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UGUST-SEPTEMBER 75¢

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TEST REPORTS
- Ampex Model 1160 Automatic Tape Recorder
- Knight-Kit Model KG-685 Color Bar/Pattern Generator
- Acoustech Model XI Power Amplifier Kit and Add-on Preamp Kit

PLANS FOR:
- Test Bench Power Supply
- Space-Age Xtal Set
- Midget Mike Preamp

RADIO-TV EXPERIMENTER

Cover Photo
by Leonard Heicklen

Aug.-Sept. 1966
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☆Cover Highlights

AUG.-SEPT. 1966

INSTITUTE OF HIGH FIDELITY INC

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RADIO-TV EXPERIMENTER

Dedicated to America's Electronics Experimenters

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POSITIVE FEEDBACK

JULIAN M. SIENKIEWICZ, EDITOR
WA2CQL/KMD4313

■ We regret to announce the passing of the long familiar and well-known generic term *cycles.* It is survived by *Hertz* (Hz), *kilohertz* (kHz), *megahertz* (mHz) and *gigahertz* (gHz) who are direct decendants of *cycles* (cps), *kilocycles* (kc), *megacycles* (mc) and *gigacycles* (gc). All of whom are well fixed in our minds and are likely to be referred to, mistakenly, as if they were still with us. The cycles family will long linger in our memories and we will mention them from time to time—indicating the place they formerly occupied in our technology.

The new terms direct honor to Heinrich R. Hertz (1857-1894) for demonstrating the propagation of electromagnetic waves with the crude equipment at his disposal. His name is now given the honor previously given to Ampere, Coulomb, Curie, Faraday, Henry, Volta and others whose names are used to identify a unit of measurement in the field of their investigations.

To keep pace with encroaching technology, we find we are forced to get in step with other published technical material that now abides by the adoption suggested by the various technical societies.

Please bear with us while we adjust to the new suffixes relating to electrical frequency—we'll probably goof now and then and use the old term since we, being somewhat human, are creatures of habit.

No Fuses Needed. A 25-million-watt battery the size of a telephone booth is being built to put out, pound for pound, almost as much energy as exploding dynamite. The U. S. Army needs it to power lasers (light amplifiers) which produce intense beams of "concentrated" light. Half a million fluorescent lamps could be lighted simultaneously by the superbattery, which the Army calls the most powerful in the world.

There is a problem, however: lasers need their huge jolts of electricity in brief, fraction-of-a-sceond pulses. Scientists of the Army Missile Command are faced with designing a split-second on-off switch for their battery before

they can even test it. They had the same trouble with the better mouse trap until someone invented cheese.

Quarks of Space. Radio waves picked up here on earth from far-distant objects in space could be used to discover that the suggested building blocks of all matter in the universe, called "quarks," actually exist. The radio-wave method of detecting quarks, now unseen but theoretically possible nuclear particles.

The existence of quarks, of which many scientists are not convinced, was first suggested about two years ago by Dr. Murray Gell-Mann of California Institute of Technology. Unlike ordinary protons or neutrons, the constituents of atomic cores having either no charge or unit charges, quarks are charged in fractions. If they exist, each would have a charge either one-third or two-thirds that of an electron, the negative carrier of electricity. The electron charge was considered a basic unit, and no fraction of this unit was thought possible. If quarks exist, they should emit radiation, some of which would be at radio wavelengths, in a manner similar to the way the hydrogen atom does. Sensitive radio telescopes such as the 300-foot antenna at the National Radio Astronomical Observatory in Green Bank, W. Va., could be used to detect such emissions.

The radiation from quarks could be picked up even if quarks are only one hundred thousandth as numerous as hydrogen in a galaxy. The quark radiation should have a wavelength of 106 centimeters, or about 42 inches, while that of the widely-studied hydrogen emission is 21 centimeters.

Strongly emitting radio galaxies, such as Cygnus A, would be the best regions to search for the quark radiation. The puzzlingly bright objects known as quasars would be even better, but they are too far away. However, radio galaxies are thought by some to be remnants of quasars. Therefore, radio galaxies should be among the most promising sources in which to look for traces of quarks, since matter there should be highly concentrated and energetic.

New Freqs. for Flyers. The Federal Communications Commission has granted the petition of the Academy of Model Aeronautics for five new radio frequencies in the 72-76 mHz (mc.) band for the express use of radio controlled model aircraft. The frequencies were available on June 20, 1966. They are 72.08 mHz (mc.), 72.24 mHz (mc.), 72.40 mHz (mc.), 72.96 mHz (mc.), and 75.64 mHz (mc.).

The new frequencies are incorporated into the class C Citizens Band, but reserved exclusively for *modeler use.* This is the same service under which radio controllers are now licensed. Therefore, no new licenses will be required. Current frequencies in the 27 mHz (mc.) band are not affected by the action.

Equipment on the new frequencies is limited

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B $159.95

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Why? A desire for better quality. And pride. Not just the pride of owning something new, but a special kind that comes from building it yourself. From watching it grow and take shape. From creating a sophisticated piece of electronics with your own hands.

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A **Deluxe 6-Transistor AM Portable** **$28.25**
• Uses 6 "D" flashlight batteries . . . only 1/10 the operating cost of pocket-size portables • 4" x 6" speaker for big-set sound • Slide-rule dial, vernier tuning, "thumb-touch" controls • RF stage & double-tuned IF stage • Built-in rod antenna picks up stations miniatures can't get • Black simulated leather case • Easy 4-6 hour assembly • Kit GR-24, 5 lbs.

B **New Deluxe 10-Band Transistor Portable** **$159.95**
• Tunes 150-400 kc longwave, 550-1600 kc broadcast, 88-108 mc FM, and 2-22.5 mc shortwave in 7 bands • 16 transistors, 6 diodes and 44 factory-built & aligned RF circuits • Separate AM & FM tuners and IF strips assure the finest in portable listening • Built-in AM & FM antennas • 4" x 6" speaker • Long-life flashlight battery operation • AFC, dial light, battery-saver switch • Rugged metal cabinet • Easy 10-hour assembly • Runs on 117 v. AC with optional converter/ charger @ $6.95 • Kit GR-43, 17 lbs.

C **Deluxe 10-Transistor FM Portable** **$44.95**
• 4" x 6" speaker • AFC for drift-free reception • Treble-cut tone control, vernier tuning, headphone jack • 3 IF stages for full fidelity • Simulated tan leather case • Operates on long-life flashlight batteries • 10-hour assembly • Kit GR-61, 6 lbs.

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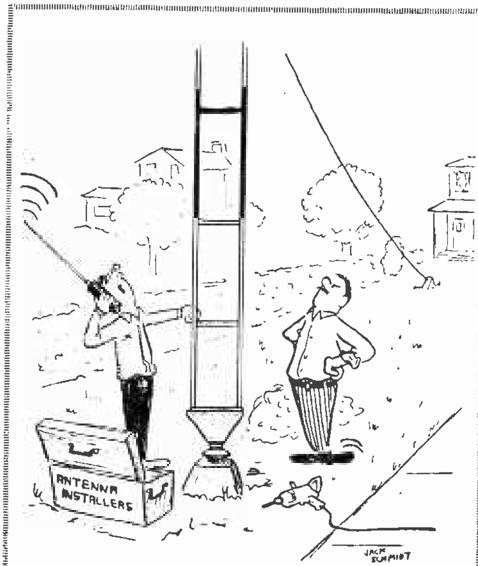
Prices & specifications subject to change without notice. GX-148 to 1 watt input power, 0.75 watts output, and .005% frequency tolerance. Transmitters must be type-accepted by the FCC, meaning that both commercial and home-built equipment must be approved before use.

The associated receiver must also be certificated for compliance with FCC Part 15 receiver radiation rules. Use of the new frequencies will be subject to the condition that no interference be caused to adjacent television channels 4 and 5.

Also, the FCC does not guarantee interference-free reception on these frequencies, which are shared with some "flea power" industrial mobile users and a very few fixed circuit links. However, the 72 to 76 mHz area is by far the least crowded of all the bands available for additional radio control frequencies.

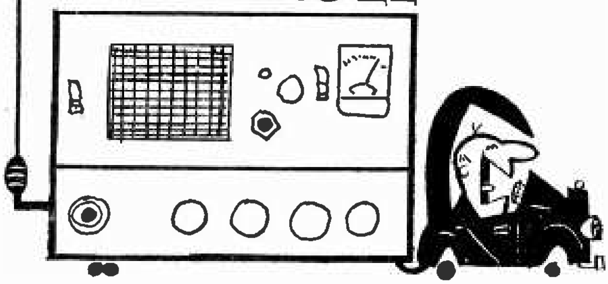
In the opinion of AMA's communications counsel. the FCC action constitutes a special recognition of the public interest embraced in modeler frequency usage and is tantamount to the creation of a new radio service especially for modeler use.

The Academy of Model Aeronautics (1239 Vermont Ave., N.W., Washington, D.C. 20005) and its crusading president, Howard E. Johnson, should be commended for their efforts in obtaining a new "home" for Part 15 modelers. Mr. Johnson hailed the Commission's action as a long-awaited advancement in radio controlled model flying. "Radio controlled flying will become safer and more popular as a result of the AMA's efforts," he said. ■



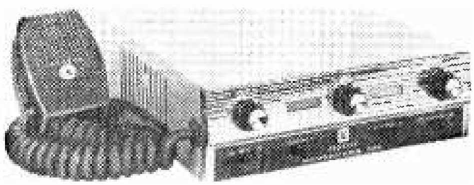
This fella says we're at the wrong address . . .

CB RIGS & RIGMAROLE



a what's new product column that's fun to read

■ Two sidebands better than one? Or, two sidebands or *not* two sidebands, 'that is the question (for you students of the immortal Bard). Anyway, the possible "new look" in CB seems to be upon us as of the announcement of the new E. F. Johnson Messenger 350 rig.



