ICE AND HEAT FROM SEMICONDUCTORS!

RADIO-TV EXPERIMENTER

WHITE'S RADIO LOG

AM-FM STATIONS
WORLD-WIDE
SHORT-WAVE LISTINGS

APRIL-MAY 75c

MONITOR POLICE, FIRE AND PLANE CALLS WITH THIS VHF CONVERTER!

PLANS FOR:

$14 Photoflood Remote Controller

$29 One-Tube Ham Midget

$3.50 Appliance Shock Tester

TEST REPORTS:

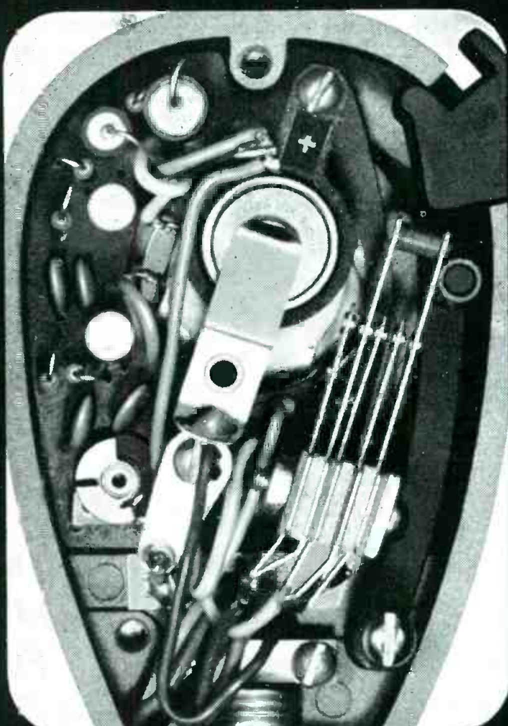
Harmon-Kardon SR-300 Transistorized FM/Stereo Receiver

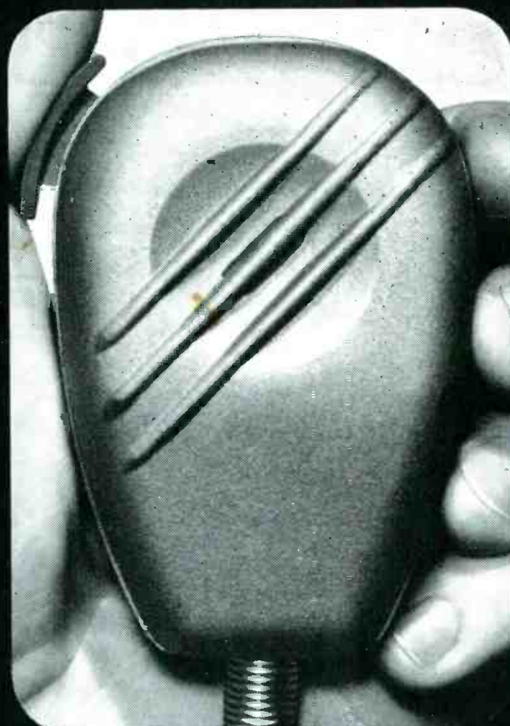
Bozak E-300K-Urban Enclosure Kit, B-207A 2-Way Speaker

Elpa PE-34 Manual Stereo Turntable

This transistorized speech clipper doubles your talk power...

when you speak into the other side!





AMERICAN MODEL D-501K SPEECH CLIPPING DYNAMIC MICROPHONE: $29.70 net

Now! A two-transistor speech clipper, that can actually double your talk power, built right inside this high quality dynamic mobile microphone!

The battery-operated speech clipper in the D-501K can double average modulation levels — so important when you must break through heavy QRM. The D-501K clips vowel peaks (that contribute little to intelligibility) while raising the modulation level of consonants. And the frequency response of the tough dynamic element is carefully shaped to further increase intelligibility.

No need to rewire your transmitter when you add the American D-501K. The speech clipper is completely self-contained. An internal potentiometer permits exact output level adjustment (up to —35 db) for maximum modulation without splatter. Standard battery lasts for months.

Add life to your transmitter. Plug in the new American D-501K Speech Clipping Dynamic Microphone. See it at your American Microphone distributor's, or write for complete specifications today.

American
MICROPHONE CO.
Division of Electro-Voice, Inc.
Dept. 458 RE, Buchanan, Mich.

RADIO-TV EXPERIMENTER

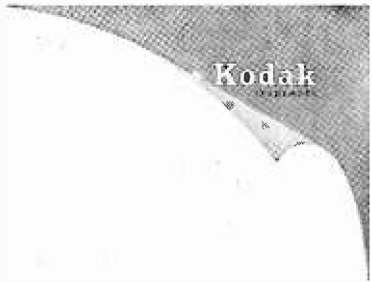
April-May, 1965

Cover Photo by Don Lothrop

CONTENTS/INDEX

Some plain talk from Kodak about tape:

Sensitivity and frequency response



Controlling every electrical factor involved in the making and using of sound tape is a bit like trying to watch a three-ring circus . . . it can be done, but you need fast eyeballs. Let's discuss two critically important parameters: sensitivity and frequency response.

Sensitivity means the degree of output for a given input.

We put in a 400-cycle signal and measure the output. The result: low-frequency sensitivity. A 400-cycle note recorded at 15 inches-per-second gives us a wave length that the tape "sees" of roughly .0375 inches, and by a happy coincidence this wave length penetrates the entire depth of the oxide coating, but not the support material. Everything else being equal, low-frequency response is a function of the thickness of the coating. The thicker the coating, the better the bass response. We choose 400 cycles instead of, let's say, 20 cycles because the 400-cycle note tells us just as much—and has an added advantage. An engineer can *hear* 400 cycles, so we have audio monitoring as well as instrumented observation on a scope face.

The high-frequency test gives us a fairly accurate picture as to just how smooth the surface of the tape is. Good high-frequency response is impossible on a tape having a rough surface. High frequencies affect fewer oxide particles. If the tape surface is rough, the low points will represent gaps in the oxide and cause a loss of H.F. response. We test our high-frequency sensitivity at 15,000 cycles. At 15 ips, the arithmetic looks like this:

$$\frac{\frac{\text{inches}}{\text{second}}}{\frac{\text{cycles}}{\text{second}}} = \frac{\text{inches}}{\text{second}} \times \frac{\text{second}}{\text{cycles}} = \frac{\text{inches}}{\text{cycles}} \text{ which is wave length } (\lambda)$$

THUS:

$$\frac{\frac{15 \text{ inches}}{\text{second}}}{\frac{15,000 \text{ cycles}}{\text{second}}} = \frac{15 \text{ inches}}{\text{second}} \times \frac{\text{second}}{15,000 \text{ cycles}} = \frac{1 \text{ inch}}{1000 \text{ cycles}} = 1 \text{ mil wave length}$$

At this high frequency we are recording only on the surface of the tape. If any roughness is present, big troubles result. For example: if you have a surface condition where the amplitude of the roughness is just .0001 inches and your recorded signal has a 1-mil wave length, you will lose 5.5 db in high-frequency response!

We are working toward a point: KODAK Sound Recording Tape is unsurpassed in smoothness, the surface varies no more than 25-50 millionths of an inch from a theoretically perfect plane.

Frequency response is the arithmetic subtraction of high-frequency sensitivity from low-frequency sensitivity. It's quite an easy matter to juggle the characteristics of an oxide around so that frequency response is nice and flat. If your oxide has poor high-frequency sensitivity, you can degrade L.F. sensitivity, and thus effect a flat response. But is the resulting L.F. loss worth it? We don't think so. That's why we designed our coating to give us superior low- and high-frequency sensitivities, as well as a nice flat response.

Next time we'll chat about a few other basic considerations.

KODAK Sound Recording Tapes are available at all normal tape outlets: electronic supply stores, specialty shops, department stores, camera stores . . . everywhere.

FREE! New comprehensive booklet covers the entire field of tape technology. Entitled "Some Plain Talk from Kodak about Sound Recording Tape," it's yours free on request when you write Department 8, Eastman Kodak Company, Rochester, N. Y. 34650.

EASTMAN KODAK COMPANY, Rochester, N. Y.

APRIL 1965—MAY 1965
VOLUME 18 No. 2

ABC MPA

RADIO-TV EXPERIMENTER

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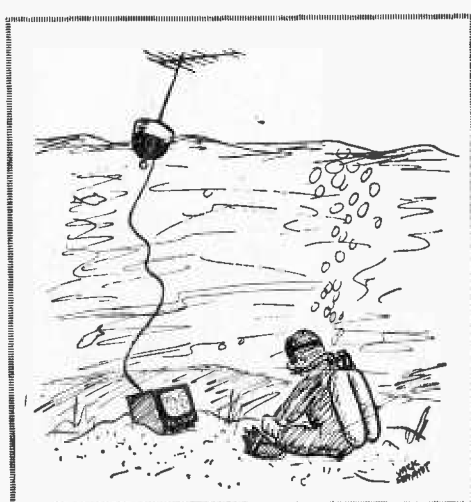
POSITIVE FEEDBACK

Julian M. Sienkiewicz, Editor
WA2CQL/2W5115

Some day in the future, present-day, 1965, CB ticket holders will be referred to as the pioneers of the Citizens Radio Service—those who endured, made their voices heard, and finally conquered the organizational chaos peculiar to all fellowships dedicated to *the greatest good for the greatest number*.

A latest plan for channel allocation—of channels 22A and 22B, specifically—has been advanced by the automobile industry. The Automobile Manufacturers Association has announced establishment of plans for a nationwide communications network to aid motorists in distress.

The system, to be known as *H.E.L.P.*, for *Highway Emergency Locating Plan*, calls for the use of CB radio equipment in private passenger cars. Motorists in need of aid would make their needs known on Channel 9, which will be monitored by a round-the-clock monitoring station within the 10 to 20-mile range of the equipment. Monitoring personnel



Positive Feedback

would include volunteer citizen teams, police agencies, road service stations and hospital emergency rooms. The AMA pointed out that of the well over two million units of CB gear already in use, approximately half are in motor vehicles.

AMA officials said the plan grew out of a growing concern by government agencies and highway safety groups over the lack of emergency communications facilities for motorists. They pointed out that this lack will become even more apparent as the nation expands construction of its limited access roadways. In seeking a solution to the problem, various states and areas have experimented with systems of roadside telephones, solar powered emergency signal systems, roadside radio transmitters and emergency road patrols.

"Such systems, while commendable, may not be the most practical or economically feasible in attempting to cover the nation's entire road system," an AMA representative said. Therefore, the industry was asked to aid in developing improved systems. In developing the plan, a special AMA engineering task force has been working more than a year in cooperation with leading radio manufacturers, volunteer citizen groups, and at least one CB publication.

A number of volunteer groups are successfully operating smaller programs in various parts of the country, AMA said, and would be urged to join *H.E.L.P* to effect a coordinated plan throughout the nation.

In addition to having the benefit of an effective emergency communications channel, motorists equipped with CB radio will be able to use the other channels for their business or personal communications. Even non-equipped vehicles will benefit from the program through "Good Samaritan" motorists with the required equipment who broadcast on their behalf. AMA said that rapid expansion of the *H.E.L.P.* program might eventually require assignment of special protected channels limited to automobile emergency use. The auto industry is petitioning FCC to study a proposal for the assignment of two such "clear channels" (22A and 22B) to encourage optimum utilization of *H.E.L.P.* installations and reduce mutual interference stemming from use of channels shaved with regular CB stations.

A *H.E.L.P.* spokesman said that design

engineers already are working to develop specialized auto radio equipment so that the highway emergency communications concept can be expanded.

Because the range of the equipment is limited and will be used by individual motorists only for short periods of time, the engineers feel that the "unused message capacity" could be used to a safety advantage by messages to motorists from police and highway authorities.

Present aims of the program according to AMA, is to encourage motorists' installation of equipment, establishment of a nationwide monitoring system by proper groups, and to gain support for the plan from groups interested in promoting highway safety.

Information on the program can be obtained from *H.E.L.P.*, 320 New Center Building, Detroit, Michigan 48202. CB manufacturers, clubs, dealers, and individual operators are invited to request this data. Of course, feel free to mention RADIO-TV EXPERIMENTER when writing.

BCB DX'ing. If you want to get started in BCB DX'ing then I suggest you turn to 830 on your AM radio dial some evening and listen to Class 1-A clear channel station WCCO. With main studios in downtown Minneapolis and transmitter at Coon Rapids, Minn., WCCO can be heard just about nation-wide most evenings. Don't believe me? Well sit yourself down and tune up your AM listening rig to 830. On 9-9:30 P.M. CST, WCCO broadcasts a quiz game program, "Honest to Goodness" several times a month. The station telephones distant listeners who have sent in their phone numbers by post card and asks the questions that listeners anywhere in the nation can reasonably answer. A prize of $8.30 is awarded for each correct answer and the prize is jacked up $8.30 with each miss.

Besides enjoying WCCO's programming, you can obtain one of their QSL cards.

Positive Feedback

WCCO likes to hear from its listeners from distant points who have made tapes of their broadcasts. They prefer 7½-ips, and who knows, you may hear your own tape rebroadcasted. Of course, WCCO replaces the tape you send along with a letter and QSL card.

Interested, get started now. Send tapes to *WCCO RADIO, Mr. Gordon A. Mikkelson, 625 Second Avenue South, Minneapolis 2, Minn.* Good DX'ing.

The February-March Issue. A reader asked if the *Auto Sentinel* on page 75 can also be used with 12-volt electrical systems. The answer is, of course, yes. All that is necessary is that you specify 12-volt DC coils for relays K2, K3, and K4; for relays K1 and K2, order Amperite 12C30 and 12C120 relays, respectively; and for solenoid K6, order the same solenoid but specify 12 volts.

10-80 Receiver. We have to say *whoops!* twice on the schematic diagram for the receiver. Make these changes in your copy: Capacitor C3, the coupling capacitor between Coils L1, and L2, in the front end of the receiver should have a value of 5-mmf, NOT 5-mf. Pick up this correction in your parts list as well. Secondly, ground the junction point common to C7, C8, and the low end of R3, the 100,000-ohm potentiometer. ■

"Sorry, Mr. Grump, I believe your interference problem is beyond my control."

BOOKMARK
by Bookworm

IN this issue of RADIO-TV EXPERIMENTER three exceptional titles will be reviewed in detail by the ol' Bookworm. All three are worthy of the space given to them in this issue, however, the first review is particularly noteworthy because of its universal appeal to all readers in the field of science—and science fiction.

Is Something Calling? At this moment there is a possibility—perhaps even a probability—that signals from other civilizations, other worlds in outer space, are impinging on our planet, according to New York Times Science Editor *Walter Sullivan,* author of *We Are Not Alone.* So startling was this idea that when the National Academy of Sciences sponsored a meeting at Green Bank, West Virginia, in 1961, to discuss the problem of communication with other worlds, it did so privately, in fear of sensational publicity. What the meeting brought to light, and the background for its prognostications, are given in full detail in *We Are Not Alone.*

Among the topics discussed is the question closest to us, inhabitants of planet Earth: Is There Life on Mars? No object in the heavens has been the subject of such bitter controversy in recent years. Even in this era of deep space probes, when we are about to discover the truth about Mars, a remarkable diversity of ideas continues to flourish. The inevitability of manned exploration of Mars was stressed at a meeting organized by the Space Science Board of the National Academy of Sciences in the summer of 1962. And, with six American vehicles scheduled

BOOKMARK

to be fired toward the planet, having started late last year and continuing through 1975, *we should soon know.*

Other key questions: Is Our Universe Unique? and The Solar System: Exception or Rule? are the subjects of chapters in which the theories of earlier scientists culminate in the reasoning of our contemporaries. Harlow Shapley, former head of the Harvard College Observatory, has written: "As far as we can tell the same physical laws prevail everywhere. The same rules apply at the center of the Milky Way, in the remote galaxies, and among the stars of our solar neighborhood. In view of a common physics and chemistry, would we not also expect to find animals and plants everywhere? It seems completely reasonable; and soon we shall say that it seems inevitable."

In a chapter: The Uniquely Rational Way, Mr. Sullivan discusses the possibility of other civilizations trying to contact our planet. In 1959 a proposal for a listening program envisaged that intelligent beings in another world could signal us. Giuseppe Cocconi and Philip Morrison, professors at Cornell University, suggested that it might be wiser to look for signals from a civilization more advanced than ours rather than to try to send signals ourselves. It was logical to assume that superior civilizations would send automated messengers to orbit each likely star and await the possible awakening of a civilization on one of that star's planets or even on a moon.

If we contemplate the resources of biological engineering, which we have not begun to tap yet, it is conceivable that some remote community could breed a subrace of space messengers, brains without bodies or limbs, storing the traditions of their society, mostly to be expended fruitlessly but some destined to be instruments of the spread of intragalactic culture. Such a messenger may be here now, in our solar system, trying to make its presence known to us.

Among the other topics which Mr. Sullivan takes up are: Puzzle of the "Slow" Stars; Creation or Evolution? Building Molecules; Wax and Wigglers; Protect Ozma; and Celestial Syntax.

In his concluding chapter, What If We Succeed? he notes the opinions of theologians from a number of denominations on the possibility of life superior to and perhaps different from ours. Discovery of beings superior to ourselves in moral, spiritual and artistic ways, as well as technologically, would shake the foundations of religion and philosophy. But we might, through them, also look ahead millions of years into the future, learning from other worlds to avoid pitfalls, cure disease, live in peace, and become part of the vast community of intelligence in our galaxy.

We Are Not Alone is a *McGraw-Hill* book aimed at the scientist or well read technician. If electronics is your game, and you would like to touch the *far out,* look for *Mr. Sullivan's* book at your favorite bookstore. Your ol' Bookworm predicts that this text will hit the best sellers list and poke its way to the top ten. If you have trouble finding it, write directly to: *McGraw-Hill Book Company, Dept. 731, 330 West 42nd Street, New York, New York 10036.* (The EDITOR strongly recommends this book to his readers.)

For Advance Servicemen. Color receivers, printed circuits, transistors, the all-channel UHF-VHF tuner—these are but the more dramatic examples of the continuing advances in television manufacture. They also exemplify the constant need of the service technician to up-date his knowledge and skills. Recognizing this need, the Electronic Industries Association (EIA) has sponsored a comprehensive next text titled Advanced Servicing Techniques, Volume I. Written by Paul B. Zbar and Peter W. Orne, this illustrated volume is a new release of John F.

Rider Publisher, Inc., New York.

This book, ideally suited for both the advanced student and the working technician, provides valuable information for understanding and servicing color and black-and-white receivers. Emphasis throughout is on

BOOKMARK

systematic, industry-approved troubleshooting procedures, utilizing the latest test instruments.

The authors treat the color set as a black-and-white receiver to which specialized color circuits have been added. The receiver is presented as a system of related functional sections that must be individually analyzed. Trouble symptoms arising in each section are presented with procedures for finding the defects they represent. The test equipment used in troubleshooting and aligning each section is also examined.

Volume II of Advanced Servicing Techniques in the Electronic Industries Association series will be published by the time you read this review. This volume gives complete coverage of maintenance, repair and troubleshooting procedures for home audio equipment such as: stereo amplifiers, record changers, tape recorders, and home intercom systems.

Volume I will sell for $8.25 and Volume II will sell for $5.95. Detail information can be had by writing directly to the publisher: *Hayden Book Company, John F. Rider Publisher, Inc., Dept. R31, 116 West 14th Street, New York, New York 10011.*

For Color TV Technicians. The new edition of the *RCA Pict-O-Guide* has been completely revised and up-dated to include the latest advances in color TV and servicing. Written expressly for the service technician, this comprehensive book is an invaluable

guide in troubleshooting and servicing color TV receivers. Produced under the guidance of John R. Meagher, RCA's nationally recognized authority on practical television servicing, the *Pict-O-Guide* includes many true-to-life color photographs and illustrated step-by-step procedures. For example, the new book demonstrates proper color mixing by showing the results of color mixing on the TV screen.

The *Pict-O-Guide* discusses in depth set-up procedures for new TV receivers, and presents greatly simplified instructions for purity, convergence, and black and white adjustments. The troubleshooting portions of the guide have also been expanded to give the reader the benefits of RCA's many years of experience in color TV servicing. In addition, oscilloscope wave-forms are shown throughout the book to help familiarize the technician with the electrical characteristics of the receiver.

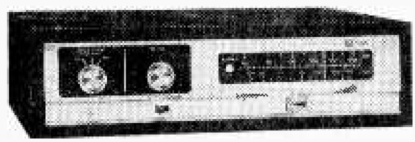
The *Pick-O-Guide* contains twelve fact-filled chapters which highlight the following: Learning to Mix Colors—Discusses the proper adjustments for the beam currents of the three electron guns in the color picture tube. Compatible Color TV—Describes the basic principles of compatible color television which should be known by the proficient service technician. Receiver Setup—Contains over 30 pages on the all-important set-up procedures required after delivery of any color set. What the Operating Controls Do—Instructs the service man on the effects of the Tint and Color controls. Using Color Test Equipment—Emphasizes the importance and use of equipment such as the dot/crosshatch/color-bar generator, and how such equipment eliminates hit-or-miss attempts in repairing color circuits. Using the green stripe signal in testing receivers. Trouble Shooting Black-and-White Defects Unique to Color Receivers. Trouble Shooting the Color Sections of the Receiver. AFPC Checks and Adjustments—How to correct for loss of color synchronization and other problems in the AFPC circuitry. When to Install a New Tricolor Picture Tube. Service Techniques—What a proper color bench set-up should include, and many other tips which the serviceman will find useful. If the Receiver Needs Alignment—Describes when alignment is required, and exactly how to do it best.

Copies of the new *RCA Pict-O-Guide* may be obtained from your local RCA Tube-Parts Distributor, or by sending $5.75 to *RCA, Commercial Engineering, Dept. RTVE 31, Electronic Components and Devices, Harrison, New Jersey.* ■

NEW *products*

Allied Radio Solid-State FM-AM Tuner Kit KG-765

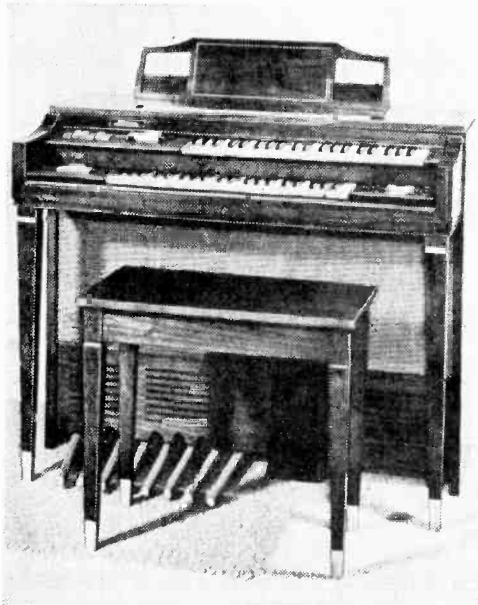
Allied Radio, makers of the *Knight-kit* line, have come up with a sure winner in their new all-transistor stereo FM-AM tuner kit, Model KG-765. The KG-765's specifications (kit and wired units) are—Power Output: IHFM Music Power, 70 watts; 35 watts per channel; 140 watts peak. Continuous Sine Wave Power, 28 watts per channel. For use with 8, 16-ohm speakers. Frequency Response: ± 1 db, 20 to 25,000 cps at rated



power output. Distortion: Harmonic, 0.5%; IM, less than 1%; measured at rated power output. Hum Level: Tuner, −80 db; Magnetic Phono, −68 db; Tape Head, −60 db. Channel Separation: 40 db. Inputs: Tape Head (NAB); Magnetic Phono (RIAA); Tuner: Aux 1; Aux 2. Lists at $99.95 for kit; $149.95 wired. Brown metal case, $4.95; economy wood case, $6.95; de luxe wood case, $12.95. (*Write to Allied Radio Corporation, Dept. 2RT2, 100 N. Western Avenue, Chicago 80, Illinois for complete details.*)

Transistorized Organ Comes in Kit Form

A kit version of the new Thomas "Coronado" BL-3 all-transistor organ has been introduced to the kit builder's market by the Heath Company—in the assemble-it-yourself form the kit builder can save up to $449. Boasted as "a professional organist's dream with a beginner's simplicity," this organ kit features 17 true organ voices; two full-size 44-note keyboards; 28 notes of chimes; 13-note heel & toe pedalboard, range C through C; Color-tone Attack, Repeat and Sustain percussion—the only organ to give you all three; Reverb; a built-in 2-speed Leslie rotating speaker plus a 2-unit Main speaker system which uses 12" speakers; new Stereo Chorus control to create interesting "stereo effects by using both speaker systems simultaneously; Vibrato; Treble Accent; Manual Balance to adjust relative volume of the two manuals; Pedal Volume; Expression Pedal; headset outlet for private play; an all-transistor 75-watt EIA peak music power amplifier; 5-year warranty of the transistor tone



generators; factory-assembled, full-bodied walnut-finished hardwood cabinet with matching bench. You don't have to be an electronics wizard to build it, nor a professional organist to play it. Heath has reduced assembly to simple-to-perform steps that require no special skills, knowledge or tools—takes around 70-80 hours. A pre-tuned tone generator is even included so you can tune the organ yourself by a counting method—no special "musical" ear needed. Called Model GD-983, the new Heathkit organ is priced at $849 which includes the matching bench. A lower-priced organ kit, Model GD-232A is also available at $349.95. *(Complete details and information concerning both organ kits are available free, by simply dropping a note or postcard with your name and address to the Heath Company, Dept. 31RE, Benton Harbor, Michigan 49023.)*

3-D Sight Booster For Experimenter

With today's fast-paced, intricate technology

NEW products

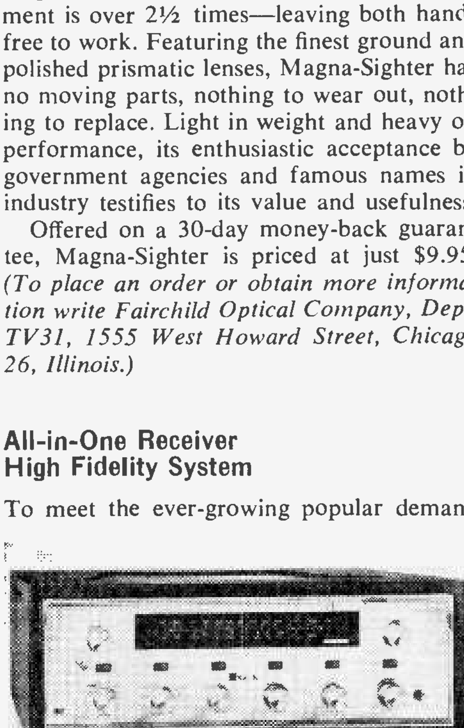
and the importance of delicate, precise work in one's business, profession or hobby, a sight-booster is often a vital necessity. Available now is a low-priced slip-on binocular magnifier that quickly returns its cost over and over. A quick, easy adjustment of the

head-band to accommodate head size, and Magna-Sighter is in place—and stays in place—even over regular glasses. To resume normal vision, just lift the head a little. No need to remove the Magna-Sighter. Like magic, lower the head and object enlargement is over 2½ times—leaving both hands free to work. Featuring the finest ground and polished prismatic lenses, Magna-Sighter has no moving parts, nothing to wear out, nothing to replace. Light in weight and heavy on performance, its enthusiastic acceptance by government agencies and famous names in industry testifies to its value and usefulness.

Offered on a 30-day money-back guarantee, Magna-Sighter is priced at just $9.95. *(To place an order or obtain more information write Fairchild Optical Company, Dept. TV31, 1555 West Howard Street, Chicago 26, Illinois.)*

All-in-One Receiver High Fidelity System

To meet the ever-growing popular demand

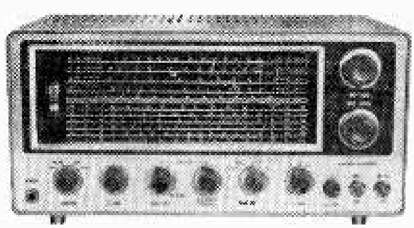


by audiophiles for an all-in-one receiver, Allied Radio has come up with the new

Knight Model KN-370 stereo multiplex FM-AM tuner/amplifier. Model KN-370 combines on a single chassis a powerful 35-watt-per-channel stereo amplifier, individual FM and AM tuning sections, multiplex circuitry that automatically switches to stereo, dual preamplifiers, with a full set of front panel controls and input jacks. Massive potted output transformers and four 7591A push-pull output tubes reduce distortion providing crystal sharp frequency response. Unit comes complete with built-in AM loopstick and FM line-cord antenna. However, inputs are provided for external 50 and 300-ohm FM antennas plus external wire AM antenna. FM section IHF sensitivity is 2.5 microvolts for 30 db of quieting; IF bandwidth is 300 kc. AM section sensitivity is 4 microvolts for 20 db of S/N ratio; selectivity is 8 kc. The KN-370 houses 20 tubes, 12 diodes, and 7 silicon rectifiers. Price: $279.95, less case. Walnut wood case, $23.95; brown metal case, $12.95. *(The KN-370 is described in the 1965 catalog (#240) available free on request from Allied Radio Corp., Dept. 317, 100 North Western Ave., Chicago 80, Illinois.)*

Amateur SWL Receiver Wired or Semi-Kit

New on the scene is Lafayette's Model HA-230 low-cost, 8-tube communications receiver for the ham and SWL'ers. The HA-230 features separate "always on" transformer which supplies constant heater volt-



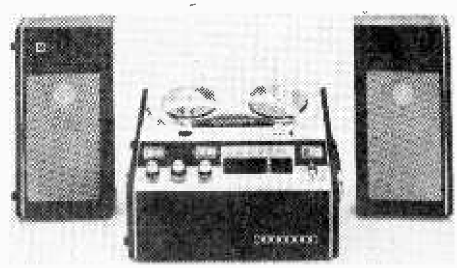
age to the mixer and oscillator stages for frequency stability. Four Bands cover 550-1600 kc; 1.6-4.8 mc; 4.8-14.5 mc and 10.5-30 mc. Other features include 8-tube superhet circuit with 1 RF and 2 IF stages; easy-to-read illuminated slide rule dial with logging scale; built-in Q-multiplier for phone operation, 1 microvolt sensitivity for 10 db S/N ratio, selectivity 60 db at 10 kc, 0.8 kc at 6 db (with Q-Multiplier); front panel headphone jack; BFO and antenna trimmer, audio output 1.5 watts for 4 or 8 ohm external

NEW products

speaker (optional). Available wired for $89.50 and as a semi-kit for $74.50, stock nos. 99-2522WX and 99-2521WX, respectively. *(For more information write to Lafayette Radio, Dept. R31T, 111 Jericho Turnpike, Syosset, L.I., New York.)*

Automatic Tape Recorder Does Some Thinking

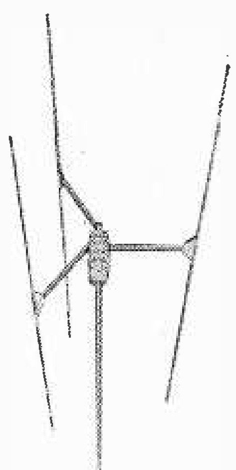
The problem with the pre-recorded tape market has not been the price of pre-recorded tape, but the inconvenience of playing pre-recorded tapes. The superior sound quality of music on tape has not been enough to compensate for the nuisance of changing reels every 15 or 20 minutes when they are



played on a manual tape recorder. Concord's Model 994 changes this. Now a single pre-recorded tape (7½ ips) can play for 40 minutes on the 994 without interruption and will repeat automatically if desired. Two pre-recorded tapes may be combined on a single 7 inch reel to play for 80 minutes continuously without interruptions or programmed to repeat and replay. One of the unusual features of the Concord 994 is its built-in "Electronic Memory." This memory enables the user to program the tape recorder for such manual or automatic operations as: single play, automatic reverse, and continuous play or record. The 994 can be programmed to play for any length of time, half-hour, hour, or all day, as desired. Among the many unusual automatic features of the 994 are: automatic threading, automatic reverse play, automatic reverse recording, automatic sound-on-sound recording, automatic stop at any point, and automatic tape lifters. The preamplifiers of the Model 994 are solid state and the unit includes a stereo 15 watt amplifier together with four speakers (2 woofers and 2 tweeters) and two cross over networks. The speaker systems are integrated in the lid of the unit and may be separated for maximum stereo effect. Operation is simplified by the use of full pushbutton controls. The recorder is designed for use as either a compact portable or for installation and play through an existing hi fidelity music system. The Concord Model 994 is priced to sell at $399.50 list. *(Concord would be happy to send you the complete specifications for the 994. Just write to Concord Electronics Corp. Dept. TE71, 809 North Cahuenga Boulevard, Los Angeles 38, California.)*

Rotorless Antenna Rotates Beam

A totally new approach to Citizen's Band beam antenna design, using no mechanical rotator, has been announced by the Antenna Specialists Co. Technically designated a *sector phased omni-beam CB base antenna,* the Scanner, Model M-119, employs all-electronic techniques to focus and rotate the beam. The antenna itself remains completely stationary. The Scanner is really three antennas in one. One of the three is used to radiate power, while the remaining two form a screen to reflect and focus the beam. Beam rotation is accomplished instantly by switching the radiating job from one element to the next. The beam patterns of the new antenna



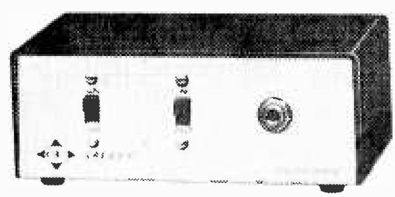
provide full-circle scan coverage with directional gain of 7.75 db.—the equivalent of 30 watts output from a 5 watt source. Noise and other interference from points outside the beam pattern are greatly reduced by the new

NEW *products*

design. An important bonus of the all-electronic beam is its great compactness. Elements of the Scanner extend only three feet from the mounting boom, while an average five-element rotator-driven beam, for the same wave-length, measures 12 feet from the boom. The compact design provides, among other things, much better wind resistance—over 100 mph, plus a safety factor. Elimination of the rotator, and its associated hardware and accessories, brings the cost of the new antenna well below that of conventional rotator-driven arrays; an average of 30% lower cost, according to the manufacturer. *(Price data is not available at time of publication. However, full details can be had by writing to The Antenna Co., Dept. RE31, 12435 Euclid Avenue, Cleveland, Ohio 44106.)*

CB Watt-Stretcher Compressor

The new CB/ham Compressor from Galaxy Electronics is guaranteed to boost "talk power" for greater range. The unit literally boosts your output 3 or 4 times and prevents "fading out," allowing your signal to be heard when others are lost. Because of the 5-watt limitations for CB'ers, output power is normally far below the 5 watts. The Galaxy



Compressor automatically amplifies the low levels of your speech allowing more powerful, clear transmissions and maximum use of your 5 watts. The unit is completely transistorized and adaptable to most AM and SSB transmitters for Citizens Band and Amateur equipment. The unit is wired for push-to-talk operation and requires one 9-volt battery (not supplied); sells for $24.95. Optional 115-volt AC power supply costs only $6.95. *(Interested? Then write to Galaxy Electronics, Dept. Rt1, 10 South 34th Street, Council Bluffs, Iowa.)* ■

ASK ME another

?

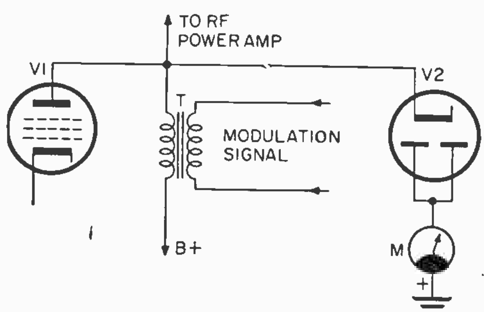
By Leo G. Sands

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 up coming issues. Sorry, the experts will be unable to answer your questions by mail.

Bum Signal Indicator

Can you give me a diagram for an over-modulation indicator for a CB set?

—A. T., Skykomish, Wash.

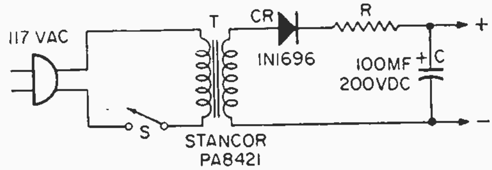


The over-modulation indicator shown can be used with a CB set or low power ham rig. Tube V2 is a 6X4 or dual diode, or it can be semiconductor diodes. The meter may be a DC voltmeter or a 0-1 DC milliammeter. The primary of transformer T is the modulation reactor. The meter needle will "kick" when the modulation exceeds 100% at which time the voltage to the RF amplifier is actually negative instead of positive.

Take It From the Outlet

I have a miniature transmitter that uses a 90-volt battery which lasts only a week. What equipment should I use to get 90 volts DC from a regular house outlet?

—L. R., Detroit, Mich.

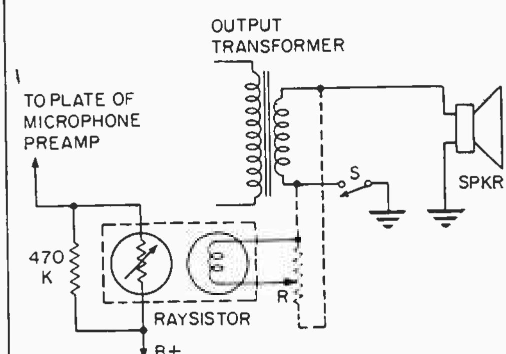


You can try a larger capacity battery or build a rectifier power supply as shown in the schematic diagram. The value (1000 to 5000 ohms) and power rating 1- or 2-watt) of resistance R depends upon the amount of current your transmitter draws. Try various values until you get 90 volts across capacitor C with the transmitter turned on and operating.

Modulation Limiter

How can I add a modulation limiter to a CB set?

R. L., Passaic, N. J.



You can buy a modulation limiter-preamplifier and connect it between the microphone and the CB set microphone input. Or you might try a Raysistor (made by Raytheon) to control the gain of the modulation amplifier as shown in the schematic diagram. Switch S is part of the transmit-receive switch or relay that disconnects the speaker from the combination output transformer-modulation reactor. Connect a 15,000-ohm potentiometer (R) across the secondary of the output transformer and to the lamp side of the Raysistor. Eliminate the microphone preamplifier plate load resistor and connect the light sensitive resistor of the Raysistor in its place.

(Continued on page 28)

ASK ME another ?

(*Continued from page 24*)

As the modulation level increases, the resistance of the light senstive resistor decreases and reduces the gain. This circuit is used in the new U.S.L. Contact 23 CB set. You may have to add an audio stage to get sufficient gain for good limiter action. After the modification you should have the transmitter checked out by a licensed operator to make sure it can't be overmodulated.

Bye Bye, 35Z5GT

Can I replace a 35Z5GT tube in an AC-DC radio with a silicon or selenium rectifier?

—G. L., San Carlos, Calif.

Yes! Just pull the tube out of its socket and leave it out. Connect the rectifier (CR) across socket terminals in 5 and 8 with polarity as shown in the diagram. Connect a 50-ohm, 5-watt resistor (R1) across 2 and 3, and a 200-ohm, 10-watt resistor (R2) across 3 and 7. The resistors take the place of the tapped tube heater. The resistors will run hot so be sure the set is well ventilated. You will obtain one added feature not bargained for and that is the surge resistance through the other heaters will be much less than previously. This is so because the cold resistance of the heater string will be higher with the resistors in the circuit in place of the 35Z5GT. However, the hot resistance of the heater string will be the same. The radio will take a few more seconds to warm up than previously.

70-Volts of Audio

My amplifier has 4-, 8-, and 16-ohm and 70-volt output terminals. What is the 70-volt output used for?

—L. J. E., Everett, Wash.

In a 70-volt sound system the amplifier gain is set so that the audio output voltage between the common and 70-volt output terminals is approximately 70 volts. The volume level is adjusted at the speakers by selecting line transformer taps as shown in the diagram. The line transformers may have a tapped secondary (T2), a tapped primary (T3), or it may be an autotransformer (T4).

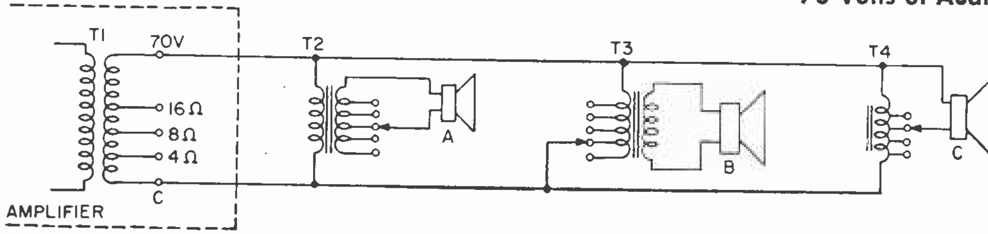
The power fed to each speaker depends upon the voltage applied to it and its load impedance. For example, if Speaker A has an impedance of 4 ohms and is connected to the 2-volt tap on T2, it will consume one watt since power in watts is equal to E^2/R and here E^2 is 4 and R is 4. If set to the 6-volt tap, the speaker power will be 8 watts, and so on.

The three types of transformers shown perform the same function—they step down the 70-volt signal to the required level. The taps permit adjustment to the voltage ratio which is proportional to the turns ratio.

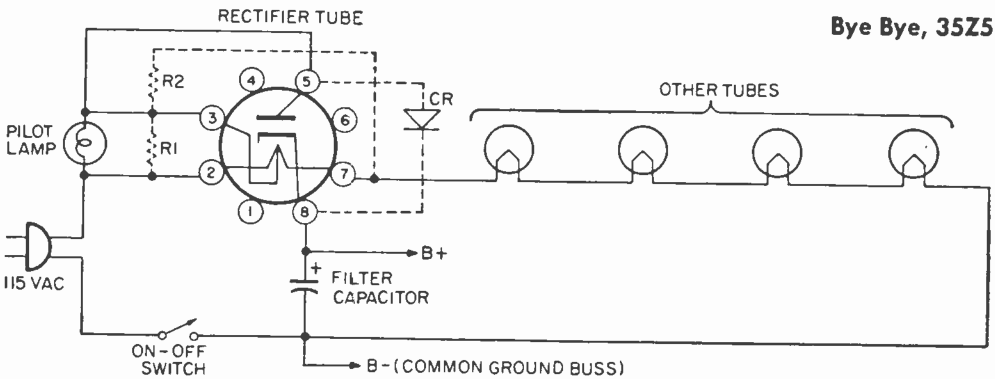
Speakers A, B and C may all be operated at different sound levels. The number of speakers that can be connected across the 70-volt line is limited by the power capability of the amplifier. For example, a 50-watt amplifier could feed 8 watts to speaker A, 10 watts to B, 2 watts to C and have 30 watts to spare for additional speakers.

On some amplifiers the 70-volt output terminal is merely window dressing and is the equivalent of a 500-ohm line output. A true 70-volt amplifier has excellent output voltage regulation permitting removal or addition of a speaker without affecting the sound level of other speakers. It is easy to work with 70-volt sound systems since we deal with volts and watts without being concerned with impedance matching. ■

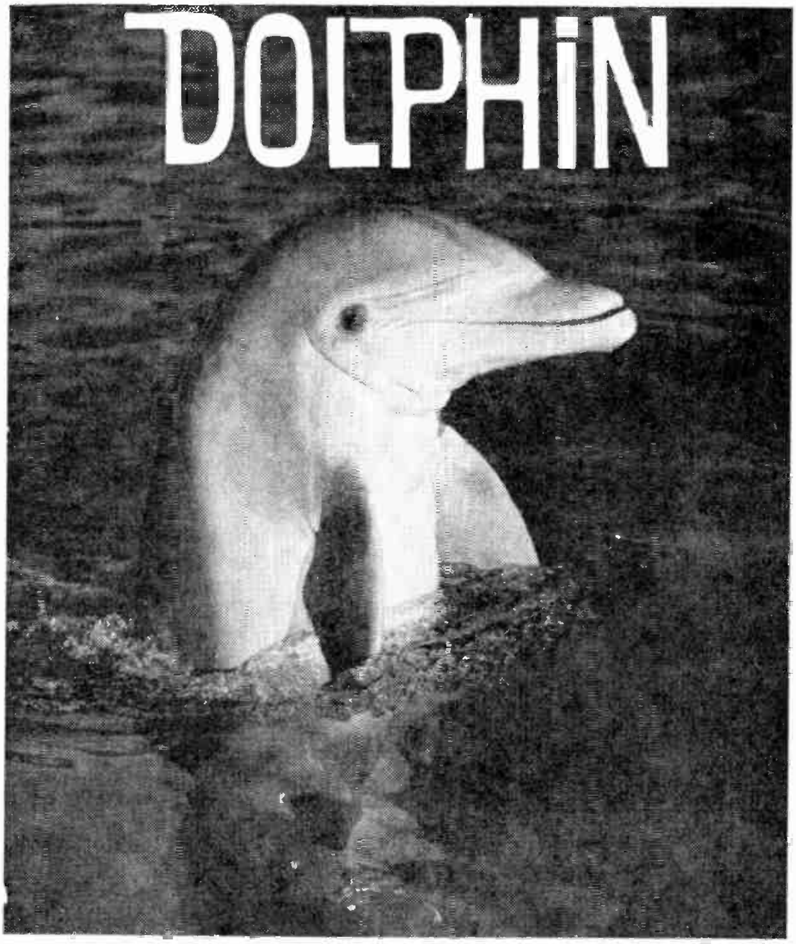
70-Volts of Audio



Bye Bye, 35Z5



THE GABBY GABBY DOLPHIN



By K. C. Kirkbride

Electronics in the form of hydrophones, acoustic spectrographs, and SCEPTRON "language" computer are the tools being used to solve the riddle of the talkative Dolphin's language!

Continued overleaf

THE GABBY GABBY DOLPHIN

Many a truth has been spoken in jest but has it been spoken in whistles, chirps, pops, clicks, squeaks, moans, groans, whines, and the Bronx cheer? American engineers plying electronic techniques to study the conversational proclivities of *tursiops truncatus* (the dolphin to you!) contend the answer to this puzzler is an emphatic *yes!*

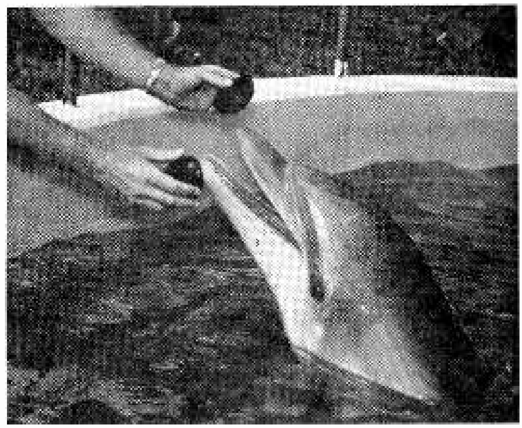
For a series of tests applying hydrophone, and sound movies, tape recorder and sonic spectrographic analysis have recorded the eight-foot-long, bottle-nose dolphin talking to fellow dolphins and one dolphin talking to man.

Florida's Marineland. It all began when Curator A. F. McBride of the fabulous Marineland of Florida near St. Augustine invited some dolphins to household in his Marineland pools. His staff, amused at tursiops' gay sense of prank and humor (at sea he will sneak up behind a fish, nip its tail and pull backwards), thought, why not teach this gay fellow some tricks?

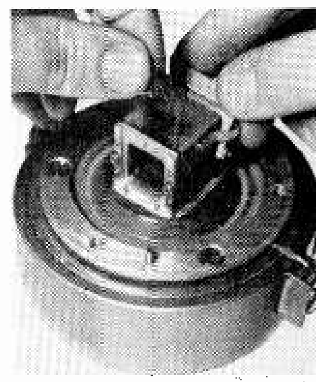
It wasn't long before the Florida trainers were putting their 300-pound guests through the jumps—some as high as sixteen feet in the air. They taught bottlenose to play basketball, tow a raft, put out a fire, jump through flaming hoops in chorus-girl style. Each dolphin, like humans, has a distinct personality, different from all other dolphins. Some will learn one trick, not another. All become bored quickly if asked to perform the same trick too often.

Moanin' Real Low. When the trainers heard their bright, temperamental pupils muttering to one another when asked to perform the same old trick day after day, they wondered, could these fellows really be "talking" in sound signals to each other? The trainers watched a seemingly bossy bottlenose snap his jaws, wave his head excitedly, frightening his more sensitive kin into swimming for cover at the far corners of the pool.

Certain "whistles" and "barks" accompanied nervous, excited behavior. The same moans, groans, squeaks, pop-pop-pops and "raspberries" sound-tracked moods of hunger, danger and courting. One moan seemed to mean a dolphin was warning another. A high "squeak" signalled "come here." Curator A. F. McBride said he suspected "three (dolphin) noises have 'language' value."



The tiny mask being inserted at right is used to program the SCEPTRON computer to recognize words uttered by Dolphins. The SCEPTRON is mounted on an audio frequency driver unit, or loudspeaker, which is used to excite the fiber arrays. Vocabulary changes are made by switching to other masks.



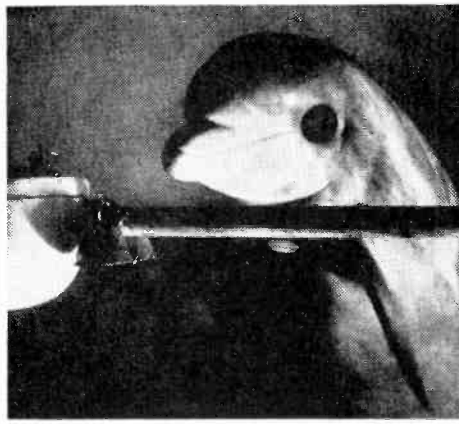
The trainers thought the response of the dolphins to human vocal instruction suggested these mammals from the sea understood human meanings; sometimes seemed eager to talk to man.

Go West, Tursiops. On the West Coast, Lockheed engineers were working on anti-submarine warfare research, studying the dolphin's sonar habits. They read the McBride findings, thought if they could possibly translate dolphin "language", the smart animal might tell them what gives under the sea.

In Lockheed and Marineland-of-the Pacific pools, engineers Dr. John Dreher and William Evans placed highly sensitive transducer hydrophones in their pool, rigged sound movies, tape recorders and acoustic spectrographs to snoop on friend tursiops.

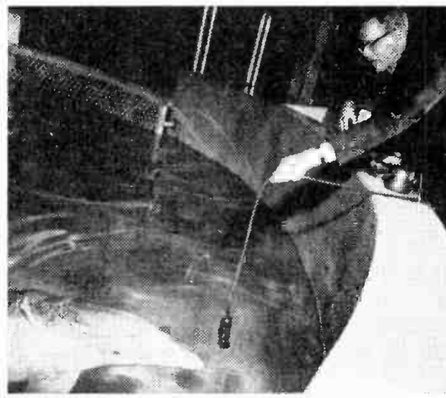
Moans. With their electronic gear, the Lockheed men could record on tape and cylindrical graph the moans, groans, pop-

A dolphin moves in to accept rubber suction cup discs over each eye (far left). With the suction discs in place (they cause no pain or discomfort), the dolphin must rely totally on its senses of hearing and sonar-sounding to maneuver with ease through obstacle course. At right, dolphin with "blindfold" on maneuvers past underwater hydrophone without so much as bumping it.



Photos courtesy Marineland of Florida

Luck, a trained dolphin, gives Robert Hawkins (right) samples of the sounds that scientists believe comprise a true dolphin's language. Hawkins is the inventor of SCEPTRON (left), a miniature computer that can memorize, distinguish between and react to sights and sounds. The tiny fiber array reacts to outside stimulus and records them.



Photos courtesy Sperry Gyroscope Company

pop-pops and clicks of the dolphin. Dreher and Evans recorded the bottlenosed-fellow in all his living activities—seeking food, playing games, teasing his trainers, courting, angry, afraid.

They matched sound-tracks with action and emotion, found one "beep" signified a dolphin was courting. Both male and female sounded the same signal but the male "beeped" first. If one was in trouble, it would sound a stress signal and all other dolphins within listening range would stop chattering, rush ambulance-speed to the stressed animal, push him to the surface of the water, sometimes to "shore."

Moans and Groans and Whines. Linking activity to moans and groans, the Lockheed men worked out a dolphin alphabet, defined a vocabulary of 32 dolphin words and assigned related meanings.

They recorded baby dolphin whistles on an acoustic spectrograph, found the young dolphin could whistle only seven of the 32, suggesting the young learned from pappa just as humans do. The spectrograph hinted too, an international dolphin language existed as the same words appeared on the graph "spoken" by dolphins of different species.

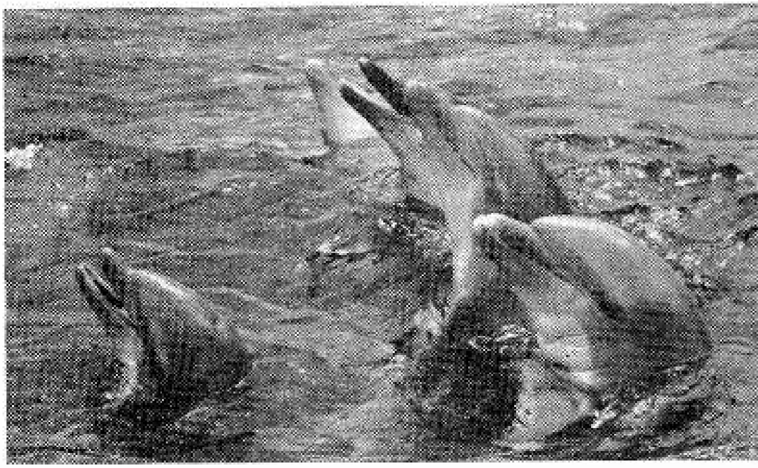
Bottlenose Gets Around. In Coconut Grove, Florida, a neurophysiologist named Dr. John C. Lilly put two dolphins in adjacent tanks in his Communications Research Institute, listened by hydrophone and tape recorder to them whispering back and forth like children.

Studying further dolphin conversations, he found most dolphins waited for a fellow dolphin to finish a sentence before answering. He would hear click exchanges between two animals with little overlap. Occasionally he heard a "duet," two animals whistling simultaneously, matching frequencies so well he could hear beat frequencies between the

THE GABBY GABBY DOLPHIN

These bottle-nosed dolphins (sometimes called porpoises) are typical of those used in experiments described in this article. Although ears can't be seen, they're located just behind the eyes, have well developed middle ear structure.

Photo courtesy Marineland of Florida



two emissions. This he thought similar to the human habit of repeating a word as the other person says it.

Lilly believed the dolphins sounded off in high frequencies, possibly through a series of sound-producing slits in the larynx leading into the animal's blowhole. No two dolphins "spoke" alike and many of their words sounded strangely human.

Talk Up. The Florida physiologist wondered, if dolphin words could sound human, why couldn't the dolphin, with proper encouragement, learn to repeat human speech? With this in mind, Dr. Lilly invited a young dolphin named Elvar to leave his happy home in the oceans and live in the laboratory tanks at the Institute.

During the first months of his visit, Dr. Lilly had to admit, Elvar was not a very pleasant guest. He was shy, aloof, subdued, indifferent to his human hosts, burying his bottlenose in the water and refusing to moan or groan. But Dr. Lilly didn't intend to let tursiops defeat him. Everyday members of the Institute staff stepped into the tank room to pay respects to their guest and talk to him in spite of his rude manners. Relating action to words, they raised their voices so the words would penetrate the water. At times, they admitted feeling pretty silly talking to a small whale that didn't even have the courtesy to answer.

But as the months wore on Elvar started to moan softly, then mutter, whine, squeak as any proper dolphin will do. And as he moaned, his human friends noticed his voice changing. He was moaning in high falsetto sounds, like a small child, in frequencies above those the normal human adult would use. Spectrographic sonic analysis showed Elvar's lowest frequencies at this point were between 1,000 to 2,000 cycles per second.

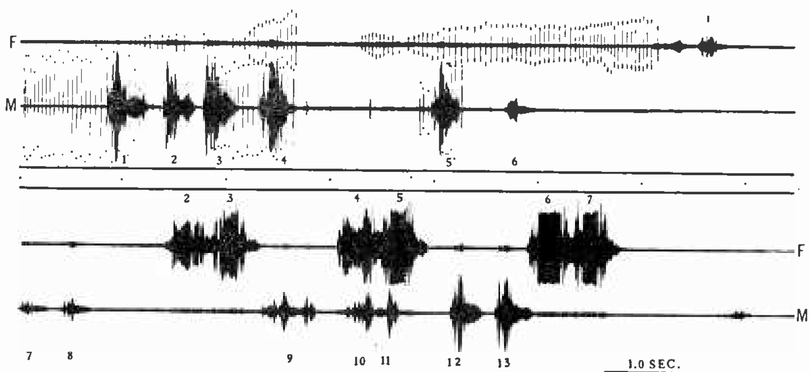
Elvar Talks. Dr. Lilly slowed the tapes of his recorder down by a factor of two to four, listened again. Now he heard sounds he had never before heard from any other dolphin. *He heard definite resemblance to the human voice!*

Dr. Lilly decided it was time to take the next step. He sent his associate, Alice Miller, to the tank room. As she stood at the edge of the tank, she spoke to Elvar. Elvar grinned in true dolphin style, filled his mouth full of water, squirted it at her, threw back his head, and laughed.

As Alice Miller hit the edge of the tank she cried out "stop it." Elvar, proving he could be as obedient as his fellow animal, man, immediately squirted water again. Alice Miller hit the side of the tank again, cried out the second time, "stop it."

On the fourth "stop it," Elvar opened up his blowhole, started to chirp very loudly in short sharp sounds. Playing back these latest Elvarisms on tape, Dr. Lilly heard a high-pitched "weeee."

"Stop It." After the fifth "stop it," Elvar said something at normal tape speed that sounded like a two-part, very short, high-pitched sound. Slowing the tape by a factor of two, Dr. Lilly now heard a very definite, human-like *"stop it"* spoken by Elvar in proper English. Elvar next repeated "bye-bye," the hydrophones and tape units picking



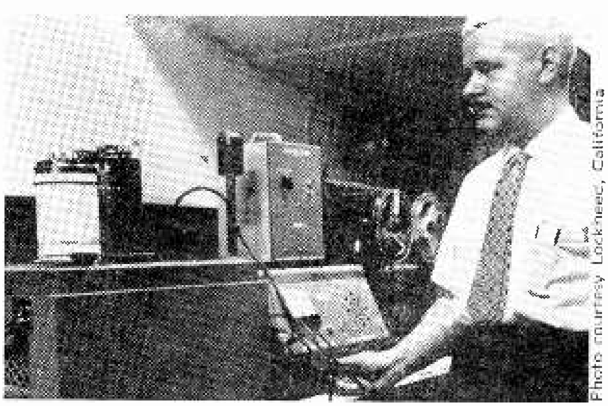
Drawing courtesy Lilly, John C. and Alice M. Miller, Science 134 (3493): 1873-1876, December 8, 1961

A graphic record of a 15 second vocal exchange between two dolphins was made in the laboratory of Communications Research Institute. Top trace in each pair shows emissions of the female "F" and the bottom trace are the emissions of the male "M." The upper pair of traces shows a click-and-whistle exchange; the lower pair, a continuation of same record without clicks.

up the components of the words as Elvar repeated them immediately after Miss Miller.

Alice Miller next told Elvar to say "more Elvar." He faltered at first on this one, but as Alice repeated, he finally chirped a high-pitched run-together "more-var." Alice Miller tried again. This time Elvar lifted his proud bottlenose head, beamed a broad dolphin smile at the lady and spoke in high-pitched human-tones *"More Elvar."*

Audio electronic spectrographic analysis showed Elvar had been steadily lowering the frequencies of his speech to accommodate his human listeners—from 1,000 down to 450 cycles within the past weeks—and that he could at will pitch back to higher frequencies two to four times the normal upper human frequency range.



Dr. John Dreher looks on equipment used to study the recorded dolphin voice patterns.

Other Voices. Dr. Lilly himself now stepped into the tank. He first asked Elvar to repeat the words he already knew, such as *"speak, up, louder, more."* Then Dr. Lilly told Elvar to repeat after him the word *"squirt."* The Doctor added the word *"water,"* asked Elvar to say the phrase *"squirt water."*

Elvar practiced *"wa"* separately from *"ter,"* then dolphin-smiled at Dr. Lilly, spoke the two words in succession in clear human tones, even rolling the "r's." For this, his crowning performance, Elvar had brought his lowest pitch down to about 200 cycles, a new low for his lowest frequencies.

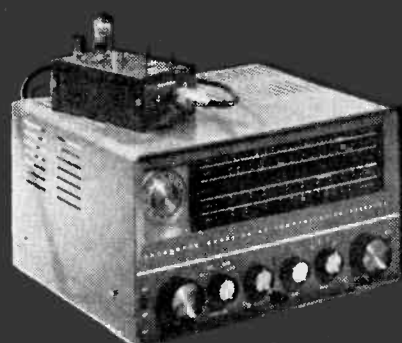
And he had proved he could not only repeat human phrases but could also analyze and repeat individual characteristics of the human voice. For *"squirt water"* was spoken in male-like brusque tones contrasting sharply with those he used in response to Alice Miller's feminine voice.

The Profit Motive. Sperry-Rand engineers say they know how to increase the dolphin's vocabulary. Feed human word-sounds into a Sceptron—Sperry Rand's miniature quartz-fiber brain cell—connect it to a mackerel dispenser so when Dolphin pronounces a new word correctly, he is automatically awarded a mackerel.

And as Mr. Tursiops is a known gourmand when it comes to mackerel, it is this writer's prediction it won't be long before the dolphin discards his moans, groans, and squeaks for human speech. ■

COVER STORY

build the VHF extender



There's no reason for your receiver to dead-end at 30 mc; move up in the listening world with this front end

By Jim Kyle, K5JKX
and Jim Speck, W5PPE

Any radio buff worthy of the name knows there's a world of excitement to be found in the VHF (very high frequency) range of the radio spectrum, but all too few of us have had a chance to get in on it. General-purpose receivers, for a number of good reasons, usually stop at about 30 megacycles—and the VHF receivers currently available as do-it-yourself projects or in military surplus hardly compare in performance with that we're used to on lower bands.

The VHF Extender is a device which can change all that for you, and let you get in on the fun for a minimum outlay of cash. Performance will be equal to that of your present SW receiver, since the purpose of the VHF Extender is simply to *extend* the frequency range of your present rig into the VHF region.

The VHF Extender can be used for any 4-megacycle-wide segment of the spectrum between 30 mc. and approximately 170 mc. and with only slight extra expense can be modified at will to cover a new slice should you tire of your first choice. This feature lets you listen to police, fire-department, aircraft-radio, or ham operators at will.

Theory Before Hookup. Before we get into the construction details of the VHF Extender, let's take a brief look at how it works. This will help you when it comes time to make the various parts-value choices needed in construction.

The VHF Extender is, primarily, a *new front end* for your receiver, which connects into the line between antenna and receiver itself. It translates the VHF signals down into the range covered by your existing receiver, so that while the on-the-air signal may be at a frequency of 136.040 mc. (for example), the signal fed into your existing receiver is at a frequency of 640 kc.—in the broadcast band.

Since the *translating* frequency is determined by a crystal-controlled oscillator, you can rely upon the dial calibration of your receiver. Thus should you be hunting a satellite signal at 136.050 mc., you could set your receiver dial to 1,050 kc. and use a 45-mc. crystal in the VHF Extender. Any signal appearing in the receiver would have to be a 136.050-mc. signal at the antenna (the 133.950-mc. *image* frequency is reduced greatly by the input RF amplifier circuit).

High performance in the critical VHF region is assured by the RF amplifier tube, a 6DS4 *Nuvistor*. The other tube, a type

6U8A, serves as both crystal oscillator and mixer. Power for the VHF Extender can be taken from the existing receiver, if it uses a transformer. Be sure to fuse the B+ (1/4 a.) and 6.3-vac (1 a.) leads to the Extender.

Get Ready to Build. The only tools absolutely necessary to build the VHF Extender are a drill, a screwdriver, cutting pliers, and a soldering iron. A grid-dip oscillator can prove very useful, however, if you happen to have one on hand. With the *GDO*, you can get along without the coil tables, simply by dipping each coil to its proper frequency.

To determine the values to be used for XTAL frequency, L1/C1, L2, L3/C3, and L4, use the tables or follow these rules. L1/C1 must tune to the desired VHF frequency band. For satellite reception, for instance, they should tune to 136 mc. L2 should tune to this same frequency when installed in the circuit and with the 6DS4 plugged in. For input frequencies between 30 and 70 mc., the XTAL frequency should be equal to the frequency of the lower end of the desired VHF band, minus the frequency of the lowest desired output frequency. For best results, the 7-11 mc. portion of the existing receiver's coverage should be used, which would make the XTAL equal to input signal frequency minus 7 mc. For input frequencies between 70 and 170 mc., proceed as before but divide the result by three. For 136-mc. input and 7-mc. output, the XTAL frequency would be 136-7 or 129/3, or 43.0 mc. L3/C3 should tune to the XTAL frequency, whatever it is determined to be, and L4 should tune, to three times XTAL frequency when installed in the circuit.

