

Radio-TV EXPERIMENTER

APRIL-MAY 75c

WHITE'S RADIO LOG

AM-FM STATIONS / WORLD-WIDE SHORTWAVE LISTINGS



IN THIS ISSUE
**2 SPECIAL
PROJECTS**



NEW!
FIRST TIME
EVER!

for Beginners— LONG-WAVE VLF RECEIVER

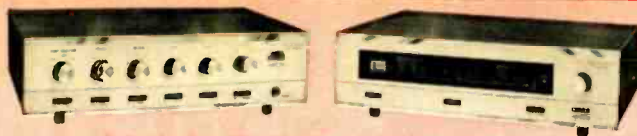
tunes radio's basement
(would you believe 20,000 meters?)

for Pro's— WIRELESS HEAT DETECTOR

measures temperatures
fully 25 ft. from source!



NOVICES: Get the chirps out of your rig!



Introducing EICO's New "Cortina Series"!

Today's electro-technology makes possible near-perfect stereo at moderate manufacturing cost: that's the design concept behind the new EICO "Cortina" all solid-state stereo components. All are 100% professional, conveniently compact (3 $\frac{3}{8}$ "H, 12"W, 8"D), in an esthetically striking "low silhouette." Yes, you can pay more for high quality stereo. But now there's no need to. The refinements will be marginal and probably inaudible. Each is \$89.95 kit, \$119.95 wired.

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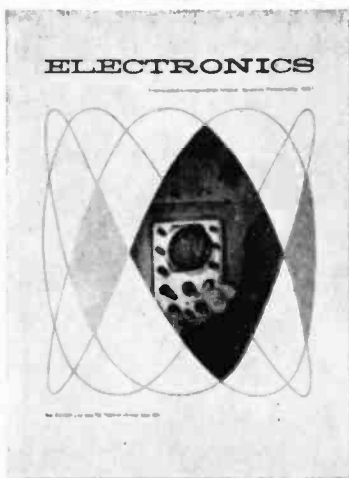
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RADIO-TV EXPERIMENTER

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Leonard Heicklen

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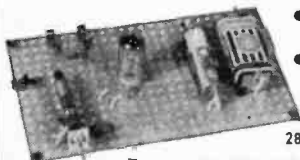
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3⁹⁵**



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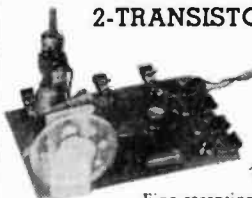
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3⁴⁹

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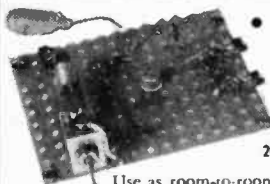
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3⁹⁸

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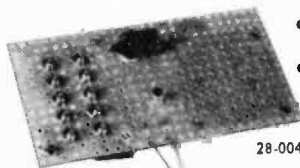
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2⁹⁸

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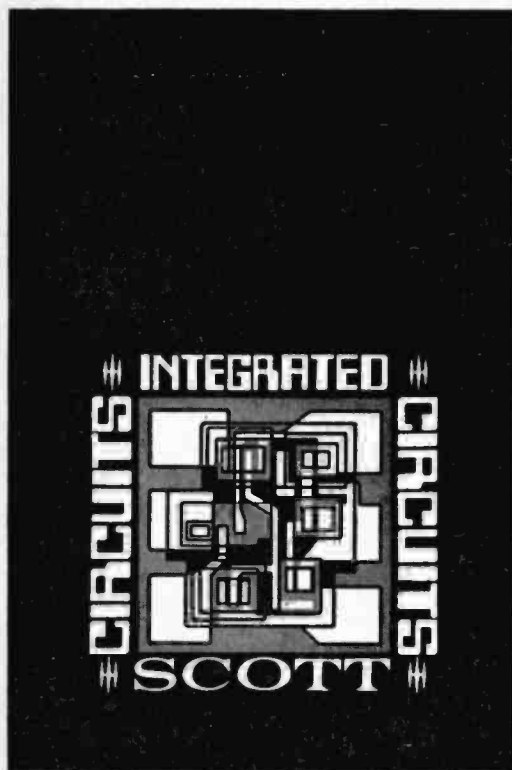
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APRIL/MAY, 1967



RADIO-TV EXPERIMENTER

Dedicated to America's Electronics Experimenters

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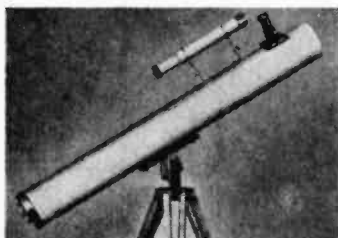
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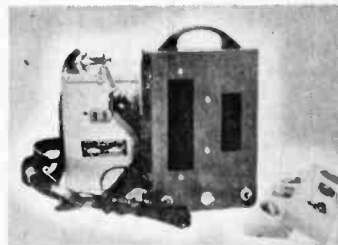
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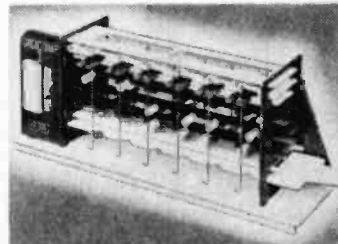
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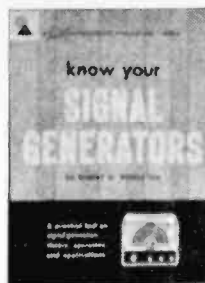
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and schematics of typical service type instruments in current use are included.

Know Your Signal Generator is available from electronics parts distributors and book stores throughout the country, or from Howard W. Sams & Co., Inc., Dept. JWM, 4300 W. 62nd St., Indianapolis, Ind. 46206.

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2CF6	6AV5GT					15V6GT
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5BK7	6BFG					15V6GT
5J6	6BGGC					15V6GT
5T8	6BHG					15V6GT
5U4G	6BHG					15V6GT
5U8	6BK5					15V6GT
5V4G	6BK7					15V6GT
5V6GT	6BL7GT					15V6GT
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6D6G	6SQ7	7C4	12AX4GT
6F6	6S57	7C5	12AZ7
6G6	6T4	7C6	12AZ7
6H6	6T8	7C7	12B4
6BQ6GT	6J5	7E6	12BA6
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Now retired, author Pyle calls upon his vast storehouse of knowledge and experience to generate magazine articles and books. His latest effort, *Building Your Amateur Radio Novice Station*, is the first construction manual on this timely subject.

The text covers everything down to the last detail, a treatment which many beginners need. Nothing, in fact, is overlooked in the course of building the station, from the very first steps to actually putting the rig on the air. Included, for



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example, are same-size drilling and cutout templates for the chassis and panels of a professional-looking transmitter and receiver. And though they cost but little, they carry a relatively high resale value should the builder ever decide to part with the rig.

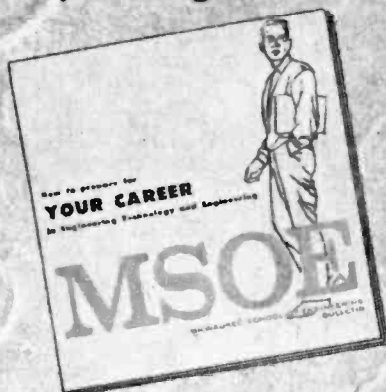
While the equipment has been specifically designed to meet all the requirements imposed on a novice amateur radio station, it will serve the General-Class amateur as well. As a finishing touch to the projects, a complete rollaway ham shack is fully described for those with limited space.

Copies are available from electronics parts distributors and bookstores throughout the country, or from the publisher, Howard W. Sams & Co., Inc., Dept. RRF, 4300 West 62nd St., Indianapolis, Ind. 46206.

Voltmeters. Over the years, the capabilities and uses of the voltmeter have considerably advanced and expanded. Today, the technician and experimenter need a greater technical proficiency—one that combines up-to-date testing know-how with a know-why understanding of operating principles. A good start toward such proficiency can be had by reading *Modern Electronic Voltmeters*, by Sol D. Presky. This book gives the technician and experimenter a thorough understanding of modern electronic voltmeters: first, by reviewing fundamental principles of the basic instrument; second, by covering well-established VTVM and transistor voltmeter test procedures.

An expanded view of the vacuum tube voltmeter encompasses the highly sensitive DC microvoltmeters (employing chopper-stabilized amplifiers), the high sensitivity AC (or audio) voltmeters, and the extremely high impedance electrometer type of voltmeter. It also includes sensitive current measurements in the micro-microampere (picoampere) ranges and covers

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industrial versions of the voltmeter in the form of millivolt recorders and digital voltmeters.

Many examples of testing are included for radio and television applications and industrial electronic systems; simplified or functional schematic diagrams are used liberally throughout. The book is published by John F. Rider, Publisher, Inc., Dept. WJW, 116 W. 14th St., New York, N. Y. 10011.

Mathematics. Paul L. Evans, electronics instructor at Foothill College, has come up with a text written especially for the future electronics technician. The book, *Mathematics for Electronics Technician*, presents all of the mathematics needed for analysis of AC and DC circuits. The author reviews high-school algebra and



392 pages
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basic trigonometry, and stresses how their principles are applied in the solution of series, parallel, series-parallel, and network circuits.

Quadratic and simultaneous equations are covered, as are uses of the slide rule, scientific notation, determinants, imaginary and complex numbers, and the use of Thevenin's and Norton's Theorems. The language of the text is decidedly for students—lengthy explanations are avoided wherever their inclusion is not necessary. In short, if mathematics has relegated you to bringing up the rear, *Mathematics for Electronics Technicians* should put you back in the driver's seat. The text is available at all bookstores. Can't get a copy? Write to John Wiley & Sons, Inc., 605 Third Ave., New York, N. Y. 10016.

Pepping Pooped Color. In using test equipment, technicians often develop a certain routine for using each piece of gear for only a limited number of tasks. *101 Ways To Use Your Color-TV Test Equipment*, by test-equipment authority Robert G. Middleton, is written to encourage service technicians to explore the total possibilities of their equipment for faster and better troubleshooting. This newly-revised and updated edition describes the many uses for various types of equipment used to pin point color-TV problems more quickly. It takes up each type of test gear and shows the ways it can be used—some conventional, some unusual.



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Methods range from the very basic to complex, but explanations are concise and easy to follow. The book includes actual photographs of the waveforms that occur at various points and discusses likely defects. Test setups, procedures, and results are described and illustrated in detail in this book which tells how to test all types of circuits found in color-TV receivers. Every serviceman can benefit from this book—it helps in getting more from your test equipment for faster troubleshooting.

Copies are available from electronics parts distributors and bookstores throughout the country, or direct from the publisher, Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis, Ind. 46206.

Blame It on Farad. One of the most difficult concepts for the hobbyist to visualize is the electrical function of capacitors. To him they appear as "breaks" in the circuit and nothing more. Actually, capacitors have special electrical characteristics which are necessary in an electrical circuit. The usual textbook explanation of capacitors is not sufficiently clear to completely remove the mystery and complexity that surrounds them.

ABC's of Capacitors, by William F. Mullin, is written in everyday language that anyone can understand. It explains how various types of capacitors are constructed, spells out typical characteristics and applications, discusses points to consider when selecting replacements, and offers several practical methods of testing and measuring capacitors. The book was written for experimenters who work with electronic circuits,

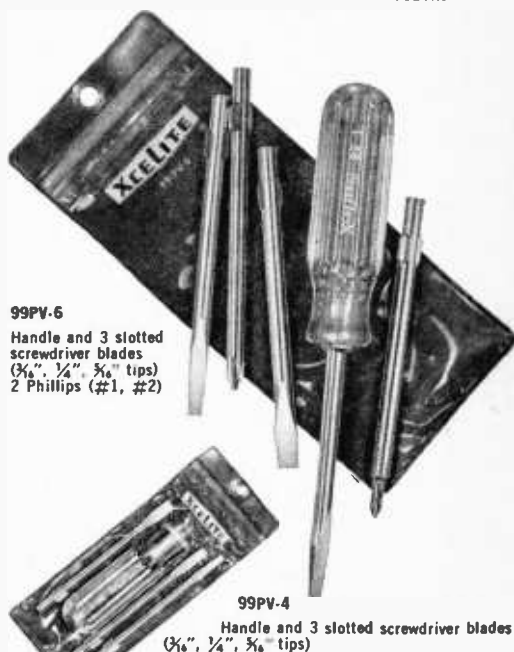
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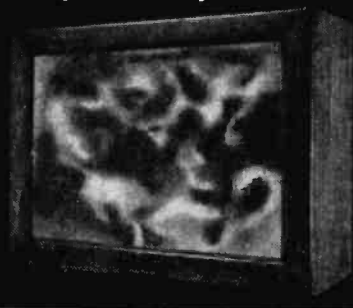
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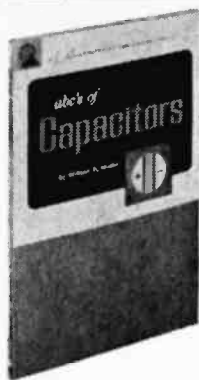
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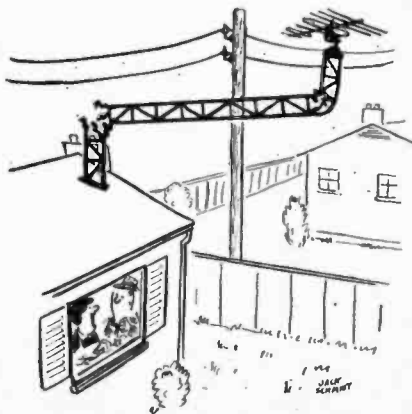


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"The men from the power company came.
They said something about 'right-of-way'."



■ **Build a Better CB.** "It's little, it's lovely, it's light," might be a good description of the latest offering from EICO Electronic Instrument Co., Inc., 131-01 39th Ave., Flushing, N.Y. 11352. Their new CB rig, the NOVA-23, seems to be worth all of the effort which they have obviously poured into its development—it's a real Hertz grabber.



Transistors, it's got; 23 channels, it's got; an S-meter, it's got; a built-in PA system, it's got; a 12-volt negative-ground/positive-ground power supply, it's got; and it weighs only 7 lbs. Is it a big deal? Well, today about all that's basic minimum for any self-respecting CB rig. But don't give up the ghost. The NOVA-23's got an extra kick or two hidden up its mike cable.

First, the rig uses an exclusive dual-crystal lattice filter. While that may sound like a fugitive from a salad plate, it's really a sophisticated gizmo for giving the set razor-sharp selectivity (ability to reject unwanted signals on nearby channels).

Another NOVA-23 exclusive is an efficient "up-converter" frequency synthesizer which provides extra stability and trouble-free performance (all crystals are supplied for full 23 channel CB'ing). The only extra you have to buy is your car.

The use of precision series-mode fundamental crystals is unusual in CB gear, but the NOVA-23's got 'em. This results in exceptional stability on transmit and receive.

While some CB rigs are plagued by ills resulting from vibration and shock during mobile use, according to EICO (which seems to be a nice way of saying that we CB'ers are rotten drivers), the NOVA-23 is put together in ruggedized mili-

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Weather will not affect the operation of the Tiger Tail.

Manufacturer is Elnex, Inc., of Naples, N.Y. Could be big things ahead for this one.

30¢ per Milliwatt. American-made communications gear has a rough time competing for low price with some of the imported stuff, and this goes double for hand-held transceivers. The result has been a shyness on the part of many CB manufacturers to come through with these popular units.



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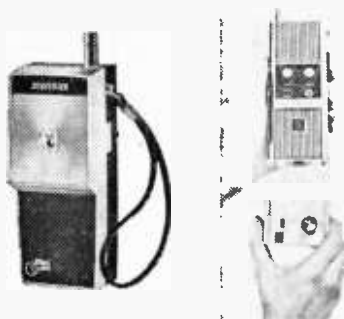
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E. F. Johnson Co., of Waseca, Minn., seems to have stumbled upon some sort of secret previously known only to foreign manufacturers.



The result is a 100-milliwatt, quality walkie-talkie which can be sold for \$29.95.

Our immediate response upon hearing about this was that, despite Johnson's excellent track record in making quality CB gear, that this was some sort of new venture of theirs into the toy market. A short romp through the specs of the unit and a five-minute field test, however, seem to pop that little balloon.

The unit features a crystal-controlled super-het megahertz inhaler with excellent sensitivity. A built-in battery meter lets you discover how far you are from instant silence.

The set is in a nifty-looking, rugged case with a leather carrying strap. License isn't required; all it takes is \$29.95 and an inquiry to E.F. Johnson or any of their many dealers.

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Fanon's address is 439 Frelinghuysen Ave., Newark, N.J.

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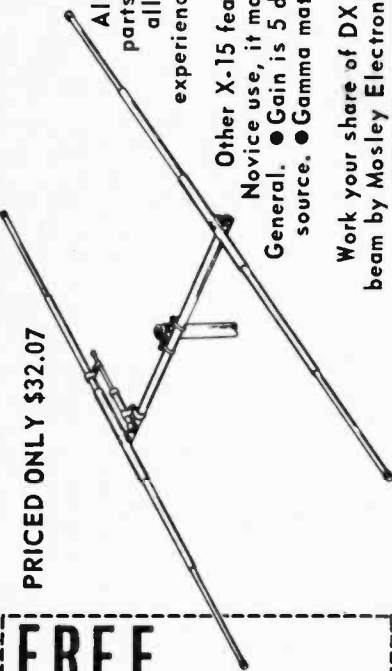
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150-Watt Stereo Receiver Kit

An outstanding stereo receiver tuning AM, FM, and stereo FM as well as accepting the output from any phonograph or tape player, the new AR-15 from Heath is designed to give kit-builders sound on a par with the finest. Pumping out 75 watts of IHF power per channel, the AR-15 has all solid-state, all-silicon circuitry. Two integrated circuits in the IF amplifier make for ultra-high gain and ultra-hard limiting. Two



Heathkit AR-15 Receiver

crystal filters replace the IF transformers, which means there are no coils to align. And field-effect transistors (FET's) in the FM front end promise extra high overload capability and extra low cross-modulation.

Four Zener diodes and two thermal circuit breakers protect the driver and output transistors from overloads and short-circuits of any duration; a special front-panel indicator even shows when the circuit breakers have opened. The "black magic" panel remains dark until the unit is turned on.

The AR-15 sells for \$329.95 in kit form; an optional 7-lb. walnut cabinet is \$19.95 extra. It's available now from the Heath Company, Benton Harbor, Mich. 49023.

Electronic Throttle

Offered in kit form, Knight-kit's new Motor-Speed/Light Control is a useful accessory for the home workbench. When assembled, it permits speed control of electric drills, saws, sanders, and other electrically-operated power tools. Used with power tools there is said to be virtually no loss of torque, even at low speeds. It



Knight-kit KG-201 Motor-Speed/Light Control

also controls the brightness of incandescent lamps and photographic photofloods. The control can be used with a soldering iron (except transformer-type guns) to limit heat for protection of delicate components.

The control's solid-state circuit uses a silicon-controlled rectifier, two diodes and a calibrated output control. In full "on" position, the appliance runs at normal speed. It can be used with any universal-wound AC-DC motor-driven device with a rating of 7.5 amps or less, or for loads up to 500 watts.

The unit is protected by a thermal circuit. Output receptacle and 6-ft. power cord are 3-wire grounded types for safety. Motor-Speed/Light Control, Model KG-201 is priced at \$9.95. Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680.

Experimenter's Slide Rule

The Shure reactance slide rule was first made available in 1943 and continues to be a sought-



Shure Reactance Slide Rule

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20W NPN SIL. 2N1647	1 for \$1	2 for 1.01
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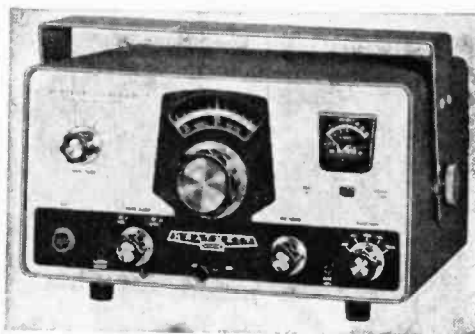
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after item, so Shure Brothers decided to reissue it. It's helpful for solving resonant frequency, capacitive reactance, inductive reactance, coil "Q" and dissipation factor problems that cover a frequency range from 5 Hz to 10,000 MHz. The rules are available for \$1.00 each. Write Shure Brothers, Inc., Sales Dept. 5, 222 Hartrey Ave., Evanston, Ill. 60204.

All You SSBers Form a Double Line

Up-proving the Heathkit SB-Series of SSB transceivers for 80, 40, or 20 meter communicating, comes a new line with not only improvements but lower price as well. The new Single-Banders have front-panel selection of upper or lower sideband operation, improved audio and AVC response, microphone and gain control, bias adjustment on the front panel for changing from fixed to mobile operation, a mode switch



Heathkit SB-Series Ham Transceivers

position for control of optional HRA-10-1 plug-in crystal calibrator, ALC input for operation with linear amplifiers, and power connectors compatible with Heath SB-Series power supplies. Full 200 watts P.E.P SSB fixed or mobile, model numbers and prices are as ensues: HW-12A, 75 meters, \$99.95; HW-22A, 40 meters, \$104.95; HW-32A, 20 meters, \$104.95; HP-13, mobile power supply, \$59.95; HP-23, fixed-station power supply, \$39.95. Heath Co., Benton Harbor, Mich. 49022.

Two-Meter Transceiver

This dandy VHF transceiver has a 25-watt DC input transmitter and sensitive triple conversion receiver with crystal-controlled mixer. The 16-tube, 4-transistor, 7-diode circuitry uses separate receiver and VFO frequency controls. Effective series gate noise limiter combines with variable squelch control for quiet standby reception. The HA-1200's output frequency may be crystal-controlled with standard 8 MHz crystals. Its illuminated edgewise meter indicates S units on receive and relative RF output on transmit. Comes with rugged push-to-talk ceramic microphone with coiled cord AC and DC power cables, and mobile mounting bracket. Has solid-state

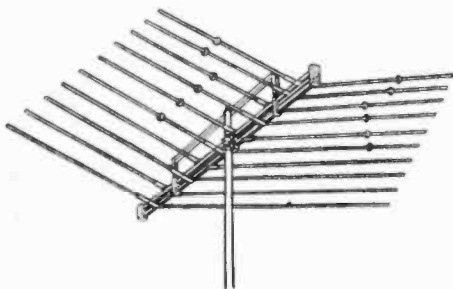


Lafayette HA-1200 Ham Transceiver

power supplies for 117 VAC and 12 VDC negative ground operation. Size, $11\frac{1}{8} \times 12\frac{3}{4} \times 5\frac{7}{8}$; price, \$189.95. From Lafayette dealers or for further dope write Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, N. Y. 11791.

JFD LPV-TV/FM OK

Further improvements have been made by JFD Electronics Co. on their LPV-TV/FM color log periodic series of antennas. The new antennas have *stronger signal response* than previous VHF log periodic antennas. Another feature of the series is a system of capacitor-coupled "cap-electronics" dipoles, which respond on the third harmonic mode, as well as the fundamental

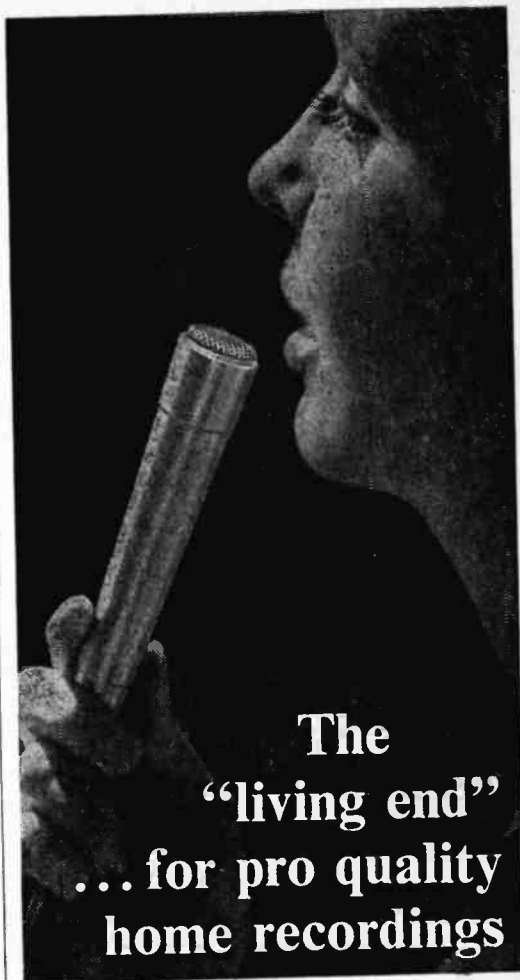


JFD LPV-TV100 VHF-FM Antenna

mode, this being especially effective in color. Plus the series has a lower-impedance twin-boom feeder, and integrated transformer design. There are eight different models ranging in price from \$14.95 for the LPV-TV40 (VHF range up to 50 miles), to \$79.95 for LPV-TV190 (VHF range up to 200 miles). Get all the facts at your distributors, or write to JFD Electronics Co., Dept. JS, 15th Ave. at 62nd St., Brooklyn, N. Y. 11219.

NTSC Color Bar Generator

Reasonably priced for the service technician, the EICO 380 solid-state color bar generator offers saturated National Television Systems Committee (NTSC) color signals. The unit's



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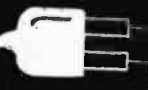
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Peacock Peeper

This eyeball gimmick, called Dynascope, has a 2 1/4-in.-diameter mirror and a clip-on 1 1/2-in.-diameter magnifying glass mounted on a 6-in.-long stainless steel rod. The serviceman attaches the unit to the color TV screen with the suction cup. This eliminates waste time and walking

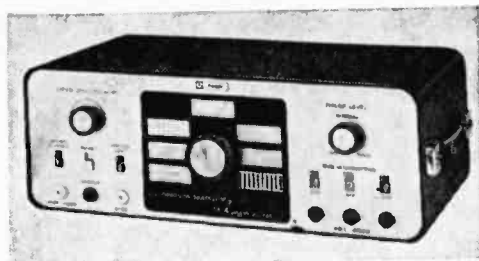


B&K Dynascope

back and forth between front screen and rear controls during focus, purity and convergence adjustments. Available at test equipment distributors, Dynascope is priced at \$7.95. Or write to: B&K Div., Dynascan Corp., 1801 W. Belle Plaine Ave., Chicago, Ill. 60613.

Put a Fix on Color

Looking for a color/bar generator in kit form? The Knight-kit KG-685 unit has some advanced details engineered into it—such as a gray scale pattern providing 6 discreet levels of brightness for gun tracking adjustments. There is a shaded light source and a steel polished service mirror. A single control selects one of seven crystal-controlled test patterns including purity, tracking, dots, cross-hatch, vertical lines, horizontal lines and color bars. Using 22 transistors and 8 diodes and measuring 4 3/4 x 9 3/4 x

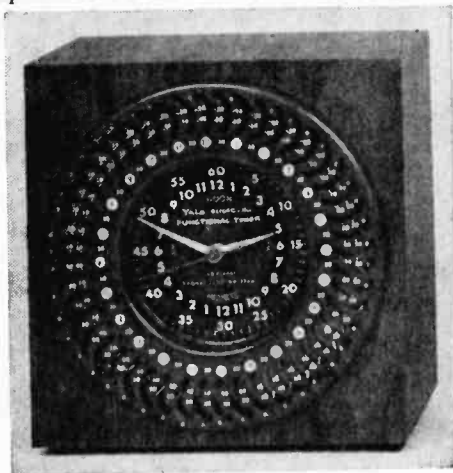


Knight-kit KG-685 Color/Bar Generator

12 in., the KG-685 with all parts, cables and instructions in kit form is \$89.95. Fully assembled it's \$129.95. For complete specifications see the Allied catalog No. 260, free from Allied Radio Corp., Dept. 20, 100 N. Western Ave., Chicago, Ill. 60680.

Round-the-Clock Switch

This automatic timer handles up to 1000 watts, comes in either 12- or 24-hour operation, and allows you to preset as many as 48 combinations of time intervals. You can be away from home and let the Functional Timer turn on the tape recorder and FM for recording a particular



Yale Audio 24-Hour Automatic Timer

program. Other suggested uses: time-lapse photography, sleep learning, background music intervals, water and lighting systems, phone answering service, machinery operation, and so on. The 24-hour model in a walnut case sells for \$65.85. The 12-hour model without the buzzer and case is priced at \$44.50. Order from Yale Audio of Florida, Dept. XII, 2732 Florida Ave., Tampa, Fla. 33602.

Amplifier-Modulator

This compact, solid-state amplifier-modulator has a 5-transistor, 1-thermistor circuit. Comes completely assembled with schematic diagram.

Thinking of a perfect Science Fair Project?



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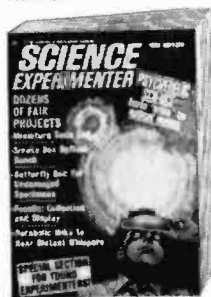
Dozens of Science Fair projects, countless ideas for further original research and experimentation cram the big 1967 edition of Science Experimenter which goes on sale March 9th. Typical of the fabulous construction projects and features are:

Psychedelic Science—Experience weird illusions, eerie "trips" by purely optical means.

Miniature Tesla Coil—Miniature in size only, for it packs 60,000 volts at 500,000 cycles per second. A perennial favorite of science buffs everywhere.

Smoke Box Optical Bench—No need for complex math and optical formulas; with this fascinating science tool, you'll actually see how each lens, prism, mirror or other optical element performs. And you won't hesitate to tackle that telescope, microscope illuminator, or colorimeter your heart is set on.

Phono-Strobe—Built for just \$2, it will make exciting stop-motion pictures and compares favorably with electronic flash strobe costing \$60 and more.



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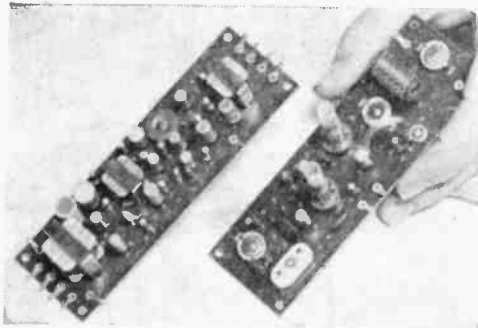
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New Products



Round Hill AA-100 Amplifier-Modulator
with mating Transmitter at right

The model AA-100 has a shielded input transformer with two primary windings: 50 ohms and high impedance. The output transformer has two secondary windings: 8 ohms (for speakers) and 500 ohms (for modulation and high impedance loads). Unit has a volume control mounted on the circuit board. Performance: low distortion, 200 milliwatt push-pull output; extremely high gain, 80 db. Circuit board is $5\frac{1}{2} \times 1\frac{3}{4}$ in., and can be powered by any 9-volt DC source. Priced at \$6.95 the AA-100 comes from Round Hill Associates, 434 6th Ave., New York, N. Y. 10011.

Daughter of Serenata

Here's a lower-priced version of Telex's famous high fidelity Serenata headset, the Serenata II, which has central comfort control dial, all-dynamic sound reproducers, fixed straight



Telex Serenata II Hi-Fi Headset

cord, deluxe ear-cushions. Response is 20-20,000 Hz; sensitivity, 92 db/mw. The price is \$44.95 from Telex-Acoustic Products, Dept. 2, 3054 Excelsior Blvd., Minneapolis, Minn. 55416.

Check with your local Hi-Fi Dealer and ask for a listening demonstration.

Stick with Stick-em

A new vinyl plastic tape has been developed with a formula that provides an adhesion value of 45 oz. per inch width, and will help you make

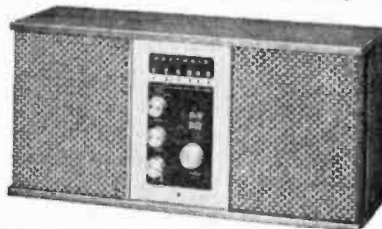


Johns-Manville Vinyl Electrical Tape

safer, more enduring splices. J-M Plastic Electrical Tape averages 9000-volts dielectric strength per layer, can be used indoors and out, and is priced according to sizes and roll lengths. Also available in a pop-up dispenser. Get your roll at any electrical supply house or write to Johns-Manville, Dutch Brand Div., Dept. X2, 7800 S. Woodlawn Ave., Chicago, Ill. 60619.

FM/Stereo Sounds in a Kit

A new FM stereo table radio kit features the same tuner and IF circuit used in deluxe Heathkit stereo components for cool transistor sound. Model GR-36 also has automatic switching to stereo, adjustable phase control, fixed automatic frequency control, built-in automatic gain con-



Heathkit GR-36 FM-Stereo Table Radio

trol, clutch-release volume control, adjustable tone control, slide-rule dial, external antenna connectors, two $5\frac{1}{4}$ -in. PM speakers. You couple the circuit board construction with the factory-assembled and aligned front panel—total assembly takes around 10-hours. The wal-

IT'S TWINS

for independence hall!

By Dick Flanagan



■ As every red-blooded American knows, Independence Hall—witness to the Declaration of Independence (not to mention the Continental Congress and the Constitutional Convention)—is located in Philadelphia, the nation's second capital (New York was first; Washington, D.C., third). And just as the capital moved south, the nation and its people spread westward.

Today, the union's most populous state is located not in the east but the west, which is another way of saying that California's 20-odd millions would have to take a mighty long trip to visit the birthplace of American liberty. Fortunately, that long journey is no longer necessary.

Located at Knott's Berry Farm in Buena Park, California, the second Independence Hall is a meticulously constructed duplicate of the original. Some 140,000 hand-finished

clay bricks went into its making, and the twin even boasts specially mixed paints and intricate hand carvings faithful to the original. But *re-creation* didn't stop there.

So that visitors to the new Hall might relive the momentous minutes when American independence was born, Walter Knott of Knott's Berry Farm commissioned Hollywood documentary producer Phil Stuart to revive that historic occasion in sound, Phil's answer: two special 14-track Ampex recorders feeding 56 James B. Lansing speakers hidden throughout the room.

As room lights fade and candles begin to flicker, today's audience hears the delegates enter and make their way to the 13 tables. Then, as the sounds of carriage wheels and children echo in the street outside, the great debates begin again—this time in a twin some 3000 miles from the original! ■

Guides in Colonial garb impart '76 flavor to "new" Hall. Replica took two years to build.



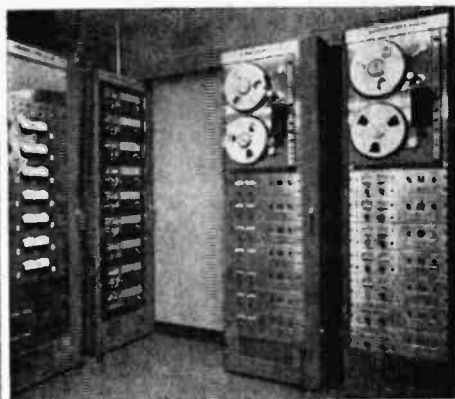
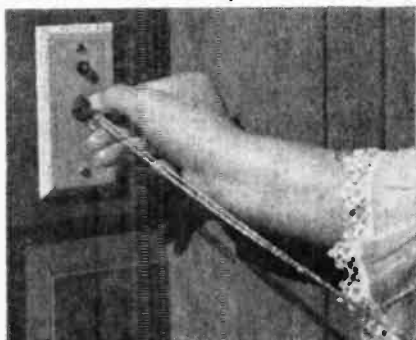
Debates associated with Declaration of Independence are recreated in room below.



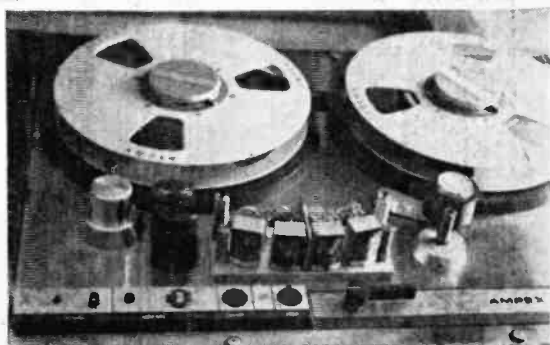
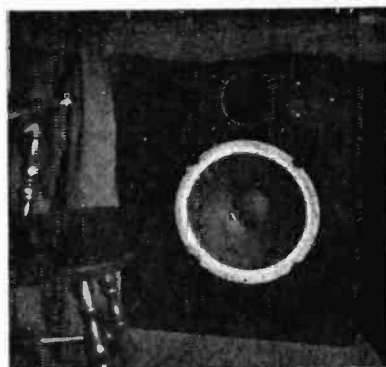
Tucked away on second floor of Independence Hall replica are two special Ampex AG-300 professional tape recorders (at right). Below, Philip Stuart, creator of the sound show, adjusts one of the recorders.



Key controls tamper-proof switch (below) which activates recorder (right). Unit rewinds automatically at end of program.



James B. Lansing S-7 (above) and S-8 (below) speaker systems are hidden throughout Hall.





Meter Protection

I would like to install a Lafayette Meter Guard or an International Rectifier MP-100 meter protection rectifier to my VOM. Are they really effective? How should I install one?

—G. D., Montreal, Quebec, Canada

Yes, they protect the meter from excessive voltage drop across the meter movement and from reversed polarity voltage. The meter protectors usually are furnished with installation instructions. Protectors are not all the same and installation procedures may differ.

What is It?

What transistor can I substitute for a TIX-882?

—F. T., Ronan, Montana

We couldn't find it listed in Datadex or in industrial catalogs. You can probably get the exact type or substitute from Allied Electronics, the industrial division of Allied Radio, at 100 North Western Avenue in Chicago by mail order. Often special-batch or experimental transistors are given company numbers—the manufacturer will often provide exact data or indicate a suitable replacement.

Quick as a Wink

I have an early transistorized hi-fi amplifier whose power supply has burned out a couple of times. I would like to modify it to use an electronic filter in place of electrolytic capacitors. Diagrams of the original power supply circuit and the proposed new circuit are enclosed. Do you think the new circuit will be better?

—A. L. W., Ithaca, N. Y.

No. If the power supply burns out because of a shorted power

transistor in the amplifier (usual cause) or because of electrolytic capacitor failure, the new circuit will be subject to the same hazards. Cure: put a fuse in the collector or emitter circuit of each power transistor—one in the power supply would have to have a much higher rating and the transistor could go before the fuse. Semiconductor diodes should have a series resistor to limit current surges into the input filter capacitor. Current surges can burn out diodes faster than a wink.

Seek and Ye Shall Find

I can't find a GE C6B silicon controlled rectifier in any of my catalogs. I am convinced you bought the last one. If you know where I can get one, please let me know.

—H. K., Eau Claire, Wisconsin

You will find it listed on page 270 of the 1967 Allied Catalog, priced at \$2.07. You can order one by mail from Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680.

Not Worth It

Can you give me a diagram of an amplifier for increasing the power of my 15-watt transmitter to 20 watts?

—F. M. B., Spring City, Tennessee

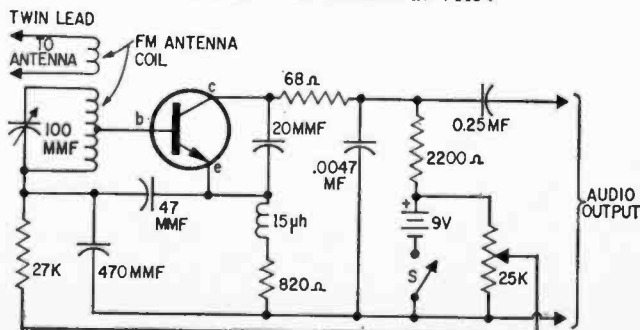
It is not worth building an amplifier to increase power only one-third. You'll get out almost as well with 15 watts as with 20. That small a change can often be accomplished by increasing the B-plus voltage 25 to 30% above what the manufacturer designed into the unit.

One-Transistor FM Set

Can you give me a circuit for a one or two transistor FM tuner?

—B. B., Rocky Ford, Colorado.

Here's a diagram of a superregenerative receiver which will receive AM or FM. For coils, pick them from the J. W. Miller catalog which any, on-his-toes parts distributor should have or should be able to order for you. Unless you are very close to an FM station, don't expect great results. And, make sure you use a transistor that will oscillate at VHF.

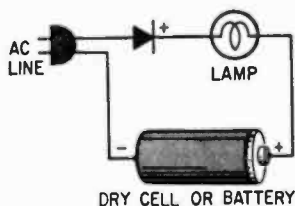


6-Volt Recharger

Can I recharge a 6-volt ignition battery using a charger as shown in the schematic?

—D. T., Mayo, Florida.

Yes. To get the full scoop, write for a copy of *Using the Secondary Capacity of Primary Cells* from Dynamic Instrument Corp., 115 E. Bethpage Road, Plainview, New York.

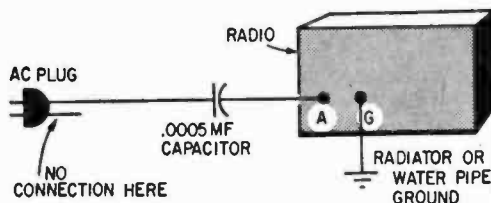


BCB Skywire

I would like to know how to improve the BCB reception of a Knight-kit Star Roamer receiver. I am in a dorm and a long wire is impossible.

—W. H. P., Troy, New York.

Try using the power line as an antenna as shown in the diagram. Reverse AC plug to see which side gives best reception. Don't overlook the signal pickup abilities of bed springs, and combination storm-screen windows (or other metal frame windows) or the rain downspout and gutter. For safety, use the capacitor when making the connections—someone else might get the same idea.



Have Whip?—Better Travel

I have a four-band Radionette which was made in Norway. Using a 10-foot whip antenna outside of the window of my third floor apartment, I can get Holland, Japan, Australia and the Voice of America and that's about it. My building is 12 stories high and made of steel and concrete. How can I upgrade my receiver?

—E. A. B., San Francisco, California

Your antenna is in a shielded, electrically noisy area. You're doing well, considering the circumstances. For better shortwave reception, get a professional communications receiver and install a doublet antenna on the roof of the building, feeding it through coaxial cable. In an apartment building in a big city, you can't expect outstanding reception.



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ELEMENTARY ELECTRONICS

For those interested in bettering their knowledge of electronics theory... the March/April ELEMENTARY ELECTRONICS tells "The Inside Story on Detectors" and the theory of operation of various "Flip-Flops" and "The Two-Cylinder Engines of Electronics."

Of special interest to Hams is the Ham Contro Center—while specifically designed for controlling power to units of a Ham station the design notes given here are applicable to Hi-Fi components or elaborate CB installations as well as the home workshop bench.

The doers aren't overlooked. Included in this BIG issue are many, many projects for a rainy day.

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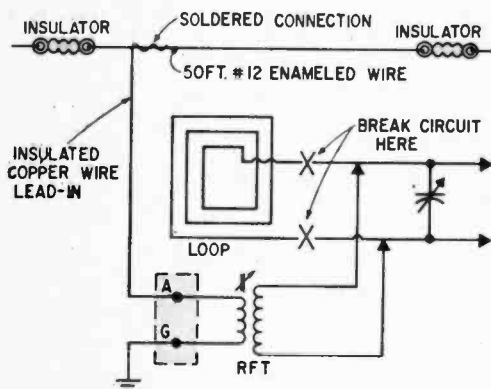
Ask Me Another

Adding Antenna Input

I am a beginning AM-BCB listener and would like to know how to set up an outside antenna for my receiver.

—J. W., Cortland, New York

If your radio has a loop antenna or loopstick, replace it with an antenna coil (RF transformer) such as Miller A-320-A as shown in the diagram and connect an antenna and ground to the primary of the transformer. Add the connections shown in heavy lines. Adjust the core of the new coil for best reception.



Some Definitions

Several questions: (1) Why does the dial of my shortwave receiver indicate 11.82 when I am tuned to a station listed at 11820 in White's Radio Log? (2) What do DX and BCB-DX mean? (3) What does kHz mean? (4) Does GMT listed in the shortwave section of White's Radio Log mean the time we should get the station here, less the five hours difference?

—B. C. H., Cherryfield, Massachusetts

Several answers: (1) 11.82 is in megacycles or megaHertz (MHz); 11820 is in kilocycles or kiloHertz (kHz); they both mean the same. (2) DX means long-distance reception; BCB-DX means BroadCast Band long-distance reception. (3) KiloHertz (kHz) is the new international term for kilocycles per second. (4) Yes, GMT minus 5 hours equals EST.

It's Called a Sleep Switch

Can you tell me how to build an automatic timer which will shut off a radio after one hour?

—J. L. B., Danville, Iowa

This would be a mechanical project, not an electronic one. For one hour electronic timing, you would require an enormous capacitor. It would

be much easier to buy a ready-made, one-hour timer such as a Rhodes Mark-Time switch, costing about \$6.50 at electronic parts or electrical distributors.

It's the End

I have an old Emerson DM 831 AC/DC radio which covers the BC, medium wave and shortwave bands to 49 meters. One tube is missing from the socket labelled "ballast." When on shortwave I pick up BCB stations and hams. What can be done?

—W. B. F., Houston, Texas

Give it a decent burial. It shouldn't work at all with the ballast tube removed. For good shortwave reception you need a more modern receiver able to cope with all the stuff that's in the air.

Narrow-Band FM Problem

I have to turn up the volume wide open on my dual-band VHF-FM monitor receiver to get clear reception. If I change the detector to a gated-beam type as you suggested in an earlier issue, will I lose something else?

—W. S., Wilmington, Delaware

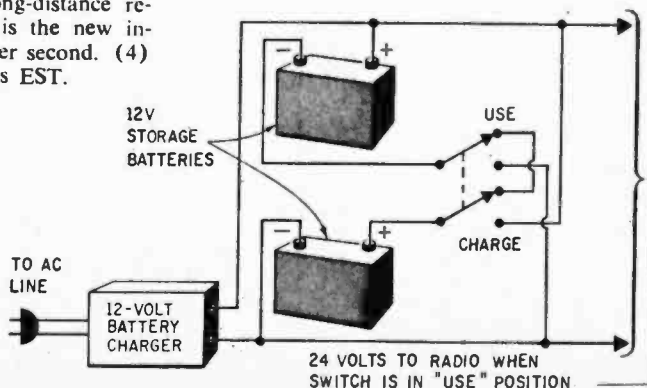
The gated-beam detector should work well on both narrow band (± 5 kHz) and wide band (± 15 kHz) FM signals.

24-Volt Power

I have a surplus BC-603 receiver, but I do not have a 24-volt power source to operate it. Could you show me a diagram of a power supply I could use?

—A. J., Hazelhurst, Wis.

Simply hook up two 12-volt storage batteries and a battery charger as shown in the diagram. While you could build a 24-volt rectifier, it might be cheaper to rewire the set for AC operation. If you'll send us the schematic, we might be able to tell you how.



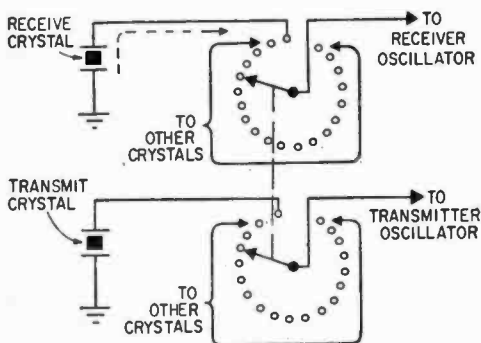
It'll Cost Ya!

My CB radio has crystal holders for only six channels. Can you give me a circuit for modifying it so I can transmit and receive on all 23 channels by turning a dial instead of having to change crystals?

—R. R., Medford, Massachusetts.

You can use the channel selector switch used in the Knight-kit Safari III connected as shown in the diagram. Order spare part No. 437-157 from Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680. You will have to add crystals and crystal sockets.

Before you put the rig on the air, have all the channel frequencies measured by a licensed operator at a two-way mobile radio shop. Otherwise, you might operate off frequency and be inviting a citation from the FCC.



All for the Want of a Horseshoe Nail!

On page 109 of the Fall 1965 issue of *Elementary Electronics*, you show a schematic of an electronic fence charger using a 12-volt ignition coil. What kind of a coil has a separate primary and secondary? No luck in finding an 1140A-2 SCR.

—L. C. R., Baltimore, Maryland

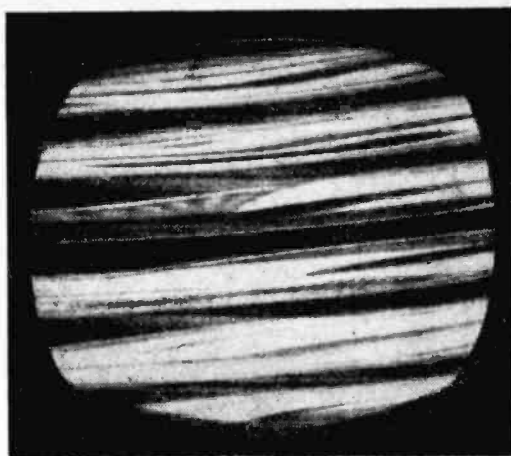
The SCR was labelled incorrectly as "1140A-2". It should have been labelled T140A2 and sells for \$2.70. A Mallory 12-T ignition coil has four terminals as shown in the original diagram.

Luck!

How can I pick up TV stations hundreds of miles away? I see letters published in your magazine about receiving TV stations more than 500 miles away. How do they do this?

—D. W., Washington, Connecticut

Long distance TV reception is possible only when skip conditions exist. It might never happen in your area at a time when you are tuned in. If you had a portable TV set on top of Mt. Shasta, you might be able to pick up TV stations



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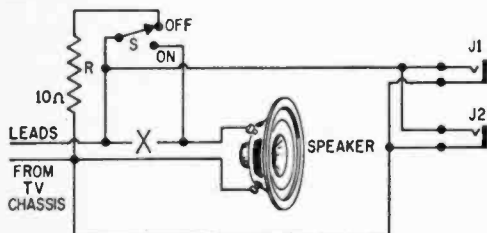
in San Francisco more than 300 miles away. The only way to do it for sure is to go to a distant city and tape-record programs and then take the tapes home and play them back through your TV set. Seriously, long distance TV reception, except via a space satellite, is not intended. The same channels are in use in several cities and long distance transmission would cause interference.

Silent TV

How can I add two headphone jacks to my TV set? I would like to use both headphones at the same time or either one individually.

—W. G. S., West Chester, Pennsylvania

Add a SPDT toggle switch (S), a 10-ohm, 2-watt resistor (R), and two open-circuit phone jacks (J1 and J2), break one side of the speaker circuit as indicated at X, and wire the parts as shown in the diagram. When S is set to OFF, the speaker is disconnected and the resistor is connected in its place. Plug in a low-impedance (6-8-ohm) headset into either jack or two into both jacks. If one lead to the speaker voice coil is grounded to the speaker frame, break the ungrounded lead (X). Mount the switch and jacks on the insulated rear cover, not the TV set chassis.



SOS in QRM

Doesn't the Coast Guard and the FCC have a monitoring device to listen in on 2182 kHz, the distress frequency? They should do so on weekends when boat owners are calling for help. So many boat owners talk back and forth on that channel and, when told to get off, they don't. There should be a \$500 fine and their licenses should be taken away for using that frequency for other than safety and calling. Why don't you publish a list of all Coast Guard, ship, fire and police, aircraft, taxi, pleasure boat, CB and amateur stations?

—T. M., Red Bank, New Jersey

The Coast Guard does monitor 2182 kHz (kc), at all times. You are right about taking action against boaters who use 2182 kHz for gabbing. Many

boat owners act as if they were CB hobbyists, monopolizing the channel that is used even by ocean liners for safety purposes. Smart boat owners are installing VHF-FM marine radios because the VHF marine channels are not congested.

It is impractical to publish a list of all non-broadcast stations since there are hundreds of thousands of them and it would require several volumes. You can get amateur call books at radio parts distributors. CB call books are available from Communications Publishing Corp., Box 63992, Oklahoma City, Okla. 73106.

Be Specific

Can you give me a schematic for a transistorized antenna amplifier?

—J. B. H., Petaluma, California

For what frequency band?

Schematic Found

One of your readers asked for a circuit of an Atwater Kent Model 20 receiver. Years ago I purchased two "Official Radio Service Manuals" (published by Gernsback) from a service man who was in the business during the late '20's and the early '30's. I find there are two Model 20's, the compact 7960 for headphones only and the 4640 for use with a loudspeaker. I would be glad to let you have copies of the diagrams.

—H. W., Manitowoc, Wisconsin

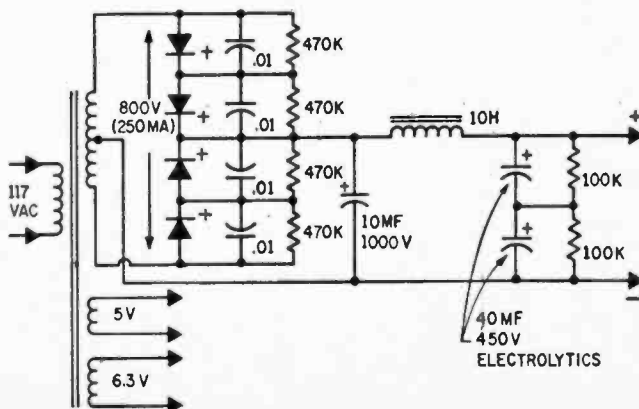
If you will loan us the diagram for publication, we will be grateful and will return it to you.

Xmitter B-plus

Please give a schematic of an economical power supply delivering 400-500 volts at 200 milliamps for a 75-watt transmitter.

—L. M., Yonkers, N. Y.

Try the circuit shown in the diagram. Pick rectifier diodes with high PIV.



BFO for SSB

I have a Lafayette HA63 receiver. It is possible to convert it so I can receive SSB signals? I like the radio but would like it more if I could get SSB.

—E. S. G., Detroit, Michigan

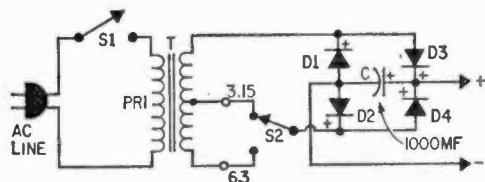
Get a Lafayette Beat Bander, a BFO that can be used externally with almost any shortwave receiver. The device furnishes the missing carrier to make it possible to receive SSB signals.

Small Power Supply

Can you give me a circuit of an AC-to-DC power supply capable of delivering 3 to 5 volts at 20 to 25 ma?

A. B. P., Philadelphia, Pennsylvania.

You can use a 6.3-volt filament transformer (T1) and four garden-variety silicon rectifiers connected in a full-wave bridge circuit as shown in the diagram. Switch S2 lets you select either full voltage (excess of 6) or half voltage. The actual voltage depends upon load current. Capacitor C filters out the ripple.



Beginner's Special Query

Can a ferrite-rod or a telescoping antenna be used for the "Beginner's Special" solid-state regen instead of the 10-15 foot long-wire antenna specified? Transistor radios use ferrite rod antennas, so can't the regen? Can I make mine truly portable?

—D. Y. N., San Diego, Calif.

The ferrite-rod antenna coil would have to be used in a plastic case instead of the aluminum chassis box specified. It will probably be suitable for some of the strong local stations. The telescoping antenna used with the ferrite coil might give you just about the same reception as with the longer (15-foot) antenna if you use a coil with the highest "Q" (figure of merit) you can find—just make sure it will match the capacitor used or you might not be able to cover the broadcast band.

Easy on the Ears

Can I use stereo headphones with my short-wave receiver so they will be rubber-foam padded for comfort?

—T. M., Red Bank, New Jersey

You can get similar phones in mono, such as Superex.

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Ask Me Another

Who Knows

What are the relative advantages of pancake versus cylindrical wound metal locator coils?

—H. P. W., Wichita Falls, Texas

Perhaps some reader who has had experience with both will write and tell us.

SCA Construction

In regard to your article on SCA background music, will you publish a schematic so I can build a SCA detector?

—C. L. Lownsbury, Somewhere, U.S.A.

Watch a future issue for a construction article.

That's Not Right

I have a Knight Star Roamer on which I get radio and TV instead of shortwave. What can I do about it?

—J. S., Denver, Colorado

You must be very close to BCB and TV stations. Try a shorter antenna. Nevertheless, you should be able to receive shortwave stations between the spurious responses from nearby stations.

Transistor Ignition Info.

Where can I get a lot of information on transistor ignition systems?

—D. I. J., Sainte-Genevieve, Missouri

Get a copy of "Transistor Ignition Systems Handbook" at your radio parts store. Publisher is Sams and price is \$2.95.

What's SHF?