E. F. Johnson Messenger 350 Transceiver

The 350 runs that mysterious "mouse chatter" known throughout the world as *single sideband* (or just plain "SSB" to insiders). SSB modulation is a totally different mode than is normally used in CB rigs, an SSB rig can communicate *only* with other SSB rigs. If you have ever tried to listen to SSB on a regular CB rig, you'd know what we mean—

On the *plus* side of the coin, SSB offers smashingly good communications and it's been in use by the military and Hams for a number of years. Without going into a whole spiel on the technical aspects of SSB (believe me, neither of us would fully understand it) it offers up to 30% greater range over ordinary 5 watt amplitude modulated CB rigs when conditions are ideal. Under actual use during bouts with high noise, intense skip, and all kinds of other rotten things, SSB can scatter your signal up to 3 times further than standard CB sets.

The basic premise of SSB is that, while a regular CB set transmits a carrier along with both of its characteristic sidebands, the SSB system eliminates the carrier completely and one of the sidebands. This concentrates the signal into the one sideband for maximum punch. You can use either the upper or lower sideband.

The Messenger 350, for instance, is capable of operating on 2 channels, but turns itself into a 4 channel rig via SSB. Let's say your 2 channels are 9 and 11. You would be able to operate on *9USB* (upper sideband), *9LSB* (lower sideband), *11USB*, and *11LSB*. This may sound like advertising hanky-panky, but 'taint! If you are on *9USB*, some other SSB station can operate at the same time on *9LSB* and neither of you would know the other was there. Sort of like that old song to the tune of the Irish Washerwoman: "McGinty is dead, McCarthy don't know it; McCarthy is dead, McGinty don't know it; Both of 'em dead in the very same bed, and neither 'em know the other is dead."

Anyway, it can take our 23 channels and make CB a 46 channel affair.

Specifically, the 350 is all solid state with diode (rather than relay) switching. It weighs 6 pounds, operates from 12 volts (AC supply optional), or from rechargeable batteries. A PA feature is included. Comes complete with 2 crystals.

Details are available from E. F. Johnson Company, Waseca, Minn. 56093.

Hooked on sky hooks? Here's a new one to hook onto the business end of your rig, it's a weirdo looking thing known as the "Ringo" (manufacturer claims it's "a new CB *star*).

Low priced at $16.95, this base station

Cush-Craft Ringo Antenna, Model CR-1

antenna is a full ½-wave vertical with an exclusive "power ring" (sort of an aluminum bagel) at the base which is claimed to drag that last milliwatt of signal out of its hiding place in your rig and fling it into the ether with 3.75 decibel gain.

The Ringo takes a 52-ohm direct coaxial cable feed, offers a low down radiation angle, and has a direct DC ground to eliminate much of the static we all know and love so well.

"CB Stickers" by S. Nussbaum

Ringo is produced by Cush-Craft, 621 Hayward Street, Manchester, N. H. 03103.

Sick Schtickers. Well, we thought we had seen just about everything but when the mailman delivered us a sheet of "CB Schtickers" we knew that we must be doing *something* right (or wrong).

"CB Schtickers" are a sheet of 30 gummed CB-oriented signs (27 different) containing such gems of wisdom as: "Please engage brain before pushing mike button," "TVI complaints answered at rear door only," "Keep your cotton pickin' hands off the goodies," and "Support CB in Bosnia & Hercegovina," to list a few. You get the drift.

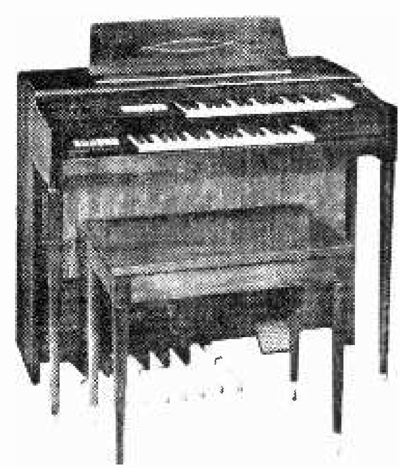
Paste 'em on your rig, on your QSL cards, your mobile unit, even on your Aunt Hattie's Honda. If these things don't create a major sensation in CB, we'll eat our ground plane.

"CB Schtickers" are available from S. Nussbaum, 1440A 50th Street, Brooklyn, N. Y. 11219. Price is 50¢ for a sheet of 30, or 3 sheets for $1, postpaid. N. Y. residents add applicable sales taxes.

CB Buyers' Guide. Just in case you did not spot it on the newsstand when you picked up this copy of RADIO-TV EXPERIMENTER, your *editors* have put out a CB annual which we titled CB BUYERS' GUIDE. Get your copy! It nit-picks 55 different CB rigs and tells you how they stack up—a *must* guide for your shack. ■

Color a Go-Go

A kit version of the Thomas COLOR-GLO Transistor "Artiste" ART-1 organ is now available from the Heath Company. The Color-Glo feature makes it possible for anyone, regardless of musical training or background, to play complete songs with melody, harmony and bass after only a few minutes of practice.



Thomas Color-Glo Transistor "Artiste" Organ Kit

The method is an ingenious, yet simple one. Each white key on the upper keyboard lights up with a letter to follow. By simply matching the letters on the music with the letters on the keys, you play the melody. For harmony, there are 3 red keys, 3 green keys, and 3 black keys on the lower keyboard. With your left hand, you press and hold the notes that match the background color in the Thomas Color-Glo music book (included with organ). To add the bass, foot pedals are marked with the same colors as the harmony notes. You just press the corresponding pedal, changing to different colors as you change with the left hand. The Color-Glo key lights may be turned off anytime, leaving a beautiful spinet organ console.

Additional features include 10 rich organ voices (a big *must* in any organ); variable repeat percussion to add banjo, mandolin, balalaika effects; 13-note heel and toe bass pedals; 2 overhanging 37-note keyboards; 12" speaker; 50-watt EIA peak music power amplifier; 2 levels of vibrato intensity; manual balance control; variable expression pedal; variable bass pedal volume, and a handcrafted, hand-rubbed walnut cabinet. The transistor plug-in tone generators, the heart of the organ, are warranted for 5 years. All parts are genuine Thomas factory-fabricated components. Total kit construction time is about 50 hours, and requires no special skills, tools or knowledge. Designated model GD-325, the new organ is priced at $349.95. A matching walnut bench is available at $24.95. Full information is yours by writing the *Heath Company*, Dept. RTVE, Benton Harbor, Michigan 49022.

Tape Recorder Kit

The 1966 Model KG-415 Knight-Kit Tape Deck is offered by Allied Radio Corp., Chicago, in their "Superba" series. Easily assembled, solid-state plug-in modular circuitry provides all the electronics needed for exceptional 4-track stereo and monophonic record and playback. Preassembled Viking tape transport is specially built to Knight-Kit specifications:

Knight-Kit Model KG-415 Tape Deck Kit

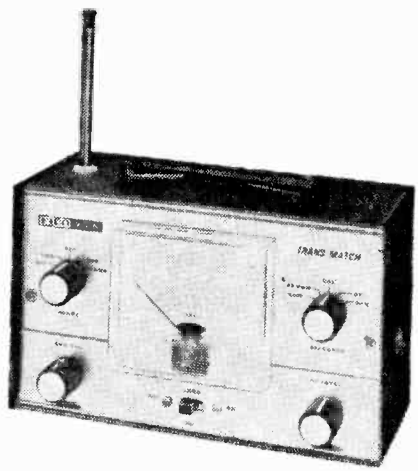
New Products

Three 4-track hyperbolic heads direct tape monitoring, sound-on-sound and echo recording; selector control with record and playback operation indicated by six illuminated windows; VU meters indicate record and playback sound level; single knob tape motion control with positive-action erase-protect pushbutton switch; push-to-reset digital counter for quick indexing of recorded selection; separate monitor-level controls for precise balance between recorded signal and source.

The Knight-Kit KG-415 with all parts, assembled Viking transport, detailed assembly instructions and 7" takeup reel is priced at $249.95. Walnut Wood Base $19.95. Full information available from Allied Radio Corp., Dept. 20, 100 N. Western, Chicago, Ill. 60680.

CB Test Gear

The new *EICO* Model 715 Transmatch is a compact, portable, easy-to-use handy "laboratory" that quickly indicates the status of all the vital RF characteristics of your equipment to help you maintain optimum operation. It is designed for both the professional and hobbyist in ham & CB work, for field or shop.



EICO Model 715 Trans/Match Ham-CB Test Set

At the flip of a switch, the 715 gives you fast, accurate reading/checking of: standing wave ratio, true RF power, modulation distortion, and relative field strength. Rugged, all solid-state, self-powered, sensitive (with 100μa meter), the 715 handsomely complements the *EICO* line of ham and CB transceivers. Kit is $34.95, wired is $44.95. Available from 2500 *EICO* dealers coast-to-coast. Write for free catalog to *EICO Electronic Instrument Co., Inc.*, 131-01 39th Avenue, Flushing, N. Y. 11352.

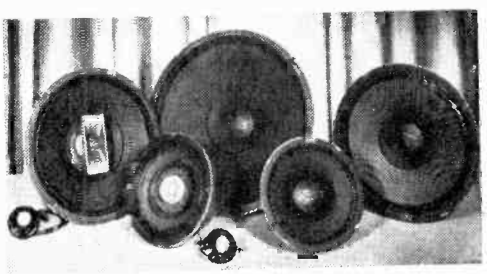
24-Hour Clock

While time has been measured by mechanical clocks since 1363 when Henry DeVick invented the earliest self-contained counterpart of the modern clock, reading of dial-faces has made for "loose time-telling." The majority of persons, in every age group, have been telling time all their lives, habitually saying, "It's about a quarter to 10" or "It's a little after 11." This new fast air-age now makes time-telling accuracy a required habit free of "clock guessing." *Tymeter's* "Time-at-a-Glance" 24-hour electric numeral clock gives the time automatically and without need for "confusing hands." This direct read-out clock is destined to save countless lost minutes in the lives of all clock users. Great for hams, commercial operators and SWL's who must maintain accurate time logs. Photos shows the Jefferson 24H-¼ Tymeter Clock, walnut or ebony, which sells for $15.00. For more information on other models write to *Numechron Co.*, Pennwood, Dept. RTV, 7249 Franstown Avenue, Pittsburgh, Pa. 15208.