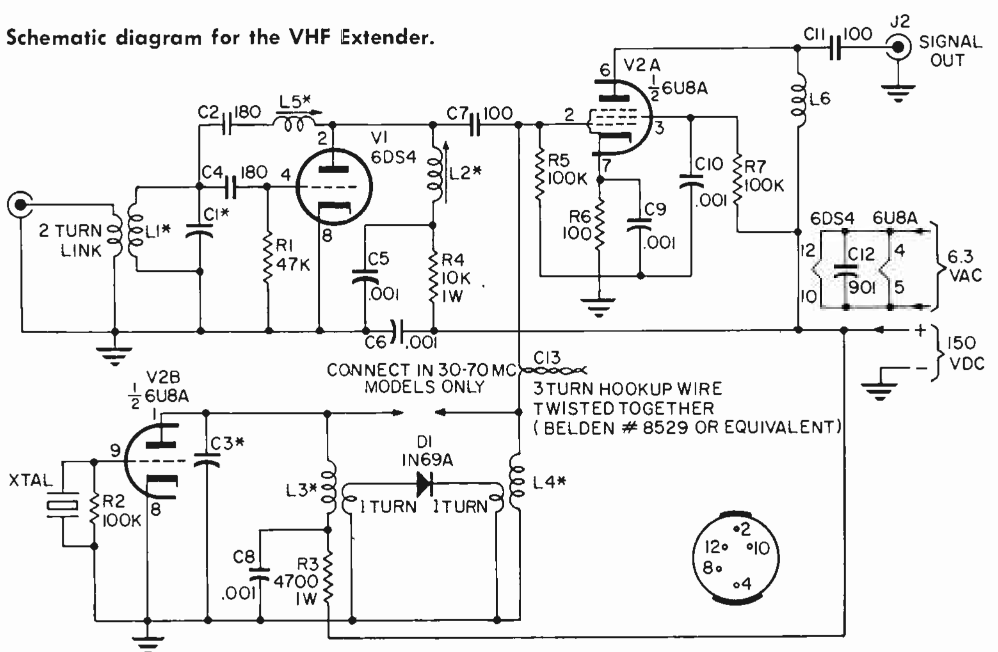
If you're using the coil table rather than a *GDO*, simply take the values shown there.

Putting It Together. The VHF Extender is built on a 2 1/8" by 3" by 5 1/4" aluminum chassis box, using the long flat side for most parts installation as shown in the photograph. Lay out and drill the box as shown in the chassis detail drawing.

Next, select the necessary coils using data from the coil tables. Install each in its proper location. Mount the tube sockets. The 6DS4 Nuvistor socket is secured by crimping its lips over tightly against the chassis. Several short wires are then soldered to the lips, and later will be soldered to the shield plate across this socket.

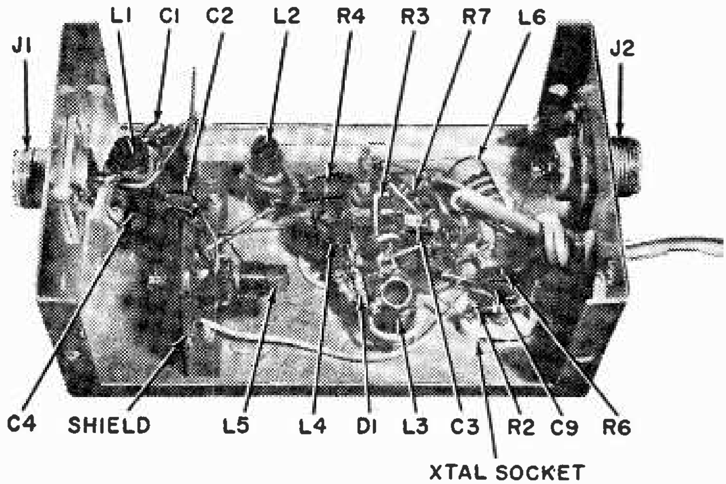
Wire the filament leads as shown on the schematic diagram before installing the copper shield partition on the 6DS4 socket, and mount the two coax connectors, J1 andJ2, in place. Then mount the partition (which must be made of copper or brass; this can usually be located at an auto-supply wholesaler under the name of 3-mil shim stock)

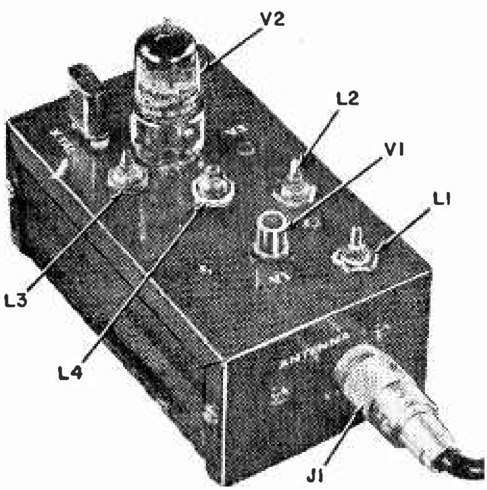
Schematic diagram for the VHF Extender.



build the VHF extender

The VHF Extender is an advanced project for the SWL experimenter. Part location is critical and should be followed closely. See photo at right and below. To make your unit identical with the author's, follow the detail drawings given in the article and follow the text without alterations.





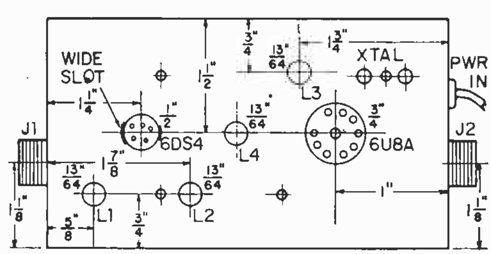
and make the rest of the connections to the tube sockets. Refer to shield detail drawing to fabricate piece.

Note from the photos that all leads must be kept as short as possible and no wiring is "fancy". Everything must take the most direct route. This makes the lower layer of wiring tough to get to later on, so check and double check at every step to make certain your connections are correct. If your wiring looks like a tight-knit rats nest—you're doing a good job.

Wiring Differences. With all coils in place and all tube-socket-connections made, the final stages consist of wiring the coils in and connecting the links between them. Only two of these are particularly unusual. Note how the long lead from the 1N69A diode, D1, is used as its own coupling link to L3. The other end of the diode wraps around L4 in the same way. Diode D1 and L4 are omitted on the 30 to 70 mc. models; this is the "extra expense" mentioned earlier to switch to other frequency bands. The other unusual connection is the twisted-wire "gimmick", C13 coupling L4 to the 6U8A pentode's grid. In the 30-70 mc. model, this wire connects to the top of L3 instead of to L4 as shown in the schematic diagram. Be extremely careful that the two wires do not short-circuit together; they form a low-value capacitor through which oscillator voltage is injected into the mixer stages, V2A.

Turn It On. When all connections are complete and rechecked, you can apply power to the VHF Extender. The 6U8A filament should light immediately, and the 6DS4 should feel warm to the touch after a few seconds. If it is hot, remove power quickly and check wiring, espcially near L5.

If all proceeds well, connect a coaxial cable from the output jack of the VHF Extender to the antenna terminals of your receiver and tune to about 7 mc. Briefly disable the 6U8A mixer, V2A, of the VHF



Detail drawing of chassis top part's layout.

Extender by shorting pin 3 to ground with an insulated screwdriver. Noise output from the receiver should diminish at the same time. If it does not, tune L3 until the noise rises sharply and suddenly. Adjust L3 carefully for maximum noise, then repeat the previous test. Don't be worried if a few 7-mc. short-wave signals come through during all this; they won't when the bottom cover of the VHF Extender is in place.

Before proceeding, you will have to locate a signal in the VHF region you're interested in. Tune it in as best you can; it may have an extremely ragged or "whistling" sound which is due to regeneration in the 6DS4 stage of the VHF Extender. Adjust the slug of L5, using an insulated tuning tool, to remove all distortion. Then tune L1 and L2 for best signal strength. You may find that readjustment of L3 (and L4) will strengthen the signal still more.

Next, unsolder either end of the 100,000-

COIL TABLE FOR 30-70 MC.

VHF Band (MC.)	L1, L2	C1 (mmf.)	L5	7-11 Mc. Output XTAL (mc.)	7-11 Mc. Output L3	7-11 Mc. Output C3 (mmf.)	BC-Band Output XTAL (mc.)	BC-Band Output L3	BC-Band Output C3 (mmf.)
30-34	20A156RBI	10	4205	23.000	20A106RBI	20	29.400	20A106RBI	20
34-38	20A156RBI	10	4205	27.000	20A106RBI	20	33.400	20A106RBI	15
38-42	20A106RBI	10	4204	31.000	20A106RBI	20	37.400	20A106RBI	15
42-46	20A106RBI	10	4204	35.000	20A106RBI	15	41.400	20A827RBI	15
46-50	20A687RBI	10	4204	39.000	20A106RBI	15	45.400	20A827RBI	10
50-54	20A687RBI	10	4204	43.000	20A827RBI	15	49.400	20A827RBI	10
54-58	20A687RBI	10	4204	47.000	20A827RBI	10	53.400	20A687RBI	10
58-62	20A687RBI	10	4204	51.000	20A827RBI	10	57.400	20A687RBI	10
62-66	20A687RBI	4.7	4203	55.000	20A687RBI	10	61.400	20A687RBI	4.7
66-70	20A687RBI	4.7	4203	59.000	20A687RBI	10	65.400	20A687RBI	4.7

Coil numbers are J. W. Miller Co. part numbers. Wind two-turn link of No. 22 hookup wire around grounded end of L1. BC-Band XTAL frequencies are for lowest megacycle of 4 Mc. VHF bands; add one mc. to XTAL for each higher megacycle desired. For instance, to cover 41-42 mc., table gives 37.4-mc. XTAL but this is upper megacycle of VHF band; add 3 mc. to XTAL frequency and use 40.400-mc. crystal.

COIL TABLE FOR 70-172 MC (7-11 MC OUTPUT)

XHF Band (MC.)	L1, L2	C1 (mmf.)	L5	7-11 Mc. Output Only (mc.)	L3	C3	L4
70-74	20A477RBI	4.7	4203	21.000	20A106RBI	27	20A156RBI
74-78	20A477RBI	4.7	4203	22.333	20A106RBI	20	20A156RBI
78-82	20A477RBI	4.7	4203	23.667	20A106RBI	20	20A156RBI
82-86	20A477RBI	4.7	4203	25.000	20A106RBI	20	20A106RBI
86-90	20A477RBI	4.7	4202	26.333	20A106RBI	20	20A106RBI
108-112	20A227RBI	4.7	4203	33.667	20A827RBI	15	20A106RBI
112-116	20A227RBI	4.7	4203	35.000	20A827RBI	15	20A106RBI
116-120	20A227RBI	4.7	4203	36.333	20A827RBI	15	20A827RBI
120-124	20A227RBI	4.7	4203	37.667	20A827RBI	15	20A827RBI
124-128	20A227RBI	4.7	4203	39.000	20A827RBI	15	20A827RBI
128-132	20A227RBI	4.7	4202	40.333	20A827RBI	15	20A827RBI
132-136	20A227RBI	4.7	10T#	41.667	20A827RBI	15	20A827RBI
136-140	20A227RBI	4.7	10T#	43.000	20A827RBI	15	20A827RBI
140-144	20A227RBI	4.7	8T#	44.333	20A827RBI	15	20A627RBI
144-148	20A227RBI	4.7	8T#	45.667	20A827RBI	15	20A627RBI
148-152	20A227RBI	4.7	8T#	47.000	20A627RBI	10	20A627RBI
152-156	20A227RBI	4.7	6T#	48.333	20A627RBI	10	20A627RBI
156-160	20A227RBI	4.7	6T#	49.667	20A627RBI	10	20A477RBI
160-164	20A227RBI	0	6T#	51.000	20A627RBI	10	20A477RBI
164-168	20A227RBI	0	5T#	52.333	20A627RBI	10	20A477RBI
168-172	20A227RBI	0	5T#	53.667	20A627RBI	10	20A477RBI

Coil numbers are J. W. Miller part numbers. L5, for bands above 132 mc. is wound on a Miller 4200 coil form with No. 24 wire, with the number of turns shown in the table. 0 value for C1 indicates part is not required.

COIL TABLE FOR 70-172 MC (BC-BAND OUTPUT)

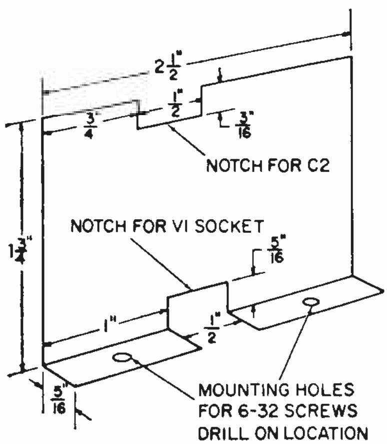
L1, L2, L5, and C1—same as given in Coil table for 70-172 mc with 7-11 mc. output.

L3—J. W. Miller type 20A106RBI from 70 mc. to 86 mc.; 20A827RBI from 86 to 140 mc.; and 20A627RBI from 140 to 172 mc.

C3—20 mmf from 70 to 86 mc.; 15 mmf 86-140 mc.; and 10 mmf 140-172 mc.

L4—Miller 20A156RBI from 70-78 mc; 20A106RBI 78-112 mc; 20A827RBI 112-136 mc.; 20A627RBI 136-152 mc.; and 20A477RBI 152-172 mc.

XTAL—23.133 mc. for 70-71 mc.; 23.467 mc. for 71-72 mc.; 23.800 mc. for 72-73 mc.; 24.133 mc. for 73-74 mc.; 24.467 mc. for 74-75 mc.; etc., increasing by 333⅓ kc. for each megacycle increase of VHF band. For 136-137 mc. coverage (satellites) Xtal is 45.133 mc., and for 145-146 mc. (Novice portion of ham 2-meter band) use 48.133 mc. Output will be from 600 to 1600 kc. on BC band, with 600 kc. equal to lowest frequency in band (136.000 mc. on satellite band; 136.040-mc. satellite would come in at 640 on BC dial).



Detail drawing of the copper shield partition installed inside the VHF Extender. Dimensions may vary slightly depending upon how accurately Nuvistor socket is placed.

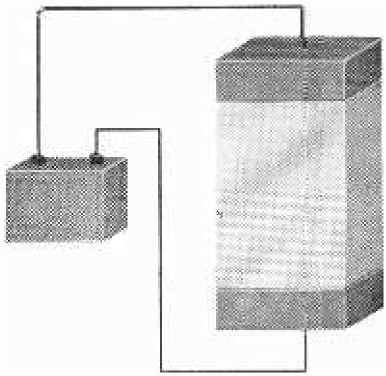
ohm resistor, R4, in the 6DS4 plate circuit, while still tuned to the VHF signal. This adjustment is best made with the strongest VHF signal you can find. Readjust L5 until the signal (with resistor disconnected) is as weak as you can get it. *DO NOT READJUST ANY OTHER COILS.* Then reconnect resistor R4, put on the bottom plate, and you're ready to enjoy the VHF Extender.

Switching Bands. To change to another frequency band, sholud you tire of your first choice, replace the crystal with one of proper frequency (see coil tables) and retune the VHF Extender as described above. If the move in frequency is not very far, you may not need to change the coils. However, if the frequency change is more than half a dozen megacycles or so, you will probably have to replace coils L1, L2, L5, and possibly L4. *(Continued on page 117)*

PARTS LIST

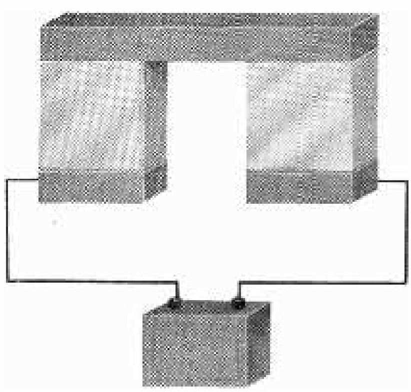
C1, C3—See Coil Tables for values—select ceramic disc NPO type capacitor
C2, C4—180-mf., 300 WVDC or better, disc or tubular ceramic NPO type capacitor
C5, C8, C9, C10, C12—.001-mf., 1000 WVDC or better, disc type capacitor
C6—.001-mf., button-bypass, standoff capacitor (Erie Ceramicon 323X5U101M or equiv.)
C73C11—100-mmf., 1000 WVDC or better, disc type capacitor
C13—Gimmick capacitor (See text)
D1—1N69A diode (Sylvania)
J1, J2—UHF coaxial connector, receptacle chassis type (Military No. SO-239 or 49194, Amphenol 83-1R, or equiv.)
L1, L2, L3, L4, L5—See Coil Tables
L6—RFC choke, 10-millihenry, ferrite core for 7-11 mc. output. Use 100,000, ½-watt resistor in place of RFC for BCB output
R1—47,000-ohm, ½-watt resistor
R2, R5, R7—100,000-ohm ½-watt resistor
R3—4700-ohm, 1-watt resistor
R4—100,000-ohm, 1-watt resistor
R6—1000-ohm, ½-watt resistor
V1—6DS4 Nuvistor (RCA)
V2—6U8A tube (GE)
XTAL—See Coil Tables for value. Select type with .050-in. diameter pins spaced .486-in. apart, .01% (.005% preferred)
1—XTAL socket (National CS-7 or equiv.)
1—2½"x3"x5¼" aluminum chassis box (Bud CU-2106A or equiv.)
1—Nuvistor socket for 5-contact tube
1—9-pin miniature tube socket with tube shield base
Misc.—Cable, wire, hardware, grommet, dials, copper shield, cement, solder, etc.

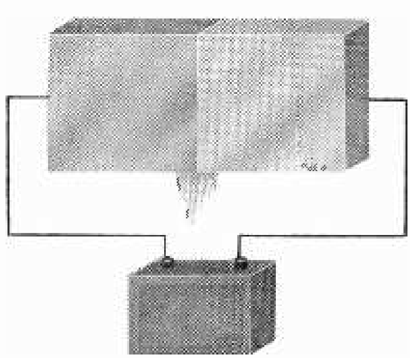
Estimated cost: $20.00
Estimated construction time: 12 hours



At last—the ol' principle of thermoelectricity has been practically applied for cooling—and heating!

electronic AIR CONDITIONING





By Len Buckwalter

Flick a switch one way, it blows hot. Flip it the other, it blows cold. That's only one striking feature of the electronic air conditioner. The others are just as remarkable. These units toss out nearly all the guts of the standard air conditioner—from bulky compressor and motor, to the out-size condenser. In their place is a compact, quiet package that can pour BTU's into a cold room in winter, or drain them from a hot space in summer. And it'll respond without the groan of spinning machinery.

Behind the electronic air conditioner are two words being applied to more mechanical and electrical devices every day—"solid-state." It's the field of the semiconductor: carefully *doped-up* metals that exhibit a dazzling array of useful qualities. It includes the transistor, diode and pin-head circuits inside high-speed computers and microminiature equipment. Now, with newly-developed properties, semiconductors are giving a big boost to the field of temperature control. A silent flow of electricity, not the

AIR CONDITIONING

brute-force action of awkward mechanical devices, can heat/or cool.

Where It Began. The idea of using electrical current to produce temperature change is not new. But it began rather indirectly back in 1821 when a German named Thomas Johann Seebeck (1770-1831) was toying with some bits of metal; a bar of antimony and some brass wire. In one experiment, Seebeck applied heat to a point where the bar and wire touched. Nothing happened—that is until he noticed slight movement in a nearby compass needle. Seebeck had accomplished a milestone in electronics, but his explanation of the event, at first, was fuzzy. He thought the heat generated magnetism which affected the compass needle.

Later, it was discovered to be a 2-step affair. What Seebeck had done was to apply heat to *two dissimilar* metals—antimony and brass—and created a flow of current. It is now called *thermoelectricity*. It'll work with any two different metals and the application of heat. Why did Seebeck's compass needle move? As current flowed in the brass wire it became an electromagnet and deflected needle. Seebeck's discovery was remarkable for his time, considering that Georg Simon Ohm (1787-1854) had not yet discovered his well-known law.

The fact that heated metals can be electrical generators paved the way for the next step. Fourteen years later, Jean Charles Peltier (1785-1845) in France followed through on *Seebeck's* experiment. In the spirit of basic research he *reversed* the process. Peltier *applied* an electrical current across dissimilar metals in contact with each other. When the current was applied in one direction he discovered that heat appeared where the metals contacted. Switching his electrical connections, which reversed the direction of current flow, that same junction point grew cool.

Two Effects. Thus the field of thermoelectricity was born. Soon the mystery surrounding those early experiments began to fall away. Both *Seebeck* and *Peltier effects* are now explained on the basis of electrical particles—negative electrons and positive protons—which form the structure of all matter. A give-and-take exchange of energy by these particles gives rise to thermoelectric effects which make possible the electronic air conditioner. First, let's consider a simple arrangement to illustrate how heat can produce an electrical unbalance, then a current flow. It's shown in Fig. 1. As in any substance, the metal bar consists of atoms containing electrons and protons which attempt to lock together. The bonds between them, however, are weaker in some substances. It happens in electrical conductors, such as the metal bar of Fig. 1. There are many "free" electrons which readily drift throughout the material. It is a willy-nilly movement with-

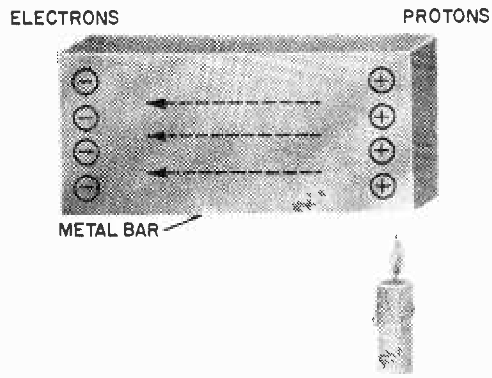
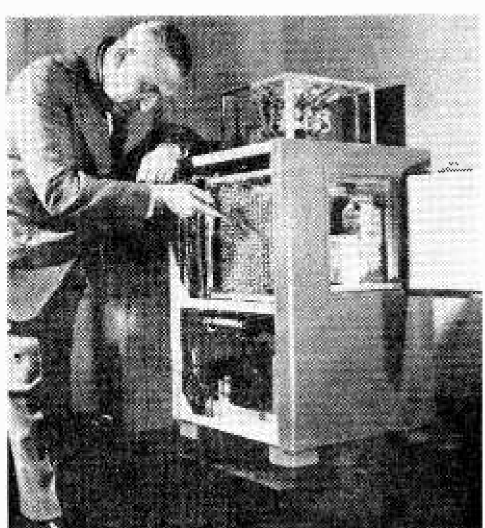


Fig. 1. Applying heat to one end of a metal bar will cause an electrical unbalance.



A noiseless electronic refrigerator, developed by RCA, has no moving parts at all. Unit has 4-cubic-foot food storage compartment (note milk carton) and a 30-cubic-inch ice cube tray.

out much order. But when the heat of the candle is applied to one end of the bar, those electrons begin to absorb energy. The result is a mass migration toward the cooler end, as shown by the arrow. Protons, on the other hand, have no such mobility and are held firmly in place by the grip of the atom's nucleus. The result: the bar becomes *electrically charged*—plus on one end, negative on the other.

Now to apply this effect in a complete circuit and see how heat and cold may be produced. In Fig. 2 the junction of two dissimilar metals is shown being heated. As in the earlier example, electrons commence to flow away from the heat source. How many electrons appear at the ends? This depends on the particular metals. Since the electrical activity of different metals will vary, so will the amount of "free" electrons. This explains why four electrons are shown at the left in the iron, while only two occur at the right for aluminum. (Actual numbers are much higher.) To the lamp connected across the ends of the bars, this difference appears as an electrical unbalance. In fact, the lamp sees a thermoelectric "battery." The end with more electrons can be considered the negative terminal. Fewer electrons on the other end make that terminal relatively more positive. This difference in electrical pressure (voltage) causes a current flow through the bulb.

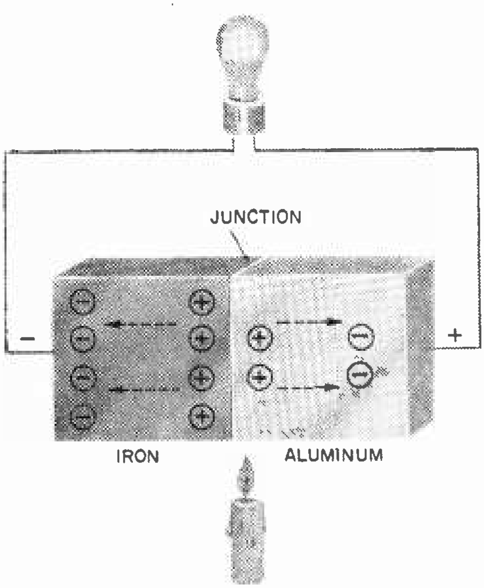
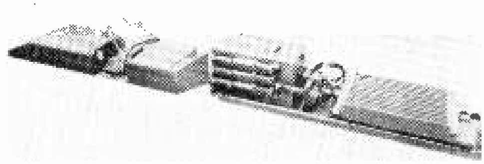
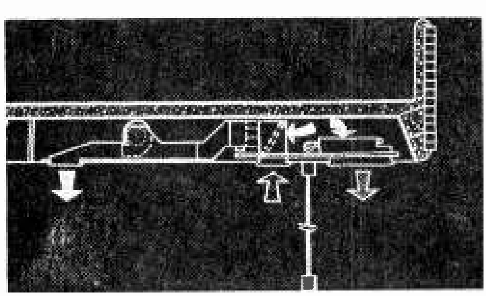


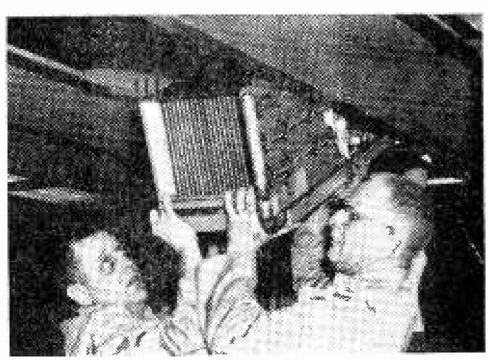
Fig. 2. Diagram shows how heat creates thermoelectricity—the famous Seebeck effect.

In Peltier's experiment, conditions are reversed, as shown in Fig. 3. A voltage source (the battery), is now connected to the ends of the bars. Let's see what happens in the bar at the left. The battery may be considered an electron pump, driving electrons up to the end of the bar. Here, they begin to interact with "free" electrons contained in the bar itself. The effect is repulsion, which happens when two like charges are brought together. Battery electrons drive the metal's "free" electrons toward the junction. If that junction were a good conductor, electrons would merely cross it with ease. The conducting path, however, is not a good one. Under the driving force of the battery, the free electrons strain to get across. But to make the final breakthrough, they must pick





Photos courtesy Carrier Corporation



Solid-state air conditioner is being installed in existing air duct (top right). Complete unit is shown upper left with solid-state section located in middle. Diagram at left shows how room and outside air are mixed and cooled. Only fan blower and damper move.

AIR CONDITIONING

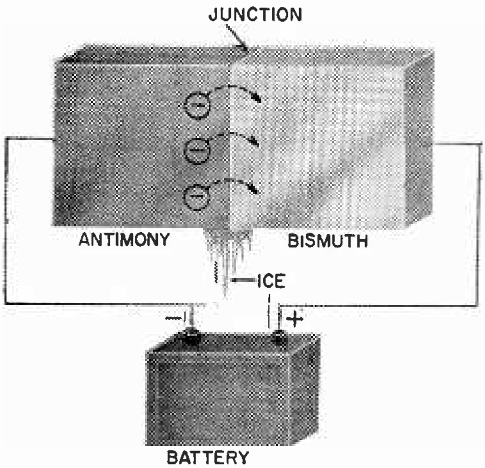


Fig. 3. Pictorial diagram showing the Peltier effect—as electrons cross junction of dissimilar metals, the antimony-bismuth junction is cooled.

up additional energy from some other source. That source is the existing warmth in the area of the junction. Heat energy is sucked out of the junction region and current flows. Removing heat leaves the junction cooler than its original state. This action produced the first crude thermoelectric refrigerator in the year 1838. With a combination of bismuth and antimony, plus a power source, experimenters froze one drop of water.

For more than 100 years these concepts of thermoelectricity remained little more than lab curiosities. There were dreams of revolutionary devices of the one-jump, no-moving-parts variety; the conversion of electricity directly into heat, cold or vice-versa. And without the friction, wear and maintenance of mechanical devices. But the scientist's dream was trammeled by a single fact. Thermoelectric devices would operate only at tiny efficiency, usually less than 1 percent. They were simply impractical except for specialized measuring instruments where accuracy, not power, is critical.

The Semiconductor. The field of thermoelectricity breathed new life with the rise of solid-state technology. New materials made hash of old efficiency figures. Today we have thermoelectric devices that are dozens of times more efficient than the old metal bars. And advances are coming thick and heavy. As we'll see in a moment, it's not just due to efficiency alone. New thermoelectric coolers can go into places where old-style refrigeration units prove too bulky.

Semiconductors greatly enhance the thermoelectric effect due to "current carriers." They are electrical charges able to move with great mobility through semiconductor material. It has been found that if certain substances are doped with a very tiny amount of impurity, they become enriched with one of two possible current carrier types. In Fig. 4 is the N-type, so-called because current carriers are negative. Such carriers are actually a surplus of free electrons. With the addition of a battery and two metal plates we have the beginning of a simple thermoelectric air conditioner. The action is comparable to what happened in Fig. 3. Battery electrons flow onto the top plate and repel free electrons in the N-type semiconductor. Again, cooling occurs as electrons pick up heat energy to bridge the junction. The top metal plate, therefore, grows cold. The lower junction heats as electrons surrender energy at that point.

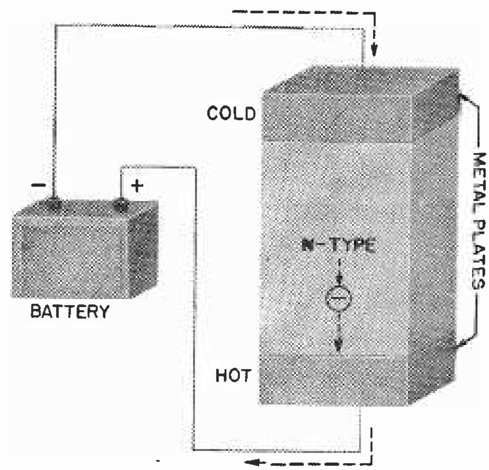


Fig. 4. Semiconductors do a much better job than metals in cooling a junction. Like Robin Hood, electrons take excess heat from the top plate and transfer it to the bottom plate.

The Hole Story. The effect is enhanced by adding the other class of semiconductor material, the P-type. Current carriers in this substance are positive. This may appear to contradict what was said earlier about positive charges in the atom. Positive particles (protons) were described as firmly fixed in place. They still remain fixed in P-type semiconductor, but there is added a new concept. It is the "hole." When the impurity is introduced to the basic substance it tends to capture free electrons. This leaves the semiconductor dotted with spaces formerly occupied by electrons. These holes, missing their electrons, exhibit positive charge. Moreover, they appear to drift. It's like the game of musical chairs: the empty seat changes position, but no chair has actually moved. The people (or electrons) do the moving. Holes provide the P-type material with positive-charge carriers that can be driven by battery voltage.

In Fig. 5 is the P-type semiconductor in action. Battery electrons introduced at the top plate commence to attract the positive holes (since unlike charges attract). As electrons and holes attempt to combine, they extract heat energy from the junction. The net effect is just as before; the top plate cools, the bottom one heats. And this continues so long as battery voltage is applied.

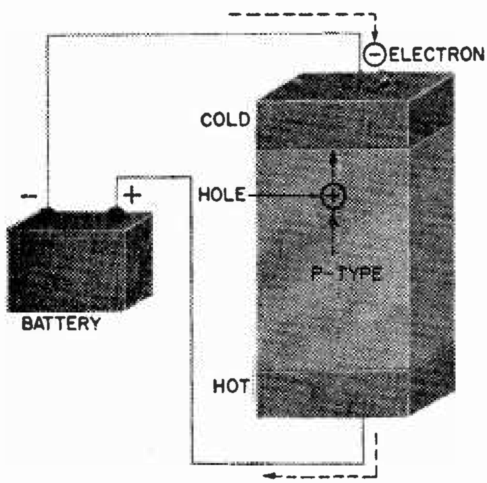


Fig. 5. Not only can electrons move heat from one place to another, so can holes. Incoming electrons combining with holes cool the top metal plate and heat the bottom.

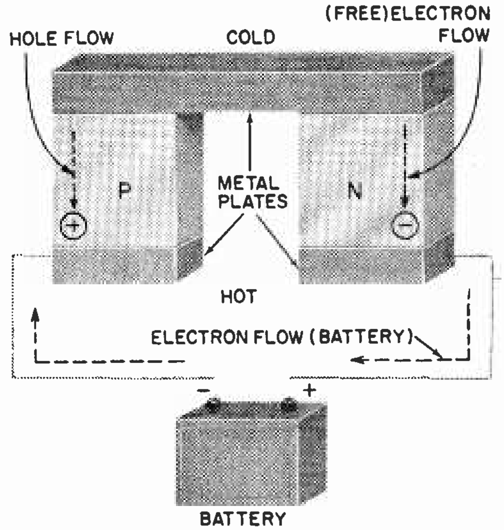


Fig. 6. Pictured here is a basic semi-conductor module used in the Carrier Corp. air conditioner. P- and N-type semiconductors are used.

Getting Together. Now we can combine both P and N semiconductors for maximum effectiveness and come up with the practical module used in the electronic air conditioner, shown in Fig. 6. The cool area is at the top, with heat generated at the bottom. The question may arise: If this module is for air conditioning, that is, for cooling purposes, why create a hot area? It's unavoidable. This system is essentially a heat pump. It extracts heat from one part of the circuit, and must surrender it at another in order to be continuous.

This pump action can be compared to that of a conventional air conditioner. When a liquid (freon) enters the cooling coils of a standard conditioner, it draws heat from the room and evaporates. It then travels as a gas

(Continued on page 117*)*

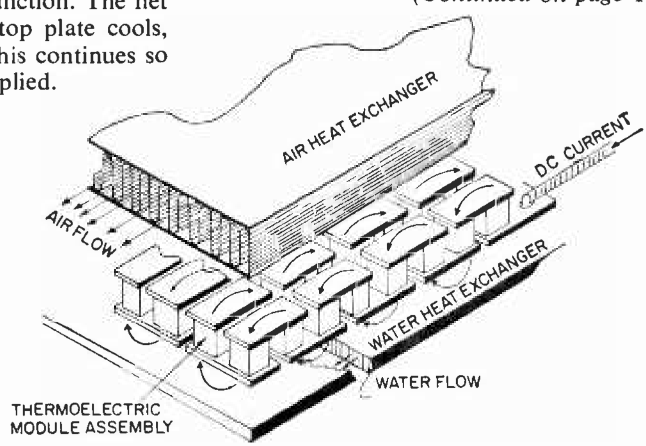
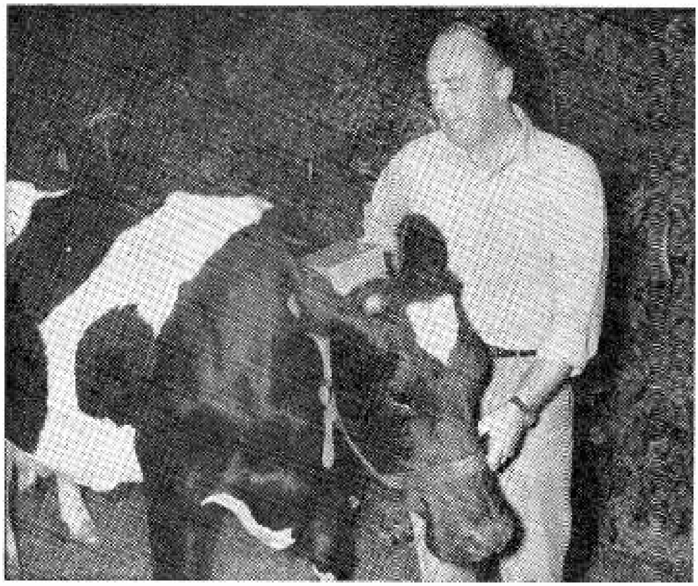


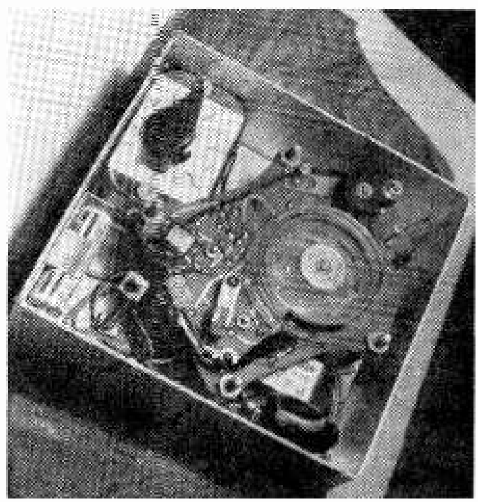
Fig. 7. A typical heat pump employing many semiconductor modules. To cool air, DC current is pumped into modules causing cool junctions to occur at the top next to the air heat exchanger. Heat is removed from the air (cooling it) and electronically pumped down to the water heat exchanger. Here, circulating water draws off the heat.



Inventor Robert W. Etter shows how his caller is attached to the halter of the herd's lead cow. Preset to operate many hours later, the farmer can take care of his chores till the cows find their way back home.

Caller is about the size of a cigar box, can be miniaturized. Timing device is at upper left. Device is similar to "Electronic Greeter" in December, 1964 issue of this magazine except spring-loaded timer is used in place of button.

Why the COWS come HOME!



THE old farm dog who's been chasing the herd to the barn for many years may lose his job. A new device just patented by an ex-dairy farmer now does the things Rover was trained to do—and it doesn't nip the cows' feet.

The invention, a brainstorm of Robert W. Etter of Birmingham, Mich., is a compact recording device that tells Bossy when to come home for milking. It fits behind the cow's ears, and at a pre-arranged time says, "Here, Bossy, Bossy. Come, Bossy. Here, Bossy, Bossy." Or whatever the farmer wants to tell her while he's busy.

Strapped onto the halter of the lead cow, the device will lure the herd back to the barn—a great timesaver for busy farmers. It's personalized: a farmer can record his own voice or any other voice to which the herd will respond.

The gadget is about the size of a cigar box, but it can be miniaturized. It consists of an endless tape and an ordinary timing device. Two batteries operate the thing—a 9-volt for the amplifier and a 1½-volt for the motor mechanism. The timing device can be pre-set to go on and off at any time.

It'll keep repeating any message for as long as it's been set. Once the cows are in the barn, the farmer can turn the unit off. ■

super tapes unreeled

If you thought polyester was a girl's name, you have lost track of the new tapes

By Art Zuckerman

Once upon a time a chap intent on using his magnetic recording machine had an important choice to make when he went down to his corner audio shop:

Should he buy 600 feet of tape wound onto a 5-inch reel, or should he be a sport and go for the 7-inch, economy-size reel that holds 1200 feet?

Today, he's got a few other options to juggle. Like, for instance, should he buy:

> Acetate or polyester, straight polyester or tensilized polyester?
> Regular-play, extended-play, double-play, or triple-play?
> Ordinary, high-performance, low-noise, low-speed, or low-print?

The poor guy even has to ponder the relative merits of the standard, 2½-inch reel hub compared to the 4-inch hub.

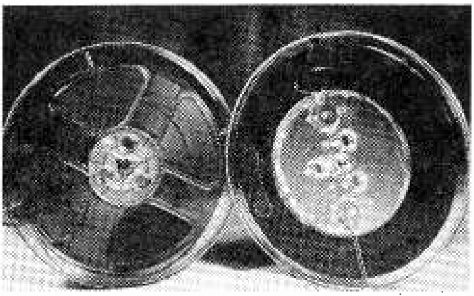
If this proliferation of options has made a befuddled tape buyer out of you, take heart. The fact of the matter is that you've never had it so good.

Looking Back. Sure, in the simple old days you didn't have to knock yourself out with choices. But, on the other hand, to get a recording that wasn't enveloped in hissy noise, you needed a machine that used the entire width of your tape in a single pass. And if you wanted to capture all those beautiful frequencies from 50 to 15,000 cycles per second, this one-track tape had to be raced past the record head at a breathtaking—and footage-consuming—15 inches per second.

Not only was all this expensive, but it made things kind of tricky when you wanted to record a long symphony—not to mention an opera. To add injury to inconvenience, a very hot, humid day frequently left your tapes stretched out of shape, and the sound along with them. And should these tapes have been exposed to bitter winter cold, they had a nasty habit of embrittling and cracking.

Worst of all, after a few years time, some

super tapes unreeled



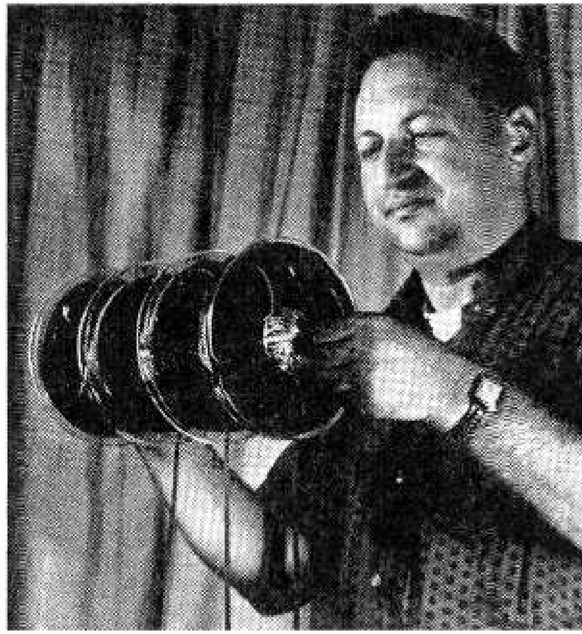
The Kodak tape reel at the left features easy thread slot and integral splicing jig. At the right is an Ampex reel with 4-inch hub that carries 1-mil tape. The large hub is quite effective in smoothing out the tape movement.

FACTS ON TAPE BASES (BACKINGS)

Backing	Physical Properties
Acetate	Relatively low strength but clean breaking; easily distorted by high humidity; sensitive to high temperatures and embrittles at low temperatures; tendency to dry out in time.
Durol (Kodak's improved acetate)	Similar to acetate but 40 per cent stronger and even cleaner breaking.
Polyester (also Mylar)	Relatively high breaking strength but susceptible to marked stretching before it breaks and breaks stringily; highly resistant to humidity changes, temperature resistant; never dries out.
Tensilized Polyester	Polyester tape strengthened primarily by stretching—usually in thin-width, extra-play versions.

Facts on Tape Lengths and Playing Time

Tape Type	FOOTAGE (7-in. reel)	Stereo Playing Time (7½ ips)	Mono Playing Time (7½ ips)
Regular	1200	1 hour	2 hours
Extra Play	1800	1½ hours	3 hours
Double Play	2400	2 hours	4 hours
Triple Play	3600	3 hours	6 hours



Today, tapes can be bought in (left to right) standard-length, extra-play, double-play, and triple-play sizes. Extra footage is put on a 7-inch reel by cutting thickness of tape base, and, for triple-play, by reducing the thickness of the oxide coating.

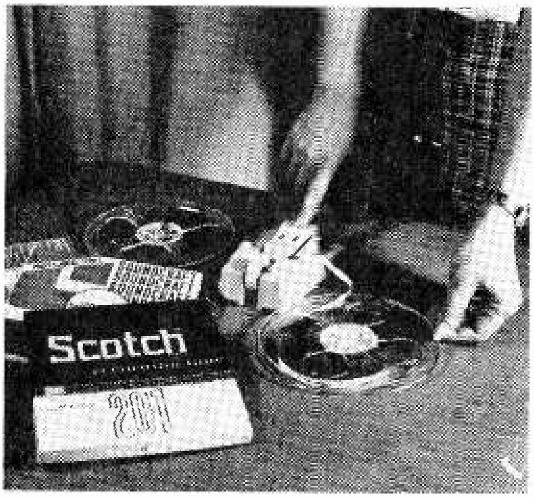
Two tape recorders, Korting 158 (left) and Uher 8000, are used to test the noise rejection of Scotch Low Noise Tape in repeated dubbings.

of your treasured recordings were frequently ruined because the tapes dried out and developed an intolerable mechanical squeal.

Today. Using only one-fourth the width of your tape, you can now enjoy true high fidelity reproduction at 7½ inches per second, and something mighty close to it at 3¾ ips. Today's tapes can even sound good at 1⅞ ips! It is possible to record as much as 1½ hours of music non-stop at the highest fidelity and double that amount while still enjoying excellent fidelity.

By flipping reels, up to 3 hours of highest-fidelity stereo can be put on a single 7-inch

Tapes can be tested for relative performance on your recorder by splicing together samples of several brands onto a single test reel. Leader tape is used to separate the samples, on which identical material is then recorded.



reel, or 6 hours of top-grade monophonic hi-fi. Go down to the second-best—but still excellent—3¾ ips speed, and you come up with 3 hours of stereo or an incredible 12 hours of monophonic good-fidelity music.

Furthermore, squeal has been banished from modern tapes, and climate extremes have lost most of their ability to harm your precious recordings.

Behind many of these dramatic improvements are the wonderful things that have been happening to the tape recorders themselves. But they would not have been possible without an equal rev. in the tape.

IPS Slowdown. The most important single development was the moving of true high-fidelity performance down from the Olympian speed of 15 ips to the 7½ ips top speed of the average home recorder. This became possible when audio engineers learned how to halve the size of the already hair-thin air gaps in the tiny electromagnets we call recording heads. The tape makers then found it necessary to put much smoother, more tightly-packed oxides on their quality audio tape products.

You might compare the problem to writing on rough, newspaper-grade paper. It works fine with a broad-pointed pencil or crayon. But it can't compete with tiny, intricate designs applied by a needle-pointed artist's pen. For such work, you must have paper with a tight surface texture.

Because the new recording head gaps were so very fine, they were much more susceptible to clogging by dirt and to abrasive wear. The smoother oxides helped to reduce abrasion, and tape makers found it possible to saturate it with silicone lubricant. This also got rid of mechanical squeal. Furthermore, binding agents used to hold the coating to the base were made stronger to prevent shedding.

Getting Thinner. At the same time, the tape makers discovered how to shave a third off the thickness of the standard, 1.5-mil acetate tape. This permitted them to increase playing time 50 per cent by adding an extra 600 feet to a 7-inch reel. But acetate, never strong to begin with, became positively fragile when it was reduced to 1 mil.

Du Pont came to the rescue with Mylar, a film version of its celebrated polyester fabric known as Dacron. It takes a truly king-size tug to break this stuff. What's more, polyester holds its shape beautifully in the most humid weather, doesn't give a hang about the cold, and never dries out. This is because, unlike acetate, it contains no plasticizer, an ingredient that evaporates with time.

Polyester was quickly picked up by such brands as Soundcraft, Scotch, and Audiotape as their standard base for extra-play tapes. Then Audiotape pulled off a coup by shaving still another half mil, to wind 2400 feet of tissue-thin tape on a 7-inch reel. The competition soon followed, and today double-play tape is a commonplace.

Wonderful as it is, polyester has its problems, too. While it takes a heck of a yank to break it, considerably less pull will stretch it into uselessness.

If the stress is great enough, you can dis-

super tapes unreeled

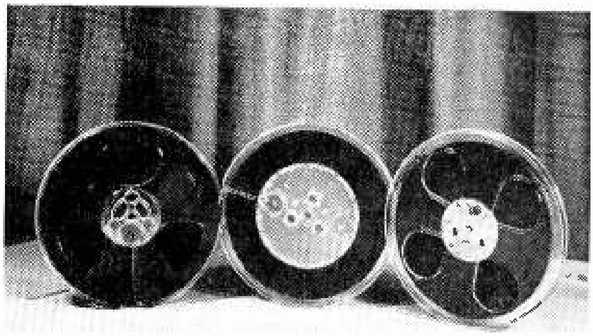
tort polyester tape until it takes on the form of string. Acetate, on the other hand, will hardly stretch at all before it snaps—and it snaps clean, while polyester becomes a stringy mess before it parts.

However, thickness for thickness, it takes a good deal more pull to stretch polyester than it does to break acetate. In a 1½-mil, standard-play version, polyester is enormously stronger than standard acetate, and it is offered as a premium tape that will preserve a recording almost indefinitely.

Too Much Stretch. Even in this superior version, nevertheless, tape editors—the people who cut and splice recorded tape into final program form—are leery of polyester. They do their job by hand-"rocking" the reels. They turn them back and forth, listening for the exact point where they want to cut. Such manually-created tension can easily build up to the point where an irreplaceable recording is stretched out of shape. A snapped acetate tape can be spliced together so that no break is audible. But a stretched length of polyester must be discarded.

Kodak has endeavored to solve the problem by improving the strength of the acetate base. Its version, called Durol, will still part considerably quicker than polyester of the same thickness, but it will do so only after enduring enough stress to ruin a recorder stretch of polyester. More important, it is about 40 per cent more break resistant than standard acetate, and when it does finally go, it parts with an even cleaner break than the standard product.

But if you want double playing time, only polyester is strong enough for the necessary ½-mil base. And it's still the only tape base in general American use that can cope with extreme humidity. But the original double-play reel was so very delicate that using it on many home machines was an invitation to disaster. It just couldn't cope with the normal operating tension these recorders applied to a tape.



Some available specialized reels include (from left to right) a Kodak reel with easy-thread slot and integral splicing jig; an Ampex reel with a 4-inch hub; and, finally, an Audiotape reel with C-slot threading feature.

So the tape makers now offer a premium version known as tempered, or tensilized, polyester. This base material is pretreated, primarily by stretching, to toughen it up, and it is almost as strong as the conventional 1-mil polyester used in extra-play reels.

Thinner Oxides. The latest play in the long-play sweepstakes was first pulled off by the 3M Company, maker of Scotch tape. It introduced *triple-play* tape! Now you can also buy it—3600 feet on a 7-inch reel—from Kodak, Audiotape, and Soundcraft, among others.

No, this time nobody tried to shave down the width of the polyester base. Instead, the oxide coating's thickness was reduced enough to add 50 per cent to the length of a half-mil tape.

When the thin tapes first came into use, re-

TABLE OF SPECIAL TAPES

Tape Type	Characteristics
Golden Tone (Soundcraft)	Premium-priced tape featuring tightly-controlled slitting, optimum frequency and noise characteristics
High Output (Kodak)	Oxide designed for higher-than-normal output, broader dynamic range
Low Noise (Scotch)	Tape designed for minimum background noise—for low speeds and dubbing (copying)
Low Print or Mastering (Kodak, Audiotape, Soundcraft)	Resistant to print-through in prolonged storage
Low Speed (Ampex)	Optimum frequency respone at 3¾, 1⅞ ips

cording engineers became increasingly aware of a problem known as print-through. Most troublesome during prolonged storage, print-through is the nasty tendency of a length of tape carrying a loud passage to partially magnetize adjacent layers of tape on the reel. The result is frequently a disturbing pre-echo and a somewhat less annoying post-echo.

The thinner the tape base, the more pronounced the print-through problem, because the magnetized oxide layers lie in closer proximity to one another. But print-through also plagues the sturdy old 1½-mil product, if it sits unused on a shelf long enough—and especially if it was recorded at maximum volume.

So, for the benefit of those who want to store valuable recordings for indefinite periods, Kodak, Audiotape, and Soundcraft offer low-print tapes that resist such cross magnetization. Their secret—a thin oxide coating on the standard 1½-mil base.

Actually, the new triple-play reels provide some low-print benefits because their coatings are relatively thin for their ½-mil bases. But this very coating thinness creates its own problem—output noticeably lower than a standard tape's. To overcome this, such brands as Soundcraft have resorted to a higher-potency oxide to boost the output of their triple-play product.

A high-output coating on a thicker base can now come in handy when you want to record a program with a broad range of intensity. An example would be a symphony orchestra, recorded live, playing a composition ranging from the whisper of a woodwind to a maelstrom of tympani, tubas, and trombones. A high-output tape such as Kodak's permits you to set your recording level to avoid overloads on the crecendoes and still capture the very faint passages.

S/N Ratio. One of the most critical factors affecting the quality of a tape recording is its signal-to-noise ratio. There is an inherent amount of noise in any electronic device. In tape recorders you hear it as hiss. If there is a wide-enough gulf between this noise and the recorded program material, you don't hear the hiss. The size of this gulf is called the signal-to-noise ratio.

A wide magnetic track has a greater signal-to-noise ratio than a narrow one. Noise also becomes less intrusive at faster recording speeds. Every time you make a copy of a tape, a little more noise appears on the copy. So a copy of a copy of a copy is considerably noisier than an original tape.

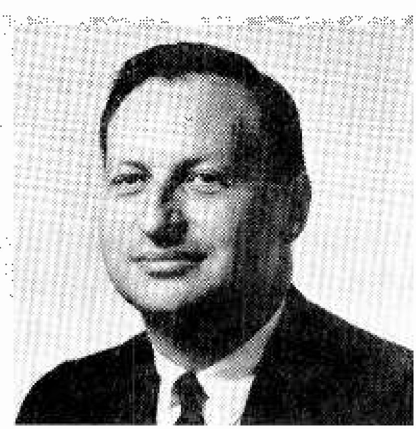
Noise was a recognized enemy when the 3M Company developed a cartridge recorder. Their design operates at only 1⅞ ips, and it records only about a third the width of a tape but 0.15-inch wide, little more than half the size of a standard ¼-inch tape.

So they developed a new kind of tape to cope with their noise problem. You can now buy this Low Noise tape on a conventional reel. It is easily recognized by its unique black oxide coating. It is so effective that professionals who do a lot of dubbing—tape copying—have adopted it as a standard tool.

A low-noise benefit is also claimed by Soundcraft for its premium-priced Golden Tone tape, together with broadened frequency range. Although it isn't touted for low-speed or copying use, it should prove valuable for such jobs.

Ampex also has gotten interested in the lower speed ranges. Its new 1000 and 2000 series recorders, in fact, sport a 1⅞ ips third speed. So Ampex has brought out a special low-speed tape, designed to yield the best

(Continued on page 120)



ABOUT THE AUTHOR

☐ **Art Zuckerman,** a Phi Beta Kappa graduate of New York University, is the author of *Magnetic Recording for the Hobbyist,* a practical guide to the hobby of tape recording published last year by Howard W. Sams & Co., Inc., and Bobbs-Merrill Co., Inc. He has also written innumerable magazine articles about tape recording, high fidelity, and other electronics subjects, many of which have appeared in RADIO-TV EXPERIMENTER and SCIENCE & MECHANICS. At the same time, Mr. Zuckerman is the engineering & design editor of *Metalworking News,* a weekly industrial newspaper.

REVAMP THE OL' AMP

Now that you're planning to upgrade the hi-fi rig with a new amplifier, don't be in a rush to get rid of *Old Faithful*. Sure, it sounds like *hell*, and you think you're putting one over on the dealer who offered you a ten buck trade-in sight unseen; but *Old Faithful* still has lots of life left, and it can give you more long term pleasure than the ten dollars will.

What's that? *Old Faithful* has *furshmergeld* sound; it makes Maria Callas sound like a gurgling porpoise; it's beyond repair? Come now, Honest Harry isn't giving ten dollar trade-in allowances for junk. He knows that with five to ten dollars worth of new *minor* components his technicians can "create" a like-new amplifier (which he'll unload for ⅔ list). So why not add the new components yourself and have an extra amplifier. Even if it's a mono job you can use it for a good quality *background music system* in the playroom, or maybe have some decent sound to liven up the backyard barbecues. Or maybe the community playhouse could use the amplifier so the sixth row orchestra could hear Mrs. Thelma Thespian (all 180 pounds of her) playing Juliette.

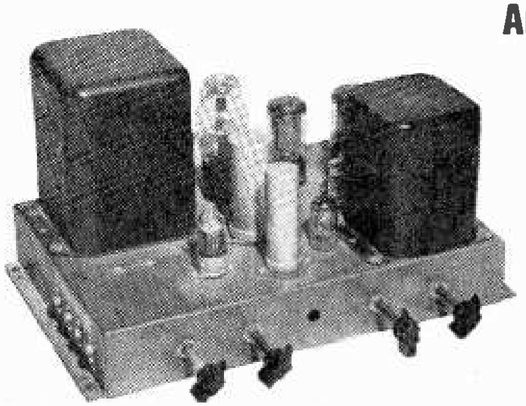
It's really quite easy to rebuild an amplifier, and contrary to myths and legends you don't have to be an advanced technician; if you can handle a soldering iron you're ready to rebuild. The secret lies in the fact that most amplifiers suffer from deterioration of minor components; rarely does the power and output transformers burn out—and all other components are minor components.

Eyeball Servicing. The key to rebuilding is *looking*. Turn the amplifier over and take a long, *long*, hard look. Does the line-cord seem dried out; is the rubber insulation cracking? Does the line-cord have a sharp bend that might result in broken strands? Unless it looks factory fresh, replace it. Look at the power resistors—anything 1 watt and larger. Are there dark bands indicating years of exposure to high heat; most likely they've changed value so replace them.

And those large power resistors in the B-plus filter. If they have solder terminals has years of heat caused the solder connections to oxidize (look gray)? Simple, just resolder the connections.

While it will be unusual to find complete breakdowns in power resistors, capacitors are another story. Remember the distortion—the breakdown on crescendos, the gurgles on the soprano. Deteriorating coupling capacitors leaking high voltage shift the grid bias

Amplifier tests prove that simple



Don't commit your ol' amp to the scrap heap— pennies and spare time will restore its fidelity

Herbert Friedman, W2ZLF

on the following tube, so take a close look at the capacitors. See the wax bubbling out of those paper jobs? Time to replace them with some modern moulded capacitors.

Remember the hiss, clicks and pops everytime you switched to *magnetic phono.* Resistors generate noise which usually is at extremely low levels, except when they're used in low level amplifiers. Simply replace the *magnetic phono preamplifier's* plate, screen, grid and cathode resistors with the modern low-noise type and *voila,* a dead quiet amplifier.

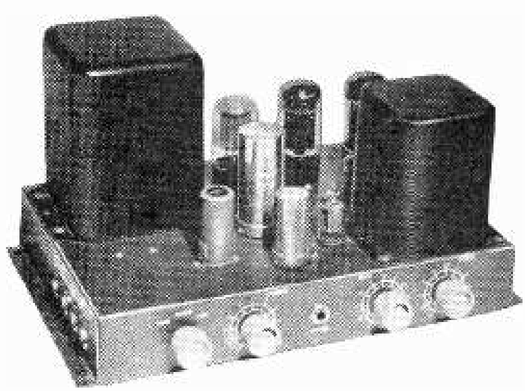
Loss of bass (low-frequency response) and increase in hum level are other aging problems. Take a look at the B-plus filter's electrolytic capacitors; aside from affecting the low frequency response they determine the hum level. Are there indications of electrolytic leakage at the terminals? Is there a white crust (dried electrolyte) where a chassis mounted capacitor enters the chassis? No matter how slight the leakage, if you find evidence of electrolyte replace the capacitor.

Sock It with Sockets. While we're on the subject of capacitors let's mention a professional technique. Electrolytics generally have terminals packed with wires, and after one or two repairs the connecting wires become a mess of burned insulation and pretzel shaped bends. If you're replacing an electrolytic use a *socket.* That's right, a socket—like for a tube. Capacitor sockets are available (Allied Radio 40 H 335 and 40 H 336) which exactly fit the wafer mounting hole. You connect to the socket just as you would to the capacitor terminals; except, from then on you simply plug-in the replacements. Any time you think a capacitor needs replacement—like if the hum increase—you just plug in a new capacitor; you don't even have to pull the chassis.

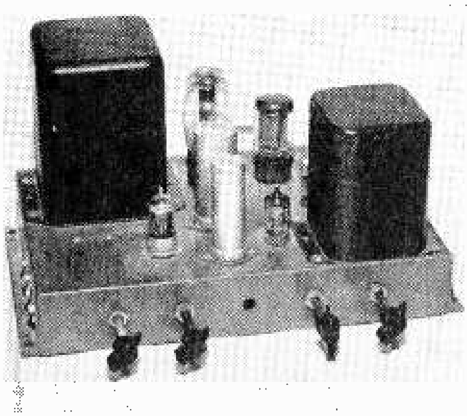
Tubes. Of course, replace the tubes. No, don't bother to check them, treat yourself to a full new set. After all, you're going to have a "new" amplifier. And you might like to really go modern by replacing the rectifier tube with silicon diodes. Silicons have no filaments so they generate no heat; the cabinet, the amplifier, and the power transformer will all run cooler. But first you must check whether *your* amplifier can use silicons.

Up Goes B-plus. Rectifier tubes used in old amplifiers have an internal voltage drop under load of about 30 volts. If they are

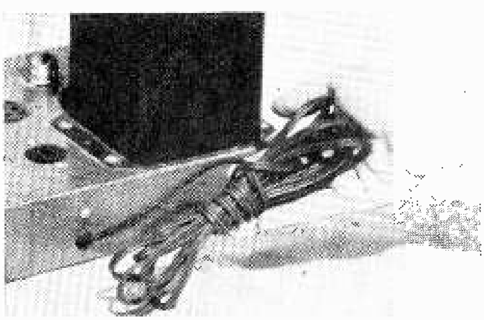
servicing tricks add new life



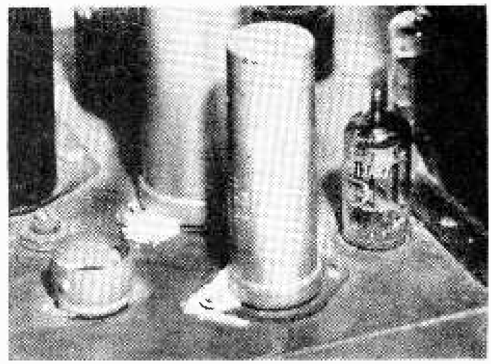
REVAMP THE OL' AMP



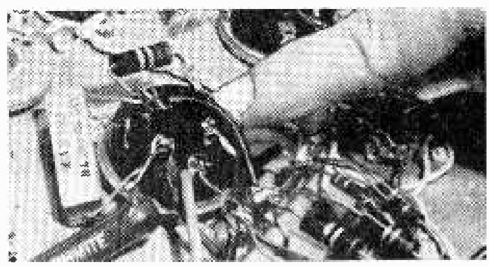
Old Faithful—fifteen years of service, yet amplifier can be saved from scrap heap.



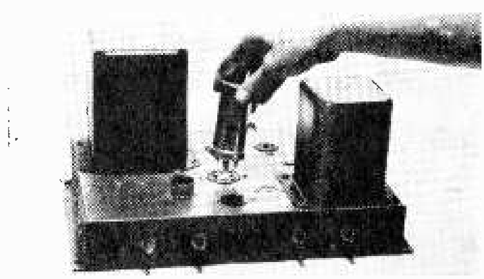
First thing to do is replace old power cord if it shows cracks. While you are at it, make it extra long. Add fuse holder if set has no overload power line protection.



Electrolyte leakage (white crust) at base of capacitors shows replacement needed.



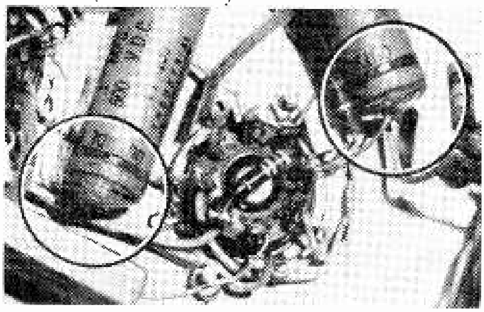
To simplify future repairs and tests, capacitor sockets are substituted for mounting wafers. Note that components are connected to lugs like on tube sockets.



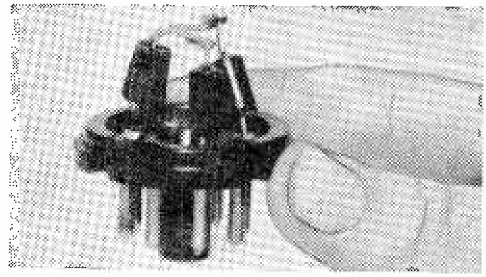
Capacitor sockets permit "filter cans" to be plugged in and taken out like tubes.

replaced with silicons—which have an internal drop of less than 1 volt—the B-plus will rise approximately 30 volts; so you must make certain the filter capacitors can withstand the extra voltage. For example, if the capacitors are rated 450 VDC but the plate supply is only 400 VDC obviously you can get away with an increase of 30 volts. But if the plate supply is 425 VDC an extra 30 volts is going to push the B-plus past the 450 volt limit. True, new capacitors can stand a little overload, but six months later—*Booooom!*

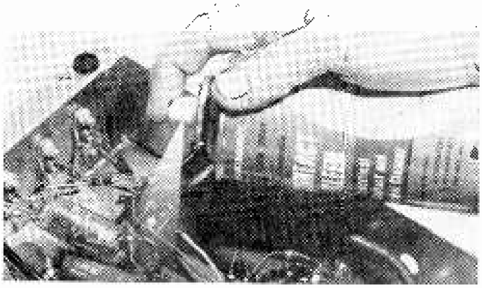
A side benefit of SR's is usually a little more power output—actually peak power—because SR's having virtually no internal resistance, offer superior regulation compared to the rectifier tube. However, sometimes the *extra* B-plus will throw off the grid bias' so the distortion *increases*. It's best to test the SR's in the amplifier before connecting them permanently across the rectifier tube socket. Scrounge-up an old rectifier tube base and connect the SR's across the appropriate pins. Plug the assembly—as shown in the photographs—into the rectifier tube socket. If the



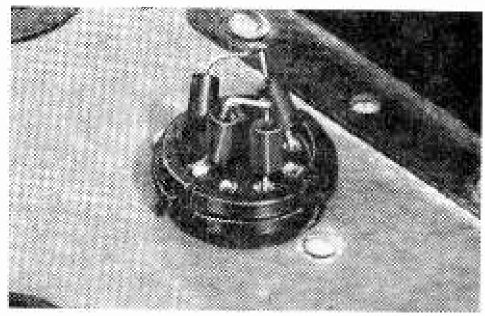
Another sure trouble spot (inside circles), paper coupling capacitors with wax oozing out of the cases. It is wise to replace with "ageless" moulded types.



