New Mars Secrets from Electronics!

RADIO-TV EXPERIMENTER

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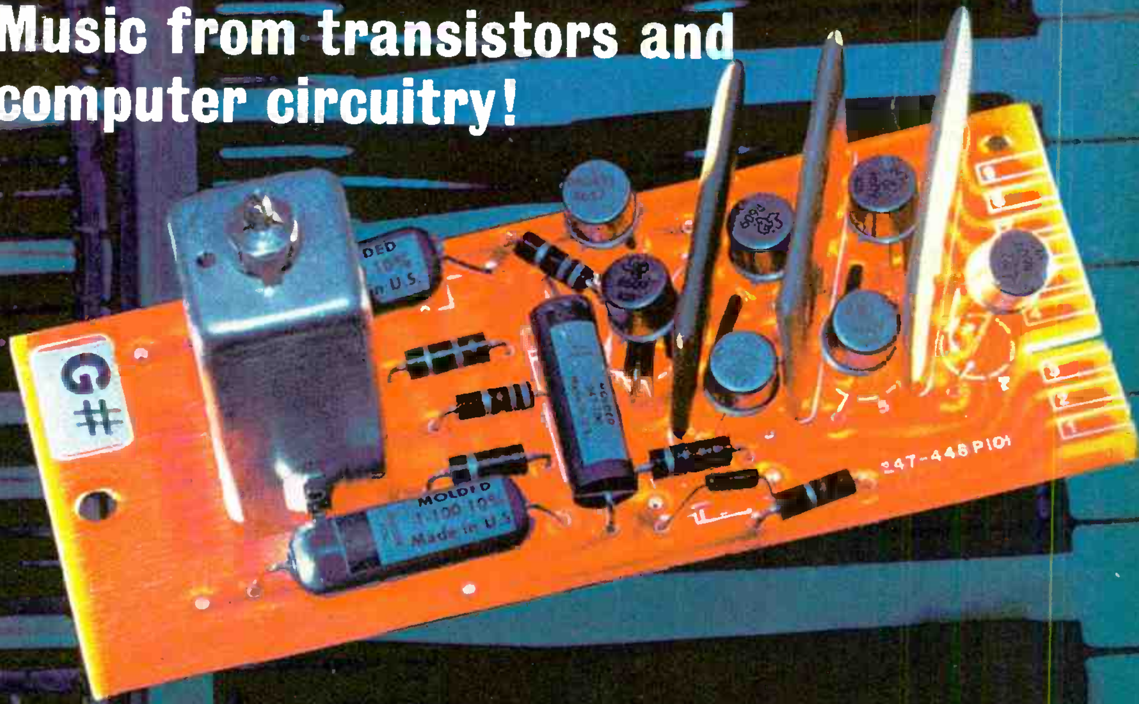
SHORT-WAVE LISTINGS

75¢ JUNE-JULY

Music from transistors and computer circuitry!



TEST REPORTS:

KLH Model 18 Stereo FM Tuner

Knight KN-4000A Tape Transport and Knight KP-70 Preamp

Raymer Model 471 SCA Music Adapter

Build a SWIMIE-TALKIE!

TALK VIA LIGHT BEAM!

$15 SCIENCE FAIR PROJECT

Pep up receiver selectivity with a mechanical filter!

Anyone Can Build These High Quality

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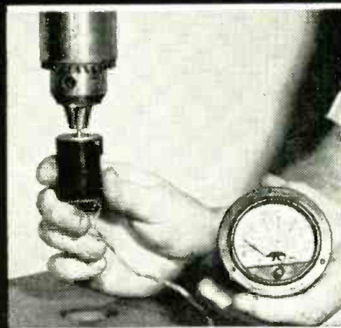
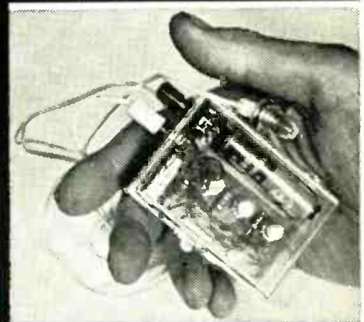
At a Substantial Savings





Precision Decade Resistance Box

Designed so the electronic experimenter can get any value of resistance at 1% accuracy. Made of precision components, this decade box offers such advantages as fast fingertip switching from any resistance value from 1 ohm to 1,111,110 ohms within seconds. Add or subtract as little as 1 ohm with 1% accuracy. And ordinary hand tools are all that's needed to assemble it in less than 2 hours.

All Purpose Shop Tachometer

This tachometer is guaranteed to outperform any $50 tach available today or your money will be refunded. This tach belongs in the tool chest of every machinist, electrician, model maker, motor serviceman and inventor. A six position rotary switch enables you to select three speed ranges in either forward or reverse rotation. Three ranges—0—500, 5000 and 15,000—cover the gamut of rpms in the home workshop or laboratory on machine tools, such as lathe cutting speeds, motor rpm, drilling speeds and other motor driven tools where rpm is an important factor.

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SCIENCE & MECHANICS, KIT DIVISION RTV-45 106
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Decade Box	☐ $24.95 Kit	☐ $29.95 Assembled

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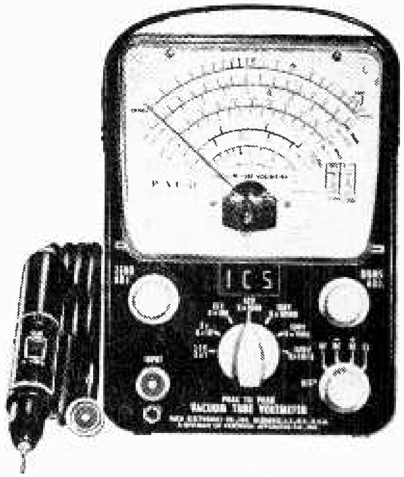

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RADIO-TV EXPERIMENTER

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June-July, 1965

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Some plain talk from Kodak about tape:

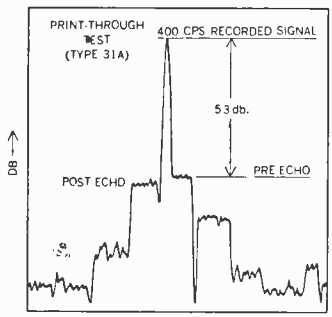
Print-through and sound brilliance

Put a magnet near a piece of iron and the iron will in turn become magnetized. That's print-through. With sound recording tape, it's simply the transfer of magnetism radiating from the recorded signal to adjacent layers on the wound roll. Print-through shows up on playback as a series of pre- and post-echoes.

All agreed. Print-through is a problem. There are some steps you can take to minimize it. You can control the environment in which you keep your tapes, for example. Store them at moderate temperatures and at no more than 50% relative humidity. Also store them "tails out" and periodically take them out for "exercising" by winding and rewinding them. You can even interleave the layers with a non-magnetic material. Any volunteers? A better way is to start with a tape that doesn't print much . . . which leads to low output problems *if* you don't make the oxide coating substantially more efficient.

And this is Kodak's solution. It's not simple, but it works. It starts with the selection of the iron oxide. In order to achieve low print-through, the oxide needles must have the proper crystalline structure. Kodak's oxide needles have that structure . . . offering the highest potential of any oxide currently available.

Milling the oxide ingredients also is very critical. If you mill for too long a time, the needles will be broken up and print-through will be drastically increased. Too short, and the dispersion will be lumpy. But other factors in the milling process are equally important. Like the speed at which the ball mill turns. It can't be rotated too fast, otherwise the needles will be broken up, and broken needles, you know, exhibit horrible print-through behavior. If you rotate the mill too slowly, the oxide and other ingredients will not be blended



uniformly. Other factors such as temperature and the composition and viscosity of the ingredients must also be critically controlled. One more thing. You've got to make sure all the needles end up the same size (.1 x .8 microns).

A very important contributor to low print-through is the binder that holds the oxide particles in suspension. The *chemical composition* of a binder contributes nothing magnetically to a tape's print-through ratio. What a binder *should* do is completely coat each individual oxide needle, thus preventing the particles from making electrical contact. And that is just what our "R-type" binder does. The final step is to take this superb brew and coat it just the right way on the base.

Print-through tests are a million laughs. We record a series of tone bursts . . . saturation, of course. We then cook the tape for 4 hours at 65°C. and then measure the amplitude of the loudest pre- or post-echo. The spread between the basic signal and the print-through is called the signal-to-print-through ratio. The higher the number, the better the results. Most of the general-purpose tapes you'll find have a ratio of 46-50 db. Low-print tapes average about 52 db. You can see from the graph that our general-purpose tape tests out at 53 db., so it functions as both a general-purpose tape and a low-print tape—and at no extra cost. High-output tapes with their thicker coatings have pretty awful print-through ratios—generally below 46 db. Kodak's high-output tape (Type 34A) has something special here, too. A ratio of 49 db—equal to most general-purpose tapes.

KODAK Sound Recording Tapes are available at electronic, camera, and department stores.

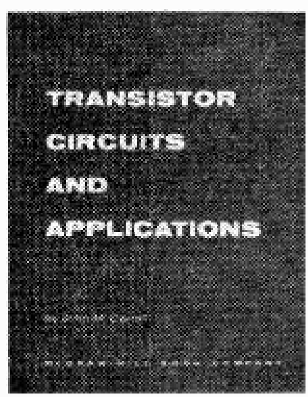
FREE! New comprehensive booklet covers the entire field of tape performance. Entitled "Some Plain Talk from Kodak about Sound Recording Tape," it's free when you write Department 8, Eastman Kodak Company, Rochester, N.Y. 14650.

EASTMAN KODAK COMPANY, Rochester, N. Y.

BOOKMARK
by Bookworm

Picking books for review is a difficult task for the ol' Bookworm. After all, what may be a complicated theory book for one reader of RADIO-TV EXPERIMENTER may be a comic book for another reader. In this issue, your ol' Bookworm has singled 5 *far out* books for review that will reach into previously untouched corners of our readers' specialized interests. Read on, see if you agree with me.

Transistor Texts. *John M. Carroll,* the former Managing Editor of Electronics magazine (a *McGraw-Hill* business/technical publication) and presently Associate Professor of Industrial Engineering at Lehigh University, has compiled the best of transistor articles previously published in Electronics into three out-standing hard cover books. Only a brief synopsis of each text can be given in our limited space. More information on the texts can be had by writing directly to the publisher, *McGraw-Hill Book Company, Dept. 740, 330 West 42nd Street, New York, New York 10036.*



234 pages
Hard cover
$10.00

☐ *Transistor Circuits and Applications*—Here is a thorough treatment of the transistor art, including a large number of typical circuits with component values and explanatory articles which deal with transistor structures, techniques, circuits, and equipment. The book provides circuit designers with a handy source of detailed information on how to

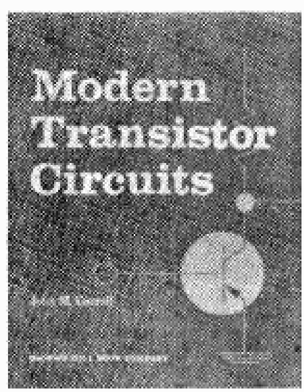
(Continued on page 10)

BOOKMARK

(Continued from page 6)

apply transistors in military, industrial, and home-entertainment equipment. It covers typical transistor operating characteristics, important circuit parameters, transistor types, problems of temperature and gain stabilization, and a large number of typical transistor circuits, including newest transistor radios. Circuits are shown with actual component values and include those used in portable and automobile radios, audio amplifiers, military communications equipment, telemeters, servo amplifiers, computers, industrial and medical instruments, and hearing aids. Operating characteristics of over 200 commercially available transistors, representing all types, are listed.

☐ *Modern Transistor Circuits*—Here is a comprehensive collection of modern transistor circuits, classified and arranged for easy reference. Almost 200 circuits are presented, with complete design information and electronic component values. The circuits are arranged both by generic types such as amplifiers, oscillators, power supplies, and pulse circuits, as well as by specialized applications such as broadcast equipment and home entertainment; audio and RF communications circuits; missile, aircraft, and satellite



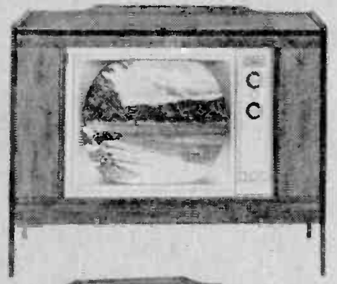
283 pages
Hard cover
$10.00

telemetering equipment; test instruments; and industrial, scientific, and medical devices. Emphasis is given to new circuits combining transistors and electron tubes, and transistors and magnetic amplifiers. There are over 200 schematic diagrams, along with important block diagrams, performance curves and

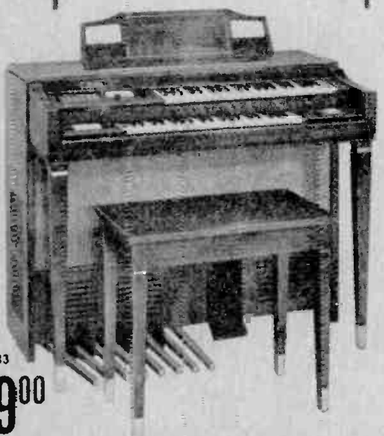
(Continued on page 14)

13 HEATHKIT VALUES... SEE THE

GR-53A
$399^00
(less cabinet)



Deluxe 21" All-Channel Hi-Fi Color TV
Only color TV you can build . . . only color TV you can adjust & maintain yourself with exclusive "built-in service center" . . . only color TV you can install 3 ways—wall, custom cabinet, or either Heath factory-built cabinet. Tunes all channels, 2 thru 83 to bring you 21" of true-to-life color and black & white pictures, plus hi-fi sound. All critical circuits prebuilt & aligned . . . assembles in just 25 hours!
Kit GR-53A, chassis tubes, tuners, speaker, 127 lbs.................................$399.00
GRA-53-7, deluxe walnut cabinet, 85 lbs.....$115.00
GRA-53-6, walnut-finished cabinet, 52 lbs.....$49.00



GD-983
$849^00
(Includes bench)

Deluxe Heathkit/Thomas "Coronado" All-Transistor Organ
Saves up to $400 . . . Easy to build & play . . . No extras to buy! Features 17 true organ voices; 28 notes of chimes; built-in 2-speed rotating Leslie, plus 2-unit main speaker systems; two full-size 44-note keyboards; reverb; attack, sustain & repeat percussion (the only organ to give you all 3); stereo chorus control for exciting "stereo" effects; 75-watt peak music power amplifier; and hand-crafted, hand-rubbed walnut cabinet & bench. Hear it yourself—Send 50c for demonstration record GDA-983-2, 7", 33⅓ rpm. Organ wt. . . 242 lbs. Also available, low-cost Heathkit/Thomas "Largo," organ only, 158 lbs......................$349.00

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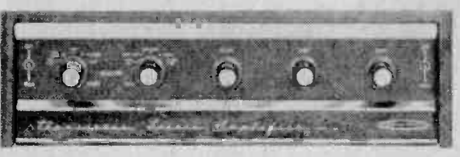
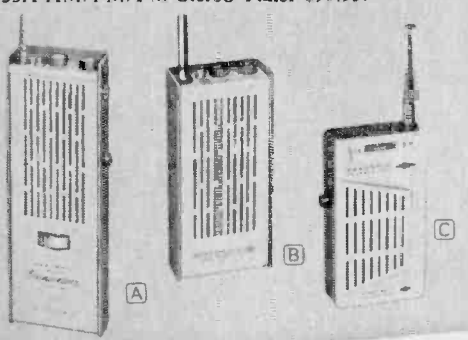


Deluxe 70-Watt Transistor Stereo Amplifier
Enjoy cool, instant operation, long life, and natural "transistor sound." Enjoy 100 watts IHF music power at ± 1 db from 13 to 25,000 cps. Walnut cabinet. 29 lbs. Matching AJ-43C AM/FM/FM Stereo tuner $129.95.

AA-21C
$149^95



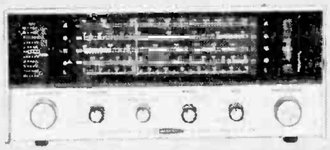
Heathkit Walkie-Talkies!

A **1-Watt GW-52** . . . up to 3-mile operation; 10-transistor, 2-diode circuit; $20 rechargeable battery; metal case; specify channel; pair $139.95, each $74.95.

B **9-Transistor GW-21** . . . up to 1-mile operation; crystal-controlled transmit & superhet receive; metal case; specify channel; pair $74.95, each $39.95.

C **4-Transistor GW-31** . . . ¼ mile operation or more; no license, tests, age limit; fits in pocket; metal case; specify channel; pair $35, each $19.95.

OTHER 237 IN FREE CATALOG!



GR-64

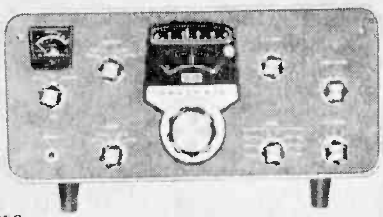
$39.95

New! Heathkit Shortwave Radio! Covers 550 kc to 30 mc—includes AM plus 3 shortwave bands; 5" speaker; lighted bandspread tuning dial, relative strength indicator & 7" slide-rule dial; BFO; 4-tube circuit plus 2 rectifiers; "low-boy" metal cabinet; 13 lbs.

MW-34

$89.95

Deluxe 5-Channel CB Transceiver! Features 5 crystal-controlled transmit & receive channels; new front-panel crystal socket to change transmit crystal of one channel; new spotting switch; new TVI filter; new calibrated "S" meter; 3-way power supply for fixed or mobile operation; metal cabinet; 19 lbs.



SB-300

$265.00

Deluxe Single Sideband Amateur Receiver! Covers 80 thru 10 meter bands with all crystals furnished, plus provisions for VHF. 1 kc dial calibrations—100 kc per dial revolution. Tuning dial to knob ratio approx. 4 to 1. Less speaker. 22 lbs. Matching transmitter & KW linear amplifier also available.

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Not a kit . . . installs in just 5 minutes! Cannot be damaged by improper installation. Provides fewer tune-ups, longer plug life, greater gas economy, instant starts in all weather. Transfer from car to car . . . present system is left intact. Operates on 6, 12, or 24 v. DC, pos. or neg. gnd. . . . any car or truck. 3 lbs.

Heathkit Vacuum Tube Voltmeter Single AC/Ohms/DC probe; 7 AC/DC/Ohm ranges; 1% precision resistors for high accuracy; frequency response ± 1 db from 25 cps to 1 mc; voltage doubler rectifier; simple circuit board construction; 5 lbs. Available wired, IMW-11, at $39.95.

IM-11

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NEW! Deluxe All-Transistor AM Portable!

GR-24

$29.95

6 transistor, 2-diode circuit gives 8 transistor performance. Uses standard flashlight batteries . . . requires only 1/10 operating cost of pocket-size portables. RF stage & double-tuned I.F. stage for greater sensitivity & selectivity. Built-in ½" dia. rod antenna, 4" x 6" speaker, vernier tuning, slide-rule dial, & black simulated leather case. 6 lbs.

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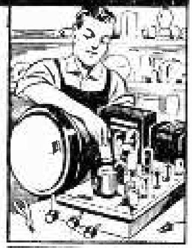
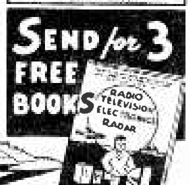
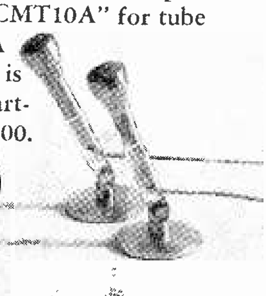




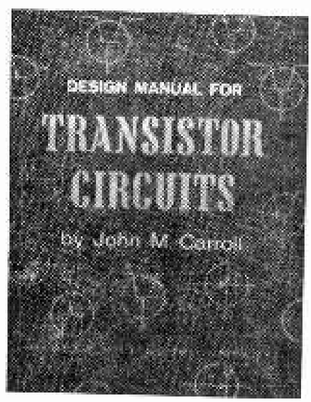


BOOKMARK

(Continued from page 10)

waveforms, and photographs illustrating construction of equipment. You can get immediate benefit from this book by using its circuits and data directly to design similar devices. It is based on more than 100 recent engineering articles in *Electronics.*

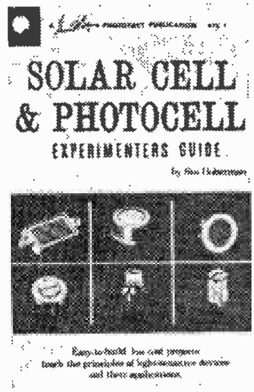
☐ *Design Manual for Transistor Circuits*—This comprehensive manual presents a collection of tested transistor circuits which design engineers may adapt to a variety of individual applications. In nearly all cases, all component values are given, and the transistors used are commercially available. Fundamentals of semiconductor devices and network applications are reviewed in the first chapter along with semiconductor materials, forward and reverse *p-n* junctions, transistor action, transistor load lines, hybrid matrix parameters, equivalent-T circuit, high-frequency transistors, and power transistors. Special devices are also included such as



381 pages
Hard cover
$10.00

unijunction transistors, controlled rectifiers, thyristers, unipolar transistors, and integrated semiconductor circuits. The material-dealing with basic circuits such as amplifiers, oscillators, and power supplies—has been grouped into 21 chapters for easy reference. They cover such specific applications as radio, f-m, and television receivers; test instruments; industrial and radiation measuring instruments; and computer circuits. Missile and satellite circuit information has been divided into two chapters for easy comprehension. One is devoted to telemetering circuits and the other to guidance circuits. Similarly, digital computing circuit information is separated into one chapter on counting circuits and three chapters on computer applications. These latter chapters cover such material as switching and control circuits, memory circuits, and circuits for input and output devices. The field of industrial electronics is covered in chapters on solid-state switching, servomechanisms, and measuring instruments. The new tunnel diode is covered in an article describing the theory of the device, typical circuits, and applications. Design charts and nomographs have been reproduced to illustrate material covered. Typical problems dealing with operation, thermal design, and transistor operating loads are discussed and analyzed. The basic information, the scope of material covered, the ease of comprehension and reference, combine to make this manual equally suited to the engineer approaching the subject for the first time and to the experienced engineer searching out specific circuits for particular applications.

Out In The Light. A new hobbiest manual, *Solar Cells and Photocells* by *Stu Hoberman,* has been placed on the bookshelves by publishers *Howard W. Sams & Co., Inc.* Solar cells and photocells are being used extensively in all types of modern devices—from elec-



128 pages
Soft cover
$2.95

tronic door openers to solar batteries in space vehicles. The basic objective of this book is to demonstrate the theory, application, and construction of light-sensitive devices. Chapter 1 discusses the basic principles of light-sensitive devices and light sources, or illuminators. The electrical characteristics and the symbols for these devices, as well as application data are given. Chapter 2 describes the various types of light beams employed and some typical applications of photoelectric controls in industry. The easy-to-build, low-cost projects presented in Chapter 3 are designed for students, experiment-

BOOKMARK

ers, and technicians. These projects range from the simple to the more complex—from light switches, photorelay drivers, and light meters to photologic circuits, remote controls, color comparators, etc. By constructing the projects presented in this book, you can acquire a greater insight into both the theory and operation of solar cells and photocells. *(For more information write to Howard W. Sams & Co., Inc., Box RTE, 4300 West 62nd Street, Indianapolis 6, Indiana.)*

Surplus. The past two decades have seen such national institutions as the hula hoop, N. Y. football Giants and the Edsel come into being and then sink into oblivion. There

192 pages
Soft cover
$3.00

are only two things left from the past, Ed Sullivan and military surplus radio year. Surplus prices aren't too different than they were after the war. You can still buy ARC-5 and 274N transmitters and receivers for under ten dollars. But the bargain is not a bargain unless you know how to convert them to peace-time use. Author *Tom Kneitel's* new book, *Surplus Conversion Handbook,* is a neat packaging job of old magazine articles detailing all that is needed to convert many of the surplus items still on the market place. We can't hope to list all the conversions in this book, but we can list a few of the equipments by military number: ARC-1, 3, 4, 5, 36, 49; BC-191, 224, 312, 314, 342, 344, 348, 375, 603, 624, 625, 779, 794, 1004, 1068A; Command transmitters and receivers; HQ-120, 129X; SCR-177, 188, 193, 399, 499, 508, 522, 528, 542, 608, 628; SP-200, 210, 400; and military crystals. *(For more information write to Cowan Publishing Corp. Dept. TK-1, 14 Vanderventer Ave., Port Washington, New York.)*

Master Index. Mr. M. M. Beitman of *Supreme Publications* has just announced the availability of the new 1964 *Master Index to Supreme Publications.* This booklet serves as an index to all 23 radio volumes and 17 TV volumes presently available. If you are interested in obtaining information and the schematic diagram for any U. S. radio made since 1926, or any U. S. TV set manufactured since 1951, this index becomes invaluable. As a special offer to RADIO-TV EXPERIMENTER readers, Mr. Beitman offers single copies of the Index for only 10¢ to cover actual postage. Send your order and 10¢ to *Supreme Publications, Box 706 1760 Balsam Road, Highland Park, Illinois.* This offer can be withdrawn at any time.

Speak Up, Bud! Your ol' Bookworm would like to know what books you have been reading during the first six months of 1965. Your reading habits will help me plan my reviews to coincide with your reading objectives. Don't be bashful, send a postal card to the *Ol' Bookworm* in care of RADIO TV-EXPERIMENTER and list the books you've read. OK to mention other magazines, if you wish. ■

NEW *products*

Lightweight Extended-Range Stereo/Mono Headset

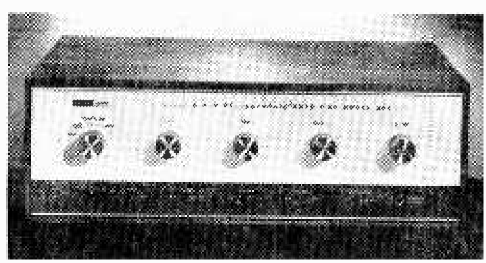
A new headset, Model AKG K-50, designed especially for stereo/mono music listening has been introduced to the high fidelity market by Audio Applications. The new headset features unusually lightweight construction totalling a mere 3.8 ounces, compactness and wide-range frequency response of 20 cps to more than 25,000 cps with extraordinarily low distortion. The manufacturer claims the AKG K-50 headset is the only unit that provides full bass response without requiring an air seal between the listener's ears and the earphones. This combined with the extremely low weight completely eliminates fatigue and discomfort. The AKG K-50 headset can be worn for many hours without inducing "head clamp" sensations or self-consciousness. It is exceptionally efficient, normally requiring a power level of only 156 milliwatts for comfortable sound. The headset is finished with crystal-clear earcups and light gray bail and drive capsules that are easily adjusted on the unobtrusive headband. Mechanical construction is such that long, trouble free life is assured. A 1-year unconditional guarantee is given for materials and workmanship by Audio Applications, Inc., national sales and service representatives for

NEW *products*

the AKG K-50 headset. The unit is available at many local retail outlets for $22.50. *(For more information and the location of your local dealer write to Audio Applications, Inc., Dept. RT31, 19 Grand Avenue, Englewood, New Jersey 07631.)*

Solid-State Integrated Amp

Latest in the *Harman-Kardon* line of solid-state high fidelity components is the Model SA-2000 integrated stereo amplifier. This all-transistor unit provides 36 watts IHF music power output (18 watts per channel). The SA-2000 utilizes no output transformer, it is able to reproduce faithfully all frequencies from 8 to 25,000 cps, with a flat response within ±1 db at normal listening levels (1 watt). At full rated power, the unit reproduces 10 to 23,000 cps with a flatness of ±1 db. The intimate direct speaker coupling is said to enable the speaker to follow the signal more closely and to provide better speaker damping. The damping factor is 25:1. Square wave rise time is only 5 microseconds. This excellent transient response prevents blending of instrument voices, enabling the discriminating listener to pick out individual instruments. Harmonic distortion is less than 1% and hum and noise suppression is at least 90 db. Controls include the following: volume control with power switch; balance control; ganged bass, and treble controls; contour switch; low cut switch; high cut switch; tape monitor switch; and speaker defeat switch. The SA-2000 features a front panel earphone receptacle,



two convenience outlets, a phono input, a tape amplifier input and two auxiliary inputs. It measures 13¼" wide x 4⅜" high x 8¾" deep and weighs nine pounds. List price is $159.00. *(Complete specs are yours for the* *asking. Write to Harman-Kardon, Inc., a subsidiary of The Jerrold Corporation, Dept. 740, 15th and Lehigh Avenue, Philadelphia 32, Pa.)*

CB Transceiver

Sonar Radio Corporation has come up with their newest CB unit—the FS-23—which incorporates every functional feature demanded by today's experienced CB'ers including frequency-synthesizing circuits. The unit's continuous one control channel switching and low-noise Nuvistor receiver RF stage

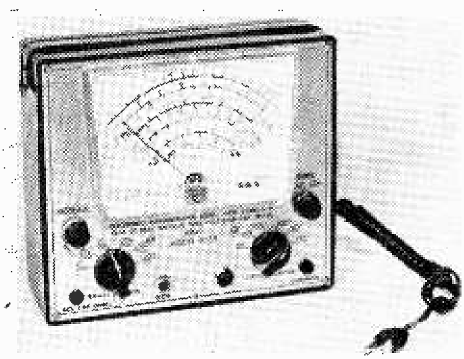
offer are just two of the many features necessary for full-time CB communications. The Sonar FS-23 uses 13 tubes, 2 silicon diodes, 1 germanium diode and 12 hermetically sealed crystals to perform in 19 stages aside from the power supply which uses 2 power transistors and 4 silicon rectifiers. The oscillators are of the fundamental frequency type as opposed to the overtone type and provide a higher degree of transceiver stability under all operating conditions. The receiver combination of a low-noise Nuvistor RF amplifier, selective IF system, gated noise-limiter, double conversion and voice-oriented audio system provides unparalleled reception in both mobile and base installations. The transmitter incorporates the best time-honored design techniques and is modulated to 100% by a class B push-pull modulator. The result is a clear penetrating signal ideal for crowded, noisy conditions. The Sonor FS-23 comes complete with microphone, power supply cables and under-dash mounting brackets; priced at $299.95. *(For more information write to Sonar Radio Corp., Dept. 731, 73 Wortman Avenue, Brooklyn, New York.)*

VTVM Measures L & C

The new *EMC* Model 107A, a wide-range vacuum-tube voltmeter (VTVM) for DC, AC, and resistance measurements, also pro-

NEW products

vides direct peak-to-peak readings on complex, asymmetrical voltage waveforms, direct capacitance readings, a zero-center scale, db scales, and indirect inductance measurement. Other features include a "wide screen" 6-inch meter faceplate for legibility and reading accuracy. This accuracy is furthered by 10 separately calibrated scales instead of combination scales. In addition to the capacitor test, the function switch includes separate positions for + or − DC. The meter movement is burnout-proof. Peak-to-peak voltage is measured in 6 ranges: 0 to 4, 28, 84, 280, 840 and 2800 volts. AC (rms) and DC, in 6 ranges: 0 to 1.5, 10, 30, 100, 300, and 1000 volts (up to 30,000 DC volts with accessory probe). Six resistance ranges cover from 0 to 1000 ohms (10 ohms center scale) up to 0 to 1000 megohms. Capacitance is measured in 6 ranges from 50 pf. to 5000 mf. Db is measured from −24 to +55 db in 6 ranges. Accuracy is 3 per cent on DC, 4 per cent on AC. Input resistance



is 16.5 megohms or 1⅔ megohms per volt on DC, 1.5 megohms on AC. A complete instruction manual for the *EMC* Model 107A VTVM includes conversion charts to obtain inductance readings in henrys and correct db readings for standards other than 0 db at 6 mw. in a 500-ohm line. Available accessories include an RF probe useful to 200 mc. and a high-voltage probe useful to 30 kv. Model 107A comes with instruction manual and test leads; in kit form, $36.50, or wired and tested, $51.40. *(Complete information is yours for the asking—write to Electronic Measurements Corporation, 625 Broadway, New York, N. Y. 10012.)*

Hully-Gully To Fox Trot It's All On One Tape

A new album exclusively dance music called "Tapeotique" has been announced available by *Roberts Electronics.* Tapeotique is a compelling collection of current dance hits termed 'Long Play' for its length in excess of 3 hours. Music of Tapeotique is programmed 4-track stereo. Dancers find it difficult to resist its selections following in close sequence. No matter what your favorite dance is, it's on this tape—Swim, Watusi, Frug, Bossa-Nova, Cha-Cha, Merengue, Samba, Twist, Hully-Gully and many others. Tape speed is 3¾ ips. with extraordinary fidelity for this speed. Sound reproduction is by *Roberts Cross Field Sound*, a process successful in delivering exceptional fidelity even at 1⅞ ips. Tapeotique is available from *Roberts* dealers who also handle the *Roberts* tape recorder line. It retails for $14.95. Dance tunes on this tape would cost $60 purchased as separate tapes. Tapeotique is also available as half-track monaural at 3¾ ips. on special order. *(For more information write to Roberts Electronics, Division of Rheem Mfg. Co., 5922 Bowcroft St., Los Angeles, Calif.)*

Electronic Exposure Meter Kit

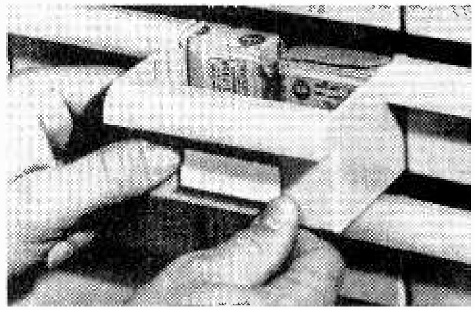
Allied Radio has come up with an electronic exposure meter kit which is so sensitive that it will get the right exposure even by moonlight. The Knight-Kit KG-275 meter uses a cadmium sulfide photocell, powered by two 1.35-volt mercury batteries. The unit will read light down to 0.014 footcandles. It reads reflected light from the subject, has built-in diffuser for incident light readings and push-button range selectors for low and high light levels. Color-coded scales indicate proper lens openings and shutter speed combinations. Push-to-test button on back of case acts as built-in battery tester. Size is 4¼ x 2¼ x 1⅜"—small enough to fit in the palm of the hand. The complete kit (assembly time 1 to 2 hours) is supplied with all parts,

case, batteries, neck cord, wire, solder and step-by-step instructions for $15.88. *(It is listed in the Allied Radio 1965 catalog, available free on request from Allied Radio Corp., Dept. RTV3, 100 N. Western Avenue, Chicago 80, Illinois.)*

Press-On Label Holders For Fast Filing And Finding

New self-adhesive press-on label holders are being introduced by Akro-Mils, Inc. to solve labeling, inventory control information, and indexing problems in a wide variety of applications for both industry and the hobbyist workbench. Made of durable extruded plastic, the pressure sensitive label holders are easy to apply and hold fast. Easy to change perforated insert cards supplied with the holders. The press-on label holders are ideal for file drawers, shelves, parts bins, ring binders and ledgers, all kinds of office books, with a wide market in stores, stockrooms, factories, hotels, hospitals, schools, mailrooms and libraries. Holders are easy to apply, simply by removing the treated paper backing and placing the press-on label hold-

NEW products



er in position. Holder sticks permanently on any clean, smooth dry surface. Perforated insert cards, in sheets, fit easily in typewriter or can be marked by hand. Cards slide easily in the holder channel, and can be changed quickly. PRESS-ON Label holders are marketed by Akro-Mils in packages of 50, in two sizes: ¾"x2" ($2.00), and ½"x1⅓" ($1.50), with 50 perforated label cards included in each package. *(For complete details and price lists, write Dept. 40RT, Akro-Mils, Box 989, Akron, Ohio 44309).*

CB Accessories

Lafayette Radio has come up with two new additions to their expanding line of Citizens Band Accessories—The "Quiet-Com" Solid State Vibrator replacement (No. 42-0121 for negative ground and No. 42-0122 for positive ground) and a CB Low Pass Filter, (No. 42-0123). They cost $5.95 each. The *Lafayette* Quiet-Com is an efficient solid state replacement for an existing 12 volt CB, Amateur or mobile communications vibrators rated up to 85-watt power consumption. Features elimination of vibrator hash noise, longer life and cooler operation. The *Lafayette* Low Pass Filter is designed to effectively reduce TVI which may emanate from CB transmitters. It attenuates radiated spurious and other undesirable harmonic signals higher than 50 megacycles approximately 50 db. Two built-in SO-239 connectors for simple installation in coax lines. Impedance 50-75 ohms (reversible. Size: 5 x 2 x 1¾. *(For more information and catalog, write to Lafayette Radio Electronics Corporation Dept. 470, 111 Jericho Turnpike, Syosset, L. I., N. Y.)*

When writing to manufacturers, always mention RADIO-TV EXPERIMENTER and issue date.

ASK ME another

By Leo G. Sands

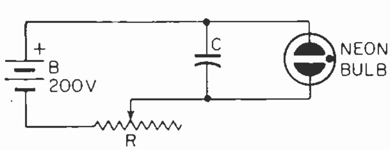
RADIO-TV EXPERIMENTER brings the know-how of electronics experts to its readers. If you have any questions to ask of this reader-service column, just type it on the back of a 4¢ postal card and send it to "Ask Me Another," RADIO-TV EXPERIMENTER, 505 Park Avenue, New York, New York 10022. The experts will try to answer your questions in the available space in upcoming issues. Sorry, the experts will be unable to answer your questions by mail.

Neon Relaxes

How can I determine the frequency of a neon lamp relaxation oscillator? It is not t = RC because different voltages produce different frequencies.

—*E. S., Springfield, Ore.*

The time constant of the circuit shown in the diagram, without the neon lamp, is equal to R in megohms times C in microfarads. If R is set to one megohm and C has a value of one microfarad, it will require one second for C to charge to 63% of the supply voltage.



When the neon lamp is in the circuit, the supply voltage and the lamp characteristics have an effect on the period of the circuit. Suppose the neon lamp fires at 100 volts and extinguishes at 70 volts. If the supply potential (B) is 200 volts, C will not charge to 63 per cent of the supply voltage (126 volts) because the neon lamp will fire when the

ASK ME another

charge in C reaches 100 volts, which it does in about half the time required to reach 126 volts.

When the lamp fires, the capacitor discharges through it, but the charge only drops to 70 volts since the lamp goes out at this point. Then, the cycle starts again, the charge in C rising exponentially from 70 volts (not from zero) to 100 volts and then dropping abrutply to 70 volts.

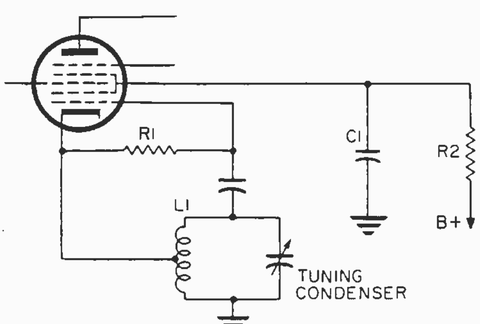
There are fairly complex equations for calculating the frequency of a neon lamp relaxation oscillator which are applicable when the characteristics of the lamp are known and the voltage source is stable. The easiest way is cut and try. It is extremely important for the voltage source to have excellent regulation in order to achieve frequency stability.

Local Oscillator Kaput!

My 5-tube AC-DC superheterodyne receiver will bring in stations near one end of the dial. The rest of the band is dead. What is the trouble?

—T. K., Long Island City, N. Y.

Either the tuning condenser plates are shorting or you probably are experiencing oscillator trouble. The oscillator may cease to function except over a limited frequency



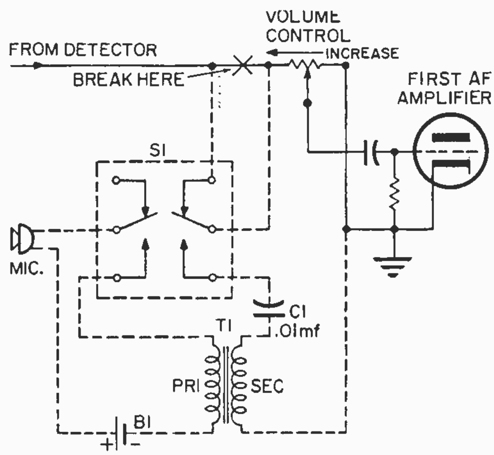
range. The trouble is usually due to a defective converter tube, change in the value of the oscillator grip leak (R1) or in the value of the screen voltage dropping resistor (R2). It could be that by-pass capacitor C1 may be leaky causing the screen voltage to drop. Try a new grid leak (R1) of the same value as the original. If that doesn't do it, change R2 and C1. Sometimes the oscillator coil (L1) absorbs moisture and its Q is lowered. Try drying it out by exposing it to an infrared lamp.

Radio Goes PA

How can I connect a microphone to an AC/DC radio so I can use its amplifier without using the radio circuit?

—A. S., Passaic, N. J.

Since the amplifier may not have enough gain for a crystal, dynamic or ceramic microphone, you can use a carbon microphone as



shown in the diaphragm. Install a d.p.d.t. toggle switch, S1, on the chassis or the set's rear cover. Mount microphone transformer T1, such as a Stancor A4705 on the chassis or rear cover, grounding transformer frame to chassis. Also install a battery holder (Lafayette 34G5005) on rear cover and slip a 1.5-volt battery (Burgess Z, Eveready 915, etc.) in the holder. Disconnect the "hot" volume control lead as indicated by "X" in the diagram. Wire the new parts into the circuit as shown, using the shortest possible leads (except microphone cord). Capacitor C1 may be an 0.01 mfd tubular.

Throw the switch one way for normal radio reception, the other way to use the mike. The volume control works for both. If there isn't enough mike volume add more batteries. Using a telephone type carbon mike, you should get lots of sound.

An alternative is to use a Philmore Junior Microphone (Cat. No. 500) which can be connected directly to the plate and cathode prongs of the first AF amplifier tube by means of clips furnished with the mike. These are sold in many radio parts stores.

Still another, and the safest way is to get a wireless broadcaster (Knight, Lafayette, etc.) which does not have to be connected tc the set and does away with the shock hazard.

Instant Radio

How can I modify an AC/DC radio so it will operate instantly when I turn it on like some TV sets I have seen advertised?

—*S. R., Roosevelt Field, N. Y.*

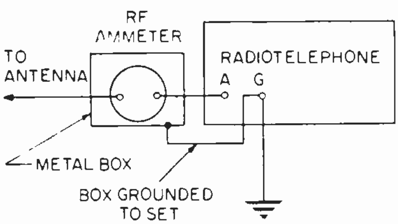
Connect a diode across the ON-OFF switch terminals of a typical AC/DC radio. With the switch turned OFF, the tubes should light but the set should not play. If it plays, reverse the polarity of the diode. Pick a diode that will handle at least 500 ma. and peak inverse voltage of at least 400 volts. They cost as little as 37 cents.

Antenna Current

How can I determine how well the antenna of a marine radiotelephone is functioning after it has been installed?

—*R. J., Detroit, Mich.*

Most marine radiotelephones have an antenna current indicator lamp whose brilliance is relative to antenna current flow. Some have an antenna ammeter or plate current milliammeter. If the radiotelephone does not have an antenna current ammeter, you can connect one temporarily between



the antenna lead-in and the antenna binding post. Then tune the transmitter for maximum antenna current on 2182 kc, the most important channel. If the transmitter is designed so that it can be tuned for optimum performance on each channel, follow the procedures in the rig's instruction book. Some sets, like the Hartman, have a front panel antenna tuner with which the set can be adjusted for best performance after selecting a channel.

The efficiency of a typical marine radio antenna is very poor because it is not practical to make it big enough for maximum performance, except on large ships. And, the ground connection is as important as the antenna.

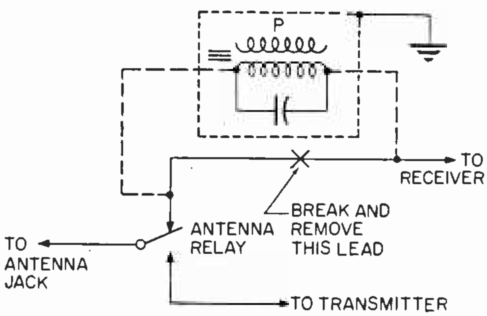
ASK ME another

Trap It

On CB channels 9 and 19 I receive a local 1000-watt AM radio station about ¾ miles away which operates on 1400 kc. I use a ground plane antenna. How can I eliminate this interference?

—D. W. G., Lawrence, Mass.

Disconnect the lead from the antenna relay to the receiver antenna coil and connect



a wave trap in its place as shown in the diagram. You can use a shielded TRF coil such as a Miller A-320 RF with a 20 pf. capacitor connected across its secondary. Leave the primary disconnected. Mount the coil shield can to the chassis or rear cover of the set (if it is metal) and use the shortest possible leads. Tune the coil core until the interference is weakest or disappears. Try different values of capacity across the secondary if the suggested value doesn't do the trick. Make sure the coil shield can is securely grounded to the set chassis.

BCB Noise

Without moving out of the New York City metropolitan area is there any way to get broadcast band reception? Using an HQ-100A and a 45-foot long wire I get good short wave but on the BC band I can't beat 300 miles.

—P. F. A., Hewlett, N. Y.

Living near New York City can impose some hardships in regard to broadcast band DX because of the presence of so many stations in the area. Lengthening your antenna may compound your problems. Also, there are so few clear channel stations that you might have to stay up late to hear distant stations operating on the same frequencies which go off the air around midnight. Just before daybreak, you should be able to hear Cuban stations. Try 700 kc at night—you should be able to receive WLW in Cincinnati.

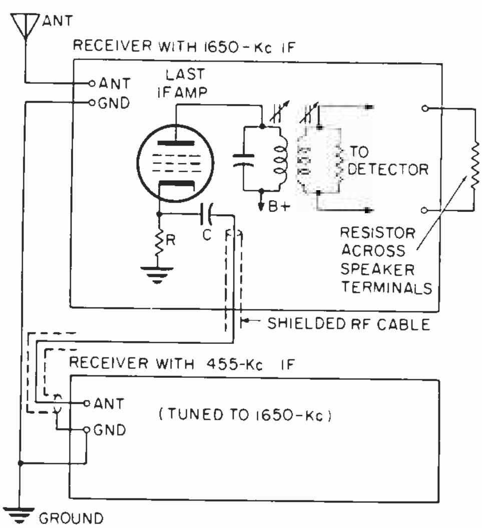
Two Receivers Go "Dual"

I have a short wave receiver with 1650-kc IF and another receiver with 455-kc IF. Would it be possible to feed the IF of the first receiver into the second receiver to get dual conversion? Would I get a worthwhile increase in gain or selectivity?

—A. L., Philpot, Ky.

It is possible, but you might run into some feedback problems. You can tap the 1650-kc IF signal at the cathode of the last IF amplifier as shown in the diagram. If the existing cathode bias resistor (R) has a bypass capacitor across it, disconnect the capacitor. Run the 1650-kc signal through low value capacitor C (5-100 mmf) and a short piece of shielded wire to the antenna (inner conductor) and ground shield terminals of the second receiver.

Connect the antenna to the antenna terminal of the first receiver and the ground wire to the ground terminals of both receivers. Disconnect the first receiver's speaker and connect a resistor in its place. The



resistor should have the same value as the speaker impedance. Tune the second receiver to 1650-kc and tune in the stations with the first receiver. The audio volume control of the first receiver will have no effect. The RF gain controls of both receivers can be varied to get the required gain.

Another way to tap the 1650-kc signal in the first set is to wrap the inner conductor of the shielded wire, but with the inner conductor insulation left on, around the lead from the plate of the last IF amplifier to the IF transformer. This forms a small capacitor.

Detector, Type Humaniod

Recently, you said that you heard someone say on a radio broadcast that he perpetrated a hoax a long time ago by claiming that he heard radio programs in his head, probably due to teeth fillings acting as a detector. I have information which leads me to believe that this has actually happened to many people.

—*C. M., Rock Creek, Ohio*

As a result of publication of my comments, one of the best informed electronics editors in the business called me to get more particulars. Perhaps the phenomenon has happened to people. However, if teeth fillings act as a detector, what serves as the transducer that converts demodulated RF (audio) into sound waves. Wonderful idea for radio paging if selective signaling can be added. Then there's this Korean vet with a pin in his arm about the size of a 3-cm. quarter-wave stab used in radar antennas who can detect aircraft up to 300 miles away, and this other guy who pierced his ears. . . .

Birth Certificate Not Necessary

What is the age limit for an amateur license?

—*D. P., Ballinger, Texas*

There is no age limit. There are quite a few "young" hams. I got my general class ticket when I was 14, but that was a long time ago. I once saw a newspaper clipping of a 6-year-old boy who passed his General Class exam. So you see, if you're reading this magazine, you're old enough!

Headset-Speaker Tie-up

My old radio has four speaker wires. How can I hook up earphones to it and cut out the speaker?

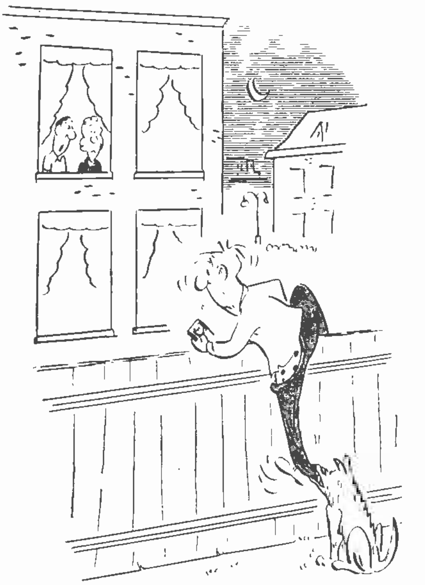
—*D. W., Bay City, Michigan*

Two of the wires undoubtedly go to the speaker's field coil. The other two go either

(*Continued on page 29*)

QSO-ing the Meter

By H. E. Holland, WA4YKK



"Burglar? No, it's that ham fella wandering around with his field strength meter again."

"I just finished building the receiver, OM, and got the meter in up-side-down."

"20 over 1900? He asked for a signal report, not the time!"

"Trying to check the output with an ohmmeter again?"

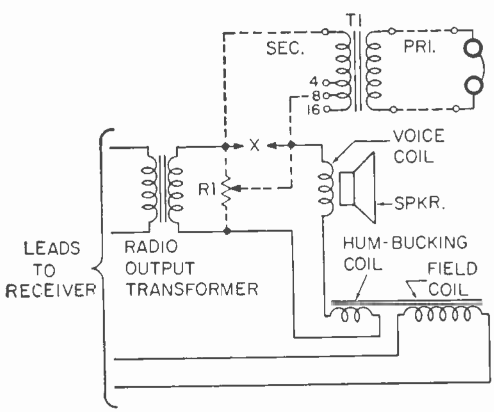
"Wouldn't it be a lot cheaper to have your eye glasses changed?"

other way, the speaker will be silent and the sound will be heard only in the headphones.

ASK ME another ?

(Continued from page 27)

directly to the voice coil or the primary of the output transformer, if the transformer is mounted on the speaker. Ignore the field leads. Disconnect the voice coil lead that goes to the output transformer (not to the hum bucking coil) as shown at "X" in the diagram. Add a 20-ohm potentiometer, R1, and connect it across the set's output transformer. Also add an extra output transformer, T1, such as a Stancor TA-44, connecting its secondary as shown in the sche-



matic diagram. Connect the headphones across its primary (high impedance side). The transformer type suggested has three taps. Try the 4, 8 and 16 ohm taps and use the one that gives best results. The purpose of the added transformer is to step up the audio voltage. To use the speaker, turn the potentiometer fully one way. Midway, both the headphones and speaker will operate (at reduced volume). When fully turned the other way, the speaker will be silent and the sound will be heard only in the headphones.

Dial Trouble

The dial of my short-wave set is inaccurate and far from the announced frequency. How can I improve it?

—*P. J. Dett., Middletown, Pa.*

If the receiver has tuning trimmers, tune in a station at a known frequency. Then set the dial to indicate that frequency and adjust the trimmers until you get the same station. Or, tune in the station and disengage the tuning dial, set it to indicate the frequency of the station and then re-engage the dial. This is a cheap and dirty way out. If results are poor, you will need a signal generator alignment.

Intercarrier Buzz

There is a buzz in the sound of my TV set. When I adjust the fine tuning control to eliminate the buzz, the picture is not right. How can I get clear sound and pictures together?

—*N. T., New Orleans, La.*

Chances are your TV set employs "intercarrier" sound and a gated beam sound detector. The usual cause of buzz in the sound channel is receiver misalignment. To align the whole receiver properly a sweep and marker generator and an oscilloscope are required. If you don't have these instruments available, try replacing the sound detector tube (6BN6, etc.). Also try tuning the gated beam detector "quadrature coil" for clear, buzz-free sound with the set tuned for the clearest picture. When tuning the coil by turning its ferrite core, use only a tuning wrench that fits. Some TV sets also have a potentiometer with which sound buzz can be minimized. Get a service manual for your

ASK ME another ?

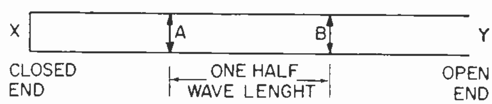
set so you can locate these components.

There are several types of Raysistors which are about the size of a crystal can. You can get complete application information on them from Raytheon Components Division, Newton, Mass.

Lecher Wire

What is a Lecher wire and how can I measure transmitter frequency with it?
—J. M., New York

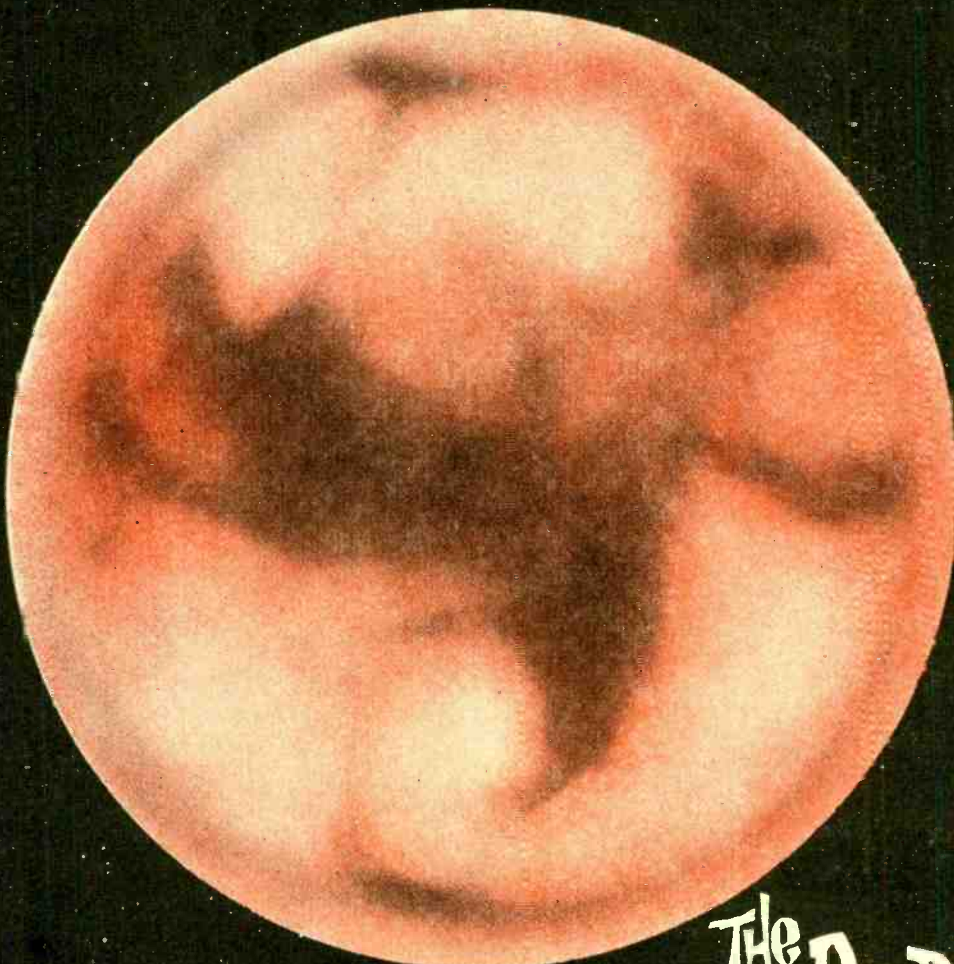
A Lecher wire was popularly used years ago to measure frequency. As shown in the diagram, two bare copper wires are stretched tight, parallel to each other (one to six inches) and supported only at their ends.



The closed end (X) is placed in the proximity of a transmitters output tank coil. While monitoring transmitter plate current, a metal shorting bar is slid along the wires. The plate current will change with the shorting bar at points one half wavelength apart as in points A and B in the diagram.

Wavelength is determined by measuring the distance between two such adjacent points. Multiplying the length in feet by 0.656 or inches by 0.0547. If the distance is 200 inches, the wavelength is 10.94 meters. Frequency in megacycles can be calculated by dividing the wavelength into 300. In the example given, the frequency would be 27.027 mc within the citizens band.

"We're lucky! Look at all he has to go through to get a license."

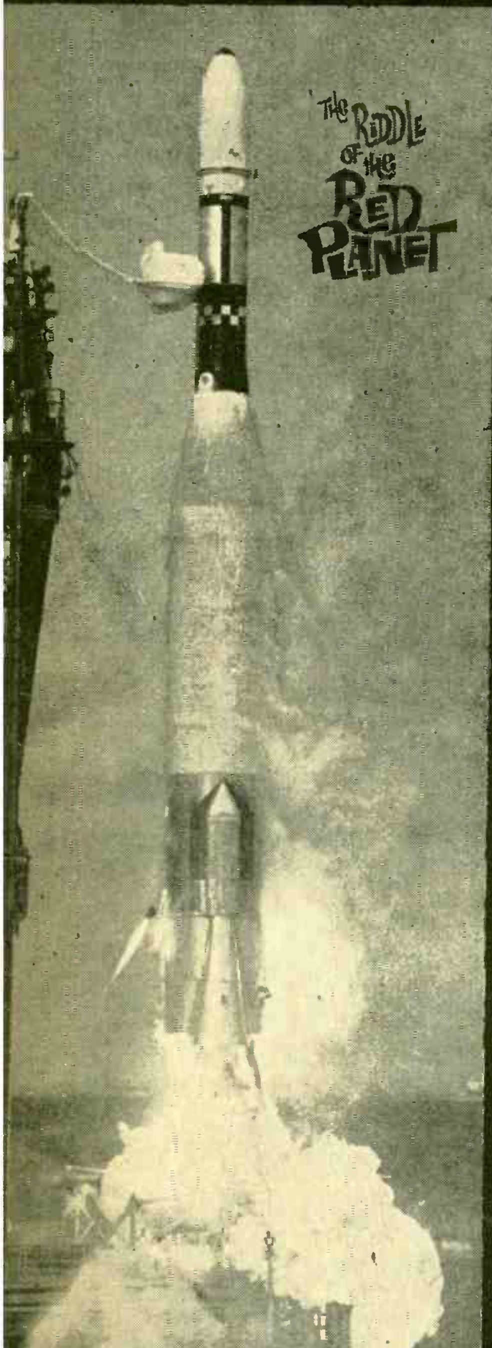


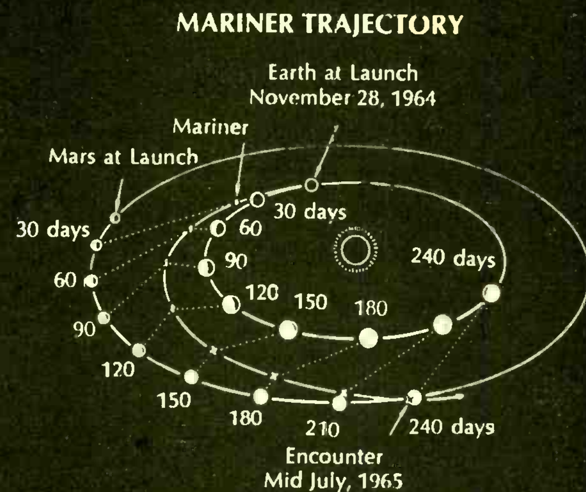
THE RIDDLE OF THE RED PLANET

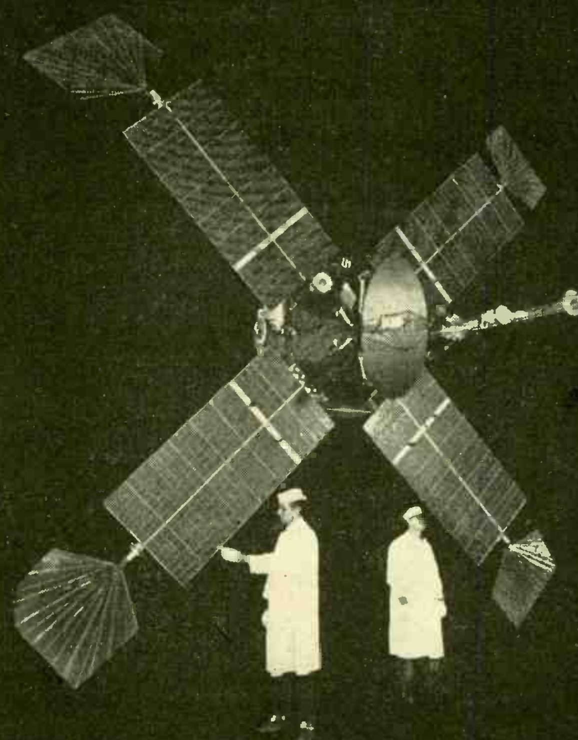
In mid-July, Mariner IV will fly by Mars and electronics will close the 45-million-mile gap of ignorance

By K. C. Kirkbride

Continued overleaf







On November 28 1964 Mariner IV lifted off its pad at Complex 12 at Cape Kennedy for its rendezvous with Mars in mid July, 1965.

In the late Fall of 1964 a group of scientists met to announce a decision that could open new worlds to man for all time. Number-one-goal of the United States space effort, the thirteen-man Space Sciences Board recommended to NASA, should be exploration of Mars. A series of flights could carry out physical and biological investigations, especially search for extraterrestrial life.

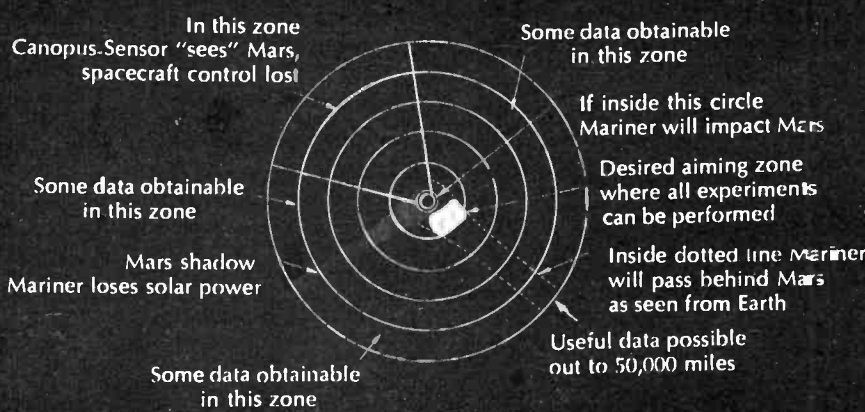
For man has long sought to solve the mysteries of the red planet. One noted astronomer of the 19th century believed he saw skillfully-built canals on the planet; another saw irrigation projects only an advanced civilization could have built. One Soviet scientist claims Mars vegetation is blue. Another astronomer theorizes Mars clouds are brown. Others see dark areas of blue-green land masses, white polar caps, red-brown deserts, seasonal color changes turning green to brown to grey within months.

Long Ago: While still another pictures a Martian civilization that lived centuries ago, one so advanced the people built both extraordinary canals and irrigation systems to sustain themselves as oxygen and water escaped from their planet's atmosphere. Then, when the canals and systems could no longer sustain them, sent artificial satellites into space (we dub them the planet's moons), built space ships and hastened off to their new satellite homes. Others, some say, travelled to far distant stars.

One astronomer claims he has seen evidence of atomic explosions on Mars. The less optimistic insist no human life or lonely plant could survive in the thin Mars atmosphere or in the cold Martian winters.

The Cause. The fact renowned scientists and astronomers have viewed the planet and produced such contradictory theories may well be due to limited instrumentation.

MARINER AIMING ZONE



WHAT'S ON MARINER

Photo & drawings courtesy of NASA

For until recently we have studied this vital planet through, first: the naked eye, then crude, sometimes home-fashioned telescopes, more recently 100 to 200-inch telescopes, the spectrograph (some blame the spectrograph for lack of water news on Mars), and still more recently, ultra-violet and infrared photography, all limited instruments when viewing a planet that at its orbiting best is 35,000,000 miles distant in space.

Better Billing Does It. But recently-sparked headline attention to Mars has spurred a group of young scientists to fashion a whole show of new electronic reporters to visit Mars personally and televise, telemeter and radio-probe until the mysteries of the red planet are solved.

First Reporter To The Scene. On November 28, 1964, a 575-pound windmill spacecraft atop a towering 100-foot Atlas-Agena flamed off the launches of Florida's Cape Kennedy. Mariner IV was headed for Mars!

At the end of a seven-months-long trip, when the spacecraft homes in on the planet, television cameras will turn on six to ten hours before the lights of Mars switch on the 330-foot long tape recorder.

When the recorder snaps on, it will signal the cameras into action, to scan 22 pictures—two at a time—through a reflecting telescope 8,600 miles from the planet. Half a day later the 200-line pictures, now stored on magnetic tape in digital form, will start beaming their way back to an eagerly-waiting audience on earth, while the craft itself soars on into space.

Why The Delay? Reason for the delay? The 250,000 bit pictures can be scanned at a speed of 10,700 bits per second but can only snail-pace their way home at a speed of 8.33 bits, taking a long suspense-ridden 8⅓ hours to completely reach earth-bound television screens.

What we will learn from this first reporter Mariner IV is anybody's guess right now. But Boeing Aircraft's young Frank S. Holman feels pretty impatient about the whole fly-by idea. He thinks we could send an orbiting instrument package to Mars by '69 that would report atmospheric news over a period of months. He sees such an orbiter dropping a round sterilized ball through the thin Martian air—sterilized because we dare not affect Mars' soil with germs from the earth.

Weighing thirty pounds and powered simply (probably by silver-cadmium battery) with a receiver-transmitter to send and respond to signals from earth, the 24-inch ball probe would tip us off as to problems future astronauts may expect from atmospheric pressures when they land on the planet.

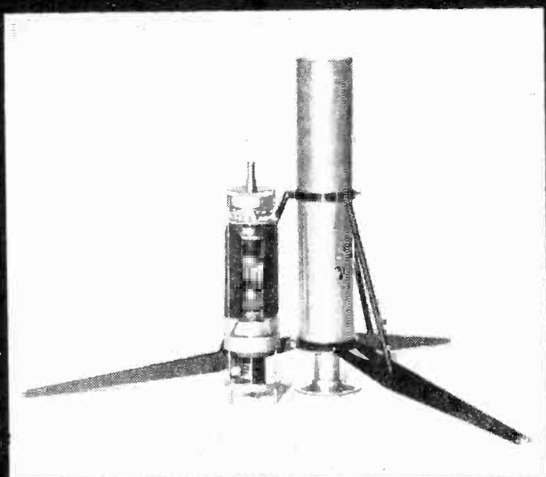
The Carafe. For more advanced missions he pictures a series of double-decker crafts, one deck to circle the planet, the other to land and relay news from the planet's surface. The lander Holman visualizes would stand a noble six-feet tall, be built like a carafe, and carry an automatic drill to bore into Martian soil and analyze its contents chemically.

Better Yet, the Multivator. Stanford University's Dr. Elliott Levinthal says "Multivator" could make it to Mars by '67. The dark-haired brilliant young scientist refers to a lander ten inches tall, 2¾ inches round, now sitting atop Stanford research tables at Palo Alto, California. Multivator's aim in life is to seek out basic carbons common to all living forms. And when it finally does go into its act on Mars, a tiny vacuum cleaner device will first scoop up samples of soil, run the "dust" through a chemical process, and if any sign of life exists, a photomultiplier will scan the chemical change, the lander then radio the news to earth.

Levinthal claims his proud Multivator will be able to spot the present stage of Martian evolutionary development, says even if it reports a sterile Mars, we may find important clues to living processes if we detect historic traces of *un*successful trials at life.

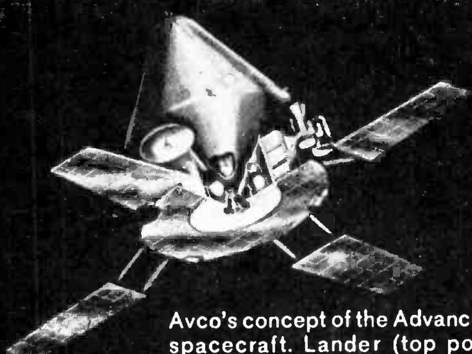
"Wolf Trap" Diets. At the University of Rochester, New York, Dr. Wolf Vishniac places a tiny three-ounce gadget (slimmed down from a robust 30 pounds) on his laboratory floor. A tiny door opens, and a small tube that looks like a miniature vacuum cleaner hose springs out. Swooshing its way around the floor, the tube draws dust into the "Wolf Trap" inner chamber. If the chemical "soup" inside turns cloudy, a beam of light

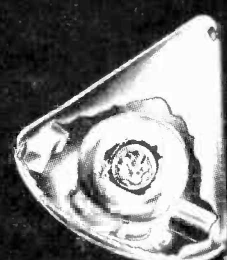
Photos courtesy of Stanford Tudor, Stanford University



Multivibrator, a biological Mars probe, is designed to seek out basic carbon compounds of life. Left, unit and container; below, fluorescent light test chamber.

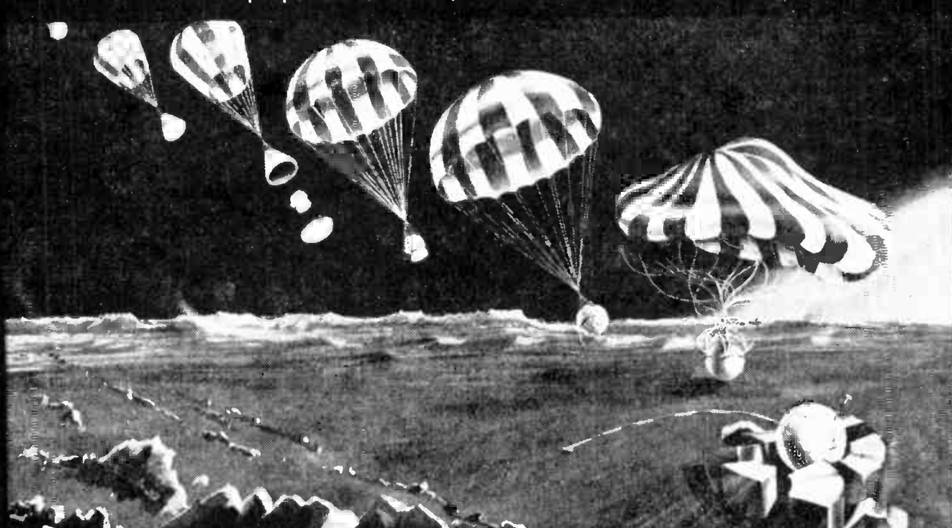
Inner sphere in Advanced Mariner lander contains scientific payload and communications, and is protected by impact crush-up case.



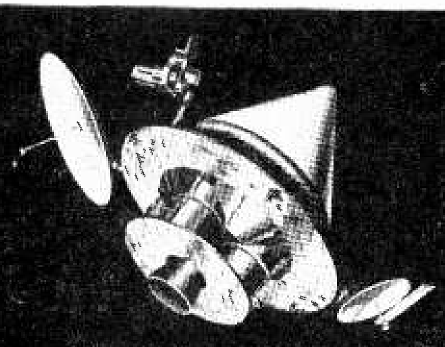


Avco's concept of the Advanced Mariner spacecraft. Lander (top portion) will separate from bus (lower portion) and it'll be propelled on an impact course.

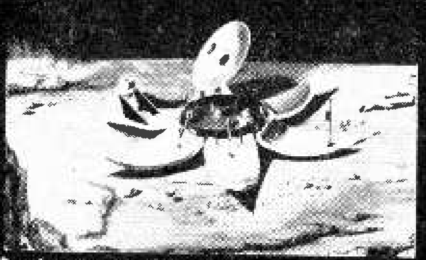
Drawings courtesy of Avco



The entry and landing sequence for the Advanced Mariner on the Martian surface.



Avco's concept of a Mars Voyager spacecraft shown in transit (above). The vehicle is oriented to keep the solar panels facing the sun. The lander will be separated and sent on an impact course to Mars. Space bus will then orbit Mars sending back to earth TV and other data. Below, Mars lander is shown after impact. Folding panels have been opened to expose scientific instruments and to allow communications antenna to aim at earth for data transmission.



Drawings courtesy of Avco

Mars, the Red Planet

☐ MARS is the fourth planet in order of distance from the sun. It has been observed from remote antiquity since its "red" or "ruddy" color and relatively rapid motion among the stars make it a very conspicuous heavenly body. Mars is best observed at opposition at midnight. The distance between earth and Mars at an average opposition is about 45,000,000 miles, but a favorable opposition occurs every 15 to 17 years when this distance is reduced to 34,000,000 miles.

Some of Mars' statistics (and earth's) are: radius, 4,200 (7,918); days in a year, 687 (365.26); million of miles mean distance from sun, 141.5 (93.0); escape velocity in mi./sec., 3.1 (7.0); surface gravity 0.38 (1.00); period of rotation, 25 hours, 37 minutes (24 hours).

will then scan organisms breeding in the chamber.

"Gulliver." Wolf Trap and Multivator have another brother named "Gulliver" living on the West Coast. Gulliver rooms at the California Institute of Technology in Pasadena, has cut *his* weight to a slim 1½ pounds, and boasts an organic chemical "soup" in his inner chamber labelled with radioactive carbon. When NASA books Gulliver to play the Mars circuit, small bullets will fire three sticky fingers of string, each 25 feet long, onto the Martian soil.

When the strings reel in they will haul back samples of soil and a radiation counter will then detect carbon dioxide gas if the samples show any signs of life.

Through Space Will Travel. But before these clever landers can perform their Martian best, they must travel a long 400,000,000-mile road up through space. For this purpose NASA books Mariner-Voyager missions to Mars over a ten-year period ending December 1975. Avco engineer Dr. Paul C. Dow, Jr., pictures just how these double-decker space missions will operate.

Same Start. Both will launch from Cape Kennedy, separate booster from craft in space, Mariner from an Atlas-Centaur launch, Voyagers to be Saturn'd, then unfold solar panels to pick up power from the sun. An onboard antenna will heed radio instructions from earth, and send back cosmic, magnetic-field and radiation news of the day.