Tymeter "Time-at-a-Glance" 24-hour Clock

Loudspeaker Line-Up

Just a glance at the Wolverine loudspeaker line by *Electro-Voice* shows that loudspeakers have come a long way since the early days of high fidelity. The slim, sturdy die-cast frames, finished in misty green metallic, are good examples of progress that has been made in the art. Two eight-inch speakers, the LS8 and LT8: two twelve-inch speakers, the LS12A and LT12: and the fifteen-inch LS15 make up the



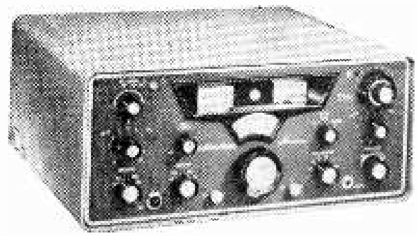
Electrovoice's Wolverine Loudspeaker line

component-quality Wolverine line. The three speakers prefixed LS are Radax coaxial types. In these units two cones divide the sound; one for maximum bass reproduction and a second, smaller cone for efficient high-frequency performance. The Wolverine LT12 uses a Radax coaxial cone with the addition of *E-V's* exclusive Sonophase VHF driver to ensure reproduction of the all-important treble range. The LT8 uses a long-throw eight-inch woofer cone for extended low-frequency response while the Radax coaxial section imparts realism in the mid-frequency areas. Lifelike reproduction of the highest musical overtones is delivered by a dynamic very-high-frequency driver. Three separate radiating elements in the LT8 have been blended to produce a cohesive wide-range character difficult to achieve in a loudspeaker only eight inches in diameter.

The striking aspect of the five loudspeakers in the Wolverine line is the styling of the speaker frames, or "baskets," an important consideration for those who plan to use an existing closet or storage area as an enclosure. Speakers of the past were apparently never intended to be seen, or so their ugly frames would indicate. Many *do-it-yourself* builders, interested in quality sound in rather limited space, have found that the installation of these units, attractive to the eye as well as to the ear, offers the ideal solution to the enclosure problem. The nationally advertised prices of Wolverine speakers range from $20.00 for the LS8 to $36.00 for the three-way LT12. Want more poop? Write to *Electro-Voice, Inc.,* Dept. RTV, Buchanan, Michigan 49107.

Power Packing Transceiver

Maximum transmitter power has been compactly packaged in a new 80, 40, 20, 15 and 10 meter transceiver, the SR-2000 made by The Hallicrafters Co. Transmitter power input is 2000 watts P.E.P. on SSB and 1000 watts on CW. With all this power, the SR-2000 measures only 7½" H x 16½" W x 15" D—just a hair more than one cubic foot. The transmit section has two 8122 output tubes. It also has a variable *pi* network. Carrier and unwanted sideband suppression is rated at 50 db, and distortion products are 30 db. The audio output



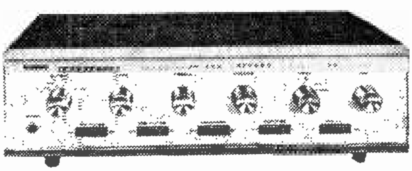
Hallicrafters Model SR-2000 Amateur Transceiver is measured at 500 to 2600 cps at 6 db. Cooling of the section is handled by an efficient two-speed air blower.

Sensitivity of the receive section is less than 1 microvolt for a 20 db signal-to-noise ratio. The audio output for driving a speaker is 2 watts, and overall gain is 1 microvolt for ½ watt output. Receiver first IF is 6.0-6.5 mHz. and the second IF is 1650 kHz.

A special feature which equips the SR-2000 for round-table net or CW operation is *Hallicrafters*' exclusive Receiver Incremental Control. This feature makes it possible to adjust the receiver ± 2 kHz independent of the transmitter. There are a number of other features of interest to amateurs. The tuning dial is calibrated to 1 kHz. The linear gear drive has less than 1 kHz readout. IF noise blanking is adjustable. Built-in features also include VOX plus break-in CW and PTT. CW sidetone is also built-in. Provision is made for a VFO/DX adapter. The SR-2000 has a 2.1 kHz crystal lattice filter, and 100 kHz crystal calibrator, and the VFO tuning range is 500 kHz. Front panel controls include: band selector; tuning; final tuning; final loading; RF level; microphone gain; AF gain; calibration adjustment; operation condition, Off/Standby/MOX/VOX; and operation mode, CW/Tune/USB/LSB.

The amateur net price of the SR-2000, including all built-in features and all crystals for 28.0 to 30.0 mHz, is $995.00. A companion P-2000AC power supply/speaker for either 115/230 volt AC operation has an amateur net price of $395.00. The power supply has a built-in speaker, all meters for final plate current and voltage, and hi-lo power switch. Additional engineering data on the SR-2000 and companion P-2000AC power supply may be obtained by writing *The Hallicrafters Co.*, Dept. RTV, 5th and Kostner Avenues, Chicago, Illinois 60624.

Stereo Amp



Lafayette LRE-80 Solid-State Stereo Amplifier

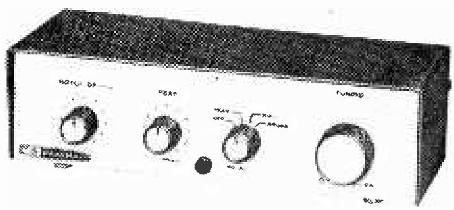
Lafayette Radio introduced its new model LRE-80 solid-state stereo amplifier. A 29-semiconductor circuit features instant operation, without hum; noise or microphonics; with power to drive any stereo speaker to its full capacity; and with special electronic short-circuit protection. Controls and inputs include: Bass, treble, dual volume, 5-position mode, 5-position input, 4-position output including power/off, speaker phase and headphone switch,

New Products

rocker switches for: low filter; high filter; loudness; tape monitor; stereo headphone jack (for tape head or phono input); plus stereo inputs for tuner, tape recorder, plus aux. 1 and 2. Two AC convenience outlets, 1 switched. The LRE-80 specs are—Power Output: 80-watts IHF (40-watts each channel). Response: ± 1db, 22-24000 Hz. Input sensitivity for rated output, phono magnetic 2.5 mv, tape head 2 mv, high level aux. 0.25 V. Harmonic distortion; less than 1%. Headphone jack impedance 8 ohms. Extruded aluminum gold finish panel. With metal case. Size: 13$\frac{1}{16}$ W x 4½ H x 10½ D. For 110-120 volts, 60 cycles AC. Price is $119.95. For more information write to Lafayette Radio Electronic Corporation, Dept. KCP, 111 Jericho Turnpike, Syosset, N. Y. 11791.

Q-Multiplier

A new Q-Multiplier that can be used with any communications receiver having an IF frequency between 450-460 kHz, is now added to the many kits made available to communications hobbyists by the Heath Company. With this *electronic filter*, the receiver IF selectivity is greatly increased (effective "Q" of 4000). It can be used to produce a sharply-peaked IF curve for CW reception, a broad peaked IF for phone operation or a deep rejection notch to eliminate a closely-interfering heterodyne.



Heathkit Model GR-64 Shortwave Receiver Kit

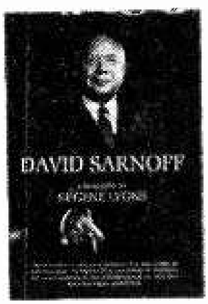
Both peak and notch positions are tuneable to any point on the receiver's IF bandpass. In addition, the unit may be used with a receiver that already has an IF filter to obtain two simultaneous functions. For example, the IF filter could be set to peak the desired signal, and the Q-Multiplier used to null an adjacent signal. Designated model GD-125, the new Q-Multiplier comes complete with a built-in power supply for 117 VAC operation, connecting IF cable, plug and socket for attachment to the receiver, and a handsomely styled charcoal cabinet and gray front panel that matches the Heathkit GR-64 Shortwave receiver. The GD-125 assembles easily in around 8 hours, and sells for $14.95. For full details, write *Heath Company*, Dept. RTV, Benton Harbor, Michigan 49022. ■

BOOKMARK
BY BOOKWORM

☐☐ **David Sarnoff.** The life story of the guiding genius of the Radio Corporation of America is one of achievement against tremendous odds. Few men in our times have started from the bottom of the pile and risen so fast to the top in their chosen fields.

There is human drama in his personal story, in his progress from a ghetto hamlet in Russia through New York's steaming slums; from office boy at fifteen to the presidency of one of the nation's major corporations before he was forty, to leadership in the communications and electronics industry and great responsibilities as advisor to five Presidents and to leaders of the Armed Forces.

There is drama, too, in his professional life, from the moment when the twenty-one-year-old wireless operator sat for three days and three nights at the Wanamaker department store radio station in New York, with all other radio stations silenced by President Taft so that he could receive the names of survivors in the Titanic disaster. For the first time the name of David Sarnoff, already known among his colleagues for his skills as a wireless telegraph operator, was heard across the nation.



Hard cover
372 pages
$6.95

And there is sharp drama of business conflict, of struggles within and between companies, highlighted by monumental legal battles and decisions that hazarded tens of millions of dollars on one man's refusal to give up his vision.

Vision has, in fact, been Sarnoff's unique contribution. In a technical and scientific environment, his strength has lain in discerning the long-range potentials of electronic research, then throwing his faith and energies behind their development. Over and over again, he pitted that faith not only against skeptics in the

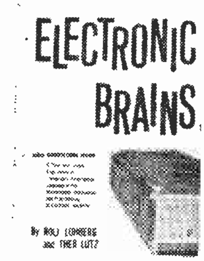
Bookmark

industry but at times among associates in his own company.

Mr. Sarnoff's impact on our times has extended far beyond his professional domain. He has been active and influential in performing notable services for his country.

The story of David Sarnoff's rise from a simple background to become an authentic son of the twentieth century is an American saga in the best sense of that term. Told with skill and sympathetic understanding by Eugene Lyons (Senior Editor, staff of Reader's Digest), this narrative of an extraordinary career is one of compelling human interest.