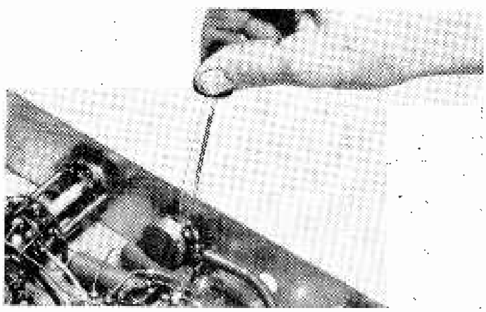
If you want to check whether your amplifier can use silicon diodes in place of the rectifier tube, an adapter can be made by wiring SR's across tube base.



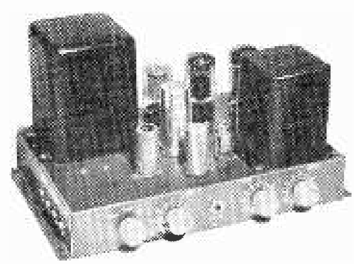
Quick spray with contact cleaner returns performance to "noisy" rotary switches.



You can either wire the diodes to a plug as the author did or wire them under the chassis directly to the rectifier socket.



Many noisy tone and volume controls can be silenced with a few drops of "no-noise" squirted into the volume control.



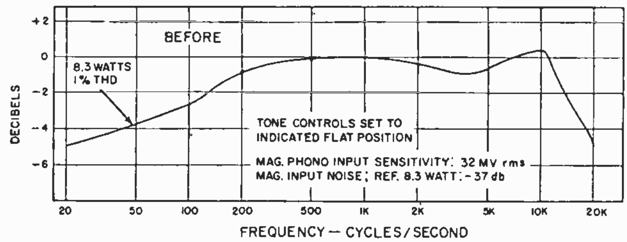
Finished! Painted, polished, new plug-in parts, knobs can make a big difference. Add decals to the switches and controls.

amplifier gives better performance either leave the assembly in place or wire the SR's across the socket terminals. If the amplifier sounds worse just remove the assembly, plug in the tube, and you've lost nothing by trying.

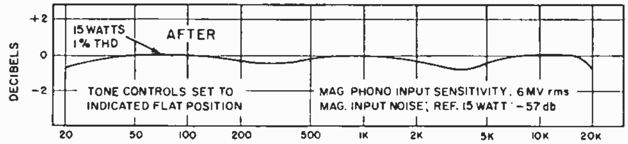
Make Good Contacts. The final step in the electronic rebuilding is to eliminate the switching and control noises. Any switch—such as the amplifier's input selector—eventually gets noisy or gets intermittent contacts. A simple cure much easier than replacement is to spray the switch with one of the "no-noise" type cleaners. Work the switch back and forth a few times and you've got a nice quiet, dependable switch.

While controls can be cleaned by shooting no-noise into the guts with one of those special "hypodermics" which fit over the control's shaft, it's a sloppy, generally messy way to do it. Actually, the hypodermics are meant for use when you can't or won't pull the chassis. Since you've already got the chassis out, use an eyedropper to pour one or two drops of cleaner directly into the control. This can usually be done through the slot in the cover directly under the terminals.

REVAMP THE OL' AMP



Don't take our word, perform the tests before and after yourself. You will be amazed with the results. Before and after graphs at right tell our story.



Work the control several times; then connect a speaker, apply power to the amplifier and listen. Most likely the noise will disappear. If a single treatment fails to "clean" the control you'll have to substitute a new potentiometer.

Now the foregoing techniques don't appear difficult—do they? Nine times out of ten they're all that's required for a complete overhaul. When you consider that the average *reliable* service shop charges about $7.50 per hour just for labor, one evening's puttering with a soldering iron can not only give you a new amplifier, it keeps quite a few dollars in your wallet.

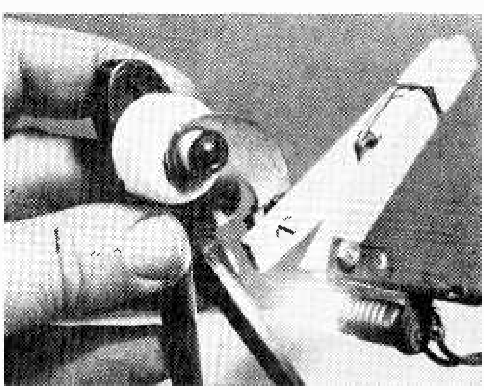
A Testimonial. How does re-building work out? We took an old amplifier with over 15 years of service on it and overhauled it just as described in this article.

When new, the amplifier delivered 15 watts at 1% THD (total harmonic distortion), and the frequency response was flat within ±1 db from 20 to 20,000 cycles. After many years of faithful service performance had deteriorated to the state shown above. Maximum power output at 1% THD was only 8.3 watts at 1 kc., with the distortion rising to 25% at 10 watts. Both the low and high end response was down; in addition, the amplifier was unstable. There was quite a high hum level (−37 db) and a magnetic phono pickup could barely drive to normal room volume.

Now look at the rebuilt performance shown above. The frequency response is right back to specs, the noise level is down where it belongs (−57 db) and the magnetic input can handle those new low level pickups. And of course, we're getting 1% THD at the rated output of 15 watts.

For a final touch, the long shafts which were meant to pass through a cabinet were cut short; and decals and modern knobs finished off our *new* utility amplifier. ■

Midget Extension Light



Almost daily there is a need for a tiny extension light for seeing in close quarters. Such a light can be easily made that will be self-supporting in two ways if this is desirable. Fasten a miniature lamp socket to one side of a spring-type clothespin. To the other side of the clothespin attach the magnet element from an automatic can opener. The light is complete for connecting to a battery power source. Connect alligator clips to the long lamp leads so they may connect to battery or 6.3-volt AC filament transformer. Magnet clings to iron tools for extra reach.

—*Glen F. Stillwell*

center scale VOLTMETER

Making your measurements without the center scale voltmeter is doing it the hard way

By L. F. Kiner

HOW many times have you wished you had an extra DC voltmeter? One with multiple ranges, a general purpose DC voltmeter that would read plus or minus voltages without switching or probe swapping, and still offer a reasonable degree of accuracy without undue circuit loading. Here is a unit designed to fulfill those requirements and one that will prove invaluable even to those already owning a VTVM or VOM. Basically a center-scale DC voltmeter, the builder may select his own voltage ranges when assembling and substitute resistors for those as shown in the author's model.

The meter movement, 50μa (microamperes) will not load the circuit to be tested while still providing 20,000-ohms/volt sensitivity. The use of one per cent resistors should suffice the accuracy requirements of all but the most demanding situations. A search through the *junk box* may be a likely spot to find these and if that is not successful, many surplus stores can supply them at very reasonable prices.

About the Circuit. There is nothing complex about a DC voltmeter circuit. It is a straight forward DC voltage measuring device with the addition of resistors to provide multiple ranges. Since we are using a zero-center meter, the instrument reflects plus or minus voltages without switching or swapping leads.

WORKBENCH TEST GEAR PROJECT

VOLTMETER

Series resistors used in the circuit are calculated from the formula:

$$Rs = E/I - Rm$$

where,

Rs = Series resistor in ohms.

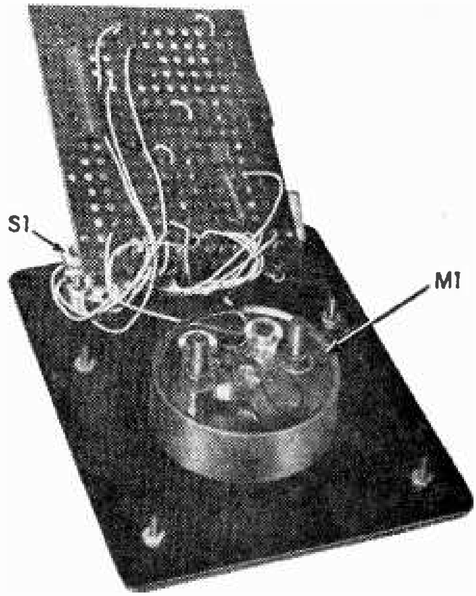
E = Maximum voltage (for the range selected) in volts.

I = $50\mu a$ (.00005 amps.) in amperes.

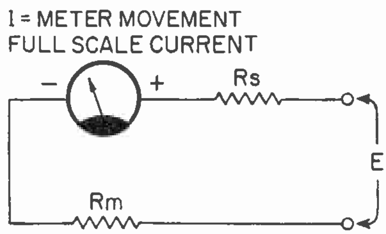
Rm = Internal resistance of the meter in ohms.

The series resistors may be purchased exactly as calculated. This, however, could prove a little expensive as 1% resistors cost the best part of a dollar bill from electronic stores. Some non-standard values would also increase the cost even more. To keep the cost down the resistors could be "scrounged" from the "junk-box," purchased from "surplus" stores or made up from series-parallel resistances. This may be a little more time consuming but will undoubtedly save some *loot*.

The internal resistance of the meter itself is generally available in the manufacturer's literature or may be found (sometimes) on the meter dial. The unit used by the author is a Simpson Model 1329 and according to the manufacturer the internal resistance is 2000 ohms.



Vectorboard is cut within meter panel dimensions; resistors are positioned for the best fit.



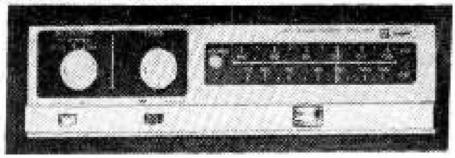
The series resistor values (Rs) are calculated using the simple formula given in the text.

In black bakelite case, meter has a professional appearance.

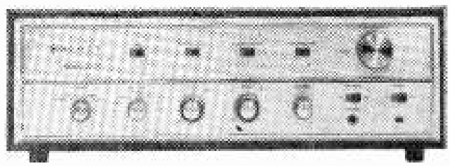
Construction. The voltmeter wiring is not at all critical and the method used by the author may be seen in the photographs. The builder should begin by laying out the components to see how they will best fit into the case or cabinet that is chosen to house the instrument. If purchased in its original box, the meter will generally have a template supplied with the meter. This is most often found on the bottom of the box and should be used in drilling the holes for the meter. The switch hole diameter is ⅜" and ¼" holes should accommodate the banana jacks.

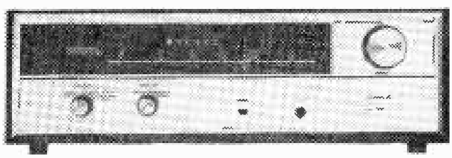
Adding Scales to the Meter Dial. Additional scales are added to the meter dial through the use of water decals available in most electronic supply houses. Very carefully remove the plastic front of the meter by applying pressure with the fingers. The meter dial is removed by taking out the two screws

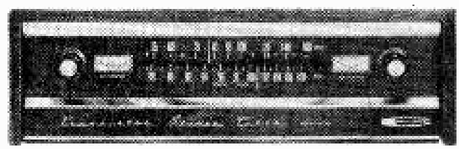
(Continued on page 95)

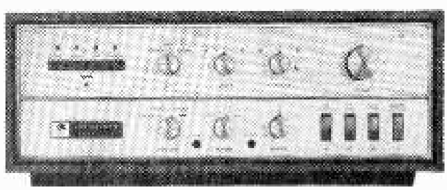


Transistor Take-over In Hi-Fi









By Hans Fantel

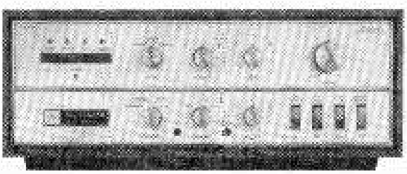
On the beach, on the bus, in the park, on the golf course, and in formerly quiet woodlands, the transistor pursues us. The raucous voice of the pocket portable is heard in the land. But only lately have transistors made notable inroads upon the hallowed precincts of high fidelity. True, a few transistor amplifiers have been on the market for some years. Pioneer designs like Harman-Kardon's Citation A and B and the Acoustech amplifier demonstrated as far back as 1962 that transistors could produce better sound than even the best tube circuits. But with their high price, these units appealed mostly to those hard-bitten hi-fiers who always want to be in the vanguard of technical progress, no matter what the cost. Most of the audio industry and its customers stuck with tubes.

All this changed within the last year. The

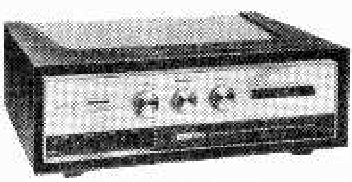
Transistor Take-over

Acoustech II—$348.00

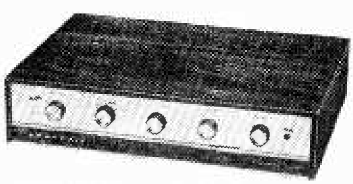
Electro-Voice E-V 66—$219.00



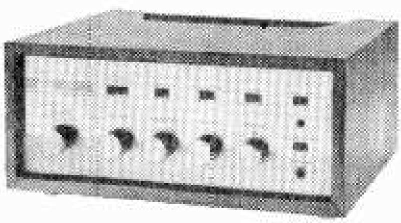
Fisher TX-300—$280.00



Harman Kardon A-1000T—$369.95



Heathkit AA-22—$99.95



KLH 16—$219.95

revolution has come at last. All across the board, in every price class, the hi-fi catalogs for 1965 bulge with new transistorized tuners, amplifiers and tape recorders proudly heralded in space-age lingo as "solid-state" devices. The battle has been decided. The transistors are taking over.

This dramatic shift raises several questions:

. . . What accounts for the sudden rush toward transistors in high fidelity?

. . . Why do companies previously *standoffish* toward transistors now go all-out for solid state?

. . . How successful and how reliable are recent transistor designs?

Tubes Vs. Transistors. Compared with tubes, the transistor has several indisputable advantages: it is much smaller; it draws less power and develops less heat; it takes less time for warm-up; it does not change its characteristics with age, and—theoretically, at least—it doesn't wear out. Unlike the tube, the transistor does not produce erratic noises when exposed to vibration—it is non-microphonic, as the engineers say. It is sturdier than tubes and better able to withstand accidental knocks. Best of all, it is inherently hum-free, and a well-designed transistor amplifier is so "quiet" that the music seems to emerge against a background of almost complete silence.

But in the eyes—and ears—of audio designers, one transistor trait easily outweighs all other merits. Transistor amplifiers need no output transformers. The power transistors can feed their signal directly into a loudspeaker, providing the loudspeaker is properly matched to their impedance. Since the output transformer has always been something of a bottleneck in the sound path through an amplifier, its elimination in transistor circuits marks significant progress. Due mainly to the absence of the output transformer, transistor amplifiers have an edge in transient response. This results in greater clarity and transparency of sound, especially in heavily orchestrated passages. Stewart Hegeman, who designed some of the best transistor equipment now on the market, says: "Transistors can produce fantastic sound. Particularly the bass becomes very clean and articulate."

Audio fans have coined the term "transistor sound" to describe the exceptional clarity of sound attained by good transistor amplifiers. It is a distinct quality that tube amplifiers do not possess. It provides excellent definition of the individual instruments in an orchestra, adding an exciting feeling of sparkle and brilliance to the reproduced sound.

Space Priority. With all these advantages, what has held back transistors for so long? And why, instead of jumping joyfully on the transistor bandwagon, do some manufacturers still straddle the fence, making both tube and transistor equipment?

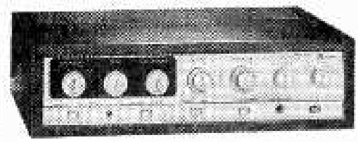
One reason is that up to now few transistors were capable of living up to their promise. The fault lay not with the audio industry, but with the transistor manufacturers, who were too concerned with making transistors for spacecraft and computers to pay much attention to the needs of the hi-fi fan. The trouble was that these space-oriented transistors had serious limitations of frequency response in the upper range. While this didn't matter in the case of portable radios, it proved a constant headache for audio engineers trying to achieve top quality in transistor equipment. But all this changed within the last year or so when the transistor manufacturers finally came up with new types of transistors specifically tailored to the needs of the audio industry. What's more, the new transistors were cheaper, thanks to new methods of automated quality control meanwhile developed by the transistor makers. For the first time now, high-quality transistors are competitive to tubes as far as price is concerned. These are the facts chiefly responsible for the present spurt in transistorized audio.

Aside from cost and reliability, other factors have held back the rise of solid-state audio in the past. Transistors require altogether different circuits than tubes, and it took the engineers time to learn to "think" in terms of transistors.

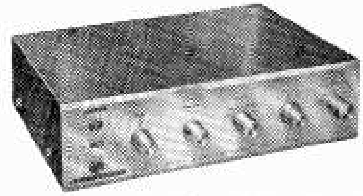
"It's like having to learn a new language," explains one technician.

New Circuits. Learning something new is always hard and painful, and some engineers were looking for excuses to skip their lessons. Transistors, they argued, are fine for pocket radios and portable TV sets where space and weight saving are important. But why bother with transistors in hi-fi? After all, it's the speakers, not the tubes, that determine the practical size of a good stereo system.

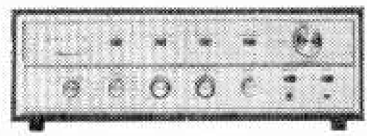
The engineers who argued that the transistor had no place in high-fidelity are now presumably looking for some other job. Size, it turned out, is important after all. Many of



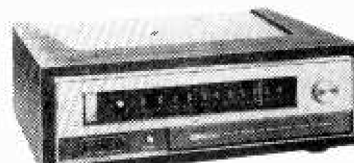
Knight-Kit KG-870—$99.95



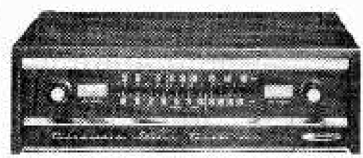
Lafayette LA-340—$79.95



H. H. Scott 260—$259.95

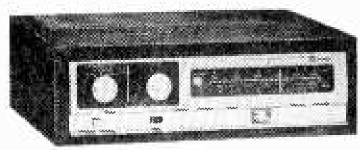


Harman Kardon F-1000T—$299.95

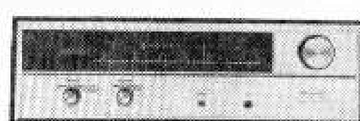


Heathkit AJ-43—$119.95

KLH 18—$129.95



Knight-Kit KG-70—$99.95



H. H. Scott 312—$259.95

Transistor Take-over

the new transistor amplifiers and tuners are a big hit precisely because they pack a lot of performance into small, neatly styled, light-weight designs that can be conveniently tucked into tight places. Besides, the highly successful new design concept of compact stereo systems (see RADIO-TV EXPERIMENTER, Feb./March, 1965) rests entirely on their smallness and low heat emission.

So while some audio companies were dragging their feet on transistor design, others were busily trying to adapt transistor circuits to the problems of high fidelity.

Hot Subject. Surely there was no lack of problems to be solved. For instance, until quite recently, power transistors would blow out as easily as a match. In fact, they blew out faster than the fuses that were supposed to protect them from overloads. Many of the early transistor amplifiers conked out the first time the volume was cranked up all the way. Only lately have adequate safeguards been devised that assure the transistor will actually last its long potential life-span. Also, transistors used to react quite temperamentally to even slight changes in temperature. On a hot day, or in a tight place with little ventilation, they'd literally wilt and raise hob with all the nicely calculated performance data of their circuits. It took quite a bit of engineering ingenuity to devise circuits to compensate automatically for these thermal variables, but the best of recent transistor units are fully stable in any climate.

All this tends to make first-rate transistor equipment rather complicated. In top-notch designs, it takes about four transistors to do the job of one tube. Hence, the greatest present challenge in transistor hi-fi is economic.

Eliminating Distortion. At first, it seemed that all good transistor equipment would have to be very expensive. Whenever short cuts were tried in order to lower the price, the perceptive listener could usually notice it in the sound quality of the product. The trouble was just the opposite of that encountered in tube amplifiers. The transistor jobs sounded fine as long as they were yelling their lungs out at top volume. But as the volume was reduced, a certain harshness crept into the sound. This was due to distortion produced in transistorized output stages. These stages operate in what engineers call Class B operation—that is, each transistor develops power for only a small fraction of the time. This prevents the transistor from overheating and burning out. By a sort of switching action, the two transistors in the output stage take turns at the job, so that the signal is bounced back and forth between them in a kind of push-pull action. That way continuous signal amplification is achieved. But where in conventional tube-type push-pull circuits there is partial overlap between the separate push-pull cycles (Class AB operation), the transistors are usually designed to make a clean cut-off. As a result, the bouncing back and forth of the signal between the output transistors must be very accurately timed. Otherwise, a time gap results between the two halves of the push-pull cycles—a brief interruption of the signal—which causes harshness of sound, particularly in solo instrument passages.

For a while this difficulty threatened to give all transistor amplifiers a bad name. Die-hard engineers in the tube camp were smirking placidly while the transistor boys scrambled to cope with the problem. Finally, they figured out feedback patterns to cancel most of this troublesome distortion. This was the last thing needed. Transistor technology was ripe for dominance in the hi-fi field.

Transistor Amplifiers. It stands to reason that the best sound of which transistors are capable is found chiefly in the more expensive units, but good transistor amplifiers are now available in all price classes. Starting in the low-budget range, both the major mail-order houses—Lafayette and Allied Radio—offer some attractive bargains. Lafayette's LA-340, for example, is a fully transistorized stereo amplifier delivering 20 watts (IHFM) per channel for only $79.95 factory-wired. Knight-Kit has among its low-cost models the handsome KG-320, which delivers 16 watts per channel for $59.95. A truly exceptional value is Knight-Kit's KG-870 with 35 watts per channel and highly versatile control facilities for $99.95 ($149.95 factory-wired). It delivers the kind of sweet-clear sound one normally hears only in amplifiers costing twice as much. And Heathkit, who pioneered transistor circuitry in kits, also offers a well-designed 35-watt per channel kit, the AA-22, for $99.95. Jointly, the Heathkit and Knight-Kit designs present a real price breakthrough, offering uncom-

(Continued on page 123)

BUILD THE

APPLIANCE SHOCK TESTER

By James G. Busse

If any of your home or shop electrical appliances tingle to the touch—you are living with a killer shock hazard

Have you ever touched an electric appliance and felt a mild, tingling sensation at your fingertips? If you have, you know what "leakage current" is. And you can thank your lucky stars that some other part of your body wasn't well grounded at the time.

Thousands of people are killed every year as a result of receiving a severe electric shock. A prime source of fatal shocks in the home is leakage current from faulty electric appliances and fixtures. You may live for years in a home that contains numerous shock hazards and never get a shock, simply because you never happen to be touching a good ground and the faulty appliance or fixture at exactly the same instant.

A nasty shock from an automatic washer prompted the author to build the electronic shock tester described in this article. Its circuit is similar to those used to those used by manufacturers to test appliances coming off the assembly line for excessive leakage current.

Easy to Build. The electronic shock tester can be assembled in less than an hour by even a beginner. Using all new components, it can be built for under $4. There is no need for calibration, nor any "bugs" to iron out of the circuit. It is so easy to operate that practically anyone can be taught how to use it.

The shock tester detects any part of an appliance or other electrical device which would allow current to flow through a person touching it and ground at the same time. Electric toasters, for instance, frequently allow a small current to flow if a person touches the metal case and, say, the kitchen sink.

Leakage Current. This leakage current may result from such things as inadequate insulation, poor circuit design, apparent cost-cutting which eliminates components essential for electrical safety, or from poor quality-control inspection procedures on the assembly line. Other appliances—particularly washing machines, cooking devices, lamps and lighting fixtures—often develop current leaks after years of use and abuse.

Consider, for example, the hazard presented by an electric broiler which has somehow come off the assembly line with a short circuit. Its outer metal shell is thus as "hot" as the power line to which it is connected. You touch this shell and don't feel a thing, until you accidentally ground yourself at the same time. If you're lucky, you may walk away with only a bad *burn.*

Remember, a ground is any conductive material which, at some point, enters the earth, or which touches another conductor that, in turn, enters the earth. Grounds are more common than most people think. They include metal water pipe, gas pipe, drain pipe; as well as any metallic device connected to any of these, such as a faucet, sink, bathtub, radiator, warm-air convector, furnace or kitchen range. A damp concrete basement floor and an outside patio are also good grounds, since there are moisture paths through them to the earth underneath. And, of course, if you're wearing ordinary shoes and standing on damp bare earth, your body is *well grounded.*

Severity of a Shock. A number of factors regulate the severity of an electric shock. These include the path of the current through the body, the duration of the shock, and the age, sex and physical condition of the victim. But the most important factor is the strength of the current involved. This is generally measured in terms of milliamperes.

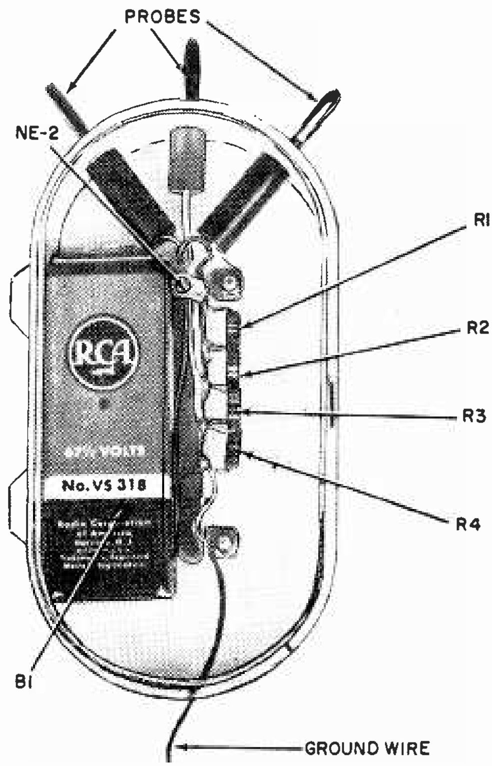
The human body is extremely sensitive to electric current. Some people can sense a flow of current through them as small as 0.2 ma. Most women and children, and about half of the adult male population, can sense a leakage current of about 1 ma. They feel it in the form of a heating, tingling, or throbbing sensation at the point of contact.

While mild shocks, by themselves, are not likely to cause any injury, they can produce a "startle reaction" if they occur unexpectantly. This could cause a person to jump back against a hot kitchen range or to drop a dangerous power tool—something that could lead to injury.

When an adult is exposed to a leakage current much above 5 milliamperes, the intensity of the shock may be in excess of the "let go" current. This is the level at which muscular contractions induced by the electricity are so severe that he cannot release his grip on the shock-causing object. The resulting continuous shock can lead to fatigue, collapse, and ultimately death.

Studies at the University of California have shown that different people have different thresholds for "let go" current. They are generally higher for men than for women. Children are believed to have the lowest threshold of all.

How the Tester Works. The heart of the electronic shock tester is a small, type NE-2 neon lamp. It takes approximately 84 volts to make this lamp fire. Once this happens, the lamp will stay lit at a much lower voltage. The NE-2 lamp is wired in series with a

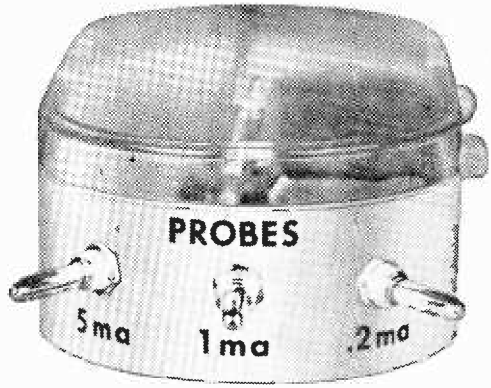


What little "guts" there are fit neatly into a plastic container. Shape is not important, and cardboard or aluminum box may be used.

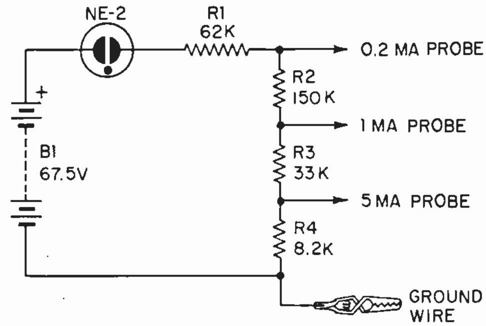
PARTS LIST

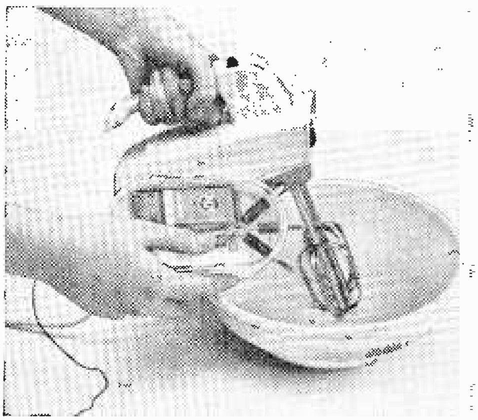
B1—67.5-volt battery (RCA VS318 or equiv.)
NE-2—neon lamp, type NE-2 (or Signalit #LT 2-27-1)
R1—62,000-ohm, ½-watt resistor, 5%
R2—150,000-ohm, ½-watt resistor, 5%
R3—33,000-ohm, ½-watt resistor, 5%
R4—8,200-ohm, ½-watt resistor, 5%
Misc.—Battery clip, alligator clip, probes, terminal strip, plastic box, wire, solder, etc.

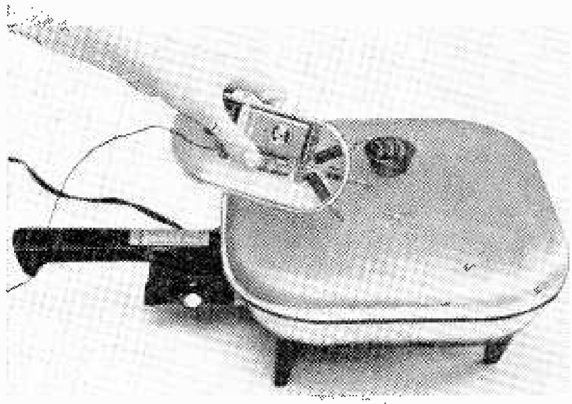
Estimated cost: $3.50
Estimated construction time: 1 hour



Identify the three external probes on the tester to correspond with the schematic diagram.







The tester is so easy to use, you should be able to check every electrical and electronic gadget in your house in an evening.

67½-volt battery and four resistors. Three simple probes tap the circuit at three different points. One side of the circuit is grounded by a long lead wire, which can be clipped to a water faucet or some other convenient ground. The components are mounted inside a non-conductive case.

Now, the neon lamp will not ordinarily fire because the battery's voltage is below the lamp's breakdown or starting voltage. However, when one of the probes is touched to an appliance leaking current, the additional voltage present with the leakage current will fire the neon lamp—R2, R3 and R4 regulate the sensitivity of each probe.

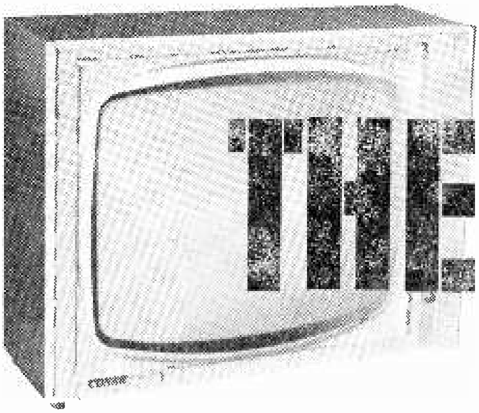
Building the Tester. There are no critical instructions connected with building the electronic shock tester. Nor is the placement of parts critical. They can be mounted in any convenient *non-conductive* container —even cast in a block of epoxy. The author chose a type of plastic box in which two spools of fishing line are sold. Any size 67½-volt battery may be used, if handy. To insure the tester's accuracy, only 5% tolerance fixed-composition resistors should be used. Probes can be made from anything ranging from phono jacks to nails with soldered connections.

Using the Tester. It's easy! Simply clip the ground wire to a good ground. Clean the case of the appliance or device you want to test. Place it on a dry, nonconductive surface. Make sure it isn't touching anything. Plug it in and switch it on.

The first probe of the electronic shock tester is sensitive to currents 0.2 ma and stronger. Carefully touch it to the appliance's case at various points. If the neon lamp lights, the appliance is leaking a 0.2 ma or greater current. If it doesn't light, the appliance is leaking a current less than 0.2 ma. You'll find that most appliances leak a small amount of current, so don't be surprised if the neon lamp lights.

Remove the first probe from the appliance. If the neon lamp stays lit (and it often does),

(Continued on page 96)



It's the voltage in your TV that you

THE HIDDEN

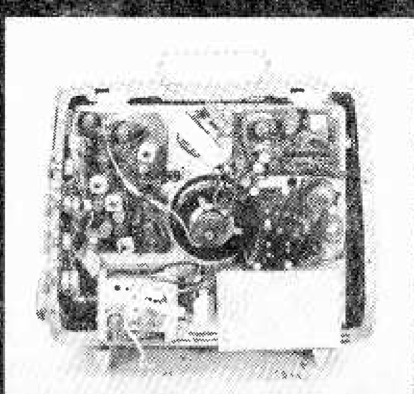
By M. Robert Beasley

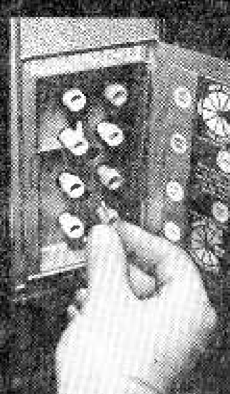
A young child touches a metal TV stand that is electrically charged because of a malfunction in the set and is electrocuted. And the most alarming aspect of this senseless tragedy is that it is not a rare one. Each year all too many people, both young and old, receive fatal electric shocks from television sets.

Manufacturers and the Underwriters' Laboratory have eliminated most of the dangers that may have existed in earlier television models due to design. But there is always the possibility of a dangerous condition due to malfunction. There are several precautions that can be taken to disarm sets of their lethal voltage if they become defective and potentially dangerous.

Hot Chassis. Television sets of the transformerless type, with the metal chassis connected to one side of the power line, have one wire of the electrical power line leading into your home grounded at the power station and again at a point where the line enters the house. When electric cord plugs of these TV sets are inserted into the wall outlet so that the wire that is connected to the metal chassis goes to the grounded wire there is no danger. But when the plug is reversed in the wall outlet, the chassis is connected directly to the voltage wire of the power line and the chassis is at that potential. Under such circumstances, a person who simultaneously touches the chassis and an externally grounded conductor such as a radiator or water pipe, literally places his body across the power line. If the current path is through the chest, the result will most often be fatal.

Insulated Chassis. To eliminate the danger of a hot chassis, manufacturers set the chassis in wooden cabinet, or placed heavy insulation between the chassis and outer case on metal cabinets. Mounting screws or metal parts that contact the chassis are either enclosed or otherwise made inaccessible. Insulating bushings and washers are also used to prevent direct contact between the chassis and outer case. Some sets have a low voltage capacitor connected between the hot line and





As you can see at the far left, the exposed chassis of the television receiver does not invite inexperienced fingers. Even though the set is disconnected, there can be several thousand volts present. Controls at the left, as all controls on your television, are insulated from chassis.

can't see, or feel . . . until it's too late

KILLER

the chassis to eliminate hum. But, to the 60-cycle line voltage, this connection is essentially an open circuit.

But an insulated chassis is not enough to prevent a possible fatal shock. A hot metal part, such as an isolation capacitor, could still be exposed, a chassis insulator could be shorted, insulation in a wooden cabinet could be defective, or, with either a wood or metal cabinet, the insulating control knobs could be removed exposing the metal shafts. Under such circumstances, where the line cord plug connects the chassis to the voltage line, there is danger of shock.

Safe Chassis. There are several ways hot chassis can be eliminated. Polarized wall outlets can be installed wherever the TV is likely to be plugged in, and the conventional two-prong plug on the end of the receiver line cord can be replaced with a corresponding polarized plug. Polarized plugs can only be inserted into corresponding outlets in such a way that the chassis will be connected to the grounded side of the power line, which eliminates all danger of a hot chassis. The disadvantage of modification is that outlets equipped with polarized connections cannot be used for other appliances with standard two-prong plugs.

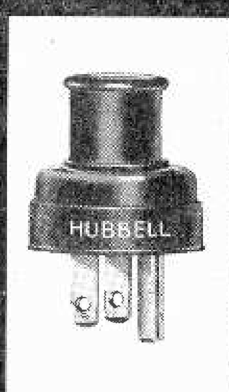
Another device that affords protection against hot metal cabinets, but doesn't present the drawbacks of polarized outlets, is the three-prong adapter. It is plugged into the wall outlet with the pigtail end of the third wire securely fastened to the center screw of wall outlet plate. The third wire of the corresponding three-wire receiver cord is connected to the metal chassis. This arrangement results in a blown fuse—not a shock hazard—if a short circuit occurs in the receiver.

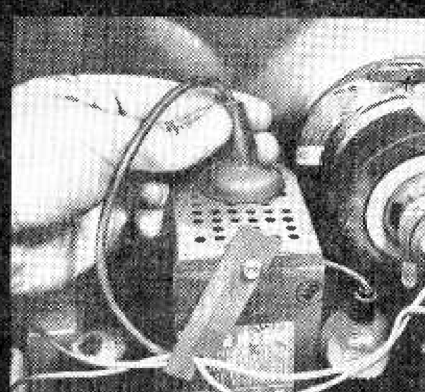
A bit more expensive, but safe and easy, is the installation of an isolation transformer between the wall outlet and the receiver line cord plug. The isolation transformer, available at most electrical stores is simply plugged into the outlet, and the receiver line cord plug is inserted into the other side of the transformer.

Safety Precautions. The sources of serious, all too frequent, and often fatal electrocutions are many. One is the attempt on the part of the untrained persons to make repairs or adjustments on their television. Although the television may be completely disconnected from the power source, high voltage is still temporarily stored within the set. This voltage can be as high as 23,000 volts with all sets having at least 14,000 volts. Several thousand volts should be sufficient reason to attempt repairs or adjustments *only* if you are thoroughly familiar with television receivers. Not only is the tinkerer exposed to physical danger, but he could cause costly damage to the set.

(Continued on page 96)

At the far right, an experienced technician grounds the anode cap of a television picture tube before beginning to troubleshoot the set. Using a three-prong plug like that shown at the right, is one of the methods that can be employed to eliminate the danger of a hot metal chassis.

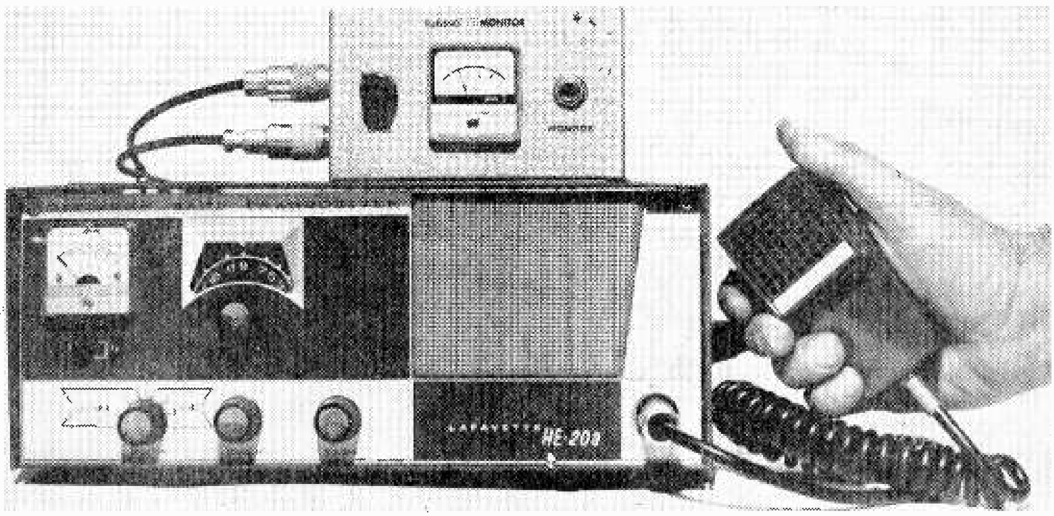




By Herbert Friedman, W2ZLF/KB19457

Keep your power and modulation up to snuff with this . . .

CB TUNING MONITOR



AS you well know, modulation quality and RF power output contribute most to a CB rig's get-out ability. Regardless of the quality of the antenna system, if you don't feed RF into the antenna you're not going to get RF out of it. And even if you squeeze every "skoomph" of RF into the antenna, no one's going to hear you if your signal's a mess of squeaks, hash, and hum.

One of the easiest ways you can be sure of maximum RF output *and* good modulation is to use a tuning monitor; a device permanently connected to the transmission line which indicates the tuning condition and allows you to monitor the modulation.

Simply a Signal Sampler. This tuning monitor is tailor made for the CB'er. While it's simple and rock-bottom in cost, it does the job of instruments many times more complex and costly. Resistor network R1-R2 takes a small sample of RF from the transmission line; D1 rectifies the RF and the resultant DC is fed to meter M1. Since the DC is representative of the RF voltage (and current) on the transmission line (which is representative of the RF power output) M1's reading indicates the transmitter tuning—when M1 peaks the transmitter is tuned. No need for SWR meters, field strength meters, etc.

Component values are chosen so a rig with maximum output—about 3.5 watts—will indicate almost full scale; while a 1 watt output (from old rigs in need of service) will indicate about one-third scale.

Once the transmitter is tuned the meter reading can be adjusted to a convenient value by rotating R3 (say half-scale); then, a change in the power output such as caused by a defective tube or a change in the antenna loading will be immediately apparent as a change in meter reading. By using an easy to remember reference—such as half scale—there'll be no question about a change in the reading.

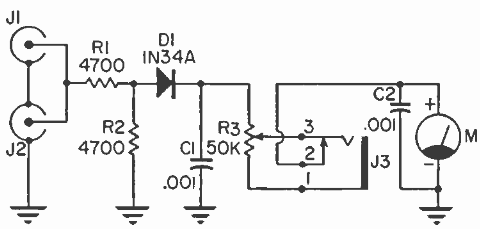
J1 permits the signal to be monitored

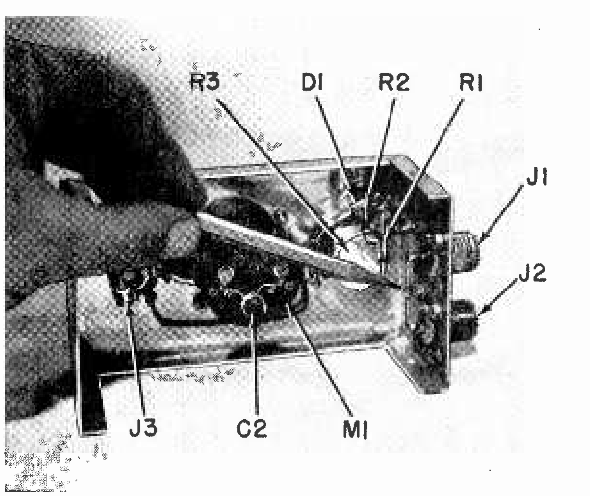
PARTS LIST

C1, C2—.001 mf ceramic disc capacitor
D1—1N34A miniature germanium diode
J1, J2—RF coax receptacle (Amphenol 83-1R)
J3—Phone jack, two-circuit normal-through (Littel 12A)
M1—Miniature illuminated "S" meter (Lafayette Radio TM-11)
R1, R2—4700-ohm, ½-watt fixed resistor
R3—50-000-ohm Q control, logarithmic taper (IRC Q13-123 or equiv.)
1—5¼" x 3" x 2⅛" aluminum chassis box (Premier PMC-1006 or equiv.)
2—RF plug connectors (Amphenol 83-1SP)
Misc.—Terminal strip, buss-bar, hookup wire, solder, nuts, bolts, etc.

Estimated cost: $7.00
Etimated construction time: 3 hours

Schematic diagram for CB Tuning Monitor. Jump J1 and J2 with heavy-copper bus wire.





Wide-open layout and few components make the CB Tuning Monitor easy-to-build. Pencil points out R1's wrap-around connection to the coaxial jacks J1 and J2 jumper. Capacitor C3 is connected across the meter's terminals to protect the meter against possible damage to any stray RF currents.

with a headset, or the modulation can be fed to a tape recorder so it can be analyzed critically. (It is often dificult to hear defects if you are monitoring while talking. By listening to a tape playback you're more likely to notice power-line hum, RF hash, etc.)

Construction. The unit is built on the main section of a 5¼ x 3 x 2⅛ inch Minibox. J1 and J2 are standard PL-259 type coaxial jacks. If your equipment uses phono or automobile radio type plugs just substitute matching jacks. While any 0-1 ma. meter can be used for M1, the one specified here, an "S" meter, is recommended because it's the most inexpensive.

The J1-J2 jumper should be heavy busbar of at least #18 gauge. If you don't have a scrap of bus-bar around, twist together four of five lengths of solid hook-up wire and apply solder until you have one solid, heavy, wire.

Diode D1 is easily damaged by heat, so use a heat sink, such as an alligator clip on each lead when soldering.

Notice carefully the wiring to J3. J3 is a two circuit phone jack—not a shorting type. The normal-thru connection (lug 2) is *not* connected to the grounded jack frame when the phone plug is removed. Use of a shorting type jack will result in the meter being inoperative.

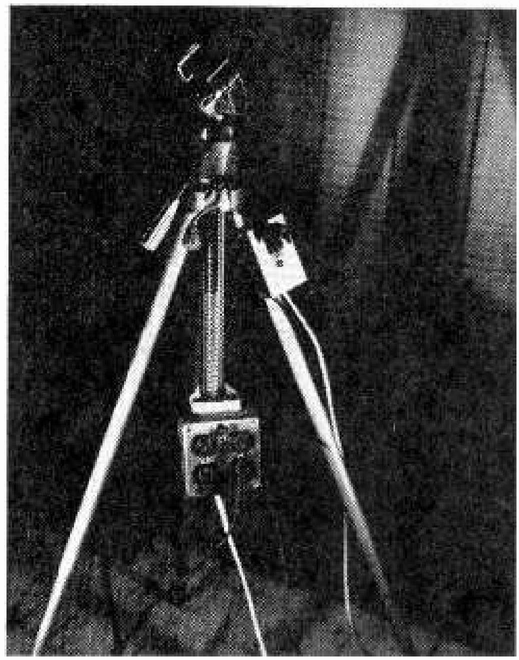
Using the tuning monitor. Normally, the most powerful transceiver will drive the meter almost to full scale. However, a high standing wave ratio (SWR) on the feedline can result in a high RF voltage at the point where the monitor is connected to the transmission line. Under these circumstances the meter might well be driven off-scale. If this occurs, simply reduce sensitivity with R3 until you make the necessary repairs.

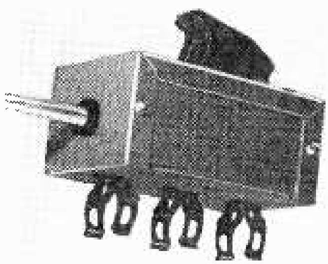
For best modulation monitoring, the headphones should be of good quality—with an impedance of 2000 ohms or higher. Earphone volume is determined by R3.

When tape recording, adjust the recorder's gain control to approximately its usual setting. Then, adjust R3 for the proper recording level. Don't run R3 wide-open and try to adjust the recording level at the recorder. On most recorders the volume control is after the microphone preamp and a wide-open level from the monitor will overload the preamp. If your recorder has sufficient gain, feed the monitor's output into the recorder's high level input—you'll get a better recording. ■

PHOTOFLOOD LAMP CONTROL UNIT

By James Robert Squires





Central switch (left) for all your photoflood lights mounts on tripod leg (above).

One flick of a switch on your tripod

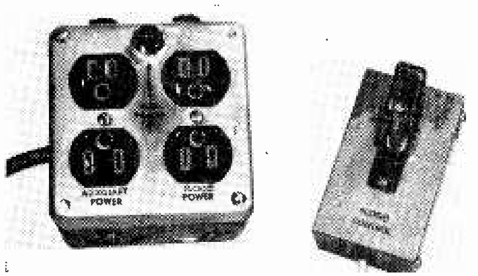
Much time can be saved, and possible aggravation avoided during a photographic setup with this control unit; it centrally locates control of all your lights at the tripod!

A setup usually involves positioning photofloods as subject lights, backlights, and perhaps, either auxiliary or assorted color lights, to illuminate your subject. Adult subjects wait patiently while you turn on all of these lights, frame the subject, study the shadows, and then finally make the exposure. Adult subjects, or more so, inanimate objects, are very cooperative during this preparation time; they realize the importance of lighting (and shadow) in the finished photograph, and they are patient. Children are often not so patient—have you ever gone back under the hood after making a tour of the lights to find that, in a split second, your subject has disappeared! Well, with one switch conveniently mounted on the tripod beneath the camera controlling all your lighting, perhaps you can catch that fidgeting young'un before he gets away.

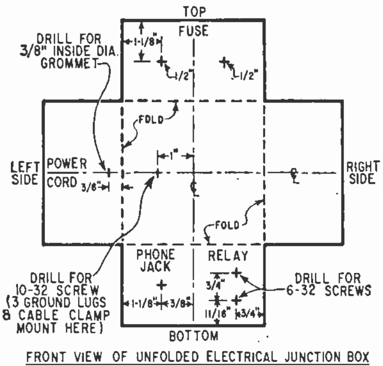
With this control all photofloods are only used when needed and can be quickly switched off when not in use. When I have to walk around and over wire and cables to turn off the floods one by one, my tendency is to leave them on. There is an obvious savings if the floods are only used when needed.

This Photographer's Approach. With the FLOOD CONTROL switch off, the left set of receptacles on the junction box is designed to have 115 vac connected to it. Standard lamps plugged into these receptacles are used to get a rough idea of subject framing focus, etc. The subject, either person or pet, doesn't have to stare into bright floods. Just before snapping the shot, I switch on the floods, take a light reading, make a few final adjustments, and—*click*—subject and photographer are pleased.

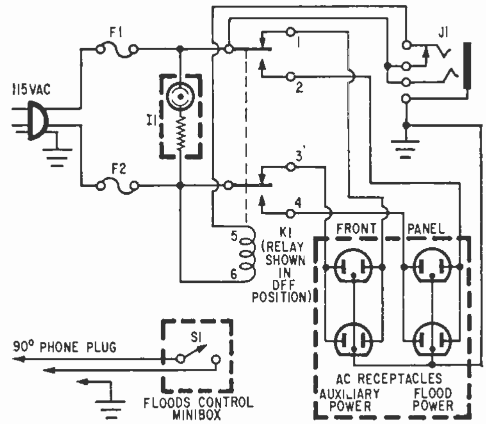
Construction and Wiring. The control unit is packaged in two boxes. The one is a 2¼-inch deep electrical junction box that is used because of its rugged construction.



The junction box, left, and the miniature cabinet housing the Flood Control switch comprise the complete control unit. As shown in the schematic diagram, the phone plug from switch S1 connects at junction box at jack J1. The power cord from the junction box connects to 115vac; then it's just a matter of plugging in your lights.



Drill center diagram saves detail measurement for mounting junction box components.



Schematic diagram of the control unit indicates function of relay K1 in circuit.

will save running from light to light—tripping as you go

Holes are drilled in the knockouts to hold the fuses, relay, and phone jack. The drill center diagram shows the location and size of these holes. It is easier to wire the six switching contacts before mounting the relay in the junction box. All wire used in the relay junction box was cut from a 25-foot coil of No. 18 zip cord. This cord is split into two separate wires and used to wire the junction box. The remaining zip cord is wired to the 90-degree plug to form the control cable that connects to switch S1 in the Flood Control unit.

As shown in the wiring photographs, the two upper and lower contacts of relay K1 each have a 7-inch wire soldered to their terminals; a lug is attached to the other end of the wires. Solder a 3-inch wire to each of the center contacts. Use caution when wiring the relay to keep its exposed terminals from touching one another and the junction box.

The two receptacle sets should be wired before they are mounted to the top cover since the connecting screws are not accessible to

PARTS LIST

F1, F2—15-ampere, 3AG fuses and fuse holders

I1—115-vac, snap-in neon panel light

J1—Phone jack, closed-transfer 1 (Mallory 703B or equiv.)

K1—Advance relay, d.p.d.t., 15-amp. continuous (Newark 24F913 or equiv.)

P1—Phone plug, 90-degree, (Switchcraft 220 or equiv.)

S1—S.p.s.t. toggle switch, 6 amp. at 125 volts

1—Cabinet, grey hammertone, 3¼" x 2⅛" x 1⅝" (Bud Minibox CU-2101A or equiv.)

1—Electrical junction box, 2¼-inch deep with cover for two receptacle sets (Order from Sears and Roebuck Co. Chicago, Ill.)

2—Duplex outlets, grounded, 15 amp 115 volt (Sears 34H5925)

1—Coil lamp cord, white No. 18, 25 feet (Allied Radio 48TT767)

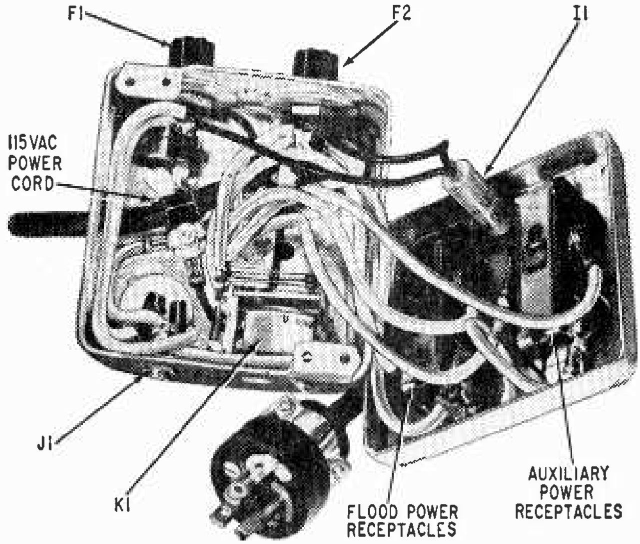
1—Coil extension cord, 300 volt, No. 16, 25 feet (Allied Radio 48TT509)

3—Spring clips ¾-inch (depending on tripod) (Allied Radio 17L498)

Misc.—Clamps, wire, solder, etc.

Estimated cost: $14.00
Estimated construction time: 3 hours

PHOTOFLOOD LAMP CONTROL UNIT

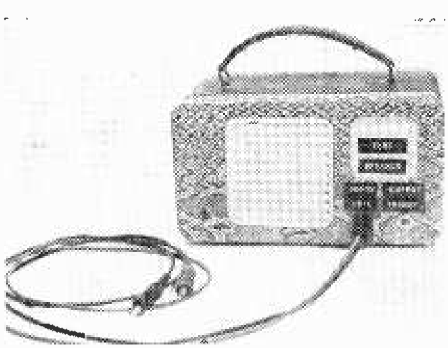


Interior of the junction box is compact indeed, and each component has its designated space. Take care to keep terminal lugs properly aligned and you'll have no short circuits.

the screwdriver once they are mounted. The neon power on indicator lamp, I1, is connected across the power line as shown in the callouts photograph. The 15-ampere, 3AG fuses are connected ahead of the indicator lamp. A cable clamp should be used to secure the heavy duty ac power cable as shown in the junction box photograph.

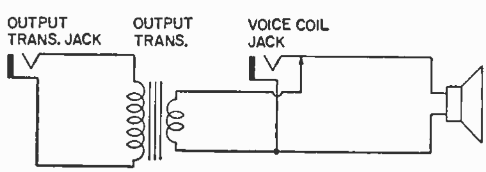
The second box is a Minibox that mounts on a tripod leg in the most convenient position for the photographer. It houses FLOOD CONTROL switch S1. The s.p.s.t switch is rated at 5 amperes at 125 volts. The switch shown happens to have a safety cover since it was recruited from a war surplus miscellany box. Three spring clips are mounted on the rear cover of the Minibox to secure it to the tripod; choose size to fit your tripod. ■

Discarded Portable Becomes Test Speaker



A patch cable consisting of two flexible leads, insulated alligator clips, and phone plug lets you tie into AC/DC radio and TV hot chassis without any danger of shock.

If you own an old tube-type radio portable that's ready for the garbage can, you're in for a windfall by simply converting it to a portable test speaker. Scrap all of the set's guts except the PM speaker and output transformer. Now scrounge up open-circuit and closed circuit phone jacks (see schematic diagram), phone plug, wire, and two alligator clips with rubber sleeve insulators. Wire up the portable case as shown in the schematic diagram and label the cabinet's front panel so you will know which jack is which. Now wire up a patch cord using 3 feet of rubber test lead lengths to the phone jack and install the alligator clips to the wire's free ends. Now you can connect the test set to speaker terminals or into audio plate circuits. ■



The CB Underground

By C. M. Stanbury II

July 2, 1965—6th meeting of STARR convened 8:00 P.M. at Col. Mayer's clifftop lodge. All security precautions were followed.

There are only 10 of us in STARR (Society To Annihilate Radio Regulations) but it was a real way out bit with plenty of kicks. Outside our mobile rigs were all under cover in the Colonel's mammoth garage. Inside the members were arranged in a circle, dressed in royal blue uniforms with 5-pointed silver star insignias on the shoulders and silver hoods too. Except Mayers (KMZ-43431) who as our leader sat in the center with silver uniform and royal blue hood.

The colonel raised his hands for silence. "STARR 3, you may lead us in the pledge tonight."

That's me. We use these STARR tactical calls on the air, too! I stood up. "We pledge to defy all federal radio authority, to destroy the FCC, and to promote general CB chaos. May STARR keep me steadfast."

He nodded and I sat down. "STARR 4, you may report on operation 5A."

She got up from the chair next to mine. I'd seen her several times without the hood. A big blond amazon with perfect proportions. Beautiful if you like *Vikings,* and I do. Incidentally STARR 4 is Mayer's daughter.

"I, STARR 4, parked behind some trees just outside the FCC monitoring station while STARR 3. . . ." She pointed to me ". . . cruised around a mile away and made continuous insulting remarks about FCC monitors over the air. His transmission lasted well over an hour thus violating several regulations. As soon as the monitoring station sent out a mobile unit, I warned STARR 3 via our secret illegal radio channel and he immediately left the air. Thereby frustrating federal law enforcement."

Like I said, STARR came up with some real way out capers. There was also the time STARR 4 and myself out of uniform (on a date) found some poor FCC monitor's car in a parking lot. Just like that she says, "siphon off the gas!" Which scared me a little because we might have got involved with the cops, but for her I did it.

The Colonel sat down and began his weekly pep talk. "The initial phase of our program has been completed." Softly, at first, but he upped his volume as he went along. "I have given you practice in basic sabotage. You have demonstrated that you can take orders."

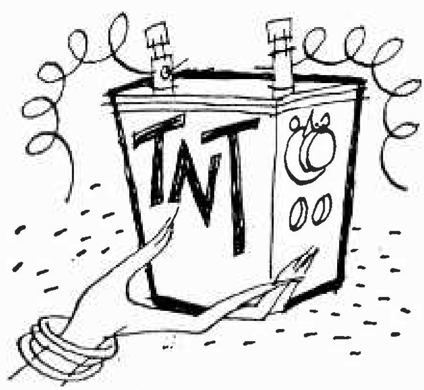
He didn't know about our clandestine dates, we were never supposed to learn each other's identities.

"And you all know what is at stake. The Commission is censoring free speech. It is doing this, mind you, in the face of Section 326 of the Federal Communications Act, which states 'Nothing in this act shall be understood or construed to give the Commission power of censorship over the radio communications or signals transmitted by any radio station."

I never went much for legal theories and technicalities. That's how I lost my CB license—and a hundred bucks to boot—in the first place.

Mayers droned on. "The Act further states 'and no regulation or condition shall be fixed by the Commission which shall interfere with the right of free speech by radio communications.' "

I reached out and took STARR 4's hand



but she pulled away. At these meetings, this *Viking* was all business.

Mayers got up and crossed to the far side of the room. "We're now ready to tackle our first major project." He pulled back a curtain exposing some crates. He carried the smallest one over to the group and opened it. Inside was some sort of portable rig.

The whole thing began to remind me just a little of those grade B spy movies on the late show. Especially with Mayers' lodge on a cliff overlooking the sea.

He handed it to his daughter. "STARR 4, will you explain this device to the group."

She nodded, held the gleaming silver box up so we all could see. "An activator! Powered by batteries it will operate up to 20 hours unless it receives a specific remote-control CB signal." She went through the bit robot style. "Once that signal is received, the batteries are discharged instantaneously and completely, setting up a high voltage charge across these terminals." She tapped two little screws at its base.

That high voltage jazz produced a funny feeling in the pit of my stomach. Just like when I siphoned off the gas.

"It will provide a *max* of about 10 volts."

I relaxed, momentarily.

She set the activator down on the floor while her father crossed back to that curtained area. Mayer bent down, rested his hand lightly on a second and larger carton. "This along with our activator will completely disable the local monitoring station." He ran his hands along the box lovingly.

There were some markings on its side but with the lighting comparatively dim I couldn't make them out across the room.

The Colonel straightened up. "This is quite heavy so you will come over here while I explain its use."

We all got up and moved in his direction. STARR 4 and myself were a few steps behind the rest. With everyone's back turned toward us, she reached out and squeezed my hand. "This is the big one, daddy!"

I moved my head up and down, yes.

"The kick to end all kicks." She hurried ahead to assist the old man.

I took another few steps—then I could make out that lettering on the box—"*T.N.T. Danger*, handle with care." I stopped dead!

He opened the box. "Few of you have ever seen explosives before, let alone handled them. Therefore STARR 4 will actually set the charge."

Beneath my silver hood I'd turned slightly *green*. The others crowded around their leader but I kept my distance.

The colonel went on with his plans. "STARR 4 assisted by one of you will plant a charge in the monitoring station and attach the activator."

I moved off quietly, got outside without being seen, started my car and backed out of the colonel's garage. Then I cut the motor so they wouldn't hear me and coasted down that long hill which led to the highway.

Once on U.S. 101, I found the nearest gas station and used their phone to call the Highway Patrol. Viking woman or no Viking woman, STARR was just a little too far out. ■

Harmon-Kardon SR-300 Transistorized FM/Stereo Receiver

Elpa PE-34 Manual Stereo Turntable

Bozak E-300K-Urban Enclosure Kit, B-207A 2-Way Speaker

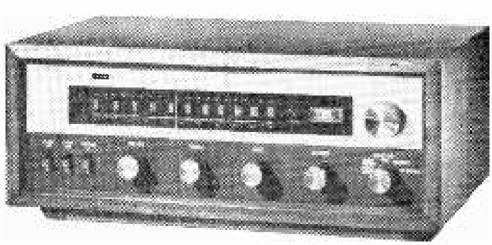
■ From the very beginning of the hi-fi boom one of the chief annoyances was, and still is, the disparity between showroom sound and home conveniences. Too often, the system which is finally chosen on the basis of hours of listening tests proves a decided inconvenience in the home. Perhaps the amplifier or receiver is so big it just doesn't fit in the space allotted in the bookshelf. Or the turntable is so sensitive the arm "jumps" if someone walks too fast across the floor; or in the attempt to squeeze the most sound into a tight budget utility (unfinished) cabinets are purchased which brings on a sense of embarrassment when company comes.

Yes, the problem is so commonplace that this month we decided to test a complete hi-fi system chosen on the basis of livability. We assumed the following needs: First, and most important, the system must be *child-proof,* capable of withstanding the manhandling of young children and toddlers. Second, it must be easy and convenient for all family members to use; if a child wants to hear *Winnie The Poo* he must be able to operate the equipment without calling for Daddy. Third, while rugged, the system must deliver hi-fi, not just good sound. And lastly, the equipment must blend harmoniously in a modest size living room with contemporary (modern) styling; the sort of place the women's magazines call "a young married's home."

Armed with a knowledge of exactly what we wanted the usual hours of showroom shopping was reduced to about 20 minutes, and we weren't subjected to "hi-fi nerves"—that effect which sets in after hours of showroom listening when *everything* starts to sound as if it was made in Heaven.

Our equipment choices were the Harman-Kardon SR-300 FM Stereo Receiver, the Elpa PE-34 turntable, the Bozak 207A speaker and the Bozak Urban E-300KU speaker enclosure kit.

HARMAN-KARDON SR-300 Transistorized FM/Stereo Receiver ($279.00 List; Cabinet $19.95)



■ The SR-300 is an all transistor FM only (no AM) stereo receiver using what can be called "family design." There is no confusing multiplicity of controls, only the bare minimum. Volume, tone and balance controls are dual function—a single knob controls both channels. The only other controls are the tuning knob, input selector, and the rumble, scratch and contour (loudness) switches. The front panel is actually no more complex than a single mono receiver. Also, there are no concealed or rear panel controls.