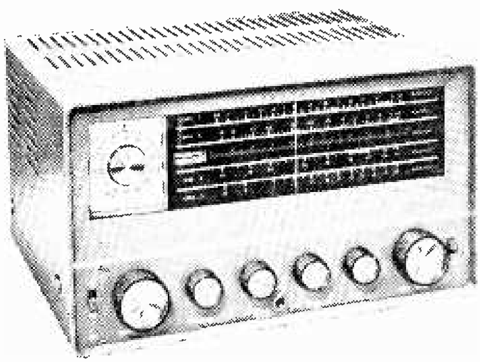
When an Advanced Mariner carrying its 1500-pound payload reaches within half-million miles of Mars, its lander will leave the "bus." The bus will then travel past the planet, snapping 100 TV pictures scanned at a distance of 4,000 miles, to relay to earth. Dr. Dow estimates these pictures may take as long as ten days to reach earth. The bus will then soar on its way round the sun.

The lander will speed toward Mars' surface, an aluminum honeycomb "crush" protecting the instrument package as it surfaces. When the force of impact opens the lander, the enclosed instruments will arrange themselves on Martian soil, sample the planet's dust, and report its findings to a nearby antenna to radio back to earth as long as power lasts, which will probably be only a few hours.

The Big Show In Space. What the Advanced Mariner missions, booked to soar to Mars, '69 on, don't tell us about the red planet, the heavier Voyagers, slated for

(Continued on page 119)

Mechanical Filter Adds Q to Your Receiver's IF's



By Herbert Friedman, W2ZLF

There's an old African proverb that says: "Not enough is no good, while too much is even worse"; and while this sage advice originally applied to the number of girl friends, it holds true for radio reception. Whether you're an amateur, SWL or DX'er, you've got to be able to hear *many* stations in order to derive full satisfaction from your hobby. But what happens when you hear too many stations? All you got is squeals and squawks; and it's debatable whether too few or too many signals ruin what would otherwise be exciting hobbies.

While it's relatively easy to snatch a few extra signals by using a better antenna or an RF preamplifier ahead of the receiver, short of spending a few hundred bucks for a super-selective receiver there's not much you can do when poor receiver selectivity buries ycu in a sea of signals—all interfering with each other. At least there was little you could do until a few months ago, but now, a *mechanical filter*—the "selectivity heart" of the most modern quality receivers—can be yours for less than $20. That's right, a real honest to goodness mechanical filter, the device used in the most expensive receivers when razor sharp selectivity is the prime objective.

Now we're not talking in terms of relatively expensive receiving equipment. The mechanical filter we've got in mind can be used by virtually anyone, even the BC DX'er with a ten buck table radio. The only requirement is that your receiver (or radio)

Update your present receiver to cope with today's crowded bands!

Pick up distant stations formally masked by strong local signals!

Achieve peak skirt selectivity with BCB, SW, AM and SSB receivers!

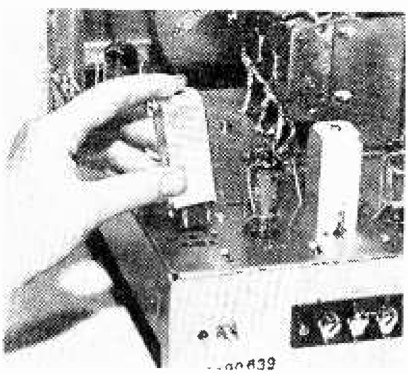
have a 455 kc. IF amplifier, no other frequency. If you fit this category stick with us and we'll tell you how to hear those rare weak ones that everyone except you seems to receive.

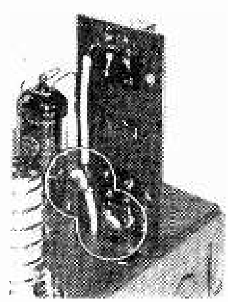
Selectivity. Let's take time out for a moment and review that magic thing called *selectivity;* for after all, you really can't get that most out of something if you don't know what in heck it's supposed to do.

The principle behind the superheterodyne receiver is the key to selectivity. The superhet uses a local oscillator to convert the received signal to a more useful frequency—one that can be easily amplified. For example, a 20 megacycle signal is not the easiest thing to amplify. If one tried to just build a string of 20 mc. amplifiers and then detect the amplified signal he would certainly run into regeneration unless heavy shielding was used, and the selectivity would be low because the tuned circuit O's would be low, and it would take two or three times the required number of amplifiers. Now don't get us wrong, it can be done, but at a hefty expense—and it wouldn't be worth the time, effort or money. But look what happens if we take the same 20 mc. signal and push it through a superhet. By using a local oscillator to *beat* the signal to, say, 455 kc., we get a signal that can be handled easily. Today, it's a snap to design a high gain 455 kc. amplifier, and at 455 kc. the tuned circuits have sufficient Q to give decent selectivity; and it's selectivity that determines a receiver's effectiveness.

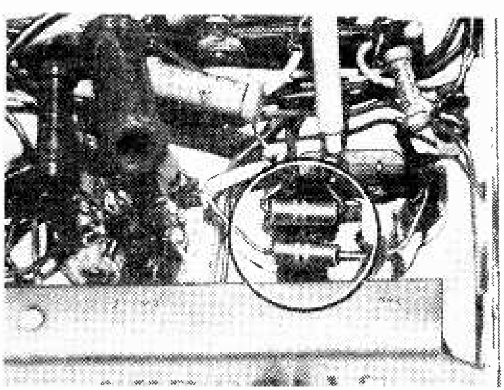
IF Bandpass. Generally, when *only* IF amplifiers are used to achieve selectivity the receiver's overall selectivity is determined by th number of IF amplifiers. As example, Fig. 1A (on page 48) shows the selectivity curve for a single stage of IF amplification.

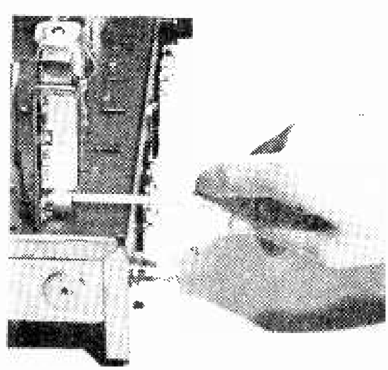
Note that maximum gain occurs at the IF frequency with the gain falling off on either side of the center frequency. If there were two signals of equal strength separated by 5 kc., and you tuned in either one, the tuned signal would be received at maximum gain (the center frequency) while the remaining signal would be received 5 kc.





How a mechanical filter is installed in a SW receiver in place of 1st IF tin. Left, remove tin; top, mechanical filter fitted with studs; right, filter in place. Circled parts were added—see diagram. Filter tunes like an IF can.



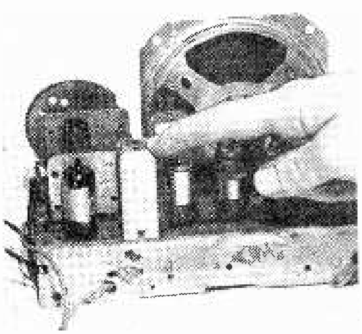


higher or lower (depending on its relationship to the tuned signal). Note, from Fig. 1A that a signal removed 5 kc. from center is attenuated (actually amplified less) 6 db. So, from the speaker you would hear two signals, the tuned signal at maximum volume and the second signal which will have one fourth (6 db less) the volume.

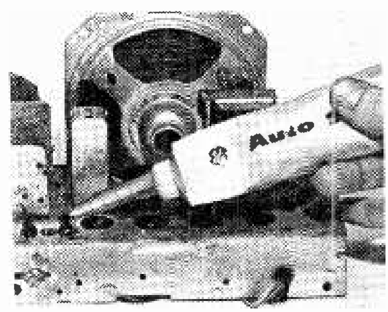
Now we all know that virtually all broadcast frequencies are just loaded to the hilt with signals, and even a 5 kc. spacing would be a luxury. Actually, there could be three, four, five, or more phone signals in a 5 kc. segment; and certainly, on the CW bands there could be ten or twenty signals. If we used a receiver with the selectivity curve in Fig. 1A we'd be drowned in a sea of incoherent signals (QRM). So manufacturers separate the signals by *narrowing* the bandpass.

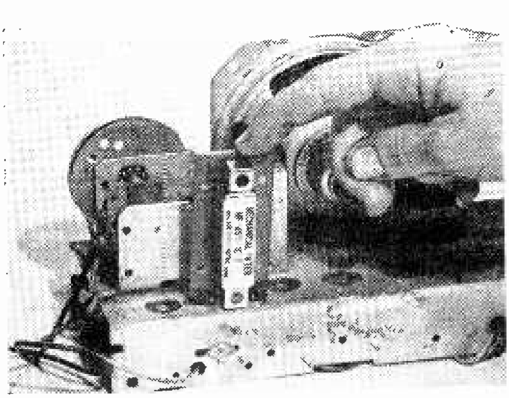
If we take the IF amplifier which produces the Fig. 1A bandpass and add a second or third amplifier, *and we use High-Q tuned circuits,* we could obtain the selectivity curve shown in Fig. 1B. Note that the signal removed 5 kc. from the tuned signal will be attenuated 60 db—you'd be hard pressed to even know it's coming out of the speaker. Naturally, the signals even closer to the center frequency will be similarly attenuated. The narrower the bandpass is made the less the interference from signals adjacent to the desired signal. (As yet, there is no way to separate two signals on the *same* frequency.)

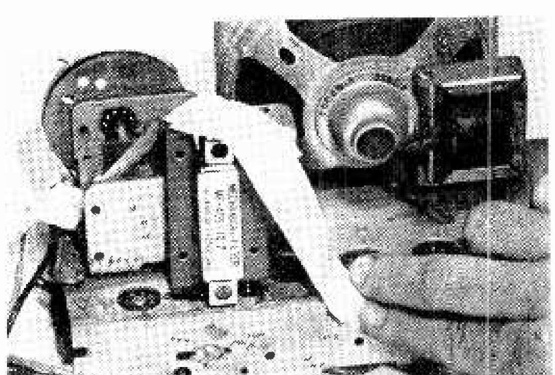
Bucks & Bandpass. But there is a practical limit to increasing selectivity through the use of IF amplification. The manufacturer designing a table radio to sell for ten to fifteen bucks certainly can't use more than one stage of IF amplification, so the BC DX'er using this radio wouldn't be able to separate the weak rare ones buried between two strong locals. And while the communications receiver manufacturer usually includes additional amplification for improved sensitivity and selectivity, selling price determines how much he can give you. (True, the modern budget receiver gives you a lot for your money, but they can always use extra selectivity.)



Adding a mechanical filter to an AC/DC receiver is electrically identical to a SW receiver except filter is secured in place with silicon rubber adhesive. First, find 1st IF tin (left) and remove; add adhesive (right) to base of hole; position filter in place (lower left) and then tape in place (lower right) and allow time for adhesive to set hard. Electrical connection and tune up procedure remain the same—quite easy to do.







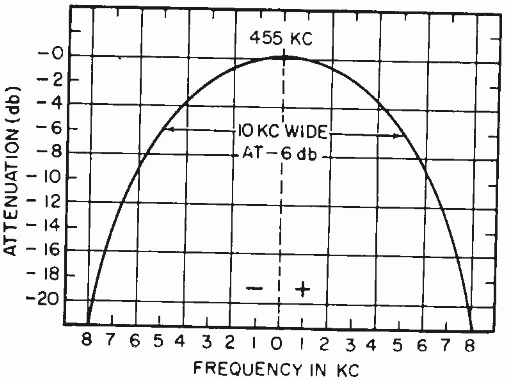
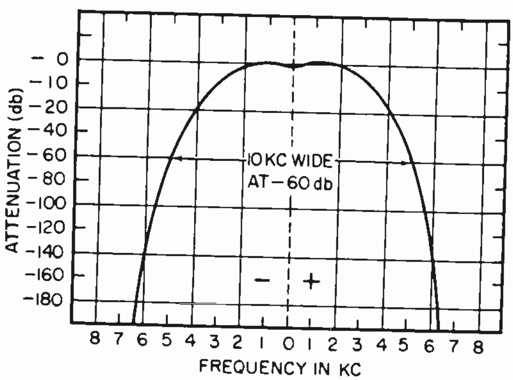


Fig. 1. In (A) above, graph shows bandpass of a simple stage of IF amplification permitting severe QRM by stations up to 5 kc. either side of center frequency. Even stations further out can cause trouble. In (B) below, tuned cascaded IF stages can give −60 db attenuation 10 kc. from center frequency—still not good for nit-picking DX AM-SW stations.



The Mechanical Filter. One of the best ways to achieve razor sharp selectivity is through the use of a mechanical filter. The filter consists of several sections made of nickel alloy resonators which pass virtually only the frequency to which they're tuned. Transformers at both ends couples the signal in and out.

Fig. 2 shows the selectivity curve of a typical mechanical filter. Now keep in mind that this is a *single* filter. Note the steep sided response; signals only two or three Kc. removed from the center frequency are very sharply attenuated. If we went back to our two signals separated by 5 kc. the interfering signal would be so sharply attenuated that you wouldn't even know it existed. Actually, even signals within two kilocycles or so of the center frequency would cause no reception problems. Within the general consumer market, it would take three, four or five stages of specially designed IF amplifiers to achieve the bandpass characteristics of a single mechanical filter.

"Okay," you say, "The mechanical filter is great, but I use a table radio for BC DX'ing and a budget receiver for SWL'ing. So what good is a lot of theory about an item used in expensive receivers?" True, mechanical filters used to be thought of in terms of expensive receivers, but now *you can consider installing one*, even in a table radio.

The Lafayette Radio Mechanical Filter Part No. *99-0123*, $19.95) has been specifically designed for easy installation by the *average* electronic hobbyist. It is supplied pre-mounted on a printed circuit board (see Fig. 3) complete with input and output transformers and soldering points. It is also pre-aligned to a high degree of accuracy; a signal generator is not required.

SW Receivers. The performance of this filter is the bandpass shown in Fig. 2; that's right, the nearly perfect illustration we used is the Lafayette filter. However, keep in mind that all is not perfect. The simplified receiver modification we will describe has one major problem; that is, the filter results in a loss of approximately one S-unit (6db) in overall sensitivity. While this might be no problem for the BC DX'er and the SWL because even budget equipment has more than enough sensitivity up to about 7 mc., it will be sharply noticeable at those frequencies to which your receiver gives only marginal performance. But keep in mind that sensitivity can often be restored by using a preamp or preselector ahead of receiver.

Cheap Jobs. Table radios used for BC DX'ing require a little thought. Many, many, low cost models are pushed to the design limit so you must carefully consider whether it can stand a loss in sensitivity of one S-unit. First count the number of IF amplifiers (do this for communication receivers too). As a general rule of thumb the IF amplifiers number one less than the number of IF transformers (usually cans), i.e: two cans equal one amplifier—one can is the input and one the output;—three cans equals two stages. If your radio or receiver has *two IF stages* it most likely can stand the loss of a little sensitivity. But if it has only one stage take careful note whether you must "strain" to hear most stations, for if you must, the receiver probably cannot stand even a one-S-unit loss. On the other hand, if you're using one of those old, handsome (and expensive) table radios that "burst" with

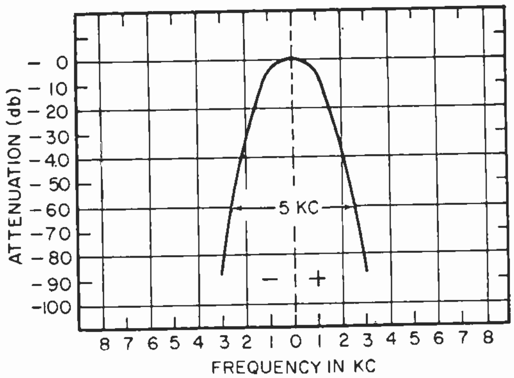


Fig. 2. Bandpass of mechanical filter is only 5 kc. wide at 60 db down. Note steep sides of curve block out side band pickup.

signals, you'll probably get away with the filter's loss even though it has only one stage of IF amplification.

Installing the Filter. The filter is installed in the plate circuit of the 455 kc. mixer or converter tube; actually, it *replaces* the first IF transformer. (If your receiver is the dual conversion type make certain you connect into the 455 kc. mixer, not the high frequency mixer.) Fig. 4 shows a typical mixer circuit. Note that the B+ feeds *through* the transformer's primary, and the AVC voltage feeds through the secondary. Now look at the mechanical filter installation in Fig. 5; note that blocking capacitors, C1 and C2, are used to prevent the B+ and AVC voltages from entering the filter's coupling transformers. Do not try to feed the voltages through the filter's input and output transformers, it's a sure way to blow twenty bucks.

Resistors R1 and R2 are added to the circuit to provide a plate impedance for the mixer and an output termination for the filter; do not eliminate these components!

That's all there is to be filter's *electrical* installation, it should certainly present no difficulties. But the physical mounting is something else, and RADIO-TV EXPERIMENTER has worked out two procedures which should work for most of you.

Installing the Filter. Table radios are notoriously short on space and the filter is going to be a tight fit. Unsolder all the leads from the IF transformer's terminals and then remove the transformer. Orient the filter over the hole in the chassis that formerly passed the IF transformer's terminals and move it around until no part of the filter extends beyond the chassis (or the chassis won't fit back into the cabinet). The filter's transformer slugs should face towards the rear apron to allow adjustment. Place two pencil marks on the chassis to indicate the ends of the assembly and remove the filter. Next, place two gobs of silicon rubber adhesive just inside the pencil marks. The rubber is available under a variety or trade names; it is made by General Electric (GE) and goes under the name of *RTV* if purchased in a radio store, or a variety of names such as *Auto Windshield Sealer* or *Clear Seal*. It also comes in several colors. Regardless of the color or name it's essentially the same product so use whatever you can get.

Line-up the filter assembly with the pencil marks and press the assembly into the rubber all the way down to the chassis. Using masking or plastic electrical tape restrain the assembly so it will be vertical when the rubber hardens (about 24 hours). Then remove the tape and connect the filter into the radio's circuits. If you are careful, you can keep on working while the adhesive sets.

Don't use "floating" connections. All components should be tied down. Either a terminal strip can be secured through one of the IF transformer mounting holes, or if there are no holes, the terminal strip can be soldered directly to the chassis immediately adjacent to the filter. Don't use long leads; long leads can result in instability of the IF strip (the IF amplifiers self-oscillate). Keep the leads and connections as short as possible

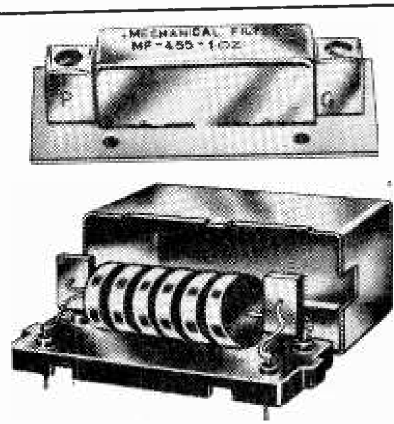


Fig. 3. The Mechanical Filter (Part No. 99-0123), priced at $19.95, is available at Lafayette Radio, 111 Jericho Turnpike, Syosset, N. Y. 11791. Technical specifications are available on request to experimenters.

and in the same relative position as the original connections.

You will note that the letters G and P are etched into the filter assembly. The connection terminals on the side marked G must connect to the IF amplifier's grid; similarly, the connections on the P end go to the mixer plate. As a general rule, you'll reduce possible instability by mounting the filter so the G terminals are nearest the chassis. Then the grid connections will be as short as possible.

Since a communications receiver generally has a lot more free chassis space, an easier and more rigid filter mounting can be made. Again, remove the first IF transformer; but now, strip it and save the mounting lugs. Mark the location of the mounting holes on the filter assembly, and then drill the PC board for a #2 or #3 screws. Attach the mounting lugs to the board and then mount the whole assembly just as the IF transformer was mounted. Use a nut on both sides of the chassis to insure rigidity. The electrical connections are the same as for the table radio installation.

Filter Effects. Turn on the radio and tune across any band to make certain the filter is working. Forget about the sound quality, all you're looking for is signals. If all signals are extremely weak—hardly distinguishable—or the receiver is inoperative, there is a wiring error. As we said, the filter

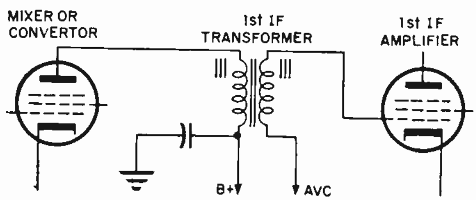


Fig. 4. Typical mixer or converter stage of a receiver showing 1st IF tunable transformer.

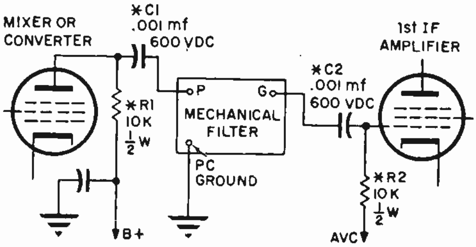


Fig. 5. Circuit modification for mechanical filter—* indicates added circuit components.

is pre-tuned, so if you've made the installation correctly the receiver should work right off-the-bat.

When you're satisfied the installation is okay, tune in a *very weak* signal, and using an insulated alignment screwdriver, adjust the filter's slugs for maximum speaker volume or maximum S-reading. That's all there is to the adjustment. (In most instances the alignment will be perfect and adjustment will make no improvement.)

The first thing you'll notice when you use the receiver is that all signals sound bassy. This is normal. The sharp bandpass cuts a phone signals sidebands, and it's the sidebands that contain the high frequency energy. If you want "extra" highs just detune the signal very slightly from center tuning.

If you're monitoring CW, say with a 1 kc. pitch, and interfering signal comes on somewhat off-frequency and jams you with a, say 5 kc. tone, just detune slightly; you'll only change the pitch of the desired signal while the interfering signal disappears as if it stepped off a cliff (detuning puts the interfering signal outside or down the bandpass).

Some receivers—particularly of the budget variety—simulate selectivity by deliberately applying regeneration to the IF amplifiers (when you want it it's called *regeneration;* when you don't want it it's called *instability*). When a regenerative amplifier is combined with a mechanical filter the overall selectivity can be so great as to make the receiver useful only for CW reception or "rare" DXing for the purpose of obtaining QSL's. The extremely sharp selectivity will make phone signals extremely "muddy," certainly not enjoyable for straight listening.

And just for your reading pleasure, here's the practical results of the two conversions shown in the photos. The communications receiver, which delivered the typical decent performance common to budget equipment, became a superb CW receiver. Where we formerly had to suffer through the severe QRM on the 80 meter band we could now virtually separate every signal.

The table radio is actually one of those old AC/battery tube type portables with good sensitivity. Where formerly we could hear two local stations right next to each other, actually sort of "touching" each other, we now can not only separate them, but at night we pick up two Canadians in between in the clear. No reason why you can't expect similar results. ■

build the AQUA-COM

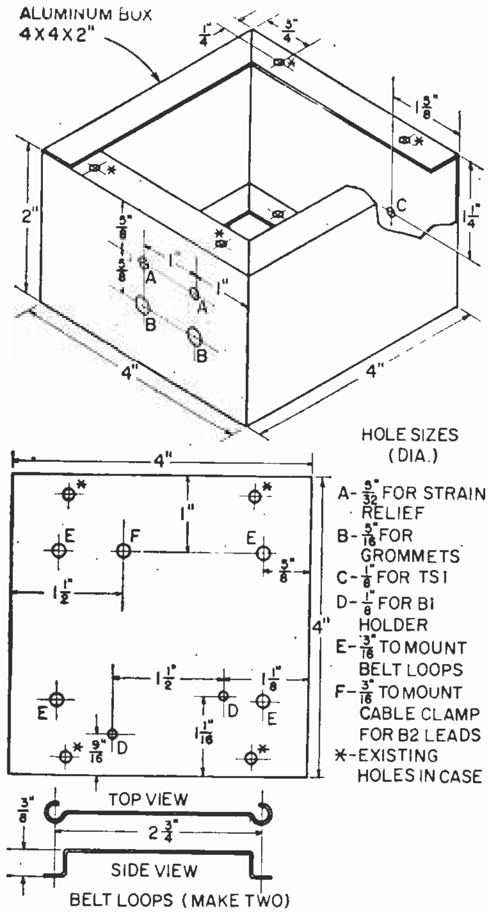
By Edward A. Morris

An inexpensive Scuba accessory for underwater communications

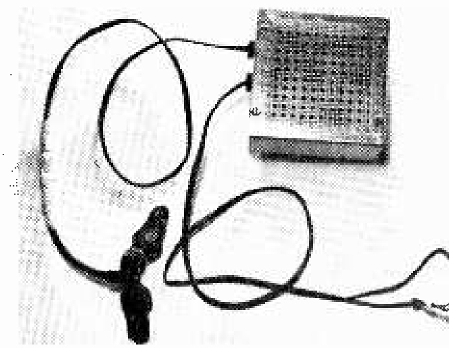
■ If you are letting a thin wallet stand between you and one of those expensive underwater diving intercoms, then the Aqua-Com is your answer! The Aqua-Com more than meets the needs of the average Scuba diver. It has a range of 10 to 15 yards, and will operate at depths of more than sixty feet. Best of all, the Aqua-Com will cost you no more than about $25 and several evenings of your spare time.

How it works. The Aqua-Com is really nothing, more or less, than a public address system that will work under water. Your voice is picked up by the throat microphone, amplified by a transistor module and fed to an underwater speaker. Sonic vibrations generated by the speaker are transmitted through the water and when they reach your ears, they are detected as speech.

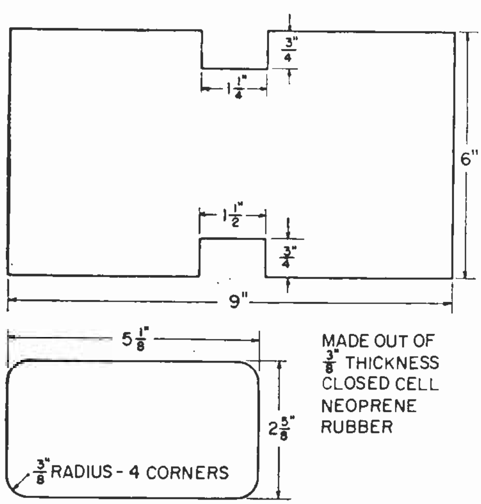
(Continued)



Detail drawings above provide the information necessary to pre-drill the aluminum case. Belt loops made from wire hangers.



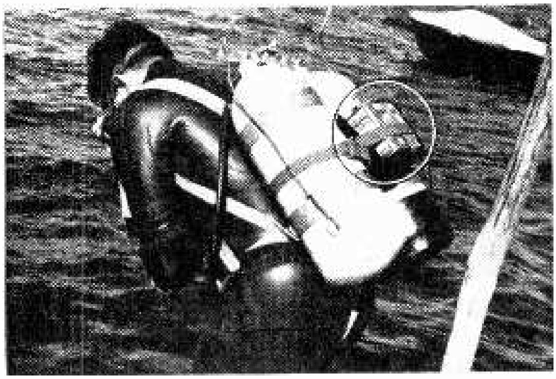
The completed unit (top photo) is all set for installation with 6-volt battery on driver. Carbon throat microphone (bottom photo) doesn't get in diver's way.

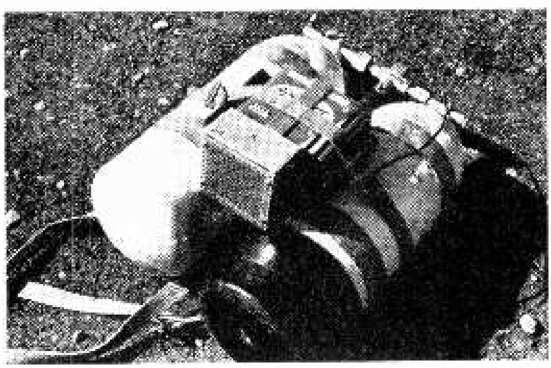


Dimensions for the rubber traction pads used to mount 6-volt battery on air tanks.

The Aqua-Com should be constructed from materials that are immune to the corrosive effects of sea water. This means use only brass, aluminum, or nylon nuts and bolts. Steel, even chromed steel will corrode when exposed to salt water. Use wire with a solid plastic or Teflon insulation. There is *no suitable substitute* for the speaker specified in the Parts List. The one specified has a plastic-impregnated speaker cone and dust cap, plus an aluminum voice coil and a heavily zinc-plated frame. Although not specifically designed to operate under water, it does a good job when modified as shown, and holds up well when cared for properly.

Liquid silicon rubber is used to seal, join, and insulate various parts of the Aqua-Com. Both General Electric and Dow Corning produces silicon rubber for sealing and caulking use in bathrooms . The silicon rubber is applied from its tube like toothpaste





Six-volt battery pack is strapped to diver's air tanks (top photo). Aqua-Com is attached to diver's belt except in bottom photo where it can be strapped to tanks.

and dries to the touch in about an hour. Use only the batteries specified in the parts list since ordinary zinc-carbon batteries are not sealed well enough to withstand immersion and will fail in a short time. The mercury and alkaline batteries specified in the Parts List are sealed well enough to be used down to 60 feet.

Actually, you can use the Aqua-Com down to 250 feet, but battery B1 won't last more than about 5 hours once its been down past 60 feet. However, battery B2 is pressurized to 250 feet, which is more than adequate. You can try sealing B1 by using epoxy cement at the seams at each end of the battery, but this trick works only with the alkaline cell specified. Don't try it with the mercury cell, since the epoxy will prevent the positive terminal from making good contact with the battery clip.

Construction. The first step in the construction of the Aqua-Com is to remove the microphone plug on the T-2 throat mike and to splice on a 3-foot length of plastic lamp cord. After cutting off the old microphone connector, strip back the cable's outer rubber insulation one inch. This exposes two rubber insulated wires. Strip ¼ inch of insulation from each of these wires, and solder on the lamp cord. Cover the connections with liquid silicon rubber to insulate. When the silicon is dry to the touch, tape a 2.5 inch section of coathanger wire over the splice. The coathanger wire serves to prevent flexing and possible failure of the splice. Cover the splice with plastic tape, then apply silicon rubber over the entire splice, including the end of the tape.

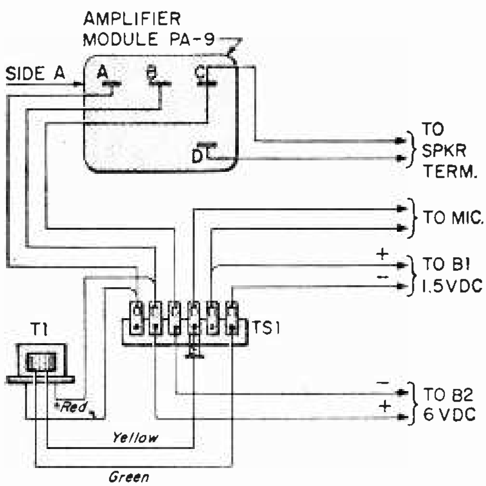
While waiting for the silicon rubber on the microphone cable to dry, remove the speaker from its original enclosure, cut off its mounting ears and smooth any ragged edges on the speaker with a file. This should leave the speaker frame more or less round. Coat the speaker's cardboard rim and center dust cap with several coats of a rubber-based cement such as Ply-O-Bond. While the cement is drying, prepare a small quantity of epoxy cement according to the manufacturer's directions. Apply the epoxy to the speaker's terminal strip. Carefully coat the entire fiber strip, top, bottom and all four edges. Don't allow any of the epoxy to drip onto the speaker cone or the terminals. Set the speaker aside and proceed with the transformer preparation.

If you use the transformer specified in the Parts List, cut the black, brown, and white wires close to the transformer body. Completely cover the transformer with silicon rubber, paying special attention to the areas around the leads. Be sure you leave no area of the transformer uncovered. Hang the transformer up by the leads to dry. If you use a different transformer than the one specified, make sure it has the same electrical ratings as the one specified.

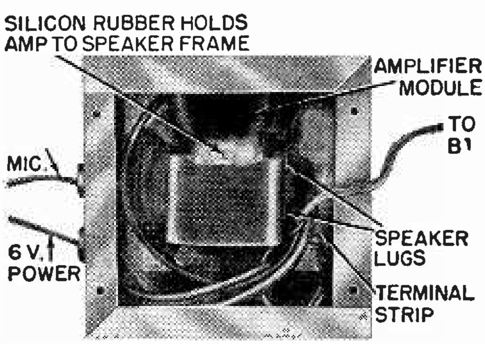
Preparing the case. The mechanical layout shown in the detail drawings allows uncrowded and easy construction. Centerpunch and drill all holes in the case. The battery clip for B1 is mounted on the back cover plate with two 4-40 x ¼-inch screws. The screw heads should be inside the case and the nuts outside, otherwise the battery will not seat properly in the clip.

Form the belt loops out of coathanger wire. You will find the wire much easier to work if the ends are first annealed. Heat the wire to a glowing orange-red in the flame of a blow torch or gas burner, allowing it to cool slowly.

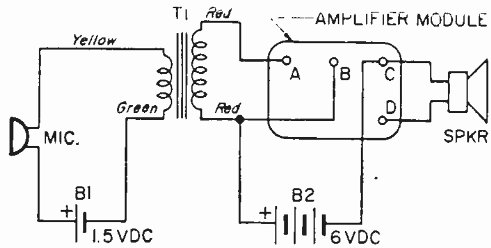
Cut the speaker grille out of a piece of perforated aluminum. Make sure that the mounting holes match with the ones on the case. If they don't, use a rat-tail file to coax them into alignment. Next, mount amplifier module PA-9 on the speaker. To be sure that the amplifier is mounted in the proper position, set the speaker on a table in front of you with the speaker lugs facing you. Place the amplifier module on the speaker frame so that it is on your *right* side. The leads from the amplifier should be coming out



The pictorial diagram shown above should be used only if the terminal configuration in the amplifier module you purchase is identical with the diagram. Otherwise, follow the diagram supplied with the unit. Although the module may appear to be different, it is an exact electrical replacement.



Parts layout is not critical, however, be sure all parts are treated as per text.



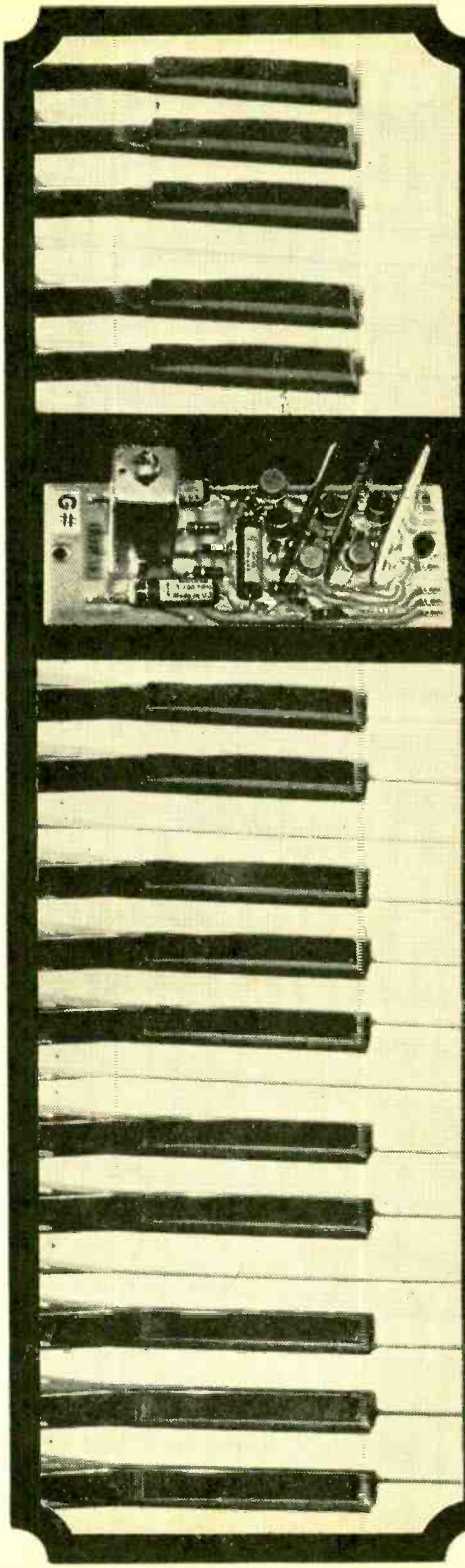
Schematic diagram does not show amplifier details—not necessary for moduled part.

Parts List

RCA VS1334 manganese alkaline cell
B2—Burgess TW1S 6-volt pressurized battery (Allied Radio 55J114). Do not make any substitution except as noted in text.
Mic.—Throat microphone, surplus type T-30 (John Meshna, Dept. TVE, 19 Allerton St., Lynn, Mass., Fair Radio Sales Co., 2133 Elida Rd., P. O. Box 1105, Lima, O., and many other electronic surplus suppliers)
SPKR—Misco weather-proof speaker, model MS-38 (Lafayette Radio 44G5201—see text)
T1—Transistor transformer; 500-ohms primary; 8-ohm secondary (Lafayette 99G6129 or equiv.)
TS1—6-lug terminal strip, terminal 4 connects to ground
1—Amplifier PA-9 module (available at Gem stores. Also, Olsen Electronics as TR-37 and Lafayette as 19G1511)
1—4" x 4" x 2" aluminum box with two removable 4" x 4" sides, must be unpainted
1—Neoprene rubber, closed cell (See text and your Scuba supplier)
1—Cotton straps, as required
Misc.—Plastic-covered lamp cord, rubber grommets, plastic cable clamps, epoxy cement, tube of rubber sealant cement (see text). 4" x 4" piece of perforated aluminum sheet, plastic tape, coat hanger wire, solder, plastic-covered wire, plastic hardware, etc.
Estimated cost: $25.00
Estimated construction time: 3 hours

toward you. Now get down to the level of the table, and make sure that the top of the speaker frame is the highest point of the assembly. The top side of the amplifier module should be slightly below the level of the top of the speaker frame. Amplifier module is now attached to the speaker frame with silicon rubber. It is temporarily held in position with a "C" clamp, or a rubber band wrapped around the amplifier and the speaker frame. Silicon rubber is to be applied so as to form a bridge between the speaker frame and the amplifier module. Make several such bridges, one on each side of the

(Continued on page 118)



Organs Without Pipes

Transistorized oscillators and exotic networks bring the sound of a church organ to your home

Time was when an organ involved huge quantities of compressed air and yard upon yard of tuned pipes, altogether a machine of such size that nothing short of a cathedral or large theater could house one.

Electronics has changed all that, and now the electronic organ is commonplace. For do-it-yourselfers, organ kits have been available for several years—and recently the Heathkit people have come out with their version of the new Thomas "Coronado" all-transistor organ in kit form (Fig. 1 on next page).

But how can a handful of transistors and semiconductor diodes replace those yards of tuned pipes, and produce the same warm sound? Answering that question is what this article is all about.

Inside Music. For a starting point, we have to stop and look at the fundamental characteristics of music itself. "Music" can be defined as an ordered arrangement of sound tones—but if it's going to sound like music to our ears, the pattern of the

By Jim Kyle and Julian M. Sienkiewicz

Organs Without Pipes

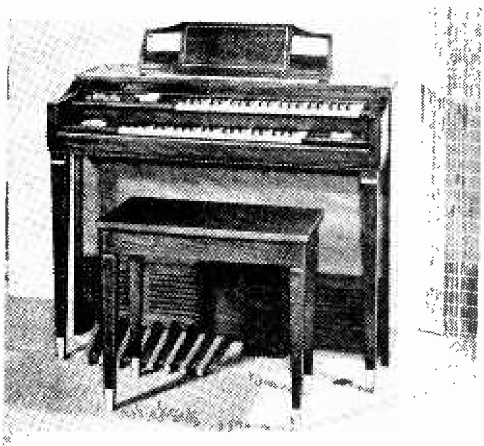


Fig. 1. For 60 hours of soldering fun, a kit builder can save over $400 by assembling the Heathkit/Thomas GD-983 transistor organ. Seventeen rich and true organ voices with countless melodious chime variations pour forth from the GD-983's semiconductor heart.

tones must follow some definite rules.

For instance, the familiar musical scale consists of 12 tones. The tones follow a precise relationship. They're usually defined in terms of the frequency of the "A above middle "C", which is also known as "A3". The frequency of A3 is 440 cycles per second.*

All notes with the same name fall into even-harmonic relationship with each other. The A an octave above A3, known as A4, has a frequency of 880 cps, while A2 (an octave below our standard) is 220 cps.

The other 11 tones of the scale fall into fractional-harmonic relationship. Middle C, or C3, is at 261.626 cps. The next note up the scale, C sharp 3, is 277.183 cps. D3 is at 293.665 cps; the remaining tone frequencies are shown in Table of Musical Notes and their frequencies.

* The British Standard Concert Pitch for A above middle C has varied throughout the years and has not been in agreement with music societies of many other nations until 1939. Below is a list of dates and frequencies used by British musicians:

1813	Original Philharmonic Pitch	424 cps.
1846–54	Mean Philharmonic Pitch	453
1874	Highest Philharmonic Pitch	455.5
1896	New Philharmonic Pitch	439
1937–8	Average pitch reached in performance by selected British orchestras	443
1939	Standard Concert Pitch agreed to by international conference	440

Why the odd relationships? The answer to this one is hidden in the answer to still another question—why don't all instruments sound the same?

Voicing. The particular "voice" of a specific type of instrument is brought about by the harmonics or "overtones" of the note sounded, which are either emphasized or suppressed by the instrument. For instance, the violin's sound contains 60 per cent fundamental-frequency sound, 20 per cent second harmonic, an octave higher, 10 per cent third harmonic, and the remaining 10 per cent is made up of still higher harmonics. (See Fig. 2.) A flute, on the other hand, produces an almost-pure sine wave (single-frequency) tone, with very few harmonics present. Now you can understand why a violin and flute sound different even on the same note.

The fractional-harmonic relationship of the notes in our scale is also due to the high-harmonic content of the instruments. For instance, the third harmonic of C3 is almost exactly the same frequency as the fundamental of G4. (See table of Musical Notes.) Similarly, the third harmonic of E3 is the same as C5.

These relationships between the notes of our scale are what make the difference between music and discord; if all the high harmonics present blend together smoothly, we have a "pleasant" sound. If not, we have "discord".

Character of Sound. And without half trying, we have slipped over into the area of "complex waveforms" without so much as a pause for breath. This somewhat frightening name is simply a way of saying "a sound waveform made up of a fundamental and a number of its harmonics, all at the same time." Since the harmonics give individual instruments their character, it's obvious that music is made up of complex waveforms.

However, the character of a musical instrument comes from more than just the harmonic content of the sound. Equally im-

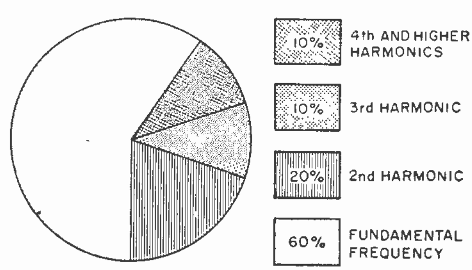


Fig. 2. Breakdown of the fundamental frequency and harmonics in a violin's sound.

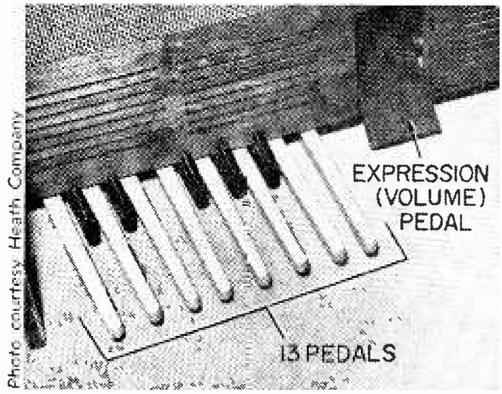
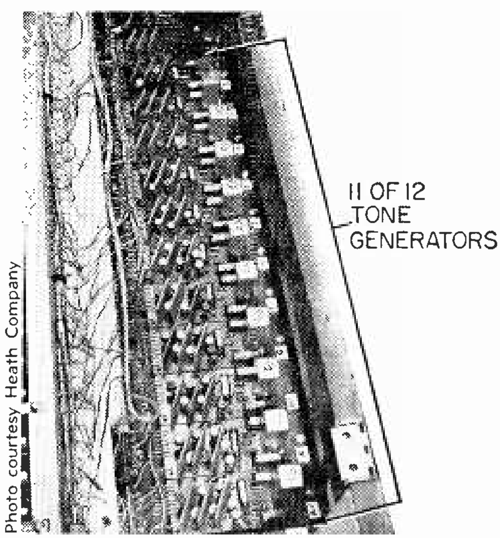


Fig. 3. Besides keeping both hands busy, the musician's feet control organ's volume and play 13-note heal-and-toe pedalboard.

Fig. 4. 12 fixed tone generators (one not visible) lined up like soldiers provide the musical tones for keyboards and pedalboard.



portant is the speed with which the sound starts and stops. For instance, a piano and an organ can be voiced with almost identical harmonic content—yet will sound far different, since in the organ the sound continues so long as the key is held down, while in the piano the sound hits rapidly, then dies away.

Differences in reverberation time can make two instruments of the same type sound radically different, as for instance the "honky-tonk" piano versus the concert grand. And the rapid flutter of pitch known as "vibrato," or its absence, does much for establishing the individuality of the instrument.

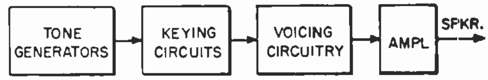


Fig. 5. Extremely simplified flow diagram of an electronic organ—cables connect blocks.

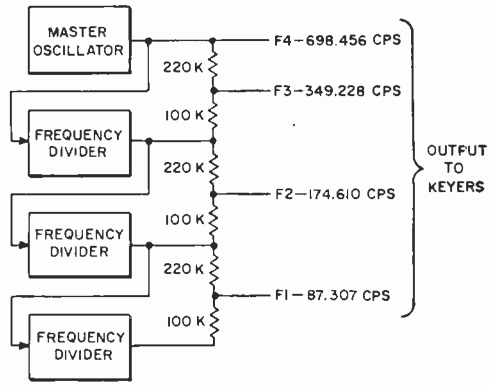


Fig. 6. Master-oscillator/triple-divider circuitry used in Heathkit/Thomas organ.

Once we know the various factors that make an organ sound like an organ, rather than like a piccolo or a piano, we can readily design electronic circuits to duplicate the sound of the organ—and we're in business, without the pipes.

The Organ. An organ keyboard contains 88 keys, like a piano, but they are arranged in two "manuals" or separate keyboards, known as the "swell" and the "great." In addition to the 22 manual keys, a pedal register is included, with 13 more tones as in the Heathkit/Thomas version (Fig. 3).

This would be a total of 101 different tones—except that an organ has a number of different stops*, and each stop produces a separate voice-tone from the same key. Thus, an organ having 16 voicing stops is capable of producing 1,616 different tones from its 101 keys, if only one stop is used at a time. Since more than one stop can be in use simultaneously, the number of different voice-tones which an organ can produce is almost unlimited.

Early electronic organs used a different tone generator or oscillator for each of the 101 keys, and some designs used additional tone generators for some of the different stops, leading to several hundred oscillators or tone generators per instrument. The mod-

* A stop on an electronic organ is a switch that adds a sound character to the organ output. If more than one stop is switched on, their different sounds mix as would the sounds from instruments in an orchestra. Stops are given names which describe their characteristic sound, such as violin, saxophone, French horn, bass clarinet, flute, etc.

Organs Without Pipes

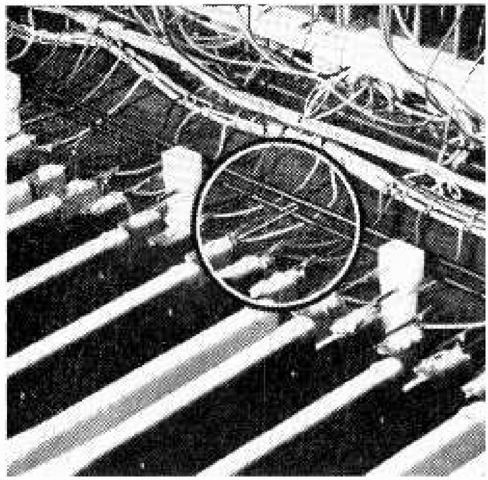


Photo courtesy Heath Company

Fig. 7. Switching in the GD-983 is a very simple affair (see photo right). One contact wire per key (below) serves as the wiper of single-pole, double-pole, spring-loaded switch.

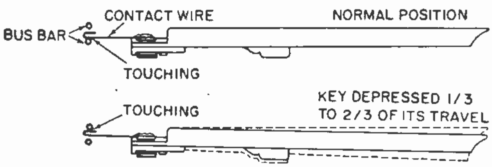


Table of Musical Notes and Their Frequencies

Note	cps	Note	cps	Note	cps	Note	cps
C0	32.703	G#1	103.826	E3	329.628	B4	987.767
C#0	34.648	A1	110.000	F3	349.228	C5	1046.502
D0	36.708	A#1	116.540	F#3	369.994	C#5	1108.731
D#0	38.891	B1	123.470	G3	391.995	D5	1174.659
E0	41.203	C2	130.810	G#3	415.305	D#5	1244.508
F0	43.654	C#2	138.591	A3	440.000	E5	1318.510
F#0	46.249	D2	146.832	A#3	466.164	F5	1396.913
G0	48.999	D#2	155.563	B3	493.883	F#5	1479.978
G#0	51.913	E2	164.814	C4	523.251	G5	1567.982
A0	55.000	F2	174.614	C#4	554.365	G#5	1661.219
A#0	58.270	F#2	184.997	D4	587.330	A5	1760.000
B0	61.735	G2	195.998	D#4	622.254	A#5	1864.655
C1	65.406	G#2	207.652	E4	659.255	B5	1975.533
C#1	69.296	A2	220.000	F4	698.456	C6	2093.003
D1	73.416	A#2	233.082	F#4	739.989	C#6	2217.461
D#1	77.782	B2	246.942	G4	783.991	D6	2349.318
E1	82.407	C3	261.626	G#4	830.609	D#6	2489.016
F1	87.307	C#3	277.183	A4	880.000	E6	2637.021
F#1	92.499	D3	293.665	A#4	932.328	F6	2793.826
G1	97.999	D#3	311.127				

ern approach typified in the Heathkit GD-983, however, uses a limited number of master tone generators, and derives all the other needed tones from these few transistorized circuits (Fig. 4).

In the GD-983, 12 main tone generators (known as master oscillators) suffice. They are tuned to produce next-to-the-highest octave available in the instrument, from 739.989 to 1396.913 cps. For the top octave, which is used only occasionally, bandpass filters separate out the second harmonic of each master oscillator. For lower octaves, cascaded frequency dividers are employed. Each divider stage cuts the tone frequency in half, dropping the note by an octave for every divider it passes through. The outputs of the tone generators then pass through the keying circuits, where keyboard-operated switches select which are to be used at any given instant, and on to the voicing circuitry which produces the correct mixture of harmonics for the selected voice stop. From the voicing circuitry, the tones go on to the amplifier and speaker. The basic organization of the instrument is shown in block form in Fig. 5, with most of the details left off for clarity.

The Tone Generators. The heart of the instrument consists of the tone generators, which in the GD-983 cover the notes from F#4 (739.989 cps.) to F5 (1396.913 cps.) by master oscillators, and produce lower notes by "counting down" in frequency dividers. The master oscillators and frequency dividers are connected as shown in Fig. 6.

The oscillator itself is designed to produce an output rich in harmonics, to assure that the voicing circuits have enough of the right harmonics to form any desired waveform. The dividers are identical to the flip-flops used in digital computers, and their outputs are square waveforms.

Square waves contain all the odd harmonics of their fundamental, but none of the *even* ones. Since most of the voicing circuits require both even and odd harmonics, the output of each divider is mixed with a part of the output of the preceding divider stage to form a staircase-shaped wave having both even and odd harmonics. This mixing is done by the resistors shown in Fig. 6.

Keying. From the tone generators, the tones pass through a multi-conductor cable to the keying circuits. Each tone, F1, F2, F3, and F4, to use the four F notes as an example—has a separate line on this cable.

To get the extra-low pedal tones, additional divider circuits are used, driven by the dividers of the main tone generators. The fifth octave is synthesized, when needed, in the voicing circuits which we'll look at a little later.

The keying circuits are operated by the manual and foot pedal keyboards, and it is here that the attack and decay times of the sound signals are shaped to meet organ specifications. In days past, the keying circuits consisted of multi-contact switches of intricate mechanical design, mounted across the back of each keyboard. (See Fig. 7.)

Diode Switching. However, computer circuitry makes another appearance in Heath's GD-983, with the use of diode-switching circuits for keying of the swell and pedal keyboard circuits. Use of the diodes reduces the switch requirement on the keyboard itself to a single contact per key, except for the 28 swell keys which produce chime notes. These must have 3 extra contacts per key, to sound the chimes.

Fig. 8 on page 92 shows a simplified schematic of the diode switching used in the GD-983. Only a part of the circuitry is shown—just enough to illustrate how the diodes route the tone signals from the generators to the various signal-output bus lines. Actually, each of the 44 keys on the swell manual keyboard of the GD-983 has six diodes associated with it.

The parts shown in Fig. 8 include two keyswitches, one for F2 tone and the other for F3 tone, and the diodes which route the F2 tone signal to the proper output bus lines when each of the keyswitches is closed.

With both keyswitches open, as drawn in Fig. 8, negative voltage from the B– line is applied to diode SD6 (F3). This reverse-biases the diode, preventing signal from passing through it.

When keyswitch F2 is pressed, it connects resistor R1(F2) to the +15-volt bus line. As soon as capacitor C1 charges, the +15 volts is applied to resistor R8(F2), and thence to diode SD4(F2). This forward-biases the diode, and allows the positive voltage to appear also at the anode of diode SD6 (F3). Since resistor R8(F2) and R11(F3) are both 47K ohms, the voltage applied to SD(F3) will be approximately half of +15, or 7½ volts, forward-biasing this diode also. With SD6(F2) forward-biased, signal from the F2 output of the tone generators can flow through SD6(F3), SD4(F2), and resistor R7(F2) to the 8-foot output bus.

The F2 tone is prevented from reaching the 16-foot output bus associated with keyswitch F3 because the 7½ volts appearing at the junction of SD6(F3) and SD4(F2) is also applied to SD4(F3), and reverse-biases this third diode.

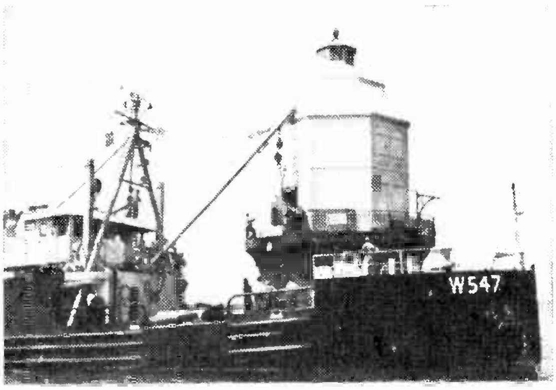
Clicks and popping noises generally associated with audio switching are prevented by the capacitor on the keyswitch line; this capacitor must charge before any diodes can switch. The click caused by the mechanical switch dies out before the capacitor charges enough to allow signal switching.

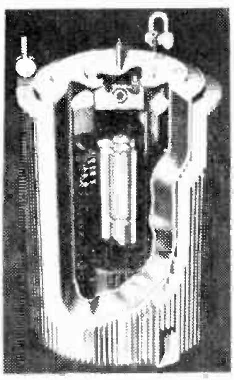
Additional diodes are used to control the attack and decay characteristics through panel-mounted stop switches. They switch additional capacitors and resistors in and out of the keying circuits, to control the time delay between keyswitch action (either opening or closure) and actual signal switching. In addition, they offer the possibility of imitating percussion instruments, by routing the keyswitch action to special control circuits and taking the outputs of these circuits to control signal-switching diodes. With the percussion option, sounds such as those of the piano, guitar, and similar instruments can be created.

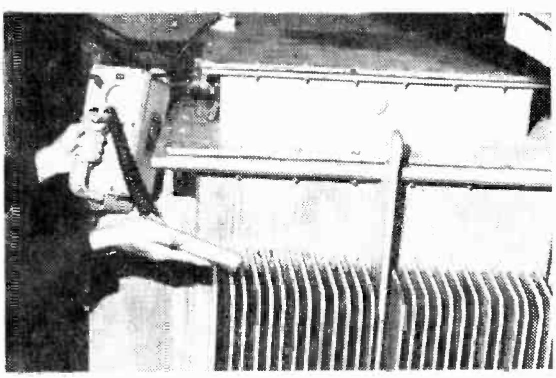
Chimes. For chime tones, three additional keyswitches are added to 28 keys of the swell manual keyboard. When "chimes" are selected, these keyswitches are connected in parallel with the switches of other keys, so that when the F3 key (for example) is

(Continued on page 92)

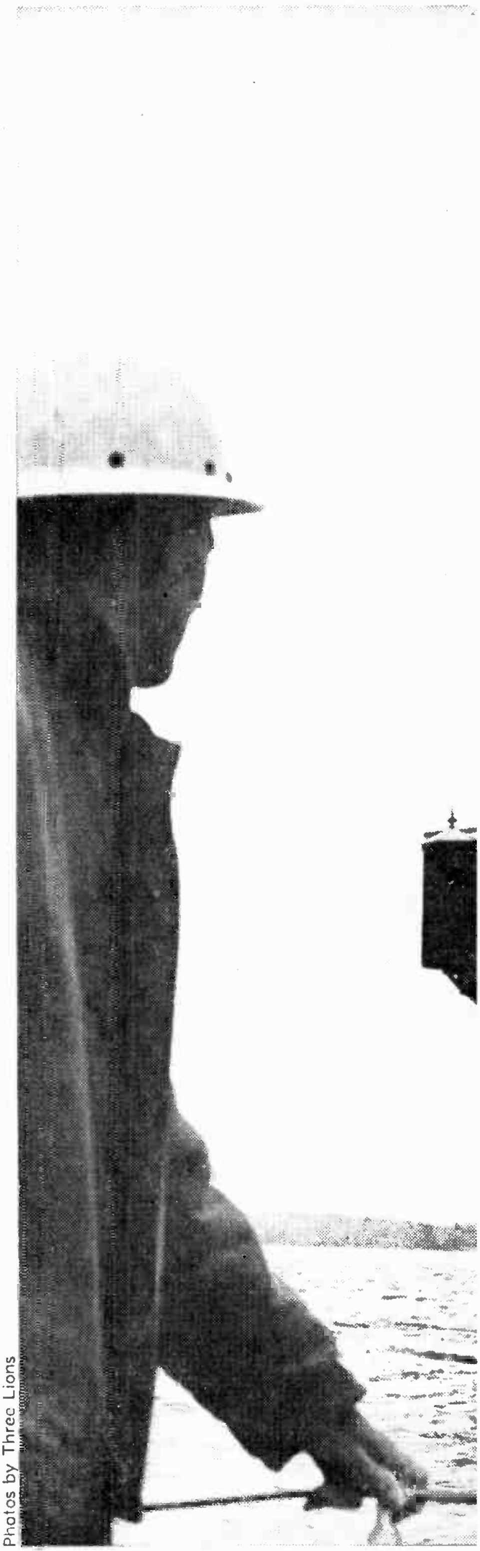
The Baltimore Light, once diesel-powered, receives its atom-powered generator (top photo). The cutaway view of the reactor (middle-left photo) contains 20 pounds of strontium titanate pellets in 14 circular cells—enough for ten years of service. The heat generated from strontium-90 pellets is converted to electricity by 120 pairs of thermocouples.



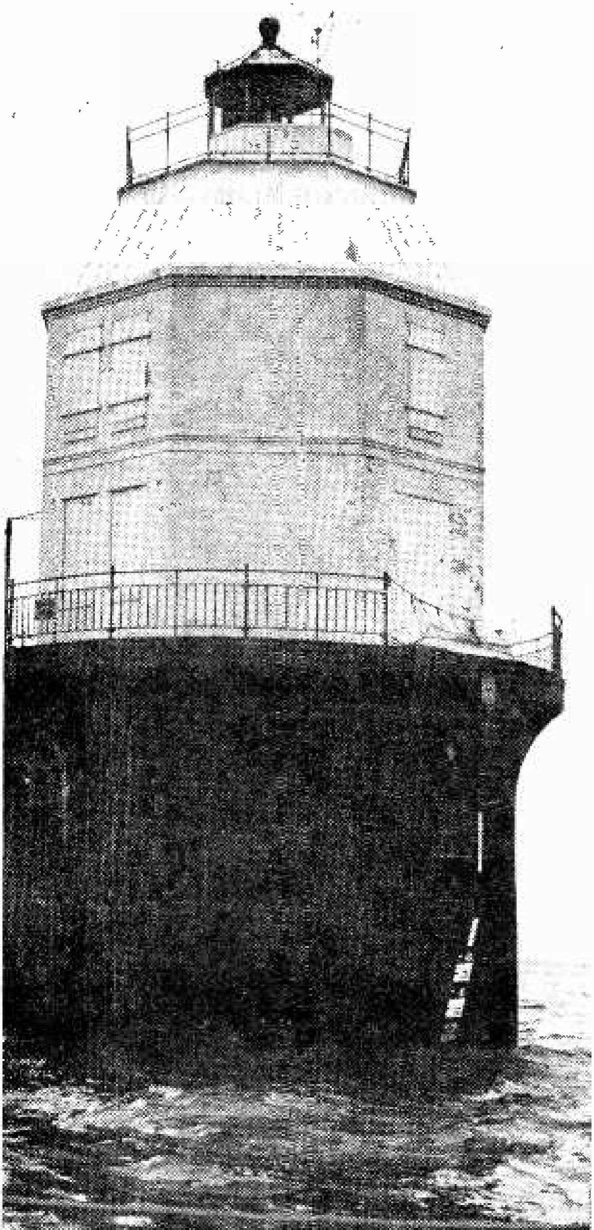




The pile that powers the light is radiation proof and tamperproof but a warning is nevertheless posted (middle-right photo) in case of unwary trespassers. Coast Guard officer inspects pile (bottom photo) regularly for stray leakage with radiation counter.



Photos by Three Lions



BALTIMORE'S ATOM-POWERED LIGHTHOUSE

☐ Baltimore has a reputation for pioneering with new lighting devices. In 1817 it was the first American city to illuminate its highways with the new-fangled gas. Now it is the first city to have an atom-powered lighthouse to light up its "Highway to the Sea"—Chesapeake Bay.

The lighthouse, known as the Baltimore Light, is over half a century old and has been converted to run on atomic power by a unit developed and manufactured for the Atomic Energy Commission by the Martin Company's Nuclear Division. The unit, known as SNAP-7B (Systems for Nuclear Auxiliary Power) is approximately the size of a trash can—34½" high and 22" in diameter—that weighs 4600 pounds. It is fueled with strontium titanate, a safe form of strontium-90—a waste product of large nuclear reactors. The decaying radioisotope develops heat which thermocouples convert into electricity for the 60-watt Baltimore Light. This type of generator is designed to provide trouble free, long-lasting sources of power for remote locations where refuelling and maintenance would pose severe problems, and for operating transmitters on space shots and satellites. The Baltimore Light is not a "remote" station, however, it has been provided with atomic power as a testing ground convenient both to the manufacturer and to the Coast Guard's Testing and Development Unit at Curtis Bay, Md. Eventually the atomic generator will be installed in some remote and inaccessible site where it will operate for ten years without attention. ■

talk on a

By Forrest H. Frantz, Sr.

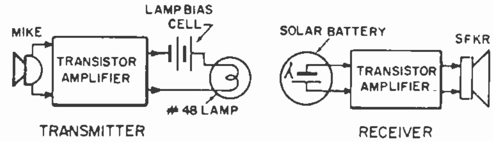
You've read a lot about the possibilities of using laser-beam communications, but did you know that ordinary light could be modulated to carry messages also? You can set up a simple light-beam communications demonstrator in about half an hour and for less than $15, and all the components can also be used for other experiments and gadgets later.

How It's Done. The basic techniques for light-beam communication consists of converting sound energy to electrical energy and then using the electrical energy to modulate a beam of light. The modulated light beam is picked up by a photocell, and converted back to electrical energy. The electrical energy serves to drive a speaker which produces sound energy at the receiving end of the apparatus.

The complete apparatus that is shown in the photos is intended for demonstration purposes only, and will not work over long distances. To simplify construction two ready-made low-cost ($3.75 each) transistor amplifiers were used, one for the transmitter and one for the receiver.

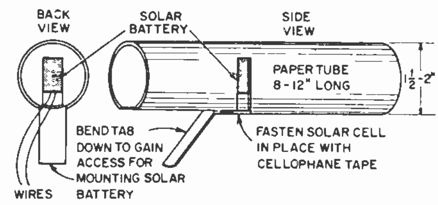
Refer to the photo of the transmitter setup, the schematic drawing and parts list. Although the photo shows only one 1.5-volt bias cell in the transmitter's lamp circuit, experiments have proved that 3 volts worked better and two series-connected dry cells should be used. No need to observe polarity when connecting lamp bias cells. The reason for using the bias battery in the output-lamp circuit deserves mention. The bias battery sets a steady light level. This light level serves as a carrier for the audio signal from the amplifier just as radio frequencies serve as the carrier in a radio transmitter. Another reason for the bias is that the lamp will respond better to the amplifier signal when

LIGHT BEAM



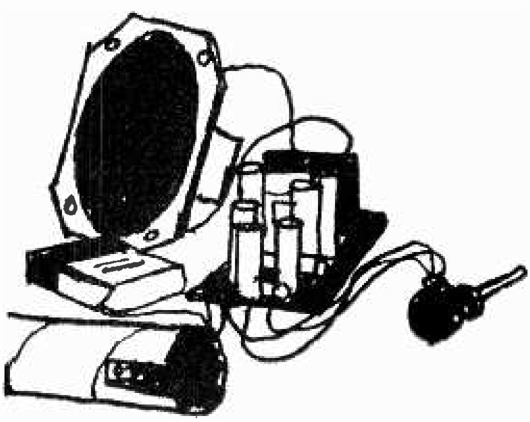
Block diagram for a simple light transmission system. No need for exotic lenses.

Here's a Science Fair project easy enough to assemble without any help from your Dad—it's a sure-fire winner!



Paper tube from 8 to 12-inches long serves as shield for photo cell—conserves gain.

All set up and ready to go! For Science Fairs, mount system on shellacked blocks.



it is biased. The transistor-amplifier connections are explained on the data sheet that comes with the amplifier.

Putting It Together. In the actual setup, it is desirable to add a parabolic reflector to the lamp. The author used a reflector from an old flashlight and glued it to a lamp socket as shown in the photo.

The receiver employs a solar battery as a sensor whose output is fed to an amplifier that drives a loudspeaker. The solar battery is mounted in a mailing tube (for shielding against "light noise") that is pointed toward the lamp. The paper tube's diameter isn't critical—1½ or 2 inches is fine. Length should be 8 to 12 inches. Cut two slits about ½-inch apart and about 2-inches long in the tube and bend down the resulting tab. Fasten the solar battery in the tube with cellophane tape as shown in the drawing with the tab replaced. Try reversing the solar battery leads—output may be increased somewhat.

PARTS LIST

- 2—Amplifier, 3-transistor (Lafayette 99G9039 or equiv.)
- 1—Microphone, crystal (Lafayette 99G6019 or equiv.)
- 2—5000-ohm volume control with switch
- 1—Socket, miniature screw-type pilot lamp
- 1—Pilot lamp, #48
- 2—9-volt transistor battery (Burgess 2U6 or equiv.)
- 2—1.5-volt penlight cells (Size AA)
- 1—battery holder for two AA cells
- 1—Reflector (See text)
- 1—Carboard mailing tube (See text)
- 1—2½-inch speaker, 8-10 ohms (Lafayette 99G6097)
- 1—Solar battery (IRC B2M or equiv.)

Estimated cost: $15.00
Estimated construction time: 2 hours

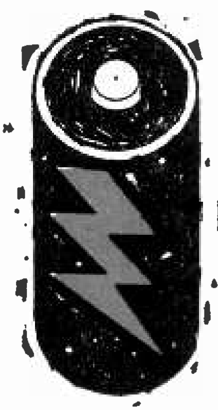
If you own an amplifier with sufficient gain, you may use it in place of one of the amplifiers but if it has too much power it may blow out the #48 bulb.

Getting More Range. The arrangement described is for demonstration purposes and

(Continued on page 91)

Here's a lousy voltage regulator

By Jim Kyle, K5JKX



CURRENT CLAMP

Whether you're designing, servicing, or just experimenting with a semiconductor circuit, you've probably already learned via the expensive route that semiconductor junctions are capable of destroying themselves much more rapidly than are fuses.

Thus, for general bench work, an "instantaneous fuse" which would interrupt current flow before the speediest semiconductor could be capable of melting would be a handy device.

The Current Clamp will, within certain limits, perform this function. While it won't interrupt the current flow, it will clamp it to a pre-set maximum value, and will not permit current to exceed this maximum. If the technician chooses his maximum current setting wisely, the semiconductors won't be harmed by excessive input.

Putting It Together. Construction and operation of the Current Clamp is so simple that one can be put together in a few minutes for any particular application, though it's handy to have a wide-range unit on hand for instant use. The author's unit has a range of zero to 25 milliamperes (although the zero-current position is more likely due to a defective variable resistor rather than to design).

The schematic diagram of the Current Clamp and the photos show how the unit can be constructed. The schematic diagram also serves to illustrate the how-it-works discussion below, essential to your ability to tailor one to fit any specific job.

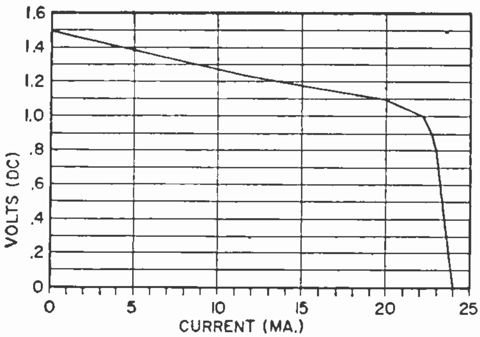
Total parts requirements are two resistors (R1, R2), a voltage-reference diode (D1), and a transistor (Q1) capable of handling the maximum current flow.

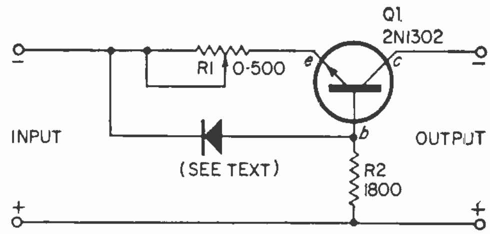
The Current Clamp uses an inexpensive top-hat 750-ma. 400-*piv* silicon diode as its voltage reference, and a 2N1302 *npn* transistor. The Clamp's circuit works equally well with 2N107 and other experimenter-grade units so long as they are capable of passing the desired current and dissipating the necessary power. The 2N1302 will pass 300 ma. and is rated to dissipate 0.3 watt, more than ample safety margins for a 25 ma. Clamp.

Use of the silicon diode (D1) as a voltage reference is not merely an economy measure. It's fairly well known by now that these diodes have a relatively stable 0.5 to 0.7 volt forward drop, and by choosing such a small reference voltage the Clamp has much less effect on the circuit with which it is being used than would a conventional current generator with a higher reference voltage. To explain the reasons for this, however, we must first discuss briefly the manner in which the Current Clamp operates:

How It Works. Current flow in the load

that is ideal for replacing power supply fuses!





Schematic diagram for the Current Clamp shows output current passing through Q1's emitter-collector circuit. Graph at left shows current limiting for 1.5-volt input.

PARTS LIST

D1—750-ma., 400-PIV silicon diode (GE 1N539 or equiv.)
Q1—2N1302 transistor (see text)
R1—500-ohm, 5-watt potentiometer (Mallory Type VW or equiv.)
R2—1,800-ohm, ½-watt resistor
Misc.—Perforated phenolic board, flea clips, wire, solder, etc.

Estimated cost: $3.00
Estimated construction time: 1 hour

(the circuit connected to the "output" terminals) must be through transistor Q1's collector lead. By the beta-multiplication effect inherent in transistors, the largest part of this current must flow through the collector-emitter path; very little can flow in the base circuit. Thus, most of the load current flows through Q1's emitter lead.

Resistor R1 is in this lead, and the current flow through it develops a voltage which is proportional to the current. With an *npn* transistor, the emitter will become more positive than the source (at the "input" terminals).

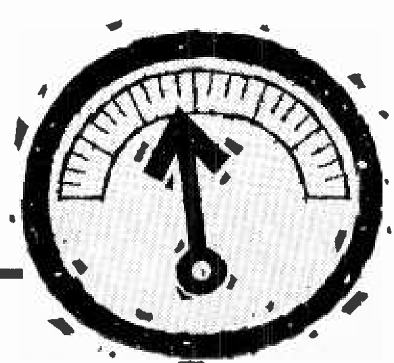
The transistor's base, meanwhile, is held at a fixed potential which is more positive than the source by the amount of voltage dropped across reference diode D1.

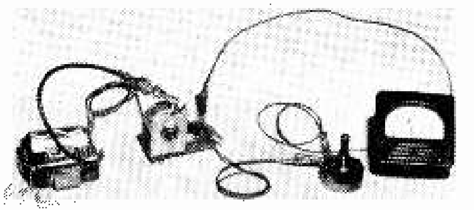
So long as the base remains more positive than the emitter, Q1 is biased to saturation and the flow of current is impeded only by R1. Since a typical value for R1 is less than 100 ohms, this offers little restriction to current.

When the voltage developed across R1 drives the emitter positive to the base, however, the transistor is cut off by the resulting reverse bias and current flow in the load ceases to be as described. Instead, load current is restricted to a value which holds the emitter voltage just exactly enough *negative* to the base to permit that amount of current to flow.

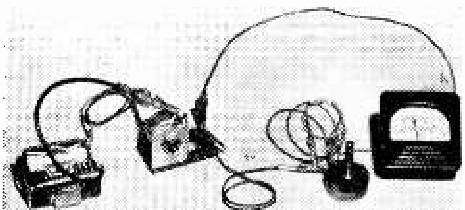
Feedback. The action is an "infinite-negative-feedback" affair, somewhat akin to the clamping of grid bias in a cathode follower vacuum-tube circuit. As more current attempts to flow, the transistor bias acts to reduce current, and vice versa. The result is that load current is restricted to a fixed value, even if the "output" terminals should be shorted together.

Note that all load current (or at least all but *1/beta* of it) must flow through R1 to





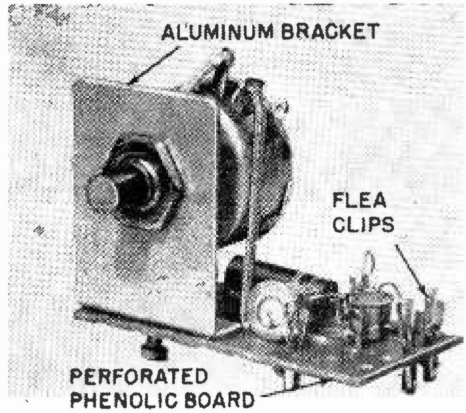
Top—current clamp set up to fuse 3-volt supply from potentiometer load. Bottom—short across pot load should drain batteries. Note meter in photos indicates no current increase. Current Clamp is doing its job.