When wading through old magazines I ran across the term SHF. Is it or isn't it real and, if it is, what are its frequency and applications?

—R. D. L., Parchment, Michigan

SHF means Super-High Frequency. It is the portion of the radio spectrum above UHF and extends from 3000 to 30,000 MHz (mc). Most microwave systems and radars operate in the SHF bands.

Hurray for Leo!

My CB transceiver has channel numbers one through eight and tuning numbers one through 23. Please translate the numbers for me in terms of megacycles.

—A. K. G., Wisner, Nebraska

The channel numbers refer to the channels for which the transceiver has crystals installed. Channel 1 could be any channel. So could Channel 2, and so on. The tuning dial refers to the CB channels, originally numbered as below by Leo G. Sands in his book "Class D Citizens Ra-

dio." Since then, the industry has adopted the same channel numbering system which is listed below.

Channel Number	Frequency (mc)
1	26.965
2	26.975
3	26.985
4	27.005
5	27.015
6	27.025
7	27.035
8	27.055
9	27.065
10	27.075
11	27.085
12	27.105
13	27.115
14	27.125
15	27.135
16	27.155
17	27.165
18	27.175
19	27.185
20	27.205
21	27.215
22	27.225
23	27.255

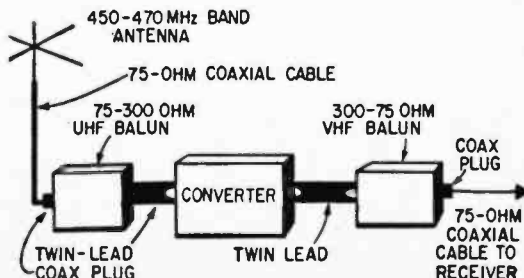
Converting Converter

How can I convert a UHF TV tuner so I can use it with a 150-174 MHz (mc) band receiver for tuning in 450-470 MHz band mobile stations?

K. W., Chicago, Illinois.

Add a slight amount of capacitance (a few mmf) across the oscillator tank until it tunes down below 470 MHz. To connect its output to your receiver, use a 300-to-75-ohm matching transformer (balun) as shown in the diagram. The impedance match into your receiver won't be perfect, but it is suitable for such an inadequate set-up.

You will also need an outdoor (rooftop) 450-470 MHz band antenna. You can get one from Mark Products in Skokie near you. The UHF balun is also required, as shown. Here again, you may have some mismatch since most communications antennas are 50 ohms.



Not Impossible—Not Easy

Is there any way I can convert my Lafayette HE-15 to operate in the 6-meter ham band?

—P. D., Woodhull, New York

You can take turns off the receiver antenna, mixer and oscillator coils and the transmitter RF amplifier output coils, or select new coils from the J. W. Miller Co. catalog (5917 South Main Street, Los Angeles, California 90035). Operate the RF amplifier as a doubler, using crystals operating at half the output frequency. Use a dip meter to determine when the coil turns are correct. This would make a good construction project article. How about a reader writing one?

It Is! It Is!

How can I change the circuit of the Test Bench Power Supply (Aug.-Sept. 1966 issue) to also have variable amperage?

—No name, Mesa, Arizona

The amperage is variable since the current depends upon voltage and load resistance ($I = E/R$).

Solid-State UHF Converter

Is there such a thing as a transistorized UHF converter for TV?

—J. J. McC., Cambridge, Mass.

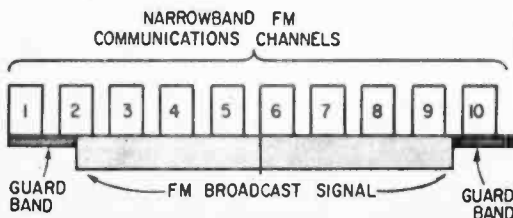
The Blonder Tongue BT-44 is solid state and sells for less than \$15.00. Your Boston parts distributors should have them available.

Never The Twain Shall Meet

Is it feasible to modify a standard portable FM radio for receiving the 30-50 mc or 150-174 mc band?

—P. H., Ukiah, California.

While you could modify the front end (mixer, oscillator, RF), the IF amplifier would be too broad and you would have trouble separating land mobile stations, several of which would fit into the 200 kHz (kc) or wider band pass of the receiver. FM broadcast stations employ wide band FM with ± 75 kHz deviation whereas communications stations mostly use only ± 5 kHz deviation. While both are FM, they are quite different.



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COMPASS GALVANOMETER

by T. A. BLANCHARD

Many electrical measuring instruments today are based on the design of the d'Arsonval *String Galvanometer*, but substitute a needle-suspended coil riding on jeweled bearings for the hanging coil employed in the original precise lab instrument.

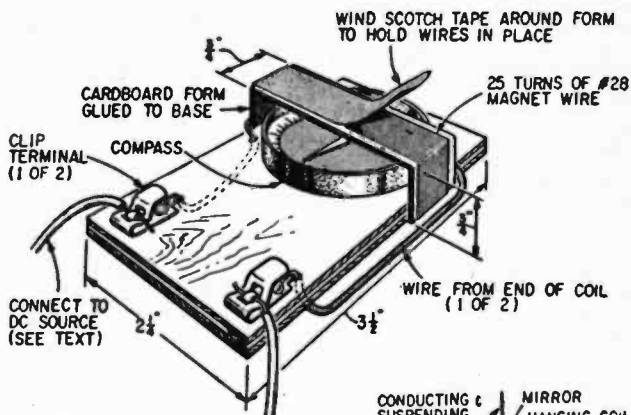
The galvanometer is not often used to measure quantity of current flowing in a circuit, but rather to indicate the polarity and presence of small currents by comparison to null methods. The compass galvanometer (made from the illustration at right) can be used with a Wheatstone bridge to indicate null points.

The d'Arsonval instrument suspends a small coil between the pole faces of a permanent *horseshoe* magnet. When a current flows through the coil it becomes an electro-magnet and its *like* poles repel the *like* poles of the horseshoe magnet, thus causing the coil to turn on the connecting wire. The strength of the current through the coil determines the extent of the coil's rotation.

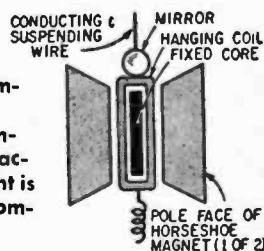
A small pointer attached to the moving coil registers on a curved dial, or a tiny mirror is attached to the galvanometer string. A beam of light is aimed at the mirror, bouncing the beam off to a wall screen or chart to give great magnification of tiny current changes in a darkened room.

Making A Simple Galvanometer. A small amount of insulated magnet wire, any Boy Scout pocket compass and a $2\frac{1}{4} \times 3\frac{1}{2}$ -in. scrap of plywood is what you need to make the compass galvanometer. Cut a strip of cardboard $\frac{3}{4}$ -in. wide and $3\frac{3}{4}$ -in. long. Score the cardboard $\frac{3}{4}$ in. from each end, with a dull knife blade and crease so the cardboard form resembles a C or bridge shape. Now glue the cardboard to the edges of the wood base. Do not use tacks!

Bind the cardboard with a rubber band until glue or cement dries. Wind 25 turns



Easy to build, the compass galvanometer (above) can be assembled in an hour at practically no cost. At right is hanging coil galvanometer used in labs.



of #28 magnet wire around the cardboard. Heavier wire and fewer turns will work, too, with a slight drop-off in sensitivity.

Scotch tape is wound around the finished coil to keep the wire turns in place. Connect the ends of the coil to screw terminals or clips. Slip the compass under the coil in a position where its needle comes under the coil and parallel to the coil turns.

Connect the galvanometer in series with a flashlight battery and bulb, a buzzer or a toy motor, etc. When the circuit is closed, the compass needle will be drawn so that it is at right angles to the coil. A slow swing of the needle indicates the circuit is drawing little current. A rapid swing denotes an increase in current flow.

To show how sensitive this simple galvanometer is, connect what appears to be a dead flashlight cell across the terminals, immediately breaking the circuit. The compass needle will spin at a merry clip, indicating there is still some life in the "dead" cell.

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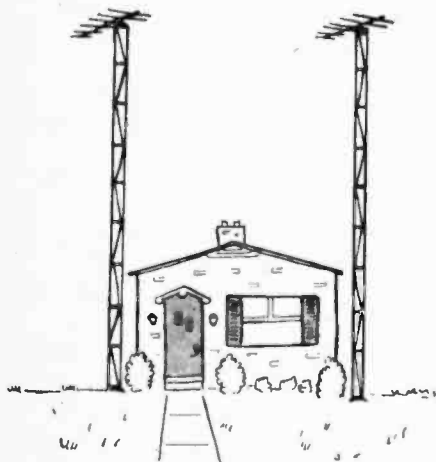
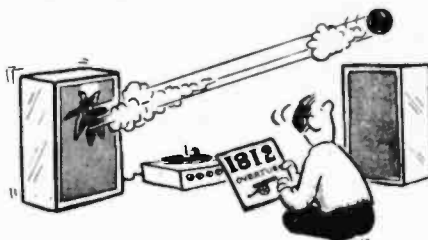
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THE MOST TRUSTED NAME IN ELECTRONICS

STEREOERETS

By
Jack Schmidt



CONTINENTS ON THE MOVE

By K. C. Kirkbride

*Had he not been millions
of years behind time,
Columbus might well have
walked to the New World!*

■ Not too long ago, three Australian scientists made a startling announcement. Their continent, they said, was on the move, and the land of sheep, Bushmen, and bikinis was creeping toward warmer climes at the steady rate of two inches a year!

University of Australia scientists, backed up by scientific facts borrowed from the University of California, had applied potassium-argon radioactive-dating to several hundred rock specimens from more than a score of sites in four areas of Eastern Australia and one in Tasmania (an island off the south coast of Australia). The rocks they found ranged from a mere 93 million to 200 million years in age, and all were tested for "remanent magnetization," magnetization imposed on them by the earth's magnetic field when they were formed.



CONTINENTS

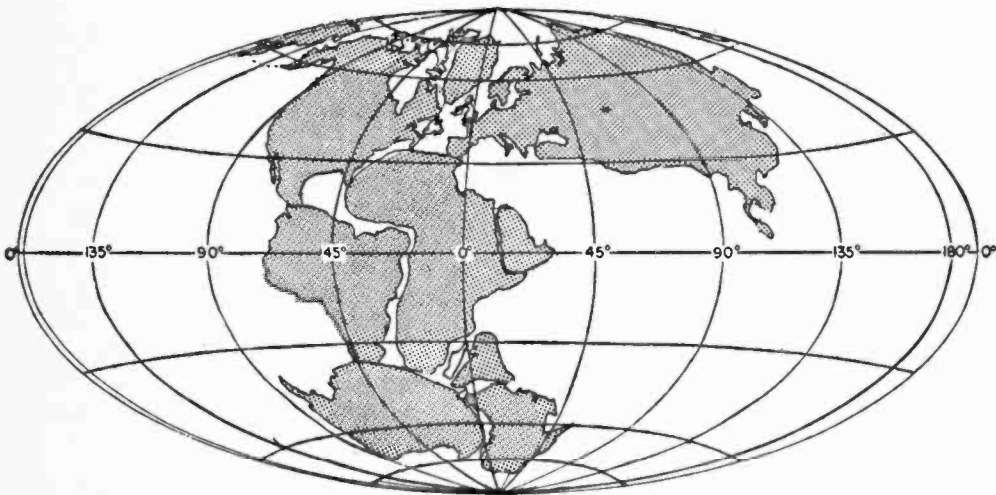
The result of their extensive testing convinced the Australian scientists that their country was not only on the move, but had been for a long time. In fact, it had traveled *3400 miles* in the past 100 million years.

According to the rock testimony, Australia at one time must have been a shivery continent close to the South Pole. Packing two feet of ice aboard, it had slowly inched its way to its new address in the balmy waters of the Pacific and Indian Oceans. And it apparently doesn't intend to stop there.

For almost from the time man could turn a globe around he has puzzled over the fact that South American shores could be pushed up against West African shores with virtually perfect jigsaw fit. The obvious question many have asked: had these continents once been linked?

As long ago as 1620 Francis Bacon suggested the answer was yes. An Austrian geologist named Edouard Suess who lived in the 19th Century thought there could have been a great super-continent about the time of the Paleozoic Age, and named it *Gondwanaland*.

But not until 1912 did German meteorologist Alfred Wegener gather geological evidence enough to present a serious case



Reconstruction shows continents as they probably were during the age of dinosaurs, flying reptiles, and early mammals about 200 million years ago. It was during this time, the mid-Mesozoic period, that continental drift occurred due to spreading from mid-ocean ridges.

When they wrote up their findings in the *Journal of Geological Studies of Australia*, the scientists explained they had arrived at their conclusions because their extensive research could lead to only one of two answers. Either the earth had boasted some pretty mixed-up magnetic fields (with more than two poles) at some time or other, or Australia had traveled a long way.

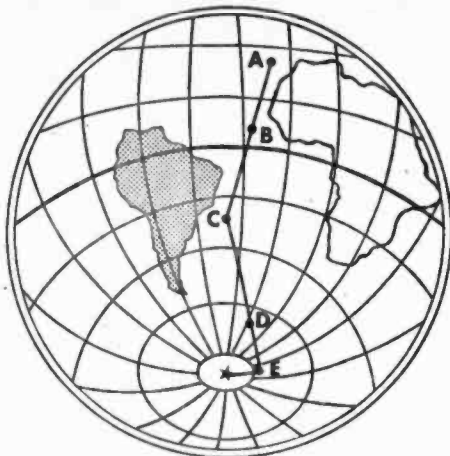
The Great Jigsaw. All of which stirred an old controversy. Had there really been, as many scientists claim, a great super-continent that stretched across the South Pole millions of years ago, a one-world continent surrounded by a single ocean? And had it been broken up by some action of nature, its sections to drift apart to form the continents we know now?

for the fact that once there had been such a continent, that it had broken into pieces and shifted to various parts of the earth. In a best-seller of his time, Wegener argued that if the earth could "flow" vertically as we know it does in the formation of mountains, why could it not flow laterally?

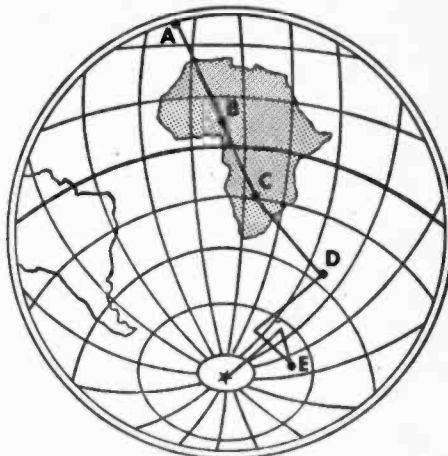
Wegener pointed to the Aspy Fault in Nova Scotia, which he said could be an extension of the Great Glen Fault in Scotland. Similarities existed in mountain ranges in Newfoundland and Scotland. And if you wanted to "move" North America over toward Europe, you could see a good fit between formations of the Appalachians on the east coast of the U.S., and the highlands of Scotland and even Scandinavia.

What's more, fossil remains found in the

POLAR WANDERING CURVES FOR SOUTH AMERICA AND AFRICA THROUGH THE AGES

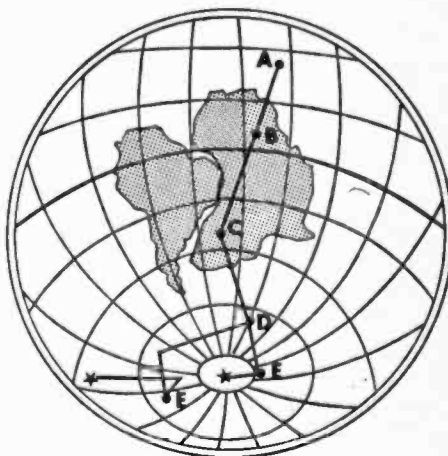


1. Polar Wandering Curve for South America



2. Polar Wandering Curve for Africa

As rocks formed from sediment, small particles of iron were locked into place. Each particle was aligned by the north-south magnetic pole field forces, much like the particles found in magnetic tape. From these "locked" particles scientists can pinpoint the south pole location millions of years ago. Called paleo-magnetic reconstruction, the study of rockbound particles reveals polar wanderings through the ages for South America (1) and Africa (2). The letters in the diagrams refer to the ages of the rocks from which the polar wandering curves were deduced: A, 400 million; B, 330 million; C, 250 million; D, 200 million; and E, 170 million years ago. By superimposing the curves in (1) and (2) on each other, scientists found the position of Africa relative to South America (3) for the interval between 400 and 200 million years ago. Note that the older parts of the curves in (1) and (2) coincide in (3) at points A through D. When the pole wandered during these ancient times, Africa and South America were one large land mass. From 200



3. Location of Africa and South America 200-400 million years ago

million years ago to today, the mated continents have drifted apart, which explains why the polar drifting curves in (3) do not match from point D to the present day (★).

South American Andes and in Western Africa of both plants and animals were so similar they could have grown side by side in the same age. And one 18-ft.-long swimming reptile, the Mesosaurus, had twin brothers in South America and West Africa and no other relatives in the world.

Disbelievers. But for all this imposing evidence, the status-quo thinkers were still not convinced. The earth had once been a

huge flaming ball, they said. And then it had cooled. And its contractions had fathered the mountain ranges, but the continents were fixed now. And the oceans stayed in place. Besides, there wasn't any power on earth that could push a continent around.

But advances in radioactive probing soon proved the earth a bit more complicated than the traditionalists held. For one thing, it was old, some 4.5 billion years. For an-

CONTINENTS

other, the cooling hasn't stopped at all. Quite the contrary, heat is still being generated from within the earth!

And much as water slowly simmers in a pan, convection currents could account for some of the motions of our crust. For the transfer of heat flowing from the earth's inner layers through the conductive material of the upper layers could cause the stress and strain known on the surface.

The Big Shift. One theory has it that the top consists of 40-50 miles of granitic solids. Resting on other layers that are hot plastic, this top layer can shift, sheer, and slide as forces command. And it can be this slow, continual churning that causes volcanic action and earthquakes. Millions of years ago, it could also have caused the earth's top layer to break, setting the continents adrift.

With this explanation, it was easier to picture the earth's crust at one time, angered by two giant heat engines—the sun above, the earth below—breaking first into mammoth cracks and pieces and then setting a massive continent adrift.

But still the scientists argued. Some geologists insisted that research into earthquake phenomena had shown the earth must be steady-state. And almost every geological convention from 1915 on went on record as having taken its own crack at the drift/anti-drift debate.

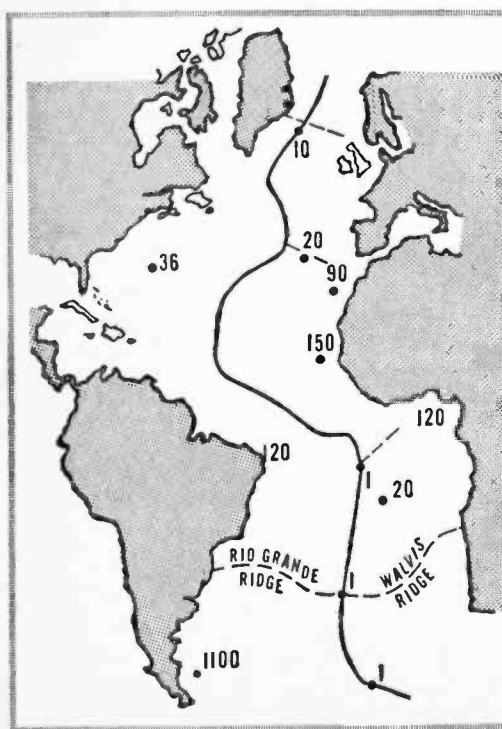
Then Dr. J. Tuzo Wilson of the Institute of Earth Science at the University of Toronto flatly came out for the "drifters." He said evidence clearly showed "great horizontal displacements" had broken the earth's crust. There were three ways he could tell:

1. Measurement of the magnetism of rocks found on various continents showed the continents must have moved in relation to the earth's magnetic poles.

2. Huge faults, cleavages in the earth's crust, seemed to have drifted tens, even hundreds of miles in their time. The great cliff in the floor of the Eastern Pacific must have shifted as much as 750 miles, if his magnetic studies were right.

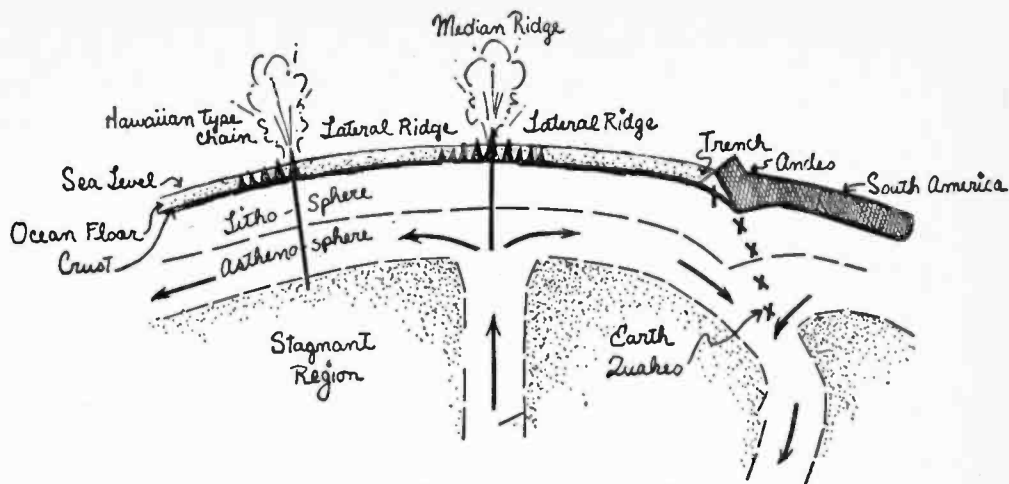
3. The islands in the oceans seemed to get older the farther they were from mid-ocean ridges.

Crack! Besides, it stood to reason that if the continents separated at one time, there should be ridges in the ocean's floor to mark where they had cracked, and these ridges



THE BIRTH OF AN OCEAN

The Atlantic Ocean did not exist 200 million years ago. It was born when the continents which now comprise the old and new worlds separated along a median ridge (solid line). Since new material belched forth from the earth to fill the void on the floor of the ocean, the volcanic islands in the Atlantic are younger than the ocean (numerals on the map indicate island ages in millions of years). Note that islands are older the further they are from the median ridge. The dashed lines indicate lateral ridges whose ends would match points on opposite continents that were previously joined. Since the island mass off the tip of South America is older than the Atlantic Ocean, it must be part of the continent that broke free during the past 200 million years. The solid dots on the map indicate islands which have active volcanoes.



Diagrammatic section of the earth in the mid-Pacific Ocean offers clues to the origin of pairs of lateral ridges, median ridge, Hawaiian-type chain and mountains. Heat from the center of the earth brings material up to a weak point in the earth's surface, pushing hot lava outward. The weak point is the median ridge (see drawing and caption at bottom of previous page). As the ocean floor moves away from the median ridge, a chain of volcanic peaks is formed, creating the lateral ridges on either side of the median ridge. A long time ago, a volcano at the median ridge remained active as it drifted westward, thus forming the Hawaiian chain. Note, no peaks are to the east of this chain. As the ocean floor bumps against the South American continent, it flows downward. When it does, the continent is suppressed on its west shore and the Andes are pushed upward to form a tall mountain chain. The earthquake region along the coast is thought to be a result of the continent snapping back into place as the ocean floor tries to push it down.

should follow the continents' shorelines.

Tracing a ridge between Europe and North America that follows much the same jigsaw pattern of the shorelines between North America and Europe was compara-

tively simple. So was tracing the ridge between West Africa and South America. But it took a survey of the Indian Ocean to trace the breaking lines between the four continents of Africa, Asia, Australia, and Antarctica.

Three such ridges have been traced and a fourth is believed to exist. Clear ridges show between Antarctica and Australia, India and Africa. Some scientists even believe that as India moved northward, it collided with the Asian land mass, *throwing up* the Himalayan mountains!

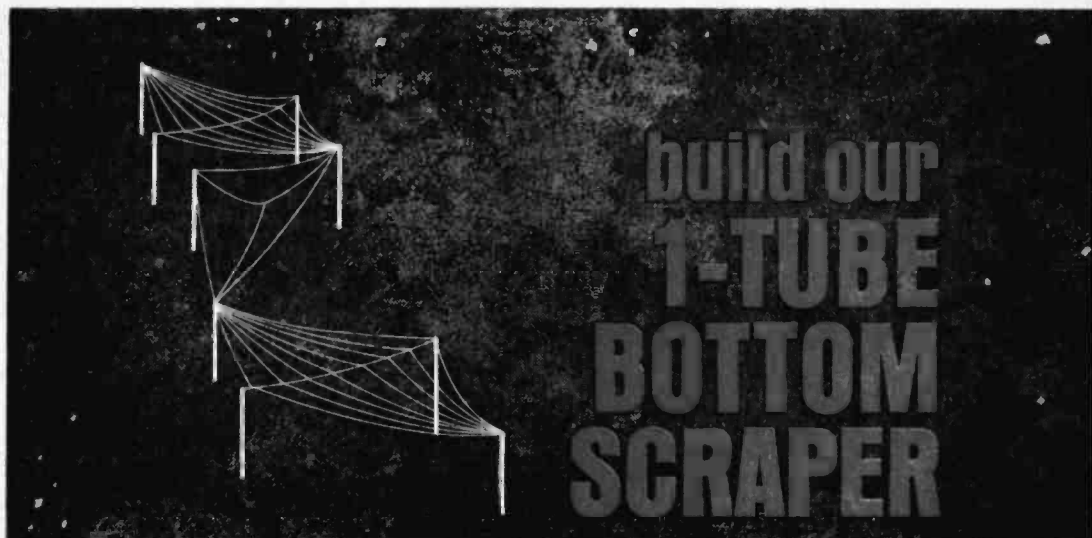
Wilson believes the rifting began millions of years ago with a crack that slowly broke North America from Europe, separating in a triangular shape forming Greenland. To the South, the rifting continued, next separating Africa from Antarctica, then spreading diagonally across what is now the Indian Ocean.

As Africa and India moved northward, they separated from Australia as well as Antarctica. And then in another sixty million years, the convection churning opened a northwesterly diagonal that separated Africa from India, and Australia from Antarctica.

(Continued on page 120)



Leading proponent of the continental drift theory is Dr. J. Tuzo Wilson (center) of the Institute of Earth Science, University of Toronto. Here, Prof. Wilson discusses the once-controversial concept with two other members of his staff: Gordon West (left) and Fraser Grant.



■ Here's a one-tube receiver project that has been designed especially for eavesdropping on the Navy's super-powered CW stations that operate in the vicinity of 20 kHz(kc). Whether you're interested in high-speed code practice with 5-letter cipher groups, want to copy the latest news flashes in plain English, or merely want to set your watch by good ol' Naval Observatory time signals, it will pay you to have a receiver that tunes to the fantastically-long wavelengths in the neighborhood of 15,000 meters.

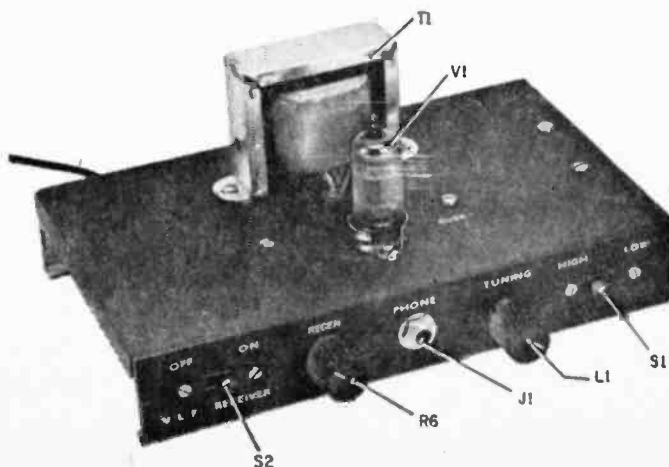
Just think of it, a half wave antenna for this range is almost 5-miles long! Of course you won't need one that long to pick up signals satisfactorily. In Michigan, where the author lives, a hundred feet of wire and

a good ground provide excellent reception, day or night, of NAA in Maine; NSS, Maryland; and NPG on the west coast. As a matter of fact, that's why Uncle Sam uses such long waves. They offer consistently good reception all over the world so that even submerged nuclear subs on the other side of the globe can get their latest orders without difficulty.

About The Circuit. The receiver consists of a regenerative detector that tunes from 13 to 28 kHz plus a single stage of audio amplification. A self-contained power supply furnishes DC for the tube.

You tune to different VLF stations by varying the position of the slug in L1, a TV horizontal-oscillator coil which is paralleled

Bottom Scraper was built on chassis without panel or cabinet. If you want a more impressive receiver, unit can be housed in a small sloping-front enclosure.



By Hartland B. Smith, W8VVD

**COVER
PROJECT
For Beginners**



... and tune in the unbelievable subbasement of radio!!!

by C1. An extra capacitor, C2, may be switched across coil L1 to provide sufficient tuning range—to cover the entire band from 13 to 28 kHz. Schematic diagram is located on page 49.

In the antenna circuit, choke L2 passes very-low frequencies, but offers a high impedance to strong local broadcast signals. It prevents them from reaching the grid of V1A where they would be detected and cause unwanted interference.

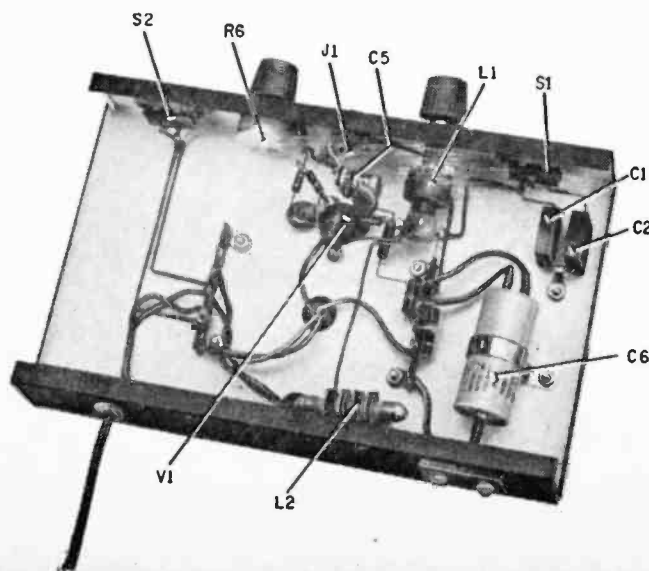
Potentiometer R6 is the regeneration control which varies the screen voltage of V1A. When this voltage is set at the proper level, V1A oscillates to provide the beat note required for reception of CW signals.

The detector's output is coupled, via C4,

to the grid of V1B where the audio signal is amplified. The plate circuit of this stage is capacitance-coupled to high-impedance headphones plugged into J1.

The half-wave rectifier power supply furnishes approximately 150-volts DC to the plates of tube V1. The filament winding of transformer T1 supplies 6.3 volts AC for the heater.

Construction. Most articles tell you to carefully follow the layout of the original and to avoid parts substitutions. This receiver is different. You can employ just about any layout that suits your fancy, without degrading the performance of the set. As a matter of fact, the short, direct leads usually required in RF circuits are of little



Bottom view of chassis of Bottom Scraper shows there is plenty of room, so smaller chassis could be used without affecting operation. Other frequencies below 540 kHz can be tuned if additional capacitors are switched by a multi-position S1.

Bottom Scraper

consequence in a unit that operates at or near the audio frequency range.

With the exception of L1, C1, and C2, component values may vary by as much as 50% from the figures specified, with little or no effect on the receiver's operation. As a result, this gadget is a natural for construction from junk box parts.

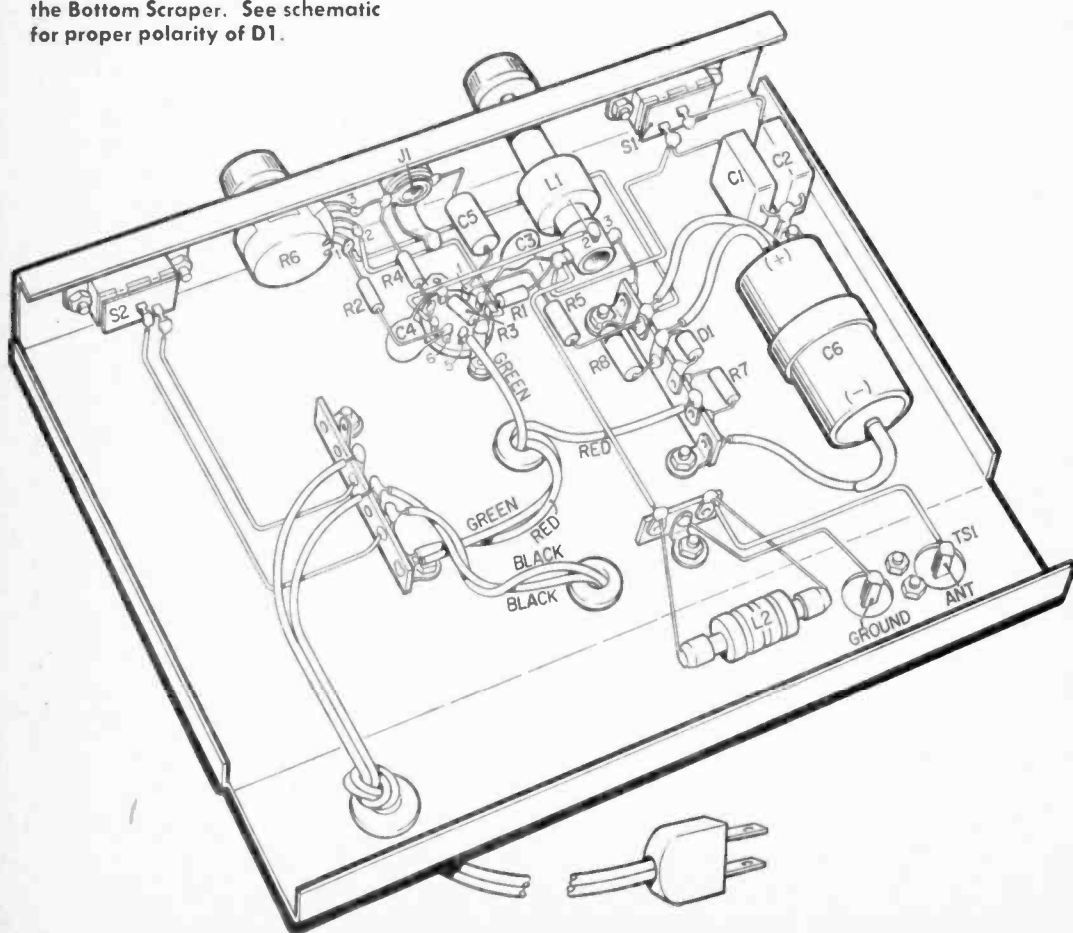
The threaded brass adjustment shaft of L1 is too small to accept knobs designed for 1/4-in. shafts. A short length of plastic rod or wooden dowel is cemented over the end

of the shaft so that an ordinary knob can be fastened to it. Since L1 was not designed by the manufacturer for constant tuning, it will pay you to apply a small amount of Lubriplate or Vaseline to the threads in order to minimize friction and wear.

Operation. Attach an antenna at least a hundred feet long to the ANT terminal of TS1 and a good cold-water pipe ground to the other terminal. Screw the slug of L1 fully counterclockwise (all the way out of the coil) and open S1 (*HIGH* setting). Plug a pair of headphones into J1 and turn S2 *on*.

After V1 has warmed up for a minute or two, advance R6 until you hear a hissing noise in the phones, which denotes that V1A is oscillating. Slowly turn the knob of L1

Pictorial diagram can be used by the beginner to successfully wire the Bottom Scraper. See schematic for proper polarity of D1.



Back the slug out a bit and the whistle will disappear. NAA, the lowest-frequency

For the best results, always operate the receiver with R6 set close to the point where oscillation just commences. Advancing the regeneration control too far will not only reduce sensitivity, but may even cause the oscillator to take off at an audio rate, producing an uncomfortably loud howl in the headphones. ■

Schematic diagram reveals simplicity of 1-tube VLF receiver.

TS1
ANT
GND
L2
2.5 MH
C1
LOW
HIGH
S1
C2
0.0015 MF
0.0025 MF
L1
R1
680K
C3
0.001 MF
V1a
6
2
7
3
R6
50K
REGENERATION
C4
0.001 MF
R2
68K
R3
560K
R4
68Ω
V1b
9
8
R5
3.3K
C5
0.068 MF
HEAD-
PHONES
J1
GND
T1
S2
Black
Red
Red
Green
Green
6.3V
R7
39Ω
D1
C6a
50MF
R8
1K
C6b
50MF
FILAMENT
V1
5
4
BOTTOM VIEW
L1

Estimated cost: \$14.00
Construction time: 3 hours

■ Each year finds thousands of bespectacled radio engineers tinkering and fussing in an effort to roll back the upper frontiers of the usable radio spectrum. Before World War II, microwaves were little more than a dream. But by the postwar years the art of radio had extended way up into the megaHertz. Today, we have stretched the radio spectrum so high in frequency that transmitted waves have taken on weird science-fiction aspects—so much so, in fact, that such words as “lasers,” “death rays,” “klystrons” and “magnetrons” are now commonplace as cornball comedians. For the truth is that SHF and EHF (super and extra high frequencies) have largely been conquered with the help of computers, sophisticated equipment, high-powered talent, and large doses of cash.

Lost in the shuffle to expand radio's glamorous high-frequency frontier is the possibly more fascinating work being done to locate the bottom end of the radio spectrum. If progress is a true measure of the stiffness of a challenge, then the VLF (very low frequency) researchers are having a much tougher time of it than the fellows working with microwaves. Each step of progress in the microwave spectrum is measured in thousands of megaHertz (a megaHertz being a million Hertz or cycles), and new barriers are broken every few years. At the low frequency end, things stand only a few kiloHertz below where they were fully 40 years ago.

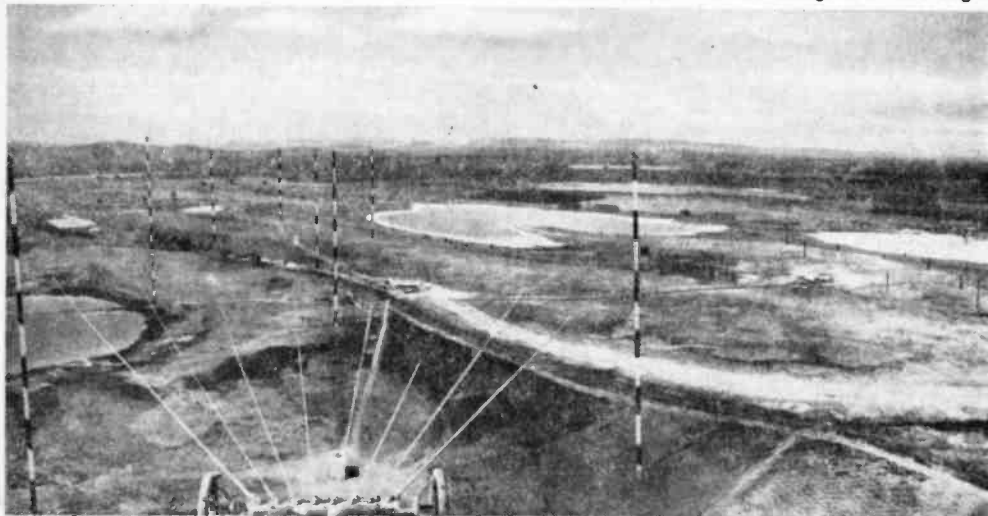
Yet that low-frequency limit is keeping many people busy on a round-the-clock schedule—and they're studying more than

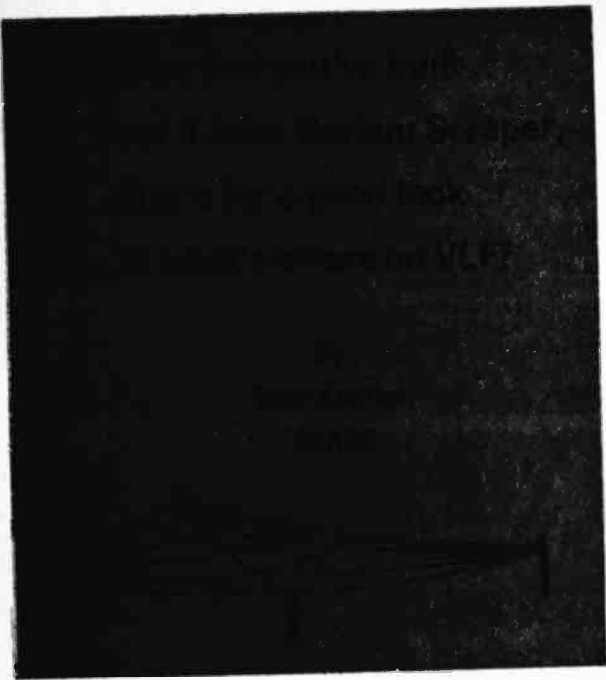


just the frontier itself. In fact, they're researching all manner of strange (and often unexplained) radio sounds and signals which mysteriously appear in their receivers.

And just as “laser” and “klystron” can be considered bywords of EHF, VLF, too, has its own special parlance, each word being a description of some of the strange sounds to be heard: “whistlers,” “the hiss,” “risers,” “clicks,” “chinks,” “tweak,” and the “dawn chorus.” (Whistlers are generated on earth by lightning; some of the other signals are

NBS antenna farm at the Fort Collins, Colo. site. Tallest mast is a towering 470 feet high.





heard only during a nuclear explosion or rocket launching; still others have left researchers scratching their heads in wonderment. One theory even has it that some sounds might be caused by minute particles flowing from the sun toward earth!)

Why VLF? But why the interest in developing a portion of the radio spectrum which may have been played out four decades ago? Laser beams and radar have already given us adequate reward for microwave research, but what—if anything—can

be gained from these very low frequencies?

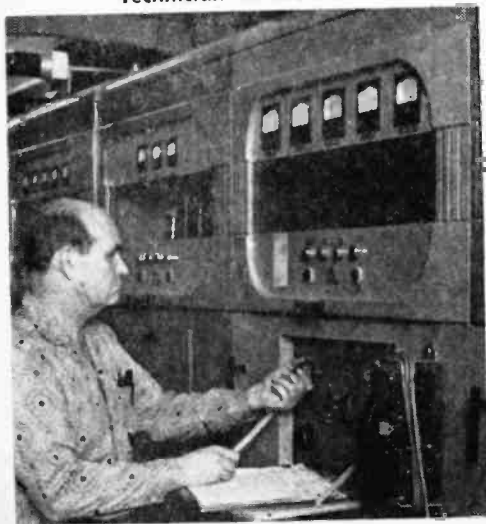
Not too long ago several interesting things were learned about VLF which did a lot to give the band increased importance. For many years it had been thought that the ionosphere would hold these signals along the surface of the earth. However, the LOFTI I satellite (launched in 1961) not only squashed this theory but set scientists to seriously considering the use of VLF for intra-space communications.

One reason stems from the fact that VLF signals aren't subject to the whims of sun-spots and various ionospheric conditions which can black out all other forms of long-distance radio communications for hours or even days. In addition, only VLF signals can be heard by submerged submarines (even as much as 100 feet down) regardless of their location.

It was also discovered that the super-accurate time and frequency standards being broadcast by the U.S. National Bureau of Standards over station WWV on shortwave were actually not nearly as accurate as the signals which were (and are) being sent over WWVL, their VLF experimental station on 20 kHz. When the space program called for precise time and frequency standards never before required, VLF saved the day.

With high-powered VLF stations established, a multitude of purposes could be served. It could be used for round-the-clock communications with nuclear subs which might stay submerged for several months; it could provide communications with other VLF land stations without fear of temporary

Technician monitors and records meter readings at transmitter in WWVL "shack" (at right).



VLF listening

interruptions which might pop up during an international crisis; it would fill the bill for the space program's needed accuracy and would be available in the event long-range communications into outer space were ever required.

The Big Ones. The U.S. Navy took up the challenge and built a gigantic VLF transmitting station, NLK in Jim Creek, Wash. Delivering a million-watt signal, the station actually pumped its power from an antenna system strung across a mountain range. The results were so encouraging that the Navy then built NAA in Cutler, Me., as a big brother for NLK.

To imagine the magnitude of NAA is a bit much for the mind of modern man (used to the trend towards micro-miniaturization

of electronics gear). The rig runs a cool 2 million watts; its antenna is comprised of 64 miles of 1-in. bronze wire which hangs from 26 towers, some nearly as high as the Empire State Building. The antenna is separated from the masts by 70-ft. insulators. Ground system? Yes, they use 11-million ft. of copper wire. As for coupling the transmitter into the antenna, the coaxial matching section is so large a man can stand inside it.

These two stations proved so successful that the Navy eventually established a network of VLF communications stations. Meanwhile, many other nations have climbed aboard the VLF bandwagon. The net result is that tuning a receiver across the band today brings in a multitude of stations from points throughout the world, all chattering away like mad. Because of the nature of the band and its signals, a simple regenerative receiver can bring in stations which, on shortwave, would be rare DX with even

Very-Low Frequency Station Listings—13.6 to 18.6 kHz

KHz	Call	Location	Kw	KHz	Call	Location	Kw
13.6	NPM	Honolulu, Hawaii	50	16.2		Yosami, Japan	500
	NBA2	Summit, Canal Zone	50		UGK	Kaliningrad, USSR	500
		Forestport, N.Y.	25	16.3		Hermosillo, Mex.	1
14.1	NAA	Cutler, Me.	2000			Merida, Mex.	1
14.29	SOA21	Warsaw, Poland	200			Mexico City, Mex.	1
14.3	UVH4	Ostachkov, USSR	15			Monterrey, Mex.	1
	UBE2	Petropavlovsk, USSR	500			Tapachula, Mex.	1
	EOY3	Piltun, USSR	1	16.4	DMA	Mainflingen, W. Germany	10
	EOB2	Preobrajenskoe, USSR	1	16.5	SOA31	Warsaw, Poland	200
14.5	CNM	Casablanca, Morocco		16.6	NPM	Pearl Harbor, Hawaii	1000
	HWU	LeBlanc, France	250	16.8	FTA2	St. Assise, France	250
14.6	UVA	Batumi, USSR	100	17	VTO	Vizagapatam, India	50
14.7	NHB	Kodiak, Alaska	1000		FUB	Paris, France	
	NPN	Guam, Marianas Is.	1000		NDT	Yokosuka, Japan	
	NPM	Pearl Harbor, Hawaii	1000	17.1	UMS	Moscow, USSR	1000
	NAA	Cutler, Me.	2000	17.2	SAQ	Varberg, Sweden	200
	NLK	Jim Creek, Wash.	1000		UMS	Kronstadt, USSR	
14.8	NAA	Cutler, Me.	2000	17.44		Yosami, Japan	500
14.9	NBA	Balboa, Canal Zone	1000	17.6	JXZ	Helgeland, Norway	350
15	UIK	Vladivostok, USSR	100		SOA41	Warsaw, Poland	200
	UMS	Kronstadt, USSR		17.8	NPM	Pearl Harbor, Hawaii	1000
15.1	FUO	Croix d'Hins, France	500		NAA	Cutler, Me.	2000
	VTI	Bombay, India	100		NSS	Washington, D.C.	1000
15.3	NHB	Kodiak, Alaska	1000	17.9	UBE2	Petropavlovsk, USSR	500
	NPN	Guam, Marianas Is.	1000		RSZD	Salair, USSR	1
	NPM	Pearl Harbor, Hawaii	1000	18	NBA	Balboa, Canal Zone	50
	EVT2	Dickson, Antarctica	200		NPL	San Diego, Calif.	1000
	NLK	Jim Creek, Wash.	1000		NLK/NPG	Jim Creek, Wash.	1000
15.5	NPM	Pearl Harbor, Hawaii	1000	18.1	UFOE	Matotchkinchar, USSR	100
	NAA	Cutler, Me.	2000	18.2	NAH	New York, N.Y.	200
	NSS	Washington, D.C.	1000	18.4	NAK	Annapolis, Md.	200
15.6	EWB	Odessa, USSR	5000		NAD	Boston, Mass.	200
15.7	NPM	Pearl Harbor, Hawaii	1000		NAH	New York, N.Y.	200
	NPL	San Diego, Calif.	500	18.5	NAA	Cutler, Me.	2000
	NPG	San Francisco, Calif.	500	18.6	NHB	Kodiak, Alaska	1000
15.975	GBR	Rugby, England	750		NPM	Pearl Harbor, Hawaii	1000
16.1	RK19	Agazy, USSR	11		NBA	Balboa, Canal Zone	1000

a high-priced multi-tube superheterodyne set.

Listening on the comparatively little-known and little-explored VLF band is twice as exciting as battling it out on shortwave. And this explains why VLF has attracted a growing number of DX hounds who are pulling new stations out of the noise by the dozens. A receiver or tuner for VLF isn't difficult to construct (plans for a very efficient receiver appear in the preceding article), and firing up a rig on VLF is well worth the small effort and investment.

If you aren't a homebrew fan, there are several military surplus receivers available which will tune down to 15 kHz. Among them are U.S. Navy models RE, RAK, RBA, RBL and DZ, the U.S. Army's BC-969A and R389 (made by Collins), and some relics of World War I vintage which can still cut the mustard—the SE-143 and SE-1420. Further, RCA has shipboard receiver called the AR-8510 which is quite good, and (if money is no object) such commercial re-

ceivers as the National HRO-500 (with VLF converter), Racal RA-17 (with converter), and Wireless Specialty IP-500 are perfect playmates.

What's To Hear? Two differences from SWling immediately become apparent to anyone trying his hand at DXing the VLF band, the most obvious being that CW (code) is the prime mode of transmission. Though some stations (chiefly in the U.S.S.R.) are authorized for voice communications, it's rather tricky trying to run 3kHz of voice modulation in this band, mainly because of the other thing which makes VLF different from shortwave—the way the stations are set up on the frequencies.

On shortwave even CW stations must be separated by at least 1 or 2 kHz so that they can be copied without the use of highly elaborate crystal, mechanical, or audio filters to reject adjacent signals. On the VLF band, where stations are sometimes separated by only 100 Hz or (*Continued on page 96*)

Very-Low Frequency Station Listings—18.6 (cont.) to 27 kHz

KHz	Call	Location	Kw	KHz	Call	Location	Kw
	NAA	Cutler, Me.	2000	21.05	HWU	LeBlanc, France	100
	NLK/NPG	Jim Creek, Wash.	1000	21.37	GYA	London, England	120
	NEJ	Seattle, Wash.	1000	21.4	NSS	Annapolis, Md.	1000
18.8	NAK	Annapolis, Md.	200		NAA	Cutler, Me.	2000
	NAD	Boston, Mass.	200	21.75	HWU	LeBlanc, France	100
	NAH	New York, N.Y.	200	22.1	NAK	Annapolis, Md.	200
18.9	UMB	Rostov, USSR	1000		NAD	Boston, Mass.	200
19	GQD	Anthorn, USSR	500		NAH	New York, N.Y.	200
	MHW	Rugby, England	350	22.3	NSS	Washington, D.C.	1000
	NPM	Pearl Harbor, Hawaii	1000	22.35	NAK	Annapolis, Md.	200
	NSS	Washington, D.C.	1000		NAD	Boston, Mass.	200
19.2	SOA51	Warsaw, Poland	200		NAA	Cutler, Me.	2000
19.3	UFAA	Pereiezdnaia, USSR	15		NAH	New York, N.Y.	250
	ULK	Djarkent, USSR	1	22.7	ARM	Chittagong, Pakistan	50
	RTBS	Povorotnyi, USSR	15		ARL	Karachi, Pakistan	50
19.4	NHB	Kodiak, Alaska	1000	23	UIT	Lazo Khabarovstock, USSR	1
	NPN	Guam, Marianas Is.	1000		UFQE	Matotchkinchar, USSR	100
	NPM	Pearl Harbor, Hawaii	1000		RFG	Millerovo, USSR	15
	NLK	Jim Creek, Wash.	1000	23.2	UFKA	Millerovo, USSR	50
	NSS	Annapolis, Md.	1000	23.4	DMB	Mainflingen, W. Germany	10
	NEJ	Seattle, Wash.	1000	24	NPM	Pearl Harbor, Hawaii	1000
19.6	GBZ	Greenwich, England	350		NBA	Balboa, Canal Zone	1000
19.7	UGE	Arkhangelsk, USSR	150		NLK	Jim Creek, Wash.	1000
19.8	NPM	Pearl Harbor, Hawaii	1000	24.3	RTF6	Sarpa, USSR	15
	NPL	San Diego, Calif.	1000	24.6	ROR/RCV	Moscow, USSR	
	NPG	San Francisco, Calif.	1000	25	ROR	Moscow, USSR	
20	PWZ	I. Governador, Brazil	50		PWB	Belem, Brazil	20
	WWVL	Fl. Collins, Colo.	40	25.3	NAA	Cutler, Me.	2000
	JG2AR	Tokyo, Japan	3	25.7	RFR6	Pioner Sovkhöz, USSR	25
20.27	IDR	Rome, Italy	500	25.82	NAA	Cutler, Me.	2000
20.6		Hermosillo, Mex.	1		NAH	New York, N.Y.	200
		Merida, Mex.	1		NSS	Washington, D.C.	1000
		Mexico City, Mex.	1	26.1	NPM	Pearl Harbor, Hawaii	1000
		Monterrey, Mex.	1		NPG	San Francisco, Calif.	1000
		Tapachula, Mex.	1		NEJ	Seattle, Wash.	1000
	RTSP	Darasun, USSR	1	26.6	CAA2A	Santiago, Chile	50
20.76	IDR	Rome, Italy	2500	27	FTA27	Paris, France	25

WIRELESS DETECTOR

By
ELMER C. CARLSON
Technical Editor

Infrared radiation pyrometer
measures temperatures
up to 25 feet from source,
costs only \$15 to build!

■ This completely portable, self-contained instrument will let you measure the temperatures of motors, flue and steam pipes, engine exhaust manifolds, freshly-painted objects within a bake oven, and other heated surfaces without even touching them. And no longer will you find it necessary to use a ladder to check the temperature of an air-conditioner compressor, wall-mounted electric fan, or lighting fixture shell.

To be sure, industrial infrared-radiation pyrometers have been around for more than a decade. But it's only recently that the heat sensing component has been available over the parts counter and at a price low enough for the experimenter and hobbyist.

Some of the industrial units have complex lens systems, periscope-type telescopic lenses, and many other design features that boost the purchase price. The end result is that a completely wired industrial pyrometer sells for some \$2,000. Of course, this isn't too expensive—for a steel mill, an aircraft manufacturer, or a utility company. But at that price you won't find many pyrometers in home workshops, which explains the beauty of the instrument about to be described.

What's Infrared? Every object radiates infrared rays unless it's so very cold that the electrons stop moving and simply huddle together. With higher temperatures, infrared radiation becomes more apparent—it's *heat*.



Easy-to-build
infrared radiation
pyrometer will
demonstrate a heat-
measurement
technique long used
by industry.

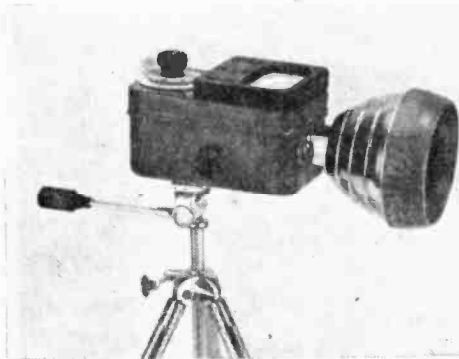
In fact, when you get up to about 1000 degrees Fahrenheit you can start to see the heat radiation as a very dull red glow. As the temperature increases, the radiation frequency increases. Eventually, it becomes white light, which means the object is actually white hot. Once the frequency has become high enough to be visible, the temperatures can be "read" by their color and you don't need instruments like thermometers and infrared radiation pyrometers.

Infrared radiation is electromagnetic radiation. Close in frequency to visible light, these waves have to be handled like light.

Being so short in wavelength we can't make antennas for them as we do for UHF and microwaves.

Significantly, infrared rays radiate from an object almost like radio waves from a broadcast station. The rays get weaker and more spread out as they get further and further away from the starting point. Thus, while we can't make antennas for infrared radiations, we can make *sensors* that react to the heat waves. These *thermistors* reduce their resistance value as they warm up. Very small thermistors—called *thermistor bolometers*, and measuring only a fraction of an inch square—are mounted so they can be exposed to infrared rays and are so designed that they can warm up and cool off very fast.