As shown in test graphs and the accompanying tabular test results, the amplifier performance is quite good, the measured frequency response being better than the claims. Since only the 4 ohm *music power* rating is given in the manual (and since we consider IHF *music power* to be a meaning-

RADIO-TV EXPERIMENTER LAB CHECK

less rating having no meaningful relation to actual performance) we tested the amplifier for continuous sine wave into 4, 8 and 16 ohms. The power outputs shown are for *each channel* at less than 1% THD (total harmonic distortion); typical of transistor amplifiers it can deliver about 50 per cent

Continuous sine-wave power output per channel for less than 1% THD:
4 ohms—13.8 watts
8 ohms—17.2 watts
16 ohms—10.8 watts
input sensitivity
Phono—2.3 mv.
Aux.—180 mv.
Hum and noise:
Unmeasurable (better than −85db)
Tone controls:
High and low boost, +14 db
High and low cut, −10db

more power at corresponding higher distortion. Also typical of transistors the power output depends on the speaker load impedance.

Two sets of input jacks are provided: RIAA magnetic phono and tape/auxiliary. A third set of jacks is for feeding the amplifier signal to a tape recorder.

There are no speaker phase or reversal switches. The instruction manual details the proper speaker connections, and once you have them there's really no need to change them.

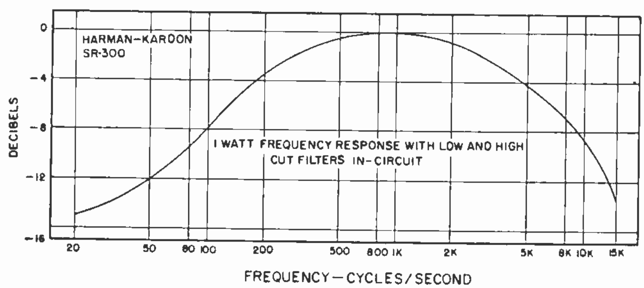
As far as the ear is concerned the amplifier is exceptionally smooth and noise free. With the volume wide-open no hum or noise can be discerned through the auxiliary input, while only the faintest hiss can be heard when the magnetic preamp is switched in. Even at the setting for deafening sound levels no noise is apparent.

The FM tuner's performance is in keeping with the amplifier's, though it may take a while to get used to the tuning meter if you've just switched from a tube type tuner. There is no extravagant sensitivity which permits listening to stations buried in the noise level. The maximum usable sensitivity is about 4 microvolts—certainly adequate. Even though a transistor front-end is used there is no "hiss overlay" on the signals, even weak ones; the quieting is up to tube standards.

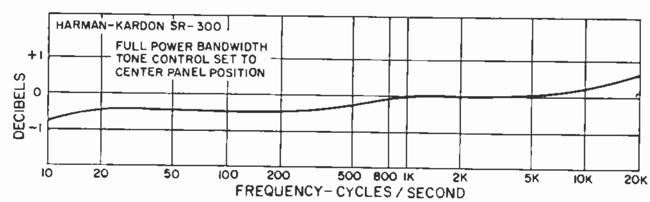
The tuning meter is a bit unusual in that it reflects the true signal strength; all signals don't come barreling in at the top of the meter scale. Weak signals read downscale and average signals slightly above midscale. Rare is the signal that "pegs the needle." We mention this so you don't confuse true meter readings with poor performance (we know users like to feel their gear is so sensitive it pulls in all signals at "full strength," but it just isn't so).

Two conveniences are provided for the stereo enthusiast. First, the mode switch can be set permanently to *FM Stereo;* when mono is broadcast the receiver plays mono. If stereo broadcasting is commenced the receiver plays stereo. Should a stereo station be so weak the stereo broadcast is buried in

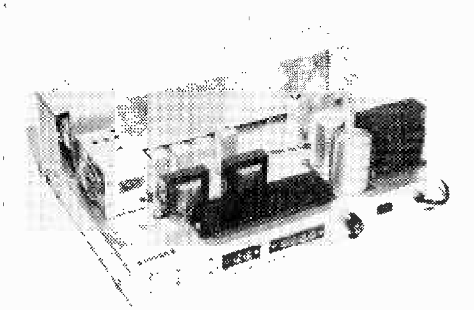
For owners of old 78-speed records, the low and high-cut-out filters can kick all the "scratch" and excess bass out of shellac discs.



Keeping the output signal at rated output and less than 1% THD at 1000 cps., the amplifier's response varies less than ±1 decibel throughout the wide-band frequency range recorded.



noise the mode switch can be set to mono—providing a better signal-to-noise ratio. The second convenience is the full time stereo indicator lamp. When the mode switch is in the mono position the lamp is on at all times to remind you that you aren't set for stereo; there is no change in the lamp's brilliance as you tune across the band. As soon as the mode is set to stereo the lamp extinguishes and only goes on when stereo transmissions are received. Should you be tuned to a station which broadcasts stereo only part time, the lamp will remain off until stereo transmissions are resumed.



Out of its optional walnut cabinet the SR-300 offers a clean, neat, easy-to-dust surface.

The overall FM performance is good. Stereo separation is equal to contemporary equipment and tuning ease is notably good.

We should mention one tuning, or rather, reception effect which we don't know is common to all models or just the one we had. When a stereo station's signal was just marginal, that is, when it could be received well one minute and then blotted with noise (like from a passing car) the next, the stereo indicator would flicker. After several hours of listening we decided the flicker was an asset since it told us were were not going to enjoy stereo; so we just set the mode to *mono* and sat back and relaxed. We found the flicker effect a decided asset, and feel that if it's common to all models it should be mentioned in the instruction manual.

ELPA PE-34 Manual/Stereo Turntable ($72.00 Net; Base $6.00)

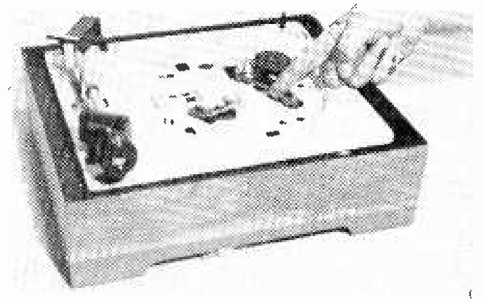
■ The Elpa PE-34, a newcomer to the hi-fi field, was chosen strictly on the basis of its *childproof arm,* which is raised and lowered by a mechanical-pneumatic action. At no time is the arm raised or lowered by hand. When positioned in the rest the arm is firmly locked by the locking lever and it cannot be deliberately jarred or pulled out of the rest.

To release the arm the locking lever is pushed towards the rear. The arm is then positioned over the record and it stays clear of the record until the locking lever is pulled forward; then the arm is very slowly lowered to the record. When the last band has been played the arm automatically raises off the record and stays there until it is returned to the rest. Once the arm is lifted clear of the record it cannot fall back—it must either be lowered by the locking lever or returned to the rest. Short of deliberately breaking the arm mechanism it is impossible to damage a record by dropping the arm.

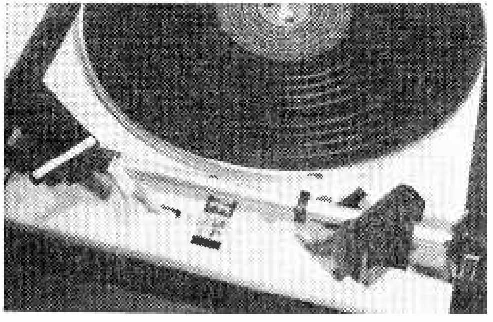
The arm has an adjustable counterweight for static balance which seems to work with virtually all cartridges *except* the Ortofon SPU-T. The Ortofon is too heavy for the normal counterweight adjustment, and the weight must be slipped back—off its threads—in order to balance the Ortofon. Lighter cartridges such as the Shure M44-5 (used in the test) work very well and should be considered when purchasing the turntable.

A spring loaded calibrated slider adjusts the stylus pressure in the 0-6 gram range. When checked against a known accurate pressure gauge the slider's calibration was within ¼ gram, certainly accurate for all users.

The motor uses a combination belt and idler drive providing the four standard speeds. Wow, flutter and speed variation is inaudible. For some reason, perhaps to allow for the purist who insists on setting his own pitch, the motor speed is variable slightly above and below normal. The speed control is right next to the on-off switch and it is easily changed in the process of turning the motor off. We found it necessary to tape the speed control in position.



To keep wow, flutter and rumble at minimum a belt drive (held by finger) is used. Stepped pully and idler permit the speed selection.



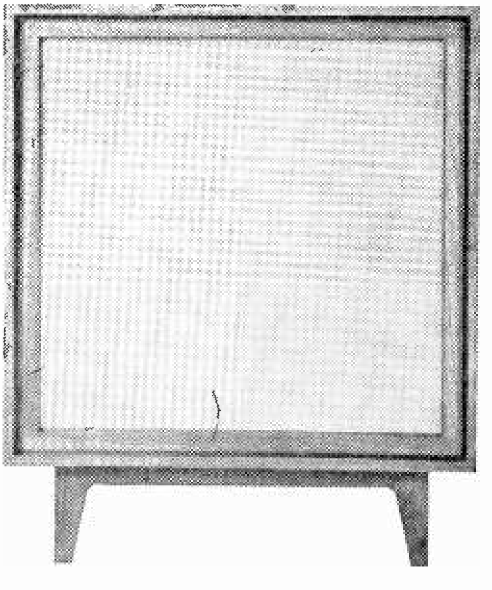
Any desired stylus pressure to 6 grams can be set by moving the slider—shown covering 1-gram mark—to the appropriate marking.

Finger points to the strobe disc which is an integral part of the turntable mat. Second knob from right is variable speed control.

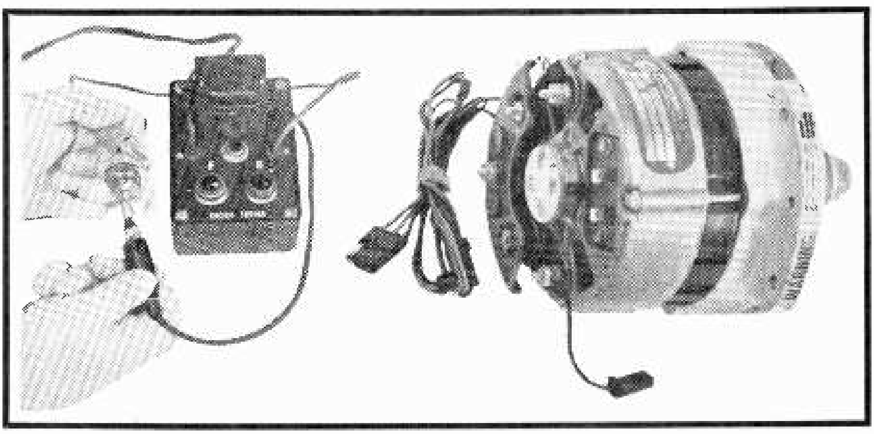
BOZAK B-207A 2-Way Speaker BOZAK E-300K-URBAN Enclosure Kit ($94.50 & $54.50)

■ The Bozak B-207A speaker system is a notably smooth sounding woofer speaker with wide angle high frequency dispersion caused by two coaxially mounted tweeters facing outward. It is the high frequency dispersion which is the "extra" feature as it is often impossible to locate a speaker in a small living room so it radiates directly into the listening area. (Few of us have those 40 x 40

(Continued on page 124)



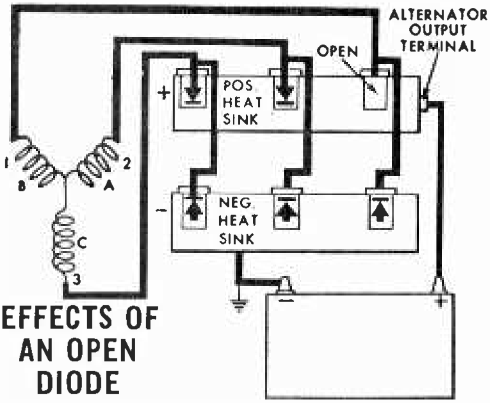
ALTERNATOR DIODE TESTER



Perhaps you have not yet had occasion to troubleshoot the alternator in your car. When the occasion does arise, you are going to need more than just the voltmeter and ammeter you used for that old DC generator—you'll need a diode tester also. Your alternator contains six or seven diodes, or silicon rectifiers, that comprise the circuit that converts the alternator output to direct current, and supplies it to the battery as required. Either a shorted or open-circuited diode will lead to electrical system difficulties resulting in a dead battery if you don't habitually check your ammeter. The effect an open-circuited or shorted diode has on the circuit is shown in the two electrical flow diagrams.

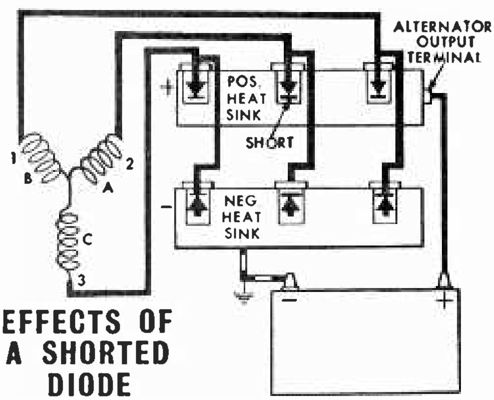
BY JAMES A. FRED

DIODE TESTER



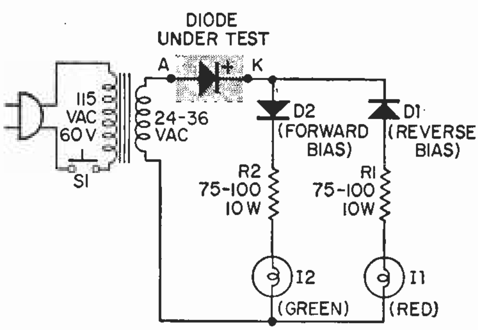
EFFECTS OF AN OPEN DIODE

Open diode will not let current flow in either direction. The circuit is not complete through the B winding to battery.



EFFECTS OF A SHORTED DIODE

Shorted diode will allow current to flow in both directions. It will flow back to the A winding instead of to the battery.



Build It Now. Why not have a diode tester on your workbench now so it's ready to hunt down a culprit diode before your battery needs charging. This one's a simple, easy to use, inexpensive device that will test for open, shorted, or even leaky diodes. Its indications are easily interpreted to obtain the condition of the alternator diodes, or other diodes used in radio, television and battery chargers for example.

Construction. Prepare a cover for the instrument case by drilling holes for the indicator lamps, push-button switch, test probe leads, and transformer mounting hardware. Drill another hole in the end of the case for the AC line cord. After securing the components on the panel cover, begin wiring the remaining resistors, diodes, and test leads referring to the schematic diagram. Note that when you use the 24-volt step-down transformer listed in the parts list, resistors R1 and R2 should be 75 ohms. The resistors shown here are 100 ohms since a 36-volt transformer salvaged from a M-H oil burner stack control was used to supply the tester voltage.

The tester can be given a smart and professional appearance by labeling the front panel with decals. You can check out your work on the tester in the following manner. Connect the tester to the line voltage, and press the pushbutton switch S1. Now short the two test clips together and observe that both indicator lamps, I1 and I2, light. If only one bulb lights, the other diode is probably connected backwards in the circuit. Note that each rectifier is connected with a different polarity to the common point.

Using The Tester. A diode under test should be connected in the diode tester circuit as shown in the schematic diagram. Failure to connect the diode with the correct polarity will result in erroneous indications.

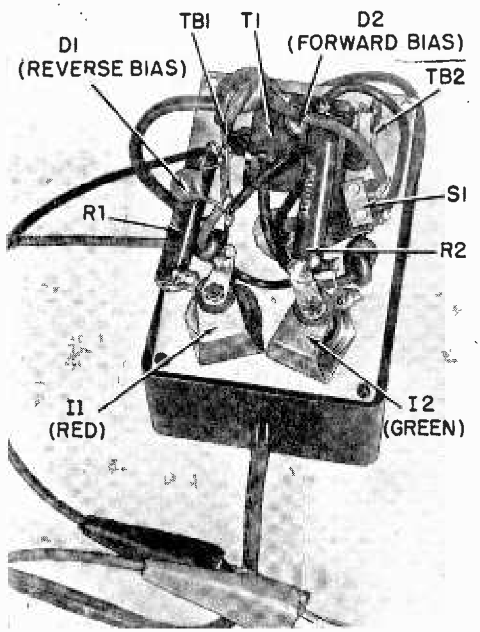
Diode tester schematic diagram shows placement of alternator diode. Analysis of circuit will yield results in table opposite.

The indications you will normally receive when using the tester are listed in the following table.

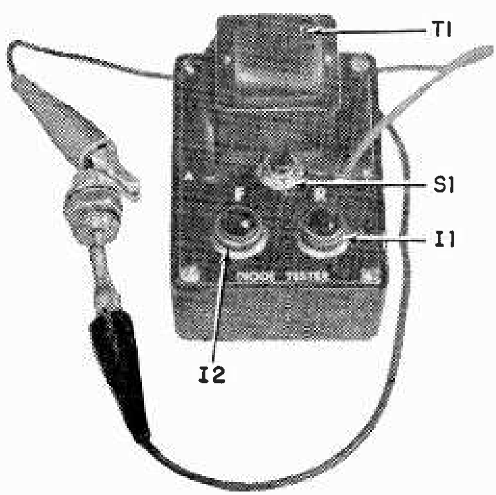
Indicator Lamps Lighted	Indicates
None	The diode is open-circuited and unusable
Red	Reverse leakage through the diode under test; discard diode
Red and Green	The diode is shorted and unusable
Green	Diode is conducting properly

In addition to checking a diode with its polarity in mind, you should be sure that one end of the diode is disconnected from its circuit or, again, erroneous readings will result. Your alternator diodes will most likely be the type shown in the accompanying illustration (p. 82). Brass case of diode is the cathode; sometimes it is marked with a black bar. The copper wire is the anode; sometimes the anode end of the diode is marked with an arrow head. If you run across a diode with the letter *R* in the type number, it must be connected in reverse since it was manufactured with its polarities reversed.

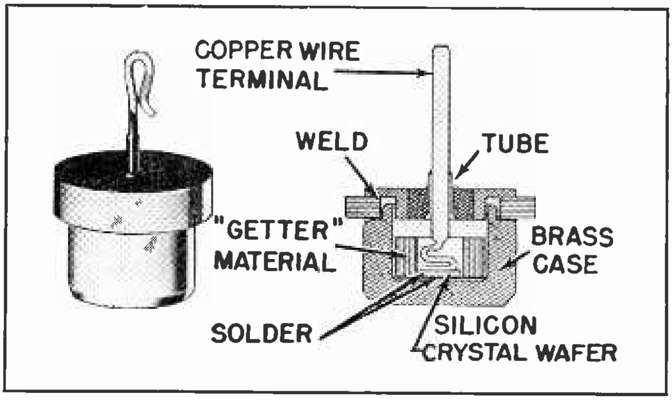
Under the Hood. Since one end of a diode under test must be disconnected from its circuit, and since you must have access to both ends for the tester probes, at least a partial disassembly of your alternator is necessary to check the diodes. In checking the Autolite alternator shown in the accompanying illustration (p. 82) stator and diode and plate assembly are removed from the rear housing. This leaves each diode in its heat sink but effectively disconnected from the circuit. Connect the anode (A) test clip from the diode tester to the negative stud. Agitate the connections gently while testing the diodes to check for a possible intermittent condition. Touch the cathode (K) test



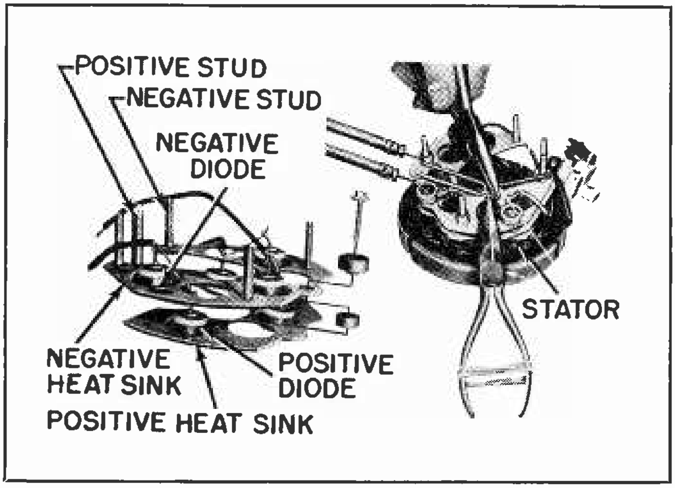
Rear view of meter case panel shows placement of parts. Test setup, below, shows anode (A) and cathode (K) test leads connected to an alternator diode. Anode is copper wire, cathode is the case of the diode.



DIODE TESTER



Actual rectifying portion of diode is small metallic disc or square of pure silicon treated with controlled impurity. Installation of disc determines whether diode is negative or positive. Observe the polarity.



Access to the Autolite alternator diode assembly, described in text, is easy. When soldering or unsoldering diodes always use heat sinks to avoid damaging the diode. Here, pliers function to carry heat away.

clip to each of the three stator wires that connect the positive and negative diodes together. Now move the anode test clip to the positive stud and repeat the test for the other three diodes. For your particular automobile, check the service manual for the alternator disassembly procedure for obtaining access to the diodes.

Under the Chassis. The diode tester need not be kept in the garage—it can be used in radio or TV work as well. It can be used to check power diodes rated at 150 milliamperes or more. It shouldn't be used to test signal diodes such as video detectors since it will ruin them.

The diode tester is a very worthwhile piece of test equipment that, at such a low do-it-yourself price, you can't afford not to have. ■

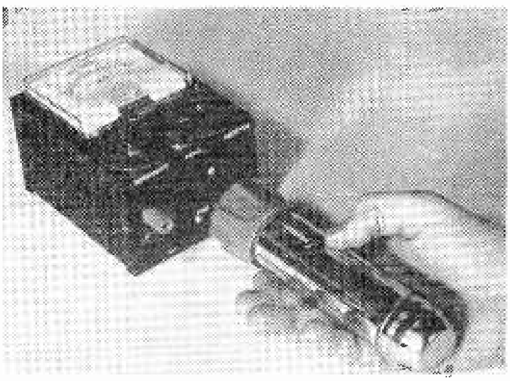
PARTS LIST

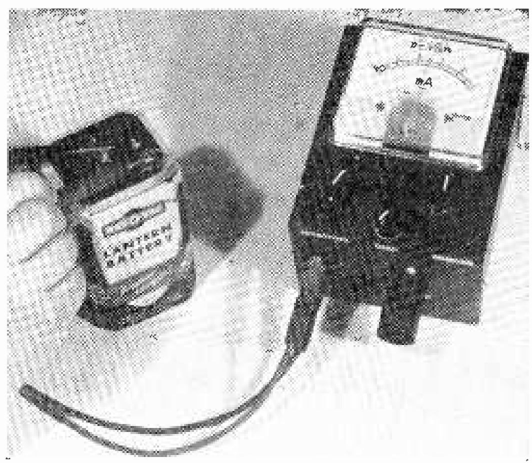
D1-D2—Silicon Rectifier diodes (Mallory Type T or 1N2091)
I1-I2—Indicator lamp assemblies, red and green, respectively (Newark Electronics 25F405 and 25F406, respectively)
R1-R2—75- or 100-ohm, 10-watt wire wound resistors (see text) (Newark Electronics 13F510 or 13F511, respectively)
S1—Push-button switch, s.p.s.t. (Allied Electronics 34B432)
T1—115- to 24-volt stepdown transformer (Burstein-Applebee 18B506)
TB1-TB2—2-terminal terminal strips
1—Bakelite instrument case $2\frac{21}{32}$" x $3\frac{25}{32}$" x $1\frac{15}{32}$" (Newark Electronics 26F145)
Misc.—Test clips and insulators, line cord, test leads, grommets, mounting hardware, wire, solder, etc.
Estimated cost: $7.00
Estimated construction time: 2 hours

WORKBENCH TEST GEAR PROJECT

A photocell and a DC ammeter comprise the heart of this FUNctional device designed to keep your emergency lights ever ready *to throw a beam*

FLASHLIGHT





TESTER

By James A. Fred

I don't know how many flashlights you have at your house, but we have *eight.* One for each member of the family, one in each automobile, and two spares in working order. Check your house! You may have several more. In factories, police stations, hospitals, fire stations, and other institutions, it is no surprise to find fifty or more flashlights ready for use. When the urgent need for a flashlight's benevolent beam is needed in your household or on the job, are your flashlights ready to deliver at 100% efficiency? One sure way to know for sure is to build the Flashlight Tester and find out.

FLASHLIGHT TESTER

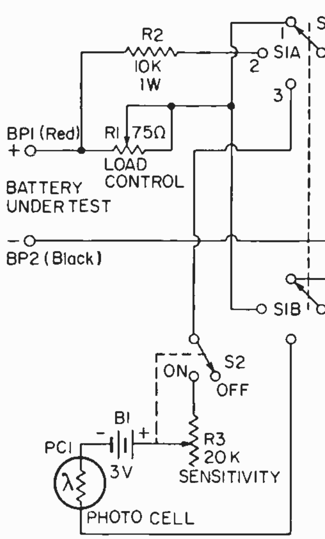
The Flashlight Tester is a "black box" at which you point a flashlight and immediately discover whether or not its output had decreased from normal output, and if so, how much. An added voltage test feature with batteries loaded to a specific current drain detects weak batteries no matter what size.

Design Considerations. Most flashlights use some type of 1.5 volt dry cells that come in several standard sizes. The larger the battery, the more power or current the battery can deliver. There are also lamps worn on the head that use either 1.5 or 6 volt batteries and camp-type lanterns that use 6-volt batteries. These batteries supply a great deal more current than the common flashlight varieties. The meter in the Flashlight Tester will indicate up to 500 ma., but the load control's R1, designed into the unit, will only safely carry 250 ma. If you desire to load a 6-volt battery and draw up to 500 ma., then it will be necessary to use a larger aluminum box and put in a 25-watt power rheostat for a load control. However, a 250 ma. load will usually prove to be sufficient for most 6-volt batteries.

A table listing all the common flash-light batteries and their recommended loads is given in this article. This table was compiled from information supplied by one of the larger battery companies. Several new and old batteries that we had on hand were checked and found that the specified loads would separate the good and bad batteries.

How It Works. The flashlight tester performs two separate functions. (Refer to the schematic diagram.) By setting selector switch S1 to position 1, it is possible to rotate load control R1 and set up any desired current load. Shunt resistor R4 placed in parallel with the 0-1 ma. meter, M1, converts it to a 0-500 ma. meter. The load control, R1, can be used to load any 1.5 volt battery to the load specified in the table, and can—*with care*—be used to load a 6-volt battery as well.

Position 2 on selector switch S1, still keeps the load on the battery, but now our 0-1 ma. meter becomes a 0-10-volt D.C. meter. The 10,000 ohm resistor, R2, in series with meter M1, is a voltage multiplier resistor and converts the 0-1 ma. meter to a voltmeter. Now, with the load control set to the proper current drain when at position 1, you can now read the battery voltage under load, on position 2. If a 1.5 volt battery reads less than 1.1 volt, throw it away. Likewise if a six-volt battery is less than 4.4 volts, discard it, too.

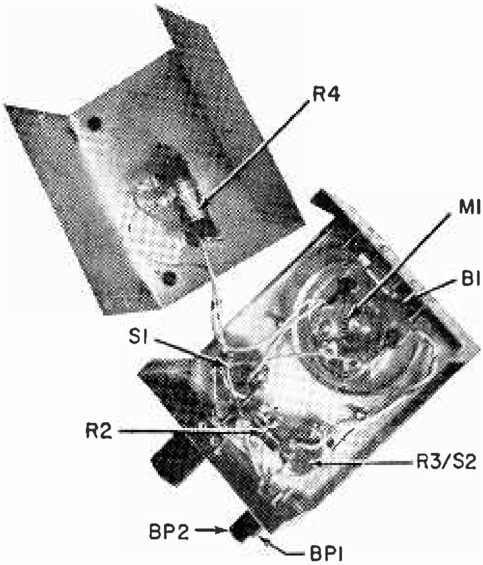


S1 POSITIONS	
1	BATTERY LOAD
2	BATTERY VOLTS
3	LIGHT OUTPUT

Schematic diagram of the flashlight tester shows switching circuits for the two tests.

B1—3-volt battery, two size AAA cells in series
BP1, BP2—Binding post, 5-way; one red and one black (Lafayette 99G6121 and 99G6120 or equiv.)
M1—0-1 ma. meter; DC movement; 2½"= wide face
PC1—Photocell (GE type A33 or equiv.)
R1—75-ohm, 5-watt, wire-wound potentiometer (Mallory VW75 or equiv.)
R2—100,000-ohm, 1-watt, 5% resistor
R3—20,000-ohm linear taper potentiometer with S2 integral part of unit (Mallory type U26 and US26 s.p.s.t. switch or equiv.)
R4—3-ohm, 10-watt, adjustable, wire-wound resistor
S1—3-pos., 2-pole rotary switch (Mallory 3223J or equiv.)
S2—S.p.s.t. switch (see R3 above)
1—Aluminum chassis box, 3" x 4" x 5" (Bud CU-2105A or equiv.)
1—Dial plate (Mallory 390 or equiv.)
1—Dial Plate (Mallory 373 or equiv.)
1—Battery holder to mount 2 size AAA cells (B1) (Keystone 138 or equiv.)
Misc.—Surplus fluorescent starter, jewel bushing (see text), wire, solder, hardware, rubber feet, etc.

Estimated cost: $12.00
Estimated Construction time: 4 hours



Aluminum chassis box (3″x4″x5″) provides good spacing for all the tester components.

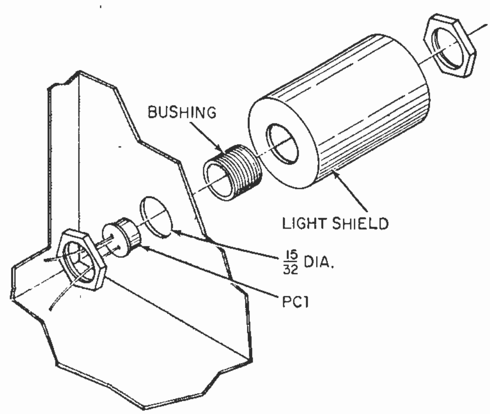
Light Check. Now comes the quick check on the amount of light your flashlight is putting out. Photocell PC1 is really a variable resistor whose resistance varies with the amount of light falling on it. Its resistance is very high when it is dark, and very little current passes through to actuate the meter. When the light from a flashlight falls on it, the resistance goes down and the meter reading goes up. The photocell is mounted behind a hole in the front of the box. A light shield keeps room light from hitting the photocell and causing false readings. It takes direct light to make an appreciable reading on the meter. Selector switch S1 is set to position 3 for this test and sensitivity switch S2 is on. With the light shining on photocell PC1, sensitivity control R3 is used to adjust the meter to a full scale reading.

Boxing It. The completed flashlight tester is housed in an aluminum box 3″ x 4″ x 5″ in size, although using a larger load control for R1 than this design shows (as previously mentioned) you will need a larger box.

The photocell light shield for PC1 is made from a fluorescent light starter and a 7/16-inch diameter bushing cut from the mounting bracket of a pilot light jewel assembly. The inside diameter of the bushing is a perfect fit for the G.E. photocell A33. A drop or two of cement will hold PC1 in the bushing. Refer to detail drawing for assembly information.

The adjustable resistor mounted on the inside lid of the box is the milliameter shunt, R4. Its purpose is to convert the 0-1 ma. meter M1, to read from zero to 500 ma. The 10,000 ohm ± 5% resistor (R2) is used as a voltmeter multiplier. The assembly and wiring is straight forward and should present no problems if the schematic diagram and photographs are followed.

Adjustment. After carefully double checking the wiring, it is time to adjust ammeter shunt R4. The simplest method is to connect another milliameter (part of a VOM) in series to binding posts BP1 and BP2, and a 1.5-volt battery with the selector switch set at position 1. Adjust the load resistor, R4, to minimum resistance and complete the external circuit, adjust load control until the external ammeter (on the VOM) reads 250 ma. Now adjust the slider strap on shunt resistor R4 until the 0-1 ma. meter, M1, in the tester reads .5 ma. or mid-scale. By multiplying the .5 reading by 500 you will have a reading of 250 ma. After mentally multiplying the readings on this scale a few times by 500 you will find yourself just naturally converting the readings as you observe the meter.



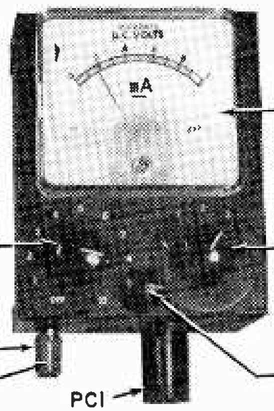
Light-tight use of bushing and shield in detail drawing of photocell installation.

Some experimenter's may want to recalibrate the scale face plate in the meter. This is a good idea but remember *Sienkiewicz's meter law* (postulated by the Editor) which states, *"any experimenter who disassembles a panel meter is sure to wreck at least one meter in his lifetime, and the wrecking usually occurs during the first few disassemblies."* So be very careful. Leave the original markings on the scale since they will be used to indicate volts (discussed later).

FLASHLIGHT TESTER

Using the Tester. Now you are ready to use the flashlight tester. Insert a pair of test leads into the binding posts BP1 and BP2, set the selector switch S1 to position 1, set the sensitivity switch S2 to off, and turn load control R1 to its CCW end of rotation. Consult the *Recommended Battery Load Table* and choose the current value for the size battery you are using. Apply the test prods to the battery (observe polarity) and adjust load control R1 until the meter reads the proper current given in the table. Remember the meter reads 500 ma. full scale. Now switch to position 2 on selector switch S1. Now the meter becomes a 0-10 volt meter and you must mentally convert the 0-1 readings to 0-10 volts. Remember, the voltage limits under load are 1.1 and 4.4 volts for 1.5- and 6-volt batteries, respectively. If you are unable to adjust the load control for the recommended reading this means that the battery is no good and further testing is unnecessary.

To measure the amount of light being put out by a flashlight, set selector switch S1 to position 3. Hold a flashlight with its lens against the end of the light shield, turn on the light and also turn on the sensitivity control. The meter will start to read. Move the flashlight around until you get a maximum reading on the meter. Now if the flashlight has new batteries installed, advance the sensitivity control until the meter reads full scale which we shall call 100%. Note the reading on the sensitivity control dial scale, and record it for future reference on the flashlight case. The next time you want to check this flashlight put its lens against the light shield and adjust for maximum reading with the sensitivity control set on the above recorded reading. Whatever the reading now is you can express as a percent of the original value. For example, if the meter now reads .6 ma., this will be 60% of the original value of light produced with the new batteries.

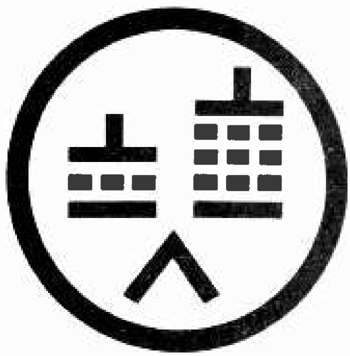


Design-for-function quality of the flashlight tester makes it easy to work with.

After you have the flashlight tester in action and have taken reference readings on all your flashlights, you will find that even first graders will be able to check their own lights unassisted. In industrial organizations the flashlight tester will prove to be invaluable as a preventative maintenance tool. ■

RECOMMENDED BATTERY LOAD TABLE

Type	Eveready	Burgess	RCA	Ray-O-Vac	Mallory	Bright Star	Rating (Volts)	Load Current (Ma.)
AAA	912	7	VSO74	400	M-24F	58	1.5	20
AA	915	Z	VSO34	—	M-15F	59	1.5	25
C	935	1	VSO35	1LP	M-14F	11M	1.5	80
D	950	2	VSO36	—	M-13F	10M	1.5	150
Ignition	6 Ignitor	6 Ign.	VS006S	6 Ign.	M-905 M-914	6 Ign.	1.5	250
Lantern	509	F4H	VSO40C	941	M-908	460	6	250



One Tube 5 Watter

An Auxiliary Transmitter With Many Uses

By Edward M. Noll, W3FQT

Every ham on occasion has need of a small low power transmitter he can operate during main transmitter repair, use for a temporary schedule on some band he doesn't frequent, or perhaps take along on a trip. If you've been working strictly phone, you may need some CW practice or, perhaps your license renewal date is near and some CW operation is mandatory. If you operate the DX or VHF bands exclusively, you may want to try a little low-band CW when your favorite bands are non-cooperative. Not much power is needed for CW work on 160 meters. Even the novice ham can often make use of a little 80 or 40 meter CW squeaker.

Pick Your Band. The little rig will operate on any band for which you will supply a crystal and output tank circuit. A 6AW8A triode-pentode combination tube is used; it is a type popular in citizens band equipment. As shown in the schematic diagram, the triode section is connected as a Pierce crystal oscillator; the pentode section, as a follow-up RF amplifier. This type of oscillator is untuned and it can be changed quickly from one band to another simply by plugging in the appropriate crystal. Only the output pi-network need be tuned in changing frequency or band. The circuit, simple and straightforward, will provide reliable trouble-free operation. The full-wave power supply uses silicon rectifiers.

Compact Package. The entire transmitter, including power supply, is built on a chassis that is a part of a miniature utility cabinet (6″ x 6″ x 6″). Placement of the components is indicated in the chassis photograph. Note that the six largest components mount snugly and neatly on the top of the chassis. Beneath the variable condenser C1 is the coaxial receptacle J2 for connecting the output signal to the antenna. The output pi-network trimming capacitor C2 is mounted firmly to one side of receptacle J2. A hole in the front panel, provides access for adjusting the trimmer capacitor.

The five-prong coil socket is mounted at the rear of the chassis. Consequently, coils can be changed readily by reaching in the open cabinet back. Barker and Williamson MCL coils are used for L1. The center pick-up loop is not used. If you wish, you can wind your own using standard five-prong coil forms or the self-supporting Air Dux type. The crystal has been mounted on the front panel for ease in switching bands.

Wiring. Except for the pi-network circuit, all the wiring is beneath the chassis as shown in the photograph of the underside. The silicon rectifiers are shown positioned in their mounts directly beneath the power transformer. The dual filter capacitor fits snugly at the rear of the chassis. In the central area is the wiring for the supply voltages and the various dropping resistors and bypass capacitors. The radio-frequency wiring is near the side, keeping the radio-frequency circuit well isolated. As a result, the transmitter has a clean CW note with no additional shielding necessary.

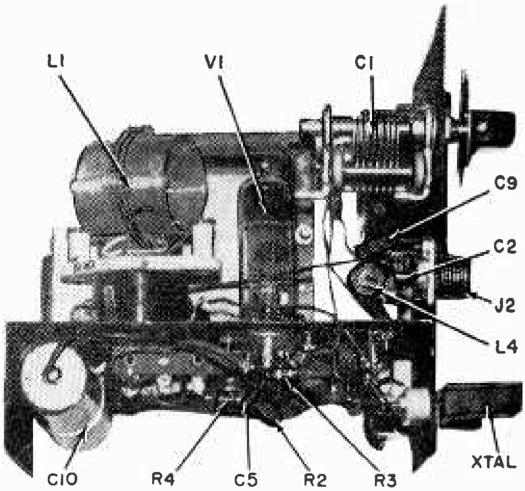
Tuning. After you have wired the transmitter check your work carefully. Insert a crystal and coil for the desired operating frequency. It is advisable to place a load on the transmitter output whenever it is turned on. Connect a dummy load to the output before applying power—either a composition 50-ohm resistor or a #47 pilot bulb

One Tube Five Watter

PARTS LIST

C1—10- to 365-mmf. variable condenser, (Fafayette 32G1103 or equiv.)
C2—100-to 580-mmf. mica trimmer capacitor, (Lafayette 32G1103 or equiv.)
C3 through C8—1000-mmf. ceramic capacitors
C9—500-mmf. mica capacitor
C10—40-40mfd. dual section electrolytic filter capacitor, 450 w.v. (Lafayette 34G5613)
D1 through D4—Silicon rectifier diodes 750 ma, 400 PIV @ 25 C; 500 ma, 400 PIV @ 90 C (Lafayette 19G4209 or equiv.)
J1—Telegraph key phono jack (and plug)
J2—RF coaxial receptacle (and plug) (Lafayette 32G2003 and 32G2004, respectively)
L1—Barker and Williamson MCL plug-in coil. Specify 10, 15, 20, 40, or 80 meters.
L2—20-henry filter choke (Stancor C-1515)
L3, L4—2.5 mh RF choke (J. W. Miller 6302)
M1—0-25 DC milliammeter (Lafayette 38G-6014 or equiv.)
R1—100,000-ohm, 1/2-watt resistor
R2—22,000-ohm, 2-watt resistor
R3—39,000-ohm, 1/2-watt resistor
R4—15,000-ohm, 2-watt resistor
R5—100,000-ohm, 1-watt resistor
R6—100-ohm, 1-watt resistor
S1—S.p.s.t. toggle switch (Lafayette 99G6150 or equiv.)
T1—Power Transformer, Pri: 115 vac, 60 cycle; Sec: 250 vdc, 25 ma; 6.3 vac (Allied 62G008 or equiv.)
V1—6AW8-A, high-mu triode—sharp-cutoff pentode tube
X1—Oscillator crystal for desired Amateur band
1—Miniature utility cabinet (6"x6"x6") with attached chassis (1 3/4"x4 7/8"x5 7/8") (Lafayette 12G8038)
Misc.—Crystal and diode holders, dial knob and plate, tube and coil sockets, mounting hardware, terminal strips, wire, line cord, solder, etc.

Estimated cost: $29.00
Estimated construction time: 12 hours



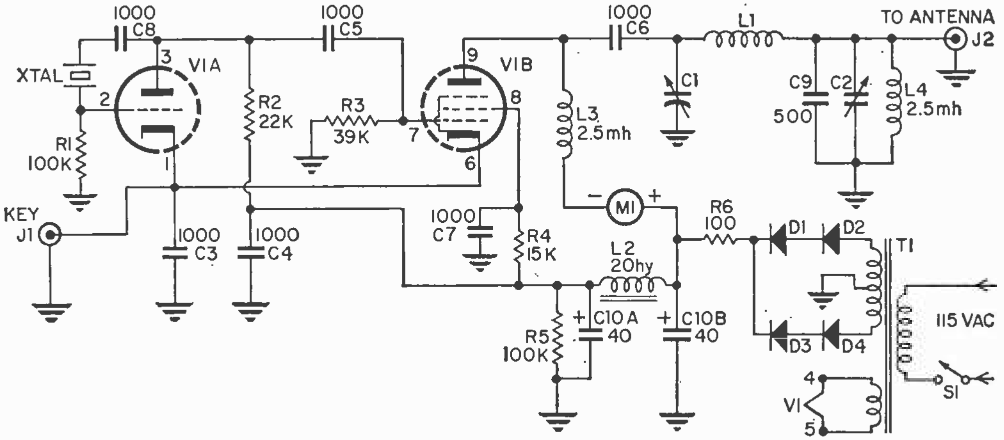
Side view of the transmitter shows placement of parts above and below the sub-chassis.

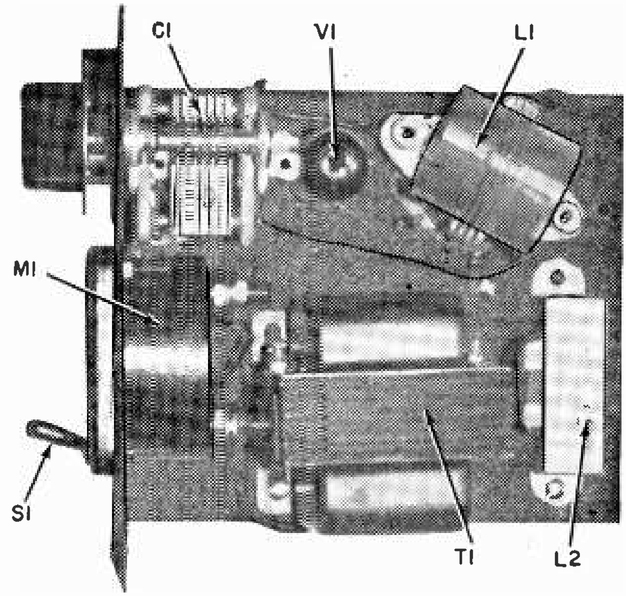
suffices.

The DC milliameter, M1, is very useful in gaining the most from your transmitter. When the transmitter is properly loaded, the plate current falls somewhere between 12 and 18 milliamperes for most antenna styles. Optimum loading into a 50-ohm load usually draws about 15 milliamperes. Normal plate supply voltage is 320 volts; and the screen grid voltage is about 150-180 volts.

Antenna. The little transmitter was operated with various types of antennas, including an 80 meter dipole, 40-meter Windom and various random lengths of wire.

Schematic diagram of the one-tube five-watter shows connection of triode section as oscillator and pentode as RF amplifier.

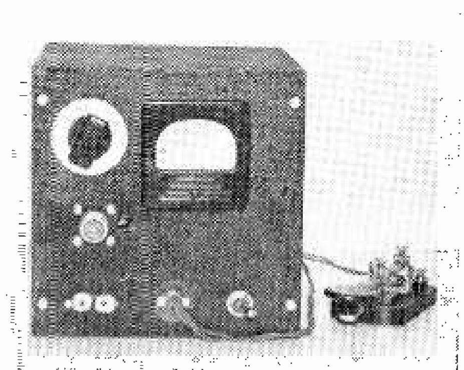


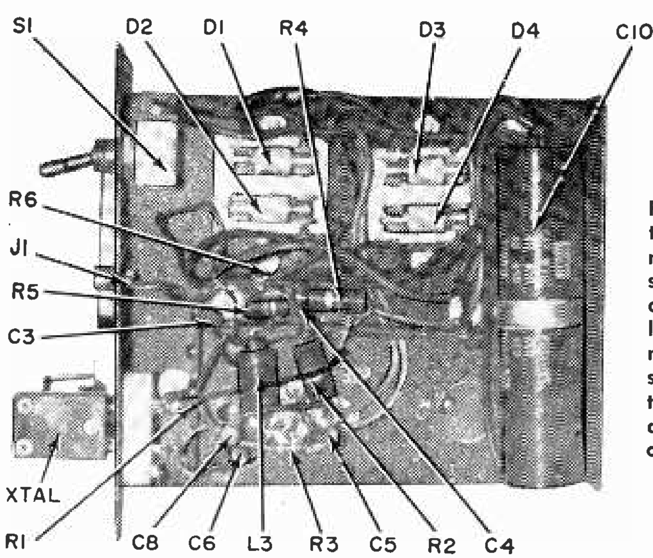


Top view of transmitter sub-chassis indicates simplicity of the circuit. Only the half dozen major components mount on cabinet's sub-chassis. Coil L1 is mounted near the rear of the sub-chassis so it may be easily replaced to change the operating band of the transmitter. Crystal is located on front for easier replacement.

Operation was restricted to mainly 160, 80, 40, and 20 meters. For operation on 20 and 15 meters it is advisable to reduce the value of the pi-network capacitance by taking capacitor C9 out of the circuit.

In tuning up on the 160, and 80 meter bands the output trimmer capacitor, C2, is first set to maximum. The input capacitor, C1, is now resonated. C2 is decreased gradually for best antenna loading while retuning C1 when necessary to maintain resonance. For 40-meter and higher band operation, begin with output trimmer C2 at minimum. ■





Front panel of one-tube five-watter is shown above. Key is connected to jack J1. Underside of sub-chassis, left, is not wired with components held to a specific location; but, in general, keep the radio frequency wiring near the side of the chassis (bottom of photograph). Power supply wiring, diodes and holders are visible on other side.

PROPAGATION FORECAST

April-May, 1965

By C. M. Stanbury II

We remind readers again that our forecasts are valid for *short-wave broadcast stations* only. It takes into account all the special factors, technical and otherwise, which govern this type of listening. Further, the bands listed will not always produce the strongest signals, but will provide the most worthwhile results. For example, at 1500 thru 1800 listener's standard time Africa will actually be loudest on 31 and 41 meters. However many more countries will be available on 49 and 60 which is what really counts. These bands are used extensively in Africa (and throughout the tropics) for regional broadcasting which accounts for higher activity.

A similar paradox applies to African reception between 1800 and 2100 listener's standard time. We should also point out that West Coast SWL's will probably be only able to take advantage of this second major opening to Africa. During the first period however WC'ers should watch for two specific 90-meter signals—*Radio Clube de Moçambique* on 3215 kc and *Radio Highweld* (a new commercial service of Radio South Africa) on 3250 kc.

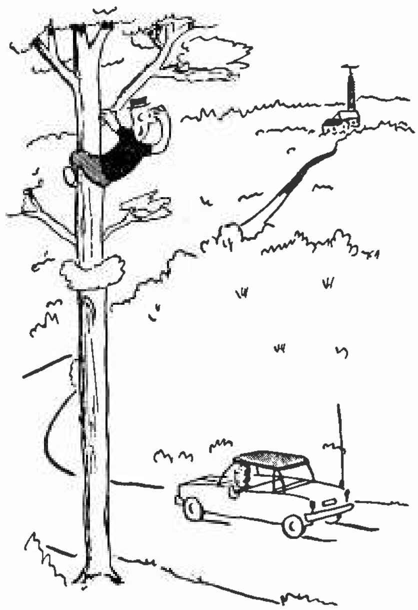
During the next three years short-wave conditions will rapidly return to normal; we will see some spectacular upper frequency openings. Right now, you'd better get those low frequency Africans while you can. ■

LOCAL TIME	0000–0300	0300–0600	0600–0900	0900–1200	1200–1500	1500–1800	1800–2100	2100–2400
Europe, North Africa, & Near East	41, 49	41 POOR	19	19, 25		19 (31, 41)	25 (19, 31)	
Africa (South of Sahara)	49, 60	41, 49 POOR	25 POOR	19, 25		49, 60	31	60, 90
Asia (except Near East)	31, 41	41, 49	25, 31	19, 25		19 (31, 41)	25 (19, 31)	
South Pacific	31, 49 (41)	49, 60	41	25				
Latin America	49, 60, 90		31	19, 25		31	49, 60	

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.

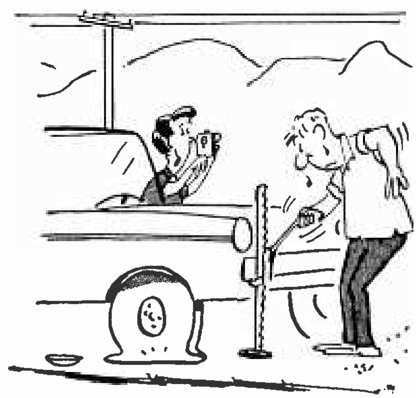
Jest to the Ham Fest

By H. E. HOLLAND



"We're on the right road. I can see the tower Bill's always bragging about."

"Only 8,642 hours to go before the next big Ham Fest."



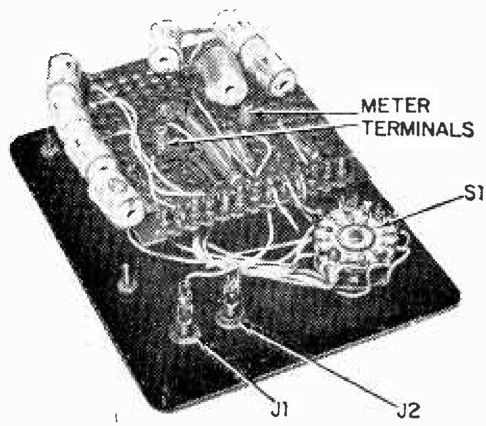
"I want some pictures of you on the way to the Ham Fest, dear . . . smile!"

"Them ham fellas? Yeah, over the fence and on top that *loooong* hill."

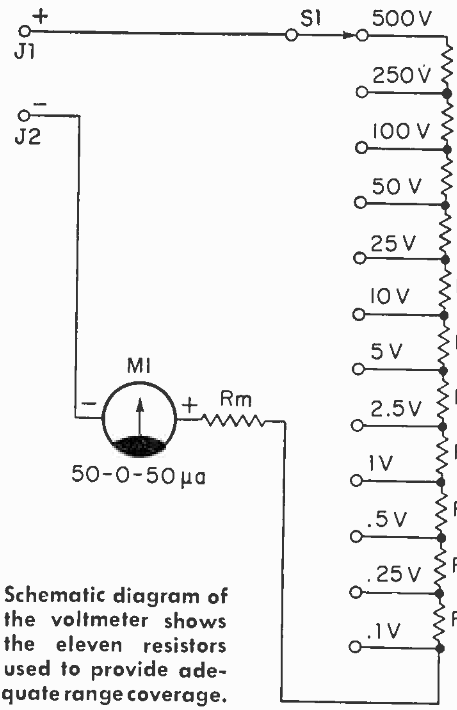
"I don't mind coming with you . . . it's just the long wait to go home."

Voltmeter

Continued from page 58



The meter terminal lugs provide convenient mounting points for the wired vectorboard.



Schematic diagram of the voltmeter shows the eleven resistors used to provide adequate range coverage.

PARTS LIST

J1, J2—Banana Jack, one red and one black (E. F. Johnson 108-902 and 108-903, respectively, or equiv.)
M1—50-0-50 microampere DC center-scale 4½" meter (Simpson Model 1329, 3½" model slightly cheaper, or equiv.)
R1—5,000,000-ohm, ½-watt resistor, 1%
R2—3,000,000-ohm, ½-watt resistor, 1%
R3—1,000,000-ohm, ½-watt resistor, 1%
R4—500,000-ohm, ½-watt resistor, 1%
R5—300,000-ohm, ½-watt resistor, 1%
R6—100,000-ohm, ½-watt resistor, 1%
R7—50,000-ohm, ½-watt resistor, 1%
R8—30,000-ohm, ½-watt resistor, 1%
R9—10,000-ohm, ½-watt resistor, 1%
R10—5,000-ohm, ½-watt resistor, 1%
R11—3,000-ohm, ½-watt resistor, 1%
(Use IRC Type DCC Epoxy-coated resistors to keep cost down)
S1—Single-pole, 12-position rotary switch (Centralab 2001 or equiv.)
1—Plastic case; $6\frac{13}{16}$" x $5\frac{9}{32}$" x $2\frac{5}{32}$" (H. Davies 260, Allied Radio 87P886, or equiv.)
1—Cover for plastic case; 6½" x 5". (H. Davies 261, Allied Radio 87P888, or equiv.)
1—Knob (H. Davies 2150 or equiv.)
Misc—Vectorboard, wire, solder, decals, etc.

Estimated cost: $28.00
Estimated construction time: 4 hours

(one on each side of the needle) and very carefully sliding the dial toward the top of the meter until free of the needle. Once this is done snap the front back on the meter case to preclude the possibility of damage to the instrument.

After you have selected what voltage ranges you want, make a sketch of approximately how the meter face will appear. Select the size decals that most closely resemble the original numbers and apply them as directed by the decal manufacturer. Using care and not hurrying may provide a pleasant surprise when you're done. To replace the meter face reverse the above procedure.

Caution. It would be well at this time to point out to those not too familiar with this type of instrument that when you're using the lower voltage ranges employ caution at all times and avoid applying excess voltages. It is suggested that the builder always start at a higher range than required and switch *down* until a reading is obtained that satisfies the user.

In Conclusion. The complete circuit diagram and parts list are given for the unit as built by the author. The reader may duplicate this or substitute his own voltage ranges taken to calculate the new required resistances. The total construction time should take approximately three hours—this would include layout, drilling and wiring.

This DC center-scale voltmeter lends itself particularly to the balancing of push-pull stages as employed in high-fidelity audio amplifiers. Proper use of this instrument in adjusting each push-pull stage for zero-plate-voltage-difference can result in rather startling reductions in distortion figures. ■

Appliance Shock Tester

Continued from page 65

extinguish it by shorting out its leads with your finger. Next, touch the second probe to the appliance. It is sensitive to currents 1 ma and stronger. If the neon lamp comes on again, the appliance is leaking a 1 ma or greater current. This means that the appliance is a borderline shock hazard. It should be checked over, and possibly grounded.

Extinguish the neon lamp and repeat the test, using the third probe. This probe is sensitive to currents 5 ma and above. If this causes the neon lamp to light, the appliance is a serious shock hazard. This amount of leakage current is approaching the' 'let go" threshold—especially that for a child—and is potentially dangerous.

It should be emphasized that any appliance can develop a serious shock hazard as its insulation ages or parts shift mechanically.

There is at least a fair chance that you will find several appliances, light fixtures, power tools or other electric devices in your home with excessive leakage currents. Proper servicing can make some of these safe again. Others, because of their poor design, will remain a shock hazard. It may be possible to ground them. If not, it is wise to discard them.

Unsafe New Appliances. Consumers Union, a non-profit organization, regularly checks new products for, among other things, potential shock hazards. The majority of products rated *Not Acceptable* by CU on the basis of this test have carried nationally-known brand names. Many of these same products also carried seals of approval from a number of well known testing organizations.

You cannot always rely on brand reputation and seals of approval alone, when it comes to judging the safety of a product. Last-minute modifications made during production, lack of adherence to standards of quality on the assembly line, or just plain carelessness can result in a faulty—potentially dangerous—product in your home.

Periodically test every electric device in your home. Make sure they're safe and in good operating condition. Finally, show your wife how to use the electronic shock tester. After all, she spends a good deal more time at home than you and is generally the first to discover a faulty appliance. ■

The Hidden Killer

Continued from page 67

Common sense and four simple rules will keep Killer Voltage safely confined where it belongs—at work *in* your TV:

1. Don't take the chance of connecting the ground wire to the hot wire of incoming power. Install polarized outlets, use a 3-prong system or connect an isolation transformer between the wall outlet and the TV line cord plug.
2. Don't position TV sets near natural ground sources. Sets should be placed a safe distance away from water pipes and radiators to make it impossible for anyone to touch the set and the ground source simultaneously. Even if the set develops a malfunction or a short circuit, the person touching the case or frame will probably not be seriously injured if he is not well grounded.
3. Never remove the insulated control knobs. Parents frequently remove insulated control knobs as prevention against children using the set without permission. This exposes the metal control shafts which are in contact with the chassis.
4. Never take the back off a TV set. Only those who are technically qualified should remove the protective back from the TV.

Under no condition should the back be left off the set. Curious youngsters, inquisitive family pets, and anyone making accidental contact with exposed components, are all subject to a lethal shock.

As a final safety measure, make sure that your TV antenna is effectively grounded. When antenna and mast are properly grounded, they serve as a lightning rod giving your home added protection. Remember, keep electricity harnessed and working for—not against—you. ■

"It's Dad's CB antenna.
Bet I'll catch something now!"

Volume 43, Part 2

WHITE'S RADIO LOG

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

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

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

In the June/July issue of RADIO-TV EXPERIMENTER, the *Log* will contain the following listings: U. S. AM Stations by Call Letters, U. S. FM Stations by Call Letters, Canadian AM Stations by Call Letters, Canadian FM Stations by Call Letters, and the expanded World-Wide Short-Wave Section.

In the event you missed any part of the *Log* published earlier this year, you will have a complete copy of *White's Radio Log* by collecting any three consecutive issues of RADIO-TV EXPERIMENTER during 1964. The three consecutive issues comprise a complete volume of *White's Radio Log* that offers complete listings with last minute station change data that can not be offered in any other magazine or book. If you are a broadcast band DX'er, FM station logger, like to photograph distant TV test patterns, or tune the short-wave bands, you will find *White's Radio Log* an unbeatable reference.