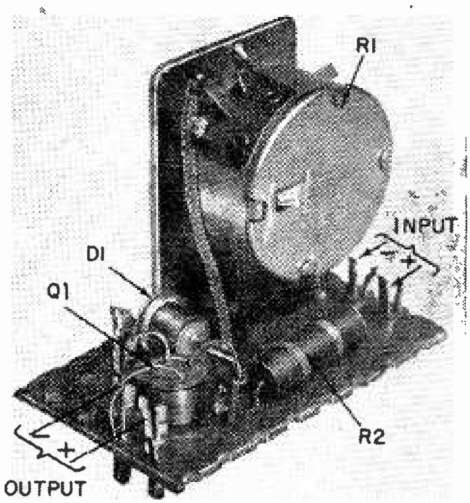
develop the control voltage. This means that the output resistance of the Current Clamp, before it goes into action, cannot be less than the value of R1. As a matter of fact, it's equal to R1 + R_{sat} where R_{sat} is the "saturation resistance" of the transistor. Since typical values of R_{sat} are usually well under one ohm, for all practical purposes the output resistance can be said to equal R1.

This is why the low-cost silicon diode with its low reference voltage is a key factor in making the Current Clamp useful. The value of R1 is chosen, or adjusted, so that at the desired clamping current level it develops a voltage approximately equal to the reference voltage. To develop 0.6 volts with a current flow of 100 ma., just for an example, requires a value of 6 ohms for R1. Were a more expensive higher voltage Zener diode used as a reference, it might require as much as a 6-volt drop. This would raise the value of R1 to 60 ohms. A 6-ohm added impedance in series with the power supply has far less chance of upsetting circuit action than would a 60-ohm addition.

The rectifier-type diode does, however, have one major disadvantage which must be admitted. Its voltage drop varies with the current flow through it. This means, in practice, that a value for R1 which would be correct to clamp at 25 ma. with a 3-volt



Front view (top photo) and rear view (bottom photo) of the Current Clamp showing location of parts and method of assembly. Entire unit can be installed in a plastic case.



supply would *not* be correct for clamping at 25 ma. with a 30-volt supply. The variations can be minimized by running a fairly stiff current through the diode, on the order of 100 ma., but it has been found more convenient to run from 1 to 10 ma. through the diode and to simply live with the variations in setting of R1.

Values shown in the schematic diagram are those employed in the wide-range unit designed by the author; for use in other ranges of either current or input voltage, make R1 equal to the diode voltage divided by desired maximum current, and R2 equal to 100 times the input voltage. Units are

(Continued on page 94)

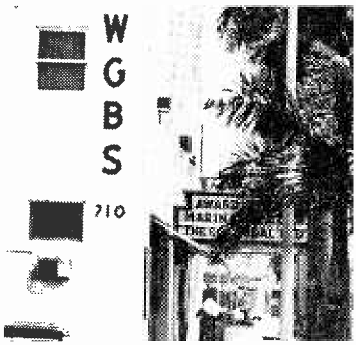
THE PRIVATE RADIO WAR AGAINST CASTRO

By C. M. Stanbury II

Spanish language broadcasts from the Voice of America, WRUL and the mysterious Radio Americas are well known to every SWL. But did you know that at least four privately owned broadcast band AM stations carry on a constant battle with the Castro regime? Not only does this quartet help counteract the Communist island's broadcast monopoly but they also spread Castro's jamming facilities paper thin.

Miami's WGBS. Possibly the most important station in this war of ideas is WGBS at Miami. By day WGBS carries regular English language programs and is a CBS affiliate but starting at 1:00 AM and continuing throughout the wee hours of the morning, it serves as an integral part of the Radio Cuba Libre network. In fact WGBS is probably the most strategic transmitter in the whole net. Its potent 10 kilowatt directional signal on 710 kc completely blankets Cuba. So effective is WGBS that it was one of the very first stations to be jammed by the Castro regime. WGBS own ID slogan is *Radio Miami*. Its transmitter, antenna and ground system are located in the Everglades, Florida's famous tropical swamp.

WKWF and WWL. Radio Cuba Libre is sponsored by the Cuban Freedom Committee which has its headquarters at 1737 H Street N. W., Washington, D. C. and is headed by Representative Roman C. Pucinski of Chi-



Three views of Radio Miami: top left, WGBS transmitter building; lower left, studio building in downtown Miami; above, directional antenna array beamed at Castro land after 0100 hours.

cago. In addition to WGBS, Radio Cuba Libre is also carried by two other private U.S. broadcast stations. WKWF on 1600 kc. at Key West is a little closer to Cuba but has less power. WWLM 870 kc. owned by Loyola University at New Orleans is of course further from the communist island but is blessed with a mighty 50-thousand watts. WKWF is now heavily jammed and there is some jamming on the 870 kc. spot too. Radio Cuba Libre is also rebroadcast during the evening hours by several Latin American stations including the well known short-wave broadcaster *Radio Santo Domingo.*

WMIE. Meanwhile another Miami station carries a myriad of less spectacular rebel programs. This is WMIE on 1140 kc. During the daytime its Spanish language programs are intended for the Cuban refugee population in Miami, a strictly commercial venture. WMIE estimates that this market is worth to its advertisers 5 million dollars a week. At night, and all night, WMIE's 5 kilowatt output is beamed directly toward Cuba and thus it becomes yet another station jammed by Castro.

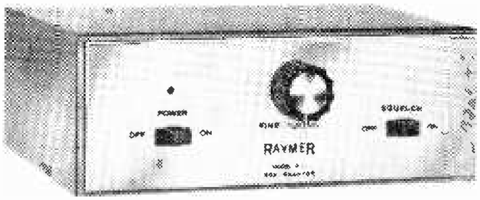
Possibly the best known WMIE revolutionary program is "El Periodico del Aire" (The Newspaper of the Air). This was the name of a well known Habana broadcaster before the Communist takeover. In Habana it operated CMCK on 980 (still on the air but now under red control of course) and COCO which some of our veteran SWL readers may recall. WMIE's version of El Periodico del Aire is directed by Juan Amadōr Rodriguez, a Cuban rebel leader.

Others to use WMIE include Arturo Artalejo (a noted Cuban news commentator), La Voz del Pueblo, and during the Cuban Missile crisis, the Voice of America itself. In fact, it was immediately after this confrontation that WMIE decided to go on a 24 hour a day basis and otherwise drastically increased its Spanish language schedule.

Success with Words. Is the campaign waged by WGBS, WKWF, WWL WMIE successful? Do they really help fight Communism and undermine Castro's dictatorship? The answer must be a resounding *yes.* If not the reds would never expend so much of their radio facilities and technicians in an effort to jam these transmissions. Further, so far as we know, these are the first stations anywhere in the world which are *wholly* under private ownership that have been jammed by a foreign power. Even more startling, we find Castro puts out more effort jamming this foursome than he does blocking Voice of America BCB transmitters in Florida. Needless to say, this is of great aid to the VOA. And incidently, we wonder how Habana explains all that jamming. ■

RADIO-TV EXPERIMENTER LAB CHECK

RAYMER MODEL 471
Background Music
SCA Adaptor



How would you like to hear the *phantom* signals of the FM band? FM stations which in many instances play hour after hour of pleasant "wall-to-wall" type music with few, if any, interruptions by an announcer extolling the virtues of the station or *Vat Aged Snake Oil.* You think we're pulling your leg? Not so. There is such a thing as FM *phantom* signals.

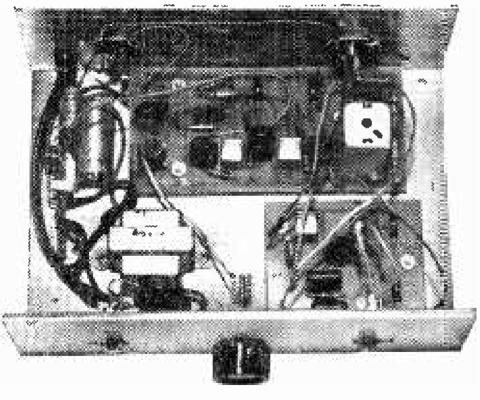
In many communities the only way an FM station can stay in the black is by selling "background music"; soft, unobtrusive arrangements intended for banks, restaurants and fancy apartment house elevators. This music is transmitted *simultaneously* with the regular program and is called the SCA—short for Subsidiary Communications Authorization.

What Is SCA. The SCA signal deserves the description *phantom* because it's there but it's not there. To your regular FM or stereo tuner the SCA signal doesn't exist; you'll never know if a station is using SCA. But tune across the band with an SCA receiver and the opposite happens; the regular FM stations disappear and nothing is heard until the music of an SCA station suddenly "pops in."

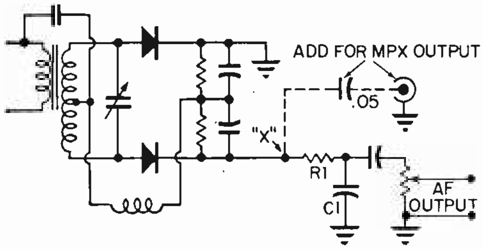
While SCA stations rent receiving equipment, you can have the pleasure of continuous music in your home without paying a rental charge. All you need do is connect an electronic gadget called the Raymer Model 471 SCA Adaptor to your present FM tuner and *voila,* wall-to-wall music. Of course, you might say, "Who needs it. I've got a terrific record collection." But it's ten to one you don't have more than one or two records with SCA type music. Remember we said SCA music was *unobtrusive*—no loud crescendos, no soaring violin slides fading into the noise level. SCA music is specially arranged as "background music" for eating, working or just plain resting.

Hook Up. The Raymer Model 471 Adaptor connects between the tuner and the amplifier, and while it has no *on-off* switch other than for power, it doesn't interfere with normal tuner operation. The adaptor's input jack is connected to the tuner's *multiplex* (MPX) output jack; the jack provided on late model monophonic tuner for the connection of an MPX adaptor for FM stereo. The adaptor cannot be connected to the tuner's AF output because the built-in de-emphasis which compensates for the high frequency boost (pre-emphasis) applied at the transmitter also attenuates the SCA signal.

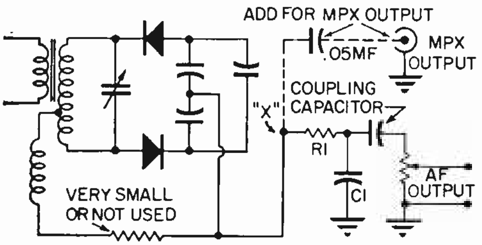
The adaptor's output is then connected to any amplifier auxiliary input. This arrangement allows you to receive regular FM programs with the amplifier mode set to



Semiconductor circuit offers long term trouble-free performance. Two jacks on rear panel connect to FM tuner and amplifier input.



If your tuner does not have a multiplex jack, you will have to provide your own by tieing into the FM tuner audio output circuit immediately before the de-emphasis network. How it is done schematically is shown above for the ratio detector and below for the discriminator detector. Actual detector circuits may vary from unit to unit, but R1-C1 network is always used to provide de-emphasis effect.



tuner and SCA signals when the amplifier is set to *auxiliary input.*

Since the difference between a tuner's MPX output and the AF output is only the de-emphasis network (actually a resistor and capacitor) it is a simple matter to add an MPX output to mono tuners not so equipped. The schematic diagram shows the two typical FM detectors—the ratio and discriminator types. Regardless of the actual detector circuit the de-emphasis network consists of R1 and C1 (Note that it is a low pass filter; the higher the frequency the greater the attenuation.) At point "X", the input to the filter, the signal has no de-emphasis and an MPX output is provided by connecting point "X" through a .05 MF/500 vdc capacitor to a jack which can be installed on the rear apron. Check your tuner very carefully, ours had a test MPX jack hidden on the MPX sub-assembly intended for the manufacturer's test equipment during alignment.

Checking it out. Using the Model 471 Adaptor couldn't be easier. Just tune in a station which is known to broadcast SCA and connect the adaptor to the amplifier. You'll hear some sound—usually distorted. Then simply adjust the fine tuning control on the adaptor's front panel for best sound and sit back and enjoy the music. If you aren't sure which stations transmit SCA just connect the adaptor and tune until you hear the signal; adjust the tuner for best sound and then give it a final touch up with the fine tuning.

The sound quality delivered by the Model 471 Adaptor depends to a large degree on the tuner. If the tuner has a wide-band IF response the sound is pretty good—not hi-fi because the SCA transmission itself isn't hi-fi. If the tuner has a narrow response, thereby attenuating the SCA signal before it ever gets to the adaptor, the overall sound quality will be best described as decent—just about passable for background music.

One very good feature of the Model 471 Adaptor is the positive-acting noise squelch circuit which eliminates all hash during intervals between music selections. Also, the adaptor had absolutely no measurable cross-talk, that is, the main FM channel does not ride through and mix with the SCA broadcast.

Physically the Model 471 adaptor consists of transistorized circuits on two printed circuit boards. One board contains the user adjusted oscillator (fine tuning) and the second board contains the SCA detector. The adaptor has been simplified to a minimum number of circuits—high-price commercial quality is not needed in the home—and in conjunction with transistors and PC boards the adaptor should give long term trouble-free performance.

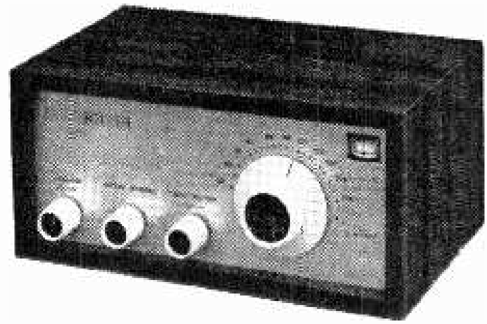
Overall handling is very easy, and it takes but one or two tries before you're an expert in tuning in SCA signals.

While we derived considerable enjoyment from the Raymer Model 471 SCA Adaptor, and we suspect you will too, there is a note of caution. Before you run out to purchase an adaptor make certain you can receive an SCA station. Most large cities have at least one SCA station; but if yours is a small town with only one or two FM stations it is quite likely the only thing the adaptor will deliver is absolute silence. One positive way to find out is to call your local FM station business office and ask them whether they have an SCA service or not.

If you are interested in the Raymer Model 471 SCA Adaptor or would like to know more about other Raymer products, write to *Trutone Electronics, Inc., Dept. RTE, 14660 Raymer Street, Van Nuys, California.* The Model 471 costs $64.50 postpaid. ■

RADIO-TV EXPERIMENTER LAB CHECK

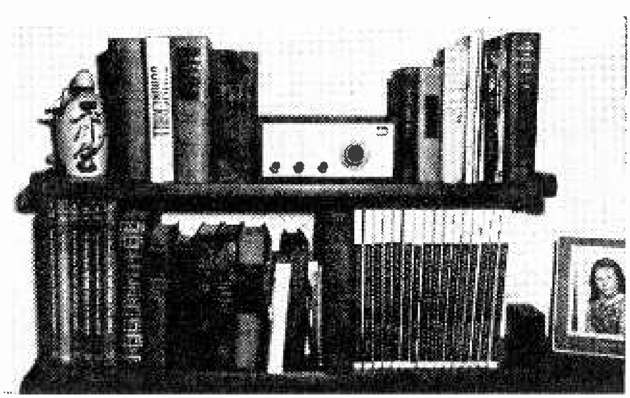
KLH MODEL EIGHTEEN
All Transistor
FM Stereo Tuner



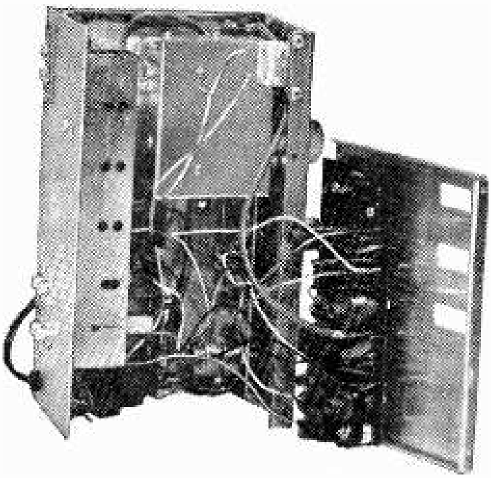
The KLH Model 18 tuner is an all transistor stereo tuner which is built as transistorized equipment should be built—extremely small. Extend your fingers, place the KLH on your palm and it just about covers the hand. Place the KLH on a bookshelf and you still have room for books—no dangling halfway off the shelf. Stand it sideways and it takes up less space than the collected works of Shakespeare.

But though it is compact the Model 18 has all the features needed for good stereo reception; nothing has been left out. The tuning is the more or less "instrument type" single dial with a very smooth vernier drive; and the calibration is excellent. It is almost possible to pre-set the tuning to a desired station before the tuner is turned *on* due to the dial's accuracy across the entire band. A full-time stereo indicator is provided which also doubles as a marginal station indicator. Whether the mode switch is set to *mono* or *stereo* the lamp lights if a station is transmitting stereo. If the stereo indicator flickers on a stereo broadcast it means the signal is marginal and will be subject to considerable noise. The noise can then be eliminated by orienting the (indoor) antenna until the lamp stays on full-time, or an antenna booster amplifier should be switched in. An SCA filter is provided to remove the "hash" which is heard when an FM stereo station also broadcasts SCA.

The KLH is provided with one of the best tuning indicators—the center tuning meter. This meter *does not* indicate relative signal strength, rather it insures that the tuner is set to the received station's exact center frequency. While modern wide-band tuners do an excellent job at receiving mono even if the station is slightly off-tune, for best stereo reception the tuner must be set to the exact "center frequency." On the KLH Model 18 you simply tune in a station until the tuning meter pointer is at the center scale mark, and you are assured of optimum stereo reception. Two audio outputs are provided, a fixed level output and volume controlled out-



A real "bookshelf" component —the KLH Model Eighteen FM tuner fits on a standard eight-inch shelf without overhang. Note "instrument type" tuning dial with smooth vernier drive — calibration is excellent.



How does KLH make it so small? The multiplex circuit is mounted on the top plate and folds over the chassis when the plate is installed. Note the extensive use of shielded cables and cover-plate metal shields—neatness helps.

put. Either one can be used; it's just a convenience which allows the user to control the volume at the tuner or at the amplifier.

On Antennas. The tuner comes equipped with two antennas, a plain section of wire attached to the antenna terminals and a moulded folded dipole. It should be pointed out that KLH does not recommend either of these antennas. In a rather good, simplified antenna section, KLH explains that best performance is obtained with a directional antenna and they specifically suggest several satisfactory "outdoor" antennas. However, KLH understands that not everyone can employ an outdoor antenna so they provide the two indoor antennas, with good instructions on how to use them, for the audiophile cursed with an uncompromising landlord.

How It Checked Out. In the performance department the KLH Model 18 is outstanding. With the antenna disconnected there is absolutely no noise from the tuner, no hum and no "transistor hiss." In fact, you cannot even tell the tuner is *on*; it is probably the quietest piece of hi-fi equipment we have heard. If you've been concerned with those persistent rumors that transistor tuners have a "built in hiss" forget it; maybe the first attempts at transistorizing tuners resulted in hissing, but not anymore. The same goes for those rumors that transistor tuners overload on strong signals. On the strongest of signals, even when we used a booster to deliberately force the signal to an overload level, the KLH did not overload—there was no cross modulation, self oscillation or distortion normally associated with overload. In fact, the KLH was even able to receive cleanly two strong adjacent signals which normally cause overlay on some tube type tuners.

The sound quality is magnificent, about the cleanest we've yet to hear; even flutes at high modulation levels were reproduced without stridency. And of course, the absence of any noise produced what has often been called "transparent sound." The stereo separation is excellent, if not outstanding.

Even the AVC (automatic volume control) is good. With the rare exceptions of extremely weak stations, tuning across the FM band did not produce thundering crashes interspersed with barely audible sound. Nearly all stations were at equal volume.

From its smooth as silk sound quality to its high styling (with oiled walnut cabinet) the KLH Model 18 must be rated at the very least *excellent*. Even the audio *purest* who spends his entire life looking for "better sound" would find no fault with the Model 18. In fact, this tuner deserves a better name than the Model 18—Mighty Midget would be more to the point. Priced at $129.95, the Model 18 offers top quality performance in the moderate-price audio showcase. For more details and complete specifications on the Model 18 write to *KLH Research and Development Corp., Dept. VC-1, 30 Cross Street, Cambridge, Mass. 02139.* ■

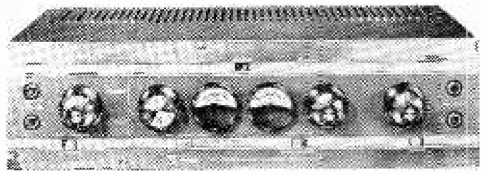
What's Been Lab-Checked

Many readers write to us asking whether we have reviewed a particular high-fidelity component or not in Radio-TV Experimenter. To answer these questions and many more that may come, the list below gives the component reported on and the issue in which it appeared.

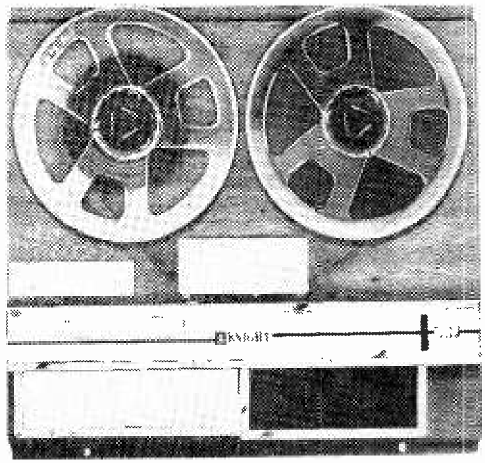
- Harman-Kardon SR-300 Transistorized FM/Stereo Receiver, *April-May, 1965*
- Bozak E-300K-Urban Enclosure Kit and Bozak B-207A 2-way Speaker, *April-May 1965*
- Elpa PE-34 Manual Stereo Turntable, *April-May, 1965*
- Heathkit AR-13A AM/FM 64-watt Stereo Receiver, *Feb.-March, 1965*
- Electro-Voice Coronet Speaker System Kits, *Feb.-March, 1965*
- AR XA Manual Hi-Fi Turntable, *Feb.-March, 1965*
- Knight-kit KG-870 Stereo Amplifier, *Dec.-Jan., 1965*
- H. H. Scott LT-110B Stereo-MX Tuner, *Dec.-Jan., 1965*
- EICO 2200 FM-Multiplex Stereo Tuner, *Oct.-Nov., 1964*
- Dynakit SCA-35 Stereo Control Amplifier, *August-Sept., 1965*

RADIO-TV EXPERIMENTER LAB CHECK

KNIGHT-KIT KP-70 Record/Playback Stereo Preamp



KNIGHT KN-4000A 4-Track Stereo Tape Transport



Audiophiles who wish to add stereo tape record and playback features to their high-fidelity systems should seriously consider the Knight KP-70 stereo preamplifier and KN-4000A stereo record/playback transport. In this Lab-Check report, we have reviewed each component individually, however, they are ideally suited to operate in combination.

☐ **Knight KP-70.** While so-called professional type flexibility is usually a dream rather than actuality in low cost recorders, the Knight KP-70 Stereo-Record/Playback Preamp does offer the average tape fan true "studio facilities" at budget prices. In fact, the operating features are equal to studio recorders and then some.

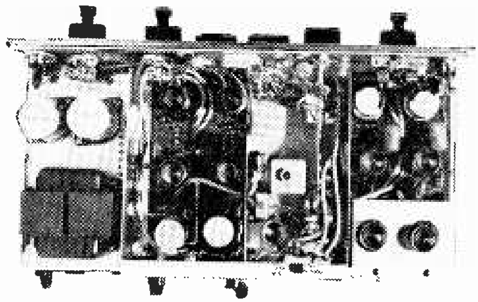
Both low level (microphone) and high level (tuners, recorders, etc.) mixers are provided for each channel, and the channel levels can be individually or tandem controlled through friction clutches. The low and high level inputs can be mixed so that one could combine narration and background music when recording, say, a sound track for a home movie. A single mode switch determines stereo, left or right channel operation for both record and playback.

Either sound-on-sound or echo effects are obtained by activating a single switch. No need for juggling of connecting cables for sound-on-sound or echo since all circuits are pre-set by the single selector switch.

Separate front panel jacks permit either single or dual plug stereo phones to be used (though they must be the crystal type). This arrangement also permits the use of mono phones when monitoring sound-on-sound recordings. A panel switch determines whether the phone monitor circuits are switched to the signal source or the playback head (on three head transports).

Similarly, the two VU meters indicate the source or playback levels; their function being determined by the phone monitor switch. An extra feature is the use of the VU meters to indicate the bias currents, which while of no extreme importance, does allow the audio purist to keep track of any changes in bias current caused by component aging.

On the electronic side the KP-70 is designed to be used with virtually any tape transport. Either Knight's matching stereo transport, stereo transports of other manufacture, and even old reliable mono-transports which have been upgraded with stereo



Two large printed circuit boards contain most of the components in the KP-70 preamp.

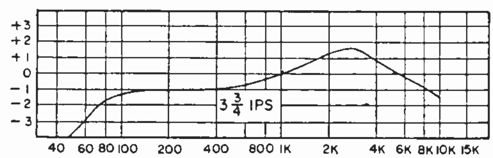
heads. All critical *head matching* circuits are user adjusted; this includes the bias and erase currents, the high frequency equalization and the recording level. Provision is even made for matching low, medium and high impedance heads. (An optional erase head is available for Sony tape transports.)

Performance. Of course, features are really second to performance, for what good are features if the sound doesn't please. With the KP-70 you've got no worries because the electronic flexibility allows almost precise matching to any brand of tape. For example, while Knight's specifications hold true for the tape they suggest (Scotch 111) the same bias and high frequency adjustments might result in poor high frequency performance from tapes of other manufacture. (This is not unusual, fixed bias tape recorders generally deliver optimum performance with specific tape brands or types. In fact, the KP-70 gives superior performance with 1.0 mil tapes, and though not mentioned in the instruction manual Knight suggests the use of "thin" tape.)

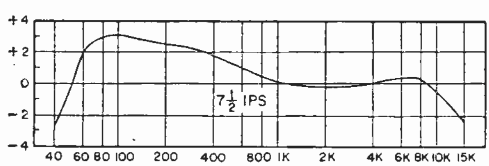
But the KP-70's electronic flexibility allows the preamp to be matched to virtually any tape (or heads). The curves shown are for *white box* tape, and even we must admit they look good—they sounded good, too.

Alignment. Knight gives two procedures for adjusting the bias and erase currents: instrument and by "ear." We found the instrument alignment delivered poor performance on tapes other than Scotch 111 and we do not recommend its use. The "ear" alignment is more useful. Knight provides a special test jack and adapters, and the user simply adjusts a few controls for specific meter readings. While this technique was reasonable, it still left a lot to be desired in the way of top quality sound.

We preferred our own alignment technique which appeared to allow more flexibility in the selection of tape brands. Select a quality tape brand and starting from the full counterclockwise position adjust the bias control for maximum tape output while recording a 400 cycle signal 10 db under maximum recording level. (As the bias current is increased the tape playback output will also increase.) At some bias setting the tape output will start to drop; keep advancing the bias current until the output drops 1 to 4 db. If the bias control locks-up before you can go through peak output back-off the bias current till the output drops about 4 db. The bias metering will tell you whether the current is increasing or decreasing. Next, feed in a 15 kc. signal (at 7½ ips) or a 10 kc. signal (at 3¾ ips) at the same −10db level and adjust the high frequency equalizers so the high frequency playback level is within 3 db of the 400 cycle reference. If you cannot obtain sufficient

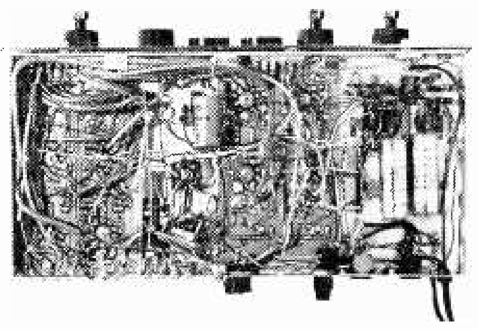


Typical response curves for the Knight-kit KP-70 record/playback stereo preamp are shown for both 7½ ips and 3¾ ips. Actual response curves for individual units will vary slightly and will also depend on particular tape, bias adjustment and high frequency boost adjustments. Always use quality tapes.



high frequency equalization at the 7½ ips speed set the equalization to maximum and very slowly adjust the bias current for flat playback response. While this adjustment may appear complex keep in mind that this is how professionals compensate for different tapes—you can pull this trick with few budget recorders.

What We Heard. Overall sound quality ranked high, with good signal to noise ratio (low hiss level). However, there was one peculiarity which should be noted. While not heard when recording program material, test tones at about 15 kc. resulted in low frequency beat notes, which though at low levels, were clearly audible. We feel this was due to the bias oscillator frequency which in our particular unit was below specs. Checks with Knight certified the bias frequency is normally higher, thereby placing any beats outside the audio range and outside the preamp's frequency response range. Should this occur in your unit the bias oscillator frequency can be changed by repositioning the oscillator coil slug: though the



Even though most components are on circuit boards, considerable wire and shielded cables are used to interconnect all audio circuits.

adjustment requires a signal generator and an oscilloscope. However, keep in mind that the beats are *inaudible* with normal program material.

The KP-70 is available wired ($139.95) or in kit form ($89.95). While the kit is quite complex, printed circuit boards for most of the electronics and card indexed resistors do reduce the possibility of wiring difficulties. While there are no really jammed-packed corners, there is just no room for sloppy layout or solder joints. It is best to try your hand at wiring an amplifier or tuner before taking on the KN-70. With one kit under your belt, the KN-70 kit will be a snap and an enjoyable experience.

☐ **Knight KN-4000A.** The Knight KN-4000A Tape Transport ($129.95) is the matching unit for the KP-70 preamp. It differs markedly from most budget equipment in that *three* separate motors are used: one for supply reel, one for take-up and one for capstan. (This is a lot better than one motor doing everything through a series of belts and pulleys; there's less to go out of wack.) Also, there are none of the familiar brake mechanisms. Dynamic braking is developed by feeding DC to the take-up and supply motors. The result is a very gentle braking action. Even stopping from the notably high rewind speed places no undue strain on the tape. The transport handles even the extra-thin (extended play) tapes without difficulties such as *stretch*. Rewind time is about 45 seconds for a 7 inch 1.5 mil reel.

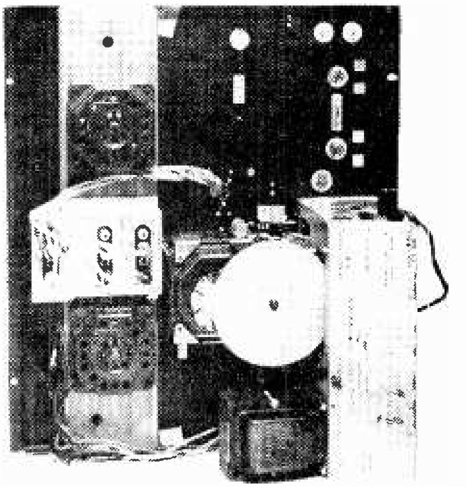
A shut-off switch is provided which removes power from the take-up motor when the tape runs through. Unfortunately, the switch does not work for rewind, and the high speed rewind could use an automatic shut-off.

The transport comes complete with *three* heads, a digital counter of the reset type, tape lifters and piano-key controls—all necessary for 4-track stereo operation.

Speed constancy at both 7½ and 3¾ ips even at the end of the reel is excellent. Wow and flutter is inaudible.

Our only gripe with the transport is that no mounting base is available—you've got to make your own or use an optional portable carrying case ($24.95) designed to hold both the transport and preamp. An optional metal case ($4.95) is available for the preamp.

Roundup. While the KP-70 and the KN-4000A are available as separate units from Allied Radio Corp., 100 N. Western Avenue,



Note three motors and large capstan stabilizer weight. Finger points to power supply which supplies DC for dynamic tape braking.

Chicago, Illinois 60680, they are sold as a package unit ($209.90 with preamp in kit form) at a slight savings over the unit prices. Frankly, the Knight KP-70 preamplifier and KN-4000A transport combination is the best budget buy available to audiophiles today. You would have to more than double the price before you can purchase comparable tape setups of equal quality and performance. ■

PROPAGATION FORECAST

June-July, 1965

By C. M. Stanbury II

While all areas of the world can be heard, sometimes with difficulty throughout most of the day, short-wave reception from each continent has its peak listening period lasting from three to twelve hours depending on the continent and your listening area. For this edition of Propagation Forecast, we have added a table, *Peak DX Periods*, showing these approximate DX listening periods. It should be noted, however, that fair European short-wave reception will be experienced most of the time on the East Coast and a similar situation applies with Asian short-wave reception on the West Coast.

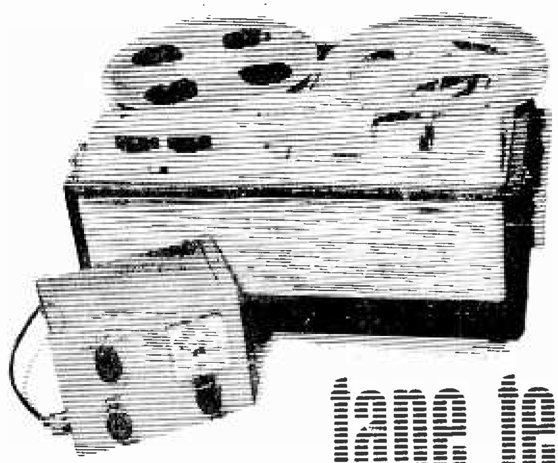
Good DX hunting. ■

Peak DX Periods

Area	Local Time—North America	
	Eastern	Western
Europe, North Africa, & Near East	1200-2400	0900-2100
Africa (South of Sahara)	1500-2400	1200-2100
Asia (except Near East)	0300-1200	0000-1200
South Pacific	0000-0600	2100-0900
Latin America	2000-0100	1900-2200

<table>
<tr><th>LOCAL TIME</th><th>0000–0300</th><th>0300–0600</th><th>0600–0900</th><th>0900–1200</th><th>1200–1500</th><th>1500–1800</th><th>1800–2100</th><th>2100–2400</th></tr>
<tr><td>Europe, North Africa, & Near East</td><td>41, 49</td><td>41 POOR</td><td>19</td><td colspan="2">19, 25</td><td>19 (31, 41)</td><td colspan="2">25 (19, 31)</td></tr>
<tr><td>Africa (South of Sahara)</td><td>49, 60</td><td>41, 49 POOR</td><td>25 POOR</td><td colspan="2">19, 25</td><td>49, 60</td><td>31</td><td>60, 90</td></tr>
<tr><td>Asia (except Near East)</td><td>31, 41</td><td>41, 49</td><td>25, 31</td><td colspan="2">19, 25</td><td>19 (31, 41)</td><td colspan="2">25 (19, 31)</td></tr>
<tr><td>South Pacific</td><td>31, 49 (41)</td><td>49, 60</td><td>41</td><td colspan="5">25</td></tr>
<tr><td>Latin America</td><td colspan="2">49, 60, 90</td><td>31</td><td colspan="2">19, 25</td><td>31</td><td colspan="2">49, 60</td></tr>
</table>

To use the table put your finger on the region you want to hear and log, move your finger to the right until it is under the local standard time you will be listening and lift your finger. Underneath your pointing digit will be the short-wave 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 easy to tune on the east coast. The short-wave bands in brackets are given as poor second choices. Refer to White's Radio Log for World-Wide Short-Wave Broadcast Stations list.



tape testing made easy

By Herb Friedman, W2ZLF

Make a master test tape for your tape machine! Check its head alignment and frequency response!

■ If you ever get a chance to spend a few days hanging around a professional recording studio one of the first things you'll notice is how often the tape recorders are checked for frequency response. And if you stop to ask questions you'll discover that the technicians are primarily interested in the *high frequency response*. For even if the heads are worn to a frazzle and has a coating of dirt *this thick* the recorder can do a good job on the low and mid-range frequencies. But get just a little headwear, or let the alignment (head azmuth adjustment) change ever so slightly, and that golden voiced soprano sounds like she's singing through a pile of straw. In fact, the less costly the recorder, the greater the sensitivity to head defects. Lower the tape speed from the professional's 30 or 15 ips to the hobbyists 7½ and 3¾ ips and head alignment becomes extremely critical—particularly so with 3 head recorders where the playback head *must* be in exact alignment to the record head.

All tape heads wear and go out of alignment, some faster than others; so for optimum frequency response both head wear and alignment should be checked frequently. While a technician generally uses somewhat expensive test equipment and alignment tapes when adjusting tape recorders, *you* can do a creditable job—a darn good job—with the Tape Tester, a low cost (less than $20) tape recorder test set specifically designed for the tape fan and music lover with a minimum knowledge of tape recorder electronics.

tape testing

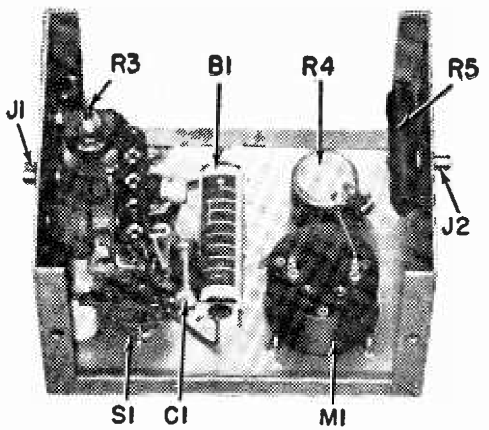
What It Can Do. With the Tape Tester you can check-out your recorder quickly and conveniently, with a minimum of fuss and bother. It tells you if your head needs alignment and when they should be replaced. It lets you make a *master test tape* (like the pros use) so you can periodically check the recorder *against original performance.*

The tester contains a two tone signal generator and an adjustable output meter. The generator produces a 1 kc. *reference signal* and an 11 kc. *alignment signal* at the same level as the reference. Both signals are adjustable to 100 millivolts, suitable for either high or low level inputs. The output meter provides an amplifier termination and indicates the recorder's playback performance. The ratio between the two test signals as measured on the output meter (or on the recorder's built-in playback meter if it is so equipped) indicates head wear and misalignment; and the same two signals are used to align the heads.

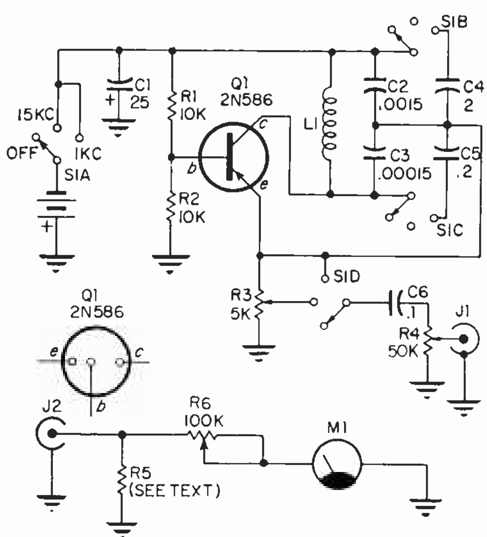
Construction. The model shown is built on the main section of a 3 x 4 x 5-inch Minibox. Parts layout and lead dress aren't critical as long as they're not sloppy. But take extra care that all components are tied down tightly—the unit is useless if the signal level drifts or pulsates.

Function/power switch S1 can be any four pole triple throw; we have used the model specified in the parts list—even though it has extra contacts—because it is small and low in cost.

Frequency determining capacitors C2, C3, C4 and C5 don't have to be the precision type; any standard brand 10 or 5 *percenters* will do. Just be certain not to use salvage or "reject" capacitors. C2 and C3 determine the



Inside view of the Tape Tester is uncluttered and easy to wire. Note that VU meter circuit is physically isolated from the oscillator.



Schematic diagram for the Tape Tester—keep S1 set at off during playback of test tape.

PARTS LIST

B1—9-volt or 22½-volt (see text)
C1—25-mf., 25-vdc electrolytic capacitor
C2—.0015 mf., 100-vdc capacitor
C3—.00015-mf., 100-vdc capacitor
C4—2-mf., 100-vdc capacitor
C5—.2 or .22-mf., 100-vdc capacitor
Capacitors C2, C3, C4 and C5 should be either 5% or 10% units.
C6—.1-mf., 75-vdc ceramic disc capacitor
J1, J2—RCA phono jack
L1—80-mh. RF choke (Meissner 19-2709)
M1—VU meter (Lafayette 99G5024)
Q1—2N586 transistor (RCA)
R1, R2—10,000-ohm, ½-watt resistor, 10% .
R3—5,000-ohm miniature potentiometer (Lafayette 32G7355 or equiv.)
R4—50,000-ohm audio taper potentiometer
R5—See text
R6—100,000-ohm audio taper potentiometer
S1—2-gang, 9-pole 3-position rotary switch (Lafayette 99G6170 or equiv.)
1—3" x 4" x 5" aluminum chassis box BuD CU2105A or equiv.)
1—4-post (One is the ground terminal) terminal strip
Misc.—hardware, solder lugs, wire, tubing, battery holder, solder, etc.

Estimated cost: $17.00
Estimated construction time: 3 hours

high frequency output and the values indicated will produce about 11 kc. which we have selected as an effective value for most hobbyist recorders. If you desire a slightly higher frequency, say 12 kc., use a .01 and .001 mfd. respectively. If you desire an even higher frequency, say 15 kc., you'll have to do a little experimenting as the lead dress will affect the output frequency—start with .008 mf and .0008 mf and add small padders until you hit 15 kc.

Regardless of your choice for C2 and C3 they are connected *in-circuit* as shown, they have no effect when the 1 kc. capacitors, C4 and C5, are switched into the circuit.

The terminal strip is mounted directly on L1 and is retained by L1's mounting screw. Warning:—don't substitute for the specified L1.

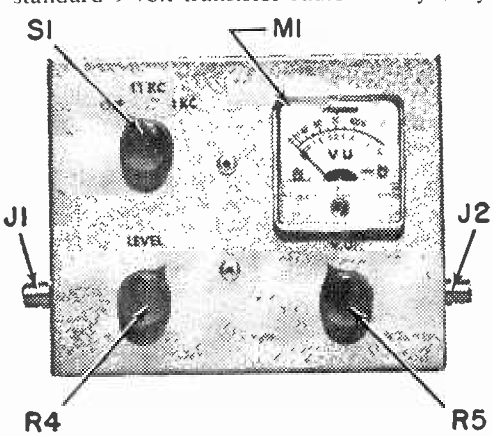
The high frequency level adjust, R3, is the subminiature type and is mounted inside the cabinet to insure its adjustment is not accidentally changed. It is mounted to an L bracket which can be made from a straightened ½ inch wide cable clamp.

Keep the leads to Q1 short and use heat sinks, such as an alligator clip, on each lead when soldering.

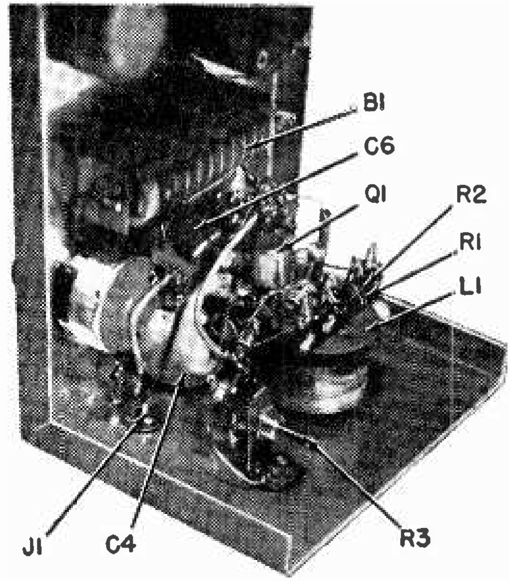
R5 is a 5 or 10 watt resistor equal to the recommended external speaker load. For example, if your recorder specifies an 8 ohm external speaker use a 7.5 ohm resistor (nearest value to 8 ohms).

Connect the VU Meter, M1, directly to R6 as shown; disregard the instructions and resistor packed with the meter.

9 V vs. 22½ V. Battery B1 is selected after the wiring is completed. First, try a standard 9-volt transistor radio battery (any



Front panel view of Tape Tester showing location of controls, VU meter and interconnecting jacks. Decals add pro look to assembly.



R3 is mounted to the cabinet with an L bracket made from straightened cable clamp.

type). If you can obtain both the 1 kc. and 11 kc. signals all is okay, install the battery. If you can obtain only the 11 kc. signal use a 22½-volt transistor radio battery (again, any type). While the tester will always work with a 22½-volt battery it pays to make the test because 9-volt batteries are less than one-half the price. Miniature batteries such as used in transistor radios will fit a standard penlight battery holder, as shown in the photograph.

Adjustment. Connect a high impedance level indicator, such as an AC VTVM, to J1 and set S1 to 1 kc. Advance level control R4 to the mid-position and carefully note the indicator's reading. Then set S1 to 11 kc. and adjust high frequency level control R3 until the 11 kc. output is exactly equal to the 1 kc. output. Switch back and forth a few times to make certain you have the proper adjustment.

Using the Tester. Maximum convenience is obtained if a Master Test Tape is made when the recorder is new, has seen only a few hours of service, or has known good heads in perfect alignment. (See the special service note at the conclusion of this article on how *you* can align a recorder with a combination record/playback head without the need for an alignment tape.)

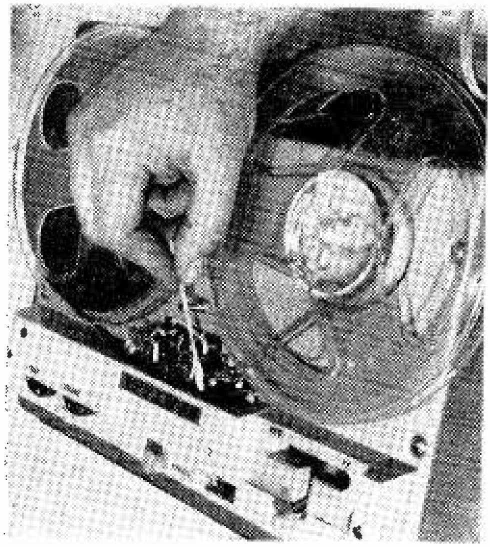
Connect J1 to the recorder's input jack, set R4 to *off*, and set the recorder's gain control full open. Then set S1 to 1 kc. and adjust R4 until the recorder's level indicator reads −10db. If your recorder uses neon lamp indicators set R4 so the *normal* lamp just flashes; make certain the *peak* lamp doesn't flash. On recorders equipped only with a peak level indicator—such as a "magic eye tube" or lamp—set R4 for a level 10 db below the level needed to close the eye tube. (The signal level must be about 10 db down to allow for the recorder's pre-emphasis applied to the high frequencies).

Record about 30 seconds of 1 kc., then kill the tone for about 10 seconds and then record about 2 minutes of 11 kc. This tone sequence will be the master test tape *only* for your recorder.

Set the recorder's volume control to normal, connect J2 to the speaker output jack, and play the tape. When the 1 kc. signal comes through adjust R6 so M1 indicates "0" VU. When you see M1 collapse to zero—the 10 seconds "dead air"—you know the 11 kc. tone follows. When M1 indicates the 11 kc. signal adjust the recorder's tone control (s) for "0" VU—the "flat" setting. Using grease pencil or tape mark the tone control's "flat" position. You are now set to test the recorder quickly and simply at all times.

For example: You purchase a pre-recorded tape and the highs are missing completely. Set the tone control to the marked position and play your test tape. If the two tones playback within a couple of db your machine's okay, the pre-recorded tape is at fault. But if the 11 kc. signal plays back several db below the 1 kc. reference the head(s) is probably out of alignment. Naturally, if realigning the head doesn't restore high frequency performance the head is probably worn. If yours is a two head recorder, aligning for playback automatically insures record alignment since the same head is used for both functions.

But if yours is a three head recorder alignment is slightly more complex, both the record and playback heads must be aligned to each other. First, play the master test tape and align the playback head. Connect J1 to the recorder and feed in the 11 kc. signal about 10db below maximum recording level. Then adjust the record head alignment for *maximum simultaneous playback output;* the two heads will now be aligned to



Tape head alignment can be checked, using a Q-Tip or finger to skew the tape up and down directly in front of playback head. If highs increase, then head realignment is required.

each other. If after alignment, the 11 kc. response is still down, examine the heads for excess wear.

Of course, high frequency loss is not always due to worn or misaligned heads, there are such things as electronic breakdowns, but it is rare for an electronic defect to affect only the high frequencies. A more common fault is the bias adjustment. At the slow tape speeds used by home recorders, a slight change in bias current can translate into a large change in the high frequency response. Also, a given bias current can produce different output levels and high frequency performance among tapes of differing manufacture. In fact a given bias current can produce varying performances between various "lines" of the same manufacturer. It is perfectly possible that even with good heads in perfect alignment one tape will deliver a "flat" frequency response while another gives reduced output and high frequency response.

While most recorders have provision for adjusting the bias for optimum response and output, the adjustment usually requires the services of a technician. However, with the Tape Tester you can test various tape brands to determine which performs best on *your* recorder. With the heads in perfect alignment, record the two tones on several brands

(Continued on page 91)

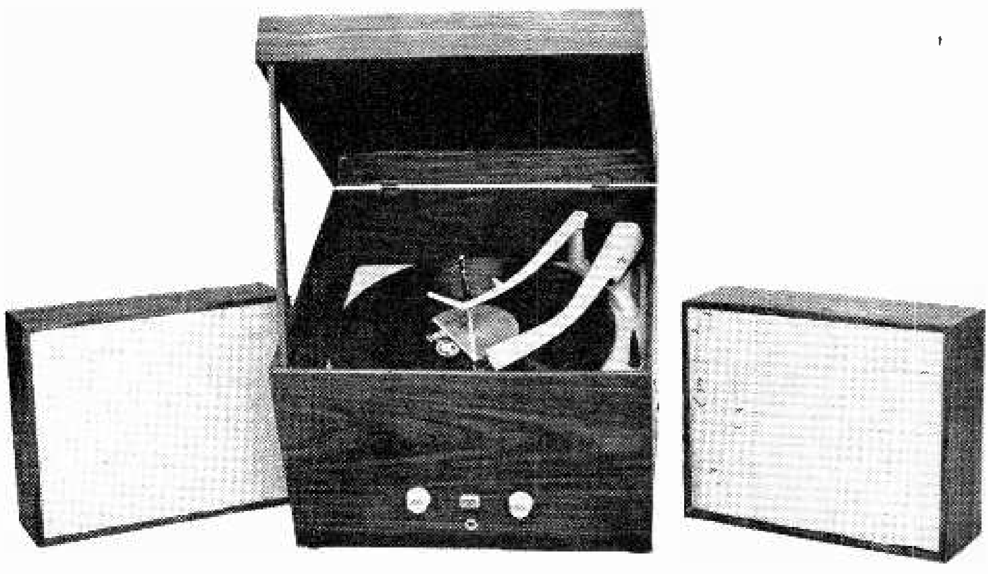
Designed for the bachelor's apartment, kid's room or even the living room this quality-fi stereo record playing system can be assembled by most anyone

So you think that a good stereo is expensive. Well, if you have an open mind, this article will show you just how *inexpensively* a good stereo system can be constructed. If you would like a couple of watts for that quiet living room late at night —or you have a small apartment that could use some real fine music . . . the Stereo Compact is for you. The only things you need are the use of a friend's power saw for fifteen minutes, a little glue, a soldering iron, a pair of pliers, a screw driver, wire cutters, and something less than $50.00. The Stereo Compact is built from commercially available amplifier modules and standard parts available from any electronic supply store and mail order houses. The Compact compares favorably to any commercially manufactured item costing three times as much. It has excellent bass response and does not distort at low volume. Best of all, if you should drop off to sleep while it is playing, it shuts itself off completely—amplifiers, power supply, and all.

This system is adaptable to almost any kind of place. It was built out of scrap plywood and covered with "Con-tact"—that sticky paper that looks like walnut, marble, pink hearts, or any one of two hundred different designs. You can match it to your den, wallpaper, end table, or if you happen to like gold *fleur-de-lis* on a silver background, the choice is yours.

Assembly. OK—let's get to work. The parts list and schematic diagram tell you what is needed to put the Stereo Compact together. The record changer came from Olson Radio in Chicago, as did the amplifiers and speakers. The grill cloth for the speakers came from a remnant shop in Oak Park, Illinois. The nuts, bolts and screws from my junk box, and the appreciation from my girl friend, her girl friends, and several male types who have frugged and hullygullied to the Compact's output beat. When I bought the amplifiers a schematic diagram came with each one of them. The schematic diagram said I could do several things with these amplifiers. The two volume controls are what they said they should be (100 K

BUILD A STEREO COMPACT



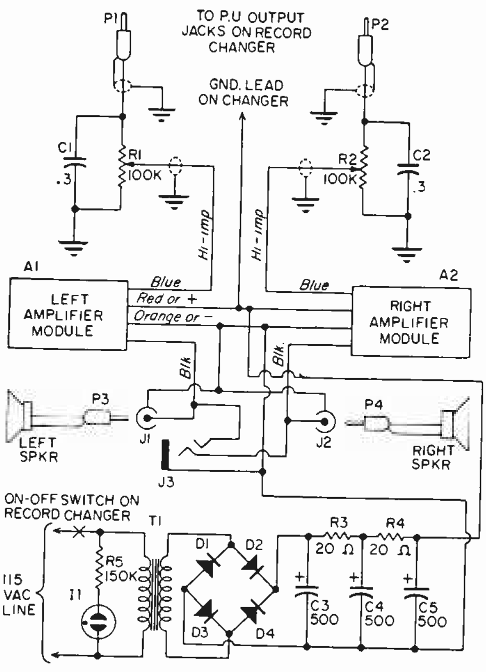
STEREO COMPACT

each) and they work like a charm. All you have to do to get that nice bass sound is put a .03 condenser across each pot like the diagram says. There is no magic about mounting the parts. The amplifiers are glued to the cabinet with Elmer's Glue. The power transformer is screwed to a 1" x 4" wooden block, as is the terminal strip on which I mounted the four rectifiers to make the bridge power assembly. At $.99 for four of these units, you can't go very far wrong. The capacitors are out of a Lafayette's catalog, as are the two resistors that stabilize this power supply. Sure . . . I thought of zener diodes for voltage regulation and all that jazz, but who needs it? Three 500 mfd. condensers glue down the regulation like it was going out of style. Zeners at $4.95 we don't need.

A few points to observe, make sure you tie the ground end of the pots (R1 and R2) used as volume controls to their own cases. It keeps hum out of the system. And I didn't tell you—this system is *all solid* state, so no worry about heat One other point—keep those audio leads from the cartridge out in the middle of the cabinet—low level audio just do not mix. Don't argue—just believe me. No fuse was inserted in the primary leads of the transformer on the power supply. The schematic says you can use one if you want, but you just add $.65 to the system, and that buys a pretty good Martini where I come from.

The record changer comes with a template that tells you how to cut out the mounting board. I recognize that $12.95 is pretty cheap for a record changer, but that's what it costs. It has four speeds and an "On and Off" switch as an integral part of the unit. Oh! You want to use a Garrard. OK, but remember, the audio amp modules are not designed for that Pickering or Shure cartridge, and besides the Ronette cartridge that comes with this outfit has enough oomph to drive the amplifiers to drink.

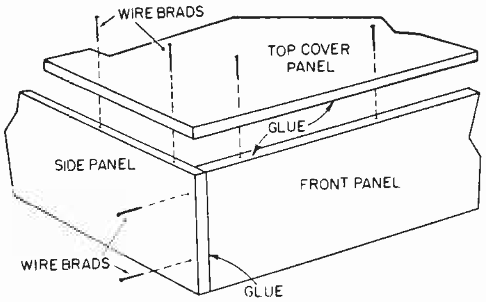
Use a couple of insulated stapes to hold the wires in place. The resistors in the power supply came with mounting hardware attached. You also need a roll of vinyl tape to insulate the leads that come out of the



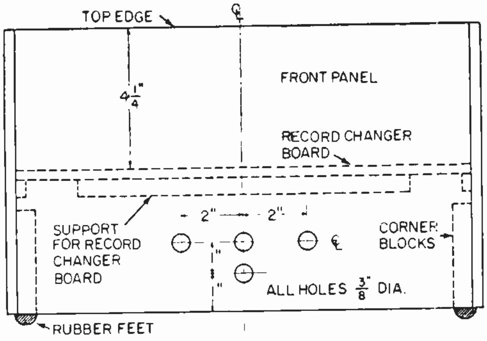
Schematic diagram for the Stereo Compact does not show amplifier details because these circuit sections are purchased modules. Note use of shielded cables on input circuits—dress these leads away from AC.

PARTS LIST

A1, A2—Audio amplifier module (Saxon Mity module, Olson AM-218, Lafayette 19G4401, or equiv.)
C1, C2—.3-mf., 100-volt papre capacitor
C3, C4, C5—500-mf., 25vdc electrolytic capacitor
D1, D2, D3, D4—500-ma., 100-piv diode rectifier (GE 1N91, Olson kit of 4 #RE-70, or equiv.)
I1—Neon indicator kit (Olsen KB-164 or equiv.)
J1—3-circuit headphone-type jack (Switchcraft Little-Jax or equiv.)
J2, J3—Double phone jack (H. H. Smith 1214 or equiv.)
P1, P2, P3, P4—Plug, phono (Switchcraft 3501-M or equiv.)
R1, R2—100,000-ohm, audio taper potentiometer (IRC Q13-128 or equiv.)
R3, R4—20-ohm, 8-watt resistor (Sprague "Brown Devil" or equiv.)
R5—150,000-ohm, ½-watt resistor
SPKR.—6" x 9" speaker, 3.2-4-ohms (2 required) (Olson S-278 or equiv.)
T1—Power transformer, 117-v. primary, 25-v. secondary (Olson T-290, Knight 61G421, Stancor P-6469, or equiv.)
1—Record changer with Ronette cartridge (Olson RP-222 or equiv.)
Misc.—Wood (see text), shielded wire, hookup wire, nuts, bolts, screws, knobs, terminal strips, rubber feet, insulated staples, etc.
Estimated cost: $50.00 or less depending on wood costs and available spare parts.
Estimated construction time: one weekend



Cabinet Detail Drawing #1—Cover for unit is glued—brads hold pieces while glue sets.



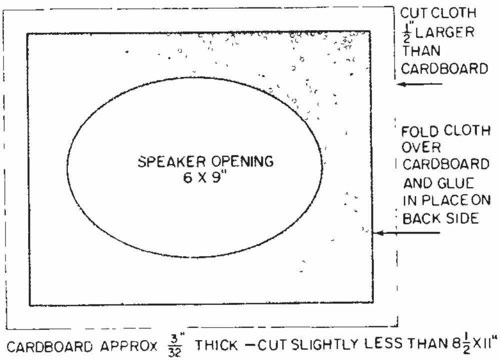
Cabinet Detail Drawing #2—Follow drawing and text instructions to avoid troubles.

amplifiers. Solder those leads together. They carry as much as 700 mills when you get those real bass notes. I have shown the leads from the Mity Modules like I bought them. If you get yours from Lafayette, or Radio Ham Shack, or Courtland Street, then observe the identification as shown on the schematic diagram instead of the colors on those leads. The manufacturer gives both right on the amplifier.

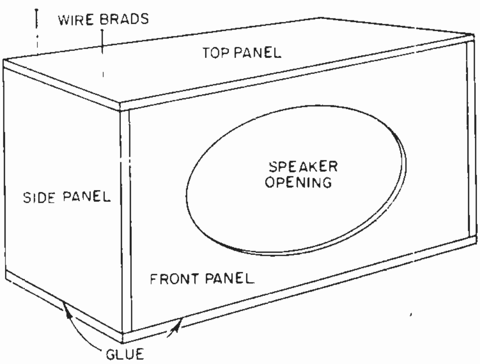
Working With Wood and What Not. The grill cloths are fastened to the speakers as shown. Cut a piece of cardboard as shown in Speaker Grill Detail Drawing, and then use old tire cement, rubber cement, airplane glue, or just plain glue, to fasten down the cloth. Cut the cloth about one-half inch bigger than the cardboard mounting and fold it over the edges of the cardboard. If you use rubber cement, place a thin layer on the cardboard first and then a thin layer on the cloth. After they are dry, they stick together like a pair of magnetic kissing dolls. Do you want to know why I made the speaker cabinets 8½x11? I just happened to have two pieces of bond typing paper to make templates for the speakers. How was it done? Simple—I put a cloth towel on a table and laid a piece of bond paper on a towel. I centered the speaker on the paper and pressed a little hard on the back of the speaker frame. Voila! When I picked up the speaker there was the outline of the speaker gasket—nice and plain. I took a pencil and outlined the inner edge of the gasket outline which gave me the template for my 6x9 speaker opening in the speaker cabinet.

How did I fasten the speaker frame to the cabinet? I glued it. Try epoxy. Then you don't have to worry about screws sticking through your grill cloth when you place it on the speaker cabinets.

Oh yes, that piece of 6″ x 4″ x 1″ wooden block you used to mount the power transformer, the terminal strip and the rectifiers —it will also hold the filter condensers (C3, C4 and C5) and the filter resistors (R3 and R4). The block is glued in place after it is completed. Elmer's glue or epoxy will do. One more thing . . . the record changer has a ground lead. Tie that ground lead to the



Speaker Grille Detail Drawing—Using materials found at home can reduce cost to zero.



Speaker Cabinet Detail Drawing—Not shown is rear panel, same dimensions as front.

positive terminal of your power supply. It gets rid of objectionable hum.

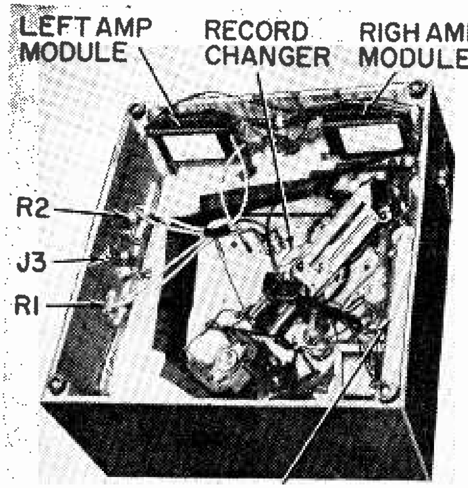
You will notice that there is a jack included in the system for a pair of stereo headphones. You might like to listen all by yourself, and the neighbors don't like your two watts at such high volume.

The Cabinet. The assembly of the cabinet is very simple. All of the panels that comprise the cabinet are of 1/4" plywood. You need the following pieces to assemble the woodwork:

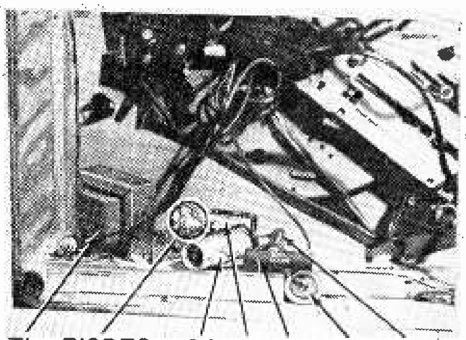
2 pcs—14" x 1-1/2" (front and rear panels)
2 pcs—13-1/2" x 1-1/2" (side panels)
1 pc —14-1/2" x 13-1/2" (top cover panel)

The five pieces described above comprise the cover and are assembled as shown in Cabinet Detail Drawing #1. Use glue on the edges and 1/2" wire brads in your assembly process. Wipe off the excess glue after the parts are nailed together. Be very sure that the small panels that are the sides of the cover are held square as the glue sets and the top cover panel is nailed on.

2 pcs—14" x 8-1/2" (front and rear panels)
2 pcs—13-1/2" x 8-1/2" (side panels)
4 pcs—11" x 1/2" (supports)
1 pc —14" x 13" (record changer board)



Upside down view of the Stereo Compact pointing out location of major assemblies.



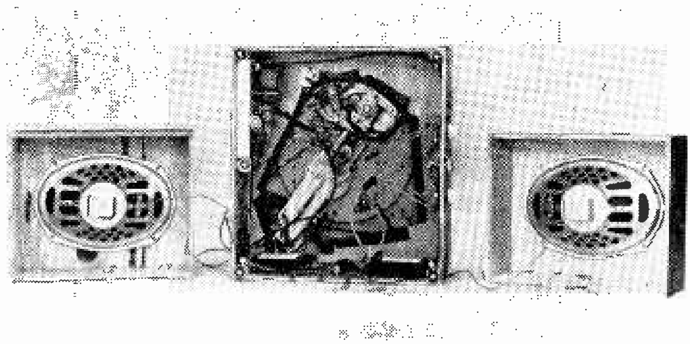
The only major electronic assembly put together by the author was the solid-state bridge-type power supply. Transformer, diodes, two resistors, and filter capacitors are mounted on a 6" x 4" x 1" wood block and installed on the cabinet's rear side.

The nine pieces described above comprise the main cabinet and are assembled as shown in Cabinet Detail Drawing # 2. When its dimensions are laid out prior to cutting it to the proper size, it is suggested that the pencil lines be actually cut out to allow the motor board to be placed within the cabinet after having been covered with "Con-tact" without binding on the sides of the cabinet.

Determine what edges are to be the top edges of the first four pieces cut in this section. Identify them and mark a line on each 4½" from each top edge and parallel to this top edge. Glue one of the 11"x½" pieces on each of the four side panels in conjunction with the line previously drawn and at the 4½" distance from the four top edges. These pieces should be placed on the side panels equidistant from each edge. These pieces are the supports for the board that holds the record player.

Assemble the four side panels in the same fashion that the side pieces for the cover were assembled, observing that the two side panels overlap the front and back panels to create a cabinet whose interior dimensions are 14"x13". Use glue and wire brads to assemble these side panels and observe that the cabinet must be maintained in its square configuration.

Speaker Cabinets. Having now assembled the cabinet for the record player and amplifiers and associated controls, we can turn our attention to the two speaker cabinets. Refer to Speaker Cabinet Detail Drawing. You need the following pieces to make the two speaker cabinets:

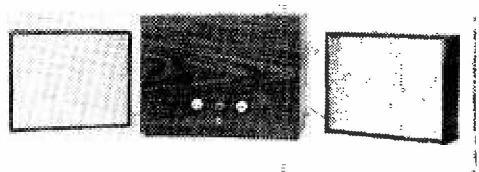


Here is the completed Stereo Compact with the rear panels left off the speaker cabinets and the phono cabinet resting on its side to show all the electronics. Notice how neat the wires and cables are routed to modules.

2 pcs—11" x 8-½" (front and rear panel)
4 pcs 8-½" x 4" (side panels)
4 pcs—11-½" x 4" (top and bottom panels)

These pieces are all fashioned from ¼" plywood. The side pieces are assembled over the part that creates the mounting board for the speaker. After the 11"x8½" pieces have been cut, the template that was created before to show the outline of the 6"x9" speaker is placed on top of these pieces and the outline of the speaker gasket is transcribed to the wooden pieces. The speaker opening is cut from these pieces prior to assembly by the use of a coping saw or sabre-saw if you happen to have one. The pieces are assembled to make a cabinet that is 11½"x9"x4". As before, the sides and top are assembled with glue and wire brads with an eye to their being essentially square. The side panels are overlapped on the speaker mounting panel to complete the speaker cabinets.

Finishing Up. It is essential that the assembled cabinets, speaker and changer board be prepared to accept the Con-tact covering. All wooden parts should be coated with white shellac or lacquer after sanding to insure a good level of adherence between wooden surface and the Con-tact covering that you use. One piece of advice . . . you can always paint the cabinets from that spare paint that you have stored away if it matches the decor of what you have in mind as a permanent resting place for the system. Having covered the parts with Con-tact or painted the surfaces, assemble the top to the bottom with 1"x1" butt hinges and acquire a side lid support that will allow you to change records with no effort when the cabinet lid is in the open position. Having now assembled all of the cabinetry, from a piece of wood ¾" square and about one foot long, cut into four equal pieces about 3" long. Place glue on two sides of these pieces and place them in the four corners of the record cabinet below the surface of the mounting board with the bottom ends of the pieces at the exact bottom end of the cabinet proper. These will later accommodate the four rubber feet that will support the entire cabinet assembly ½" above the surface on which it will rest, and allow a convection type ventilation for the power transformer which may trend to warm up a bit.



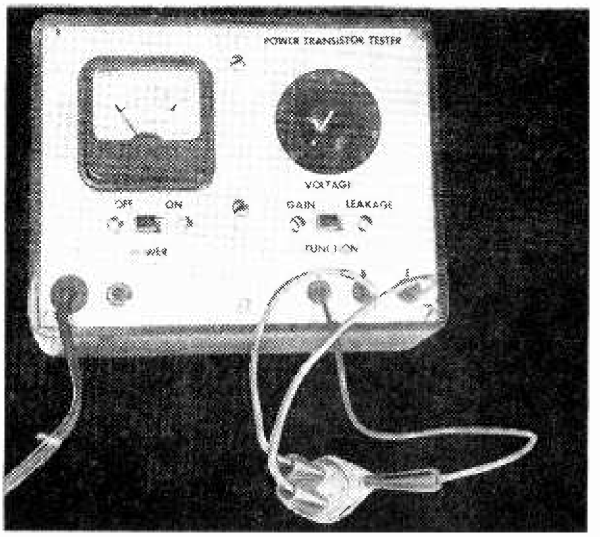
Once completed and finished with care and pride, Stereo Compact will be a handsome, as well as useful, medium-fi phono-amp.

Determine which face of the larger cabinet you intend to make the front face of the unit, and drill four ⅜" holes in the face as shown on Cabinet Detail Drawing #2. These holes will accommodate the two volume controls for the Left and Right channel, the On-Off indicator and the headphone jack.

In evaluating this unit against many others which are a great deal more expensive, it is only fair to say that 2 watts of audio cannot compete with the 70 or 80 watt monsters that can drive 15" speakers to sound like the Staten Island Ferry in a fog bank. One thing I am sure you will say is that the lovely quiet sound when you need it is about equal to any other unit at the same volume level that this unit will give you. Anyway, you spend less than $50.00 to make the Stereo Compact and I would like some commentary on the reception you get from your friends who are romantically inclined. ■

Power Transistor Tester

By James A. Fred



Transistors are like vacuum tubes—they can become leaky or go bad.

There are many transistor testers available for low power or small signal transistors but very few, if any, reasonably priced power transistor testers are available.

Those of you who service modern transistor auto radios have had many opportunities to check leakage and gain of power output transistors if only a power transistor tester were on the workbench. The transistor manufacturers people would like to have us believe that transistors have indefinite life, and never need to be replaced. But those of you at the repair benches and home workshops know better, and it was with this thought in mind that we designed the tester described in this article.

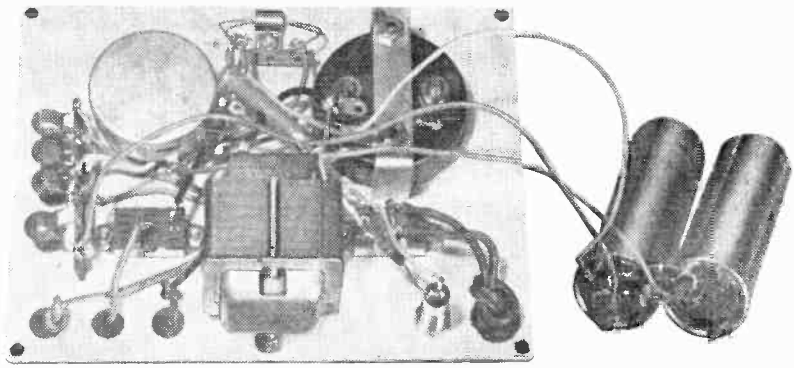
Design Features. The most important section of the power transistor tester is its constant voltage power supply. A conventional full-wave bridge rectifier is used to provide about 18 volts of DC which is then regulated to 12 volts by a Zener diode.

The transistor leakage is indicated on a 0-100 ma. DC meter. One of the important characteristics of a power transistor is the leakage between the emitter and collector with the base floating. This tester applies a maximum of 12-volts DC to these elements and leakage should not exceed 50 ma. A variable resistor provides a voltage that can be adjusted between 0 and 12 volts so that you can detect 50 ma. leakage without burning out the meter. The other important thing to measure is gain by applying a small bias voltage to the base. If the transistor has gain it will show up as an increase in current on the meter. The increase in current will vary depending on several factors, but should be at least two to four times.

This tester was styled to match the author's Lafayette Transistor Analyzer Kit, model 223. However, a standard aluminum chassis box can be used to replace the plastic cabinet. Slide switches were used although toggle switches would have done as well. Any meter of the proper range can be used as long as it will physically fit the space allowed.

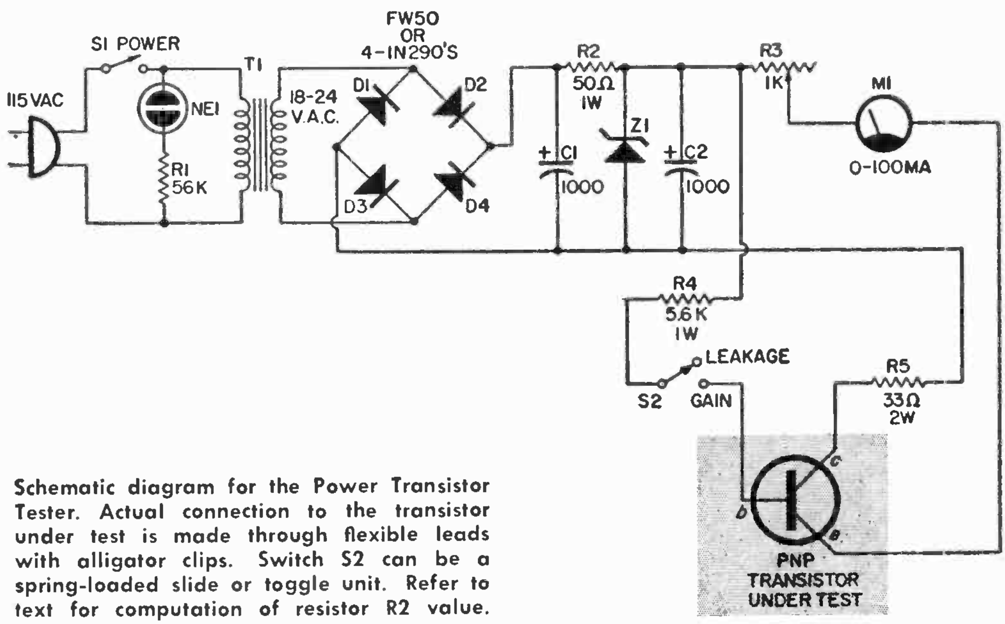
The front panel was made from .050-inch-thick aluminum that was etched in strong lye water to give it a satin finish. When etching aluminum in this way do it either out of doors or in a well ventilated room. Do not make the lye water too strong or it will turn the panel black. Mix common household lye in hot water in an enameled pan or stoneware crock. Do not mix in an iron or aluminum container. After etching rinse carefully in cold water and dry with a soft cloth without touching the front of the panel. Apply black decals or any other type of lettering and spray with a protective coating.