☐ ☐ **Chit-Chat on Computers.** Here is a book to take the mystery out of computer language and operation, a book that really and truly explains (among many things) output and input, gates and bits, flip-flops and negaters, binary addition and heuristic trial and error—terms that have frequently been a puzzle to every layman. It is entitled Electronic Brains and authored by Rolf Loberg and Theo Lutz.



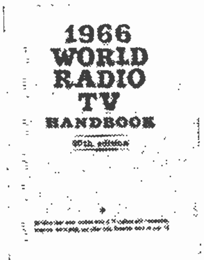
Hard cover
221 pages
$4.95

Specially aimed at the non-mathematically minded, this book is written in a conversational style, supplemented by amusing drawings. Together these make crystal clear to the untutored reader how machines and punch cards and tapes are used to sort out and analyze all types of information, convert them into electronic impulses, which can then be stored in memory units to form the framework for analysis of new information, etc.

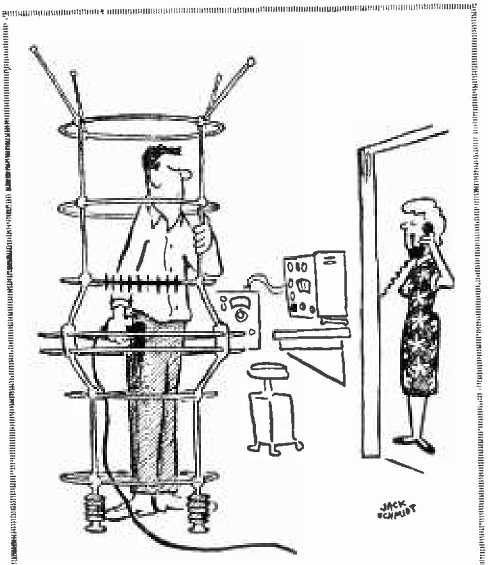
Chapter by chapter the reader is carried along on words of wit, entertainment and brilliant analogies, utilizing, for instance, games such as "What's My Line" and the Marienbad match game. The authors indelibly impress programming on your mind, for example, by comparing it to Swiss music boxes. The authors draw the reader, young or old, so shrewdly into the fascinating world of computers that it becomes sheer joy to get absorbed in this subject that for so long has been considered strictly taboo, almost impenetrable to the uninitiated.

A reading of this book will enable you to use basic knowledge as a springboard to more advanced technical studies. Pick up your copy at a local bookstore or write to Sterling Publishing Co., Inc., Dept. RT, 419 Park Avenue So., New York, N. Y. 10016.

☐ ☐ **SWL's Silent Partner.** There's little more that anyone can say about the 1966 World Radio TV Handbook that has not been said about the nineteen previous editions. This 304-page handbook is the only up-to-the-minute guide to all broadcasting radio and TV stations throughout the entire world. It's pretty doubtful that any SWL should be without a copy of the new edition at his elbow. The 1966 WRH lists frequencies, callsigns, programs, addresses, power, ID signals, personnel, etc. of thousands of broadcasters—country by country. You can add to this a lot of useful tables on time conversion, satellites, DX clubs, postage rates, etc. With its fine print and jam-packed pages, it will take days to read. The 1966 World Radio TV Handbook is sold mail order from Gilfer Associates, P.O. Box 219, Park Ridge, N. J. 07656—who, incidentally, carry a variety of other goodies for SWL's. ■



Soft cover
304 pages
$4.95



"He can't answer right now, Bert, he just finished soldering himself inside of his new antenna!"

Commercial QSL's

How can I get QSL from commercial code stations which broadcast CQ, CQ, CQ? Please help.

—*R. R., Bristol, Conn.*

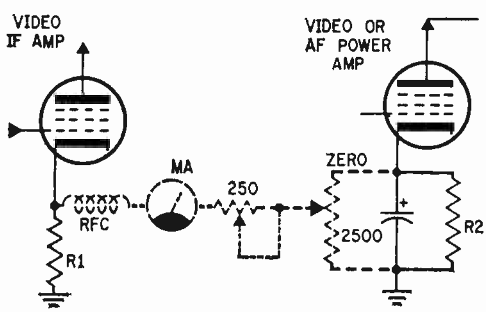
According to the law, no one is supposed to reveal the content of any radio transmission except to the addressee, or even that a transmission took place from any but an amateur or broadcasting station. While CQ is a general call, in this case it is a call addressed to other stations in a network (not to listeners-in). Since it is not illegal to make known that such a transmission ever existed, don't expect an acknowledgement (QSL). Sorry I can't help you.

S-Meter for TV

How can I connect "S" meters to my TV set for both audio and video?

—*M. G., Chicago, Ill.*

The first diagram shows an 0-1-ma DC milliammeter connected between the cathode of an AGC-controlled sound-IF-amplifier tube and the cathode of the AF-power-amplifier tube. The RF choke (RFC) may be required to avoid upsetting the IF circuit. To measure the relative strength of the sound-channel signal, connect a 0-50 DC microammeter in series with the grid-return resistor of the sound-IF amplifier/limiter as shown. Potentiometer R2 is a meter shunt which should be adjusted so that the meter won't indicate off scale. Beware. If your TV set is one of the power-transformerless wonders, these simple circuits might not be suitable.



Definitions

What are AM, FM, HF, VHF and UHF and what are their applications?

—*A. S. S., Karachi, Pakistan*

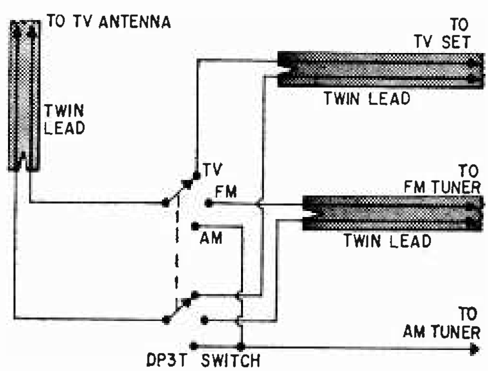
AM is *amplitude modulation* of a radio-frequency carrier for broadcasting and communications. FM is *frequency modulation* of a radio-frequency carrier for high fidelity broadcasting, land mobile and marine (in the VHF band) communications. HF means *high frequency*, the 3- to 30-mc portion of the radio spectrum. VHF means *very-high frequency*, the 30- to 300-mc portion, and UHF means *ultrahigh frequency*, the 300-3000 mc portion of the radio spectrum. The HF bands are used for long-range communication, except in the 27-mc citizens band in the U. S. The VHF bands are used for television and FM broadcasting and air, marine and land-mobile radio communication. The UHF bands are used for television broadcasting, land-mobile communication, telemetry transmission, radar and point-to-point (microwave) communication.

TV-leadin Sky Wire

How can I use my TV antenna for AM and FM radio reception?

—*H. J., Pocatello, Idaho*

Use a three-position, double-pole wafer switch and connect the roof-top antenna twin lead to the switch rotors and leads to the TV set and AM-FM tuner as shown in the diagram. For FM and TV, the antenna is used as a horizontal-



ly-polarized directional antenna as normally intended. For AM, the antenna assembly and the twin-lead form a capacitance-top, vertical antenna.

Ham Radio Log

Why don't you publish the frequencies and call letters of ham stations?

—C. B., Seattle, Wash.

Since there are more than 250,000 ham licenses, it would require a very large book. Ham call books are available at many radio parts stores. Hams are not assigned specific frequencies. They may operate on any frequency within bands covered by their particular class of license.

W1AW Code Practice

Who broadcasts code practice?

—R. K., Morton Grove, Ill.

W1AW, operated by the American Radio Relay League, transmits code practice at 8:30 P.M. Central Time. The station operates on 1820 kc (160-meter band), 3555 and 3945 kc (80-meter band), 7080 and 7255 kc (40-meter band), 14,100 and 14,280 kc (20-meter band), 21,075 and 21,330 kc (15-meter band), and on 28,080 and 29,000 kc (10-meter band). The schedules are published in the magazine QST.

There's Still Hope

Where can I buy unusual parts for obsolete communications equipment?

—L. C., Bronx, N. Y.

Try Spera Electronics, 3220 37th Ave., Long Island City, N. Y. 11101. Spera carries a large inventory of new, used and surplus parts and equipment, much of it listed in their free catalog. Just drop them a line.

WHAT TO KEEP?

I have a very old Columbia-Kolster electric phonograph which was considered to be one of the best sounding instruments when it was new. It plays only 78-rpm records. How can I modernize it?

—L. G., San Francisco, Calif.

Replace the turntable, motor and pickup with modern ones or a record changer. You will also need a preamplifier (G.E. A1-203 or UPX-300B, etc.) if you use a magnetic pickup cartridge and want to use the old amplifier. However, the amplifier, which was magnificent in its day, is not capable of what is considered hi-fi today. The speaker too was tremendous. But, replace both the speaker and the amplifier with one that will accommodate the new pickup without an external pre-amplifier. ■

The new & improved supersensitive S & M photo-meter

now better than ever!

Every photographer knows that the high quality of his photos depends on the accuracy of his equipment. Here is a precision instrument that meets the highest standards of any meter available. MODERN PHOTOGRAPHY says, "This is certainly one of the most unusual, most versatile and most sensitive exposure meters at any price today." U. S. CAMERA wrote "It is as sensitive as anything on the market. It's so adaptable—those 4 separate ranges of sensitivity have the effect of spreading the meter's scale."

Now, this S & M is better than ever! A new design feature, the use of plug and jack connections for probes, makes interchangeability of probes possible. Users of this most outstanding Light Meter can now easily find out what sensitivity values of probes are best suited for their specific applications. A new plastic cap protects the probe and permits diffused light to be read with the cap on (the probe is normally used to take readings with the cap removed). Another improvement is the battery test circuit, which indicates instantly the condition of the mercury cell that powers the unit.

This Photo Meter is utilized extensively in Photo Labs, Physics and Research Labs, Hospitals, High Schools, Universities and many industries. It is successfully used with movie or still cameras, microscopes and telescopes. For Photomicrography it is a MUST! It can even be set up for use as a densitometer.

