus Electronics Corp., MRT, 502—22nd Street, Union City, N. J. 07087.

POLICE—Fire—Aircraft—Marine—Amateur calls on your broadcast radio! Free catalog. Salch Company, Woodsboro EE14, Texas 78393.

RADIO & TV Tubes 33¢. Free Catalog. Cornell, 4217 West University, San Diego, California 92105.

RECEIVING & INDUSTRIAL TUBES, TRANSISTORS, All Brands—Biggest Discounts. Technicians, Hobbyists, Experimenters—Request Free Giant Catalog and Save! Zalytron, 469 Jericho Turnpike, Mineola, N. Y. 11501.

HEAR Police + fire radio dispatchers. Catalog of exclusive "confidential" official police/fire dispatcher stations. Call signs! Frequencies! Send stamp. Communications, Box 56-RT, Commack, New York 11725.

GERMAN and JAPANESE TUBES—Parts. Send $1.00 for Price List. The Matthews Company, Box 151, Lawton, Oklahoma 73501.

"DISTANCE Crystal Set Construction" Handbook—50¢. "Coil Winding"—50¢. Catalog. Laboratories, 12041-H Sheridan, Garden Grove, Calif. 92640.

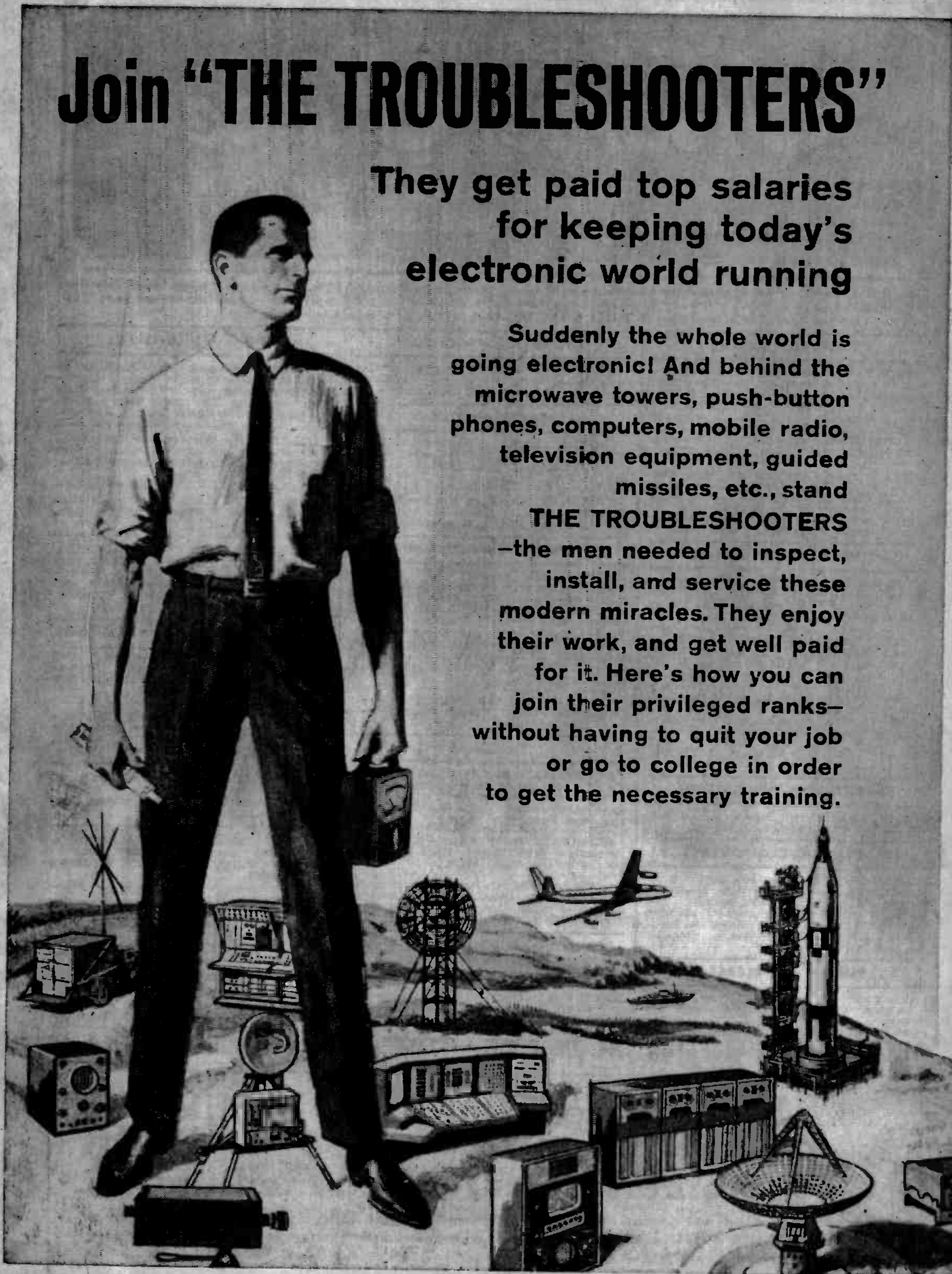
SUPER Distance AM Broadcast Reception, "Music Magnet" Kit $2.95. Information 25¢. Rand Laboratories, Winthrop, Maine 04364.

C.B. BUYERS' Guide—A new magazine for the buyers of Citizen's Band Electronic Equipment. Send $1.25—includes Postage to C. B. Buyers' Guide, 229 Park Avenue South, New York, New York 10003.