The bridge rectifier can be built up with four separate rectifiers or one of the new potted types may be used. The filter capacitors are necessary to make as pure a DC voltage as possible so that no ripple will be introduced into the transistor under test which would upset the gain measurement. The



All the parts are assembled on an aluminum panel cut to size of plastic case.

Don't guess and replace power transistors blindly—test them first.



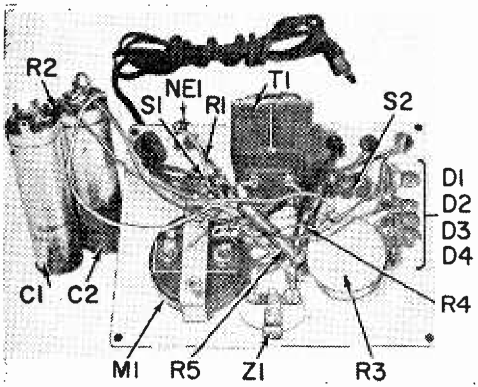
Schematic diagram for the Power Transistor Tester. Actual connection to the transistor under test is made through flexible leads with alligator clips. Switch S2 can be a spring-loaded slide or toggle unit. Refer to text for computation of resistor R2 value.

transformer used in our tester was salvaged from a piece of Minneapolis-Honeywell equipment although any transformer with a secondary of 18 to 24 volts, rated for a current of at least 200 ma. can be used. In order to determine the resistance of R2, the Zener current limiting resistor, for a different secondary voltage use the following equation.

$$R2 = \frac{Vs - Vo}{1.1 \times I\ max.}$$

Vs is the supply voltage at the output of the bridge rectifier, *Vo* is the input voltage to wirewound control R3, or in this case 12 volts, *I max.* is the load current maximum or in our case 100 ma. As an example let us say that our bridge rectifier is putting out 24 volts DC. Subtract 12 volts from 24 volts leaving 12 volts. 1.1 times 100 ma., which is our maximum load current, gives .110 amperes. Dividing gives a value for R2 of 109 ohms. A standard value 100 ohm resistor at 2 watts

Power Transistor



Although parts location is not critical for proper operation of the unit, builders will find it difficult to squeeze parts into the plastic case if they ignore author's layout.

would be satisfactory. The wattage rating of Zener diode Z1 can be arrived at by multiplying the voltage rating of the Zener, which is 12, by the maximum current through it, or 1.32 watts. Our tester uses a 1 watt Zener, but we have secured it tightly against the front panel with a cable clamp and it runs cool. The front panel thus serves as a large heat sink. Unless you want to do the same you had better use the 10-watt unit specified in the parts list. Construction is straight forward with only one safety tip, and that is, "Don't over heat the silicon rectifiers or Zener diode. Use a heat sink when soldering them."

Just in case you are wondering why there is no *npn-pnp* reversing switch, forget it. Power transistors used in auto radios are *pnp* units almost without exception. Just in case you run up against an odd-ball, you can jury-rig a test setup using the testers power supply. Just do things upside down, that is reverse the power supply leads coming from the zener diode to the testing circuit. Watch M1's polarity.

Using the Tester. After assembly, wiring and testing the instrument is ready for use. Place Gain-Leakage switch S2 on Leakage, rotate the voltage control to the counter-clockwise end of rotation, attach the *pnp* power transistor (out of its circuit) to the test leads, and turn on the power. Advance the voltage control and observe the meter.

PARTS LIST

- C1, C2—1000-mf, 25-vdc electrolytic capacitor
- D1, D2, D3, D4—1N91 (four required) or 1 bridge rectifier module (Mallory FW50 or equiv.)
- M1—0-100-ma. DC meter (EMICO Model RF-2¼C or equiv.)
- NE1—Neon lamp NE-51H or Tineon Indicator 36N2311-6 complete with jewel and internal resistor, or equiv.
- R1—56,000-ohm, ½-watt resistor (not required if NE1 is a Tineon Indicator)
- R2—See text
- R3—800 to 1,000-ohm, 4-watt wirewound potentiometer
- R4—56,000-ohm, 1-watt resistor
- R5—33-ohm, 2-watt resistor
- S1, S2—S.p.s.t. slide or toggle switch
- T1—Transformer; 115-volt pri.; 18-25-volt sec. at 200 ma.
- Z1—1N2976 zener diode (Mallory ZA12 or equiv.) (see text)
- 1—6-13/16" x 5-9/32" x 2-5/16" plastic case (Allied Radio 87P886 or equiv.)
- 3—Alligator clips with 3 different colored insulators
- 1—Dial plate (Mallory #389 or #390, or equiv.)
- 1—7" x 5" aluminum sheet for front panel (see text)
- Misc.—Line cord, knob, terminal strips, wire, solder, hardware, decals, lye, etc.

Estimated cost: $22.00
Estimated construction time: 4 hours

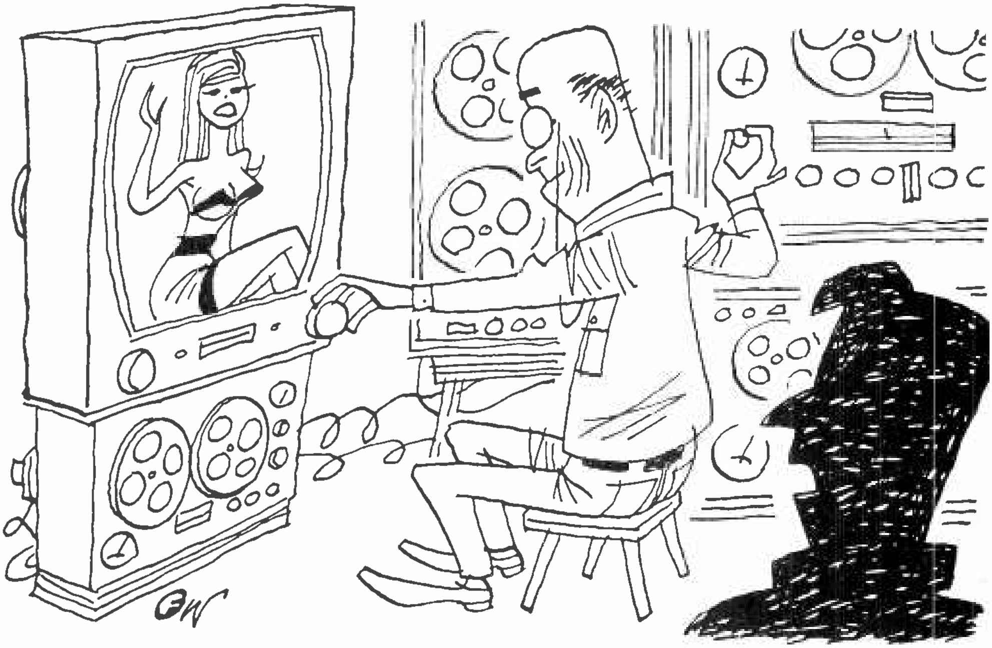
If the meter reads 50 ma. STOP! If not rotate the control to its full clockwise position. If the meter reading hasn't exceeded 50 ma., it has passed the leakage test and may be tested for Gain. Set the voltage control back to seven on its dial. Push the switch to Gain and the current reading should increase. On transistors with appreciable leakage the increase in current will only be from two to four times. On units with very little leakage the current increase may be as much as twenty-five times. Power transistors with high leakage and low gain can be used, but will not perform nearly as well as low leakage high gain units. As you gain experience in using the tester and the tested transistors in actual sets you will learn to appreciate the difference in power transistors. Keep a record of leakage and gain and actual circuit operation of each power transistor you test and you will soon be able to interpret your readings like an expert. There aren't any real tight specifications on power transistors that the average serviceman can use.

Experience is still the best teacher when it comes to testing and using power transistors. ■

THE STATIC CAPER

By C. M. Stanbury II

When DX is beneath you, then it may be Tefnut of the Dark Satellite



Let's face it, yours truly has been around. If someone hung a sign on my back, *This Engineer for Hire,* he'd be close to right. SWL'ing wasn't enough, I had to travel. So when I got my degree as an electronics engineer, I took a job in Bhutan, setting up a British owned commercial SWBC station atop the Himalayas. Then it was Colombia for a couple years where I put together a BCB network. Which brings me to this job for the bearded one—Ammer Ded—second-in-charge of his secret relay station in Southern Adindan near the Egypt-Sudan border. As you can see, I'm pretty neutral. I'll work for anybody. You might also call me a DX fanatic. Before I started on these travels, I would dream about DX and DX places, complete with nightmare static. I had to travel.

In charge of the Adindan operation was one Professor Von Kirk. After a couple weeks on the job, I decided he was crazy. Not so far gone he couldn't function, but still crazy. I had gone looking for him with paper work, official reports to be signed. His office was empty.

So I went down to the professor's quarters. Knocked. Silence. But the door was unlocked and I went on in. In the center of the room Von Kirk's large desk. To the right and left of me were banks of computer racks. The set-up looked like something from the late, late horror show.

"Professor." Nothing, so I shouted louder, "Professor."

More silence.

An open book was on his desk. I moved in closer to get a look at it. Curiosity killed the cat but then cats have nine lives.

THE LIGHT OF THE NEAR EAST, VOLUME I by *Thomas H. Burgoyne.* It was opened at Section III, Chapter III, "The Dark Satellite."

I just skipped over the words quickly. Some jazz about this satellite populated by evil beings, supernatural races or something like that. And about their agents on the earth, the Inversive Brethren.

Von Kirk came in then. Followed by two of our local Arab workers, unskilled but with plenty of muscle. They carried in a crate. He motioned and they put it down behind his desk. Then he saw me. "What do you want? These are my private quarters!"

I showed him the reports. Von Kirk took them, pointed for the Arabs to go. I started to move out behind them—

"Wait!" He crossed the room, shut and locked the door.

Like locked in the tiger's cage. Beside that weird book and way out electronics gear, there was the professor himself. If ever there were doubles on Earth, Von Kirk and Boris Karloff qualified.

"I am in complete charge of this base. You understand that. My word is law."

I nodded.

"What you see here is my own personal project financed with my own resources. It has nothing to do with the Adindan government." He fiddled with THE LIGHT OF THE NEAR EAST on his desk.

I nodded again.

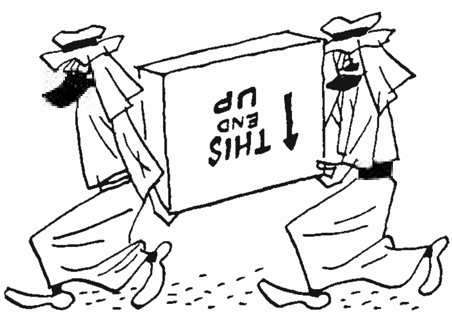
He considered me a moment. "I need a qualified assistant." Hesitated. "I am willing to pay you an amount in addition to your regular salary."

"How much?" Play it safe, play along.

"If this does not interest you, then apply to Cairo for a transfer." Von Kirk circled me a couple times.

"How much?"

"$50 a week, U. S. money."



I spread my hands. "Good enough." Why not! All I had to do was humor this crazy old man and pile up the extra moola.

Von Kirk shut his book with a bang. "Then it is settled." He sat down. "Unpack that crate while I explain to you what is involved here."

It was quite the bit. Von Kirk had found that dark satellite. It revolves inside the earth which is hollow. The inhabitants of this satellite use static, that's right, atmospheric noise to communicate with their agents on the earth, those *Inversive Brethren.* Because this dark satellite is nearer the surface in the tropics, their messages were considerably louder, other scientific theories to the contrary. By the use of computers, Von Kirk hoped to break their code.

I got the crate open. Inside—a TV set!

"The messages may take either aural or visual form."

So every day and part of the night, too, we kept at it. I didn't mind working during the hours of darkness, but days—that heat from the desert sun made his lab almost unbearable. But Von Kirk wouldn't wilt or rest.

"When I began my work in Baden many years ago, time was expendable. Now there is not much left." Von Kirk made the station a real funland.

His approach was simple enough. With a broadband receiver (one he invented himself) he would pick up all the frequencies below 3 mc., feed them into a speaker and TV picture tube—but the signals were first rearranged in sequence and comparative volume via those banks of computers. I took the left bank, him the right.

We did get voices of course, however, these were usually traceable to one of the high powered BCB stations in the Near East, like Cairo itself on 773 kc. and Omdurman down in the Sudan on 572. But then a voice did come through we couldn't identify. At 2.00 AM, female, soft and deep. She said quite clearly "prepare to relay intelligence to the South African resistance command," then slipped off into the noise.

Von Kirk circled the room swiftly noting computer settings. "That was Tefnut, daughter of the primeval being, princess of the Dark Satellite."

I concluded *TefNUT* summed up his whole project pretty well.

When he finished, Boris, I mean Von Kirk, stopped dead and just stared at me. "You found her voice attractive?"

I laughed and nodded.

"You must be careful. She will try to tempt you and recruit you into the Inversive Brethren." Von Kirk considered the danger briefly. "We will have to risk it. Tomorrow night at the same time!"

After which I went to bed, exhausted from the heat, and dreamed about DX again for the first time in a couple months. Only now the station I wanted was Tefnut. Static, oceans of static, with her voice audible on occasions. Then on came Radio Berlin International and blocked out the frequency.

I woke up in a cold sweat.

After being stuck in Adindan for three

(Continued on page 94)

UHF ANTENNA INSTALLATION

By John Potter Shields

If your TV set can receive any of the 70 UHF-TV channels then it's time for some top-level thinking on your roof

The FCC requirement that, as of March, 1964, all TV receivers intended for interstate shipment must be capable of receiving UHF channels, coupled with the cropping up of many new UHF stations in all areas of the country, indicate that UHF TV is finally here to stay. This boils down to the fact that in all probability UHF either has, or is about to be coming to your town. The question is . . . are you able, or will you be able to receive it? Even though you may have purchased a new TV receiver capable of receiving all 82 channels, or added a UHF converter to your present set, there is much more to receiving a good UHF signal than hanging a wire out the window or simply tying on to your present VHF antenna. UHF signals are a bit trickier to handle than the old familiar VHF. Let's take a look at why UHF is around in the first place, as well as at the UHF signal itself and how we may best capture it for feeding to the receiver.

Why UHF? Originally, when the 13 VHF TV channels were created, it was felt that they would provide adequate capacity for the TV market. It was subsequently found, that additional channels would be required to handle the desires of many areas for additional outlets. Another reason for UHF is that it permits two channels of the same frequency to operate relatively close together

UHF ANTENNA INSTALLATION

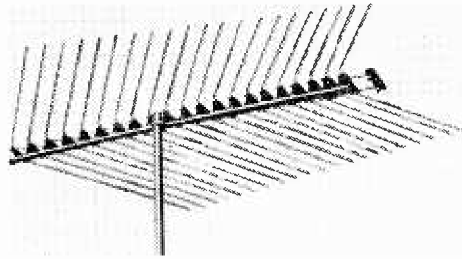
. . . say in adjacent cities. This has been a problem with VHF; the advent of more powerful transmitters and more sensitive receivers has resulted in interference between like channels in relatively widely separated areas. Thus, in a nutshell, UHF permits: 1. a larger number of available channels, and 2. these channels may be spaced more closely together than in the case of VHF channels.

Now that we've seen why we have UHF, let's take a look at the basic UHF signal in order to get a better idea of how to handle it. The first and most obvious difference between the VHF and UHF signals is their frequency. Both VHF and UHF signals are high enough in frequency so as to travel in a straight line (like a searchlight beam) rather than following the curvature of the earth as do lower frequency signals. However, lower band VHF TV signals are susceptible to a phenomenon known as "skip" as shown by the sketch, Fig. 1. This "skip" occurs when the transmitted signals bounce off the ionosphere (a layer of charged particles encircling the earth) and return to a receiving point many miles from their point of origin. This "skip" explains some of those amazing TV-DX accounts we hear about.

This "skip" effect is non-existent at the UHF TV channels thus eliminating the chance of interference between widely separated channels. The UHF TV signals are more readily blocked by relatively small objects such as buildings, etc. due to the much shorter wavelengths involved. The cumulative effect of this again cuts down the range of UHF signals. Also, the radiated signal strength of UHF signals is generally lower than in the case of VHF signals . . . another factor is their reduced coverage when compared to VHF.

UHF signals are also more directional than lower frequency VHF signals, and as a result, ghosting due to multi-path signal reception is more of a problem with VHF signals.

Capturing the UHF Signal. The most logical starting place is at the antenna. UHF antennas pretty much follow the same basic types as found in VHF—the dipole, folded



JFD Model LPV-U21

Fig. 2. A log periodic UHF antenna with 21 cells—good for working stations 80 miles.

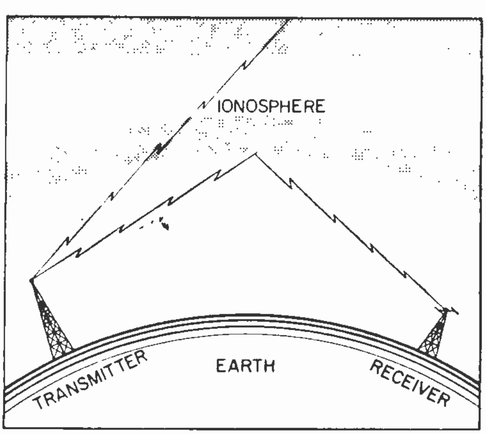


Fig. 1. VHF signals skip to distant receivers—UHF signals pass through ionosphere.

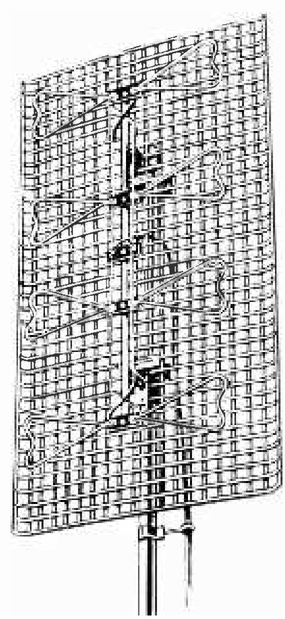


Fig. 3. Four individual bays are stacked one on top of the other for greater gain.

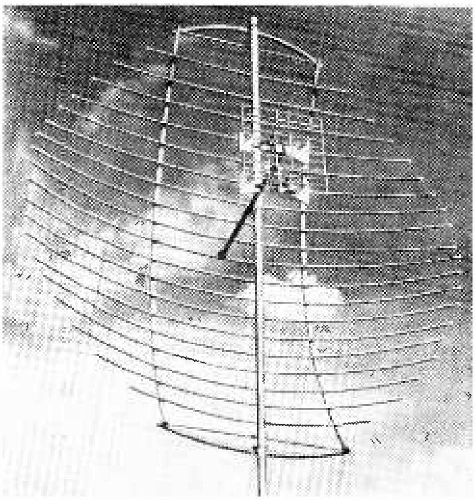


Fig. 4. UHF antenna using a parabolic reflector to gather in signal for high gain.

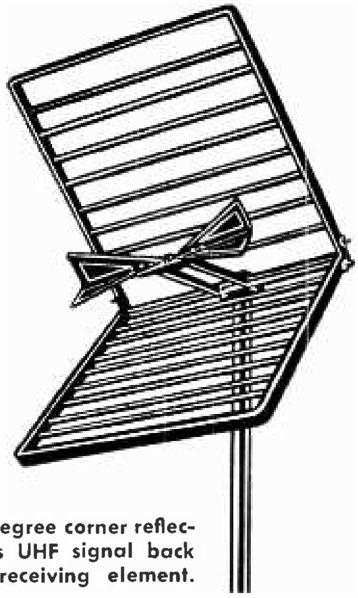


Fig. 5. 90-degree corner reflector bounces UHF signal back to dipole receiving element.

dipole, conical, yagi, etc. However, the physical construction of UHF antennas differ considerably from corresponding VHF types. For one thing, all UHF antennas are considerably smaller than their VHF counterparts. The reason for this, of course, is the shorted wavelengths up in the UHF spectrum. Remember, the element length(s) of any antenna, dipole, yagi, or what have you, is a direct function of the wavelength being received.

The smaller physical dimensions of the UHF antenna make possible many arrays not practical with the larger, more bulky, lower frequency VHF antennas. For example, look at the log-periodic UHF antenna pictured in Fig. 2. The design of this type of antenna for VHF frequencies would be very difficult due to the considerably longer element lengths required as well as the greater spacing between elements. Maintaining structural strength would be extremely difficult, and the increased weight would also be a problem.

Fig. 3 is another example of the physical advantage gained with UHF antennas. A large number of individual bays are easily stacked for increased gain without taking up an unreasonable amount of space or becoming unwieldly or overly heavy.

The smaller dimensions of UHF antennas offer still another advantage . . . much better performance. As just mentioned, a fairly large number of arrays may be stacked by increased gain. It is also feasible to employ the parabolic antenna design (similar to those microwave dish antennas). This design, somewhat similar to using a reflector behind a searchlight to increase intensity . . . only in reverse, results in greatly increased antenna gain (sensitivity). Fig. 4 pictures an antenna using this approach. Note the curved reflector which resembles a section of a parabolic reflector. It's pretty obvious that this type of construction would be just about mechanically impossible with a VHF antenna.

Fig. 5 shows another type of UHF antenna construction. Actually, a dipole with reflector, this unit differs from the VHF dipole and reflector in that a number of

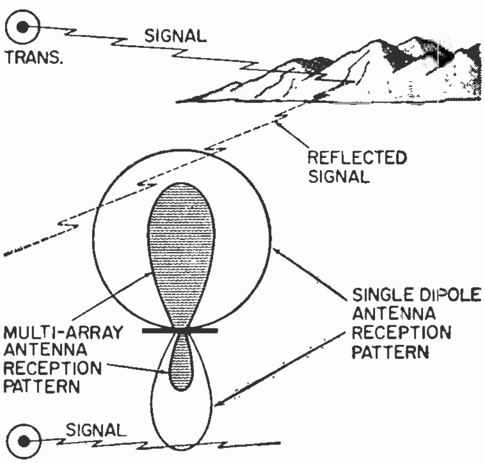


Fig. 6. Multi-array UHF antennas can eliminate ghosts caused by multi-reflections.

UHF ANTENNA INSTALLATION

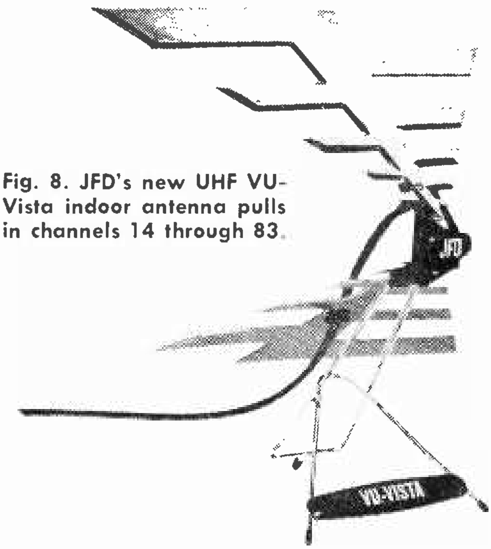


Fig. 8. JFD's new UHF VU-Vista indoor antenna pulls in channels 14 through 83.

individual reflectors are used in place of a simple tubular rod reflector element. This screen improves antenna gain and sharpens its selectivity.

Besides providing increased gain, the "fancier" arrays possible with the smaller UHF antennas offer sharper pickup patterns. Just what this means is shown in Fig. 6. As we mentioned earlier, UHF signals are particularly prone to ghosting as a result of multiple path reflections. Notice that the sharp reception pattern of the multibay UHF antennas effectively reduced the pickup of multiple path reflections as well as signal pickup from its rear.

In areas where a strong UHF signal is present, "bowtie" UHF dipole antennas such as pictured in Fig. 7 will be satisfactory. Fig. 8 shows an indoor antenna of unusual shape, a UHF log periodic trapezoid.

The Antenna to Receiver Path. Although the installation of a UHF antenna is essentially the same as for a VHF, you still have to lug it up to the roof or up to the attic. There are also a number of differences that you should note:

For one thing, signal losses are much greater at UHF frequencies, as we mentioned before. This means that care must be taken to reduce or eliminate all sources of possible signal loss between the antenna and receiver, or converter, input terminals.

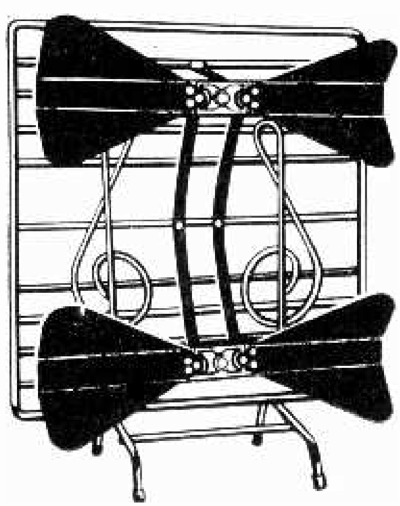


Fig. 7. TV top UHF antenna resembles its outdoor brother—works well in urban areas.

Beginning at the antenna itself, make sure that lead-in cable connections to the antenna terminals are tight and that the antenna terminals themselves are free from all corrosion. While in this area, don't overlook the antenna terminal block and antenna insulators. Avoid getting any oil or grease on these parts, as these substances make excellent signal-killing dirt catchers.

The type and care of the lead-in wire or cable is especially important at UHF frequencies. A source of signal loss at VHF frequency, signal loss in the lead-in, is a considerably larger problem at UHF frequencies. The least "lossy" type of lead-in is the "open-wire" type such as shown in Fig. 9. As you can see, it consists of two parallel wires, separated at regular intervals by low-loss spacers. Due to air being the only dielectric between the wires, except for the widely spaced insulators, this lead-in has extremely low loss at UHF frequencies. The

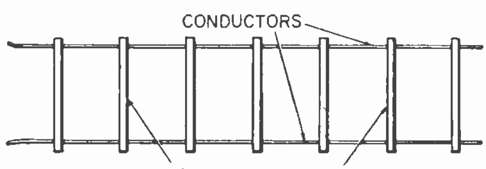


Fig. 9. Open-wire type TV lead-in is best when losses must be minimized. Spacers between conductors are made of porcelain glass.

one disadvantage of this type of lead-in, however, is that it is more difficult to handle than the other types of lead-in.

The next least lossy type of lead-in is the tubular type. The advantage of the tubular lead-in as compared to the flat type is that, being circular, it provides a longer leakage path between conductors. One point though . . . be sure to seal the ends of tubular lead-in with either a match flame or hot soldering iron after it has been installed to prevent any water from getting into it.

In areas where interference, such as automobile ignition noise, is a problem, shielded coaxial cable is your best bet. Since this cable is usually 75 ohms unbalanced line, a matching transformer will probably be needed at the antenna as most antennas have a nominal impedance of around 300 ohms. Similarly, a second transformer will be required if the converter or TV's input is rated at 300 ohms.

When installing the lead-in, it's of course important to keep it well away from other objects, especially metallic ones. Aslo, the length of lead-in from antenna to set should be kept as short as possible to minimize signal loss.

While still on the subject of signal loss, it's important to keep in mind that some types of lightning arrestors can cause severe signal loss at UHF frequencies. If, after completing your UHF installation, you find that you are losing signal, check the lightning

Fig. 10. Typical UHF converter made by Jerold selects UHF channel and provides boost.

arrestor. If the signal improves without it, replace with a higher quality unit.

Orienting the antenna for best picture is a bit trickier at UHF frequencies. Since the UHF signal bounces around more than VHF, careful orientation can be a bit touchy . . . only a change of a few degrees can make the difference between no picture and

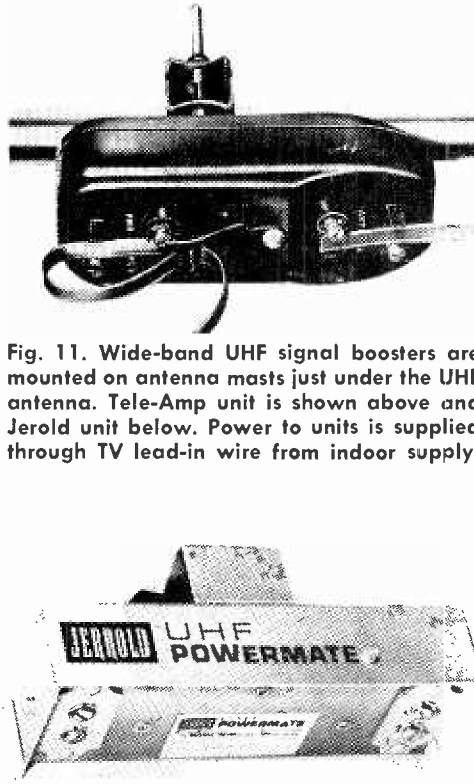


Fig. 11. Wide-band UHF signal boosters are mounted on antenna masts just under the UHF antenna. Tele-Amp unit is shown above and Jerold unit below. Power to units is supplied through TV lead-in wire from indoor supply.

a good quality picture. Likewise, raising or lowering the antenna just a foot or so can make all the difference in the world. In some instances, it's possible to get a stronger signal from a reflected signal rather than the direct signal from the transmitter.

UHF Converters and Boosters. If your TV set is not equipped to receive UHF, then obviously you must obtain a UHF converter in order to be able to receive any UHF stations. One exception to this is if your receiver's tuner is of the type which will receive UHF strips. In this case, you simply obtain the strip for the desired UHF channel.

UHF converters come in all sizes, shapes, and forms nowadays . . . a typical unit being shown in Fig. 10. Some manufacturers offer transistorized converters which offer the advantages of low power consumption and cool operation. Converters are available which may be placed on top of, or near, the receiver. Others may be placed unobtrusively behind the set.

There are a few precautions to watch when installing a UHF converter. To prevent converter oscillation (indicated by either interference bars or excessive "snow" in the picture), keep the converter's input and output leads well separated. Also, keep the leads from the converter's output to receiver antenna terminals as short as possible.

Heat is an enemy of UHF converters . . . especially transistorized ones! To minimize converter drift due to excessive temperatures, keep the converter well isolated from such relatively high temperature spots as the rear of a TV that is placed smack against a wall.

UHF boosters are now available. Similar in results to VHF units, they give the UHF signal extra "oomph" before it reaches the converter or receiver. Fig. 11 shows two types of antenna mounted UHF boosters which amplify the signal before it is sent down the lead-in. This is an advantage as the stronger signal tends to override the noise and interference picked up by the antenna lead-in.

UHF "two-set" couplers are also available

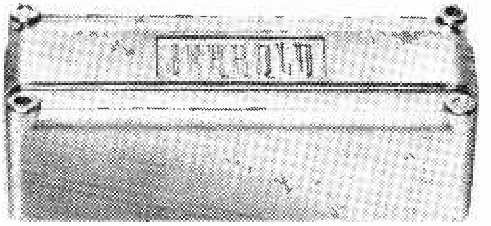


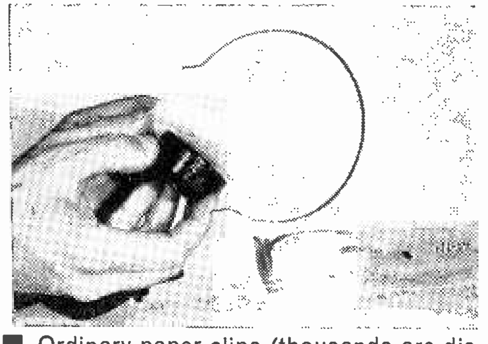
Fig. 12. Since anyone can splice wire, far too often two set couplers are eliminated in installations causing loss of signal, ghosts.

. . . a typical unit being pictured in Fig. 12. These couplers are designed for minimum signal loss at UHF frequencies and provide better performance than a conventional VHF coupler.

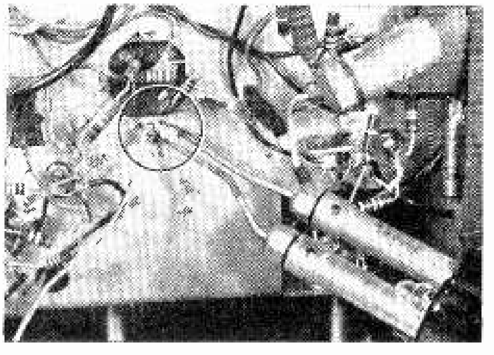
Equipped now with the scoop on UHF and a *clear picture* of the reception process, you're ready to start pulling in those ultra-high frequency broadcasts. ■

Workbench Tips

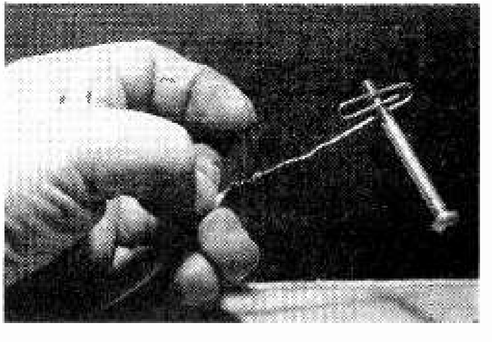
■ A frequent cause of hum (and sometimes even whistles from radios) is an improperly grounded can-type filter capacitor. Most can installations rely on their twist lock for connection to ground. In time an oxide forms—a high resistance circuit occurs. To prevent trouble, always solder at least one lug to ground in kits and when replacing.

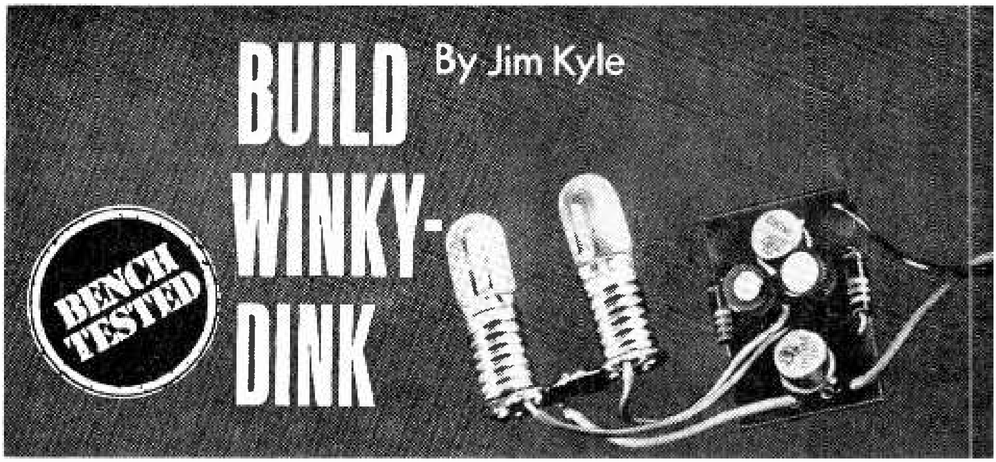


■ Ordinary paper clips (thousands are discarded hourly) make handy, quick detachable, connectors for electrical wire ends with only slight alteration. Simply straighten out one end of the clip and attach the wire. The wire end may be spot soldered or inserted in a loop, then the loop is squeezed together in a vise or with pliers. The remaining portion of the paper clip may be used as a washer with the tab end under a terminal nut or as a simple hookup as shown in photo at right.



■ If your SW ear phones weigh heavy on your head, take a tip from the makers of hi-fi headsets and pad them with foam rubber. Foam rubber powder puffs are ideal for the purpose and are available at most cosmetic counters. To install, simply cut a ¾" hole in the puff's center, and cement in place as shown in photo at left. Install puffs wherever headband meets top of your head.





If you're looking for a useful construction project, which can help you test salvaged parts or log rarer DX, the Winky-Dink isn't for you. But if, like most of us, you enjoy a *strictly fun* gadget from time to time, then Winky-Dink is what you have been looking for.

Winky-Dink is a one-hour project leaving the remainder of the evening free to experiment with different blink rates. Only eight components are employed, and total cost should be under $3.00 (less if you're lucky and have some of the parts in your junkbox).

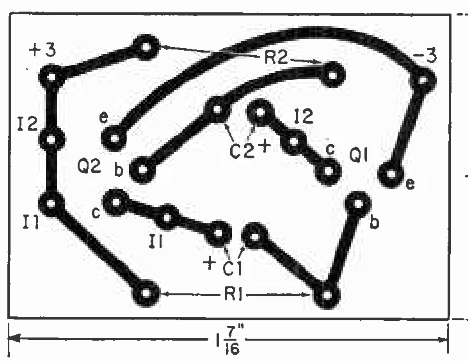
The completed Winky-Dink does nothing more than sit on the table and wink its two light-bulb eyes back and forth continually, but it's a conversation-stopper to non-electronic-minded visitors. In a home lab crammed with exotic (and expensive) equipment, Winky-Dink easily steals the show when anyone drops in.

If you *must* be practical, it makes a fine toy for a young child. To use it for this, perform simple surgery on a stuffed animal. Remove the sewn-on eyes and replace them with Winky-Dink's bulbs; then provide a zippered compartment for batteries and pack the tiny circuit board into the animal's interior.

Construction. Arrange the two transistors, the capacitors, and the resistors on the circuit board and solder the leads to a home-made printed circuit board. See Detail Drawing. Use a small, hot iron and work rapidly; the transistors are rated to withstand soldering-iron heat for no more than 15 seconds at a distance of 1⁄16-inch from the case.

Rather than using the etched board, you may prefer to lay out the components in similar arrangement on perforated hardboard. Stiff cardboard is also an excellent "chassis" material; necessary holes can be punched with the point of a drawing compass or with an ice-pick.

Leads to the bulbs can be connected either by soldering them directly to the bulb bases, or by using sockets. Since either #48 or #49

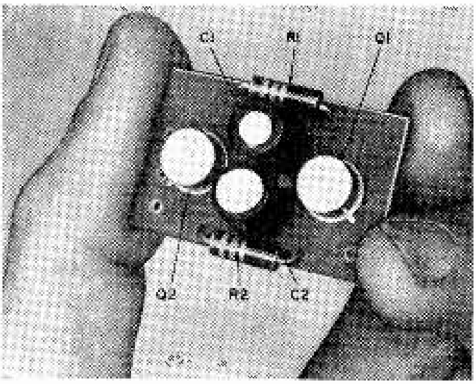


Detailed diagram of underside of printed circuit board—be sure to copy to scale.

pilot lamps can be used (electrically they are identical), you can use either screw or bayonet-type lamp sockets—whichever you have in the junk box.

Battery connections are best made by using a battery holder, although with care you can solder directly to the two cells. The holder is recommended as Winky-Dink draws approximately 60 milliamperes from a fresh pair of D cells, which will require battery replacement from time to time. If the large ignition-type cells are used for power, they should last their shelf life.

Thumbnail Theory. Winky-Dink is an astable collector-coupled multivibrator, sim-



Winky-Dink circuit board all wired and ready for lamp and battery connections. Be careful not to overheat transistor leads.

plified to the most extreme degree possible. The transistors function as switches to turn the bulbs on and off, and the capacitors make one transistor stay "off" whenever the other is "on."

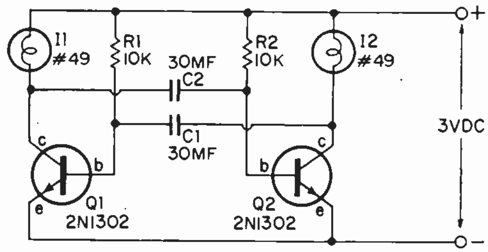
For instance, if transistor Q1 happens to be "on," its collector voltage will be nearly zero. This places the positive end of C2 at ground level. However, if Q2 is "off" at the same time, its collector voltage will be the same as that of the battery—3 volts. Thus C1 is charged to 3 volts, through bulb I2.

While C1 is charging, the current flowing to charge it passes through the base-emitter junction of Q1, keeping Q1 "turned on." When C1 reaches full charge, however, this current flow ceases, and Q1 tends to "turn off."

This raises the collector voltage of Q1 positive to ground, then the change in Q1's collector voltage is transferred through C2 to the base of Q2, tending to turn Q2 "on."

This action, in turn, causes the collector voltage of Q2 to drop. The change in collector voltage of Q2 is transmitted through C1 back to the base of Q1, further tending to turn Q1 "off." In addition, the 3-volt charge on C1 adds to the change, so that the base voltage of Q1 is 3 volts more negative than the collector voltage of Q2. This action is cumulative, and rapidly switches Q1 "off" and Q2 "on."

So long as the 3-volt charge remains on C1, Q1 will be held in cutoff and cannot conduct. C1 "reverse charges" through R1, until the base of Q1 becomes sufficiently posi-



Be sure to connect positive leads of electrolytic capacitors to Q1 and Q2 collectors.

tive to allow conduction to begin. Then Q1 begins to turn "on" again, turning Q2 "off" as just described. The process continues indefinitely—as long as the battery lasts.

Parts Substitutions. Almost any of the parts may be changed to fit your own availability situation. *Npn* transistors were used because they were on hand. *PNP's* can be used by reversing polarity of the battery and the capacitors. Resistor values for R1 and R2 can be anything between 4700 ohms and 33,000 ohms; the larger values will produce a slower wink rate. The capacitors can be larger but appreciably smaller ones are not recommended; the wink rate becomes so rapid the effect is lost. However, do not substitute the more common No. 47 pilot bulbs; they require 250 milliamperes for proper operation, which results in abnormally short battery life.

Should Winky-Dink fail to wink for you, the trouble should not be hard to find. If both lamps light dimly, you probably have a defective or disconnected capacitor. If one bulb lights brightly while the other is out, the capacitor connected to the same collector as the dark bulb is probably shorted. If both lamps light brightly, either both capacitors the shorted or your transistors are defective (either event is rare). If the bulbs wink, but dimly, you probably have weak batteries. ■

PARTS LIST

- C1, C2—30-mfd., 6-v electrolytic capacitor, subminiature type for printed circuit boards (Lafayette 99G6076 or equiv.)
- I1, I2—#49 (screw type) or #49 (bayonet type) pilot lamp
- Q1, Q2—2N1302 transistor (RCA) (npn, average beta—100)
- R1, R2—10,000-ohm, ½-watt resistor
- Misc.—Printed circuit board (optional), sockets for pilot lamps (optional), wire, solder, etc.

Estimated cost: $3.00
Estimated construction time: 1 hour without printed circuit board

Talk on a Light Beam

Continued from page 55

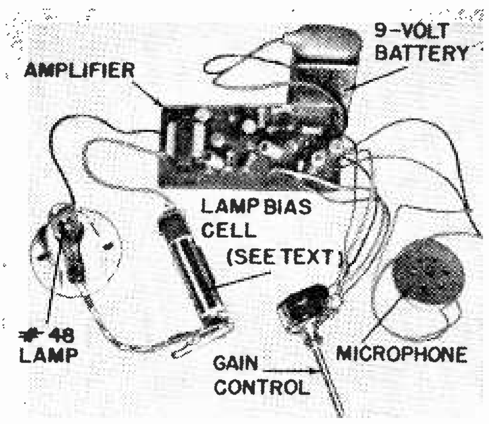
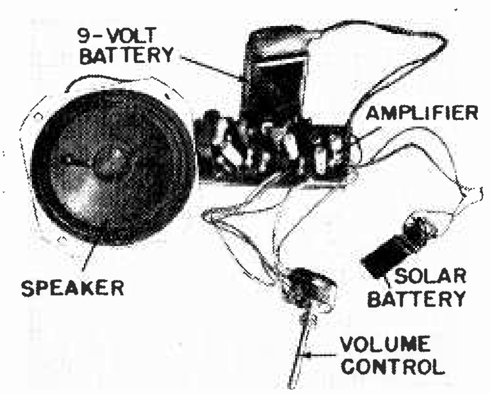


Table-top setup for talking on a light beam is shown in the photos. Above, the transmitter or light amplifier is shown, and below, the light-actuated sound amplifier.



shouldn't be expected to work at a range over a couple of feet. If you operate in a darkened room and go to some trouble in positioning the lamp and solar cell relative to each other, you can gain some range. For longer distances you need an amplifier with greater gain and power output handling capability and a larger bulb (perhaps a #47) with a better focusing system. For demonstration purposes at Science Fairs, you can use your hand as a volume control. Slowly place your hand between the lamp and solar cell. The volume of the signal transmitted on the light beam will be reduced and eventually eliminated. ■

Tape Testing Made Easy

Continued from page 72

of tape; the tape which plays back the two tones within a few db of each other is obviously the tape to use. But note that there may well be a difference in output levels, and a tape may deliver several db greater output. Do not be influenced by output level, since the high level tape might deliver a poor high frequency response from *your* recorder (it might be great tape for another recorder). Standardize on the tape that delivers the best high frequency response, any recorder has enough extra gain to compensate for a lower output level.

Special Service Note. The average tape recorder user often does not realize that a single combination record/playback (R/P) head goes out of alignment. This is because even if the head goes severely out of alignment, the playback azmuth is exactly the same as the record azmuth—it must be because the same head is used. However, should the user attempt to playback a prerecorded tape—which is usually in perfect alignment—then he would notice a muddy muffled sound. Even if you never use prerecorded tapes *your* R/P head should be in perfect alignment—it's the only way you'll be able to swap tapes with friends and still get maximum fidelity.

Even if you lack an alignment tape, alignment is a simple procedure; and once done, you can use the tester to make a Master Test Tape. Preferable, borrow a prerecorded tape (alignment tapes are hard to borrow). If you can't, use an old tape—one made when the recorder was brand new.

Run the tape through the recorder, set the tone control to full treble boost, and using the edge of a Q-tip or your finger, gently skew the tape up and down *right after the R/P head* (as close as possible). If the highs *increase* as the tape is skewed in either direction the head is out of alignment. Demagnetize a screwdriver (or wrench) and adjust the alignment screw for maximum high frequency response—the head is now in perfect alignment. Immediately, clean the heads (erase head too) and make a Master Test Tape. (If yours is a three head recorder the playback head can be aligned using the same procedure.) Once the Master Test Tape is made you can use the simple tests and alignment procedure previously given. ■

Organs Without Pipes

Continued from page 51

pressed, the switches operate for not only F3, but also for F4 (the over tone), C4, (the fifth tone), and A2 (the hum tone, which is the third tone one octave lowered). The simultaneous sounding of all these keys creates the effect of a chime.

Voicing. From the keyer circuits, the chosen signals go to the voicing circuitry. Here, certain harmonics are *removed* from the signals by filters so that the remaining signal will be similar to that created by a pipe stopped to the degree chosen by the musician.

Voicing for the swell manual includes 10 stops; four of these are known as "flute" voices and the other six are called "complex". (See Fig. 9 of Heathkit organ.)

The flute voices are low in harmonic content, while the complex voices have strong harmonics. To obtain the flute voices, the tone signals are passed through low-pass RC filters which remove the higher harmonics. Since F4, for instance, is the eighth harmonic of F1, a number of different filters must be used to allow F4 to be passed while the harmonics of F1 are blocked (the F1 tone goes through a filter which blocks F4, while the F4 tone goes through a different filter which blocks the harmonics of F4).

The four flute voices differ only in pitch. The "16-foot" flute sounds tones an octave lower than the keyboard would indicate. The "8-foot" flute sounds the normal flute note. The "5⅓-foot" flute or "quint" sounds the tone a musical fifth above the keyboard note selected, and the "4-foot" flute or "flute d'amour" sounds an octave higher than the keyboard.

The fifth octave of the frequency range—the one above that covered by the master oscillators—is created by bandpass filtering in the flute circuitry; it is used only to sound the upper notes of the keyboard when the "flute d'amour" stop is chosen.

The six "complex" voices of the swell include three "16-foot" stops, all of which sound an octave lower than the note struck; and three "8-foot" stops, which sound the note selected. The 16-foot stops are "diapason," "bass clarinet," and "trumpet," while the 8-footers are "English horn," "violin," and "oboe."

All are created by passing tone signals through high-pass, low-pass, and bandpass filters in various combinations, to remove all undesired harmonics and leave only those present in similarly-named stops of a pipe organ.

The great manual offers a choice of four voicing stops, all of which produce the notes chosen on the keyboard rather than producing notes an octave or more away. All four of these voices are complex; they are produced by filtering action also.

The pedal keyboard has two stops, "8-foot" and "16-foot," plus a third switch which selects both together. The 8-foot stop sounds the note selected, while the 16-footer sounds an octave lower. If both are chosen, both notes will sound together when a single pedal is pressed. The pedal tones are filtered through a low-pass RC network to remove most high harmonics, leaving a "full-bodied" tone composed primarily of fundamental frequency.

Reverberation. While the "color" or voicing, as determined by the voicing filter circuitry, is an important part of the "organ sound," it's not all there is. An equally important component is the reverberation pattern created for a pipe organ by the large number of pipes spread over a wide physical area. In electronic instruments, this pattern is simulated by use of a device known as a *Leslie* speaker.

Tremolo & Vibrato. The *Leslie* speaker consists of a speaker coupled to a special horn; the horn rotates at right angles to the direction of the speaker, and disperses the sound over a wide area while at the same time impressing a combination of amplitude and phase modulation upon all of the sound waves, by its rotation.

Speed of rotation of the *Leslie* speaker is

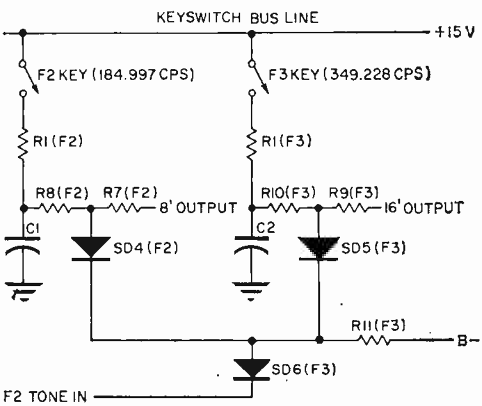


Fig. 8. Simplified schematic showing the diode switching used in the Heathkit organ.

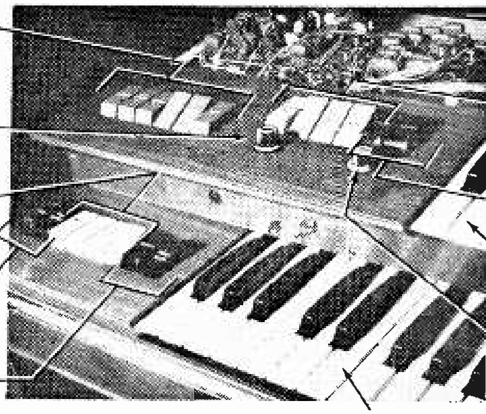


Fig. 9. Photo of left side of keyboards shows complex switching used to get voicing.

under control of the musician. Two speeds are available. In "tremolo" position, the horn rotates at about 360 RPM, or 6 cycles per second, adding a tremolo effect to the music but not producing a discernible tone of its own. In "celeste" position, rotation is slowed to 42 RPM, or 7/10 cycle per second, producing a "fluttering" effect very like that of a large pipe organ. If desired, the Leslie speaker may be turned off and the conventional main speakers used alone.

In some instruments, the proper reverb pattern has been achieved by use of electromechanical reverberation units. However, such units have not seen wide acceptance; the Leslie speaker is used on the majority of today's instruments.

Another characteristic of organ sound is a vibrato effect. In the original pipe organs, this was due to random variations in air pressure. In the electronic instruments, it is produced by special vibrato circuits which frequency-modulate the master oscillators to produce an almost undetectable fluctuation of pitch during each note. Frequency variation is at the rate of about 6 cycles per second, when vibrato is selected by the organist. Like all other effects in the organ, vibrato may be turned off when desired.

Amplification. To build the final organ output signal up to proper loudness (a pipe organ has a *big* sound), an amplifier must follow all the tone generating, keying, and voicing circuits. This amplifier is much the same as an ordinary hi-fi circuit—and in fact, hi-fi amplifiers have been used in many home-built organs.

Following the amplifier, of course, comes a speaker to convert the signal to sound. Unlike the amplifier, though, the speaker need *not* be the ultimate in hi-fi. When the designer plans the entire organ, he can frequently hold cost down somewhat by using less perfect speakers which do have some coloration and character of their own—and then taking these speaker characteristics into account in the design of his voicing systems. Thus the speaker must be considered as a part of the complete organ, rather than as simply a conversion device hung onto the end. An excellent example of this technique is the use of the Leslie speaker already described, to produce the reverb pattern.

Or, in other words, attempts to "improve" upon an organ by putting in a high-grade hi-fi speaker will usually result in noticeably *poorer* and less life-like sound from the instrument.

Other Electronic Instruments. The organ is not the only instrument which may be duplicated by electronics. At least one firm markets an electronic piano, which allows private practice by the use of headphones. In addition, a number of purely-electronic instruments such as the Theremin have entered the musical field—and several motion pictures have been produced in which the entire music background has been produced by electronic instruments.

What's more, a number of scientists have worked out systems in which digital computers are programmed to follow the rules of musical composition, then compose *and perform* non-human works, by controlling electronic instruments. The similarities between electronic organs and computers have already been brought out in this article. Maybe in another 100 years or so musicians, too, will suffer from "technological unemployment!" ■

Current Clamp

Continued from page 58

ohms, volts, and amperes. Take 0.6 volts as the average diode voltage for a silicon power diode and trim R1 as needed in use.

Measured performance of the Current Clamp is shown graphically. You can see that output voltage changes very little until the clamping point is reached, at which time current holds virtually constant and voltage drops off. These measurements were made with ordinary bench instruments, and no corrections for resistor tolerance or meter error have been included; thus you find such items as 1.25 volts driving 11 ma. through a 100-ohm load. Settings for the tests were 1½ volts supply and 24-ma. clamping level. A 100-ohm variable resistor furnished the load.

Set Up. To set up the Current Clamp, once built, follow this procedure. First remove the load and connect a VTVM across the "output" terminals (where it remains throughout the tests unless needed elsewhere), and connect the "input" terminals to an adjustable regulated power supply. Then adjust the power supply for desired value of output voltage as read on the VTVM.

Next, set R1 to its maximum value, connect a milliammeter of appropriate range to the "output" terminals of the Clamp, and short-circuit the output side of the meter. Now set R1 for any desired maximum current flow.

Then connect a load of sufficient resistance to approximate the expected current flow in the circuit to be checked, and measure the output voltage to see how much of it has been changed by the adjustment of R1. If it has changed, readjust the power supply to compensate. Then again short the output terminals and re-set R1 for desired maximum current. This process sometimes must be repeated a third time, but more frequently the initial adjustment holds without even a touch-up.

When the milliammeter indicates maximum desired current on short-circuit load, and the VTVM indicates desired output voltage with approximately the desired load, remove the load resistors and connect to the circuit to be tested, confident that no components are going to be cooked by excessive current before you can turn things off. It's a most secure feeling! ■

Static Caper

Continued from page 82

months, a temptation would have really hit the spot. But suddenly it began to bug me, I was actually taking Tefnut seriously. Like maybe if I hung around much longer, yours truly would be as crazy as Von Kirk.

That following night (which was complete with sand storm and zero visibility outside) we set exactly the same computer combination with some very slight variations as calculated by the professor.

Just like clockwork her voice came through. "This is Tefnut calling Inverse 7." Then we got a picture on the screen too. Tefnut was everything we lacked in the local Adindan talent. If you can imagine the rarest of DX in female form, that's Tefnut.

Von Kirk was so excited his hands were trembling.

"You are to dispatch agent 63333 to Southern Adindan and abduct he who is second-in-command at the secret radio relay station there."

I turned several different shades of aqua.

"Ignore the old man. He is already considered slightly insane and will not be believed." Tefnut stood up. "But the younger one is a suitable subject for rehabilitation."

Von Kirk dashed across the room and threw the main switch. "You must take the government plane and fly out of Adindan at once."

Calm now, I pointed to the storm outside. "When there is visibility."

So now I have two choices. That storm will probably move on before Inverse agent 63333 arrives. Or I can stick around and find out just how good a temptress Tefnut really is. ■

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44. A new short-form catalog (pocket size) is yours for the asking from *EICO*. Includes hi-fi, test gear, CB rigs and amateur equipment—many kits are solid-state projects.

AMATEUR RADIO

45. Catering to hams for 29 years, *World Radio Laboratories* has a new FREE 1965 catalog which includes all products deserving space in any ham shack. Quarterly fliers, chock-full of electronic bargains are also available.

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

CITIZENS BAND SHORT-WAVE RADIO

48. *Hy-Gain's* new 16-page CB antenna catalog is packed full of useful information and product data that every CB'er should know about. Get a copy.

49. Want to see the latest in communication receivers? *National Radio Co.* puts out a line of mighty fine ones and their catalog will tell you all about them.

50. Are you getting all you can from your Citizens Band radio equipment? *Cadre Industries* has a booklet that answers lots of the questions you may have.

51. If you're a bug on CB communications or like to listen in on VHF police, fire, emergency bands, then *Regency Electronics* would like to send you their latest specs on their receivers.

53. When private citizens group together for the mutual good, something big happens. *Hallicrafters, Inc.* is backing the CB React teams and if you're interested in CB, circle #53.

54. A catalog for CB'ers, hams and experimenters, with outstanding values. Terrific buys on antennas, mikes and accessories. Just circle #54 to get *Grove Electronics* free 1964 Catalog of Values.

55. Interested in CB or business-band radio? Then you will be interested in the catalogs and literature *Mosley Electronics* has to offer.

Also see Item 46.

SCHOOLS AND EDUCATIONAL

56. *Bailey Institute of Technology* offers courses in electronics, basic electricity and drafting as well as refrigeration. More information in their informative pamphlet.

57. *National Radio Institute*, a pioneer in home-study technical training, has a new book describing your opportunities in all branches of electronics. Unique training methods make learning as close to being fun as any school can make it.

58. Would you like to learn all about television servicing quickly at home? *Coyne Electronics Institute* would like to show you how easy it is, and at a low cost, too.

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*.

60. Facts on accredited curriculum in E. E. Technology is available from *Central Technical Institute* plus a 64-page catalog on modern practical electronics.

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."

ELECTRONIC PRODUCTS

62. Information on a new lab transistor kit is yours for the asking from *Arkay International*. Educational kit makes 20 projects.

63. A complete booklet and price list giving you the inside data on *Schober Organs* are yours for the asking.

64. If you can use 117-volts, 60-cycle power where no power is available, the *Terado Corp.* Trav-Electric 50-160 is for you. Specifications are for the asking.

65. Want power plus for your auto? New Transistorized Ignition adds 20% more MPG. 3 to 5 times more spark plug life. Lower maintenance cost. Free catalog and instruction booklet.

67. Get the most measurement value per dollar." That's what *Electronic Measurements Corp.* says. Looking through the catalogue they send out, they very well might be right!

TELEVISION

70. The first entry into the color-TV market in kit form comes from the *Heath Company*. A do-it-yourself money saver that all TV watchers should know about.

71. Attention, TV servicemen! *Barry Electronics* "Green Sheet" lists many TV tube, parts, and equipment buys worth while examining. Good values, sensible prices.

72. Get your 1964 catalog of *Cisin's* TV, radio, and hi-fi service books. Bonus—TV tube substitution guide and trouble-chaser chart is yours for the asking.

SLIDE RULE

74. Get your copy of *CIE's (Cleveland Institute of Electronics)* 2-color data sheet on their electronics slide rule and information on their free "Auto-Programmed" 4-lesson instruction course.

TOOLS

78. Do more jobs with fewer tools. *Xcelite* bulletin N563 describes double-duty midget-nut and screwdriver sets that have power and reach of standard drivers.

Radio-TV Experimenter, Dept. LL-740
505 Park Avenue, New York, N. Y. 10022

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

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☐ Indicate total number of booklets requested

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Service on this coupon expires October 1, 1965

Volume 43, No. 3

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 third and last part of *White's Radio Log*, now published in three parts twice each year. This format presentation enables 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 its accuracy.

In this issue of *White's Radio Log* we have included 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, Cuban and Mexican AM Stations by Call Letters, and the World-Wide Short-Wave Section.

In August-September, 1965 issue of RADIO-TV EXPERIMENTER, Volume 44, No. 1, the *Log* will contain the following listings: U. S. AM Stations by Frequency, Canadian AM Stations by Frequency, U. S. Television Stations by States, Canadian Television Stations by Location and the World-Wide Short-Wave Section. In the event you missed a part of the *Log* published during the first half of 1965, you will have a complete volume of *White's Radio Log* by collecting any three consecutive issues of RADIO-TV EXPERIMENTER during the remainder of the year. The three consecutive issues are an entire volume of *White's Radio Log* that offers complete listings with last minute station change data that are not 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 the new *White's* format an unbeatable and up-to-date reference.

QUICK REFERENCE INDEX

U. S. AM Stations by Call Letters

C.L.	Location	Kc.
KAAA	Kingman, Ariz.	1230
KAAB	Hot Springs, Ark.	1340
KAAY	Little Rock, Ark.	1090
KABC	Los Angeles, Calif.	790
KABE	Westwego, La.	1540
KABH	Midland, Tex.	1510
KABI	Abilene, Kans.	1560
KABL	Oakland, Calif.	960
KABQ	Albuquerque, N.M.	1350
KABR	Aberdeen, S.Dak.	1420
KACE	Riverside, Calif.	1570
KACI	The Dalles, Oreg.	1300
KACL	Santa Barbara, Cal.	1290
KACT	Andrews, Tex.	1360
KACY	Port Hueneme, Calif.	1520
KADA	Ada, Okla.	1230
KADL	Pine Bluff, Ark.	1270
KADO	Marshall, Tex.	1410
KADY	St. Charles, Mo.	1460
KAFY	Bakersfield, Calif.	550
KAGE	Winona, Minn.	1380
KAGH	Crossett, Ark.	800
KAGI	Grants Pass, Oreg.	930
KAGO	Klamath Falls, Oreg.	1150
KAGR	Yuba City, Calif.	1450
KAGT	Anacortes, Wash.	1340
KAHI	Auburn, Calif.	950
KAHR	Redding, Calif.	1330
KAHU	Waipahu, Hawaii	940
KAIM	Honolulu, Hawaii	870
KAIN	Nampa, Ida.	1340
KAIR	Tucson, Ariz.	1490
KAJO	Grants Pass, Oreg.	1270
KAKA	Wickenburg, Ariz.	1250
KAKC	Tulsa, Okla.	970
KAKE	Wichita, Kan.	1240
KALB	Alexandria, La.	580
KALE	Richland, Wash.	960
KALF	Mesa, Ariz.	1510
KALG	Alamogordo, N.Mex.	1230
KALI	San Gabriel, Cal.	1430
KALL	Salt Lake City, Utah	910
KALM	Thayer, Mo.	1290
KALN	Iola, Kan.	1370
KALO	Little Rock, Ark.	1250
KALT	Atlanta, Tex.	900
KALV	Alva, Okla.	1430
KAMD	Camden, Ark.	910
KAML	Kenedy-Karnes City, Tex.	990
KAMO	Rogers, Ark.	1390
KAMP	El Centro, Calif.	1430
KAMY	McCamey, Tex.	1450
KANA	Anaconda, Mont.	580
KANB	Shreveport, La.	1300
KAND	Corsicana, Tex.	1340
KANE	New Iberia, La.	1240
KANI	Wharton, Tex.	1500
KANN	Ogden, Utah	1250
KANO	Anoka, Minn.	1470
KANS	Larned, Kan.	1510
KAOH	Duluth, Minn.	1390
KAOK	Lake Charles, La.	1400
KAOL	Carrollton, Mo.	1430
KAOR	Oroville, Calif.	1340
KAPA	Raymond, Wash.	1340
KAPB	Marksville, La.	1370
KAPE	San Antonio, Tex.	1480
KAPI	Pueblo, Colo.	690
KAPR	Douglas, Ariz.	930
KAPS	Mt. Vernon, Wash.	1470
KAPT	Salem, Ore.	1220
KAPY	Port Angeles, Wash.	1290
KARA	Albuquerque, N.M.	1310
KARE	Atchison, Kan.	1470
KARI	Blaine, Wash.	550
KARK	Little Rock, Ark.	920
KARM	Fresno, Calif.	1430
KARR	Great Falls, Mont.	1400
KARS	Belen, N.M.	860
KART	Jerome, Idaho	1400
KARY	Prosser, Wash.	1310
KASH	Eugene, Ore.	1590
KASI	Ames, Iowa	1430
KASK	Ontario, Calif.	1510
KASL	Newcastle, Wyo.	1240
KASM	Albany, Minn.	1150
KASO	Minden, La.	1240
KAST	Astoria, Ore.	1370
KASY	Auburn, Wash.	1220
KATA	Arcata, Calif.	1340
KATE	Albert Lea, Minn.	1450

C.L.	Location	Kc.
KATI	Casper, Wyo.	1400
KATL	Miles City, Mont.	1340
KATN	Boise, Idaho	1010
KATO	Safford, Ariz.	1230
KATQ	Texarkana, Tex.	940
KATR	Eugene, Ore.	1320
KATY	San Luis Obispo, Cal.	1340
KATZ	St. Louis, Mo.	1600
KAUS	Austin, Minn.	1480
KAVE	Carlsbad, N.Mex.	1240
KAVI	Rocky Ford, Colo.	1320
KAVL	Lancaster, Calif.	610
KAVR	Apple Valley, Calif.	960
KAWA	Waco-Marlin, Tex.	1010
KAWL	York, Neb.	1370
KAWT	Douglas, Ariz.	1450
KAYC	Beaumont, Tex.	1450
KAYE	Puyallup, Wash.	1450
KAYG	Lakewood, Wash.	1480
KAYL	Storm Lake, Iowa	990
KAYO	Seattle, Wash.	1150
KAYS	Hays, Kans.	1400
KAYT	Rupert, Idaho	970
KBAB	Indianola, Iowa	1490
KBAL	San Saba, Tex.	1410
KBAM	Longview, Wash.	1270
KBAN	Bowie, Tex.	1410
KBAR	Burley, Idaho	1230
KBAT	San Antonio, Tex.	680
KBBA	Benton, Ark.	690
KBBB	Borger, Tex.	1600
KBBC	Centerville, Utah	1600
KBBO	Yakima, Wash.	1390
KBBR	North Bend, Oreg.	1340
KBBS	Buffalo, Wyo.	1450
KBCH	Oceanlake, Oreg.	1380
KBCL	Shreveport, La.	1220
KBEA	Mission, Kans.	1480
KBEC	Waxahachie, Tex.	1390
KBEE	Modesto, Calif.	970
KBEK	Elk City, Okla.	1240
KBEL	Idabel, Okla.	1240
KBEN	Carrizo Sprgs., Tex.	1450
KBER	San Antonio, Tex.	1150
KBET	Reno, Nev.	1340
KBEV	Portland, Oreg.	1010
KBEW	Blue Earth, Minn.	1560
KBFS	Belle Fourche, S.Dak.	1450
KBGN	Caldwell, Idaho	910
KBGO	Waco, Tex.	1580
KBHB	Sturgis, S. D.	1280
KBHC	Nashville, Ark.	1260
KBHM	Branson, Mo.	1220
KBHS	Hot Springs, Ark.	590
KBIB	Monette, Ark.	1560
KBIF	Fresno, Calif.	900
KBIG	Avalon, Cal.	740
KBIM	Roswell, N.Mex.	910
KBIS	Bakersfield, Calif.	970
KBIX	Muskogee, Okla.	1490
KBIZ	Ottumwa, Iowa	1240
KBJT	Fordyce, Ark.	1570
KBKR	Baker, Oreg.	1490
KBKW	Aberdeen, Wash.	1450
KBLA	Burbank, Calif.	1500
KBLE	Seattle, Wash.	1050
KBLF	Red Bluff, Calif.	1490
KBLI	Blackfoot, Idaho	690
KBLL	Helena, Mont.	1240
KBLR	Bolivar, Mo.	1550
KBLT	Big Lake, Tex.	1290
KBLU	Yuma, Ariz.	1320
KBLY	Gold Beach, Oreg.	1220
KBMI	Henderson, Nev.	1400
KBMN	Bozeman, Mont.	1230
KBMO	Benson, Minn.	1290
KBMR	Bismarck, N. D.	1350
KBMW	Wahpeton, N.D.-Breckenridge, Minn.	1450
KBMX	Coalinga, Calif.	1470
KBMY	Billings, Mont.	1240
KBND	Bend, Oreg.	1110
KBOA	Kennett, Mo.	830
KBOE	Oskaloosa, Iowa	740
KBOI	Boise, Idaho	950
KBOK	Malvern, Ark.	1310
KBOL	Boulder, Colo.	1490
KBOM	Bismark-Mandan, N. Dak.	1270
KBON	Omaha, Nebr.	1490
KBOP	Pleasanton, Tex.	1380
KBOR	Brownsville, Tex.	1600

C.L.	Location	Kc.
KBOW	Butte, Mont.	550
KBOX	Dallas, Tex.	1480
KBOY	Medford, Oreg.	730
KBPS	Portland, Oreg.	1450
KBRC	Mt. Vernon, Wash.	1430
KBRI	Brinkley, Ark.	1570
KBRK	Brookings, S.Dak.	1430
KBRL	McCook, Nebr.	1300
KBRN	Brighton, Colo.	800
KBRO	Bremerton, Wash.	1490
KBRR	Leadville, Colo.	1230
KBRS	Springdale, Ark.	1340
KBRV	Soda Sprgs., Ida.	540
KBRX	O'Neill, Nebr.	1350
KBRZ	Freeport, Texas	1460
KBSF	Springhill, La.	1460
KBSN	Crane, Tex.	970
KBST	Big Spring, Tex.	1490
KBTA	Batesville, Ark.	1340
KBTC	Houston, Mo.	1250
KBTM	Jonesboro, Ark.	1230
KBTN	Neosho, Mo.	1420
KBTO	El Dorado, Kans.	1360
KBTR	Denver, Colo.	710
KBUD	Athens, Tex.	1410
KBUH	Brigham City, Utah	800
KBUN	Bemidji, Minn.	1450
KBUR	Burlington, Iowa	1490
KBUS	Mexia, Tex.	1590
KBUY	Amarillo, Tex.	1010
KBUZ	Mesa, Ariz.	1310
KBVM	Lancaster, Calif.	1380
KBVU	Bellevue, Wash.	1540
KBWD	Brownwood, Tex.	1380
KBXM	Kennett, Mo.	1540
KBYE	Okla. City, Okla.	890
KBYG	Big Spring, Tex.	1400
KBYP	Shamrock, Tex.	1580
KBYR	Anchorage, Alaska	1270
KBZY	Salem, Oreg.	1490
KBZZ	LaJunta, Colo.	1400
KCAB	Dardanelle, Ark.	980
KCAC	Phoenix, Ariz.	1010
KCAD	Abilene, Tex.	1560
KCAL	Redlands, Calif.	1410
KCAM	Glennallen, Alaska	790
KCAN	Canyon, Tex.	1550
KCAP	Helena, Mont.	1340
KCAR	Clarksville, Tex.	1350
KCAS	Slaton, Tex.	1050
KCAT	Pine Bluff, Ark.	1530
KCBC	Des Moines, Iowa	1390
KCBD	Lubbock, Tex.	1590
KCBQ	San Diego, Calif.	1170
KCBS	San Fran., Calif.	740
KCCB	Corning, Ark.	1260
KCCL	Paris, Ark.	1460
KCCO	Lawton, Okla.	1050
KCCR	Pierre, S.Dak.	1590
KCCT	Corpus Christi, Tex.	1150
KCCV	Independence, Mo.	1510
KCEE	Tucson, Ariz.	790
KCEY	Turlock, Calif.	1390
KCFA	Spokane, Wash.	1330
KCFH	Cuero, Tex.	1600
KCFI	Cedar Falls, Iowa	1250
KCGM	Columbia, Mo.	1580
KCHA	Charles City, Iowa	1580
KCHE	Cherokee, Iowa	1440
KCHI	Chillicothe, Mo.	1010
KCHJ	Delano, Calif.	1010
KCHR	Charleston, Mo.	1350
KCHS	Truth or Consequences, New Mexico	1400
KCHV	Coachella, Calif.	970
KCHY	Cheyenne, Wyo.	1530
KCID	Caldwell, Idaho	1490
KCII	Washington, Iowa	1380
KCIJ	Shreveport, La.	1050
KCIL	Houma, La.	1490
KCIM	Carroll, Iowa	1380
KCIN	Victorville, Calif.	1590
KCJB	Minot, N.Dak.	910
KCJH	Arroyo Grande, Cal.	1280
KCKC	San Bernardino, Cal.	1350
KCKG	Sonora, Tex	1240
KCKN	Kansas City, Kans.	1340
KCKW	Jena, La.	1480
KCKY	Coolidge, Ariz.	1150
KCLA	Pine Bluff, Ark.	1400
KCLE	Cleburne, Tex.	1120
KCLN	Clinton, Iowa	1390
KCLO	Leavenworth, Kans.	1410
KCLR	Ralls, Tex.	1530
KCLS	Flagstaff, Ariz.	600
KCLU	Rolla, Mo.	1590
KCLV	Clovis, N.Mex.	1240
KCLW	Hamilton, Tex.	900
KCLX	Colfax, Wash.	1450
KCMC	Texarkana, Tex.	1230
KCMJ	Palm Sprgs., Calif.	1010
KCMO	Kansas City, Mo.	810
KCMS	Manitou Sprgs., Colo.	1490
KCNI	Broken Bow, Nebr.	1280
KCNO	Alturas, Calif.	570
KCNY	San Marcos, Tex.	1470
KCOB	Newton, Iowa	1280
KCOG	Centerville, Iowa	1400