QUICK REFERENCE INDEX

WHITE'S RADIO LOG

U. S. AM Stations by Location

Location	C.L.	Kc.
Abbeville, Ala.	WARI	1480
Abbeville, La.	KROF	960
Abbeville, S.C.	WABV	1590
Aberdeen, Md.	WAMD	970
Aberdeen, Miss.	WMPA	1240
Aberdeen, S.Dak.	KSDN	930
	KXRO	1320
Aberdeen, Wash.	KBKW	1450
Abilene, Tex.	KRBC	1470
	KCAD	1560
	KNIT	1280
	KWKC	1340
Abilene, Kansas	KABI	250
Abingdon, Va.	WBBI	1230
Ada, Okla.	KADA	1230
Adel, Ga.	WAAG	1470
Adrian, Mich.	WABJ	1490
Agana, Guam	KUAM	610
Aguadilla, P.R.	WABA	850
	WGRF	1340
Ahoskie, N.C.	WRCS	970
Aiken, S.C.	WAKN	990
	WLOW	1300
Aitkin, Minn.	KKIN	1000
Akron, Ohio	WAKR	1590
	WADC	1350
	WCUE	1150
	WHLO	640
Alamogordo, N.M.	KALG	1230
	KRAC	1270
Alamo Heights, Tex.		
	KDRY	1110
Alamosa, Colo.	KGIW	1450
Albany, Ga.	WALG	1590
	WFAZ	960
	WLYB	1250
	WGPC	1450
	WJAZ	960
Albany, Ky.	WANY	1390
Albany, Minn.	KASM	1150
Albany, N.Y.	WABY	1400
	WOKO	1460
	WPTR	1540
	WROW	590
Albany, Oreg.	KWIL	790
	KRKT	990
Albemarle, N.C.	WABZ	1010
	WZKY	1580
Albert Lea, Minn.	KATE	1450
Albertville, Ala.	WAVU	630
Albion, Mich.	WALM	1260
Albuquerque, N.M.	KABQ	1350
	KDEF	1150
	KGGM	610
	KHIP	1520
	KOB	770
	KQEO	920
	KARA	1310
	KVOD	730
	KLOS	1450
	KRZY	1580
Alcoa, Tenn.	WEAG	1470
Alexander City, Ala.		
	WRFS	1050
Alexandria, La.	KALB	580
	KDBS	1410
	KSYL	970
Alexandria, Minn.	KXRA	1490
Alexandria, Va.	WPIK	730
Algona, Iowa	KLGA	1600
Alice, Tex.	KOPY	1070
Alisal, Cal	KRSA	1570
Allentown, Pa.	WHOL	1600
	WAEB	790
	WKAP	1320
	WSAN	1470
Alliance, Nebr.	KCOW	1400
Alliance, Ohio	WFAH	1310
Alisal, Calif.	KRSA	1570
Alma, Ga.	WCQS	1400
Alma, Mich.	WFYC	1280
Alpena Township, Mich.		
	WATZ	1450
Alpine, Tex.	KVLF	1240
Altavista, Va.	WKDE	1280
Alton, Ill.	WOKZ	1570
Altona, Man.	CFAM	1290
Altoona, Pa.	WFBG	1290
	WRTA	1240
	WVAM	1430
Alturas, Calif.	KCNO	570
Altus, Okla.	KWHW	1450
Alva, Okla.	KALV	1430
Amarillo, Tex.	KBUY	1010
	KFDA	1440
	KGNC	710
	KIXZ	940
	KRAY	1360
	KZIP	1310
Ambridge, Pa.	WMBA	1460
Americus, Ga.	WDEC	1290
	WISK	1390
Ames, Iowa	KASI	1430
	WOI	640
Amherst, Mass.	WTTT	1430
Amherst, N.S.	CKDH	1400
Amherst, N.Y.	WUFO	1080
Amite, La.	WABL	1570
Amory, Miss.	WAMY	1580
Amsterdam, N.Y.	WAFS	1570
	WCSS	1490
Anaconda, Mont.	KANA	580
Anacortes, Wash.	KAGT	1340
Anaheim, Calif.	KEZY	1190
Anchorage, Alaska	KBYR	1270
	KFQD	730
	KENI	550
Andalusia, Ala.	WCTA	920
Anderson, Cal.	KMRE	1580
Anderson, Ind.	WHUT	1470
	WHBU	1240
Anderson, S.C.	WAIM	1230
	WANS	1280
Andrews, Tex.	KACT	1360
Annapolis, Md.	WANN	1190
	WYRE	810
	WNAV	1430
Ann Arbor, Mich.	WAAM	1600
	WPAG	1050
Anna, Ill.	WRAJ	1440
Anniston, Ala.	WANA	1490
	WDNG	1450
	WHMA	1390
Anoka, Minn.	KANO	1470
Ansonia, Conn.	WADS	690
Antigo, Wis.	WATK	900
Apollo, Pa.	WAVL	910
Apopka, Fla.	WTLN	1520
Apple Valley, Cal.	KAVR	960
Appleton, Wis.	WAPL	1570
	WHBY	1230
Arab, Ala.	WRAB	1380
Arcadia, Fla.	WAPG	1480
Arcata, Calif.	KENL	1340
	KATA	1340
Ardmore, Okla.	KVSO	1240
Arecibo, P.R.	WCMN	1280
	WMIA	1070
	WNIK	1230
Argentia, Nfld.	VOUS	1480
Arkadelphia, Ark.	KVRC	1240
Arkan. City, Kans.	KSOK	1280
Arlington, Fla.	WQTY	1220
Arlington, Va.	WAVA	780
	WEAM	1390
Artesia, N.M.	KSVP	990
Arvada, Colo.	KDAB	1550
Arroyo Grande, Calif.		
	KCJH	1280
Ashburn, Ga.	WMES	1570
Asbury Park, N.J.	WJLK	1440
	WHTG	1410
Asheboro, N.C.	WGWR	1260
Asheville, N.C.	WISE	1310
	WLOS	1380
	WSKY	1230
	WWNC	570
Ashland, Ky.	WCMI	1340
	WTCR	1420
Ashland, Ohio	WNCO	1340
Ashland, Oreg.	KWIN	1400
	KRVC	1350
Ashland, Va.	WIVE	1430
Ashland, Wis.	WATW	1400
Ashtabula, Ohio	WAQI	1600
	WREO	970
Aspen, Colo.	KSNO	5000
Astoria, Oreg.	KAST	1370
	KVAS	1230
Atchison, Kans.	KARE	1470
Athens, Ga.	WGAU	1340
	WDOL	1470
	WKAC	1080
	WRFC	960
	KQXI	790
Athens, Ohio	WATH	970
	WOUB	1340
Athens, Tenn.	WLAR	1450
Athens, Tex.	KBUD	1410
Atlanta, Ga.	WPLO	590
	WAKE	1340
	WAOK	1380
	WERD	860
	WGKA	1600
	WGST	920
	WIIN	970
	WQXI	790
	WSB	750
	WYZE	1480
Atlanta, Tex.	KALT	900
Atlantic, Iowa	KJAN	1220
Atlantic Beach, Fla.	WKTX	1600
Atlantic City, N.J.	WFPG	1450
	WLDB	1490
	WMID	1340
Atmore, Ala.	WATM	1590
Attleboro, Mass.	WARA	1320
Auburn, Ala.	WAUD	1230
Auburn, Calif.	KAHI	950
Auburn, N.Y.	WMBO	1340
	WAUB	1590
Auburn, Wash.	KASY	1220
Auburndale, Fla.	WTWB	1570
Auburndale, Wis.	WLBL	930
Augusta, Ga.	WAUG	1050
	WBBQ	1340
	WBIA	1230
	WGAC	580
	WRDW	1480
Augusta, Maine	WRDO	1400
	WFAU	1340
Aurora, Colo.	KOSI	1430
Aurora, Ill.	WMRO	1280
	WKKD	1580
Aurora, Mo.	KSWM	940
Austin, Minn.	KAUS	1480
	KQAQ	970
Austin, Tex.	KNOW	1490
	KHFI	970
	KTBC	590
	KOKE	1370
	KVET	1300
Avalon, Calif.	KGLM	740
Avon Park, Fla.	WAVP	1390
Avondale Estates, Ga.		
	WAVO	1420
Aztec, N. Mex.	KHAP	1340
Babylon, N.Y.	WBAB	1440
	WGLI	1290
Bad Axe, Mich.	WLEW	1340
Bainbridge, Ga.	WMGR	930
	WAZA	1360
Baker, Mont.	KFLN	960
Baker, Oreg.	KBKR	1490
Bakersfield, Calif.	KAFY	550
	KBIS	970
	KERN	1410
	KGEE	1230
	KUZZ	800
	KLYD	1350
	KWAC	1490
	KPMC	1560
Bellingham, Wash.	KPUG	1170
Baldwinsville, N.Y.	WSEN	1050
Ballinger, Tex.	KRUN	1400
Baltimore, Md.	WBAL	1090
	WBMD	750
	WCAO	600
	WCBM	680
	WEBB	1360
	WFBR	1300
	WITH	1230
	WSID	1010
	WWIN	1400
Bamberg, S.C.	WWBD	790
Bangor, Maine	WABI	910
	WGUY	1250
	WLBZ	620
Banning, Calif.	KPAS	1490
Barboursville, Ky.	WBVL	950
Bardstown, Ky.	WBRT	1320
Barnesboro, Pa.	WNCC	950
Barnwell, S.C.	WBAW	740
Barre, Vt.	WSNO	1450
Barstow, Calif.	KWTC	1230
	KIOT	1310
Bartlesville, Okla.	KWON	1400
Bartow, Fla.	WBAR	1460
Bassett, Va.	WODY	900
Bastrop, La.	KTRY	730
	KVOB	1340
Batavia, N.Y.	WBTA	1490
Batesburg, S.C.	WBLR	1430
Batesville, Ark.	KBTA	1340
Batesville, Miss.	WBLE	1290
Bath, Maine	WJTO	730
Bath, N.Y.	WFSR	1580
Baton Rouge, La.	WAIL	1460
	WLUX	1550
	WYNK	1380
	WIBR	1300
	WJBO	1150
	WLCS	910
	WXOK	1260
Battle Creek, Mich.	WBCK	930
	WKFR	1400
	WVOC	1500
Baxley, Ga.	WHAB	1260
Bay City, Mich.	WBCM	1440
	WWBC	1250
Bay City, Tex.	KIOX	1270
Bay Minette, Ala.	WBCA	1150
Bayamon, P.R.	WBPR	1600
	WSRJ	1560
Baytown, Tex.	KWBA	1360
Beacon, N.Y.	WBNR	1260
Beardstown, Ill.	WRMS	790
Beatrice, Nebr.	KWBE	1450
Beaufort, N.C.	WBMA	1400
Beaufort, S.C.	WBEU	960
	WSIB	1490
Beaumont, Tex.	KLVI	560
	KPYC	1450
	KTRM	990
Beaver Dam, Wis.	WBEV	1430
Beaver Falls, Pa.	WBVP	1230
Beckley, W. Va.	WJLS	560
	WWNR	620
Bedford, Ind.	WBIW	1340
Bedford, Pa.	WBFD	1310
Bedford, Va.	WBLT	1350
Beeville, Tex.	KIBL	1490
Bel Air, Md.	WVCB	1520
Belen, N.Mex.	KARS	860
Belfast, Me.	WBME	1230
Belgrade, Mont.	KGVW	630
Bellaire, Ohio	WOMP	1290
Bellefontaine, Ohio		
	WOHP	1390
Bellefonte, Pa.	WBLF	1330
Bell Fourche, S.Dak.	KBFS	1450
Belle Glade, Fla.	WSWN	900
Belleville, Ont.	CJBQ	800
Belleville, Ill.	WIBV	1260
Bellevue, Wash.	KFKF	1330
	KBVU	1540
Bellingham, Wash.	KPUG	1170
	KGMI	790
	KOQT	1550
Bellingham-Ferndale, Wash.		
	KENY	930
Belmont, N.C.	WCGC	1270
Beloit, Wis.	WGEZ	1490
	WBEL	1380
Belton, S.C.	WHPB	1390
Belton, Tex.	KTON	940
Belzoni, Miss.	WELZ	1460
Bemidji, Minn.	KBUN	1450
Bend, Oreg.	KBND	1110
	KGRL	940
Bennetsville, S.C.	WBSC	1550
Bennington, Vt.	WBTN	1370
Benson, Minn.	KBMO	1290
Benson, N.C.	WPYB	1580
Benton, Ark.	KBBA	690
	KGKO	1600
Benton, Ky.	WCBL	1290
Benton Harbor, Mich.		
	WHFB	1060
Berkeley, Calif.	KPAT	1400
Berkeley Springs, W.Va.		
	WCST	1010
Berlin, N.H.	WMOU	1230
	WBRL	1400
Berry Hill, Tenn.	WVOL	1470
Berryville, Ark.	KTHS	1480
Berwick, Pa.	WBRX	1280
Bessemer, Ala.	WYAM	1450
Bethesda, Md.	WUST	1120
Bethlehem, Pa.	WGPA	1100
Beverly, Mass.	WMLO	1570
Biddeford, Maine	WIDE	1400
Big Delta, Alaska	WXLL	980
Big Lake, Tex.	KBLT	1290
Big Rapids, Mich.	WBRN	1460
Big Sprg., Tex.	KBST	1490
	KHEM	1270
	KBYG	1400
Big Stone Gap, Va.	WLSD	1220
Bijou, Cal.	KOWL	1490
Biloxi, Miss.	WLOX	1490
	WVMI	570
Billings, Mont.	KBMY	1240
	KGHL	790
	KOOK	970
	KOYN	910
	KURL	730
Binghamton, N.Y.	WINR	680
	WKOP	1360
	WNBF	1290
Birmingham, Ala.	WAPI	1070
	WBHM	1550
	WBRC	960
	WCRT	1260
	WEZB	1220
	WENN	1320

Location	C.L.	Kc.
	WATV	900
	WSGN	610
	WYDE	850
	WVOK	690
Bisbee, Ariz.	KSUN	1230
Bishop, Calif.	KIBS	1230
Bishopville, S.C.	WAGS	1380
Bismarck, N.Dak.	KFYR	550
	KBMR	1350
Bismarck-Mandan, N.Dak.	KBOM	1270
Black Mountain, N.C.	WBMT	1350
	WFGW	1010
Black River Falls, Wis.	WWIS	1260
Blackfoot, Idaho	KBLI	690
Blackshear, Ga.	WBSG	1350
Blackstone, Va.	WKLV	1440
Blackwell, Okla.	KLTR	1580
Blaine, Wash.	KARI	550
Blakely, Ga.	WBBK	1260
Blanding, Utah	KUTA	790
Bloomington, Ill.	WJBC	1230
Bloomington, Ind.	WTTS	1370
Bloomsburg, Pa.	WCNR	930
	WHLM	550
Blountstown, Fla.	WKMK	1370
Blue Earth, Minn.	KBEW	1560
Bluefield, W.Va.	WHIS	1440
	WKOY	1240
Blythe, Calif.	KYOR	1450
Blytheville, Ark.	KLCN	910
Boaz, Ala.	WBSA	1300
Boca Raton, Fla.	WSBR	740
Bogalusa, La.	WIKC	1490
	WBOX	920
Boise, Idaho	KATN	1010
	KBOI	950
	KEST	790
	KGEM	1140
	KIDO	630
	KYME	740
Bolivar, Mo.	KBLR	1550
Bolivar, Tenn.	WBOL	1560
Bonham, Tex.	KFYN	1420
Boone, Iowa	KFGQ	1260
	KWBG	1590
Boone, N.C.	WATA	1450
Boonville, Ind.	WBNL	1540
Boonville, Mo.	KWRT	1370
Booneville, Miss.	WBIP	1400
Boonville, N.Y.	WBRV	900
Borger, Tex.	KHUZ	1490
	KBBB	1600
Boston, Mass.	WBZ	1030
	WCOP	1150
	WILD	1090
	WNAC	680
	WEZE	1260
	WEEI	590
	WHDH	850
	WMEX	1510
	WORL	950
Boulder, Colo.	KBOL	1490
	KDEY	1360
Bowie, Tex.	KBAN	1410
Bowling Green, Ky.	WKCT	930
	WBGN	1340
	WLBJ	1410
Bowl. Green, Ohio	WMGS	730
Boynton Beach, Fla.	WZZZ	1510
Bozeman, Mont.	KXXL	1450
	KBMN	1230
Bradbury Hgts., Md.	WPGC	1580
Braddock, Pa.	WLOA	1550
Braddocks Heights, Md.	WMHI	1370
Bradenton, Fla.	WTRL	1490
	WBRD	1420
Bradford, Pa.	WESB	1490
Brady, Tex.	KNEL	1490
Brainerd, Minn.	KLIZ	1380
	KVBR	1340
Branson, Mo.	KBHM	1220
Brantford, Ont.	CKPC	1380
Brattleboro, Vt.	WTSA	1450
	WKVT	1490
Brawley, Calif.	KROP	1300
Brazil, Ind.	WWCM	1380
Breckenridge, Minn.	KBMW	1450
Breckenridge, Tex.	KSTB	1430
Bremen, Ga.	WWCC	1440
Bremerton, Wash.	KBRO	1490
Brenham, Tex.	KWHI	1280
Brevard, N.C.	WPNF	1240
Brewster, N.Y.	WBRW	1510
Brewton, Ala.	WEBJ	1240
Bridgeport, Ala.	WBTS	1480
Bridgeport, Conn.	WICC	600
	WNAB	1450
Bridgeton, N.J.	WSNJ	1240
Brigham City, Utah	KBUH	800
Brighton, Colo.	KBRN	800
Brinkley, Ark.	KBRI	1570
Bristol, Conn.	WBIS	1440
Bristol, Tenn.	WOPI	1490
	WKYE	1550
Bristol, Va.	WCYB	690
	WFHG	980
Brockton, Mass.	WBET	1460

Location	C.L.	Kc.
	WOKW	1410
Brockville, Ont.	CFJR	1450
Broken Bow, Nebr.	KCNI	1280
Brookfield, Conn.	WINE	940
Brookfield, Mo.	KGHM	1470
Brookhaven, Miss.	WCHJ	1470
	WJMB	1340
Brookings, Oreg.	KURY	910
Brookings, S.Dak.	KBRK	1430
Brookline, Mass.	WBOS	1600
Brooksville, Fla.	WWJB	1450
Brownfield, Tex.	KKUB	1300
Brownsville, Tenn.	WBHT	1520
Brownsville, Tex.	KBOR	1600
Brownwood, Tex.	KBWD	1380
	KEAN	1240
Brunswick, Ga.	WGIG	1440
	WMOG	1490
	WYNR	790
Brunswick, Maine	WCME	900
Bryan, Ohio	WBNO	1520
Bryan, Tex.	KORA	1240
	WTAW	1150
Buckhannon, W.Va.	WBUC	1460
Bucyrus, Ohio	WBCO	1540
Buffalo, N.Y.	WBEN	930
	WYSL	1400
	WEBR	970
	WGR	550
	WKBW	1520
	WWOL	1120
Buffalo, Wyo.	KBBS	1450
Buford, Ga.	WDYX	1460
Burbank, Calif.	KBLA	1500
Burley, Idaho	KBAR	1230
Burlington, Iowa	KBUR	1490
Burlington, N.C.	WBBB	920
	WBAG	1150
Burlington, Vt.	WDOT	1400
	WJOY	1230
	WVMT	620
Burnett, Tex.	KTSL	1340
Burns, Oreg.	KRNS	1230
Butler, Ala.	WPRN	1240
Butler, Mo.	KMAM	1530
Butler, Pa.	WBUT	1050
	WISR	680
Butte, Mont.	KBOW	550
	KXLF	1370
Cadillac, Mich.	WATT	1240
Caguas, P.R.	WNEL	1430
	WVJP	1110
Cairo, Ga.	WGRA	790
Cairo, Ill.	WKRO	1490
Calais, Maine	WQDY	1230
Caldwell, Idaho	KCID	1490
	KBGN	910
Calera, Ala.	WBYE	1370
Calexico, Calif.	KICO	1490
Calhoun, Ga.	WCGA	900
Camas, Wash.	KVAN	1480
Cambridge, Md.	WCEM	1240
Cambridge, Mass.	WTAO	740
Cambridge, Ohio	WILE	1270
Camden, Ark.	KAMD	910
	KJWH	1450
Camden, N.J.	WCAM	1310
	WKDN	800
Camden, S. C.	WACA	1590
Camden, Tenn.	WFWL	1220
Cameron, Tex.	KMIL	1330
Camilla, Ga.	WCLB	1220
Campbell, Ohio	WHOT	1330
Campbellsville, Ky.	WTCO	1450
Canandaigua, N.Y.	WCGR	1550
Cannon City, Colo.	KRLN	1400
Canonsburg, Pa.	WARO	540
Canton, Ga.	WCHK	1290
Canton, Ill.	WBYS	1560
Canton, Miss.	WMGO	1370
Canton, N.C.	WWIT	970
Canton, Ohio	WCNS	900
	WHOF	1060
	WHBC	1480
	WINW	1520
Canyon, Tex.	KCAN	1550
Cape Girardeau, Mo.	KFVS	960
	KZIM	1220
	KGMO	1550
Carbondale, Ill.	WCIL	1020
Carbondale, Pa.	WCDL	1440
Caribou, Maine	WFST	600
Carlisle, Pa.	WHYL	960
Carlsbad, N.Mex.	KAVE	1240
	KPBM	740
Carmel, Calif.	KRML	1410
Carmi, Ill.	WROY	1460
Carnegie, Pa.	WZUM	1590
Caro, Mich.	WKYO	1360
Carolina, P. R.	WVOZ	1400
Carrington, N.Dak.	KDAK	1600
Carrizo Springs, Tex.	KBEN	1450
Carroll, Iowa	KCIM	1380
Carrollton, Ala.	WRAG	590
Carrollton, Ga.	WLBB	1100
Carrollton, Mo.	KAOL	1430
Carson City, Nev.	KPTL	1300
Cartersville, Ga.	WBHF	1450
	WKRW	1270
Carthage, Ill.	WCAZ	990
Carthage, Mo.	KDMO	1490
Carthage, Miss.	WECP	1480

Location	C.L.	Kc.
Carthage, Tenn.	WRKM	1350
Carthage, Tex.	KGAS	1590
Caruthersville, Mo.	KCRV	1370
Casa Grande, Ariz.	KPIN	1260
Casey, Ill.	WKZI	800
Casper, Wyo.	KTWO	1470
	KATI	1400
Cathedral City, Calif.	KVOC	1230
Cayce, S.C.	WCAY	620
Cedar City, Utah	KSUB	590
Cedar Falls, Iowa	KCFI	1250
Cedar Rapids, Iowa	KCRG	1600
	KLWW	1450
	WMT	600
	KHAK	1360
Cedartown, Ga.	WGAA	1340
Celina, Ohio	WCSM	1350
Center, Ala.	WEIS	990
	WAGC	1550
Center, Tex.	KDET	930
Centerville, Iowa	KCOG	1400
Centerville, Ind.	WHON	930
Centreville, Miss.	WLBS	1580
Centerville, Tenn.	WHLP	1570
Centerville, Utah	KBBC	1600
Central City, Ky.	WNES	1050
	WMTA	1380
Centralia, Ill.	WCNT	1210
Centralia & Chehalis, Wash.	KELA	1470
Centerville, Ala.	WBIB	1590
Centreville, Miss.	WLBS	1580
Ceres, Calif.	KLOC	920
Chadburn, N.C.	WVOE	1590
Chadron, Nebr.	KCSR	610
Chambersburg, Pa.	WCHA	800
	WCBG	1590
Champaign, Ill.	WDWS	1400
Chanute, Kans.	KCRB	1460
Chapel Hill, N.C.	WCHL	1360
Charleroi, Pa.	WESA	940
Charles City, Iowa	KCHA	1580
Charleston, Ill.	WEIC	1270
Charleston, Mo.	KCHR	1350
Charleston, S.C.	WCSC	1390
	WOKE	1340
	WPAL	730
	WQSN	1450
	WTMA	1250
Charleston, W.Va.	WCAW	680
	WCHS	580
	WGKV	1490
	WKAZ	950
	WTIP	1240
	WXVA	1550
Charlotte, Mich.	WCER	1390
Charlotte, N.C.	WBT	1100
	WAYS	610
	WGIV	1600
	WKTC	1310
	WSOC	930
	WIST	1240
	WWOK	1480
	WRPL	1540
Charlotte Amalie, V.I.	WBNB	1000
	WSTA	1340
	WBNB	1000
Charlottesville, Va.	WCHV	1260
	WELK	1010
	WINA	1400
Chase City, Va.	WMEK	980
Chattahoochee, Fla.	WSBP	1580
Chattanooga, Tenn.	WMOC	1450
	WAPO	1150
	WDEF	1370
	WDOD	1310
	WDXB	1490
	WNOO	1260
Cheboygan, Mich.	WCBY	1240
Cheektowaga, N.Y.	WNIA	1230
Chehalis-Centralia, Wash.	KITI	1420
Chelan, Wash.	KOZI	1220
Cheraw, S.C.	WCRE	1420
Cherryville, N. C.	WCSL	1590
Cherokee, Iowa	KCHE	1440
Chester, Ill.	KSGM	980
Chester, Pa.	WEEZ	1590
	WVCH	740
Chester, S.C.	WGCD	1490
Chester, Va.	WIKI	1410
Chestertown, Md.	WCTR	1530
Cheyenne, Wyo.	KFBC	1240
	KCHY	1530
	KRAE	1480
	KVWO	1370
Chicago, Ill.	WAAF	950
	WAIT	820
	WBBM	780
	WCFL	1000
	WEDC	1240
	WGN	720
	WIND	560
	WJJD	1160
	WLS	890
	WMAQ	670
	WMBI	1110
	WNUS	1390

Location	C.L.	Kc.
	WSBC	1240
Chicago Hgts., Ill.	WMPP	1470
	WCGO	1600
Chickasha, Okla.	KWCO	1560
Chico, Calif.	KHSL	1290
	KPAY	1060
Chicopee, Mass.	WACE	730
Childress, Tex.	KCTX	1510
Chillicothe, Mo.	KCHI	1010
Chillicothe, Ohio	WBEX	1490
	WCHI	1350
Chipley, Fla.	WBGC	1240
Chippewa Falls, Wis.	WAXX	1150
Christiansburg, Va.	WBCR	1260
Christiansted, V.I.	WIVI	970
Church Hill, Tenn.	WMCH	1260
Cicero, Ill.	WVON	1450
Cincinnati, Ohio	WCKY	1530
	WCIN	1480
	WCPO	1230
	WKRC	550
	WLW	700
	WSAI	1360
	WZIP	1050
Clanton, Ala.	WKLF	980
Clare, Mich.	WCRM	990
Claremont, N.H.	WTSV	1230
Claremore, Okla.	KWPR	1270
Clarion, Pa.	WWCH	1300
Clarksburg, W.Va.	WBOY	1400
	WHAR	1340
	WPDX	750
Clarksdale, Miss.	WROX	1450
	WKDL	1600
Clarksville, Ark.	KLYR	1360
Clarksville, Tenn.	WJZM	1400
	WDXN	540
Clarksville, Tex.	KCAR	1350
Claxton, Ga.	WCLA	1470
Clayton, Ga.	WGHC	1570
Clayton, Mo.	KXLW	1320
	KFUO	850
Clayton, N.Mex.	KLMX	1450
Clearfield, Pa.	WCPA	900
Clearwater, Fla.	WTAN	1340
	WAZE	860
Cleburne, Tex.	KCLE	1120
Clermont, Fla.	WSLC	1340
Cleveland, Ga.	WRWH	1350
Cleveland, Miss.	WCLD	1490
	WDSK	1410
Cleveland, Ohio	KYW	1100
	WDOK	1260
	WERE	1300
	WGAR	1220
	WHK	1420
	WABQ	1540
	WJW	850
Cleveland, Tenn.	WBAC	1340
	WCLE	1570
Cleveland, Tex.	KVLB	1410
Cleve. Hgts., Ohio	WJMO	1490
Clewiston, Fla.	WOWY	1590
Clifton, Ariz.	KCLF	1400
Clifton Forge, Va.	WCFV	1230
Clincho, Va.	WDIC	1430
Clinton, Ill.	WHOW	1520
Clinton, Iowa	KCLN	1390
	KROS	1340
Clinton, Mo.	KDKD	1280
	KITH	1350
Clinton, N.C.	WRRZ	880
Clinton, Okla.	KWOE	1320
Clinton, S.C.	WPCC	1410
Clinton, Tenn.	WYSH	1380
Cloquet, Minn.	WKLK	1230
Clovis, N.Mex.	KCLV	1240
	KICA	980
Coachella, Calif.	KCHV	970
Coalinga, Calif.	KBMX	1470
Coatesville, Pa.	WCOJ	1420
Cocoa, Fla.	WKKO	860
	WEZY	1350
Cocoa Beach, Fla.	WRKT	1300
Cody, Wyo.	KODI	1400
Coeur d'Alene, Ida.	KVNI	1240
Coffeyville, Kans.	KGGF	690
Colby, Kans.	KXXX	790
Coldwater, Mich.	WTVB	1590
Coleman, Tex.	KSTA	1000
Colfax, Wash.	KCLX	1450
College Park, Ga.	WEAD	1570
Colonial Heights, Va.	WPVA	1290
Colorado City, Tex.	KVMC	1320
Colo. Sprgs., Colo.	KRDO	1240
	KPIK	1580
	KVOR	1300
	KSSS	740
	KYSN	1460
	KRYT	1530
Columbia, Ky.	WAIN	1270
Columbia, Miss.	WCJU	1450
Columbia, Mo.	KFRU	1400
	KCGM	1580
Columbia, Pa.	WCOY	1580
Columbia, S.C.	WCOS	1400
	WIS	560
	WOIC	1320
	WNOK	1230
	WQXL	1470

WHITE'S RADIO LOG

Location	C.L.	Kc.
Columbia, Tenn.	WMCP	1280
	WKRM	1340
Columbus, Ga.	WDAK	540
	WRBL	1420
	WGBA	1270
	WCLS	1580
	WOKS	1340
	WPNX	1460
Columbus, Ind.	WCSI	1010
Columbus, Miss.	WACR	1050
	WCBI	550
Columbus, Nebr.	KJSK	900
	KTTT	1510
Columbus, Ohio	WBNS	1460
	WCOL	1230
	WMNI	920
	WOSU	820
	WTVN	610
	WVKO	1580
Colville, Wash.	KCVL	1270
Comanche, Tex.	KCOM	1550
Commerce, Ga.	WJJC	1270
Concord, Calif.	KWUN	1480
Concord, N.H.	WKXL	1450
Concord, N.C.	WEGO	1410
Concordia, Kans.	KNCK	1390
	KFRM	550
Conneaut, Ohio	WWOW	1360
Connellsville, Pa.	WCVI	1340
Connersville, Ind.	WCNB	1580
Conroe, Tex.	KMCO	900
Conway, Ark.	KCON	1230
	KVEE	1330
Conway, N.H.	WBNC	1050
Conway, S.C.	WLAT	1330
Cookeville, Tenn.	WHUB	1400
	WPTN	1550
Coolidge, Ariz.	KCKY	1150
Coos Bay, Oreg.	KOOS	1230
	KYNG	1420
Copper Hill, Tenn.	WLSB	1400
Coquille, Oreg.	KWRO	630
Coral Gables, Fla.	WRIZ	1550
	WVCG	1070
Corbin, Ky.	WCTT	680
	WYGO	1330
Cordele, Ga.	WMJM	1490
Cordova, Alaska	KLAM	1450
Corinth, Miss.	WCMA	1230
Cornelia, Ga.	WCON	1450
Corning, Ark.	KCCB	1260
Corning, N.Y.	WCBA	1350
	WCLI	1450
Corona, Cal.	KREL	1370
Corpus Christi, Tex.	KCTA	1030
	KCCT	1150
	KEYS	1440
	KRYS	1360
	KSIX	1230
	KUNO	1400
Corry, Pa.	WOTR	1370
Corsicana, Tex.	KAND	1340
Cortez, Colo.	KVFC	740
Cortland, N.Y.	WKRT	920
	KLOO	1340
	KFLY	1240
	KLOO	1350
Corvallis, Ore.	KLOO	1340
Corydon, Ind.	WPDF	1550
Coshocton, Ohio	WTNS	1560
Cottage Grove, Ore.	KNND	1400
Cottonwood, Ariz.	KVRD	1240
	KVIO	1600
Coudersport, Pa.	WFRM	600
Council Bluffs, Iowa	KFNF	920
	KSWI	1560
Courtenay, B.C.	CFCP	1440
Covington, Ga.	WGFS	1430
Covington, Ky.	WCLU	1320
Covington, La.	WARB	730
Covington, Tenn.	WKBL	1250
Covington, Va.	WKEY	1340
Cowan, Tenn.	WZYX	1440
Craig, Colo.	KRAI	550
Crane, Tex.	KCRR	1380
	KBSN	970
Crawfordsville, Ind.	WCVL	1550
Crescent City, Calif.	KPLY	1240
	KPOD	1310
Creston, Iowa	KSIB	1520
Crestview, Fla.	WCNU	1010
	WJSB	1050
Crewe, Va.	WSVS	800
Crockett, Tex.	KIVY	1290
Crookston, Minn.	KROX	1260
Crossett, Ark.	KAGH	800
Crossville, Tenn.	WAEW	1330
Crowley, La.	KSIG	1450
Cuero, Tex.	KCFH	1600
Cullman, Ala.	WFMH	1460
	WKUL	1340
Culpeper, Va.	WCVA	1490
Cumberland, Ky.	WCPM	1280
Cumberland, Md.	WCUM	1230
	WTBO	1450
Cummings, Ga.	WSNE	1410
Cushing, Okla.	KUSH	1600
Cuyahoga Falls, Ohio	WCUE	1150
Cypress Gardens, Fla.	WGTO	540
Cynthiana, Ky.	WCYN	1400
Dade City, Fla.	WDCF	1350
Dadeville, Ala.	WDVC	910
Dalhart, Tex.	KXIT	1410
Dallas, N.C.	WAAK	960
Dallas, Oreg.	KROW	1460
Dallas, Tex.	KRLD	1080
	KIXL	1040
	KSKY	660
	KLIF	1190
	WFAA	570
	WFAA	820
	KBOX	1480
	WRR	1310
Dalton, Ga.	WBLJ	1230
	WRCD	1430
	WTTI	1530
Danbury, Conn.	WLAD	800
Danville, Ill.	WDAN	1490
	WITY	980
Danville, Ky.	WHIR	1230
Danville, Pa.	WPGM	1570
Danville, Va.	WBTM	1330
	WYPR	970
	WDVA	1250
	WILA	1580
Dardanelle, Ark.	KCAB	980
Darlington, S.C.	WDAR	1350
Davenport, Iowa	WOC	1420
	KWNT	1580
	KSTT	1170
Dawson, Ga.	WDWD	990
Dayton, Ohio	WHIO	1290
	WING	1410
	WONE	980
	WAVI	1210
Dayton, Tenn.	WDNT	1280
Daytona Beach, Fla.	WNDB	1150
	WMFJ	1450
	WROD	1340
Deadwood, S.Dak.	KDSJ	980
Dearborn, Mich	WKNR	1310
Decatur, Ala.	WHOS	800
	WAJF	1490
	WMSL	1400
Decatur, Ga.	WGUN	1010
	WOMN	1310
Decatur, Ill.	WDZ	1050
	WSOY	1340
	WADM	1540
Decorah, Iowa	KDEC	1240
	KWLC	1240
Deer Lodge, Mont.	KDRG	1400
Deerfield, Va.	WABH	1150
Defiance, Ohio	WONW	1280
De Funiak Springs, Fla.	WDSP	1280
	WZEP	1460
De Kalb, Ill.	WLBK	1360
De Land, Fla.	WJBS	1490
	WOOO	1310
Delano, Calif.	KCHJ	1010
Delaware, Ohio	WDLE	1550
Delray Bch., Fla.	WDBF	1420
Del Rio, Tex.	KDLK	1230
Delta, Colo.	KDTA	1400
Deming, N.Mex.	KOTS	1230
Demopolis, Ala.	WXAL	1400
	WJWT	1350
Denham Sprgs., La.	WLBI	1220
Denison, Iowa	KDSN	1580
Denison-Sherman, Tex.	KDSX	950
Denton, Tex.	KDNT	1440
Denver, Colo.	KDEN	1340
	KFML	1390
	KHOW	630
	KIMN	950
	KLIR	990
	KLZ	560
	KBTR	710
	KOA	850
	KPOF	910
	KFSC	1220
	KTLN	1280
Denver City, Tex.	KKAL	1580
De Queen, Ark.	KDQN	1390
DeRidder, La.	KDLA	1010
Des Moines, Iowa	KCBC	1390
	KIOA	940
	KRNT	1350
	KSO	1460
	KWKY	1150
	WHO	1040
Detroit, Mich.	WCAR	1130
	WJBK	1500
	WJLB	1400
	WJR	760
	WWJ	950
	WXYZ	1270
Detroit Lakes, Minn.	KDLM	1340
Devils Lake, N.Dak.	KDLR	1240
Dexter, Mo.	KDEX	1590
Diboll, Tex.	KSPL	1260
Dickinson, N.Dak.	KDIX	1230
Dickson, Tenn.	WDKN	1260
Dillon, Mont.	KDBM	800
Dillon, S.C.	WDSC	800
Dimmitt, Tex.	KDHN	1470
Dinuba, Calif.	KRDU	1130
Dixon, Ill.	WIXN	1460
Dodge City, Kans.	KGNO	1370
	KEDD	1550
Donaldsonville, Ga.	WSEM	1500
Doniphan, Mo.	KDFN	1500
Dothan, Ala.	WAGF	1320
	WDIG	1450
	WOOF	560
Douglas, Ariz.	KAWT	1450
	KAPR	930
Douglas, Ga.	WDMG	860
	WOKA	1310
Douglas, Wyo.	KWIV	1050
Douglasville, Ga.	WDGL	1520
Dover, Del.	WDOV	1410
	WKEN	1600
Dover, N.J.	WRAN	1510
Dover, N.H.	WTSN	1270
Dover, Ohio	WJER	1450
Dowagiac, Mich.	WDOW	1440
Doylestown, Pa.	WBUX	1570
Dublin, Ga.	WMLT	1330
	WXLI	1230
Du Bois, Pa.	WCED	1420
Dubuque, Iowa	KDTH	1370
	WDBQ	1490
Duluth, Minn.	KDAL	610
	WEBC	560
	KAOH	1390
Dumas, Tex.	KDDD	800
Duncan, Okla.	KRHD	1350
Dundalk, Md.	WAYE	860
Dundee, N.Y.	WFLR	1570
Dunkirk, N.Y.	WDOE	1410
Dunn, N.C.	WCKB	780
Du Quoin, Ill.	WDQN	1580
Durango, Colo.	KIUP	930
	KDGO	1240
Durant, Okla.	KSFO	750
Durham, N.C.	WDNC	620
	WSRC	1410
	WSSB	1490
	WTIK	1310
Dyersburg, Tenn.	WDSG	1450
	WTRO	1330
Eagle Pass, Tex.	KEPS	1270
Eagle River, Wis.	WERL	950
Easley, S.C.	WELP	1360
E. Grand Forks, Minn.	KRAD	1590
Eastland, Tex.	KERC	1590
E. Lansing, Mich.	WKAR	870
E. Liverpool, Ohio	WOHI	1490
East Longmeadow, Mass.	WTYM	1600
Eastman, Ga.	WPFE	1580
E. Moline, Ill.	WDLM	960
E. Point, Ga.	WTJH	1260
E. St. Louis, Ill.	WAMV	1490
Easton, Md.	WEMD	1460
Easton, Pa.	WEEX	1230
	WEST	1400
Eatontown, N.J.	WHTG	1410
Eau Claire, Wis.	WEAQ	790
	WBIZ	1400
	WECL	1050
Eau Gallie, Fla.	WMEG	920
Ebensburg, Pa.	WEND	1580
Edenton, N.C.	WCDJ	1260
Edinburg, Tex.	KURV	710
Edmonds, Wash.	KGDN	630
Effingham, Ill.	WCRA	1090
Elba, Ala.	WELB	1350
Elberton, Ga.	WSGC	1400
El Cajon, Calif.	KDEO	910
El Campo, Tex.	KULP	1390
El Centro, Calif.	KXO	1230
	KAMP	1430
El Dorado, Ark.	KDMS	1290
	KELD	1400
Eldorado, Kans.	KBTO	1360
Eldorado Springs, Mo.	KESM	1580
Elgin, Ill.	WRMN	1410
Elizabeth City, N. C.	WCNC	1240
	WGAI	560
Elizabethton, Tenn.	WBEJ	1240
	WIDD	1520
Elizabethtown, Ky.	WIEL	1400
Elizabethtown, N.C.	WBLA	1440
Elizabethtown, Pa.	WHRY	1600
Elk City, Okla.	KBEK	1240
Elkhart, Ind.	WTRC	1340
	WCMR	1270
Elkins, N.C.	WIFM	1540
Elkins, W.Va.	WDNE	1240
Elko, Nev.	KELK	1240
Elkton, Md.	WSER	1550
Ellensburg, Wash.	KXLE	1240
Ellsworth, Me.	WDEA	1370
Elmira, N.Y.	WELM	1410
	WENY	1230
Elmira Heights-Horseheads, N.Y.	WEHH	1590
El Paso, Tex.	KROD	600
	KELP	920
	KHEY	690
	KINT	1590
	KIZZ	1150
	KSET	1340
	KTSM	1380
El Reno, Okla.	KELR	1460
Ely, Minn.	WELY	1450
Ely, Nev.	KELY	1230
Elyria, Ohio	WEOL	930
Eminence, Ky.	WSTL	1600
Emporia, Kans.	KVOE	1400
Emporia, Va.	WEVA	860
Emporium, Pa.	WLEM	1250
Endicott, N.Y.	WENE	1430
Englewood, Colo.	KGMC	1150
Englewood, Fla.	WENG	1530
Enid, Okla.	KCRC	1390
	KGWA	960
Enterprise, Ala.	WIRB	600
Enterprise, Oreg.	KWVR	1340
Ephrata, Pa.	WGSA	1310
Ephrata, Wash.	KULF	730
Erie, Pa.	WWYN	1260
	WICU	1330
	WJET	1400
	WWGO	1450
Erwin, Tenn.	WEMB	1420
Escanaba, Mich.	WDBC	680
	WLST	600
Escondido, Calif.	KOWN	1450
Espanola, N. M.	KDCE	970
Etowah, Tenn.	WCPH	1220
Eufaula, Ala.	WULA	1240
Eugene, Oreg.	KORE	1450
	KPIR	1500
	KASH	1600
	KATR	1320
	KERG	1280
	KUGN	590
	KWFS	1540
Eunice, La.	KEUN	1490
Eureka, Calif.	KINS	980
	KDAN	790
	KRED	1480
Eustis, Fla.	WLCO	1240
Evanston, Ill.	WEAW	1330
	WNMP	1590
Evanston, Wyo.	KEVA	1240
Evansville, Ind.	WROZ	1400
	WGBF	1280
	WIKY	820
	WJPS	1330
Eveleth, Minn.	WEVE	1340
Everett, Pa.	WWDS	1110
Everett, Wash.	KRKO	1380
	KWYZ	1230
Evergreen, Ala.	WBLO	1470
Fairbanks, Alaska	KFAR	610
	KFRB	900
Fairbury, Nebr.	KGMT	1310
Fairfax, Va.	WEEL	1310
Fairfield, Ill.	WFIW	1390
Fairfield, Iowa	KMCD	1570
Fairhope, Ala.	WABF	1220
Fairmont, Minn.	KSUM	1370
Fairmont, N.C.	WFMO	860
Fairmont, W.Va.	WMMN	920
	WTCS	1490
Fairway, Kan.	KUDL	1380
Fajardo, P.R.	WMDD	1480
Falfurrias, Tex.	KPSO	1260
Fall River, Mass.	WALE	1400
	WSAR	1480
	KVLV	980
Falls Church, Va.	WFAX	1220
Falls City, Nebr.	KTNC	1230
Fargo, N.Dak.	WDAY	970
	KFNW	900
	KUTT	1550
	KXGO	790
Faribault, Minn.	KDHL	920
Farmersville, La.	KTDL	1470
Farmington, Me.	WKTJ	1380
Farmington, Mo.	KREI	800
Farmington, N.M.	KENN	1390
	KWYK	960
	KRZE	1280
Farmville, N.C.	WFAG	1250
Farmville, Va.	WFLO	870
Farrell, Pa.	WFAR	1470
Farwell, Tex.	KZOL	1570
Fayette, Ala.	WWWF	990
Fayetteville, Ark.	KHOG	1440
	KFAY	1250
Fayetteville, N.C.	WFAI	1230
	WFNC	940
	WFLB	1490
	WIDU	1600
Fayetteville, Tenn.	WEKR	1240
Fergus Falls, Minn.	KOTE	1250

Location	C.L.	Kc.
Fernandina Beach, Fla.	WPAP	1570
Ferriday, La.	KFNV	1600
Festus, Mo.	KJCF	1400
Festus-St. Louis, Mo.	KXEN	1010
Findlay, Ohio	WFIN	1330
Fisher, W.Va.	WELD	690
Fitchburg, Mass.	WEIM	1280
	WFGM	960
Fitzgerald, Ga.	WBHB	1240
Flagstaff, Ariz.	KCLS	600
	KJKJ	1400
	KEOS	690
	KEOS	1290
Flat River, Mo.	KFMO	1240
Flint, Mich.	WFDF	910
	WTRX	1330
	WAMM	1420
	WMRP	1570
	WKMF	1470
	WTAC	600
Flomaton, Ala.	WTCB	990
Florence, Ala.	WJOI	1340
	WOWL	1240
Florence, S.C.	WJMX	970
	WOLS	1230
	WYNN	540
Floydada, Tex.	KFLD	900
Foley, Ala.	WHEP	1310
Fond du Lac, Wis.	KFIZ	1450
Fordyce, Ark.	KBJT	1570
Forest, Miss.	WMAG	860
Forest City, N.C.	WBBO	780
	WAGY	1320
Forest Grove, Ore.	KWAY	1570
Forrest City, Ark.	KXJK	950
Ft. Atkinson, Wis.	WFAW	940
Ft. Bragg, Calif.	KDAC	1230
Ft. Campbell, Ky.	WABD	1370
Ft. Collins, Colo.	KCOL	1410
	KZIX	600
Ft. Dodge, Iowa	KVFD	1400
	KWMT	540
Ft. Knox, Ky.	WSAC	1470
Ft. Lauderdale, Fla.	WFTL	1400
	WWIL	1580
Ft. Madison, Iowa	KXGI	1360
Ft. Morgan, Colo.	KFTM	1400
Ft. Myers, Fla.	WINK	1240
	WMYR	1410
	WCAI	1350
Ft. Payne, Ala.	WFPA	1400
	WZOB	1250
Ft. Pierce, Fla.	WARN	1330
	WIRA	1490
Ft. Scott, Kans.	KMDO	1600
Ft. Smith, Ark.	KFPW	1230
	KFSA	950
	KTCS	1410
	KWHN	1320
Ft. Stockton, Tex.	KFST	860
Ft. Valley, Ga.	WFPM	1150
Ft. Walton Beach, Fla.	WNUE	1400
	WFTW	1260
Ft. Wayne, Ind.	WGL	1250
	WOWO	1190
	WANE	1450
	WKJG	1380
Ft. Worth, Tex.	KJIM	870
	KCUL	1540
	KFJZ	1270
	KNOK	970
	WBAP	570
	WBAP	820
	KXOL	1360
Fostoria, Ohio	WFOB	1430
Fountain City, Tenn.	WGYW	1430
	WROL	1490
Fountain Inn, S.C.	WFIS	1600
Fowler, Calif.	KLIP	1220
Framingham, Mass.	WKOX	1190
Frankfort, Ind.	WILO	1570
Frankfort, Ky.	WFKY	1490
Franklin, Ky.	WFKN	1220
Franklin, La.	KFRA	1390
Franklin, N.C.	WFSC	1050
Franklin, N.H.	WFTN	1240
Franklin, Pa.	WFRA	1430
Franklin, Tenn.	WAGG	950
Franklin, Va.	WYSR	1250
Frederick, Md.	WFMD	930
Frederick, Okla.	KTAT	1570
Fredericksburg, Tex.	KNAF	910
Fredericksburg, Va.	WFVA	1230
	WFLS	1350
Fredericktown, Mo.	KFTW	1450
Fredonia, N.Y.	WBUZ	1570
Freeport, Ill.	WFRL	1570
Freeport, N.Y.	WGBB	1240
Freeport, Tex.	KBRZ	1460
Fremont, Mich.	WBFC	1490
	WSHN	1550
Fremont, Nebr.	KHUB	1340
Fremont, Ohio	WFRO	900
Fresno, Calif.	KARM	1430
	KBIF	900
	KIRV	1510

Location	C.L.	Kc.
	KEAP	980
	KXEX	1550
	KFRE	940
	KGST	1600
	KMAK	1340
	KMJ	580
	KYNO	1300
Front Royal, Va.	WFTR	1450
Frostburg, Md.	WFRB	560
Fulton, Ky.	WFUL	1270
Fulton, Mo.	KFAL	900
Fulton, N.Y.	WOSC	1300
Fuquay Sprgs., N.C.	WFVG	1460
Gadsden, Ala.	WGAD	1350
	WETO	930
	WAAX	570
	WEAC	1500
Gaffney, S.C.	WFGN	1570
Gainesville, Fla.	WDVH	980
	WGGG	1230
	WRUF	850
Gainesville, Ga.	WGGA	550
	WDUN	1240
	WLBA	1580
Gainesville, Tex.	KGAF	1580
Gaithersburg, Md.	WHMC	1150
Galax, Va.	WBOB	1360
Galesburg, Ill.	WGIL	1400
	WAIK	1590
Gallatin, Tenn.	WHIN	1010
Gallipolis, Ohio	WJEH	990
Gallup, N. Mex.	KGAK	1330
	KYVA	1230
Galveston, Tex.	KILE	1400
	KGBC	1540
Gander, Nfld.	CBG	1450
Garden City, Kans.	KNCO	1050
	KIUL	1240
Garden City, Mich.	WERB	1090
Gardner, Mass.	WGAW	1340
Gary, Ind.	WWCA	1270
	WLTH	1370
Gastonia, N.C.	WGNC	1450
	WLTC	1370
Gate City, Va.	WGAT	1050
Gaylord, Mich.	WATC	900
Geneseo, Ill.	WGEN	1500
Geneva, Ala.	WGEA	1150
Geneva, Ill.	WGSB	1480
Geneva, N.Y.	WGVA	1240
Georgetown, Del.	WJWL	900
Georgetown, Ky.	WAXU	1580
Georgetown, S.C.	WGTN	1400
	WGOO	1470
Georgetown, Tex.	KGTN	1530
Gettysburg, Pa.	WGET	1320
Gillette, Wyo.	KIML	1490
Gilroy, Calif.	KPER	1290
Gladewater, Tex.	KEES	1430
Glasgow, Ky.	WKAY	1490
	WCDS	1440
Glasgow, Mont.	KLTZ	1240
Glen Burnie, Md.	WISZ	1590
Glendale, Ariz.	KRUX	1360
Glendale, Calif.	KIEV	870
Glendive, Mont.	KXGN	1400
	KGLE	590
Glennallen, Alaska	KCAM	790
Glens Falls, N.Y.	WSET	1410
	WWSC	1450
Glenville, Ga.	WKIG	1580
Glenwood Sprgs., Colo.	KGLN	980
Globe, Ariz.	KZOW	1240
Gloucester, Va.	WDDY	1420
Gloversville-Johnston, N.Y.	WENT	1340
Gold Beach, Oreg.	KBLY	1220
Golden, Colo.	KICM	1250
Golden Meadow, La.	KLEB	1600
Golden Valley, Minn.	KQRS	1440
	KUXL	1570
Goldsboro, N.C.	WFMC	730
	WGBR	1150
	WGOL	1300
Gonzales, Tex.	KCTI	1450
Goodland, Kans.	KLOE	730
Goshen, Ind.	WKAM	1460
Gouverneur, N.Y.	WIGS	1230
Grafton, N.D.	KGPC	1340
Grafton, W.Va.	WVVW	1260
Graham, Tex.	KSWA	1330
Grand Coulee, Wash.	KFDR	1360
Grand Forks, N.D.	KFJM	1370
	KILO	1440
	KNOX	1310
Grand Haven, Mich.	WGHN	1370
Grand Island, Nebr.	KMMJ	750
	KRGI	1430
Grand Junction, Colo.	KREX	920
	KEXO	1230
	KSTR	620
	KWSL	1340
Grand Prairie, Tex.	KPCW	730
Grand Rapids, Mich.		

Location	C.L.	Kc.
	WJEF	1230
	WFUR	1570
	WGRD	1410
	WLAV	1340
	WMAX	1480
	WOOD	1300
Grand Rapids, Minn.	KOZY	1490
Grangeville, Idaho	KORT	1230
Granite City, Ill.	WGNU	920
Granite Falls, N. C.	WKJK	1580
Grants, N.Mex.	KMIN	980
Grants Pass, Oreg.	KAGI	930
	KAJO	1270
Grayson, Ky.	WGOH	1370
Gt. Barrington, Mass.	WSBS	860
Gt. Bend, Kans.	KVGB	1590
Gt. Falls, Mont.	KFBB	1310
	KUDI	1450
	KMON	560
	KARR	1400
Greeley, Colo.	KFKA	1310
	KYOU	1450
Green Bay, Wis.	WBAY	1360
	WJPG	1440
	WDUZ	1400
Greeneville, Tenn.	WGRV	1340
	WSMG	1450
Greenfield, Mass.	WHAI	1240
Greensboro, N.C.	WBIG	1470
	WCOG	1320
	WEAL	1510
	WKTB	1550
	WGBG	1400
	WPET	950
Greenburg, Ind.	WGRB	1330
Greensburg, Pa.	WHJB	620
Greenville, Ala.	WGYV	1380
Greenville, Ky.	WKYF	1600
Greenville, Mich.	WPLB	1380
Greenville, Miss.	WJPR	1330
	WDOT	900
	WGVM	1260
Greenville, Pa.	WGRP	940
Greenville, N.C.	WGTC	1590
	WOOW	1340
	WPXY	1550
Greenville, S.C.	WESC	660
	WFBC	1330
	WMRB	1490
	WMUU	1260
	WQOK	1440
Greenville, Tex.	KGVL	1400
Greenwich, Conn.	WGCH	1490
Greenwood, Miss.	WABG	960
	WGRM	1240
	WLWF	1540
Greenwood, S.C.	WCRS	1450
	WGSW	1350
Greer, S.C.	WEAB	800
	WCKI	1300
Grenada, Miss.	WNAG	1400
Gresham, Oreg.	KRDR	1230
Gretna, Va.	WMNA	730
Griffin, Ga.	WKEU	1450
	WHIE	1320
	WRIX	1410
Grinnell, Iowa	KGRN	1410
Groton, Conn.	WSUB	980
Grove City, Pa.	WSAJ	1340
Grundy, Va.	WNRG	940
Guayama, P.R.	WXRF	1590
Gulfport, Miss.	WROA	1390
	WGCM	1240
Gunnison, Colo.	KGUC	1490
Guntersville, Ala.	WGSV	1270
Guthrie, Okla.	KWRW	1490
Guymon, Okla.	KGYN	1220
Hagerstown, Md.	WARK	1490
	WJEJ	1240
Haines City, Fla.	WHAN	930
Haleyville, Ala.	WJBB	1230
Halfway, Md.	WHAG	1410
Hamden, Conn.	WDEE	1220
Hamilton, Ala.	WERH	970
Hamilton, Mont.	KYLQ	980
Hamilton, Ohio	WMOH	1450
	WCNW	1560
Hamilton, Tex.	KCLW	900
Hamlet, N. C.	WKDX	1250
Hammond, Ind.	WJOB	1230
Hammond, La.	WFPR	1400
Hammonton, N.J.	WNJH	1580
Hampton, S.C.	WBHC	1270
Hampton, Va.	WVEC	1490
Hancock, Mich.	WMPL	920
Hanford, Calif.	KNGS	620
Hannibal, Mo.	KHMO	1070
Hanover, N.H.	WTSL	1400
	WDCR	1340
Hanover, Pa.	WHVR	1280
Hardin, Mont.	KHDN	1230
Harlan, Ky.	WHLN	1410
Harlingen, Tex.	KGBT	1530
Harriman, Tenn.	WHBT	1600
Harrisburg, Ill.	WEBQ	1240
Harrisburg, Pa.	WFEC	1400
	WCMB	1460
	WHP	580
	WKBO	1230
Harrison, Ark.	KHOZ	900

Location	C.L.	Kc.
Harrisonburg, Va.	WHBG	1360
	WSVA	550
Harrodsburg, Ky.	WHBN	1420
Hartford, Conn.	WDRC	1360
	WCCC	1290
	WPOP	1410
	WTIC	1080
Hartford, Wis.	WTKM	1540
Hartselle, Ala.	WHRT	860
Hartsville, S.C.	WHSC	1450
Hartwell, Ga.	WKLY	980
Harvard, Ill.	WMCW	1600
Harvey, Ill.	WBEE	1570
Hastings, Mich.	WBCH	1220
Mastings, Minn.	KDWA	1460
Hastings, Nebr.	KHAS	1230
	KICS	1550
Hattiesburg, Miss.	WBKH	950
	WFOR	1400
	WHSY	1230
	WXXX	1310
Havelock, N.C.	WUSM	1330
Haverhill, Mass.	WHAV	1490
Havre, Mont.	KOJM	610
Havre de Grace, Md.	WASA	1330
Hawkinsville, Ga.	WCEH	610
Haynesville, La.	KLUV	1580
Hays, Kans.	KAYS	1400
Hayward, Wis.	WHSM	910
Hazard, Ky.	WKIC	1390
Hazelhurst, Ga.	WVOH	920
Hazlehurst, Miss.	WMDC	1220
Hazleton, Pa.	WAZL	1490
	WTHT	1300
Helena, Ark.	KFFA	1360
Helena, Mont.	KCAP	1340
	KBLL	1240
Hemet, Calif.	KHSJ	1320
Hempstead, N.Y.	WHLI	1100
Henderson, Ky.	WSON	860
Henderson, Nev.	KBMI	1400
	KTOO	1280
Henderson, N.C.	WHNC	890
	WIZS	1450
Henderson, Tex.	KGRI	1000
	KWRD	1470
Hendersonville, N.C.	WHKP	1450
	WHVL	1600
Henryetta, Okla.	KHEN	1590
Hereford, Tex.	KPAN	860
Herkimer, N.Y.	WALY	1420
Hermiston, Oreg.	KOHU	1570
Herrin, Ill.	WJPF	1340
Hettinger, N.Dak.	KNDC	1490
Hibbing, Minn.	WMFG	1240
Hickory, N.C.	WHKY	1290
	WIRC	630
	WSPF	1000
Highland, Ill.	WINU	1510
Highland Park, Ill.	WEEF	1430
Highland Park, Tex.	KVIL	1150
Highland Springs, Va.	WENZ	1450
High Point, N.C.	WMFR	1230
	WNOS	1590
	WHPE	1070
Hillsboro, Ohio	WSRW	1590
Hillsboro, Oreg.	KUIK	1360
Hillsboro, Tex.	KHBR	1560
Hillsdale, Mich.	WCSR	1340
Hillsville, Va.	WHHV	1400
Hilo, Hawaii	KHBC	970
	KIPA	1110
	KIMO	850
Hinesville, Ga.	KGML	990
Hinton, W. Va.	WMTD	1380
Hobbs, N.Mex.	KWEW	1480
	KHOB	1390
Holbrook, Ariz.	KDJI	1270
Holdenville, Okla.	KVYL	1370
Holdredge, Nebr.	KUVR	1380
Holland, Mich.	WHTC	1450
	WJBL	1260
Hollister, Calif.	KGHT	1520
Hollywood, Fla.	WGMA	1320
Holly Hill, S.C.	WHHL	1440
Holyoke, Mass.	WREB	930
Homer, La.	KHAL	1320
Homestead, Fla.	WIII	1430
Homewood, Ala.	WJLD	1400
Honolulu, Hawaii	KAIM	870
	KGMB	590
	KZOO	1210
	KHAI	1090
	KPOI	1380
	KIKI	830
	KGU	760
	KHVH	1040
	KNDI	1270
	KOHO	1170
	KOLL	1420
	KORL	650
	KTRG	990
	KULA	690
Hood River, Oreg.	KIHR	1340
Hope, Ark.	KXAR	1490
Hopewell, Va.	WHAP	1340
Hopkinsville, Ky.	WHOP	1230
	WKOA	1480
Hoquiam, Wash.	KHOK	1560

WHITE'S RADIO LOG

Location	C.L.	Kc.
Hornell, N.Y.	WWHG	1320
	WLEA	1480
Hot Springs, Ark.	KAAB	1340
	KBHS	590
	KZNG	1470
Hot Springs, S.Dak.		
	KOBH	580
Houghton, Mich.	WHDF	1400
Houghton Lake, Mich.		
	WHGR	1290
Houlton, Maine	WHOU	1340
Houma, La.	KCIL	1490
Houston, Miss.	WCPC	940
Houston, Mo.	KTBC	1250
Houston, Tex.	KCOH	1430
	KILT	610
	KNUZ	1230
	KODA	1010
	KPRC	950
	KTHT	790
	KTRH	740
	KXYZ	1320
	KYOK	1590
Howell, Mich.	WHMI	1350
Hudson, N.Y.	WHUC	1230
Hugo, Okla.	KIHN	1340
Humacao, P.R.	WALO	1240
Humboldt, Tenn.	WIRJ	740
Huntingdon, Pa.	WHUN	1150
Huntington, Ind.	WHLT	1300
Huntington, N.Y.	WGSM	740
Huntington, W.Va.		
	WKEE	800
	WSAZ	930
	WWHY	1470
Huntsville, Ala.	WBHP	1230
	WEUP	1600
	WFIX	1450
	WAAY	1550
Huntsville, Tex.	KSAM	1490
Huron, S.Dak.	KIJV	1340
Hutchinson, Kans.	KWBW	1450
	KWHK	1260
Hutchinson, Minn.	KDUZ	1260
Hyde Park, N.Y.	WHVW	950
Idabel, Okla.	KBEL	1240
Idaho Falls, Idaho	KID	590
	KTEE	1260
Immokalee, Fla.	WCOF	1490
Independence, Ia.	KUPI	980
	KOUR	1220
Independence, Kans.		
	KIND	1010
Independence, Mo.	KCCX	1510
Indiana, Pa.	WDAD	1450
Indianapolis, Ind.	WATI	810
	WBRI	1500
	WFBM	1260
	WGEE	1590
	WIBC	1070
	WIFE	1310
	WIRE	1430
	WXLW	950
Indianola, Iowa	KBAB	1490
Indianola, La.	KBAB	1490
Indianola, Miss.	WNLA	1380
Indian Rocks Beach, Fla.		
	WGNP	1520
Indio, Calif.	KREO	1400
Inglewood, Calif.	KTYM	1460
Inkster, Mich.	WCHB	1440
International Falls, Minn.		
	KGHS	1230
Iola, Kansas	KALN	1370
Ionia, Mich.	WION	1430
Iowa City, Iowa	KXIC	800
	WSUI	910
Iowa Falls, Iowa	KFIG	1510
Iron Mtn., Mich.	WMIQ	1450
Irondale, Ala.	WIXI	1480
Ironton, Ohio	WIRO	1230
Ironwood, Mich.	WJMS	630
Irvine, Ky.	WIRV	1550
Isabella, P.R.	WISA	1390
Ishpeming, Mich.	WJPD	1240
	WJAN	970
Islip, N.Y.	WBIC	540
Ithaca, N.Y.	WHCU	870
	WTKO	1470
Iuka, Miss.	WVOM	1270
Jackson, Ala.	WTHG	1290
Jackson, Mich.	WIBM	1450
	WKHM	970
	WJCO	1510
Jackson, Miss.	WJDX	620
	WJQS	1400
	WJXN	1450
	WJAQ	1550
	WOKJ	1590

Location	C.L.	Kc.
	WRBC	1300
	WSLI	930
Jackson, Ohio	WLMJ	1280
Jackson, Tenn.	WDXI	1310
	WJAK	1460
	WTJS	1390
Jackson, Wis.	WYLO	540
Jackson, Wyo.	KSGT	1340
Jacksonville, Ark.	KGMR	1500
Jacksonville, Fla.	WJAX	930
	WAPE	690
	WZOK	1320
	WIVY	1050
	WMBR	1460
	WOBS	1360
	WPDQ	600
	WQIK	1280
	WRHC	1400
Jacksonville, Ill.	WJIL	1550
	WLDS	1180
Jacksonville, N.C.	WJNC	1240
	WLAS	910
Jacksonville, Tex.	KEBE	1400
Jacksonville Bch., Fla.		
	WBIX	1010
Jamestown, N.Dak.	KEYJ	1400
	KSJB	600
Jamestown, N.Y.	WJTN	1240
	WKSN	1340
Jamestown, Tenn.	WCLC	1260
Janesville, Wis.	WCLO	1230
Jasper, Ala.	WWWB	1360
	WARF	1240
Jasper, Ind.	WITZ	990
Jasper, Tex.	KTXJ	1350
Jefferson City, Mo.	KLIK	950
	KWOS	1240
Jefferson City, Tenn.		
	WJFC	1480
Jeffersonville, Ind.	WXVW	1450
Jena, La.	KCKW	1480
Jennings, La.	KJEF	1290
Jerome, Idaho	KART	1400
Jerseyville, Ill.	WJBM	1480
Jesup, Ga.	WBGR	1370
John Day, Ore.	KJDY	1400
Johnson City, Tenn.		
	WJCW	910
	WETB	790
Johnston, S.C.	WJES	250
Johnstown, Pa.	WJAC	850
	WARD	1490
	WCRO	1230
Joliet, Ill.	WJOL	1340
	WJRC	1510
Joliette, Que.	CJLM	1350
Jonesboro, Ark.	KBTM	1230
	KNEA	970
Jonesboro, La.	KTOC	920
Jonesboro, Tenn.	WJSO	1590
Jonesville, La.	KANV	1480
Joplin, Mo.	WMBH	1450
	KQYX	1560
	KFSB	1310
	KODE	1230
Junction, Tex.	KMBL	1450
Junc. City, Kans.	KJCK	1420
Juneau, Alaska	KINY	800
	KJNO	630
Kailua, Hawaii	KLEI	1130
Kalamazoo, Mich.	WKPR	1420
	WKZO	590
	WKLZ	1470
	WKMI	1360
Kalispell, Mont.	KGEZ	800
	KOFI	930
Kane, Pa.	WADP	960
Kankakee, Ill.	WKAN	1320
Kannapolis, N.C.	WGTL	870
	WRKB	1460
Kans. City, Kans.	KCKN	1340
Kansas City, Mo.	KCMO	810
	KMBC	980
	KPRS	1590
	WDAF	610
	WHB	710
Kenedy-Karnes City, Texas		
	KAML	990
Kealakekua, Hawaii	KEKO	790
Kearney, Nebr.	KGFW	1340
	KRNY	1460
Keene, N.H.	WKNE	1290
	WKBK	1220
Kelso, Wash.	KLOG	1490
Kemmerer, Wyo.	KMER	950
Kendallville, Ind.	WAWK	1570
Kenedy, Tex.	KAML	990
Kennett, Mo.	KBOA	830
	KBXN	1540
Kennewick-Pasco-Richland, Wash.	KEPR	610
Kenosha, Wis.	WLIP	1050
Kent, O.	WKNT	1520
Keokuk, Iowa	KOKX	1310
Kermit, Tex.	KERB	600
Kerrville, Tex.	KERV	1230
Kershaw, S.C.	WKSC	1300
Ketchikan, Alaska	KTKN	930
Kewanee, Ill.	WKEI	1450
Keyser, W.Va.	WKYR	1270
	WKLP	1390
Key West, Fla.	WKWF	1600
	WKIZ	1500

Location	C.L.	Kc.
Kilgore, Tex.	KOCA	1240
Killeen, Tex.	KLEN	1050
Kimball, Nebr.	KIMB	1260
King, N.C.	WKTE	1090
King City, Calif.	KRKC	1490
Kingman, Ariz.	KAAA	1230
Kings Mountain, N.C.		
	WKMT	1220
Kingsport, Tenn.	WKIN	1320
	WKPT	1550
Kingston, N.Y.	WBAZ	1550
	WGHQ	920
	WKNY	1490
Kingstree, S.C.	WDKD	1310
Kingsville, Tex.	KINE	1330
Kinston, N.C.	WELS	1010
	WFTC	960
	WISP	1230
Kirkland, Wash.	KYAC	1460
	KNBX	1050
Kirksville, Mo.	KIRX	1450
Kissimmee, Fla.	WOSL	1220
Kittanning, Pa.	WACB	1380
Klamath Falls, Oreg.		
	KAGO	1150
	KFLW	1450
	KLAD	960
Knoxville, Iowa	KNIA	1320
Knoxville, Tenn.	WBIR	1240
	WIVK	860
	WATE	620
	WKXV	900
	WNOX	990
	WROL	1490
Kokomo, Ind.	WIOU	1350
Kosciusko, Miss.	WKOZ	1350
Laconia, N.H.	WLNH	1350
	WEMJ	1490
LaCrosse, Wis.	WKBH	1410
	WLCX	1490
	WKTY	580
Ladysmith, Wis.	WLDY	1340
Lafayette, Ga.	WLFA	1590
Lafayette, Ind.	WASK	1450
	WAZY	1410
	WBAA	920
Lafayette, La.	KPEL	1420
	KVOL	1330
	KXKW	1520
Lafayette, Tenn.	WEEN	1460
LaFollette, Tenn.	WLAF	1450
LaGrande, Oreg.	KLBM	1450
LaGrange, Ga.	WLAG	1240
	WTRP	620
LaGrange, Ill.	WTAQ	1300
LaGrange, Tex.	KVLG	1570
LaJunta, Colo.	KBZZ	1400
Lake Charles, La.	KLOU	1580
	KPLC	1470
	KAOK	1400
Lake City, Fla.	WDSR	1340
	WGRO	960
Lake City, S.C.	WJOT	1260
Lake Geneva, Wis.	WMIR	1550
Lakeland, Fla.	WLAK	1430
	WONN	1230
	WWAB	1330
Lake Placid, N.Y.	WIRD	920
Lake Providence, La.	KLPL	1050
Lake Tahoe, Calif.	KOWL	1490
Lakeview, Oreg.	KQIK	1230
Lake Wales, Fla.	WIPC	1280
Lakewood, Colo.	KLAK	1600
Lakewood Center, Wash.		
	KFHA	1480
Lake Worth, Fla.	WLIZ	1380
Lamar, Colo.	KLMR	920
Lamesa, Tex.	KPET	690
Lampasas, Tex.	KCYL	1450
Lancaster, Calif.	KAVL	610
	KBVM	1380
Lancaster, N.Y.	WMMJ	1300
Lancaster, Ohio	WHOK	1320
Lancaster, Pa.	WGAL	1490
	WLAN	1390
Lancaster, S.C.	WLCM	1360
	WAGL	1560
Lander, Wyo.	KOVE	1330
Lanett, Ala.	WRLD	1490
Lansdale, Pa.	WNPV	1440
Lansford, Pa.	WLSH	1410
Lansing, Mich.	WILS	1320
	WJIM	1240
	WITL	1010
Lapeer, Mich.	WMPC	1230
	WTHM	1530
LaPorte, Ind.	WLOI	1540
Laramie, Wyo.	KLME	1490
	KOWB	1290
Laredo, Tex.	KGNS	1300
	KVOZ	1490
Larned, Kans.	KANS	1510
LaSalle, Ill.	WLPO	1220
LasCruces, N.Mex.	KOBE	1450
	KGRT	570
Las Vegas, Nev.	KENO	1460
	KLAV	1230
	KORK	1340
	KRAM	920
	KLUC	1050
	KVEG	970
Las Vegas, N.Mex.	KFUN	1230
Latrobe, Pa.	WPKV	1570