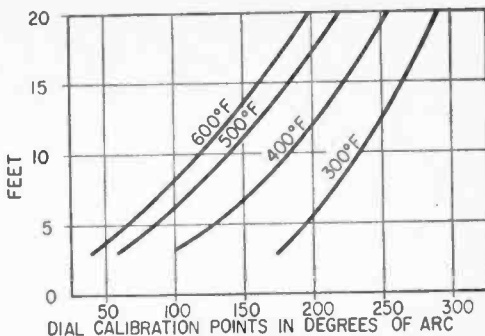
The amount of heat (infrared) radiation reaching the thermistor bolometer is very small, but what does reach it determines the amount of resistance change. For maximum sensitivity (maximum resistance change), there must be maximum infrared radiation pick up and concentration on the thermistor bolometer.



Completed unit is mounted on a camera tripod. Once zeroed in on heat source the unit is locked in position to make temperature readings. Cost of tripod is not included as part of cost estimate.

Infrared frequencies are between microwaves and visible light frequencies. Many of the methods of handling light and microwaves can also be used on infrared rays. The most common item used to collect and concentrate light and microwaves is the reflector. And the larger the reflector the greater the number of rays that can be collected and concentrated. The greater the infrared radiation reaching the bolometer, the greater will be the change in resistance value of the bolometer.

Calibration Chart. This change in bol-



Calibration chart can be used for greater accuracy. Use finely graduated 270-degree dial. For greatest accuracy substitute a 10-turn potentiometer and dial for R6.

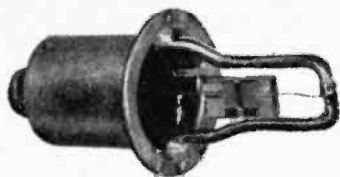
ometer resistance can be recorded in a table or plotted as curves on a graph. And if you're going to use the pyrometer as a portable instrument you will need a calibration chart.

Radiation picked up 20 feet from the heat source will be much less than that picked up only 5 feet from the heat source. (You can actually see this weakening with white light, but infrared is invisible. In fact, most people can't even feel heat rays unless they are very close to the source or the heat source is very large and the heat very intense.)

You'll have to make your own calibration chart. The sample shown here won't be very accurate for any other pyrometer. You can see one reason for this if you use the reflector as a flashlight. The flashlight beam changes in size and shape as you move closer or further from the surface you're shining it on. This beam shape will greatly affect the temperature indications received from distant heat sources. Even the size of the heat source will change the temperature indication (a large warm area can give off the same amount of infrared radiation as a much smaller, very hot heat source). In short, infrared radiation pyrometry has some built-in pitfalls, though if it didn't pyrometers wouldn't cost several-thousand dollars and there would be a lot more of them around.

The Circuit. As already suggested, the heart of this build-it-yourself pyrometer is a little heat-sensitive element called a *thermistor bolometer*. When this bolometer is protected from infrared radiation it has a high value of resistance. Any heat makes the resistance value of the bolometer get lower. (If you measure the resistance of the bolometer with the ohmmeter range of a VTVM you'll get a reading of about 250,000 ohms.

HEAT DETECTOR



Enlarged view of heat detector shows the tiny bolometer suspended from U-shaped support. Flanged base is identical to that used on PR-series flashlight bulbs.

However, the resistance of the bolometer is actually higher, since current from the ohmmeter battery heats the bolometer and immediately reduces its resistance value.)

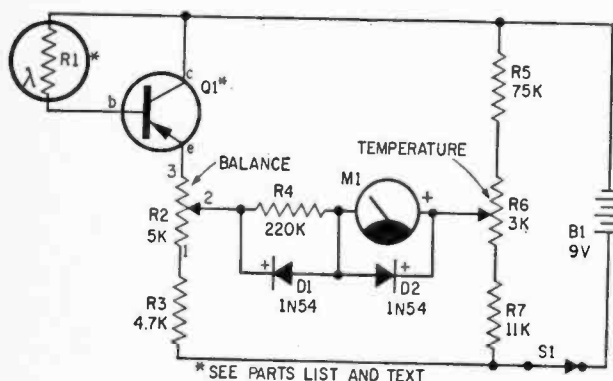
In the schematic diagram, R1 is the heat-sensitive bolometer. As its resistance decreases, more current flows through Q1 because of the change in current in the base circuit. The additional current flow in the

emitter end of its rotation, Balance control R6 is adjusted for a zero indication on meter M1. Now any change in emitter current is indicated as an up-scale reading on M1. The diodes protect meter M1 from excessive current.

The Meter. For maximum sensitivity and reading accuracy a special circuit was designed. Most zero-center meters available at low cost are FM-tuning meters and their sensitivities are only ± 50 or ± 100 microamperes. While ratings of this order are passable for our purposes the scale length on such units leaves much to be desired for making accurate readings.

Since most readings of temperature are up-scale indications, scale length to the left of zero can be kept to a minimum. Accordingly, the pointer-adjust screw was rotated for maximum up-scale reading, and this spot on the meter became the new zero point.

Diode D2 prevents up-scale meter overload—just as in many VOMs that have protected movements. To prevent left-of-zero



Circuit is basically that used in all bridge circuits for exacting measurements. The diodes make it possible to use off-the-shelf meter instead of special unit. R1 and Q1 are part of Infrared Detector kit—bolometer element is shown above, at top left of page.

base-to-emitter circuit increases the voltage drop across R2 and R3.

This voltage drop could be measured directly and calibrated in terms of temperature. But the voltage-drop change is small and accurate readings would be very difficult to make.

By using an old circuit (the bridge), zero to full-scale indications can be made by the same voltage-drop change that would be but a few minor scale divisions on a voltmeter across R2 and R3 (or a milliammeter in series with the emitter or collector to indicate the change in current.)

The bridge circuit balances out the residual (always present) voltage drop from the emitter of Q1 to the battery end of R3. With the reflector covered and with R2 set to the

PARTS LIST

- B1—9-volt transistor radio battery (NEDA 1604 or equiv.)
- D1, D2—1N54 germanium diode or equivalent
- M1—0-50 μ A panel meter (Lafayette 99C5042 or equiv.)
- Q1—Transistor, general-purpose pnp (part of Radio Shack 276-543 Infrared Detector Kit)
- R1—Infrared detector bolometer (part of Radio Shack 276-035, 276-543 or equiv.)
- R2—5,000-ohm potentiometer (linear taper)
- R3—4,700-ohm, $\frac{1}{2}$ -watt resistor
- R4—220,000-ohm, $\frac{1}{2}$ -watt resistor
- R5—75,000-ohm, $\frac{1}{2}$ -watt, 5% resistor
- R6—3,000-ohm potentiometer (linear taper)
- R7—11,000-ohm, $\frac{1}{2}$ -watt, 5% resistor
- Misc.—Knobs, plastic discs, plastic foam, wire, solder, etc.

Estimated cost: \$15

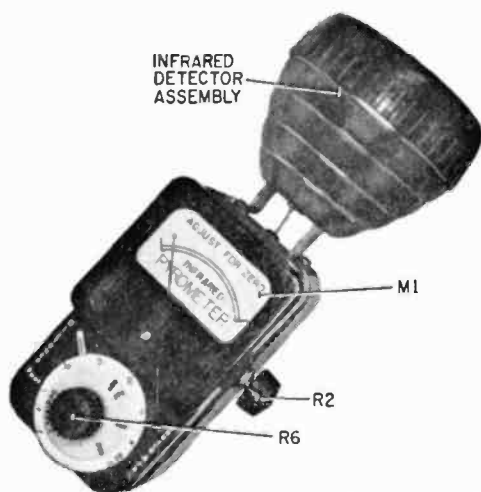
Construction time: 2 hours (calibration time not included)

indications from pinning the meter pointer (and possibly ruining the meter movement), diode D1 was connected in series with the meter. This effectively stopped *all* down-scale pointer movement.

With no down-scale pointer movement, it is impossible to set the pointer to electrical zero with any degree of accuracy. Resistor R4, in parallel with D1, allows down-scale indications but limits pointer travel to the extent that even when the pointer goes off scale to the left it doesn't jam and stick in the off-scale position.

Resistors R3, R5, and R7 reduce the total resistance needed for potentiometers R2 and R6—giving maximum rotation, minimum difficulty in making control adjustments, and maximum scale on the calibrated dial of potentiometer R6.

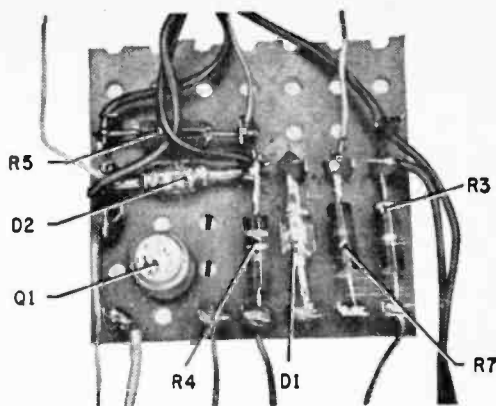
Construction. The thermistor bolometer



Infrared detector is mounted in searchlight head of flashlight—red blinker is discarded. Shop carefully as cost of the flashlight can push cost above estimate.

in the Infrared Detector kit comes with a reflector. However, it is small compared to the 3¼-in. infrared filter (red plastic) that is also supplied along with a general-purpose *pnp* transistor and a low-current pilot-light bulb. For maximum infrared pick up a larger reflector is needed.

In an effort to get the largest possible reflector that will take a flange-type, pre-focussed flashlight bulb (like the PR-12 or PR-13 used in the flashlights with 4 or 5 dry cells or a 6-volt lantern battery), an imported flashlight equipped with a large reflector and large square battery box that



Most of circuit is contained on scrap of perforated board, shown almost exact size. All interconnections are on under side.

normally housed a 6-volt lantern battery was selected. The sides are high enough to accommodate controls and the top wide enough for the 0-50 microammeter (after the handle with the blinker lamp was removed).

The hinge joint on the rear of the reflector housing is bent and attached directly to the battery box. Three holes are drilled into that end of the battery box—two for mounting the reflector housing and one for the lead to the center of the prefocus socket.

Remember to pick the flashlight only for reflector size and meter mounting space—the flashlight can be either plastic or metal—as can the reflector. There is nothing critical with parts placement, and all parts can be mounted on less than a 2-in. square of perforated phenolic board. (Though a transistor socket is used on this perforated board, it isn't needed—it was used only to make it easier to try several different types of transistors. Both *nnp* and *pnp* general-purpose types worked equally well. High-gain and switching types can be a little critical since in some there is too rapid a current change with just a little change in bolometer resistance.)

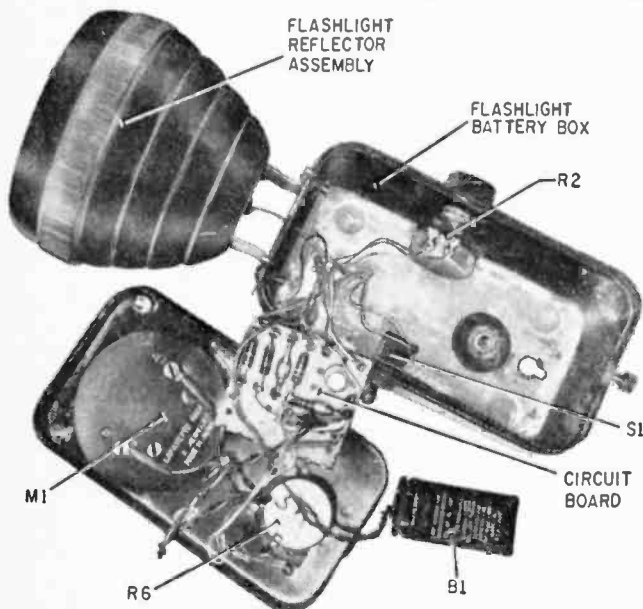
Solder Quickly. Even with the short leads, no heat sink was used when the components were soldered to the push-in terminals. A clean, hot soldering-iron tip was the secret—a 47-watt, pencil-tip soldering iron will heat a joint properly before the heat can creep up the low-heat-conductance alloy leads of diodes and transistors. A low-wattage iron takes longer to heat the joint and heat can travel further. The biggest danger of ruining a semiconductor with heat is when the current is applied. The heat changes the

HEAT DETECTOR

characteristics of the semiconductor (diode or transistor), allowing more-than-usual current to flow. This, in turn, creates more heat, more current, and still more heat.

While both components and construction are not critical, the calibration is overly critical. The care taken in calibration, and subsequent temperature readings, determines the accuracy of the temperature indications.

Preliminary Testing. Once the wiring is complete you'll be able to make some quick tests to see if the instrument is working.



Red plastic infrared filter fits in reflector without cutting. Clear plastic lens holds it in its position. Miniature switches and controls can be used to save space. Heavy washers on both sides strengthen area around tapped stud—shown in bottom of battery box. Circuit board is not mounted inside battery box—it is wrapped with plastic foam.

First rotate the *balance* knob. The meter pointer should move back and forth through the zero point as you rotate the knob from one end of its rotation to the other. Make sure the opening to the reflector is tightly covered.

Rotating the *temperature* knob should have the same effect on the meter pointer. Set the *temperature* knob, which controls the wiper arm of the potentiometer (R6) so the arm is at the extreme counterclockwise end of its rotation.

Adjust the *Balance* knob for a zero indication on the meter with the bolometer element covered so it can't pick up any radiation.

Now aim the bolometer element (in its reflector) at your heated soldering iron. From

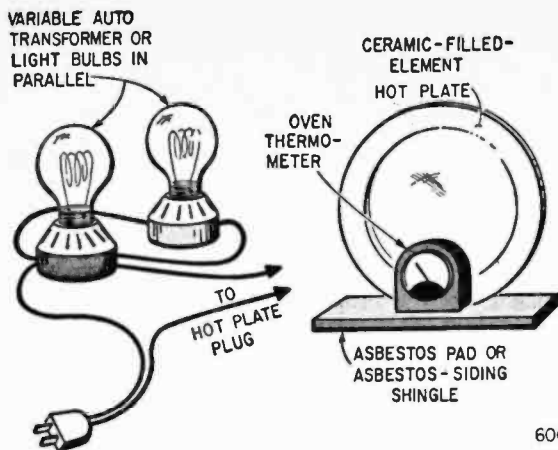
two or three feet there should be a very definite increase (up-scale indication) of the meter reading.

Heat Source. Quite accurate calibrations can be made using an electric hot plate as a heat source and an oven thermometer as an indicator. This will cover a range from about 150 F to around 600 F, depending on the thermometer. Of course, the accuracy of the thermometer used will determine the accuracy of the calibration chart.

There must be some method of controlling the voltage applied to the hot plate. A variable autotransformer is a big help—if you have one that will pass the current required to heat the hot plate. (If you don't have a 5- or 10-ampere variable autotransformer,

you can connect regular household light bulbs in series with the hot plate. The higher the wattage of the lamps, the more heat will issue from the hot plate.)

The next thing you'll have to have is patience—once you set the voltage applied to the hot plate, you'll have to wait for the thermometer to catch up to the temperature of the hot plate. If you try to make your calibrations as the hot plate warms up you'll come up with an entirely different curve than if you wait for the thermometer pointer to stop moving. The difference is shown by the dotted line in the calibration chart. By comparing the two curves for 3-foot distance you'll see that there is about 100 F difference—indicating that there is about 100 degrees lag between the surface of the hot plate and



the heat at the bi-metallic element of the thermometer.

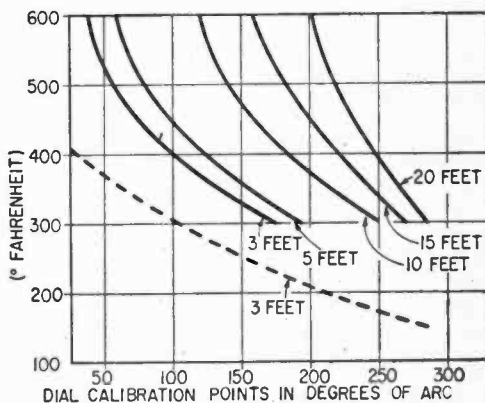
Place your heat source where it will be protected from drafts which will upset the heat transfer between the hot plate and the oven thermometer. Place the oven thermometer so that its bi-metallic coil is about $\frac{1}{4}$ in. from the surface of the hot plate—you'll probably have to bend the bracket or even turn the thermometer upside down in its socket to get the thermometer close enough to the hot plate. Now plug in the hot plate and let it heat up with about half voltage (60 volts) applied.

Set-Up Area. While the hot plate is heating you can mark your distances from the heat source. Strips of masking tape at the 3-, 5-, 10-, 15-, 20-, and 25-foot distances will be about all you'll need. (After about 25 feet the pattern of the infrared pick up will become too broad to be reliable unless you have a very-well-focused reflector or a very-large heat source.) Just make sure you have enough room for the tripod legs to set on the floor easily.

Calibration. While the heat source is still stabilizing you can make a few preliminary tests and get used to the technique of aiming the radiation pyrometer at the heat source.

If you have a movie-camera tripod with gear-driven vertical and horizontal panning, you'll find aiming the radiation pyrometer much easier—particularly as you get further and further away from the oven heat source. First cover the reflector, and (with the temperature-calibrated potentiometer set to the extreme counterclockwise end of its rotation) adjust the *balance* control for a zero indication on the meter. This compensates for minor ambient temperature changes and sets

Hot plate used as calibrating heat source is the type supplied in hobby copper-ensemeling kits. Light bulbs or autotransformer reduce temperature to between 200°F and 600°F. Bimetallic coil of oven thermometer is kept about $\frac{1}{4}$ in. away from ceramic element. Maintain constant temperature for five minutes or more before making a calibration run. Without sufficient warm up thermometer may indicate as much as 100 degrees lower than surface of element as shown, by dotted line, below.



the calibration dial to its lowest-temperature point.

Aiming the Pyrometer. Uncover the reflector and aim it toward the heat source. As you pick up radiation the meter pointer moves up scale. If the pointer goes off scale, rotate the *temperature-calibrated* knob for about a half-scale indication on the meter. Keep aiming the reflector up and down, left and right until there is no longer any increase in the meter-pointer indication, then lock the pyrometer in that position. Next, rotate the *temperature* knob for a zero indication on the meter pointer.

Now move the pyrometer back to the next distance marker and repeat the procedure. If you notice continued change in the *balance* setting, try another transistor (once you are sure that the battery voltage is not slowly dropping—shifting the transistor to a different point on its operating curve). As you get further and further away from the heat source, you will get less and less indication on the meter.

Once you have mastered the technique of aiming the pyrometer and the heat source
(Continued on page 118)

Propagation Forecast

By C. M. Stanbury II

April/May, 1967

■ Shortwave conditions are constantly changing. They are seldom exactly the same from day to day. Thus, any prediction can only select the band or bands which will more often than not be best during a certain time period. Because conditions do vary, the best SWBC band may be the one above or below the one listed in the table.

On the other hand, the operating patterns of the SWBC stations themselves modifies our table a wee bit. For example, at 0900-1500 listener's time, 16- and 19-meter bands are listed as best for Europe. Technically speaking, on a few days, 13 meters will actually provide stronger signals from Europe than 19 meters. But, as yet, not

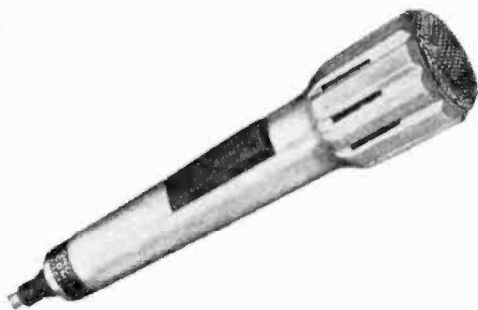
quite enough Europeans have moved up to the 13-meter band to warrant its listing as an important second choice.

Meanwhile, static has again become an important factor on frequencies below 7 MHz (41 meters), but, these frequencies will still be best for Latin America at night. Why? Well, simply because that's where most of their SWBC stations operate. Most other SW prediction columns around these days don't bother to take this little matter into account. Now is also the time to watch these lower frequencies for stations from the southern part of Africa—Rhodesia, Zambia, S. Africa, etc. See WHITE'S RADIO LOG (pages 114 to 116) for frequencies. ■

RADIO-TV EXPERIMENTER PROPAGATION FORECAST

Apr.-May 1967	ASIA (except Near East)	EUROPE, NEAR EAST & AFRICA (N. of the Sahara)	AFRICA (S. of the Sahara)	SOUTH PACIFIC	LATIN AMERICA
0000-0300	31, 25	31 (41, 25)	41, 49, 60	41, 31	49, 60 (90)
0300-0600	31, 25	31	41, 31 (poor)	40, 49 (90, 41)	49, 60 (90)
0600-0900	25, 19, 16	19	19 (poor)	31, 25	31 (40)
0900-1200	19	19, 16	19, 16	25 (31)	25
1200-1500	19	19, 16	19, 16	25 (poor)	19
1500-1800	19, 16	25, 19 (31)	31 (41)	19 (poor)	31
1800-2100	19, 16	31, 25 (41, 19)	31	25, 19, 16	31, 60 (49)
2100-2400	19, 16 (25)	31, 25 (41, 19)	41, 49, 60	25, 19, 16	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 along side 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 prediction 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. However, Asia and the South Pacific stations will generally be received stronger in the West while Europe and Africa will be easier to tune on the east coast. The shortwave bands in brackets are given as second choices. Refer to White's Radio Log for World-Wide Shortwave Broadcast Stations list.



SONOTONE CDM-80

Cardioid

Dynamic Microphone

■ Whether your tape recorder is an inexpensive budget model or one of the "professional" types, it's more than likely the microphone that came with it is *junk*. Oh, yes, the mike might be "professionally" styled with a slim metal casing, and it might be of the dynamic type. But the active element (often called the cartridge) is still junk—with a poor frequency curve, high distortion, and the total inability (due to omnidirectional sensitivity) to discriminate against unwanted sounds.

Clearly, good tape recordings require a good microphone. And one of the best we've

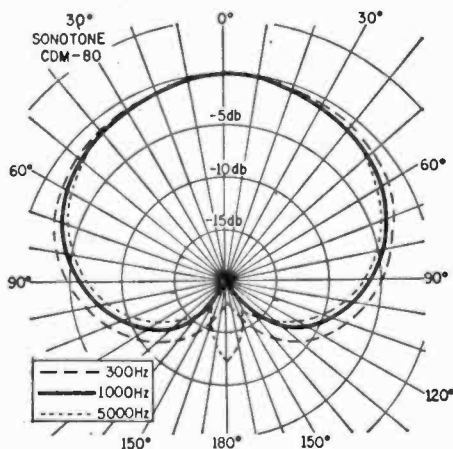
seen, considering its price, is Sonotone's model CDM-80.

Cardioid Pattern. First, and most important, the CDM-80 has a *cardioid* response, which means it's insensitive to sounds arriving from the rear and exhibits somewhat reduced sensitivity to sounds arriving from the sides. The CDM-80's actual response is shown in the polar-pattern diagram. The 0° mark represents sound arriving into the microphone from the front, and 180° represents sound arriving from the rear.

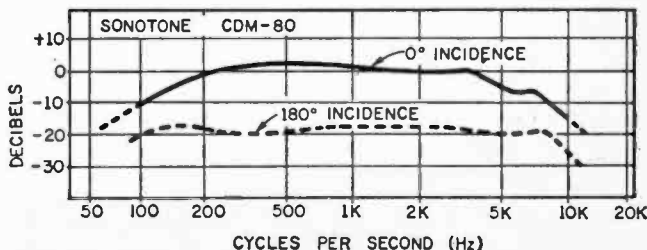
The importance of the cardioid pattern is that it sharply reduces the echo effect so common in homes. In other words, sounds bouncing off the walls and ceilings which do not arrive directly into the diaphragm are attenuated. And unlike many inexpensive "cardioid" mikes, which are actually omnidirectional at the higher frequencies, the CDM-80 has almost an overlapping (uniform) cardioid pattern clear up to 5000 Hz (cps).

In one of the roughest tests, a single mike pick up of a piano in a 12 x 15 full-panel room, the CDM-80 proved an admirable performer. While there was considerable echo, there was a decided presence caused by an almost direct pick up of the incident piano sound. On the other hand, the same recording made with a typical "factory supplied"

(Continued on page 116)



Diagrams show polar response (above) and frequency response (right) for the Sonotone CDM-80 microphone. Note that the unit maintains its cardioid pattern extremely well at frequencies as high as 5000 Hz.



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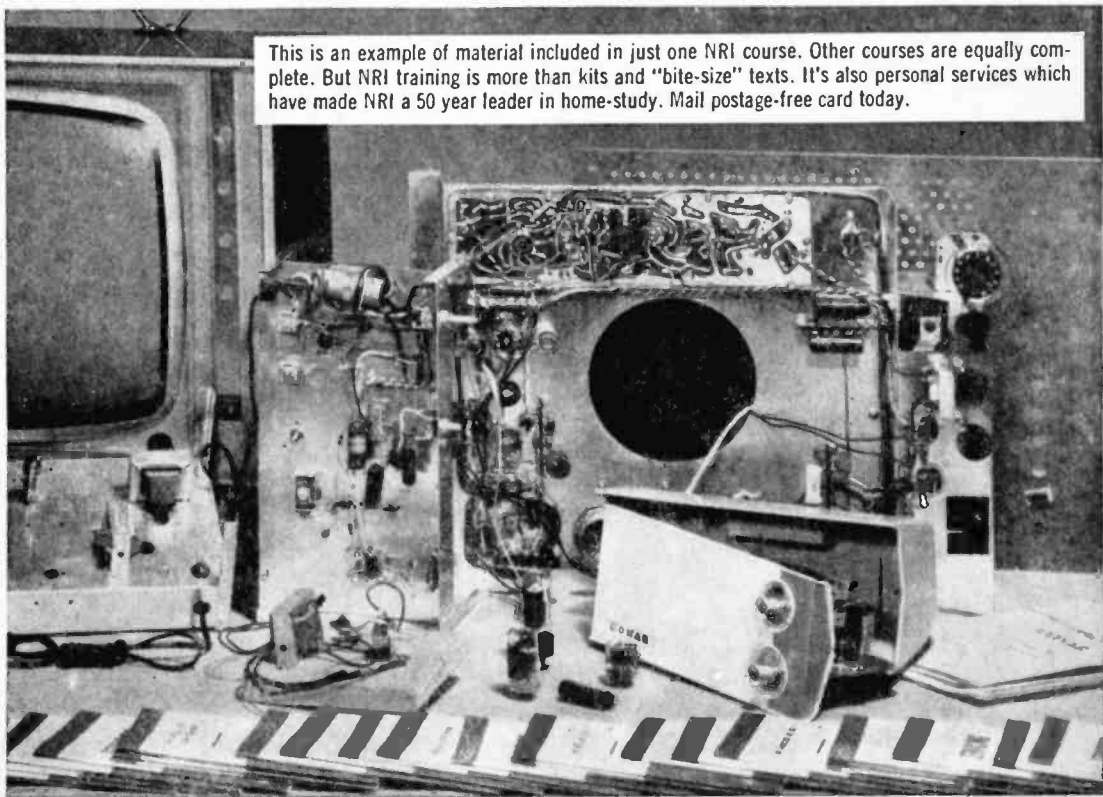
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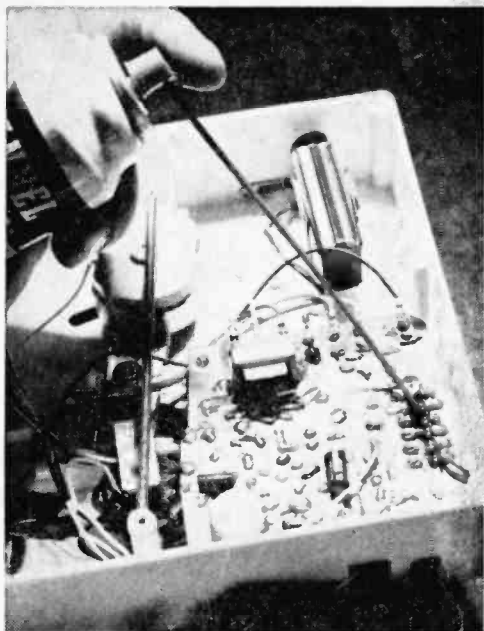
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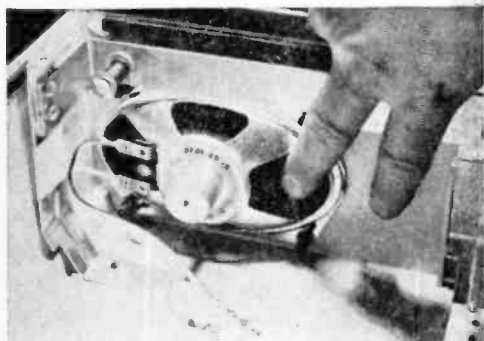
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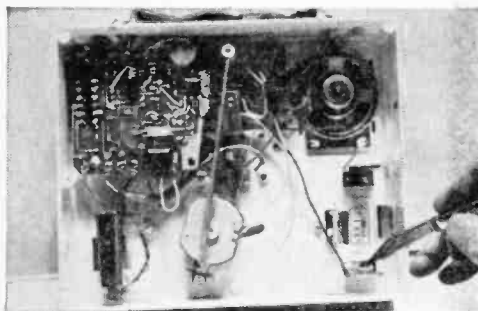




Oil has caused more tape troubles than it has cured, though it can be a godsend if used sparingly. But oil mechanical parts only.



Speaker is often responsible for distorted sound, particularly if finger pressed against cone corrects trouble. Remedy is new speaker.



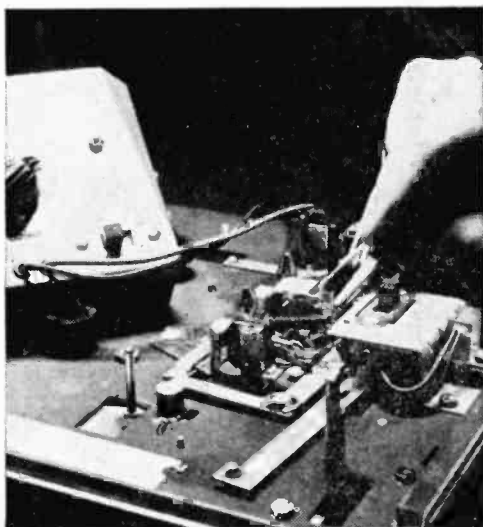
Batteries (if used) should be replaced often and removed whenever recorder is stored. Knife here points to corroded terminals.

THOSE MINOR TAPE TROUBLES

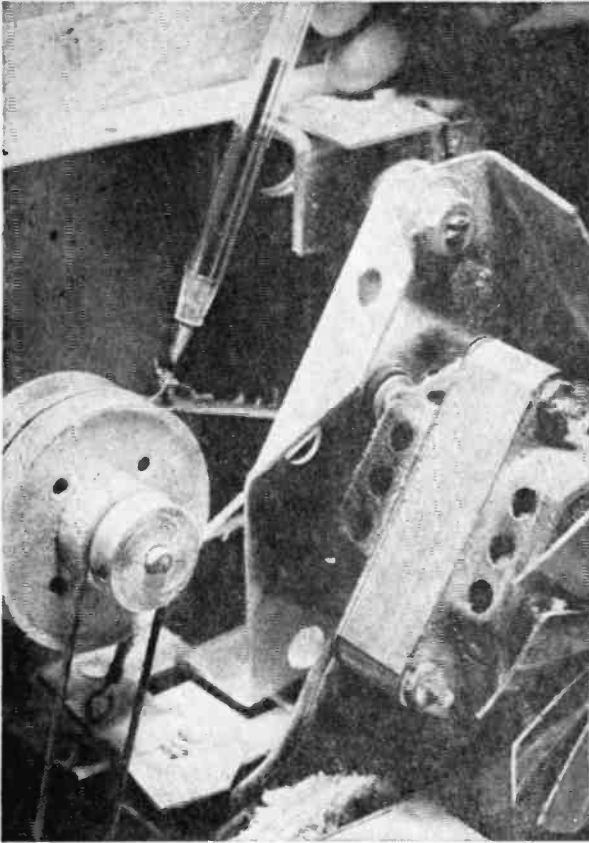
... and what you
can do about them

By HOMER L. DAVIDSON

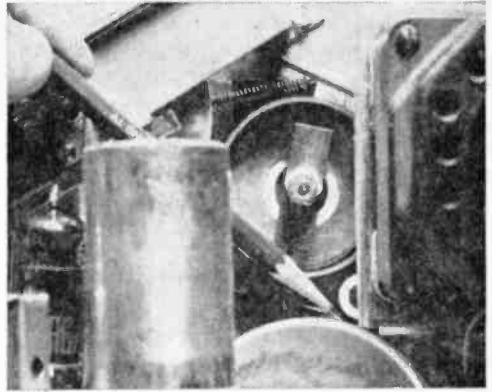
■ Ben Franklin wasn't thinking of tape-recorder repair when he observed that "a penny saved is a penny earned," but the fact is that you *can* cut service calls by making minor recorder repairs yourself. Our photos present a rogue's gallery of common tape-recorder ills, with the suggested remedy indicated in each case. A quick perusal will no doubt reveal what you have long suspected—that the answer to your tape troubles lies right in your own two hands. ■



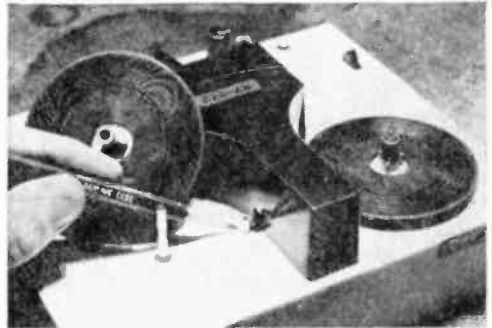
Tubes or transistors are chief reason for loss of record/play functions. Audio generator should quickly pinpoint defective one.



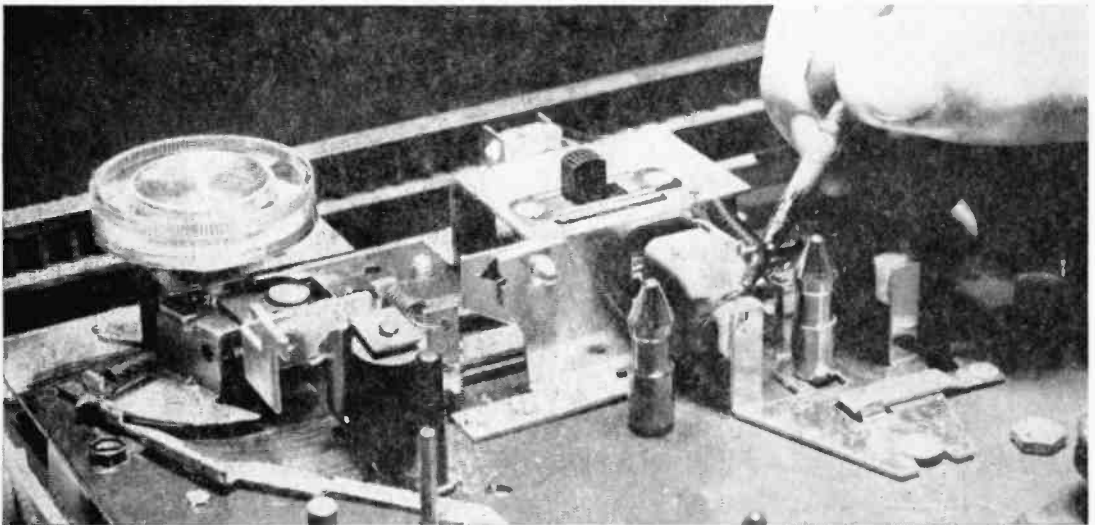
Drive belt may be culprit in recorder with too-slow tape speed. Clean belt with fluid; be certain idler pulley(s) are well oiled.



Capstan flywheel, if oily, can result in slippage, as can hardened rubber drive assembly. Remedies: clean flywheel, replace drive.



Tape guides and levers can slow tape, even stop recorder if bent or otherwise damaged. To fix, check and correct tape path.

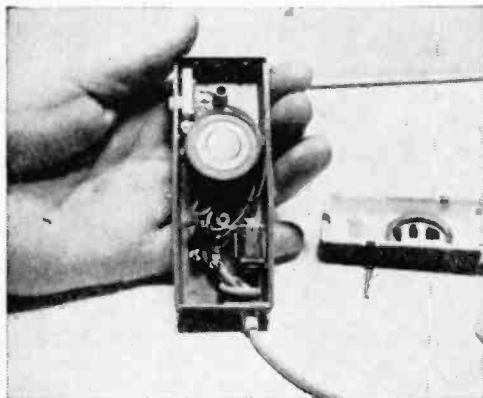
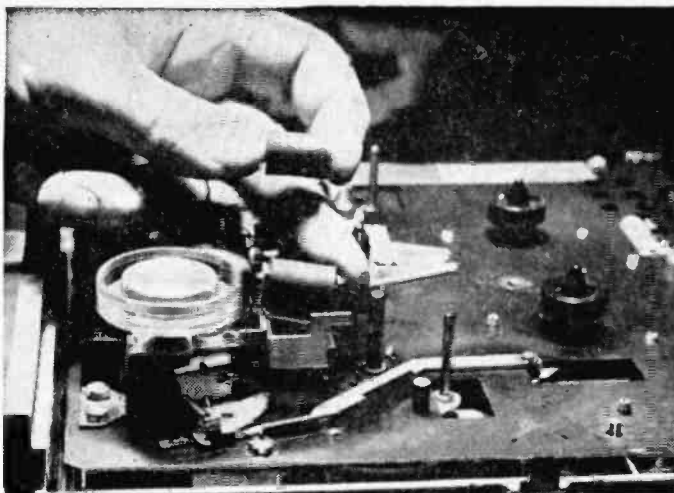


Record/play head holds key to proper operation of any recorder and can be source of weak, noisy, or distorted recordings. Use Q-tip moistened in head cleaner to remove dirt and residue; use demagnetizer to remove residual magnetism and place head in neutral state.

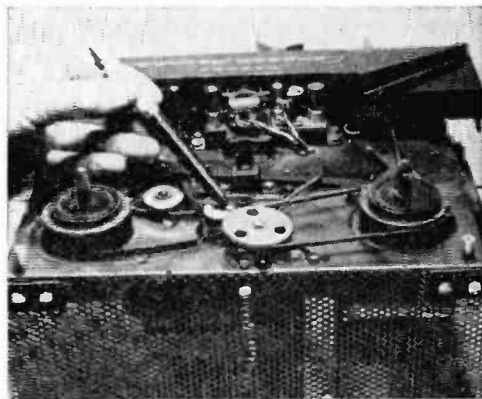
TAPE TROUBLES

Continued

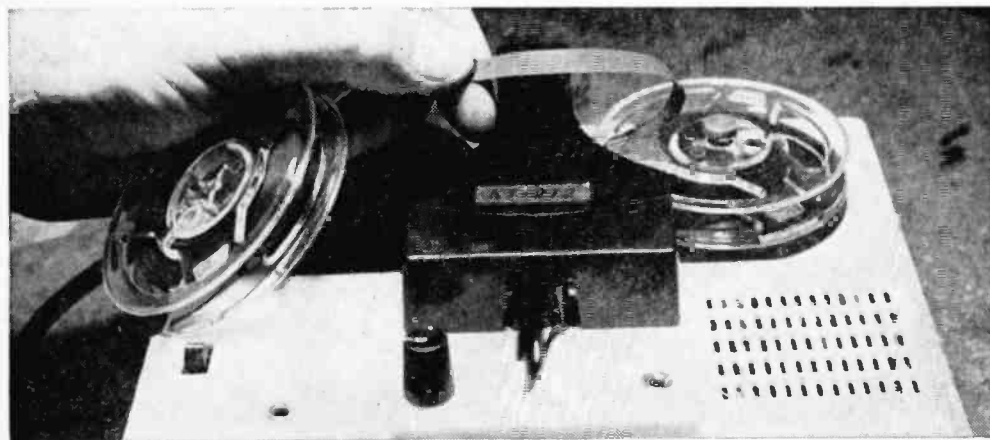
Rubber pressure roller can result in uneven tape motion, particularly if badly worn (as is roller being held by hand in photo). Since a worn roller cannot be repaired, an exact replacement must be secured from either the manufacturer or his agent.



Mike cord can be explanation for intermittent recording, and mike can go completely dead if one or more wires in cable are broken. New cord or mike will solve problem.



Rewind drive wheel can prevent proper operation during rewind function if it is bent or otherwise defective. In portable units, batteries can also be to blame.



Tape itself holds clue to many a minor trouble. Dull side of tape must face heads if recorder is to function properly; tape must be fully erased if recording is to be clean and unblemished (virgin or bulk-erased tape being the best bet for good recordings).

By Marshall Lincoln
W7DQS

CHIRP CHUCKING

made easy



A chirpy CW signal is for the birds. So now is the time to get off your perch and shake your tailfeathers if you want to clean up your nest before the FCC swoops down on you.

■ There it goes again! *Chowpy chowpit chow chowpy chow!*

What a horrible CW note that Ham has! Sounds like a motorcycle bouncing down a rocky road with a flat tire. What on earth could cause such a horrible signal? Is that guy keying his rig with a hammer instead of a telegraph key?

Probably not, but he does have troubles. The simple truth is that fellow has a bad case of *chirp*.

Chirp is a fairly common disease on the Ham bands. Recently licensed Hams, especially, have trouble with chirping transmitters, although they are not the only operators putting chirpy notes on the air. You can occasionally hear old timers, some with two-letter calls, putting out chirp, too.

Older fellows may be too lazy or too indifferent to fix their rigs. The newcomer, though, who has the pep and energy to do the necessary troubleshooting, is the fellow this article is aimed at.

To this bright-eyed fellow, the thrill of putting out any kind of signal at all is so great that he may not be critically checking the *quality* of his signal. Or, he may sense there is something wrong with his signal, but he may not know just what it is or what to do about it.

But then comes that dark day when he gets a notice from the FCC stating his chirpy signal has been picked up by a monitoring station. Oh, woe! What to do now?

The thing to do is plain and simple—fix the trouble, and preferably before anyone else learns of it.

Chirp isn't a heinous crime, since it can happen in the best of families. But it should not go unattended for any length of time. Careful attention to the causes and cures given here should help the beginning Ham solve this little problem before it gets him into trouble with the FCC.

What Is Chirp? Perhaps the best way to define chirp is to say that it's the carrier shifting in frequency each time the transmitter is keyed. Every time the key is closed, the output frequency changes slightly—instead of remaining absolutely steady as the FCC rules and regs require. This produces the *chowpy chowpit* beat note with the BFO in a receiver. And the FCC isn't interested in the chirping transmitter because it sounds terrible. For the fact is that the chirpy signal is taking up a lot more room than it should and thus actually depriving other operators of precious space in the band.

Shifting Carrier. That chirpy signal is caused by the transmitter oscillator shifting

CHIRP CHUCKING

frequency. Frequently, it's because of poor power-supply regulation, though there are several other possible culprits.

Most everyone who has ever used one knows a VFO is sensitive to all sorts of outside influences that may shift its frequency. But some fellows (such as Novices), who use crystal-controlled rigs, feel they are immune to chirp trouble. A crystal oscillator can't possibly chirp, they say, because its frequency is rigidly controlled by the crystal itself—*Rock steady*, to use a pun.

Unfortunately, this isn't so. Crystal oscillators definitely can, and do, chirp.

Low-cost transmitters, whether home-brew or store-bought, are usually more susceptible to chirp because some of the niceties of design have been omitted to save money. Even the fancy chrome-plated jobs with the big price tags will chirp if something breaks down.

Since chirp is no respecter of age or income bracket, let's tackle its causes and cures. Power-supply regulation has already been mentioned as the No. 1 enemy, so we'll start by delving into that little wicket in greater detail.

Applied Voltage. Whenever the plate or screen voltage applied to an oscillator stage changes, the frequency of that stage will probably change, too. This means that to have a stable oscillator, the plate and screen voltages supplied to that oscillator must be stable, also.

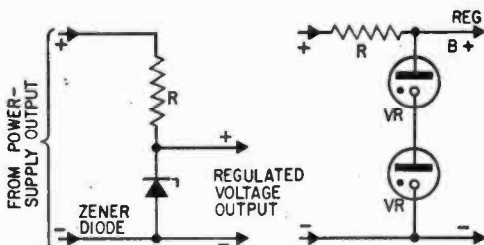
However, the actual voltage put out by a simple power supply will vary as the load (current drawn) on that supply is varied. In a Ham transmitter, for example, when the key is closed, a signal is sent through all stages to the final amplifier, where most of the power is used. This sudden demand for power—this current drain—saps the power-supply filter capacitors of some of their stored energy, and loads the power transformer. As a result, the voltage at the output of the power supply drops.

When this change in voltage is passed along to the oscillator, the oscillator frequency shifts. The result is chirp.

Good transmitter design avoids this situation. First, the B-plus to the oscillator stage is regulated. Second, the oscillator may have its own private power supply—separate

from the heavy-duty power supply connected to the driver and final stages. Neither of these steps is guaranteed to prevent chirp, but they definitely will help.

Constant Voltage. Voltage regulation is accomplished primarily with either a gas-discharge voltage-regulator tube (VR tube) or a Zener diode. Two or more VR tubes or Zener diodes can be connected in series to regulate higher voltages, as shown in the schematic diagram.



Voltage drop across R maintains regulated voltage. Zener diode or VR tubes draw more or less current, maintaining voltage.

For the oscillator B-plus to be regulated, of course, the regulator components must be of proper value and in good condition. A quick check with a voltmeter will tell you if your oscillator is getting the voltage called for in the manual. Another quick check is to watch the voltage-regulator tube, if your rig has one, to be sure it glows all the time—both during key down (maximum current) and key up (minimum current) conditions. The glow in the VR tube is the ionized gas in the tube—ionized by the voltage applied to it.

Glow in the VR tube may change intensity slightly when the transmitter is keyed, but it should not flicker or go out. If it does, the voltage getting to the oscillator stage is no longer being regulated. The trouble may be a faulty VR tube. Or the series resistor connected to the VR-tube anode may have increased in value. When replacing a VR tube, be sure you use the type designated on the chassis or in the manual. Each type of VR tube has its own voltage rating. Using the wrong one will result in incorrect or unregulated voltage being applied to the oscillator stage.

Power-supply voltage regulation by itself may not solve all the problems in an amateur transmitter. Sometimes the 117-volt line voltage itself may vary, creating problems which the VR tube just can't quite iron out.

Line-to-Load. Even when the line voltage supplied by the power company is pretty

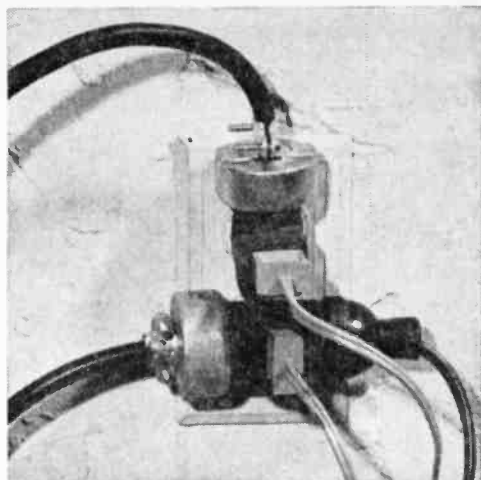


Miniature VR tubes have replaced the much larger octal-based types. Standard voltages are 59, 75, 105 and 150. Resistance value must be varied for voltage changes.

stable, the line voltage at the rig's line plug can be a horse of another color. There can be a voltage drop in the house wiring or the socket itself. This voltage drop will vary with the load placed on the wiring by the equipment. When the transmitter is keyed, more current is drawn from the power line and the voltage drop is greater. This means the voltage reaching the rig will vary with the keying—a possible cause of chirp.

Improper tuning of the rig or loading of the antenna can cause chirp, too, by imposing varying or excessive loads on the transmitter power supply. Modifying a transmitter to put out more power (for example—by using higher-power final-amplifier tubes) may lead to chirp trouble, too, unless the power supply is uprated so it will not be overloaded.

Filter and Bleeder. Some operators overlook the fact that the bleeder resistor and filter capacitors in the power supply itself have a function in regulating the supply's voltage. They do this by imposing a fixed load on the power supply. This tends to stabilize the power-supply voltage. Although the capacitors and the bleeder resistor do not hold the voltage to an absolutely steady value as a VR tube does, they do smooth out some of the power-supply variations that would otherwise occur as the load on the supply varies. Consequently, if the filter capacitors dry out (and change value or become open) or if the bleeder resistor opens, the stabilizing influence of these components is taken away. The result is the power supply voltage is no longer as stable as it should



Outlet octopus has many chances for poor electrical contacts. It only takes one ohm of contact resistance to drop line voltage 1-volt, at 100 watts of AC power,

be, and, once again, there is chirp.

Sometimes an oscillator tube, either in a VFO or a crystal-controlled oscillator, can go sour, causing chirp. This may be due to an actual mechanical defect that develops in the tube—for example, an electrode that comes loose from its support. Alternatively,



Heat often oxidizes tube pins and other connections. Pulling tube and reinserting in socket often cleans the contacts.

it may be caused by a change in the tube's characteristics. A shift in interelectrode capacitance, for example, will affect the frequency of the oscillator. This trouble is about the easiest of all to fix—just plug in a new tube.

So far, we have covered only *electrical*

CHIRP CHUCKING

causes of chirp. These are the most common, but there can be *mechanical* causes of chirp as well.

Mechanical Shock. Oscillators used to control the frequency of transmitters are almost always enclosed in separate metal cabinets for shielding and rigidity. This rigidity is very important. If any part of the oscillator's tuned circuit (such as a coil, capacitor, or a connecting lead to one of these components) is moved very slightly, the frequency of the oscillator may change. This can also occur with a slight bending of the oscillator enclosure or by a sharp impact (or vibration) that reaches the components within the oscillator enclosure.

Beginners are often amazed to find how sensitive some oscillators are to mechanical shock. Sometimes just one loose mounting screw in the oscillator enclosure can shift the oscillator frequency with each vibration

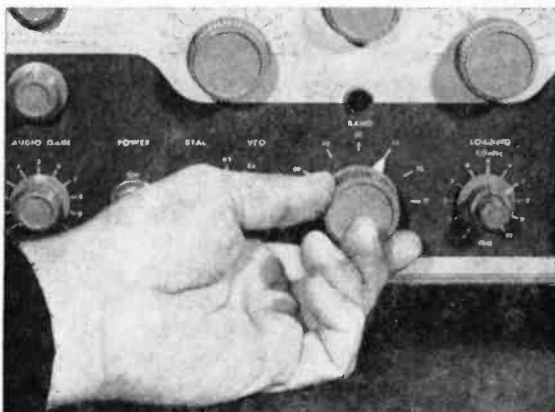
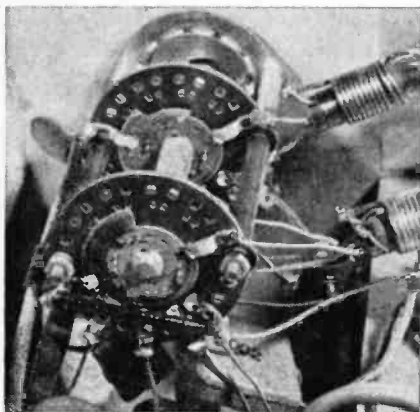
signal and an awful-sounding chirpy one.

Another mechanical cause of chirp may be a *microphonic* oscillator tube—that is, a tube sensitive to vibrations similar to those which can affect a poorly secured oscillator enclosure.

Dirty or loose switch contacts can cause a chirpy signal, too. By not making good electrical contact, they cause erratic operation. The contacts which usually cause this kind of trouble are those on the VFO portion of the bandswitch.

Spring tension of the contacts will often become weakened when the bandswitch is left in the same position for a long time. Parking the bandswitch on a band which you do not use often may help avoid this trouble. Rotating the bandswitch through all positions a few times whenever you sit down at the rig can also be of help in cleaning the contacts.

If this does not do the job, try cleaning them with some aerosol-spray contact cleaner—available at most electronics parts stores. Look very carefully at each switch contact as you slowly rotate the switch through all



Contact cleaner will loosen oxidization and tarnish from bandswitch contacts. Just spray it on; rotate switch several times. For more stubborn cases rub with a cotton-tipped swab.

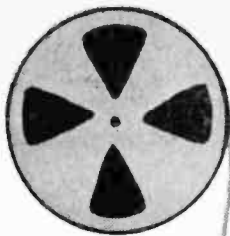
that reaches it. An operator, sending with a straight key (and pounding it fairly hard), can transmit vibration through the table top to the rig. The result is another chirpy signal.

A loose mounting screw on a tuning capacitor or coil, or a loose tuning slug in one of the VFO coils, can have the same effect. Whenever working on an oscillator, always double-check all mounting screws, nuts, and machine screws to be sure they are tightened securely. A few extra minutes spent in such a simple housekeeping chore may make the difference between a clean

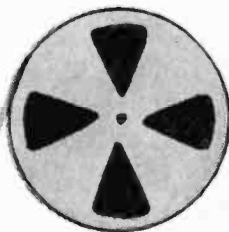
positions and make sure that each stationary contact moves slightly as the moving contact slides under it. If it does not move, then this stationary contact is not pressing firmly against the sliding contact, and so probably isn't making a good electrical connection.

You ordinarily can fix it by bending the stationary contact *very carefully* with a very small screwdriver, needle-nosed pliers, or tweezers. Be very cautious when making this adjustment—the switch contacts are delicate and you may do irreparable damage if you get rough with them.

(Continued on page 117)



THE SPICE OF Life



Master a few tricks and techniques of the tape splicing trade, and your recordings can take on the sheen and polish you ordinarily associate with those made by pros

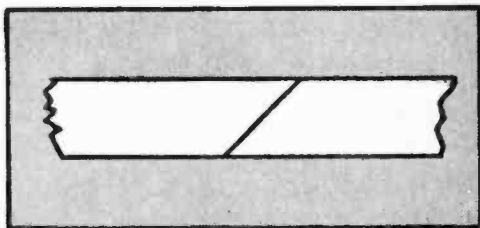
—By LEN BUCKWALTER

■ Become a sharp tape splicer and you may well succeed in getting Richard Burton to mouth "Yeah! Yeah! Yeah!" or Bugs Bunny to garble "please" and "thank you." For in the splice lies the key to much tape fiddling and juggling, not to mention mending. Fortunately, tape splicing is a simple enough accomplishment. The only catch is that joints must be popless, snag-free, and move through the recorder like a lubricated leopard.

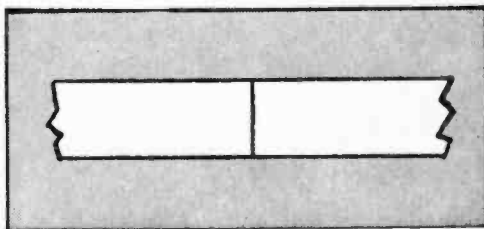
It's important, for example, never to use ordinary cellophane tape for splicing. It'll ooze and glue together turns of tape on the reel, gum up heads, and likely cause flutter during playback. Any tape made expressly for splicing avoids this problem. Just be sure the cut ends of the tape butt tightly together at the splice, since an exposed portion of splicing tape here can also introduce stickiness.

Be certain, too, that scissors, razor blade, or other cutting tool isn't magnetized or you may end up doing things to the tape you weren't counting on. Best way to avert this danger is with a bulk eraser, although the tip of a gun-type soldering iron (which emits a demagnetizing AC field) will also suffice.

(Continued on next page.)



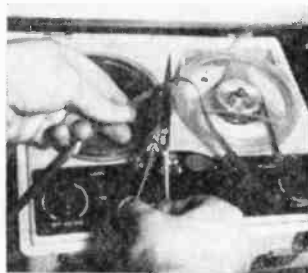
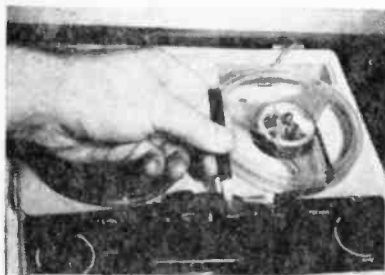
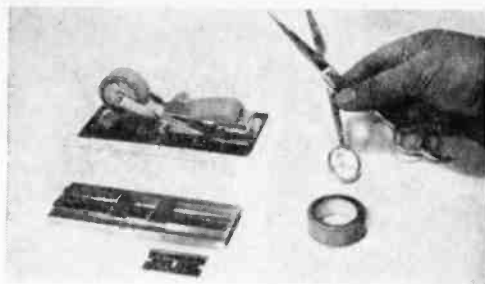
Two most common types of splices are the diagonal cut (above) and the right-angle cut (below). Most splices are of the diagonal variety, since cut travels across head at an angle and ordinarily produces no abrupt change in sound. Right-angle splice is preferred for very tight editing, such as removing the "s" from "tomatoes" or the plop of an annoying switch click.