C.L.	Location	Kc.
KCOH	Houston, Tex.	1430
KCOK	Tulare, Calif.	1270
KCOL	Ft. Collins, Colo.	1410
KCOM	Comanche, Tex.	1550
KCON	Conway, Ark.	1230
KCOR	San Antonio, Tex.	1350
KCOW	Alliance, Nebr.	1400
KCOY	Santa Maria, Calif.	1400
KCPX	Salt Lake City, Utah	1320
KCRA	Sacramento, Calif.	1320
KCRB	Chanute, Kans.	1460
KCRC	Enid, Okla.	1390
KCRG	Cedar Rapids, Iowa	1600
KCRM	Crane, Tex.	1380
KCRS	Midland, Tex.	550
KCRT	Trinidad, Colo.	1240
KCRV	Caruthersville, Mo.	1370
KCSJ	Pueblo, Colo.	590
KCSR	Chadron, Nebr.	610
KCTA	Corpus Christi, Tex.	1030
KCTI	Gonzales, Tex.	1450
KCTY	Salinas, Calif.	980
KCTX	Childress, Tex.	1510
KCUB	Tucson, Ariz.	1290
KCUE	Red Wing, Minn.	1250
KCUL	Fort Worth, Tex.	1540
KCVL	Colville, Wash.	1270
KCVR	Lodi, Calif.	1570
KCYL	Lampasas, Tex.	1450
KDAB	Arvada, Colo.	1550
KDAC	Ft. Bragg, Calif.	1230
KDAD	Weed, Calif.	800
KDAK	Carrington, N.D.	1600
KDAL	Duluth, Minn.	610
KDAN	Eureka, Calif.	790
KDAV	Lubbock, Tex.	580
KDAY	Santa Monica, Calif.	1580
KDB	Santa Barbara, Calif.	1490
KDBM	Dillon, Mont.	800
KDBS	Alexandria, La.	1410
KDCE	Espanola, N.M.	970
KDDD	Dumas, Tex.	800
KDEC	Decorah, Iowa	1240
KDEF	Albuquerque, N.Mex.	1150
KDEN	Denver, Colo.	1340
KDEO	El Cajon, Calif.	910
KDES	Palm Sprgs., Calif.	920
KDET	Center, Tex.	930
KDEX	Dexter, Mo.	1590
KDEY	Boulder, Colo.	1360
KDFN	Doniphan, Mo.	1500
KDGO	Durango, Colo.	1240
KDHI	Twenty-nine Palms, California	1250
KDHL	Faribault, Minn.	920
KDHN	Dimmitt, Tex.	1470
KDIA	Oakland, Calif.	1310
KDIO	Ortonville, Minn.	1350
KDIX	Dickinson, N.Dak.	1230
KDJI	Holbrook, Ariz.	1270
KDKA	Pittsburgh, Pa.	1020
KDKD	Clinton, Mo.	1280
KDKO	Littleton, Colo.	1510
KDLA	DeRidder, La.	1010
KDLK	Del Rio, Tex.	1230
KDLM	Detroit Lakes, Minn.	1340
KDLR	Devils Lake, N.Dak.	1240
KDLS	Perry, Iowa	1310
KDMA	Montevideo, Minn.	1450
KDMO	Carthage, Mo.	1490
KDMS	El Dorado, Ark.	1290
KDNC	Spokane, Wash.	1440
KDNT	Denton, Tex.	1440
KDOK	Tyler, Tex.	1330
KDOL	Mojave, Calif.	1340
KDOM	Windom, Minn.	1580
KDON	Salinas, Calif.	1460
KDOT	Scottsdale, Ariz.	1440
KDOV	Medford, Oreg.	1300
KDQN	DeQueen, Ark.	1390
KDRG	Deer Lodge, Mont.	1400
KDRO	Sedalia, Mo.	1490
KDRS	Paragould, Ark.	1490
KDRY	Alamo Hts., Tex.	1110
KDSJ	Deadwood, S.Dak.	980
KDSN	Denison, Iowa	1580
KDSX	Denison-Sherman, Tex.	950
KDTA	Delta, Colo.	1400
KDTH	Dubuque, Iowa	1370
KDUZ	Hutchinson, Minn.	1260
KDWA	Hastings, Minn.	1460
KDWB	St. Paul, Minn.	630
KDWT	Stamford, Tex.	1400
KDXE	No. Little Rock, Ark.	1380
KDXI	Mansfield, La.	1360
KDXU	St. George, Utah	1450
KDYL	Tooele, Utah	990
KDZA	Pueblo, Colo.	1230
KEAN	Brownwood, Tex.	1240
KEAP	Fresno, Calif.	980
KEBE	Jacksonville, Tex.	1400
KECH	Ketchikan, Alaska	620
KECK	Odessa, Tex.	920
KEDD	Dodge City, Kans.	1550
KEDO	Longview, Wash.	1400

WHITE'S RADIO LOG

C.L.	Location	Kc.
KEED	Springfield-Eugene, Ore.	1120
KEEE	Nacogdoches, Tex.	1230
KEEL	Shreveport, La.	710
KEEN	San Jose, Calif.	1370
KEEP	Twin Falls, Idaho	1450
KEES	Gladewater, Tex.	1430
KEKO	Kealakekua, Hawaii	790
KELA	Centralia-Chekalis, Wash.	1470
KELD	El Dorado, Ark.	1400
KELI	Tulsa, Okla.	1430
KELK	Elko, Nev.	1240
KELO	Sioux Falls, S.Dak.	1320
KELP	El Paso, Tex.	920
KELR	El Reno, Okla.	1460
KELY	Ely, Nev.	1230
KENA	Mena, Ark.	1450
KEND	Cheyenne, Wyo.	980
KENE	Toppenish, Wash.	1490
KENI	Anchorage, Alaska	550
KENM	Portales, N.Mex.	1450
KENN	Farmington, N.M.	1390
KENO	Las Vegas, Nev.	1460
KENT	Prescott, Ariz.	1340
KENY	Bellingham-Ferndale, Wash.	930
KEOS	Flagstaff, Ariz.	690
KEPR	Kennevick-Richland-Pasco, Wash.	610
KEPS	Eagle Pass, Tex.	1270
KERB	Kermit, Tex.	600
KERC	Eastland, Tex.	1590
KERG	Eugene, Oreg.	1280
KERN	Bakersfield, Calif.	1410
KERV	Kerrville, Tex.	1230
KESM	Eldorado Springs, Mo.	1580
KEST	Boise, Idaho	790
KETO	Seattle, Wash.	1590
KETX	Livingston, Tex.	1440
KEUN	Eunice, La.	1490
KEVA	Evanston, Wyo.	1240
KEVL	White Castle, La.	1590
KEVT	Tucson, Ariz.	690
KEWB	Oakland, Calif.	910
KEWI	Topeka, Kans.	1440
KEX	Portland, Oreg.	1190
KEXO	Grand Junc., Colo.	1230
KEYD	Oakes, N.Dak.	1220
KEYE	Perryton, Tex.	1400
KEYJ	Jamestown, N.Dak.	1400
KEYL	Long Prairie, Minn.	1400
KEYR	Terrytown, Nebr.	690
KEYS	Corpus Christi, Tex.	1440
KEYY	Provo, Utah	1450
KEYZ	Williston, N.Dak.	1360
KEZU	Rapid City, S.Dak.	920
KEZY	Anaheim, Calif.	1190
KFAB	Omaha, Nebr.	1110
KFAC	Los Angeles, Calif.	1330
KFAH	Lakewood Center, Wash.	1480
KFAL	Fulton, Mo.	900
KFAM	St. Cloud, Minn.	1450
KFAR	Fairbanks, Alaska	610
KFAX	San Francisco, Calif.	1100
KFAY	Fayetteville, Ark.	1250
KFAZ	Liberty, Tex.	1050
KFBB	Great Falls, Mont.	1310
KFBC	Cheyenne, Wyo.	1240
KFBK	Sacramento, Calif.	1530
KFCB	Redfield, S. Dak.	1380
KFDA	Amarillo, Tex.	1440
KFDF	Van Buren, Ark.	1580
KFDI	Wichita, Kansas	1070
KFDR	Grand Coulee, Wash.	1360
KFEL	Pueblo, Colo.	970
KFEQ	St. Joseph, Mo.	680
KFFA	Helena, Ark.	1360
KFGQ	Boone, Iowa	1260
KFGT	Flagstaff, Ariz.	930
KFH	Wichita, Kans.	1330
KFI	Los Angeles, Calif.	640
KFIF	Tucson, Ariz.	1550
KFIV	Modesto, Calif.	1360
KFIZ	Fond du Lac, Wis.	1450
KFJB	Marshalltown, Iowa	1230
KFJM	Grand Forks, N.Dak	1370
KFJZ	Ft. Worth, Tex.	1270
KFKA	Greeley, Colo.	1310
KFKF	Bellevue, Wash.	1330
KFKU	Lawrence, Kans.	1250
KFLA	Scott City, Kans.	1310
KFLD	Floydada, Tex.	900
KFLI	Mountain Home, Ida.	1240
KFLJ	Walsenburg, Colo.	1380
KFLN	Baker, Mont.	960
KFLW	Klamath Falls, Oreg.	1450
KFLY	Corvallis, Oreg.	1240
KFMB	San Diego, Cal.	760
KFMJ	Tulsa, Okla.	1050
KFML	Denver, Colo.	1390
KFMO	Flat River, Mo.	1240
KFNF	Shenandoah, Iowa	920
KFNV	Ferriday, La.	1600
KFNW	Fargo, N.Dak.	900
KFOR	Lincoln, Nebr.	1240
KFOX	Long Beach, Calif.	1280
KFPW	Ft. Smith, Ark.	1230
KFQD	Anchorage, Alaska	730
KFRA	Franklin, La.	1390
KFRB	Fairbanks, Alaska	900
KFRC	San Francisco, Calif.	610
KFRD	Rosenberg-Richmond, Tex.	980
KFRE	Fresno, Calif.	940
KFRM	Kansas City, Mo.	550
KFRO	Longview, Tex.	1370
KFRU	Columbia, Mo.	1400
KFSA	Ft. Smith, Ark.	950
KFSB	Joplin, Mo.	1310
KFSC	Denver, Colo.	1220
KFST	Ft. Stockton, Tex.	860
KFTM	Ft. Morgan, Colo.	1400
KFTV	Paris, Tex.	1250
KFTW	Fredericktown, Mo.	1450
KFUN	Las Vegas, N.Mex.	1230
KFUO	Clayton, Mo.	850
KFVS	Cape Girardeau, Mo.	960
KFWB	Los Angeles, Calif.	980
KFXD	Nampa, Idaho	580
KFXM	San Bernardino, Calif.	590
KFYN	Bonham, Tex.	1420
KFYO	Lubbock, Tex.	790
KFYR	Bismarck, N.Dak.	550
KGA	Spokane, Wash.	1510
KGAF	Gainesville, Tex.	1580
KGAK	Gallup, N.Mex.	1330
KGAL	Lebanon, Oreg.	920
KGAR	Vancouver, Wash.	1550
KGAS	Carthage, Tex.	1590
KGAY	Salem, Oreg.	1430
KGB	San Diego, Calif.	1360
KGBA	Santa Clara	1430
KGBC	Galveston, Tex.	1540
KGBS	Los Angeles, Calif.	1020
KGBT	Harlingen, Tex.	1530
KGBX	Springfield, Mo.	1260
KGCA	Rugby, N.D.	1450
KGCX	Sidney, Mont.	1480
KGDN	Edmonds, Wash.	630
KGEE	Bakersfield, Calif.	1230
KGEK	Sterling, Colo.	1230
KGEM	Boise, Idaho	1140
KGEN	Tulare, Calif.	1370
KGER	Long Beach, Calif.	1390
KGEZ	Kalispell, Mont.	600
KGFF	Shawnee, Okla.	1450
KGFJ	Los Angeles, Calif.	1230
KGFL	Roswell, N.Mex.	1400
KGFW	Kearney, Nebr.	1340
KGFX	Pierre, S.Dak.	630
KGGF	Coffeyville, Kans.	690
KGGM	Albuquerque, N.Mex.	610
KGHL	Billings, Mont.	790
KGHM	Brookfield, Mo.	1470
KGHS	International Falls, Minn.	1230
KGHT	Hollister, Calif.	1520
KGIL	San Fernando, Calif.	1260
KGIW	Alamosa, Colo.	1450
KGKB	Tyler, Tex.	1490
KGKL	San Angelo, Tex.	960
KGKO	Benton, Ark.	1600
KGLC	Miami, Okla.	910
KGLE	Glendive, Mont.	590
KGLM	Avalon, Calif.	740
KGLN	Glenwood Sprgs., Colo.	980
KGLO	Mason City, Iowa	1300
KGLU	Safford, Ariz.	1480
KGMB	Honolulu, Hawaii	590
KGMC	Englewood, Colo.	1150
KGMI	Bellingham, Wash.	790
KGMO	Cape Girardeau, Mo.	1220
KGMR	Jacksonville, Ark.	1500
KGMS	Sacramento, Calif.	1380
KGMT	Fairbury, Nebr.	1310
KGNB	New Braunfels, Tex.	1420
KGNC	Amarillo, Tex.	710
KGNO	Dodge City, Kans.	1370
KGNS	Laredo, Tex.	1390
KGO	San Francisco, Calif.	810
KGOL	Palm Desert, Cal.	1270
KGOS	Torrington, Wyo.	1490
KGPC	Grafton, N.Dak.	1340
KGRB	West Loma, Cal.	900
KGRI	Henderson, Tex.	1000
KGRL	Bend, Oreg.	940
KGRN	Grinnell, Iowa	1410
KGRS	Pasco, Wash.	1340
KGRT	Las Cruces, N.Mex.	570
KGST	Fresno, Calif.	1600
KGTN	Georgetown, Tex.	1530
KGU	Honolulu, Hawaii	760
KGUC	Gunnison, Colo.	1490
KGUD	Santa Barbara, Calif.	990
KGUL	Port Lavaca, Tex.	1560
KGVL	Greenville, Tex.	1400
KGVO	Missoula, Mont.	1290
KGVW	Belgrade, Mont.	630
KGW	Portland, Oreg.	620
KGWA	Enid, Okla.	960
KGY	Olympia, Wash.	1240
KGYN	Guymon, Okla.	1220
KHAI	Honolulu, Hawaii	1090
KHAK	Cedar Rapids, Iowa	1360
KHAL	Homer, La.	1300
KHAP	Aztec, N.M.	1340
KHAR	Anchorage, Alaska	590
KHAS	Hastings, Nebr.	1230
KHAT	Phoenix, Ariz.	1480
KHBC	Hilo, Hawaii	970
KHBM	Monticello, Ark.	1430
KHBR	Hillsboro, Tex.	1560
KHDN	Hardin, Mont.	1230
KHEM	Big Springs, Tex.	1270
KHEN	Henryetta, Okla.	1590
KHEP	Phoenix, Ariz.	1280
KHER	Santa Maria, Calif.	1600
KHEY	El Paso, Tex.	690
KHFH	Sierra Vista, Ariz.	1420
KHFI	Austin, Tex.	970
KHHH	Pampa, Tex.	1230
KHIP	Albuquerque, N.M.	1520
KHIT	Walla Walla, Wash.	1320
KHJ	Los Angeles, Calif.	930
KHMO	Hannibal, Mo.	1070
KHOB	Hobbs, N.Mex.	1390
KHOE	Truckee, Calif.	1400
KHOG	Fayetteville, Ark.	1440
KHOK	Hoquiam, Wash.	1560
KHOS	Tucson, Ariz.	940
KHOT	Madera, Calif.	1250
KHOW	Denver, Colo.	630
KHOZ	Harrison, Ark.	900
KHQ	Spokane, Wash.	590
KHRT	Minot, N. D.	1320
KHSJ	Hemet, Calif.	1320
KHSL	Chico, Calif.	1290
KHUB	Fremont, Nebr.	1340
KHUM	Santa Rosa, Calif.	1580
KHUZ	Borger, Tex.	1490
KHVH	Honolulu, Hawaii	1040
KIBE	Palo Alto, Calif.	1220
KIBH	Seward, Alaska	950
KIBL	Beeville, Tex.	1490
KIBS	Bishop, Calif.	1230
KICA	Clovis, N.M.	980
KICD	Spencer, Iowa	1240
KICK	Springfield, Mo.	1340
KICM	Golden, Colo.	1250
KICO	Calexico, Calif.	1490
KICS	Hastings, Neb.	1550
KICY	Nome, Alaska	850
KID	Idaho Falls, Idaho	590
KIDD	Monterey, Calif.	630
KIDO	Boise, Idaho	630
KIEV	Glendale, Calif.	870
KIFG	Iowa Falls, Ia.	1510
KIFN	Phoenix, Ariz.	860
KIFW	Sitka, Alaska	1230
KIHN	Hugo, Okla.	1340
KIHR	Hood River, Oreg.	1340
KIJV	Huron, S.Dak.	1340
KIKI	Honolulu, Hawaii	830
KIKK	Pasadena, Tex.	650
KIKO	Miami, Ariz.	1340
KIKS	Sulphur, La.	1310
KILE	Galveston, Tex.	1400
KILO	Grand Forks, S.Dak.	1440
KILT	Houston, Tex.	610
KIMA	Yakima, Wash.	1460
KIMB	Kimball, Nebr.	1260
KIML	Gillette, Wyo.	1490
KIMM	Rapid City, S.D.	1150
KIMN	Denver, Colo.	950
KIMO	Hilo, Hawaii	850
KIMP	Mt. Pleasant, Tex.	960
KINO	Independence, Kans.	1010
KINE	Kingsville, Tex.	1330
KING	Seattle, Wash.	1090
KINO	Winslow, Ariz.	1230
KINS	Eureka, Calif.	980
KINT	El Paso, Tex.	1590
KINY	Juneau, Alaska	800
KIOA	Oes Moines, Iowa	940
KIOT	Barstow, Calif.	1310
KIOX	Bay City, Tex.	1270
KIPA	Hilo, Hawaii	1110
KIQS	Willows, Calif.	1560
KIRO	Seattle, Wash.	710
KIRT	Mission, Tex.	1580
KIRV	Fresno, Cal.	1510
KIRX	Kirksville, Mo.	1450
KISD	Sioux Falls, S.Dak.	1230
KISI	Salina, Kan.	910
KISN	Vancouver, Wash.	910
KIST	Santa Barbara, Calif.	1340
KIT	Yakima, Wash.	1280
KITE	San Antonio, Tex.	930
KITH	Clinton, Mo.	1350
KITI	Chahalis-Centralia, Wash.	1420
KITN	Olympia, Wash.	920
KIUL	Garden City, Kans.	1240
KIUN	Pecos, Tex.	1400
KIUP	Durango, Colo.	930
KIVY	Crockett, Tex.	1290
KIWA	Sheldon, Iowa	1550
KIXI	Seattle, Wash.	910
KIXL	Dallas, Tex.	1040
KIXX	Provo, Utah	1400
KIXZ	Amarillo, Tex.	940
KIZZ	El Paso, Tex.	1150
KJAM	Madison, S.Dak.	1390
KJAN	Atlantic, Iowa	1220
KJAX	Santa Rosa, Calif.	1150
KJAY	Sacramento, Calif.	1430
KJBC	Midland, Tex.	1150
KJCF	Festus, Mo.	1400
KJCK	Junction City, Kans.	1420
KJDY	John Day, Ore.	1400
KJEF	Jennings, La.	1290
KJEM	Oklahoma City, Okla.	800
KJET	Beaumont, Tex.	1380
KJFJ	Webster City, Iowa	1570
KJIM	Ft. Worth, Tex.	870
KJKJ	Flagstaff, Ariz.	1400
KJLT	North Platte, Nebr.	970
KJNO	Juneau, Alaska	630
KJOE	Shreveport, La.	1480
KJOY	Stockton, Calif.	1280
KJPW	Waynesville, Mo.	1390
KJR	Seattle, Wash.	950
KJRG	Newton, Kans.	950
KJSK	Columbus, Nebr.	900
KJWH	Camden, Ark.	1450
KKAL	Oenver City, Tex.	1580
KKAM	Pueblo, Colo.	1350
KKAN	Phillipsburg, Kans.	1490
KKAR	Pomona, Calif.	1220
KKAS	Silsbee, Tex.	1300
KKEY	Vancouver, Wash.	1150
KKHI	San Francisco, Calif.	1550
KKIN	Aitkin, Minn.	930
KKIS	Pittsburg, Calif.	990
KKIT	Taos, N.Mex.	1340
KKJO	St. Joseph, Mo.	1550
KKOK	Lompoc, Calif.	1410
KKUB	Brownfield, Tex.	1300
KLAC	Los Angeles, Calif.	570
KLAD	Klamath Falls, Oreg.	960
KLAK	Lakewood, Colo.	1600
KLAM	Cordova, Alaska	1450
KLAN	Lemoore, Calif.	1320
KLAV	Las Vegas, Nev.	1230
KLBK	Lubbock, Tex.	1340
KLBM	La Grande, Oreg.	1450
KLBS	Los Banos, Calif.	1330
KLCB	Libby, Mont.	1230
KLCN	Blytheville, Ark.	910
KLCO	Poteau, Okla.	1280
KLEA	Lovington, N.Mex.	630
KLEB	Golden Meadow, La.	1600
KLEE	Ottumwa, Iowa	1480
KLEI	Kailua, Hawaii	1130
KLEM	LeMars, Iowa	1410
KLEN	Killeen, Tex.	1050
KLEO	Wichita, Kans.	1480
KLER	Orofino, Idaho	950
KLEX	Lexington, Mo.	1570
KLFD	Litchfield, Minn.	1410
KLFF	Mead, Wash.	1590
KLGA	Algona, Iowa	1600
KLGN	Logan, Utah	1390
KLGR	Redwood Falls, Minn.	1490
KLIB	Liberal, Kans.	1470
KLIC	Monroe, La.	1230
KLID	Poplar Bluff, Mo.	1340
KLIF	Oallas, Tex.	1190
KLIK	Jefferson City, Mo.	950
KLIN	Lincoln, Nebr.	1400
KLIP	Fowler, Calif.	1220
KLIQ	Portland, Oreg.	1290
KLIR	Denver, Colo.	990
KLIV	San Jose, Cal.	1590
KLIX	Twin Falls, Idaho	1310
KLIZ	Brainerd, Minn.	1380
KLKC	Parsons, Kans.	1540
KLLA	Leesville, La.	1570
KLLL	Lubbock, Tex.	1460
KLME	Laramie, Wyo.	1490
KLMO	Longmont, Colo.	1060
KLMR	Lamar, Colo.	920
KLMS	Lincoln, Nebr.	1480
KLMX	Clayton, N.Mex.	1450
KLO	Ogden, Utah	1430
KLOA	Ridgecrest, Calif	1240
KLOC	Ceres, Calif.	920
KLOE	Goodland, Kans.	730
KLOG	Kelso, Wash.	1490
KLOH	Pipestone, Minn.	1050
KLOK	San Jose, Calif.	1170
KLOM	Lompoc, Calif.	1330
KLOO	Corvallis, Ore.	1340
KLOS	Albuquerque, N.Mex.	1450
KLOU	Lake Charles, La.	1580
KLOW	Loveland, Colo.	1570
KLPL	Lake Providence, La.	1050
KLPM	Minot, N.Dak.	1390
KLPR	Okla. City, Okla.	1140
KLRA	Little Rock, Ark.	1010
KLRS	Mountain Grove, Mo.	1360
KLTF	Little Falls, Minn.	960
KLTR	Blackwell, Okla.	1580
KLTZ	Glasgow, Mont.	1240
KLUB	Salt Lake City, Utah	570
KLUC	Las Vegas, Nev.	1050
KLUE	Longview, Tex.	1280
KLUV	Haynesville, La.	1580
KLVI	Beaumont, Tex.	560
KLVL	Pasadena, Tex.	1480
KLVT	Levelland, Tex.	1230
KLWN	Lawrence, Kans.	1320
KLWT	Lebanon, Mo.	1230
KLWW	Cedar Rapids, Iowa	1450
KLYD	Bakersfield, Calif.	1350
KLYQ	Hamilton, Mont.	980
KLYR	Clarksville, Ark.	1360

C.L.	Location	Kc.
KLZ	Denver, Colo.	560
KMA	Shenandoah, Iowa	960
KMAC	San Antonio, Tex.	630
KMAD	Madill, Okla.	1550
KMAE	McKinney, Tex.	1600
KMAK	Fresno, Calif.	1340
KMAM	Butler, Mo.	1530
KMAN	Manhattan, Kans.	1350
KMAQ	Maquoketa, Iowa	1320
KMAR	Winnsboro, La.	1570
KMAS	Shelton, Wash.	1280
KMBC	Kansas City, Mo.	980
KMBL	Junction, Tex.	1450
KMBY	Monterey, Calif.	1240
KMCD	Fairfield, Iowa	1570
KMCM	McMinnville, Oreg.	1260
KMCO	Conroe, Tex.	900
KMDO	Ft. Scott, Kans.	1600
KMED	Medford, Oreg.	1440
KMEL	Wenatchee, Wash.	1340
KMEN	San Bernardino, California	1290
KMER	Kemmerer, Wyo.	950
KMHL	Marshall, Minn.	1400
KMHT	Marshall, Tex.	1450
KMIL	Cameron, Tex.	1330
KMIN	Grants, N.M.	980
KMIS	Portageville, Mo.	1050
KMJ	Fresno, Calif.	580
KMLB	Monroe, La.	1440
KMMJ	Grand Island, Nebr.	750
KMMO	Marshall, Mo.	1300
KMNS	Sioux City, Iowa	620
KMO	Tacoma, Wash.	1360
KMON	Great Falls, Mont.	560
KMOP	Tucson, Ariz.	1330
KMOX	St. Louis, Mo.	1120
KMPC	Los Angeles, Calif.	710
KMRC	Morgan City, La.	1430
KMRE	Anderson, Cal.	1580
KMRS	Morris, Minn.	1230
KMSL	Ukiah, Calif.	1250
KMUL	Muleshoe, Tex.	1380
KMUR	Murray, Utah	1230
KMUS	Muskogee, Okla.	1380
KMVI	Wailuku, Hawaii	550
KMYC	Marysville, Calif.	1410
KNAF	Fredericksburg, Tex.	910
KNAK	Salt Lake City, Utah	1280
KNAL	Victoria, Tex.	1410
KNBA	Vallejo, Calif.	1190
KNBE	Lincoln, Neb.	1530
KNBI	Norton, Kan.	1530
KNBR	San Francisco, Cal.	680
KNBY	Newport, Ark.	1280
KNCK	Concordia, Kans.	1390
KNCM	Moberly, Mo.	1230
KNCO	Garden City, Kans.	1050
KNCY	Nebraska City, Nebr.	1600
KNDC	Hettinger, N.Dak.	1490
KNDI	Honolulu, Hawaii	1270
KNDY	Marysville, Kans.	1570
KNEA	Jonesboro, Ark.	970
KNEB	Scottsbluff, Nebr.	960
KNED	McAlester, Okla.	1150
KNEL	Brady, Tex.	1490
KNEM	Nevada, Mo.	1240
KNET	Palestine, Tex.	1450
KNEW	Spokane, Wash.	790
KNEX	McPherson, Kans.	1540
KNEZ	Lompoc, Calif.	960
KNGL	Paradise, Calif.	930
KNGS	Hanford, Calif.	620
KNIA	Knoxville, Iowa	1320
KNIC	Winfield, Kan.	1550
KNIN	Wichita Falls, Tex.	990
KNIT	Abilene, Tex.	1280
KNND	Cottage Grove, Oreg.	1400
KNOC	Natchitoches, La.	1450
KNOE	Monroe, La.	540
KNOG	Nogales, Ariz.	1340
KNOK	Ft. Worth, Tex.	970
KNOP	N. Platte, Nebr.	1410
KNOR	Norman, Okla.	1400
KNOT	Prescott, Ariz.	1450
KNOW	Austin, Tex.	1490
KNOX	Grand Forks, N.Dak.	1310
KNPT	Newport, Ore.	1310
KNUI	Makawao, Hawaii	1310
KNUJ	New Ulm, Minn.	860
KNUZ	Houston, Tex.	1230
KNWC	Sioux Falls, S.D.	1270
KNWS	Waterloo, Iowa	1090
KNX	Los Angeles, Calif.	1070
KOA	Denver, Colo.	850
KOAC	Corvallis, Oreg.	550
KOAD	Lemoore, Calif.	1240
KOAL	Price, Utah	1230
KOAM	Pittsburg, Kans.	860
KOB	Albuquerque, N.Mex.	770
KOBE	Las Cruces, N.Mex.	1450
KOBH	Hot Springs, S.Dak.	580
KOCA	Kilgore, Tex.	1240
KOCY	Oklahoma City, Okla.	1340
KODA	Houston, Tex.	1010
KODE	Joplin, Mo.	1230
KODI	Cody, Wyo.	1400
KODL	The Dalles, Oreg.	1440
KODY	North Platte, Nebr.	1240
KOEL	Oelwein, Iowa	950
KOFE	Pullman, Wash.	1150
KOFI	Kalispell, Mont.	930
KOFO	Ottawa, Kans.	1220
KOFY	San Mateo, Calif.	1050
KOGA	Ogallala, Nebr.	930
KOGO	San Diego, Calif.	600
KOGT	Orange, Tex.	1600
KOH	Reno, Nev.	630
KOHI	St. Helens, Ore.	1600
KOHO	Honolulu, Hawaii	1170
KOHU	Hermiston, Oreg.	1570
KOIL	Omaha, Nebr.	1290
KOIN	Portland, Oreg.	970
KOJM	Havre, Mont.	610
KOKA	Shreveport, La.	1550
KOKE	Austin, Tex.	1370
KOKL	Okmulgee, Okla.	1240
KOKO	Warrensburg, Mo.	1450
KOKX	Keokuk, Iowa	1310
KOKY	Little Rock, Ark.	1440
KOL	Seattle, Wash.	1300
KOLD	Tucson, Ariz.	1450
KOLE	Port Arthur, Tex.	1340
KOLJ	Quanah, Tex.	1150
KOLL	Honolulu, Hawaii	1420
KOLM	Rochester, Minn.	1520
KOLO	Reno, Nev.	920
KOLR	Sterling, Colo.	1490
KOLS	Pryor, Okla.	1570
KOLT	Scottsbluff, Nebr.	1320
KOLY	Mobridge, S.Dak.	1300
KOMA	Okla. City, Okla.	1520
KOME	Tulsa, Okla.	1300
KOMO	Seattle, Wash.	1000
KOMW	Omak, Wash.	680
KOMY	Watsonville, Calif.	1340
KONE	Reno, Nev.	1450
KONG	Visalia, Calif.	1400
KONI	Spanish Fork, Utah	1480
KONO	San Antonio, Tex.	860
KONP	Port Angeles, Wash.	1450
KOOK	Billings, Mont.	970
KOOL	Phoenix, Ariz.	960
KOOO	Omaha, Nebr.	1420
KOOS	Coos Bay, Oreg.	1230
KOPR	Butte, Mont.	550
KOPY	Alice, Tex.	1070
KOQT	Bellingham, Wash.	1550
KORA	Bryan, Tex.	1240
KORC	Mineral Wells, Tex.	1140
KORD	Pasco, Wash.	910
KORE	Eugene, Oreg.	1450
KORK	Las Vegas, Nev.	1340
KORL	Honolulu, Hawaii	650
KORN	Mitchell, S.Dak.	1490
KORT	Grangeville, Idaho	1230
KOSA	Odessa, Tex.	1230
KOSE	Osceola, Ark.	860
KOSG	Panshuska, Okla.	1500
KOSI	Aurora, Colo.	1430
KOSY	Texarkana, Ark.	790
KOTA	Rapid City, S.Dak.	1380
KOTE	Fergus Falls, Minn.	1250
KOTN	Pine Bluff, Ark.	1490
KOTS	Deming, N.M.	1230
KOUR	Independence, Iowa	1220
KOVC	Valley City, N.Dak.	1490
KOVE	Lander, Wyo.	1330
KOVO	Provo, Utah	960
KOWA	Hastings, Minn.	1460
KOWB	Laramie, Wyo.	1290
KOWH	Omaha, Neb.	660
KOWL	Bijou, Calif.	1490
KOWN	Escondido, Calif.	1450
KOXR	Oxnard, Calif.	910
KOY	Phoenix, Ariz.	550
KOYL	Odessa, Tex.	1310
KOYN	Billings, Mont.	910
KOZE	Lewiston, Idaho	1300
KOZI	Chelan, Wash.	1220
KOZY	Grand Rapids, Minn.	1490
KPAC	Port Arthur, Tex.	1250
KPAL	Palm Springs, Calif.	1450
KPAM	Portland, Oreg.	1410
KPAN	Hereford, Tex.	860
KPAS	Banning, Calif.	1490
KPAT	Berkeley, Calif.	1400
KPAY	Chico, Calif.	1060
KPBA	Pine Bluff, Ark.	1590
KPBM	Carlsbad, N.Mex.	740
KPCA	Marked Tree, Ark.	1580
KPCN	Grand Prairie, Tex.	730
KPDN	Pampa, Tex.	1340
KPDQ	Portland, Oreg.	800
KPEG	Spokane, Wash.	1380
KPEL	Lafayette, La.	1420
KPEP	San Angelo, Tex.	1420
KPER	Gilroy, Calif.	1290
KPET	Lamesa, Tex.	690
KPGE	Page, Ariz.	1340
KPHO	Phoenix, Ariz.	910
KPIK	Colorado Sprgs., Colo.	1580
KPIN	Casa Grande, Ariz.	1260
KPIR	Eugene, Wash.	1500
KPLC	Lake Charles, La.	1470
KPLT	Paris, Tex.	1490
KPLY	Crescent City, Calif.	1240
KPMC	Bakersfield, Calif.	1560
KPNG	Port Neches, Tex.	1150
KPOC	Pocahontas, Ark.	1420
KPOD	Crescent City, Calif.	1310
KPOF	Denver, Colo.	910
KPOI	Honolulu, Hawaii	1380
KPOJ	Portland, Oreg.	1330
KPOL	Los Angeles, Calif.	1540
KPOR	Quincy, Wash.	1370
KPOS	Post, Tex.	1370
KPOW	Powell, Wyo.	1260
KPPC	Pasadena, Calif.	1240
KPQ	Wenatchee, Wash.	560
KPRB	Redmond, Oreg.	1240
KPRC	Houston, Tex.	950
KPRK	Livingston, Mont.	1340
KPRL	Paso Robles, Calif.	1230
KPRM	Park Rapids, Minn.	1240
KPRO	Riverside, Calif.	1440
KPRS	Kansas City, Mo.	1590
KPSO	Falfurrias, Tex.	1260
KPST	Preston, Idaho	1340
KPTL	Carson City, Nev.	1300
KPUB	Pueblo, Colo.	1480
KPUG	Bellingham, Wash.	1170
KQAQ	Austin, Minn.	970
KQCY	Quincy, Calif.	1370
KQEN	Roseburg, Ore.	1240
KQEO	Albuquerque, N.Mex.	920
KQIK	Lakeview, Oreg.	1230
KQMS	Redding, Calif.	1400
KQOT	Yakima, Wash.	940
KQRS	Golden Valley, Minn.	1440
KQTE	Missoula, Mont.	1340
KQV	Pittsburgh, Pa.	1410
KQXI	Atlanta, Ga.	790
KQYX	Joplin, Mo.	1560
KRAC	Alamogordo, N.M.	1270
KRAD	E. Grand Forks, Minn.	1590
KRAF	Reedsport, Ore.	1470
KRAI	Craig, Colo.	550
KRAK	Sacramento, Cal.	1140
KRAL	Rawlins, Wyo.	1240
KRAM	Las Vegas, Nev.	920
KRAN	Morton, Tex.	1280
KRAY	Amarillo, Tex.	1360
KRBA	Lufkin, Tex.	1340
KRBC	Abilene, Tex.	1470
KRBI	St. Peter, Minn.	1310
KRBN	Red Lodge, Mont.	1450
KRCB	Council Bluffs, Ia.	1360
KRCK	Ridgecrest, Calif.	1360
KRCO	Prineville, Oreg.	690
KRDD	Roswell, N. M.	1320
KRDG	Redding, Calif.	1230
KRDO	Colo. Springs, Colo.	1240
KRDR	Gresham, Ore.	1230
KRDS	Tolleson, Ariz.	1190
KRDU	Dinuba, Calif.	1240
KREB	Shreveport, La.	980
KRED	Eureka, Calif.	1480
KREH	Oakdale, La.	900
KREI	Farmington, Mo.	800
KREK	Sapulpa, Okla.	1550
KREL	Corona, Cal.	1370
KREM	Spokane, Wash.	970
KREN	Renton, Wash.	1420
KREO	Indio, Calif.	1400
KREW	Sunnyside, Wash.	1230
KREX	Grand Junc., Colo.	920
KRFO	Owatonna, Minn.	1390
KRFS	Superior, Nebr.	1600
KRGI	Grand Island, Neb.	1430
KRGV	Weslasco, Tex.	1290
KRHD	Duncan, Okla.	1350
KRIB	Mason City, Iowa	1490
KRIG	Odessa, Tex.	1410
KRIH	Rayville, La.	990
KRIK	Roswell, N. Mex.	960
KRIO	McAllen, Tex.	910
KRIZ	Phoenix, Ariz.	1230
KRKC	King City, Calif.	1490
KRKD	Los Angeles, Calif.	1150
KRKO	Everett, Wash.	1380
KRKT	Albany, Ore.	990
KRLA	Pasadena, Calif.	1110
KRLC	Lewiston, Ida. -Clarkston, Wash.	1350
KRLD	Dallas, Tex.	1080
KRLN	Canon City, Colo.	1400
KRLW	Walnut Ridge, Ark.	1320
KRMD	Shreveport, La.	1340
KRMG	Tulsa, Okla.	740
KRML	Carmel, Calif.	1410
KRMO	Monett, Mo.	990
KRMS	Osage Beach, Mo.	1150
KRNO	San Bernardino, Calif.	1240
KRNR	Roseburg, Oreg.	1490
KRNS	Burns, Oreg.	1230
KRNT	Des Moines, Iowa	1350
KRNY	Kearney, Nebr.	1460
KROB	Robstown, Tex.	1510
KROC	Rochester, Minn.	1340
KROD	El Paso, Tex.	600
KROE	Sheridan, Wyo.	930
KROF	Abbeville, La.	960
KROP	Brawley, Calif.	1300
KROS	Clinton, Iowa	1340
KROW	Dallas, Ore.	1460
KROX	Crookston, Minn.	1260
KROY	Sacramento, Calif.	1240
KRPL	Moscow, Idaho	1400
KRRR	Ruidoso, N.Mex.	1340
KRRV	Sherman, Tex.	910
KRSA	Alisal, Calif.	1570
KRSC	Othello, Wash.	1400
KRSD	Rapid City, S.Dak.	1340
KRSI	St. Louis Park, Minn.	950
KRSL	Russell, Kans.	990
KRSN	Los Alamos, N.Mex.	1490
KRSY	Roswell, N.Mex.	1230
KRTN	Raton, N.Mex.	1490
KRTR	Thermopolis, Wyo.	1490
KRUN	Ballinger, Tex.	1400
KRUS	Ruston, La.	1490
KRUX	Glendale, Ariz.	1360
KRVC	Ashland, Oreg.	1350
KRVN	Lexington, Nebr.	1010
KRWB	Roseau, Minn.	1410
KRXK	Rexburg, Idaho	1230
KRYS	Corpus Christi, Tex.	1360
KRYT	Colo. Springs, Colo.	1530
KRZE	Farmington, N.M.	1280
KRZY	Albuquerque, N.M.	1580
KSAC	Manhattan, Kans.	580
KSAL	Salina, Kans.	1150
KSAM	Huntsville, Tex.	1490
KSAY	San Francisco, Calif.	1010
KSBW	Salinas, Calif.	1380
KSCB	Liberal, Kans.	600
KSCJ	Sioux City, Iowa	1360
KSCO	Santa Cruz, Calif.	1080
KSD	St. Louis, Mo.	550
KSDN	Aberdeen, S.Dak.	930
KSDO	San Diego, Calif.	1130
KSDR	Waterton, S.Dak.	1480
KSEE	Santa Maria, Calif.	1480
KSEI	Pocatello, Idaho	930
KSEK	Pittsburg, Kans.	1340
KSEL	Lubbock, Tex.	950
KSEM	Moses Lake, Wash.	1470
KSEN	Shelby, Mont.	1150
KSEO	Durant, Okla.	750
KSET	El Paso, Tex.	1340
KSEW	Sitka, Alaska	1400
KSEY	Seymour, Tex.	1230
KSFA	Nacogdoches, Tex.	860
KSFE	Needles, Calif.	1340
KSFO	San Francisco, Calif.	560
KSGM	Ste. Genevieve, Mo.	1340
KSGT	Jackson, Wyo.	1340
KSHA	Medford, Ore.	860
KSIB	Creston, Iowa	1520
KSID	Sidney, Nebr.	1340
KSIG	Crowley, La.	1450
KSIL	Silver City, N.Mex.	1340
KSIM	Sikeston, Mo.	1400
KSIR	Wichita, Kans.	900
KSIS	Sedalia, Mo.	1050
KSIW	Woodward, Okla.	1450
KSIX	Corpus Christi, Tex.	1230
KSJB	Jamestown, N.Dak.	600
KSKI	Sun Valley, Idaho	1340
KSKY	Dallas, Tex.	660
KSL	Salt Lake City, Utah	1160
KSLM	Salem, Oreg.	1390
KSLO	Opelousas, La.	1230
KSLV	Monte Vista, Colo.	1240
KSLY	San Luis Obispo, Cal.	1400
KSMA	Santa Maria, Calif.	1240
KSMM	Shakopee, Minn.	1530
KSMN	Mason City, Iowa	1010
KSMO	Salem, Mo.	1340
KSNN	Pocatello, Ida.	1290
KSNO	Aspen, Colo.	1260
KSNY	Snyder, Tex.	1450
KSO	Des Moines, Iowa	1460
KSOK	Arkansas City, Kans.	1280
KSOL	San Francisco, Cal.	1450
KSON	San Diego, Calif.	1240
KSOO	Sioux Falls, S.Dak.	1140
KSOP	Salt Lake City, Utah	1370
KSOX	Raymondville, Tex.	1240
KSPA	Santa Paula, Calif.	1400
KSPI	Stillwater, Okla.	780
KSPL	Diboll, Tex.	1260
KSPO	Spokane, Wash.	1230
KSPT	Sandpoint, Idaho	1400
KSRA	Salmon, Idaho	960
KSRC	Socorro, N.Mex.	1290
KSRO	Santa Rosa, Calif.	1350
KSRV	Ontario, Oreg.	1380
KSSS	Colorado Springs, Colo.	740
KSST	Sulphur Springs, Tex.	1230
KSTA	Coleman, Tex.	1000
KSTB	Breckenridge, Tex.	1430
KSTL	St. Louis, Mo.	690
KSTN	Stockton, Calif.	1420
KSTP	Minneapolis-St. Paul, Minn.	1500
KSTR	Grand Junction, Colo.	620
KSTT	Davenport, Iowa	1170
KSTV	Stephenville, Tex.	1510
KSUB	Cedar City, Utah	590
KSUD	W. Memphis, Ark.	730
KSUE	Susanville, Calif.	1240
KSUM	Fairmont, Minn.	1370
KSUN	Bisbee, Ariz.	1230
KSVC	Richfield, Utah	980
KSVN	Ogden, Utah	730
KSVP	Artesia, N.Mex.	990
KSWA	Graham, Tex.	1330
KSWM	Aurora, Mo.	940
KSWO	Lawton, Okla.	1380
KSXX	Salt Lake City, Utah	630
KSYC	Yreka, Calif.	1490
KSYL	Alexandria, La.	970
KSYX	Santa Rosa, N.Mex.	1420
KTAC	Tacoma, Wash.	850
KTAE	Taylor, Tex.	1260
KTAN	Tucson, Ariz.	580
KTAR	Phoenix, Ariz.	620
KTAT	Frederick, Okla.	1570
KTBB	Tyler, Tex.	600
KTBC	Austin, Tex.	590
KTCB	Malden, Mo.	1470
KTCR	Minneapolis, Minn.	690
KTCS	Fort Smith, Ark.	1410
KTDL	Farmersville, La.	1470

WHITE'S

RADIO LOG

C.L.	Location	Kc.
KTDO	Toledo, Oreg.	1230
KTEE	Idaho Falls, Idaho	1260
KTEL	Walla Walla, Wash.	1490
KTEM	Temple, Tex.	1400
KTEO	San Angelo, Tex.	1340
KTER	Terrell, Tex.	1570
KTFI	Twin Falls, Idaho	1270
KTFO	Seminole, Tenn.	1250
KTFS	Texarkana, Tex.	1400
KTHE	Thermopolis, Wyo.	1240
KTHO	Tahoe Valley, Calif.	590
KTHS	Berryville, Ark.	1480
KTHT	Houston, Tex.	790
KTIB	Thibodaux, La.	630
KTIL	Tillamook, Oreg.	1590
KTIM	San Rafael, Calif.	1510
KTIP	Porterville, Calif.	1450
KTIS	Minneapolis, Minn.	900
KTIX	Pendleton, Ore.	1240
KTKN	Ketchikan, Alaska	930
KTKR	Taft, Calif.	1310
KTKT	Tucson, Ariz.	990
KTLD	Tullulah, La.	1360
KTLN	Denver, Colo.	1280
KTLO	Mtn. Home, Ark.	1490
KTLQ	Tahlequah, Okla.	1350
KTLU	Rusk, Tex.	1580
KTLW	Texas City, Tex.	920
KTMC	McAlester, Okla.	1400
KTMN	Trumann, Ark.	1530
KTMS	Santa Barbara, Calif.	1250
KTNC	Falls City, Nebr.	1230
KTNM	Tucumcari, N.Mex.	1400
KTNT	Tacoma, Wash.	1400
KTOB	Petaluma, Cal.	1490
KTOC	Jonesboro, La.	920
KTOD	Sinton, Tex.	1590
KTOE	Mankato, Minn.	1420
KTOH	Lihue, Hawaii	1490
KTOK	Oklahoma City, Okla.	1000
KTON	Belton, Tex.	940
KTOO	Henderson, Nev.	1280
KTOP	Topeka, Kans.	1490
KTOW	Sand Spring, Okla.	1340
KTPA	Prescott, Ark.	1370
KTRB	Modesto, Calif.	860
KTRC	Santa Fe, N.Mex.	1400
KTRE	Lufkin, Tex.	1420
KTRF	Thief River Falls, Minn.	1230
KTRG	Honolulu, Hawaii	990
KTRH	Houston, Tex.	740
KTRI	Sioux City, Iowa	1470
KTRM	Beaumont, Tex.	990
KTRN	Wichita Falls, Tex.	1290
KTRY	Bastrop, La.	730
KTSA	San Antonio, Tex.	550
KTSL	Burnett, Tex.	1340
KTSM	El Paso, Tex.	1380
KTTN	Trenton, Mo.	1600
KTTR	Rolla, Mo.	1490
KTTS	Springfield, Mo.	1400
KTTT	Columbus, Nebr.	1510
KTUC	Tucson, Ariz.	1400
KTUE	Tulia, Tex.	1260
KTW	Seattle, Wash.	1250
KTWO	Casper, Wyo.	1470
KTXJ	Jasper, Tex.	1350
KTXO	Sherman, Tex.	1500
KTYM	Inglewood, Calif.	1460
KUAI	Eleele, Kanai, Hawaii	720
KUAM	Agana, Guam	610
KUBA	Yuba City, Calif.	1600
KUBC	Montrose, Colo.	580
KUBO	San Antonio, Tex.	1310
KUDE	Oceanside, Calif.	1320
KUDI	Great Falls, Mont.	1450
KUDL	Fairway, Kan.	1380
KUDU	Ventura, Calif.	1590
KUDY	Spokane, Wash.	1280
KUEN	Wenatchee, Wash.	900
KUEQ	Phoenix, Ariz.	740
KUGN	Eugene, Oreg.	590
KUIK	Hillsboro, Oreg.	1360
KUJ	Walla Walla, Wash.	1420
KUKA	San Antonio, Tex.	1250
KUKI	Ukiah, Calif.	1400
KUKU	Willow Springs, Mo.	1330
KULA	Honolulu, Hawaii	690
KULE	Ephrata, Wash.	730
KULP	El Campo, Tex.	1390
KULY	Ulysses, Kan.	1420
KUMA	Pendleton, Oreg.	1290
KUNO	Corpus Christi, Tex.	1400
KUOA	Siloam Springs, Ark.	1290
KUOM	Minneapolis, Minn.	770
KUPD	Tempe, Ariz.	1060
KUPI	Idaho Falls, Idaho	980
KURA	Moab, Utah	1450
KURL	Billings, Mont.	730
KURV	Edinburg, Tex.	710

C.L.	Location	Kc.
KURY	Brookings, Oreg.	910
KUSD	Vermillion, S.Dak.	690
KUSH	Cushing, Okla.	1600
KUSN	St. Joseph, Mo.	1270
KUTA	Blanding, Utah	790
KUTI	Yakima, Wash.	980
KUTT	Fargo, N.Dak.	1550
KUTY	Palmdale, Calif.	1470
KUVR	Holdredge, Nebr.	1380
KUXL	Golden Valley, Minn.	1570
KUZN	W. Monroe, La.	1310
KUZZ	Bakersfield, Calif.	800
KVAL	Sauk Rapids, Minn.	800
KVAN	Camas, Wash.	1480
KVAS	Astoria, Ore.	1230
KVBR	Brainerd, Minn.	1340
KVCK	Wolf Point, Nebr.	1450
KVCL	Winnfield, La.	1270
KVCV	Redding, Calif.	600
KVEC	San Luis Obispo, Calif.	920
KVEE	Conway, Ark.	1330
KVEG	Las Vegas, Nev.	970
KVEL	Vernal, Utah	1250
KVEN	Ventura, Calif.	1450
KVET	Austin, Tex.	1300
KVFC	Cortez, Colo.	740
KVFD	Ft. Dodge, Iowa	1400
KVGB	Great Bend, Kans.	1590
KVI	Seattle, Wash.	570
KVIC	Victoria, Tex.	1340
KVIL	Highland Park, Tex.	1150
KVIM	New Iberia, La.	1360
KVIN	Vinita, Okla.	1470
KVIO	Cottonwood, Ariz.	1600
KVIP	Redding, Calif.	540
KVKM	Monahans, Tex.	1330
KVLB	Cleveland, Tex.	1410
KVLC	Little Rock, Ark.	1050
KVLF	Alpine, Tex.	1240
KVLG	LaGrange, Tex.	1570
KVLH	Pauls Valley, Okla.	1470
KVLL	Livingston, Tex.	1220
KVLV	Fallon, Nev.	980
KVMA	Magnolia, Ark	630
KVMC	Colorado City, Tex.	1320
KVML	Sonora, Calif.	1450
KVNC	Winslow, Ariz.	1010
KVNI	Coeur d'Alene, Idaho	1240
KVNU	Logan, Utah	610
KVOB	Bastrop, La.	1340
KVOC	Casper, Wyo.	1230
KVOD	Albuquerque, N. Mex.	730
KVOE	Emporia, Kans.	1400
KVOG	Ogden, Utah	1490
KVOL	Lafayette, La.	1330
KVOM	Morrilton, Ark.	800
KVON	Napa, Calif.	1440
KVOO	Tulsa, Okla.	1170
KVOP	Plainview, Tex.	1400
KVOR	Colo. Springs, Colo.	1300
KVOU	Uvalde, Tex.	1400
KVOW	Riverton, Wyo.	1450
KVOX	Moorhead, Minn.	1280
KVOY	Yuma, Ariz.	1400
KVOZ	Laredo, Tex.	1490
KVPI	Ville Platte, La.	1050
KVRC	Arkadelphia, Ark.	1240
KVRD	Cottonwood, Ariz.	1240
KVRE	Santa Rosa, Calif.	1460
KVRH	Salida, Colo.	1340
KVRS	Rock Springs, Wyo.	1360
KVSA	McGehee, Ark.	1220
KVSF	Santa Fe, N.Mex.	1260
KVSH	Valentine, Nebr.	940
KVSO	Ardmore, Okla.	1240
KVWC	Vernon, Tex.	1490
KVWG	Pearsall, Tex.	1280
KVWM	Show Low, Ariz.	970
KVWO	Cheyenne, Wyo.	1370
KVYL	Holdenville, Okla.	1370
KWAC	Bakersfield, Calif.	1490
KWAD	Wadena, Minn.	920
KWAK	Stuttgart, Ark.	1240
KWAL	Wallace, Idaho	620
KWAM	Memphis, Tenn.	990
KWAT	Watertown, S.Dak.	950
KWAY	Forest Grove, Oreg.	1570
KWBA	Baytown, Tex.	1360
KWBB	Wichita, Kans.	1410
KWBC	Navasota, Tex.	1550
KWBE	Beatrice, Nebr.	1450
KWBG	Boone, Iowa	1590
KWBW	Hutchinson, Kans.	1450
KWCB	Searcy, Ark.	1300
KWCL	Oak Grove, La.	1280
KWCO	Chickasha, Okla.	1560
KWEB	Rochester, Minn.	1270
KWED	Seguin, Tex.	1580
KWEI	Weiser, Idaho	1260
KWEL	Midland, Tex.	1440
KWEW	Hobbs, N.Mex.	1480
KWFA	Merkle, Tex.	1500
KWFR	San Angelo, Tex.	1260
KWFS	Eugene, Oreg.	1540
KWFT	Wichita Falls, Tex.	620
KWG	Stockton, Calif.	1230
KWHI	Brenham, Tex.	1280
KWHK	Hutchinson, Kans.	1260
KWHN	Fort Smith, Ark.	1320
KWHO	Salt Lake City, Utah	860
KWHW	Altus, Okla.	1450
KWIC	Salt Lake City, Utah	1570
KWIK	Pocatello, Idaho	1240

C.L.	Location	Kc.
KWIL	Albany, Oreg.	790
KWIN	Ashland, Oreg.	580
KWIP	Merced, Calif.	1580
KWIQ	Moses Lake, Wash.	1260
KWIV	Douglas, Wyo.	1050
KWIZ	Santa Ana, Calif.	1480
KWJJ	Portland, Oreg.	1080
KWK	St. Louis, Mo.	1380
KWKC	Abilene, Tex.	1340
KWKH	Shreveport, La.	1130
KWKW	Pasadena, Calif.	1300
KWKY	Des Moines, Iowa	1150
KWLA	Many, La.	1530
KWLC	Decorah, Iowa	1240
KWLM	Willmar, Minn.	1340
KWMT	Ft. Dodge, Iowa	540
KWNA	Winnemucca, Nev.	1400
KWNO	Winona, Minn.	1230
KWNS	Pratt, Kans.	1290
KWNT	Davenport, Iowa	1580
KWOA	Worthington, Minn.	730
KWOC	Poplar Bluff, Mo.	930
KWOE	Clinton, Okla.	1320
KWON	Bartlesville, Okla.	1400
KWOR	Worland, Wyo.	1340
KWOS	Jefferson City, Mo.	1240
KWOW	Pomona, Calif.	1600
KWPC	Muscatine, Iowa	860
KWPM	West Plains, Mo.	1450
KWPR	Claremore, Okla.	1270
KWRC	Woodburn, Ore.	940
KWRD	Henderson, Tex.	1470
KWRE	Warrenton, Mo.	730
KWRF	Warren, Ark.	860
KWRG	New Roods, La.	1500
KWRO	Coquille, Oreg.	630
KWRT	Boonville, Mo.	1370
KWRV	McCook, Nebr.	1360
KWRW	Guthrie, Okla.	1490
KWSC	Pullman, Wash.	1250
KWSD	Mt. Shasta, Calif.	620
KWSH	Wewoka-Seminole, Oklahoma	1260
KWSL	Grand Junction, Colo.	1340
KWSO	Wasco, Calif.	1050
KWTC	Barstow, Calif.	1230
KWTO	Springfield, Mo.	560
KWTX	Waco, Tex.	1230
KWUN	Concord, Cal.	1480
KWVR	Enterprise, Oreg.	1340
KWVY	Waverly, Iowa	1470
KWWL	Waterloo, Iowa	1330
KWYK	Farmington, N.Mex.	960
KWYN	Wynne, Ark.	1400
KWYO	Sheridan, Wyo.	1410
KWYR	Winner, S.Dak.	1260
KWYZ	Everett, Wash.	1230
KXA	Seattle, Wash.	770
KXAR	Hope, Ark.	1490
KXEL	Waterloo, Iowa	1540
KXEN	Festus-St. Louis, Mo.	1010
KXEO	Mexico, Mo.	1340
KXEW	Tucson, Ariz.	1600
KXEX	Fresno, Calif.	1550
KXGI	Ft. Madison, Iowa	1360
KXGN	Glendive, Mont.	1400
KXGO	Fargo, N. Dak.	790
KXIC	Iowa City, Iowa	800
KXIT	Dalhart, Tex.	1410
KXIV	Phoenix, Ariz.	1400
KXJK	Forrest City, Ark.	950
KXKW	Lafayette, La.	1520
KXL	Portland, Oreg.	750
KXLE	Ellensburg, Wash.	1240
KXLF	Butte, Mont.	1370
KXLJ	Helena, Mont.	1240
KXLL	Missoula, Mont.	1450
KXLO	Lewiston, Mont.	1230
KXLR	Little Rock, Ark.	1150
KXLW	Clayton, Mo.	1320
KXLY	Spokane, Wash.	920
KXO	El Centro, Calif.	1230
KXOA	Sacramento, Calif.	1470
KXOK	St. Louis, Mo.	630
KXOL	Ft. Worth, Tex.	1360
KXOX	Sweetwater, Tex.	1240
KXRA	Alexandria, Minn.	1490
KXRJ	Russellville, Ark.	1490
KXRO	Aberdeen, Wash.	1320
KXRX	San Jose, Calif.	1500
KXXL	Bozeman, Mont.	1450
KXXX	Colby, Kans.	790
KXYZ	Houston, Tex.	1320
KYA	San Francisco, Calif.	1260
KYAC	Kirkland, Wash.	1460
KYCA	Prescott, Ariz.	1490
KYCN	Wheatland, Wyo.	1340
KYES	Roseburg, Oreg.	950
KYJC	Medford, Oreg.	1230
KYME	Boise, Idaho	740
KYMN	Oregon City, Ore.	1520
KYND	Tempe, Ariz.	1580
KYNG	Coos Bay, Oreg.	1420
KYNO	Fresno, Calif.	1300
KYNT	Yankton, S.Dak.	1450
KYOK	Houston, Tex.	1590
KYOR	Blythe, Calif.	1450
KYOS	Merced, Calif.	1480
KYOU	Greeley, Colo.	1450
KYRO	Potosi, Mo.	1280
KYSM	Mankato, Minn.	1230
KYSN	Colorado Sprgs., Colo.	1460
KYSS	Missoula, Mont.	910

C.L.	Location	Kc.
KYUM	Yuma, Ariz.	560
KYVA	Gallup, N.Mex.	1230
KYW	Cleveland, Ohio	1100
KZEE	Weatherford, Tex.	1220
KZEY	Tyler, Tex.	690
KZIP	Amarillo, Tex.	1310
KZIX	Fort Collins, Colo.	600
KZNG	Hot Springs, Ark.	1470
KZOE	Princeton, Ill.	1490
KZOL	Farwell, Tex.	1570
KZOO	Honolulu, Hawaii	1210
KZOT	Marianna, Ark.	1460
KZOW	Globe, Ariz.	1240
KZUN	Opportunity, Wash.	630
KZYM	Cape Girardeau, Mo.	1220
KZZN	Littlefield, Tex.	1490
VOUS	Argentia, Nfld.	1480
WAAA	Winston-Salem, N.C.	980
WAAB	Worcester, Mass.	1440
WAAC	Terre Haute, Ind.	1300
WAAF	Chicago, Ill.	950
WAAG	Adel, Ga.	1470
WAAK	Dallas, N.C.	960
WAAM	Ann Arbor, Mich.	1600
WAAP	Peoria, Ill.	1350
WAAT	Trenton, N.J.	1300
WAAX	Gadsden, Ala.	570
WAAY	Huntsville, Ala.	1550
WABA	Aguadilla, P.Rico	850
WABB	Mobile, Ala.	1480
WABC	New York, N.Y.	770
WABD	Ft. Campbell, Ky.	1370
WABF	Fairhope, Ala.	1220
WABG	Greenwood, Miss.	960
WABH	Deerfield, Va.	1150
WABI	Bangor, Maine	910
WABJ	Adrian, Mich.	1490
WABL	Amite, La.	1570
WABO	Waynesboro, Miss.	990
WABQ	Cleveland, Ohio	1540
WABR	Winter Park, Fla.	1440
WABT	Tuskegee, Ala.	580
WABV	Abbeville, S.C.	1590
WABY	Albany, N.Y.	1400
WABZ	Albemarle, N.C.	1010
WACA	Camden, S.C.	1590
WACB	Kittanning, Pa.	1380
WACE	Chicopee, Mass.	730
WACI	The Dalles, Ore.	1300
WACK	Newark, N.Y.	1420
WACL	Waycross, Ga.	570
WACO	Waco, Tex.	1460
WACR	Columbus, Miss.	1050
WACT	Tuscaloosa, Ala.	1420
WACY	Moss Point, Miss.	1460
WADA	Shelby, N.C.	1390
WADE	Wadesboro, N.C.	1210
WADK	Newport, R.I.	1540
WADM	Decatur, Ind.	1540
WADO	New York, N.Y.	1280
WADP	Kane, Pa.	960
WADS	Ansonia, Conn.	690
WAEB	Allentown, Pa.	790
WAEL	Mayaguez, P.Rico	600
WAEW	Crossville, Tenn.	1330
WAFC	Staunton, Va.	900
WAFS	Amsterdam, N.Y.	1570
WAGC	Centre, Ala.	1550
WAGE	Leesburg, Va.	1290
WAGF	Dothan, Ala.	1320
WAGG	Franklin, Tenn.	950
WAGL	Lancaster, S. C.	1550
WAGM	Presque Isle, Maine	950
WAGN	Menominee, Mich.	1340
WAGR	Lumberton, N.C.	580
WAGS	Bishopville, S.C.	1380
WAGY	Forest City, N.C.	1320
WAIK	Galesburg, Ill.	1590
WAIL	Baton Rouge, La.	1460
WAIM	Anderson, S.C.	1230
WAIN	Columbia, Ky.	1270
WAIR	Winston-Salem, N.C.	1340
WAIT	Chicago, Ill.	820
WAJF	Decatur, Ala.	1490
WAJR	Morgantown, W.Va.	1440
WAKE	Atlanta, Ga.	1340
WAKI	McMinnville, Tenn.	1230
WAKN	Aiken, S.C.	990
WAKO	Lawrenceville, Ill.	910
WAKR	Akron, Ohio	1590
WAKY	Louisville, Ky.	790
WALD	Walterboro, S.C.	1220
WALE	Fall River, Mass.	1400
WALG	Albany, Ga.	1590
WALK	Patchogue, N.Y.	1370
WALL	Middletown, N.Y.	1340
WALM	Albion, Mich.	1260
WALO	Humacao, P.R.	1240
WALT	Tampa, Fla.	1110
WALY	Herkimer, N.Y.	1420
WAMD	Aberdeen, Md.	970
WAME	Miami, Fla.	1260
WAMI	Opp, Ala.	860
WAML	Laurel, Miss.	1340
WAMM	Flint, Mich.	1420
WAMO	Homestead, Pa.	860
WAMR	Venice, Fla.	1320
WAMS	Wilmington, Del.	1380
WAMV	East St. Louis, Ill.	1490
WAMW	Washington, Ind.	1580
WAMY	Amory, Miss.	1580
WANA	Anniston, Ala.	1490
WANB	Waynesburg, Pa.	1580

C.L.	Location	Kc.
WANE	Ft. Wayne, Ind.	1450
WANN	Annapolis, Md.	1190
WANS	Anderson, S.C.	1280
WANT	Richmond, Va.	990
WANV	Waynesboro, Va.	970
WANY	Albany, Ky.	1390
WAOK	Atlanta, Ga.	1380
WAOV	Vincennes, Ind.	1450
WAPA	San Juan, P.R.	680
WAPC	Riverhead, N.Y.	1570
WAPE	Jacksonville, Fla.	690
WAPF	McComb, Miss.	980
WAPG	Arcadia, Fla.	1480
WAPI	Birmingham, Ala.	1070
WAPL	Appleton, Wis.	1570
WAPO	Chattanooga, Tenn.	1150
WAPX	Montgomery, Ala.	1600
WAQE	Towson, Md.	1570
WAQI	Ashtabula, Ohio	1600
WAQY	Birmingham, Ala.	1220
WARA	Attleboro, Mass.	1320
WARB	Covington, La.	730
WARD	Johnstown, Pa.	1490
WARE	Ware, Mass.	1250
WARF	Jasper, Ala.	1240
WARI	Blaine, Wash.	550
WARK	Hagerstown, Md.	1490
WARM	Scranton, Pa.	590
WARN	Ft. Pierce, Fla.	1330
WARO	Canonsburg, Pa.	540
WART	Moulton, Ala.	1530
WARU	Peru, Ind.	1600
WASA	Havre de Grace, Md.	1330
WASK	Lafayette, Ind.	1450
WATA	Boone, N.C.	1450
WATC	Gaylord, Mich.	900
WATE	Knoxville, Tenn.	620
WATH	Athens, Ohio	970
WATI	Indianapolis, Ind.	810
WATK	Antigo, Wis.	900
WATM	Atmore, Ala.	1590
WATN	Watertown, N.Y.	1240
WATO	Oak Ridge, Tenn.	1290
WATP	Marion, S.C.	1430
WATR	Waterbury, Conn.	1320
WATS	Sayre, Pa.	960
WATT	Cadillac, Mich.	1240
WATV	Birmingham, Ala.	900
WATW	Ashland, Wis.	1400
WATZ	Alpena, Mich.	1450
WAUB	Auburn, N.Y.	1590
WAUC	Wauchula, Fla.	1310
WAUD	Auburn, Ala.	1230
WAUG	Augusta, Ga.	1050
WAVA	Arlington, Va.	780
WAVE	Louisville, Ky.	970
WAVI	Dayton, Ohio	1210
WAVL	Apollo, Pa.	910
WAVN	Stillwater, Minn.	1220
WAVO	Avondale Estates, Ga.	1420
WAVP	Avon Park, Fla.	1390
WAVU	Albertville, Ala.	630
WAVY	Portsmouth, Va.	1350
WAVZ	New Haven, Conn.	1300
WAWA	West Allis, Wis.	1590
WAWK	Kendallville, Ind.	1570
WAWZ	Zarephath, N.J.	1380
WAXE	Vero Beach, Fla.	1370
WAXU	Georgetown, Ky.	1580
WAXX	Chippewa Falls, Wis.	1150
WAYB	Waynesboro, Va.	1490
WAYE	Dundalk, Md.	860
WAYK	Valparaiso, Ind.	1500
WAYN	Rockingham, N.C.	900
WAYR	Orange Park, Fla.	550
WAYS	Charlotte, N.C.	610
WAYX	Waycross, Ga.	1230
WAYZ	Waynesboro, Pa.	1380
WAZA	Bainbridge, Ga.	1360
WAZE	Clearwater, Fla.	860
WAZF	Yazoo City, Miss.	1230
WAZL	Hazelton, Pa.	1490
WAZS	Summerville, S.C.	780
WAZY	Lafayette, Ind.	1410
WBAA	West Lafayette, Ind.	920
WBAB	Babylon, N.Y.	1440
WBAC	Cleveland, Tenn.	1340
WBAG	Burlington, N.C.	1150
WBAL	Baltimore, Md.	1090
WBAM	Montgomery, Ala.	740
WBAP	Fort Worth, Tex.	570
	8c	820
WBAR	Bartow, Fla.	1460
WBAT	Marion, Ind.	1400
WBAW	Barnwell, S.C.	740
WBAX	Wilkes-Barre, Pa.	1240
WBAY	Green Bay, Wis.	1360
WBAZ	Kingston, N.Y.	1550
WBBA	Pittsfield, Ill.	1580
WBBB	Burlington, N.C.	920
WBBF	Rochester, N.Y.	950
WBBI	Abingdon, Va.	1230
WBBK	Blakely, Ga.	1260
WBBL	Richmond, Va.	1480
WBBM	Chicago, Ill.	780
WBBO	Forest City, N.C.	780
WBBQ	Augusta, Ga.	1340
WBBR	Travelers Rest, S.C.	1580
WBBT	Lyons, Ga.	1340
WBBW	Youngstown, Ohio	1240
WBBX	Portsmouth, N.H.	1380
WBBY	Wood River, Ill.	590
WBBZ	Ponca City, Okla.	1230
WBCA	Bay Minette, Ala.	1150
WBCB	Levittown, Pa.	1490
WBCH	Hastings, Mich.	1220
WBCI	Williamsburg, Va.	740
WBCK	Battle Creek, Mich.	930
WBCM	Bay City, Mich.	1440
WBCO	Bucyrus, Ohio	1540
WBCU	Union, S.C.	1460
WBEC	Pittsfield, Mass.	1420
WBEE	Harvey, Ill.	1570
WBEJ	Elizabethton, Tenn.	1240
WBEL	Beloit, Wis.	1380
WBEN	Buffalo, N.Y.	930
WBER	Moncks Corner, S. C.	950
WBET	Brockton, Mass.	1460
WBEU	Beaufort, S.C.	960
WBEV	Beaver Dam, Wis.	1430
WBEX	Chillicothe, Ohio	1490
WBFD	Bedford, Pa.	1310
WBFJ	Woodbury, Tenn.	1540
WBGC	Chipley, Fla.	1240
WBGN	Bowling Green, Ky.	1340
WBGR	Jesup, Ga.	1370
WBGS	Slidell, La.	1560
WBHB	Fitzgerald, Ga.	1240
WBHC	Hampton, S.C.	1270
WBHF	Cartersville, Ga.	1450
WBHM	Birmingham, Ala.	1550
WBHP	Huntsville, Ala.	1230
WBHT	Brownsville, Tenn.	1520
WBIA	Augusta, Ga.	1230
WBIB	Centreville, Ala.	1590
WBIC	Islip, N.Y.	540
WBIE	Marietta, Ga.	1080
WBIG	Greensboro, N.C.	1470
WBIL	Leesburg, Fla.	1410
WBIP	Booneville, Miss.	1400
WBIR	Knoxville, Tenn.	1240
WBIS	Bristol, Conn.	1440
WBIW	Bedford, Ind.	1340
WBIX	Jacksonville Beach, Fla.	1010
WBIZ	Eau Claire, Wis.	1400
WBKH	Hattiesburg, Miss.	950
WBKN	Newton, Miss.	1410
WBKV	West Bend, Wis.	1470
WBLA	Elizabethtown, N.C.	1440
WBLE	Batesville, Miss.	1290
WBLF	Bellefonte, Pa.	1330
WBLG	Lexington, Ky.	1300
WBLJ	Dalton, Ga.	1230
WBLO	Evergreen, Ala.	1470
WBLR	Batesburg, S.C.	1430
WBLT	Bedford, Va.	1350
WBLU	Salem, Va.	1480
WBLY	Springfield, Ohio	1600
WBMA	Beaufort, N.C.	1400
WBMC	McMinnville, Tenn.	960
WBMD	Baltimore, Md.	750
WBME	Belfast, Mo.	1230
WBMK	West Point, Ga.	1310
WBML	Macon, Ga.	1240
WBMT	Black Mountain, N.C.	1350
WBNB	Charlotte Amalie, Virgin Islands	1000
WBNC	Conway, N.H.	1050
WBNL	Boonville, Ind.	1540
WBNO	Bryan, Ohio	1520
WBNR	Beacon, N.Y.	1260
WBNS	Columbus, Ohio	1460
WBNT	Oneida, Tenn.	1310
WBNX	New York, N.Y.	1380
WBOB	Galax, Va.	1360
WBOC	Salisbury, Md.	960
WBOK	New Orleans, La.	800
WBOL	Bolivar, Tenn.	1560
WBOP	Pensacola, Fla.	980
WBOS	Brookline, Mass.	1600
WBOW	Terre Haute, Ind.	1230
WBOX	Bogalusa, La.	920
WBOY	Clarksburg, W.Va.	1400
WBPR	Bayamon, P.R.	1600
WBPZ	Lock Haven, Pa.	1230
WBRB	Mt. Clemens, Mich.	1430
WBRC	Birmingham, Ala.	960
WBRD	Bradenton, Fla.	1420
WBRE	Wilkes-Barre, Pa.	1340
WBRG	Lynchburg, Va.	1050
WBRI	Indianapolis, Ind.	1500
WBRJ	Marietta, O.	910
WBRK	Pittsfield, Mass.	1340
WBRL	Berlin, N.H.	1400
WBRM	Marion, N.C.	1250
WBRN	Big Rapids, Mich.	1460
WBRO	Waynesboro, Ga.	1310
WBRT	Bardstown, Ky.	1320
WBRV	Boonville, N.Y.	900
WBRW	Brewster, N.Y.	1510
WBRX	Berwick, Pa.	1280
WBRY	Waterbury, Conn.	1590
WBSA	Boaz, Ala.	1300
WBSC	Bennetsville, S.C.	1550
WBSG	Blackshear, Ga.	1350
WBSM	New Bedford, Mass.	1420
WBSR	Pensacola, Fla.	1540
WBT	Charlotte, N.C.	1110
WBTA	Batavia, N.Y.	1490
WBTC	Uhrichsville, O.	1540
WBTH	Williamson, W.Va.	1400
WBTM	Danville, Va.	1330
WBTN	Bennington, Vt.	1370
WBTO	Linton, Ind.	1600
WBTS	Bridgeport, Ala.	1480
WBUC	Buckhannon, W.Va.	1460
WBUD	Trenton, N.J.	1260
WBUG	Ridgeland, S.C.	1430
WBUT	Butler, Pa.	1050
WBUX	Doylestown, Pa.	1570
WBUY	Lexington, N.C.	1440
WBUZ	Fredonia, N.Y.	1570
WBVL	Barbourville, Ky.	950
WBVM	Utica, N.Y.	1550
WBVP	Beaver Falls, Pa.	1230
WBYE	Calera, Ala.	1370
WBYG	Savannah, Ga.	1450
WBYS	Canton, Ill.	1560
WBZ	Boston, Mass.	1030
WBZB	Selma, N. C.	1510
WBZE	Wheeling, W. Va.	1470
WBZY	Torrington, Conn.	990
WCAI	Fort Myers, Fla.	1350
WCAL	Northfield, Minn.	770
WCAM	Camden, N.J.	1310
WCAO	Baltimore, Md.	600
WCAP	Lowell, Mass.	980
WCAR	Detroit, Mich.	1130
WCAT	Orange, Mass.	1390
WCAU	Philadelphia, Pa.	1210
WCAW	Charleston, W.Va.	680
WCAY	Cayce, S.C.	620
WCAZ	Carthage, Ill.	990
WCBA	Corning, N.Y.	1350
WCBG	Chambersburg, Pa.	1590
WCBI	Columbus, Miss.	550
WCBL	Benton, Ky.	1290
WCBM	Baltimore, Md.	680
WCBS	New York, N.Y.	880
WCBT	Roanoke Rapids, N.C.	1230
WCBY	Cheboygan, Mich.	1240
WCCC	Hartford, Conn.	1290
WCCF	Punta Gorda, Fla.	1580
WCCM	Lawrence, Mass.	800
WCCN	Neillsville, Wis.	1370
WCCO	Minneapolis-St. Paul, Minn.	830
WCCW	Traverse City, Mich.	1310
WCDJ	Edenton, N.C.	1260
WCDL	Carbondale, Pa.	1440
WCDS	Glasgow, Ky.	1440
WCDT	Winchester, Tenn.	1340
WCEC	Rocky Mount, N.C.	810
WCED	DuBois, Pa.	1420
WCEF	Parksburg, W.Va.	1050
WCEH	Hawkinsville, Ga.	610
WCEM	Cambridge, Md.	1240
WCEN	Mt. Pleasant, Mich.	1150
WCER	Charlotte, Mich.	1390
WCFL	Chicago, Ill.	1000
WCFR	Springfield, Vt.	1480
WCFV	Clifton Forge, Va.	1230
WCGA	Calhoun, Ga.	900
WCGC	Belmont, N.C.	1270
WCGO	Chicago Hghts., Ill.	1600
WCGR	Canandaigua, N.Y.	1550
WCHA	Chambersburg, Pa.	800
WCHB	Inkster, Mich.	1440
WCHE	Westchester, Pa.	1520
WCHI	Chillicothe, Ohio	1350
WCHJ	Brookhaven, Miss.	1470
WCHK	Canton, Ga.	1290
WCHL	Chapel Hill, N.C.	1360
WCHN	Norwich, N.Y.	970
WCHO	Washington Court House, Ohio	1250
WCHS	Charleston, W.Va.	580
WCHV	Charlottesville, Va.	1260
WCIC	Cambridge, Minn.	1300
WCIL	Carbondale, Ill.	1020
WCIN	Cincinnati, Ohio	1480
WCIT	Lima, Ohio	940
WCJU	Columbia, Miss.	1450
WCKB	Dunn, N.C.	780
WCKI	Greer, S.C.	1300
WCKM	Winnsboro, S.C.	1250
WCKY	Cincinnati, Ohio	1530
WCLA	Claxton, Ga.	1470
WCLB	Camilla, Ga.	1220
WCLC	Jamestown, Tenn.	1260
WCLD	Cleveland, Miss.	1490
WCLE	Cleveland, Tenn.	1570
WCLG	Morgantown, W.Va.	1300
WCLI	Corning, N.Y.	1450
WCLO	Janesville, Wis.	1230
WCLS	Columbus, Ga.	1580
WCLT	Newark, Ohio	1430
WCLU	Covington, Ky.	1320
WCLW	Mansfield, Ohio	1570
WCMA	Corinth, Miss.	1230
WCMB	Harrisburg, Pa.	1460
WCMC	Wildwood, N.J.	1230
WCME	Brunswick, Maine	900
WCMI	Ashland, Ky.	1340
WCMN	Arecibo, P.R.	1280
WCMP	Pine City, Minn.	1350
WCMR	Elkhart, Ind.	1270
WCMS	Norfolk, Va.	1050
WCMT	Martin, Tenn.	1410
WCMY	Ottawa, Ill.	1430
WCNB	Connersville, Ind.	1580
WCNC	Elizabeth City, N.C.	1240
WCND	Shelbyville, Ky.	940
WCNF	Weldon, N.C.	1400
WCNH	Quincy, Fla.	1230
WCNL	Newport, N. H.	1010
WCNR	Bloomsburg, Pa.	930
WCNS	Canton, O.	900
WCNT	Centralia, Ill.	1210
WCNU	Crestview, Fla.	1010
WCNX	Middletown, Conn.	1150
WCOA	Pensacola, Fla.	1370
WCOC	Meridian, Miss.	910
WCOF	Immokalee, Fla.	1490
WCOG	Greensboro, N.C.	1320
WCOH	Newnan, Ga.	1400
WCOJ	Coatesville, Pa.	1420
WCOL	Columbus, Ohio	1230
WCON	Cornelia, Ga.	1450
WCOP	Boston, Mass.	1150
WCOR	Lebanon, Tenn.	900
WCOS	Columbia, S.C.	1400
WCOU	Lewiston, Maine	1240
WCOV	Montgomery, Ala.	1170
WCOW	Sparta, Wis.	1290
WCOY	Columbia, Pa.	1580
WCPA	Clearfield, Pa.	900
WCPC	Houston, Miss.	940
WCPH	Etowah, Tenn.	1220
WCPM	Cumberland, Ky.	1280
WCPO	Cincinnati, Ohio	1230
WCPS	Tarboro, N.C.	760
WCQS	Alma, Ga.	1400
WCRA	Effingham, Ill.	1090
WCRB	Waltham, Mass.	1330
WCRE	Cheraw, S.C.	1420
WCRI	Scottsboro, Ala.	1050
WCRK	Morristown, Tenn.	1150
WCRL	Oneonta, Ala.	1570
WCRM	Clare, Mich.	990
WCRO	Johnstown, Pa.	1230
WCRS	Greenwood, S.C.	1450
WCRT	Birmingham, Ala.	1260
WCRV	Washington, N.J.	1580
WCRW	Chicago, Ill.	1240
WCRY	Macon, Ga.	900
WCSA	Ripley, Mass.	1260
WCSC	Charleston, S.C.	1390
WCSH	Portland, Maine	970
WCSI	Columbus, Ind.	1010
WCSJ	Morris, Ill.	1550
WCSL	Cherryville, N. C.	1590
WCSM	Celina, Ohio	1350
WCSR	Hillsdale, Mich.	1340
WCSS	Amsterdam, N.Y.	1490
WCST	Berkeley Springs, W.Va.	1010
WCTA	Andalusia, Ala.	920
WCTC	New Brunswick, N.J.	1450
WCTR	Chestertown, Md.	1530
WCTT	Corbin, Ky.	680
WCTW	New Castle, Ind.	1550
WCUB	Manitowoc, Wis.	980
WCUE	Cuyahoga Falls, Ohio	1150
WCUM	Cumberland, Md.	1230
WCVA	Culpeper, Va.	1490
WCVI	Connellsville, Pa.	1340
WCVP	Murphy, N.C.	600
WCVS	Springfield, Ill.	1450
WCWC	Ripon, Wis.	1600
WCWR	Tarpon Springs, Fla.	1470
WCYB	Bristol, Va.	690
WCYN	Cynthiana, Ky.	1400
WDAD	Indiana, Pa.	1450
WDAE	Tampa, Fla.	1250
WDAF	Kansas City, Mo.	610
WDAK	Columbus, Ga.	540
WDAL	Meridian, Miss.	1330
WDAN	Danville, Ill.	1490
WDAR	Darlington, S.C.	1350
WDAS	Philadelphia, Pa.	1480
WDAX	McRae, Ga.	1410
WDAY	Fargo, N. Dak.	970
WDBC	Escanaba, Mich.	680
WDBF	Delray Beach, Fla.	1420
WDBJ	Roanoke, Va.	960
WDBL	Springfield, Tenn.	1590
WDBM	Statesville, N.C.	550
WDBO	Orlando, Fla.	580
WDBQ	Dubuque, Iowa	1490
WDCF	Dade City, Fla.	1350
WDCR	Hanover, N.H.	1340
WDDT	Greenville, Miss.	900
WDDY	Gloucester, Va.	1420
WDEA	Ellsworth, Me.	1370
WDEC	Americus, Ga.	1290
WDEE	Hamden, Conn.	1220
WDEF	Chattanooga, Tenn.	1370
WDEH	Sweetwater, Tenn.	800
WDEL	Wilmington, Del.	1150
WDEV	Waterbury, Vt.	550
WDEW	Westfield, Mass.	1570
WDGL	Douglasville, Ga.	1520
WDGY	Minneapolis, Minn.	1130
WDIA	Memphis, Tenn.	1070
WDIC	Clinchco, Va.	1430
WDIG	Dothan, Ala.	1450
WDIX	Orangeburg, S.C.	1150
WDJS	Mt. Olive, N.C.	1430
WDKN	Dickson, Tenn.	1260
WDLA	Walton, N.Y.	1270
WDLB	Marshfield, Wis.	1450
WDLC	Port Jervis, N.Y.	1490
WDLR	Delaware, Ohio	1550
WDLM	E. Moline, Ill.	960
WDLP	Panama City, Fla.	590
WDLT	Indianola, Miss.	1380
WDMC	Otsego, Mich.	980
WDMG	Douglas, Ga.	860
WDMJ	Marquette, Mich.	1320