Location	C.L.	Kc.
	WQTW	1570
	WTRA	1480
Laurel, Miss.	WAML	1340
	WLAU	1600
	WNSL	1260
Laurens, S.C.	WLBG	860
Laurinburg, N.C.	WEWO	1080
	WLNC	1300
Lawrence, Kans.	KFKU	1250
	KLWN	1320
Lawrence, Mass.	WCCM	800
Lawrenceburg, Tenn.		
	WDXE	1370
Lawrenceville, Ga.	WLAW	1360
Lawrenceville, Ill.	WAKO	910
Lawrenceville, Va.	WLES	580
Lawton, Okla.	KSWO	1380
	KCCO	1050
Leadville, Colo.	KBRR	1230
Leaksville, N.C.	WLOE	1490
Leavenworth, Kans.	KCLO	1410
Lebanon, Ky.	WLBN	1590
Lebanon, Mo.	KLWT	1230
Lebanon, Oreg.	KGAL	920
Lebanon, Pa.	WLBR	1270
Lebanon, Tenn.	WCOR	900
Leesburg, Fla.	WLBE	790
	WBIL	1410
Leesburg, Va.	WAGE	1290
Leesville, La.	KLLA	1570
Lehighton, Pa.	WYNS	1150
Leitchfield, Ky.	WMTL	1580
Leland, Miss.	WESY	1580
LeMars, Iowa	KLEM	1410
Lemoore, Calif.	KLAN	1320
	KOAD	1240
Lenoir, N.C.	WJRI	1340
Lenoir, Tenn.	WLIL	730
Leonardtown, Md.	WKIK	1370
Levelland, Tex.	KLVT	1230
Levittown, Pa.	WBCB	1490
Lewisburg, Pa.	WUNS	1010
Lewisburg, Tenn.	WJJM	1490
Lewiston, Idaho	KRLC	1350
	KOZE	1300
Lewiston, Maine	WCOU	1240
	WLAM	1470
Lewistown, Mont.	KXLO	1230
Lewistown, Pa.	WKVA	920
	WMRF	1490
Lexington, Ky.	WLAP	630
	WBLG	1300
	WVLK	590
Lexington, Miss.	WXTN	1150
Lexington, Mo.	KLEX	1570
Lexington, Nebr.	KRVN	1010
Lexington, N.C.	WBUY	1440
Lexington, Tenn.	WDXL	1490
Lexington, Va.	WREL	1450
Lexington Pk., Md.	WPTX	920
Libby, Mont.	KLCB	1230
	KLIB	1470
Liberal, Kans.	KSCB	1270
Liberty, Ky.	WPHN	1560
Liberty, N.Y.	WVOS	1240
Liberty, Tex.	KFAZ	1050
Lihue, Hawaii	KTOH	1490
Lima, Ohio	WIMA	1150
	WCIT	940
Lincoln, Ill.	WPRC	1370
Lincoln, Me.	WLKN	1450
Lincoln, Nebr.	KFOR	1240
	KLIN	1400
	KLMS	1480
	KNBE	1530
Lincolnton, N.C.	WLON	1050
Linton, Ind.	WBTO	1600
Litchfield, Ill.	WSMI	1540
Litchfield, Minn.	KLFD	1410
Little Falls, Minn.	KLTF	960
Little Falls, N.Y.	WLFH	1230
Littlefield, Tex.	KZZN	1490
Little Rock, Ark.	KARK	920
	KALO	1250
	KLRA	1010
	KOKY	1440
	KAAY	1090
	KVLC	1050
Littleton, Colo.	KMOR	1510
Littleton, N. H.	WLTN	1400
Live Oak, Fla.	WNER	1250
Livingston, Mont.	KPRK	1340
Livingston, Tenn.	WLIV	920
Livingston, Tex.	KETX	1440
	KVLL	1220
Lock Haven, Pa.	WBPZ	1230
Lockport, N.Y.	WUSJ	1340
Lodi, Calif.	KCVR	1570
Logan, Utah	KVNU	610
	KSTU	1300
	KLGN	1390
Logan, W.Va.	WLOG	1230
	WVOW	1290
Logansport, Ind.	WSAL	1230
Lompoc, Calif.	KKOK	1410
	KLOM	1330
	KNEZ	960
London, Ky.	WFTG	1400
Long Beach, Calif.	KFOX	1280
	KGER	1390
Longmont, Colo.	KLMO	1050
Long Prairie, Minn.	KEYL	1400

Location	C.L.	Kc.
Longview, Tex.	KFRO	1370
	KLUE	1280
Longview, Wash.	KEDO	1400
	KBAM	1270
Lookout Mtn., Tenn.	WFLI	1070
Lorain, Ohio	WWIZ	1380
Loris, S.C.	WLSC	1570
Los Alamos, N.Mex.	KRSN	1490
Los Angeles, Calif.	KABC	790
	KFI	640
	KHJ	930
	KFWB	980
	KGFJ	1230
	KFAC	1330
	KLAC	570
	KMPC	710
	KNX	1070
	KPOL	1540
	KGBS	1020
	KRKD	1150
Los Banos, Calif.	KLBS	1330
Louisburg, N.C.	WYRN	1480
Louisville, Ga.	WPEH	1420
Louisville, Ky.	WAVE	970
	WAKY	790
	WHAS	840
	WKLO	1080
	WINN	1240
	WKYW	900
	WLOU	1350
	WTMT	620
Louisville, Miss.	WLSM	1270
Loveland, Colo.	KLOV	1570
Loves Park, Ill.	WLUV	1520
Lovington, N.Mex.	KLEA	630
Lowell, Mass.	WCAP	980
	WLLH	1400
Lubbock, Tex.	KCBD	1590
	KDAV	580
	KLBK	1000
	KFYO	790
	KLLL	1460
	KSEL	950
Lucedale, Miss.	WHHT	1440
Ludington, Mich.	WKLA	1450
Lufkin, Tex.	KRBA	1340
	KTRE	1420
Lumberton, N.C.	WAGR	580
	WTSB	1340
Luray, Va.	WRAA	1330
Lynchburg, Va.	WLVA	590
	WDMS	1320
	WWOD	1390
	WBRG	1050
Lynn, Mass.	WLYN	1360
Lyons, Ga.	WBBT	1340
Macomb, Ill.	WKAI	1510
Macon, Ga.	WBML	1240
	WCRY	900
	WIBB	1280
	WMAZ	940
	WNEX	1400
Macon, Miss.	WMBC	1400
Madawaska, Me.	WSJR	1230
Madera, Calif.	KHOT	1250
Madill, Okla.	KMAD	1550
Madison, Fla.	WMAF	1230
Madison, Ga.	WYTH	1250
Madison, Ind.	WORX	1270
Madison, S.D.	KJAM	1390
Madison, Tenn.	WENO	1430
Madison, Wis.	WHA	750
	WIBA	1310
	WISM	1480
	WKOW	1070
Madisonville, Ky.	WFMW	730
	WTTL	1310
Magee, Miss.	WSJC	790
Magnolia, Ark.	KVMA	630
Makawao, Hawaii	KNUI	1310
Malden, Mo.	KTCB	1470
Malone, N.Y.	WICY	1490
Malvern, Ark.	KBOK	1310
Manassas, Va.	WPRW	1460
Manati, P.R.	WMNT	1500
Manchester, Conn.	WINF	1230
Manchester, Ga.	WFDR	1370
Manchester, Ky.	WWXL	1450
Manchester, N.H.	WFEA	1370
	WGIR	610
	WKBR	1250
Manchester, Tenn.	WMSR	1320
Manhattan, Kans.	KSAC	580
	KMAN	1350
Manistee, Mich.	WMTE	1340
Manitou Springs, Colo.		
	KCMS	1490
Manitowoc, Wis.	WCUB	980
	WOMT	1240
Mankato, Minn.	KYSM	1230
	KTOE	1420
Manning, S.C.	WYMB	1410
Mansfield, La.	KDXI	1360
Mansfield, Ohio	WMAN	1400
	WCLW	1570
Maplewood, Minn.	WRCR	1010
Maquoketa, Iowa	KMAQ	1320
Marathon, Fla.	WFFG	1300
Marianna, Ark.	KZOT	1460

Location	C.L.	Kc.
Marianna, Fla.	WTYS	1340
	WTOT	980
Marietta, Ga.	WFOM	1230
	WBIE	1080
Marietta, Ohio	WMOA	1490
	WBRJ	910
Marine City Mich.	WDOG	1590
Marinette, Wis.	WMAN	570
Marion, Ala.	WJAM	1310
Marion, Ill.	WGGH	1150
Marion, Ind.	WBAT	1400
	WMRI	860
Marion, N.C.	WBRM	1250
Marion, Ohio	WMRN	1490
Marion, S.C.	WATP	1430
Marion, Va.	WMEV	1010
	WOLD	133
Marked Tree, Ark.	KPCA	1580
Marksville, La.	KAPB	1370
Marlborough, Mass.	WSRO	1470
Marquette, Mich.	WDMJ	1320
Marshall, Mich.	WMRR	1540
Marshall, Minn.	KMHL	1400
Marshall, Mo.	KMMO	1300
Marshall, N.C.	WMMH	1460
Marshall, Tex.	KMHT	1450
	KADO	1410
Marshalltown, Iowa	KFJB	1230
Marshfield, Wis.	WDLB	1450
Martin, Tenn.	WCMT	1410
Martinsburg, W.Va.	WEPM	1340
Martinsville, Va	WHEE	1370
	WMVA	1450
Marystown, Nfld. Can.		
	CHCM	560
Marysville, Calif.	KMYC	1410
Marysville, Kans	KNDY	1570
Maryville, Tenn.	WGAP	1400
Mason City, Iowa	KGLO	1300
	KRIB	1490
	KSMN	1010
Massena, N.Y.	WMSA	1340
	WSTS	1050
Massillon, Ohio	WTIG	990
Matawan, W.Va.	WHJC	1360
Mattoon, Ill.	WLBH	1170
Mauston, Wis.	WRJC	1270
Mayaguez, P.R.	WAEL	600
	WKJB	710
	WORA	760
	WPRA	990
	WTIL	1300
Mayfield, Ky.	WNGO	1320
Mayodan, N.C.	WMYN	1420
Maysville, Ky.	WFTM	1240
McAlester, Okla.	KTMC	1400
	KNED	1150
McAllen, Tex.	KRIO	910
McCamey, Tex.	KAMY	1450
McComb, Miss.	WHNY	1250
	WAPF	980
McCook, Nebr.	KBRL	1300
	KWRV	1360
McGehee, Ark.	KVSA	1220
McKeesport, Pa.	WEDO	810
	WMCK	1360
McKenzie, Tenn.	WHDM	1440
McKinney, Tex.	KMAE	1600
McMinnville, Oreg.	KMCM	1260
McMinnville, Tenn.	WBMC	960
	WAKI	1230
McPherson, Kans.	KNEX	1540
McRae, Ga.	WDAX	1410
Mead, Wash.	KLFF	1590
Meadville, Pa.	WMGW	1490
Medford, Mass.	WHIL	1430
Medford, Oreg.	KMED	1440
	KSHA	860
	KDOV	1300
	KBOY	730
	KYJC	1230
Medford, Wis.	WIGM	1490
Media, Pa.	WXUR	690
Melbourne, Fla.	WMMB	1240
Memphis, Tenn.	WHBQ	560
	WHER	1430
	WMC	790
	WDIA	1070
	WMPS	680
	WLOK	1340
	WMQM	1480
	WREC	600
	KWAM	990
Mena, Ark.	KENA	1450
Menominee, Mich.	WAGN	1340
Menomonie, Wis.	WMNE	1360
Merced, Calif.	KYOS	1480
	KWIP	1580
Meriden, Conn.	WMMW	1470
Meridian, Miss.	WCOC	910
	WDAL	1330
	WMOX	1010
	WOKK	1450
	WQIC	1390
Merkle, Tex.	KWFA	1500
Merrill, Wis.	WXMT	730
Mesa, Ariz.	KBUZ	1310
	KALF	1510
Metropolis, Ill.	WMOK	920
Metter, Ga.	WMAC	1360
Mexia, Tex.	KBUS	1590

Location	C.L.	Kc.
Mexico, Mo.	KXEO	1340
Mexico, Pa.	WJUN	1220
Miami, Ariz.	KIKO	1340
Miami, Fla.	WGBS	710
	WIOD	610
	WFAB	990
	WMBM	1220
	WAME	1260
	WMIE	1140
	WQAM	560
	WSKP	1450
	WINZ	940
Miami, Okla.	KGLC	910
Miami Beach, Fla.		
	WMBM	1490
	WKAT	1360
	WFUN	790
Michigan City, Ind.	WIMS	1420
Middleport-Pomeroy, Ohio		
	WMPO	1390
Middlesboro, Ky.	WMIK	560
Middletown, Conn.	WCNX	1150
Middletown, N.Y.	WALL	1340
Middletown, Ohio	WPFB	910
Midland, Mich.	WMDN	1490
Midland, Tex.	KCRS	550
	KJBC	1150
Midland, Tex.	KWEL	1440
	KABH	1510
Milan, Tenn.	WKBJ	1600
Miles City, Mont.	KATL	1340
Milford, Conn.	WFIF	1500
Milford, Del.	WKSB	930
Milford, Mass.	WMRC	1490
Milledgeville, Ga.	WMVG	1450
Millen, Ga.	WGSR	1570
Millington, Tenn.	WGMM	1380
Millinocket, Me.	WMKR	1240
Millville, N.J.	WMVB	1440
Milton, Fla.	WEBY	1330
	WSRA	1490
Milton, Pa.	WMLP	1570
	WARC	1380
Milwaukee, Wis.	WEMP	1250
	WFOX	860
	WRIT	1340
	WISN	1150
	WMIL	1290
	WOKY	920
	WTMJ	620
Minden, La.	KASO	1240
Mineola, N.Y.	WFYI	1520
Mineola, Tex.	KMOO	1510
Mineral Wells, Tex.	KORC	1140
Minneapolis, Minn.	WCCO	830
	WLOL	1330
	WMIN	1400
	WDGY	1130
	WPBC	980
	WWTC	1280
	KTCR	690
	KTIS	900
	KUOM	770
	KSTP	1500
Minot, N. Dak.	KLPM	1390
	KHRT	1320
	KCJB	910
Mission, Kans.	KBEA	1480
Mission, Tex.	KIRT	1580
Missoula, Mont.	KGVO	1290
	KXLL	1450
	KQTE	1340
	KYSS	910
Mitchell, S.Dak.	KORN	1490
Moab, Utah	KURA	1450
Moberly, Mo.	KNCM	1230
Mobile, Ala.	WALA	1410
	WABB	1480
	WGOK	900
	WMOO	1550
	WTUF	840
	WKRG	710
	WLIQ	1360
	WMOZ	960
Mobridge, S.Dak.	KOLY	1300
Mocksville, N.C.	WDSL	1520
Modesto, Calif.	KTRB	860
	KBEE	970
	KFIV	1360
Mojave, Calif.	KDOL	1340
Moline, Ill.	WQUA	1230
Monahans, Tex.	KVKM	1330
Moncks Corner, S. C.		
	WBER	950
Monett, Mo.	KRMO	990
Monette, Ark.	KBIB	1560
Monmouth, Ill.	WRAM	1330
Monroe, Ga.	WMRE	1490
Monroe, La.	KMLB	1440
	KLIC	1230
	KNOE	540
Monroe, Mich.	WQTE	560
Monroe, N.C.	WMAP	1060
Monroe, Wis.	WEKZ	1260
Monroeville, Ala.	WMFC	1360
Monterey, Calif.	KIDD	630
	KMBY	1240
Montevideo, Minn.	KDMA	1460
Monte Vista, Colo.	KSLV	1240
Montezuma, Ga.	WMNZ	1050
Montgomery, Ala.	WBAM	740
	WCOV	1170
	WAPX	1600

Location	C.L.	Kc.
	WHHY	1440
	WMGY	800
	WRMA	950
Montgomery, W.Va.		
	WMON	1340
Monticello, Ark.	KHBM	1430
Monticello, Ky.	WFLW	1360
Montpelier-Barre, Vt.		
	WSKI	1240
Montrose, Colo.	KUBC	580
Montrose, Pa.	WPEL	1250
Mooresville, N.C.	WHIP	1350
Moorhead, Minn.	KVOX	1280
Morehead, Ky.	WMOR	1330
Morehead City, N.C.		
	WMBL	740
Morgan City, La.	KMRC	1430
Morganfield, Ky.	WMSK	1550
Morganton, N.C.	WMNC	1430
Morgantown, W.Va.	WAJR	1440
	WCLG	1300
Morrilton, Ark.	KVOM	800
Morris, Ill.	WCSJ	1550
Morris, Minn.	KMRS	1230
Morristown, N.J.	WMTR	1250
Morristown, Tenn.	WCRK	1150
	WMTN	1300
Morton, Tex.	KRAN	1280
Moscow, Idaho	KRPL	1400
Moses Lake, Wash.	KSEM	1470
	KWIQ	1260
Moss Point, Miss.	WACY	1460
Moulton, Ala.	WLCB	1530
Moultrie, Ga.	WMGA	1400
	WMTM	1300
Moundsville, W.Va.	WEIF	1370
Mountain Grove, Mo.	KLRS	1360
Mountain Home, Ark.		
	KTLO	1490
Mountain Home, Ida.		
	KFLI	1240
Mt. Airy, N.C.	WPAQ	740
	WSYD	1300
Mt. Carmel, Ill.	WVMC	1360
Mt. Clemens, Mich.		
	WBRB	1430
Mt. Dora, Fla.	WVGT	1580
Mt. Holly, N.J.	WJJZ	1460
Mt. Jackson, Va.	WSIG	790
Mt. Kisco, N.Y.	WVIP	1310
Mt. Olive, N.C.	WDJS	1430
Mt. Pleasant, Mich.	WCEN	1150
Mt. Pleasant, Tex.	KIMP	960
Mt. Shasta, Calif.	KWSD	620
Mt. Sterling, Ky.	WMST	1150
Mt. Vernon, Ill.	WMIX	940
Mt. Vernon, Ind.	WPCO	1590
Mt. Vernon, Ky.	WRVK	1460
Mt. Vernon, Ohio	WMVO	1300
Mt. Vernon, Wash.	KAPS	1470
	KBRC	1430
Muleshoe, Tex.	KMUL	1380
Mullins, S.C.	WJAY	1280
Muncie, Ind.	WLBC	1340
Munfordville, Ky.	WLOC	1150
Munising, Mich.	WMAB	1400
Murfreesboro, Tenn.	WGNS	1450
	WMTS	810
Murphy, N.C.	WCVP	600
	WKRK	1320
Murphysboro, Ill.	WINI	1420
Murray, Ky.	WNBS	1340
Murray, Utah	KMUR	1230
Muscatine, Iowa	KWPC	860
Muscle Shoals City, Ala.		
	WLAY	1450
Muskegon, Mich.	WKBZ	850
	WKJR	1520
	WTRU	1600
	WMUS	1090
Muskogee, Okla.	KBIX	1490
	KMUS	1380
Myrtle Beach, S.C.	WMYB	1450
Nacogdoches, Tex.	KEEE	1230
	KSFA	860
Nampa, Idaho	KFXD	580
	KAIN	1340
Nanticoke, Pa.	WNAK	730
Napa, Calif.	KVON	1440
Naples, Fla.	WNOG	1270
Narrows, Va.	WNRV	990
Nashua, N.H.	WOTW	900
	WSMN	1590
Nashville, Ark.	KBHC	1260
Nashville, Ga.	WNGA	1600
Nashville, Tenn.	WKDA	1240
	WLAC	1510
	WMAK	1300
	WNAH	1360
	WSIX	980
	WSM	650
	WWGM	1560
Nassau, Bahamas	ZNS-2	1240
Natchez, Miss.	WMIS	1240
	WNAT	1450
Natchitoches, La.	KNOC	1450
Naugatuck, Conn.	WOWW	860
Navasota, Tex.	KWBC	1550
Nebraska City, Nebr.		
	KNCY	1600
Needles, Calif.	KSFE	1340
Neenah, Wis.	WNAM	1280

WHITE'S RADIO LOG

Location	C.L.	Kc.
Neillsville, Wis.	WCCN	1370
Neon, Ky.	WNKY	1480
Neosho, Mo.	KBTN	1420
Nevada, Mo.	KNEM	1240
New Albany, Ind.	WNUW	1570
New Albany, Miss.	WNAU	1470
Newark, Del.	WNRK	1260
Newark, N.J.	WJRZ	970
	WNJR	1430
	WVNJ	620
Newark, N.Y.	WACK	1420
Newark, Ohio	WCLT	1430
New Bedford, Mass.	WBSM	1420
	WNBH	1340
New Bern, N.C.	WHIT	1450
	WRNB	1490
Newberry, S.C.	WKDK	1240
New Boston, Ohio	WIOI	1010
New Braunfels, Tex.	KGNB	1420
New Britain, Conn.	WHAY	910
	WRYM	840
New Brunswick, N.J.	WCTC	1450
Newburgh, N.Y.	WGNY	1220
Newburyport, Mass.	WNBP	1470
New Castle, Ind.	WCTW	1550
New Castle, Pa.	WKST	1280
Newcastle, Wyo.	KASL	1240
New Haven, Conn.	WAVZ	1300
	WELI	960
	WNHC	1340
New Iberia, La.	KANE	1240
	KVIM	1360
New Kensington, Pa.	WKPA	1150
New London, Conn.	WNLC	1510
New Martinsville, W.Va.	WETZ	1330
Newnan, Ga.	WCOH	1400
	WNEA	1300
New Orleans, La.	WDSU	1280
	WNNR	990
	WBOK	800
	WNOE	1060
	WSMB	1350
	WNPS	1450
	WTIX	690
	WWL	870
	WWOM	600
	WYLD	940
Newport, Ark.	KNBY	1280
Newport, Ky.	WNOP	740
Newport, N.H.	WCNL	1010
Newport, Oreg.	KNPT	1310
Newport, R.I.	WADK	1540
Newport, Tenn.	WLIK	1270
Newport, Vt.	WIKE	1490
Newport News, Va.	WGH	1310
	WTID	1270
Newport Richey, Fla.	WGUL	1500
New Richmond, Wis.	WIXK	1590
New Roads, La.	KWRG	1500
New Rochelle, N.Y.	WVOX	1460
New Smyrna Beach, Fla.	WSBB	1230
	WORT	1550
Newton, Iowa	KCOB	1280
Newton, Kans.	KJRG	950
Newton, Miss.	WBKN	1410
Newton, N.J.	WNNJ	1360
Newton, N.C.	WNNC	1230
New Ulm, Minn.	KNUJ	860
New York, N.Y.	WABC	770
	WADO	1280
	WBNX	1380
	WCBS	880
	WEVD	1330
	WHN	1050
	WHOM	1480
	WINS	1010
	WLIB	1190
	WMCA	570
	WNBC	660
	WNEW	1130
	WNYC	830
	WOR	710
	WPOW	1330
	WQXR	1560
Niagara Falls, N.Y.	WHLD	1270
	WJJL	1440
Nicholasville, Ky.	WNVL	1250
Niles, Mich.	WNIL	1290
Niles, Ohio	WNIO	1540
Nogales, Ariz.	KNOG	1340
Nome, Alaska	KICY	850
Norfolk, Nebr.	WJAG	780
Norfolk, Va.	WTAR	790
	WCMS	1050
	WNOR	1230
	WRAP	850
Normal, Ill.	WIOK	1440
Norman, Okla.	WNAD	640
	KNOR	1400
Norristown, Pa.	WNAR	1110
N. Adams, Mass.	WMNB	1230
N. Augusta, S.C.	WGUS	1380
	WFNL	1600
	WTHB	1550
North Bend, Oreg.	KFIR	1340
North Charleston, S.C.	WNCG	910
Northampton, Mass.	WHMP	1400
Northfield, Minn.	WCAL	770
N. Little Rock, Ark.	KOXE	1380
	KXLR	1150
North Platte, Nebr.	KJLT	970
	KNOP	1410
	KOOY	1240
No. Syracuse, N.Y.	WSOQ	1220
N. Vernon, Ind.	WOCH	1460
No. Wilkesboro, N.C.	WKBC	810
Norton, Kans.	KNBI	1530
Norton, Va.	WNVA	1350
Norwalk, Conn.	WNLK	1350
Norwich, Conn.	WICH	1310
Norwich, N.Y.	WCHN	970
Oakdale, La.	KREH	900
Oakes, N.Dak.	KEYD	1220
Oak Grove, La.	KWCL	1280
Oak Hill, W.Va.	WOAY	860
Oakland, Calif.	KEWB	910
	KABL	960
	KDIA	1310
Oakland, Md.	WMSG	1050
Oakland Park, Fla.	WIXX	1520
Oak Park, Ill.	WOPA	1490
Oak Ridge, Tenn.	WATO	1290
Ocala, Fla.	WMOP	900
	WTMC	1290
	WKOS	1370
Ocean City, Md.	WETT	1590
Ocean City, N. J.	WYKP	1520
Ocean City, Somers Pt., N.J.	WSLT	1520
Oceanlake, Oreg.	KBCH	1380
Oceanside, Calif.	KUDE	1320
Ocilla, Ga.	WSIZ	1380
Odessa, Tex.	KECK	920
	KOSA	1230
	KOYL	1310
	KRIG	1410
Oelwein, Iowa	KOEL	950
Ogallala, Nebr.	KOGA	930
Ogden, Utah	KLO	1430
	KANN	1250
	KSVN	730
	KVOG	1490
Ogdensburg, N.Y	WSLB	1400
Oil City, Pa.	WKRZ	1340
Okeechobee, Fla.	WOKC	1570
Okla. City, Okla.	KBYE	890
	KLPR	1140
	KOCY	1340
	KOMA	1520
	KTOK	1000
	KJEM	800
	WKY	930
Okmulgee, Okla.	KOKL	1240
Old Saybrook, Conn.	WLIS	1420
Olean, N.Y.	WMNS	1360
	WHDL	1450
Olney, Ill.	WVLN	740
Olympia, Wash.	KGY	1240
	KITN	920
Omaha, Nebr.	KBON	1490
	KFAB	1110
	KOIL	1290
	KOOO	1420
	KOWH	660
	WOW	590
Omak, Wash.	KOMW	680
Oneida, N.Y.	WMCR	1600
Oneida, Tenn.	WBNT	1310
O'Neill, Nebr.	KBRX	1350
Oneonta, Ala.	WCRL	1570
Oneonta, N.Y.	WDOS	730
Ontario, Calif.	KASK	1510
Ontario, Oreg.	KSRV	1380
Opelika, Ala.	WPHO	1400
Opelousas, La.	KSLO	1230
Opp, Ala.	WAMI	860
Opportunity, Wash.	KZUN	630
Orange, Mass.	WCAT	1390
Orange, Tex.	KOGT	1600
Orange, Va.	WJMA	1340
Orangeburg, S.C.	WDIX	1150
	WORG	1580
	WTND	920
Orange Park, Fla.	WAYR	550
Oregon City, Ore.	KYMN	1520
Orlando, Fla.	WDBO	580
	WHOO	990
	WHIY	1270
	WLOF	950
	WKIS	740
Ormond Bch., Fla.	WQXQ	1380
Orofino, Idaho	KLER	950
Oroville, Calif.	KAOR	1340
Ortonville, Minn.	KDIO	1350
Osage Bch., Mo.	KRMS	1150
Osceola, Ark.	KOSE	860
Oshkosh, Wis.	WOSH	1490
Oskaloosa, Iowa	KBOE	740
Oswego, N.Y.	WSGO	1440
Othello, Wash.	KRSC	1400
Otsego, Mich.	WDMC	980
Ottawa, Ill.	WCMY	1430
Ottawa, Kans.	KOFO	1220
Ottumwa, Iowa	KBIZ	1240
	KLEE	1480
Owatonna, Minn.	KRFO	1390
Owego, N.Y.	WEBO	1330
Owensboro, Ky.	WOMI	1490
	WVJS	1420
Owosso, Mich.	WOAP	1080
Oxford, Miss.	WSUH	1420
Oxford, N.C.	WOXF	1340
Oxnard, Calif.	KOXR	910
Ozark, Ala.	WOZK	900
Paducah, Ky.	WDXR	1560
	WKYX	570
	WPAD	1450
Page, Ariz.	KPGE	1340
Pahokee, Fla.	WRIM	1250
Painesville, Ohio	WPVL	1460
Paintsville, Ky.	WSIP	1490
Palatka, Fla.	WWPF	1260
	WSUZ	800
Palestine, Tex.	KNET	1450
Palm Bch., Fla.	WQXT	1340
Palm Sprgs., Calif.	KCMJ	1010
	KDES	920
	KPAL	1450
Palmdale, Calif.	KUTY	1470
Palo Alto, Calif.	KIBE	1220
Pampa, Tex.	KPDN	1340
	KHHH	1230
Panama City, Fla.	WDLP	590
	WPCF	1430
Panama City Beach, Fla.	WTHR	1480
	WSCM	1290
Paoli, Ind.	WVAK	1560
Paradise, Calif.	KNGL	930
Paragould, Ark.	KDRS	1490
Paris, Ark.	KCCL	1460
Paris, Ill.	WPRS	1440
Paris, Ky.	WKLX	1440
Paris, Tenn.	WTPR	710
Paris, Tex.	KPLT	1490
	KFTV	1250
Parkersburg, W.Va.	WCEF	1050
	WPAR	1450
	WTAP	1230
Park Falls, Wis.	WPFP	1450
Park Rapids, Minn.	KPRM	1240
Parsons, Kans.	KLKC	1540
Pasadena, Cal.	KPPC	1240
	KRLA	1110
	KWKW	1300
Pasadena, Tex.	KLVL	1480
	KIKK	650
Pascagoula-Moss Point, Miss.	WPMP	1580
Pasco, Wash.	KORD	910
	KGRS	1340
Paso Robles, Calif.	KPRL	1230
Patchogue, L.I., N.Y.	WALK	1370
	WPAC	1580
Paterson, N.J.	WPAT	930
Pauls Valley, Okla.	KVLH	1470
Pawhuska, Okla.	KOSG	1500
Pawtucket, R.I.	WXTR	550
Pearsall, Tex.	KVWG	1280
Pecos, Tex.	KIUN	1400
Peekskill, N.Y.	WLNA	1420
Pekin, Ill.	WSIV	1140
Pell City, Ala.	WFHK	1430
Pendleton, Oreg.	KTIX	1240
	KUBE	1050
	KUMA	1290
Pennington Gap, Va.	WSWV	1570
Pensacola, Fla.	WBOP	980
	WBSR	1540
	WMEL	610
	WNVY	1230
	WCOA	1370
Peoria, Ill.	WAAP	1350
	WMBD	1470
	WIRL	1290
	WPEO	1020
Perry, Fla.	WPRY	1400
	WGKR	1310
Perry, Ga.	WPGA	980
Perry, Iowa	KDLS	1310
Perryton, Tex.	KEYE	1400
Peru, Ind.	WARU	1600
Petaluma, Calif.	KTOB	1490
Petersburg, Va.	WSSV	1240
Petoskey, Mich.	WMBN	1340
Phenix City, Ala.	WPNX	1460
Philadelphia, Miss.	WHOC	1490
Philadelphia, Pa.	WCAU	1210
	WDAS	1480
	WFIL	560
	WFLN	900
	WHAT	1340
	WIBG	990
	WIP	610
	WJMJ	1540
	WPEN	950
	WRCV	1060
	WTEL	860
Philipsburg, Pa.	WPHB	1260
Phillipsburg, Kans.	KKAN	1490
Phoenix, Ariz.	KIFN	860
	KXIV	1400
	KHAT	1480
	KHEP	1280
	KCAC	1010
	KOY	550
	KOOL	960
	KPHO	910
	KUEQ	740
	KRIZ	1230
	KTAR	620
Picayune, Miss.	WRJW	1320
Piedmont, Ala.	WPID	1280
Pierre, S.Dak.	KGFX	630
	KCCR	1590
Pikeville, Ky.	WLSI	900
	WPKE	1240
Pine Bluff, Ark.	KCLA	1400
	KADL	1270
	KOTN	1490
	KCAT	1530
	KPBA	1590
Pine City, Minn.	WCMP	1350
Pinellas Park, Fla.	WFSO	570
Pineville, Ky.	WMLF	1230
Pineville, W.Va.	WWYO	970
Pipestone, Minn.	KLOH	1050
Piqua, Ohio	WPTW	1570
Pittsburg, Calif.	KKIS	990
Pittsburg, Kans.	KOAM	860
	KSEK	1340
Pittsburgh, Pa.	KDKA	1020
	KQV	1410
	WAMO	860
	WJAS	1320
	WPIT	730
	WRYT	1250
	WEEP	1080
	WWSW	970
Pittsfield, Ill.	WBBA	1580
Pittsfield, Mass.	WBEC	1420
	WBRK	1340
Pittston, Pa.	WPTS	1540
Plainfield, N.J.	WERA	1590
Plainview, Tex.	KVOP	1400
Plant City, Fla.	WPLA	910
Platteville, Wis.	WSWW	1590
Plattsburg, N.Y.	WEAV	960
	WIRY	1340
Pleasanton, Tex.	KBOP	1380
Pleasantville, N.J.	WOND	1400
Plymouth, Ind.		1050
Plymouth, Mass.	WPLM	1390
Plymouth, N.C.	WPNC	1470
Plymouth, N.H.	WPNH	1300
Plymouth, Wis.	WPLY	1420
Pocahontas, Ark.	KPOC	1420
Pocatello, Idaho	KSEI	930
	KWIK	1240
	KSNN	1290
Pocomoke City, Md.	WDMV	540
Pomona, Calif.	KWOW	1600
	KKAR	1220
Pompano Beach, Fla.	WLOD	980
	WRBD	1470
Ponca City, Okla.	WBBZ	1230
Ponce, P.R.	WPRP	910
	WEUC	1420
	WPAB	550
	WLEO	1170
	WISO	1260
Pontiac, Mich.	WPON	1460
Pontotoc, Miss.	WSEL	1440
Pooli, Ind.	WVAK	1560
Poplar Bluff, Mo.	KWOC	930
	KLID	1340
Poplarville, Miss.	WRPM	1530
Portage, Pa.	WWML	1470
Portage, Wis.	WPDR	1350
Portageville, Mo.	KMIS	1050
Portales, N.Mex.	KENM	1450
Port Angeles, Wash.	KAPY	1000
	KONP	1450
Port Arthur, Tex.	KOLE	1340
	KPAC	1250
Porterville, Calif.	KTIP	1450
Port Hueneme, Calif.	KACY	1520
Port Huron, Mich.	WHLS	1450
	WTTH	1380
Port Jervis, N.Y.	WDLC	1490
Port Lavaca, Tex.	KGUL	1560
Portland, Ind.	WPGW	1440
Portland, Maine	WCSH	970
	WGAN	560
	WLOB	1310
	WPOR	1490
Portland, Oreg.	KBPS	1450
	KBEV	1010
	KLIQ	1290
	KEX	1190

Location	C.L.	Kc.
	KGW	620
	KOIN	970
	KPAM	1410
	KPDQ	800
	KPOJ	1330
	KWJJ	1080
	KXL	750
Port Neches, Tex.	KPNG	1150
Portsmouth, N.H.	WBBX	1380
	WHEB	750
Portsmouth, Ohio	WPAY	1400
	WNXT	1260
Portsmouth, Va.	WHIH	1400
	WPMH	1010
	WAVY	1350
Port Washington, Wis.		
	WGLB	1560
Post, Tex.	KPOS	1370
Poteau, Okla.	KLCO	1280
Potomac-Cabin John, Md.		
	WXLN	950
Potosi, Mo.	KYRO	1280
Potsdam, N.Y.	WPDM	1470
Pottstown, Pa.	WPAZ	1370
Pottsville, Pa.	WPAM	1450
	WPPA	1360
Poughkeepsie, N.Y.	WEOK	1390
	WKIP	1450
Powell, Wyo.	KPOW	1260
Poynette, Wis.	WIBU	1240
Prairie du Chien, Wis.		
	WPRE	980
Pratt, Kan.	KWNS	1290
Prescott, Ariz.	KYCA	1490
	KENT	1340
	KNOT	1450
Prescott, Ark.	KTPA	1370
Presque Isle, Me.	WAGM	950
	WEGP	1390
Preston, Idaho	KPST	1340
Prestonsburg, Ky.	WPRT	960
	WDOC	1310
Price, Utah	KOAL	1230
Prichard, Ala.	WSIM	1270
Prince Albert, Sask.	CKBI	900
Princeton, Ill.	WZOE	1490
Princeton, Ind.	WRAY	1250
Princeton, Ky.	WPKY	1580
Princeton, N.J.	WHWH	1350
Princeton, W.Va.	WLOH	1490
Prineville, Oreg.	KRCO	690
Prosser, Wash.	KARY	1310
Providence, R.I.	WEAN	790
	WHIM	1110
	WICE	1290
	WJAR	920
	WLKW	990
	WPRO	630
	WRIB	1220
Provo, Utah	KIXX	1400
	KEYY	1450
	KOVO	960
Pryor, Okla.	KOLS	1570
Pueblo, Colo.	KDZA	1230
	KAPI	690
	KCSJ	590
	KFEL	970
Pueblo, Colo.	KKAM	1350
	KPUB	1480
Pulaski, Tenn.	WKSR	1420
Pulaski, Va.	WPUV	1580
Pullman, Wash.	KWSC	1250
	KOFE	1150
Punta Gorda, Fla.	WCCF	1580
Punxsutawney, Pa.	WPME	1540
Putnam, Conn.	WINY	1350
Puyallup, Wash.	KAYE	1450
Quanah, Tex.	KOLJ	1150
Quantico, Va.	WQVA	1530
Quincy, Calif.	KQCY	500
Quincy, Fla.	WCNH	1230
Quincy, Ill.	WGEM	1440
	WTAD	930
Quincy, Mass.	WJDA	1300
Quincy, Wash.	KPOR	1370
Quitman, Ga.	WSFB	1490
Racine, Wis.	WRAC	1460
	WRJN	1400
Radford, Va.	WRAD	1460
Raeford, N.C.	WSHB	1400
Raleigh, N.C.	WKIX	850
	WNOH	1550
	WPTF	680
	WLLE	570
	WRAL	1240
Ralls, Tex.	KCLR	1530
Rantoul, Ill.	WRTL	1460
Rapid City, S.Dak.	KOTA	1380
	KIMM	1150
	KRSD	1340
	KEZU	920
Raton, N.Mex.	KRTN	1490
Ravenswood, W.Va.	WMOV	1360
Rawlins, Wyo.	KRAL	1240
Raymond, Wash.	KAPA	1340
Raymondville, Tex.	KSOX	1240
Rayville, La.	KRIH	990
Reading, Pa.	WEEU	850
	WHUM	1240
	WRAW	1340
Redding, Calif.	KRDG	1230
	KAHR	1330
	KQMS	1400

Location	C.L.	Kc.
	KVCV	600
	KVIP	540
Red Bluff, Calif.	KBLF	1490
Redfield, S.Dak.	KFCB	1380
Redlands, Calif.	KCAL	1410
Red Lion, Pa.	WGCB	1440
Red Lodge, Mont.	KRBN	1450
Redmond, Oreg.	KPRB	1240
Red Wing, Minn.	KCUE	1250
Redwood Falls, Minn.		
	KLGR	1490
Reedsburg, Wis.	WRDB	1400
Reedsport, Oreg.	KRAF	1470
Reidsville, N.C.	WFRC	1600
	WREV	1220
Remsen, N.Y.	WREM	1480
Reno, Nev.	KOH	630
	KBET	1340
	KOLO	920
	KONE	1450
	KCBN	1280
Rensselaer, Ind.	WRIN	1560
Rensselaer, N.Y.	WEEE	1300
Renton, Wash.	KREN	1420
Rexburg, Idaho	KRXK	1230
Rhinelander, Wis.	WOBT	1240
Rice Lake, Wis.	WJMC	1240
Richfield, Utah	KSVC	980
Richland, Wash.	KALE	960
Richland, Wis.	WRCO	1450
Richlands, Va.	WRIC	540
Richmond, Ind.	WKBV	1490
	WHOM	930
Richmond, Ky.	WEKY	1340
Richmond, Va.	WANT	990
	WBBL	1480
	WRGM	1540
	WLEE	1480
	WEET	1320
	WMBG	1380
	WRNL	910
	WRVA	1140
	WXGI	950
	WWWW	1540
Richwood, W.Va.	WVAR	1280
Ridgecrest, Calif.	KRCK	1360
	KLOA	1240
Ridgeland, S.C.	WBUG	1430
Rio Piedras, P.R.	WUNO	1320
	WRAI	1190
Ripley, Miss.	WSCA	1260
Ripley, Tenn.	WTRB	1570
Ripon, Wis.	WCWC	1600
Riverhead, N.Y.	WRIV	1390
	WAPC	1570
Riverside, Calif.	KPRO	1440
	KACE	1570
Riverton, Wyo.	KVOW	1450
Riviera Beach, Fla.	WHEW	1600
Roanoke, Ala.	WELR	1360
Roanoke, Va.	WDBJ	960
	WRIS	1410
	WHYE	910
	WROV	1240
	WSLS	610
Roanoke Rapids, N.C.		
	WCBT	1230
Roaring Sprgs., Pa.		
	WKMC	1370
Roberval, Que.	CHRL	910
Robinson, Ill.	WTAY	1570
Robstown, Tex.	KROB	500
Rochester, Minn.	KROC	1340
	KFAV	1520
	KWEB	1270
Rochester, Minn.	KOLM	1520
	KWEB	1270
Rochester, N.H.	WWNH	930
Rochester, N.Y.	WBBF	950
	WHAM	1180
	WHEC	1460
	WRVM	680
	WSAY	1370
	WROC	1280
Rockford, Ill.	WROK	1440
	WJRL	1150
	WRRR	1330
Rock Hill, S.C.	WRHI	1340
	WTYC	1150
Rockingham, N.C.	WAYN	900
Rock Island, Ill.	WHBF	1270
Rockland, Maine	WRKD	1450
Rockmart, Ga.	WPLK	1220
Rock Springs, Wyo.	KVRS	1360
Rockville, Md.	WINX	1600
Rockwood, Tenn.	WRKH	580
Rocky Ford, Colo.	KAVI	1320
Rocky Mount, N.C.	WCEC	810
	WEED	1390
	WRMT	1490
	WKWS	1290
Rocky Mount, Va.	WYTI	1570
Rogers, Ark.	KAMO	1390
Rogers City, Mich.	WHAK	960
Rogersville, Tenn.	WRGS	1370
Rolla, Mo.	KCLU	1590
	KTTR	1490
Rome, Ga.	WLAQ	1410
	WIYN	1360
	WRGA	1470
	WROM	710
Rome, N.Y.	WKAL	1450
	WRNY	1350

Location	C.L.	Kc.
Ronceverte, W.Va.	WRON	1400
Roseau, Minn.	KRWB	1410
Roseburg, Oreg.	KRNR	1490
	KQEN	1240
	KRXL	1250
	KYES	950
Rosenberg, Tex.	KFRD	980
Roservelt, N.M.	KRDD	1320
Rossville, Ga.	WRIP	980
Roswell, N.Mex.	KRSY	1230
	KGFL	1430
	KBIM	910
	KRDD	1320
	KRIK	960
Roxboro, N.C.	WRXO	1430
Royal Oak, Mich.	WEXL	1340
Rugby, N. Dak.	KGCA	1450
Ruidoso, N.Mex.	KRRR	1340
Rumford, Me.	WRUM	790
Rupert, Idaho	KAYT	970
Rushton, La.	KRUS	1490
Rusk, Texas	KTLU	1580
Russell, Kans.	KRSL	990
Russellville, Ala.	WWWR	920
Russellville, Ark.	KXRJ	1490
Russellville, Ky.	WRUS	610
Rutland, Vt.	WHWB	1000
	WSYB	1380
Sacramento, Calif.	KCRA	1320
	KFBK	1530
	KGMS	1380
	KJAY	1430
	KRAK	1140
	KROY	1240
	KXOA	1470
Safford, Ariz.	KGLU	1480
	KATO	1230
Sag Harbor, N.Y.	WLNG	1600
Saginaw, Mich.	WKNX	1210
	WSAM	1400
	WSGW	790
St. Albans, Vt.	WWSR	1420
St. Albans, W.Va.	WKLC	1300
St. Augustine, Fla.	WFOY	1240
	WETH	1420
St. Charles, Mo.	KADY	1460
St. Cloud, Minn.	KFAM	1450
	WJON	1240
Ste. Genevieve, Mo.	KSGM	1340
St. George, S.C.	WQIZ	1300
St. George, Utah	KDXU	1450
St. Helen, Mich.	WMIC	1590
St. Helens, Oreg.	KOHI	1600
St. Johns, Mich.	WJUD	1580
St. Johnsbury, Vt.	WTWN	1340
St. Joseph, Mich.	WSJM	1400
St. Joseph-Benton Harbor,		
Mich.	WHFB	1060
St. Joseph, Mo.	KFEQ	680
	KKJO	1550
	KUSN	1270
St. Louis, Mo.	KATZ	1600
	KMOX	1120
	KSD	550
	KSTL	690
	KXOK	630
	WEW	770
	WIL	1430
	KXEN	1010
St. Louis Park, Minn.		
	KRSI	950
St. Mary's, Pa.	WKBI	1400
St. Paul, Minn.	KSTP	1500
	KDWB	630
	WMIN	1400
	WCCO	830
St. Peter, Minn.	KRBI	1310
St. Petersburg, Fla.	WPIN	680
	WSUN	620
	WLCY	1380
St. Petersburg Beach, Fla.		
	WILZ	1590
Salamanca, N.Y.	WGGO	1590
Salem, Ill.	WJBD	1350
Salem, Ind.	WSLM	1220
Salem, Mass.	WESX	1230
Salem, Mo.	KSMO	1340
Salem, Oreg.	KSLM	1390
	KAPT	1220
	KBZY	1490
	KGAY	1430
Salem, Va.	WBLU	1480
Salida, Colo.	KVRH	1340
Salina, Kans.	KSAL	1150
	KCTY	980
	KISI	910
Salinas, Calif.	KDON	1460
	KSBW	1380
Salinas, Calif.	KCTY	980-1000
Saline, Mich.	WOIB	1290
Salisbury, Md.	WBOC	960
	WICO	1320
	WJDY	1470
Salisbury, N.C.	WSTP	1490
	WSAT	1280
Salmon, Idaho	KSRA	960
Salt Lake City, Utah		
	KALL	910
	KCPX	1320
	KLUB	570
	KNAK	1280
	KSL	1160
	KSOP	1370

Location	C.L.	Kc.
	KSXX	630
	KWHO	860
	KWIC	1570
San Angelo, Tex.	KTEO	1340
	KGKL	960
	KPEP	1420
	KWFR	1260
San Antonio, Tex.	KAPE	1480
	KBAT	680
	KBER	1150
	KCOR	1350
	KITE	930
	KUKA	1250
	KUBO	1310
	KMAC	630
	KONO	860
	KTSA	550
	WOAI	1200
San Bernardino, Calif.		
	KCKC	1350
	KFXM	590
	KRNO	1240
	KMEN	1290
Sandersville, Ga.	WSNT	1490
San Diego, Calif.	KCBQ	1170
	KFMB	540
	KOGO	600
	KGB	1360
	KSON	1240
	KSDO	1130
Sandpoint, Idaho	KSPT	1400
Sand Spring, Okla.	KTOW	1340
Sandusky, Ohio	WLEC	1450
San Fernando, Calif.	KGIL	1260
Sanford, Fla.	WTRR	1400
	WSFR	1360
Sanford, Me.	WSME	1220
Sanford, N.C.	WEYE	1290
	WWGP	1050
San Francisco, Calif.		
	KFRC	610
	KCBS	740
	KFAX	1100
	KGO	810
	KNBR	680
	KKHI	1550
	KSAY	1010
	KSFO	560
	KSOL	1450
	KYA	1260
San Gabriel, Cal.	KAIL	1430
San German, P. R.	WRJS	1060
Sanitobia, Miss.	WSAO	1550
San Jose, Calif.	KLOK	1170
	KLIV	1590
	KEEN	1370
	KXRX	1500
San Juan, P.R.	WAPA	680
	WHOA	870
	WIAC	740
	WIPR	940
	WKAQ	580
	WKVM	810
	WKYN	630
	WITA	1140
San Luis Obispo, Calif.		
	KATY	1340
	KSLY	1400
	KVEC	920
San Marcos, Tex.	KCNY	1470
San Mateo, Calif.	KOFY	1050
San Rafael, Calif.	KTIM	1510
San Saba, Tex.	KBAL	1410
San Sebastion, P.R.		
	WFBA	1460
Santa Ana, Calif.	KWIZ	1480
Santa Barbara, Cal.	KDB	1490
	KGUD	990
	KIST	1340
	KTMS	1250
	KACL	1290
Santa Clara, Calif.	KGBA	1430
Santa Cruz, Calif.	KSCO	1080
Santa Fe, N.Mex.	KTRC	1400
	KVSF	1260
Santa Maria, Cal.	KCOY	1400
	KHER	1600
	KSMA	1240
	KSEE	1480
Santa Monica, Cal.	KDAY	1580
Santa Paula, Calif.	KSPA	1400
Santa Rosa, Calif.	KSRO	1350
	KHUM	1580
	KVRE	1460
	KJAX	1150
Santa Rosa, N.Mex.	KSYX	1420
Sapulpa, Okla.	KREK	1550
Saranac Lake, N.Y.	WNBZ	1240
Sarasota, Fla.	WKXY	930
	WSAF	1220
	WSPB	1450
	WYND	1280
Saratoga, N.Y.	WSPN	900
Saratoga Springs, N.Y.		
	WKAJ	900
Sauk Rapids, Minn.		
	WVAL	800
Sault Ste. Marie, Mich.		
	WSOO	1230
Savannah, Ga.	WBYG	1450
	WEAS	900
	WSAV	630
	WSGA	1400

WHITE'S RADIO LOG

Location	C.L.	Kc.
	WTOC	1290
	WSOK	1230
Savannah, Tenn.	WORM	1010
Sayre, Pa.	WATS	960
Scheffield, Ala.	WSHF	1290
Schenectady, N.Y.	WGY	810
	WSNY	1240
Scotland Neck, N.C.	WYAL	1280
Scott City, Kans.	KFLA	1310
Scottsbluff, Nebr.	KNEB	960
	KOLT	1320
Scottsboro, Ala.	WCRI	1050
	WROS	1330
Scottsdale, Ariz.	KDOT	1440
Scottsville, Ky.	WLCK	1250
Scranton, Pa.	WARM	590
	WEJL	630
	WGBI	910
	WICK	1400
	WSCR	1320
Seaford, Del.	WSUX	1280
Searey, Ark.	KWCB	1300
Seaside, Oreg.	KSRG	730
Seattle, Wash.	KAYO	1150
	KIXI	910
	KING	1090
	KIRO	710
	KJR	950
	KOL	1300
	KOMO	1000
	KETO	1590
	KTW	1250
	KVI	570
	KXA	770
	KBLE	1050
Sebring, Fla.	WJCM	960
	WSEB	1340
Sedalia, Mo.	KDRO	1490
	KSIS	1050
Seguin, Tex.	KWED	1580
Selma, Ala.	WGWC	1340
	WHBB	1490
	WRWJ	1570
Seminole, Tex.	KTFO	1250
Senatobia, Miss.	WSAO	1550
Seneca Township, S.C.	WSNW	1150
Sevierville, Tenn.	WSEV	930
Seward, Alaska	KIBH	950
Seymour, Ind.	WJCD	1390
Seymour, Tex.	KSEY	1230
Shallotte, N.C.	WVCB	1410
Shamokin, Pa.	WISL	1480
Shamrock, Tex.	KBYP	1580
Sharon, Pa.	WPIC	790
Shawano, Wis.	WTCH	960
Shawnee, Okla.	KGFF	1450
Sheboygan, Wis.	WHBL	1330
	WKTS	950
Sheffield, Ala.	WSHF	1290
Shelby, Mont.	KSEN	1150
Shelby, N.C.	WOHS	730
	WADA	1390
Shelbyville, Ind.	WSVL	1520
Shelbyville, Ky.	WCND	940
Shelbyville, Tenn.	WHAL	1400
	WLIJ	1580
Sheldon, Iowa	KIWA	1550
Shelton, Wash.	KMAS	1280
Shenandoah, Iowa	KMA	960
	KFNF	920
Shenandoah, Pa.	WMBT	1530
Sheridan, Wyo.	KWYO	1410
	KROE	930
Sherman, Tex.	KRRV	910
	KTXO	1500
Shippensburg, Pa.	WSHP	1480
Show Low, Ariz.	KVWM	970
Shreveport, La.	KANB	1300
	KBCL	1220
	KEEL	710
	KOKA	1550
	KJOE	1480
	KCIJ	980
	KRMD	1340
	KWKH	1130
Sidney, Mont.	KGCX	1480
Sidney, Nebr.	KSID	1340
Sidney, O.	WMVR	1080
Sierra Vista, Ariz.	KHFH	1420
Sikeston, Mo.	KSIM	1400
Siler City, N.C.	WNCA	1570
Siloam Sprgs., Ark.	KUOA	1290
Silsbee, Tex.	KKAS	1300
Silver City, N.Mex.	KSIL	1340
Silver Sprgs., Md.	WQMR	1050
Simcoe, Ont.	CFRS	1560
Sinton, Tex.	KTOD	1590
Sioux City, Iowa	KSCJ	1360
	KMNS	620
	KTRI	1470
Sioux Falls, S.Dak.	KISD	1230
	KELO	1320
	KNWC	1270
	KSOO	1140
Sitka, Alaska	KIFW	1230
	KSEW	1400
Skowhegan, Maine	WGHM	1150
Slaton, Tex.	KCAS	1050
Slidell, La.	WBGS	1560
Smithfield, N.C.	WMPM	1270
Smithville, Tenn.	WJLE	1480
Smyrna, Ga.	WSMA	1550
Snyder, Tex.	KSNY	1450
Socorro, N.Mex.	KSRC	1290
Soda Sprgs., Idaho	KBRV	540
Solvay, N.Y.	WQSR	1320
Somerset, Ky.	WSFC	1240
	WTLO	1480
Somerset, Pa.	WVSC	990
Sonora, Calif.	KVML	1450
Sonora, Tex.	KCKG	1240
So. Bend, Ind.	WNDU	1490
	WJVA	1580
	WSBT	960
Southbridge, Mass.	WESO	970
So. Boston, Va.	WHLF	1400
Southern Pines, N.C.	WEEB	990
South Charleston, W. Va.	WRDS	1410
South Daytona Beach, Fla.	WELE	1590
So. Gastonia, N.C.	WGAS	1420
So. Haven, Mich.	WJOR	940
So. Knoxville, Tenn.	WSKT	1580
So. Paris, Me.	WKTQ	1450
So. Pittsburg, Tenn.	WEPG	910
So. St. Paul, Minn.	KDWB	630
So. Williamsport, Pa.	WMPT	1450
Spanish Fork, Utah	KONI	1480
Sparks, Nev.	KBUB	1270
Sparta, Ill.	WHCO	1230
Sparta, Tenn.	WSMT	1050
Sparta, Wis.	WKLJ	990
	WCOW	1290
Spartanburg, S.C.	WHCQ	1400
	WORD	910
	WSPA	950
Spencer, Iowa	KICD	1240
Spencer, W.Va.	WSPZ	1400
Spokane, Wash.	KGA	1510
	KDNC	1440
	KSPO	1230
	KPEG	1380
	KHQ	590
	KNEW	790
	KREM	970
	KXLY	920
	KCFA	1330
	KUDY	1280
Springdale, Ark.	KBRS	1340
Springfield, Ill.	WCVS	1450
	WMAY	970
	WTAX	1240
Springfield, Mass.	WHYN	560
	WMAS	1450
	WSPR	1270
Springfield, Mo.	KGBX	1260
	KICK	1340
	KTTS	1400
	KWTO	560
Springfield, Ohio	WIZE	1340
	WBLY	1600
Springfield-Eugene, Ore.	KEED	1120
Springfield, Tenn.	WDBL	1590
Springfield, Vt.	WCFR	1480
Springhill, La.	KBSF	1460
Spring Lake, N. C.	WFBS	1450
Spring Valley, N.Y.	WRRC	1300
Spruce Pine, N.C.	WTOE	1470
Stamford, Conn.	WSTC	1400
Stamford, Tex.	KDWT	1400
Stanford, Ky.	WRSL	1520
Starke, Fla.	WPXE	1490
Starkville, Miss.	WSSO	1230
State College, Pa.	WMAJ	1450
	WRSC	1390
Statesboro, Ga.	WWNS	1240
Statesville, N.C.	WSIC	1400
	WDBM	550
Staunton, Va.	WTDN	1240
	WAFC	900
Stephenville, Tex.	KSTV	1510
Sterling, Colo.	KGEK	1230
	KOLR	1490
Sterling, Ill.	WSDR	1240
Steubenville, Ohio	WSTV	1340
Stevens Point, Wis.	WSPT	1010
Stillwater, Minn.	WAVN	1220
Stillwater, Okla.	KSPI	780
Stockton, Calif.	KJOY	1280
	KSTN	1420
	KWG	1230
Storm Lake, Iowa	KAYL	990
Streator, Ill.	WIZZ	1250
Stroudsburg, Pa.	WVPO	840
Stuart, Fla.	WSTU	1450
Stuart, Va.	WHEO	1270
Sturgeon Bay, Wis.	WDOR	910
Sturgis, Mich.	WSTR	1230
Sturgis, S. D.	KBNB	1280
Stuttgart, Ark.	KWAK	1240
Suffolk, Va.	WLPM	1460
Sullivan, Ind.	WKQV	1550
Sulphur, La.	KIKS	1310
Sulphur Sprgs., Tex.	KSST	1230
Summerville, Ga.	WGTA	950
Summerville, S.C.	WALS	980
Sumter, S.C.	WFIG	1290
	WDXY	1240
	WSSC	1340
Sunbury, Pa.	WKOK	1240
Sunnyside, Wash.	KREW	1230
Sun Valley, Ida.	KSKI	1340
Superior, Nebr.	KRFS	1600
Superior, Wis.	WDSM	710
	WIGL	970
	WWJC	1270
	WQMN	1320
Susanville, Calif.	KSUE	1240
Sutton, W. Va.	WSGB	1490
Swainsboro, Ga.	WJAT	800
Sweetwater, Tenn.	WDEH	800
Sweetwater, Tex.	KXOX	1240
Sylacauga, Ala.	WFEB	1340
	WMLS	1290
Sylva, N.C.	WMSJ	1480
Sylvania, Ga.	WSYL	1490
Syracuse, N.Y.	WHEN	620
	WFBL	1390
	WNDR	1260
	WOLF	1490
	WSYR	570
Tabor City, N.C.	WTAB	1370
Tacoma, Wash.	KMO	1360
	KTAC	850
	KTNT	1400
	KVI	570
Taft, Calif.	KTKR	1310
Tahlequah, Okla.	KTLQ	1350
Tahoe Valley, Calif.	KTHO	590
Talladega, Ala.	WEYY	1580
	WNUZ	1230
Tallahassee, Fla.	WMEN	1330
	WONS	1410
	WTAL	1450
	WTNT	1270
Tallassee, Ala.	WTLS	1300
Tallulah, La.	KTLD	1360
Tampa, Fla.	WALT	1110
	WDAE	1250
	WYOU	1550
	WFLA	970
	WHBO	1050
	WINQ	1010
	WTMP	1150
	WSOL	1300
Taos, N. Mex.	KKIT	1340
Tarboro, N.C.	WCPS	760
Tarpon Springs, Fla.	WCWR	1470
Tasley, Va.	WESR	1330
Taunton, Mass.	WPEP	1570
Tawas City, Mich.	WIOS	1480
Taylor, Tex.	KTAE	1260
Taylorsville, N. C.	WSTH	860
	WTLK	1570
Taylorville, Ill.	WTIM	1410
Tazewell, Tenn.	WNTT	1250
Tell City, Ind.	WTCJ	1230
Tempe, Ariz.	KUPD	1060
	KYND	1580
Temple, Tex.	KTEM	1400
Terre Haute, Ind.	WBOW	1230
	WAAC	1300
	WTHI	1480
Terrell, Tex.	KTER	1570
Terrytown, Nebr.	KEYR	690
Texarkana, Ark.	KOSY	790
Texarkana, Tex.	KCMC	740
	KATQ	940
	KTFS	1400
Texas City, Tex.	KTLW	920
Thayer, Mo.	KALM	1290
The Dalles, Oreg.	KODL	1440
	KACI	1300
Thermopolis, Wyo.	KRTR	1490
	KTHE	1240
Thief River Falls, Minn.	KTRF	1230
Thibodaux, La.	KTIB	630
Thomaston, Ga.	WSFT	1220
	WTGA	1590
	WTHN	1500
Thomasville, Ala.	WJDB	630
Thomasville, Ga.	WPAX	1240
	WLDR	730
Thomasville, N.C.	WTNC	790
Thomson, Ga.	WTWA	1240
Three Rivers, Mich.	WLKM	1510
Ticonderoga, N.Y.	WIPS	1250
Tiffin, Ohio	WTTF	1600
Tifton, Ga.	WTIF	1340
	WWGS	1430
Tillamook, Oreg.	KTIL	1590
Titusville, Fla.	WRMF	1050
Titusville, Pa.	WTIV	1230
Toccoa, Ga.	WLET	1420
	WNES	630
Toledo, Ohio	WOHO	1470
	WSPD	1370
	WTOD	1560
	WTOL	1230
	WTTO	1520
Toledo, Oreg.	KTDO	1230
Tolleson, Ariz.	KRDS	1190
Tomah, Wis.	WTMB	1460
Tompkinsville, Ky.	WTKY	1370
Tooele, Utah	KDYL	990
Topeka, Kans.	WIBW	580
	KEWI	1440
	WREN	1250
	KTOP	1490
Toppenish, Wash.	KENE	1490
Torrington, Conn.	WBZY	990
	WTOR	610
Torrington, Wyo.	KGOS	1490
Towanda, Pa.	WTTC	1550
Towson, Md.	WAQE	1570
Trail, B.C.	CJAT	610
Travelers Rest, S.C.	WBBR	1580
Traverse City, Mich.	WTCM	1400
	WCCW	1310
Trenton, Mo.	KTTN	1600
Trenton, N.J.	WAAT	1300
	WBUD	1260
	WTTM	920
Trinidad, Colo.	KCRT	1240
Troy, Ala.	WTBF	970
Troy, N.Y.	WHAZ	1330
	WTRY	980
	WXKW	1600
Troy, N. C.	WJRM	1390
Truckee, Calif.	KHOE	1400
Trumann, Ark.	KTMN	1530
Truth or Consequences, New Mexico	KCHS	1400
Tryon, N.C.	WTYN	1550
Tucson, Ariz.	KTUC	1400
	KXEW	1600
	KAIR	1490
	KCEE	790
	KTAN	580
	KCUB	1290
	KEVT	690
	KHOS	940
	KMOP	1330
	KFIF	1550
	KTKT	990
	KOLD	1450
Tucumcari, N.Mex.	KTNM	1400
Tulare, Calif.	KCOK	1270
	KGEN	1370
Tulia, Tex.	KTUE	1260
Tullahoma, Tenn.	WJIG	740
Tulsa, Okla.	KAKC	970
	KOME	1300
	KRMG	740
	KELI	1430
	KVOO	1170
	KFMJ	1050
Tupelo, Miss.	WELO	580
	WTUP	1490
Turlock, Calif.	KCEY	1390
Tuscaloosa, Ala.	WJRD	1150
	WACT	1420
	WNPT	1280
	WTUG	790
	WTBC	1230
Tuscumbia, Ala.	WVNA	1590
	WRCK	1410
Tuskegee, Ala.	WABT	580
Twenty-Nine Palms, Calif.	KDHI	1250
Twin Falls, Idaho	KTFI	1270
	KLIX	1310
	KEEP	1450
Two Rivers, Wis.	WTRW	1590
Tyler, Tex.	KDOK	1330
	KGJB	1490
	KTBB	600
	KZEY	690
Tyrone, Pa.	WTRN	1340
Uhrichsville, Ohio	WUND	1540
	WBTC	1540
Ukiah, Calif.	KUKI	1400
	KMSL	1250
Ulysses, Kan.	KULY	1420
Union, S.C.	WBCU	1460
Union City, Tenn.	WENK	1240
Uniontown, Pa.	WMBS	590
Urbana, Ill.	WILL	580
	WKID	1580
Utica, N.Y.	WIBX	950
	WBVM	1550
	WRUN	1150
	WTLB	1310
Utuado, P.R.	WUPR	1530
Uvalde, Tex.	KVOU	1400
Valdese, N.C.	WSVM	1490
Valdosta, Ga.	WGOV	950
	WGAF	910
	WJEM	1150
	WVLD	1450
Valentine, Nebr.	KVSH	940
Vallejo, Calif.	KNBA	1190
Valley City, N.Dak.	KOVC	1490
Valparaiso-Niceville, Fla.	WNSM	1340
Valparaiso, Ind.	WAYK	1500