The S & M Supersensitive Photo Meter uses the newest Clairex Corp. CL-505L Cadmium Sulfide Light Cell to measure light levels from twilight to bright sunlight at ASA speeds of 3 to 25,000. A new ⅝" high eased type probe is now available as an accessory. The Computer gives F stops from .7 to 90; lists exposure time from 1/15,000 sec. to 8 hours; 4 range selection; EV-EVS-LV settings; weighs only 10 ounces.

And yet—this all-inclusive kit can be assembled with a soldering iron and screw driver in less than 2 hours. Step-by-step instructions make it easy. If you prefer, order your S & M Supersensitive Photo Meter fully assembled and factory tested. Complete with attractive carrying case and computer.

$29.95	$34.95	$2.00	Additional Computer $1.00
No. 101—In Kit Form with carrying case	No. 102—fully assembled with carrying case	No. 103 carrying case only	Easel Probe $6.50

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☐ No. 102—fully assembled $34.95 with carrying case ☐ Additional Computer $1.00

Add 10% for Canadian and foreign order. New York City residents add 5% for N.Y.C. sales tax.

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VTVM DRY CELL ELIMINATOR

■ When you stop to think about it, a VTVM is a pretty reliable instrument. In fact, about the only periodic maintenance required is replacement of the ohmmeter dry cell or cells. This operation, though simple, is troublesome. And, when the need arises, it must be handled immediately to prevent damage to the VTVM due to electrolyte leakage. The dry-cell eliminator described here will put an end to this annoying task.

A common dry cell, the kind usually found in a VTVM, is a low-impedance power source; that is, it provides a constant voltage under varying load conditions. Any device used to replace a dry cell must have the same output characteristics. This, then, is the first requirement for our dry-cell eliminator. Other requirements include simplicity and compactness.

What Is It? The battery eliminator is a transistorized voltage regulator powered by a

BY DONALD E. BOWEN

You say your VTVM's ohmmeter won't read full scale? You're worn out replacing weak dry cells? Do you worry about cells leaking electrolyte? Get rid of your biggest VTVM problem—simply build a dry-cell eliminator!

DRY CELL

low-voltage winding on the VTVM power transformer. When properly constructed, it occupies no more space than the dry cell it replaces. It requires additional power only during the time required to take a resistance reading. Although the unit described here replaces the 1.5-volt cell used in most VTVM's, the principle of operation can be applied to meters requiring higher voltages.

How It Works. The added winding on the power transformer (Fig. 1.) supplies approximately 3 volts for the circuit. Diode D1 rectifies the supply voltage. The resulting DC voltage, filtered by C1, supplies the collector of Q1, as well as the reference circuit (R1, D2, D3, D4). R1 limits the current through D2, D3 and D4 to approximately 30 milliamperes. D2 and D3 are forward-biased silicon diodes. The nominal forward voltage drop across silicon diodes is 0.7 volt per diode, and is relatively constant over a wide current range. Thus, the drop across two diodes in series is approximately 1.4 volts, which is the nominal output of a dry cell.

Diode D4 is a germanium diode with a drop of about 0.2 volt. This compensates for the base-to-emitter drop in Q1. The constant 1.6 volts across the diodes is the base voltage for Q1, an emitter follower. Although the voltage gain of Q1 is approximately unity, there is a nominal base-to-emitter drop of approximately 0.2 volt; thus the output voltage across R2 (and across an external load) is approximately 1.4 volts. Within the limitations of rectifier and filter circuit, the output is relatively constant with a varying load.

Transformer Winding. Power for the dry-cell eliminator is supplied by a winding added to the VTVM power transformer. The nominal DC voltage required is 1.4 volts. Allowing for a drop of 0.2 volt across transistor Q1 (this is the base-to-emitter drop for a germanium transistor), and an additional 0.7-volt drop across rectifier D1 (this is the drop across a silicon diode), the transformer must supply not less than 2.3-volts rms. But this value does not allow for line-voltage variations from the design center. Considering a ±10% line-voltage variation, the minimum requirement becomes 2.4 + 0.24, or 2.64 volts. In practice, the new winding on the transformer should supply more than 3-volts rms—as measured with an AC volt-

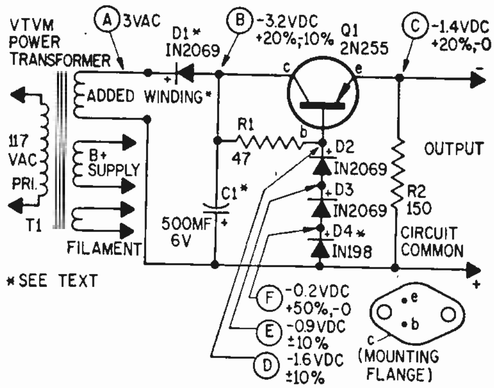


Fig. 1. Hardest part of this circuit is adding winding to existing transformer.

meter. This permits an adequate drop across Q1 for better regulation.

Determine the exact number of turns experimentally as follows. Wind a full layer of #22 or #24 awg enamelled wire on the power transformer. Be sure to count the number of turns.

In most cases, there is plenty of room between the winding and the core of service type instruments. (Some laboratory-type and military-surplus instruments have hermetically sealed transformers. In this case, a separate transformer, perhaps a small output transformer, to change 117 volts to 3 volts, must be added.) Generally, the power transformer is accessible and does not have to be removed to add the extra winding.

After the one-layer winding is in place, apply power to the instrument. Measure the voltage with the winding loaded by a 15-ohm, 2-watt resistor. The voltage will probably be more than 3-volts AC. Using the ratio

$$\frac{E_1}{N_1} = \frac{E_2}{N_2}$$

determine the number of turns required for 3 volts and remove the extra turns from the transformer. For example, suppose that you added 50 turns (N_1), and this provided exactly 5 volts (E_1). Substituting in the formula, the required number of turns (N_2) is 30. Thus, 20 turns must be removed, leaving the required 30 turns. After the turns have been removed, check the voltage again with the 15-ohm load. Take off (or add) turns as required to get 3 volts. When you trim off the excess wire leave at least six inches of lead wire on the transformer. Put sleeving over the leads and secure the winding with tape.

Fig. 3. Basic VTVM ohmmeter circuit.

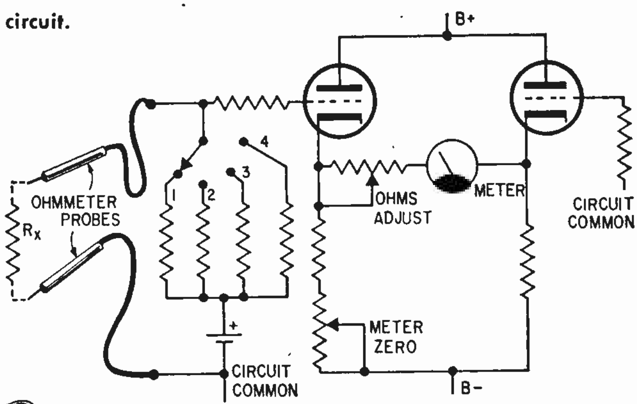
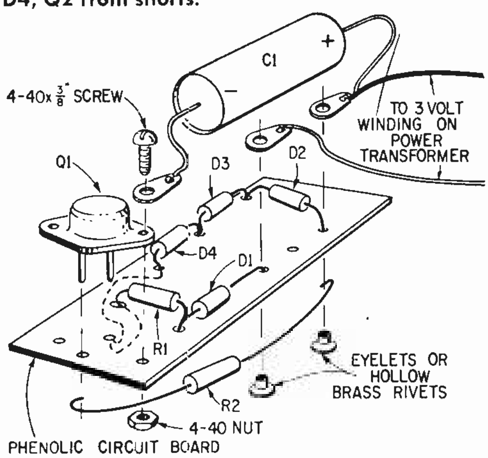


Fig. 2. You can use any transistor that can safely handle the 500-ma maximum current. A ½-amp meter-type fuse connected between D1 and the collector of Q1 will protect D2, D3, D4, Q2 from shorts.



PARTS LIST

C1—500-mf., 6-volt tubular electrolytic capacitor
D1—500-ma., 50-prv (piv) minumum rating silicon diode (1N2069, 1N2609, 1N4001 or equiv.)
D2, D3—30-ma., 25-prv minimum rating silicon diode (1N198A, 1N294, 1N34 or equiv.)
Q1—Power transistor, pnp (SK3009, 2N2061, 2N255 or equiv.)
R1—47-ohm, ½-watt resistor
R2—150-ohm, ½-watt resistor

Estimated construction cost: $3.00
Estimated construction time: 2 hours

Rectifier and Regulator Circuits. Build this assembly on a small phenolic board, approximately 1 inch by 3 inches, and at least 1/16-inch thick. The exact size and shape depends on where it will be mounted. Study the schematic (Fig. 1) and pictorial wiring diagram (Fig. 2) for details. It's a good idea to breadboard the unit before putting it in final form. This way, you can determine if the circuit is just right for your meter. The limiting factor is the center-scale reading of the low-ohms, or R×1 range on your ohmmeter. Fig. 3 shows a typical ohmmeter circuit. Maximum current flow occurs when the meter is on the R×1 range and the probes are shorted to adjust for zero. In the example shown, maximum current is:

$$I = \frac{E}{R}$$

$$I = \frac{1.4 \text{ volts}}{10 \text{ ohms}} = 140 \text{ ma.}$$

The author's meter has a center-scale reading of 30 ohms. The circuit shown in Fig. 1 is satisfactory for this. However, on the R×1 range the power supply ripple at point B (see Fig. 1) increases—resulting in a decrease in the average DC level at point C. If the center-scale reading of your ohmmeter on the R×1 range is much below 30 ohms, increase the value of C1 to 1000-mf (Blue Beaver BR 1000-25). In extreme cases, replace D1 with a full-wave bridge, as shown in Fig. 4. Changing the rectifier from half-wave to full-wave doubles the ripple frequency and improves the performance of the power supply under heavy load.