WHITE'S RADIO LOG

C.L.	Location	Kc.
WDMS	Lynchburg, Va.	1320
WDMV	Pocomoke City, Md.	540
WDNC	Durham, N.C.	620
WDNE	Elkins, W.Va.	1240
WDNG	Anniston, Ala.	1450
WDNT	Dayton, Tenn.	1280
WDOB	Canton, Miss.	1370
WDOC	Prestonsburg, Ky.	1310
WDOD	Chattanooga, Tenn.	1310
WDOE	Dunkirk, N.Y.	1410
WDOG	Marine City, Mich.	1590
WDOK	Cleveland, Ohio	1260
WDOL	Athens, Ga.	1470
WDON	Wheaton, Md.	1540
WDOR	Sturgeon Bay, Wis.	910
WDOS	Oneonta, N.Y.	730
WDOT	Burlington, Va.	1400
WDOV	Dover, Del.	1410
WDOW	Dowagiac, Mich.	1440
WDQN	DuQuoin, Ill.	1580
WDRC	Hartford, Conn.	1360
WDSC	Dillon, S.C.	800
WDSG	Dyersburg, Tenn.	1450
WDSK	Cleveland, Miss.	1410
WDSL	Mocksville, N. C.	1520
WDSM	Superior, Wis.	710
WDSP	DeFuniak Springs, Florida	1280
WDSR	Lake City, Fla.	1340
WDUN	Gainesville, Ga.	1240
WDUX	Waupaca, Wis.	800
WDUZ	Green Bay, Wis.	1400
WDVA	Danville, Va.	1250
WDVH	Gainesville, Fla.	980
WDVL	Vineland, N.J.	1270
WDWD	Dawson, Ga.	990
WDWS	Champaign, Ill.	1400
WDXB	Chattanooga, Tenn.	1490
WDXE	Lawrenceburg, Tenn.	1370
WDXI	Jackson, Tenn.	1310
WDXL	Lexington, Tenn.	1490
WDXN	Clarksville, Tenn.	540
WDXR	Paducah, Ky.	1560
WDXY	Sumter, S.C.	1240
WDYX	Buford, Ga.	1460
WDZ	Decatur, Ill.	1050
WEAB	Greer, S.C.	800
WEAC	Gaffney, S. C.	1500
WEAD	College Park, Ga.	1570
WEAG	Alcoa, Tenn.	1470
WEAL	Greensboro, N. C.	1510
WEAM	Arlington, Va.	1390
WEAN	Providence, R.I.	790
WEAQ	Eau Claire, Wis.	790
WEAS	Savannah, Ga.	900
WEAT	W. Palm Beach, Fla.	850
WEAV	Plattsburg, N.Y.	960
WEAW	Evanston, Ill.	1330
WEBB	Baltimore, Md.	1360
WEBC	Duluth, Minn.	560
WEBJ	Brewton, Ala.	1240
WEBO	Owego, N.Y.	1330
WEBQ	Harrisburg, Ill.	1240
WEBR	Buffalo, N.Y.	970
WEBY	Milton, Fla.	1330
WECL	Eau Claire, Wis.	1050
WEDC	Chicago, Ill.	1240
WEDO	McKeesport, Pa.	810
WEEB	Southern Pines, N.C.	990
WEED	Rocky Mount, N.C.	1390
WEEE	Rensselaer, N.Y.	1300
WEEF	Highland Park, Ill.	1430
WEEI	Boston, Mass.	590
WEEL	Fairfax, Va.	1310
WEEN	Lafayette, Tenn.	1460
WEEP	Pittsburgh, Pa.	1080
WEER	Warrenton, Va.	1250
WEET	Richmond, Va.	1320
WEEU	Reading, Pa.	850
WEEW	Washington, N.C.	1320
WEEX	Easton, Pa.	1230
WEEZ	Chester, Pa.	1590
WEGO	Concord, N.C.	1410
WEGP	Presque Isle, Maine	1390
WEHH	Elmira Heights-Horseheads, N. Y.	1590
WEIC	Charleston, Ill.	1270
WEIF	Moundsville, W. Va.	1370
WEIM	Fitchburg, Mass.	1280
WEIR	Weirton, W.Va.	1430
WEIS	Center, Ala.	990
WEJL	Scranton, Pa.	630
WEKR	Fayetteville, Tenn.	1240
WEKY	Richmond, Ky.	1340
WEKZ	Monroe, Wis.	1260
WELB	Elba, Ala.	1350
WELC	Welch, W.Va.	1150
WELD	Fisher, W.Va.	690
WELE	S. Daytona, Fla.	1590
WELI	New Haven, Conn.	960
WELK	Charlottesville, Va.	1010
WELM	Elmira, N.Y.	1410

C.L.	Location	Kc.
WELO	Tupelo, Miss.	580
WELP	Easley, S.C.	1360
WELR	Roanoke, Ala.	1360
WELS	Kinston, N.C.	1010
WELW	Willoughby, O.	1330d
WELY	Ely, Minn.	1450
WELZ	Belzoni, Miss.	1460
WEMB	Erwin, Tenn.	1420
WEMD	Easton, Md.	1460
WEMJ	Laconia, N.H.	1490
WEMP	Milwaukee, Wis.	1250
WENC	Whiteville, N.C.	1220
WEND	Edensburg, Pa.	1580
WENE	Endicott, N.Y.	1430
WENG	Englewood, Fla.	1530
WENK	Union City, Tenn.	1240
WENN	Birmingham, Ala.	1320
WENO	Madison, Tenn.	1430
WENT	Gloversville, N.Y.	1340
WENY	Elmira, N.Y.	1230
WENZ	Highland Springs, Va.	1450
WEOK	Poughkeepsie, N.Y.	1390
WEOL	Elyria, Ohio	930
WEPG	S. Pittsburgh, Tenn.	910
WEPM	Martinsburg, W.Va.	1340
WERA	Plainfield, N.J.	1590
WERB	Garden City, Mich.	1090
WERD	Atlanta, Ga.	860
WERE	Cleveland, Ohio	1300
WERH	Hamilton, Ala.	970
WERI	Westerly, R.I.	1230
WERL	Eagle River, Wis.	950
WERT	Van Wert, Ohio	1220
WERX	Wyoming, Mich.	1530
WESA	Charleroi, Pa.	940
WESB	Bradford, Pa.	1490
WESC	Greenville, S.C.	660
WESO	Southbridge, Mass.	970
WESR	Tasley, Va.	1330
WEST	Easton, Pa.	1400
WESX	Salem, Mass.	1230
WESY	Leland, Miss.	1580
WETB	Johnson City, Tenn.	790
WETC	Wendell-Zebulon, N.C.	540
WETH	St. Augustine, Fla.	1420
WETO	Gadsden, Ala.	930
WETT	Ocean City, Md.	1590
WETU	Wetumpka, Ala.	1250
WETZ	New Martinsville, West Virginia	1330
WEUC	Ponce, P.R.	1420
WEUP	Huntsville, Ala.	1600
WEVA	Emporia, Va.	860
WEVD	New York, N.Y.	1330
WEVE	Eveleth, Minn.	1340
WEW	St. Louis, Mo.	770
WEWO	Laurinburg, N.C.	1080
WEXL	Royal Oak, Mich.	1340
WEXT	W. Hartford, Conn.	1550
WEYE	Sanford, N.C.	1290
WEYY	Talladega, Ala.	1580
WEZE	Boston, Mass.	1260
WEZJ	Williamsburg, Ky.	1440
WEZQ	Winfield, Ala.	1300
WEZY	Cocoa, Fla.	1350
WFAA	Dallas, Tex.	570
		820
WFAB	Miami, Fla.	990
WFAG	Farmville, N.C.	1250
WFAH	Alliance, Ohio	1310
WFAI	Fayetteville, N.C.	1230
WFAR	Farrell, Pa.	1470
WFAS	White Plains, N.Y.	1230
WFAU	Augusta, Me.	1340
WFAW	Ft. Atkinson, Wis.	940
WFAX	Falls Church, Va.	1220
WFBA	San Sebastion, P.R.	1460
WFBC	Greenville, S.C.	1330
WFBG	Altoona, Pa.	1290
WFBL	Syracuse, N.Y.	1390
WFBM	Indianapolis, Ind.	1260
WFBR	Baltimore, Md.	1300
WFBS	Spring Lake, N. C.	1450
WFDF	Flint, Mich.	910
WFDR	Manchester, Ga.	1370
WFEA	Manchester, N.H.	1370
WFEB	Sylacauga, Ala.	1340
WFEC	Harrisburg, Pa.	1400
WFFF	Columbia, Miss.	1360
WFFG	Marathon, Fla.	1300
WFGM	Fitchburg, Mass.	960
WFGN	Gaffney, S.C.	1570
WFGW	Black Mountains, N.C.	1010
WFHG	Bristol, Va.	980
WFHK	Pell City, Ala.	1430
WFHR	Wis. Rapids, Wis.	1320
WFIF	Milford, Conn.	1500
WFIG	Sumter, S.C.	1290
WFIL	Philadelphia, Pa.	560
WFIN	Findlay, Ohio	1330
WFIS	Fountain Inn, S.C.	1600
WFIW	Fairfield, Ill.	1390
WFIX	Huntsville, Ala.	1450
WFKN	Franklin, Ky.	1220
WFKY	Frankfort, Ky.	1490
WFLA	Tampa, Fla.	970
WFLB	Fayetteville, N.C.	1490
WFLI	Lookout Mtn., Tenn.	1070
WFLN	Philadelphia, Pa.	900
WFLO	Farmville, Va.	870
WFLR	Dundee, N.Y.	1570
WFLS	Fredericksburg, Va.	1350

C.L.	Location	Kc.
WFLW	Monticello, Ky.	1360
WFMC	Goldsboro, N.C.	730
WFMD	Frederick, Md.	930
WFMH	Cullman, Ala.	1460
WFMJ	Youngstown, Ohio	1390
WFMO	Fairmont, N.C.	860
WFMW	Madisonville, Ky.	730
WFNC	Fayetteville, N.C.	1390
WFNL	No. Augusta, S.C.	1600
WFOB	Fostoria, Ohio	1430
WFOL	Hamilton, Ohio	1560
WFOM	Marietta, Ga.	1230
WFOR	Hattiesburg, Miss.	1400
WFOX	Milwaukee, Wis.	860
WFOY	St. Augustine, Fla.	1240
WFPA	Fort Payne, Ala.	1400
WFPG	Atlantic City, N.J.	1450
WFPM	Fort Valley, Ga.	1150
WFPR	Hammond, La.	1400
WFRA	Franklin, Pa.	1430
WFRB	Frostburg, Md.	560
WFRC	Reidsville, N.C.	1600
WFRL	Freeport, Ill.	1570
WFRM	Coudersport, Pa.	600
WFRO	Fremont, Ohio	900
WFRX	West Frankfort, Ill.	1300
WFSC	Franklin, N.C.	1050
WFSG	Boca Raton, Fla.	740
WFSO	Pinellas, Fla.	570
WFSR	Bath, N.Y.	1380
WFST	Caribou, Maine	600
WFTC	Kinston, N.C.	960
WFTG	London, Ky.	1400
WFTL	Ft. Lauderdale, Fla.	1400
WFTM	Maysville, Ky.	1240
WFTN	Franklin, N.H.	1240
WFTR	Front Royal, Va.	1450
WFTW	Ft. Walton Beach, Florida	1260
WFUL	Fulton, Ky.	1270
WFUR	Grand Rapids, Mich.	1570
WFVA	Fredericksburg, Va.	1230
WFVG	Fuquay Sprgs., N.C.	1460
WFWL	Camden, Tenn.	1220
WFYC	Alma, Mich.	1280
WFYI	Mineola, N.Y.	1520
WGAA	Cedartown, Ga.	1340
WGAC	Augusta, Ga.	580
WGAD	Gadsden, Ala.	1350
WGAF	Valdosta, Ga.	910
WGAI	Elizabeth City, N.C.	560
WGAL	Lancaster, Pa.	1490
WGAN	Portland, Maine	560
WGAP	Maryville, Tenn.	1400
WGAR	Cleveland, Ohio	1220
WGAS	S. Gastonia, N.C.	1420
WGAT	Gate City, Va.	1050
WGAU	Athens, Ga.	1340
WGAW	Gardner, Mass.	1340
WGBA	Columbus, Ga.	1270
WGBB	Freeport, N.Y.	1240
WGBC	Chipley, Fla.	1240
WGBF	Evansville, Ind.	1280
WGBG	Greensboro, N.C.	1400
WGBI	Scranton, Pa.	910
WGBR	Goldsboro, N. C.	1150
WGBS	Miami, Fla.	710
WGCB	Red Lion, Pa.	1440
WGCD	Chester, S.C.	1490
WGCH	Greenwich, Conn.	1490
WGCM	Gulfport, Miss.	1240
WGEA	Geneva, Ala.	1150
WGEE	Indianapolis, Ind.	1590
WGEM	Quincy, Ill.	1440
WGET	Gettysburg, Pa.	1320
WGEZ	Beloit, Wis.	1490
WGFA	Watseka, Ill.	1360
WGFS	Covington, Ga.	1430
WGGA	Gainesville, Ga.	550
WGGG	Gainesville, Fla.	1230
WGGH	Marion, Ill.	1150
WGGO	Salamanca, N.Y.	1590
WGH	Newport News, Va.	1310
WGHB	Maplewood, Minn.	1010
WGHC	Clayton, Ga.	1570
WGHM	Skowegan, Maine	1150
WGHN	Grd. Haven, Mich.	1370
WGHQ	Kingston, N.Y.	920
WGIG	Brunswick, Ga.	1440
WGIL	Galesburg, Ill.	1400
WGIR	Manchester, N.H.	610
WGIV	Charlotte, N.C.	1600
WGKA	Atlanta, Ga.	1600
WGKR	Perry, Fla.	1310
WGKV	Charleston, W. Va.	1490
WGL	Fort Wayne, Ind.	1250
WGLB	Port Wash., Wis.	1560
WGLC	Mendota, Ill.	1090
WGLI	Babylon, N.Y.	1290
WGMA	Hollywood, Fla.	1320
WGML	Hinesville, Ga.	990
WGMM	Millington, Tenn.	1380
WGMS	Washington, D.C.	570
WGN	Chicago, Ill.	720
WGNC	Gastonia, N.C.	1450
WGNI	Wilmington, N.C.	1450
WGNP	Indian Rocks Beach, Fla.	1520
WGNS	Murfreesboro, Tenn.	1450
WGNU	Granite City, Ill.	920
WGNY	Newburgh, N.Y.	1220
WGOG	Walhalla, S. C.	1000
WGOH	Grayson, Ky.	1370
WGOK	Mobile, Ala.	900

C.L.	Location	Kc.
WGOL	Goldsboro, N.C.	1300
WGOO	Georgetown, S. C.	1470
WGOV	Valdosta, Ga.	950
WGPA	Bethlehem, Pa.	1100
WGPC	Albany, Ga.	1450
WGR	Buffalo, N.Y.	550
WGRA	Cairo, Ga.	790
WGRB	Greensburg, Ind.	1330
WGRD	Grand Rapids, Mich.	1410
WGRI	Griffin, Ga.	1410
WGRM	Greenwood, Miss.	1240
WGRO	Lake City, Fla.	960
WGRP	Greenville, Pa.	940
WGRV	Greeneville, Tenn.	1340
WGSA	Ephrata, Pa.	1310
WGSB	Geneva, Ill.	1480
WGSM	Huntington, N.Y.	740
WGSR	Millen, Ga.	1570
WGST	Atlanta, Ga.	920
WGSV	Guntersville, Ala.	1270
WGSW	Greenwood, S.C.	1350
WGTA	Summerville, Ga.	950
WGTC	Greenville, N.C.	1590
WGTL	Kannapolis, N.C.	870
WGTM	Wilson, N.C.	590
WGTN	Georgetown, S.C.	1400
WGTO	Cypress Gardens, Fla.	540
WGUL	New Port Richey, Fla.	1500
WGUN	Decatur, Ga.	1010
WGUS	North Augusta, S.C.	1380
WGUY	Bangor, Maine	1250
WGVA	Geneva, N.Y.	1240
WGVM	Greenville, Miss.	1260
WGWC	Selma, Ala.	1340
WGWR	Asheboro, N.C.	1260
WGY	Schenectady, N.Y.	810
WGYV	Greenville, Ala.	1380
WGYW	Fountain City, Tenn.	1430
WHA	Madison, Wis.	750
WHAB	Baxley, Ga.	1260
WHAG	Halfway, Md.	1410
WHAI	Greenfield, Mass.	1240
WHAK	Rogers City, Mich.	960
WHAL	Shelbyville, Tenn.	1400
WHAM	Rochester, N.Y.	1180
WHAN	Haines City, Fla.	930
WHAP	Hopewell, Va.	1340
WHAR	Clarksburg, W.Va.	1340
WHAS	Louisville, Ky.	840
WHAT	Philadelphia, Pa.	1340
WHAV	Haverhill, Mass.	1490
WHAW	Weston, W.Va.	980
WHAY	New Britain, Conn.	910
WHAZ	Troy, N.Y.	1330
WHB	Kansas City, Mo.	710
WHBB	Selma, Ala.	1490
WHBC	Canton, Ohio	1480
WHBF	Rock Island, Ill.	1270
WHBG	Harrisonburg, Va.	1360
WHBL	Sheboygan, Wis.	1330
WHBN	Harrodsburg, Ky.	1420
WHBO	Tampa, Fla.	1050
WHBQ	Memphis, Tenn.	560
WHBT	Harriman, Tenn.	1600
WHBU	Anderson, Ind.	1240
WHBY	Appleton, Wis.	1230
WHCC	Waynesville, N.C.	1400
WHCO	Sparta, Ill.	1230
WHCQ	Spartanburg, S.C.	1400
WHCU	Ithaca, N.Y.	870
WHDF	Houghton, Mich.	1400
WHDH	Boston, Mass.	850
WHDL	Olean, N.Y.	1450
WHDM	McKenzie, Tenn.	1440
WHEB	Portsmouth, N.H.	750
WHEC	Rochester, N.Y.	1460
WHEE	Martinsville, Va.	1370
WHEN	Syracuse, N.Y.	620
WHEO	Stuart, Va.	1270
WHEP	Foley, Ala.	1310
WHER	Memphis, Tenn.	1430
WHEW	Riveria Beach, Fla.	1600
WHFB	Benton Harbor-St. Joseph, Mich.	1060
WHGR	Houghton L., Mich.	1290
WHHH	Warren, Ohio	1440
WHHL	Holly Hill, S.C.	1440
WHHT	Lucedale, Miss.	1440
WHHV	Hillsville, Va.	1400
WHHY	Montgomery, Ala.	1440
WHIE	Griffin, Ga.	1320
WHIH	Portsmouth, Va.	1400
WHIL	Medford, Mass.	1430
WHIM	Providence, R.I.	1110
WHIN	Gallatin, Tenn.	1010
WHIO	Dayton, Ohio	1290
WHIP	Mooresville, N.C.	1350
WHIR	Danville, Ky.	1230
WHIS	Bluefield, W.Va.	1440
WHIT	New Bern, N.C.	1450
WHIY	Orlando, Fla.	1270
WHIZ	Zanesville, Ohio	1240
WHJB	Greensburg, Pa.	620
WHJC	Matawan, W.Va.	1360
WHK	Cleveland, Ohio	1420
WHKP	Hendersonville, N.C.	1450
WHKY	Hickory, N.C.	1290
WHLB	Virginia, Minn.	1400
WHLD	Niagara Falls, N.Y.	1270
WHLF	South Boston, Va.	1400
WHLI	Hempstead, N.Y.	1100
WHLL	Wheeling, W.Va.	1600

C.L.	Location	Kc.
WHLM	Bloomsburg, Pa.	550
WHLN	Harlan, Ky.	1410
WHLO	Akron, Ohio	640
WHLP	Centerville, Tenn.	1570
WHLS	Port Huron, Mich.	1450
WHLT	Huntington, Ind.	1300
WHMA	Anniston, Ala.	1390
WHMC	Gaithersburg, Md.	1150
WHMI	Howell, Mich.	1350
WHMP	Northampton, Mass.	1400
WHN	New York, N.Y.	1050
WHNC	Henderson, N.C.	890
WHNY	McComb, Miss.	1250
WHO	Des Moines, Iowa	1040
WHOA	San Juan, P.R.	870
WHOC	Philadelphia, Miss.	1490
WHOD	Jackson, Ala.	1290
WHOF	Canton, Ohio	1060
WHOK	Lancaster, Ohio	1320
WHOL	Allentown, Pa.	600
WHOM	New York, N.Y.	1480
WHON	Centerville, Ind.	930
WHOO	Orlando, Fla.	990
WHOP	Hopkinsville, Ky.	1230
WHOS	Decatur, Ala.	800
WHOT	Campbell, Ohio	1330
WHOU	Houlton, Maine	1340
WHOW	Clinton, Ill.	1520
WHP	Harrisburg, Pa.	580
WHPB	Belton, S.C.	1390
WHPE	High Point, N.C.	1070
WHPL	Winchester, Va.	610
WHRT	Hartselle, Ala.	860
WHRV	Ann Arbor, Mich.	1600
WHRY	Elizabethtown, Pa.	1600
WHSC	Hartsville, S.C.	1450
WHSL	Wilmington, N.C.	1490
WHSM	Hayward, Wis.	910
WHSY	Hattiesburg, Miss.	1230
WHTC	Holland, Mich.	1450
WHTG	Asbury Park-Eatontown, N.J.	1410
WHUB	Cookeville, Tenn.	1400
WHUC	Hudson, N.Y.	1230
WHUM	Reading, Pa.	1240
WHUN	Huntington, Pa.	1150
WHUT	Anderson, Ind.	1470
WHVL	Hendersonville, N.C.	1600
WHVR	Hanover, Pa.	1280
WHVW	Hyde Park, N.Y.	950
WHWB	Rutland, Vt.	1000
WHWH	Princeton, N.J.	1350
WHYE	Roanoke, Va.	910
WHYL	Carlisle, Pa.	960
WHYN	Springfield, Mass.	560
WIAC	San Juan, P.R.	740
WIAM	Williamston, N.C.	900
WIBA	Madison, Wis.	1310
WIBB	Macon, Ga.	1280
WIBC	Indianapolis, Ind.	1070
WIBG	Philadelphia, Pa.	990
WIBM	Jackson, Mich.	1450
WIBR	Baton Rouge, La.	1300
WIBU	Poynette, Wis.	1240
WIBV	Belleville, Ill.	1260
WIBW	Topeka, Kans.	580
WIBX	Utica, N.Y.	950
WICC	Bridgeport, Conn.	600
WICE	Providence, R.I.	1290
WICH	Norwich, Conn.	1310
WICK	Scranton, Pa.	1400
WICO	Salisbury, Md.	1320
WICU	Erie, Pa.	1330
WICY	Malone, N.Y.	1490
WIDE	Biddeford, Maine	1400
WIDD	Elizabethton, Tenn.	1520
WIDU	Fayetteville, N.C.	1600
WIEL	Elizabethtown, Ky.	1400
WIFE	Indianapolis, Ind.	1310
WIFM	Elkin, N.C.	1540
WIGL	Superior, Wis.	970
WIGM	Medford, Wis.	1490
WIGS	Gouverneur, N.Y.	1230
WIII	Homestead, Fla.	1430
WIIN	Atlanta, Ga.	970
WIKC	Bogalusa, La.	1490
WIKE	Newport, Vt.	1490
WIKI	Chester, Va.	1410
WIKY	Evansville, Ind.	820
WIL	St. Louis, Mo.	1430
WILA	Danville, Va.	1580
WILD	Boston, Mass.	1090
WILE	Cambridge, Ohio	1270
WILI	Willimantic, Conn.	1400
WILK	Wilkes-Barre, Pa.	980
WILL	Urbana, Ill.	580
WILM	Wilmington, Del.	1450
WILO	Frankfort, Ind.	1570
WILS	Lansing, Mich.	1320
WILZ	St. Petersburg Beach, Florida	1590
WIMA	Lima, Ohio	1150
WIMO	Winder, Ga.	1300
WIMS	Michigan City, Ind.	1420
WINA	Charlottesville, Va.	1400
WINC	Winchester, Va.	1400
WIND	Chicago, Ill.	560
WINE	Brookfield, Conn.	940
WINF	Manchester, Conn.	1230
WING	Dayton, Ohio	1410
WINI	Murphysboro, Ill.	1420
WINK	Fort Myers, Fla.	1240
WINN	Louisville, Ky.	1240
WINQ	Tampa, Fla.	1010
WINR	Binghamton, N.Y.	680
WINS	New York, N.Y.	1010
WINT	Winter Haven, Fla.	1360
WINU	Highland Park, Ill.	1510
WINX	Rockville, Md.	1600
WINY	Putnam, Conn.	1350
WINZ	Miami, Fla.	940
WINU	Highland, Ill.	1510
WINW	Canton, Ohio	1520
WIOD	Miami, Fla.	610
WIOI	New Boston, Ohio	1010
WIOK	Normal, Ill.	1440
WION	Ionia, Mich.	1430
WIOS	Tawas City, Mich.	1480
WIOU	Kokomo, Ind.	1350
WIP	Philadelphia, Pa.	610
WIPC	Lake Wales, Fla.	1280
WIPR	San Juan, P.R.	940
WIPS	Ticonderoga, N.Y.	1250
WIRA	Ft. Pierce, Fla.	1400
WIRB	Enterprise, Ala.	600
WIRC	Hickory, N.C.	630
WIRD	Lake Placid, N.Y.	920
WIRE	Indianapolis, Ind.	1430
WIRJ	Humboldt, Tenn.	740
WIRK	W. Palm Beach, Fla.	1290
WIRL	Peoria, Ill.	1290
WIRO	Ironton, Ohio	1230
WIRV	Irvine, Ky.	1550
WIRY	Plattsburg, N.Y.	1340
WIS	Columbia, S.C.	560
WISA	Isabella, P.R.	1390
WISE	Asheville, N.C.	1310
WISK	Americus, Ga.	1390
WISL	Shamokin, Pa.	1480
WISM	Madison, Wis.	1480
WISN	Milwaukee, Wis.	1130
WISO	Ponce, P.R.	1260
WISP	Kinston, N.C.	1230
WISR	Butler, Pa.	680
WIST	Charlotte, N.C.	1240
WISV	Viroqua, Wis.	1360
WISZ	Glen Burnie, Md.	1590
WITA	San Juan, P.R.	1140
WITH	Baltimore, Md.	1230
WITL	Lansing, Mich.	1010
WITN	Washington, N.C.	930
WITY	Danville, Ill.	980
WITZ	Jasper, Ind.	990
WIVE	Ashland, Va.	1430
WIVI	Christiansted, V.I.	970
WIVK	Knoxville, Tenn.	860
WIVV	Vieques, P.R.	1370
WIVY	Jacksonville, Fla.	1050
WIXK	New Richmond, Wis.	1590
WIXN	Dixon, Ill.	1460
WIXX	Oakland Park, Fla.	1520
WIYN	Rome, Ga.	1360
WIZE	Springfield, Ohio	1340
WIZS	Henderson, N.C.	1450
WIZZ	Streator, Ill.	1250
WJAB	Westbrook, Me.	1440
WJAC	Johnstown, Pa.	850
WJAG	Norfolk, Nebr.	780
WJAK	Jackson, Tenn.	1460
WJAM	Marion, Ala.	1310
WJAN	Ishpeming, Mich.	970
WJAR	Providence, R.I.	920
WJAS	Pittsburgh, Pa.	1320
WJAT	Swainsboro, Ga.	800
WJAX	Jacksonville, Fla.	930
WJAY	Mullins, S.C.	1280
WJAZ	Albany, Ga.	960
WJBB	Haleyville, Ala.	1230
WJBC	Bloomington, Ill.	1230
WJBD	Salem, Ill.	1350
WJBK	Detroit, Mich.	1500
WJBL	Holland, Mich.	1260
WJBM	Jerseyville, Ill.	1480
WJBO	Baton Rouge, La.	1150
WJBS	DeLand, Fla.	1490
WJCD	Seymour, Ind.	1390
WJCM	Sebring, Fla.	960
WJCO	Jackson, Mich	1510
WJCW	Johnson City, Tenn.	910
WJDA	Quincy, Mass.	1300
WJDB	Thomasville, Ala.	630
WJDX	Jackson, Miss.	620
WJDY	Salisbury, Md.	1470
WJEF	Grand Rapids, Mich.	1230
WJEH	Gallipolis, Ohio	990
WJEJ	Hagerstown, Md.	1240
WJEM	Valdosta, Ga.	1150
WJER	Dover, Ohio	1450
WJES	Johnston, S.C.	1570
WJET	Erie, Pa.	1400
WJFC	Jefferson City, Tenn.	1480
WJHO	Opelika, Ala.	1400
WJIG	Tullahoma, Tenn.	740
WJIL	Jacksonville, Ill.	1550
WJIM	Lansing, Mich.	1240
WJJC	Commerce, Ga.	1270
WJJD	Chicago, Ill.	1160
WJJJ	Christiansburg, Va.	1260
WJJL	Niagara Falls, N.Y.	1440
WJJM	Lewisburg, Tenn.	1490
WJJZ	Mount Holly, N.J.	1460
WJLB	Detroit, Mich.	1400
WJLD	Homewood, Ala.	1400
WJLE	Smithville, Tenn.	1480
WJLS	Beckley, W.Va.	560
WJMA	Orange, Va.	1340
WJMB	Brookhaven, Miss.	1340
WJMC	Rice Lake, Wis.	1240
WJMO	Cleveland Hgts., Ohio	1490
WJMS	Ironwood, Mich.	630
WJMW	Athens, Ala.	730
WJMX	Florence, S.C.	970
WJNC	Jacksonville, N.C.	1240
WJNO	W. Palm Beach, Fla.	1230
WJOB	Hammond, Ind.	1230
WJOE	Port Joe, Fla.	1080
WJOI	Florence, Ala.	1340
WJOL	Joliet, Ill.	1340
WJON	St. Cloud, Minn.	1240
WJOR	South Haven, Mich.	940
WJOT	Lake City, S.C.	1260
WJOY	Burlington, Vt.	1230
WJPA	Washington, Pa.	1450
WJPD	Ishpeming, Mich.	1240
WJPF	Herrin, Ill.	1340
WJPG	Green Bay, Wis.	1440
WJPR	Greenville, Miss.	1330
WJPS	Evansville, Ind.	1330
WJPW	Rockford, Mich.	810
WJQS	Jackson, Miss.	1400
WJR	Detroit, Mich.	760
WJRC	Joliet, Ill.	1510
WJRD	Tuscaloosa, Ala.	1150
WJRI	Lenoir, N.C.	1340
WJRL	Rockford, Ill.	1150
WJRM	Troy, N.C.	1390
WJRZ	Newark, N.J.	970
WJSB	Crestview, Fla.	1050
WJSO	Jonesboro, Tenn.	1590
WJTN	Jamestown, N.Y.	1240
WJTO	Bath, Me.	730
WJUD	St. Johns, Mich.	1580
WJUN	Mexico, Pa.	1220
WJVA	South Bend, Ind.	1580
WJW	Cleveland, Ohio	850
WJWL	Georgetown, Del.	900
WJWS	South Hill, Va.	1370
WJWT	Demopolis, Ala.	1350
WJXN	Jackson, Miss.	1450
WJZM	Clarksville, Tenn.	1400
WKAC	Athens, Ala.	1080
WKAI	Macomb, Ill.	1510
WKAJ	Saratoga Springs, N.Y.	900
WKAL	Rome, N.Y.	1450
WKAM	Goshen, Ind.	1460
WKAN	Kankakee, Ill.	1320
WKAP	Allentown, Pa.	1320
WKAQ	San Juan, P.R.	580
WKAR	East Lansing, Mich.	870
WKAT	Miami Beach, Fla.	1360
WKAY	Glasgow, Ky.	1490
WKAZ	Charleston, W.Va.	950
WKBA	Vinton, Va.	1550
WKBC	N. Wilkesboro, N.C.	810
WKBH	La Crosse, Wis.	1410
WKBJ	Milan, Tenn.	1600
WKBK	Keene, N.H.	1220
WKBL	Covington, Tenn.	1250
WKBN	Youngstown, Ohio	570
WKBO	Harrisburg, Pa.	1230
WKBR	Manchester, N.H.	1250
WKBV	Richmond, Ind.	1490
WKBW	Buffalo, N.Y.	1520
WKBX	Winston-Salem, N.C.	1500
WKBZ	Muskegon, Mich.	850
WKCT	Bowling Green, Ky.	930
WKCW	Warrenton, Va.	1420
WKDA	Nashville, Tenn.	1240
WKDE	Altavista, Va.	1280
WKDK	Newberry, S.C.	1240
WKDL	Clarksdale, Miss.	1600
WKDN	Camden, N.J.	800
WKDX	Hamlet, N.C.	1250
WKEE	Huntington, W.Va.	800
WKEI	Kewanee, Ill.	1450
WKEN	Dover, Del.	1600
WKER	Pompton Lakes, N.J.	1500
WKEU	Griffin, Ga.	1450
WKEY	Covington, Va.	1340
WKFD	Wickford, R.I.	1370
WKFE	Yauco, P.R.	1550
WKFR	Battle Creek, Mich.	1400
WKGN	Knoxville, Tenn.	1340
WKHM	Jackson, Mich.	970
WKIC	Hazard, Ky.	1390
WKID	Urbana, Ill.	1580
WKIG	Glenville, Ga.	1580
WKIK	Leonardtown, Md.	1370
WKIN	Kingsport, Tenn.	1320
WKIP	Poughkeepsie, N.Y.	1450
WKIS	Orlando, Fla.	740
WKIX	Raleigh, N.C.	850
WKIZ	Key West, Fla.	1500
WKJB	Mayaguez, P.R.	710
WKJG	Fort Wayne, Ind.	1380
WKJK	Granite Falls, N.C.	1580
WKJR	Muskegon, Mich.	1520
WKKD	Aurora, Ill.	1580
WKKO	Cocoa, Fla.	860
WKKS	Vanceburg, Ky.	1570
WKLA	Ludington, Mich.	1450
WKLC	St. Albans, W.Va.	1300
WKLE	Washington, Ga.	1370
WKLF	Clanton, Ala.	980
WKLK	Cloquet, Minn.	1230
WKLM	Wilmington, N.C.	980
WKLO	Louisville, Ky.	1080
WKLP	Keyser, W. Va.	1390
WKLV	Blackstone, Va.	1440
WKLX	Paris, Ky.	1440
WKLY	Hartwell, Ga.	980
WKLZ	Kalamazoo, Mich.	1470
WKMC	Roaring Sprgs., Pa.	1370
WKMF	Flint, Mich.	1470
WKMI	Kalamazoo, Mich.	1360
WKMK	Blountstown, Fla.	1370
WKMT	Kings Mtn., N.C.	1220
WKNE	Keene, N.H.	1290
WKNR	Dearborn, Mich.	1310
WKNT	Kent, Ohio	1520
WKNX	Saginaw, Mich.	1210
WKNY	Kingston, N.Y.	1490
WKOA	Hopkinsville, Ky.	1480
WKOK	Sunbury, Pa.	1070
WKOP	Binghamton, N.Y.	1360
WKOS	Ocala, Fla.	1370
WKOV	Wellston, Ohio	1330
WKOW	Madison, Wis.	1070
WKOX	Framingham, Mass.	1190
WKOY	Bluefield, W.Va.	1240
WKOZ	Kosciusko, Miss.	1350
WKPA	New Kensington, Pa.	1150
WKPR	Kalamazoo, Mich.	1420
WKPT	Kingsport, Tenn.	1400
WKQV	Sullivan, Ind.	1550
WKRC	Cincinnati, Ohio	550
WKRG	Mobile, Ala.	710
WKRK	Murphy, N.C.	1320
WKRM	Columbia, Tenn.	1340
WKRO	Cairo, Ill.	1490
WKRS	Waukegan, Ill.	1220
WKRT	Cortland, N.Y.	920
WKRW	Cartersville, Ga.	
WKRZ	Oil City, Pa.	1340
WKSB	Milford, Del.	930
WKSC	Kershaw, S.C.	1300
WKSK	W. Jefferson, N.C.	1600
WKSN	Jamestown, N.Y.	1340
WKSR	Pulaski, Tenn.	1420
WKST	New Castle, Pa.	1280
WKTC	Charlotte, N.C.	1310
WKTG	Thomasville, Ga.	730
WKTJ	Farmington, Maine	1380
WKTQ	South Paris, Maine	1450
WKTS	Sheboygan, Wis.	950
WKTX	Atlantic Beach, Fla.	1600
WKTY	LaCrosse, Wis.	580
WKUL	Cullman, Ala.	1340
WKVA	Lewistown, Pa.	920
WKVK	Virginia Beach, Va.	1550
WKVM	San Juan, P.R.	810
WKVT	Brattleboro, Vt.	1490
WKWF	Key West, Fla.	1600
WKWK	Wheeling, W.Va.	1400
WKWS	Rocky Mount, Va.	1290
WKXL	Concord, N.H.	1450
WKXV	Knoxville, Tenn.	900
WKXY	Sarasota, Fla.	930
WKY	Oklahoma City, Okla.	930
WKYE	Bristol, Tenn.	1550
WKYF	Greenville, Ky.	1600
WKYN	Rio Piedras, P.R.	630
WKYO	Caro, Mich.	1360
WKYR	Keyser, W.Va.	1270
WKYW	Louisville, Ky.	900
WKYX	Paducah, Ky.	570
WKZI	Casey, Ill.	800
WKZO	Kalamazoo, Mich.	590
WLAC	Nashville, Tenn.	1510
WLAD	Danbury, Conn.	800
WLAF	LaFollette, Tenn.	1450
WLAG	La Grange, Ga.	1240
WLAK	Lakeland, Fla.	1430
WLAM	Lewiston, Maine	1470
WLAN	Lancaster, Pa.	1390
WLAP	Lexington, Ky.	630
WLAQ	Rome, Ga.	1410
WLAR	Athens, Tenn.	1450
WLAS	Jacksonville, N.C.	910
WLAT	Conway, S.C.	1330
WLAU	Laurel, Miss.	1600
WLAV	Grand Rapids, Mich.	1340
WLAW	Lawrenceville, Ga.	1360
WLAY	Muscle Shoals, Ala.	1450
WLBA	Gainesville, Ga.	1580
WLBB	Carrollton, Ga.	1100
WLBC	Muncie, Ind.	1340
WLBE	Leesburg, Fla.	790
WLBG	Laurens, S.C.	860
WLBH	Mattoon, Ill.	1170
WLBI	Denham Springs, La.	1220
WLBJ	Bowling Green, Ky.	1410
WLBK	DeKalb, Ill.	1360
WLBL	Auburndale, Wis.	930
WLBN	Lebanon, Ky.	1590
WLBR	Lebanon, Pa.	1280
WLBS	Centerville, Miss.	1580
WLBZ	Bangor, Maine	620
WLCB	Moulton, Ala.	1530
WLCK	Scottsville, Ky.	1250
WLCM	Lancaster, S.C.	1360
WLCN	Laurensburg, N.C.	1300
WLCO	Eustis, Fla.	1240
WLCS	Baton Rouge, La.	910
WLCX	LaCrosse, Wis.	1490
WLCY	St. Petersburg, Fla.	1380
WLDB	Atlantic City, N.J.	1490
WLDS	Jacksonville, Ill.	1180
WLDY	Ladysmith, Wis.	1340
WLEA	Hornell, N.Y.	1480
WLEC	Sandusky, Ohio	1450

WHITE'S RADIO LOG

C.L.	Location	Kc.
WLEE	Richmond, Va.	1480
WLEF	Greenwood, Miss.	1540
WLEM	Emporium, Pa.	1240
WLES	Lawrenceville, Va.	580
WLET	Toccoa, Ga.	1420
WLEW	Bad Axe, Mich.	1340
WLFA	Lafayette, Ga.	1590
WLFH	Little Falls, N.Y.	1230
WLIB	New York, N.Y.	1190
WLIJ	Shelbyville, Tenn.	1580
WLIK	Newport, Tenn.	1270
WLIL	Lenoir City, Tenn.	730
WLIP	Kenosha, Wis.	1050
WLIQ	Mobile, Ala.	1360
WLIS	Old Saybrook, Conn.	1420
WLIV	Livingston, Tenn.	920
WLIZ	Lake Worth, Fla.	1380
WLKM	Three Rivers, Mich.	1510
WLKN	Lincoln, Me.	1450
WLKW	Providence, R.I.	990
WLLE	Raleigh, N.C.	570
WLLH	Lowell, Mass.	1400
WLLI	Brookneal, Va.	1230
WLLY	Wilson, N.C.	1350
WLMD	Laurel, Md.	900
WLNC	Laurinburg, N.C.	1300
WLMJ	Jackson, Ohio	1280
WLNA	Peekskill, N.Y.	1420
WLNG	Sag Harbor, N.Y.	1600
WLNH	Laconia, N.H.	1350
WLOA	Braddock, Pa.	1550
WLOB	Portland, Maine	1310
WLOC	Munfordville, Ky.	1150
WLOD	Pompano Beach, Fla.	980
WLOE	Leaksville, N.C.	1490
WLOF	Orlando, Fla.	950
WLOG	Logan, W.Va.	1230
WLOH	Princeton, W.Va.	1490
WLOI	LaPorte, Ind.	1540
WLOK	Memphis, Tenn.	1340
WLOL	Minneapolis, Minn.	1330
WLON	Lincolnton, N.C.	1050
WLOR	Thomasville, Ga.	730
WLOS	Asheville, N.C.	1380
WLOU	Louisville, Ky.	1350
WLOW	Aiken, S.C.	1300
WLOX	Biloxi, Miss.	1490
WLPM	Suffolk, Va.	1460
WLPO	LaSalle, Ill.	1220
WLPS	Lehighton, Pa.	1150
WLRC	Whitehall, Mich.	1490
WLS	Chicago, Ill.	890
WLSB	Copper Hill, Tenn.	1400
WLSC	Loris, S.C.	1570
WLSD	Big Stone Gap, Va.	1220
WLSE	Wallace, N.C.	1400
WLSH	Lansford, Pa.	1410
WLSI	Pikeville, Ky.	900
WLSM	Louisville, Miss.	1270
WLST	Escanaba, Mich.	600
WLSV	Wellsville, N.Y.	790
WLTC	Gastonia, N.C.	1370
WLTH	Gary, Ind.	1370
WLTN	Littleton, N. H.	1400
WLUV	Loves Park, Ill.	1520
WLVA	Lynchburg, Va.	590
WLUX	Baton Rouge, La.	1550
WLW	Cincinnati, Ohio	700
WLWO	(V.O.A.) Marathon, Fla.	1040
WLWO	(V.O.A.) Marathon, Fla.	1180
WLYB	Albany, Ga.	1250
WLYC	Williamsport, Pa.	1050
WLYN	Lynn, Mass.	1360
WLYO	New Orleans, La.	940
WMAB	Munising, Mich.	1400
WMAC	Netter, Ga.	1360
WMAD	Madison, Wis.	1550
WMAF	Madison, Fla.	1230
WMAG	Forest, Miss.	860
WMAJ	State College, Pa.	1450
WMAK	Nashville, Tenn.	1300
WMAL	Washington, D.C.	630
WMAM	Marinette, Wis.	570
WMAN	Mansfield, Ohio	1400
WMAP	Monroe, N.C.	1060
WMAQ	Chicago, Ill.	670
WMAS	Springfield, Mass.	1450
WMAT	Lansing, Mich.	1010
WMAX	Grand Rapids, Mich.	1480
WMAY	Springfield, Ill.	970
WMAZ	Macon, Ga.	940
WMBA	Ambridge, Pa.	1460
WMBC	Macon, Miss.	1400
WMBD	Peoria, Ill.	1470
WMBG	Richmond, Va.	1380
WMBH	Joplin, Mo.	1450
WMBI	Chicago, Ill.	1110
WMBL	Morehead City, N.C.	740
WMBM	Miami Beach, Fla.	1490
WMBN	Petoskey, Mich.	1340
WMBO	Auburn, N.Y.	1340
WMBR	Jacksonville, Fla.	1460
WMBS	Uniontown, Pa.	590
WMBT	Shenandoah, Pa.	1530
WMC	Memphis, Tenn.	790
WMCA	New York, N.Y.	570
WMCH	Church Hill, Tenn.	1260
WMCK	McKeesport, Pa.	1360
WMCP	Columbia, Tenn.	1280
WMCR	Oneida, N.Y.	1600
WMCW	Harvard, Ill.	1600
WMDC	Hazlehurst, Miss.	1220
WMDD	Fajardo, P.R.	1480
WMDN	Midland, Mich.	1490
WMEG	Eau Gallie, Fla.	920
WMEK	Chase City, Va.	980
WMEL	Pensacola, Fla.	610
WMEN	Tallahassee, Fla.	1330
WMEV	Marion, Va.	1010
WMEX	Boston, Mass.	1510
WMFC	Monroeville, Ala.	1360
WMFD	Wilmington, N.C.	630
WMFG	Hibbing, Minn.	1240
WMFJ	Daytona Beach, Fla.	1450
WMFR	High Point, N.C.	1230
WMGA	Moultrie, Ga.	1400
WMGR	Bainbridge, Ga.	930
WMGS	Bowling Green, Ohio	730
WMGW	Meadville, Pa.	1490
WMGY	Montgomery, Ala.	800
WMID	Atlantic City, N.J.	1340
WMIE	Miami, Fla.	1140
WMIK	Middlesboro, Ky.	560
WMIL	Milwaukee, Wis.	1290
WMIN	Mpls.-St. Paul, Minn.	1400
WMIQ	Iron Mountain, Mich.	1450
WMIR	Lake Geneva, Wis.	1550
WMIS	Natchez, Miss.	1240
WMIX	Mt. Vernon, Ill.	940
WMJM	Cordele, Ga.	1490
WMKR	Millinocket, Me.	1240
WMLF	Pineville, Ky.	1230
WMLO	Beverly, Mass.	1570
WMLS	Sylacauga, Ala.	1290
WMLT	Dublin, Ga.	1330
WMMB	Melbourne, Fla.	1240
WMMH	Marshall, N.C.	1460
WMMJ	Lancaster, N.Y.	1300
WMMM	Westport, Conn.	1260
WMMN	Fairmont, W.Va.	920
WMMW	Meriden, Conn.	1470
WMNA	Gretna, Va.	730
WMNB	No. Adams, Mass.	1230
WMNC	Morganton, N.C.	1430
WMNE	Menomonie, Wis.	1360
WMNI	Columbus, Ohio	920
WMNS	Olean, N.Y.	1360
WMNT	Manati, P.R.	1500
WMNZ	Montezuma, Ga.	1050
WMOA	Marietta, Ohio	1490
WMOC	Chattanooga, Tenn.	1450
WMOG	Brunswick, Ga.	1490
WMOH	Hamilton, Ohio	1450
WMOK	Metropolis, Ill.	920
WMON	Montgomery, W.Va.	1340
WMOO	Mobile, Ala.	1550
WMOP	Ocala, Fla.	900
WMOR	Morehead, Ky.	1330
WMOU	Berlin, N.H.	1230
WMOV	Ravenswood, W.Va.	1360
WMOX	Meridian, Miss.	1240
WMOZ	Mobile, Ala.	960
WMPA	Aberdeen, Miss.	1240
WMPC	Lapeer, Mich.	1230
WMPL	Hancock, Mich.	920
WMPM	Smithfield, N.C.	1270
WMPO	Middleport-Pomeroy, Ohio	1390
WMPP	Chicago Heights, Ill.	1470
WMPS	Memphis, Tenn.	680
WMPT	So. Williamsport, Pa.	1450
WMQM	Memphis, Tenn.	1480
WMRB	Greenville, S.C.	1490
WMRC	Milford, Mass.	1490
WMRE	Monroe, Ga.	1490
WMRF	Lewistown, Pa.	1490
WMRI	Marion, Ind.	860
WMRN	Marion, Ohio	1490
WMRO	Aurora, Ill.	1280
WMRP	Flint, Mich.	1570
WMRR	Marshall, Mich.	1540
WMSA	Massena, N.Y.	1340
WMSG	Oakland, Md.	1050
WMSJ	Sylva, N.C.	1480
WMSK	Morganfield, Ky.	1550
WMSL	Decatur, Ala.	1400
WMSR	Manchester, Tenn.	1320
WMST	Mt. Sterling, Ky.	1150
WMT	Cedar Rapids, Iowa	600
WMTA	Central City, Ky.	1380
WMTC	Vancleve, Ky.	730
WMTD	Hinton, W. Va.	1380
WMTE	Manistee, Mich.	1340
WMTL	Leitchfield, Ky.	1580
WMTM	Moultrie, Ga.	1300
WMTN	Morristown, Tenn.	1300
WMTR	Morristown, N.J.	1250
WMTS	Murfreesboro, Tenn.	810
WMUS	Muskegon, Mich.	1090
WMUU	Greenville, S.C.	1260
WMVA	Martinsville, Va.	1450
WMVB	Millville, N.J.	1440
WMVG	Milledgeville, Ga.	1450
WMVO	Mt. Vernon, Ohio	1300
WMVR	Sidney, Ohio	1080
WMWM	Wilmington, O.	1090
WMYB	Myrtle Beach, S.C.	1450
WMYN	Mayodan, N.C.	1420
WMYR	Ft. Myers, Fla.	1410
WNAB	Bridgeport, Conn.	1450
WNAC	Boston, Mass.	680
WNAD	Norman, Okla.	640
WNAE	Warren, Pa.	1310
WNAG	Grenada, Miss.	1400
WNAH	Nashville, Tenn.	1360
WNAK	Nanticoke, Pa.	730
WNAM	Neenah, Wis.	1280
WNAR	Norristown, Pa.	1110
WNAT	Natchez, Miss.	1450
WNAU	New Albany, Miss.	1470
WNAV	Annapolis, Md.	1430
WNAX	Yankton, S.Dak.	570
WNBC	New York, N.Y.	660
WNBF	Binghamton, N.Y.	1290
WNBH	New Bedford, Mass.	1340
WNBP	Newburyport, Mass.	1470
WNBS	Murray, Ky.	1340
WNBT	Wellsboro, Pa.	1490
WNBZ	Saranac Lake, N.Y.	1240
WNCA	Siler City, N.C.	1570
WNCC	Barnesboro, Pa.	950
WNCG	N. Charleston, S.C.	910
WNCO	Ashland, Ohio	1340
WNCT	Greenville, N. C.	1590
WNDB	Daytona Beach, Fla.	1150
WNDR	Syracuse, N.Y.	1260
WNDU	South Bend, Ind.	1490
WNEB	Worcester, Mass.	1230
WNEG	Taccoa, Ga.	630
WNER	Live Oak, Fla.	1250
WNES	Central City, Ky.	1050
WNEW	New York, N.Y.	1130
WNEX	Macon, Ga.	1400
WNGA	Nashville, Ga.	1600
WNGO	Mayfield, Ky.	1320
WNHC	New Haven, Conn.	1340
WNIA	Cheektowaga, N.Y.	1230
WNIK	Arecibo, P.R.	1230
WNIL	Niles, Mich.	1290
WNIO	Niles, Ohio	1540
WNJH	Hammonton, N.J.	1580
WNJR	Newark, N.J.	1430
WNKY	Neon, Ky.	1480
WNLC	New London, Conn.	1510
WNLK	Norwalk, Conn.	1350
WNMP	Evanston, Ill.	1590
WNNC	Newton, N.C.	1230
WNNJ	Newton, N.J.	1360
WNNR	New Orleans, La.	990
WNNT	Warsaw, Va.	690
WNOE	New Orleans, La.	1060
WNOG	Naples, Fla.	1270
WNOH	Raleigh, N. C.	1550
WNOK	Columbia, S.C.	1230
WNOO	Chattanooga, Tenn.	1260
WNOP	No. Platte, Neb.	1410
WNOR	Norfolk, Va.	1230
WNOS	High Point, N.C.	1590
WNOW	York, Pa.	1250
WNOX	Knoxville, Tenn.	990
WNPS	New Orleans, La.	1450
WNPT	Tuscaloosa, Ala.	1280
WNPV	Lansdale, Pa.	1440
WNRG	Grundy, Va.	940
WNRI	Woonsocket, R.I.	1380
WNRK	Newark, Del.	1260
WNRV	Narrows, Va.	990
WNSL	Laurel, Miss.	1260
WNSM	Valparaiso-Niceville, Florida	1340
WNTT	Tazewell, Tenn.	1250
WNUE	Ft. Walton Bch., Fla.	1400
WNUS	Chicago, Ill.	1390
WNUW	New Albany, Ind.	1570
WNUZ	Talladega, Ala.	1230
WNVA	Norton, Va.	1350
WNVL	Nicholasville, Ky.	1250
WNVY	Pensacola, Fla.	1230
WNXT	Portsmouth, Ohio	1260
WNYC	New York, N.Y.	830
WOAI	San Antonio, Tex.	1200
WOAP	Owosso, Mich.	1080
WOAY	Oak Hill, W.Va.	860
WOBS	Jacksonville, Fla.	1360
WOBT	Rhinelander, Wis.	1240
WOC	Davenport, Iowa	1420
WOCB	W. Yarmouth, Mass.	1240
WOCH	North Vernon, Ind.	1460
WOCK	Okeechobee, Fla.	1570
WODY	Bassett, Va.	900
WOGA	Sylvester, Ga.	1540
WOHI	E. Liverpool, Ohio	1490
WOHO	Toledo, Ohio	1470
WOHP	Bellefontaine, Ohio	1390
WOHS	Shelby, N.C.	730
WOI	Ames, Iowa	640
WOIB	Saline, Mich.	1290
WOIC	Columbia, S.C.	1320
WOKA	Douglas, Ga.	1310
WOKB	Winter Garden, Fla	1600
WOKE	Charleston, S.C.	1340
WOKK	Meridian, Miss.	1450
WOKO	Albany, N.Y.	1460
WOKS	Columbus, Ga.	1340
WOKW	Brockton, Mass.	1410
WOKY	Milwaukee, Wis.	920
WOKZ	Alton, Ill.	1570
WOL	Washington, D.C.	1450
WOLD	Marion, Va.	1330
WOLF	Syracuse, N.Y.	1490
WOLS	Florence, S. C.	1230
WOMI	Owensboro, Ky.	1490
WOMN	Decatur, Ga.	1310
WOMP	Bellaire, Ohio	1290
WOMT	Manitowoc, Wis.	1240
WONA	Winona, Miss.	1570
WOND	Pleasantville, N.J.	1400
WONE	Dayton, Ohio	980
WONN	Lakeland, Fla.	1230
WONS	Tallahassee, Fla.	1410
WONW	Defiance, Ohio	1280
WOOD	Grand Rapids, Mich.	1300
WOOF	Dothan, Ala.	560
WOOK	Washington, D.C.	1340
WOOO	Deland, Fla.	1310
WOOW	Greenville, N.C.	1340
WOPA	Oak Park, Ill.	1490
WOPI	Bristol, Tenn.	1490
WOR	New York, N.Y.	710
WORA	Mayaguez, P.R.	760
WORC	Worcester, Mass.	1310
WORD	Spartanburg, S.C.	910
WORG	Orangeburg, S.C.	1580
WORK	York, Pa.	1350
WORL	Boston, Mass.	950
WORM	Savannah, Tenn.	1010
WORT	New Smyrna Beach, Florida	1550
WORX	Madison, Ind.	1270
WOSC	Fulton, N.Y.	1300
WOSH	Oshkosh, Wis.	1490
WOSL	Kissimmee, Fla.	1220
WOSU	Columbus, Ohio	820
WOTR	Corry, Pa.	1370
WOTT	Watertown, N.Y.	1410
WOTW	Nashua, N.H.	900
WOUB	Athens, Ohio	1340
WOVE	Welch, W.Va.	1340
WOW	Omaha, Nebr.	590
WOWL	Florence, Ala.	1240
WOWO	Ft. Wayne, Ind.	1190
WOWW	Naugatuck, Conn.	860
WOWY	Clewiston, Fla.	500d
WOXF	Oxford, N.C.	1340
WOZK	Ozark, Ala.	900
WPAB	Ponce, P.R.	550
WPAC	Patchogue, N.Y.	1580
WPAD	Paducah, Ky.	1450
WPAG	Ann Arbor, Mich.	1050
WPAL	Charleston, S.C.	730
WPAM	Pottsville, Pa.	1450
WPAP	Fernandina Beach, Florida	1570
WPAQ	Mount Airy, N.C.	740
WPAR	Parkersburg, W.Va.	1450
WPAT	Paterson, N.J.	930
WPAX	Thomasville, Ga.	1240
WPAY	Portsmouth, Ohio	1400
WPAZ	Pottstown, Pa.	1370
WPBC	Minneapolis, Minn.	980
WPCC	Clinton, S.C.	1400
WPCF	Panama City, Fla.	1430
WPCO	Mt. Vernon, Ind.	1590
WPDF	Corydon, Ind.	1550
WPDM	Potsdam, N.Y.	1470
WPDQ	Jacksonville, Fla.	600
WPDR	Portage, Wis.	1350
WPOX	Clarksburg, W.Va.	750
WPEG	Winston-Salem, N.C.	1550
WPEH	Louisville, Ga.	1420
WPEL	Montrose, Pa.	1250
WPEN	Philadelphia, Pa.	950
WPEO	Peoria, Ill.	1020
WPEP	Taunton, Mass.	1570
WPET	Greensboro, N.C.	950
WPFB	Middletown, Ohio	910
WPFE	Eastman, Ga.	1580
WPFP	Park Falls, Wis.	1450
WPGA	Perry, Ga.	980
WPGC	Bradbury Hghts., Md.	1580
WPGF	Burgaw, N. C.	1470
WPGM	Danville, Pa.	1570
WPGW	Portland, Ind.	1440
WPHB	Philipsburg, Pa.	1260
WPHC	Waverly, Tenn.	1540
WPHN	Liberty, Ky.	1560
WPIC	Sharon, Pa.	790
WPID	Piedmont, Ala.	1280
WPIK	Alexandria, Va.	730
WPIN	St. Petersburg, Fla.	680
WPIT	Pittsburgh, Pa.	730
WPKE	Pikeville, Ky.	1240
WPKO	Waverly, Ohio	1380
WPKY	Princeton, Ky.	1580
WPLA	Plant City, Fla.	910
WPLB	Greenville, Mich.	1380
WPLK	Rockmart, Ga.	1220
WPLM	Plymouth, Mass.	1390
WPLO	Atlanta, Ga.	590
WPLY	Plymouth, Wis.	1420
WPMB	Vandalia, Ill.	1500
WPME	Punxsutawney, Pa.	1540
WPMH	Portsmouth, Va.	1010
WPMP	Pascagoula, Miss.	1580
WPNC	Plymouth, N.C.	1470
WPNF	Brevard, N.C.	1240
WPNH	Plymouth, N. H.	1300
WPNX	Columbus, Ga.	1460