Location	C.L.	Kc.
Van Buren, Ark.	KFDF	1580
Van Cleve, Ky.	WMTC	730
Vanceburg, Ky.	WKKS	1570
Vancouver, Wash.	KISN	910
	KKEY	1150
	KGAR	1550
Vandalia, Ill.	WPMB	1500
Van Wert, Ohio	WERT	1220
Venice, Fla.	WAMR	1320
Ventura, Calif.	KVEN	1450
	KUDU	1590
Vermillion, S.Dak.	KUSD	690
Vernal, Utah	KVEL	1250
Vernon, Tex.	KVWC	1490
Vero Beach, Fla.	WAXE	1370
	WTTB	1490
Vicksburg, Miss.	WQBC	1420
	WVIM	1490
Victoria, Tex.	KNAL	1410
	KVIC	1340
Victorville, Calif.	KCIN	1590
Vidalia, Ga.	WVOP	970
Vieques, P.R.	WIVV	1370
Ville Platte, La.	KVPI	1050
Vincennes, Ind.	WAOV	1450
Vineland, N.J.	WWBZ	1360
	WDVL	1270
Vinita, Okla.	KVIN	1470
Vinton, Va.	WKBA	1550
Virginia, Minn.	WHLB	1400
Virginia Beach, Va.	WKUK	1550
Virouqua, Wis.	WISV	1360
Visalia, Calif.	KONG	1400
Vivian, La.	KLVI	1600
Waco, Tex.	WACO	1580
	KAWA	1010
	KBGO	1580
	KWTX	1230
Wadena, Minn.	KWAD	920
Wadesboro, N.C.	WADE	1210
Wahpeton, N.D.-Breckenridge, Minn.	KBMW	1450
Wailuku, Hawaii	KMVI	550
Waipahu, Hawaii	KAHU	940
Walhalla, S.C.	WGOG	1000
Wallace, Idaho	KWAL	620
Wallace, N.C.	WLSE	1400
Walla Walla, Wash.	KHIT	1320
	KUJ	1420
	KTEL	1490
Walnut Ridge, Ark.	KRLW	1320
Walsenburg, Colo.	KFLJ	1380
Walterboro, S.C.	WALD	1220
Waltham, Mass.	WCRB	1330
Walton, N.Y.	WDLA	1270
Ward Ridge, Fla.	WJOE	1570
Ware, Mass.	WARE	1250
Warner Robbins, Ga.	WRPB	1350
Warren, Ark.	KWRF	860
Warren, Ohio	WHHH	1440
Warren, Pa.	WNAE	1310
Warrensburg, Mo.	KOKO	1450
Warrenton, Mo.	KWRE	730
Warrenton, Va.	WEER	1250
	WKCW	1420
Warsaw, Ind.	WRSW	1480
Warsaw, Va.	WNNT	690
Warwick-E.Greenwich, R.I.	WYNG	1590
Wasco, Calif.	KWSO	1050
Washington, D.C.	WGMS	570
	WMAL	630
	WOL	1450
	WOOK	1340
	WWDC	1260

Location	C.L.	Kc.
	WRC	980
	WTOP	1500
Washington, Ga.	WKLE	1370
Washington, Ind.	WAMW	1580
Washington, Iowa	KCII	1380
Washington, N.J.	WCRV	1580
Washington, N.C.	WEEW	1320
	WITN	930
Washington, Pa.	WJPA	1450
Washington Court House, Ohio	WCHO	1250
Waterbury, Conn.	WATR	1320
	WBRY	1590
	WWCO	1240
Waterbury, Vt.	WDEV	550
Waterloo, Iowa	KXEL	1540
	KNWS	1090
	KWWL	1330
Watertown, N.Y.	WATN	1240
	WOTT	1410
	WWNY	790
Watertown, S.Dak.	KSDR	1480
	KWAT	950
Watertown, Wis.	WTTN	1580
Waterville, Me.	WTVL	1490
Watseka, Ill.	WGFA	1360
Watsonville, Calif.	KOMY	1340
Wauchula, Fla.	WAUC	1310
	WPRV	1600
Waukegan, Ill.	WKRS	1220
Waukesha, Wis.	WAUX	1510
Waupaca, Wis.	WDUX	800
Wausau, Wis.	WRIG	1400
	WSAU	550
	WXCO	
Waverly, Iowa	KWVY	1470
Waverly, Ohio	WPKO	1380
Waverly, Tenn.	WPHC	1540
Waxahachie, Tex.	KBEC	1390
Waycross, Ga.	WACL	570
	WAYX	1230
Waynesboro, Ga.	WBRO	1310
Waynesboro, Miss.	WABO	990
Waynesboro, Pa.	WAYZ	1380
Waynesboro, Va.	WAYB	1490
	WANV	970
Waynesburg, Pa.	WANB	1580
Waynesville, Mo.	KJPW	1390
Waynesville, N.C.	WHCC	1400
Weatherford, Tex.	KZEE	1220
Webster City, Iowa	KJFJ	1570
Weed, Calif.	KDAD	800
Weirton, W.Va.	WEIR	1430
Weiser, Idaho	KWEI	1260
Welch, W.Va.	WELC	1150
	WOVE	1340
Weldon, N.C.	WCNF	1400
Wellsboro, Pa.	WNBT	1490
Wellston, Ohio	WKOV	1330
Wellsville, N.Y.	WLSV	790
Wenatchee, Wash.	KPQ	560
	KUEN	900
	KMEL	1340
Wendell-Zebulon, N.C.	WETC	540
Weslaco, Tex.	KRGV	1290
West Allis, Wis.	WAWA	1590
W. Bend, Wis.	WBKV	1470
Westbrook, Me.	WJAB	1440
West Chester, Pa.	WCHE	1520
West Covina, Cal.	KGRB	900
W. Frankfort, Ill.	WFRX	1300
West Jefferson, N.C.	WKSK	1600
West Looma, Cal.	KGRB	900
W. Memphis, Ark.	KSUD	730
W. Monroe, La.	KUZN	1310
W. Palm Beach, Fla.	WEAT	850

Location	C.L.	Kc.
	WJNO	1230
	WIRK	1290
West Plains, Mo.	KWPM	1450
West Point, Ga.	WBMK	1310
West Point, Miss.	WROB	1450
Westport, Conn.	WMMM	1260
W. Springfield, Mass.	WTXL	1490
W. Yarmouth, Mass.	WOCB	1240
Westerly, R.I.	WERI	1230
Westfield, Mass.	WDEW	1570
Westminster, Md.	WTTR	1470
Weston, W.Va.	WHAW	980
W. Warwick, R.I.	WWRI	1450
Westwego, La.	KABE	1540
Wetumpka, Ala.	WETU	1250
Wewoka-Seminole, Okla.	KWSH	1260
Wharton, Tex.	KANI	1500
Wheatland, Wyo.	KYCN	1340
Wheaton, Md.	WDON	1540
Wheeling, W.Va.	WHLL	1600
	WBZE	1470
	WKWK	1400
	WWVA	1170
White Castle, La.	KEVL	1590
Whitehall, Mich.	WLRC	1490
White Plains, N.Y.	WFAS	1230
White River Junc., Vt.	WVTR	910
Whitesburg, Ky.	WTCW	920
Whiteville, N.C.	WENC	1220
Wichita, Kans.	KAKE	1240
	KLEO	1480
	KFDI	1070
	KFH	1330
	KSIR	900
	KWBB	1410
Wichita Falls, Tex.	KNIN	990
	KTRN	1290
	KWFT	620
Wickenburg, Ariz.	KAKA	1250
Wickford, R.I.	WKFD	1370
Wildwood, N.J.	WCMC	1230
Wilkes-Barre, Pa.	WBAX	1240
	WBRE	1340
	WILK	980
Williamsburg, Ky.	WEZJ	1440
Williamsburg, Va.	WBCI	740
Williamson, W.Va.	WBTH	1400
Williamsport, Pa.	WLYC	1050
	WRAK	1400
	WWPA	1340
Williamston, N.C.	WIAM	900
Willimantic, Conn.	WILI	1400
Williston, N.D.	KEYZ	1360
Willmar, Minn.	KWLM	1340
Willoughby, Ohio	WELW	1330
Willow Springs, Mo.	KUKU	1330
Willows, Calif.	KIQS	1560
Wilmington, Del.	WAMS	1380
	WDEL	1150
	WILM	1450
	WTUX	1290
Wilmington, N.C.	WMFD	630
	WHSL	1490
	WKLM	980
	WGNI	1340
Wilmington, O.	WMWM	1090
Wilson, N.C.	WGTM	590
	WLLY	1350
	WVOT	1420
Winchester, Ky.	WWKY	1380
Winchester, Tenn.	WCDT	1340
Winchester, Va.	WINC	1400
	WHPL	610

Location	C.L.	Kc.
Windber, Pa.	WWBR	1350
Windemere, Fla.	WXIV	1480
Winder, Ga.	WIMO	1300
Windom, Minn.	KDOM	1580
Windsor, Conn.	WSOR	1480
Winfield, Ala.	WEZQ	1300
Winfield, Kan.	KNIC	1550
Winnemucca, Nev.	KWNA	1400
Winnfield, La.	KVCL	1270
Winner, S.Dak.	KWYR	1260
Winnsboro, La.	KMAR	1570
Winnsboro, S.C.	WCKM	1250
	WRBI	980
Winona, Minn.	KWNO	1230
	KAGE	1380
Winona, Miss.	WONA	1570
Winslow, Ariz.	KVNC	1010
	KINO	1230
Winston-Salem, N.C.	WAAA	980
	WAIR	1340
	WPEG	1550
	WSJS	600
	WTOB	1380
	WKBX	1500
Winter Garden, Fla.	WOKB	1600
Winter Haven, Fla.	WSIR	1490
	WINT	1360
Winter Park, Fla.	WABR	1440
Wisconsin Rapids, Wis.	WFHR	1320
	WRNE	1220
Wolf Pt., Mont.	KVCK	1450
Woodbury, Tenn.	WBFJ	1540
Wood River, Ill.	WBBY	590
Woodside, N.Y.	WWRL	1600
Woodward, Okla.	KSIW	1450
Woonsocket, R.I.	WNRI	1380
	WWON	1240
Wooster, Ohio	WWST	960
Worcester, Mass.	WAAB	1440
	WNEB	1230
	WORC	1310
	WTAG	580
Worland, Wyo.	KWOR	1340
Worthington, Minn.	KWOA	730
Worthington, Ohio	WRFD	880
Wynne, Ark.	KWYN	1400
Wyoming, Mich.	WERX	1530
Wytheville, Va.	WYVE	1280
Yakima, Wash.	KIT	1280
	KIMA	1460
	KBBO	1390
	KQOT	940
	KUTI	980
	KYAK	1390
Yankton, S.D.	KYNT	1450
	WNAX	570
Yauco, P.R.	WKFE	1550
Yazoo City, Miss.	WAZF	1230
York, Nebr.	KAWL	1370
York, Pa.	WNOW	1250
	WORK	1350
	WSBA	910
York, S.C.	WYCL	1580
Youngstown, Ohio	WBBW	1240
	WFMJ	1390
	WKBN	570
Ypsilanti, Mich.	WYSI	1480
	WYNZ	1520
Yreka, Calif.	KSYC	1490
Yuba City, Calif.	KUBA	1600
	KAGR	1450
Yuma, Ariz.	KBLU	1320
	KVOY	1400
	KYUM	560
Zanesville, Ohio	WHIZ	1240
Zarephath, N.J.	WAWZ	1380
Zephyr Hills, Fla.	WZRH	1400

U. S. FM Stations by States

Location	C.L.	Mc.
ALABAMA		
Albertville	WAVU-FM	105.1
Alexander City	WRFS-FM	106.1
Andalusia	WCTA-FM	98.1
Anniston	WHMA-FM	100.5
Athens	WJOF	104.3
Bay Minette	WBCA-FM	105.5
Birmingham	WAPI-FM	99.5
	WBRC-FM	106.9
	WSFM	93.7
Clanton	WKLF-FM	100.9
Cullman	WFMH-FM	101.1
Decatur	WHOS-FM	102.1
Dotham	WOOF-FM	99.7
Homewood	WJLN	104.7
Huntsville	WAHR	99.1
	WNDA	92.9
Jackson	WTHG-FM	104.9
Mobile	WKRG-FM	99.9
	WLPR	96.1
Montgomery	WFMI	98.9
	WAJM	103.3
Muscle Shoals	WLAY-FM	105.5
Sylacauga	WMLS-FM	98.3
Tuscumbia	WVNA	100.3
Tuscaloosa	WTBO-FM	95.7
	WUOA	*91.7
ALASKA		
Anchorage	KNIK	105.5
	KBYR-FM	102.1
College	KUAC	104.9
ARIZONA		
Globe	KWJB-FM	100.3
Mesa	KBUZ-FM	104.7
Phoenix	KRFM-FM	95.5
	KFCA	*88.5
	KOOL-FM	94.5
	KITH	101.3
	KNIX	102.5
	KOY-FM	92.5
	KMEO	96.9
	KTAR-FM	98.7
	KYEW	93.3
	KHEP-FM	101.5
Show Low	KVWM-FM	93.5
Sun City	KTPM	106.3
Tempe	KUPD-FM	97.9
Tucson	KFMM	99.5
	KSOM	92.9
	KVOA-FM	93.7
ARKANSAS		
Blytheville	KLCN-FM	96.1
El Dorado	KRIL	99.3
	KELD-FM	103.1
Fayetteville	KFAY-FM	92.1
Ft. Smith	KFPW-FM	94.9
	KTCS-FM	99.9
Harrison	KHOZ-FM	102.9
Hot Springs	KBHS-FM	96.7
Jonesboro	KBTM-FM	101.9
	KASU	91.9
Little Rock	KARK	103.7
Mammoth Springs	KAMS	103.9
Osceola	KOSE-FM	98.1
Pine Bluff	KOTN-FM	92.3
Siloam Springs	KUOA-FM	105.7
CALIFORNIA		
Alameda	KJAZ	92.7
Anaheim	KEZR-FM	95.9
Angwin	KANG	88.1
Apple Valley	KAVR-FM	102.3
Arcata	KTOO	*90.5
Atherton	KPEN	101.3
Auburn	KAFI	101.1
Avalon	KBIG	104.3
Bakersfield	KERN-FM	94.1
	KGEE-FM	97.5
	KIFM	96.5
Berkeley	KPFA	94.1
	KPFB	*89.3
	KPAT-FM	102.9
Bijou	KHUR	99.9
Carmel	KRML-FM	101.7
Claremont	KSPC	*88.9
Coachella	KCHQ-FM	93.7
El Cajon	KECR	93.3

WHITE'S

RADIO LOG

Location	C.L.	Mc.
Fremont	KFMR	104.9
Fresno	KARM-FM	101.9
	KCIB-FM	94.5
	KFRE-FM	93.7
	KMJ-FM	97.9
	KXQR	102.7
Garden Grove	KGGK	94.3
Glendale	KFMU	97.1
	KUTE	101.9
Hayward	KBBM	101.7
Hemet	KHSJ-FM	105.5
Inglewood	KTYM-FM	103.9
LaSierra	KSDA	*89.7
Lodi	KCVR-FM	97.7
Long Beach	KFOX-FM	102.3
	KLON	*88.1
	KNOB	97.9
Los Altos	KPGM	97.7
	KFJC	88.7
Los Angeles	KABC-FM	95.5
	KBBI	107.5
	KBCA	105.1
	KBIQ	104.3
	KBMS	105.9
	KCBH	98.7
	KFAC-FM	92.3
	KGLA	*103.5
	KHJ	101.1
	KMLA	100.3
	KNX-FM	93.1
	KPFK	*90.7
	KPOL-FM	93.9
	KRHM	94.7
	KRKD-FM	96.3
	KLAC-FM	102.7
	KUSC	*91.5
	KXLU	*89.1
	KHOF	99.5
Los Banos	KLBS-FM	95.9
Los Gatos	KLGS	95.3
Marysville	KRFD	99.9
Modesto	KBEE-FM	103.3
	KTRB-FM	104.1
Monterey	KHFR	96.9
Newport Beach	KNBB	103.1
Northridge	KEDC-FM	88.5
Oakland	KAFE	98.1
Oceanside	KUDE	102.1
Ontario	KASK-FM	93.5
Oxnard	KPMJ	104.7
Pasadena	KPCS	89.3
	KPPC-FM	106.7
Palm Springs	KDES-FM	104.7
Redondo Beach	KAPP	93.5
Redlands	KCAL-FM	96.7
Ridgecrest	KLOA-FM	105.5
Riverside	KBBL	99.1
	KACE-FM	92.7
	KDUO	97.5
Sacramento	KCRA-FM	96.1
	KERS	*88.9
	KFBK-FM	96.9
	KJML	106.5
	KEBR	100.5
	KHIQ	105.1
	KJML	95.3
	KRAK-FM	92.9
	KSFM	96.9
	KXRQ	98.5
	KXOA-FM	107.9
Salinas	KSBW-FM	102.5
	KRSA-FM	100.7
San Bernardino	KVCR	*91.9
	KFMW	99.9
	KEBS	*89.5
San Diego	KOGO-FM	94.1
	KFMB-FM	100.7
	KFMX	96.5
	KGB-FM	101.5
	KITT	105.3
	KJLM	98.1
	KLRO	94.9
	KPRI	106.5
	KSDS	*88.3
	KBBW	102.9
	KSDO-FM	103.7
	KSEA	97.3
San Fernando	KVFM	94.3
San Francisco	KALW	*91.7
	KBRG	105.3
	KCBS-FM	98.9
	KDFC	102.1
	KEAR	97.3
	KFOG	104.5
	KFRC-FM	106.1
	KGO-FM	103.7
	KNBR-FM	99.7
	KMPX	106.9
	KPEN	101.3

Location	C.L.	Mc.
	KRON-FM	96.5
	KSFR	94.9
	KQBY-FM	95.7
	KXKX	88.5
	KYA-FM	93.3
	KCMA	*90.3
	KBRG	105.3
	KAFE	98.1
	KKHI-FM	95.7
San Jose	KSJO-FM	92.3
	KRPM	98.5
	KSJS	90.7
	KPLX	106.5
	KEEN-FM	100.3
San Luis Obispo	KATY-FM	96.1
	KVEC-FM	93.3
San Mateo	KCSM	*90.9
	KUFY	107.7
San Rafael	KTIM	100.9
Santa Ana	KWIZ-FM	96.7
	KYMS	106.3
Santa Barbara	KRCW	97.5
	KDB-FM	93.7
	KMUZ	103.3
	KCSB-FM	91.1
Santa Clara	KSCU	*90.1
	KREP	105.7
Santa Cruz	KSCO-FM	99.1
Santa Maria	KEYM	99.1
	KSMA-FM	102.5
Santa Monica	KCRW	*89.9
	KSRF	103.1
Santa Rosa	KEFM	100.1
Sierra Madre	KMAX	107.1
Stanford	KZSU	*90.1
Stockton	KUOP	*91.3
	KSTN-FM	107.3
	KWG-FM	105.7
Thousand Oaks	KNJO	92.7
Turlock	KHOM	92.9
Twenty-Nine Palms	KDHI-FM	95.3
Ventura-Oxnard	KVEN-FM	100.7
Visalia	KONG-FM	92.9
Walnut Creek	KDFM	92.1
West Covina	KSGV	98.3
Woodland	KATT	95.3

COLORADO

Location	C.L.	Mc.
Boulder	KRNW	97.3
Colorado Springs	KRCC	*91.3
	KKFM	96.5
	KSHS	*90.5
	KVOR-FM	92.9
	KLST	94.3
Cortez	KZFM	94.1
Denver	KFML-FM	98.5
	KLIR-FM	100.3
	KLZ-FM	106.7
	KMET	99.5
	KOA-FM	103.5
	KOCI-FM	101.1
	KTGM	105.1
	KIMN-FM	95.5
	KBPI	105.9
Ft. Collins	KCSU-FM	*90.9
	KZIX-FM	93.3
Grand Junction	KREX-FM	92.3
Longmount	KLMO-FM	104.3
Manitou Springs	KCMS-FM	102.7

CONNECTICUT

Location	C.L.	Mc.
Bridgeport	WJZZ	99.9
	WPKN	88.1
Brookfield	WGHF	95.1
Danbury	WLAD-FM	98.3
Darien	WDRM	95.9
Farifield	WSHU	*91.1
Hamden	WDEE	101.3
Hartford	WHCN	105.9
	WDRC-FM	102.9
	WCCC-FM	106.9
	WSCH	93.7
	WRTC-FM	*89.3
	WTIC-FM	96.5
Manchester	WINF-FM	107.9
Meriden	WBMI	95.7
Middletown	WESU	88.1
New Haven	WNHC-FM	99.1
	WYBC-FM	94.3
Stamford	WSTC-FM	96.7
Storrs	WHUS	*90.5
Waterbury	WATR-FM	92.5
	WWCO-FM	104.1
Westport	WMMM	107.9

DELAWARE

Location	C.L.	Mc.
Dover	WDOV-FM	94.7
Wilmington	WDEL-FM	93.7
	WJBR	99.5

D. C.

Location	C.L.	Mc.
Washington	WASH	97.1
	WAMU-FM	*88.5
	WFAN	100.3
	WGAY	99.5
	WGMS-FM	103.5
	WGTB	*90.1
	WMAL-FM	107.3
	WOL-FM	98.7
	WRC-FM	93.9

Location	C.L.	Mc.
	WTOP-FM	96.3
	WWDC-FM	101.1

FLORIDA

Location	C.L.	Mc.
Atlantic Beach	WKTZ-FM	96.1
Belle Glade	WSWN-FM	93.5
Boca Raton	WWOG	103.3
Bradeton	WBRD-FM	103.3
Clear Water	WTAN-FM	95.7
Cocoa Beach	WXBR	101.1
Coral Gables	WVCG-FM	105.1
Daytona Beach	WNDB-FM	94.5
De Funiak Springs	WZEP-FM	103.1
Fort Lauderdale	WWIL-FM	103.5
	WFLM	105.9
	WFTL-FM	107.7
	WMJR	100.7
Ft. Meyers	WINK-FM	96.9
Fort Pierce	WARN	98.7
Ft. Walton Beach	WFTW-FM	99.3
Gainesville	WRUF-FM	*104.1
Jacksonville	WJAX-FM	95.1
	WIVY-FM	92.5
	WKTZ-FM	96.1
	WQIK	99.1
Key West	WKIZ-FM	92.5
Marianna	WTOT-FM	100.9
Melbourne	WMMB-FM	102.3
Miami	WKAT-FM	93.3
	WGBS	96.3
	WIOD-FM	97.3
	WTHS	*91.7
	WEDR	99.1
	WWPB	101.5
Miami Beach	WKAT-FM	93.1
	WAEZ-FM	94.9
	WMBM-FM	93.9
Milton	WXBM-FM	102.3
Mount Dora	WFAC	107.7
Naples	WNFM	94.5
Ocala	WMOP-FM	93.7
Orlando	WDBO-FM	92.3
	WHOO-FM	96.5
	WKIS-FM	100.3
Palm Beach	WWOS-FM	97.9
Panama City	WMAI-FM	107.9
Pensacola	WPEX-FM	94.1
	WCOA-FM	100.7
St. Augustine	WFOY-FM	97.7
St. Petersburg	WGNB	101.5
	WTCX	99.5
	WPIN-FN	107.3
Sarasota	WYAK	102.5
	WSPB-FM	106.3
Stuart	WSTU-FM	92.7
Tallahassee	WFSU-FM	*91.5
	WBGM-FM	98.9
Tampa	WDAE-FM	100.7
	WEMI	94.9
	WFLA-FM	93.3
	WPKM	104.7
	WTUN	*88.9
	WUSF	*89.7
West Palm Beach	WPBF	107.9
Winter Haven	WINT-FM	97.5
Winter Park	WPRK	*91.5

GEORGIA

Location	C.L.	Mc.
Albany	WGPC-FM	104.5
	WJIZ	96.3
Americus	WDEC-FM	94.3
Athens	WGAU-FM	102.5
	WDOL-FM	104.7
Atlanta	WABE	*90.1
	WAVQ	94.9
	WPLO-FM	103.3
	WGKA-FM	92.9
	WSB-FM	98.5
	WLTA-FM	99.7
Augusta	WAUG-FM	105.7
	WBBQ-FM	103.7
Canton	WCHK-FM	105.5
Carrollton	WLBB-FM	92.1
Columbus	WRBL-FM	102.9
	WGBA-FM	107.3
Cornelia	WCON-FM	99.3
Gainesville	WDUN-FM	103.9
Lagrange	WLAG-FM	104.1
Macon	WMAZ-FM	99.1
Manchester	WFDR-FM	99.3
Marietta	WBIE-FM	101.5
	WKLS	96.1
Moultrie	WNTM-FM	93.9
Newnan	WCOH-FM	96.7
Savannah	WTOC-FM	94.1
Smyrna	WDJK	*91.4
Swainsboro	WJAT-FM	101.7
Toccoa	WLET-FM	106.1
West Point	WBMK-FM	100.9

HAWAII

Location	C.L.	Mc.
Honolulu	KAIM-FM	95.5
	KHVH-FM	93.9
	KPOI-FM	97.5
	KVOK	*88.1
	KUOH	*90.5

IDAHO

Location	C.L.	Mc.
Boise	KBOI-FM	97.9
Idaho Falls	KID-FM	96.1
Lewiston	KOZE-FM	96.7
Moscow	KUID	*91.7
Pocatello	KBGL	*88.7

ILLINOIS

Location	C.L.	Mc.
Alton	WOKZ-FM	100.3
Anna	WRAJ-FM	92.7
Arlington Heights	WNWC	92.7
Aurora	WKKD	95.9
Bloomington	WJBC-FM	101.5
Carbondale	WSIU	*91.9
Carmi	WROY-FM	97.3
Champaign	WDWS-FM	97.5
	WLRW-FM	94.5
Chicago	WBBM-FM	96.3
	WBEZ	*91.5
	WLS-FM	94.7
	WDHF	95.5
	WEBH	93.9
	WEFM	99.5
	WHFC	97.9
	WENR-FM	94.7
	WFMF	100.3
	WFMQ	107.5
	WFMT	98.7
	WKFM	103.5
	WMAQ-FM	101.1
	WMBI-FM	*90.1
	WNIB	97.1
	WXRT	93.1
	WJJD-FM	104.3
Columbia	WCBW	104.9
Crete	WTAS	102.3
Decatur	WSOY-FM	102.9
DeKalb	WNIC	*89.7
	WLBK-FM	92.5
Dixon	WIXN-FM	101.7
E. St. Louis	WBBR	101.1
Effingham	WCRA-FM	95.7
	WELG	103.9
	WRMN-FM	94.3
Elgin	WEPS	*88.1
	WELG	103.9
	WRMN-FM	94.3
Elmhurst	WRSE-FM	*88.7
Elmwood Park	WXFM	105.9
Evanston	WEAW	105.1
	WNUR	*88.7
Flossmoor	WHFH	*88.5
Freeport	WFRL-FM	98.5
Galesburg	WYKC-FM	*88.1
Glen Ellyn	WELF	107.1
Greenville	WGRN	*89.3
Harrisburg	WEBQ-FM	99.9
Highland Park	WEEF-FM	103.1
Jacksonville	WLDS-FM	100.5
	WAJP	93.5
Joliet	WJOL-FM	96.7
Kankakee	WKAK-FM	99.9
LaSalle	WLPO-FM	99.3
Litchfield	WSMI-FM	106.1
Loves Park	WLUV-FM	96.7
Macomb	WWKS	*91.3
Madison	WGNO	106.5
Mattoon	WLBH-FM	96.9
Morris	WRMI-FM	104.7
Mt. Carmel	WSAB	94.9
	WVMC-FM	101.1
Mt. Vernon	WMIX-FM	94.1
Oak Park	WOPA-FM	102.7
Olney	WSEI-FM	92.9
Ottawa	WOLI	98.3
Paris	WPRS-FM	98.3
Park Forest	WRHS	*88.1
Park Ridge	WMTH	*88.5
Peoria	WMBD-FM	92.5
Quincy	WGEM-FM	105.1
	WTAD-FM	99.5
Robinson	WTAY-FM	100.7
Rockford	WROK-FM	97.5
Rock Island	WHBF-FM	98.9
Rock Island	WVIK	90.9
Skokie	WRSV	98.3
South Beloit	WBEL-FM	103.1
Springfield	WTAX-FM	103.7
Streator	WIZZ-FM	97.7
Taylorville	WGGM	95.0
Urbana	WILL-FM	*90.9
Waukegan	WEFA	102.3
Wheaton	WETN-FM	*88.1
Winnetka	WNTH	*88.1

INDIANA

Location	C.L.	Mc.
Anderson	WAFM	97.9
Bloomington	WFIU	*103.7
	WTTV-FM	92.3
Bluffton	WCRD	100.1
Columbus	WCSI-FM	98.3
Connersville	WCNB-FM	100.3
Crawfordsville	WBBS-FM	106.3
Elkhart	WCMR-FM	104.7
	WTRC-FM	100.7
	WXAX	104.7
Elwood	WBMP	101.7
Evansville	WIKY-FM	104.1
	WEVC	*91.5
	WPSR	90.7
	WVHI	105.3

Location	C.L.	Mc.
Franklin	WFCI	*89.3
Frankfort	WILO-FM	99.7
Fort Wayne	WPTH	95.1
	WKJG-FM	97.3
Gary	WGVE	*88.1
Goshen	WGCS	91.1
Greencastle	WGRE	*91.7
Greenfield	WSMJ	99.5
Greensburg	WTRE	107.3
Hammond	WYCA	92.3
Hartford City	WHCI	*91.9
	WWHC	104.9
Huntington	WVSH	*91.9
Indianapolis	WAJC	*104.5
	WICR	*88.7
	WISH-FM	107.9
	WAIV	105.7
	WFBM-FM	94.7
	WFMS	95.5
	WGEE-FM	103.3
	WIAN	*90.1
	WIBC-FM	93.1
Jasper	WITZ-FM	104.7
Kendallville, Ind.		
	WAWK-FM	93.3
Kokomo	WFKO	100.5
	WKMO	93.5
Lafayette	WASK-FM	105.3
	WAZY-FM	96.7
La Porte	WLOI-FM	96.7
Madison	WORX-FM	96.7
Marion	WMRI-FM	106.9
	WBST	*90.7
Muncie	WMUN	104.1
	WWHI	*91.5
New Albany	WNAS	*88.1
New Castle	WCTW-FM	102.5
	WYSN	*91.1
North Vernon	WOCH-FM	106.1
Plainfield	WJMK	98.3
Princeton	WRAY-FM	98.1
Richmond	WGLM	96.1
	WECI	*91.5
	WKBV-FM	101.3
Seymour	WJOD	93.7
South Bend	WETL	*91.9
	WHME	103.1
	WNDU-FM	92.9
	WPFR	102.7
	WJVA-FM	103.9
Terre Haute	WTHI-FM	99.9
	WVTS	100.7(s)
	WISU	*89.7
Wabash	WSKS	*91.3
Warsaw	WRSW-FM	107.3
Washington	WFML	106.5
West Lafayette	WBAA-FM	99.1

IOWA

Location	C.L.	Mc.
Ames	WOI-FM	*90.1
Boone	KFGQ	*99.3
Cedar Falls	KTCF	*88.1
Cedar Rapids	KHAK-FM	98.1
	WMT-FM	104.5
Clarion	KRIT	96.9
Clinton	KROS-FM	96.1
Davenport	WOC-FM	103.7
Des Moines	KDPS	*88.1
	KDMI	97.3
	KSO	98.5
	WHO-FM	100.3
	KFMG	94.9
	KWOM	93.3
Iowa City	WMT-FM	*91.7
Mt. Vernon	KRNL-FM	*89.7
Muscatine	KWPC-FM	92.9
Oskaloosa	KBOE-FM	106.3
Sioux City	KDVR	97.9
	KTFC	103.3
Storm Lake	KAYL-FM	101.5
Waterloo	KNWS-FM	101.9
Waverly	KWAR	89.1

KANSAS

Location	C.L.	Mc.
Emporia	KSTE	*88.7
Garden City	KNCO-FM	97.3
Kansas City	KCFC	98.1
	KCKN-FM	94.1
Lawrence	KANU	*91.5
	KLWN-FM	105.9
Leavenworth	KCLO-FM	98.9
Manhattan	KSDB-FM	*88.1
Newton	KJRG-FM	92.3
Ottawa	KTJO-FM	*88.1
	KOFO-FM	95.7
Parsons	KPPS-FM	*91.1
Salina	KAFM	99.9
Scott City	KFLA-FM	95.3
Topeka	KTOP	100.3
	WIBW-FM	97.3
Wichita	KFH-FM	100.3
	KQTY	101.3
	KMUW	*89.1
	KCBM-FM	107.3

KENTUCKY

Location	C.L.	Mc.
Ashland	WCMI-FM	93.7
Bowling Green	WLBJ-FM	96.7
Campbellsville	WTCO-FM	103.9
Central City	WNES-FM	101.9
Erlanger	WKKY-FM	100.9
Ft. Knox	WSAC-FM	105.5
Fulton	WFUL-FM	104.9
Georgetown	WRVG	*90.1
Glasgow	WGGC	95.1
Greenville	WKYF-FM	101.1
Hazard	WKIC-FM	101.1
Henderson	WSON-FM	99.5
Hopkinsville	WRLX	98.7
	WKOF	100.3
Lexington	WBKY	*91.3
	WLAP-FM	94.5
Louisville	WFPK	*91.9
	WFPL	*89.3
	WKLO-FM	99.7
	WLRS	102.3
	WXEL	103.9
Madisonville	WFMW-FM	93.9
	WNGO-FM	94.7
Manfordville	WLOC-FM	102.3
Owensboro	WOMI-FM	92.5
	WVJS-FM	96.1
Paducah	WPAD-FM	96.9
	WKYX-FM	93.3
Paintsville	WISP-FM	100.1
Prestonburg	WDOC-FM	95.5
Russellville	WRUS-FM	92.1
Somerset	WSFC-FM	96.7
Whitesburg	WTCW-FM	103.9

LOUISIANA

Location	C.L.	Mc.
Alexandria	KALB-FM	96.9
Baton Rouge	WJBO-FM	101.5
Hammond	WTGI	107.1
Houma	KCIL-FM	107.1
Jennings	KJEF-FM	92.7
Lafayette	KRVS-FM	*88.3
Monroe	KMLB-FM	104.1
Mt. Vernon	KRNL-FM	105.3
New Orleans	WBEH	89.3
	WDSU-FM	93.3
	WRCM	97.1
	WMMT	95.7
Opelousas	KSLO-FM	107.1
Shreveport	KRMD-FM	101.1
	KBCL-FM	96.5
	KWKH-FM	94.5

MAINE

Location	C.L.	Mc.
Augusta	WFAU-FM	101.3
Bangor	WABI-FM	97.1
Brunswick	WBOR	*91.1
	WCME-FM	98.9
Caribou	WFST-FM	97.7
Lewiston	WCOU-FM	93.9
	WLAM-FM	107.5
	WRJR	91.5
Orono	WMEB-FM	91.9
Poland Springs	WMTW-FM	94.9
Portland	WLOB-FM	97.9

MARYLAND

Location	C.L.	Mc.
Annapolis	WNAV-FM	99.1
	WANN-FM	107.9
	WXTC	107.9
	WAQE-FM	101.9
Baltimore	WBJC	*88.1
	WCAO-FM	102.7
	WCBM-FM	106.5
	WFMM-FM	93.1
	WRBS	95.1
	WSID	92.3
	WBAL-FM	97.9
	WITH-FM	104.3
	WSID-FM	92.3
Bethesda	WJMD	94.7 (s)
	WHFS	102.3
Bradbury Heights	WPGC	95.5
Catonsville, Md.	WCBC	105.7
Cumberland	WCUM-FM	102.9
Frederick	WFMD-FM	99.9
Hagerstown	WJEJ-FM	104.7
	WARK-FM	106.9
Halfway	WHAG-FM	96.7
Havre de Grace	WASA-FM	103.7
Oakland	WBUZ	95.5
Salisbury	WBOC-FM	94.3
Tacoma Park	WGTS-FM	*91.9
Waldorf	WSMD	104.1
Westminster	WTTR-FM	100.7

MASSACHUSETTS

Location	C.L.	Mc.
Amherst	WAMF	*88.1
	WFCR	*88.5
	WMUA	*91.1
Andover	WPAA	91.7
Boston	WBUR	*90.9
	WBCN	104.1
	WBZ-FM	106.7
	WCOP-FM	100.7
	WEEI-FM	103.3
	WERS	*88.9
	WHDH-FM	94.5
	WRKO-FM	98.5
	WXHR	96.9
Brockton	WBET-FM	97.7
Brookline	WBOS-FM	92.9
Cambridge	WGBH-FM	*89.7
	WHRB-FM	95.3
	WTBS	88.1
Fitchburg	WBNE-FM	104.5
Framingham	WKOX-FM	105.7
Greenfield	WHAI-FM	98.3
Haverhill	WHAV-FM	92.5
Lawrence	WGHJ	93.7
Lowell	WLLH-FM	99.5
Lynn	WHIL-FM	107.9
	WLYM-FM	101.7
Medford	WISK	107.9
New Bedford	WBSM-FM	97.3
	WNBH-FM	98.1
N. Adams	WMNB-FM	100.1
Pittsfield	WQRB-FM	105.5
Plymouth	WPLM-FM	99.1
S. Hadley	WMHC	*88.5
Springfield	WHYN-FM	93.1
	WSCB	*88.9
	WMAS-FM	94.7
Waltham	WCRB-FM	102.5
W. Yarmouth	WOCB-FM	94.9
Williamstown	WCFM	*91.3
Winchester	WHSR-FM	*91.9
Worcester	WAAB	107.3
	WSRS	96.1

MICHIGAN

Location	C.L.	Mc.
Alma	WFYC-FM	104.9
Alpena	WHSB	107.7
Battle Creek	WKFR-FM	103.3
Big Rapids	WBRN-FM	100.9
Ann Arbor	WUOM	*91.7
Bay City	WBCM-FM	96.1
	WNEM-FM	102.5
Benton Hrbr.	WHFB-FM	99.9
Birmingham	WHFI	94.7
Charlotte	WCER-FM	92.7
Coldwater	WTVB-FM	98.3
Dearborn	WKNR-FM	100.3
Detroit	WDET-FM	*101.9
	WBFG-FM	98.7
	WCHD	105.9
	WDTM	106.7
	WABX	99.5
	WDTR	*90.9
	WGPM	107.5
	WJBK-FM	93.1
	WMUZ	103.5
	WGPR	97.9
	WJR-FM	96.3
	WOMC-FM	104.3
	WQRS-FM	105.1
	WRMK-FM	98.7
	WWJ-FM	97.1
	WXYZ-FM	101.1
	WLIN	92.3
E. Lansing	WKAR-FM	*90.5
	WSWM	99.1
	WVIC-FM	95.7
Flint	WFBE	*95.1
	WGMZ-FM	107.9
	WMRP-FM	105.5
Grand Rapids	WFUR-FM	102.9
	WJEF-FM	93.7
	WLAV-FM	96.9
	WMAX-FM	101.3
	WOOD-FM	105.7 (s)
	WVGA-FM	104.1
	WXTO-FM	97.9
	WKLW-FM	95.7
Greenville, Mich.		
	WPLB-FM	107.3
Highland Pk.	WHPR	*88.1
Holland	WJBL-FM	94.5
	WHTC-FM	96.1
Houghton Lake	WJGS	98.5
Interlochen	WGYA	*103.1
	WIAA	89.7
Jackson	WBBC	94.1
	WKHM-FM	106.1
Kalamazoo	WMCR	*102.1
	WKMI-FM	106.5
Lansing	WJIM-FM	97.5
	WYFE	100.7
Marquette	WNMR	90.1
Midland	WQDC-FM	99.7
Mount Clemens	WBRB-FM	102.7
Mount Pleasant	WCMU	*90.1
Muskegon	WMUS-FM	106.9
Oak Park	WLDM	95.5
Port Huron	WHLS-FM	107.1
Royal Oak	WOAK	*89.3
	WOMC	104.3
Saginaw	WSAM-FM	98.1
Spring Arbor	WSAE	*89.3
Sturgis	WSTR-FM	103.1
Warren	WPHS	91.5

MINNESOTA

Location	C.L.	Mc.
Brainerd	KLIZ-FM	95.9
Golden Valley	KQRS-FM	92.5
Mankato	KMSO	*90.5
	KYSM-FM	103.5
Minneapolis	KTIS-FM	*98.5
	KWFM	97.1
	WLOL-FM	99.5
	WPBC-FM	101.3
	WAYL	93.7
	WCTS-FM	100.3
Rochester	KROC-FM	106.9
St. Cloud	KFAM-FM	104.7
St. Louis Park	KRSI-FM	104.1
St. Paul	KNOF	95.3
Willmar	KWLM-FM	102.5
Worthington	KWOA-FM	94.9

MISSISSIPPI

Location	C.L.	Mc.
Forest	WMAG-FM	93.5
Greenwood	WSWG	99.1
Gulfport	WORA	107.1
Jackson	WJDX-FM	102.9
	WWHO	94.7
Laurel	WNSL-FM	100.3
Meridian	WMMI	*88.1
Moss Point	WACY-FM	104.9
Pascogonla	WPMP-FM	98.9

MISSOURI

Location	C.L.	Mc.
Carrollton	KAOL-FM	101.1
Clayton	KFUO-FM	99.1
Clinton	KCIC	95.3
Columbia	KWWC-FM	90.5
El Dorado Springs		
	KESM-FM	107.1
Joplin	WMBH-FM	96.1
	KSYN	92.5
Kansas City	KCMO-FM	94.9
	KBEY	104.3
	KTSR	*90.1
	WDAF-FM	102.1
	KCMK	93.3
	KCUR-FM	*89.3
	KMBC-FM	99.7
	KPRS-FM	103.3
	KXTR	96.5
Kennett	KBOA-FM	98.9
Osage Beach	KRMS-FM	93.5
Poplar Bluff	KWOC-FM	94.5
Rolla	KCLU-FM	94.3
	KMSM	*88.5
St. Joseph	KUSN-FM	105.1
St. Louis	KCFM	93.7
	KADI	96.5
	WAMV-FM	101.1
	WIL-FM	92.3
	KSLH	*91.5
	KSTL-FM	98.1
	KRFD	106.9
Sedalia	KSIS-FM	92.1
Springfield	KTTS-FM	94.7
	KTXR	101.5
Waynesville	KFBD	97.7
West Plains	KWPM-FM	93.9

MONTANA

Location	C.L.	Mc.
Belgrade	KGVW-FM	96.7
Billings	KURL-FM	97.1
Bozeman	KBHF	93.7
Great Falls	KARR-FM	106.3
Missoula	KUFM	*88.1

NEBRASKA

Location	C.L.	Mc.
Beatrice	KWBE-FM	92.9
Columbus	KJSK-FM	101.1
Hastings	KICS-FM	93.5
Kearney-Holdrege		
	KRNY-FM	98.9
Lexington	KRUN-FM	93.1
Lincoln	KFMQ	95.3
	KWHG	106.3
Omaha	KQAL-FM	94.3
	KFAB-FM	99.9
	WOW-FM	92.3
	KICN	96.1
Scottsbluff	KNEW-FM	94.1

NEVADA

Location	C.L.	Mc.
Las Vegas	KORK-FM	97.1
	KRGN	101.9
	KLUC-FM	98.5
	KXLV	93.1
Reno	KNEV	95.5
	KUNR	88.1

NEW HAMPSHIRE

Location	C.L.	Mc.
Berlin	WMOU-FM	103.7
Claremont	WTSV-FM	106.1
Durham	WUNH	*90.3
Exeter	WPEA	*88.1
Laconia	WLNH-FM	98.3
Keene	WKNE-FM	103.7
Manchester	WKBR-FM	95.7
	WGIR-FM	101.1
Mt. Washington	WMTW-FM	94.9
Nashua	WOTW-FM	106.3
Portsmouth	WHEB-FM	100.3

NEW JERSEY

Location	C.L.	Mc.
Asbury Park	WJLK-FM	94.3
	WHTG-FM	105.5
Atlantic City	WFPG-FM	96.9
	WMGM	103.7
	WRNJ	95.1
Bridgeton	WSNJ-FM	107.7
Camden	WKDN-FM	106.9
Dover	WDHA-FM	105.5
E. Orange	WFMU	*91.1
Eatontown	WHTG-FM	105.3
Franklin	WLVP	102.3
Franklin Lakes	WRRH	88.7

WHITE'S RADIO LOG

Location	C.L.	Mc.
Glassboro	WGLS-FM	*89.7
Hackettstown	WNTI	*91.9
Long Branch	WRLB	107.1
Millville	WMVB-FM	97.3
Newark	WHBI	105.9
	WFME	94.7
	WVNJ-FM	100.3
	WBGO	*88.3
New Brunswk.	WCTC-FM	98.3
Paterson	WPAT-FM	93.1
Princeton	WPRB	103.3
Red Bank	WFHA-FM	106.3
South Orange	WSOU	*89.5
Trenton	WBUD-FM	101.5
	WTOA	97.5
Wildwood	WCMC-FM	100.7
Zarephath	WAWZ-FM	99.1

NEW MEXICO

Location	C.L.	Mc.
Albuquerque	KANW	*89.1
	KARA-FM	99.5
	KECL	92.3
	KHFM	96.3
	KOAT-FM	100.3
Clovis	KTQM-FM	99.9
Los Alamos	KRSN-FM	98.5
Mountain Park	KMFM	97.9
Roswell	KBIM-FM	97.1
University Park	KRWG	*91.7

NEW YORK

Location	C.L.	Mc.
Albany	WAMC	*90.3
Auburn	WMBO-FM	96.1
Babylon	WTFM	103.5
	WGU-FM	102.3
Binghamton	WNBF-FM	98.1
	WKOP-FM	95.3
Brooklyn	WNYE	*91.5
Brookville	WCWP	88.1
Buffalo	WBEN-FM	102.5
	WDCX	99.5
	WBFO	*88.7
	WBUF	93.3
	WEBR	94.5
	WGR-FM	96.9
	WTSL-FM	103.3
	WWOL-FM	104.1
	WYSL-FM	103.3
	WDIF	96.1
Canton	WSLU	*89.3
Central Square	WCSQ	*89.3
Cherry Valley	WJIV	101.9
Clinton	WHCL-FM	88.7
Corning	WCLI-FM	106.1
Cortland	WKRT-FM	99.9
Depew	WBLK-FM	93.7
DeRuyter	WOIV	105.1
Elmira	WECW	*88.1
Floral Park	WSHS	*90.3
Garden City	WLIR	92.7
Geneso	WGSU	88.3
Hempstead	WHLI-FM	98.3
	WVHC	*88.7
Hornell	WWHG-FM	105.3
Ithaca	WHCU-FM	97.3
	WICB	*91.7
	WEIV	103.7
	WVBR-FM	101.7
Jamestown	WJTN-FM	93.3
	WKSN-FM	101.7
Kenmore	WYSL-FM	103.3
Lake Success	WTFM	103.5
Liberty	WVOS-FM	95.9
Loudonville	WVCR-FM	89.1
Middletown	WALL-FM	92.7
Mt. Kisco	WRNW	107.1
	WVIP-FM	106.3
New Rochelle	WVOX-FM	93.5
New York	WABC-FM	95.5
	WBAI	99.5
	WCBS-FM	101.1
	WEVD-FM	97.9
	WFUV	*90.7
	WHOM-FM	92.3
	WKCR-FM	*89.9
	WLIB	107.5
	WNCN	104.3
	WNEW-FM	102.7
	WNBC-FM	97.1
	WNYC-FM	93.9
	WNYE	91.5
	WOR-FM	98.7
	WPIX-FM	101.9
	WQXR-FM	96.3
	WRFM	105.1
	WRVR	106.7
Niagara Falls	WHLD-FM	98.5
Norwich	WCHN-FM	103.9
Olean	WHDL-FM	95.7
Plattsburg	WEAV-FM	99.9
Patchogue	WALK-FM	97.5(s)
	WPAC-FM	106.1
Peekskill	WLNA-FM	100.7
Potsdam	WTSC-FM	91.1
Poughkeepsie	WKIP-FM	104.7
	WEOK-FM	101.5
Riverhead	WAPC-FM	103.9(s)
Rochester	WHFM	98.9
	WBBF-FM	100.1
	WCMF	96.5
	WIRQ	*90.9
	WROC-FM	97.9
	WVOR	100.5
	WRVM-FM	92.5
Schenectady	WGFM	99.5
South Bristol	WMIV	95.1
Springville	WSPE	*88.1
Syracuse	WAER	*88.1
	WDDS-FM	93.1
	WONO	107.9
	WSYR-FM	94.5
Troy	WFLY	92.3
	WRPI	*91.5
Utica	WRUN-FM	105.7
Wethersfield	WBIV	105.7
White Plains	WFAS-FM	103.9

NORTH CAROLINA

Location	C.L.	Mc.
Albemarle	WABZ-FM	100.9
Asheboro	WGWR-FM	92.3
Asheville	WLOS-FM	104.3
Burlington	WBBB-FM	101.1
	WFNS-FM	93.9
Black Mountain	WMIT	106.9
Burgaw	WPGF-FM	99.9
Burlington-Graham	WBAG-FM	92.9
Chapel Hill	WUNC	*91.5
Charlotte	WBT-FM	107.9
	WIST-FM	95.1
	WSOC-FM	103.7
	WYFM	104.7
Clingman's Pk.	WMIT	106.9
Concord	WEGO-FM	97.9
Durham	WDNC-FM	105.1
Elkin	WIFM-FM	100.9
Fayetteville	WFNC-FM	98.1
Forest City	WBBO-FM	93.3
	WAGY-FM	105.3
Gastonia	WGNC-FM	101.9
Goldsboro	WEQR	96.9
Greensboro	WMDE	98.7
	WQMG-FM	97.1
	WUAG	*89.9
Greenville	WWWS	*91.3
	WNCT-FM	107.7
Grifton	WITN-FM	93.3
Henderson	WHNC-FM	92.5
	WHKP-FM	102.5
Hendersonville	WHKP-FM	102.5
Hickory	WHKY-FM	102.9
	WIRC-FM	95.7
High Point	WHPE-FM	95.5
	WHPS	*89.3
	WMFR-FM	99.5
	WNOS-FM	100.3
Kannapolis	WRKB-FM	99.7
Laurinburg	WEWO-FM	96.5
Leaksville	WLOE-FM	94.5
Lexington	WBUY-FM	94.3
Lumberton	WTSB-FM	95.7
	WAGR-FM	102.3
North Wilkesboro	WKBC-FM	97.3
Raleigh	WKIX-FM	96.1
	WPTF-FM	94.7
	WRAL-FM	101.5
Reidsville	WWMO-FM	102.1
Rocky Mount	WEED-FM	92.1
	WFMA	100.7
Rochester	WVOR	92.5
Roxboro	WRXO-FM	96.7
Salisbury	WSTP-FM	106.5
Sanford	WWGP-FM	105.5
Shelby	WOHS-FM	96.1
Statesville	WFMX	105.7
Tarboro	WCPS-FM	104.3
Thomasville	WTNC-FM	98.3
Washington	WITN-FM	93.3
Williamston	WIAM	103.7
Wilmington	WPRV	93.9
Wilson	WVOT-FM	106.1
Winston-Salem	WAIR-FM	93.1
	WYFS	107.5
	WFDD-FM	*88.1
	WSJS-FM	104.1

NORTH DAKOTA

Location	C.L.	Mc.
Fargo	KFNW-FM	97.9
	WDAY-FM	93.7

OHIO

Location	C.L.	Mc.
Akron	WAKR-FM	97.5
	WAPS	*89.1
	WCUF	96.5
Alliance	WFAH-FM	101.7
Ashland	WNCO-FM	101.3
Ashtabula	WREO-FM	97.1
Athens	WOUB-FM	*91.5
	WATH-FM	105.5
Barberton	WDBN	94.9
Bellaire	WOMP-FM	100.5
Berea	WBWC	*88.3
Bowling Green	WAWR-FM	93.5
	WBGU	*88.1
Bucyrus	WBCO-FM	92.7
Cambridge	WILE-FM	96.7
Canton	WHBC-FM	94.1
	WCNO	106.9
	WTOF-FM	98.1
Celina	WMER-FM	94.3
Chillicothe	WBEX-FM	93.3
Cincinnati	WAEF-FM	98.5
	WCPO-FM	105.1
	WAKW-FM	93.3
	WGUC	*90.9
	WKRC-FM	101.9
	WSAI-FM	98.5
	WOIO	94.1
Circleville	WNRE	104.9
	WZIP-FM	92.5
Cleveland	KYW-FM	105.7
	WBOE	*90.3
	WCRF	103.3
	WCLV	95.5
	WDOK-FM	102.1
	WERE-FM	98.5
	WGAR-FM	99.5
	WHK-FM	100.7
	WJW-FM	104.1
	WNOB	107.9
	WXEN	106.5
	WZAK	93.1
Cleveland Hts.	WCUY-FM	92.3
Columbus	WCBE	*90.5
	WBNS-FM	97.1
	WCOL-FM	92.3
	WMNI-FM	99.7
	WOSU-FM	*89.7
	WTVN-FM	96.3
	WVKO	94.7
Conneault	WFIZ	104.9
Dayton	WHIO-FM	99.1
	WONE-FM	104.7
	WDAO	107.7
Delaware	WSLN	*91.1
East Liverpool	WOHI-FM	104.3
Eaton	WCTM	92.9
Elyria	WEOL-FM	107.3
Findlay	WFIN-FM	100.5
Fostoria	WFOB	96.7
Fremont	WFRO-FM	99.3
Gallipolis	WJEH-FM	101.5
Granville	WDUB-FM	91.3
Greenville	WDRK-FM	106.5
Hamilton	WQMS	96.7
	WHOH	103.5
	WFOL-FM	94.9(s)
Hillsboro	WSRW-FM	106.7
Kent	WKSU-FM	*88.1
Kenton	WKTN	
Kettering	WVUD-FM	99.9
Lancaster	WHOK-FM	95.5
Lima	WIMA-FM	102.1
Mansfield	WVNO	106.1
Marietta	WCMO	*89.3
Marion	WMRN-FM	106.9
Miamisburg	WFCJ	93.9
Middletown	WPFB-FM	105.9
Mt. Vernon	WMVO-FM	93.7
New Concord	WMCO-FM	*91.9
Newark	WCLT-FM	100.3
Norwalk	WLKR-FM	95.3
Oxford	WMUB	*88.5
	WOXR	97.7
Piqua	WPTW-FM	95.7
Port Clinton	WRWR-FM	94.5
Portsmouth	WPAY-FM	104.1
Salem	WSOM-FM	105.1
Sandusky	WLEC-FM	102.7
Springfield	WBLY-FM	103.9
	WEEC-FM	100.7
Steubenville	WSTV-FM	103.5
Tiffin	WTTF-FM	103.3
Toledo	WSPD-FM	101.5
	WMHE	92.5
	WTDS	*91.3
	WTOL-FM	104.7
	WTRT	99.9
Van Wert	WERT-FM	98.9
Wapakoneta	WERM	92.1
Westerville	WOBN	*91.5
Wilberforce	WJSC-FM	*88.9
Wooster	WWST-FM	104.5
Worthington-Columbus	WRFD-FM	97.9
Xenia	WHBM-FM	103.9
Yellow Springs	WYSO	*91.5
Youngstown	WKBN-FM	98.9
	WBBW-FM	93.3
	WRED	101.1
Zanesville	WHIZ-FM	102.5

OKLAHOMA

Location	C.L.	Mc.
Durant	KSEO-FM	107.3
Edmond	KWHB	97.7
Lawton	KLAW	101.5
McAlester	KNED-FM	101.3
Midwest City	KMWC	94.7
	KTEA-FM	92.5
Norman	WNAD-FM	*90.9
Nowata	KNFB	94.3
Oklahoma City	KOKH	*88.9
	KEFM	94.7
	KIOO	100.5
	KJEM-FM	102.7
	KOCY-FM	96.1
	KOFM	104.1
	KYFM	98.9
	KFNB	101.9
Shawnee	KBGC	*89.9
Stillwater	KOSU-FM	*91.7
	KSPI-FM	93.9
Tulsa	KWGS	*90.5
	KRMG-FM	95.5
	KOCW	97.5
	KOGM-FM	92.9
	KRAV	96.5

OREGON

Location	C.L.	Mc.
Corvallis	KFLY-FM	101.5
Eugene	KRVM	*91.9
	KEED-FM	93.1
	KFMY	97.9
	KUGN-FM	99.1
	KWAX	*91.1
	KBMC	94.5
Grants Pass	KGPO	96.9
Medford	KBOY-FM	95.3
Oretech	KTEC	*88.3
Portland	KOAP-FM	92.3
	KGMG	95.5
	KOIN-FM	101.1
	KPDQ-FM	105.3
	KPFM	97.1
	KPOJ-FM	98.5
	KQFM	100.3
	KRRC	*89.3

PENNSYLVANIA

Location	C.L.	Mc.
Allentown	WFMZ	100.7
	WAEB-FM	104.1
Altoona	WVAM-FM	100.1
	WFBG-FM	98.1
Beaver Falls	WBVP-FM	106.7
Bethlehem	WGPA-FM	95.1
Bloomsburg	WHLM-FM	106.5
Boyertown	WBYC-FM	107.5
Braddock	WLOA-FM	96.9
Butler	WBUT-FM	97.7
Carbondale	WCDL-FM	94.3
Carlisle	WHYL-FM	102.3
Chambersburg	WCHA-FM	95.1(s)
DuBois	WCED-FM	102.1
Easton	WEST-FM	107.9
	WJRH	*90.5
	WEEX-FM	99.9
Edensburg	WEND	103.9
Elizabethtown	WMSH-FM	106.7
Erie	WJET-FM	103.7
	WWYN-FM	99.9
Gettysburg	WGET-FM	107.7
Glenside	WIFI	92.5
Greensburg	WHJB	107.1
Harrisburg	WHP-FM	97.3
	WMSP	94.9
	WTPA-FM	104.1
	WCMB-FM	99.3
Havertown	WHHS	*89.3
Hazleton	WAZL-FM	97.9
Jenkintown	WIBF	103.9
Johnstown	WARD-FM	92.1
	WJAC-FM	95.5
Lancaster	WGAL-FM	101.3
	WDAC	94.5
	WLAN-FM	96.9
Lebanon	WLBR-FM	100.1
Lewisburg	WVBU-FM	95.9
Lewiston	WMRF-FM	95.9
Martinsburg	WJSM	92.7
Meadville	WARC	*90.3
	WMGW-FM	100.3
Media	WXUR-FM	100.3
Montrose	WPEL-FM	96.5
New Kensington-Tarentum	WYDD	100.7
Oil City	WDJR	98.5
Palmyra	WJWR	92.1
Philadelphia	WCAU-FM	98.1
	WPBS-FM	105.3
	WDAS-FM	105.3
	WJMJ-FM	104.5
	WFIL-FM	102.1
	WDVR	101.1
	WFLN	95.7
	WHAT-FM	96.5
	WUHY-FM	*90.9
	WIFI	92.5
	WIBG-FM	94.1
	WIP-FM	93.3
	WPEN-FM	102.9
	WPWT	*91.7
	WQAL	106.1
	WRTI-FM	*90.1
	WXPN	*88.9

Location	C.L.	Mc.
Pittsburgh	KDKA-FM	92.9
	WAMO	105.9
	WEEP-FM	107.9
	WRYT-FM	106.1
	KQV-FM	102.5
	WDUQ	*91.5
	WJAS-FM	99.7
	WKJF	93.7
	WPIT-FM	101.5
	WWSW-FM	94.5
Pottsville	WPPA-FM	101.9
Reading	WRFY-FM	102.5
Red Lion	WGCB-FM	96.1
Scranton	WGBI-FM	101.3
	WUSV	*88.9
	WWDL-FM	104.9
Sharon	WPIC-FM	102.9
State College	WMAJ-FM	103.1
Stroudsburg	WVPO-FM	93.5
Sunbury	WKOK-FM	94.1
Towanda	WTTC-FM	95.3
Tyrone	WGMR-FM	101.1
University Park	WDFM	*91.1
Warren	WRRN	92.3
Washington	WJPA-FM	95.3
Waynesboro	WAYZ-FM	101.5
Wilkes-Barre	WBRE-FM	98.5
	WYZZ	92.9
Williamsport	WLYC-FM	105.1
	WRAK-FM	100.3
York	WNOW-FM	105.7
	WSBA-FM	103.3

PUERTO RICO

Location	C.L.	Mc.
Aguadilla	WABA-FM	100.3
San Juan	WIPR-FM	*91.3
	WITA-FM	93.7
	WOLA	105.7

RHODE ISLAND

Location	C.L.	Mc.
Cranston	WLOV	99.9
Kingston	WRTU	*91.1
Providence	WPJB-FM	105.1
	WICE-FM	107.7
	WPFM	95.5
	WPRO-FM	92.3
	WCRQ	101.5
	WHIM-FM	94.1
Woonsocket	WWON-FM	106.3

SOUTH CAROLINA

Location	C.L.	Mc.
Anderson	WCAC	101.1
Beaufort	WBEU-FM	98.7
Charleston	WCSC-FM	96.9
	WTMA-FM	95.1
Clemson	WSBF-FM	*88.1
Columbia	WCOS-FM	97.9
	WNOK-FM	104.7
	WUSC-FM	*89.9
Conway	WLAT-FM	104.1
Dillon	WDSC-FM	92.9
Easley	WELP-FM	103.9
Florence	WJMX-FM	103.1
Greenville	WESC-FM	92.5
	WFBC-FM	93.7
	WMVU-FM	94.5
Laurens-Clinton	WLBG-FM	100.5
N. Charleston	WKTM	102.5
Rock Hill	WRHI-FM	98.3
Seneca	WSNW-FM	98.1
Spartanburg	WSPA-FM	98.9
Sumter	WFIG-FM	101.3

SOUTH DAKOTA

Location	C.L.	Mc.
Hot Springs	KOBH-FM	96.7
Sioux Falls	KELO-FM	92.5

TENNESSEE

Location	C.L.	Mc.
Bristol	WOPI-FM	96.9
Chattanooga	WDOD-FM	96.5
	WLON	106.5
	WDEF-FM	92.3
Cleveland	WCLE-FM	100.7
Collegedale	WSMC-FM	*88.1
Cookeville	WHUB-FM	98.3
	WPTN-FM	94.3
Dickson	WOKN-FM	102.3
Franklin	WFLT-FM	100.1
Gallatin	WFMG	104.5
Greeneville	WGRV-FM	94.9
Humboldt	WIRJ-FM	102.3
Jackson	WTJS-FM	104.1
Johnson City	WJCW-FM	101.5
Kingsport	WKPT-FM	98.5
Knoxville	WBIR-FM	93.5
	WKCS	*91.1
	WUOT	*91.9
	WCAS	97.5
Lexington	WDXL-FM	99.3
Livingston	WRHM-FM	95.9
Manchester	WMSR-FM	99.7
McKenzie	WKTA	106.9
McMinnville	WHNR	101.7
Memphis	WMC-FM	99.7
	WMPS-FM	97.1
	WNTL	102.7
Milan	WKBJ-FM	92.3
Morristown	WMTN-FM	95.9
Nashville	WLAC-FM	105.9
	WPLN	90.3
	WSIX-FM	97.9
Sevierville	WSEV-FM	102.1
Sparta	WSMT-FM	105.5
Springfield	WDBL-FM	94.3
Tullahoma	WJIG-FM	93.3