THE SPLICE OF LIFE

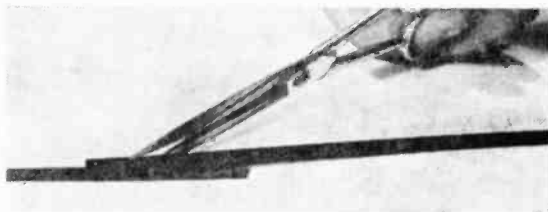
(Continued)

Simplest tape splicer is at right—ordinary scissors and a roll of splicing tape. Second system is splicing block at lower left. Its disadvantage: it won't help you make the important "waist" cut. Splicer at top left is most convenient: it holds, cuts, and trims in semi-automatic fashion.

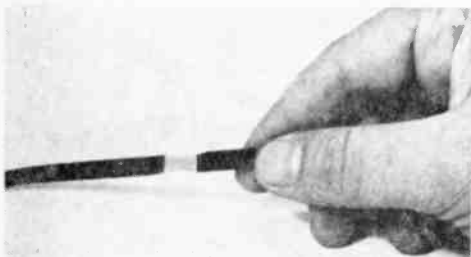
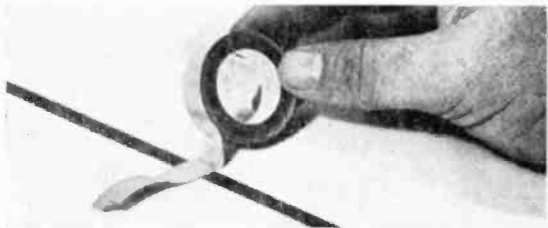


To locate point of splice, stop machine at desired moment in program. Lift tape and mark shiny side with grease pencil. Snip tape at marked point, run undesired tape through machine, then stop, mark, and cut, as before.

With scissor method, two tape ends to be spliced are brought together, shiny sides up. For diagonal splice, overlap ends and snip through both tapes simultaneously at 45-degree angle. Make sure both tapes are perfectly aligned with edges running in a straight line before you cut.

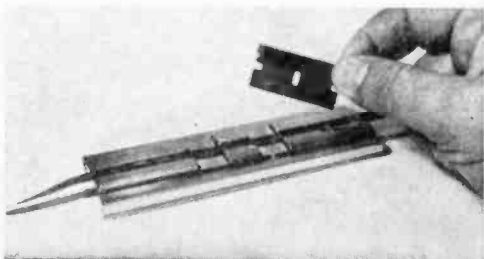


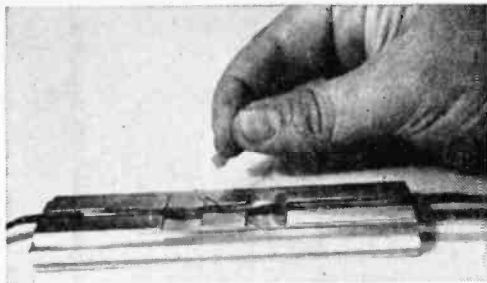
Cut ends of tape are then brought together so they join with no overlap and covered with a piece of splicing tape. Running a fingernail over splice will help adhesive form a good bond; note that splicing tape is applied only to one surface of each section of tape—the shiny side.



Last step (above) in simple scissors technique is to trim edges of splice with slight indentation (called a "waist"). Properly made, waist will prevent possible snagging when tape is played on machine.

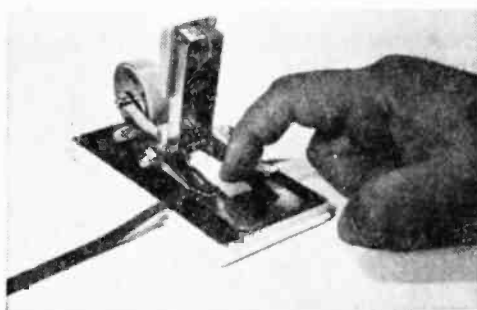
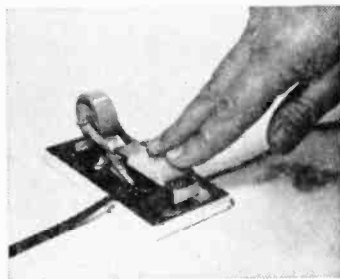
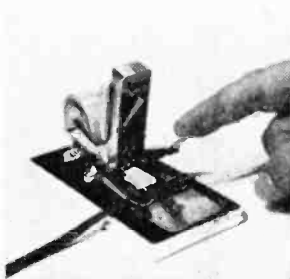
Splicing block is superior to scissors since tape ends are pressed into recesses which hold lengths in perfect alignment. Razor blade drawn along V-notch in block slices neat diagonal across two tape sections.



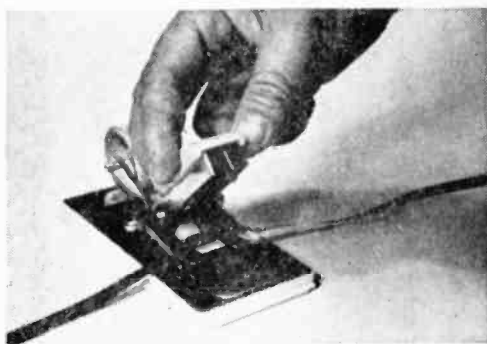


You can again join edges with regular splicing tape, but another useful tool is called a "patch." A short, pre-cut section of adhesive material, it is pressed over the joint, then rubbed with a finger. Tape should be given a waist cut after removal from block to trim away excess adhesive.

Last tape-splicing method is most elaborate, but also most convenient. Splicer at right is made by Robins and called the "Gibson Girl" for reasons which will become apparent. Pressing down metal fingers holds tape in place; bringing down cutter slices diagonal cut through tape ends.

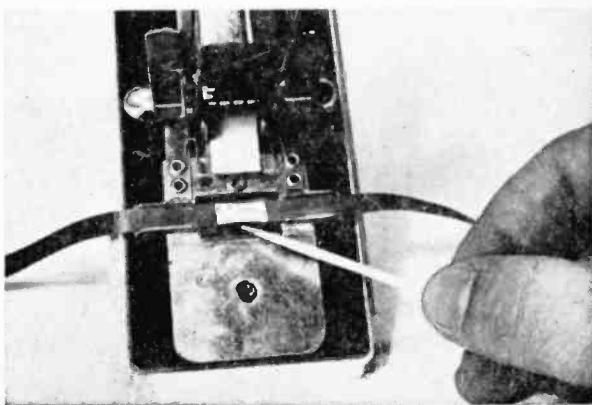


Cutting head is brought down again, having first been slid forward slightly to position another cutter over the tape. This time, cutter effects waist cut on tape.



Since splicer carries an entire roll of splicing tape in special holder at rear of device, there's never any need to search for splicing tape. End is simply brought forward and pressed over the tape joint.

Toothpick points to finished splice with curved-in middle reminiscent of pinched-waist Gibson Girl of a generation ago. Tape is now ready for test-run on recorder to determine whether splice is correctly positioned and is serving its intended purpose. If it isn't, tape can be returned to splicer for second try.

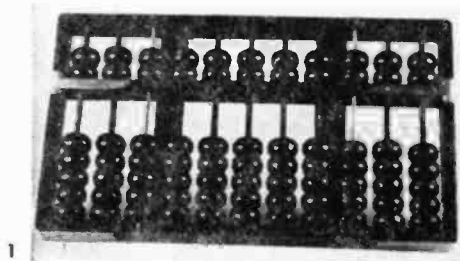




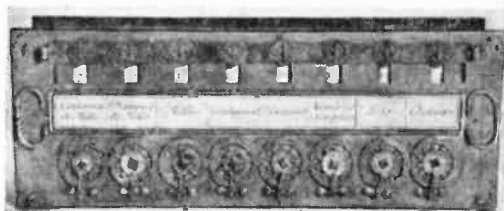
No Numbers...

■ Though computers have come a long way since the invention of the lowly abacus (which likely took place shortly after the dawn of civilization), few people realize exactly *how* far.

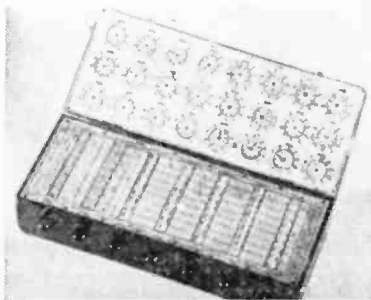
Even the ancient Roman, hampered beyond belief when confronted with the need to add such unwieldy figures as DCCXC and CCCLXX, was actually better off than *his* ancestors. For while both the Egyptians and Babylonians had developed primitive number systems, it wasn't until around 100



1



2



3

- 1 Abacus (date unknown)
- 2 Pascal's Calculator (1642)
- 3 Grillet Calculator
- 4 Babbage's "Difference Engine" (1812)
- 5 Babbage's "Analytical Engine" (1834)
- 6 Bollee Calculating Machine
- 7 Olivetti Underwood Divisumma 24 (1967)

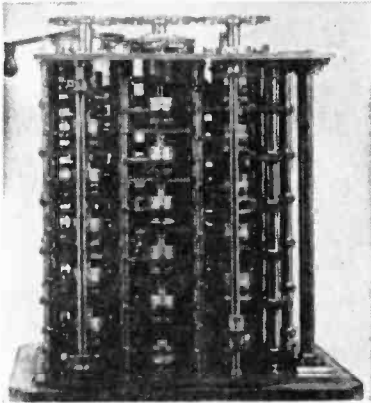
No Nothing...

B.C. that the Romans came up with the idea of allowing simple marks to stand for small numbers (the *one, two, three, four* of the matter) and letters for all others.

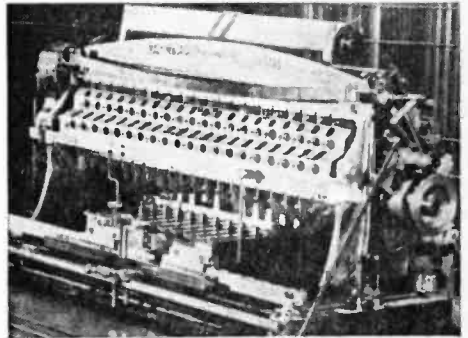
Yet another snag in the Roman style of computing was lack of a symbol to stand for "nothing." For the unfortunate truth is that mathematics was hampered for countless years by the missing "nothing" concept. Finally, sometime in the Middle Ages, the 0 reached Europe along with other Arabic numbers via Arabic trade routes.

Still used by school children and Oriental businessmen, the abacus also comes into play for scoring in billiards. But the centuries have witnessed emergence of a wealth of other devices to aid man in his mathematical musings (see our photos). Today, even the old-fashioned mechanical adding machine has succumbed to the electronic computer, probably the most revolutionary development on the numbers scene since the days when there were no numbers, no nothing.

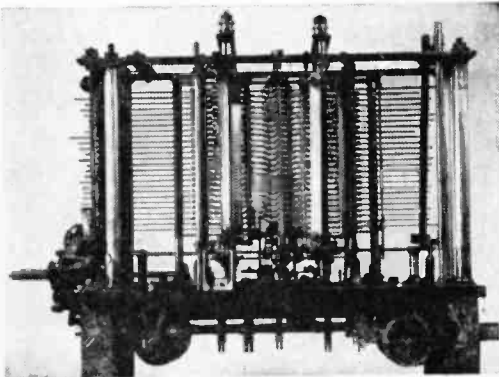
—Robert Levine.



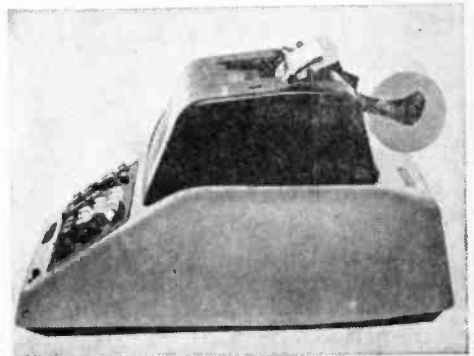
4



6

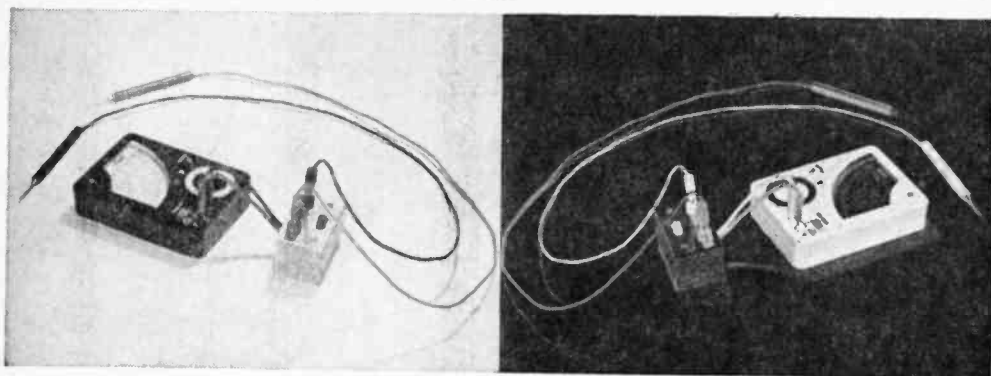


5



7

Add a Flip-Flop to Your Meter



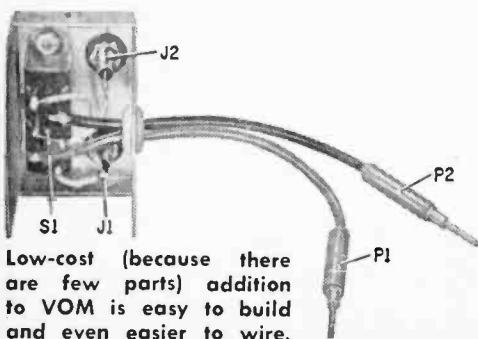
Make your troubleshooting less trouble—build a low-cost test-lead reversing switch for your VOM and VTVM.

by Marshal Lincoln, W7DQS

■ VOM's, multimeters, pocket voltmeters, and all their brothers and cousins come in a thousand shapes and sizes these days. But though priced to fit any purse and purpose, many of them lack a very handy feature which you yourself can add in an hour or less. This is the Meter Flip-Flop, or, by a more descriptive name, a *polarity-reversing switch*. Some testers have this feature built in, but a surprising number of VOM's, many of them rather expensive models, do not.

To be sure, for AC voltage or resistance measurements, the lack of such a switch poses no problem. But when measuring DC, it's amazingly easy to accidentally connect the meter backwards into the circuit under test. This immediately throws the meter off scale—*downscale*, which means you then have to reverse either the test prods on the circuit under test, or reverse the pins plugged into the meter.

With the handy Meter Flip-Flop, you just leave the clips on the test leads where they



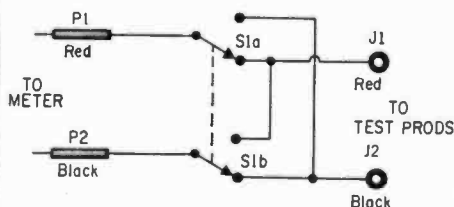
Low-cost (because there are few parts) addition to VOM is easy to build and even easier to wire.

PARTS LIST

- J1, J2—Tip or banana jack (to match meter leads)
- P1, P2—Pin tip or banana plug (to match meter jacks J1, J2)
- S1—D.p.d.t. switch (slide, see-saw, or toggle type)
- 1—Chassis box, 2 1/4 x 1 1/2 x 1 3/8-in. (LMB type M00, Burstein-Applebee 20A458, or equiv.)
- Misc.—Test-lead wire, hookup wire, solder, grommet, machine screws and nuts, etc.

Estimated cost: \$1.50

Construction time: 1 hour



Simple circuit, shown in schematic form, can be used for other purposes like reversing battery connections powering a permanent-magnet motor.

are, flip the switch, and go right ahead with your work. The switch reverses the polarity of the test prods with respect to the meter.

Construction, shown in the photos and wiring diagram, is very simple, with nothing critical involved. A d.p.d.t. switch, two jacks and two plugs of the type used by your own meter and test prods, some hookup wire, (Continued on page 120)

EICO MODEL 378

Switch-Selectable Audio Signal Generator



■ With audio equipment reaching an almost theoretically perfect performance level in respect to frequency response and distortion, the "service grade" audio frequency generators found on experimenter workbenches are just about worthless. For how can you test a modern, "ruler-flat" amplifier having a distortion rating of 0.5% with an AF generator having an uneven output level and a residual distortion of approximately 1.0%?

Modern audio equipment cannot be checked with what we used to call service-grade instruments. Today's audio gear requires lab-quality test equipment. Fortunately, in the audio field, lab-quality test gear isn't necessarily synonymous with a multi-hundred-dollar price tag. In fact, there are a few lab-quality, sine-waveform AF signal generators in the \$50 price range.

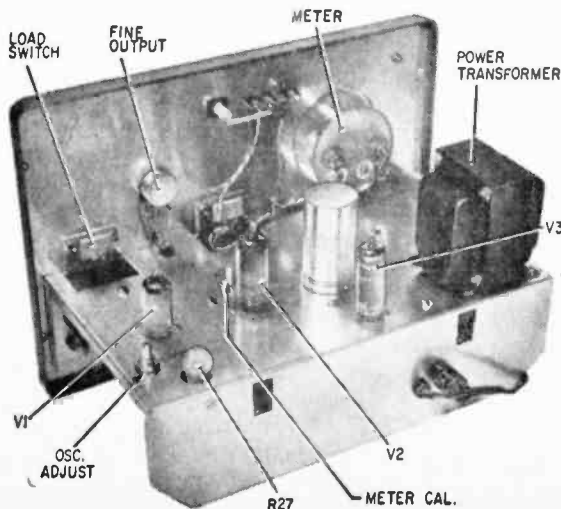
A typical example of low-cost lab quality

is EICO's Model 378 Audio Signal Generator, which is available in kit form at \$49.95, or factory-wired at \$69.95. Unlike the conventional AF generator in which a manual-controlled sweep dial picks any frequency between the lower and upper limits with some degree of accuracy, the EICO 378 lets you select discreet frequencies right on the button.

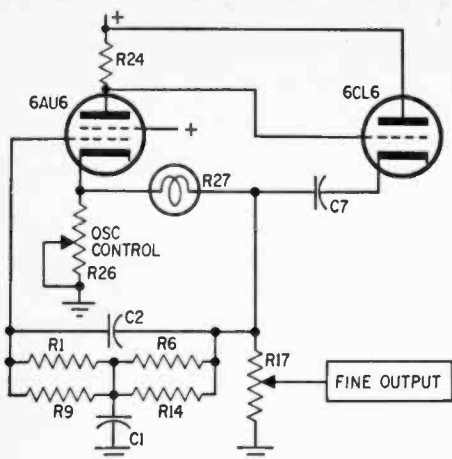
The EICO 378's output frequency is selected by twisting three selector switches. The first switch selects the cycles in units of 10; the second switch selects cycles in units of 1; and the third selector determines the multiplier from X1 to X1000. For example, if you needed, say, 25 Hz (cps), you would set the first switch to 20, the second to 5, and the multiplier to X1. If you needed a 3600 Hz output, the first switch would be set to 30, the second to 6, and the multiplier to X100.

The generator's output voltage is fully metered in terms of both voltage and decibels. The output range switch provides six full-scale ranges from .003 volt (-60 db) to 1 volt (0 db) into a 600-ohm output impedance. Two additional switch positions provide a 3-volt (+10 db) and 10-volt (+22 db) output at high impedance. A load switch provides for internal or external 600-ohm load for all ranges below 1 volt.

When the internal load is used, the



Rear view of EICO 378 chassis reveals well-spaced components without even so much as a hint of crowding. Meter calibration and oscillator adjust are the only two user-set controls at rear.



Simplified diagram of oscillator circuit in EICO 378 shows 6AU6 oscillator and 6CL6 cathode follower with bridged-T filter consisting of C1, C2, R1, R6, R9, and R14. See text below for details of circuit operation and performance.

output meter will indicate the output voltage with the generator working into an external load of 10,000 ohms or higher (such as a typical AF amplifier or recorder). Naturally, the output meter gives correct readings when an external load or the high-impedance output ranges are used. A *fine* output control adjusts the output level of each range from zero to full scale.

How It Works. The basic AC circuit (AC path only, no DC) is best used to describe circuit operation (see schematic diagram). The oscillator is the 6AU6 stage, which works into the 6CL6 cathode follower. Regenerative (positive) feedback from the 6CL6 cathode through C7 and R27 (a lamp) would normally tend to cause the circuit to break into oscillation. However, a bridged-T "notch filter," consisting of C1, C2, R1, R6, R9, and R14, provides a degenerative (negative) feedback path greater than the regeneration, thereby "cancelling" the regeneration and stabilizing the 6AU6 stage.

At one frequency, determined by resistor and capacitor values, the "notch filter" provides a minimum of degeneration and zero phase shift. The positive feedback is not cancelled at this particular "notch" frequency, and the 6AU6 stage breaks into oscillation.

In the EICO 378, the values of C1 and C2 are determined by the *multiplier* switch (X1, X10, etc.). The first *cycles* switch (0-100) determines the value of R1/R6, and the second *cycles* switch (0-10) determines

the value of R9/R14. (These resistor and capacitor designations correspond with those appearing on the actual EICO schematic.)

Is \$50 Really Lab-Grade? Since the EICO 378 is touted as a lab-grade generator, we checked it against instruments commonly found in a quality lab: a Hewlett-Packard AC VTVM and a General Radio distortion meter.

Over the audio range of 20 to 20,000 Hz (the limits of the distortion meter), the 378's distortion was so low there is no need to show a curve. While EICO claims a maximum distortion of 0.1%, the measured distortion of the kit version (user-calibrated) was a consistent 0.05% to 0.06% over the entire range, save near 100 Hz where the distortion measured 0.08%.

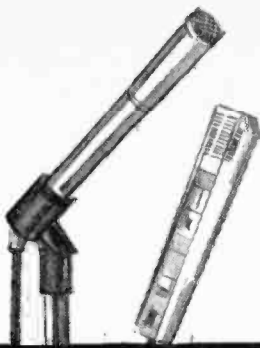
The unit's output meter accuracy was excellent. Our tests showed it to be within ½ db of the AC VTVM standard between the limits of 10 and 1,000,000 Hz. Also of note is the meter's outstanding decading accuracy, which was superior to most AC VTVM units. When the 378's AC VTVM meter indicated the lowest readable value of 0.1, we decaded two ranges down. Result: the meter reading was exactly on the "1" mark, which fact speaks for good performance.

Of course, you may ask the question: "If the EICO 378 is so good, why is it at least \$100 cheaper than a laboratory signal generator?" We feel the explanation lies primarily in the component quality and long-term frequency stability. The EICO 378 utilizes standard-grade components, while a laboratory signal generator (in today's market) meets Mil-Spec. Similarly, a laboratory signal generator would require no re-calibration over a period of several years, while the EICO might have to be re-calibrated yearly (a ten-minute process). Also, the EICO 378 doesn't come in an expensive steel cabinet with a deep-etched panel.

The kit version is to be recommended. It's a two-evening project that saves the factory wiring cost. The chassis is way over-size, and the components get lost in the wide open spaces. In addition, there are absolutely no tight corners.

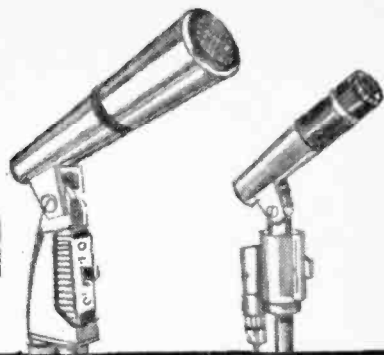
Since there are relatively few components, construction would present no problems, even to a beginner, if it weren't for the assembly manual. The manual we received had several errors (since corrected), and

(Continued on page 119)



The MIX-MASTER

By Herb Friedman, KBI-9457



Studio-type audio consolette lets you mix inputs just like a pro.

■ If you're a typical tape-recording hobbyist, your big interest in life is to produce recordings with as much "studio quality" as possible. But in all too many cases, what finally pours from the tape bears little resemblance to what comes out of even the worst studio.

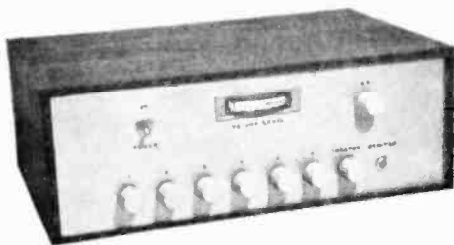
Actually, the problem is not you; it's your equipment. For even the best of recorders—the so-called "pro" models—are likely to have the same old one-mike, one-line input arrangement. Yet "studio quality" recordings often require a *blend* of several sound sources. In other words, they rely on more than one microphone and they perhaps throw in sound effects from another recorder, or background music from a phonograph. To turn such tricks, a recording

easily be obtained in the home by simply providing several high- and low-level mixers, full metering of the output line, and monitoring.

Just such a consolette appears in our photo at left. (Hold on—don't yell "It's got tubes!" and skip ahead, as we'll see shortly.) The consolette provides four inputs for microphones, and two inputs for high-level devices such as tape recorders or phonographs. Any combination of the six inputs can be simultaneously mixed together. A master gain control, R29, controls the overall output level of all sound sources. As a result, the consolette's output level can be adjusted while the level of all inputs is determined by the individual mixer controls, R11 through R16.

The mixer circuits, which consist of V1 and V2, plus $\frac{1}{2}$ of V3, provide a 0.1 v output from an input level of 3 mv at the microphone jacks, J1 through J4. Only 50 mv is needed at the high level inputs, J5 and J6, for a 0.1 v output.

The second half of V3 and transistor Q1 provide the necessary amplification and impedance matching for VU meter M1. The VU amplifier gain is adjustable, allowing M1 to be calibrated to "read zero" at any



Neat appearance of finished Mix-Master consolette matches component hi-fi units housed in similar oiled walnut cabinets.

studio utilizes a *consolette*—a unit that mixes inputs from various mikes and high-level sources. Such a device boasts VU metering and a monitor that allows the engineer to "ride" gain to control the various sound levels at all times.

While a studio consolette costs several thousand dollars, most of the circuits are unnecessary as far as the recording hobbyist is concerned. In fact, "studio quality" can

SPECIFICATIONS

Input impedance—1 megohm
Source impedance—Inputs 1 through 6, any equipment rated "high impedance"
Output terminating impedance—100,000 ohms or higher
Frequency response— ± 1.5 db, 40 to 20,000 Hz
Output level—0.1-volt rms
THD at 1 kHz for rated output—0.3 %
Noise level below rated output—60 db

MIX-MASTER

output level up to 0.1 v. Phone jack J7, which is connected across the VU meter, provides the headphone monitor output.

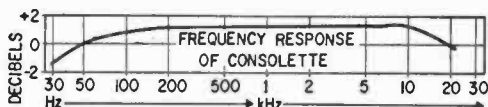
Frequency response is ± 1.5 db between 40 and 20,000 Hz (cps), and the VU meter's response matches the consolette's response for all practical purposes. The response was tailored to roll off below 40 Hz to avoid excess rumble pickup—rumble being a common recording problem. To extend frequency response down to 20 Hz (which we don't recommend), simply replace capacitors C1, C2, C3, C4, and C7 with 0.1 mf units.

Why Tubes? While solid-state is superior to tube design from the viewpoint of power requirements and heating effects, solid-state also tends to be synonymous with a high hiss level. (The measured noise level of solid-state recorders might appear to be lower than equivalent tube equipment, but the predominant noise of solid-state gear occurs at the frequencies where the ear is most sensitive. The noise from tube equipment, in contrast, is largely hum, which falls at a frequency where the ear is less sensitive.)

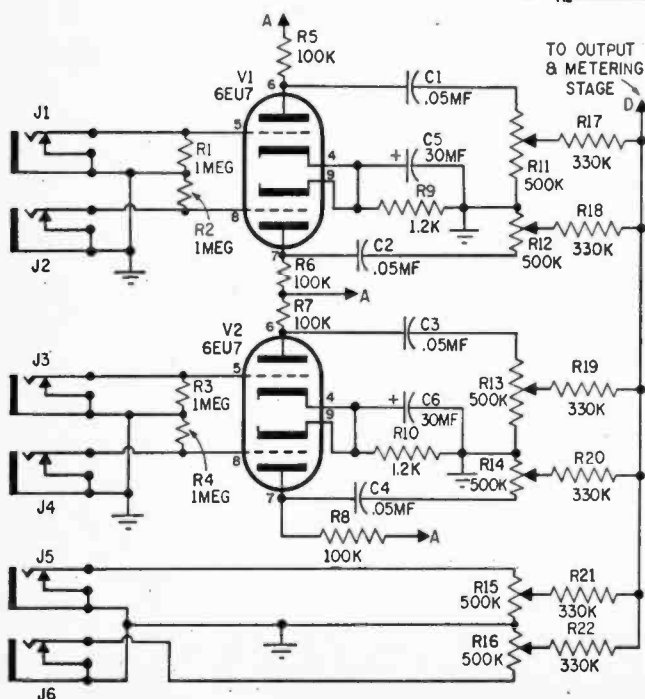
To reduce hum, the consolette design maintains the heater circuit at a positive DC potential above the cathode bias voltage by using a tap on a fixed voltage divider across the B-plus supply. The junction of resistors R39 and R40 provides a +10-volt bias for the heater circuit (which is "center-tapped" by R37 and R38). Since the heater is now positive at all times with respect to the cathode, there can be no electron flow from heater to cathode, and hum is eliminated.

The second method used to reduce noise is to provide a line-level output of 0.1 v. Since the line-level output connects to the line-level input of the recorder, low-level, noise-producing amplifiers in the recorder are bypassed. This again tends to reduce the overall hiss level. In addition, the use of extra-heavy filtering in the power supply further cuts hum and noise so that the resulting noise level is 60 db below 0.1 v.

Construction. Since the consolette can be built on virtually any chassis and in any cabinet, it's an easy matter to match your existing equipment. All that's needed is a suitable cabinet and a sheet of aluminum for the front panel. The consolette shown utilizes a walnut cabinet actually intended for



Graph illustrates the frequency response of the Mix-Master audio consolette. Response at 20 Hz can be improved by changing the coupling capacitors to those of increased value as explained in text.



Circuit for input stages of Mix-Master audio consolette shows four low-level inputs and two high-level inputs (J5 and J6). Two low-level inputs can be eliminated (if you have no need for them) by leaving out one duo-triode and the associated resistors and capacitors.

a Harman-Kardon amplifier. The panel is gold-anodized aluminum with the titling photo-printed into the aluminum.

Since the negative for our panel already exists, the manufacturer will supply a gold anodized panel for ten dollars (see Parts List). They are untrimmed and can be cut to fit a maximum size of 15½-in. wide x 5¼-in. high. The centers and cut-outs are printed on the aluminum along with the control titles.

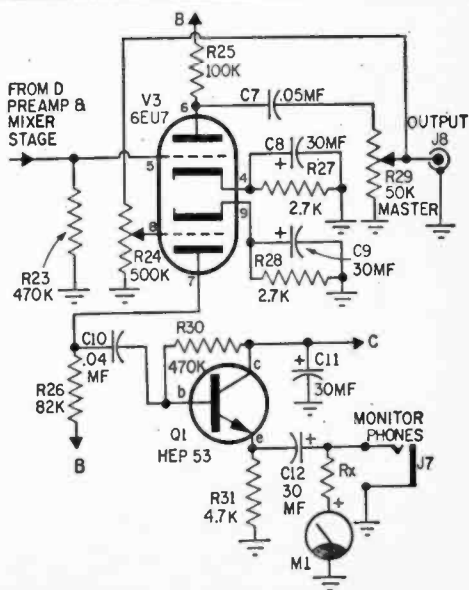
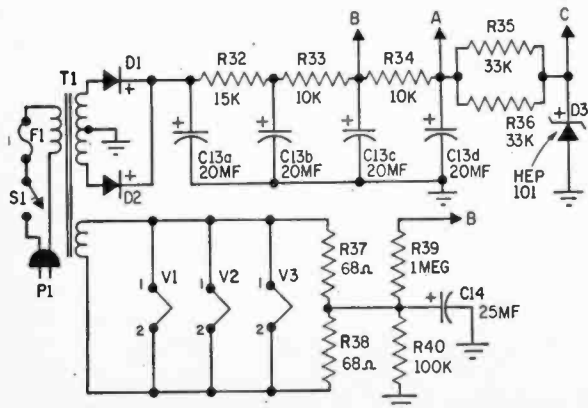
PARTS LIST FOR AUDIO CONSOLETTTE

C1, C2, C3, C4, C7—.05 mf, 200 volt capacitor
C5, C6, C8, C9, C12—30-mf, 6-volt electrolytic capacitor
C10—.04-mf, 200-volt capacitor
C11—30 mf, 12-volt electrolytic capacitor
C13—20/20/20/20 mf, 450-volt 4-section electrolytic capacitor
C14—25-mf, 25-volt electrolytic capacitor
D1, D2—Silicon diode, 400-volt piv, 750 ma or higher
D3—10-volt Zener diode, Motorola HEP-101 (Allied HEP101 or equiv.)
F1—1-ampere slo-blo pigtail fuse
J1, J2, J3, J4, J5, J6—Shorting-type phone jack
J7—Phone jack
J8—Phone jack
M1—VU meter (Lafayette 90 C 5033 or equiv.)
P1—AC power plug
Q1—Transistor, Motorola type HEP-53 (Allied HEP53 or equiv.)
R1, R2, R3, R4, R39—1 megohm, ½-watt resistor
R5, R6, R7, R8, R25, R40—100,000 ohm, ½-watt resistor
R9, R10—1200-ohm, ½-watt resistor
R11, R12, R13, R14, R15, R16, R24—500,000-ohm, audio-taper potentiometer (IRC PQ13128

or equiv.)
R17, R18, R19, R20, R21, R22—330,000-ohm, ½-watt resistor
R23, R30—470,000-ohm, ½-watt resistor
R26—82,000-ohm, ½-watt resistor
R27, R28—2700-ohm, ½-watt resistor
R29—50,000-ohm, audio-taper potentiometer (IRC PQ13123, or equiv.)
R31—4700-ohm, ½-watt resistor
R32—15,000-ohm, ½-watt resistor
R33, R34—10,000-ohm, ½-watt resistor
R35, R36—33,000-ohm, 1-watt resistor
R37, R38—68-ohm, ½-watt resistor
Rx—3600-ohm resistor (supplied with meter)
S1—S.p.s.t. switch
T1—Power transformer: 117 VAC primary; 2050 VAC secondary @ 25-ma and 6.3-volt secondary @ 1a (Allied 54A2008 or equiv.)
V1, V2, V3—6EU7 vacuum tube
Misc.—Chassis, cabinet, terminal strips, shielded cable, etc. (see text)
(Front panel is available from Mahler Research, GPO Box 1159, New York, N.Y. 10001)

Estimated cost: \$45.00
Construction time: 8 hours

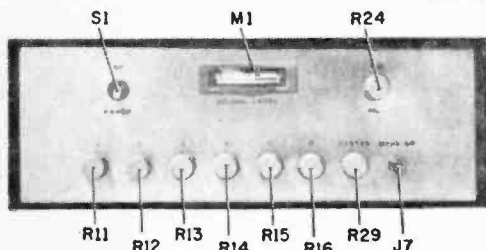
Full-wave power supply (below) provides DC for tubes as well as the transistor. Phones used for monitoring affect the calibration of the VU meter—the higher the phone's impedance the less effect on meter calibration. Always use same phones.



The MIX-MASTER

Incidentally, when making the cutouts for the tube sockets, make certain the tubes are spaced on either side of the meter. Since the meter is positioned below the top of the tubes, any tube mounted in this area will prevent installation of the meter.

Great care must be taken in construction to insure minimum hum and noise. The sockets for V1 and V2 should be the shielded type where the base provides $\frac{1}{3}$ shielding



Front panel shows location of all Mix-Master level controls. Edgewise meter removes much of the "scientific look" often associated with modern hi-fi units.

of the tube (top shields will not be needed). Further, shielded leads in most instances are grounded at one end only. Specifically, the shielded lead from J1 to V1 is grounded at both ends; the leads for J2 through J6 are grounded only at the jacks.

The shielded lead from R29 to R24 is grounded at R29; the shielded lead from R24 to V3 is grounded at both ends.

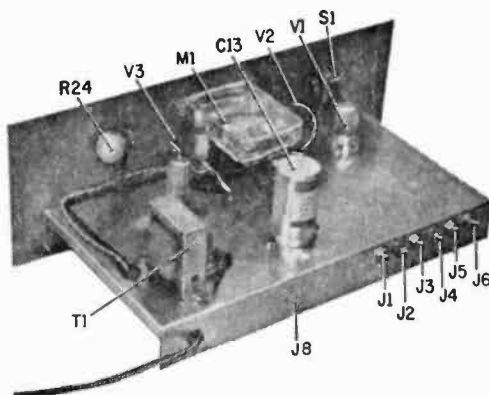
If you want to go to a little extra trouble to eliminate hum from possible ground loops, insulate J1-J6 from the chassis with shoulder washers, connect the J1-J6 ground terminals together, and run a lead to the case of R11. Jacks J1 through J6 are of the shorting-type, which automatically ground the "hot" conductor when the plug is removed.

Ground connections for controls R11-R16 are made to a ground buss of solid wire. Position the controls so that the ground lugs point nearly straight up when the chassis is upside-down. Then pass a wire through the ground lugs of R11-R16. If necessary, twist the mixer lugs so the wire passes through the terminal hole.

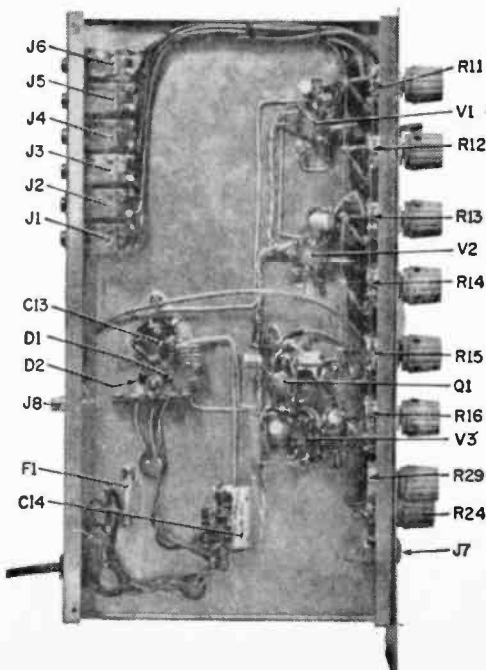
Make certain the wire (buss) doesn't touch any of the mixer cases, then solder

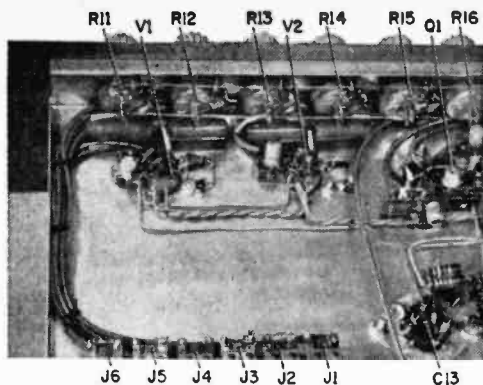
each of the ground terminals, ultimately soldering the buss to the case of R11. The ground terminal for the master level control, R29, is connected via the shielded output lead to J8's ground lug.

The "mixer buss" is installed in a similar manner. Solder a single terminal strip to the cover of each mixer, taking care to position the terminal so a wire can be passed through to the next terminal. Connect the appropriate isolation resistor (R17, R18, etc.) between the wiper of each mixer and its terminal strip, and pass a wire through all six terminals and solder. The end of the wire at

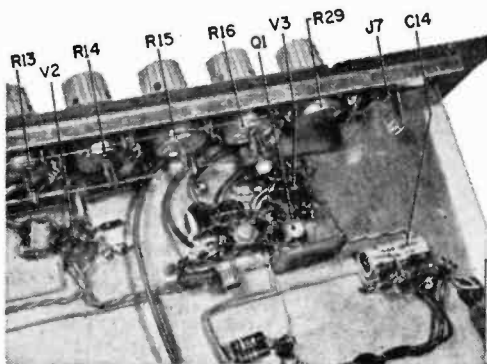


Rear-panel view shows location of jacks and tubes (above); under-chassis view (below) shows concentration of resistors, capacitors, and controls with wiring.





Single bare wire makes the common ground connection to all gain controls. Single ground point to chassis eliminates the hum-causing ground loops. Heater leads are twisted to balance out hum-inducing magnetic field surrounding AC power leads.



mixer #6 is connected to one grid (pin 5) of V3.

Lighting The Meter. Though the VU meter indicated in the Parts List doesn't contain a pilot light, it can be illuminated by positioning a #47 pilot lamp against the side of the meter case (since this is an optional circuit it isn't shown in the schematic). Use one of the meter mounting screws to fasten a pilot lamp assembly to the meter mounting bracket, and bend the bracket so the lamp is alongside of and nearly touching the meter case. Use a lamp socket which has *both* leads isolated from the chassis mount, and connect the lamp leads to the filament winding of T1.

The Cathode Follower. The transistor cathode-follower amplifier is assembled on two adjacent terminal strips as illustrated in the photographs. The 10-volt source for the amplifier is provided by the Zener diode D3. Do not substitute another unit for the specified D3. Also, make certain D3's cathode,

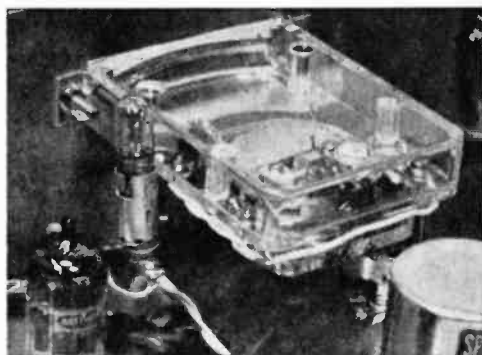
the end marked with a thin white band, is connected to R35 and R36.

Resistor Rx (3600 ohms) is supplied with the meter specified in the Parts List. Do not attempt to increase meter sensitivity by eliminating Rx, since this resistor is essential for meter calibration.

Fuse F1, a 1-ampere slo-blo pigtail type, is wired directly into the circuit. If you prefer, a standard fuseholder can be used.

Avoiding Problems. The construction of the console should present no problems as long as standard construction techniques are used, and the usual care given to diode and capacitor polarities. While it makes no difference how the tubular capacitors (C1, C2, etc.) are installed, make certain the electrolytics (C5, C8, etc.) are installed exactly as shown (note the "+" polarity symbols in the schematic). Similarly, install diodes D1, D2 and D3 as shown; the symbol (+) indicates the diode's cathode—the end often marked with a thin white band.

Calibration. Typical connections for VU meter calibration are made as follows: Connect J8 to the recorder's input. Connect a signal source—preferably a signal generator, but you can use a microphone—to any of the mike inputs (J1-J4). (A tape- or phono-signal source should be connected to J5 or J6). Set the master gain control (R29) to the 3/4-open position and line-level gain control full open. Then, speaking into the mike, or using a mike-level signal (—50 db) from the generator, advance the appropriate control (R11-R16) until the recorder's volume indicator shows normal maximum recording level. Holding the input signal constant, ad-



Pilot lamp is attached to side of plastic meter case, producing a subdued glow at front panel. You might want to use jewel type pilot assembly on front panel for a more outstanding indication that AC is on.

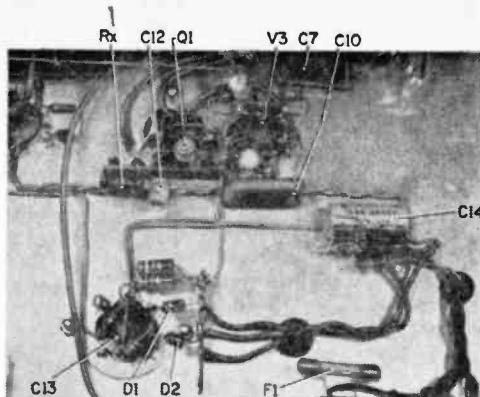
MIX-MASTER

just the VU calibrate control R24 until M1 indicates 0 VU; indications on M1 will now correspond to those on the recorder.

On some recorders, the built-in volume indicator is only lightly damped, though it may be styled as a VU meter. When a complex waveform is fed to the consolette, the meter on such a recorder will indicate peaks far above the zero mark at the same time the consolette's meter is indicating below zero. Since the ballistics of the meter in the recorder are sometimes selected to allow "pushing" the recording level to tape saturation, the meter in the consolette should be adjusted to correspond to the recorder's meter—not vice versa. If necessary, always advance R24 so the peaks indicated on M1 correspond to the peaks indicated on the recorder's meter.

Using The Consolette. The consolette is intended to be connected to the high-level input of a recorder or PA amplifier. If the consolette output is connected to a microphone (low-level) input, the recorder or amplifier will likely be overloaded or there will be severe hum.

Low-level input (at J1, J2, J3 and J4) to the consolette can be from any high-impedance microphone—a 50,000-ohm dynamic or a high-impedance crystal or ceramic type. For J5 and J6, use a high-level high-impedance source such as a crystal or ceramic phono cartridge, the output of a tape deck, or an AM or FM tuner. In normal use, it is suggested that the recorder's



Grommet protects leads from power transformer. Diodes are mounted right at base of filter capacitor. Filament leads run to right—to bleeder for positive bias.

line-level gain be set to near maximum.

The consolette's output can be monitored with headphones at J7, which is intended for phones of 2000-ohms impedance or higher. Phones of 2000- to 4000-ohms impedance will cause the meter to indicate from 1 to 3 db below the actual output level. (Crystal headphones will have less effect on the meter indications.) If you have this problem, simply connect a 2700-ohm resistor in series with J7. The volume level at J7 is comfortable; not too loud and not too low. While R24 can be used to vary the monitor level, keep in mind that R24 also determines M1's calibration.

Now you're all set to make professional-like recordings. The main thing is to keep those monitor phones on and watch that jiggling meter pointer—boost those low levels and ease down on those peaks. All it takes is practice. ■

STRAIGHT FROM THE SHOULDER

■ "Look ma, no hands!" (a phrase traditionally associated with cyclists) can now be attributed to many a fireman, policeman, or industrial worker. For a unique two-way radio distributed by American Teletronics Corp. (AMTEL) in San Francisco weighs a mere 5 oz. and is purposely designed for hands-free operation. Pictured is one model of the unit (trade-named "Shoulder Talk"), which can be installed in almost any safety helmet in a matter of minutes. Also available is a model for use with a gas mask. ■



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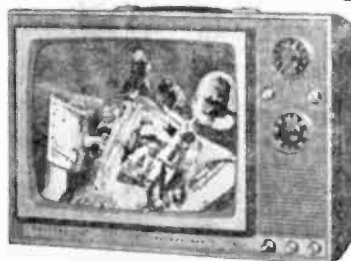
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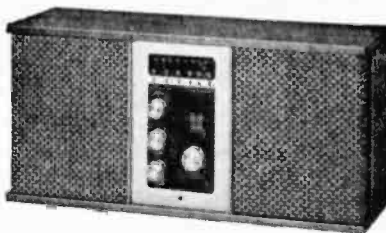
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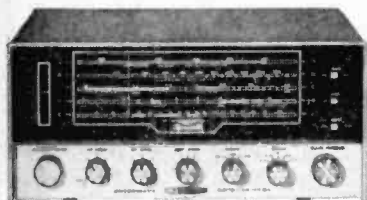
NEW! Deluxe Solid-State FM /FM Stereo Table Radio



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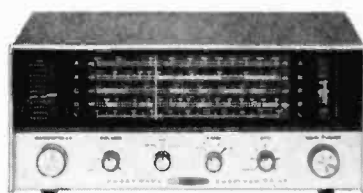
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New! Heathkit 60-Watt Solid-State Guitar Amplifier

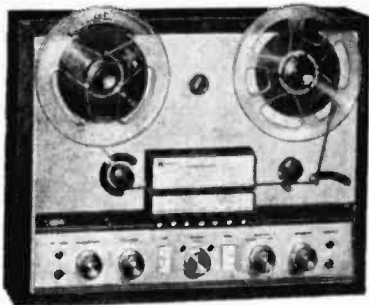


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All The Features Guitarists Want Most . . . 60 watts peak power; two channels, one for accompaniment, accordion, organ or mike, the other has variable reverb and tremolo for lead guitars; 2 inputs per channel; two foot switches for reverb & tremolo; two 12" heavy-duty speakers; hum reduction switch; one easy-to-build circuit board with 13 transistors, 6 diodes — total kit assembly time 12 hours; 28" W x 9" D x 19" H leather-textured black vinyl cabinet of $\frac{3}{4}$ " stock; 120 v. or 240 v. AC operation; extruded aluminum front panel; chrome-plated knobs. 52 lbs.

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Kit AD-16
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(less cabinet)

Save \$170 by doing the easy assembly yourself. Features solid-state circuitry; 4-track stereo or mono playback and record at 7½ & 3¾ ips; sound-on-sound, sound-with-sound and echo capabilities; 3 separate motors; solenoid operation; die-cast top-plate, flywheel and capstan, shaft housing; all push-button controls; automatic shut-off; plus a host of other professional features. 45 lbs. Optional walnut base \$19.95, adapter ring \$4.75

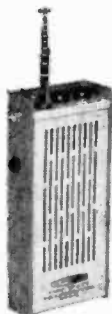
New! SB-101 80-10 Meter SSB Transceiver — Now With Improved CW Transceive Capability



Kit SB-101
\$360⁰⁰
(less speaker)

Now features capability for front panel switch selection of either the USB/LSB standard 2.1 kHz SSB filter or the optional SBA-301-2 400 Hz CW filter ... plus simplified assembly at no increase in price over the already famous Heathkit SB-100. Also boasts 180-watt P.E.P. input, 170 watts input CW, PTT & VOX, CW sidetone, Heath LMO for truly linear tuning and 1 kHz dial calibrations. 23 lbs. SBA-301-2, 400 Hz CW filter ... \$20.95. Kit HP-13, mobile power supply ... \$59.95. Kit HP-23, fixed station supply.....\$39.95

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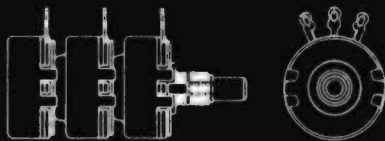
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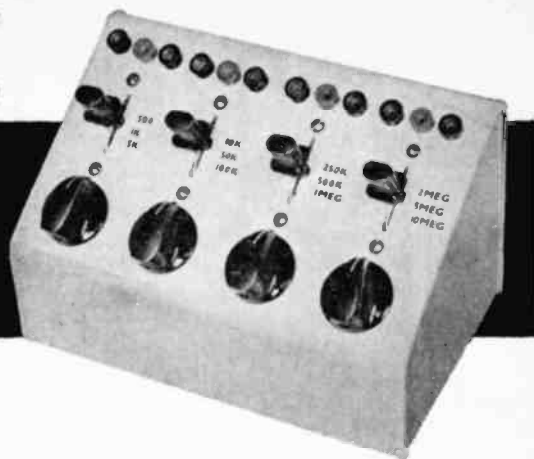
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CL-274

POT BOX



by Jack Brayton

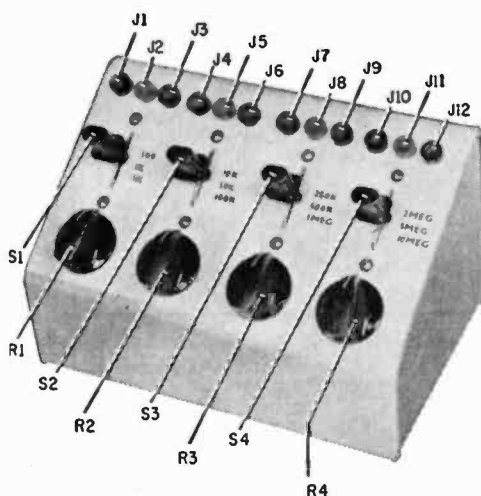


Flip a switch, twist a wrist—the resistance you want, when you want it.

■ If there's one thing the experimenter almost never has it's the correct pot (potentiometer in Webster's) for the circuit he's building or fixing. Those pots in the junk box always seem to be either noisy, dirty, broken, or their values are simply wrong for the project at hand.

Sure, you can manage (after wasting time searching) to find a pot that works in the circuit you're breadboarding. But can you find another one with a slightly-higher or lower-resistance value to locate the circuit's outside limits? Are you sure your final choice is well within those limits? You can do all these things, simply, easily, with the *Pot Box*. You can also temporarily replace a few of those fixed resistors with pots—to see how the circuit would act if these fixed units were higher, or lower in resistance value. Since the *Pot Box* has twelve overlapping ranges you can have *continuous* coverage from a few ohms to 10 Meg.! Still another advantage is that individual range switches allow up to four pots to be used *simultaneously*.

Cost is not prohibitive—the complete, 4-section, 12-range unit costs only about \$22.00 to build. Even this price can be cut by \$5.00 or more simply by eliminating one of the lesser used sections at the high or low end. Using 3-position, double-pole slide switches will also reduce costs by about



Each group of three jacks is for one potentiometer. Lever switches select one of the wafers of each triple-section unit.

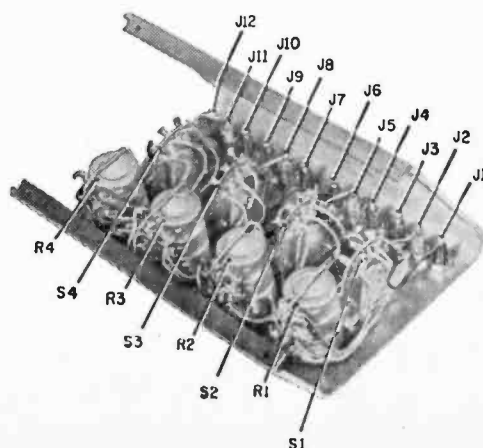


TABLE OF POTENTIOMETER RANGES

R1a—500	R2a—10K*	R3a—250K*	R4a—2Meg.*
R1b—1K	R2b—50K	R3b—500K*	R4b—5 Meg.
R1c—5K	R2c—100K*	R3c—1 Meg.*	R4c—10 Meg.

*Indicates values available in log (audio) tapers.

75¢ for each of the sections. (Use Continental-Wirt G338; Allied 35Z032.)

Its Secret. Its secret is simple and neat. Triple-section controls are used which means only four knobs are on the panel even though twelve potentiometer values are available at the jacks. As we've already mentioned, low-cost, double-pole, lever-type range switches are utilized to connect the four triple-section potentiometers to the various output jacks.

PARTS LIST FOR POT BOX

J1-J12—Tip jacks (or banana jacks) (H. H. Smith 1515 or equiv.)

R1a, b, c—500-ohm, 1,000-ohm, 5,000-ohm, triple-section potentiometer (Allied 46D1892C—type 45-D501-MD102-MD502-16)

R2a, b, c—10,000-ohm, 50,000-ohm, 100,000-ohm, triple-section potentiometer (Allied 46D1892C—type 45-D103-MD503-MD104-16)

R3a, b, c—250,000-ohm, 500,000-ohm, 1,000,000-ohm, triple-section potentiometer (Allied 46D1892C—type 45-D254-MD504-MD105-16)

R4a, b, c—2,000,000-ohm, 5,000,000-ohm, 10,000,000-ohm, triple-section potentiometer (Allied 46D1892C—type 45-D205-MD505-MD106-16)

S1-S4—3-p.d.t., positive-action, non-shorting lever switch (Centralab 1454 or equiv.)

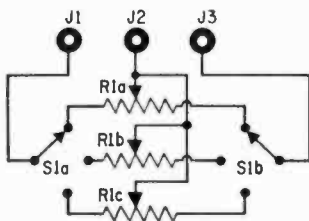
1—Sloping-panel utility cabinet, 7-in. wide (Bud C1609—steel; AC1613—aluminum, or equiv.)

4—Knobs for 1/4-in. round shaft

Misc.—Wire, solder, machine screws and nuts, panel marking decals, paint, etc.