C.L.	Location	Kc.
WPON	Pontiac, Mich.	1460
WPOP	Hartford, Conn.	1410
WPOR	Portland, Maine	1490
WPOW	New York, N.Y.	1330
WPPA	Pottsville, Pa.	1360
WPRA	Mayaguez, P.R.	990
WPRC	Lincoln, Ill.	1370
WPRE	Prairie Du Chien, Wis.	980
WPRN	Butler, Ala.	1240
WPRO	Providence, R.I.	630
WPRP	Ponce, P.R.	910
WPRS	Paris, Ill.	1440
WPRT	Prestonsburg, Ky.	960
WPRV	Wauchula, Fla.	1600
WPRW	Manassas, Va.	1460
WPRY	Perry, Fla.	1400
WPSL	Monroeville, Pa.	1510
WPTF	Raleigh, N.C.	680
WPTL	Canton, N.C.	920
WPTN	Cookeville, Tenn.	1500
WPTR	Albany, N.Y.	1540
WPTS	Pittston, Pa.	1540
WPTW	Piqua, Ohio	1570
WPTX	Lexington Pk., Md.	920
WPUV	Pulaski, Va.	1580
WPVA	Colonial Hghts., Va.	1290
WPVL	Painesville, Ohio	1460
WPXE	Starke, Fla.	1490
WPXY	Greenville, N. C.	1550
WPYB	Benson, N.C.	1580
WQAM	Miami, Fla.	560
WQBC	Vicksburg, Miss.	1420
WQDY	Calais, Maine	1230
WQIC	Meridian, Miss.	1390
WQIK	Jacksonville, Fla.	1280
WQIZ	St. George, S. C.	1300
WQMN	Superior, Wis.	1320
WQMR	Silver Spring, Md.	1050
WQOK	Greenville, S.C.	1440
WQSN	Charleston, S.C.	1450
WQSR	Solvay, N.Y.	1320
WQTE	Monroe, Mich.	560
WQTW	Latrobe, Pa.	1570
WQTY	Arlington, Fla.	1220
WQUA	Moline, Ill.	1230
WQVA	Quantico, Va.	1530
WQXI	Atlanta, Ga.	790
WQXL	Columbia, S.C.	1320
WQXQ	Ormond Bch., Fla.	1380
WQXR	New York, N.Y.	1560
WQXT	Palm Beach, Fla.	1340
WRAA	Luray, Va.	1330
WRAB	Arab, Ala.	1380
WRAC	Racine, Wis.	1460
WRAD	Radford, Va.	1460
WRAG	Carrollton, Ala.	590
WRAI	Rio Piedras, P.R.	1190
WRAJ	Anna, Ill.	1440
WRAK	Williamsport, Pa.	1400
WRAL	Raleigh, N.C.	1240
WRAM	Monmouth, Ill.	1330
WRAN	Dover, N.J.	1510
WRAP	Norfolk, Va.	850
WRAW	Reading, Pa.	1340
WRAY	Princeton, Ind.	1250
WRBC	Jackson, Miss.	1300
WRBD	Pampano Beach, Fla.	1470
WRBL	Columbus, Ga.	1420
WRC	Washington, D.C.	980
WRCD	Dalton, Ga.	1430
WRCK	Tuscumbia, Ala.	1410
WRCO	Richland, Wis.	1450
WRCR	Maplewood, Minn.	1010
WRCS	Ahoskie, N.C.	970
WRCV	Philadelphia, Pa.	1060
WRDB	Reedsburg, Wis.	1400
WRDO	Augusta, Maine	1400
WRDS	S. Charleston, W.Va.	1410
WRDW	Augusta, Ga.	1480
WREB	Holyoke, Mass.	930
WREC	Memphis, Tenn.	600
WREL	Lexington, Va.	1450
WREM	Remsen, N.Y.	1480
WREN	Topeka, Kans.	1250
WREO	Ashtabula, Ohio	970
WREV	Reidsville, N.C.	1220
WREX	Grand Junction, Colo.	920
WRFC	Athens, Ga.	960
WRFD	Worthington, Ohio	880
WRFS	Alexander City, Ala.	1050
WRGA	Rome, Ga.	1470
WRGM	Richmond, Va.	1540
WRGS	Rogersville, Tenn.	1370
WRHC	Jacksonville, Fla.	1400
WRHI	Rock Hill, S.C.	1340
WRIB	Providence, R.I.	1220
WRIC	Richlands, Va.	540
WRIG	Wausau, Wis.	1400
WRIM	Pahokee, Fla.	1250
WRIN	Rensselaer, Ind.	1560
WRIP	Rossville, Ga.	980
WRIS	Roanoke, Va.	1410
WRIT	Milwaukee, Wis.	1340
WRIV	Riverhead, N.Y.	1390
WRIZ	Coral Gables, Fla.	1550
WRJC	Mauston, Wis.	1270
WRJN	Racine, Wis.	1400
WRJS	San German, P. R.	1060
WRJW	Picayune, Miss.	1320
WRKB	Kannapolis, N.C.	1460
WRKD	Rockland, Maine	1450
WRKH	Rockwood, Tenn.	580
WRKL	New York, N.Y.	910
WRKM	Carthage, Tenn.	1350
WRKT	Cocoa Beach, Fla.	1300
WRLD	Lanitt, Ala.	1490
WRMA	Montgomery, Ala.	950
WRMF	Titusville, Fla.	1050
WRMN	Elgin, Ill.	1410
WRMS	Beardstown, Ill.	790
WRMT	Rocky Mount, N.C.	1490
WRNB	New Bern, N.C.	1490
WRNE	Wis. Rapids, Wis.	1220
WRNL	Richmond, Va.	910
WRNY	Rome, N.Y.	1350
WROA	Gulfport, Miss.	1390
WROB	West Point, Miss.	1450
WROC	Rochester, N.Y.	1280
WROD	Daytona Beach, Fla.	1340
WROK	Rockford, Ill.	1440
WROL	Fountain City, Tenn.	1490
WROM	Rome, Ga.	710
WRON	Ronceverte, W.Va.	1400
WROS	Scottsboro, Ala.	1330
WROV	Roanoke, Va.	1240
WROW	Albany, N.Y.	590
WROX	Clarksdale, Miss.	1450
WROY	Carmi, Ill.	1460
WROZ	Evansville, Ind.	1400
WRPB	Warner Robbins, Ga.	1350
WRPL	Charlotte, N.C.	1540
WRPM	Poplarville, Miss.	1530
WRR	Dallas, Tex.	1310
WRRC	Spring Valley, N. Y.	1300
WRRR	Rockford, Ill.	1330
WRRZ	Clinton, N.C.	880
WRSA	Saratoga Sprgs., N.Y.	1280
WRSC	State College, Pa.	1390
WRSJ	Bayamon, P. R.	1560
WRSL	Stanford, Ky.	1520
WRSW	Warsaw, Ind.	1480
WRTA	Altoona, Pa.	1240
WRTL	Rantoul, Ill.	250d
WRUF	Gainesville, Fla.	850
WRUM	Rumford, Maine	790
WRUN	Utica, N.Y.	1150
WRUS	Russellville, Ky.	610
WRVA	Richmond, Va.	1140
WRVK	Mt. Vernon, Ky.	1460
WRVM	Rochester, N.Y.	680
WRWD	Augusta, Ga.	1480
WRWH	Cleveland, Ga.	1380
WRWJ	Selma, Ala.	1570
WRXO	Roxboro, N.C.	1430
WRYM	New Britain, Conn.	840
WRYT	Pittsburgh, Pa.	1250
WSAC	Fort Knox, Ky.	1470
WSAF	Sarasota, Fla.	1220
WSAI	Cincinnati, Ohio	1360
WSAJ	Grove City, Pa.	1340
WSAL	Logansport, Ind.	1230
WSAM	Saginaw, Mich.	1400
WSAN	Allentown, Pa.	1470
WSAO	Senatobia, Miss.	1550
WSAR	Fall River, Mass.	1480
WSAT	nr. Salisbury, N.C.	1280
WSAU	Wausau, Wis.	550
WSAV	Savannah, Ga.	630
WSAY	Rochester, N.Y.	1370
WSAZ	Huntington, W.Va.	930
WSB	Atlanta, Ga.	750
WSBA	Savannah, Ga.	1400
WSBB	New Smyrna Beach, Florida	1230
WSBC	Chicago, Ill.	1240
WSBR	Boca Raton, Fla.	740
WSBS	Gt. Barrington, Mass.	860
WSBT	South Bend, Ind.	960
WSCM	Panama City Beach, Florida	1290
WSBP	Chattahoochee, Fla.	1580
WSCR	Scranton, Pa.	1320
WSDR	Sterling, Ill.	1240
WSEB	Sebring, Fla.	1340
WSEL	Pontotoc, Miss.	1440
WSEM	Donaldsonville, Ga.	1500
WSEN	Baldwinsville, N.Y.	1050
WSER	Elkton, Md.	1550
WSET	Glen Falls, N.Y.	1410
WSEV	Sevierville, Tenn.	930
WSFB	Quitman, Ga.	1490
WSFC	Somerset, Ky.	1240
WSFR	Sanford, Fla.	1360
WSFT	Thomaston, Ga.	1220
WSGA	Savannah, Ga.	1400
WSGB	Sutton, W.Va.	1490
WSGC	Elberton, Ga.	1400
WSGN	Birmingham, Ala.	610
WSGO	Oswego, N.Y.	1440
WSGW	Saginaw, Mich.	790
WSHB	Raeford, N.C.	1400
WSHF	Sheffield, Ala.	1290
WSHN	Fremont, Mich.	1550
WSHO	New Orleans, La.	1230
WSHP	Shippenburg, Pa.	1480
WSIB	Beaufort, S.C.	1490
WSIC	Statesville, N.C.	1400
WSID	Baltimore, Md.	1010
WSIG	Mount Jackson, Va.	790
WSIM	Prichard, Ala.	1270
WSIP	Paintsville, Ky.	1490
WSIR	Winter Haven, Fla.	1490
WSIV	Pekin, Ill.	1140
WSIX	Nashville, Tenn.	980
WSJC	Magee, Miss.	1280
WSJM	St. Joseph, Mich.	1400
WSJR	Modawaska, Me.	1230
WSJS	Winston-Salem, N.C.	600
WSKI	Montpelier-Barre, Vt.	1240
WSKP	Miami, Fla.	1450
WSKT	S. Knoxville, Tenn.	1580
WSKY	Asheville, N.C.	1230
WSLB	Ogdensburg, N.Y.	1400
WSLC	Clermont, Fla.	1340
WSLG	Clermont, Fla.	1340
WSLI	Jackson, Miss.	930
WSLM	Salem, Ind.	1220
WSLR	Akron, Ohio	1350
WSLS	Roanoke, Va.	610
WSLT	Ocean City-Somers Pt., N. J.	1520
WSM	Nashville, Tenn.	650
WSMA	Smyrna, Ga.	1550
WSMB	New Orleans, La.	1350
WSME	Sanford, Maine	1220
WSMG	Greenville, Tenn.	1450
WSMI	Litchfield, Ill.	1540
WSMN	Nashua, N.H.	1590
WSMT	Sparta, Tenn.	1050
WSNE	Cummings, Ga.	1410
WSNJ	nr. Bridgeton, N.J.	1240
WSNO	Barre, Vt.	1450
WSNT	Sandersville, Ga.	1490
WSNW	Seneca Twnshp., S.C.	1150
WSNY	Schenectady, N.Y.	1240
WSOC	Charlotte, N.C.	930
WSOK	Savannah, Ga.	1230
WSOL	Tampa, Fla.	1300
WSOM	Salem, Ohio	600
WSON	Henderson, Ky.	860
WSOO	Sit. Ste. Marie, Mich.	1230
WSOQ	No. Syracuse, N.Y.	1220
WSOR	Windsor, Conn.	1480
WSOY	Decatur, Ill.	1340
WSPA	Spartanburg, S.C.	950
WSPB	Sarasota, Fla.	1450
WSPD	Toledo, Ohio	1370
WSPF	Hickory, N.C.	1000
WSPN	Saratoga, N. Y.	900
WSPR	Springfield, Mass.	1270
WSPT	Stevens Pt., Wis.	1010
WSPZ	Spencer, W.Va.	1400
WSRA	Milton, Fla.	1490
WSRC	Durham, N.C.	1410
WSRO	Marlborough, Mass.	1470
WSRW	Hillsboro, Ohio	1590
WSSB	Durham, N.C.	1490
WSSC	Sumter, S.C.	1340
WSSO	Starkville, Miss.	1230
WSSV	Petersburg, Va.	1240
WSTC	Stamford, Conn.	1400
WSTH	Taylorsville, N. C.	860
WSTK	Woodstock, Va.	1230
WSTL	Eminence, Ky.	1600
WSTP	Salisbury, N.C.	1490
WSTR	Sturgis, Mich.	1230
WSTS	Massena, N.Y.	1050
WSTU	Stuart, Fla.	1450
WSTV	Steubenville, Ohio	1340
WSUB	Groton, Conn.	980
WSUH	Oxford, Miss.	1420
WSUI	Iowa City, Iowa	910
WSUN	St. Petersburg, Fla.	620
WSUX	Seaford, Del.	1280
WSUZ	Palatka, Fla.	800
WSVA	Harrisonburg, Va.	550
WSVL	Shelbyville, Ind.	1520
WSVN	Valdese, N.C.	1490
WSVM	Valdese, N.C.	1490
WSVS	Crewe, Va.	800
WSWN	Belle Glade, Fla.	900
WSWV	Pennington Gap, Va.	1570
WSWW	Platteville, Wis.	1590
WSYB	Rutland, Vt.	1380
WSYD	Mt. Airy, N.C.	1300
WSYL	Sylvania, Ga.	1490
WSYR	Syracuse, N.Y.	570
WTAB	Tabor City, N.C.	1370
WTAC	Flint, Mich.	600
WTAD	Quincy, Ill.	930
WTAG	Worcester, Mass.	580
WTAL	Tallahassee, Fla.	1450
WTAN	Clearwater, Fla.	1340
WTAO	Cambridge, Mass.	740
WTAP	Parkersburg, W.Va.	1230
WTAQ	LaGrange, Ill.	1300
WTAR	Norfolk, Va.	790
WTAW	Bryan, Tex.	1150
WTAX	Springfield, Ill.	1240
WTAY	Robinson, Ill.	1570
WTBC	Tuscaloosa, Ala.	1230
WTBF	Troy, Ala.	970
WTBO	Cumberland, Md.	1450
WTCA	Plymouth, Ind.	1050
WTCB	Flomaton, Ala.	990
WTCH	Shawano, Wis.	960
WTCJ	Tell City, Ind.	1230
WTCM	Traverse City, Mich.	1400
WTCO	Campbellsville, Ky.	1450
WTCR	Ashland, Ky.	1420
WTCS	Fairmont, W.Va.	1490
WTCW	Whitesburg, Ky.	920
WTEL	Philadelphia, Pa.	860
WTGA	Thomaston, Ga.	1590
WTHI	Terre Haute, Ind.	1480
WTHM	Lapeer, Mich.	1530
WTHN	Thomaston, Ga.	1500
WTHR	Panama City Fla.	1480
WTHT	Hazleton, Pa.	1300
WTIC	Hartford, Conn.	1080
WTID	Newport News, Va.	1270
WTIF	Tifton, Ga.	1340
WTIG	Massillon, Ohio	990
WTIK	Durham, N.C.	1310
WTIL	Mayaguez, P.R.	1300
WTIM	Taylorville, Ill.	1410
WTIP	Charleston, W.Va.	1240
WTIQ	Manistique, Mich.	1490
WTIX	New Orleans, La.	690
WTJH	East Point, Ga.	1260
WTJS	Jackson, Tenn.	1390
WTKM	Hartford, Wis.	1540
WTKO	Ithaca, N.Y.	1470
WTKY	Tompkinsville, Ky.	1370
WTLB	Utica, N.Y.	1310
WTLK	Taylorsville, N.C.	1570
WTLN	Apopka, Fla.	1520
WTLO	Somerset, Ky.	1480
WTLS	Tallasee, Ala.	1300
WTMA	Charleston, S.C.	1250
WTMB	Tomah, Wis.	1390
WTMC	Ocala, Fla.	1290
WTMJ	Milwaukee, Wis.	620
WTMP	Tampa Fla.	1150
WTMT	Louisville, Ky.	620
WTNC	Thomasville, N.C.	790
WTND	Orangeburg, S.C.	920
WTNS	Coshocton, Ohio	1560
WTNT	Tallahassee, Fla.	1270
WTOB	Winston-Salem, N.C.	1380
WTOC	Savannah, Ga.	1290
WTOD	Toledo, Ohio	1560
WTOE	Spruce Pine, N.C.	1470
WTOJ	Tomah, Wis.	1460
WTOL	Toledo, Ohio	1230
WTON	Staunton, Va.	1240
WTOP	Washington, D.C.	1500
WTOR	Torrington, Conn.	610
WTOT	Marianna, Fla.	980
WTPR	Paris, Tenn.	710
WTRA	Latrobe, Pa.	1480
WTRB	Ripley, Tenn.	1570
WTRC	Elkhart, Ind.	1340
WTRL	Bradenton, Fla.	1490
WTRN	Tyrone, Pa.	1340
WTRO	Dyersburg, Tenn.	1330
WTRP	LaGrange, Ga.	620
WTRR	Sanford, Fla.	1400
WTRU	Muskegon, Mich.	1600
WTRW	Two Rivers, Wis.	1590
WTRX	Flint, Mich.	1330
WTRY	Troy, N.Y.	980
WTSA	Brattleboro, Vt.	1450
WTSB	Lumberton, N.C.	1340
WTSL	Hanover-Lebanon, New Hampshire	1400
WTSN	Dover, N.H.	1270
WTSV	Claremont, N.H.	1230
WTTB	Vero Beach, Fla.	1490
WTTC	Towanda, Pa.	1550
WTTF	Tiffin, Ohio	1600
WTTH	Port Huron, Mich.	1380
WTTI	Dalton, Ga.	1530
WTTL	Madisonville, Ky.	1310
WTTM	Trenton, N.J.	920
WTTN	Watertown, Wis.	1580
WTTO	Toledo, Ohio	1520
WTTR	Westminster, Md.	1470
WTTS	Bloomington, Ind.	1370
WTTT	Amherst, Mass.	1430
WTUF	Mobile, Ala.	840
WTUG	Tuscaloosa, Ala.	790
WTUP	Tupelo, Miss.	1490
WTUX	Wilmington, Del.	1290
WTVB	Coldwater, Mich.	1590
WTVL	Waterville, Maine	1490
WTVN	Columbus, Ohio	610
WTWA	Thomson, Ga.	1240
WTWB	Auburndale, Fla.	1570
WTWN	St. Johnsbury, Vt.	1340
WTXL	W. Spgfd., Mass.	1490
WTYC	Rock Hill, S.C.	1150
WTYM	East Longmeadow, Mass.	1600
WTYN	Tryon, N.C.	1550
WTYS	Marianna, Fla.	1340
WUFD	Amherst, N.Y.	1080
WULA	Eufaula, Ala.	1240
WUMU	Gainesville, Fla.	1390
WUNA	Aguadilla, P. R.	1340
WUND	Uhrichsville, Ohio	1540
WUNE	Baton Rouge, La.	1550
WUNI	Mobile, Ala.	1410
WUNO	Rio Piedras, P.R.	1320
WUNS	Lewisburg, Pa.	1010
WUPR	Utado, P.R.	1530
WUSJ	Lockport, N.Y.	1340
WUSM	Havelock, N.C.	1330
WUST	Bethesda, Md.	1120
WVAK	Paoli, Ind.	1560
WVAL	Sauk Rapids, Minn.	800
WVAM	Altoona, Pa.	1430
WVAR	Richwood, W.Va.	1280
WVCB	Shallotte, N. C.	1410
WVCF	Apopka, Fla.	1520
WVCG	Coral Gables, Fla.	1070
WVCH	Chester, Pa.	740
WVEC	Hampton, Va.	1490
WVGT	Mt. Dora, Fla.	1580
WVIC	E. Lansing, Mich.	730
WVIM	Vicksburg, Miss.	1490
WVIP	Mt. Kisco, N.Y.	1310
WVJP	Caguas, P.R.	1110
WVJS	Owensboro, Ky.	1420
WVKO	Columbus, Ohio	1580

WHITE'S RADIO LOG

C.L.	Location	Kc.
WVLD	Valdosta, Ga.	1450
WVLK	Lexington, Ky.	590
WVLN	Olney, Ill.	740
WVMC	Mt. Carmel, Ill.	1360
WVMI	Biloxi, Miss.	570
WVMT	Burlington, Vt.	620
WVNA	Tuscumbia, Ala.	1590
WVNJ	Newark, N.J.	620
WVOB	Bel Air, Md.	1520
WVOC	Battle Creek, Mich.	1500
WVOE	Chadburn, N.C.	1590
WVOH	Hazelhurst, Ga.	920
WVOK	Birmingham, Ala.	690
WVOL	Berry Hill, Tenn.	1470
WVOM	Iuka, Miss.	1270
WVON	Cicero, Ill.	1450
WVOP	Vidalia, Ga.	970
WVOS	Liberty, N.Y.	1240
WVOT	Wilson, N.C.	1420
WVOW	Logan, W.Va.	1290
WVOX	New Rochelle, N.Y.	1460
WVOZ	Carolina, P.R.	1400
WVPO	Stroudsburg, Pa.	840
WVSC	Somerset, Pa.	990
WVTR	White River Junc., Vt.	910
WVVW	Grafton, W.Va.	1260
WWAB	Lakeland, Fla.	1330
WWBC	Cocoa, Fla.	1510

C.L.	Location	Kc.
WWBD	Bamberg, S.C.	790
WWBR	Windber, Pa.	1350
WWBZ	Vineland, N.J.	1360
WWCA	Gary, Ind.	1270
WWCC	Bremen, Ga.	1440
WWCH	Clarion, Pa.	1300
WWCM	Brazil, Ind.	1380
WWCO	Waterbury, Conn.	1240
WWDC	Washington, D.C.	1260
WWDS	Everett, Pa.	1110
WWGM	Nashville, Tenn.	1560
WWGO	Erie, Pa.	1450
WWGP	Sanford, N.C.	1050
WWGS	Tifton, Ga.	1430
WWHG	Hornell, N.Y.	1320
WWHY	Huntington, W.Va.	1470
WWIL	Ft. Lauderdale, Fla.	1580
WWIN	Baltimore, Md.	1400
WWIS	Black River Falls, Wis.	1260
WWIT	Canton, N.C.	970
WWIZ	Lorain, Ohio	1380
WWJ	Detroit, Mich.	950
WWJB	Brooksville, Fla.	1450
WWJC	Superior, Wis.	1270
WWKY	Winchester, Ky.	1380
WWL	New Orleans, La.	870
WWML	Portage, Wis.	1470
WWNC	Asheville, N.C.	570
WWNH	Rochester, N.H.	930
WWNR	Beckley, W.Va.	620
WWNS	Statesboro, Ga.	1240
WWNY	Watertown, N.Y.	790
WWOD	Lynchburg, Va.	1390
WWOK	Charlotte, N.C.	1480
WWOL	Buffalo, N.Y.	1120
WWOM	New Orleans, La.	600
WWON	Woonsocket, R.I.	1240
WWOW	Conneaut, Ohio	1360
WWPA	Williamsport, Pa.	1340

C.L.	Location	Kc.
WWPF	Palatka, Fla.	1260
WWRI	W. Warwick, R.I.	1450
WWRL	Woodside, N.Y.	1600
WWSC	Glens Falls, N.Y.	1450
WWSR	St. Albans, Vt.	1420
WWST	Wooster, Ohio	960
WWSW	Pittsburgh, Pa.	970
WWTC	Minneapolis, Minn.	1280
WWUN	Jackson, Miss.	1590
WWVA	Wheeling, W.Va.	1170
WWWB	Jasper, Ala.	1360
WWWF	Fayette, Ala.	990
WWWR	Russellville, Ala.	920
WWXL	Manchester, Ky.	1450
WWYN	Erie, Pa.	1260
WWYO	Pineville, W.Va.	970
WXAL	Demopolis, Ala.	1400
WXCO	Wausau, Wis.	1230
WXGI	Richmond, Va.	950
WXIG	Windemere, Fla.	1480
WXKW	Troy, N. Y.	1600
WXLI	Dublin, Ga.	1230
WXLL	Big Delta, Alaska	980
WXLN	Potomac-Cabin John, Md.	950
WXLW	Indianapolis, Ind.	950
WXOK	Baton Rouge, La.	1260
WXOX	Bay City, Mich.	1250
WXMT	Merrill, Wis.	730
WXRF	Guayama, P.R.	1590
WXTN	Lexington, Miss.	1150
WXTR	Pawtucket, R.I.	550
WXUR	Media, Pa.	690
WXVA	Charles Town, W.Va.	1550
WXVW	Jeffersonville, Ind.	1450
WXXX	Hattiesburg, Miss.	1310
WXYC	Ft. Myers, Fla.	1350
WXYZ	Detroit, Mich.	1270
WYAL	Scotland Neck, N.C.	1280
WYAM	Bessemer, Ala.	1450

C.L.	Location	Kc.
WYCL	York, S.C.	1580
WYDE	Birmingham, Ala.	850
WYGO	Corbin, Ky.	1330
WYHE	Bristol, Tenn.	1550
WYKP	Ocean City, N. J.	1520
WYLD	New Orleans, La.	940
WYLO	Jackson, Wis.	540
WYMB	Manning, S.C.	1410
WYND	Sarasota, Fla.	1280
WYNG	Warwick-East Greenwich, R.I.	1590
WYNK	Baton Rouge, La.	1380
WYNN	Florence, S.C.	540
WYNR	Brunswick, Ga.	790
WYNS	Lehighton, Pa.	
WYNZ	Ypsilanti, Mich.	1520
WYOQ	Wyoming, Mich.	1530
WYOU	Tampa, Fla.	1550
WYPR	Danville, Va.	970
WYRE	Annapolis, Md.	810
WYRN	Louisburg, N.C.	1480
WYSH	Clinton, Tenn.	1380
WYSI	Ypsilanti, Mich.	1480
WYSL	Buffalo, N.Y.	1400
WYSR	Franklin, Va.	1250
WYTH	Madison, Ga.	1250
WYTI	Rocky Mount, Va.	1570
WYVE	Wytheville, Va.	1280
WYZE	Atlanta, Ga.	1480
WZEP	DeFuniak Sprgs., Fla.	1460
WZIP	Cincinnati, Ohio	1050
WZKY	Albemarle, N.C.	1580
WZOB	Ft. Payne, Ala.	1250
WZOE	Princeton, Ill.	1490
WZOK	Jacksonville, Fla.	1320
WZRH	Zephyr Hills, Fla.	1400
WZUM	Carnegie, Pa.	1590
WZYX	Cowan, Tenn.	1440
WZZZ	Boynton Beach, Fla.	1510

U. S. FM Stations by Call Letters

Abbreviation: (s)—broadcasts stereo

C.L.	Location
KABC-FM	Los Angeles, Calif.
KACA	Prosser, Wash.
KACE-FM	Riverside, Calif.
KADI	St. Louis, Mo.
KAFE	San Francisco, Cal.
KAFI	Auburn, Calif.
KAFM	Salina, Kans.
KAIM-FM	Honolulu, Hawaii(s)
KAJS	Newport Beach, Calif.
KAKC	Tulsa, Okla.
KAKI	San Antonio, Tex.
KALB-FM	Alexandria, La.
KALH	Denver, Colo.
KALW	San Francisco, Calif.
KAMS	Mammoth Spring, Ark.
KANG	Angwin, Cal.
KANT-FM	Lancaster, Calif.
KANU	Lawrence, Kans.(s)
KANW	Albuquerque, N.Mex.
KAOL-FM	Carrollton, Mo.
KAPP	Redondo Beach, Calif.
KARA-FM	Albuquerque, N.M.
KARK	Little Rock, Ark.
KARM-FM	Fresno, Calif.
KASK-FM	Ontario, Calif.
KASU	Jonesboro, Ark.
KATT	Woodland, Calif.
KATY-FM	San Luis Obispo, Calif.
KAVR-FM	Applevalley, Cal.
KAYD	Beaumont, Tex.
KAZZ	Austin, Tex.
KBBI	Los Angeles, Calif.
KBBL	Riverside, Cal.
KBBM	Hayward, Calif.
KBBW	San Diego, Cal.(s)
KBCA	Los Angeles, Calif.
KBCL-FM	Shreveport, La. (s)
KBEE-FM	Modesto, Calif.
KBEY	Kansas City, Mo.
KBFI	Boise, Idaho
KBFM	Lubbock, Tex.
KBGL	Pocatello, Ida.
KBHF	Bozeman, Mont.
KBHS-FM	Hot Springs, Ark.
KBIG-FM	Los Angeles-Avalon, Cal.
KBIM-FM	Roswell, N.Mex.
KBLE-FM	Seattle, Wash.
KBMC	Eugene, Ore.
KBMF-FM	Spearman, Tex.
KBMS	Los Angeles, Calif.
KBNO	Houston, Tex. (s)
KBOA-FM	Kennett, Mo.
KBOC	Ogden, Utah (s)
KBOE-FM	Oskaloosa, Iowa
KBOI-FM	Boise, Ida.(s)
KBOX-FM	Dallas, Tex.
KBOY-FM	Medford, Oreg.
KBPI	Denver, Colo.
KBRG	San Francisco, Cal.
KBRO-FM	Bremerton, Wash.
KBTM-FM	Jonesboro, Ark.
KBUZ-FM	Mesa, Ariz.
KBYR-FM	Anchorage, Alaska(s)
KBYU-FM	Provo, Utah
KCAL-FM	Redlands, Calif.

C.L.	Location
KCBH	Beverly Hills, Calif.(s)
KCBS-FM	San Francisco, Calif.
KCEE-FM	Tucson, Ariz.
KCFC	Kansas City, Kan.
KCFM	St. Louis, Mo.(s)
KCHQ-FM	Conchella, Calif.(s)
KCIB-FM	Fresno, Calif.(s)
KCIC	Clinton, Mo.
KCIL-FM	Houma, La.
KCKN-FM	Kansas City, Kan.
KCLB	Carlsbad, Cal.
KCLE-FM	Cleburne, Tex.
KCLO-FM	Leavenworth, Kans.
KCLU-FM	Rolla, Mo.
KCMA	San Francisco, Cal.
KCMB-FM	Wichita, Kans.
KCMI	Los Angeles, Calif.
KCMK	Kansas City, Mo.
KCMO-FM	Kansas City, Mo.(s)
KCMS-FM	Manitou Springs, Colo.
KCOM	Omaha, Nebr.
KCPS	Tacoma, Wash.
KCPX-FM	Salt Lake City, Utah
KCRA-FM	Sacramento, Calif.
KCRW	Santa Monica, Calif.
KCSB-FM	Santa Barbara, Cal.
KCSM	San Mateo, Calif.
KCSU-FM	Ft. Collins, Colo.
WCTS FM	Minneapolis, Minn.
KCUE-FM	Red Wing, Minn.
KCUI	Pella, Ia.
KCUL-FM	Ft. Worth, Tex. (s)
KCUR-FM	Kansas City, Mo.
KCVR-FM	Lodi, Calif.
KCWS-FM	Ellensburg, Wash.
WDAF-FM	Kansas, Mo.
KDB-FM	Santa Barbara, Calif.
KDDD-FM	Dumas, Tex.
KDEF-FM	Albuquerque, N.Mex.
KDES-FM	Palm Spgs., Calif. (s)
KDFC	San Francisco, Calif.
KDFM	Walnut Creek, Cal.
KDFR	Tulare, Cal.
KDHI-FM	Twenty-Nine Palms, Cal.
KDKA-FM	Pittsburgh, Pa.
KDLA-FM	De Ridder, La.
KDMC	Corpus Christi, Tex.
KDMI	Des Moines, Iowa(s)
KDNT-FM	Denton, Tex.
KDOK-FM	Tyler, Tex.
KDPS	Des Moines, Iowa
KDUO	Riverside, Calif.(s)
KDUX-FM	Aberdeen, Wash. (s)
KDVR	Sioux City, Ia.(s)
KEAR	San Francisco, Calif.
KEAX	National City, Calif.
KEBJ	Phoenix, Ariz.
KEBR	Sacramento, Calif.
KEBS	San Diego, Calif.
KECL	Albuquerque, N.M.
KECR	El Cajon, Calif.
KEDC-FM	Northridge, Cal.
KEED-FM	Springfield-Eugene, Oregon(s)

C.L.	Location
KEEN-FM	San Jose, Calif.
KEEZ	San Antonio, Tex.(s)
KEFC	Waco, Tex.(s)
KEFM	Santa Posa, Cal.
KEFW	Honolulu, Hawaii
KELD-FM	El Dorado, Ark.(s)
KELE	Phoenix, Ariz.
KELO-FM	Sioux Falls, S. D.
KELT	Harlingen, Tex.
KEMO	St. Louis, Mo.
KERI	Bellingham, Wash.
KERN-FM	Bakersfield, Calif.
KERS	Sacramento, Cal.
KESM-FM	El Dorado Springs, Mo.
KETO-FM	Seattle, Wash.(s)
KEWC-FM	Cheney, Wash.
KEZE	Anaheim, Calif.
KFAB-FM	Omaha, Nebr.
KFAC-FM	Los Angeles, Calif.
KFAM-FM	St. Cloud, Minn.
KFAY-FM	Fayetteville, Ark.
KFBD	Waynesville, Mo.
KFBK-FM	Sacramento, Calif.
KFCA	Phoenix, Ariz.
KFGQ-FM	Boone, Iowa
KFH-FM	Wichita, Kans.
KFJC	Los Altos, Cal.
KFJZ	Fort Worth, Tex.
KFLA-FM	Scott City, Kan.
KFLY-FM	Corvallis, Ore.
KFMB-FM	San Diego, Calif.
KFMC	Portland, Oreg.
KFMG	Des Moines, Ia.
KFMK	Houston, Tex.(s)
KFML-FM	Denver, Colo.
KFMM	Tucson, Ariz.
KFMN	Abilene, Tex.
KFMP	Port Arthur, Tex.(s)
KFMQ	Lincoln, Nebr.
KFMR	Fremont, Cal.
KFMU	Glendale, Calif. (s)
KFMV	Minneapolis, Minn
KFMW	San Bernardino, Calif.
KFMX	San Diego, Calif.(s)
KFMY	Eugene, Oreg.(s)
KFNB	Oklahoma City, Okla.(s)
KFNE	Big Springs, Tex.
KFNW-FM	Fargo, N.D.
KFOG	San Francisco, Calif. (s)
KFOX-FM	Long Beach, Calif.
KFRC-FM	San Francisco, Calif.
KFRE-FM	Fresno, Calif.
KFUO-FM	Clayton, Mo.
KGAF-FM	Gainesville, Tex.
KGB-FM	San Diego, Calif.(s)
KGBC-FM	Galveston, Tex.
KGBI-FM	Omaha, Neb.
KGBN-FM	Caldwell, Idaho
KGEE-FM	Bakersfield, Cal. (s)
KGFM	Edmonds, Wash.
KGGK	Garden Grove, Calif.(s)
KGLA	Los Angeles, Calif.
KGME-FM	Centralia, Wash.
KGMG	Portland, Oreg.(s)

C.L.	Location
KGMI-FM	Bellingham, Wash.
KGNC-FM	Amarillo, Tex.
KGO-FM	San Francisco, Calif.
KGPO	Grants Pass, Oreg.
KGRI-FM	Henderson, Tex.
KGUD-FM	Santa Barbara, Calif.
KGVW-FM	Belgrade, Mont.
KHAK-FM	Cedar Rapids, Iowa(s)
KHBL	Plainview, Tex.
KHBR-FM	Hillsboro, Tex.
KHCB-FM	Houston, Tex.
KHEP-FM	Phoenix, Ariz.
KHFI-FM	Austin, Tex.
KHFM	Albuquerque, N.Mex.(s)
KHFR-FM	Monterey, Calif.(s)
KHGM	Beaumont, Tex.(s)
KHIQ	Sacramento, Calif.(s)
KHJ-FM	Los Angeles, Calif.
KHMS	El Paso, Tex.
KHOF	Los Angeles, Calif.
KHOK-FM	Hoquiam, Wash.
KHOL-FM	Kearney-Holdrege, Neb.
KHOM-FM	Turlock, Calif.(s)
KHOZ-FM	Harrison, Ark.
KHPC	Brownwood, Tex.
KHQ-FM	Spokane, Wash.
KHSC	Arcata, Calif.
KHSJ-FM	Hemet, Cal.
KHUL	Houston, Tex.
KHVH-FM	Honolulu, Hawaii
KHVR	Bijou, Calif.
KHYI	Fremont, Calif.
KICS-FM	Hastings, Neb.
KICN	Omaha, Nebr.
KID-FM	Idaho Falls, Ida.
KIEM	Eureka, Calif.
KIFM	Bakersfield, Cal.
KIHI	Tulsa, Okla.
KIMN-FM	Denver, Colo.
KIMP-FM	Mt. Pleasant, Tex.
KING-FM	Seattle, Wash.
KIOO	Oklahoma, Okla.
KIRO-FM	Seattle, Wash.
KISA	Kansas City, Mo.
KISS	San Antonio, Tex.
KISW	Seattle, Wash.(s)
KITH	Phoenix, Ariz.
KITT	San Diego, Calif.
KITY	San Antonio, Tex. (s)
KIXI-FM	Seattle, Wash.
KIXL-FM	Dallas, Tex.(s)
KJAZ	Alameda, Calif.
KJCK-FM	Junction City, Kan.
KJEF-FM	Jennings, La.
KJEM-FM	Okla. City, Okla.
KJIM	Ft. Worth, Tex.
KJLM	San Diego, Calif.
KJML	Sacramento, Calif.
KJOY-FM	Burlington, Vt.
KJPO	Fresno, Calif.
KJRG-FM	Newton, Kans. (s)
KJSB	Houston, Tex.
KJSK-FM	Columbus, Neb.
KKFM	Colorado Springs, Colo.

C.L.	Location
KKHI-FM	San Francisco, Cal.
KLAC-FM	Los Angeles, Calif.
KLAW	Lawton, Okla. (s)
KLAY-FM	Tacoma, Wash. (s)
KLBS-FM	Los Banos, Cal.
KLCN-FM	Blytheville, Ark.
KLEF	Houston, Tex. (s)
KLEN-FM	Killeen, Tex.
KLGS	Los Gatos, Cal.
KLFM	Beverly Hills, Calif.
KLIR-FM	Denver, Colo. (s)
KLIZ-FM	Brainerd, Minn.
KLJT	Lake Jackson, Tex.
KLMO-FM	Longmont, Colo.
KLOA-FM	Ridgecrest, Calif.
KLON	Long Beach, Calif.
KLRO	San Diego, Calif. (s)
KLSN	Seattle, Wash. (s)
KLST	Colorado Springs, Colo. (s)
KLUB-FM	Salt Lake City, Utah
KLUE-FM	Longview, Tex.
KLUR	Wichita Falls, Tex.
KLVL	Pasadena, Tex.
KLWN-FM	Lawrence, Kan.
KLXN	Seattle, Wash.
KLYD-FM	Bakersfield, Calif.
KLYN-FM	Lynden, Wash.
KLYX	Memphis, Tenn.
KLZ-FM	Denver, Colo.
KMAG	Ft. Smith, Ark.
KMAK-FM	Fresno, Calif.
KMAP	Dallas, Tex.
KMAX	Sierra Madre, Calif.
KMBC-FM	Kansas City, Mo. (s)
KMCP	Portland, Oreg.
KMCS	Seattle, Wash.
KMEO	Phoenix, Ariz. (s)
KMER	Fresno, Calif.
KMET	Denver, Colo.
KMFM	San Antonio, Tex.
KMHT	Marshall, Tex.
KMJ-FM	Fresno, Calif.
KMLB-FM	Monroe, La. (s)
KMMK	Little Rock, Ark.
KMOD-FM	Midland, Tex.
KMOX-FM	St. Louis, Mo.
KMPX	San Francisco, Calif. (s)
KMSC	Clear Lake City, Tex.
KMSM	Rolla, Mo.
KMSU	Mankato, Minn.
KMUW	Wichita, Kans.
KMYC-FM	Marysville, Calif.
KMUZ	Santa Barbara, Calif. (s)
KNBB	Newport Beach, Cal.
KNBR-FM	San Francisco, Calif.
KNCO-FM	Garden City, Kans.
KNDX	Yakima, Wash.
KNEB-FM	Scottsbluff, Nebr.
KNED-FM	McAlester, Okla.
KNER	Dallas, Tex.
KNEV	Reno, Nev. (s)
KNEW-FM	Scottsbluff, Nebr.
KNFB	Nowata, Okla.
KNFM	Midland, Tex.
KNIK-FM	Anchorage, Alaska
KNIX-FM	Phoenix, Ariz. (s)
KNJO	Thousand Oaks, Calif.
KNOB	Long Beach, Calif. (s)
KNOC-FM	Natchitoches, La.
KNOF	St. Paul, Minn.
KNOK-FM	Ft. Worth, Tex.
KNRO-FM	Conroe, Tex.
KNTO	Wichita Falls, Tex. (s)
KNWS-FM	Waterloo, Iowa
KNX-FM	Los Angeles, Calif.
KNXR	Rochester, Minn.
KOA-FM	Denver, Colo.
KOAP-FM	Portland, Ore.
KOAT-FM	Albuquerque, N.M.
KOBH-FM	Hot Springs, S.D.
KOCI-FM	Denver, Colo.
KOCV	Odessa, Tex.
KOCW	Tulsa, Okla. (s)
KOCY-FM	Oklahoma City, Okla.
KODA-FM	Houston, Tex. (s)
KOFM	Oklahoma City, Okla.
KOFO-FM	Ottawa, Kan.
KOGM-FM	Tulsa, Okla
KOGO	San Diego, Calif.
KOIN-FM	Portland, Oreg.
KOKH	Oklahoma City, Okla.
KOL-FM	Seattle, Wash.
KONG-FM	Visalia, Calif. (s)
KOOL-FM	Phoenix, Ariz.
KOPR-FM	Great Falls, Mont.
KORK	Las Vegas, Nev. (s)
KOSE-FM	Osceola, Ark.
KOST	Dallas, Tex.
KOSU-FM	Stillwater, Okla. (s)
KOTN-FM	Pine Bluff, Ark.
KOZE-FM	Lewiston, Idaho
KPAC-FM	Port Arthur, Tex.
KPAN-FM	Hereford, Tex.
KPAT-FM	Berkeley, Calif.
KPCS	Pasadena, Calif.
KPDQ-FM	Portland, Ore.
KPEN	San Francisco, Cal. (s)
KPET-FM	Lamesa, Tex.
KPFA	Berkeley, Calif.
KPFB	Berkeley, Calif.
KPFK	Los Angeles, Calif.
KPLC-FM	Lake Charles, La.
KPLX	San Jose, Cal.
KPFM	Portland, Oreg. (s)
KPGM	Los Altos, Calif.
KPLR-FM	St. Louis, Mo.
KPMT	Oxnard, Cal.
KPOI-FM	Honolulu, Hawaii (s)
KPOJ-FM	Portland, Oreg.
KPOL-FM	Los Angeles, Calif. (s)
KPPC-FM	Pasadena, Calif.
KPPS-FM	Parsons, Kans.
KPRI	San Diego, Calif. (s)
KPRN	Seattle, Wash.
KPRS-FM	Kansas City, Mo.
KPSD	Dallas, Tex.
KQAL-FM	Omaha, Nebr. (s)
KQBY-FM	San Francisco, Calif.
KQFM	Portland, Oreg.
KQIP	Odessa, Tex.
KQRO	Dallas, Tex.
KQRS-FM	Golden Valley, Minn.
KQTY	Wichita, Kan.
KQUE	Houston, Tex. (s)
KQV-FM	Pittsburgh, Pa.
KRAB	Seattle, Wash.
KRAK-FM	Stockton, Calif.
KRAM-FM	Las Vegas, Nev.
KRAV	Tulsa, Okla. (s)
KRBE	Houston, Tex. (s)
KRCC	Colorado Springs, Colo.
KRCW	Santa Barbara, Calif.
KREM-FM	Spokane, Wash.
KREP	Santa Clara, Cal.
KREX-FM	Grand Junction, Colo.
KRFM	Phoenix, Ariz. (s)
KRHM	Los Angeles, Calif. (s)
KRIL	El Dorado, Ark. (s)
KRIT	Clarion, Iowa
KRKD-FM	Los Angeles, Calif.
KRKH-FM	Lubbock, Tex.
KRKY	Denver, Colo.
KRLD-FM	Dallas, Tex.
KRMD-FM	Shreveport, La.
KRMG-FM	Tulsa, Okla.
KRML-FM	Carmel, Cal.
KRMS-FM	Osage Beach, Mo.
KRNL-FM	Mt. Vernon, Ia.
KRNW	Boulder, Colo.
KRNY-FM	Kearney-Holdrege, Nebraska
KROC-FM	Rochester, Minn.
KRON-FM	San Francisco, Calif.
KROS-FM	Clinton, Iowa
KROW	Santa Barbara, Calif.
KROY-FM	Sacramento, Calif.
KRPM	San Jose, Calif.
KRRC	San Jose, Calif.
KRSA-FM	Salinas, Cal.
KRSI	Minneapolis, Minn. (s)
KRSI-FM	St. Louis Park, Minn.
KRSN-FM	Los Alamos, N.Mex.
KRVM	Eugene, Oreg.
KRVN-FM	Lexington, Nebr.
KRWG	University Park, N. M. (s)
KRVS-FM	Lafayette, La.
KSCO	Santa Cruz, Calif.
KSBW-FM	Salinas, Calif.
KSDA	La Sierra, Calif.
KSDB-FM	Manhattan, Kans.
KSDO-FM	San Diego, Cal.
KSDS	San Diego, Calif.
KSEA	San Diego, Calif.
KSEL-FM	Lubbock, Tex.
KSEO-FM	Durant, Okla.
KSFM	Dallas, Tex. (s)
KSFR	San Francisco, Calif. (s)
KSFV	San Fernando, Calif.
KSFX	San Francisco, Calif.
KSGV	West Covina, Cal.
KSHE	Crestwood, Mo. (s)
KSHS	Colorado Springs, Colo.
KSIS-FM	Sedalia, Mo. (s)
KSJO-FM	San Jose, Calif. (s)
KSJS	San Jose, Calif.
KSJT	San Angelo, Tex.
KSL-FM	Salt Lake City, Utah (s)
KSLA	Seattle, Wash. (s)
KSLH	St. Louis, Mo.
KSLO-FM	Opelousas, La.
KSLT	Tyler, Tex.
KSMA-FM	Santa Maria, Calif.
KSO-FM	Des Moines, Iowa
KSOM	Tucson, Ariz.
KSOP-FM	Salt Lake City, Utah
KSPC	Claremont, Calif.
KSPI-FM	Stillwater, Okla.
KSPL-FM	Diboll, Tex.
KSRF	Santa Monica, Calif.
KSTE	Emporia, Kans.
KSTL-FM	St. Louis, Mo.
KSTN-FM	Stockton, Calif.
KSUI	Iowa City, Iowa
KSYN	Joplin, Mo. (s)
KTAC-FM	Tacoma, Wash.
KTAL	Texarkana, Tex.
KTAP	Tucson, Ariz.
KTAR-FM	Phoenix, Ariz.
KTBC-FM	Austin, Tex. (s)
KTCF	Cedar Falls, Iowa
KTCS-FM	Ft. Smith, Ark.
KTCU-FM	Ft. Worth, Tex.
KTEA-FM	Midwest City, Okla.
KTEC	Oretech, Oreg.
KTFC	Sioux City, Ia.
KTGM	Denver, Colo.
KTIM	San Rafael, Calif.
KTIS-FM	Minneapolis, Minn.
KTJO-FM	Ottawa, Kans.
KTNT-FM	Tacoma, Wash.
KTOD-FM	Sinton, Tex. (s)
KTOP	Topeka, Kan.
KTOY	Tacoma, Wash.
KTQM-FM	Clovis, N. M.
KTRB-FM	Modesto, Calif.
KTRH-FM	Houston, Tex.
KTSM-FM	El Paso, Tex.
KTSR	Kansas City, Mo.
KTTS-FM	Springfield, Mo.
KTW-FM	Seattle, Wash.
KTXJ-FM	Jasper, Tex.
KTXN-FM	Victoria, Tex.
KTWR	Tacoma, Wash.
KTXR-FM	Springfield, Mo. (s)
KTXT-FM	Lubbock, Tex.
KTYM-FM	Inglewood, Calif.
KUAC	College, Alaska
KUID	Moscow, Ida.
KUDE-FM	Oceanside, Calif.
KUDU-FM	Ventura-Oxnard, Calif. (s)
KUER	Salt Lake City, Utah
KUFM	Missoula, Mont.
KUFY	Redwood City, Calif.
KUGN-FM	Eugene, Oreg.
KUHF	Houston, Tex.
KUMD-FM	Duluth, Minn.
KUOA-FM	Siloam Springs, Ark.
KUOH	Honolulu, Hawaii
KUOP	Stockton, Cal. (s)
KUOW	Seattle, Wash.
KUPD-FM	Tempe, Ariz.
KURL-FM	Billings, Mont.
KUSC	Los Angeles, Calif.
KUSN-FM	St. Joseph, Mo.
KUSU-FM	Logan, Utah
KUT-FM	Austin, Tex.
KUTE	Glendale, Calif.
KVCR	San Bernardino, Calif.
KVEC-FM	San Luis Obispo, Calif. (s)
KVEG-FM	Las Vegas, Nev.
KVEN-FM	Ventura, Calif.
KVFM	San Fernando, Calif.
KVII-FM	Amarillo, Tex.
KVIL-FM	Highland Park-Dallas, Tex.
KVOA-FM	Tucson, Ariz.
KVOF-FM	El Paso, Tex.
KVOK	Honolulu, Hawaii
KVOP-FM	Plainview, Tex.
KVOR-FM	Colorado Springs, Colo.
KVSC	Logan, Utah
KVTT	Dallas, Tex.
KVWM	Show Low, Ariz.
KVXN	Los Angeles, Cal.
KWAR	Waverly, Iowa
KWAX	Eugene, Oreg.
KWBE-FM	Beatrice, Neb.
KWDM	Des Moines, Ia. (s)
KWFM	Minneapolis, Minn. (s)
KWG-FM	Stockton, Calif.
KWGN-FM	Abernathy, Tex.
KWGS	Tulsa, Okla.
KWHG	Lincoln, Neb.
KWHI-FM	Brenham, Tex.
KWHO-FM	Salt Lake City, Utah
KWHP	Edmond, Okla.
KWIX	St. Louis, Mo.
KWIZ-FM	Santa Ana, Calif.
KWJB-FM	Globe, Ariz.
KWKC-FM	Abilene, Tex.
KWKC-FM	Abilene, Tex. (s)
KWKH-FM	Shreveport, La.
KWLM-FM	Willmar, Minn.
KWLW	San Angelo, Tex.
KWMF-FM	Walnut Creek, Cal.
KWMO	Odessa, Tex.
KWOA-FM	Worthington, Minn.
KWOC-FM	Poplar Bluff, Mo.
KWPC-FM	Muscatine, Iowa
KWPM-FM	West Plains, Mo.
KWWC-FM	Columbia, Mo.
KXEL-FM	Waterloo, Iowa (s)
KXFM	Santa Maria, Cal.
KXJK-FM	Forrest City, Ark.
KXKX	San Francisco, Calif.
KXLU	Los Angeles, Calif.
KXLV	Las Vegas, Nev.
KXLY-FM	Spokane, Wash.
KXOA	Sacramento, Calif.
KXOL-FM	Ft. Worth, Tex. (s)
KXQR	Fresno, Calif. (s)
KXRQ	Sacramento, Calif.
KXTR	Kansas City, Mo. (s)
KXYZ	Houston, Tex. (s)
KYA-FM	San Francisco, Calif.
KYEW	Phoenix, Ariz.
KYFM	Oklahoma City, Okla.
KYLE-FM	Temple, Tex.
KYMS	Santa Ana, Cal.
KYSM-FM	Mankato, Minn.
KYW-FM	Cleveland, Ohio
KZAM	Seattle, Wash. (s)
KZFM	Cortez, Colo.
KZIX-FM	Ft. Collins, Colo.
KZOM	Oklahoma City, Okla.
KZSU	Stanford, Cal.
KZUN-FM	Opportunity, Wash
WAAB-FM	Worcester, Mass.
WAAM-FM	Parkersburg, W.Va.
WAAZ-FM	Crestview, Fla.
WABA-FM	Aguadilla, P.R.
WABC-FM	New York, N.Y.
WABE	Atlanta, Ga.
WABI-FM	Bangor, Maine
WABQ	Cleveland, Ohio
WABX-FM	Detroit, Mich. (s)
WABZ-FM	Albemarle, N.C.
WACO	Waco, Tex.
WACY-FM	Moss Point, Miss.
WAEB-FM	Cincinnati, Ohio
WAEF-FM	Cincinnati, O.
WAER	Syracuse, N.Y.
WAEZ	Miami Beach, Fla. (s)
WAGR-FM	Lumberton, N.C.
WAHR	Huntsville, Ala.
WAIC	San Juan, P.R.
WAIR-FM	Winston-Salem, N.C.
WAIV	Indianapolis, Ind.
WAJC	Indianapolis, Ind.
WAJM	Montgomery, Ala. (s)
WAJP	Joliet, Ill.
WAJR-FM	Morgantown, W.Va.
WAKR-FM	Akron, Ohio
WAKW-FM	Cincinnati, Ohio
WALK-FM	Patchogue, N.Y.
WALL-FM	Middletown, N. Y.
WAMC	Albany, N.Y.
WAMF	Amherst, Mass.
WAMO-FM	Pittsburgh, Pa.
WAMU-FM	Washington, D.C.
WANG	Goldwater, Mich.
WAPC-FM	Riverhead, N.Y. (s)
WAPI-FM	Birmingham, Ala.
WAPS	Akron, Ohio
WAQE-FM	Towson, Md. (s)
WARC	Meadville, Pa.
WARD-FM	Johnstown, Pa.
WARK	Little Rock, Ark. (s)
WARN-FM	Fort Pierce, Fla.
WARU-FM	Peru, Ind.
WASA-FM	Havre De Grace, Md.
WASH	Washington, D.C. (s)
WASK-FM	Lafayette, Ind.
WATH-FM	Athens, O.
WATR-FM	Waterbury, Conn.
WAUG-FM	Augusta, Ga.
WAUK-FM	Waukesha, Wis.
WAUP	Akron, Ohio
WAVA-FM	Arlington, Va.
WAVQ	Atlanta, Ga.
WAVU-FM	Albertville, Ala.
WAVY-FM	Portsmouth, Va.
WAWK-FM	Kendallville, Ind.
WAWR-FM	Bowling Green, O.
WAWZ-FM	Zarephath, N.J.
WAXO	Kenosha, Wis.
WAYL	Minneapolis, Minn. (s)
WAYZ-FM	Waynesboro, Pa.
WAZL-FM	Hazelton, Pa.
WAZY-FM	Lafayette, Ind.
WBAA-FM	W. Lafayette, Ind.
WBAB-FM	Babylon, N.Y.
WBAI	New York, N.Y.
WBAP-FM	Ft. Worth, Tex. (s)
WBAY	Green Bay, Wis. (s)
WBBB-FM	Burlington, N.C. (s)
WBBF-FM	Rochester, N.Y.
WBBM-FM	Chicago, Ill.
WBBO-FM	Forest City, N.C.
WBBQ-FM	Augusta, Ga.
WBBR-FM	E. St. Louis, Ill.
WBBS	Crawfordsville, Ind.
WBBW-FM	Youngstown, Ohio (s)
WBCA-FM	Bay Minette, Ala.
WBCB-FM	Levittown-Fairless Hills, Pa.
WBCI-FM	Williamsburg, Va.
WBCL-FM	South Beloit, Ill.
WBCM-FM	Bay City, Mich.
WBCN	Boston, Mass. (s)
WBCO-FM	Bucyrus, O.
WBDG	Indianapolis, Ind.
WBEN-FM	Buffalo, N.Y.
WBET-FM	Brockton, Mass.
WBEU-FM	Beaufort, S.C. (s)
WBEX-FM	Chillicothe, Ohio
WBEZ	Chicago, Ill.
WBFG	Detroit, Mich.
WBFO	Buffalo, N.Y.
WBGM	Tallahassee, Fla.
WBGO	Newark, N.J.
WBGU	Bowling Green, Ohio
WBIE-FM	Marietta, Ga.
WBIR	Knoxville, Tenn.
WBIV	Wethersfield, N.Y.
WBJC	Baltimore, Md.
WBKV-FM	West Bend, Wis. (s)
WBKW	Beckley, W.Va.
WBKY	Lexington, Ky.
WBLK-FM	Depew, N. Y.
WBLR-FM	Datesburg, S. C.
WBLY-FM	Springfield, Ohio
WBMK-FM	West Point, Ga.
WBMI	Meriden, Conn. (s)
WBNE-FM	Fitchburg, Mass.
WBNT-FM	Oneida, Tenn.
WBMP	Elwood, Ind.
WBNO-FM	Bryan, Ohio
WBNS-FM	Columbus, Ohio (s)
WBOC-FM	Salisbury, Md.

WHITE'S RADIO LOG

C.L.	Location
WBOE	Cleveland, Ohio
WBON	Milwaukee, Wis.
WBOR	Brunswick, Maine
WBOS-FM	Brookline, Mass.
WBRB-FM	Mt. Clemens, Mich.
WBRC	Birmingham, Ala.
WBRD-FM	Bradenton, Fla.
WBRE-FM	Wilkes-Barre, Pa.
WBRN-FM	Big Rapids, Mich.
WBSM-FM	New Bedford, Mass.
WBST	Muncie, Ind.
WBT-FM	Charlotte, N.C.(s)
WBTC-FM	Houston, Mo.
WBUD-FM	Trenton, N.J.(s)
WBUF	Buffalo, N.Y.
WBUR	Boston, Mass.
WBUT-FM	Butler, Pa.
WBUY-FM	Lexington, N.C.
WBVA	Woodbridge, Va.
WBVP-FM	Beaver Falls, Pa.
WBWC	Berea, Ohio
WBYM	Bayamon, P.R.
WBYO	Boyertown, Pa.(s)
WBZ-FM	Boston, Mass.
WCAC	Anderson, S.C.
WCAO-FM	Baltimore, Md.
WCAR-FM	Detroit, Mich.
WCAS	Knoxville, Tenn.
WCAU-FM	Philadelphia, Pa.
WCBC	Catonsville, Md.
WCBE	Columbus, Ohio
WCBM-FM	Baltimore, Md.
WCBS-FM	New York, N.Y.
WCBW	Columbia, Ill.
WCCC-FM	Hartford, Conn.
WCCM-FM	Lawrence, Mass.
WCCN-FM	Neillsville, Wis.
WCCV-FM	Charlottesville, Va.
WCDL-FM	Carbondale, Pa.
WCED-FM	Dubois, Pa.
WCEN-FM	Mt. Pleasant, Mich.(s)
WCER-FM	Charlotte, Mich.
WCFM	Williamstown, Mass.
WCHA-FM	Chambersburg, Pa.(s)
WCHD	Detroit, Mich.
WCHK-FM	Canton, Ga.
WCHN-FM	Norwich, N.Y.
WCLE-FM	Cleveland, Tenn.
WCLI-FM	Corning, N.Y.
WCLO-FM	Janesville, Wis.
WCLT-FM	Newark, Ohio
WCLV	Cleveland, O.(s)
WCLW-FM	Mansfield, Ohio
WCMC-FM	Wildwood, N.J.
WCMB-FM	Harrisburg, Pa.
WCME-FM	Brunswick, Maine
WCMF-FM	Rochester, N.Y.(s)
WCMI-FM	Ashland, Ky.
WCMO	Marietta, Ohio
WCMS-FM	Norfolk, Va.
WCMU-FM	Mt. Pleasant, Mich.
WCNB-FM	Connersville, Ind.
WCNO	Canton, Ohio(s)
WCNT-FM	Centralia, Ill.
WCNW-FM	Hamilton, Ohio
WCOA-FM	Pensacola, Fla.
WCOD	Richmond, Va.
WCOH-FM	Newnan, Ga.
WCOL-FM	Columbus, Ohio
WCON-FM	Cornelia, Ga.
WCOP-FM	Boston, Mass.
WCOS-FM	Columbia, S.C.
WCOU-FM	Lewiston, Maine
WCOW-FM	Sparta, Wis.
WCPO-FM	Cincinnati, Ohio
WCPS-FM	Tarbor, N.C.
WCRA-FM	Effingham, Ill.
WCRB-FM	Waltham, Mass.(s)
WCRD	Bluffton, Ind.
WCRF-FM	Cleveland, Ohio
WCRQ	Providence, R. I.
WCRT-FM	Birmingham, Ala.(s)
WCSC-FM	Charleston, S.C.
WCSI-FM	Columbus, Ind.(s)
WCSQ	Central Square, N.Y.
WCST-FM	Berkeley Springs, W. Va.
WCTA-FM	Andalusia, Ala.
WCTC-FM	New Brunswick, N.J.
WCTM	Eaton, Ohio
WCTW-FM	New Castle, Ind.
WCUF	Akron, Ohio
WCUM-FM	Cumberland, Md.
WCUY-FM	Cleveland Hts., Ohio
WCWC-FM	Ripon, Wis.
WCWM	Williamsburg, Va.
WDAC	Lancaster, Pa.
WDAE-FM	Tampa, Fla.
WDAF-FM	Kansas City, Mo.
WDAO	Dayton, Ohio
WDAS-FM	Philadelphia, Pa.
WDAY-FM	Fargo, N. D.
WDBJ-FM	Roanoke, Va.
WDBL-FM	Springfield, Tenn.
WDBN	Akron, Ohio(s)
WDBO-FM	Orlando, Fla.
WDBQ-FM	Dubuque, Iowa
WDCX	Buffalo, N.Y.(s)
WDDE	Hamden, Conn.
WDDS-FM	Syracuse, N.Y.
WDEC-FM	Americus, Ga.
WDEE	Hamden, Conn.
WDEF-FM	Chattanooga, Tenn.
WDEL-FM	Wilmington, Del.
WDET-FM	Detroit, Mich.
WDFM	University Park, Pa.
WDHA-FM	Dover, N.J.(s)
WDHF	Chicago, Ill.
WDIF	Buffalo, N.Y.
WDJK	Atlanta, Ga.
WDJK	Smyrna, Ga.
WDJR	Oil City, Pa.
WDKN-FM	Dickson, Tenn.
WDMB-FM	Statesville, N.C.
WDNS-FM	Lynchburg, Va.
WDNC-FM	Durham, N.C.
WDOC-FM	Prestonsburg, Ky.
WDOD-FM	Chattanooga, Tenn.
WDOK-FM	Cleveland, Ohio
WDOL-FM	Athens, Ga.
WDOV-FM	Dover, Del.
WDRC-FM	Hartford, Conn.
WDRK-FM	Greenville, Ohio
WDRM	Darien, Conn.
WDSC-FM	Dillon, S.C.
WDSU-FM	New Orleans, La.
WDTM	Detroit, Mich.(s)
WDTR	Detroit, Mich.
WDUB	Granville, Ohio
WDUN-FM	Gainesville, Ga.(s)
WDUQ	Pittsburgh, Pa.
WDUX-FM	Aberdeen, Wash.
WDUZ-FM	Green Bay, Wis.
WDVR	Philadelphia, Pa.
WDWS-FM	Champaign, Ill.
WDXE-FM	Lawrenceburg, Tenn.
WDXL-FM	Lexington, Tenn.
WEAU-FM	Eau Claire, Wis.
WEAV-FM	Plattsburgh, N.Y.
WEAW-FM	Evanston, Ill.
WEBH	Chicago, Ill.
WEBQ-FM	Harrisburg, Ill.
WEBR-FM	Buffalo, N.Y.
WECI	Richmond, Ind.
WECW	Elmira, N.Y.
WEDA-FM	Grove City, Pa.
WEDR-FM	Miami, Fla.
WEEC	Springfield, Ohio
WEED-FM	Rocky Mount, N.C.
WEEF-FM	Highland Park, Ill.
WEEI-FM	Boston, Mass.
WEEP-FM	Pittsburgh, Pa.
WEEX-FM	Easton, Pa.
WEFA	Waukegan, Ill.
WEFM	Chicago, Ill.(s)
WEGO-FM	Concord, N.C.
WEIV	Ithaca, N.Y.
WEKZ-FM	Monroe, Wis.
WELF	Glen Ellyn, Ill.
WELG	Elgin, Ill.
WELP-FM	Easley, S. C.
WEMC	Harrisonburg, Va.
WEMI	Tampa, Fla.
WEMP-FM	Milwaukee, Wis.
WEOK-FM	Poughkeepsie, N.Y.
WEOL-FM	Elyria, Ohio
WEPM-FM	Martinsburg, W.Va.
WEPS	Elgin, Ill.
WEQR	Goldsboro, N.C.
WERE-FM	Cleveland, Ohio
WERI-FM	Westerly, R.I.
WERM	Wapakoneta, Ohio
WERS	Boston, Mass.
WERT-FM	Van Wert, Ohio
WESC-FM	Greenville, S.C.
WEST-FM	Easton, Pa.
WETL	South Bend, Ind.
WETN	Wheaton, Ill.
WEVC	Evansville, Ind
WEVD-FM	New York, N.Y.
WEWO-FM	Laurinburg, N.C.
WFAA-FM	Dallas, Tex.
WFAC	Mt. Dora, Fla.
WFAH-FM	Alliance, Ohio
WFAN	Washington, D.C.
WFAS-FM	White Plains, N.Y.
WFAU-FM	Augusta, Maine
WFAW	Fort Atkinson, Wis.
WFBC-FM	Greenville, S.C.
WFBE	Flint, Mich.
WFBG-FM	Altoona, Pa.
WFBM-FM	Indianapolis, Ind.
WFBS-FM	Winston-Salem, N.C.
WFCI	Franklin, Ind.
WFCJ	Miamisburg, Ohio
WFCR	Amherst, Mass.
WFDR-FM	Manchester, Ga.
WFDS-FM	Baltimore, Md.
WFFM	Cincinnati, Ohio
WFHA-FM	Red Bank, N.J.
WFHR-FM	Wisconsin Rapids, Wis.
WFID	Rio Piedras, P.R.(s)
WFIG	Sumter, S.C.
WFIL-FM	Philadelphia, Pa.
WFIN-FM	Findlay, Ohio(s)
WFIU	Bloomington, Ind.
WFIZ	Conneault, O.
WFKO	Kokomo, Ind.
WFLA-FM	Tampa, Fla.
WFLM	Ft. Lauderdale, Fla.(s)
WFLN-FM	Philadelphia, Pa.(s)
WFLO	Farmville, Va.
WFLT-FM	Franklin, Tenn.
WFLY	Troy, N.Y.
WFMA	Rocky Mount, N.C.
WFMD-FM	Frederick, Md.
WFME	Newark, N.J.
WFMF	Chicago, Ill.
WFMG	Gallatin, Tenn.
WFMH-FM	Cullman, Ala.
WFMI	Montgomery, Ala.
WFMK	Mt. Horeb, Wis.
WFML	Washington, Ind.
WFMM-FM	Baltimore, Md.
WFMQ	Chicago, Ill.(s)
WFMS	Indianapolis, Ind.(s)
WFMT	Chicago, Ill.(s)
WFMU	East Orange, N.J.
WFMW-FM	Madisonville, Ky.
WFMX	Statesville, N.C.
WFMZ	Allentown, Pa.
WFNC-FM	Fayetteville, N.C.
WFNS-FM	Burlington, N.C.
WFNY	Racine, Wis.
WFOB-FM	Fostoria, Ohio
WFOL	Hamilton, Ohio(s)
WFOS	South Norfolk, Va.
WFOY-FM	St. Augustine, Fla.
WFPG	Atlantic City, N.J.
WFPK	Louisville, Ky.
WFPL	Louisville, Ky.
WFQM	San Juan, P.R.
WFRE-FM	Fresno, Cal.
WFRL-FM	Freeport, Ill.
WFRO-FM	Fremont, Ohio
WFST-FM	Caribou, Maine
WFSU-FM	Tallahassee, Fla.
WFTL-FM	Ft. Lauderdale, Fla.
WFTW-FM	Ft. Walton Beach, Fla.
WFUL-FM	Fulton, Ky.
WFUR-FM	Grand Rapids, Mich.
WFUV	New York, N.Y.
WFVA-FM	Fredericksburg, Va.
WFYC-FM	Alma, Mich.
WGAL-FM	Lancaster, Pa.
WGAR-FM	Cleveland, Ohio
WGAU-FM	Athens, Ga.(s)
WGAY	Silver Spring, Md.
WGBE-FM	Columbus, Ga.
WGBH-FM	Cambridge, Mass.(s)
WGBI-FM	Scranton, Pa.
WGBS-FM	Miami, Fla.
WGCB-FM	Red Lion, Pa.
WGCS	Goshen, Ind.
WGEE-FM	Indianapolis, Ind.
WGEM-FM	Quincy, Ill.(s)
WGET-FM	Gettysburg, Pa.
WGFM	Schenectady, N.Y.(s)
WGGC	Glasgow, Ky.
WGGM	Taylorville, Ill.
WGH-FM	Newport News, Va.
WGHF	Brookfield, Conn.(s)
WGKA-FM	Atlanta, Ga.
WGLI	Babylon, N.Y.
WGLM	Richmond, Ind.
WGLS	Glassboro, N. J.
WGMR-FM	Tyrone, Pa.
WGMS-FM	Washington, D.C.
WGMZ	Flint, Mich.(s)
WGNB	St. Petersburg, Fla.
WGNC-FM	Gastonia, N.C.
WGNO	Madison, Ill.
WGPA-FM	Bethlehem, Pa. (from Ga.)
WGPC-FM	Albany, Ga. (s)
WGPM	Detroit, Mich.
WGPR	Detroit, Mich.(s)
WGPS	Greensboro, N.C.
WGR-FM	Buffalo, N.Y.
WGRE	Greencastle, Ind.
WGRN	Greenville, Ill.
WGRP-FM	Greenville, Pa.
WGRV-FM	Greeneville, Tenn.
WGSU	Genesco, N.Y.
WGTB-FM	Washington, D.C.
WGTS-FM	Takoma Park, Md.
WGUC	Cincinnati, Ohio
WGVE	Gary, Ind.
WGWR-FM	Asheboro, N.C.
WGYA	Interlochen, Mich.
WHA-FM	Madison, Wis. (s)
WHAD	Delafield, Wis.
WHAG-FM	Halfway, Md. (s)
WHAI-FM	Greenfield, Mass.
WHAT-FM	Philadelphia, Pa. (s)
WHAV-FM	Haverhill, Mass.
WHBC-FM	Canton, Ohio
WHBF-FM	Rock Island, Ill.(s)
WHBI	Newark, N.J.
WHBM-FM	Xenia, Ohio
WHCI	Hartford City, Ind.
WHCL-FM	Clinton, N.Y.
WHCN	Hartford, Conn.
WHCU-FM	Ithaca, N.Y.
WHDH-FM	Boston, Mass.
WHDL-FM	Allegheny, N.Y.
WHEB-FM	Portsmouth, N.H.
WHEN-FM	Syracuse, N.Y.
WHFB-FM	Benton Harbor, Mich.
WHFC	Chicago, Ill.
WHFH	Flossmoor, Ill.
WHFI	Birmingham, Mich.
WHFM	Rochester, N.Y.
WHFS	Bethesda, Md.(s)
WHHI	Highland, Wis.
WHHS	Havertown, Pa.
WHIL-FM	Medford, Mass.
WHIM-FM	Providence, R.I.
WHIO-FM	Dayton, Ohio
WHIZ-FM	Zanesville, Ohio
WHJB	Greensburg, Pa.
WHK-FM	Cleveland, Ohio
WHKP-FM	Hendersonville, N.C.
WHKW	Chilton, Wis.
WHKY-FM	Hickory, N. C. (s)
WHLA	Holmen, Wis.
WHLD-FM	Niagara Falls, N. Y.
WHLF-FM	South Boston, Va.
WHLI-FM	Hempstead, N.Y.
WHLM-FM	Bloomsburg, Pa.
WHLS-FM	Port Huron, Mich.
WHMA-FM	Anniston, Ala.
WHMD	Marinette, Wis.
WHME	South Bend, Ind.
WHNC-FM	Henderson, N.C.
WHNR	McMinnville, Tenn.
WHO-FM	Des Moines, Iowa
WHOD-FM	Jackson, Ala.
WHOH	Hamilton, Ohio
WHOK-FM	Lancaster, Ohio
WHOM-FM	New York, N.Y.
WHOO-FM	Orlando, Fla.(s)
WHOP-FM	Hopkinsville, Ky.
WHOS-FM	Decatur, Ala.
WHOV	Hampton, Va.
WHP-FM	Harrisburg, Pa.
WHPE-FM	High Point, N.C.
WHPR	Highland Park, Mich.
WHPS	High Point, N.C.
WHRB-FM	Cambridge, Mass.
WHRM	Wausau, Wis.
WHSA	Highland Twp., Wis.
WHSB	Alpena, Mich.
WHSR-FM	Winchester, Mass.
WHTC-FM	Holland, Mich. (s)
WHTG-FM	Asbury Park, N.J.
WHUB-FM	Cookeville, Tenn.
WHUS	Storrs, Conn.
WHWC	Colfax, Wis.
WHYL-FM	Carlisle, Pa.
WHYN-FM	Springfield, Mass.
WIAC-FM	San Juan, P. R. (s)
WIAL	Eau Claire, Wis.
WIAM-FM	Williamston, N.C.
WIAN	Indianapolis, Ind.
WIBA-FM	Madison, Wis.
WIBC-FM	Indianapolis, Ind.
WIBF	Jenkintown, Pa.
WIBG-FM	Philadelphia, Pa.
WIBM-FM	Jackson, Mich.
WIBW-FM	Topeka, Kan.
WICB	Ithaca, N.Y.
WICR	Indianapolis, Ind.
WIFI	Glenside, Pa.(s)
WIFM	Franklin, Ind.
WIKY-FM	Evansville, Ind.
WIL-FM	St. Louis, Mo.
WILE-FM	Cambridge, O.
WILL-FM	Urbana, Ill.
WILO-FM	Frankfort, Ind.
WILS-FM	Lansing, Mich.
WIMA-FM	Lima, Ohio
WINA-FM	Charlottesville, Va.
WINE-FM	Kenmore, N.Y.
WINK-FM	Ft. Myers, Fla.
WINT-FM	Winter Haven, Fla.
WINZ-FM	Miami, Fla.
WIOD-FM	Miami, Fla.
WIP-FM	Philadelphia, Pa.
WIPR-FM	San Juan, P.R.
WIRA-FM	Ft. Pierce, Fla.
WIRC-FM	Hickory, N. C. (s)
WIRJ-FM	Humboldt, Tenn.
WISA-FM	Isabela, P.R.
WIRQ	Rochester, N.Y.
WISH-FM	Indianapolis, Ind.(s)
WISK	Medford, Mass.
WISM-FM	Madison, Wis.(s)
WISN-FM	Milwaukee, Wis.
WIST-FM	Charlotte, N.C.
WISU	Terre Haute, Ind.
WISZ-FM	Glen Burnie, Md.
WITA-FM	San Juan, P.R.
WITH-FM	Baltimore, Md.
WITN-FM	Washington, N. C.
WITZ-FM	Jasper, Ind.
WIUS	Christiansted, V.I.
WIVY-FM	Jacksonville, Fla.
WIXN-FM	Dixon, Ill.
WIZZ-FM	Streator, Ill.
WJAC-FM	Johnstown, Pa.(s)
WJAS-FM	Pittsburgh, Pa.
WJAX-FM	Jacksonville, Fla.
WJAZ	Albany, Ga.
WJBC-FM	Bloomington, Ill.
WJBI	Cincinnati, Ohio
WJBK-FM	Detroit, Mich.
WJBL-FM	Holland, Mich.
WJBO-FM	Baton Rouge, La.
WJBR	Wilmington, Del.(s)
WJCD-FM	Seymour, Ind.