Increasing the number of turns on the transformer will also help, although this might require a higher value for R1. One

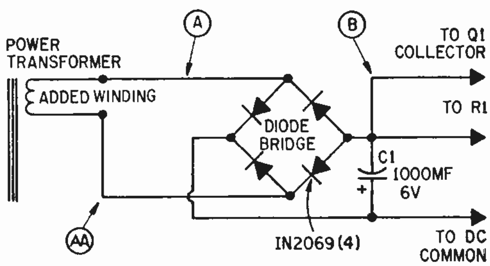


Fig. 4. Bridge rectifier circuit doubles ripple frequency and improves filtering.

DRY CELL

disadvantage of increasing the supply voltage is the additional drain on the primary of the VTVM power transformer. Usually these transformers are sized close to the requirements of the unit without the added winding. If the added circuitry requires too much power, it might upset other circuits. Since current drain (determined by the R×1 ohmmeter circuit) is 100 ma (or more), voltage from the added winding should be maintained at as low a level as possible to keep the power in the primary to a minimum.

In constructing the final assembly, take into account the space available. If possible, build the unit to fit where the cell was mounted. The dry-cell eliminator shown in the photographs replaces a penlite (size Z or AA) cell; consequently, we removed the battery clip and soldered the unit in place at that point. If the VTVM is crowded, you might have to find some other place to mount the device.

Checkout. Typical voltage readings are indicated in Fig. 1. Although readings at points A and B may vary, the other voltages should be within the limits shown. This assumes, of course, that the ohmmeter requires a single 1.4-volt dry cell. For higher voltages, readings should increase accordingly. In most cases, the ohmmeter zero reading will have to be readjusted for the low range, but this is often true for even a size-D cell. Most service-type ohmmeters use a size-C cell; and, when properly constructed, the battery eliminator will perform comparably.

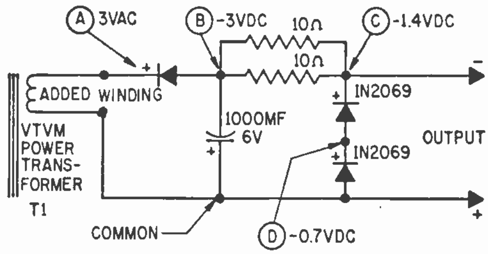
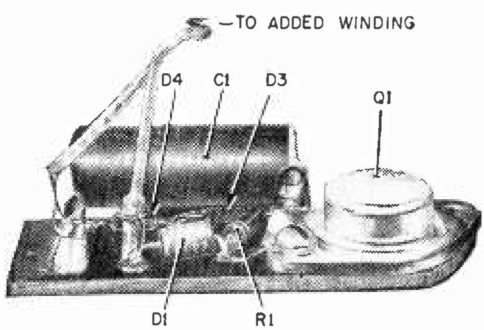


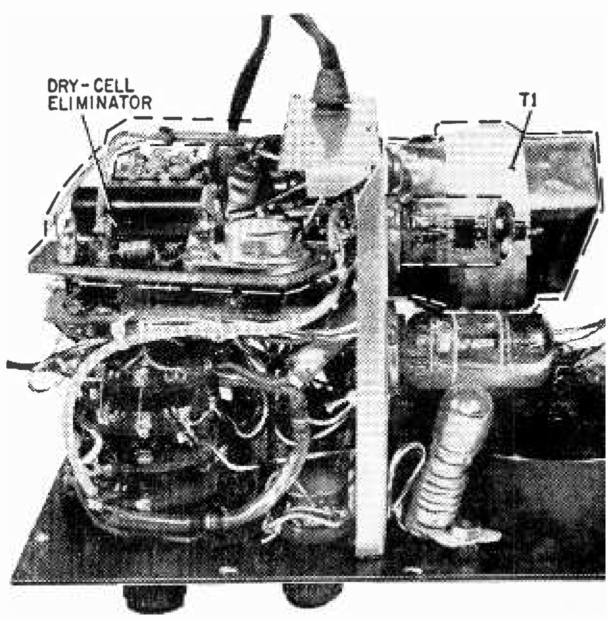
Fig. 5. This simpler circuit doesn't use a series regulator to load—here load is in parallel to the shunt regulator diodes.

Other Possibilities. One of the advantages of this circuit is that it requires only a few milliamperes during standby. A disadvantage is that it is more complex than other workable schemes. The circuit in Fig. 5 is an example. Performance compares favorably with the transistorized circuit previously described except that it draws maximum current (approximately 300 ma) whenever power is applied to the VTVM. Using the ohmmeter does not change the current required. Total current required by the ohmmeter and regulator circuit combined is 300 ma.

(Continued on page 112)



Dry-cell eliminator is about same length as two power transistors. Its thickness is about that of penlight cell and can be fitted into most metal-cased VTVMs.



One more modification to this reworked VTVM is the dry-cell eliminator. Leads from T1 are routed away from vacuum-tube circuit wiring.

Perf-Board Project

Space-Age Xtal Set

Position a few push-in terminals; wire in a few basic electronic components and solder on a few interconnecting wires—then sit down and listen to music.

■ More than 60 years ago man listened to radio signals on a crystal set—a coil, tuning capacitor, headphones, and the *cat's whisker* crystal detector. Today, jets zoom overhead, a burst of light *welds* a detached retina (in the human eye), and computers do complex problems in a fraction of a second—yet we're still peddling 60-year-old crystal sets

The small-fry can tune this set as easily as any of the larger ones. The silence for the rest of the family is really welcome.

to the kids. Sure, instead of diddling with the *cat's whisker* to find the most sensitive spot on a crystal we substitute something like the 1N34 diode, but it still takes an umpty-ump-foot-long antenna and—as they say—a *solid ground* just to pick up the 50 KW. station on the other side of town.

Man, this is the space age—let's do it right. Pull out that crystal, throw in a transistor (a triode crystal) and with no other components other than a penlight cell you can pull in that fifty kilowatter with 2 feet of wire for an antenna. If you want to splurge and use a long-wire antenna and a ground you'll get enough signal to overload the headphones.

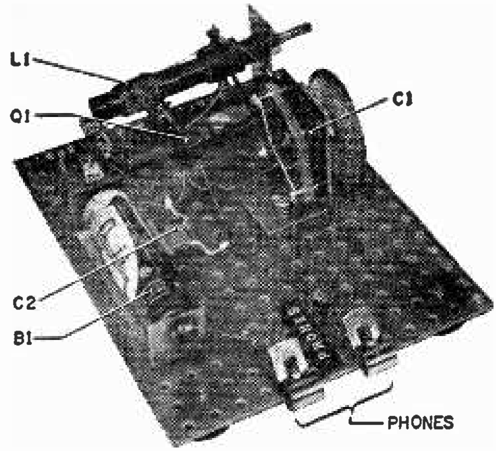
The Space-Age Xtal set is shown in the schematic. Note that transistor Q1 alone—no extra resistors and capacitors are needed—replaces our old friend the diode. Where's the detection? Simple. Q1's base-emitter junction *is* a diode, providing the *detection* or rectification. The signal variations (audio) between the base and emitter then become the input signal to the "entire" transistor which is also an audio amplifier. That's all! The single transistor provides detection and amplification. A power switch? None needed; when the headphones are disconnected the battery circuit is opened.

Something for the kids! Again, instead of going back 60 years and squashing some components into a hunk of wood—generally euphemistically called a breadboard—let's stick to the space age and use perf-board wiring. In fact, you can throw the perf-board into the box of parts and get the kids off your back for at least an hour. Figure another couple of hours of freedom as they listen to rock-and-roll on a radio *they* built.

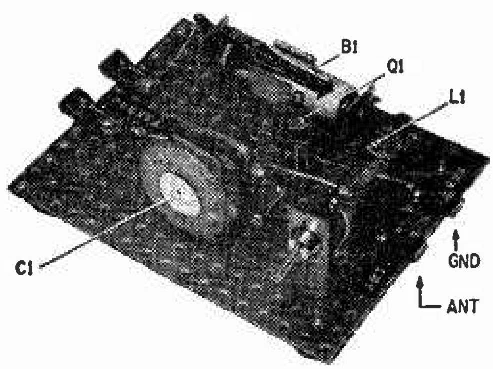
The entire radio is built on a standard 3½ x 4½-inch perf-board (actually perforated-phenolic board but it is also called a terminal board). As supplied by General Electric for a paltry *buck*, the board comes complete with a dozen *push-in terminals* (sometimes called *flea clips* although really quite different) and four rubber feet, one for each corner. The rubber feet prevent the terminals, which protrude through the board, from scratching your Louis XXV dining room table. Another advantage in using the G.E.'s ETR-4288 Terminal Board is that the terminal holes are just the right size for tapping in #4 machine screws or those extra self-tapping screws left over from aluminum chassis cabinets.

First step is to mount the rubber feet at each corner with supplied self-tapping screws. Then mount coil L1.

L1 has what appears to be a loosely wound



Parts layout is not critical. Just keep lead lengths (wires) between C1, L1 and Q1 reasonably short. RF-bypass or filter (C2) controls average voltage from detector—too high a capacitance will affect treble tones of music—effect will be noticeable with hi-fi phones.

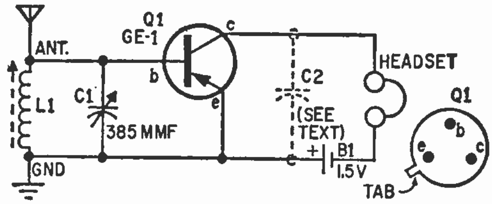


Transformer can be used to match low-impedance headphones to Space-Age Xtal Set output—try an output transformer from tube-type radio. Strong signals will give low volume on speaker for quiet-room listening.

PARTS LIST

B1—1½-volt penlight cell
C1—385-mmf., miniature tuning capacitor (Lafayette 99R6217 or equiv.)
C2—500 mmf to 0.001-mf., (any voltage rating—see text)
Q1—Transistor, pnp (General Electric GE-1, 2N247, 2N409, 2N1284 or equiv.)
L1—Ferrite antenna coil (Miller 6300 or equiv.)
1—1000-5000-ohm headphones (magnetic type)
Misc.—perforated-phenolic board; Fahnestock clips, wire, solder, rubber feet, brackets, mounting screws, etc.