Estimated cost: \$22.00

Construction time: 4 hours



ALTERNATE PARTS LIST

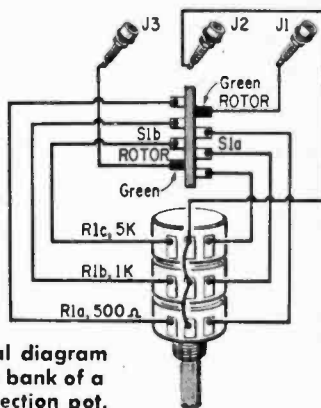
(For Log-Tapered Audio Controls)

R2a, b, c—10,000-ohm, 50,000-ohm, 100,000-ohm, triple-section potentiometer (Allied 46D1892C—type A103-MD503-MA104-16)

R3a, b, c—250,000-ohm, 500,000-ohm, 1,000,000-ohm, triple-section potentiometer (Allied 46D1892C—type 45A254-MA504-MA105-16)

R4a, b, c—2,000,000-ohm, 5,000,000-ohm, 10,000,000-ohm, triple-section potentiometer (Allied 46D1892C—type 45-A205-MD505-MD106-16)

Parts. All of the parts, except the controls, are standard and widely available. The four controls are from Allied's *industrial catalog* and may be ordered (\$3.00 each) using the stock and type numbers shown in the Parts List. It's important to note that the *stock* number merely indicates a triple-section control while the *type* number indicates the placement and resistance values used to make up the control. Thus, *both* the stock and



Pictorial diagram for one bank of a triple-section pot.

type numbers must be clearly written on the order.

Linear instead of logarithmic (log) tapered pots are specified in the Parts List because tapered pots do not come in all of the values needed. However, if you do a lot of audio or related work and want log-tapered pots in as many values as possible, simply substitute the stock and type numbers shown in Alternate Parts List when ordering the controls. The values marked with an asterisk (*) in the table would then be log tapered pots.

Construction. Of course, construction is started by laying out the sloping panel of the utility box on 1/4-inch graph paper as shown. Then cut it out; tape it to the front panel; center punch the holes; and, finally, drill them. The switch slots are started in the 1/4-inch center holes and are sawed with a keyhole hack saw. A thin, flat file is used to smooth the edges and widen the slots slightly.

The parts are mounted as shown in the illustrations. You can't mount the switches wrong (upside down) since their terminals are symmetrical, the same in either position. Furthermore, the rotor terminals are identified by a green dye.

Wiring. Wiring is simple and easy because each of the four sections are wired exactly the same. The schematic diagram shows the

(Continued on page 120)



LITERATURE

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50. Make your connection with *Amphenol*—tune in to the latest on CB product news with specs and pics on new gear. Keep informed on *Amphenol's* new products.

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

54. A catalog for CB'ers, hams and experimenters, with outstanding values. Terrific buys on *Grove Electronics'* antennas, mikes and accessories.

96. If a rugged low-cost business/industrial two-way radio is what you've been looking for, be sure to send for the brochure on *E. F. Johnson Co.'s* brand new Messenger "202."

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

KITS

★42. Here's a colorful 108-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.

★44. *EICO's* new 48-page 2-color pocket-size short form catalog is just off the press. Over 250 products: Ham radio, CB, hi-fi—in kit and wired form—are illustrated. Also, discover *EICO's* new experimenter kit line.

ELECTRONIC PRODUCTS

66. Try instant lettering to mark control panels and component parts. *Datapak's* booklets and sample show this easy dry transfer method.

108. Get the facts on *Mercury's* line of test equipment kits—designed to make troubleshooting easier, faster and more profitable.

67. "Get the most measurement value per dollar," says *Electronics Measurements Corp.* Send for their catalog and find out how!

92. How about installing a transistorized electronic ignition system in your current car? *AEC Laboratories* will mail their brochure giving you specifications, schematics.

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.

HI-FI/AUDIO

★26. Always a leader, *H. H. Scott* introduces a new concept in stereo console catalogs. "At Home With Stereo," offers decorating ideas, a complete explanation of the more technical aspects of stereo consoles.

85. Need a tuner? Preamp? Amp? Tape deck? Then inspect *Dyna* for kits or wired units. It's worthwhile looking at test reports *Dyna* sends you way.

110. Get the latest facts on sound columns. *American Geloso Electronics Inc.* offers a ten-page booklet giving the hows and whys plus method of installation and arrangement of sound columns.

15. A name well-known in audio circles is *Acoustic Research*. Here's its booklet on the famous AR speakers and the AR turntable.

16. Discover how Cueing Control, anti-scatting and other *Garrard* features in the Lab 80 offer tops in audio listening. 32-page *Garrard* Comparator Guide will make you a wiser buyer—get it.

17. Build your own bass reflex enclosures from fool-proof plans offered by *Electro-Voice*. At the same time get the specs on *EV's* solid-state hi-fi line—a new pace setter for the audio industry.

19. *Empire Scientific's* new 8-page, full color catalog is now available to our readers. Don't miss the sparkling decorating-with-sound ideas.

24. Need a hi-fi or PA mike? *University Sound* has an interesting microphone booklet audio fans should read before making a purchase.

27. An assortment of high fidelity components and cabinets are described in the *Sherwood* brochure. The cabinets can almost be designed to your requirements, as they use modules.

95. Confused about stereo? Want to beat the high cost of hi-fi without compromising on the results? Then you need the new 24-page catalog by *Jensen Manufacturing*.

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

TAPE RECORDERS AND TAPE

113. *Scotch* is the product and it's made by *Minnesota Mining and Mfg. Co. (3M)*. Get a packet full of facts and tape data from 3M and learn all about your tape recorder and the tape it needs.

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.

32. "Everybody's Tape Recording Handbook" is the title of a booklet that *Sarkes-Tarzan* will send you. It's 24-pages jam-packed with info for the home recording enthusiast. Includes a valuable table of recording times for various tapes.

33. Become the first to learn about *Norelco's* complete Carry-Corder 150 portable tape recorder outfit. Four-color booklet describes this new cartridge-tape unit.

34. You can't pick the tape recorder you need without a program—and *Sony Superscope* has one. Full color 16-page booklet is as good as your dealer's showcase. Includes accessories.

35. If you are a serious tape audiophile, you will be interested in the new *Viking of Minneapolis* line—they carry both reel and cartridge recorders you should know about.

91. Sound begins and ends with a *Uher* tape recorder. Write for this new 20 page catalog showing the entire line of *Uher* recorders and accessories. How to synchronize your slide projector, execute sound on sound, and many other exclusive features.

HI-FI ACCESSORIES

112. *Telex* would like you to know about their improved Serenata Headset—and their entire line of quality stereo headsets.

39. A 12-page catalog describing the audio accessories that make hi-fi living a bit easier is yours from *Switchcraft, Inc.* The cables, mike mixers, and junctions are essentials!

98. Swinging to hi-fi stereo headsets? Then get your copy of *Superex Electronics'* 16-page catalog featuring a large selection of quality headsets.

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

AMATEUR RADIO

46. A long-time builder of ham equipment, *Hallcrafters* will send you lots of info on the ham, CB and commercial radio-equipment.

SCHOOLS AND EDUCATIONAL

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.

★59. For a complete rundown on curriculum, lesson outlines, and full details from a leading electronic school, ask for this brochure from the *Indiana Home Study Institute*.

★61. *ICS (International Correspondence Schools)* offers 236 courses including many in the fields of radio, TV, and electronics. Send for free booklet "It's Your Future."

★74. How to get an F.C.C. license, plus a description of the complete electronic courses offered by *Cleveland Institute of Electronics* are in their free catalog.

105. Get the low-down on the latest in educational electronic kits from *Trans-Tek*. Build light dimmers, amplifiers, metronomes, and many more. *Trans-Tek* helps you to learn while building.

TOOLS

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.

★78. Need a compact screwdriver kit? *Xcelite's* 99PV-4 and 99PV-6 consists of handle, 3 and 5 blades, respectively, in "see-thru" zipper case. Get *Xcelite's* catalog 166.

TELEVISION

★70. *The Heath Co.* now has a 19" color TV to complement their 21" and 25" models. A new B&W portable model will be a hot seller for the mobile set. Get the facts today!

72. Get your 1967 catalog of *Cistlin's* TV, radio, and hi-fi service books. Bonus—TV tube substitution guide and trouble-chaser chart is yours for the asking.

97. Interesting, helpful brochures describing the TV antenna discovery of the decade—the log periodic antenna for UHF and UHF-TV, and FM stereo. From *JFD Electronics Corporation*.

ELECTRONIC PARTS

117. Don't build that next project until you get your mits on *Bigelow's* 13th anniversary catalog. You've got to read this one to believe the buys.

★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 latest *Allied Radio* catalog? The surprising thing is that it's free!

★2. The new 1967 Edition of *Lafayette's* catalog features sections on stereo hi-fi, CB, ham gear, test equipment, cameras, optics, tools and much more. Get your copy today.

★3. Bargains galore! Parts, tools, test equipment, radios and many more specials at ultra-low prices. *Progressive Edu-Kits* will send latest catalog.

★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.

★23. No electronics bargain hunter should be caught without the 1967 copy of *Radio Shack's* catalog. Some equipment and kit offers are so low, they look like misprints. Buying is believing.

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

★106. With 70 million TV's 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 flat rate per tube.

★7. Whether you buy surplus or new, you will be interested in *Fair Radio Sales Co.'s* latest catalog—chuck full of surplus buys for every experimenter.

8. Want a colorful catalog of goodies? *John Meshna, Jr.* has one that covers everything from assemblies to zener diodes. Listed are government surplus radio, radar, parts, etc. All at unbelievable prices.

★6. Bargains galore, that's what's in store! *Poly-Paks Co.* will send you their latest eight-page flyer listing the latest in merchandise available, including a giant \$1 special sale.

10. *Burstein-Applebee* offers a new giant catalog containing 100's 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.

12. VHF listeners will want the latest catalog from *Kuhn Electronics*. All types and forms of complete receivers and converters.

RADIO-TV EXPERIMENTER, Dept. 467
505 Park Avenue, New York, N. Y. 10022

Please have literature whose numbers I have encircled sent to me as soon as possible. I am enclosing 25¢ (no stamps) to cover handling charges.



1	2	3	4	5	6	7	8	10	11	12	15	16	17
19	23	24	26	27	31	32	33	34	35	39	42	44	45
46	48	50	54	57	59	61	66	67	70	72	74	78	85
91	92	93	95	96	97	98	99	100	101	103	104	105	106
107	108	109	110	111	112	113	114	115	116	117	118		

☐

I am a subscriber

☐

Indicate total number of booklets requested

NAME (Print clearly) _____

ADDRESS _____

CITY _____

STATE _____

ZIP _____

VLF Listening

Continued from page 53

less, there is seldom an interference problem even with a broadly tuned receiver.

A typical example was station GBR in England, a long-time VLF resident on 16 kHz. For reasons known only to the GBR staff, it was decided to change the station's frequency for better coverage. The end result was a new transmitting frequency of 15.975 kHz (a mere 25 Hz away from the original frequency). Such a shift would hardly have been detected on shortwave, but it was sufficient on this band to make the needed difference.

It's interesting to note that high-speed CW cannot be transmitted on VLF and the normally rapid U.S. Navy communications must be idled down to 25 wpm or less. It also seems that because of some unique antenna resonance problems found in VLF transmission, signals cannot be sent which require a greater bandwidth than the antenna can handle—at least not without seriously damaging the transmitting equipment in the process. As a result, many VLF stations transmit code so slowly that even someone who is not able to read CW can write down the dots and dashes and decipher them later from a chart.

As a true DX fiend, you're probably wondering about the possibilities of getting QSL's from these stations (and who wouldn't like to lay claim to a card from a 2-million watt station?). Rest easy, for these stations have always been very cooperative, even to the point of being encouraging, to those hardy DX enthusiasts who have ventured into radio's most mysterious frontier.

Future Of VLF. Experiments are still continuing to establish new records in low-frequency transmission. For a while the lowest frequency achieved was 800 Hz (0.8 kHz), which was the low-frequency edge of the Naval Research Laboratory's experimental "whistler" receiver. More recently, the U.S. Air Force was successful in sending a signal about 750 miles (from a 300,000 watt transmitter) on a frequency of 400 Hz!

Researchers have now discovered that a resonant cavity exists between the surface of the earth and the ionosphere. This frequency is estimated as being just below 8 Hz, which point could turn out to be rock-bottom.

Meanwhile, from a practical standpoint, the U.S. Navy is in the process of establishing a new VLF long-range navigational system dubbed "Omega," with stations already established in Norway, the Canal Zone, Trinidad, Hawaii, Forestport (N.Y.), and three other locations, including one at an undisclosed point in the U.S. midwest ("Omega" incidentally, is apparently intended to be the navigational system for our nuclear submarine fleet.)

Each station transmits two sequential radio pulses on 10.2 and 13.6 kHz, at a specific time during a 10-second period. Receivers aboard Navy vessels will compare minute time differences between any three or more of the signals and a series of lines can be then plotted on a chart which will show the exact location of the vessel. Some of the "Omega" stations have already been heard on 13.6 kHz.

Though VLF was almost dead and buried after World War I, the renewed interest in this band has been truly exciting for anybody interested in electronics. And as a unique brand of radio communications, VLF can well be considered the last outpost in an otherwise tamed frontier. Why not tune in on the excitement this last frontier has to offer—all it takes is a receiver less complicated than a table radio to make you a full-fledged member of the "in" crowd! ■



NATO VLF station at Anthorn, England, has six halyard winches around the base of main mast. At the present time it is the largest single antenna system to be found in Western Europe.

Volume 47, Part 2

WHITE'S RADIO LOG

An up-to-date Broadcasting Directory of North American AM, FM and TV Stations. Including a Special Section on World-Wide Short-Wave Stations

This is the second part of *White's Radio Log*, published in three parts twice each year. This format permits the Editors of RADIO-TV EXPERIMENTER to offer its readers two complete volumes of *White's Radio Log* each year, while increasing the scope of the *Log* and inserting station changes as they occur.

In this issue of *White's Radio Log* we have included the following listings: U. S. AM Stations by Location, U. S. FM Stations by States, Canadian AM Stations by Location, Canadian FM Stations by Location, and the expanded, up-to-date World-Wide Short-Wave Section.

In the June/July issue of RADIO-TV EXPERIMENTER, the *Log* will contain the following listings: U. S. AM Stations by Call

Letters, U. S. FM Stations by Call Letters, Canadian AM Stations by Call Letters, Canadian FM Stations by Call Letters, and the expanded World-Wide Short-Wave Section.

In the event you missed any part of the *Log* published earlier this year, you will have a complete copy of *White's Radio Log* by collecting any three consecutive issues of RADIO-TV EXPERIMENTER during 1966. The three consecutive issues comprise a complete volume of *White's Radio Log* that offers complete listings with last minute station change data that can not be offered in any other magazine or book. If you are a broadcast band DX'er, FM station logger, like to photograph distant TV test patterns, or tune the short-wave bands, you will find *White's Radio Log* an unbeatable reference.

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U. S. AM Stations by Location

Every effort has been made to ensure accuracy of the information listed in this publication, but absolute accuracy is not guaranteed and of course, only information available up to press-time could be included. Copyright 1967 by Science & Mechanics Publishing Co., a subsidiary of Davis Publications, Inc., 505 Park Avenue, New York, New York 10022.

WHITE'S RADIO LOG

Location	C.L.	kHx
Coleman, Tex.	KSTA	1000
Colfax, Wash.	KCLX	1450
College Park, Ga.	WAlA	1570
Collierville, Tenn.	WPiP	1590
Colonial Heights, Va.	WPVA	1290
Colorado City, Tex.	KVMC	1320
Colo. Sprgs., Colo.	KRDO	1240
	KPIK	1580
	KVOR	1300
	KSSS	740
	KYSN	1460
	KRYT	1530
Columbia, Ky.	WAIN	1270
Columbia, Miss.	WCJU	1450
Columbia, Mo.	KFRU	1400
	KCBM	1580
Columbia, Pa.	WCQY	1580
Columbia, S.C.	WCOS	1400
	WIS	560
	WOIC	1320
	WNOK	1230
	WQXL	1470
	WNCN	1280
Columbia, Tenn.	WKRM	1340
	WDAK	540
Columbus, Ga.	WRBL	1420
	WHYD	1270
	WCLS	1580
	WOKS	1340
Columbus, Ind.	WCSB	1010
Columbus, Miss.	WCAR	1050
	WCBI	550
Columbus, Nebr.	KJSK	900
	KTTT	1510
Columbus, Ohio	WBNS	1460
	WCOL	1230
	WMMN	920
	WOSU	820
	WTVN	610
	WVYO	1580
Colville, Wash.	KCVL	1270
Comanche, Tex.	KCOM	1550
Commerce, Ga.	WJJC	1270
Concord, Calif.	KWUN	1490
Concord, N.H.	WKXL	1450
Concord, N.C.	WEGO	1410
Concordia, Kans.	KNCK	1390
Conneaut, Ohio	WWOW	1360
Connellsville, Pa.	WCVI	1340
Connersville, Ind.	WCNB	1580
Conroe, Tex.	KNCQ	900
Conway, Ark.	KCON	1230
	KVEE	1330
Conway, N.H.	WBNC	1050
Conway, S.C.	WLAT	1330
Cookeville, Tenn.	WHUB	1490
Coolidge, Ariz.	WPTN	1550
Cos Bay, Dreg.	KCKY	1150
	KYNG	1420
Copper Hill, Tenn.	WLSB	1400
Coquille, Oreg.	KWRO	630
Coral Gables, Fla.	WRIZ	1550
	WVCG	1080
	WCTT	680
Corbin, Ky.	WYGO	1330
Cordale, Ga.	WMJM	1490
Cordova, Alaska	KLAM	1450
Corinth, Miss.	WCMA	1250
	WKCU	1350
Corneille, Ga.	WCQN	1450
Corning, Ark.	KCCB	1260
Corning, N.Y.	WCBA	1350
	WCLI	1450
Corona, Cal.	KREL	1370
Corpus Christi, Tex.	KCTA	1030
	KCCT	1150
	KEYS	1440
	KFRY	1560
	KXIS	1230
	KUNO	1400
Corry, Pa.	WOTR	1370
Corsicana, Tex.	KAND	1340
Cortez, Colo.	KVFC	740
Cortland, N.Y.	KKRY	920
	KELV	1240
Corvallis, Ore.	KLOO	1340
Corydon, Ind.	WPDF	1550
Coshocton, Ohio	WTNS	1560
Cottage Grove, Ore.	KNND	1400
Cottonwood, Ariz.	KVRD	1240
	KVIO	1600
Coudersport, Pa.	WFRM	600
Council Bluffs, Iowa	KFNF	920
	KRCB	1360

Location	C.L.	kHx
Courtenay, B.C.	CFCP	1440
Covington, Ga.	WGFS	1430
Covington, Ky.	WCLU	1320
Covington, La.	WARR	730
Covington, Tenn.	WKBL	1250
Covington, Va.	WKCY	1340
Cowan, Tenn.	WZYX	1440
Cograd, Neb.	KAMH	1580
Craig, Colo.	KRAI	550
Crane, Tex.	KCCR	1380
	KBSN	970
Crawfordsville, Ind.	WCVL	1550
Crescent City, Calif.	KFLY	1240
	KPOD	1310
Creston, Iowa	KSIB	1520
Crestview, Fla.	WCNU	1010
	WISB	1050
Crewe, Va.	WSVS	800
Crockett, Tex.	KIVY	1290
Crookston, Minn.	KROX	1260
Crossett, Ark.	KAMH	800
Crossville, Tenn.	WAEW	1330
Crowley, La.	KSIG	1450
Crystal Lake, Ill.	WCLR	850
Cuero, Tex.	KCFH	1600
Cullman, Ala.	WFMH	1480
	WKUL	1340
Culpeper, Va.	WKVA	1490
Cumberland, Ky.	WCPI	1580
Cumberland, Md.	WCUM	1230
	WKYR	1270
	WTBO	1450
Cummings, Ga.	WSNE	1410
Cushing, Okla.	KUSH	1600
Cuyahoga Falls, Ohio	WCUE	1150
Cypress Gardens, Fla.	WGTO	540
Cynthiana, Ky.	WCYN	1400
Dade City, Fla.	WDCE	1350
Dadeville, Ala.	WDVC	910
Dainersfield, Tex.	KEGG	1560
Dalhousie, Tex.	KJLI	940
Dallas, N.C.	WAAK	960
Dallas, Oreg.	KROW	1460
Dallas, Tex.	KRLD	1080
	KIXL	1040
	KSKY	660
	KLIF	1190
	WFAA	570
	WFAA	820
	KBOX	1480
	WRR	1310
Dalton, Ga.	WBLJ	1230
	WTTI	1330
Danbury, Conn.	WLAD	800
Danville, Ill.	WDAN	1490
	WITY	980
Danville, Ky.	WHIR	1230
Danville, Pa.	WPGM	1570
Danville, Va.	WBTM	1330
	WYPR	970
	WDVA	1250
	WILA	1580
Dardanelle, Ark.	KCAB	980
Darlington, S.C.	WDAR	1350
Davenport, Iowa	WOC	1420
	KWNT	1580
	KSTT	1170
Dawson, Ga.	WDWT	990
Dayton, Ohio	WHIO	1290
	WING	1410
	WDNE	980
	WAVI	1210
	WDNT	1280
Dayton, Tenn.	WVNB	1150
Daytona Beach, Fla.	WMFJ	1450
	WROD	1340
Deadwood, S.Dak.	KDSJ	980
Deaborn, Mich.	WKNR	1310
Decatur, Ala.	WHOS	800
	WAIF	1490
	WMSL	1400
Decatur-Atlanta, Ga.	KGUN	1010
	WOMN	1310
Decatur, Ill.	WDZ	1050
	WSOY	1340
Decatur, Ind.	WADM	1540
Decatur, Iowa	KDEC	1240
	KWLC	1240
Deer Lodge, Mont.	KDRG	1400
Deerfield, Va.	WABH	1150
Defiance, Ohio	WONW	1280
De Funak Springs, Fla.	WDSP	1280
	WUEP	1460
De Kalb, Ill.	WLBK	1360
De Land, Fla.	WJBS	1490
	WOOO	1310
Delano, Calif.	KCHJ	1010
Delaware, Ohio	WDEE	1550
Delray, Beh., Fla.	WBBF	1420
Del Rio, Tex.	KDLK	1230
Delta, Colo.	KDIA	1400
Deming, N.Mex.	KOTS	1230
Demopolis, Ala.	WXAL	1400
Denham Sprgs., La.	WLBI	1220
Denison, Iowa	KDSN	1580
Denison-Sherman, Tex.		

Location	C.L.	kHx
Denmark-Bamberg, S.C.	KDSX	950
	WBBD	790
Denton, Tex.	KDNT	1440
Denver, Colo.	KDEN	1340
	KFML	1390
	KHOW	630
	KIMN	950
	KLIR	990
	KLZ	560
	KBTR	710
	KOA	850
	KPOF	910
	KFSQ	1280
Denver City, Tex.	KKAL	1580
De Queen, Ark.	KDQN	1390
De Ridder, La.	KDLA	1010
Des Moines, Iowa	KCBC	1390
	KIOA	940
	KRNT	1550
	KSO	1460
	WKWY	1150
	WHO	1040
Detroit, Mich.	WCAR	1130
	WJBK	1500
	WJLB	1460
	WJR	760
	WVA	950
	WXYZ	1270
Detroit Lakes, Minn.	KDLM	1340
Devils Lake, N.Dak.	KDLR	1240
	KEXE	1250
Dexter, Mo.	KESL	1260
Diboll, Tex.	KSLP	1260
Dickinson, N.Dak.	KDIX	1230
Dickson, Tenn.	WDKN	1260
Dillon, Mont.	KDBM	800
Dillon, S.C.	WDSC	800
Dimmitt, Tex.	KDHN	1470
Dinuba, Calif.	KDBJ	1130
Dixon, Ill.	WIXN	1460
Dodge City, Kans.	KGNO	1370
	KEDD	1550
Donaldsonville, Ga.	WSEM	1500
Doniphan, Mo.	KDFN	1500
Dothan, Ala.	WAGF	1320
	WDIG	1450
	WOOF	560
Douglas, Ariz.	KAWT	1450
	KAPR	930
Douglas, Ga.	WDMG	860
	WOKA	1310
Douglas, Wyo.	KWIV	1050
Douglasville, Ga.	WDVG	1520
Dover, Del.	WDOV	1410
	WKEN	1500
Dover, N.J.	WRAN	1510
Dover, N.H.	WTSN	1270
Dover, Ohio	WJER	1450
Dowagiac, Mich.	WDOW	1440
Doylestown, Pa.	WDTN	1370
Dublin, Ga.	WMLT	970
	WXLI	1230
Du Bois, Pa.	WCED	1420
Dubuque, Iowa	KDTH	1270
	WDBQ	1490
Duluth, Minn.	KDAL	610
	KWGB	580
	KAOH	1390
Dumas, Ark.	KDDA	1560
Dumas, Tex.	KDDD	800
Duncan, Okla.	KRDD	1350
Dundee, N.Y.	WFLR	1570
Dunkirk, N.Y.	WDDE	1410
Dunn, N.C.	KWVJ	780
Du Quoin, Ill.	WDQN	1580
Durango, Colo.	KIUP	990
	KDGO	1240
Durant, Okla.	KSFO	750
Durham, N.C.	WDNC	620
	WSRC	1410
	WSSB	1490
	WTKI	1360
Dyersburg, Tenn.	WDSG	1450
	WTRO	1330
Eagle Pass, Tex.	KEPS	1270
Eagle River, Wis.	WERL	950
Easley, S.C.	WELP	1360
E. Grand Forks, Minn.	KRAD	1590
Eastland, Tex.	KERC	1590
E. Lansing, Mich.	WKAR	870
	WVIC	730
E. Liverpool, Ohio	WOHI	1490
East Longmeadow, Mass.	WYTM	1600
Eastman, Ga.	WUEP	710
E. Moline, Ill.	WOLM	960
E. Point, Ga.	WTJH	1260
East Prairie, Mo.	KGLC	1080
E. Syracuse, N.Y.	WPWA	1540
Easton, Md.	WEMD	1460
Easton, Pa.	WEEK	1330
	WSTT	1400
Eatonville, Ga.	WXPQ	1520
Eatonville, N.J.	WHTG	1410
Eau Claire, Wis.	WEAQ	790
	WBIZ	1400
	WECL	1050
Eau Gallie, Fla.	WNEG	920
	WTAI	1560

Location	C.L.	kHx
Ebensburg, Pa.	WEND	1580
Edenton, N.C.	WCDJ	1260
Edinburg, Tex.	KURV	710
Edmonds, Wash.	KGDN	630
Elmhurst, Ill.	WCRA	1090
Elba, Ala.	WELB	1450
Elberton, Ga.	WSGC	1400
El Cajon, Calif.	KDEO	910
El Campo, Tex.	KULP	1390
El Centro, Calif.	KXO	1230
	KAMP	1430
El Dorado, Ark.	KDMS	1290
	KELD	1400
Eldorado, Kans.	KBTO	1360
Eldorado Springs, Mo.	KESM	1580
Eleele, Kanai, Hawaii		
	KUAI	720
Elgin, Ill.	WRMN	1410
Elizabeth City, N. C.	WCNC	1240
	WGAI	560
Elizabethton, Tenn.	WBEJ	1240
	WIDD	1520
Elizabethtown, Ky.	WIEL	1400
Elizabethtown, N.C.		
	WBLA	1440
Elizabethtown, Pa.	WHRY	1600
Elk City, Okla.	KBEK	1240
Elkhart, Ind.	WTRC	1340
	WCMR	1270
Elkins, N.C.	WIFM	1540
Elkins, W.Va.	WDNE	1240
Elko, Nev.	KELK	1240
Elkton, Md.	WSEB	1550
Ellensburg, Wash.	KXLE	1240
Ellenville, N.Y.	WELV	1370
Ellsworth, Me.	WDEA	1370
Elmira, N.Y.	WELM	1410
	WENY	1230
Elmira Heights-Horseheads, N.Y.		
	WEHH	1590
El Paso, Tex.	KROD	600
	KELP	920
	KHEY	690
	KINT	1590
	KUIZ	1150
	KSET	1340
	KTSM	1390
El Reno, Okla.	KELR	1460
Ely, Minn.	WELY	1450
Ely, Nev.	KELY	1230
Elyria, Ohio	WEOL	930
Emmenete, Ky.	WSTL	1090
Emporia, Kans.	KVOE	1400
Emporia, Va.	WEVA	860
Emporium, Pa.	WLEM	1250
Endicott, N.Y.	WENE	1430
Englewood, Colo.	KGMC	1150
Englewood, Fla.	WENG	1580
Englewood, Tenn.	WERN	1090
Enid, Okla.	KCRC	1390
	KGWA	960
Enterprise, Ala.	WIRB	600
Enterprise, Oreg.	KWVR	1340
Ephrata, Pa.	WGSA	1310
Ephrata, Wash.	KULF	730
Erie, Pa.	WWYN	1260
	WJBT	1400
	WJET	1400
	WWGO	1450
Erwin, Tenn.	WEMB	1420
Escanaba, Mich.	WDDB	680
	WLST	600
Eseccido, Calif.	KOWA	1450
Espanola, N. M.	KDCE	970
Etowah, Tenn.	WCPC	1270
Eufaula, Ala.	WULA	1240
Eugene, Oreg.	KORE	1450
	KPIR	1500
	KASH	1600
	KATR	1320
	KERC	1280
	KUGN	990
	KWFS	1540
Eunice, La.	KEUN	1490
Eureka, Calif.	KINS	980
	KDAN	790
Eustis, Fla.	WLCO	1240
Evanston, Ill.	WELW	1330
	WNMP	1590
Evanston, Wyo.	KEVA	1240
Evansville, Ind.	WROZ	1400
	WGFB	1280
	WIKY	820
	WJPS	1330
Evleth, Minn.	WEVE	1430
Everett, Pa.	WDDS	1050
Everett, Wash.	KRKO	1380
	KWYZ	1230
Evergreen, Ala.	WBLO	1470
Exeter, N.H.	WKXR	1540
Fairbanks, Alaska	KFRB	660
Fairbault, Minn.	KDRB	920
Fairbury, Nebr.	KGMT	1310
Fairfax, Va.	WEEL	1310
Fairfield, Ill.	WELN	1300
Fairfield, Iowa	KMCD	1570
Fairfield, O.	WCNW	1560
Fairhope, Ala.	WABF	1220
Fairmont, Minn.	KSUM	1370

Location	C.L.	kHz	Location	C.L.	kHz	Location	C.L.	kHz	Location	C.L.	kHz
Fairmont, N.C.	WFMO	860	Fortuna, Cal.	KXOL	1360	Glenville, Ga.	WWSC	1450	Grundy, Va.	WNRG	940
Fairmont, W.Va.	WMNM	920	Foston, Minn.	KIXF	1280	Glenwood Sprs., Colo.	WKIG	1580	Guayama, P.R.	WXRJ	1590
Fairway, Kan.	WTCS	1490	Fostoria, Ohio	KEHG	1480	Globe, Ariz.	KGLN	980	Gulfport, Miss.	WROA	1390
Fallurrias, Tex.	WDDI	1480	Fountain Inn, S.C.	WFIS	1600	Gloverville, N.Y.	WENT	1340	Guntersville, Ala.	KGUC	1490
Fall River, Mass.	WSAR	1480	Fowler, Calif.	KLIP	1220	Golden Beach, Oreg.	KBLV	1220	Guthrie, Okla.	KWRW	1490
	KVLR	980	Framingham, Mass.	WKOK	1190	Golden, Colo.	KICM	1250	Guyon, Okla.	KGYN	1220
Falls Church, Va.	WFAJ	1220	Frankfort, Ind.	WIL0	1570	Golden Meadow, La.	KLEB	1600	Hagerstown, Md.	WARK	1490
Falls City, Nebr.	KTNC	1230	Frankfort, Ky.	WFKY	1490	Golden Valley, Minn.	KQRS	1440	Haines City, Fla.	WHAN	930
Fargo, N.Dak.	WDAY	970	Franklin, Ky.	WFKN	1220		KUXL	1570	Halesville, Ala.	WJBB	1230
	KFND	790	Franklin, La.	KFRA	1390		WFCM	730	Halfway, Md.	WUAT	1270
	KFNW	900	Franklin, N.C.	WFSC	1050		WGBR	1100	Hamden, Conn.	WDEE	1220
	KQWB	1550	Franklin, N.H.	WFTN	1240		WGOL	1300	Hamilton, Ala.	WERH	970
Farlbaull, Minn.	KDHL	920	Franklin, Pa.	WFR4	1450		WGSR	1350	Hamilton, Mont.	KYLO	980
Farmersville, La.	KTDL	1470	Franklin, Tenn.	WAGG	950		WGUL	1300	Hamilton, Ohio	WMOH	1450
Farmington, Mo.	WKTI	1380	Franklin, Va.	WYSR	1250	Gonzales, Tex.	KSWI	1330	Hamilton, Tex.	KCLW	900
Farmington, Mo.	KENN	1390	Franklin, La.	WFCG	1110	Goodland, Kans.	KLOE	730	Hamlet, N.C.	WBDX	1250
Farmington, N.M.	KWYK	960	Frederick, Md.	WFMM	930	Goshen, Ind.	WKAM	1460	Hammond, Ind.	WJDB	1230
	KRZE	1280	Frederick, Okla.	KTAT	1570	Gouverneur, N.Y.	WIGS	1230	Hammond, Tenn.	WJBT	1400
Farmville, N.C.	WFAG	1250	Fredericksburg, Tex.	KNAF	910	Grafton, N.D.	KGPC	1340	Hammonett, N.J.	WNJH	1580
Farmville, Va.	WFLO	870	Fredericksburg, Va.	WFVA	1230	Grafton, W.Va.	WVWV	1260	Hampton, S.C.	WBHC	1270
Farrell, Pa.	WFAK	1470	Fredericktown, Mo.	WFLA	1350	Graham, Tex.	KSWI	1330	Hampton, Va.	WVEC	1490
Farwell, Tex.	KZOL	1570		KFTW	1450	Grand Coulee, Wash.	KFDR	1360	Hancock, Mich.	WMPL	920
Fayette, Ala.	WWVW	980	Frederonia, N.Y.	WBUZ	1570	Grand Forks, N.D.	KFMJ	1370	Hanford, Calif.	KNGS	820
Fayetteville, Ark.	KHOG	1440	Freeport, Ill.	WFRJ	1570		KILD	1440	Hannibal, Mo.	KHMO	1070
	KFAV	1250	Freeport, N.Y.	WGBB	1240		KNOX	1310	Hanover, N.H.	WDCR	1340
Fayetteville, N.C.	WFAI	1230	Freeport, Tex.	KBRZ	1460	Grand Haven, Mich.	WGHN	1370	Hanover, Pa.	WHVR	1280
	WFNC	940	Freemont, Mich.	WBFC	1490	Grand Island, Nebr.	KMMJ	750	Hardin, Mont.	KHDN	1230
	WFLB	1490	Freemont, Ohio	WSHN	1550		KRGJ	1430	Harlan, Ky.	WHLN	1410
	WIDU	1600	Freemont, Nebr.	KHUB	1340	Grand Junction, Colo.	KREX	920	Harlingen, Tex.	KGST	1530
Fergus Falls, Minn.	WEKR	1240	Fremont, Ohio	WFR0	900		KEXD	1230	Harrison, Tenn.	WBTZ	1600
	KOTE	1250	Fresno, Calif.	KARM	1430		KSTR	820	Harrisburg, Ill.	WEBQ	1240
Fernandino Beach, Fla.	WFBF	1570		KBIF	900		KWSL	1340	Harrisburg, Pa.	WFEC	1400
Ferriday, La.	KFNV	1600		KIRV	1510	Grand Prairie, Tex.	KPCW	730		WCMB	1460
Festus, Mo.	KJCF	1400		KEAP	980					WHP	580
Festus-St. Louis, Mo.	KXEN	1010		KXEX	1550	Grand Rapids, Mich.	WJEF	1230	Harrison, Ark.	WKBD	1230
	WFID	1330		KFRE	940		WFUR	1570	Harrisonburg, Va.	WHBG	1360
Fisher, W.Va.	WELN	1280		KMAK	1340		WGRD	1410		WSVA	550
Fitchburg, Mass.	WFGM	960		KMJ	580		WLAV	1340	Harrodsburg, Ky.	WHBN	1420
Fitzgerald, Ga.	WBBH	1240		KYNO	1800		WMAX	1480	Hartford, Conn.	WDRG	1360
Flagstaff, Ariz.	KCLS	600	Frlona, Tex.	KNNN	1070		WOOD	1300		WCCC	1290
	KAFF	930	Front Royal, Va.	WETR	1450	Grand Rapids, Minn.	KOZY	1490		WPDP	1410
	KIKJ	1400	Frostburg, Md.	WFRB	560	Grangeville, Idaho	KORT	1230	Hartford, Wis.	WTKM	1540
	KEOS	690	Fulton, Ky.	WFUL	1270	Granite City, Ill.	WGNU	920	Hartselle, Ala.	WHRT	860
	KDOL	1250	Fulton, Mo.	KFAL	900	Granite Falls, N.C.	WGNO	1410	Hartsville, S.C.	WHSC	1450
Flat River, Mo.	WDFD	910	Fulton, N.Y.	WOSC	1300		WKJK	1580	Hartsville, Tenn.	WJKM	1090
Flint, Mich.	WTRX	1330	Fuquay Sprs., N.C.	WVFG	1460		WAGI	980	Hartwell, Ga.	WKLY	980
	WAMM	1420		WGAD	1350	Grants, N.Mex.	KJNO	1270	Harvard, Ill.	WHCO	1600
	WMRP	1570	Gadsden, Ala.	WETO	930	Grants Pass, Oreg.	KAGI	930	Harvey, Ill.	WBEE	1570
	WKMF	1470		WEAC	1500	Grayson, Ky.	WGOH	1370	Hastings, Mich.	WBCH	1220
	WFAA	600	Gaffney, S.C.	WDFN	1570	Gt. Barrington, Mass.	WSBS	860	Hastings, Minn.	KDWA	1460
Flomaton, Ala.	WTCB	900	Gainesville, Fla.	WGVH	980		KVGB	1590	Hastings, Nebr.	KHAS	1230
Florence, Ala.	WJOI	1340		WGGG	1230	Gt. Bend, Kans.	KUDL	1410		KICS	1550
Florence, S.C.	WJMX	970		WRUF	850	Gt. Falls, Mont.	KMOH	560	Hattiesburg, Miss.	WBKH	950
	WOLS	1230		WUWU	1390		KARR	1400		WFOR	1400
Floydada, Tex.	WYNN	540	Gainesville, Ga.	WGG4	550		KFK4	1430	Havelock, N.C.	WUSM	1330
Foley, Ala.	WHPE	1310		WDBN	1240		KYQU	1450	Haverhill, Mass.	WHAV	1490
Fond du Lac, Wis.	KFIZ	1450	Gainesville, Tex.	WGAF	1580		WBPJ	1360	Havre, Mont.	KOJM	610
Fordyce, Ark.	KBJT	1570	Galatonsburg, Md.	WHMC	1150	Green Bay, Wis.	WDPG	1400	Havre de Grace, Md.	WASA	1330
Forest, Miss.	WMAG	860	Galax, Va.	WBOB	1360		WPUZ	1400		WCEH	610
Forest City, N.C.	WBBO	780	Galesburg, Ill.	WGIL	1400	Greenville, Tenn.	WGRV	1340	Hawkinsville, La.	KLVU	1580
	KWYI	1570	Gallatin, Tenn.	WAIK	1590		WMSG	1450	Hays, Kans.	KAYS	1400
Forest Grove, Oreg.	KXJK	950	Gallipolis, Ohio	WAGI	1010	Greenville, Mass.	WHA1	1240	Hayward, Wis.	WHSM	910
Forest City, Ark.	WFAW	940	Gallup, N. Mex.	WKAG	1330	Greenfield, Mass.	WBG1	1470	Hazard, Ky.	WHIC	1390
Ft. Bragg, Calif.	KDAC	1230	Galt, N.Y.	KYVA	1230	Greensboro, N.C.	WABG	1300	Hazlehurst, Ga.	WAGH	920
Ft. Campbell, Ky.	WABD	1370	Galveston, Tex.	KILE	1400		WEAL	1510	Hazlehurst, Miss.	WMDG	1220
Ft. Collins, Colo.	KCOL	1410		KGCB	1540		WKTB	1550	Hazleten, Pa.	WAZL	1490
	KZIX	600	Gander, Nfld.	WGNW	1270		WGBG	1400	Heber Springs, Ark.	KAWW	1370
Ft. Dodge, Iowa	KVFD	1400	Garden City, Kan.	KUIL	1240		WPET	950		KFFA	1360
	KWMT	540		KUPK	1050	Greensburg, Ind.	WTRE	1330	Helena, Mont.	KBLI	1240
Ft. Knox, Ky.	WSAC	1470	Garden City, Mich.	WTAK	1090	Greensburg, Pa.	WHJB	620	Hemet, Calif.	KHSJ	1320
Ft. Lauderdale, Fla.	WFTL	1400		WGAW	1340	Greenville, Ala.	WGVV	1380	Hempstead, N.Y.	WHLI	1100
	WVIL	1580	Gardner, Mass.	WGWC	1270	Greenville, Ky.	WKYF	1600	Henderson, Ky.	WSON	860
Ft. Madison, Iowa	KGI	1360	Gary, Ind.	WLTH	1370	Greenville, Mich.	WPLB	1380	Henderson, Nev.	KBNM	1400
Ft. Morgan, Colo.	KFTM	1400	Gastonia, N.C.	WGNC	1450	Greenville, Miss.	WJPR	1330		KTD0	1280
Ft. Myers, Fla.	WINK	1240		WLTC	1370		WDDT	900	Henderson, N.C.	WZIS	1450
	WMYR	1410	Gate City, Va.	WGAT	1050	Greenville, Pa.	WGRP	940	Henderson, Tex.	KGRI	1000
	WCAI	1350	Gaylord, Mich.	WATC	900	Greenville, N.C.	WQOY	1350		KWRD	1470
Ft. Payne, Ala.	WZOB	1250	Geneseo, Ill.	WGEN	1500		WESC	690	Hendersonville, N.C.	WKHP	1450
Ft. Pierce, Fla.	WARN	1330	Geneva, Ala.	WGEA	1150		WFCB	1330		WHVL	1600
	WIRA	1400	Geneva, Ill.	WGSB	1480		WNRB	1490	Henryetta, Okla.	KHEN	1390
Ft. Scott, Kans.	KMDO	1600	Geneva, N.Y.	WGV4	1240		WNIU	1260	Hereford, Tex.	KPAN	860
Ft. Smith, Ark.	KFPW	1230	Georgetown, Del.	WJWL	900		WQOK	1440	Herkimer, N.Y.	WALY	1420
	KFSA	950	Georgetown, Ky.	WAXU	1580	Greenville, Tex.	KGLV	1400	Hermiston, Oreg.	KOHU	1570
	KCOL	1410	Georgetown, S.C.	WGTH	1400	Greenwich, Conn.	WGCH	1490	Herndon, Va.	WHRN	1440
	KWHN	1320		WG00	1470	Greenwood, Miss.	WABG	950	Herrin, Ill.	WJPF	1340
Ft. Stockton, Tex.	KFST	860	Georgetown, Tex.	KGTN	1530		WGRN	1240	Hettinger, N.Dak.	KNDC	1490
Ft. Valley, Ga.	WFFM	1150	Gettysburg, Pa.	WGTE	1320		WLEF	1540	Hibbing, Minn.	WNFG	1240
Ft. Walton Beach, Fla.	WNUE	1400		KIML	1270		WCBS	1450	Hickory, N.C.	WHKY	1290
	WFTW	1260	Gillette, Wyo.	KPER	1290	Greenwood, S.C.	WEAB	800		WIRC	680
	WGL	1250	Gilroy, Calif.	KEES	1430		WCKI	1300	Highland, Ill.	WSPF	1000
Ft. Wayne, Ind.	WOWO	1100	Gladewater, Tex.	WKAY	1490		WNAK	1400	Highland Park, Ill.	WIFU	1510
	WLYV	1450	Glasgow, Ky.	WCD5	1440	Greer, S.C.	KRDR	1230		WEEF	1430
	WKJG	1380	Glasgow, Mont.	KLIZ	1240	Gresham, Miss.	WNAK	1400	Highland Park, Tex.	KVIL	1150
	KJIM	870	Glen Burnie, Md.	KRUX	1360	Gresham, Oreg.	WKEU	1450	Highland Springs, Va.	WENZ	1450
Ft. Worth, Tex.	KCLU	1540	Glendale, Ariz.	KIEV	870		WHIE	1320		WFRJ	1230
	KFIZ	1270	Glendale, Calif.	KXGN	1400		KGRN	1410	High Point, N.C.	WNOS	1590
	KNOK	970	Glendive, Mont.	KGLE	590	Grinnell, Iowa	WSUB	980		WHPE	1070
	WBAP	570	Glennallen, Alaska	KCAM	790	Groton, Conn.	WSAJ	1340	Hillsboro, Ohio	WSRW	1590
	WBAP	820	Glens Falls, N.Y.	WBZA	1410	Grove City, Pa.					

WHITE'S RADIO LOG

Location C.L. kHz

Hillsboro, Oreg.	KUIK 1360
Hillsboro, Tex.	KHBR 1560
Hillsdale, Mich.	WCSR 1340
Hillsville, Va.	WHWV 1400
Hilo, Hawaii	KPUA 970
	KIPA 1110
Hinesville, Ga.	KIMO 850
Hinton, W. Va.	KGML 990
Hobbs, N.Mex.	WMTD 1480
	KWEO 1380
Holbrook, Ariz.	KHOB 1390
Holmden, Okla.	KDJJ 1270
Holmdredge, Nebr.	KVYL 1370
Holland, Mich.	KUVR 1580
	WHTS 1450
Hollister, Cal.	WJBL 1260
Hollywood, Fla.	KMPG 1520
Holly Hill, S.C.	WGMA 1320
Holly Springs, Miss.	WHHL 1440
	KBRA 1110
Holyoke, Mass.	KREB 930
Homer, La.	KHAL 1320
Homestead, Fla.	WHII 1430
Homewood, Ala.	WILD 1400
Honolulu, Hawaii	KAIM 870
	KCCN 1429
	KGMB 590
	KZOD 1210
	KHAI 1090
	KPOI 1380
	KIKI 830
	KGU 760
	KHYV 1040
	KNDI 1270
	KOHO 1170
	KORL 650
	KTRG 890
	KULA 690
Hood River, Oreg.	KIHR 1340
Hope, Ark.	KXAR 1490
Hopewell, Va.	KHOP 1340
Hopkinsville, Ky.	WHOP 1230
	WKOA 1480
Hogalum, Wash.	KGOH 1560
Hornell, N.Y.	WWHG 1320
	WLEA 1480
Hot Springs, Ark.	KBHS 590
	KHWP 1420
	KZNG 1470
Hot Springs, S.Dak.	KOBH 580
Houghton, Mich.	WHDF 1400
Houghton Lake, Mich.	WHGR 1290
	WHOR 1340
Houlton, Maine	KHOU 1340
Houma, La.	KCHL 1490
Houston, Miss.	WCPC 940
Houston, Mo.	KBTC 1250
Houston, Tex.	KCOH 1430
	KENR 1070
	KILT 610
	KLUZ 1230
	KODA 1010
	KPRC 950
	KTHT 790
	KTRH 740
	KXYZ 1320
	KXOK 1590
Howell, Mich.	WHMI 1350
Hudson, N.Y.	WHUC 1230
Hugo, Okla.	KIHN 1340
Humacao, P.R.	WALO 1240
Humboldt, Tenn.	WIRJ 740
Huntingdon, Pa.	WHUN 1150
Huntington, Ind.	WHLT 1300
Huntington, N.Y.	WGSW 1490
Huntington, W.Va.	
	WKEE 800
	WSAZ 930
	WWHY 1470
Huntsville, Ala.	WBHP 1230
	WEUP 1600
	WFKI 1450
	WAAY 1550
Huntsville, Tex.	KSAM 1490
Huron, S.Dak.	KIJV 1340
Hutchinson, Kans.	KWBW 1450
	KWHK 1260
Hutchinson, Minn.	KDUZ 1260
Hyde Park, N.Y.	WWVW 950
Idabel, Okla.	KBEL 1240
Idaho Falls, Idaho	KID 590
	KTEE 1260
Immokalee, Fla.	WCOF 1490
Independence, Ia.	KUPI 980
	KOUR 1220
Independence, Kans.	
	KIND 1010
Independence, Mo.	KCCX 1510

Indiana, Pa.	WDAW 1450
Indianapolis, Ind.	WATI 810
	WBRI 1500
	WFBM 1260
	WGEE 590
	WIBO 1070
	WIFE 1310
	WIRE 1430
	WXLW 950
Indianola, Iowa	KBAB 1490
Indianola, Miss.	WNLA 1380
Indian Rocks Beach, Fla.	
	WGNP 1520
Indio, Calif.	KREO 1400
Inglewood, Calif.	KTYM 1480
Inkster, Mich.	WCHB 1440
International Falls, Minn.	
	KGHS 1230
Inverness, Fla.	WYSE 1560
Iola, Kansas	KAIN 1870
Ionia, Mich.	WION 1430
Iowa City, Iowa	KXIC 800
	WSUI 910
Iowa Falls, Iowa	KFIG 1510
Iron Mtn., Mich.	WMIQ 1450
Ironton, Ohio	WLPH 1480
Ironton, Ohio	WIRO 1230
Ironwood, Mich.	WWS 1450
Irvine, Ky.	WIRV 1550
Isabella, P.R.	WISA 1390
Ishpeming, Mich.	WJPD 1240
	WCKD 970
Islip, N.Y.	WBIC 540
Itasca, N.Y.	WHCU 870
	WTKO 1470
Juka, Miss.	WVOM 1270
Jackson, Ala.	WHOD 1290
Jackson, Mich.	WIBM 1450
	WKHM 970
	WJCO 1510
	WJDX 620
	WJON 1400
	WJXN 1450
	WOKJ 1550
	WWUN 1590
	WRBC 1300
	WSLI 980
Jackson, Ohio	WJMI 1280
Jackson, Tenn.	WDXS 1310
	WJAK 1460
	WJIS 1390
Jackson, Wis.	WYLO 540
Jackson, Wyo.	KSQT 1340
Jacksonville, Ark.	KGMR 1500
Jacksonville, Fla.	WJAX 980
	WABE 690
	WBOM 970
	WZOK 1320
	WIVY 1050
	WMBR 1460
	WOBBS 1360
	WPDA 690
	WQK 1090
	WRHC 1400
Jacksonville, Ill.	WJIL 1550
	WLDS 1180
Jacksonville, Miss.	WJQS 1400
Jacksonville, N.C.	WJNC 1240
Jacksonville, Tex.	WLAS 910
Jacksonville Beh., Fla.	WBE 1400
	WBIX 1010
Jamestown, N.Dak.	KEYJ 1400
	KSJB 600
Jamestown, N.Y.	WJTN 1240
	WKSJ 1340
Jamestown, Tenn.	WCLE 1280
Janesville, Wis.	WCLO 1230
Jasper, Ala.	WWWB 1360
	WARF 1240
Jasper, Ind.	WITZ 990
Jasper, Tex.	KTJX 1350
Jefferson City, Mo.	KLK 950
	KWOS 1240
Jefferson City, Tenn.	
	WJFC 1480
Jeffersonville, Ind.	WXYW 1450
Jena, La.	KCKW 1480
Jennings, La.	KJEF 1290
Jerome, Idaho	KART 1400
Jessville, Ill.	WJBM 1480
Jesup, Ga.	WLOP 1370
John Day, Ore.	KJDY 1400
Johnson City, Tenn.	
	WJCW 910
	WETB 790
Johnston, S.C.	WJES 1370
Johnstown, N.Y.	KZRT 930
Johnstown, Pa.	WJAC 850
	WARD 1490
	WCRO 1230
Joliet, Ill.	WJOL 1340
	WJRC 1510
Joliet, Que.	CJLM 1350
Jonesboro, Ark.	KBTM 1230
	KNEA 970
Jonesboro, La.	KTCO 920
Jonesboro, Tenn.	WJSO 1590
Jonesville, La.	KANV 1480
Joplin, Mo.	WMBH 1450
	KQYX 1560
	KFSB 1310

Location	C.L. kHz
Junction, Tex.	KODE 1290
June, City, Kans.	KMBL 1450
Juneau, Alaska	KJCK 1420
	WGE 630
Kailua, Hawaii	KLEI 1130
Kalamazoo, Mich.	WKPR 1420
	WKZO 590
	WKLZ 1470
	WKMI 1360
Kalispol, Mont.	KGEZ 930
	KPR 1350
	WKZA 960
Kane, Pa.	WKAN 1320
Kankakee, Ill.	WGTL 870
Kannapolis, N.C.	WRKB 1460
Kans. City, Kans.	KCKN 1340
Kansas City, Mo.	KCMO 810
	KWBG 980
	PRR 1590
	WDAF 610
	WHB 710
Kaukauna, Wis.	WKAU 1050
Kenedy-Karnes City, Texas	
	KAML 990
Kealahakua, Hawaii	KONA 790
	KGFW 1430
Kearney, Nebr.	KRNY 1490
Keene, N.H.	WKNE 1260
	WRKB 1220
Keilo, Wash.	KLOG 1490
Kemmerer, Wyo.	KMER 950
Kendallville, Ind.	WKTE 1140
Kendy, Tex.	KAML 990
Kennett, Mo.	KBOA 830
	KBXN 1540
Kennebec, Wash.	KSMK 1340
Kennebec-Pasco-Richland, Wash.	KEPR 610
Kenosha, Wis.	WKNT 1050
Kent, O.	WKNT 1520
Keokuk, Iowa	KOKX 1310
Kermit, Tex.	KERR 600
Kerrville, Tex.	KERV 1230
Kershaw, S.C.	WKSC 1350
Ketchikan, Alaska	KTKN 930
Kewanee, Ill.	WKLE 1490
Keyer, W.Va.	WKLP 1390
Key West, Fla.	WKWF 1600
	WKIZ 1500
Kilgore, Tex.	KOCA 1240
Killeen, Tex.	KLEN 1050
Kimball, Nebr.	KIMB 1260
King, N.C.	WKTE 1090
King City, Calif.	KRKC 1490
Kingman, Ariz.	KAAA 1230
Kings Mountain, N.C.	
	WKMT 1220
Kingsport, Tenn.	WKIN 1320
	WKRT 1550
Kingston, N.Y.	WBZE 1550
	WGHO 920
	WKNY 1490
Kingstree, S.C.	WKDK 1310
Kingsville, Tex.	KINE 1330
Kinston, N.C.	WELS 1010
	WFTC 960
Kirkland, Wash.	WISP 1230
	KYAC 1460
	KBLE 1050
Kirksville, Mo.	KIRX 1450
Kissimmee, Fla.	WFIV 1080
	WJPB 1220
Kittanning, Pa.	WACB 1380
Klamath Falls, Oreg.	KAGO 1150
	KFLW 1450
	KLAD 960
Knoxville, Iowa	KNIA 1320
Knoxville, Tenn.	WBIR 1240
	WIVK 850
	WATE 620
	WKXV 900
	WNOX 990
	WROL 1490
	WIOU 1350
Kokomo, Ind.	WKOD 1350
Kosciusko, Miss.	WLNH 1350
Laconia, N.H.	WELM 1450
	WKBH 1410
LaCrosse, Wis.	WLXC 1490
	WKTY 580
	WLDY 1340
Ladysmith, Wis.	WLFA 1590
Lafayette, Ga.	WASK 1450
Lafayette, Ind.	WAZY 1410
	WBAA 920
Lafayette, La.	KPEL 1420
	KVOL 1330
	KKKW 1520
Lafayette, Tenn.	WEEN 1460
LaFollette, Tenn.	WLAF 1450
LaGrande, Oreg.	KLBM 1450
LaGrange, Ga.	WLAG 1420
	WTRP 620
LaGrange, Ill.	WTAQ 1300
LaGrange, Tex.	KVLG 1570
LaJunta, Colo.	KBZZ 1400
Lake Charles, La.	KLOU 1590
	KPLC 1470
	KAKO 1400
Lake City, Fla.	WDSR 1340