TEXAS

Location	C.L.	Mc.
Abernathy	KWGN-FM	99.5
Abilene	KACC-FM	*91.1
	KFMN	99.3
	KWKC-FM	105.1
Amarillo	KGNC-FM	93.1
	KVII-FM	94.1
Austin	KHFI-FM	98.3
	KAZZ	95.5
	KTBC-FM	93.7
	KUT-FM	*90.7
Beaumont	KHCB-FM	105.7
	KAYD-FM	97.5
Big Spring	KFNE-FM	95.3
Brenham	KWHI-FM	106.3
Brownwood	KHPC	88.1
Clear Lake City	KMSC	102.1
Cleburne	KCLE-FM	94.9
College Station	WTAW-FM	92.1
Conroe	KNRO	106.9
Corpus Christi	KZFM	95.5
Dallas	KIXL-FM	104.5
	KMAP	105.3
	KNER	*88.1
	KRLD-FM	92.5
	KLIF-FM	98.7
	WFAA-FM	97.9
	WRR-FM	101.1
	KVTT	*91.7
	KQRO	102.9
	KBOX-FM	100.3
Denton	KDNT-FM	106.1
DiBoll	KSPL-FM	95.5
Dumas	KDDD-FM	95.3
El Paso	KVOF-FM	*88.5
	KTSM-FM	99.9
	KHMS	94.7
Ft. Worth	WBAP-FM	96.3
	KXFM	99.5
	KFJZ-FM	97.1
	KJIM-FM	102.1
	KCUL-FM	93.9
	KNOK-FM	107.5
	KTCU-FM	*89.1
Gainesville	KGAF-FM	94.5
Galveston	KGBC-FM	106.5
Harlingen	KELT	94.5
Henderson	KGRI-FM	100.1
Highland Park-Dallas	KVIL-FM	103.7
Hillsboro	KHBR-FM	102.3
Houston	KHGM	102.9
	KHCB-FM	105.7
	KHUL	95.7
	KFMK	97.9
	KODA-FM	99.1
	KLEF	94.5
	KOST	100.3
	KQUE	102.9
	KRBE	104.1
	KXYZ-FM	96.5
	KTRH-FM	101.1
	KUHF	*91.3
	KBNO	93.7
Killeen	KLEN-FM	93.3
Humboldt	WIRJ-FM	102.3
Jasper	KTXJ-FM	102.3
Lake Jackson	KLJT	107.3
Lamesa	KPET-FM	100.3
Longview	KLUE-FM	105.7
Lubbock	KSEL-FM	93.7
	KBFM	96.3
	KTXT-FM	*91.9
Marshall	KMHT-FM	97.3
Midland	KNFM	92.3
	KMOD-FM	93.3
Mt. Pleasant	KIMP-FM	100.7
Odessa	KQIP	96.7
	KWMO	99.1
Odessa	KOCV	91.3
Pasadena	KLVL-FM	92.5
Plainview	KHBL	*88.1
Port Arthur	KFMP	93.3
	KPAC-FM	98.5
San Angelo	KWLW	93.9
San Antonio	KISS	99.5
	KEEZ	97.3
	KAKI-FM	98.1
	KITY	92.9
	KMFM	96.1
Sinton	KTOD-FM	101.3
Spearman	KBMF-FM	98.3
Temple	KYLE-FM	104.9
Texarkana	KTAL-FM	98.1
Tyler	KSLT	93.1
	KDOK-FM	101.5
Victoria	KTNX-FM	92.1
Waco	KEFC	97.5
Wichita Falls	KLUR	99.9
	KNTO	95.1

UTAH

Location	C.L.	Mc.
Ephraim	KEPH	*88.9
Logan	KUSU-FM	*91.5
Provo	KBYU-FM	*88.9
Salt Lake City	KCPX-FM	98.7
	KLUB-FM	97.1
	KSL-FM	100.3
	KSOP-FM	104.3
	KWHO-FM	63.3

VERMONT

Location	C.L.	Mc.
Burlington	WJOY-FM	98.5

VIRGINIA

Location	C.L.	Mc.
Arlington	WAVA-FM	105.1
	WCCV-FM	97.5
Blacksburg	WVVV	104.9
Charlottesville	WINA-FM	95.3
	WTJU	91.3
Covington	WKEY-FM	100.9
Crewe	WSVS-FM	104.7
Farmville	WFLO-FM	95.7
Fredericksburg	WFVA-FM	101.5
Gretna	WMNA-FM	103.3
Grundy	WNRG-FM	97.7
Hampton	WVEC-FM	101.3
	WHOV	*88.3
Harrisonburg	WEMC	*91.7
	WSVA-FM	100.7
Lynchburg	WWOD-FM	100.1
	WDMS-FM	101.7
Manassas	WPRW-FM	106.7
Marion	WMEV-FM	93.9
Martinsville	WMVA-FM	96.3
Newport News	WGH-FM	97.3
Norfolk	WMTI	*91.5
	WCMS-FM	100.5
	WNOR-FM	98.7
	WRVC	102.5
	WTAR-FM	95.7
	WXRI	104.5
	WYFI-FM	99.7
Portsmouth	WAVY-FM	96.9
Radford	WRAD-FM	101.7
Richmond	WCOD	98.1
	WRFK	91.1
	WRVA-FM	94.5
	WRNL-FM	102.1
Roanoke	WDBJ-FM	94.9
	WLRJ	92.3
	WROV-FM	103.7
	WSLS-FM	99.1
South Boston	WHLF-FM	97.5
South Norfolk	WFOS	*90.5
Staunton	WSGM-FM	93.5
Williamsburg	WCWM	89.1
	WRCI	96.5
Winchester	WRFL	92.5
Woodbridge	WXRA	105.9

WASHINGTON

Location	C.L.	Mc.
Aberdeen	WDUX-FM	104.7
Bellingham	KGMI-FM	92.9
	KERI	104.3
Bremerton	KBRO-FM	106.9
Centralia	KGME-FM	102.9
Cheney	KEWC-FM	*89.1
College Place	KGTS	91.3
Edmunds	KGFM	105.3
Ellensburg	KCWS-FM	*91.5
Eugene	KBMC	104.5
Hoquiam	KHOK-FM	103.9
Lynden	KLYN-FM	106.5
Opportunity	KZUN-FM	96.1
Prosser	KACA	102.3
Seattle	KING-FM	98.1
	KBLE-FM	93.3
	KETO-FM	101.5
	KGMJ	95.7
	KIRO-FM	100.7
	KISW	99.9
	KLXN	96.5
	KMCS	98.9
	KOL-FM	94.1
	KRAB	107.7
	KTW-FM	102.5
	KUOW	94.9
	KIXI-FM	95.7
	KZAM	92.5
Spokane	KREM-FM	92.9
	KXLY-FM	99.9
	KHQ-FM	98.1
Tacoma	KCPS	90.9
	KLAY-FM	106.3
	KTNT-FM	97.3
	KTOY	*91.7
	KTAC-FM	103.9
Yakima	KNDX-FM	106.3

WEST VIRGINIA

Location	C.L.	Mc.
Beckley	WBKW	99.5
Berkeley Springs	WCST-FM	93.5
Bluefield	WHIS-FM	104.5
Charleston	WKAZ-FM	97.5
	WKNA	98.5
	WTIO	105.9
	WVAF	99.9
Huntington	WKEE-FM	100.5
	WMUL	*88.1
	WVQM	103.3
Martinsburg	WEPM-FM	97.5
Morgantown	WAJR-FM	99.3
Norfolk	WCMS-FM	100.5
Oak Hill	WOAY-FM	94.1
Parkersburg	WTAP-FM	103.1
Wheeling	WKWK-FM	97.3
	WWVA-FM	98.7
	WTRF-FM	107.5

WISCONSIN

Location	C.L.	Mc.
Appleton	WLFM	*91.1
Chilton	WHKW	*89.3
Colfax	WHWC	*88.3
Delafield	WHAD	*90.7
Eau Claire	WIAL	94.1
	WEAU-FM	100.7
Fort Atkinson	WFAW	107.3
Green Bay	WBAY-FM	101.1
Greenfield Twp.	WWCF	94.9
Highland	WHHI	91.3
Highland Twp.	WHSA	*89.9
Janesville	WCLO-FM	99.9
Kenosha	WLIP	95.1
La Crosse	WHLA	*90.3
	WWLA	93.3
Madison	WHA-FM	*88.7
	WIBA-FM	101.5
	WISM-FM	98.1
	WMFM	104.1(s)
	WRVB-FM	102.5
Merrill	WLIN	100.7
Milwaukee	WFMR	96.5
	WMIL-FM	95.7
	WISN-FM	97.3
	WRIT-FM	102.9
	WMKE	102.1
	WQFM	93.3
	WTMJ	94.5
	WBON	107.7
	WEMP-FM	99.1
	WUWM	*89.7
Monroe	WEKZ-FM	93.7
Mt. Horeb	WFMK	92.3
Neillsville	WCCN-FM	105.5
Platteville	WSCI-FM	*89.5
Racine	WRJN-FM	100.7
	WFNY	92.1
Rice Lake	WJMC-FM	96.3
Ripon	WCWC-FM	95.9
Sauk City	WVLR	96.7
Sparta	WCOW-FM	97.1
Stevens Point	WSPT-FM	97.9
Superior	WWJC-FM	105.1
Tomah	WTMB-FM	98.9
Watertown	WTTN-FM	104.7
Waukesha	WAUK-FM	106.1
Wausau	WHRM	*91.9
	WRIG-FM	101.9
Wauwatosa	WTOS	103.7
West Bend	WBKV-FM	92.5
Whitewater	WSUW	91.7
Wisc. Rapids	WFHR-FM	103.3

WYOMING

Location	C.L.	Mc.
Cheyenne	KVWO-FM	106.3

WHITE'S

RADIO LOG

Canadian AM Stations by Location

Location	C.L.	Kc.
Abbotsford, B.C.	CFVR	1240
Altona, Man.	CFAM	1290
Amherst. N.S.	CKDH	1400
Amos, Que.	CHAD	1340
Antigonish, N.S.	CJFX	580
Barrie, Ont	CKBB	950
Bathurst, N.B.	CKBC	1360
Belleville, Ont.	CJBQ	800
Blind River, Ont.	CJNR	730
Brampton, Ont.	CHIC	790
Brandon. Man	CKX	1150
Brantford, Ont.	CKPC	1380
Bridgewater, N.S.	CKBW	1000
Brockville. Ont.	CFJR	1450
Cabano, Que.	CJAF	1340
Calgary, Alta.	CFAC	960
	CFCN	1060
	CKXL	1140
Callander, Ont.	CFCH	600
Campbell River, B.C.	CFWB	1490
Campbellton, N.B.	CKNB	950
Camrose, Alta.	CFCW	790
Causapscol, Que.	CJBM	1450
Charlottetown, P.E.I.	CFCY	630
Chatham, Ont.	CFCO	630
Chicoutimi, Que.	CBJ	1580
	CJMT	1420
Chilliwack, B.C.	CHWK	1270
Churchill, Man.	CHFC	1230
Cobourg. Ont.	CHUC	1450
Corner Brook, Nfld.	CBY	990
	CFCB	570
Cornwall, Ont.	CFML	1110
	CJSS	1220
Courtenay, B.C.	CFCP	1440
Cranbrook, B.C.	CKEK	570
Dartmouth, N.S.	CFDR	790
Dauphin, Man.	CKDM	730
Dawson Creek, B.C.	CJDC	1350
Drumheller, Alta.	CJDV	910
Drummondville, Que.	CHRD	1340
Dryden, Ont.	CKDR	900
Edmonton, Alta.	CBX	1010
	CBXA	740
	CFRN	1260
	CHED	630
	CHFA	680
	CJCA	930
	CKUA	580
Edmundston, N.B.	CJEM	570
Estevan, Sask.	SJSL	1280
Flin Flon, Man.	CFAR	590
Fort Frances, Ont.	CFOB	800
Fort Simpson, N.W.T.	CFMR	1490
Fort St. John, B.C.	CKNL	970
Fort William, Ont.	CJLX	800
Fredericton, N.B.	CFNB	550
	CBZ	1480
Galt, Ont.	CFTJ	1110

Location	C.L.	Kc.
Gander, Nfld.	CBG	1450
Goose Bay, Nfld.	CFGB	1340
Granby. Que.	CHEF	1450
Grande Prairie, Alta.	CFGP	1050
Grand Bank, Nfld.	CHOX	710
Grand Falls, Nfld.	CBT	540
	CKCM	620
Gravelbourg, Sask.	CFRG	710
	CFGR	1230
Guelph, Ont.	CJOY	1460
Halifax, N.S.	CBH	860
	CHNS	960
	CJCH	920
Hamilton, Ont.	CHML	900
	CKOC	1150
	CHIQ	1280
Hauterive, Que.	CHLC	580
Huntsville, Ont.	CKAR	630
Hull. Que.	CKCH	970
Inuvik, N.W.T.	CHAK	860
Joliette. Que.	CJLM	1350
Jonquiere, Que.	CKRS	590
Kamloops, B. C.	CFJC	910
Kelowna. B.C.	CKOV	630
Kenora. Ont.	CJRL	1220
Kentville. N.S.	CKEN	1350
Kingston, Ont.	CFRC	1490
	CKLC	1380
	CKWS	960
Kirkland Lake, Ont.	CJKL	560
Kitchener, Ont.	CKCR	1490
Kitimat, B.C.	CKTK	1230
	CKKW	1320
Langley. B.C.	CJJC	850
La Sarre, Que.	CKLS	1240
La Tuque, Que.	CFLM	1240
Leamington. Ont.	CJSP	710
Lethbridge, Alta.	CHEC	1090
	CJOC	1220
Lindsay. Ont.	CKLY	910
Lloydminster, Alta.	CKSA	1150
London. Ont.	CFPL	980
	CKSL	1410
Marystown, Nfld.	CHCM	560
Matane, Que.	CKBL	1250
Medicine Hat, Alta.	CHAT	1270
Middleton, N.S.	CKAD	1490
Midland. Ont.	CKMP	1230
Moncton, N.B.	CBAF	1300
	CKCW	1220
Mont Laurier. P.Q.	CKML	610
Montmagny. Que.	CKBM	1490
Montreal, Que.	CBF	690
	CBM	940
	CFCF	600
	CFMB	1410
	CJAD	800
	CJMS	1280
	CKAC	730
	CKGM	980
	CKLM	1570
Moose Jaw, Sask.	CHAB	800
Nanaimo, B.C.	CHUB	1570
Nelson, B.C.	CKLN	1390
New Carlisle, Que.	CHNC	610
Newcastle, N.B.	CKMR	790
New Glasgow, N.S.	CKEC	1320
New Westminster, B.C.	CKNW	980
Niagara Falls, Ont.	CJRN	1600

Location	C.L.	Kc.
North Battleford, Sask.	CJNB	1050
North Vancouver, B.C.	CKLG	730
Oakville, Ont.	CHWO	1250
Orillia. Ont.	CFOR	1570
Oshawa, Ont.	CKLB	1350
Ottawa, Ont.	CBO	910
	CBOF	1250
	CFRA	580
	CKOY	1310
	CKPM	1440
Owen Sound. Ont.	CFDS	560
Parry Sound, Ont.	CKAR-1	1340
Peace River, Alta.	CKYL	610
Pembroke, Ont.	CHOV	1350
Penticton, B.C.	CKOK	800
Peterborough, Ont.	CHEX	980
	CKPT	1420
Pointe Claire, Que.	CFOX	1470
Portage La Prairie, Man.	CFRY	920
Port Albemi, B.C.	CJAV	1240
Port Arthur, Ont.	CFPA	1230
	CKPR	580
Prince Albert. Sask.	CKBI	900
Prince George, B.C.	CKPG	550
Prince Rupert, B.C.	CFPR	1240
Quebec, Que.	CBV	980
	CFOM	1340
	CHRC	800
	CJLR	1060
	CJQC	1340
	CKCV	1280
Quesnel, C.C.	CKCQ	570
Red Deer, Alta.	CKRD	850
Regina, Sask.	CBK	540
	CJME	1300
	CKCK	620
	CKRM	980
Richmond Hill, Ont.	CFGM	1310
Rimouski, Que.	CJBR	900
Riviere du Loup, Que.	CJFP	1400
Roberval, Que.	CHRL	910
Rouyn, Que.	CKRN	1400
Ste. Anne de la Pocatiere, Que.	CHGB	1310
St. Boniface, Man.	CKSB	1050
St. Catharines, Ont.	CKTB	610
St. Hyacinthe, Que.	CKBS	1240
St. Jean, Que.	CHRS	1090
St. Jerome, Que.	CKJL	900
St. John, N.B.	CBD	1110
St. John's, Nfld.	CBN	640
	CJON	930
	VOAR	1230
	VOCM	590
	VOWR	800
St. Joseph d'Alma, Que.	CFGT	1270
St. Thomas, Ont.	CHLO	680
Sackville, N.B.	CBA	1070
Saint John, N.B.	CFBC	930
	CHSJ	1150
Sarnia. Ont.	CHOK	1070
Saskatoon, Sask.	CFNS	1170
	CFQC	600
	CKOM	1250
Sault Ste. Marie, Ont.	CJIC	1050
	CKCY	920
Sept-Iles, Que.	CKCN	560
Shawinigan, Que.	CKSM	1220

Location	C.L.	Kc.
Shefferville, Que.	CFKL	1230
Sherbrooke, Que.	CHLT	630
	CKTS	900
Simcoe, Ont.	CFRS	1560
Smiths Falls, Ont.	CJET	630
Smithers, B.C.	CFBV	1230
Sorel, Que.	CJSO	1320
Stratford, Ont.	CJCS	1240
Steinbach, Man.	CHSM	1250
Sudbury, Ont.	CFBR	550
	CHNO	900
	CKSO	790
Summerside, P.E.I.	CJRW	1240
Swift Current, Sask.	CKSW	1400
Sydney, N.S.	CBI	1140
	CJCB	1270
Terrace, B.C.	CFTK	1140
Thetford Mines. Que.	CKLD	1230
Thompson, Man.	CHTM	610
Trois-Rivieres, Que.	CHLN	550
	CKTR	1150
Tillsonburg, Ont.	CKOT	1510
Timmins, Ont.	CFCL	620
	CKGB	680
Toronto, Ont.	CBL	740
	CFRB	1010
	CHFI	1540
	CHUM	1050
	CJBC	860
	CKEY	590
	CKFH	1430
Trail. B.C.	CJAT	610
Truro. N.S.	CKCL	600
Val d'Or, Que.	CKVD	1230
Valleyfield, Que.	CFLY	1370
Vancouver, B.C.	CBU	690
	CFUN	1410
	CHQM	1320
	CJOR	600
	CKLG	730
	CKWX	1130
Verdun, Que.	CKVL	850
Vernon, B.C.	CJIB	940
Victoria, B.C.	CFAX	1070
	CJVI	900
	CKDA	1220
Victoriaville, Que.	CFDA	1380
Ville Marie, Que.	CKVM	710
Ville St. Georges, Que.	CKRB	1460
Wawa, Ont.	CJWA	1240
Welland. Ont.	CHOW	1470
Weyburn, Sask.	CFSL	1340
Whitehorse, Y. T.	CFWH	570
Williams Lake, B.C.	CKCQ-1	1240
Windsor, N.S.	CFAB	1450
Windsor, Ont.	CBE	1550
	CKLW	800
	CKWW	580
Wingham. Ont.	CKNX	920
Winnipeg, Man.	CBW	990
	CJOB	680
	CJQM	1470
	CKRC	630
	CKY	580
Woodstock, N.B.	CJCJ	920
Woodstock, Ont.	CKOX	1340
Yarmouth, N.S.	CJLS	1340
Yellowknife, N.W.T.	CFYK	1340
Yorkton, Sask.	CJGX	940

Canadian FM Stations by Location

Location	C.L.	Mc.
Belleville, Ont.	CJBQ-FM	97.1
Brandon, Man.	CKX-FM	96.1
Brantford, Ont.	CKPC-FM	92.1
Calgary, Alta	CHFM-FM	95.9
Cornwall, Ont.	CJSS-FM	104.5
Edmonton, Alta.	CFRN-FM	100.3
	CJCA-FM	99.5
	CKUA-FM	98.1
Halifax, N.S.	CHNS-FM	96.1
Hamilton, Ont.	CHML-FM	95.3
Kamloops, B.C.	CFFM-FM	98.3
Kingston, Ont.	CFRC-FM	91.9
	CKLC-FM	99.5
	CKWS-FM	96.3

Location	C.L.	Mc.
Kitchener, Ont.	CKCR-FM	96.7
Lethbridge, Alta.	CHEC-FM	100.9
London, Ont.	CFPL-FM	95.9
Montreal, Que.	CBF-FM	95.1
	CBM-FM	100.7
	CFCF-FM	92.5
	CJFM-FM	95.9
	CJMS-FM	94.3
	CKGM-FM	97.7
Oshawa. Ont.	CKLB-FM	93.5
Ottawa, Ont.	CBO-FM	103.3
	CFMO-FM	93.9
Port Arthur, Ont.	CKPR-FM	94.3

Location	C.L.	Mc.
Quebec, Que.	CHRC-FM	98.1
Rimouski, Que.	CJBR-FM	101.5
Sault Ste. Marie, Ont.	CJIC-FM	100.5
	CKCY-FM	104.3
Sherbrooke, Que.	CHLT-FM	102.7
St. Catharines, Ont.	CKTB-FM	97.7
St. Norbet, (Winnipeg) Man.	CFMW-FM	98.3
Sydney, N.S.	CJCB-FM	94.9
Timmins, Ont.	CKGB-FM	94.5
Toronto, Ont.	CBC-FM	99.1

Location	C.L.	Mc.
	CHFI-FM	98.1
	CHUM-FM	104.5
	CJRT-FM	91.1
	CKFM-FM	99.9
Vancouver, B.C.	CBU-FM	105.7
	CFQM-FM	103.5
	CKLG-FM	99.3
Verdun, Que.	CKVL-FM	96.9
Victoria, B.C.	CKDA-FM	98.5
Windsor, Ont.	CKLW-FM	93.9
Winnipeg, Man.	CJOB-FM	97.5
	CKQM-FM	94.3
	CKY-FM	92.1

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.

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.

QSL Cards. Many beginners in the hobby of listening for distant stations (or "DX'ing," as it is commonly known) aren't aware of the fact that merely *hearing* the stations is only half of the battle—getting the prized "QSL card" from the station can be just as much fun and equally rewarding too.

"QSL cards" are postcards sent out by just about every broadcasting station upon receipt of correct reception reports from listeners. To the listener who sends in the report to the broadcaster, the QSL card is a means of proving that he actually did hear the station in question, and it is also a colorful means of decorating the walls of the listening post. Most of these QSL cards are gayly colored and quite attractive.

On the other end of the situation, the broadcasters are usually pleased to send out these cards because it encourages people to listen to them and also to write to their engineering department. These reports are valuable to let the station know how well it is being received in various parts of the world, if it suffers from interference, if its signals fade, if it is being jammed, etc. They can also determine the size of their listening audience in given parts of the world.

To get a QSL card, however, means more than just sending a broadcaster stating: "I heard your station today, please send a QSL card." Such a report (and they are plentiful) is less than useless to a broadcaster and never brings a QSL card.

Here is how to be just about assured of getting one of these cards for your collection. First, listen to the station for at least 15 minutes—write down everything you hear, such as names of songs, topics of discussions, commercials, names of station personnel mentioned over the air. If you cannot understand the language being used, you can still list the type of programming. For example: "0715- Dance recording played featuring flute," or "0719- Woman read

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news bulletin apparently about Viet Nam."

When you have completed your listening you are then ready to send your report. Include in the report the date you heard the station, the time of day (stations prefer you to use Greenwich Mean Time, but this isn't absolutely necessary), the details of the program material you heard, the strength of their signals, if they were interferred with by another station, the frequency you heard them on, and information on the type of receiver and antenna which you use. It is helpful to pass along to the station any comments which you have about their programming, such as: "I enjoy your musical programs," or "I would like to hear some folk music of your country played in the evenings," etc.

As a further addition to your signal report, add a short paragraph about yourself and your interest in DX'ing. Tell how many stations you have heard, how many countries, how many QSL cards you have received. You can tell the station your age or occupation, or, if you go to school, where you go and the grade you are in.

The station can usually be sent a letter without any street address on the letter, in the event you did not get their address over the air. A letter addressed to "The Voice of America, Washington, D. C.," or "Radio Sweden, Stockholm, Sweden," will be delivered promply. It is not necessary for you to enclose return postage for reports sent to broadcasting stations which are operated by governmental agencies, however return postage sent to small commercial broadcasters (especially in Central and South America) can sometimes be the deciding factor in whether or not you will receive that prized QSL.

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:

Joseph Green, Hamilton, Ont.
Kees Hamming, Meadow Bank, P.E.I.
John Balgord, Wausau, Wisc.
Joseph W. Portka, Rochester, N.Y.
Tom Kneitel, New York, N.Y.
Mike Long, Shadyside, Ohio
Alan Anway, Cedar Falls, Iowa
R. D. Jones, Sarnia, Ont.
John Brings, Toronto, Ont.
C. May, Westminster, Mass.
Mike Jones, Dallas, Tex.
Charles Haynes, Beaumont, Tex.
Russell Hawkins, La Vergne, Tenn.
Julian M. Sienkiewicz, Brooklyn, N.Y.
Mark Davis, Vallejo, Calif.
Grace Rademacher, Hamden, Conn.
Larry Esco, Birmingham, Ala.
David Bernstein, Lancaster, Pa.
Herb Friedman, Laurelton, N.Y.
Ronald Miller, Peoria, Ill.
Francisco Viau, Guatemala City, Guat.
Sol Nussbaum, Brooklyn, N.Y.
Lee Rand, Old Town, Me.
Mike J. Dougherty, Phoenix, Ariz.
Richard George, Wichita, Kans.
Richard Goldblatt, Atlanta, Ga.
Rex Holmes, Oklahoma City, Okla.
Art Finnegan, Vancouver, B.C.
Jim Gibson, Forest Hills, N.Y.
Rick Slattery, Miami, Fla.

Freq.	Call	Name	Location	EST
2182	WUE211	Lock 11*	Wellsburg, W. Va.	0710
	NOW	NOW (U.S.C.G.)*	Pt. Angeles, Wash.	2230
	NMF	NMF (U.S.C.G.)*	Boston, Mass.	1750
	—	(marine emerg.)*	various ship & land	—
2430	YVCN	Escuelas R.	San Fernando, Venez.	2130
2450	4VEH	V. Evangelique	Cap Hatien, Haiti	0645
	KLH	S.F. Marine Oper.*	San Francisco, Calif.	0110
	KOE	Eureka Marine Op.*	Eureka, Calif.	0100
2514	WAY	Chicago*	Chicago, Ill.	1810
2530	KQP	Galveston Marine Op.*	Galveston, Tex.	2010

Kc/s	Call	Name	Location	EST
2598	KFX	Astoria Marine Op.*	Astoria, Ore.	2300
2716	NAS	Pensacola R. (U.S.N.)*	Pensacola, Fla.	2300
3230	ELWA	R. Village	Monrovia, Liberia	0140
3255	ELBC	Liberian BC	Monrovia, Liberia	0130
3260	—	R. Niger	Niamey, Niger	1615
3284	VRH9	Fiji BC	Suva, Fiji Is.	0102
3297	—	R. Brazzaville	Brazzaville, Congo	0000
3300	—	Brit. Hond. BC	Belize, Brit. Honduras	1730
3325	YVRA	R. Monagas	Maturin, Venez.	2315
3346	HIAS	Onda Musical	Sto. Domingo, Dom. Rep.	2308
3368	—	E. Official	Luanda, Angola	1830
3375	ZYK28	R. Olinda	Olinda, Braz.	2300
3390	HCOTI	R. Saracay	Sto. Domingo, Ecuador	2108
3824	ZNF4V	—	Maseru, Basutoland	2345
3930	CR4AC	R. Barlavento	S. Vicente, Cape Verde Is.	1850
3925	MCM	BBC	London, England	1045
3960	—	R. Iran	Teheran, Iran	1100
3975	GRC	BBC	London, England	0030
3985	—	V. UN Command	Seoul, S. Korea	0300
3990	—	A.F.R.S.	Taipei, Formosa	0600
3995	VQO3	Solomin I. BC	Honiara, Solomon Is.	0310
4560	VL7AX	Hobart Police*	Hobart, Tasmania	0910
	VLC	Melbourne Police*	Melbourne, Australia	0910
4742	CP77	R. Sararenda	Camiri, Bolivia	2100

60 Meter Band—4750 to 5060 Kc/s

Kc/s	Call	Name	Location	EST
4765	HCAK2	R. del Ecuador	Guayaquil, Ecuador	2200
4795	—	R & TV Franc.	Brazzaville, Congo	0000
4807	—	R. Club Sao Tome	Sao Tome	1500
4820	—	E. Official	Luanda, Angola	0100
4825	HJHC	R. Narino	Pasto, Columbia	2345
	—	Govorit Ashkhabad	Ashkhabad, USSR	1605
4835	—	R. Malaysia	Kuching, Sarawak	0900
4865	PRG5	R. Club de Para	Belem, Brazil	2145
4873	—	R. Centenairio	Sta. Cruz, Bolivia	2230
4880	HCWEI	R. Nac. Espejo	Quito, Ecuador	2130
4950	—	R. Malaysia	Kuching, Sarawak	0730
	YVQA	R. Sucre	Cumana, Venez.	2100
4968	—	R. Kuwait	Kuwait	1215
4990	YVMQ	R. Barquisimeto	Barquisimeto, Venez.	2145
5047	—	R. du Togo	Lome, Togo	0030
5050	—	R. Tanganyika	Dar es Salaam, Tangan.	2300
5145	—	R. Peking	Peking, China	1445

49 Meter Band—5950 to 6200 Kc/s

Kc/s	Call	Name	Location	EST
5960	—	Trans World R.	Monte Carlo, Monaco	1130
	CP81	R. Pio Doce	Llallagua, Bolivia	0400
5970	CKNA	R. Canada	Montreal, P.Q.	0715
	—	R & TV Franc.	Brazzaville, Congo	1100
	—	R. Berlin Int'l.	Berlin, E. Germany	2000
	HJKA	R. Horizonte	Bogota, Colombia	0350
5975	MCP	BBC	London, England	0030
	—	V. America	Honolulu, Hawaii	0800
5980	—	Lebanese BC	Beirut, Lebanon	2330
	—	R. Nederland	Hilversum, Holland	0100
5990	MCU	BBC		
6000	—	R. Americas		
6015	HLK52	V. Free Korea		
	—	R. Havana		
	ZPA10	R. Paraguay		
6020	—	R. Nederland		
6025	—	E. Official	Luanda, Angola	0100
	—	R. Portugal	Lisbon, Port.	2115
6030	—	R. Baghdad	Baghdad, Iraq.	1430
	TGTZ	R. Internacional	Guatemala City, Guat.	0048
6035	XZK3	Burma BC	Rangoon, Burma	0945
6050	GSA	BBC	London, England	1735
	—	R. Havana	Havana, Cuba	2100
6065	XEXG	R. Mexico	Mexico D.F., Mexico	1945
6070	—	R. Sofia	Sofia, Bulgaria	1500
6075	CXA3	R. Ariel	Montevideo, Uruguay	0430
6086	HI4SB	R. Sto. Domingo	Sto. Domingo, Dom. Rep.	2322
6090	LRY1	RAE	Buenos Aires, Arg.	1500
6095	—	BBC	London, England	1735
	—	R. Baghdad	Baghdad, Iraq	1430
	BED29	V. Free China	Taipei, Formosa	2150
6100	HCSP4	V. del Volante	Portoviejo, Ecuador	0000
6110	GSL	BBC	London, England	1200
	HRXW2	R. Comayaquela	Comayaquela, Hond.	1930
6120	4VEH	V. Evangelique	Cap Hatien, Haiti	0645
6125	GWA	BBC	London, England	1735
	—	V. America	Honolulu, Hawaii	0345
6130	—	R. Nac de Espana	Madrid, Spain	2000
	VUD	All India R.	Delhi, India	1445
6135	—	R. Havana	Havana, Cuba	0000
6150	GRW	BBC	London, England	0145
	HCLT4	R. Costa Azul	Portoviejo, Ecuador	2200
6160	CBNX	CBC	Vancouver, B.C.	2130
6180	GRO	BBC	London, England	1745
6185	—	R. Portugal	Lisbon, Portugal	2115
6190	—	R. Maroc	Robat, Morocco	0135
6195	—	E. Oficial	Luanda, Angola	0600
6210	—	R. Peking	Peking, China	1605
6215	TIGPH	R. Costa Rica	San Jose, C.R.	2330
6240	WJG	Memphis*	Memphis, Tenn.	2030
6250	—	E. R. Sta. Isabel	Sta. Isabel, Sp. Guinea	1730
6268	OAX7C	R. Tahuantisuyo	Cuzco, Peru	2327
6270	—	R. Peking	Peking, China	1545
6290	—	R. Peking	Peking, China	1430
6567	YVCLBM	(aircraft)*	—	2310
	CMI	Boyeros*	Havana, Cuba	2333
	WSY70	New York*	New York, N.Y.	2320
	WHZ	Balboa*	Balboa, C.Z.	2015
	WRW70	San Juan*	San Juan, P.R.	2210
	WBR	Miami*	Miami, Fla.	1321
	6YK	Kingston*	Kingston, Jamaica	1314
6825	—	R. Peking	Peking, China	1445
7035	—	R. Peking	Peking, China	0700
7050	—	R. Cairo	Cairo, U.A.R.	1030
7080	—	R. Peking	Peking, China	1605
7090	—	R. Tirana	Tirana, Albania	1500
7105	—	R & TV Franc.	Brazzaville, Congo	0600
7110	MCS	BBC	London, England	1430
7120	—	Govorit Kiev	Kiev, USSR	1940
7125	VUD	All India R.	Delhi, India	1445
7145	—	R. Bamakao	Bamakao, Mali	1730
7150	GRT	BBC	London, England	0730
7160	—	R. Malaysia	Kuching, Sarawak	0900
7170	—	Govorit Kiev	Kiev, USSR	0040
	—	R. Noumea	Noumea, New Caledonia	0520
7180	—	Govorit Kiev	Kiev, USSR	1940
	VUD	All India R.	Delhi, India	1340
7185	GRK	BBC	London, England	1430
7195	—	R. Japan	Tokyo, Japan	1400
	—	V. America	Monrovia, Liberia	1745
7210	GWL	BBC	London, England	0145
	—	Int'l Red Cross	Geneva, Switz.	0103
7220	—	R. Australia	Melbourne, Australia	1030
7225	VUD	All India R.	Delhi, India	1930
7235	VUD	All India R.	Delhi, India	1445
	—	E. Oficial	Luanda, Angola	0600
7255	—	Deutsche Welle	Kigali, Rwanda	1520
7260	GSU	BBC	London, England	0145
	—	Trans World R.	Monte Carlo, Monaco	0335
7280	—	R. Bamako	Bamako, Mali	1730
7295	—	Deutsche Welle	Kigali, Rwanda	2330
7305	—	R. Budapest	Budapest, Hungary	1930
7310	—	Govorit Kiev	Kiev, USSR	1940
7325	GRJ	BBC	London, England	1745
7330	—	Govorit Kiev	Kiev, USSR	1940
7340	—	R. Peking	Peking, China	1430
7450	—	R. Peking	Peking, China	1430
8746	GCN4	Griggon*	Griggon, England	1900
8799	WMI	Lorain*	Lorain, Ohio	2040
8806	VIS	Sydney*	Sydney, Australia	0050
9390	—	R. Tirana	Tirana, Albania	1500
9415	—	V. UN Command	Seoul, S. Korea	0410
9453	—	R. Portugal Livre	clandestine	1615
9455	OAX4W	R. America	Lima, Peru	2125
9457	—	R. Peking	Peking, China	1605
9495	—	R. Cairo	Cairo, U.A.R.	1030

31 Meter Band—9500 to 9775 Kc/s

Kc/s	Call	Name	Location	EST
9505	—	R. Japan	Tokyo, Japan	0315
9510	GSB	BBC	London, England	0730
9520	OZF5	V. Denmark	Copenhagen, Den.	1600
9520	—	R. Havana	Havana, Cuba	1715

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Kc/s	Call	Name	Location	EST
9525	—	R. Japan	Tokyo, Japan	1400
9545	—	Lebanese BC	Beirut, Lebanon	0430
	XEFT	V. de Vera Cruz	Vera Cruz, Mex.	0038
9570	—	R. Australia	Melbourne, Austr.	1030
9575	—	RAI	Rome, Italy	1925
9580	—	R. Australia	Melbourne, Austr.	0800
9585	ZYR56	R. Excelsior	Sao Paulo, Brazil	1700
9595	ZOZ3	Nihon Tampa Hoso	Tokyo, Japan	0300
9600	—	R. Australia	Melbourne, Austr.	1300
	—	R. Nac. de Espana	Tenerife, Canary Is.	0005
	CE960	R. Pres. Balmaceda	Santiago, Chile	0600
9605	—	R. Damascus	Damascus, Syria	1730
9625	GWO	BBC	London, England	0145
9635	—	R. Afghanistan	Kabul, Afghanistan	1405
9640	HLK5	Korean BC	Seoul, Korea	0000
	WRUL	R. N.Y. Worldwide	New York, N.Y.	1400
9645	—	Vatican R.	Vatican City	1950
9650	—	R. Peking	Peking, China	0700
	—	V. of America	Honolulu, Hawaii	0345
	—	R. Havana	Havana, Cuba	1400
9660	—	Goverit Kiev	Kiev, USSR	1940
	—	R. Nationale	Leopoldville, Congo	0800
9668	TGNA	R. Cultural	Guatemala City, Guat.	2300
9670	—	R. Australia	Melbourne, Austr.	0400
9675	—	R. Moscow	Moscow, USSR	0230
	—	R. Senegal	Dakar, Senegal	1230
9680	—	Lebanese BC	Beirut, Labanon	2130
	VUD	All India R.	Delhi, India	1340
9685	BED73	V. of Free China	Taipei, Formosa	2150
9690	VUD	All India R.	Delhi, India	1445
9695	—	R. Nac Khmere	Phnom Penh, Cambodia	0800
9705	—	R. Japan	Tokyo, Japan	1000
9710	LRX2	R. El Mundo	Buenos Aires, Arg.	2205
	OAX9D	R. Tropical	Tarapoto, Peru	2230
9715	—	R. Nederland	Hilversum, Holland	0100
9720	—	R. Senegal	Dakar, Senegal	1100
9730	—	R & TV Franc.	Brazzaville, Congo	0000
9745	ORU	R-TV Belge	Brussels, Belgium	1730
	—	R. Bamako	Bamako, Mali	1730
9752	—	R. Pyongyang	Pyongyang, N. Korea	1600
9755	—	BBC	London, England	0730
9760	—	R. Hanoi	Hanoi, N. Vietnam	1030
9765	VUD	All India R.	Delhi, India	1930
	ETLF	R. V. of Gospel	Addis Ababa, Ethiopia	0845
	—	BBC	London, England	1700
9770	4VEH	V. Evangelique	Cap Hatien, Haiti	0645
9833	—	R. Budapest	Budapest, Hungary	2030
9835	—	Goverit Minsk	Minsk, USSR	1630
9840	—	R. Hanoi	Hanoi, N. Vietnam	1030
9860	—	R. Peking	Peking, China	1430
9905	ZBD42	Cable & Wireless*	Port-of-Spain Trinidad	1540
9915	VUD	All India R.	Delhi, India	1445
10110	—	R. Espana Independ.	clandestine	1535
11260	—	R. Espana Independ.	clandestine	1535
11690	—	R. Moscow	Moscow, USSR	1100

25 Meter Band—11700 to 11975 Kc/s

Kc/s	Call	Name	Location	EST
11710	—	R. Australia	Melbourne, Australia	0400
	KGEI	V. of Friendship	San Francisco, Calif.	1730
11720	CHOL	R. Canada	Montreal, P.Q.	1016
	PRL8	R. Naciolal	Brasilia, Brazil	1655
11730	—	R. Teheran	Teheran, Iran	1500
11740	—	Far East BC	Manila, Philippines	0315
	VUD	All India R.	Delhi, India	1445
	CE1174	R. Nuevo Mundo	Santiago, Chile	1815
11750	—	Far East Network	Tokyo, Japan	0100
11755	HCJB	V. of the Andes	Quito, Ecuador	1645
11770	—	Lebanese BC	Beirut, Lebanon	1330
11780	LRY2	RAE	Buenos Aires, Argentina	1600
	—	BBC	London, England	0730
	DMQ	Deutsche Welle	Cologne, W. Germany	0230
	—	Govorit Volograd	Volograd, USSR	0500
11795	WINB	WINB	Red Lion, Pa.	1500
11800	—	R. Nederland	Hilversum, Holland	1700
	—	R. Stockholm	Stockholm, Sweden	2045
11820	GSN	BBC	London, England	0730
	—	R. Australia	Melbourne, Australia	1700
11825	BED69	V. of Free China	Taipei, Formosa	2150
11835	—	R & TV Algerienne	Algiers, Algeria	1700
	4VEH	V. Evangelique	Cap Hatien, Haiti	0645
	CXA19	R. el Espectador	Montevideo, Uruguay	2037
11840	—	R. Australia	Melbourne, Australia	1430
	WRUL	R. N.Y. Worldwide	New York, N.Y.	1400
11860	—	R. Moscow	Moscow, USSR	1100
	—	Trans World R.	Bonaire, Neth. Ant.	1410
11885	XEHH	R. Commerciales	Mexico D.F., Mex.	2300
11895	—	Windward Is. BC	St. Georges, Grenada	1500
11905	—	RAI	Rome, Italy	1925
	—	AFRTS	New York, N.Y.	1400
11910	HSK9	Overseas BC	Bangkok, Thailand	0800
11915	—	R. Damascus	Damascus, Syria	1730
11920	—	AFRTS	New York, N. Y.	1315
11925	HLK6	Korean BC	Seoul, Korea	2200
11935	—	R. Portugal	Lisbon, Portugal	1315
11940	VUD	All India R.	Delhi, India	1340
11945	—	R. Afghanistan	Kabul, Afghanistan	1300
11955	—	R. Nederland	Hilversum, Holland	1400
13745	CGA2	Can. Overseas Tel.*	Montreal, P.Q.	0550
14423	FYA G	Postes Tel. & Tel.*	Paris, France	0800
14490	OEF34	Linz*	Linz, Austria	1835

19 Meter Band—15100 to 15450 Kc/s

Kc/s	Call	Name	Location	EST
15110	—	R. Teheran	Teheran, Iran	1500
15120	—	R. Warsaw	Warsaw, Poland	0230
15135	—	R. Havana	Havana, Cuba	1550
15150	—	Vatican R.	Vatican City	0630
	—	V. of America	Dixon, Calif.	1747
15160	TAU	Ankara	Ankara, Turkey	1700
15165	VUD	All India R.	Delhi, India	0500
	—	R. Damascus	Damascus, Syria	1730
	OZF7	V. of Denmark	Copenhagen, Den.	0700
15180	GSO	BBC	London, England	0730
15185	—	Finnish BC	Helsinki, Finland	0730
15190	—	R & TV Franc.	Brazzaville, Congo	0600
15195	—	R. Japan	Tokyo, Japan	0315
15220	—	R. Australia	Melbourne, Australia	0000
15225	VUD	All India R.	Delhi, India	0830
	—	R. Afghanistan	Kabul, Afghanistan	0545
	—	AFRTS	New York, N.Y.	0930
15230	GWD	BBC	London, England	0730
15240	—	R. Australia	Melbourne, Australia	1700
15270	—	R. Havana	Havana, Cuba	1400
15280	—	AFRTS	New York, N.Y.	0930
15285	—	R. Prague	Prague, Czech.	1000
15290	—	R & TV Franc.	Brazzaville, Congo	1100
15295	DMQ	Deutsche Welle	Cologne, W. Germany	0230
15305	HER6	Swiss BC	Berne, Switz.	1030
15310	—	R. Japan	Tokyo, Japan	0315
15320	CKCS	R. Canada	Montreal, P.Q.	0715
15333	—	R. Ceylon	Colombo, Ceylon	0200
15380	—	R. Portugal	Lisbon, Portugal	0845
15445	—	R. & TV Franc.	Brazzaville, Congo	0730
15448	—	R. Prague	Prague, Czech.	1000
17665	4XA67	Tel Aviv*	Tel Aviv, Israel	1000
17695	—	BBC	London, England	0730
17720	WINB	WINB	Red Lion, Pa.	1200
	—	R & TV Franc.	Brazzaville, Congo	0730
17760	WRUL	R. N.Y. Worldwide	New York, N.Y.	1400
17793	—	R. Cultural	Sao Paulo, Brazil	1100
17795	HE18	Swiss BC	Berne, Switz.	1030
17820	CKNC	R. Canada	Montreal, P.Q.	0715
17825	LLN	R. Norway	Oslo, Norway	1100
17840	—	R. Australia	Melbourne, Australia	2115
17855	—	V. of America	Tangiers, Morocco	1230
17895	—	R. Portugal	Lisbon, Portugal	0845
18862	ZEO89	Cable & Wireless*	Hong Kong	1800
21500	—	R & TV Franc.	Brazzaville, Congo	0730
21650	—	AFRTS	New York, N.Y.	1030

Electronic Air Conditioning

(Continued from page 45)

to a condenser where it is compressed back into a liquid. During this phase, heat is given up and blown outdoors. Similarly, the thermo-electric unit draws heat from one region and surrenders it to another.

Doing It Today. Now we can consider the diagram of a practical thermoelectric air-conditioning system now in use. It appears in Fig. 7. In the center are the numerous modules with their semiconductor material strapped together. Electrical power is introduced at the right. According to the earlier description, the top plates of each module grow cold, as the bottom surfaces heat. The cooling cycle begins as air to be conditioned (from the room) is drawn through the top duct, or air-heat exchanger. The cool surfaces of the duct extract heat from the air.

The second part of the process is drawing heat from the module assembly. This is done by a water-heat exchanger at the bottom. A circulation of water is used here as a heat sink. The water is then led to coils which release the heat.

Controlling operating temperature is considerably simplified. Instead of on-off action, common to standard units, cooling is smoothly regulated by changing the electrical current flow. And in winter, a reversal of current flow reverses the whole process for heating. During this function, the air duct at the top is warmed by the thermoelectric modules. This system was created by Carrier and installed in Racine, Wisconsin, for the offices of S. C. Johnson & Son (the wax people). It was selected over the conventional air conditioner for several reasons. The company wished to cool 28 offices, but didn't want to mar the internal or external appearance of the building. (It was designed by Frank Lloyd Wright.) Conventional systems were deemed unacceptable; they meant cutting through outside walls or elaborate disguising of equipment which couldn't be hidden in a basement. Regular piping and ductwork meant considerable expense, loss of man-hours and much inconvenience. Compact thermoelectric units, each fitting into overhead space, solved the problem.

"Where Can I Get One?" Although Johnson's installation is proving successful, electronic air conditioning on a big scale is still over the horizon for the bigger consumer market. Despite its present state of development, there is still an intense search for materials that will bring its price down to competitive levels. Another wrinkle to be overcome is the relatively long time required to reach maximum cooling temperature. This is no problem in nuclear submarines, where thermoelectric conditioners cool on a continuous basis. Nor is it a limitation for special applications in the research lab where such devices are used for "spot" cooling. But there are signs of increasing consumer applications, even now. You can purchase a small portable thermoelectric refrigerator for auto, boat or camping use. Some hotels have already installed ice-cube coolers in each room. If the scientists are correct in their forecasts, the silent, maintenance-free electronic air conditioner is definitely out of the dream stage. ■

VHF Extender

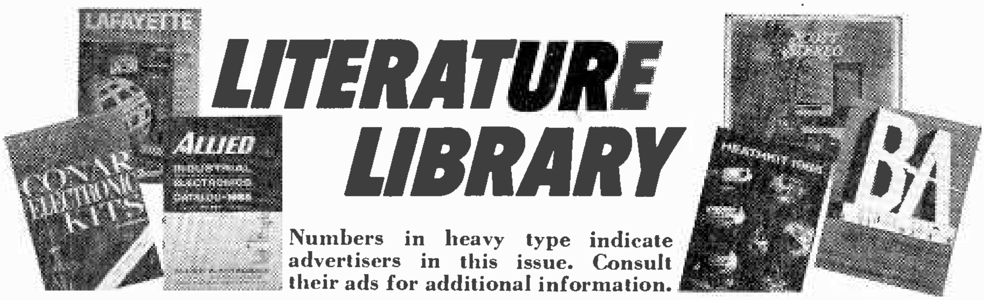
(Continued from page 40)

To change from low-band to high-band operation, you must either add D1 and L4.

Don't be alarmed at the thought of using the VHF Extender and a standard short-wave receiver to listen to the FM signals of most commercial VHF communications gear. The VHF gear must now use restricted bandwidth for its transmissions, and as a result you can get very clean copy from the FM signal with an AM receiver simply by tuning a trifle to one side of the signal itself.

Going Mobile. And the VHF Extender can be used with auto radios, too, by using the "BC-Band" component values in the coil tables and supplying 150 volts DC from an external supply.

It should be pointed out that VHF projects are the most difficult to construct and require considerable skill and craftsmanship on the part of the builder. The VHF Extender is not a beginner's project and should not be attempted by a novice experimenter. Cleanliness counts—use just enough solder; scrape off excess rosin; beware of cold solder or *rosin* joints. Construction time is not important—do not race the clock to get the job done. ■



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ELECTRONIC PARTS

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

2. The new 516-page 1965 edition of *Lafayette Radio's* multi-colored catalog is a perfect buyer's guide for hi-fi'ers, experimenters, kit builders, CB'ers and hams. Get your free copy, today!

3. *Progressive "Edu-Kits" Inc.* now has available their new 1965 catalog featuring hi-fi, CB, Amateur, test equipment in kit and wired form. Also lists books, parts, tools, etc.

4. We'll exert our influence to get you on the *Olson* mailing list. This catalog comes out regularly with lots of new and surplus items. If you find your name hidden in the pages, you win $5 in free merchandise!

5. Unusual scientific, optical and mathematical values. That's what *Edmund Scientific* has. War surplus equipment as well as many other hard-to-get items are included in this new 148-page catalog.

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

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

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

9. Are you still paying drugstore prices for tubes? *Nationwide Tube Co.* will send you their special bargain list of tubes. This will make you light up!

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

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

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

HI-FI/AUDIO

13. Here's a beautifully presented brochure from *Altec Lansing Corp.* Studio-type mikes, two-way speaker components and other hi-fi products.

14. For the love of mikes! *Astatic Corp.* has lots. Studio types, ham types, recording types, etc. See its catalog sheets for the details.

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

16. *Garrard* has prepared a 32-page booklet on its full line of automatic turntables including the Lab 80, the first automatic transcription turntable. Accessories are detailed too.

17. Two brand new full-color booklets are being offered by *Electro-Voice, Inc.* that every audiophile should read. They are: "Guide to Outdoor High Fidelity" and "Guide to Compact Loudspeaker Systems."

18. Speakers and enclosures from *Argos Products Co.* feature a new and novel well-mounting system. To find out more, *Argos* will be happy to send literature.

19. A valuable 8-page brochure from *Empire Scientific Corp.* describes technical features of their record playback equipment. Also included are sections on basic facts and stereo record library.

20. Tape recorder heads wear out. After all, the head of a tape deck is like the stylus of a phonograph, and *Robins Industries* has a booklet showing exact replacements. Lots of good info on how the things are built, too.

21. *Wharfedale,* a leading name in loudspeakers and speaker systems, has a colorful booklet to send to you on its product line. Complete with prices, it is a top-notch buyers guide.

22. A wide variety of loudspeakers and enclosures from *Utah Electronics* lists sizes shapes and prices. All types are covered in this 16-page heavily illustrated brochure.

24. Here's a complete catalog of high-styled speaker enclosures and loudspeaker components. *University* is one of the pioneers in the field that keeps things up to date.

26. When a manufacturer of high-quality high fidelity equipment produces a line of kits, you can just bet that they're going to be of the same high quality! *H. H. Scott, Inc.,* has a catalog showing you the full-color, behind-the-panel story.

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

28. Very pretty, very efficient, that's the word for the new *Betacom* intercom. It's ideal for stores, offices, or just for use in the home, where it doubles as a baby-sitter.

TAPE RECORDERS AND TAPE

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

31. "The Care and Feeding of Tape Recorders" is the title of a booklet that *Sarkes-Tarzian* will send you. It's 16-pages jam-packed with info for the home recording enthusiast. Includes a valuable table of recording times for various tapes.

32. You can learn lots about tape recorders. Big tape recorders for studios, little tape recorders for business men, all kinds of tape recorders from *American Concertone.*

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

34. The 1964 line of *Sony* tape recorders, microphones and accessories is illustrated in a new 16-page full color booklet just released by *Superscope, Inc.,* exclusive U.S. distributor.

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

36. Tone-arms, cartridges, hi-fi, and stereo preamps and replacement tape heads and conversions are listed in a complete *Shure Bros.* catalog.

HI-FI ACCESSORIES

38. An entirely new concept in customizing electron tubes has generated a new replacement line. *Gold Lion* tubes give higher output and lower distortion than ordinary production high-fidelity tubes.

KITS

41. Here's a firm that makes everything from TV kits to a complete line of test equipment. *Conar* would like to send you their latest catalog—just ask for it.

42. Here's a 100-page catalog of a wide assortment of kits. They're high-styled, highly-versatile, and *Heath Co.* will happily add your name to the mailing list.

43. Want to learn about computers the easy way? Brochure from *Digication Electronics* describes its line of transistorized kits.

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.

47. Here's a goodly assortment of literature covering the products of the *Dow-Key Co.* They make coaxial relays, switches, and preamps for hams and CB'ers.

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. Antennas for CB and ham use as well as for commercial installations is the specialty of *Antenna Specialists Co.* They also have a generator for power in the field.

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 items 46 and 47.

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. Interested in ETV? *Adler Electronics* has a booklet describing educational television and this goes into a depth study of ETV in all its ramifications. There's a good science fair project here for someone!

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."

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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!

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69. Interested in tackling a TV kit? *Arkay International, Inc.* will send you full literature (including a schematic) of this truly educational kit. It's used in many of the electronic schools.

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. The smallest television set to date is featured in this beautiful prepared brochure from *SONY Corp.* You'll be amazed at the variety this firm offers.

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

75. Want to find rapid solutions to complicated math problems? Solve interest and ratio, log and trig problems with 10-scale slide rule. *Alsynco* will send complete information.

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78. Learn about *Xcelite's* line of pliers and snips, specialized for radio, TV and electronic work. Xcelite's hand tools offer many advantages worth looking into—get bulletins N464 and N664.

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Super Tapes

Continued from page 51

possible frequency response at 3¾ and 1⅞ ips.

The lower the speed and the smaller the gap length of the recording head, the more important it is for the tape to hug the head closely. This fact led Ampex to wind 1200 feet of pliant, 1-mil polyester tape onto a 7-inch reel and price it like an equivalent-length reel of 1½-mil acetate. The hub of this special reel has a 4-inch diameter, instead of the normal 2¼ inches. Besides making the tape fill the reel, this outside hub smoothes out speed irregularities that frequently crop up in popular-priced recorders toward the end of a reel.

What's Best for You. How do the super tapes perform? Pretty much as billed. But, like all tapes, their performance will vary from one machine to another, because different brands of home recorders use different bias frequencies. Bias is a high-frequency signal fed to the record head to reduce distortion and improve recording quality.

A good way to find out what tapes work best on your recorder is to invest in sample reels of those that interest you, then make up a test reel by splicing together equal lengths from each sample and recording the same material on each specimen. To tell each specimen from its neighbors, separate them with a length of leader tape.

This writer used just such a procedure to compare the sound quality of a number of specialized tapes. The comparison reel was played on a Uher 8000 Royal quartertrack stereo recorder and fed into a home hi-fi amplifier and speaker system. Here's what we found:

Scotch Low Noise tape and Kodak's High Output tape gave, without a doubt, the cleanest, clearest sound at every speed from 7½ to 1⁵⁄₁₆ ips. for the sample types sampled by the author.

Kodak's High Output tape provided a noticeably stronger signal than the other types. As used on the Uher, though, it appeared to have a bit more background noise than the other tapes. But Kodak points out that this tape works best when your recorder is matched to it by adjusting the bias. If you can adjust the bias on your recorder, Kodak's High Output tape would probably offer the best signal-to-noise figure for your machine.

Two reels of Scotch Low-Noise tape were used to make successive copies back and forth between a Korting 158 quarter-track stereo recorder and the Uher 8000. We managed to get more than five generations away from the original recording without hearing significant degradation of sound quality.

In normal recording and playback, Soundcraft's Golden Tone tape, a premium-price offering, was second only to the tapes mentioned above. Amper's Low-Speed tape, did quite well at its 3¾ and 1⅞ ips design speeds and demonstrated very impressive bass response at both 3¾ ips and the standard hi-fi speed of 7½ ips.

Low-Print tapes by Kodak and Soundcraft delivered somewhat less output than the other tapes because of their thinner oxide coatings. But their sound quality was good.

Of triple-play tapes tested, Soundcraft's came closest to standard tapes in output strength, and it had excellent sound quality. Audiotape triple-play tape ran it a close second.

What This Means to You. If you do cut-and-splice editing, use standard 1½-mil acetate. Where you edit by dubbing—or do considerable copying and recopying—invest in a Low-Noise or similar tape. This is also good advice for top quality at lower speeds.

Low-print tapes at this writing come only on an acetate base. But if you plan to store a tape recorded at peak signal for a prolonged time period—and you can control storage humidity and heat—this is a good tape to consider. Long life under less-controlled climatic conditions is better assured with a polyester tape. Just try to be a bit more judicious in your level setting to reduce the danger of print-through.

And, of course, polyester is a must in tropic areas or the far North.

What about the merits of standard-, extended-, double-, and triple-play tapes? This depends on three things:

How much recording time do you need?

How important is higher-speed quality for the job at hand?

How gently do you and your recorder treat thin tapes?

Whatever your recording problem, today you can be pretty sure to find the tape that will solve it. Which is a lot more than you could say for the good old days. ■

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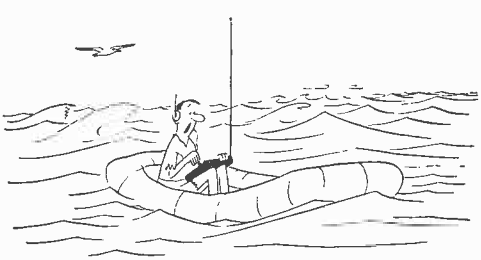


"Listen carefully, little boy! Is your dad home . . . the one who built the set?"

ADVERTISING INDEX

Transistor Take-over

Continued from page 62

monly high performance per dollar invested.

From these inexpensive units, transistor amplifiers take a sizable price jump into the $200 region. One of the outstanding designs in this price class is the KLH Model 16, delivering 45 watts per channel with an exceptionally sweet, warm, natural sound. The tag is $219.95, which makes it a kind of "best buy," along with Lafayette's LA-900, which delivers 30 watts per channel for $189.50. In the same performance class are Harman-Kardon's Model A1000T (35 watts per channel) and Scott's Model 260 (40 watts per channel) priced at $369.95 and $259.95, respectively. The power ratings may seem rather low for equipment in this price range. However, this is offset by the fact that transistors recover far more quickly than tubes from stress imposed by momentary peak loads. From a musical point of view, transistors therefore have a greater effective power reserve at a given wattage rating than their tube counterparts.

Beyond this level of unquestioned excellence is a group of transistor amplifiers that represent the ultimate state of the art. Transistor amplifiers in this group cannot be considered as commercial products in the ordinary sense, for they are not primarily designed "for a market." Rather, they represent their designers' private passion to push back the limits of the possible—the striving for the imaginable best. It may take a keen ear to tell the difference between these "ultimate" designs and those in the middle-price class. But if they are used with the best available loudspeakers, turntables, and cartridges, the difference — though small — is quite noticeable.

Representative units of this kind are the Acoustech Model I transistor power amplifier and the Model II preamplifier which jointly yield 40 watts sine wave power per channel with a frequency response from 5 to 50,000 cps at full output with less than 0.5 percent distortion—all for $734. And Harman-Kardon's all-transistor combination of the Citation A preamp and Citation B power amp provide 40 watts per channel sine wave power with a frequency response of 1 to 100,000 cps and 0.5 distortion for $519.80 (factory-wired).

Confronted with such specifications, you might ask: "What is the point of extending frequency response so far above and below the audible range? You couldn't hear those frequencies anyhow." The answer is that this extended range permits the amplifier to handle sudden sound bursts, called transients, with greater clarity. Transistor amplifiers with very wide frequency response (above 25,000 cps) are usually characterized by extremely clear sound texture, other factors being equal.

Another advantage of transistor units is their exceptionally low hum level, which permits the music to be heard against a background of almost complete silence. Some of the better transistor amplifiers have hum levels 80 and even 90 db below the signal level (at full output).

Transistor Tuners. One of the neatest items among transistorized tuners is the brand-new KLH Model 18 all-transistor stereo tuner. No bigger than a cigar box, it offers excellent sensitivity, selectivity, and ease of tuning for $129.95 (factory finished). Its novel circuitry is extremely stable so that it won't need frequent realignment to stay in top performing condition. Low-cost kit designs are also available, notably the Heath AJ-33 ($99.95) and AJ-43 ($119.95), either of which also provide broadcast reception.

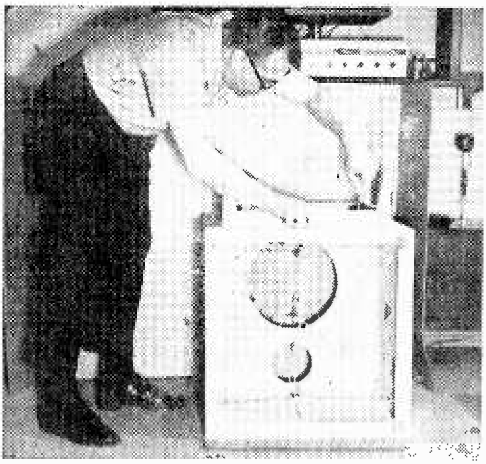
Among higher priced tuners, Harman-Kardon's F-1000T ($299.95), Fisher's TF-300 ($329.50), Scott's Model 312 ($259.95) all boast excellent specifications and are providing convincing evidence that the problems of RF circuit design for transistors have been successfully solved.

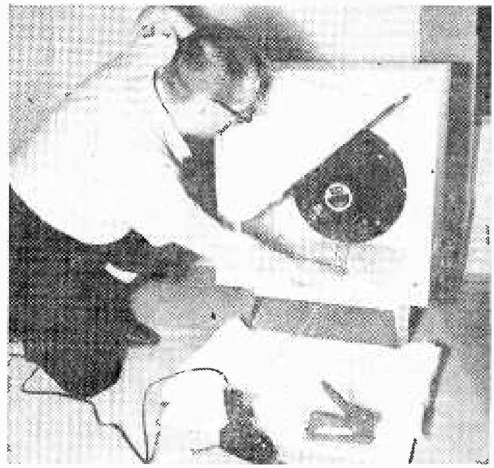
The transistor's conquest of audio has been easiest in the tape recorder field. Tape recorders do not have to develop the high power levels that audio amplifiers must furnish and they do not have to deal with tricky RF circuits, as must FM tuners. On the other hand, compactness, sturdiness, and low power drain, three main virtues of the transistor, are a vital advantage in designing portable tape machines. So it is hardly surprising that the fully transistorized tape recorder is now the rule rather than the exception, and it becomes unnecessary to single out individual designs.

When you consider that only three years ago, only three companies were making transistorized hi-fi gear (a grand total of six different models), the present picture proves that the transistor take-over in audio has been completely successful. ■

Lab Check

Continued from page 78





At right base is being attached to bottom of cabinet. Note strings holding the unit together while glue sets. Above, speaker and acoustical material in place—now screw back on.

living rooms shown in hi-fi magazines.)

As is the case with any speaker, frequency curves are meaningless since each speaker has its own individual coloration, and you must make the decision yourself. But we highly recommend you listen to the 207A before you buy a speaker or speaker system.

Trying to keep the total system cost within that mythological figure called the "young married's budget," we had our choice of a small, finished, general purpose enclosure or the kit version of the Bozak Urban E-300U—which meant we had to do our own finishing. Since speakers usually sound best in a cabinet specifically designed for a given speaker we decided to go along with the kit. The completed kit is exactly the same as the finished models except for a savings of about $30. The cabinet is an infinite baffle which preserves the speaker's smoothness, tonal balance, and excellent transient response.

The kit is assembled like any other piece of fine furniture: with screws and glue. While the assembly is notably easy—less than one hour—there's a major problem. Bozak assumes you have furniture clamps for gluing. Now not everyone has furniture clamps, and if one must purchase the clamps the savings are wiped out—it might even cost more in the long run. We got around the clamps by devising our own clamp system. As shown in the photograph, we attached cup hooks to the inside surfaces of the enclosure and held the assembly together with string purchased in a 5 & dime store—and it worked just as well as the clamps.

The enclosure is made of ¾-inch compacted-wood with a walnut veneer. It comes complete with matching legs and grill-cloth. You can lighten or darken the veneer with commercial finishing products.

The front panel is pre-cut for a 15 inch speaker and for a midrange, should you desire to add one at a later date. We found the cabinet equipped with only the 207A speaker gave a most pleasing sound. Nothing spectacular, no shattering "pumping lows" or ear straining highs, just a smooth natural quality—just that old fashioned kind of music you hear when seated before the recording group.

OUR IMPRESSIONS

■ We were more than surprised at the *total* success of our selections, particularly how well the entire system met our assumed needs. Perhaps, if we'd done extensive showroom shopping and selected each component individually, we might have attained similar results. We can therefore recommend, that before you step through the door of your local showroom, you have the hi-fi system planned down to the minutest detail—you'll be most likely to get the system you want at the first try. You can be sure that the components in this system review will function equally as well in other systems—this is a typical characteristic of quality audio components. ■

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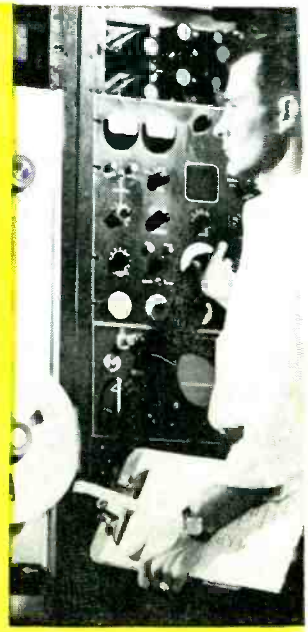

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