Estimated construction cost:	$4.00
Estimated construction time:	1 hour



Even parts are not critical. C1 and L1 can be salvaged from any broadcast-band receiver. Q1: any general purpose unit.

coil over the main coil. But it really isn't a coil; it happens to be a short antenna lead. Simply unwrap the loose winding and cut it off. The metal strip packaged with L1 is the mounting bracket. Drill a hole in the solid end for a #4 or #6 screw, fold it as shown in the photographs about one third up from the bottom (the end with your hole) and mount it to the board with a single screw.

Tuning capacitor C1 is mounted on an L-bracket fashioned from ½-in. wide scrap aluminum or a heavy tin can. Any reasonable size will do as the mounting isn't critical.

Push in three terminals, as shown, to provide transistor Q1's tie points. Don't bunch them up as there's plenty of room on the board. Penlight cell B1 is held in place with a battery holder though you can be real cheap and just tie it to the board, soldering the connecting leads to each end of the battery.

Capacitor C2 controls the overall gain—to a degree. Without it you'll get roaring headphone volume when connected to a long-wire antenna; with the capacitor and a long wire the signal is even louder and might actually overload the headphones. If you want enough gain for a very-short antenna, C2 must be used.

Fahnestock clips are used for the headphone and for L1's antenna and ground connections.

Operation. It should work right off the bat. Simply connect a length of wire to L1's antenna connection, connect the phones and adjust C1 till you hear a station. If you live in God's country—a long, long way from the nearest broadcast station—you might have to connect L1's ground terminal to a ground—like a cold water pipe.

To calibrate the dial supplied with C1, simply adjust L1's slug either in or out.

Have fun building it, but don't expect 5-tube performance. Like all crystal radios the Space-Age model has broad tuning, and a strong station can easily take up half the dial.—*Herb Friedman* ■

Ham Radio Handicaps

by John Demchuck

"He can have all the amateur equipment he built himself."

"Those curlers of yours detuned my final last night!"

"You say your lifetime linear amplifier went dead, eh?"

"Why can't you stop for a drink on the way home like other men?"

David Sarnoff

Photo by Karsh, Ottawa

His rise from immigrant boy to industrial giant is an inspiring record. As head of RCA and pioneer in electronics and communications, he has probably affected our daily lives more than anyone since Edison.

■ In 1901, a tall, lean, long-faced man named Guglielmo Marconi, sent three faint sparks—the letter "S" in Morse Code—across the Atlantic Ocean, from St. Johns Newfoundland, to England, and the new age of wireless was born.

Five years later, in the morning hours of September 30, 1906, a fifteen-year-old young man with intent grey-green eyes, walked up to a busy traffic manager named George DeSousa, at the Marconi Wireless Telegraph Company of America, at 27 William Street, New York City, and asked for a job.

Operator. He could qualify as an operator, he said, for he had been working for the Commercial Cable Company as a messenger. He had saved his pennies, bought a telegraphy set, and taught himself Morse Code.

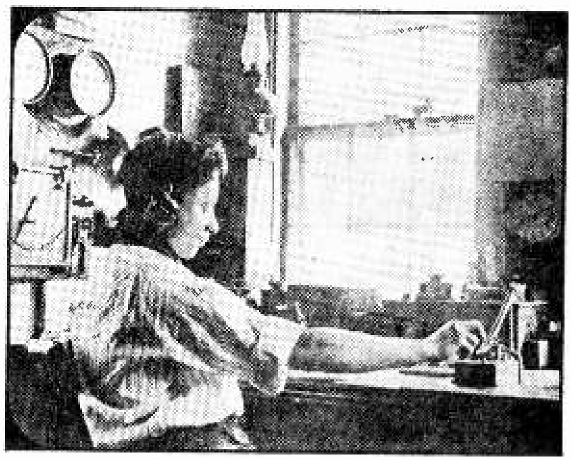
The busy traffic manager might have turned down any other applicant making such a claim, but as George DeSousa told a friend later, he sensed something in the intent look of the young man before him.

No, he said, he had no job openings for operators, but if he wanted to work as an office boy he could start him at $5.50 a week.

The Start. That was the beginning. An office boy beginning that was to lead to expansive offices in one of the world's tallest skyscrapers, leading one of the world's

Becoming head of the family at age 10, young David Sarnoff was delivering papers before daybreak and telegraph messages after school.

As an office boy, in 1907, the $5.50 a week salary was welcomed.



At 17 he earned the munificent salary of $60 a month—working long hours at the Marconi station at Siasconset, Mass.

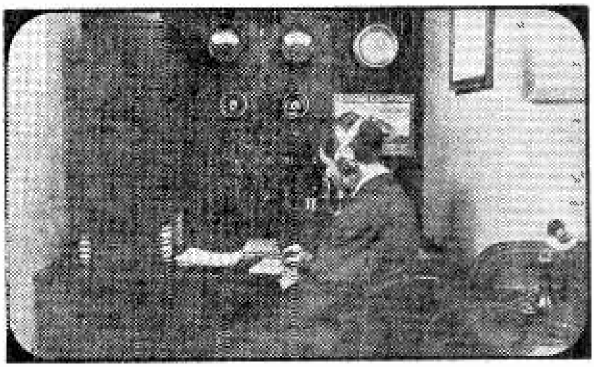
most influential companies, to commendations from United States presidents, and other world leaders. But all David Sarnoff knew at the time was he could not be close to the new "wireless," and that he had some responsibilities.

Six years before, his mother had brought her family from Uzlian, Russia, to join her husband, and a few months later the father died from overwork, the result of his efforts to bring his family to the new country.

Nine Years Old. Not quite ten years old, David Sarnoff became head of his family. Up before daybreak, he ran a newspaper route. After school, he worked as a messenger. But telegraph cables did not quite fire his active imagination. He wanted to know more about the new-fangled business people called "wireless."

It wasn't long before he was to know his first true thrill in his new occupation for one day walking up Broadway he found himself carrying the briefcase of the tall inventor who had first sent the strange sparks across the ocean, a man who was to become his close friend and confidante in later years—Marchese Guglielmo Marconi.

Shipping out while still in his teens, David Sarnoff, found more time to study and more money in his pay envelope for "pounding brass" on S.S. Beothic (above) during Arctic sealing expedition in 1911.

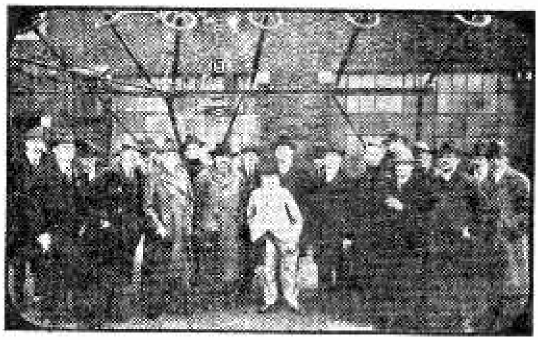


From this "desk" atop the Wanamaker Department Store, in New York City, David Sarnoff worked S.S. Titanic sinking distress messages for 72 hours.

Operator. When he was seventeen he won the chance he sought, as operator at a Marconi station at Siasconset, Mass., at the massive salary of $60 a month. And at this station, he met some of the top wireless operators of the time, the men who worked the transatlantic liners. Within two-three years time, Sarnoff himself was working ships running between New York and Boston, New York and New Orleans, sometimes to the Arctic Icefields.

Learning fast, but not fast enough to suit his eager mind, he applied for a post at Seagate, New York, where he could enroll evenings at Pratt Institute, study electrical engineering, and it was this study that won him his next notch up, as operator at the Marconi station atop Wanamakers Department Store in New York City.

Distress. It was April 14, 1912, and Sarnoff was on duty. The first distress signals sparked over the wireless. The liner S. S. Titanic, moving across the Atlantic, had struck an iceberg, and was sinking. A nearby ship, the Carpathia, was picking up survivors from the icy waters. Its urgent operator tapped out on his ship wireless the names of survivors as they came aboard. *(Continued overleaf)*



1921 demonstration of RCA transoceanic station, at New Brunswick, N.J., brought together David Sarnoff (front row, second from left), Steinmetz, Einstein and Langmuir.

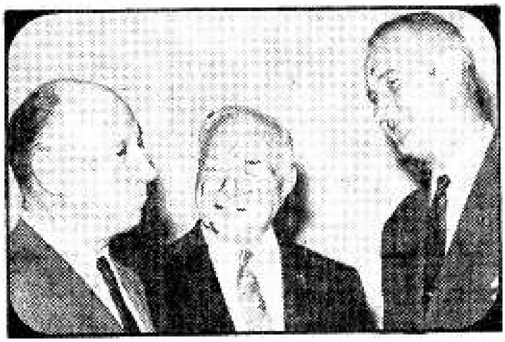
A maestro of the business world, David Sarnoff, and a music Maestro, Arturo Toscanini, get together.

A far cry from the crude spark transmitters of earlier years, the inventor, Gugliemo Marconi, is conducted on 1933 tour of Long Island station by David Sarnoff.

President William Taft, alerted, shut off all stations on the Eastern seaboard to clear the lanes for the young Marconi operator known for his "bull fist." For 72 hours without relief, Sarnoff reported to an anxious world the names of the people boarding the Carpathia, a feat that won acclaim for both Sarnoff and wireless. For people recognized for the first time that this tinker-toy wireless might prove a real value at that.

Moving Up. The Titanic achievement led to fresh promotions. From Chief Inspector to Assistant Chief Engineer, to Assistant Traffic Manager in 1915. To suggest improvements in the new growing business, Sarnoff would write letters to his superiors, spend his off-hours studying the work of the men in the "laboratories" of the time. One day in '16 he sent a note to his superior, General Manager Edward J. Nally, that proved historic:

"I have in mind a plan of development which would make radio a household utility in the same sense as a piano or phonograph. The idea is to bring music into the home by wireless."



Then Vice-President, Lyndon B. Johnson and Senator Jacob Javits with David Sarnoff in Washington—1961.

During active service in World War II, Reserve Colonel David Sarnoff was promoted to rank of Brigadier General.