Location	C.L. kHz
	WGRO 960
Lake City, S.C.	WJOT 1260
Lake Geneva, Wis.	WMIR 1550
Lakeland, Fla.	WKAK 1480
	WONN 1230
	WWAB 1330
Lake Placid, N.Y.	WIRD 920
Lakeport, Cal.	KBLC 1270
Lake Providence, La.	KLPL 1050
Lake Tahoe, Calif.	KOWL 1490
Lakeview, Oreg.	KWAK 1480
Lake Wales, Fla.	WIPC 1280
Lakewood, Colo.	KLAK 1600
Lakewood Center, Wash.	
	KFHA 1480
Lake Worth, Fla.	WLIZ 1380
Lamar, Colo.	KLMR 920
Lamesa, Tex.	KPET 690
Lampasas, Tex.	KCVL 1450
Lancaster, Calif.	KAVL 1510
	KBYM 1390
Lancaster, Ky.	WIXI 1280
Lancaster, N.Y.	WMNJ 1300
Lancaster, Ohio	WHOK 1320
Lancaster, Pa.	WGAL 1490
	WLAN 1390
Lancaster, S.C.	WLCM 1360
	WZBO 1260
Lander, Wyo.	KOVE 1830
Landett, Ala.-W. Point, Ga.	
	WRLD 1490
Lansdale, Pa.	WNPV 1440
Lansford, Pa.	WLSH 1410
Lansing, Mich.	WILS 1320
	WJIM 1240
	WV 1010
LaPeer, Mich.	WMPC 1230
	WTHM 1530
LaPlata, Md.	WSMD 1560
LaPorte, Ind.	WLOI 1540
Laramie, Wyo.	KLME 1490
	KGNB 1300
Laredo, Tex.	KVOZ 1490
	KANS 1510
Larned, Kans.	WLPO 1220
LaSalle, Ill.	KOBE 1450
Las Cruces, N.Mex.	KGR 570
Las Vegas, Nev.	KENO 1460
	KWKV 1570
	KORK 1340
	KRAM 920
	KLUC 1050
	KVEG 970
Las Vegas, N.Mex.	KFUN 1280
Latrobe, Pa.	KWV 1570
	WQTV 1480
	WTRA 1480
Laurel, Md.	WLMD 900
Laurel, Miss.	WAML 1340
	WLAW 1600
	WNSL 1260
Laurens, S.C.	WLBG 860
Laurinburg, N.C.	WV 1080
	WNC 1300
Lawrence, Kans.	KFKU 1250
	KLWN 1320
Lawrence, Mass.	WCCM 800
Lawrenceburg, Tenn.	
	WDXE 1370
Lawrenceville, Ga.	WLAX 1360
Lawrenceville, Ill.	WLAK 1490
Lawrenceville, Va.	WLES 560
Lawton, Okla.	KSWO 1380
	KCCO 1050
Leadville, Colo.	KBBR 1230
Leaksville, N.C.	WLOE 1490
Leavenworth, Kans.	KCLO 1410
Lebanon, Ky.	WLBK 1590
Lebanon, Mo.	KLWT 1230
Lebanon, Oreg.	KGAL 920
Lebanon, Pa.	WLBK 1270
Lebanon, Tenn.	WCOB 900
Leesburg, Fla.	WLBK 790
	WZST 1410
Leesburg, Va.	WAGE 1290
Leesville, La.	KLA 1490
Lehighton, Pa.	WYNS 1150
Leitchfield, Ky.	WMTL 1580
Leland, Miss.	WESY 1500
LeMars, Iowa	KLEM 1410
Lemmon, S.D.	KBJM 1400
Lemoore, Calif.	KLAN 1320
	KOAD 1240
Lenoir, N.C.	WJRI 1340
Lenoir, Tenn.	WLIL 730
Lenoir City, Tenn.	WBLG 1360
Leonardtown, Md.	WKIK 1370
Levelland, Tex.	KLVT 1230
Levittown, Pa.	WBCB 1490
Lewisburg, Pa.	WUNS 1010
Lewisburg, Tenn.	WJIN 1490
Lewiston, Idaho	KRLC 1350
	KOZE 1300
Lewiston, Maine	WCOU 1240
	WLAM 1470
Lewistown, Mont.	KXLO 1230
Lewistown, Pa.	KVVA 920
	WJIN 1490
Lexington, Ky.	WLAP 630
	WBLG 1300
	WVLK 590

Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz
Lexington, Miss.	WXTN 1000		WDMS 1320		WPRA 990		WOKY 920
Lexington, Mo.	KLEX 1570		WWOD 1390		WTLI 1300		WTMJ 820
Lexington, Nebr.	KRVN 1010	Lynn, Mass.	WBRG 1050	Mayfield, Ky.	WNGO 1320	Minden, La.	KASO 1240
Lexington, N.C.	WBUT 1440	Lyons, Ga.	WLYN 1360	Mayodan, N.C.	WMYN 1420	Mincola, N.Y.	WTHE 1520
Lexington, Tenn.	WDXL 1490	Macomb, Ill.	WBST 1340	Mayville, N.O.	KMAV 1520	Minneapolis, Minn.	KMOO 1510
Lexington, Va.	WREL 1450	Macomb, Ga.	WKAI 1510	Maysville, Ky.	WTFM 1400	Mineral Wells, Tex.	KORC 1140
Lexington Pk., Md.	WPTX 920		WBML 1240	McAlester, Okla.	KFTC 1240		KORC 830
Libby, Mont.	KLCB 1230		WCRT 900		KFLS 1150		KSTP 1500
Liberal, Kans.	KSCB 1270		WIBB 1280	McAllen, Tex.	KRDC 910		KLCL 1330
	KLIB 1470		WMAZ 940	McCall, Ida.	KMCL 1240		WDTG 1130
Liberty, Ky.	WPHN 1560		WNEX 1400	McCamey, Tex.	KAMY 1450		WWTC 1280
Liberty, N.Y.	WYOS 1240		WMBC 1400	McComb, Miss.	WHNY 1250		KTCR 690
Lima, Hawaii	KTOH 1490	Macon, Miss.	KLTI 1560		WAPF 980		KTIS 900
Lima, Ohio	WIMA 1150	Macon, Mo.	WSJR 1230		KBC 1300		KUOM 770
	WCIT 940	Madawaska, Me.	KHST 1250		KICX 1360		KUPT 1340
Lincoln, Ill.	WPRC 1370	Madera, Calif.	KMAD 1550	McGehee, Ark.	KWOC 910	Minot, N. Dak.	KMP 1390
Lincoln, Mo.	WLKN 1450	Madill, Okla.	WMAF 1280	McKeesport, Pa.	WEDO 810		KHRT 1320
Lincoln, Nebr.	KFOR 1240	Madison, Ga.	WYTH 1250		WMCK 1360		KCJB 910
	KLIN 1400	Madison, Ind.	WORX 1270	McKenzie, Tenn.	WHDM 1440	Mission, Kans.	KBEA 1480
	KLMS 1450	Madison, S.D.	KJAM 1390	McKinney, Tex.	KYAL 1600	Missouri, Tex.	KIRT 1580
	KLOL 1530	Madison, Tenn.	WENO 1430	McMinnville, Oreg.	KMCM 1260	Missoula, Mont.	KGVO 1290
Lincolnton, N.C.	WLON 1050	Madison, Wis.	WHA 750	McMinnville, Tenn.	WBMC 960		KLL 1450
Linton, Ind.	WBTO 1600		WIBA 1510		WKAK 1540		KLNL 1340
Litchfield, Ill.	WSMI 1450		WISM 1480	McPherson, Kans.	KNNK 1540		KYSS 910
Litchfield, Minn.	KLFD 1410		WKOW 1070	McRae, Ga.	WDAX 1410	Mitchell, S. Dak.	KORN 1490
Little Falls, Minn.	KLTF 960		WMAD 1550	Meadvale, Pa.	WMGW 1490	Moab, Utah	KURA 1450
Little Falls, N.Y.	WLFB 1230		WFMW 730	Medford, Mass.	WHIL 1430	Moberly, Mo.	KNCN 1230
Litchfield, Tex.	KZZN 1490		WTTT 1310	Medford, Oreg.	KMED 1440	Mobile, Ala.	WUNI 1410
Little Rock, Ark.	KARK 920	Magee, Miss.	WSJC 810		KSHA 860		WABB 1480
	KALO 1250	Magnolia, Ark.	KVMA 630		KTOY 1300		WGDF 900
	KLRA 1010	Makawao, Hawaii	KNUJ 1310		KBOY 730		WNOD 550
	KOKY 1440	Malden, Mo.	KTCB 1470		KYJC 1230		WTFU 840
	KAAY 1090	Malone, N.Y.	KTCB 1470	Medford, Wis.	WIGH 1490		WKRK 710
	KVLC 1050	Malvern, Ark.	KBOK 1310	Media, Pa.	WXUR 690		WLOJ 1360
Littleton, Colo.	KOKO 1510	Manassas, Va.	WPRW 1465	Memphis, Fla.	WMMB 1240		WMQZ 960
Littleton, N. H.	WLTN 1400	Manati, P.R.	WMNT 1550		WHBQ 560		KOLY 1300
Live Oak, Fla.	WNER 1250	Manchester, Conn.	WINF 1230		KBGH 1380	Mocksville, N.C.	KWLS 1450
Livingston, Mont.	KPRK 1340	Manchester, Ga.	WFDR 1370		WHEN 1430	Modesto, Calif.	KTRB 860
Livingston, Tenn.	WLIV 920	Manchester, Ky.	WWXL 1450		WNC 790		KBBE 970
Livingston, Tex.	KETX 1440	Manchester, N.H.	WFEA 1370		WOIA 1070		KFIV 1360
	KVLL 1220		WGR 610		WMPS 680	Mojave, Calif.	KDOL 1340
	WBPF 1230		WKBR 1250		WLOK 1340	Moline, Ill.	WQUA 1230
Look Haven, Pa.	WUSJ 1340	Manchester, Tenn.	WMRS 1320		WMGM 1480	Monahans, Tex.	KVKM 1330
Lodi, Calif.	KCVR 1570	Manhattan, Kans.	KSAC 580		WREC 600	Moncks Corner, S. C.	WBER 950
Logan, Utah	KVNU 610		KMAN 1350		KWAM 990	Monett, Mo.	KRMO 980
	KSTU 1300	Manistee, Mich.	WMTE 1340	Mena, Ark.	KWAM 990	Monetta, Ark.	KBIB 1560
	KLGN 1390	Manistiquie, Mich.	WTFQ 1490	Mendota, Ill.	WGIC 1090	Monmouth, Ill.	WRAM 1330
Logan, W. Va.	WLOG 1230	Manitou Springs, Colo.	KCMS 1490	Menominee, Mich.	WAGN 1340	Monroe, Ga.	WMRE 1490
Logansport, Ind.	WSAL 1230		WCUB 980	Menomonee, Wis.	WMNE 1360	Monroe, La.	KMLB 1440
Lompoc, Calif.	KKOK 1410	Manitowoc, Wis.	WMOT 1240	Merced, Calif.	KYOS 1480		KLIC 1230
	KLOM 1330	Mankato, Minn.	KYSM 1230		KWIP 1580		KQIE 540
	KNEZ 960		KTOE 1420	Meriden, Conn.	WMWV 1470	Monroe, Mich.	WQAE 560
London, Ky.	WFTG 1400	Manning, S.C.	WYMB 1410		WMX 1470	Monroe, N.C.	WMAP 1060
Long Beach, Calif.	KFOX 1280	Marathon, La.	KDOL 1450		WDM 1330	Monroe, Wis.	WEKZ 1260
	KGER 1390	Marshfield, Ohio	WMAN 1400		WOKK 1010	Monroeville, Ala.	WMFC 1360
Longmont, Colo.	KLM 1060		WCLW 1410		WQIC 1390	Monterey, Calif.	KIDD 630
Lone Prairie, Minn.	KEYL 1400	Maplewood, Minn.	WRCR 1010		KWFA 1500		KMBY 1240
Longview, Tex.	KFRD 1370	Maquoketa, Iowa	KMAQ 1320	Merkle, Tex.	KWFA 1500	Montevideo, Minn.	KDML 1460
	KLUE 1280	Marathon, Fla.	WFFG 1300	Merrill, Wis.	WMX 1470	Monte Vista, Colo.	KSLV 1240
	KEDO 1400	Marianna, Ark.	KZOT 1460	Mesa, Ariz.	KBUZ 1510		KMNZ 1050
Lookout Mtn., Tenn.	WFLI 1070	Marianna, Fla.	WTFY 1340		KALF 1510	Montgomery, Ala.	WBAM 740
Lorain, Ohio	WVLI 1380		WTOT 980	Metropolis, Ill.	WMOK 920		WAPX 1600
Loretto, Pa.	WWSF 1400	Marietta, Ga.	WFOM 1230	Mexia, Tex.	KBUS 1590		WCOW 1170
Loris, S.C.	WLSC 1570		WBIE 1080	Mexico, Mo.	KXEO 1340		WFMJ 1500
Los Alamitos, N. Mex.	KRSN 1490	Marietta, Ohio	WMOA 1490	Mexico, Pa.	WHJH 1220		WHRY 1440
Los Angeles, Calif.	KABC 790		WBRJ 910	Miami, Ariz.	KIKO 1340		WNGY 800
	KFI 640	Marine City, Mich.	WSMA 1590	Miami, Fla.	WGBS 710		WRNA 950
	KFWB 980		WSMA 1590		WJOD 610	Montgomery, W. Va.	WMON 1340
	KGFJ 1230	Marion, Ala.	WJAM 1310		WFB 990	Monticello, Ark.	KHBM 1430
	KFAC 1330	Marion, Ill.	WGGH 1150		WAME 1260	Monticello, Fla.	WSD 1360
	KLAC 570	Marion, Ind.	WBAT 1400		WOAH 1220	Monticello, Ky.	WFLW 1360
	KMPK 710		WBR 860		WQAM 560	Montpelier, Ida.	KYSI 1450
	KNX 1070	Marion, N.C.	WMRI 1250		WOCN 1450	Montpelier-Barre, Vt.	WSKI 1240
	KPOL 1450	Marion, Ohio	WMRN 1490		WINZ 940		KUBC 580
	KGBS 1020	Marion, S.C.	WATP 1430	Miami, Okla.	KGLC 910	Montrose, Colo.	KUBC 580
	KRKO 1150	Marion, Va.	WMEV 1010	Miami Beach, Fla.	WBMB 1490	Montrose, Pa.	WPEL 1230
Los Banos, Calif.	KLBS 1330		WOLD 133		WKAT 1360	Mooresville, N.C.	WHIR 1350
Louisburg, N.C.	WYRN 1480	Marked Tree, Ark.	KPCA 1580		WFUN 790	Morehead, Minn.	KVOX 1280
Louisville, Ga.	WPEH 1420	Marksville, La.	KAPB 1370		WIMS 1420	Morehead, Ky.	WMOR 1330
Louisville, Ky.	WAVE 970	Marlborough, Mass.	WSRO 1470	Michigan City, Ind.	WFAD 1490	Morehead City, N.C.	WMBL 740
	WAKY 790	Marquette, Mich.	WMR 1540	Middlebury, Vt.	WFAD 1490		KMRC 1430
	WHAS 480	Marshall, Mich.	WMRR 1540	Middleport-Pomeroy, Ohio	WMPO 1390	Morgan City, La.	KMRC 1430
	WKLO 1080	Marshall, Minn.	KMHL 1400		WMK 560	Morganfield, Ky.	WMSC 1550
	WINN 1240	Marshall, Mo.	KMMO 1300	Middlesboro, Ky.	WMK 560	Morgantown, N.C.	WMNC 1430
	WFA 900	Marshall, N.C.	WMMH 1460	Middletown, Conn.	WCNI 1150	Morgantown, W. Va.	WJRW 1440
	WLOU 1350	Marshall, Tex.	KNOX 1410	Middletown, N.Y.	WALL 1340		WCLG 1300
	WTMT 620		KNOX 1410	Middletown, Ohio	WPF 910	Morrilton, Ark.	KVOM 800
Louisville, Miss.	WLSM 1270	Marshalltown, Iowa	KFJB 1230	Midland, Mich.	WMDN 1490	Morris, Ill.	WCJS 1550
Loveland, Colo.	KLOV 1570	Marshallville, Wis.	WDLB 1450	Midland, Tex.	KJBC 1150	Morris, Minn.	KMRS 1280
Loves Park, Ill.	WLVS 1520	Martin, Tenn.	WCMT 1410		KWEL 1440	Morrilton, N.J.	WMTR 1250
Lovington, N. Mex.	KLEA 630	Martinsville, Ind.	WCBK 1540		WASH 1510	Morristown, Tenn.	WCRK 1150
Lowell, Mass.	WCAP 980	Martinsville, W. Va.	WEPM 1340		WMB 1500		WMT 1510
	WLLH 1400	Martinsville, Va.	WHHE 1370	Milan, Tenn.	WKBJ 1600	Morton, Tex.	KRAN 1280
	KCB 1590	Marysville, Mo.	KNIM 1580	Miles City, Mont.	KATL 1340	Moscow, Idaho	KRPL 1400
Lubbock, Tex.	KDAY 580	Marysville, Calif.	KMYC 1410	Milford, Conn.	WFIF 1500	Moses Lake, Wash.	KSEM 1470
	KLBK 1340	Marysville, Kans.	KNDY 1570	Milford, Del.	WKS 930		KWQ 1260
	KFYD 790	Marysville, Tenn.	WGAP 1400	Milford, Mass.	WMRG 1450	Moss Point, Miss.	WAGY 1460
	KLL 1460	Mason, Mich.	WUNN 1110	Milledgeville, Ga.	WMS 1450	Moulton, Ala.	WCB 1530
	KSEL 950	Mason City, Iowa	KGL 1370	Milford, Ga.	WGSR 1570	Moultrie, Ga.	WMEA 1430
	WHHT 1440		KRIB 1490	Mililinet, Tenn.	WGM 1340		WMTN 300
Lucedale, Miss.	WKLA 1450		KSMN 1010	Mililinet, N.J.	WMB 1340	Moundsville, W. Va.	WEIF 1370
Ludington, Mich.	KRBA 1340	Massena, N.Y.	WMSA 1340	Milton, Pa.	WVBY 1430	Mountain Grove, Mo.	KLRS 1360
Lufkin, Tex.	KTR 1420		WYBG 1050		WSRA 1490	Mountain Home, Ark.	KTLO 1240
	WAGR 580	Massillon, Ohio	WTIG 990		WMLP 1380		KFLI 1240
	WTSB 1430	Matawan, W. Va.	WHJC 1360		WARG 1360	Mt. Airy, N.C.	WSD 1300
Luray, Va.	WRAA 1330	Matteson, Ill.	WLBH 1270		WFO 860		WVNC 1360
Lynchburg, Va.	WLVA 590	Mayaguez, P.R.	WAE 600		WFO 860	Mt. Carmel, Ill.	WVNC 1360
	WLL 930		WKJB 710		WISN 1130	Mt. Clemens, Mich.	WBRB 1430
			WORA 760		WMIL 1290		

WHITES RADIO LOG

Location C.L. kHz

Mt. Dora, Fla.	WVGT 1580
Mt. Jackson, Va.	WSJG 390
Mt. Kisco, N.Y.	WVIF 1310
Mt. Olive, N.C.	WDJS 1430
Mt. Pleasant, Mich.	WCEN 1150
Mt. Pleasant, Tex.	KIMP 960
Mt. Shasta, Calif.	KWSD 620
Mt. Sterling, Ky.	WMST 1540
Mt. Vernon, Ill.	WMIX 940
Mt. Vernon, Ind.	WPCO 1590
Mt. Vernon, Ky.	WRVK 1460
Mt. Vernon, Ohio	WMVO 1300
Mt. Vernon, Wash.	KAPS 1470
Muleshoe, Tex.	KBRK 1430
Mullins, S.C.	KMUL 1380
Muncie, Ind.	WJAY 1280
	WLBC 1340
	WERK 990
Murfreesboro, Ky.	WLOC 1150
Munising, Mich.	WGN 1400
Murfreesboro, N.C.	
	WDDR 1080
Murfreesboro, Tenn.	WGSN 1450
	WR 810
Murphy, N.C.	WCVP 600
	WKRK 1320
Murphysboro, Ill.	WINI 1420
Murray, Ky.	WNBS 1340
Murray, Utah	KMOR 1230
Muscatine, Iowa	KWCP 860
Muscle Shoals City,	WLAY 1450
	WKBZ 850
Muskogee, Mich.	WKJR 1520
	WTRU 1600
	WMUS 1090
Muskogee, Okla.	KBIX 1490
	KMUS 1380
Myrtle Beach, S.C.	WMBY 1460
	WTRG 1520
Nacogdoches, Tex.	KEEE 1230
	KSFA 860
Nampa, Idaho	KFKX 580
	KAIN 1340
Nanticoke, Pa.	KNAN 730
Napa, Calif.	KVON 1440
Naples, Fla.	WNQG 1270
Narrows, Va.	WNRV 990
Nashua, N.H.	WOTW 900
	WSMN 1590
Nashville, Ark.	KBHC 1260
Nashville, Ga.	WNGA 1600
Nashville, Tenn.	WKOA 1240
	WLAC 1510
	WMAK 1300
	WNAH 1360
	WSIX 980
	WSM 560
	WNCM 1560
Nassau, Bahamas	ZNS-5 1240
Natchez, Miss.	WMIS 1240
	WNAT 1450
Natehitoches, La.	KNOC 1450
Naugatuck, Conn.	WOWW 860
Navasota, Tex.	WKBC 1550
Nebraska City, Nebr.	
	KNCY 1600
Needles, Calif.	KSFE 1340
Neenah, Wis.	WNAM 1280
Neillsville, Wis.	WCEN 1370
Neon, Ky.	WNKY 1480
Neosho, Mo.	KBTN 1420
Neovada, Mo.	KNEM 1240
New Albany, Ind.	WHEL 1570
	WREY 1290
New Albany, Miss.	WNAU 1470
Newark, Oel.	WNRK 1260
Newark, N.J.	WJRZ 970
	WNJR 1430
	WVNI 620
Newark, N.Y.	KDKA 1420
Newark, Ohio	WCLT 1430
New Bedford, Mass.	WBSM 1420
	WNBH 1340
New Bern, N.C.	WHIT 1450
	WRNB 1490
Newberry, Mich.	WNBY 1450
Newberry, S.C.	WKOK 1240
New Boston, Ohio	WIOI 010
New Braunfels, Tex.	KGNB 1420
New Britain, Conn.	
	WRCH 910
	WRYM 840
New Brunswick, N.J.	
	WCCT 1450
Newburgh, N.Y.	WGNV 1220
Newburyport, Mass.	WNBP 1470
New Castle, Ind.	WCTW 1550
New Castle, Pa.	WKST 1280
Newcastle, Wyo.	KASL 1240

Location C.L. kHz

New City, N.Y.	WRKL 910
New Haven, Conn.	WAVZ 1300
	WELJ 960
	WNHC 1340
New Iberia, La.	KANE 1240
	KNTR 1360
New Kensington, Pa.	
	WKPA 1150
New London, Conn.	WNLC 1510
New Martinsville, W.Va.	
	WETZ 1330
Newnan, Ga.	WCOH 1400
	WNEA 1300
New Orleans, La.	WDSU 1280
	WNNR 990
	WBOK 800
	WNOE 1060
	WSMB 1350
	WNPS 1450
	WSHO 1230
	WXTX 690
	WWL 870
	WWMO 600
	WYLD 940
Newport, Ark.	KNBY 1280
Newport, N.H.	WCNL 1010
Newport, Oreg.	KNPT 1810
Newport, R.I.	WADK 1450
Newport, Tenn.	WLK 1270
Newport, Vt.	WIKI 1490
Newport News, Va.	WGH 1310
	WTID 1270
Newport Richey, Fla.	
	WGUL 1500
New Richmond, Wis.	
	WIXK 1590
New Roads, La.	KWRG 1500
New Rochelle, N.Y.	WVOX 1460
New Smyrna Beach, Fla.	
	WSBB 1230
	WGOO 1530
Newton, Iowa	KCOB 1280
Newton, Kans.	KJRG 950
Newton, Mass.	WNTN 1550
Newton, Miss.	WBKN 1410
Newton, N.J.	WNNJ 1360
Newton, N.C.	WNNC 1230
New Ulm, Minn.	KNUJ 860
New York, N.Y.	WABC 770
	WAOO 1280
	WBNS 1380
	WCBX 880
	WEVO 1330
	WHN 1050
	WHOM 1480
	WINS 1010
	WLIB 1190
	WMCA 570
	WNBC 660
	WNEW 1130
	WNYC 830
	WOR 710
	WPOW 1330
	WRR 1600
Niagara Falls, N.Y.	WJLD 1270
	WJIL 1440
Niceville, Valparaiso, Fla.	
	WNSM 1340
Nicholasville, Ky.	WNVL 1250
Niles, Mich.	WNIL 1290
Niles, Ohio	WNIO 1540
Nogales, Ariz.	KNOG 1340
Nome, Alaska	KICY 650
Norfolk, Nebr.	WJAG 780
Norfolk, Va.	WTAR 790
	WCMS 1050
	WNOR 1230
	WRAP 850
	WIOK 1440
Normal, Ill.	WNAO 640
Norman, Okla.	KNOR 1400
	KNR 1400
Norristown, Pa.	WNAR 1110
N. Adams, Mass.	WMNB 1230
N. Atlanta, Ga.	WATY 680
N. Augusta, S.C.	WGUS 1800
	WFNL 1600
	KFRF 1340
North Bend, Oreg.	
North Charleston, S.C.	
	WNCG 910
Northampton, Mass.	
	WHMP 1400
North East, Pa.	WHYP 1530
Northfield, Minn.	WCAL 770
N. Little Rock, Ark.	KOKE 1380
	KXLR 1150
North Platte, Nebr.	KJLT 970
	KNOP 1410
	KODY 1240
No. Syracuse, N.Y.	WSOQ 1220
N. Vernon, Ind.	WOCH 460
No. Wilkesboro, N.C.	
	WKBC 810
	KNBI 1530
Norton, Va.	WNVA 1350
Norwalk, Conn.	WNLK 1350
Norwich, Conn.	WICH 1310
Norwich, N.Y.	WCHN 970
Oakdale, La.	KREH 900
Oakes, N.Dak.	KEYD 1220
Oak Grove, La.	KWCL 1280
Oak Hill, W.Va.	WOAY 860
Oakland, Cal.	KNEW 910

Location C.L. kHz

KABL 960	
KDIA 1310	
WMSG 1050	
WIXX 1520	
WOPA 1490	
WFO 790	
WMO 900	
WTMC 1290	
WWKE 1370	
WETT 1590	
Ocean City, Md.	
Ocean City, Somers Pt., N.J.	
Oceanlake, Oreg.	WSLT 1400
Oceanside, Calif.	KKBC 1380
Ocella, Ga.	KUDE 1320
Oconto, Wis.	WSIZ 1390
Odessa, Tex.	WOCO 1260
	KECK 920
	KOSA 1230
	KOYL 1310
	KRIG 1410
Oelwein, Iowa	KOEL 950
Ogallala, Nebr.	KOGA 980
Ogden, Utah	KLO 1430
	KANN 1250
	KSVN 730
	KVOG 1490
Ogdensburg, N.Y.	WSLB 1400
Oil City, Pa.	WKRZ 1340
Okechobee, Fla.	KOKY 1570
Okla. City, Okla.	KBYE 890
	KLPR 1140
	KOCY 1340
	KOMA 1520
	KTKO 1000
	KJEM 800
	KOEL 930
Okmulgee, Okla.	KOKL 1240
Old Saybrook, Conn.	WLIS 1420
Olean, N.Y.	WMNS 1360
	WHDL 1450
Olney, Ill.	WLVN 1440
Olympia, Wash.	KGY 720
	KRZ 920
Omaha, Nebr.	KBN 1490
	KFAB 1110
	KOIL 1290
	KOOO 1420
	KOWH 560
	WOW 590
Omak, Wash.	KOWW 580
Oneida, N.Y.	WMCR 1600
Oneida, Tenn.	WBNT 1310
O'Neill, Nebr.	KBRX 1350
Oneonta, Ala.	WCRL 1570
Oneonta, N.Y.	WODS 730
Ontario, Calif.	KASK 1380
Ontario, Oreg.	KSV 1380
Opelika, Ala.	WPHO 1400
Opelousas, La.	KSLO 1230
Opp, Ala.	WAMI 860
Opportunity, Wash.	KZUN 630
Orange, Mass.	WCAT 1390
Orange, Tex.	KOGT 1690
Orange, Va.	WJIN 1340
Orangeburg, S.C.	WDIX 1550
	WORG 1580
	WTNO 920
Orange Park, Fla.	WYAY 550
Ord, Neb.	KNLV 1060
Oregon City, Ore.	KYMN 1520
Orlando, Fla.	WOS 1580
	WHOO 990
	WHY 1270
	WLFO 950
	WKIS 740
Ormond Beh., Fla.	WQXQ 1380
Orono, Idaho	KLER 950
Oroville, Calif.	KADR 1340
Ortonville, Minn.	KOIO 1350
Osage Beh., Mo.	KRMS 1150
Oseola, Ark.	KOSE 860
Oshkosh, Wis.	WOSH 1490
Oskaloosa, Iowa	KBOE 740
Oswego, N.Y.	WSGO 1440
Othello, Wash.	KRSG 1400
Otsego, Mich.	WOM 980
Ottawa, Ill.	WCMY 1430
Ottawa, Kans.	KOFO 1220
Ottumwa, Iowa	KBIZ 1240
	KLEE 1480
Owatonna, Minn.	KRFO 1390
Owego, N.Y.	WEOB 1330
Owensboro, Ky.	WYU 1490
	WVJS 1420
Owosso, Mich.	WOAP 1080
Oxford, Miss.	WSUH 1420
Oxford, N.C.	WOXF 1340
Oxnard, Calif.	KOXR 910
Ozark, Ala.	WOZK 900
Paducah, Ky.	WAXR 1560
	WYU 570
	WPAD 1450
Page, Ariz.	KPGE 1340
Painesville, Ohio	WPVL 1460
Paintsville, Ky.	WSP 1490
Palatka, Fla.	WWPF 1260
	WSUZ 800
Palatine, Tex.	KNAO 1450
Palm Beh., Fla.	WQXT 1340
Palm Sprs., Calif.	KCMJ 1010
	KOES 920
	KPAL 1450
Palmdale, Calif.	KUTY 1470

Location C.L. kHz

Palm Desert, Cal.	KGOL 1270
Palo Alto, Calif.	KIBE 1220
Pampa, Tex.	KPDN 1340
	KHHN 1290
Panama Beach, Fla.	
	WGNE 1480
	WSCM 1290
Panama City, Fla.	WDLF 590
	WPFC 1430
Paoli, Ind.	WVAK 1560
Paradise, Calif.	KNGL 930
Paragould, Ark.	KORS 1490
Paris, Ark.	KCOL 1460
Paris, Ill.	WPRS 1440
Paris, Ky.	WPDE 1440
Paris, Tenn.	WTPR 710
Paris, Tex.	KPLT 1490
	KFTV 1250
Parkersburg, W.Va.	WCEF 1050
	WPAR 1450
	WAP 1450
Park Falls, Wis.	WFPF 1450
Park Rapids, Minn.	
	KPRM 1240
Parsons, Kans.	KLKC 1540
Pasadena, Cal.	KPPC 1240
	KRLA 1110
	KWKW 1300
	KLVH 1470
	KIKK 850
Pascagoula-Moss Point, Miss.	
	WPMP 1580
Pasco, Wash.	KORD 910
Paso Robles, Calif.	KPRL 1230
Patchogue, L.I., N.Y.	
	WALK 1570
	WPAC 1580
Paterson, N.J.	WPAT 930
Pauls Valley, Okla.	KVLH 1470
Pawhuska, Okla.	KOSG 1500
Pawtucket, R.I.	WXTR 550
Payette, Ida.	KYET 1450
Pearsall, Tex.	KWAB 1470
Pecos, Tex.	KIUN 1400
Peekskill, N.Y.	WLNA 1420
Pekin, Ill.	WSIV 1140
Pell City, Ala.	WFHK 1430
Pendleton, Oreg.	KTXI 1420
	KUMA 1290
Pennington Gap, Va.	
	WSWV 1570
Pensacola, Fla.	WPOR 980
	WBSR 1540
	WMEL 610
	WNVY 1230
	WCOA 1370
Peoria, Ill.	WXGL 1350
	WOL 1470
	WIRL 1290
	WPED 1020
Perry, Fla.	WPRI 1400
	WGRK 1310
Perry, Ga.	WPGA 980
Perry, Iowa	KOLS 1510
Perryton, Tex.	KWY 1600
Peru, Ind.	WARU 1610
Petaluma, Calif.	KTOB 1490
Petersburg, Va.	WSSV 1240
Petoskey, Mich.	WMBN 1340
Phenix City, Ala.	WPNX 1460
Philadelphia, Miss.	WHOC 1490
Philadelphia, Pa.	WPH 1460
	WCAU 1210
	WOAS 1480
	WFIL 560
	WFLN 900
	WHAT 1340
	WHOC 1490
	WIBG 980
	WIP 610
	WFEN 950
	WRCF 1540
	WTEL 860
Philipsburg, Pa.	WPHB 1260
Phillipsburg, Kans.	KKAN 1490
Phoenix, Ariz.	KIFN 860
	KUEQ 740
	KHAT 1480
	KHEP 1280
	KCAC 1010
	KOY 550
	KOOL 960
	KPHO 910
	KQED 740
	KRIZ 1230
	KTAR 620
Phoenix City, Ala.	
	WPNX 1460
Piedmont, Ala.	WPID 1280
Piedmont, Mo.	KPWB 1140
Pierre, S.D.	KYU 1480
	KCCR 1240
Pikeville, Ky.	WLSI 900
	WPKE 1240
Pine Bluff, Ark.	KCLA 1400
	KAOL 1270
	KPTN 1490
	KCAZ 1530
	KPBA 1590
Pine City, Minn.	WCMP 1350
Pineville, Ky.	WANO 1230
Pineville, Ky.	WNLF 1230
Pineville, W.Va.	WWYO 970

Location	C.L.	kHz	Location	C.L.	kHz	Location	C.L.	kHz	Location	C.L.	kHz
Pipestone, Minn.	KLOH	1050	Prentiss, Miss.	WKPO	1510	Richmond, Ind.	WKBV	1490	Sacramento, Calif.	WSYB	1380
Piqua, Ohio	WPTW	1570	Prescott, Ariz.	KYCA	1490	Richmond, Ky.	WEKY	1340	KCRA	1320	
Pittsburg, Calif.	KKIS	990		KENT	1340	Richmond, Va.	WRNT	990	KFRB	1530	
Pittsburg, Kans.	KOAM	860		KNOT	1450		WBBL	1480	KGMS	1380	
	KSEK	1340	Prescott, Ark.	KTPA	1370		WRGM	1540	KJAY	1430	
Pittsburgh, Pa.	KDKA	1020	Presque Isle, Me.	WAGM	950		WLEE	1480	KRAM	1440	
	KQV	1410		WEGP	1390		WGET	1320	KROY	1240	
	WAMO	860	Preston, Idaho	KPST	1340		WGDE	1590	KXOA	1470	
	WJAS	1320	Preston, Minn.	KFIL	1060		WTVR	1380	Safford, Ariz.	KGLU	1480
	WPIT	730	Prestonsburg, Ky.	WPRT	980		WRNL	910		KATO	1230
	WTAE	1250		WDOC	1310		WRVA	1140	Sag Harbor, N.Y.	WLNG	1600
	WEEP	1080	Price, Utah	KOAL	1230		WXGI	950	Saginaw, Mich.	WXNX	1210
Pittsfield, Ill.	WWSW	970	Prichard, Ala.	WZAM	1270	Richwood, W.Va.	WRGM	1400		KWAM	1400
Pittsfield, Mass.	WBAC	1420	Prince Albert, Sask.	CKBI	900	Ridgecrest, Calif.	WVAR	1280		WSGW	790
	WBEC	1420	Princeton, Ill.	WZOE	1490		KRCK	1360	St. Albans, Vt.	WYSR	1420
	WBRK	1340	Princeton, Ind.	WRAY	1250		KLOA	1240	St. Albans, W.Va.	WKLC	1300
Pittston, Pa.	WPTS	1540	Princeton, Ky.	WPKY	1580	Ridgeland, S.C.	WBUG	1430	St. Anthony, Ida.	KIGO	1400
Plainfield, N.J.	WERA	1490	Princeton, N.J.	WHWH	1350	Rio Piedras, P.R.	WUNO	1320	St. Augustine, Fla.	WFOY	1240
Plainville, Tex.	KVOP	1400	Princeton, W.Va.	WLHO	1490		WRAI	1190		WETH	1420
Plant City, Fla.	WPLA	910	Prineville, Oreg.	KRCO	690	Ripley, Miss.	WWSA	1260	St. Charles, Mo.	KADY	1460
Platteville, Wis.	WSWW	1590	Prosser, Wash.	KARY	1310	Ripley, Tenn.	WTRB	1570	St. Cloud, Minn.	KFAM	1450
Plattsburg, N.Y.	WEAV	960	Providence, R.I.	WEAN	790	Ripon, Wis.	WCWC	1600		WJON	1240
	WIRY	1340		WHIM	1110	Riverhead, N.Y.	WVOP	1390	Ste. Genevieve, Mo.	KSGM	1340
Pleasanton, Tex.	KBOB	1380		WICE	1290		WAPC	1370	St. George, S.C.	WQIZ	1300
Pleasantville, N.J.	WOND	1400		WJAR	920	Riverside, Calif.	KPRO	1440	St. George, Utah	KDUL	1350
Plymouth, Ind.	WTCA	1050		WLKW	930		KACE	1570	St. Helena, Mich.	WMIC	1590
Plymouth, Mass.	WPLM	1390		WPRO	690		KVOW	1450	St. Helena, Oreg.	KOHI	1600
Plymouth, N.C.	WPNC	1470		WIRB	1220	Riverton, Wyo.	WHWE	1600	St. Ignace, Mich.	WIDG	940
Plymouth, N.H.	WPNH	1300		KIXX	1400	Riviera Beach, Fla.	WELR	1800	St. Johns, Mich.	WJUD	1580
Plymouth, Wis.	WPLY	1420		KEYY	1450	Roanoke, Va.	WRO	960	St. Johnsbury, Vt.	WTWN	1340
Pocahontas, Ark.	KPOC	1420		KOVO	960		WPRX	910	St. Joseph, Mich.	WSJM	1400
Pocatello, Idaho	KSEI	980		KDZA	1230		WROV	1240	St. Joseph-Benton Harbor, Mich.	WHFB	1060
	KWIL	1240		KAPI	690	Roanoke Rapids, N.C.	WLSL	610		KFEQ	680
	KSNM	1290		KCSJ	980		WCBT	1230	St. Joseph, Mo.	KKJO	1550
Pocomoke City, Md.	WDMV	540		KFEI	970	Roaring Sprgs., Pa.	WKMC	1370		KUSN	1270
Pomona, Calif.	KWOW	1600		KKAM	1350		CHRR	110	St. Louis, Mo.	KATZ	1600
	KKAR	1220		KPUB	1480		WTAY	1570		KMCD	1120
Pompton Lakes, N. J.	WKER	1500		WKSR	1420	Roberval, Que.	CHRR	110		KSD	550
Pompano Beach, Fla.				WPUV	1580	Robinson, Ill.	KROB	50		KSTL	690
	WLDD	980		KWCS	1250	Robstown, Tex.	KROB	50		KWK	1380
	WRBD	1470		KDFE	1150	Rochelle, Ill.	WRHL	1060		KXOK	630
Ponca City, Okla.	WBBD	1230		WCCF	1580	Rochester, Minn.	KROB	1340		WEW	770
Ponce, P.R.	WPRP	910		WPME	1540		KWCB	1270		WIL	1430
	WEUC	1420		WPNM	1350		KOLM	1520		KXEN	1010
	WPAB	550		KAYE	1450	Rochester, N.H.	WNNH	930	St. Louis Park, Minn.	KRSI	950
	WLEO	1170		WQVA	1530		WBFB	950	St. Mary's, Pa.	WKBI	1400
	WISO	1260		KQCY	500	Rochester, N.Y.	WHAM	1180	St. Paul, Minn.	KSTP	1500
Pontiac, Ill.	WPDK	1080		WCNN	1230		WNYR	680		KDWB	630
Pontiac, Mich.	WPON	1460		WTAD	930		WSAY	1370		WMNM	1400
Pontotoc, Miss.	WSEL	1440		WIDA	1300		WROC	1280		WMKT	1370
Poole, Ind.	WYAK	1560		KPDR	1370	Rockford, Ill.	WRWK	1440		WCCO	830
Poplar Bluff, Mo.	KWOC	930		WFSB	1490		WYFE	1150	St. Pauls, N.C.	WBYB	1060
	KLID	1340		WRAC	1460		WRRR	1330	St. Peter, Minn.	KRBI	1310
Poplarville, Miss.	WRPM	1530		WRJN	1400	Rock Hill, S.C.	WYTC	1150	St. Petersburg, Fla.	WSPN	680
Portage, Mich.	WTSP	1560		WSHB	1400		WJFW	810		WSUN	620
Portage, Pa.	WWML	1470		WKIX	850	Rockingham, N.C.	WAYN	900	St. Petersburg Beach, Fla.	WLZY	1380
Portage, Wis.	WPDR	1350		WVNA	1550	Rock Island, Ill.	WHBF	1270		WILZ	1590
Portageville, Mo.	KNNM	1050		WPTF	680	Rockland, Maine	WRKD	1450	Salamanca, N.Y.	WGGG	1590
Portales, N.Mex.	KENN	1450		WLE	570	Rockmark, Ga.	WPLK	1220	Salem, Ill.	WJBD	1350
Port Angeles, Wash.	KAPY	1000		WRNC	1240	Rock Springs, Wyo.	KVRS	1360	Salem, Ind.	WSLM	1220
	KONP	1450		KCLR	1530	Rockville, Conn.	WRKY	800	Salem, Mass.	WQSO	1340
Port Arthur, Tex.	KOLE	1340		WRTL	1160	Rockville, Md.	WINX	1600	Salem, Mo.	KSMO	1340
	KPAC	1250		KOTA	1880	Rockwood, Tenn.	WRKH	580	Salem, N.J.	WJIC	1510
Porterville, Calif.	KCTP	1410		KIMM	1450	Rocky Ford, Colo.	KAVI	1320	Salem, O.	WSOM	600
Port Hueneme, Calif.	KACY	1520		KRSD	1340	Rocky Mount, N.C.	WCEC	810	Salem, Oreg.	KSLM	1590
Port Huron, Mich.	WHLS	1450		KEZU	920		WEDP	1390		KAPT	1220
	WTHH	1380		KRTN	1490		WRMT	1490		KBZY	1490
Port Jervis, N.Y.	WDLG	1490		WMOV	1360	Rocky Mount, Va.	WYTI	1570	Salem, Va.	WBLU	1480
Port Lavaca, Tex.	KGUL	1560		KRAL	1240	Rogers, Ark.	KAMO	1390	Salida, Colo.	KVRH	1340
Portland, Ind.	WPGW	1440		KAPA	1340	Rogers City, Mich.	WHAK	960	Salina, Kans.	KSAI	1150
Portland, Maine	WCSH	970		KSOX	1240	Rosenville, Tenn.	WGRS	1370		KFRM	550
	WGAN	560		KRIH	990	Rolla, Mo.	KLL	1590	Salinas, Calif.	KISI	910
	WLOB	1310		WEEU	850		KTRR	1490		KSBW	1380
	WPOR	1490		WHUM	1240	Rome, Ga.	WLAQ	1410	Salinas, Calif.	KCTY	980-1000
Portland, Oreg.	KBPS	1450		WRAW	1340		WLYN	1360	Saline, Mich.	WOIB	1290
	KBEV	1010		KAHK	1330	Rome, N.Y.	WKAL	1450	Salisbury, Md.	WBOD	960
	KLIJ	1290		KVCV	600		WRN	1350		WICO	1320
	KEX	1190		KVP	540	Ronceverte, W.Va.	WRON	1400	Salisbury, N.C.	WJTY	1280
	KGW	620		KBLF	1490	Roseau, Minn.	KRWB	1410		WSTP	1280
	KOIN	970		KFCB	1380	Roseburg, Oreg.	KRRR	1490	Salmon, Idaho	KSRA	960
	KPAM	1410		KCAL	1410		KQEN	1240	Salt Lake City, Utah	KALL	910
	KPD	800		KCRB	1450		KRXJ	1250		KCPX	1320
	KPOJ	1330		KPRB	1240	Rosenberg, Tex.	KVES	950		KLUB	570
	KWJJ	1080		KQUC	1250	Roswell, N.M.	KRDD	1320		KNAK	1280
	KXL	750		KLGR	1490	Rosville, Ga.	KRSY	1230		KSL	1160
Port Neches, Tex.	KPNG	1150		KRAF	1470	Roswell, N.Mex.	KGFL	1430		KSTP	1370
Portsmouth, N.H.	WBXB	1380		WREC	1250		KBIM	910		KSSX	630
	WHES	750		WREM	1480		KROD	1320		KWHO	860
Portsmouth, Ohio	WPAY	1400		KOH	630		KRIK	960	San Angelo, Tex.	KTEO	1840
	WNXT	1260		KBET	1340		KSW	1020		KGKL	960
Portsmouth, Va.	WHH	1400		KOLO	920		WRXO	1430		KPEP	1420
	WPHM	1010		KONE	1450	Roxboro, N.C.	WEXL	1430		KWFR	1260
	WVAY	1350		KCBN	1230	Royal Oak, Mich.	KGCA	1450	San Antonio, Tex.	KAPE	1480
Port Sulphur, La.	KPBC	1510		KWRN	1350	Rugby, N. Dak.	KGCA	1450		KBAT	980
Port Washington, Wis.				WFRB	1600	Ruidoso, N.Mex.	KRRR	1340		KBER	1150
	WGLB	1560		WREC	1250	Rumford, Me.	WRUM	900		KCOR	1350
Post, Tex.	KPOS	1370		WREH	1480	Rupert, Idaho	KAYT	970		KEDA	1540
Poteau, Okla.	KLCO	1280		KOH	630	Rushton, La.	KRUS	1490		KITE	930
Potomac-Cabin John, Md.				KBET	1340	Rusk, Texas	KTLU	1580		KUKA	1250
	WXLN	950		KOLO	920	Russell, Kans.	KRSL	990		KUBO	1310
Potosi, Mo.	KYRD	1280		KONE	1450	Russellville, Ala.	WWWR	920		KMAC	630
Potsdam, N.Y.	WPDM	1470		KCBN	1230	Russellville, Ark.	KXRJ	1490		KONO	860
Pottstown, Pa.	WPAZ	1370		KWRN	1350	Russellville, Ky.	WRUS	610		KTSA	550
Pottsville, Pa.	WPAM	1450		WREC	1250	Rutland, Vt.	WHWB	1000		WOAI	1200
	WPPA	1360		WRCO	1450						
Poughkeepsie, N.Y.	WEOK	1390									
	WPIB	1450									
Powell, Wyo.	KPDW	1260									
Poynette, Wis.	WIBU	1240									
Prairie du Chien, Wis.	WPRE	980									
Pratt, Kan.	KWNS	1290									

WHITE'S RADIO LOG

Location	C.L.	kHx
	KCKC	1350
	KFXM	590
	KRNO	1240
	KMEN	1290
Sandersville, Ga.	WSNT	1490
San Diego, Calif.	KCBQ	1170
	KFMB	760
	KOGO	600
	KGB	1360
	KSON	1240
	KSDO	1330
Sandpoint, Idaho	KSPY	1400
Sand Spring, Calif.	KTOW	1340
Sandusky, Mich.	WMIC	1560
Sandusky, Ohio	WLEC	1450
San Fernando, Calif.	KGIL	1260
Sanford, Fla.	WTRR	1400
Sanford, Me.	WSME	1220
Sanford, N.C.	WEWE	1290
	WGP	1050
San Francisco, Calif.	KFRG	610
	KCBS	740
	KFXA	1100
	KGO	810
	KNBR	680
	KKHI	1550
	KSAV	1010
	KSFQ	560
	KSOL	1450
	KYA	1260
San Gabriel, Cal.	KAIL	1430
San German, P. R.	WRIS	1060
Sanitobia, Miss.	WSAO	1550
San Jose, Calif.	KLOK	1170
	KLIV	1590
	KEEN	1370
	KXRX	1500
San Juan, P.R.	WAPA	680
	WIAQ	870
	WIPR	940
	WKAQ	580
	WKVM	810
	WKYN	630
	WITA	1140
San Luis Obispo, Calif.	KATY	1340
	KATY	1400
	KVEC	920
San Marcos, Tex.	KCNV	1470
San Mateo, Calif.	KOFY	1050
San Rafael, Calif.	KTIM	1510
San Saba, Tex.	KBAL	1410
San Sebastian, P.R.	WFB	1460
Santa Ana, Calif.	KWIZ	1480
Santa Barbara, Calif.	KDB	1490
	KGUD	990
	KIST	1340
	KTMS	1250
	KACL	1290
Santa Clara, Calif.	KGNU	1430
Santa Cruz, Calif.	KSCD	1080
Santa Fe, N.Mex.	KTRC	1400
	KAFB	810
	KVSE	1260
	KCOY	1400
Santa Maria, Cal.	KHER	1600
	KSMA	1240
	KMEV	1480
Santa Monica, Cal.	KDAY	1580
Santa Paula, Calif.	KSPA	1400
Santa Rosa, Calif.	KSRQ	1350
	KHUB	1580
	KVRE	1460
	KJAX	1150
Santa Rosa, N.Mex.	KSYX	1420
Sapulpa, Okla.	KREK	1550
Saranac Lake, N.Y.	WNBZ	1240
Sarasota, Fla.	WKXY	930
	KSAF	1220
	WSPB	1450
	WYND	1280
Saratoga, N.Y.	WSPN	900
Saratoga Springs, N.Y.	WKAJ	900
Sauk Rapids, Minn.	WVAL	800
Sault Ste. Marie, Mich.	WSOO	1230
Savannah, Ga.	WBYG	1450
	WEAS	900
	WSAV	630
	WSGA	1400
	WTOC	1290
	WSOK	1230
Savannah, Tenn.	WORM	1010
Sayre, Pa.	WATS	950

Location	C.L.	kHx
Seheffield, Ala.	WSHF	1290
Schenectady, N.Y.	WGY	810
Scotland Neck, N.C.	WSNY	1240
Scott City, Kans.	KFLA	1310
Scottsbluff, Nebr.	KNEB	960
	KOLT	1320
Scottsboro, Ala.	WCRI	1050
	WROS	1330
Scottsdale, Ariz.	KDOT	1440
Scottsville, Ky.	WLCK	1250
Scranton, Pa.	WARM	590
	WEIL	630
	WGBI	910
	WICK	1400
	WSCR	1320
Seaford, Del.	WSUX	1280
Seary, Ark.	KWCB	1800
Seattle, Wash.	KAYO	1150
	KIXI	910
	KING	1090
	KIRO	710
	KJR	950
	KOL	1300
	KOMO	1000
	KETO	1590
	KTW	1250
	KVI	570
	KXA	770
	KBLE	1050
Sebring, Fla.	WICM	960
	WMB	1330
Sedalia, Mo.	KORO	1340
	KSIS	1050
Seguin, Tex.	KWED	1580
Selma, Ala.	WGWG	1340
	WHBB	1480
Selma, N.C.	WBZB	1090
Seminole, Tex.	KTFO	1250
Senatobia, Miss.	WSAO	1550
Seneca Township, S.C.	WSNW	1150
Sevierville, Tenn.	WSEV	940
Seward, Alaska	KIBH	950
Seymour, Ind.	WJCD	1380
Seymour, Tex.	KSEY	1230
Shakopee, Minn.	KSMH	1330
Shallotte, N.C.	WVCB	1410
Shamokin, Pa.	WISL	1480
Shamrock, Tex.	KBYV	1580
Sharon, Pa.	WPIC	790
Shawano, Wis.	WTCH	960
Shawnee, Okla.	KGFF	1450
Sheboygan, Wis.	WHLB	1330
	WHTS	950
Sheffield, Ala.	WSHF	1290
Shelby, Mont.	KSEN	1150
Shelby, N.C.	WOHS	730
	WADA	1390
Shelbyville, Ind.	WCND	940
Shelbyville, Ky.	WCND	940
Shelbyville, Tenn.	WHAL	1400
	WLIJ	1550
Sheldon, Iowa	KIWA	1550
Shelton, Wash.	KMAS	1280
Shenandoah, Iowa	KMA	960
	KFNT	920
Shenandoah, Pa.	WWSL	1530
Sheridan, Wyo.	KWYO	1410
	KROE	930
Sherman, Tex.	KRRV	910
	KTXO	1500
Shippensburg, Pa.	WSHP	1480
Show Low, Ariz.	KVWM	970
Shreveport, La.	KANB	1300
	KBCI	1220
	KEEL	710
	KOKA	1550
	KJOE	1480
	KCIJ	980
	KRM	1340
Sidney, Mont.	KGCX	1480
Sidney, Nebr.	KSID	1340
Sidney, O.	WMVR	1080
Sierra Vista, Ariz.	KHFH	1420
Sikeston, Mo.	KSIM	1400
	KMPL	1520
Siler City, N.C.	KWCA	1570
Siloam Sprs., Ark.	KUOL	1290
Silabee, Tex.	KKAS	1300
Silver City, N.Mex.	KSIL	1340
Silver Sprs., Md.	WQMR	1050
Simcoe, Ont.	CFRS	1560
Sinton, Tex.	KTOO	1590
Sioux City, Iowa	KSCJ	1360
	KMNS	820
	KTRI	1470
Sioux Falls, S.Dak.	KISD	1230
	KELO	1320
	KNWC	1270
	KSOO	1140
Sitka, Alaska	KFW	1230
	KSEW	1400
Skowhegan, Maine	WGMM	1150
Slaton, Tex.	KCAS	1050
Sildell, La.	WBGS	1560
Smithfield, N.C.	WMPM	1270
Smithville, Tenn.	WJLE	1480
Smyrna, Ga.	WYNX	1550
Snyder, Tex.	KSNY	1450
Socorro, N.Mex.	KSRC	1290
Soda Sprs., Idaho	KBRV	540

Location	C.L.	kHx
Somersat, Ky.	WSFC	1240
	WTLO	1480
Somersat, Pa.	WVSC	990
Sonora, Calif.	KVNL	1450
Sonora, Tex.	KCKK	1240
So. Bend, Ind.	WVNU	1490
	WJVA	1580
	WSBT	960
Southbridge, Mass.	WESO	970
So. Boston, Va.	WHLF	1400
Southern Pines, N.C.	WEEB	990
South Charleston, W.	WRDS	1410
South Daytona Beach, Fla.	WELE	1590
So. Gastonia, N.C.	WGAS	1420
So. Haven, Mich.	WJOR	940
So. Knoxville, Tenn.	WSKT	1580
So. Paris, Me.	WKTK	1450
So. Pittsburg, Tenn.	WEPG	910
So. St. Paul, Minn.	KDWB	630
	WMKT	1370
So. Williamsport, Pa.	WMPT	1450
Spanish Fork, Utah	KONI	1480
Sparks, Nev.	KBUS	1270
Sparta, Ill.	WICO	1230
Sparta, N.C.	WCOK	1060
Sparta, Tenn.	WSMT	1050
Sparta, Wis.	WKLI	990
	WCOW	1290
Spartanburg, S.C.	WHQC	1400
	WORD	910
	WSPR	950
	WASC	1530
Spencer, Iowa	KICO	1240
Spencer, W.Va.	WYRC	1400
Spokane, Wash.	KGA	1510
	KDNC	1440
	KSPQ	1230
	KUOY	1280
Springdale, Ark.	KBRS	1340
	KSPR	1590
Springfield, Ill.	WCVS	1450
	WMAY	970
Springfield, Mass.	WTAX	1240
	WHYN	360
	WMAS	1450
	WSPR	1270
Springfield, Mo.	KGBX	1520
	KICK	1340
	KTTS	1400
Springfield, Ohio	KWTO	560
	WIZE	1340
Springfield-Eugene, Ore.	KBLY	1600
Springfield, Tenn.	WDBL	1590
Springfield, VT.	WCFR	1480
Springhill, La.	KBSF	1460
Spring Lake, N.C.	WFBS	1450
Spring Valley, N.Y.	WRRG	1300
Spruce Pine, N.C.	WTQE	1470
Stamford, Conn.	WSTC	1400
Stamford, Tex.	KDWT	1420
Stamford, Ky.	WRSI	1500
Starkie, Fla.	WPXE	1490
Starkie, Miss.	WSTK	1230
State College, Pa.	WMAJ	1450
	WRSC	1390
Statesboro, Ga.	WWNS	1240
Statesville, N.C.	WSIC	1400
	WDBM	550
Staunton, Va.	WTON	1240
	WAFB	900
Stephenville, Tex.	KSTV	1510
Sterling, Colo.	KGEK	1230
	KOLR	1490
Sterling, Ill.	WSDR	1240
Stevensville, Ohio	WSTV	1340
Stevens Point, Wis.	WSPY	1010
Stillwater, Minn.	WAPR	1220
Stillwater, Okla.	KSPI	1460
Stockton, Calif.	KJOY	1280
	KSTN	1420
	KWG	1230
Storm Lake, Iowa	KAYL	990
Stratford, Ill.	WIZZ	1250
Stroudsburg, Pa.	WAPR	840
Stuart, Fla.	WSTU	1450
Stuart, Va.	WNEO	1270
Sturgeon Bay, Wis.	WDOR	910
Sturgis, Mich.	WSTR	1280
Sturgis, S. D.	KBNB	1230
Stuttgart, Ark.	KWAK	1240
Suffolk, Va.	WPN	1460
Sullivan, Ind.	WKQV	1550
Sullivan, Mo.	KTUI	1560
Sulphur, La.	KIKS	1310
Sulphur Sprs., Tex.	KSTT	1230
Summersville, Ga.	WGTA	950
Summersville, S.C.	WALS	190
Sumner, Wash.	KDFL	1560
Sumter, S.C.	WFIG	1290