## STAMP COLLECTING

FREE 121 Flag Stamps With Approvals. W-B Stamps, Wilkes-Barre, Penna. 18703.

**THERE IS NO CHARGE FOR THE ZIP CODE—PLEASE USE IT IN YOUR CLASSIFIED AD**


Join "THE TROUBLESHOOTERS"
They get paid top salaries for keeping today's electronic world running
Suddenly the whole world is going electronic! And behind the microwave towers, push-button phones, computers, mobile radio, television equipment, guided missiles, etc., stand THE TROUBLESHOOTERS —the men needed to inspect, install, and service these modern miracles. They enjoy their work, and get well paid for it. Here's how you can join their privileged ranks— without having to quit your job or go to college in order to get the necessary training.

JUST THINK how much in demand you would be if you could prevent a TV station from going off the air by repairing a transmitter...keep a whole assembly line moving by fixing automated production controls...prevent a bank, an airline, or your government from making serious mistakes by servicing a computer.

Today, whole industries depend on Electronics. When reakdowns or emergencies occur, someone has got to ove in, take over, and keep things running. That calls for one of a new breed of technicians—The Troubleshooters.

Because they prevent expensive mistakes or delays, they get top pay—and a title to match. At Xerox and Philco, they're called Technical Representatives. At IBM they're Customer Engineers. In radio or TV, they're the Broadcast Engineers.

What do you need to break into the ranks of The Troubleshooters? You might think you need a college degree, but you don't. What you need is know-how—the kind a good TV service technician has—only lots more.

### Think With Your Head, Not Your Hands

As one of The Troubleshooters, you'll have to be ready to tackle a wide variety of electronic problems. You may not be able to dismantle what you're working on—you must be able to take it apart "in your head." You'll have to know enough Electronics to understand the engineering specs, read the wiring diagrams, and calculate how the circuits should test at any given point.

Learning all this can be much simpler than you think. In fact, you can master it without setting foot in a classroom...and without giving up your job!

For over 30 years, the Cleveland Institute of Electronics has specialized in teaching Electronics at home. We've developed special techniques that make learning easy, even if you've had trouble studying before. Our AUTO-PROGRAMMED® lessons build your knowledge as easily and solidly as you'd build a brick wall—one brick at a time. And our instruction is personal. Your teacher not only grades your work, he analyzes it to make sure you are thinking correctly. And he returns it the same day received, while everything is fresh in your mind.

### Always Up-To-Date

To keep up with the latest developments, our courses are constantly being revised. This year CIE students are getting new lessons in Laser Theory and Application, Microminiaturization, Single Sideband Techniques, Pulse Theory and Application, and Boolean Algebra.

In addition, there is complete material on the latest troubleshooting techniques including Tandem System, Localizing through Bracketing, Equal Likelihood and Half-Split Division, and In-circuit Transistor Checking. There are special lessons on servicing two-way mobile radio equipment, a lucrative field in which many of our students have set up their own businesses.

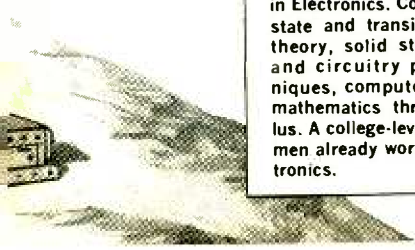
### Your FCC License—or Your Money Back!

Two-way mobile work and many other types of troubleshooting call for a Government FCC License, and our training is designed to get it for you. But even if your work doesn't require a license, it's a good idea to get one. Your FCC License will be accepted anywhere as proof of good electronics training.

And no wonder. The licensing exam is so tough that two out of three non-CIE men who take it fail. But our training is so effective that 9 out of 10 CIE graduates pass. That's why we can offer this famous warranty with confidence: If you complete a license preparation course, you get your FCC License—or your money back.

### Mail Card for 2 Free Books

Want to know more? Send for our 44-page catalog describing our courses and the latest opportunities in Electronics. We'll send a special book on how to get a Government FCC License. Both are free—just mail the bound-in postpaid card. If card is missing, use coupon below.



**NEW COLLEGE-LEVEL COURSE IN**
**ELECTRONICS ENGINEERING**

**for men with prior experience in Electronics. Covers steady-state and transient network theory, solid state physics and circuitry pulse techniques, computer logic and mathematics through calculus. A college-level course for men already working in Electronics.**

**ENROLL UNDER NEW G.I. BILL**

All CIE courses are available under the new G.I. Bill. If you served on active duty since January 31, 1955, or are in service now, check box on card or coupon for G.I. Bill information.

**CIE Cleveland Institute of Electronics**
1776 East 17th Street, Cleveland, Ohio 44114

---

**Cleveland Institute of Electronics**
1776 East 17th Street, Cleveland, Ohio 44114

Please send me without cost or obligation:

1. Your 44-page book "How to Succeed in Electronics" describing the job opportunities in Electronics today, and how your courses can prepare me for them.

2. Your book on "How To Get A Commercial FCC License."

I am especially interested in:

- ☐ Electronics Technology
- ☐ Broadcast Engineering
- ☐ First Class FCC License
- ☐ Electronic Communications
- ☐ Industrial Electronics
- ☐ Electronics Engineering

Name ______________________ (PLEASE PRINT)

Address ______________________

City ____________ State ____________ Zip ______

☐ Check here for G. I. Bill information. EX-34