C.L.	Location
WJCW-FM	Johnson City, Tenn.
WJDX-FM	Jackson, Miss.
WJEF-FM	Grand Rpds., Mich.(s)
WJEH-FM	Gallipolis, Ohio
WJEJ-FM	Hagerstown, Md.
WJET-FM	Erie, Pa.
WJGS	Houghton, Mich.
WJHL-FM	Johnson City, Tenn.
WJIG-FM	Tullahoma, Tenn.(s)
WJIM-FM	Lansing, Mich.
WJIV	Cherry Valley, N.Y.
WJIZ	Albany, Ga.
WJJD-FM	Chicago, Ill.
WJLK-FM	Asbury Park, N.J.
WJLN	Birmingham, Ala.
WJMC-FM	Rice Lake, Wis.
WJMD	Bethesda, Md.(s)
WJMJ-FM	Philadelphia, Pa.
WJMK	Plainfield, Ind.
WJMX-FM	Florence, S.C.
WJNC-FM	Jacksonville, N. C.
WJOF	Athens, Ala.
WJOL-FM	Joliet, Ill.(s)
WJOY-FM	Burlington, Vt.
WJPA-FM	Washington, Pa.
WJR-FM	Detroit, Mich.
WJRH	Easton, Pa.
WJSC-FM	Wilberforce, Ohio
WJSM	Martinsburg, Pa.
WJTN-FM	Jamestown, N.Y.
WJVA-FM	South Bend, Ind.
WJW-FM	Cleveland, Ohio
WJWR	Palmyra, Pa.
WJZZ	Bridgeport, Conn.
WKAK	Kankakee, Ill.
WKAQ-FM	San Juan, P.R.
WKAR-FM	E. Lansing, Mich.
WKAT-FM	Miami, Fla.
WKAY-FM	Glasgow, Ky.
WKAZ-FM	Charleston, W.Va.
WKBC-FM	N. Wilkesboro, N.C.
WKBJ-FM	Milan, Tenn.
WKBN-FM	Youngstown, Ohio
WKBR-FM	Manchester, N.H.
WKBV-FM	Richmond, Ind.
WKCQ	Berlin, N.H.
WKCR-FM	New York, N.Y.
WKCS	Knoxville, Tenn.
WKDN-FM	Camden, N.J.
WKEE-FM	Huntington, W.Va.
WKET-FM	Kettering, Ohio(s)
WKEY-FM	Covington, Va.
WKFM	Chicago, Ill.(s)
WKFR-FM	Battle Creek, Mich.
WKHM-FM	Jackson, Mich.
WKIC-FM	Hazard, Ky.
WKIP-FM	Poughkeepsie, N.Y.
WKIS-FM	Orlando, Fla.
WKIX-FM	Raleigh, N.C.
WKIZ-FM	Key West, Fla.
WKJB-FM	Mayaguez, P. R.
WKJF	Pittsburgh, Pa.(s)
WKJG-FM	Ft. Wayne, Ind.
WKKD	Aurora, Ill.
WKKY-FM	Erlanger, Ky.
WKLF-FM	Clanton, Ala.
WKLS	Marietta, Ga.(s)
WKLW-FM	Grand Rapids, Mich.
WKMH-FM	Dearborn, Mich.
WKMI-FM	Kalamazoo, Mich.
WKMO	Kokomo, Ind.
WKNA	Charleston, W.Va.(s)
WKNE-FM	Keene, N.H.
WKOF	Hopkinsville, Ky.
WKOK-FM	Sunbury, Pa.
WKOP-FM	Binghamton, N.Y.
WKOX-FM	Framingham, Mass.
WKOZ-FM	Kosciusko, Miss.
WKPT-FM	Kingsport, Tenn.(s)
WKRC-FM	Cincinnati, Ohio (s)
WKRG-FM	Mobile, Ala.
WKRT-FM	Cortland, N.Y.
WKSN-FM	Jamestown, N. Y.
WKSU-FM	Kent, Ohio
WKTA	McKenzie, Tenn.
WKTM	N. Charleston, S.C.
WKTM-FM	Mayfield, Ky.(s)
WKTZ-FM	Jacksonville, Fla.(s)
WKWK-FM	Wheeling, W.Va.
WKYX-FM	Paducah, Ky.
WLAC-FM	Nashville, Tenn.
WLAD-FM	Danbury, Conn.
WLAE	Hartford, Conn.
WLAG-FM	LaGrange, Ga.
WLAM-FM	Lewiston, Me.
WLAN-FM	Lancaster, Pa.
WLAP-FM	Lexington, Ky.
WLAT-FM	Conway, S.C.
WLAV-FM	Grand Rapids, Mich.
WLAY-FM	Muscle Shoals, Ala.
WLBB-FM	Carrollton, Ga.
WLBG-FM	Laurens-Clinton, S.C.
WLBH-FM	Mattoon, Ill.
WLBJ-FM	Bowling Green, Ky.
WLBK-FM	DeKalb, Ill.
WLBR-FM	Lebanon, Pa.
WLCM-FM	Lancaster, S.C.
WLDM	Oak Park, Mich.(s)
WLDS-FM	Jacksonville, Ill.
WLEC-FM	Sandusky, Ohio
WLET-FM	Toccoa, Ga.
WLFM	Appleton, Wis.
WLIB-FM	New York, N.Y.
WLIN	Detroit, Mich.
WLIP-FM	Kenosha, Wis.
WLIR	Hicksville, N.Y.(s)
WLIV-FM	Livingston, Tenn.
WLKR-FM	Norwalk, Ohio
WLLH-FM	Lowell, Mass.
WLMC	Okeechobee, Fla.
WLNA-FM	Peekskill, N.Y.
WLNH-FM	Laconia, N.H.
WLNO	London, Ohio
WLOA-FM	Braddock, Pa.(s)
WLOB-FM	Portland, Maine
WLOC-FM	Munfordville, Ky.
WLOE-FM	Leaksville, N.C.
WLOI-FM	La Porte, Ind.
WLOL-FM	Minneapolis, Minn.
WLOM	Chattanooga, Tenn.
WLOS-FM	Asheville, N.C.
WLOV	Cranston, R.I.
WLPO-FM	La Salle, Ill.
WLPR	Mobile, Ala.
WLRS	Louisville, Ky.
WLRJ	Roanoke, Va.
WLRW	Champaign, Ill.
WLS-FM	Chicago, Ill.
WLTA-FM	Atlanta, Ga.(s)
WLUV-FM	Loves Park, Ill.(s)
WLVL	Louisville, Ky.
WLVP	Franklin, N. J.
WLYC-FM	Williamsport, Pa.
WLYM-FM	Lynn, Mass.
WMAG-FM	Forest, Miss.
WMAI-FM	Panama City, Fla.
WMAJ-FM	State College, Pa.
WMAL-FM	Washington, D.C.
WMAM-FM	Marinette, Wis.
WMAQ-FM	Chicago, Ill.(s)
WMAS-FM	Springfield, Mass.
WMAX-FM	Grand Rapids, Mich.
WMAZ-FM	Macon, Ga.
WMBD-FM	Peoria, Ill.
WMBI-FM	Chicago, Ill.
WMBM	Miami Beach, Fla.
WMBO-FM	Auburn, N.Y.
WMCF	Stuart, Fla. (s)
WMCO	New Concord, Ohio
WMCR	Kalamazoo, Mich.
WMDE	Greensboro, N.C.(s)
WMEB-FM	Orono, Maine
WMER	Celina, Ohio
WMEV-FM	Marion, Va.
WMFM	Madison, Wis.(s)
WMFP	Ft. Lauderdale, Fla.
WMFR-FM	High Point, N.C.
WMGM	Atlantic City, N.J.
WMGW-FM	Meadville, Pa.
WMHC	South Hadley, Mass.
WMHE	Toledo, Ohio
WMIL-FM	Milwaukee, Wis.
WMIT	Black Mountain,N.C.
WMIV	S. Bristol, N.Y.
WMIX-FM	Mt. Vernon, Ill.
WMJR	Ft. Lauderdale, Fla.
WMLS-FM	Sylacauga, Ala.
WMLW	Milwaukee, Wis.
WMMB-FM	Melbourne, Fla.
WMMM	Westport, Conn.
WMNA-FM	Gretna, Va.
WMNB-FM	North Adams, Mass. (s)
WMNI-FM	Columbus, Ohio
WMOB-FM	Ocala, Fla.
WMOU-FM	Berlin, N.H.
WMPS-FM	Memphis, Tenn.
WMRF-FM	Lewistown, Pa.
WMRI-FM	Marion, Ind.
WMRN-FM	Marion, Ohio
WMRO-FM	Aurora, Ill.
WMRP-FM	Flint, Mich.
WMSH-FM	Elizabethtown, Pa.
WMSP	Harrisburg, Pa.
WMSR-FM	Manchester, Tenn.
WMT-FM	Cedar Rapids, Iowa (s)
WMTH	Park Ridge, Ill.
WMTI	Norfolk, Va.
WMTM-FM	Moultrie, Ga.
WMTN-FM	Morristown, Tex.(s)
WMTW-FM	Mt. Washington, N.H.(s)
WMUA	Amherst, Mass.
WMUB	Oxford, Ohio
WMUL	Huntington, W.Va.
WMUS-FM	Muskegon, Mich.
WMUN	Muncie, Ind.
WMUU-FM	Greenville, S.C.
WMUZ	Detroit, Mich.
WMVA-FM	Martinsville, Va.(s)
WMVB-FM	Millville, N.J.
WMVO-FM	Mount Vernon, Ohio
WMVR-FM	Sidney, Ohio
WMYB-FM	Myrtle Beach, Fla.
WMYR-FM	Ft. Myers, Fla.
WNAD-FM	Norman, Okla.
WNAS	New Albany, Ind.
WNAV-FM	Annapolis, Md
WNBC-FM	New York, N.Y.
WNBD-FM	Daytona Beach, Fla.
WNBF-FM	Binghamton, N.Y.
WNBH-FM	New Bedford, Mass.
WNCN	New York, N.Y.
WNCO-FM	Ashland, Ohio
WNCT-FM	Greenville, N.C.
WNDA	Huntsville, Ala.(s)
WNDU-FM	South Bend, Ind.
WNEM-FM	Bay City, Mich.(s)
WNES-FM	Central City, Ky.
WNEW-FM	New York, N.Y.
WNEX-FM	Macon, Ga.
WNFM	Naples, Fla.
WNFO-FM	Nashville, Tenn.(s)
WNGO-FM	Mayfield, Ky.
WNHC-FM	New Haven, Conn.
WNIB	Chicago, Ill.
WNIC	DeKalb, Ill.
WNNJ-FM	Newton, N.J.
WNNR-FM	New Orleans, La.
WNOB	Cleveland, Ohio (s)
WNOF	St. Paul, Minn.
WNOK-FM	High Point, N.C.
WNOR-FM	Norfolk, Va.
WNOS-FM	High Point, N.C.
WNOW-FM	York, Pa.
WNRE	Circleville, Ohio
WNRG-FM	Grundy, Va.
WNSL-FM	Laurel, Miss.
WMTH	Winnetka, Ill.
WNTI	Hackettstown, N.J.
WNTL	Memphis, Tenn.
WNUR	Evanston, Ill.
WNWC-FM	Arlington Hts., Ill.
WNYC-FM	New York, N.Y.
WNYE	New York, N.Y.
WOAK	Royal Oak, Mich.
WOAY-FM	Oak Hill, W.Va.
WOBN	Westerville, Ohio
WOC-FM	Davenport, Iowa
WOCB-FM	W. Yarmouth, Mass.
WOCH-FM	North Vernon, Ind.
WOHS-FM	Shelby, N.C.
WOI-FM	Ames, Iowa
WOIO	Cincinnati, Ohio
WOIV	De Ruyter, N.Y.
WOKZ-FM	Alton, Ill.
WOL-FM	Washington, D.C.
WOLA	San Juan, P.R.
WOLI	Ottawa, Ill.
WOMC	Royal Oak, Mich.(s)
WOMI-FM	Owensboro, Ky.
WOMP-FM	Bellaire, Ohio
WONE-FM	Dayton, O.
WONO	Syracuse, N.Y.
WOOD-FM	Grand Rapids, Mich.(s)
WOOF-FM	Dolham, Ala.
WOPA-FM	Oak Park, Ill.
WOPI-FM	Bristol, Tenn.
WOR-FM	New York, N.Y.
WORA-FM	Mayaguez, P.R.
WORX-FM	Madison, Ind.
WOSC-FM	Fulton, N.Y.
WOSU-FM	Columbus, Ohio
WOTW-FM	Nashua, N.H.
WOUB-FM	Athens, Ohio
WOW-FM	Omaha, Nebr.
WOXR	Oxford, Ohio
WPAA	Andover, Mass.
WPAC-FM	Patchogue, N.Y.(s)
WPAD-FM	Paducah, Ky.
WPAT-FM	Paterson, N. J. (s)
WPAY-FM	Portsmouth, Ohio (s)
WPBC-FM	Richfield, Minn. (s)
WPBF	W. Palm Beach, Fla.
WPBS	Philadelphia, Pa.
WPCA-FM	Philadelphia, Pa.
WPEA	Exeter, N.H.
WPEL-FM	Montrose, Pa.
WPEN-FM	Philadelphia, Pa.
WPEX-FM	Pensacola, Fla.(s)
WPFB-FM	Middletown, Ohio (s)
WPFK	Los Angeles, Cal.
WPFM	Providence, R.I.(s)
WPFR	Terre Haute, Ind.
WPGC	Bradbury Hts., Md.
WPGF-FM	Burgaw, N.C.
WPGI	Pittsburgh, Pa.
WPHS	Warren, Mich.
WPIC-FM	Sharon, Pa.
WPIN-FM	St. Petersburg, Fla.
WPIT-FM	Pittsburgh, Pa.
WPIX-FM	New York, N. Y.
WPJB-FM	Providence, R.I.
WPKM	Tampa, Fla.
WPLB	Greenville, Mich.
WPLM-FM	Plymouth, Mass.
WPLN	Nashville, Tenn.
WPLO-FM	Atlanta, Ga.
WPMP-FM	Pascagoula, Miss.
WPPA-FM	Pottsville, Pa.
WPRB	Princeton, N.J.
WPRK	Winter Park, Fla.
WPRM	San Juan, P.R.
WPRO-FM	Providence, R.I.
WPRS-FM	Paris, Ill.
WPRW-FM	Manassas, Va.
WPSR	Evansville, Ind.
WPTF-FM	Raleigh, N.C.
WPTH	Fort Wayne, Ind.
WPTN-FM	Crookeville, Tenn.
WPTW-FM	Piqua, Ohio
WPWT	Philadelphia, Pa.
WQAL	Philadelphia, Pa.(s)
WQDC-FM	Midland, Mich.(s)
WQFM	Milwaukee, Wis.
WQIK-FM	Jacksonville, Fla.
WQMF	Babylon, N.Y.(s)
WQMG	Greensboro, N.C.(s)
WQMS	Hamilton, Ohio
WQRB-FM	Pittsfield, Mass.
WQRS-FM	Detroit, Mich.
WQXI-FM	Atlanta, Ga.
WQXR-FM	New York, N.Y.(s)
WRAD-FM	Radford, Va.
WRAJ-FM	Anna, Ill.
WRAK-FM	Williamsport, Pa.
WRAL-FM	Raleigh, N.C.
WRAY-FM	Princeton, Ind.
WRBL-FM	Columbus, Ga.
WRBS	Baltimore, Md.
WRC-FM	Washington, D.C.
WREC-FM	Memphis, Tenn.
WRED	Youngstown,Ohio
WREK	Woodstock, Ill.
WREO-FM	Ashtabula, Ohio
WRFD-FM	Worthington-Columbus, Ohio
WRFK	Richmond, Va.
WRFL	Winchester, Va.
WRFM	New York, N.Y.
WRFS-FM	Alexander City, Ala.
WRFY-FM	Reading, Pa.
WRHS	Park Forest, Ill.
WRIG-FM	Wausau, Wis.
WRIP-FM	Rossville, Ga
WRIT-FM	Milwaukee, Wis.
WRIU	Kingston, R. I.
WRJN-FM	Racine, Wis.
WRJR	Lewiston, Maine
WRKB-FM	Kannapolis, N.C.
WRKO-FM	Boston, Mass.
WRKT-FM	Cocoa Beach, Fla.(s)
WRLB	Long Branch, N.J.(s)
WRLD-FM	Lanett, Ala.
WRMI-FM	Morris, Ill.
WRMN-FM	Elgin, Ill.
WRNJ	Atlantic City, N.J.
WRNL-FM	Richmond, Va.
WRNW	Mount Kisco, N.Y.
WROA-FM	Gulfport, Miss.
WROC-FM	Rochester, N.Y.
WROK-FM	Rockford, Ill.
WROM-FM	Rome, Ga.
WROW-FM	Albany, N.Y.
WROY-FM	Carmi, Ill.
WRPI	Troy, N.Y.
WRPN-FM	Ripon, Wis.
WRR-FM	Dallas, Tex.
WRRH	Franklin Lakes, N.J.
WRRN	Warren, Pa.
WRSJ-FM	Bayamon, P.R.
WRSV	Skokie, Ill.
WRSE-FM	Elmhurst, Ill.
WRSJ-FM	Bayamon, P. R.
WRSW-FM	Warsaw, Ind.
WRTC-FM	Hartford, Conn.
WRTI-FM	Philadelphia, Pa.
WRUF-FM	Gainesville, Fla.
WRUN-FM	Utica, N.Y.
WRUS-FM	Russellville, Ky.
WRVA-FM	Richmond, Va.
WRVB-FM	Madison, Wis.
WRVC	Norfolk, Va.
WRVG	Georgetown, Ky.
WRVM-FM	Rochester, N.Y.
WRVP	New York, N.Y.
WRWR	Port Clinton, Ohio(s)
WRXO-FM	Roxboro, N.C.
WRYT-FM	Pittsburgh, Pa.
WSAB	Mt. Carmel, Ill.
WSAC-FM	Ft. Knox, Ky.
WSAE	Spring Arbor, Mich.
WSAL-FM	Logansport, Ind.
WSAM-FM	Saginaw, Mich.
WSAU-FM	Wausau, Wis.
WSB-FM	Atlanta, Ga.(s)
WSBA-FM	York, Pa.
WSBC-FM	Chicago, Ill.(s)
WSBF-FM	Clemson, S.C.
WSCB	Springfield, Mass.
WSCI-FM	Platteville, Wis.
WSEI	Olney, Ill.
WSEV-FM	Sieverville, Tenn. (s)
WSFC-FM	Somerset, Ky.
WSFM	Birmingham, Ala.(s)
WSHS	Floral Park, N.Y.
WSHU	Fairfield, Conn.
WSID	Baltimore, Md.
WSIM-FM	Salem,Ind.
WSIP-FM	Paintsville, Ky.
WSIU	Carbondale, Ill.
WSIV-FM	Pekin, Ill.
WSIX-FM	Nashville, Tenn.(s)
WSJG	Hallandale, Fla.
WSJS-FM	Winston-Salem, N.C.
WSKS	Wabash, Ind.
WSLN	Delaware, Ohio
WSLS-FM	Roanoke, Va.(s)
WSLU	Canton, N.Y.
WSMC-FM	Collegedale, Tenn.
WSMD-FM	Waldorf, Md.
WSMI-FM	Litchfield, Ill.
WSMJ	Greenfield, Ind.
WSMT-FM	Sparta, Tenn.
WSNJ-FM	Bridgeton, N.J.
WSNW-FM	Seneca, S.C.
WSOC-FM	Charlotte, N.C.
WSOM-FM	Salem, Ohio
WSON-FM	Henderson, Ky.
WSOU	S. Orange, N.J.
WSOY-FM	Decatur, Ill.
WSPA-FM	Spartanburg, S.C.(s
WSPB-FM	Sarasota, Fla.
WSPD-FM	Toledo, Ohio

WHITE'S RADIO LOG

C.L.	Location
WSPE	Springville, N.Y.
WSPT-FM	Stevens Point, Wis.
WSRS	Worchester, Mass.
WSRW-FM	Hillsboro, Ohio
WSTC-FM	Stamford, Conn.
WSTO	Owensboro, Ky. (s)
WSTP-FM	Salisbury, N.C.
WSTR-FM	Sturgis, Mich.
WSTU-FM	Stuart, Fla.
WSTV-FM	Steubenville, Ohio
WSUP	Platteville, Wis.
WSUW	Whitewater, Wis.
WSVA-FM	Harrisonburg, Va.
WSVB	Tamaqua, Pa.
WSVL-FM	Shelbyville, Ind.
WSVS-FM	Crewe, Va.
WSWG	Greenwood, Miss.
WSWM	East Lansing, Mich.(s)
WSWN-FM	Belle Glade, Fla.
WSYR-FM	Syracuse, N.Y.(s)
WTAD-FM	Quincy, Ill.
WTAP-FM	Parkersburg, W. Va.
WTAR	Norfolk, Va.(s)
WTAS	Crete, Ill.
WTAW-FM	College Station, Tex.
WTAX-FM	Springfield, Ill.
WTAY-FM	Robinson, Ill.
WTBC-FM	Tuscaloosa, Ala.
WTBO-FM	Cumberland, Md.
WTBS	Cambridge, Mass.
WTCO-FM	Campellsville, Ky.
WTCW-FM	Whitesburg, Ky.
WTCX	St. Petersburg, Fla.(s)
WTDS	Toledo, Ohio
WTFM	Lake Success, N.Y.(s)
WTGI	Hammond, La.
WTHI-FM	Terre Haute, Ind.
WTHS	Miami, Fla.
WTIC-FM	Hartford, Conn.(s)
WTIO	Charleston, W. Va.
WTJS-FM	Jackson, Tenn.
WTJU	Charlottesville, Va.
WTMA-FM	Charleston, S.C.
WTMB-FM	Tomah, Wis.
WTMJ-FM	Milwaukee, Wis.(s)
WTNC-FM	Thomasville, N.C.
WTOA	Trenton, N.J.
WTOC-FM	Savannah, Ga.
WTOD-FM	Toledo, Ohio
WTOF	Canton, Ohio
WTOL-FM	Toledo, Ohio
WTOP-FM	Washington, D.C.
WTOS	Wauwatosa, Wis.
WTOT-FM	Marianna, Fla.
WTRC-FM	Elkhart, Ind.
WTRE	Greensburg, Ind.
WTRF-FM	Wheeling, W.Va.
WTSB-FM	Lumberton, N.C.
WTSS-FM	Buffalo, N.Y.
WTSV-FM	Claremont, N.H.
WTTC-FM	Towanda, Pa.
WTTF-FM	Tiffin, Ohio
WTTR-FM	Westminster, Md.
WTTV-FM	Bloomington, Ind.
WTUN	Tampa, Fla.
WTVN-FM	Columbus, Ohio
WUAG	Greensboro, N. C.
WUCB-FM	Chicago, Ill.
WUFM	Utica, N.Y.(s)
WUHY-FM	Philadelphia, Pa.
WULX-FM	Richmond, Ind.
WUNC	Chapel Hill, N.C.
WUNH	Durham, N.H.
WUOA	Tuscaloosa, Ala.
WUOM	Ann Arbor, Mich.
WUOT	Knoxville, Tenn.
WUPY	Lynn, Mass.(s)
WUSC-FM	Columbia, S.C.
WUSF	Tampa, Fla.
WUST-FM	Bethesda, Md.
WUSV	Scranton, Pa.
WUWM	Milwaukee, Wis.
WVAM-FM	Altoona, Pa.
WVBR-FM	Ithaca, N.Y.
WVBU-FM	Lewisbury, Pa.
WVCA-FM	Gloucester, Mass.
WVCG-FM	Coral Gables, Fla.(s)
WVEC-FM	Hampton, Va.
WVEM	Springfield, Ill.
WVGR-FM	Grand Rapids, Mich.
WVHC	Hempstead, N.Y.
WVHI	Evansville, Ind.
WVIC-FM	E. Lansing, Mich.
WVIP-FM	Mount Kisco, N.Y.
WVIS	Terre Haute, Ind.
WVJS-FM	Owensboro, Ky.
WVKC-FM	Galesburg, Ill.
WVKO-FM	Columbus, Ohio
WVLK-FM	Lexington, Ky.(s)
WVLR	Sauk City, Wis.
WVMC-FM	Mt. Carmel, Ill.
WVNA-FM	Tuscumbia, Ala.
WVNJ-FM	Newark, N.J.
WVNO-FM	Mansfield, Ohio(s)
WVOR	Rochester, N.Y.
WVOS-FM	Liberty, N.Y.
WVOT-FM	Wilson, N.C.
WVOX-FM	New Rochelle, N.Y.
WVPO-FM	Stroudsburg, Pa.
WVQM	Huntington, W.Va.
WVSH	Huntington, Ind.
WVST	St. Petersburg, Fla.
WVTS	Terre Haute, Ind.(s)
WVUD-FM	Kettering, Ohio
WVVV	Blacksburg, Va.
WVWO-FM	Cheyenne, Wyo.
WWCF	Greenfield, Wis.
WWCO-FM	Waterbury, Conn.
WWDC-FM	Washington, D.C.
WWDL	Scranton, Pa. (s)
WWGP-FM	Sanford, N.C.
WWHC	Hartford City, Ind.
WWHG-FM	Hornell, N.Y.
WWHI	Muncie, Ind.
WWHO	Jackson, Miss.
WWIL-FM	Ft. Lauderdale, Fla.
WWJ-FM	Detroit, Mich.
WWJC-FM	Superior, Wis.
WWKS	Macomb, Ill.
WWLA	La Crosse, Wis.
WWMO	Reidsville, N.C.
WWMT	New Orleans, La.(s)
WWOD-FM	Lynchburg, Va.
WWOG	Boca Raton, Fla.
WWOL-FM	Buffalo, N.Y.
WWOM-FM	New Orleans, La.
WWON-FM	Woonsocket, R.I.
WWOS	Palm Beach, Fla.
WWPB	Miami, Fla.(s)
WWST-FM	Wooster, Ohio
WWSW-FM	Pittsburgh, Pa.
WWTV-FM	Cadillac, Mich.
WWVA-FM	Wheeling, W.Va.
WWWS	Greenville, N.C.
WWYN-FM	Erie, Pa.
WXAX	Elkhart, Ind.
WXBM-FM	Milton, Fla.
WXBR	Cocoa Beach, Fla.
WXEL	Louisville, Ky.
WXEN-FM	Cleveland, Ohio
WXFM	Elmwood Park, Ill.
WXHR	Cambridge, Mass.
WXPN	Philadelphia, Pa.
WXQR-FM	Jacksonville, N. C.
WXRA	Woodbridge, Va.
WXRI	Norfolk, Va.
WXTC	Annapolis, Md.
WXTO-FM	Grand Rapids, Mich.
WXUR-FM	Media, Pa.
WXYW	Suffolk, Va.
WXYZ-FM	Detroit, Mich.
WYAK	Sarasota, Fla.(s)
WYBC-FM	New Haven, Conn.
KYDD	New Kensington, Pa.
WYCA	Hammond, Ind.
WYCE	Warwick, R.I.
WYCR	York-Hanover, Pa.
WYFE	Lansing, Mich.
WYFI	Norfolk, Va.(s)
WYFM	Charlotte, N.C.
WYFS	Winston-Salem, N.C.
WYSL-FM	Buffalo, N.Y.
WYSO	Yellow Springs, Ohio
WYZZ	Wilkes-Barre, Pa.
WZAK	Cleveland, O.
WZEP-FM	DeFuniak, Springs, Fla.
WZIP-FM	Cincinnati, Ohio

Canadian AM Stations By Call Letters

C.L.	Location	Kc.
CBA	Sackville, N.B.	1070
CBAF	Moncton, N.B.	1300
CBD	St. John, N. B.	1110
CBE	Windsor, Ont.	1550
CBF	Montreal, Que.	690
CBG	Gander, Nfld.	1450
CBH	Halifax, N.S.	860
CBI	Sydney, N.S.	1140
CBJ	Chicoutimi, Que.	1580
CBK	Regina, Sask.	540
CBL	Toronto, Ont.	740
CBM	Montreal, Que.	940
CBN	St. John's, Nfld.	640
CBO	Ottawa, Ont.	910
CBOF	Ottawa, Ont.	1250
CBR	Calgary, Alta.	1010
CBT	Grand Falls, Nfld.	540
CBU	Vancouver, B.C.	690
CBV	Quebec, Que.	980
CBW	Winnipeg, Man.	990
CBX	Edmonton, Alta.	1010
CBY	Corner Brook, Nfld.	990
CBZ	Fredericton, N.B.	1480
CFAB	Windsor, N.S.	1450
CFAC	Calgary, Alta.	960
CFAM	Altona, Man.	1290
CFAR	Flin Flon, Man.	590
CFAX	Victoria, B.C.	810
CFBC	Saint John, N.B.	930
CFBR	Sudbury, Ont.	550
CFBV	Smithers, B.C.	1230
CFCB	Corner Brook, Nfld.	570
CFCF	Montreal, Que.	600
CFCH	Callander, Ont.	600
CFCL	Timmins, Ont.	620
CFCN	Calgary, Alta.	1060
CFCO	Chatham, Ont.	630
CFCP	Courtenay, B.C.	1440
CFCW	Camrose, Alta.	790
CFCY	Charlottetown, P.E.I.	630
CFDA	Victoriaville, Que.	1380
CFDR	Dartmouth, N.S.	790
CFGB	Goose Bay, Nfld.	1340
CFGM	Richmond Hill, Ont.	1310
CFGP	Grande Prairie, Alta.	1050
CFGR	Gravelbourg, Sask.	1230
CFGT	Saint-Joseph-d'Alma, Que.	1270
CFJC	Kamloops, B.C.	910
CFJR	Brockville, Ont.	1450
CFKL	Schefferville, Que.	1230
CFLM	La Tuque, Que.	1240
CFLV	Valleyfield, Que.	1370
CFMB	Montreal, Que.	1410
CFML	Cornwall, Ont.	1110
CFMR	Fort Simpson, N.W.T.	1490
CFNB	Fredericton, N.B.	550
CFNS	Saskatoon, Sask.	1170
CFOB	Fort Frances, Ont.	800
CFOM	Quebec, Que.	1340
CFOR	Orillia, Ont.	1570
CFOS	Owen Sound, Ont.	560
CFOX	Pointe Claire, Que.	1470
CFPA	Port Arthur, Ont.	1230
CFPL	London, Ont.	980
CFPR	Prince Rupert, B.C.	1240
CFQC	Saskatoon, Sask.	600
CFRA	Ottawa, Ont.	580
CFRB	Toronto, Ont.	1010
CFRC	Kingston, Ont.	1490
CFRG	Gravelbourg, Sask.	710
CFRN	Edmonton, Alta.	1260
CFRS	Simcoe, Ont.	1560
CFRY	Portage la Prairie, Man.	920
CFSL	Weyburn, Sask.	1340
CFSX	Stephenville, Nfld.	910
CFTJ	Galt, Ont.	1110
CFTK	Terrace, B.C.	1140
CFUN	Vancouver, B.C.	1410
CFVR	Abbotsford, B.C.	1240
CFYK	Yellowknife, N.W.T.	1340
CFWB	Campbell River B.C.	1490
CFWH	Whitehorse, Y.T.	570
CHAB	Moose Jaw, Sask.	800
CHAD	Amos, Que.	1340
CHAK	Inuvik, N.W.T.	860
CHAT	Medicine Hat, Alta.	1270
CHCM	Marystown, Nfld.	560
CHEC	Lethbridge, Alberta	1090
CHED	Edmonton, Alta.	630
CHEF	Granby, Que.	1450
CHEX	Peterborough, Ont.	980
CHFA	Edmonton, Alta.	680
CHFC	Churchill, Man.	1320
CHFI	Toronto, Ont.	1540
CHGB	Sainte-Anne-de-la-Pocatière, Que.	1310
CHIC	Brampton, Ont.	1090
CHIQ	Hamilton, Ont.	1280
CHLC	Saguenay Co., Que.	580
CHLN	Trois-Rivières, Que.	550
CHLO	St. Thomas, Ont.	680
CHLT	Sherbrooke, Que.	630
CHML	Hamilton, Ont.	900
CHNC	New Carlisle, Que.	610
CHNO	Sudbury, Ont.	900
CHNS	Halifax, N.S.	960
CHOK	Samia, Ont.	1070
CHOV	Pembroke, Ont.	1350
CHOW	Welland, Ont.	1470
CHQM	Vancouver, B.C.	1320
CHOR	Calgary, Alta.	810
CHRC	Quebec, Que.	800
CHRD	Drummondville, Que.	1340
CHRL	Roberval, Que.	910
CHRS	St-Jean, Que.	1090
CHSJ	Saint John, N.B.	1150
CHSM	Steinbach, Man.	1250
CHTM	Thompson, Man.	610
CHUB	Nanaimo, B.C.	1570
CHUC	Cobourg, Ontario	1500
CHUM	Toronto 7, Ontario	1050
CHWK	Chilliwack, B.C.	1270
CHWO	Oakville, Ont.	1250
CJAD	Montreal, Que.	800
CJAF	Cabano, Que.	1340
CJAT	Trail, B.C.	610
CJAV	Port Alberi, B.C.	1240
CJBC	Toronto, Ont.	860
CJBM	Rimouski, Que.	1450
CJBQ	Belleville, Ont.	800
CJBR	Rimouski, Que.	900
CJCA	Edmonton, Alta.	930
CJCB	Sydney, N.S.	1270
CJCH	Halifax, N.S.	920
CJCJ	Woodstock, N.B.	920
CJCN	Grand Falls, Nfld.	680
CJCS	Stratford, Ont.	1240
CJDC	Dawson Creek, B.C.	1350
CJDV	Drumheller, Alta.	910
CJEM	Edmundston, N.B.	570
CJET	Smiths Falls, Ont.	630
CJFP	Riviere-du-Loup, Que.	1400
CJFX	Antigonish, N.S.	580
CJGX	Yorkton, Sask.	940
CJIB	Vernon, B.C.	940
CJIC	Sault Ste. Marie, Ont.	1050
CJJC	Langley, B.C.	850
CJKL	Kirkland Lake, Ont.	560
CJLM	Joliette, Que.	1050
CJLR	Quebec, Que.	1060
CJLS	Yarmouth, N.S.	1340
CJLX	Fort William, Ont.	800
CJME	Regina, Sask.	1300
CJMS	Montreal, Que.	1280
CJMT	Chicoutimi, Que.	1420
CJNB	North Battleford, Sask.	1460
CJNR	Blind River, Ont.	730
CJOB	Winnipeg Man.	680
CJOC	Lethbridge, Alta.	1220
CJON	St. John's, Nfld.	930
CJOR	Vancouver, B.C.	600
CJOX	Grand Bank, Nfld.	710
CJOY	Guelph, Ont.	1460
CJQM	Winnipeg, Manitoba	1470
CJRL	Kenora, Ont.	1220
CJRN	Niagara Falls, Ont.	1600
CJRW	Summerside, P.E.I.	1240
CJSL	Estevan, Sask.	1280
CJSO	Sorel, Que.	1320
CJSP	Leamington, Ont.	710
CJSS	Cornwall, Ont.	1220
CJVI	Victoria, B.C.	900
CJWA	Sault Ste. Marie, Ont.	1240
CKAC	Montreal, Que.	730
CKAD	Middletown, N.S.	1490
CKAR	Huntsville, Ont.	630
CKAR-1	Huntsville, Ont.	1340
CKAY	Duncan, B. C.	1500
CKBB	Barrie, Ont.	950
CKBC	Bathurst, N.B.	1360
CKBI	Prince Albert, Sask.	900
CKBL	Matane, Que.	1250
CKBM	Montmagny, Que.	1490
CKBS	St. Hyacinthe, Que.	1240
CKBW	Bridgewater, N.S.	1000
CKCH	Hull, Que.	970
CKCK	Regina, Sask.	620
CKCL	Truro, N.S.	600
CKCM	Grand Falls Nfld.	620
CKCN	Sept-Iles, Que.	360
CKCQ	Quesnel, B.C.	570
CKCR	Kitchener, Ont.	1490
CKCV	Quebec, Que.	1280
CKCW	Moncton, N.B.	1220
CKCY	Sault Ste. Marie, Ont.	920
CKDA	Victoria, B.C.	1220
CKDH	Amherst, N.S.	1400
CKDM	Dauphin, Man.	730
CKDR	Kenora, Ont.	900
CKEC	New Glasgow, N.S.	1320
CKEK	Cranbrook, B.C.	570
CKEN	Kentville, N.S.	1350
CKEY	Toronto, Ont.	580
CKFH	Toronto, Ont.	1430
CKGB	Timmins, Ont.	680
CKGM	Montreal, Que.	980
CKJL	Saint-Jérôme, Que.	900
CKKW	Kitchener, Ontario	1320
CKLB	Oshawa, Ont.	1350
CKLC	Kingston, Ont.	1380
CKLD	Thetford Mines, Que.	1230
CKLG	Vancouver, B.C.	730
CKLM	Montreal, Que.	1570
CKLN	Nelson, B.C.	1390
CKLS	La Sarre, Que.	1240
CKLW	Windsor, Ont.	800
CKLY	Lindsay, Ont.	910
CKML	Mont Laurier, Que.	610
CKMP	Midland, Ont.	1230
CKMR	Newcastle, N.B.	790

C.L.	Location	Kc.	C.L.	Location	Kc.	C.L.	Location	Kc.	C.L.	Location	Kc.
CKNB	Campbellton, N.B.	950	CKPC	Brantford, Ont.	1380	CKSB	Saint-Boniface, Man.	1050	CKVM	Ville-Marie, Que.	710
CKNL	Fort St. John, B.C.	950	CKPG	Prince George, B.C.	550	CKSL	London, Ont.	1290	CKWL	Williams Lake, B. C.	1240
CKNW	New Westminister, B.C.	980	CKPM	Ottawa, Ont.	1440	CKSM	Shawinigan, Que.	1220	CKWS	Kingston, Ont.	960
CKNX	Wingham, Ont.	920	CKPR	Port Arthur, Ont.	580	CKSO	Sudbury, Ont.	790	CKWW	Windsor, Ont.	580
CKOC	Hamilton, Ont.	1150	CKPT	Peterborough, Ont.	1420	CKSW	Swift Current, Sask.	1400	CKWX	Vancouver, B.C.	1130
CKOK	Penticton, B.C.	800	CKRB	Cté de Beauce, Que.	1460	CKTB	St. Catharines, Ont.	610	CKX	Brandon, Man.	1150
CKOM	Saskatoon, Sask.	1250	CKRC	Winnipeg, Man.	630	CKTK	Kitimat, B. C.	1230	CKXL	Calgary, Alta.	1140
CKOT	Tillsonburg, Ont.	1510	CKRD	Red Deer, Alta.	850	CKTR	Trois-Rivières, Que.	1150	CKY	Winnipeg, Man.	580
CKOV	Kelowna, B.C.	630	CKRM	Regina, Sask.	980	CKTS	Sherbrooke, Que.	900	CKYL	Peace River, Alta.	610
CKOX	Woodstock, Ont.	1340	CKRN	Rouyn, Que.	1400	CKUA	Edmonton, Alta.	580	VOAR	St. John's Nfld.	1230
CKOY	Ottawa, Ont.	1310	CKRS	Jonquière Que.	590	CKVD	Val-d'Or, Que.	1230	VOCM	St. John's Nfld.	590
			CKSA	Lloydminster, Alta.	1150	CKVL	Verdun, Que.	850	VOWR	St. John's, Nfld.	800

Canadian FM Stations by Call Letters

Abbreviations: (s) broadcasts stereo

C.L.	Location		C.L.	Location		C.L.	Location		C.L.	Location	
CBC-FM	Toronto, Ont.	99.1	CHEC-FM	Lethbridge, Alta.	100.9	CJFM-FM	Montreal, Que. (s)	95.9	CKLC-FM	Kingston, Ont.	99.5
CBF-FM	Montreal, Que.	95.1	CHFI	Toronto, Ont. (s)	98.1	CJIC-FM	Sault Ste. Marie, Ont. (s)	100.5	CKLG-FM	Vancouver, B. C. (s)	99.3
CBM-FM	Montreal, Que.	100.7	CHFM-FM	Calgary, Alta.	95.9	CJMS-FM	Montreal, Que. (s)	94.3	CKLW-FM	Windsor, Ont. (s)	93.9
CBO-FM	Ottawa, Ont.	103.3	CHIC-FM	Brampton, Ont.	102.1	CJOB-FM	Winnipeg, Man. (s)	97.5	CKPC-FM	Brantford, Ont.	92.1
CBU-FM	Vancouver, B. C.	105.7	CHLT-FM	Sherbrooke, Que. (s)	102.7	CJRT-FM	Toronto, Ont.	91.1	CKPR-FM	Port Arthur, Ont.	94.3
CFCF-FM	Montreal, Que. (s)	92.5	CHML-FM	Hamilton, Ont. (s)	95.3	CJSS-FM	Cornwall, Ont.	104.5	CKQM-FM	Winnipeg, Man. (s)	94.3
CFFM-FM	Kamloops, B. C. (s)	98.3	CHNS-FM	Halifax, N. S.	96.1	CKCR-FM	Kitchener, Ont.	96.7	CKTB-FM	St. Catharines, Ont.	97.7
CFMO-FM	Ottawa, Ont. (s)	93.9	CHRC-FM	Quebec, Que. (s)	98.1	CKCY-FM	Sault Ste. Marie, Ont. (s)	104.3	CKUA-FM	Edmonton, Alta.	98.1
CFMW-FM	St. Norbert, (Winnipeg) Man. (s)	98.3	CHUM-FM	Toronto, Ont. (s)	104.5	CKDA-FM	Victoria, B. C.	98.5	CKVL-FM	Verdun, Que. (s)	96.9
CFPL-FM	London, Dnt. (s)	95.9	CJBQ-FM	Belleville, Ont.	97.1	CKFM-FM	Toronto, Ont. (s)	99.9	CKWS-FM	Kingston, Ont.	96.3
CFQM-MF	Vancouver, B. C. (s)	103.5	CJBR-FM	Rimouski, Que.	101.5	CKGB-FM	Timmins, Ont.	94.5	CKX-FM	Brandon, Man. (s)	96.1
CFRC-FM	Kingston, Ont.	91.9	CJCA-FM	Edmonton, Alta.	99.5	CKGM-FM	Montreal, P. Q. (s)	97.7	CKY-FM	Winnipeg, Man. (s)	92.1
CFRN-FM	Edmonton, Alta. (s)	100.3	CJCB-FM	Sydney, N. S.	94.9	CKLB-FM	Oshawa, Ont.	93.5			

Cuba and Mexico AM Stations by all Letters

The broadcast stations listed below carry regular program material and transmit with 5000 watts or better power output during at least part of their broadcasting day.

Location	C.L.	Kc.
Cuba		
Havana	CMCY	550
	CMW	590
	CMQ	640
	CMCU	660
	CMBC	690
	CMCA	730
	CMCD	760
	CMCH	790
	CMCU	820
	CMBZ	830
	CMBL	860
	CMCF	910
	CMBF	950
	CMCK	980
	CMBF	1010
	CMCX	1040
	CMBS	1090
	CMBQ	1160
	CMK	1180
	CMCI	1260
	CMBG	1360
	CMBX	1390
	CMCQ	1420
	CMOX	1490
	CMBD	1520
Holguin	CMKJ	740
Santa Clara	CMHI	570
	CMHQ	630
Mexico		
Acapulco, Gro.	XEBB	600
Chetumal, Q.R.	XEDB	960
Chihuahua, Chih.	XEFI	580
	XEBU	620
	XEM	1390
	XEII	1420
Ciudad Acuna, Coah.	XERF	1570
Ciudad Juarez, Chih.	XELO	800
	XEJ	970
	XEF	1420
Ciudad Obregon, Son.	XEIC	810
	XEOX	1430
Coatzacoalcos, Ver.	ZEZS	1170
Culiacan, Sin.	XENW	710
	XEWS	1010
Guadalajara, Jal.	XEAV	580
	XEZZ	760
	XEHL	1010
	XEWK	1190
	XEDK	1250
Hermosillo, Son.	XEBH	920
	XEDM	1580
Irapuato, Gto.	XEWE	1420
Jalapa, Ver.	XEJJ	1550
La Piedad, Mich.	XELC	980
Leon, Gto.	XELG	680
	XEX	730
	XEXG	6065
Matamoros, Tams.	XEEW	1420
Merida, Yuc.	ZEQW	50
Mexicali, B.C.	XECL	990
	XED	1050
	XEKC	1590
Mexico City	XEPH	590
	XENK	620
	XERPM	660
	XEN	690
	XEX	730
	XERC	790
	XELA	830
	XEUN	860
	XEW	900
	XEQ	940
	XEDF	970
	XEOY	1000
	XEQR	1030
	XEDP	1060
	XERCN	1110
	XEJP	1150
	XEB	1220
	XEL	1260
	XEBS	1410
	XELZ	1440
	XESM	1470
	XERH	1500
	XEMC	1590
	XEWW	6165
	XEWW	9515
	XEQQ	9680
	XEHH	11880
	XERR	15110
	XEWW	15160
	XESC	15205
Monterrey, N.L.	XEWA	540
	XEAR	570
	XEFB	630
	XENL	860
	XET	990
	XEG	1050
	XEMR	1140
	XEAW	1280
	XEFZ	1370
Nogales, Son.	XEHF	1370
Nuevo Laredo, Tams.	XEK	960
Oaxaca, Oax.	XEOA	570
Orizaba, Ver.	XETQ	850
Parras De La Fuente, Coah.	XEJQ	1440
Patzcauro, Mich.	XEXL	1370
Piedras Negras, Coah.	XEWU	580
Poza Rica, Ver.	XEPR	1480
Puebla, Pue.	XEPA	1370
Reynosa, Tams.	XERT	1170
Rio Bravo, Tams.	XEFD	590
Sabinas, Coah.	XEBX	610
San Luis Potosi, S.L.P.	XEWA	540
	XEBM	920
Tampico, Tams.	XEFW	810
Tijuana, B.C.	XETRA	690
	XEMO	860
	XEAU	1470
Torreon, Coah.	XEVK	1010
	XEBP	1310
	XETB	1350
Tuxpan, Nay.	XEUX	810
Tuxpan, Ver.	XETL	1390
Uruapan, Mich.	XEUF	610
Veracruz, Ver.	XEWB	760
	XEU	920
	XELL	1430
Villahermosa, Tab.	XEVA	790
	XEVT	970
Zamora., Mich.	XEZM	650
Zitacuaro, Mich.	XELX	1460

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World-Wide Short-Wave Stations

The World-Wide short wave stations section of *White's Radio Log* is, as its name implies, a *log*, that lists stations actually monitored by listeners in the United States, Canada and overseas. It is *not* intended to be a listing of *all* shortwave transmitters, licensed as such listings contain numerous inactive transmitters, and low powered stations which are rarely heard by DX'ers. The stations listed here, therefore, are those most often reported and consistently heard during the past few months. Many have been monitored by DX Central, the official Radio-TV Experimenter monitoring post in New York City.

Because of the fact that this log represents actual monitoring reports rather than data taken from published program schedules received from the stations, you may find that frequencies (and operating times) given here differ from *official listings*. This is because foreign short-wave stations frequently operate several kilocycles away from their assigned (and announced) frequencies. In addition, the schedules of these stations are often changed and the changes are not published in the schedules until many months later. We feel that the type of log which *White's Radio Log* is presenting represents a very realistic picture of the current status of short-wave broadcasting, and is something which cannot be obtained elsewhere.

For the DX'er. If you care to roam the bands for DX, we present here some information which will be of invaluable use to you in tracking down DX stations.

Although the current radio propagation conditions have made the high frequency bands (11 and 13 meter bands) relatively poor for DX'ers, the other bands are generally good during certain periods of the year. As a general rule, the following bands are "hot for DX" during the daily and seasonal times indicated:

60-meter band=Winter nights.
49-meter band=Winter nights.
41-meter band=Winter nights.
31-meter band=Nights, all year.
25-meter band=Nights, all year.
19-meter band=Days all year, and Summer nights.
16- meter band=Days, all year, and Summer nights.
13-meter band=Days, all year.
11-meter band=Days, all year.

More on QSL's. In the last issue of Radio-TV Experimenter we discussed the collecting of QSL cards from broadcasting stations, one of the finer aspects of the art of DX'ing. When our issue came out we received considerable mail asking about the possibilities of QSL cards from *non*-broadcasting radio stations, such as hams, police, ships, etc.

Ham stations generally swap QSL cards with each other after a "contact," and a good percentage of ham operators will also QSL a monitoring report if they find it useful. The addresses of ham operators may be obtained from *The Radio Amateurs Callbook* which may be purchased at Ham radio stores or by mail from any of the major parts supply houses.

Police stations, ships, and other "odd ball" stations sometimes QSL, but generally they will ignore your report unless you include with it a prepared QSL card (stamped, too) which they can sign and return to you without much bother. The radio-telephone stations frequently heard with test tapes on single-sideband are tough to QSL because they prefer to keep their transmissions as unpublicized as possible.

Citizens Band operators will frequently QSL SWL reports, but finding their addresses is a problem because of the absence of adequate callbooks. Each month there is a listing of about 1000 CB operators in *S9 Magazine*, which is available on many newsstands throughout the U. S. and Canada.

In our December-January issue we had an item about a station calling itself "Radio Free Dixie." In a report just received from Bill Brubaker of Miami, Fla., we understand that they are on from 2300 to 2400 EST on 690 kc's with a powerful signal. Programs consist of jazz music and commentaries. Our expert on "weirdo stations," Tom Kneitel, K3FLL/WB2AAI, says that this is a bootleg station operated in Cuba by Castro, designed to stir racial unrest throughout our southern states.

In our listings, a station or frequency marked with an asterisk (*) indicates a non-broadcast station or frequency. This might include aeronautical, maritime, military, or other type of transmission, either in regular AM or single sideband (SSB). In instances where many non-broadcast stations use the same frequency, we have given you a clue as to the type of stations to be found there, rather than pin down only one station.

Let Us Know. Listeners are invited to submit their loggings to us for publication in the Shortwave section of *White's Radio Log*. Be sure to include the following information for each station you report: approximate frequency, callsign and/or station name, city and country, and time heard in Eastern Standard Time, 24 hour clock. Address your reports to: DX CENTRAL, *White's Radio Log*, c/o RADIO-TV EXPERIMENTER, 505 Park Avenue, New York, N. Y. 10022, U.S.A.

Time To Listen. All times shown in *White's Radio Log* are in the 24 hour EST clock system. For example, 0800 is 8:00 AM EST, 1200 is noon EST, 1800 is 6 PM EST, and so on. For conversion to other time zones, subtract 1 hour for CST (0800 EST is 7 AM CST), 2 hours for MST, 3 hours for PST.

The following abbreviations are used in our listings: BC—Broadcasting Company, Corporation, or System; E—Emissora; R—Radio or Radiodiffusion; V—Voice or Voz.

TNX. We are indebted to the following DX'ers who added their loggings to those of DX CENTRAL, the official RADIO-TV EXPERIMENTER monitoring station in New York City, to bring you this month's listings:

Tom Kneitel, New York, N.Y.
Dave Mateyka, Steger, Ill.
Richard F. Kline, Englewood, N.J.
Dale Koby, Van Nuys, Calif.
Robert Luke, Canton, Ohio
Roger Camire, Manchester, N.H.
Harvey Conely, Rockaway, N.J.
Bob Pressey, Glenview, Ill.
Peter Grenier, Fall River, Mass.
Alan Kapala, Lodi, N.J.
Warren Lambard, Alexandria, La.
Irwin Tatelman, Chicago, Ill.
Glenn W. Dye, Wildwood, N. J.
P. Richmond, Chilliwack, B.C.
Gerald W. Dickson, Scarborough, Ont.
Richard Tygrest, Hopewell, Va.
Walter L. Read, North Bend, Ore.
Dale Slack, Springhill, La.
Walter P. Pyne, Hagerstown, Md.
Edmond N. Roux, Lowell, Mass.
L. P. Ackerman, Phoenix, Ariz.
John Engel, Mankato, Minn.
Ralph J. Monson, Lancaster, Va.
Mike Poulter, San Angelo, Texas
L. Bruce Meyer, Portland, Ore.
Lawrence Whitehead, Wewoka, Okla.
Sol Nussbaum, Brooklyn, N.Y.
David Wood, Dearborn Hts, Mich.
Ronald Smeltzer, Montreal, Que.
Shaler Hanisch, Hartford, Conn.
Peter De Hart, Middletown, Pa.
Doug Lamerson, Richmond Hill, N.Y.
A2C Manuel Borges, Walker AFB, N.M.
Rick Slattery, Miami, Fla.
Dr. Gerhart Heinisch, Winnipeg, Man.
W. T. Grubb, Dubuque, Iowa
Julian M. Sienkiewicz, Brooklyn, N.Y.
Steve Wilkes, Dallas, Tex.
Dennis Letendre, Miami, Fla.
Edward F. Wiegano, Rochester, N.Y.
Frank J. Voltz, Trenton, N.J.
Norman Hopkins, Neligh, Nebr.
Robert Wilson, Flushing, N.Y.
Karl Simmons, Jacksonville, Fla.
Gordon Amey, Jr., Baltimore, Md.
Melvin Hickman, Walla Walla, Wash.
Barry L. Schneider, Flushing, N.Y.
Bolling Smith, Camerton, N.C.
Frank Fox, Inman, Kans.
Steve Shimko, Baltimore, Md.
Carl C. Ebbetts, Travis AFB, Calif.
Geoff Check, Lacon, Ill.

Freq.	Call	Name	Location	EST
2246	—	R-TV Francaise	St. Denis, Reunion I.	2130
2415	—	Windw. I. BC	St. Georges, Grenada	1740
2430	YVCN	Escuelas R.	San Fernando, Venez.	2105
2966	PJG*	Curacao	Curacao, Neth. Ant.	1818
	CMI*	Boyeros	Havana, Cuba	1825
	KIL8*	Miami	Miami, Fla.	1921
	6YK*	Kingston	Kingston, Jamaica	1837
	WEK*	New Orleans	New Orleans, La.	2100
	WHZ*	Balboa	Balboa, C.Z.	2006
	WWA3*	San Juan	San Juan, P.R.	2022
3240	—	R. Baghdad	Baghdad, Iraq	1700
3280	—	Windw. I. BC	St. Georges, Grenada	1700
3284	VRH9	Fiji BC	Suva, Fiji Is.	0500
3305	YVKX	V. de Patria	Caracas, Venez.	2150
3340	—	R. Uganda	Kampala, Uganda	0845
3346	VRH9	Fiji BC	Suva, Fiji Is.	0330
3368	HI2D	R. Hit Musical	Santo Domingo, Dom. Rep.	0600
3380	—	T TV Francais	St. Denis, Reunion I.	2130
3910	—	Far East Net.	Tokyo, Japan	1637
3930	CR4AC	R. Barlavento	S. Vicente, Cape Verde Is.	1740
3940	ZBW3	R. Hong Kong	Hong Kong	0445
3940	—	V. of America	Okinawa	1700
3953	MCM	BBC	London, England	2200
3975	GRC	BBC	London, England	2300
4273	—	Govorit Khabarovsk	Khabarovsk, USSR	0500
4807	—	R-TV Francaise	St. Denis, Reunion	2130
4815	ZYH27	R. Icarema de Fort.	Fortaleza, Brazil	1900
4835	ZYA	R. Roraima	Boa Vista, Brazil	1930
4850	—	Mauritius BC	Forest Side, Moritius	1230
4865	CSA93	E. Nacional	Ponta Delgada, Azores	1725
	PRC5	R. Clube do Para	Belem, Brazil	2000
4868	OAZ4T	R. Chanchamayo	La Merced, Peru	1800
4873	CP66	R. Centenario	Santa Cruz, Bolivia	2200
4874	HCMG7	R. Rio Amazonas	Macuma, Ecuador	1800
4875	—	R. Villavicencio	Villavicencio, Colombia	1800
4890	—	Austr. BC Comm.	Pt. Moresby, Papua	1500
4899	HCVS6	V. de Saquisili	Saquisili, Ecuador	1900
4925	EAJ206	V. de Rio Muni	Bata, Span. Guinea	1625
4939	HCXZI	R. Nacional	Quito, Ecuador	2230
4960	—	R. Quito	Quito, Ecuador	2220
4965	—	R. Santa Fe	Santa Fe, Colombia	1845
4970	YVLK	R. Rumboa	Caracas, Venez.	1745
4973	—	R. Yaounde	Yaounde, Cameroon	1630
4975	ZYV9	R. Timbira	Sao Luis, Brazil	1830
4976	—	R. Uganda	Kampala, Uganda	0900

WHITE'S

RADIO LOG

Freq.	Call	Name	Location	EST
4980	YVOC	Ecos del Torbes	San Cristobal, Venez.	1900
4990	YVMQ	R. Barquismeto	Barquismeto, Venez.	1830
5010	—	Windw. I. BC	St. Georges, Grenada	1700
5010	—	Govorit Vladivostok	Vladivostok, USSR	0500
5026	—	R. Uganda	Kampala, Uganda	0900
5030	YVKM	R. Continente	Caracas, Venez.	1830
5035	—	R. Centrafrique	Bangui, Cent. Afr. Rep.	2300
5050	—	R. Tanganyika	Dar-es-Salaam, Tanzania	1400
5053	—	V. de Cali	Cali, Colombia	2130
5060	—	R. Clube do Huambo	Huambo, Angola	1530
5075	HJGC	R. Sutatenza	Bogota, Colombia	2145
5507	KUA3*	Honolulu	Honolulu, Hawaii	0200
	—	Tokyo	Tokyo, Japan	0212
	—	Wake	Wake I.	0204
5522	KWD6*	Anchorage	Anchorage, Alaska	0050
	VFW*	Vancouver	Vancouver, B.C.	0052
	—	Cold Bay*	Cold Bay, Alaska	0055
	4YP*	Ocean Sta. Papa	(ship, N. Pacific)	0050
5619	KIL8*	Miami	Miami, Fla.	1800
	6YK	Kingston	Kingston, Jamaica	1808
	WHZ	Balboa	Balboa, C.Z.	1800
5900	ZNB	ZNB	Mafeking, Bechuanaland	1200
5930	—	R. Prague	Prague, Czech.	2005
5940	—	R. Cambodge	Phnom-Penh, Cambodia	0745
5950	—	R. Warsaw	Warsaw, Poland	1530
5960	—	RAI	Rome, Italy	1310
	—	Trans World R.	Monte Carlo, Monaco	0930
5965	KCBR	AFRS	Delano, Calif.	2300
5980	ZPA6	R. Guaira	Villarica, Paraguay	0500
5981	ZFY	R. Demerara	Georgetown, B. Guiana	0545
5990	—	R. Sweden	Stockholm, Sweden	0900
6005	—	RIAS	Berlin, W. Germany	0100
	CFCX	Canadian Marconi	Montreal, Que.	1936
6010	HJFK	V. Amiga	Pereira, Colombia	0030
	—	RAI	Rome, Italy	1320
	XEOI	R. Mil	Mexico City, Mexico	1900
6015	WRUL	R. N.Y. Worldwide	New York, N.Y.	1700
6055	—	R. Prague	Prague, Czech.	0500
6065	—	R. Sweden	Stockholm, Sweden	1115
6070	—	R. Sofia	Sofia, Bulgaria	2000
	—	R. Moscow	Moscow, USSR	2100
6075	DMQ6	Deutsche Welle	Cologne, W. Germany	0545
6085	—	Bayerischer R.	Munich, W. Germany	0300
6087	HI4SB	R. Sto. Domingo	Sto. Domingo, Dom. Rep.	1900
6095	KCBR	AFRS	Delano, Calif.	0400
6100	—	R. Belgrade	Belgrade, Yugoslavia	1600
6105	—	V. of Malaysia	Singapore, Malaysia	1830
6110	YVCM	Escuelas R.	San Fernando, Venez.	2015
6115	XEUDS	Univ. Sonora	Hermosillo, Mexico	2100
6120	4VEH	V. Evangelique	Cap Hatien, Haiti	0630
6130	CHNX	V. of Halifax	Halifax, N.S.	2000
	—	R. Nacional	Madrid, Spain	2000
6135	—	R. Warsaw	Warsaw, Poland	1330
	—	R. Havana	Havana, Cuba	1000
6145	DMQ6	Deutsche Welle	Cologne, W. Germany	1710
6150	—	R. Havana	Havana, Cuba	1000
	—	VTVN	Vientane, Laos	1840
6155	—	Far East Net.	Tokyo, Japan	0335
6165	—	R. Damascus	Damascus, Syria	0000
6175	—	V. of Malaysia	Singapore, Malaysia	1830
6180	TGWB	R. Nacional	Guatemala City, Guat.	1955
6185	—	V. of the West	Lisbon, Portugal	2100
6195	—	R. Burundi	Usumbura, Burundi	2300

Freq.	Call	Name	Location	EST
6205	TIHBG	R. Reloj	San Jose, C.R.	2000
	TIJCD	R. Atenas	Atenas, C.R.	1800
6234	—	R. Budapest	Budapest, Hungary	1930
6290	—	R. Peking	Peking, China	1430
6540	—	R. Pyongyang	Pyongyang, N. Korea	1300
6577	—	R. Kukesi	Kukesi, Albania	1300
6700	—	Bayar R.	(clandestine, Cyprus)	0030
6890	—	R. Peking	Peking, China	1430
7085	—	R. Mecca	Mecca, Saudi Arabia	0930
7103	—	R. Tirana	Tirana, Albania	1500
7105	—	R. Nacional	Madrid, Spain	2000
7105	—	R. Nepal	Kathmandu, Nepal	0400
7110	—	V. of Malaysia	Singapore, Malaysia	1830
	—	R. Uganda	Kampala, Uganda	0100
7115	—	R. Prague	Prague, Czech.	2005
7120	—	Red Cross	Geneva, Switz.	0100
7125	—	R. Warsaw	Warsaw, Poland	1330
7145	—	R. Warsaw	Warsaw, Poland	1530
	—	R. Damascus	Damascus, Syria	0900
7150	—	R. Moscow	Moscow, USSR	2100
7195	—	R. Uganda	Kampala, Uganda	0845
7200	—	R. Moscow	Moscow, USSR	2100
7210	—	R. Sweden	Stockholm, Sweden	0730
7220	—	R. Centrafrique	Bangui, Centr. Afr. Rep.	0600
7225	—	R. Mecca	Mecca, Saudi Arabia	0930
7230	—	Far East BC	Manila, Philippines	1830
7235	—	RAI	Rome, Italy	1300
	CR6RZ	Emis. Oficial	Luanda, Angola	1215
7265	ETLF	R. V. of Gospel	Addis Ababa, Ethiopia	1200
7275	—	RAI	Rome, Italy	1320
7300	—	R. Liberdad	clandestine	2215
7305	—	R. Budapest	Budapest, Hungary	1930
7310	—	R. Moscow	Moscow, USSR	2100
7550	—	Govorit Kiev	Kiev, Moscow	1940
7335	CHU*	Dominion Observ.	Ottawa, Ont.	1600
7390	—	R. Damascus	Damascus, Syria	1000
7443	HBX37	U.N. R.	Geneva, Switz.	1330
7345	—	R. Prague	Prague, Czech.	2005
7450	—	R. Peking	Peking, China	1430
8215	—	R. Shkodra	Shkoder, Albania	1400
9009	4XB31	Kol Yisrael	Jerusalem, Israel	1515
9360	—	R. Nacional	Madrid, Spain	2000
9415	—	V. U.N. Comm.	Seoul, S. Korea	0300
9457	—	R. Peking	Peking, China	0455
9475	—	R. Cairo	Cairo, Egypt	1700
9480	—	R. Comerce	Port au Prince, Haiti	1630
9505	—	R. Prague	Prague, Czech.	0500
9520	VLT9	Austral. BC	Pt. Moresby, New Guinea	1715
9530	—	R. Berlin Int'l.	Berlin, E. Germany	0200
9535	HER4	Swiss BC	Berne, Switz.	2015
9540	—	R. Budapest	Budapest, Hungary	1930
	—	R. Warsaw	Warsaw, Poland	1730
	ZL2	R. New Zealand	Wellington, N.Z.	0140
9550	—	R. Moscow	Moscow, USSR	2100
9555	—	R. Damascus	Damascus, Syria	1700
	—	E. Oficial	Luanda, Angola	0445
	—	V. of West	Lisbon, Portugal	1230
9560	—	R. Amman	Amman, Jordan	1315
	OAX4R	R. Nacional	Lima, Peru	2235
9565	ETLF	R. V. Gospel	Addis Ababa, Ethiopia	1200
9570	YVOM	R. San Cristobal	San Cristobal, Venez.	0635
9575	—	RAI	Rome, Italy	1930
9580	GSC	BBC	London, England	1600
9600	—	Govorit Tashkent	Tashkent, USSR	2000
	CE960	R. Pres. Balmaceda	Santiago, Chile	2350
9605	DMQ9	Deutsche Welle	Cologne, Germany	0545
	—	Hellenic BC	Athens, Greece	0220
9615	—	R. Rodina	Moscow, USSR	1400
9620	—	R. Sweden	Stockholm, Sweden	0600
	—	R. Moscow	Moscow, USSR	2100
	—	R. Leopoldville	Leopoldville, Congo	1430
9625	—	Kol Yisrael	Jerusalem, Israel	1515
9630	TFJ	Utvarp Reykjavik	Reykjavik, Iceland	1430
	—	RAI	Rome, Italy	0830
9635	—	R. Kabul	Kabul, Afghanistan	1400
9640	—	R. Moscow	Moscow, USSR	2200
	WRUL	R. N.Y. Worldwide	New York, N.Y.	1515
9645	—	Vatican R.	Vatican City	1930
9655	VUD	All India R.	Calcutta, India	0500
9660	—	R. Moscow	Moscow, USSR	2100
9665	HEU3	Swiss BC	Berne, Switz.	0700

Freq.	Call	Name	Location	EST
9670	—	R. Mecca	Mecca, Saudi Arabia	0930
9675	—	R. Warsaw	Warsaw, Poland	0230
9680	—	R. Erivan	Erivan, Armenian SSR	0330
9690	LRA32	RAE	Buenos Aires, Argentina	0500
9700	—	R. Oficial	Luanda, Angola	0445
9700	KCBR	AFRS	Delano, Calif.	2030
9705	ETLF	R. V. of Gospel	Addis Ababa, Ethiopia	1300
9710	—	Mauritius BC	Forest Side, Maurit.	0430
9715	—	Far East BC	Manila, Philippines	2100
9728	—	Kol Yisrael	Jerusalem, Israel	1515
9730	—	R. Moscow	Moscow, USSR	2230
9735	DMQ9	Deutsche Welle	Cologne, W. Germany	1710
9750	—	V. of Malaysia	Singapore, Malaysia	1830
	—	R. Beirut	Beirut, Lebanon	1800
9755	ETLF	R. V. Gospel	Addis Ababa, Ethiopia	1000
9760	—	R. Hanoi	Hanoi, N. Vietnam	1900
9765	ETLF	R. V. of Gospel	Addis Ababa, Ethiopia	1045
9770	OAX80	R. Amazonas	Iquitos, Peru	2010
	4VEH	V. Evangelique	Cap Hatien, Haiti	0905
9833	—	R. Budapest	Budapest, Hungary	1940
9840	—	R. Hanoi	Hanoi, Vietnam (N.)	2330
9860	—	R. Peking	Peking, China	1430
10530	—	Govorit Alma Ata	Alma Ata, USSR	0630
10688	WAR*	U.S. Army	Washington, D.C.	0216
10885	—	Govorit Ulan Bator	Ulan Bator, Mongolia	2030
11650	—	R. Peking	Peking, China	0455
11762	—	R. Pakistan	Karachi, Pakistan	0835
11705	KCBR	AFRS	Delano, Calif.	0800
	—	R. Sweden	Stockholm, Sweden	0600
	—	Hellenic BC	Athens, Greece	0220
11710	VUD	All India R.	Calcutta, India	0500
11765	—	R. Berlin Int'l.	Berlin, E. Germany	0700
11720	CHOL	Canadian BC	Montreal, Que.	0715
11740	—	Far East BC	Manila, Philippines	2100
11750	—	R. Beirut	Beirut, Lebanon	2030
11760	—	R. Hanoi	Hanoi, Vietnam (N.)	1900
11770	VUD	All India R.	Calcutta, India	0500
	—	R. Tupi	Sao Paulo, Brazil	1700
11775	CP7	R. Illimiani	La Paz, Bolivia	1845
11780	—	Utvarp Reykjavik	Reykjavik, Iceland	0730
	ZL3	N.Z. Calling	Wellington, N.Z.	1830
11790	KCBR	AFRS	Delano, Calif.	2100
11795	DMQ11	Deutsche Welle	Cologne, W. Germany	0445
11800	—	R. Nacional	Canary Is.	1900
	—	R. Ceylon	Colombo, Ceylon	0930
11805	—	Utvarp Reykjavik	Reykjavik, Iceland	1930
	—	R. Globo	Rio de Janeiro, Brazil	1900
11810	—	R. Sweden	Stockholm, Sweden	0730
	—	RAI	Rome, Italy	0400
11832	—	R. Leopoldville	Leopoldville, Congo	1430
11840	—	R. Warsaw	Warsaw, Poland	0230
	—	R. Hanoi	Hanoi, Vietnam (N.)	2330
	WRUL	R. N.Y. Worldwide	New York, N.Y.	1230
11850	LLK	V. of Norway	Oslo, Norway	1025
11855	WRUL	R. N.Y. Worldwide	New York, N.Y.	1515
	DZH8	Far East BC	Manila, Philippines	1830
11900	—	V. of Malaysia	Singapore, Malaysia	1830
	—	V. of Nigeria	Lagos, Nigeria	1400
11910	—	R. Cairo	Cairo, Egypt	1700
11915	—	R. Damascus	Damascus, Syria	1830
11920	—	Far East BC	Manila, Philippines	0330
11938	—	R. Malaysia	Kuala Lumpur, Malaysia	1830
11940	WRUL	R. N.Y. Worldwide	New York, N.Y.	0700
	—	Trans World R.	Bonaire, Neth. Ant.	1300
11945	ZPA5	R. Encarnacion	Encarnacion, Paraguay	1720
11965	—	R. Kabul	Kabul, Afghanistan	2200
11970	—	R. Amman	Amman, Jordan	1745
11810	—	R. Amman	Amman, Jordan	1600
11990	—	R. Prague	Prague, Czech.	2005
15020	—	R. Moscow	Moscow, USSR	0915
15035	—	R. Peking	Peking, China	0800
15060	—	R. Peking	Peking, China	0700
15085	—	R. Moscow	Moscow, USSR	0915
15095	—	R. Peking	Peking, China	0800
	—	R. Pakistan	Karachi, Pakistan	0835
15100	—	R. Hanoi	Hanoi, Vietnam (N.)	1900
15105	VUD	All India R.	Calcutta, India	0500
15110	XERR	R. Comerciales	Mexico City, Mex.	1045
	ZL21	N.Z. Calling	Wellington, N.Z.	1830
15120	—	R. Warsaw	Warsaw, Poland	0230
15125	—	R. Kabul	Kabul, Afghanistan	0600
15130	—	V. of America	Honolulu, Hawaii	1718
15135	—	R. Havana	Havana, Cuba	1300
	WRUL	R. N.Y. Worldwide	New York, N.Y.	0700
	—	R-TV Francais	Paris, France	1230
15140	—	R. Moscow	Moscow, USSR	2230
15150	—	R. Rodina	Moscow, USSR	0800
	—	U.N. R.	Greenville, S.C.	1030
15115	—	R. Osterreich	Vienna, Austria	0840
15155	ELWA	R. Village	Monrovia, Liberia	1630
15165	—	R. Damascus	Damascus, Syria	0955
	VUD	All India R.	Calcutta, India	0500
	OZF7	V. Denmark	Copenhagen, Denmark	1000
15180	—	R. Moscow	Moscow, USSR	2200
15190	—	R. Damascus	Damascus, Syria	1830
15210	—	V. Nigeria	Lagos, Nigeria	1300
	KCBR	AFRTS	Delano, Calif.	0200
15225	—	R. Kabul	Kabul, Afghanistan	0530
15240	—	R. Berlin Int'l.	Berlin, E. Germany	0300
15260	GSI	BBC	London, England	1450
15270	—	R. Nat. Malagache	Tananarive, Malagasy Rep.	1100
	CR7BG	R. Clube de Mozamb.	Lourenco Marques, Mozamb.	1130
15280	ZL4	N.Z. Calling	Wellington, N.Z.	1830
15290	—	V. of America	Tangiers, Morocco	1100
15300	DZH9	Far East BC	Manila, Philippines	1700
15320	—	V. of America	Monrovia, Liberia	1500
15340	—	R. Berlin Int'l.	Berlin, E. Germany	1030
15345	LRA33	RAE	Buenos Aires, Argentina	0900
15360	—	Radio Free Europe	Munich, Germany	0850
15385	DZF3	Far East BC	Manila, Philippines	2000
15400	—	RAI	Rome, Italy	0400
15410	KCBR	AFRTS	Delano, Calif.	1630
15425	—	R. Nederland	Hilversum, Neth.	0730
15440	WRUL	R. N.Y. Worldwide	New York, N.Y.	0700
15445	—	R. Nederland	Hilversum, Neth.	1230
	HCJB	V. of the Andes	Quito, Ecuador	1730
	—	V. of America	Monrovia, Liberia	1230
15450	PZC	R. Suriname	Paramaribo, Surinam	1017
		16 Meter Band—17700 to 17900 kc/s		
17720	WINB	WINB	Red Lion, Pa.	1330
17730	—	U.N. R.	Bound Brook, N.J.	1030
17760	WRUL	R. N.Y. Worldwide	New York, N.Y.	0700
17770	—	RAI	Rome, Italy	1035
17790	GSG	BBC	London, England	0730
17800	—	RAI	Rome, Italy	0400
17810	DZ16	Far East BC	Manila, Philippines	2100
17820	KCBR	AFRTS	Delano, Calif.	1630
17825	LLN	V. Norway	Oslo, Norway	1050
17830	—	R. Ceylon	Colombo, Ceylon	0400
17835	—	R. Peking	Peking, China	0455
17855	—	R. Havana	Havana, Cuba	1000
17855	VUD	All India R.	Calcutta, India	0500
17865	—	R. Damascus	Damascus, Syria	1830
21520	—	U.N. R.	Bethany, Ohio	1030
21560	—	RAI	Rome, Italy	1035

"Meet Ed, our ace high-voltage expert"

Build the Aqua-Con

Continued from page 46

amplifier module. After the silicon rubber is applied, set the speaker aside to dry.

Final assembly and testing. The grommets are installed in "B" holes and the strain reliefs are mounted with 6-32 x ⅜-inch screws in holes "A" and "F." Center the speaker in the opening of the case, the speaker should be mounted face down in the case as shown in the Detail Drawing with the speaker lugs facing directly away from the two grommet holes "B." If done correctly the speaker cone will be facing the open end closest to grommet holes "B." The two strain reliefs in the case should face toward the back of the case.

Next prepare the 6-volt battery cable. Cut a piece of plastic lamp cord 3-feet long, and strip off ⅜-inch of insulation from the end of each wire. Solder terminal lugs on the wires as shown in the photos. Knot one wire of the pair at each end of the cable to identify the positive lead. Using the silicon rubber carefully coat the area of the terminal lug where the wire is soldered and the insulation is stripped off. This seals water out of the cable safeguarding the copper wires from corrosion. Leave enough of the terminal lug free of silicon rubber so the lug can make good electrical connection with the battery terminals.

Solder 8-inch leads to B1's battery clip. Coat the terminals on the battery clip with silicon rubber. Pass these leads through the cable clamp mounted in hole "F" on the back cover plate. It may be necessary to wrap several layers of plastic tape around these wires so they can be gripped by the cable clamp. Pass about 8 inches of wire from the microphone and 6-volt battery cable through the cable clamps in the side of the case, but don't tighten the clamps yet.

Wire the unit according to the detailed wiring diagram. When complete, recheck all connections and the polarity of the battery connectors. Remember the end of the battery cable with the knot is the positive lead. When you wire terminal strip TS1, dress the leads so they come out straight away from the terminal strip. Don't mount TS1 until the unit has been tested and coated with silicon rubber. Tighten the cable clamps.

Install B1 in its holder, noting that if you use the mercury cell, the case is positive, *not* negative, as in the alkaline cell. Connect the 6-volt battery cable to B2.

Testing. Adjust the microphone on your throat, positioned just above the adams apple. The microphone elements should be equally spaced on both sides of the throat. When you speak, you should hear your amplified voice coming from the speaker. When you're sure that the unit is working, coat and seal TS1 with silicon rubber. Pay special attention to the points where the leads emerge. Mount TS1 with 4-40 x ¼-inch hardware.

Mount transformer T1 between TS1 and the rear lip of the case. Connect the leads from T1 to terminal strip TS1, and cover everything over with silicon rubber.

The battery harness is assembled from two cotton straps. One strap is cut down to 18 inches and sewn onto the second strap, at a right angle, seven inches from the buckle of the first strap. The two rubber pads are cut out of ⅜-inch closed-cell neoprene rubber. This is the same material that wet suits are made of. If you can't obtain this rubber in a ⅜-inch thickness, use the more common ¼-inch thickness. These rubber pads are used to provide a non-slip surface between the tank and the battery.

Use and care. When you're using the Aqua-Com, speak slowly and enunciate each word carefully. If your Scuba rig uses either a single-, or a double-hose system, you won't be able to pronounce some sounds. You won't have this difficulty if you use a full face mask.

Adjust the microphone strap for a snug, but comfortable fit with the elements positioned so they are spaced equally on both sides of the neck, just above the adams apple.

Don't forget to remove both B1 and B2 between dives to conserve battery life. After the last dive of the day, remove the batteries and rinse all parts of the Aqua-Com including the batteries with clear water. Try to keep the Aqua-Com out of enclosed hot areas and out of direct sunlight as temperatures over 140 degrees may damage the transistorized amplifier. Incorrect connection of battery B2 may also permanently damage the battery. Remember that the positive lug is the one with the knot on it. If the Aqua-Com is treated with the same care normally accorded to Scuba equipment, the only maintenance likely to be needed is the replacement of the batteries when necessary. See you at 10 fathoms. ■

The Riddle of the Red Planet

Continued from page 36

launching in the 70's, should. For Voyager missions as planned are a true triumph in electronic staging. An eight-foot-diameter antenna is to ride on a large scientific platform to televise the planet's surface for a period of months. Its landers will take separate television pictures of the surface as it zeroes in toward the planet's surface.

Voyager landers will place five-foot parabolic antennas on the planet's surface to report soil findings, while another VHF self-levelling antenna beams its back-up news to the orbiter to be relayed back to earth separately. Voyager missions are even going to pick the spot where they'll land. Right now they hope to find a nice polar cap to land by or a spot in the dark areas astronomers have studied for centuries. And if all goes well, these sophisticated electronic reporters hope to keep telling Mars' story over a period of six months, and get the answers to all the questions man has asked about the red planet.

They're the Tops: To ease the suspense about just what we will learn from these vitally-important Mariner and Voyager missions, RADIO-TV EXPERIMENTER scanned the field, chose two of our top Mars authorities to question.

Dr. N. H. Horowitz, of the California Institute of Technology in Pasadena, one of the biologists to work out our present theory of life's origins, says that if we find chemical make-up of organisms on Mars resemble those on earth, we can assume living matter was transported from one planet to the other. He says "There is already some spectroscopic and other evidence suggesting that life may exist on Mars."

Dr. Stephen H. Dole of the Rand Corporation, who has written two books on habitable planets, isn't quite so optimistic about Mars. He doubts human life can exist there. "Mars is too small to produce or retain an atmosphere suitable for human beings."

He does believe though, that there are 600,000,000 habitable planets in outer space, and that "The universe may be inhabited by varieties of men who are not only of separate species but whose criteria of habitability on planets may not be the same" as ours. In this context, there *could* be men on Mars. Dr. Dole sees future colonies of earth-men travelling through space and settling down on far planets, a process which may bring amazing evolutionary changes in man.

He thinks man may create new variations of himself as he adjusts to new atmospheres and new gravities, and that he will adapt fast genetically, thus changing his whole appearance.

Dr. Dole thinks future colonies of men will travel to Mars to live, folks who will draw water from rocks, live in hermetically sealed "hot houses," grow their own food in the soil, though still be dependent to some extent upon supplies sent from earth.

Dr. Stephen H. Dole of the RAND Corporation

The Antenna Hairdo. But before we sell the hard-won business or sublet the family household or start visualizing just what *we* will look like as outer-space citizens, this writer suggests we wait until Mariner and Voyager report "live" from Mars.

For we might possibly find ourselves confronted by the one-cyed fellow with the spike head and antenna hairdo our TV script writers envision. And in turn, spike-head might think earthlings with their two eyes, two ears, and their two legs were strictly weirdies from the pages of science fiction, and send us rocketing right back to earth.

When we do hear all the news from the six Mariner-Voyager missions, we should have an idea whether or not there are small men or no men on Mars. Whether the missions report a live Mars or a dead Mars, blue vegetation or only lichens and lonely plantlife—and this writer predicts we will find just that, lichens and plants and perhaps the records of a deceased civilization—we can never turn back after we have electronically landed on Mars.

For we will have challenged a new coastline, much as Columbus did five centuries ago, a new coastline that will beachhead new landings, not only in space, but in thought. Perhaps the most awesome element about man's latest electronics venture is we may be forced, when we know all we seek to know about Mars, to change our whole concepts of life and its origins. ■

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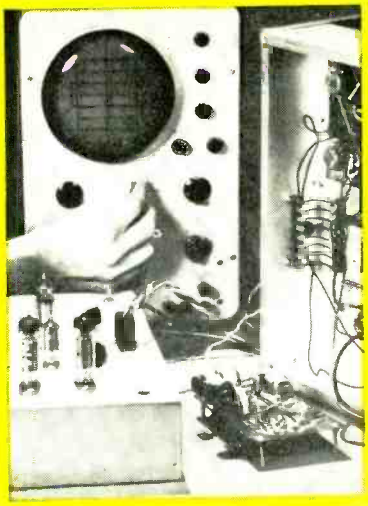

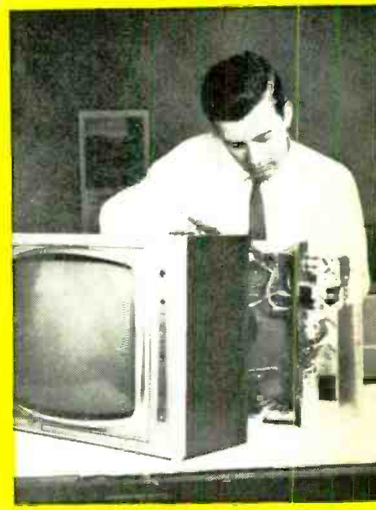

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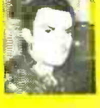

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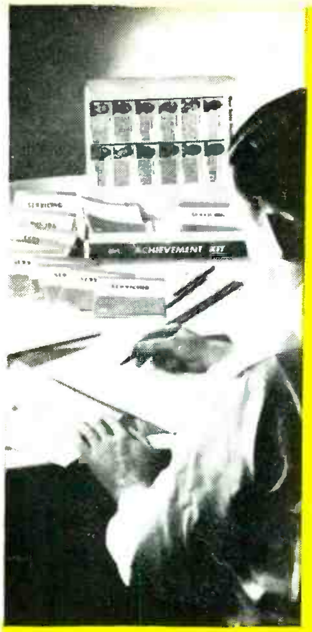

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