Location	C.L.	kHx
	WDOX	1240
	WSSC	1340
Sunbury, Pa.	WKOK	1070
Sunnyside, Wash.	KREW	1230
Sun Valley, Ida.	KSK1	1340
Superior, Nebr.	KPSB	1600
Superior, Wis.	WDSM	710
	WIGL	970
	WWJC	1270
	WAXK	1320
Susanville, Calif.	KSUE	1240
Sutton, W. Va.	WGSB	1490
Swainsboro, Ga.	WJAT	800
Sweetwater, Tenn.	KXOX	1240
Sweetwater, Tex.	WFEB	1340
Sylacauga, Ala.	WMLS	1290
	WMSJ	1490
Sylva, N.C.	WSYL	1480
Sylvania, Ga.	WOGA	1540
Sylvester, Ga.	WHEN	620
Syracuse, N.Y.	WFL	1360
	WNDR	1260
	WOLF	1490
	WSYR	570
Tabor City, N.C.	WTAB	1370
Tacoma, Wash.	KMO	1350
	KTAC	850
	KTRN	1400
	KVI	1470
Taft, Calif.	KTLL	1350
Tahlequah, Okla.		
Tahoe Valley, Calif.		
Talladega, Ala.	KTHO	590
	WEYF	1580
	WJZZ	1380
Tallahassee, Fla.	WMEN	1330
	WQNS	1410
	WTAL	1450
	WTNT	1270
Tallassee, Ala.	WTLS	1500
Tallulah, La.	KTLD	1360
Tampa, Fla.	WALT	1110
	WDAE	1250
	WYOU	1550
	WFLA	970
	WHBO	1050
	WTNP	1010
	WTMP	1150
	WSD	1300
Taos, N. Mex.	KKIT	1430
Tarboro, N.C.	WCPS	760
Tarpon Springs, Fla.	WCWR	1470
Tasley, Va.	WESR	1330
Taylor, Mo.	WEP	1570
Texas City, Mich.	WIOS	1480
Taylor, Tex.	KTAE	1260
Taylorville, N. C.	WST	860
	WTLK	1570
Taylorville, Ill.	WTIM	1410
Tazewell, Tenn.	WNTT	1250
Tazewell, Va.	WTZE	1470
Tell City, Ind.	KTCI	1220
Tempe, Ariz.	KUPD	1060
	KYND	1580
Temple, Tex.	KTEM	1400
Terre Haute, Ind.	WBOW	1230
	WAAC	1300
	WTHI	1460
Terrell, Tex.	KTER	1370
Terrytown, Nebr.	KEYR	990
Texarkana, Ark.	KOSY	790
Texarkana, Tex.	KCMC	740
	KATQ	940
	KTFB	1400
Texas City, Tex.	KTLL	920
Thayer, Mo.	KALH	1290
The Dalles, Oreg.	KODL	1440
	KACI	1300
Thermopolis, Wyo.	KRTR	1490
	KTHE	1240
Thief River Falls, Minn.	KTRF	1230
Thibodaux, La.	KTIB	690
Thomaston, Ga.	WSTF	1220
	WATA	1590
	WTHN	1500
Thomasville, Ala.	WJDB	630
Thomasville, Ga.	WPAX	1240
	WLDR	730
Thomasville, N.C.	WTNC	790
Thomson, Ga.	WTWA	1240
Three Rivers, Mich.		
Ticonderoga, N.Y.	WLKM	1510
Tiffin, Ohio	WIPS	1250
Tiffin, Ga.	WTFF	1600
	WTIF	1340
	WGSB	1480
Tillamook, Oreg.	KTIL	1590
Titusville, Fla.	WRMF	1050
Titusville, Pa.	WTIV	1230
Toccoa, Ga.	WLET	1420
	WNES	630
Toledo, Ohio	WOHO	1470
	WSPD	1370
Toledo, Oreg.	WTOO	1560
Toilesen, Ariz.	KTDO	1230
Tombah, Wis.	WTMB	1460
Tompkinsville, Ky.	WTKY	1370

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WHITE'S

Location	C.L.	MHz
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ALABAMA

Albertville	WQSB	105.1
Alexander City	WRFS-FM	100.1
Andalusia	WNBX	98.9
Anniston	WHMA-FM	100.5
Athens	WJOJ	104.3
Bay Minette	WATM-FM	104.1
Birmingham	WBCA-FM	105.5
	WAPI-FM	99.5
	WBRC-FM	106.9
	WCRT	96.5
Carrollton	WSFM	93.7
Clanton	WRAG-FM	94.1
Cullman	WKLF-FM	97.7
Decatur	WFMM-FM	101.1
	WDRM	102.1
Dothan	WRSA	96.9
	WOOF-FM	99.7
Fairhope	WABF-FM	92.1
Gadsden	WJOI-FM	107.3
GadSDen	WLJM	103.7
Hamilton	WERH-FM	97.7
Homewood	WJLN	104.7
Huntsville	WAHR	99.1
	WNDA	92.9
Jackson	WHOD-FM	104.9
Mobile	WKRQ-FM	99.9
	WMFC-FM	98.5
Montgomery	WLPR	96.1
	WJHI	98.9
	WAJM	103.3
	WHHY-FM	101.9
Muscle Shoals	WLAY-FM	105.5
Scottsboro	WCNA-FM	98.3
Selma	WHBB-FM	100.1
	WHPD	100.1
Sylacauga	WMLS-FM	98.3
Tusculmba	WVNA	100.3
Tuscaloosa	WTBO-FM	97.9
	WUOQ	91.7
	WACT-FM	105.5

ALASKA

Anchorage	KNIK	105.5
	KBYR-FM	102.1
	KHAR-FM	103.9
College	KUAC	104.9

ARIZONA

Flagstaff	KAFF-FM	92.9
Globe	KWIB-FM	100.3
Mesa	KBUZ-FM	104.7
Phoenix	KMND-FM	93.3
	KRFM	95.5
	KFCA	91.5
	KITH	101.3
	KOOL-FM	94.5
	KNIX-FM	102.5
	KOY-FM	92.5
	KMEO	98.9
	KTAR-FM	98.7
	KYEW	93.3
	KHEP-FM	101.5
	KVVM	93.5
Show Low	KUPD-FM	97.9
Tempe	KFMM	99.3
Tucson	KCEE-FM	96.1
	KSQM	92.9
	KVOA-FM	93.7

ARKANSAS

Blytheville	KLCN-FM	96.1
Conway	KASC	91.5
	KVEE-FM	105.1
Dardanelle	KCAB-FM	102.3
El Dorado	KRIL	95.3
	KELD-FM	103.1
Fayetteville	KFAV	92.1
	KNWA	103.9
FL Smith	KFPW-FM	94.9
	KWAG	99.1
	KTOS-FM	99.9
Harrison	KHOZ-FM	102.9
Hot Springs	KBHS-FM	96.7
	KUGUS	97.3
Jacksonville	KGMR-FM	103.3
Jonesboro	KBTM-FM	101.9
	KASU	91.9
	KNEA-FM	107.9
	KARK	102.9
Little Rock	KMYO-FM	95.7
	KAMS	103.9
Mammoth Springs	KNBY-FM	105.5
Newport	KDSE-FM	98.1
Osceola	KOSN-FM	98.3
Pine Bluff	KQOA-FM	101.1
Siloam Springs		

Location

C.L.

MH7

Location

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CALIFORNIA

Akiah	KLFL	94.3
Alameda	KJAZ	92.7
Anaheim	KEZR-FM	95.9
Angwin	KANG	89.9
Apple Valley	KAYR-FM	102.3
Arcata	KTOD	90.5
Atherton	KPEN	101.1
Auburn	KAFI	101.3
Avalon	KBIG	104.3
Bakersfield	KEPR-FM	94.7
	KGEE-FM	97.5
	KIFM	96.5
Berkeley	KPFA	94.1
	KPFB	89.3
	KPAT-FM	102.9
Bijou	KHUR	99.9
Bishop	KIBS-FM	102.7
Carlsbad	KARL-FM	95.9
Carmel	KRML-FM	101.1
Claremont	KSPC	88.7
Coachella	KCHV-FM	93.7
El Cajon	KEGR	93.3
Escondido	KOWN-FM	92.1
Fremont	KFMR	89.7
Fresno	KARM-FM	101.9
	KCIB-FM	94.5
	KFRE-FM	93.7
	KMJ-FM	97.9
	KXQR	102.7
Garden Grove	KFTJ	94.3
Glendale	KFMU	97.7
	KUTE	101.9
Hayward	KTUX	101.7
Hemet	KHSJ-FM	105.5
Ingewood	KTYM-FM	103.9
La Canada	KUNF	88.9
La Sierra	KSDA	89.7
Lodi	KCVR-FM	97.7
Lompoc	KLOM-FM	92.7
Long Beach	KJLH	102.3
	KLON	88.1
	KNOB	97.9
Los Altos	KPGM	97.7
Los Angeles	KJFC	88.7
	KABC-FM	95.5
	KBBJ	107.5
	KBCA	105.1
	KBNM	105.9
	KCBH	93.7
	KCFX-FM	92.3
	KFOX-FM	100.3
	KADS	103.5
	KGDS-FM	97.1
	KHJ	101.1
	KMET	94.7
	KMLA	100.3
	KNN-FM	93.1
	KPFK	90.7
	KPOL-FM	93.9
	KRHM	102.7
	KRKD-FM	96.3
	KUSC	91.5
	KXLU	89.1
	KHOF	99.5
Los Angeles-Avalon	KBIG-FM	104.3
Los Banos	KLBS-FM	95.9
Los Galos	KLGS	95.3
Marysville	KFRD	99.9
Merced	KAMB	101.5
Modesto	KBEE-FM	103.3
	KTRB-FM	104.1
Monterey	KMBY-FM	96.9
Newport Beach	KOCM	103.1
Norridge	KEDC-FM	88.5
Oakland	KARE	98.9
Oceanside	KUDE	102.1
Ontario	KPMJ	93.5
Orxnard	KPMJ	104.7
Pasadena	KPCS	89.3
Palm Springs	KPPC-FM	106.7
Pedding	KDES-FM	104.7
Redondo Beach	KFRJ	92.9
Redlands	KKOP	93.5
	KCAL-FM	96.7
	KUOR-FM	89.1
	KLOA-FM	105.5
Redgeest	KBBL	99.1
iverside	KACE-FM	92.7
	KDUO	97.5
	KUCR	88.1
iverside	KCRA-FM	96.9
racramento	KERS	89.1
	KFBK-FM	96.9
	KJML	106.5
	KEBR	100.5
	KHIQ	105.1
	KJML	95.5
	KRAK-FM	92.9
	KSFM	96.9
	KXRR	90.5
	KXDA-FM	107.9
allinas	KSBW-FM	96.5
	KRSA-FM	100.7
	KERR	103.9
an Bernardino	KVCR	91.9
	KFMV	99.9
	KEBS	89.1
	KRCS	95.5
an Diego	KNGS-FM	92.7

KFMB-FM 100.7

	KFMX	96.5
	KGB-FM	101.5
	KITT	105.3
	KDIG	98.1
	KLRO	94.9
	KPRI	106.5
	KSOS	88.3
	KBBW	102.9
	KSDO-FM	103.7
San Fernando	KSEA	97.3
San Francisco	KMFM	84.3
	KALW	91.7
	KBRG	105.3
	KCBS-FM	98.9
	KDFC	102.1
	KEAR	97.3
	KFOG	104.5
	KFRG-FM	104.9
	KGO-FM	103.7
	KNBR-FM	99.9
	KMPX	106.6
	KOIT	93.3
	KPEN	101.3
	KRON-FM	96.5
	KSFR	94.9
	KXXK	88.5
	KCMA	90.3
	KBRG	105.3
	KABL-FM	98.1
	KKHI-FM	95.7
San Jose	KSJO-FM	92.3
	KRPM	96.3
	KJSJ	90.7
	KPLX	106.5
	KEEN-FM	100.3
	KATY-FM	96.1
San Mateo	KSBY-FM	93.3
	KISM	90.9
	KUFY	107.7
San Rafael	KTIM	100.9
Santa Ana	KWIZ-FM	96.7
	KYMS	106.3
Santa Barbara	KCSB-FM	91.1
	KDGF-FM	93.7
	KMUZ	103.3
	KTMS	97.5
Santa Clara	KSCU	90.1
	KREP	105.7
Santa Cruz	KSCO-FM	99.1
Santa Maria	KXFM	99.1
Santa Monica	KSMA-FM	92.3
	KCRW	89.9
Sierra Madre	KSRF	103.1
Stanford	KMAX	107.1
Tockton	KZSU	90.1
	KUOP	91.3
Shore Valley	KSTW-FM	107.3
Thousand Oaks	KWVG-FM	103.7
Vernance	KTHO-FM	103.1
Van Nuys	KNJO	92.7
Venice	KNHS	89.7
Walters	KSRJ	100.9
	KDFR	106.7
Whittier	KGEN-FM	94.9
Woodland	KOSO	93.1
	KDHI-FM	95.7
Yuba	KUKI-FM	93.5
Yuba City	KVEN-FM	100.7
Yuba City	KONG-FM	92.9
Yuba City	KZPD	92.9
Yuba City	KSGV	98.3
Yuba City	KATT	95.3
COLORADO		
Aspen	KRNW	97.3
Aspen	KRCC	91.5
Aspen	KKFM	96.5
Aspen	KSHS	90.5
Aspen	KVOR-FM	92.9
Aspen	KPIK-FM	94.3
Aspen	KRDO-FM	95.1
Aspen	KRYT-FM	101.9
Aspen	KZFM	94.1
Aspen	KFML-FM	90.3
Aspen	KLIR-FM	100.5
Aspen	KLZ-FM	107.7
Aspen	KDEN-FM	99.5
Aspen	KOA-FM	103.5
Aspen	KOSI-FM	105.1
Aspen	KTGM	101.1
Aspen	KMYR	95.5
Aspen	KBFI	105.9
Aspen	KCSU-FM	93.9
Aspen	KFMF	93.9
Aspen	KFTM-FM	94.3
Aspen	KREX-FM	92.3
Aspen	KLAK-FM	107.5
Aspen	KLMO-FM	102.3
Aspen	KLOV-FM	104.3
Aspen	KCMF-FM	102.3
Aspen	KVMN	98.9
Aspen	KAVI-FM	95.9
CONNECTICUT		
Bridgeport	WJZZ	99.9
Bridgeport	WPKN	88.1
Bridgeport	WGHF	95.5
Bridgeport	WLAD-FM	98.3

WD

Hartford	WHCN	105.9
	WDRG-FM	102.9
	WCCC-FM	104.9
	WLAE	93.7
	WRTC-FM	89.3
	WTIC-FM	96.5
Meriden	WBMI	95.7
Middletown	WESU	88.1
New Haven	WNHC-FM	99.1
	WYBG-FM	94.3
Norwalk	WDRN	95.9
Norwich	WICH-FM	97.7
Stamford	WSTC-FM	96.7
Storrs	WHUS	90.5
Waterbury	WATR-FM	92.5
	WWCO-FM	104.1
Westport	WMMM	107.9

DELAWARE

Dover	WDOV-FM	94.7
Wilmington	WDEL-FM	93.7
	WJBR	99.5

D. C.

Washington	WASH	97.1
	WAMU-FM	88.5
	WFAN	100.3
	WGAY	99.5
	WGMS-FM	103.5
	WGTB	90.1
	WMAL-FM	107.3
	WOL-FM	98.7
	WRC-FM	93.9
	WTOP-FM	96.3
	WWDC-FM	101.1

FLORIDA

Atlantic Beach	WKTZ-FM	96.1
	WQAB-FM	104.9
Belle Glade	WSWN-FM	92.5
Boca Raton	WYOG	99.9
Bradenton	WBRO-FM	103.3
Clear Water	WTAN-FM	95.5
Cocoa	WEZY-FM	99.3
Cocoa Beach	WXBR	101.1
Coral Gables	WRTT-FM	104.3
Crusteville	WYCF-FM	103.1
	WAAZ-FM	99.9
Daytona Beach	WNDB-FM	94.5
	WMFJ-FM	101.9
De Funiak Springs	WZEP-FM	103.1
Fort Lauderdale	WWIL-FM	103.5
	WFLM	105.9
	WTOV	106.7
	WMJR	100.1
Ft. Meyers	WINK-FM	96.9
	WMYR-FM	101.9
Ft. Pierce	WARN-FM	98.7
Ft. Walton Beach		
	WFTW-FM	99.3
Gainesville	WRUF-FM	103.7
Immokalee	WJAX-FM	95.9
Jacksonville	WJAX-FM	98.9
	WQIK-FM	99.1
	WRLJ	96.9
	WIVY-FM	92.5
Jacksonville	WKTZ-FM	96.1

COLORADO

Boulder	KRNW	97.3	M
Colorado Springs	KRCC	91.5	
	KKFM	96.5	
	KSMS	90.5	
	KVOR-FM	92.9	
	KPIK-FM	94.3	
	KRDO-FM	95.1	
	KRYT-FM	101.9	M
Cortez	KZFM	94.1	
Denver	KFML-FM	98.5	
	KLIR-FM	100.3	
	KLZ-FM	106.7	
	KDEN-FM	99.5	N
	KOA-FM	103.1	
	KOSI-FM	101.1	O
	KTGM	105.1	
	KMYR	105.9	
	KBPI	105.9	
Ft. Collins	KCSU-FM	90.9	
	KLSF-FM	93.9	P
Ft. Morgan	KFTN-FM	97.3	
Grand Junction	KREX-FM	97.3	
Lakewood	KLAK-FM	102.5	P
Longmont	KLMO-FM	104.3	
Loveland	KLOV-FM	102.3	
Manitou Springs	KCMS-FM	102.7	St
Pueblo	KVMN	97.7	
Rocky Ford	KAVI-FM	95.9	

CONNECTICUT

Bridgeport	WJZZ	99.9
	WPKN	88.1
Brookfield	WGHF	95.1
Danbury	WLAD-FM	98.3
Eastfield	WGHM	94.1

Atlantic City	WKAT-FM	93.1
Atlantic City	WFYI-FM	92.5
Key West	WVFM	93.5
Kauai	WTLN-FM	95.3
Maui	WTOT-FM	100.9
Marlana	WMMB-FM	102.3
Melbourne	WKAT-FM	93.3
Miami	WGBS	96.3
	WIOD-FM	97.3
	WDSH	91.7
	WTOH	99.1
	WWPB	101.5
Miami Beach	WAEZ-FM	94.9
	WGOS	93.9
Millton	WBXM-FM	102.3
St. Dora	WHYI-FM	107.7
Naples	WNFM	94.5
Orlando	WMOP-FM	93.7
Palmdale	WLWC	92.1
Sanchocho	WD80-FM	95.3
San Diego	WHOO-FM	96.5
	WKIS-FM	100.3
	WWQS	105.1
Salm Beach	WQOS-FM	97.9
	WPBA-FM	107.1
Sanama City	WMAI-FM	107.9
	WOLP-FM	92.5
Sansacola	WPCX-FM	94.1
	WOCA-FM	102.7
St. Augustine	WFOY-FM	97.7
St. Petersburg	WGNB	101.5
	WTCX	99.5
	WPIN-FM	107.3
	WYAK	102.5
Spring	WSPB-FM	106.3
Stuart	WSEB	105.5
	WMCF	92.7
Tallahassee	WFSU-FM	91.5
	WGBM-FM	98.9
	WMEN-FM	104.1

Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz
	WEMI	94.9		WELG	103.9	Kendallville, Ind.	WAWK-FM	93.3		KQTY	101.3
	WFLA-FM	93.3		WRMN-FM	94.3	Kokomo	WFKO	100.5		KMUW	89.1
	WPKM	104.7		WEPS	88.1		WKMO	93.5		KCBM-FM	107.3
	WUSF	89.7	Elgin	WELG	103.9	Lafayette	WASK-FM	105.3	KENTUCKY		
Titusville	WRMF-FM	98.3		WRMN-FM	94.3		WALY-FM	96.7	Albany	WANY-FM	106.3
West Palm Beach	WPBF	107.9	Elmhurst	WRSE-FM	88.7		WALY-FM	96.7	Ashland	WCLB-FM	93.7
Winter Haven	WXKL	87.5	Elmwood Park	WXFM	105.9	La Porte	WSAL-FM	102.3	Beattyville	WLJC	102.3
Winter Park	WPRK	91.5	Evansville	WEAW	105.1	Logansport	WLOI-FM	96.7	Benton	WBLJ-FM	96.7
	WLOQ	103.1		WNUJ	88.7	Marion	WMRI-FM	106.9	Bowling Green	WTOC-FM	103.9
GEORGIA			Fairfield	WFIW-FM	104.9		WBST	90.7	Campbellsville	WNES-FM	101.9
Albany	WGPC-FM	104.5	Flossmoor	WELL-FM	98.5	Michigan City	WMCB-FM	95.9	Central City	WKYF-FM	101.1
	WJIZ	96.3	Galesburg	WYKC-FM	88.1	Monticello	WMUN	95.3	Erleranger	WYAC-FM	105.5
Americus	WDEC-FM	94.3	Glen Elyn	WELF	107.1	Muncie	WWHI	91.5	Frankfort	WKYF	104.9
Athens	WGAU-FM	102.5	Greenville	WGRN	89.9	New Albany	WNAS	88.1	Fulton	WFUL-FM	104.9
	WDOL-FM	104.7	Harrisburg	WBOJ-FM	99.9	New Castle	WCTW-FM	102.5	Georgetown	WRVG	90.1
Atlanta	WABE	90.1	Highland Park	WEEF-FM	103.1		WYSN	91.1	Glasgow	WGGC	95.1
	WPLG-FM	103.3	Hicksonville	WLOS-FM	100.5	North Vernon	WOCH-FM	106.1	Grayson	WGOH-FM	102.3
	WGKA-FM	92.9	Joliet	WAJP	93.5	Peru	WARU-FM	98.3	Greenville	WVIC-FM	101.1
	WVSB-FM	98.5	Kankakee	WKAK-FM	99.9	Plainfield	WJMK	98.3	Hazard	WSDN-FM	99.5
Augusta	WLTA-FM	99.7	Kewanee	WKEL-FM	99.9	Plymouth	WTCA-FM	94.3	Hopkinsville	WHOP-FM	98.7
	WAUG-FM	105.7	LaSalle	WLNR-FM	106.3	Richmond	WRAY-FM	98.1		WKOF	100.3
	WBBQ-FM	104.3	Lawrenceville	WLPO-FM	99.3		WGLM	96.1	Jamestown	WJRS-FM	103.1
Brunswick	WGIG-FM	100.7	Lithfield	WAKO-FM	103.1		WKBV-FM	101.3	Lexington	WBKY	91.3
	WYNR-FM	101.5	Loves Park	WLUV-FM	96.7	Scottsburg	WIFI	100.9		WLP-FM	94.5
Canton	WCHK-FM	105.3	Macomb	WWKS	91.3	Seymour	WJBT	93.7		WEX-FM	101.1
Carrollton	WLBB-FM	102.9	Madison	WKAJ-FM	100.1	Shelbyville	WSVL-FM	97.1		WVLK-FM	92.9
Columbus	WRBL-FM	102.9	Madison	WGNU-FM	106.5	South Bend	WETL	91.9	Louisville	WFPL	89.3
	WGBA-FM	107.3	Mattson	WLBH-FM	96.9		WHME	103.1		WHAS-FM	97.5
Cornelia	WCON-FM	99.3	Mendota	WGLC-FM	100.9		WPFH	102.7		WKLO-FM	99.3
Decatur	WACO-FM	94.9	Morris	WRMI-FM	104.7		WJVA-FM	103.9		WLRS	102.7
Oublin	WXLI-FM	92.7	Morrison	WMHS	91.5		WSBT-FM	101.5	Madisonville	WFWM-FM	93.9
Gainesville	WDUG-FM	103.7	Mt. Carmel	WSAB	94.9	Terre Haute	WHII-FM	99.9		WNGO-FM	94.7
	WWQT	97.1	Mt. Vernon	WVNC-FM	101.1		WBOJ-FM	107.5	Manfordville	WLCC-FM	102.3
Griffin	WKEU-FM	97.7	Normal	WMIX-FM	94.1		WPFH	102.7	Maysville	WFTM-FM	95.9
Lagrange	WLAG-FM	104.1	Oak Park	WOPA-FM	102.7		WVTS	100.7	Monticello	WFLW-FM	101.7
Macon	WMZZ-FM	99.1	Olney	WSEI-FM	92.9		WISU	99.3	Morehead	WMOR-FM	92.1
Manchester	WFDR-FM	99.3	Ottawa	WOLI	98.3	Wabash	WSKS	91.7		WMKY-FM	95.9
Marletta	WBIE-FM	98.1	Paris	WPRS-FM	88.3	Warsaw	WWSW-FM	107.3	Morganfield	WMSK-FM	95.3
	WKLS	101.5	Park Forest	WRHS	88.5	Washington	WFML	106.5	Murray	WAAW	103.7
Milldegeville	WMVG-FM	102.3	Park Ridge	WMTH	88.5	West Lafayette	WBAA-FM	99.1	Owensboro	WQMI-FM	92.5
Moultrie	WMTM-FM	93.9	Pekin	WSIV-FM	95.3	W. Terre Haute	WWVR	105.1		WVJS-FM	96.5
Newnan	WCOH-FM	96.7	Peoria	WMBD-FM	93.3	Valparaiso	WVUR-FM	90.3		WPAO-FM	98.9
Perry	WPGA-FM	100.9		WJSI	106.9	Vincennes	WAOV-FM	96.7		WXYK-FM	103.1
Rome	WRGA-FM	102.3	Pittsfield	WBBA-FM	97.7	IOWA			Paducah	WPAO-FM	98.9
	WRMG-FM	97.7	Quincy	WGBM-FM	105.1		WOI-FM	90.1	Paintsville	WXYK-FM	103.1
Rossville	WRMG-FM	105.5		WTAO-FM	100.7	Ames	KJAN-FM	103.7	Pikeville	WPKE-FM	92.1
Savannah	WTQC-FM	94.1	Reboston	WTAY-FM	100.7	Atlantic	KFGQ	99.3	Prestonburg	WDOC-FM	95.5
	WEAS-FM	93.1	Rockford	WROK-FM	97.5	Boone	KFGQ	99.3	Russellville	WRUS-FM	92.1
Smyrna	WKXI	94.1	Rock Island	WHBF-FM	98.9	Carroll	KCIM-FM	93.7	St. Matthews	WSTM	103.1
Statesboro	WMD	100.1	Skokie	WVJK	90.9	Cedar Falls	KTCF	98.1	Somers	WSEK	96.7
Swainsboro	WJAT-FM	101.7	South Beloit	WRSV	98.3	Cedar Rapids	KHAK-FM	98.1	Whitesburg	WTCW-FM	104.9
Toccoa	WLCI-FM	108.1	Springfield	WBEL-FM	103.7		WMT	104.5			
Valdosta	WGOV-FM	92.9		WTAF-FM	108.7	Clarion	KRIT	96.9	Alexandria	KALB-FM	96.9
W. Point	WCJM	100.9		WFMB	104.5	Clinton	KROS-FM	96.1	Baton Rouge	WBFO-FM	102.5
HAWAII				WVEM	101.9	Creston	KSIB-FM	101.7		WQXY-FM	100.7
Honolulu	KAIM-FM	95.5		WJVM	94.3	Oavenport	WOC-FM	103.7	DeRidder	KDLA-FM	94.3
	KHVV-FM	93.9	Sterling	WIZZ-FM	97.7	Des Moines	KWNT-FM	106.5	Golden Meadow	KLEB-FM	96.7
	KPOI-FM	97.5	Streator	WGGM	95.0		KDPS	88.1	Hammond	WTCI	103.3
	KVOK	88.1	Taylorville	WILL-FM	90.9		KDMJ-FM	90.3	Houma	KCIF-FM	107.1
	KUOH	90.5	Urbana	WPGU	103.9		WHO-FM	90.3	Jennings	KJEF-FM	92.7
IDAHO				WFEA	102.3		KFMG	94.9	Krys-FM	KRYS-FM	88.3
Boise	KBOI-FM	97.9		WETN-FM	88.1		KWDM	93.3	KPEL-FM	KPEL-FM	99.9
Idaho Falls	KID-FM	96.1		WNTN	88.1	Dubuque	WBQ-FM	105.3		KSMB	94.5
	KGVN-FM	99.1		WREK	105.5		KDTH-FM	92.9	Lake Charles	KPLC-FM	99.5
Lewiston	KOZE-FM	96.7	INDIANA				KWMT-FM	94.5		KWK	96.1
Moscow	KUID	91.7	Anderson	WAFM	97.9		KWMT-FM	94.5	La Place	KWCKW	92.3
Pocatello	KBGL	88.7	Bloomington	WFIU	103.7		KWMT-FM	94.5	Monroe	KMLB-FM	104.1
ILLINOIS				WTTV-FM	92.3	Iowa Falls	KIFG-FM	95.3		KNOE-FM	101.9
Alton	WKZ-FM	100.3	Bluffton	WCRD	100.1		KMAQ-FM	95.3		KREB	106.1
Anna	WRAJ-FM	92.7	Columbus	WCSI-FM	98.3	Maquoketa	KRNLFM	89.7		KRNL-FM	105.3
Arlington Heights	WNWC	92.7	Connersville	WCNB-FM	100.3	Mt. Vernon	KWPC-FM	99.7		KNOC-FM	97.7
Aurora	WKKD-FM	95.9	Crawfordsville	WNDY	106.3	Muscatine	KUWS-FM	95.9	New Orleans	WBEH	89.3
	WMRO-FM	107.9	Elkhart	WCMB-FM	104.7	Newton	KBOE-FM	104.9		WDSU-FM	105.3
Bloomington	WJBC-FM	101.5		WTRC-FM	100.7	Oskaloosa	KOVR	97.9		WNNR-FM	97.1
Carbondale	WSIU	91.9		WXAX	104.7	Sioux City	KTFC	103.3		WWOM-FM	98.5
Carmel	WRDY-FM	97.3		WBMP	101.7	Spencer	KICD-FM	107.7		WMMT	95.5
Centralia	WCNT-FM	95.3	Elwood	WKY-FM	104.1	Storm Lake	KAYL-FM	101.5	Opelousas	KSLO-FM	107.1
Champaign	WDWS-FM	97.5	Evansville	WEVC	91.5	Waterloo	KNWS-FM	101.9	Ruston	KRMD-FM	101.1
	WLRW-FM	94.5		WPSR	90.7		KXEL-FM	105.7	Shreveport	KBCL-FM	96.5
	WLEI	91.7		WVH	105.3	Waverly	KWAR	89.1		KWKH-FM	94.5
Charleston	WBBM-FM	96.3	Fort Wayne	WPTH	95.1	KANSAS				KTBIF-FM	106.3
Chicago	WBZ	91.5	Franklin	WKJG-FM	97.3		KNBU	88.9	Thibodaux	KVPI-FM	93.5
	WCLM	101.9		WFCI	89.3	Baldwin	KGNO-FM	95.5	Ville Platte	KVZN-FM	98.5
	WLS-FM	94.7		WIFN	95.9	Dodge City	KSTE	88.7	W. Monroe	KUOL-FM	92.1
	WDHF	95.5	Frankfort	WILQ-FM	99.7	Emporia	KVOE-FM	104.3			
	WDEB	93.9	Gary	WVGE	88.1		KUPK-FM	97.9	Augusta	WFAU-FM	101.3
	WDFM	97.9	Goshen	WGCS	91.1		KJCK-FM	94.5	Bangor	WABI-FM	97.1
	WDSM	97.9	Greencastle	WGRE	91.7	Garden City	KKCF	98.1	Brunswick	WBOR	91.1
	WFMF	100.3		WXTA	94.3	Junction City	KCKN-FM	94.1		WCME-FM	98.9
	WNUS-FM	107.5		WSMJ	95.5	Kansas City	KANS-FM	96.7		WFST-FM	97.7
	WFMT	98.7		WTRF-FM	107.3		KANU	91.5	Caribou	WBE-FM	95.7
	WKFM	103.5		WYGA	92.3	Larned	KLWN-FM	105.9	Ellsworth	WCOU-FM	93.9
	WMAQ-FM	102.1		WYCI	91.9	Lawrence	KDSD-FM	88.1	Lewiston	WRJR	91.5
	WMBI-FM	90.1		WYHC	104.9		KDSD-FM	88.1		WMB-FM	91.9
	WNIB	97.1		WHLT-FM	103.1	Leavenworth	KDSD-FM	88.1	Ore	WMTW-FM	94.9
	WXRT	93.1		WAJC	104.5	Manhattan	KDSD-FM	88.1	Poland Springs	WLOB-FM	97.9
	WJJD-FM	104.3		WBDG	90.9	Newton	KDSD-FM	88.1	Portland	WPOR-FM	101.9
Columbia	WCBW	104.9		WICR	88.7	Ottawa	KDSD-FM	88.1		WGAN-FM	102.9
Crete	WTAS	102.3		WISH-FM	107.9	Parsons	KDSD-FM	88.1			
Danville	WDAV-FM	102.1		WVAV	105.7	Pratt	KDSD-FM	88.1			
Decatur	WDOV-FM	102.9		WFBM-FM	94.7	Russell	KDSD-FM	88.1			
DeKalb	WNIC	89.7		WFMS	95.5	Sallina	KDSD-FM	88.1			
	WLBK-FM	92.5		WGEE-FM	103.3	Scott City	KDSD-FM	88.1			
Dixon	WIXN-FM	101.7		WIAN	90.1	Topeka	KDSD-FM	88.1			
Dundee	WVVF	103.9		WIBC-FM	98.1	Wichita	KDSD-FM	88.1			
E. St. Louis	WMRY	101.1		WITZ-FM	104.7						
Effingham	WCRA-FM	95.7	Jasper								

WHITE'S RADIO LOG

Location C.L. MHz

Baltimore	WBIC	91.5
	WCAD-FM	102.7
	WCBM-FM	106.5
	WFMM-FM	93.1
	WRBS	95.1
	WSD	92.3
	WBAL-FM	97.9
	WTH-FM	104.3
	WSD-FM	92.3
Bethesda	WJMD	94.7
	WHFS	102.3
Bradbury Heights	WPCC	95.5
Catonville, Md.	WCBG	105.7
Cumberland	WCUM-FM	102.9
Frederick	WFMD-FM	99.9
Frostburg	WFRB-FM	105.3
Glen Burnie	WISZ-FM	95.9
Hagerstown	WJEJ-FM	104.7
	WARK-FM	106.9
Halfway	WHAG-FM	96.7
Havre de Grace	WASA-FM	103.5
Oakland	WBSB-FM	94.3
Salisbury	WBQC-FM	94.3
Tacoma Park	WGTS-FM	91.9
Waldorf	WSDT-FM	104.1
Westminster	WTRR-FM	100.7

MASSACHUSETTS

Amherst	WAMF	88.1
	WFCR	88.5
	WMUA	91.1
Andover	WPAA	91.7
Boston	WBUR	90.9
	WBEN	104.1
	WBZ-FM	106.7
	WCOF-FM	102.9
	WEEL-FM	103.3
	WERS	88.9
	WHDH-FM	94.5
	WRKO-FM	98.5
	WXHR-FM	96.9
	WBET-FM	97.7
	WGBS-FM	92.9
	WGBH-FM	98.7
	WHRB-FM	95.3
	WTBS	88.1
Fitchburg	WBNE-FM	104.5
Framingham	WKOX-FM	105.7
Glocester	WBCA-FM	104.9
Greenfield	WHAJ-FM	98.3
Haverhill	WHAY-FM	95.3
Hyannis	WKOD-FM	106.1
	WBRK-FM	101.7
Lawrence	WCCM-FM	93.7
Lowell	WLH-FM	99.5
Lynn	WLYN-FM	99.5
Medford	WHIL-FM	107.9
New Bedford	WBSM-FM	97.3
	WNBH-FM	98.1
N. Adams	WMNB-FM	100.1
Northampton	WHMP-FM	99.3
Pittsfield	WQRB-FM	105.5
	WFOE-FM	101.7
Plymouth	WPLM-FM	99.1
S. Hadley	WMHC	88.5
Springfield	WHYN-FM	93.1
	WCSB	88.9
	WMAS-FM	94.7
	WRLM	97.3
Taunton	WCRB-FM	102.5
Waltham	WOCB-FM	94.3
W. Yarmouth	WCFM	91.9
Williamstown	WHSR-FM	91.9
Winchester	WAAB	107.3
Worcester	WRSR	98.1

MICHIGAN

Adrian	WLEN	103.9
Alma	WFYC-FM	104.9
Alpena	WHSB	107.7
	WATZ-FM	93.5
Battle Creek	WKFR-FM	103.3
Big Rapids	WBRN-FM	100.9
Ann Arbor	WJUM	91.7
Bay City	WBCM-FM	98.7
	WNEM-FM	102.5
	WHFB-FM	99.9
Benton Hrbr.	WHFI	94.7
Birmingham	WCER-FM	92.7
Charlotte	WCBY-FM	105.1
Cheboygan	WTB-FM	90.3
Coldwater	WKNR-FM	100.3
Dearborn	WDET-FM	101.9
Detroit	WBFG	98.7
	WCHD	105.9
	WDTM	106.7
	WABX	99.5
	WDR	90.9
	WGP	107.5
	WJBK-FM	93.1

Location C.L. MHz Location C.L. MHz Location C.L. MHz

	WNUZ	103.5	New Albany	WNAU-FM	103.5	Eatontown	WHTG-FM	106.3
	WGPR	97.9	Pascagoula	WPMP-FM	99.1	Franklin	WLVP	102.3
	WJFR-FM	96.3	Paulsboro	WRPM-FM	107.9	Franklin Lakes	WRRH	88.7
	WOMC-FM	104.3	Pentotote	WSEL-FM	96.7	Glassboro	WGLS-FM	89.7
	WQRS-FM	105.1	Tupelo	WELU-FM	98.3	Hackettstown	WNTI	91.9
	WRMK-FM	98.7	Vicksburg	WQMV	98.7	Hanover	WHPH	90.3
	WWJ-FM	97.1				Long Branch	WTFB	93.1
	WXYZ-FM	101.1				Millville	WMBV-FM	97.9
	WCAR-FM	92.8				Newark	WHBI	105.9
E. Lansing	WICAR-FM	90.5	Canoe Glirardeau	KZYN-FM	100.9		WFME	94.7
	WITL-FM	100.7	Carrollton	KAOL-FM	101.1		WVNI-FM	100.3
	WSWM	99.1	Clayton	KFUOU-FM	99.1		WBGD	88.3
Flint	WVIC-FM	95.7	Columbia	KWVC-FM	90.5	New Brunswick	WCTC-FM	98.3
	WVFE	95.1	Drexelwood	KSHE	94.7	Patterson	WPAT-FM	93.1
	WGMZ-FM	107.9	Oxeter	KDEX-FM	107.3	Princeton	WPRB	103.3
	WMRP-FM	105.5	El Dorado Springs			Red Bank	WFHA-FM	106.3
Grand Rapids	WFR-FM	102.9				South Orange	WSOU	89.5
	WJEF	93.7				Trenton	WBDU-FM	101.5
	WLAV-FM	96.9	Houston	KESM-FM	101.7		WTOA	97.5
	WYON	101.3	Joplin	KBTC-FM	99.3		WTSR	89.7
	WOOD-FM 105.7 (s)			WMBH-FM	96.1		WTTM-FM	104.5
	WVGA-FM	104.1	Kansas City	KSY	92.5		WCMC-FM	100.7
	WXTO-FM	97.9		KCMO-FM	94.9		WAWZ-FM	99.1
	WKLW-FM	95.7		KBEY	104.3	Wildwood		
				KTSR	90.1	Zarephath		

MISSOURI

Buffalo	KBFL	91.3	Kennett	Kirksville	WVLA-FM	102.1
Cape Girardeau	KZY-M-FM	102.9	Kirksville	Kirksville	WDAF-FM	102.1
Carrollton	KAOL-FM	101.1	Kirksville	Kirksville	WDAF-FM	102.1
Clayton	KFOU-FM	99.1	Kirksville	Kirksville	WDAF-FM	102.1
Crestwood	KWOC-FM	90.5	Kirksville	Kirksville	WDAF-FM	102.1
Dexter	KSHF	94.9	Kirksville	Kirksville	WDAF-FM	102.1
El Dorado Springs	KDEX-FM	107.3	Kirksville	Kirksville	WDAF-FM	102.1
	KESM-FM	101.7	Kirksville	Kirksville	WDAF-FM	102.1
Houston	KBTC-FM	96.1	Kirksville	Kirksville	WDAF-FM	102.1
Joplin	WMBH-FM	99.3	Kirksville	Kirksville	WDAF-FM	102.1
	KSYN	92.5	Kirksville	Kirksville	WDAF-FM	102.1
Kansas City	KCMO-FM	94.9	Kirksville	Kirksville	WDAF-FM	102.1
	KBEY	104.3	Kirksville	Kirksville	WDAF-FM	102.1
	KTSR	90.1	Kirksville	Kirksville	WDAF-FM	102.1
	WDAF-FM	102.1	Kirksville	Kirksville	WDAF-FM	102.1
	KCMK	99.3	Kirksville	Kirksville	WDAF-FM	102.1
	KCUR-FM	98.3	Kirksville	Kirksville	WDAF-FM	102.1
	KMBR	99.7	Kirksville	Kirksville	WDAF-FM	102.1
	KPRS-FM	103.3	Kirksville	Kirksville	WDAF-FM	102.1
	KXTR	96.5	Kirksville	Kirksville	WDAF-FM	102.1
	KBOA-FM	98.9	Kirksville	Kirksville	WDAF-FM	102.1
	KRLX	94.5	Kirksville	Kirksville	WDAF-FM	102.1
	KWWR-FM	95.7	Kirksville	Kirksville	WDAF-FM	102.1
	KRES	104.7	Kirksville	Kirksville	WDAF-FM	102.1
	KRM-FM	93.5	Kirksville	Kirksville	WDAF-FM	102.1
	KSOZ	88.1	Kirksville	Kirksville	WDAF-FM	102.1
	KWOC-FM	94.5	Kirksville	Kirksville	WDAF-FM	102.1
	KCLU-FM	94.3	Kirksville	Kirksville	WDAF-FM	102.1
	KMSM	88.5	Kirksville	Kirksville	WDAF-FM	102.1
	KUSN-FM	105.1	Kirksville	Kirksville	WDAF-FM	102.1
	KCFM	89.7	Kirksville	Kirksville	WDAF-FM	102.1
	KACO	107.7	Kirksville	Kirksville	WDAF-FM	102.1
	KADI	96.5	Kirksville	Kirksville	WDAF-FM	102.1
	WAMV-FM	101.1	Kirksville	Kirksville	WDAF-FM	102.1
	WIL-FM	92.3	Kirksville	Kirksville	WDAF-FM	102.1
	KSIL	91.5	Kirksville	Kirksville	WDAF-FM	102.1
	KSTL-FM	98.1	Kirksville	Kirksville	WDAF-FM	102.1
	KRFD	106.9	Kirksville	Kirksville	WDAF-FM	102.1
	KSIS-FM	92.1	Kirksville	Kirksville	WDAF-FM	102.1
	KTTS-FM	94.7	Kirksville	Kirksville	WDAF-FM	102.1
	KTXR	101.5	Kirksville	Kirksville	WDAF-FM	102.1
	KLPW-FM	101.7	Kirksville	Kirksville	WDAF-FM	102.1
	KFB	97.7	Kirksville	Kirksville	WDAF-FM	102.1
	KWPM-FM	98.9	Kirksville	Kirksville	WDAF-FM	102.1

NEW MEXICO

Alamogordo	KXXI	94.3	Carlsbad	Carlsbad	WAMC	90.3
	KOTO	105.5	Clovis	Clovis	WHR	103.1
Albuquerque	KANW	89.1	Hobbs	Hobbs	WMBD-FM	106.9
	KBNM	99.5	Los Alamos	Los Alamos	WTFM	103.5
	KDEF-FM	94.9	Las Cruces	Las Cruces	WGSN-FM	94.3
	KRST	92.3	Las Vegas	Las Vegas	WBBB-FM	102.3
	KHFM	96.3	Mountain Park	Mountain Park	WNB-FM	98.1
	KOAT-FM	100.3	Roswell	Roswell	WHRW	90.5
	KOB-FM	93.3	Santa Fe	Santa Fe	WKOF-FM	99.1
	KUNM	90.1	Taos	Taos	WNYE	91.5
	KCNM	92.1	Tucumcari	Tucumcari	WCWP	88.1
	KTQM-FM	94.9	University Park	University Park	WBEN-FM	102.5
	KHOB-FM	95.7			WDCX	99.5
	KRSN-FM	98.5			WFO	88.7
	KGRD-FM	103.9			WBUF	93.3
	KEDP	91.1			WBBR	94.5
	KLEA-FM	101.7			WGR-FM	95.9
	KMFM	97.9			WTSI-FM	103.3
	KBIM-FM	94.9			WWOL-FM	104.1
	KSNM	95.5			WYSL-FM	103.3
	KKIT-FM	99.3			WBNY-FM	96.1
	KTNM-FM	92.7			WSLU	99.7
	KRWG	91.7			WCSQ	89.3

NEW YORK

Royal Oak	WOAK	89.3	Westerville	KLPW-FM	101.7	Albany	WAMC	90.3	
	WOMC	104.3	West Plains	KWPM-FM	93.9		WHR	103.1	
Saginaw	WSAN-FM	98.1	MONTANA				Auburn	WMBD-FM	106.9
St. Joseph	WSJM-FM	107.1					Babylon	WTFM	103.5
Spring Arbor	WSAE	99.3	Belgrade	KGWV-FM	96.7			WGSN-FM	94.3
Sturgis	WSTR-FM	103.1	Bozeman	KURL-FM	97.1	Binghamton	WMBB-FM	102.3	
Traverse City	WDR-FM	101.9	Bozeman	KBHF	93.7		WNB-FM	98.1	
	WTOM-FM	103.5	Great Falls	KOPR-FM	106.3		WHRW	90.5	
Warren	WPHS	91.5	Missoula	KUFM	88.1		WKOP-FM	99.1	
Ypsilanti	WEMU	98.1						WNYE	91.5
MINNESOTA			NEBRASKA			Brooklyn	WCWP	88.1	
Anoka	KTWN	107.9	Beatrice	KWBE-FM	92.9	Brookville	WBEN-FM	102.5	
Blue Earth	KBEW-FM	100.9	Columbus	KJSK-FM	101.1	Buffalo	WDCX	99.5	
Brainerd	KLJZ-FM	95.9	Hastings	KJCS-FM	93.5		WFO	88.7	
Collegeville	KSJS-FM	95.9	Kearney-Holdrege	KRNY-FM	98.9		WBUF	93.3	
Golden Valley	KQRS-FM	92.5	Lexington	KRUN-FM	95.3		WBBR	94.5	
Mankato	KMSO	90.5	Lincoln	KFMQ	93.1		WGR-FM	96.9	
	KYSM-FM	103.5		KWHG	102.7		WTSI-FM	103.3	
Minneapolis-St. Paul	KTIS-FM	98.5	Omaha	KQAL-FM	93.7		WWOL-FM	104.1	
	KWFM	97.1		KFAB-FM	99.9		WYSL-FM	103.3	
	KNOF	95.3		KFBI-FM	100.7	Canton	WBNY-FM	96.1	
	WPBC-FM	101.3		KOWH-FM	94.1		WSLU	89.7	
	WYAY	93.7		WOW-FM	92.3	Central Square	WCSQ	89.3	
	WCTS-FM	100.3		KICN	96.1	Cherry Valley	WHJ	101.9	
Moorhead	KVOX-FM	99.9	Scottsbluff	KNEW-FM	94.1	Clinton	WHCL-FM	88.7	
						Corning	WCLL-FM	106.1	

MONTANA

Belgrade	KGWV-FM	96.7
Billings	KURL-FM	97.1
Bozeman	KBHF	93.7
Great Falls	KOPR-FM	106.3
Missoula	KUFM	88.1

NEBRASKA

Beat

WHITE'S RADIO LOG

Location	C.L.	MHz
Barnwell	WBAL-FM	101.7
Batesburg	WBIR-FM	101.7
Beaufort	WBEU-FM	98.7
Charleston	WCSB-FM	96.9
	WTMA-FM	95.1
Clemson	WSBF-FM	88.1
Columbia	WCOS-FM	97.9
	WNOX-FM	104.7
	WUSC-FM	89.9
Conway	WLAT-FM	104.7
Darlington	WDAR-FM	105.5
Dillon	WDSC-FM	92.9
Eastley	WELP-FM	103.9
Florence	WJMX-FM	103.1
Greenville	WESC-FM	92.5
	WFBC-FM	93.7
	WMUU-FM	94.5
	WCRS-FM	96.7
Greenwood	WDKO-FM	100.1
Kingstree	WLCM-FM	107.1
Lancaster	WLBG-FM	100.5
Laurens-Clinton	WNYB-FM	92.1
Myrtle Beach	WKTM	102.5
N. Charleston	WLAX-FM	104.7
Orangeburg	WRHI-FM	98.3
Rock Hill	WBFM	98.9
Spartanburg	WSPA-FM	98.9
Sumter	WFIG-FM	101.3

SOUTH DAKOTA

Hot Springs	KOBH-FM	96.7
Sioux Falls	KELQ-FM	92.5

TENNESSEE

Bristol	WOPJ-FM	96.9
Brownsville	WBHT-FM	95.3
Chattanooga	WDOD-FM	96.5
	WLON	106.5
	WDEF-FM	92.3
Cleveland	WCLE-FM	100.7
Clinton	WYSN-FM	104.9
Collegedale	WYSC-FM	101.7
Columbia	WYFY-FM	101.7
Cookeville	WHUB-FM	98.3
	WPTN-FM	94.3
Covington	WKBL-FM	93.5
Crossville	WAEW-FM	99.3
Dickson	WDKN-FM	102.3
Franklin	WFLT-FM	100.1
Gallatin	WFG	104.5
Greeneville	WOFM	94.9
Humboldt	WIRJ-FM	102.3
Jackson	WTJS-FM	104.1
Jamestown	WDEB	100.1
Johnson City	WJCW-FM	101.5
Kingsport	WKPT-FM	98.5
Knoxville	WBIR-FM	93.5
	WIVK-FM	102.7
	WKCS	91.1
	WUOT	91.9
	WCAS	97.5
Lawrenceburg	WDXE-FM	95.9
Lebanon	WFMQ	91.3
Lexington	WDXL-FM	99.3
Livingston	WLIV-FM	95.9
Manchester	WMSR-FM	92.7
McKenzie	WKTA	106.9
McMinnville	WHNR	101.7
Memphis	WMC-FM	99.7
	KLYX	101.1
	WMP5-FM	97.1
	WNLT	104.5
Milan	WREC-FM	102.7
Morristown	WKBJ-FM	92.3
Murfreesboro	WMTN-FM	95.9
Nashville	WMTS-FM	96.3
	WLAC-FM	105.9
	WPLN	90.3
	WLWM	95.5
	WNFO	103.3
	WSIX-FM	94.3
	WATO-FM	94.3
Onelda	WBNT-FM	105.5
Savannah	WORM-FM	101.9
Sevierville	WSEV-FM	102.1
Sparta	WSMT-FM	105.5
Springfield	WDBL-FM	94.3
Tullahoma	WJIG-FM	93.3

TEXAS

Abernathy	KWGO-FM	99.5
Ablene	KACC-FM	91.1
	KFMN	99.3
	KWKQ-FM	105.1
Amarillo	KGNC-FM	93.1
	KYLI-FM	94.1
Austin	KHFI-FM	98.3
	KAZZ	95.5

Location	C.L.	MHz
	KMFA	89.5
	KTBC-FM	93.7
	KUT-FM	90.7
	KVET-FM	100.7
	KHCB-FM	105.7
	KAYD-FM	92.5
	KTRM-FM	95.5
	KJET-FM	107.7
	KLVI-FM	94.1
	KFNE	95.3
	KWHI-FM	106.3
	KHPC	88.1
	KFRN-FM	99.3
	KORA-FM	98.3
	KMSC	102.1
	KCLE-FM	94.9
	WTAW-FM	92.1
	KNRO	106.9
	KNRO-FM	106.5
	KZFM	95.5
	KXIT-FM	94.3
	KMP	104.5
	KEIR	102.9
	KMAP	105.3
	KNER	88.1
	KNUS	98.7
	KRLD-FM	92.5
	WFAA-FM	97.9
	WRR-FM	101.1
	KVTT	91.7
	KBOX-FM	100.3
	KDLK-FM	94.3
	KDNT-FM	106.1
	KSPL-FM	95.5
	KDDD-FM	95.3
	KVOP-FM	98.5
	KTSM-FM	99.7
	KHMS	94.7
	WBAP-FM	96.3
	KFJZ-FM	97.1
	KFWT-FM	102.1
	KCUL-FM	93.9
	KNOK-FM	107.5
	KTCU-FM	96.3
	KGAF-FM	94.5
	KELT	94.5
	KGRI-FM	100.1
	KPAN-FM	106.3
	KVIL-FM	103.7
	KHBR-FM	102.3
	KHGM	102.9
	KHCB-FM	105.7
	KIKK-FM	95.7
	KFMK	97.9
	KODA-FM	99.1
	KLEF	94.5
	KST	100.3
	KQLE	102.9
	KRBE	104.1
	KXYZ-FM	96.5
	KTRH-FM	101.1
	KUMF	91.3
	KBNO	93.7
	KLEN-FM	93.3
	WIKR	102.1
	KSAM-FM	101.7
	KTXJ-FM	102.3
	KLJT	107.3
	KPET-FM	100.3
	KLUE-FM	105.7
	KSEL-FM	93.7
	KBFM	96.3
	KLBK-FM	94.5
	KTXF-FM	91.9
	KMHT-FM	97.3
	KQXX	98.5
	KNFM	92.3
	KMOD-FM	93.3
	KIMP-FM	100.7
	KMUL-FM	103.1
	KQIP	96.7
	KWMO	99.1
	KOCV	91.3
	KOYL-FM	97.9
	KPLT-FM	99.3
	KLVF-FM	92.5
	KHBL	98.3
	KFMF	93.3
	KPAC-FM	98.5
	KROB-FM	99.9
	KWLW	93.9
	KSJF	97.5
	KISS	99.5
	KBER-FM	100.3
	KEEZ	97.3
	KAKI-FM	98.1
	KITY	92.9
	KMFM	96.1
	KWFR-FM	94.5
	KCOR-FM	101.9
	KITE-FM	104.5
	WKBI-FM	90.3
	KTDQ-FM	101.3
	KBMF-FM	98.3
	KYLE-FM	104.9
	KTAL-FM	98.1
	KDSY-FM	102.5
	KZAK-FM	93.1
	KDQX-FM	101.5
	KTXN-FM	92.5
	KEFC	95.5

Location	C.L.	MHz
Wichita Falls	KWBU	89.9
	KLUR	99.9
	KNTD	95.1

UTAH

Ephraim	KEPH	88.9
Logan	KUSU-FM	91.5
	KBOC	101.9
	KWCR-FM	88.1
	KBYU-FM	88.9
	KPMC	96.1
	KCPX-FM	98.7
	KLUB-FM	97.1
	KSL-FM	100.3
	KSDP-FM	104.3
	KWHO-FM	93.3

VERMONT

Burlington	WJOY-FM	98.5
	WRUV	90.1

VIRGINIA

Arlington	WAVA-FM	105.1
	WCCV-FM	97.5
	WVTV	104.9
Blocksburg	WINA-FM	95.3
Charlottesville	WTJU	91.3
	WFOS	90.5
Chesapeake	WKCV-FM	100.9
Covington	WSVS-FM	104.7
Crawe	WFLO-FM	95.7
Farmville	WVFA-FM	101.5
Fredericksburg	WMNA-FM	103.3
Gretna	WNRG-FM	97.7
Grundy	WVEC-FM	101.3
Hampton	WHOV	88.3
	WENC	91.7
Harrisonburg	WSVA-FM	100.7
Lynchburg	WWOD-FM	100.1
	WDM5-FM	101.7
	WPRV-FM	106.7
	WNE-FM	93.9
	WVA-FM	96.3
	WGH-FM	97.3
	WMTI	91.5
	WCMS-FM	100.5
	WNOR-FM	98.7
	WPHD	104.5
	WVRC	102.5
	WTAR-FM	95.7
	WXFI	105.3
	WYFI-FM	99.7
	WSSV-FM	99.3
	WAVY-FM	96.9
	WRAD-FM	101.7
	WCOD	98.1
	WRFK	91.1
	WRYA-FM	98.5
	WRNL-FM	102.1
	WDBJ-FM	94.9
	WLRJ	92.3
	WROV-FM	103.7
	WLSL-FM	99.1
	WHLR-FM	97.5
	WFOS	90.5
	WSGM-FM	93.5
	WXYW	92.9
	WEER-FM	107.7
	WCWM	89.1
	WRCI	96.5
	WRF	92.5
	WEGF	102.5
	WXRA	105.9
	WYCS	91.5

WASHINGTON

Aberdeen	WDUX-FM	104.7
Bellevue	KFKF-FM	92.5
Bellevue	KGMI-FM	92.9
Bellevue	KERI	104.3
Bremerton	KBRO-FM	106.9
Centralia	KGME-FM	102.9
Cheney	KEWC-FM	89.1
College Place	KGTS	91.3
Edmonds	KGFM	105.3
Ellensburg	KCWS-FM	91.5
Eugene	KBMC	104.5
Hoquiam	KGHO-FM	103.9
Lynden	KLYN-FM	106.5
Opportunity	KZUN-FM	96.1
Prosser	KACA	101.7
Richland	KCY5	95.1
Seattle	KING-FM	98.1
	KBBX	98.9
	KBLE-FM	93.3
	KETO-FM	101.5
	KIRO-FM	100.7
	KISW	99.9
	KLSN	96.5
	KOL-FM	94.1
	KRAB	107.7
	KTW-FM	102.5
	KUOV	94.9
	KIXI-FM	95.7
	KREM-FM	92.9
	KDNC-FM	93.7
	KTWD	105.7
	KXLY-FM	99.9
	KHQ-FM	98.1
	KPCS	100.9
	KLAY-FM	106.1

Location	C.L.	MHz
	KPLU	88.5
	KTNT-FM	97.3
	KTOY	91.7
	KYAC-FM	103.9
	KNDX-FM	106.3

WEST VIRGINIA

Beckley	WBKW	99.5
Berkeley Springs	WSCF-FM	93.5
Bathany	WVBC	88.1
Bluefield	WHIS-FM	100.5
Charleston	WKAZ-FM	97.5
	WCHS-FM	96.1
	WKNA	98.5
	WTIO	102.7
	WVAF	99.9
	WZFM	98.3
Charlestown	WKEE-FM	100.5
Huntington	WMUL	88.1
	WVQM	103.3
	WEPM-FM	97.5
Morgantown	WAJR-FM	101.9
Norfolk	WCMS-FM	100.5
Oak Hill	WDAY-FM	94.1
Parkersburg	WTAF-FM	103.1
	WDEF-FM	99.3
	WKLC-FM	105.1
	WKWK-FM	97.3
	WVVA-FM	98.7
	WTRF-FM	102.5

WISCONSIN

Appleton	WLFM	91.1
	WAPL-FM	105.7
Beloit	WBOR-FM	88.1
Chilton	WHKW	89.3
Colfax	WHWC	88.3
Delafield	WHAD	90.7
Eau Claire	WIAL	94.1
	WEAU-FM	104.5
Fort Atkinson	WFAW	107.3
Green Bay	WBAY-FM	101.1
	WDJR	104.5
Greenfield Twp.	WVCF	94.9
Highland	WHHI	91.3
Highland Twp.	WHSA	89.9
Janesville	WCLO-FM	99.9
Kenosha	WLIP	95.1
La Crosse	WHLA	90.3
	WVLA	88.3
Madison	WHA-FM	88.7
	WIBA-FM	101.5
	WISM-FM	98.1
	WFMF	104.1
	WRVB-FM	102.5
	WKUB	92.1
	WHD	91.1
	WDRB	106.5
	WZMF	98.3
	WLIN	100.7
	WFMR	96.5
	WMLF-FM	95.7
	WISN-FM	97.3
	WVIT-FM	102.9
	WAWA-FM	94.5
	WQFM	93.3
	WTMJ	94.5
	WBON	107.7
	WEMP-FM	99.1
	WUWM	99.7
	WEKZ-FM	93.7
	WFMK	92.3
Monroe		
Mt. Horeb		
Neenah-Menasha		
	WNAM-FM	99.3
	WCEN-FM	107.5
	WMKC	96.7
	WRST-FM	88.1
	WOSH-FM	99.3
	WSPU	90.5
Platteville	WSWW-FM	99.3
Port Washington		
	WGLB-FM	100.1
	WRJN-FM	100.7
	WFNY	92.1
Racine	WOBT-FM	107.9
Rhineland	WJMC-FM	96.3
Rice Lake	WRBC	98.1
Richtland Center	WRCO-FM	95.9
Ripon	WCXN-FM	95.9
Sauk City	WVLR	96.7
Shawano	WTCH-FM	100.1
Sparta	WCOW-FM	97.1
Stevens Point	WSPT-FM	97.9
Sturgeon Bay	WDRR-FM	95.9
Superior	WJCF-FM	105.1
	WSSU	91.3
Tomah	WTFM	98.9
Two Rivers	WTBW-FM	102.1
Watertown	WTTN-FM	104.7
Waukesha	WAUK-FM	106.1
Wausau	WHRM	91.9
	WRIG-FM	101.9
Wauwatosa	WTOS	92.5
West Bend	WBKV-FM	92.5
Whitewater	WSUW	91.7
Wisc. Rapids	WFHR-FM	103.3
WYOMING		
Casper	KATI-FM	94.5
Cheyenne	KVOW-FM	106.3

Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz
GUAM			Aguadilla	WABA-FM	100.3	WORA-FM	97.5		WOLA	105.7	
Agana	KUAM-FM	93.9	Bayamon	WRSJ-FM	100.7	WQYE-FM	94.1	VIRGIN ISLANDS			
PUERTO RICO			Carolina	WVOZ-FM	100.7	WLEO-FM	101.9	St. Croix, Christiansted	WIVI-FM	99.5	
Arecibo	WCNN-FM	104.3	Corozal	WORO	92.5	WPAB-FM	93.3	Christiansted, St. Croix	WIVI-FM	99.5	
	WNIK-FM	107.3	Fajardo	WMDO-FM	96.5	WIPR-FM	91.3				
			Guayama	WXR-FM	96.5	WIAF-FM	102.3				
			Mayaguez	WKJB-FM	99.1	WITA-FM	107.7				

Canadian AM Stations by Location

Location	C.L.	kHz	Location	C.L.	kHz	Location	C.L.	kHz	Location	C.L.	kHz
Abbotsford, B.C.	CFVR	1240		CKCM	620	Orillia, Ont.	CFOR	1570	Sherbrooke, Que.	CHLT	630
Alma, Que.	CFGT	1270		CJCN	680	Oshawa, Ont.	CKLB	1350		CKTS	900
Altona, Man.	CFAM	1290	Gravelbourg, Sask.	CFRG	710	Ottawa, Ont.	CBQ	910	Simcoe, Ont.	CFRS	1560
Amherst, N.S.	CKDH	900		CFGR	1230		CBQF	1250	Smiths Falls, Ont.	CJET	630
Amos, Que.	CHAD	1340	Guelph, Ont.	CJOY	1460		CFRA	580	Smithers, B.C.	CFBV	1230
Antigonish, N.S.	CJFX	580	Halifax, N.S.	CBH	860		CKOY	1310	Sorel, Que.	CJSO	1320
Barrie, Ont.	CKBB	950		CHNS	960		CKPM	1440	Stratford, Ont.	CJCS	1240
Bathurst, N.B.	CKBK	1360		CJCH	920	Owen Sound, Ont.	CFOS	560	Steinbach, Man.	CHSM	1250
Belleville, Ont.	CJBQ	800	Hamilton, Ont.	CHML	900	Parry Sound, Ont.	CKAR-1	1340	Stevensville, Nfld.	CFSK	910
Blind River, Ont.	CJNR	730		CKOC	1150	Peace River, Alta.	CKYL	610	Sudbury, Ont.	CHNO	900
Brampton, Ont.	CHIC	790		CHIQ	1280	Pembroke, Ont.	CHOV	1350		CKNO	900
Brandon, Man.	CKX	1150	Hauterive, Que.	CHLC	580	Pentticon, B.C.	CKOK	800	Summerside, P.E.I.	CKSO	790
Brantford, Ont.	CKPC	1380	Huntsville, Ont.	CKAR	630	Peterborough, Ont.	CHEX	980	Swift Current, Sask.	CJRW	1240
Bridgewater, N.S.	CKBW	1000	Hull, Que.	CKCH	970		CKPT	1420	Sydney, N.S.	CHBI	1400
Brockville, Ont.	CFJR	1450	Inuvik, N.W.T.	CKAK	860	Pointe Claire, Que.	CFQX	1470		CHER	950
Burns Lake, B.C.	CFLD	1400	Joliette, Que.	CJLM	1350	Portage La Prairie, Man.	CFRY	920		CJCB	1270
Cabano, Que.	CJAF	1240	Jonquiere, Que.	CKRS	590		CFYV	1240	Terrace, B.C.	CFTK	950
Calgary, Alta.	CBR	1010	Kamloops, B.C.	CFJC	910	Port Alberni, B.C.	CJAV	1240	Thetford Mines, Que.	CKLD	1230
	CFAC	960	Kapuskasing, Ont.	CKAP	580	Port Arthur, Ont.	CFPA	1230	Thompson, Man.	CHTM	610
	CFCH	1060	Kelowna, B.C.	CKOV	630		CKPR	580	Trois-Rivières, Que.	CHLN	550
	CHQR	810	Kenora, Ont.	CJRL	1220	Prince Albert, Sask.	CKBI	900		CKTR	1150
	CKXL	1140	Kentville, N.S.	CKEN	1350	Prince George, B.C.	CKPG	550	Tillsonburg, Ont.	CKOT	1510
Callander, Ont.	CFCH	600	Kingston, Ont.	CFRC	1490	Prince Rupert, B.C.	CFPR	860	Timmins, Ont.	CFCL	620
Cambell River, B.C.	CFWB	1490		CKLC	1380		CHTK	560	Toronto, Ont.	CHBN	680
Campbellton, N.B.	CKNB	950		CKWS	960	Quebec, Que.	CBV	980		CFBL	740
Camrose, Alta.	CFWG	790	Kirkland Lake, Ont.	CKJL	560		CHRC	900		CHFI	680
Causapscal, Que.	CJEB	1450	Kitchener, Ont.	CKHY	1490		CHRC	900		CHIN	1540
Charlottetown, P.E.I.	CFCY	630		CKWK	1320	Quesnel, B.C.	CKCV	1280		CHUM	1050
Chatham, Ont.	CFCO	630	Kittimat, B.C.	CKTK	1230	Red Deer, Alta.	CKRD	550		CJBC	860
Chicoutimi, Que.	CBJ	1580	Langley, B.C.	CJJC	850	Regina, Sask.	CKBK	540		CKEY	590
	CJMT	1420	La Pocatiere, Que.	CHGB	1310		CJME	1300		CKFN	1430
Chilliwack, B.C.	CHWK	1270	La Sarre, Que.	CKLS	1240		CKCK	620	Trall, B.C.	CJAT	610
Chilliwack, Man.	CHFC	1230	La Tuque, Que.	CFLM	1240		CKCR	980	Truro, N.S.	CKCL	600
Cobourg, Ont.	CHUC	1450	Leamington, Ont.	CJSP	710	Revelstoke, B.C.	CKCR	1340	Val d'Or, Que.	CKVD	900
Collingwood, Ont.	CKGB	1400	Lethbridge, Alta.	CHEC	1090	Richmond Hill, Ont.	CFGM	1310	Valleyfield, Que.	CFVY	1370
Corner Brook, Nfld.	CBY	990		CJOC	1220	Rimouski, Que.	CJBR	900	Vancouver, B.C.	CBU	990
	CFCB	570	Lindsay, Ont.	CKLY	910	Rivière du Loup, Que.	CJFP	1400		CFUN	1410
Cornwall, Ont.	CFML	1110	Lloydminster, Alta.	CKSA	1080	Roberval, Que.	CHRL	910		CFUN	1410
	CJSS	1220	London, Ont.	CFPL	980	Rosetown, Sask.	CKRR	1330		CJOR	600
Courtenay, B.C.	CFCP	1440		CKSL	1410	Rouyn, Que.	CKRN	1400		CKLG	730
Cranbrook, B.C.	CKEK	570	Marystown, Nfld.	CHCM	560	Ste. Anne de la Pocatiere, Que.	CHGB	1310	Verdun, Que.	CKVL	850
Dartmouth, N.S.	CFDR	790	Matane, Que.	CKCB	1250	St. Boniface, Man.	CKSB	1050	Vernon, B.C.	CJIB	940
Dauphin, Man.	CKDY	730	Medicine Hat, Alta.	CHAT	1270	St. Catharines, Ont.	CKTB	610	Victoria, B.C.	CFAX	1070
Dawson Creek, B.C.	CJDC	1350	Middleton, N.S.	CKAD	1490	St. Hyacinthe, Que.	CKBS	1240		CFOW	900
Drumheller, Alta.	CJCV	910	Midland, Ont.	CKMP	1230	St. Jean, Que.	CHRS	1090		CKDA	1270
Drummondville, Que.	CHRD	1340	Moncton, N.B.	CKBA	1300	St. Jerome, Que.	CHRS	1090	Victoriaville, Que.	CFDA	1330
Dryden, Ont.	CKDR	900		CKCW	1220	Saint John, N.B.	CKBD	1110	Ville Marie, Que.	CKVM	710
Duncan, B.C.	CKAY	1500	Mont Laurier, Que.	CKML	610	St. John's Nfld.	CKBN	640		CKRB	1460
Edmonton, Alta.	CKBX	1240	Montreal, Que.	CKMB	690		CJDN	930		CJWA	1240
	CFRN	1260		CKBM	940		VOAR	1230	Wawa, Ont.	CHOW	1470
	CHED	630		CKCF	600		VOCM	390	Welland, Ont.	CFSL	1340
	CHFA	680		CKFB	1410	St. Joseph d'Alma, Que.	CFGT	1270	Whitby, Ont.	CFWH	570
	CHQT	1110		CJAD	800	St. Thomas, Ont.	CHLO	880	Williams Lake, B.C.	CKLW	1240
	CJCA	930		CJMS	1280	Sackville, N.B.	CKBA	1070	Windsor, N.S.	CFAB	1450
Edmundston, N.B.	CKUA	580		CKAC	730	Saint John, N.B.	CKBD	1110	Windsor, Ont.	CKBE	1550
Estevan, Sask.	CJEM	570		CKLM	1570		CFBC	930		CKLW	800
Flin Flon, Man.	CFAR	590	Moose Jaw, Sask.	CKGM	980		CHSJ	1150		CKWW	580
Fort Frances, Ont.	CFOB	800	Nanaimo, B.C.	CKHB	800	Salmon Arm, B.C.	CKSR	580	Wingham, Ont.	CKNX	920
Fort Simpson, N.W.T.			Nelson, B.C.	CKLN	1390	Sarnia, Ont.	CHOK	1070	Winnipeg, Man.	CBW	990
	CFMR	1490	New Carlisle, Que.	CHNC	610	Saskatoon, Sask.	CFNS	1170		CJQM	1470
Fort St. John, B.C.	CKNL	560	Newcastle, N.B.	CKMR	790		CFQC	600		CKRC	330
Fort William, Ont.	CJLX	800	New Glasgow, N.S.	CKEC	1320		CKOM	1250		CKY	580
Fredericton, N.B.	CFNB	550	New Westminster, B.C.			Sault Ste. Marie, Ont.	CJIC	1050	Woodstock, N.B.	CJGJ	920
	CFNT	1110		CKNW	980		CKCY	920	Woodstock, Ont.	CKOX	1340
Galt, Ont.	CBG	1450	Niagara Falls, Ont.	CJNR	1600	Savona, B.C.	CFMM-FM-1	104.3	Victoria, B.C.	CFMS	98.5
Gander, Nfld.	CFGB	1340	North Battleford, Sask.	CJNB	1050	Sherbrooke, Que.	CHLT-FM	102.7	Winnipeg, Man.	CKQM-FM	94.3
Goose Bay, Nfld.	CFGB	1340				Sudbury, Ont.				CBW-FM	98.3
Granby, Que.	CHFE	1450	North Vancouver, B.C.	CKLG	730	Sydney, N.S.	CJCB-FM	94.9		CKY-FM	92.1
Grande Prairie, Alta.	CFGP	1050	Oakville, Ont.	CHWO	1250						
Grand Bank, Nfld.	CJOX	710				Schefferville, Que.	CBDR	1230			
Grand Falls, Nfld.	CBT	540				Sept-Isles, Que.	CKCN	560			
						Shawinigan, Que.	CKSM	1220			

Canadian FM Stations by Location

Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz
Belleville, Ont.	CJBQ-FM	97.1	CKWS-FM	96.3	Port Arthur, Ont.	CKPR-FM	94.3	Tillsonburg, Ont.	CKOT-FM	100.5	
Brampton, Ont.	CHIC-FM	102.1	CKHY-FM	96.7	Quebec, Que.	CHRC-FM	98.1	Timmins, Ont.	CKGB-FM	94.5	
Brandon, Man.	CKX-FM	96.1	La Pocatière, Que.	CHGB-FM	102.9	Red Deer, Alta.	CKRO-FM	98.9	Toronto, Ont.	CBG-FM	98.1
Brantford, Ont.	CKPC-FM	92.1	Lethbridge, Alta.	CHGB-FM	102.9	Regina, Sask.	CFMQ-FM	92.1		CHFI-FM	98.1
Calgary, Alta.	CHFM-FM	95.9		CHEC-FM	100.9	Rimouski, Que.	CJBR-FM	101.5		CHUM-FM	104.5
Clearwater, B.C.				CFPL-FM	100.9	Saint John, N.B.	CFBC-FM	98.9		CJRT-FM	91.1
	CFMM-FM-2	92.7	London, Ont.	CFB-FM	103.9	Saskatoon, Sask.	CFMC-FM	103.9		CKFM-FM	99.9
Cornwall, Ont.	CJSS-FM	104.5	Merritt, B.C.	CFB-FM	103.9		CJUS-FM	89.7	Truro, N.S.	CKCL-FM	100.9
Edmonton, Alta.	CFRN-FM	100.3	Montreal, Que.	CFB-FM	95.1	Sault Ste. Marie, Ont.			Vancouver, B.C.	CHQM-FM	103.5
	CJCA-FM	98.5		CBM-FM	100.7		CJIC-FM	100.5		CKGL-FM	99.3
Halifax, N.S.	CKUA-FM	98.1		CFCF-FM	92.5		CKCY-FM	104.3	Verdun, Que.	CKVL-FM	96.9
Hamilton, Ont.	CHNS-FM	96.1		CJFM-FM	95.9	Savona, B.C.	CFMM-FM-1	104.3	Victoria, B.C.	CFMS-FM	98.5
Kamloops, B.C.	CFMM-FM	98.3		CJMS-FM	94.3	Sherbrooke, Que.	CHLT-FM	102.7	Windsor, Ont.	CKLW-FM	93.9
Kelowna, B.C.	CJOV-FM	104.7		CKGM-FM	97.7	St. Catharines, Ont.			Winnipeg, Man.	CJOB-FM	97.5
Kentville, N.S.	CKWM-FM	97.7	Oshawa, Ont.	CKGM-FM	97.7		CKTB-FM	97.7		CBW-FM	98.3
Kingston, Ont.	CFRC-FM	91.9	Ottawa, Ont.	CKBO-FM	103.3	Sudbury, Ont.	CKSO-FM	92.7		CKQM-FM	94.3
	CKLC-FM	98.3		CFMO-FM	93.9	Sydney, N.S.	CJCB-FM	94.9		CKY-FM	92.1
			Pentlton, B.C.	CKOK-FM	97.1						

White's World-Wide Shortwave Stations

■ **Noticing** that a number of the reader reports we receive at DX Central are lacking in a few of the basics, we thought that this might be a good opportunity to briefly hash over a couple of the musts.

Would you believe that each issue finds a number of reports filed in the *circular file* because the listeners who sent them in forgot to include the time that the station was heard? Alas, too true. How many reports do you think we receive which show a time heard, but don't indicate the time system? Yup, plenty of reports show a time heard as, say, "1425." Great, but 1425 doesn't mean very much unless it says somewhere that it's GMT, EST, PST, or whatever (by the way, we prefer GMT here).

Nobody expects that all DX monitors have frequency measuring gear (although some do), but it's sort of tough making use of a report which indicates something as generalized as "41-meter band" as the frequency of a station heard. Even saying "6-MHz band" is a bit fuzzy. Okay, your receiver isn't too accurate, but try to at least get as close—like "6.2 MHz."

Station identification? Well if you say "Sweden" we'll know that you mean "Radio Sweden" because that's about the only station to be heard on the SWBC bands from that country. "Brazil" or "Mexico" mean little or nothing because there are scores of different stations to be heard from these countries. We need to know some specific data on the exact station heard (especially Central and South American broadcasters).

In other words, send us as much detailed and specific information as you can. Let us sort through it and eliminate any facts we don't need—we would rather have too much than too little.

It's a sobering fact to learn that more than half of the reports we receive are utterly useless. We want your reports, but sending us vague facts is a waste of your time and ours.

In your report to us please indicate the name and/or call of the station, the location, the approximate frequency, and the time in (GMT) monitored. Send as many as you like. We will use as many as space will allow.

kHz	Call	Name	Location	GMT
2149	—	V. of West	Lisbon, Portugal	0815
2410	4VU	R. Lumiere	Pt. au Prince, Haiti	1000

90-Meter Band—3200 to 3400 kHz

3204	—	Nigerian BC	Ibadan, Nigeria	0520
3210	—	R. Sol	Higüey, Dom. Rep.	2300
3245	—	R. Monte-Ceneri	Dom. Rep.	2230
3268	—	R. Timor	Timor	1500
3280	—	Windward I. BC	St. Georges, Grenada	2200
3304	VL8BD	R. Daru	New Guinea	0700
3305	YVKK	V. de la Patria	Caracas, Venez.	0015
3315	—	R. Gazeta	Alagoas, Brazil	0200
3325	YVRA	R. Monagas	Maturin, Venez.	0040
3335	VL9CD	R. Wewak	Papua	1100
3346	—	R. Zambia	Lusaka, Zambia	0415
3380	—	West. Nigerian BC	Ibadan, Nigeria	2200
3385	—	R. Rabaul	New Guinea	0615
3396	—	Nigerian BC	Kaduna, Nigeria	2150
3824	—	R. Maseru	Maseru, Lesotho	0700
3980	—	Nigerian BC	Enugu, Nigeria	0500
3985	9UB92	R. Cordac	Bujumbura, Burundi	0400
4710	VQO4 ZYF24	Solomon I. BC R. Maranhao	Honiara, Sol. Is. Sao Luiz, Brazil	0845 0215

60-Meter Band—4750 to 5060 kHz

4770	ELWA	R. Village	Monrovia, Liberia	2215
4775	—	R. Kabul	Kabul, Afghanistan	1515
4780	HIAS	Onda Musical	Sto. Domingo, Dom. Rep.	0300
4783	—	R. Mali	Bamako, Mali	2240
4795	—	R. Comercial	Se da Banderia, Angola	2305
4810	—	R. S. Africa	Paradys, S. Africa	0430
4815	—	R. Ouagadougou	Ouagadougou, Up. Volta	2140
4820	CR6RZ	R. Angola	Luanda, Angola	2235

4835	—	R. Mali	Bamako, Mali	0600
4850	—	R. Malaysia	Sarawak	1330
4855	—	East. Nigerian BC	Enugu, Nigeria	2135
4870	—	R. Dahomey	Cotonou, Dahomey	2130
4880	—	R. Congo	Leopoldville, Congo	2135
4890	YVKB	R. Venezuela	Caracas, Venezuela	0100
4900	YVNK	R. Juventud	Caracas, Venezuela	0300
4910	HIN	R. HIN	Sto. Domingo, Dom. Rep.	0230
4920	VLM4	Australian BC	Brisbane, Australia	1110
4930	YVOT	R. Junin	San Cristobal, Venez.	0330
4940	—	R. Abidjan	Abidjan, Ivory Coast	0600
4945	HJCW	E. Suramerica	Bogota, Colombia	0350
4950	—	R. Malaysia	Sarawak	1230
4955	—	R. Catar	Portoviejo, Brazil	0200
4965	—	R. Zambia	Lusaka, Zambia	1830
4967	—	R. Kuwait	Kuwait	1600
4970	YVLK	R. Rumbos	Caracas, Venezuela	0255
4980	YVOC	Ecos del Torbes	San Cristobal, Venez.	2300
4985	—	R. Malaysia	Sarawak	1100
4990	YVMO	Nigerian BC	Lagos, Nigeria	0530
4995	—	R. Barquisimeto	Barquisimeto, Venez.	1012
4995	ZYY2	R. Brazil Central	Goiana, Brazil	0550
5005	OAX2S	R. Jaen	Jaen, Peru	0300
5010	—	R. Garoua	Garoua, Cameroon	2140
5015	YVRW	R. Bocono	Caracas, Venezuela	0415
5015	—	R. Vladivostok	Vladivostok, USSR	1010
5020	4VGS	R. Independence	Gonaives, Haiti	2330
5025	—	R. Malaysia	Kuala Lumpur, Malaysia	1100
5035	HROE	V. de las Fronteras	Tegucigalpa, Hond.	1200
5037	—	R. Malaysia	Sarawak	1135
5040	—	R. Tbilisi	Tbilisi, USSR	0155
5045	ZK5	R. Rarotonga	Rarotonga, Cook Is.	0510
5047	—	R. Lome	Lome, Togo	2100
5050	—	R. Tanzania	Dar es Salaam, Tanzan.	1600
5180	—	R. Atlantida	Iquitos, Peru	0200
5917	—	Bizim R.	(clandestine)	2030

kHz	Call	Name	Location	GMT	kHz	Call	Name	Location	GMT
49-Meter Band—5950 to 6200 kHz					31-Meter Band—9500 to 9775 kHz				
5954	TIQ	R. Casino	Puerto Limon, C.R.	1105	9500	—	Bizim R.	(clandestine)	2030
5960	—	Trans World R.	Bonaire, N.W.I.	0430	9505	—	R. Prague	Prague, Czech.	0930
—	DMQ5	Deutsche Welle	Cologne, W. Germ.	0345	9508	—	R. Omdurman	Omdurman, Sudan	0400
5970	HJVN	R. Horizonte	Bogota, Colombia	0400	9510	—	BBC Relay	Ascension I.	0658
5980	—	Lebanese BC	Beirut, Lebanon	1425	9525	OEI49	Austrian R.	Vienna, Austria	0000
5990	—	RAI	Rome, Italy	2020	9540	ZL2	R. New Zealand	Wellington, N.Z.	0645
—	—	R. Sweden	Stockholm, Sweden	0000	9545	DMQ9	Deutsche Welle	Cologne, W. Germ.	2240
6000	—	R. Kabul	Kabul, Afghanistan	0730	9560	—	Vatican R.	Vatican City	2200
6010	—	RAI	Rome, Italy	0100	9570	—	R. Australia	Melbourne, Australia	0730
—	CJCX	CJCX	Sydney, N.C.	0955	9580	—	R. Erevan	Erevan, USSR	0800
6015	—	R. Habana	Havana, Cuba	0730	9600	—	V. America Relay	Monrovia, Liberia	0605
6022	OAX4Q	R. Victoria	Lima, Peru	1055	—	R. Tashkent	Tashkent, USSR	1400	
6025	CSA52	V. of West	Lisbon, Portugal	0000	9605	DMQ9	Deutsche Welle	Cologne, W. Germ.	1940
6030	CFVP	V. of Praries	Calgary, Alta.	1205	9615	ORU4	R-TV Belge	Brussels, Belgium	2115
6050	—	Vatican R.	Vatican City	0030	9620	—	VTVN	Saigon, S. Vietnam	1230
6055	—	R. Prague	Prague, Czech.	0930	—	—	Trans World R.	Bonaire, N.W.I.	0230
6060	HIAZ	R. Santiago	Santiago, Dom. Rep.	1100	9630	—	RAI	Rome, Italy	0100
6065	—	R. Sweden	Stockholm, Sweden	2015	9640	—	R. Pakistan	Karachi, Pakistan	1945
6070	—	R. Ghana	Accra, Ghana	0300	9645	—	Vatican R.	Vatican City	1400
—	CFRX	CFRX	Toronto, Ont.	1010	9655	—	R. Habana	Havana, Cuba	0730
6080	ZL7	R. New Zealand	Wellington, N.Z.	0645	9675	—	R. South Africa	Capetown, S. Afr.	2326
6082	OAX4Z	R. National	Lima, Peru	0300	9680	—	V. West	Lisbon, Portugal	0000
6090	—	R. Kaduna	Kaduna, Nigeria	0530	—	—	R. Habana	Havana, Cuba	0930
—	VLI6	Australian BC	Sydney, Australia	1025	9700	—	R. Kabul	Kabul, Afghanistan	1830
6095	—	R. Mogadiscio	Mogadiscio, Somalia	1800	9715	—	R. Tirana	Tirana, Albania	0115
6100	DMQ6	Deutsche Welle	Cologne, W. Germ.	0000	9720	—	R. Prague	Prague, Czech.	0110
6105	XEQM	R. Yucatan	Merida, Mex.	0000	9725	4XB51	Kol Zion	Tel Aviv, Israel	2045
6110	—	R. Baku	Baku, USSR	1630	9730	—	Bizim R.	(clandestine)	2030
—	—	R. Ghana	Accra, Ghana	0330	—	—	V. West	Lisbon, Portugal	2015
6120	DMQ6	Deutsche Welle	Cologne, W. Germ.	1940	9735	DMQ9	Deutsche Welle	Cologne, W. Germ.	0345
—	4VE	V. Evangelique	Cap Haitien, Haiti	1030	9740	ORU	R-TV Belge	Brussels, Belgium	1600
6130	—	R. Ghana	Accra, Ghana	0300	—	HCB	V. of Andes	Quito, Ecuador	0530
6135	DMQ6	Deutsche Welle	Cologne, W. Germ.	0555	9755	—	VTVN	Saigon, S. Vietnam	1230
6140	VLW6	Australian BC	Perth, Australia	1030	9760	—	R. Ghana	Accra, Ghana	0430
6150	VLR6	Australian BC	Melbourne, Australia	1115	—	—	R. S. Africa	Capetown, S. Africa	2345
6155	OEI21	Austrian R.	Vienna, Austria	0500	9770	—	Austrian R.	Vienna, Austria	2300
6157	—	R. Tirana	Tirana, Albania	2200	9833	—	V. Evangelique	Cap Haitien, Haiti	1030
6165	—	Swiss BC	Berne, Switz.	0700	9840	—	R. Budapest	Budapest, Hungary	1940
6185	CSA29	V. of West	Lisbon, Portugal	0000	9915	—	R. Baku	Baku, USSR	1600
6190	—	Vatican R.	Vatican City	1915	9950	—	BBC	London, England	1945
6195	—	BBC	London, England	0400	9972	—	R. Peking	Peking, China	1510
6234	—	R. Budapest	Budapest, Hungary	1330	10300	—	R. Peking	Peking, China	2000
6250	EAJ206	R. S. Isabel	Fernando Po	1855	—	—	V. Japan	Tokyo, Japan (?)	1600
7035	—	R. Peking	Peking, China	1100					
7090	—	R. Tirana	Tirana, Albania	2220					
41-Meter Band—7100 to 7300 kHz					25-Meter Band—11700 to 11975 kHz				
7105	—	R. Budapest	Budapest, Hungary	1940	11705	—	R. Sweden	Stockholm, Sweden	1600
7120	VUB	All India R.	Bombay, India	1105	11715	ORU	R-TV Belge	Brussels, Belg.	1600
7130	CSA55	V. of West	Lisbon, Portugal	2015	—	—	R-TV Marocaine	Tangier, Morocco	2230
—	BED7	V. Free China	Taipei, Free China	0250	11740	—	Vatican R.	Vatican City	1400
7165	—	R. Free Europe	Munich, W. Germ.	2235	—	—	V. America Relay	Monrovia, Liberia	0510
7175	—	V. America Relay	Poro, Philippines	1100	11760	—	Lebanese BC	Beirut, Lebanon	0130
7195	VUD	All India R.	New Delhi, India	1045	—	—	R. Vienna	Vienna, Austria	0300
7200	—	R. Kabul	Kabul, Afghanistan	1515	11770	HCB	V. of the Andes	Quito, Ecuador	2030
7205	—	V. America Relay	Thessaloniki, Greece	2200	11780	—	Trans World R.	Bonaire, N.W.I.	2215
7210	—	R. Hanoi	Hanoi, N. Vietnam	1000	—	—	Hashemite BC	Amman, Jordan	0100
7215	—	All India R.	New Delhi, India	2220	11795	ZL3	R. New Zealand	Wellington, N.Z.	2345
7225	—	R. Hanoi	Hanoi, N. Vietnam	1000	—	DMQ11	Deutsche Welle	Cologne, W. Germ.	2240
7225	—	R-TV Marocaine	Sebaa Aïoun, Morocco	2230	11800	—	R. Ghana	Accra, Ghana	2000
7230	—	R. Ouagadougou	Ouagadougou, Up. Volta	0600	11810	—	R. Sweden	Stockholm, Sweden	1400
7240	—	RAI	Rome, Italy	2115	11820	—	R. Tahiti	Papeete, Tahiti	0200
7245	OEI33	Austrian R.	Vienna, Austria	0600	11823	—	R. Jor. Comercio	Recife, Brazil	2330
7250	—	Vatican R.	Vatican City	1815	11825	BED69	V. Free China	Taipei, Free China	0250
7265	—	R. Tirana	Tirana, Albania	0530	11830	4VEH	V. Evangelique	Cap Haitien, Haiti	1030
—	—	Trans World R.	Monte Carlo, Monaco	1400	11835	—	Vatican R.	Vatican City	1800
7270	—	R. Sweden	Stockholm, Sweden	2245	11840	CSA31	V. West	Lisbon, Port.	0815
7275	—	RAI	Rome, Italy	2020	11845	—	V. Japan	Japan (?)	1000
7290	—	Trans World R.	Monte Carlo, Monaco	1400	11855	—	R. Habana	Havana, Cuba	1855
7345	—	R. Prague	Prague, Czech.	0105	11890	—	Swiss BC	Berne, Switz.	1220
9009	—	Kol Zion	Tel Aviv, Israel	2045	11895	ORU	BBC Relay	Singapore	0000
9295	PRN9	R. Seguranc	Rio de Janeiro, Braz.	0120	11900	—	R-TV Belge	Brussels, Belg.	2115
9360	—	R. Tirana	Tirana, Albania	0530	11910	HCB	Swiss BC	Berne, Switz.	1515
					11925	—	V. Andes	Quito, Ecuador	0900
					11930	—	Tashkent R.	Tashkent, USSR	1400
					11975	VUD	R. Habana	Havana, Cuba	2110
					12065	—	All India R.	New Delhi, India	1945
					14520	—	West Indies BC	St. Georges, Grenada	0005
					15080	—	R. Peking	Peking, China	2000
						—	Korean Cent. BC	Pyongyang, N. Korea	0100
						—	R. Euzkadi	(clandestine)	2230

kHz Call Name Location GMT

19-Meter Band—15100 to 15450 kHz

15105	—	BBC Relay	Ascension I.	1800
15110	ZL21	R. New Zealand	Wellington, N.Z.	2345
15115	HCJB	V. Andes	Quito, Ecuador	2030
15120	—	Vatican R.	Vatican City	1400
15125	BED60	V. Free China	Taipei, Free China	0250
15145	ZYK33	R. Jor. Comercio	Recife, Brazil	2330
—	HCJB	V. Andes	Quito, Ecuador	2000
15155	—	R. Habana	Havana, Cuba	0730
15160	TAU	V. Ankara	Ankara, Turkey	1830
—	OZF7	R. Denmark	Copenhagen, Den.	1600
15235	—	Swiss BC	Berne, Switz.	1330
15250	—	R. Euzkadi	(clandestine)	2230
15255	—	Swiss BC	Berne, Switz.	1515
15270	—	R. Kabul	Kabul, Afghanistan	1830
15285	—	R. Ghana	Accra, Ghana	1645
15305	—	Swiss BC	Berne, Switz.	1515
15310	—	BBC Relay	Ascension I.	0700
15320	HCJB	V. Andes	Quito, Ecuador	1800
15325	—	Lebanese BC	Beirut, Lebanon	2300
15330	—	R. Ceylon	Colombo, Ceylon	0700
15340	—	R. Tanzania	Dar es Salaam, Tanz.	1600
15345	BED49	V. Free China	Taipei, Free China	0250
15350	—	Lebanese BC	Beirut, Lebanon	1830
15365	—	R. Canada	Montreal, Que.	1215
15410	OE166	Austrian R.	Vienna, Austria	2240
15430	—	Austrian R.	Vienna, Austria	0000

kHz Call Name Location GMT
15440 WNYW R. N.Y. Worldwide New York, N.Y. 0000

16-Meter Band—17700 to 17900 kHz

17755	WNYW	R. N.Y. Worldwide	New York, N.Y.	1630
17820	TAV	R. Ankara	Ankara, Turkey	1415
17830	—	Swiss BC	Berne, Switz.	1330
17840	WNYW	R. N.Y. Worldwide	New York, N.Y.	2000
—	—	R. Sweden	Stockholm, Sweden	1400
—	—	V. West	Lisbon, Port.	0730
17850	—	R. Ceylon	Colombo, Ceylon	0915
17870	—	R. Habana	Havana, Cuba	2140
17880	HCJB	V. Andes	Quito, Ecuador	1800
17890	—	R. Budapest	Budapest, Hungary	1940
—	CSA46	V. West	Lisbon, Port.	0815
—	BED40	V. Free China	Taipei, Free China	0250
17910	—	R. Ghana	Accra, Ghana	1330
17950	—	R. Pakistan	Karachi, Pakistan	1335

13-Meter Band—21450 to 21750 kHz

21485	WNYW	R. N.Y. Worldwide	New York, N.Y.	1200
21495	CSA67	V. West	Lisbon, Port.	0730
21520	—	Swiss BC	Berne, Switz.	1330
21545	—	R. Ghana	Accra, Ghana	1815
21590	—	BBC	London, England	1415

Sonotone CDM-80 Mike

Continued from page 61

mike and a budget "cardioid" type resulted in severe echo, making the resultant recording most unpleasant.

Naturally, the CDM-80's cardioid response will improve straight speech pickup for Hams and CBers by reducing the mike's sensitivity to extraneous noises.

Frequency Response. The CDM-80's frequency response is rated, by modern standards, for speech—80 to 10,000 Hz. While it does not have the so-called "music range" of 50 to 15,000 Hz, what there is, is exceptionally clean. In fact, the distortion checked out considerably below that of low-cost hi-fi mikes, which have a wide response but very high relative distortion.

The CDM-80 is one of the most pop-proof mikes we've run across. With the mike against the lips, and the level at a shout, there was just a trace of popping on the *p*'s, *d*'s, *r*'s, etc. This is a definite advantage in home recording where the mike often gets "swallowed."

Name Your Impedance. The CDM-80's output impedance is designed for both the amateur and professional recordist. The output cable, of which 15 feet is supplied, has three leads plus a shield. By using the appropriate leads, the mike's output impedance is either 200 ohms balanced, 200 ohms unbalanced, or 50,000 ohms.

Of course, even the amateur recordist will find the low-impedance output of value, particularly for long cable runs. To avoid hum and noise pick-up in the cable, the 200-ohm balanced output can be used, with a low-to-high-impedance transformer at the end of the cable.

The Output Level. The CDM-80's rated output level of -59 db is considerably less than the output level of the inexpensive mikes supplied with many recorders. Nonetheless, it is approximately that of any other good-quality microphone.

A desk stand, the model CMS-10, priced at \$5.25, is optional. The supplied microphone holder, actually a *lavalier*, is a total disaster. Worn around the neck, the holder makes the mike stick out at right angles, almost as if someone stabbed the user with the mike.

Summing Up. While the CDM-80 does not have a "music" frequency response, it is most suitable as a general-purpose home microphone, performing exceptionally well on speech and most pleasantly on musical instruments (not hi-fi, but very clean and smooth quality). The cardioid pattern more than makes up for the deficiency in frequency response: music recordings made with the CDM-80 in the home often surpassed those made with a hi-fi omnidirectional microphone.

With a user net (list) price of \$43.50, the CDM-80 is recommended as a "replacement microphone." Additional information can be obtained by writing Sonotone Corp., Dept. RG, Elmsford, N.Y. 10523. ■

Chirp Chucking

Continued from page 72

Bad Rock. A defective crystal also can be a cause of chirp—a crack in the crystal, or a crystal that is dirty or loose in its holder. A cracked crystal cannot be repaired; you'll have to throw it away. A dirty crystal, on the other hand, can be cleaned with alcohol.

Sometimes an operator will open the case and remove a crystal from its holder—rubbing the crystal blank lightly with a soft pencil to lower its frequency. This works, but sometimes it causes poor electrical contact between the crystal and the holder. The result is an intermittent or unstable oscillator. A modified crystal may take spells of oscillating at *both* its "old" and "new" frequencies, or it may jump unpredictably from one to the other. This can really produce a queer-sounding signal!

Listen! How can you know if you have chirp? The only way to know for sure is to monitor your own transmitted signal. If each dot and dash is a steady whistle, your signal

is clean. But if it makes a sound that you might call a *yelp* or a *burp*, you have chirp.

The best way to monitor your CW signal is in your own receiver. Instead of muting your receiver when you transmit, leave the receiver *alive* so you can hear your own signal just like the other guys are hearing it. Make sure, though, that the wire from the antenna terminals on the back of the receiver to the antenna relay is very short. This wire acts as an antenna and picks up some of the transmitted signal. If this signal coming into the receiver when you transmit is too strong, it may burn out the antenna coil on your receiver.

It's a good idea, too, to reduce the input signal to the receiver with the receiver's RF gain control. This will help protect the input stage of the receiver as well as protect your own ears from the strong blast of your own signal!

This method of monitoring will also tell you if you are operating on the same frequency as the operator to whom you are talking. If your note has the same pitch as his, you are on the same frequency. If not, you are near his frequency, but not right on it.

RF Monitor. In working DX, you sometimes deliberately get on a frequency different from the station you are calling, so you will need a different system for monitoring your own signal. Such a system, used by many CW operators, is an RF monitor. This is a tiny, broad-tuned receiver, housed in a small box placed near the transmitter.

The RF monitor picks up the strong RF signal from the transmitter near it, regardless of frequency, and converts this signal to an audio tone. Some RF monitors have their own small speaker, while others have only enough audio power to operate headsets.

An RF monitor will allow you to hear your own signal, just as it is going on the air, regardless of whether you have your receiver tuned to your transmitter frequency or not.

Either method of monitoring will tell you immediately if your rig chirps. An important side benefit, of course, is that a monitor will help you send better code because you will be listening to your own sending.

This sums up the main causes of chirp; how to detect chirp; what to do about it if you find it. Armed with this information, you should be able to maintain your signal as one of the cleanest on the air. Remember: chirp belongs in a bird cage, not in a Ham transmitter! ■

CHIRP-CHUCKERS CHECK LIST

Trouble	Look For
Unstable DC-supply voltage	Defective VR tube or Zener diode.
	Defective series resistor in regulator circuit.
	Weak or open power-supply filter capacitors.
	Open power-supply bleeder resistor.
	Lack of any voltage regulation for oscillator power supply.
Unstable AC power-line voltage	Improperly tuned transmitter or improperly loaded antenna.
	Overloaded wall plug or house wiring.
	Poor plug-in contacts or dirty fuse contacts.
	Poor wiring connections or corroded splices.
Erratic oscillator operation	Defective oscillator tube.
	Dirty or loose oscillator switch contacts.
	Insecure oscillator housing.
	Loose oscillator capacitor, coil, or coil tuning slug.
	Defective or dirty crystal.

Heat Detector

Continued from page 59

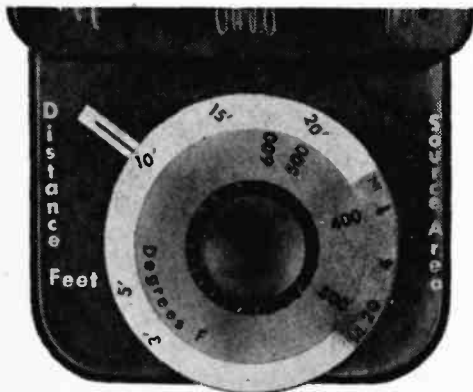
has stabilized (the thermometer hasn't changed its indication for five minutes or more), you're ready to start on your calibration chart or direct-reading dial. You can make a simple table or a series (or family) of curves on a graph. Once you have the table you can make either of the two graphs—or both of them.

To make an accurate calibration chart you'll need a finely graduated dial. If you don't want to go to the expense of a 10-turn precision potentiometer and a 10-turn counting dial, the next best choice is a vernier dial like the National AM-6 which is calibrated around 270 degrees of its circumference. The direct-reading dial eliminates that additional cost, but the temperature calibration won't be as accurate.

With the temperature of the heat source stabilized at some temperature, start at the most distant marker and make your temperature readings and record the *Temperature* knob readings as on the chart. Differences in the bolometer, transistor, reflector, and even potentiometers make it necessary to calibrate each pyrometer individually.

With your complete set of calibration charts you'll be able to take temperature readings of objects that would be all but impossible to attach a thermometer to—because of their shape or their inaccessibility.

Direct Reading Dial. To make temperature measurement easier a computing dial



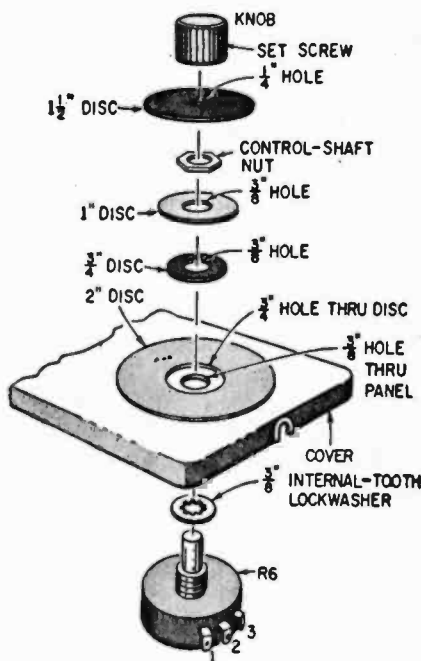
Direct-reading dial shows major calibration points. Additional points can be indicated to increase accuracy of readings.

can be made. Temperature readings are then as simple as making exposure readings with a photographic lightmeter. The construction and calibration of the dial itself is probably the most difficult part of the whole project, since it computes (like a circular slide rule) three variables:

- 1) the radiation temperature of the heat source (in degrees F);
- 2) The distance from the heat source (in feet);
- 3) the heat-radiating area of the source (in square inches).

For calibration purposes you have control over all three, but during actual measurements you only know two—the distance, and the area of the target.

Where To Start. First you'll have to make discs—one about 2-in., the other about 1½-in. in diameter. The smaller one is cemented to the knob of R6. The temperature calibrations can be placed on the smaller disc using readings plotted on the calibration chart—first transferring them to polar-coordinate graph paper. Or you can mark them directly on the knob without first making a calibration chart (though this is more difficult and less accurate).



Construction and assembly of the direct-reading dial is not difficult. Cut discs from thin plastic or heavy paper stock.

★★FREE—Set of four prepared dial scales. See page 33!★★

The 2-inch Disc. At one point on the 2-in. disc indicate the 10-foot-distance calibration point; directly across from it, on the opposite edge of the disc, indicate the 20-square-inch point.

Now mark a line on the metal panel to be used as a pointer to indicate the distance from the heat source. Next you have to mount the 2-in. disc, temporarily, as shown in the drawing. (You'll have to take the disc off if you apply press-on numbers for the calibration markings.)

Set up the pyrometer ten feet from the calibrating heat source and adjust the instrument for a zero reading. Now place the knob-mounted disc on the shaft of R6 so the temperature indicated by the thermometer (measuring the heat source) coincides with the 20-square-inch calibration mark. (The 20-square-inch calibration mark is the index—pointer—for all temperature indications of areas of 20 square inches.)

Of course, if you haven't made a calibration chart and precalibrated the temperature knob (R6), you can place the knob in any position and mark the temperature on the 1½ in. disc. (Follow the directions given under calibration.)

Once you have all the temperature points marked on the 1½-in. disc, you move the pyrometer to a position 15 feet from the calibrating heat source and again adjust for a zero reading on the panel meter—with the heat source at 400 F.

Rotate the 2-in. disc—setting the 20-square-inch calibration mark adjacent to the 400 F temperature marking. The spot on the edge of the 2-in. disc indicated by the line on the panel is the 15-foot calibration. Repeat the procedure for the 5-foot and 20-foot calibrations (and any other distances that you might want in between). Just make sure that the temperature of the calibration heat source remains constant throughout this



Completed unit shows circuit board wrapped in foam and secured with transparent tape.

portion of the calibration procedure.

Area Calibration. This is the simple part. All you have to do is take a large piece (of at least ¼-in. thick) cardboard, fiberboard, plywood, or pressed board and cut a hole 1-in. square in it. Place the shield between the calibrating heat source and the pyrometer and as close to the heat source as possible.

With the pyrometer set up at 10 feet, re-adjust R6 for a zero indication on the meter. Set the 2-in. disc to indicate 10 feet. Next to the 400 F calibration, place (on the 2-in. disc) the calibration mark for 1 square-inch.

Repeat the procedure for 4 square-inches and any other size areas you want for future measurement. It is best to keep the area shields as separate items—one for each size—for those calibration checks that are sure to be made at some later date.

Now you're all set to measure temperature like you've never been able to measure temperature before—from a distance. ■

EICO 378 Generator

Continued from page 80

several instructions left too much up to the builder's judgment. In mounting, some parts weren't precisely identified.

On the other hand, the operating-maintenance manual is very good, particularly with regard to user adjustment and calibration of the output level meter. Incidentally, the manual claims that minimum distortion is

obtained when the 378 is adjusted with a distortion meter, but we found no significant difference between distortion meter and the user-adjustment techniques presented in the manual.

In terms of performance, the 378 is indeed of laboratory quality. And it isn't often that kit test gear can claim to be of lab quality and live up to that claim.

For additional information on the Model 378 Audio Generator, write to EICO, Dept. ME, 131-01 39th Ave., Flushing, N. Y. 11352. ■

Drifting Continents

Continued from page 45

Wilson points out, too, that the ends of the Rio Grande and the Walvis lateral ridges are exactly opposite points on the coasts of South America and Western Africa and could have fitted together at one time. Northern ridges extending from Iceland to Greenland to the continental shelf of Europe could also link in a continental fit.

But even Wilson sought the added assurance that proof by study of rock magnetization could bring. For rocks can give "fixes" like fossilized compasses on the North and South Poles, spotting the continents' locations as they must have existed in line with the poles in different ages. Rocks laid down during the past 50 to 100 million years have magnetizations that generally point due north. Older rocks do not.

Formed of sediment, mud, sand, and pieces of iron or titanium, rocks lay in the earth's magnetic field. As they cool, they

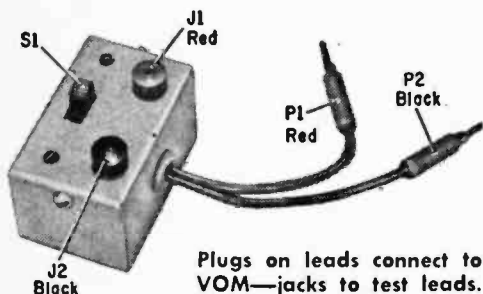
ultimately take on the character of history books. For centuries later, they still reveal the latitude and orientation of the land where they lay at the time of their formation.

Looking Ahead. Today, scientists measuring the magnetization of rocks known to have been formed in the period the continents were breaking can come to only two conclusions. Either the earth's magnetic field at that time had some mighty peculiar configurations (such as more than two poles), or the continents have definitely drifted apart from each other.

Recently, another group of scientists from the University of Sao Paulo in Brazil and the University of California found some ancient rocks in South America and West Africa they think can decide the issue once and for all. If dating these rocks with radioactive potassium-argon and rubidium-strontium reveals they are the same age, this should clinch the "drift" theory, thereby settling a centuries-old scientific question. Do we live on continents that are conservative, old stay-at-homes? Or are our continents more like the rolling stones that just won't say put? ■

Meter Flip-Flop

Continued from page 78



A slide switch is used in the unit shown in the photos, but a toggle, see-saw, or rotary switch can be used if you wish. If you build your unit in a metal box, as shown here, be sure to use insulating shoulder washers when mounting the two jacks.

For frequent use, or for ease in carrying your test equipment, you can attach the switch box to the side or bottom of your VOM with screws and nuts. Or, it may be kept as a separate unit, connected to the meter only when making DC measurements. In either case, you will find it a very handy addition to your multimeter. ■

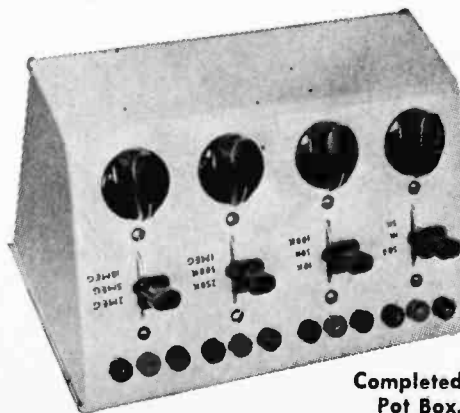
Pot Box

Continued from page 93

wiring of a single section and all remaining sections are wired exactly the same.

The last step is checking the wiring and solder joints. Also, if an ohmmeter is available, it's a good idea to check the resistance values for each switch position to make sure the controls are connected to the output jacks in the order listed in the table.

Having built the Pot Box it's certain that you'll never have a potentiometer shortage around your shop. ■



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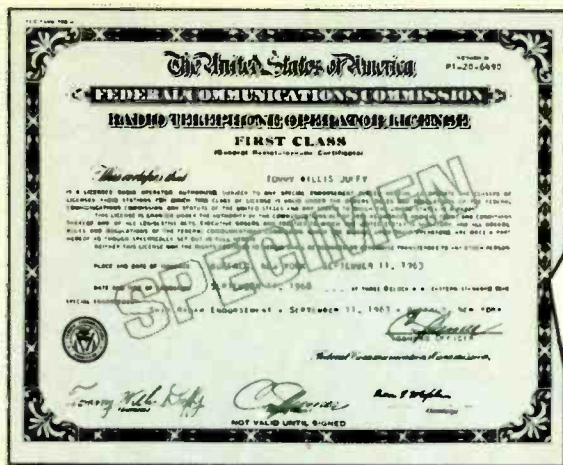
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