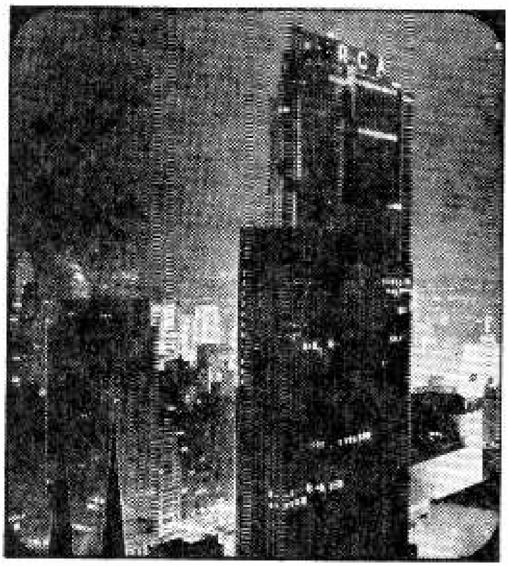
The young traffic manager thought radio could broadcast not only music but lectures, and "events of national importance" as they happened. A year later, he moved up to become Commercial Manager of Marconi.

War. During the last years of the First World War, President Wilson decided to *wireless* his "Fourteen Points" for peace to the German people, appealing for peace and repudiation of their autocratic leaders. Adding the Alexanderson alternator for power, from a wireless station in New Brunswick, New Jersey, the President's points were transmitted overseas and ten months later, by the same means, Wilson sent his terms for armistice.

The powerful impact of these messages in bringing about collapse of the German regime impressed Wilson so much that, on his way to Europe to seek treaty terms, he began to comprehend the influence this new medium might wield in the future. The recent war had proved cables could be cut. Whichever nation led in the new communication could hold decisive advantage in time of crisis in the future.

RCA Now. Formation of the Radio Corporation of America, at the request of the United States Government followed; a new company absorbing American

General David Sarnoff is just another one of the "boys" as he receives honorary diploma from New York's Stuyvesant High School in 1958.



The original RCA Building (above), at Broad and Beaver Streets, New York City, has long been replaced by a skyscraper (left) in famed Radio City. General Sarnoff's desk is now in a grand office on 53rd floor of corporate headquarters of RCA.

Marconi Company patents and personnel. And David Sarnoff, General Manager of Marconi, became the new General Manager of RCA.

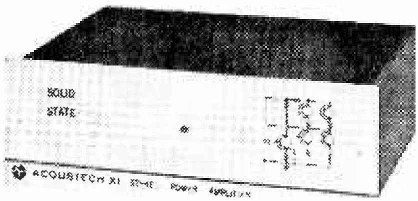
Within three years he was appointed Vice-President, and the same year he foresaw the birth of another new branch of electronics, one that would add "sight to sound." But it wasn't until April 30, 1939 he stood before a World's Fair audience to announce:

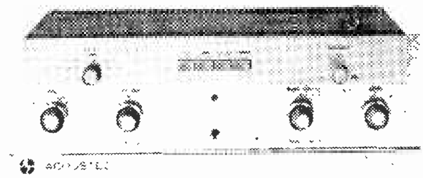
> *"Now we add sight to sound. It is a feeling of humbleness I come to this moment, announcing the birth of a new art so important . . . it is bound to affect all society . . . an art which shines like a torch in the troubled world . . . a creative force which we must learn to utilize for the benefit of all mankind."*

Trees. What he didn't tell his audience that day was that the "new art" might not have been any "torch" at all if it hadn't been for David Sarnoff. For several years before, Dr. Vladimir Zworykin had asked for a brief audience with the man he had heard of and thought would listen. *(Continued on page 87)*

RADIO-TV EXPERIMENTER LAB CHECK

ACOUSTECH ADD-A-KIT
Solid-State Power Amplifier XI
and Preamplifier Module P/M





■ How good is *great*. If we're talking about amplifiers, *good* and *great* often depends on the individual tester's measurements, the interpretation of the measurements, and his evaluation of dcllar value. But if we're talking solely of the reproduction of virtually undistorted and uncolored sound the term *great* fits within narrow limits—the space between the input and output jacks of the Acoustech XI amplifier.

The Acoustech amplifier, available only in kit form, is actually two separate kits on the same chassis. The basic kit is the XI power amplifier—strictly a solid-state stereo power amplifier with no controls, it must be connected to the user's control center (preamp). With the addition of the Acoustech P/M kit, the amplifier is converted to complete integrated amplifier. Whether you start with just the power amplifier or go immediately for both kits for a complete integrated amplifier depends on your own budget.

How the Amp Checked. Fig. 1 shows the performance of the basic amplifier. While it is rated at 35-watts continuous sine-wave power per channel, the protective fusing creates a bit of a problem in testing. The fuses cannot take more than a few minutes of continuous steady tone before they blow. While there's no problem with music as even at a 35-watt peak the music power constantly varies, we could not make continuous measurements at 35 watts. We therefore made the tests at 15 watts per channel with both channels driven and then spot checked

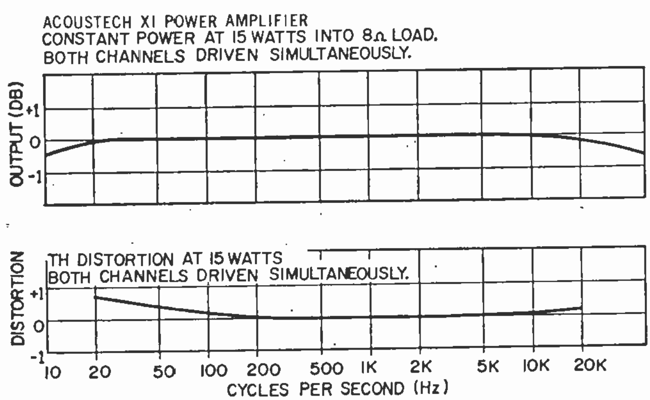


Fig. 1. You will have to squint to see the fraction of a db the constant-power curve drops at 20 Hz and at 20,000 Hz—the drop is less than .2 db. Percent total harmonic distortion never exceeded .7 db (at 20 Hz) and averaged about .25 db throughout the listening range. To make the tests valid, both channels were driven at full 15 watts out.

RADIO-TV EXPERIMENTER LAB CHECK

various frequencies at 35-watts output.

The curves shown in Fig. 1 are the constant power frequency response (top) and the related harmonic distortion (bottom). As you'll note, distortion is virtually nil. Spot checked at 30 watts, the frequency response fell off a little faster above 20,000 Hz (cps) while the distortion increased but 0.2%.

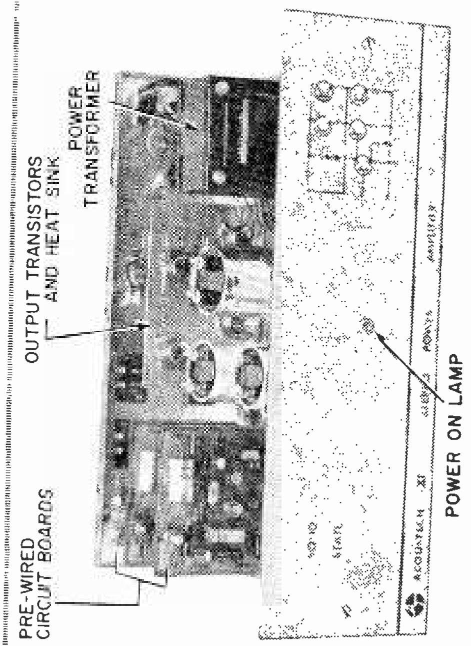
The amplifier is built like military equipment; components appear to be at least two grades higher than comparable consumer equipment. All components fit into a U-shaped frame with the sides of the U forming the front and rear panel. Though it is basically a power amplifier, the front and rear panels are pre-punched for the preamplifier/control center. The power amplifier's input stages are supplied pre-wired on a printed circuit board; after you've wired the power supply, output amplifiers and associated wiring, the input stages are simply plugged in.

Adding the Preamp. The preamp/control center is added to the basic power amplifier. Actually, you remove the amplifier's "solid" panel and substitute a panel drilled for the controls. Then you mount two printed circuit board sockets and complete the power and signal wiring. The preamp stages are supplied pre-wired on printed circuit boards and as with the amplifier you simply plug them into a jack.

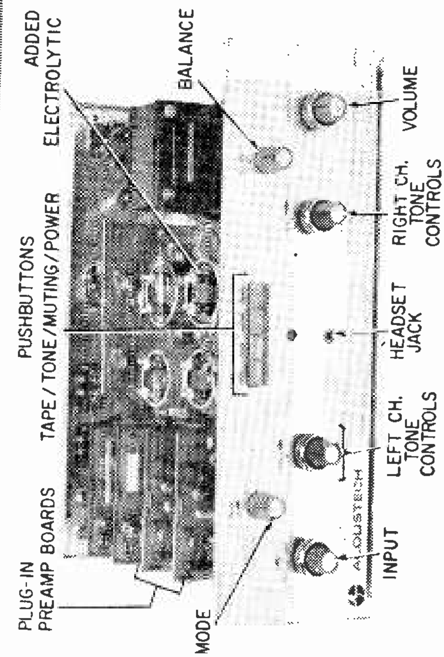
What you get. The completed unit, that is, the amplifier plus control center features two magnetic phono inputs, one low and one high level (switch selected), a tuner and an auxiliary input, a line level tape input and a line level tape output. There is no tape head input. A front panel jack is provided for headphones.

The amplifier is push-button controlled. One button turns the power *on* and *off* while a second *mutes* the speakers for headphone listening. A third push-button completely bypasses the tone controls so the amplifier works perfectly flat—no tone compensation. The fourth button connects the tape input.

A mode switch offers almost unlimited switched arrangements with the options of mono, stereo, stereo reverse, right channel only, or left channel only. A switched AC



The Acoustech X1 power amplifier (left) is as simple to wire as most beginner kits. Completed unit has open areas for preamp module.



Just replace the faceplate, add controls plus new circuit parts supplied with the preamp module kit and the power amp becomes integrated amplifier.

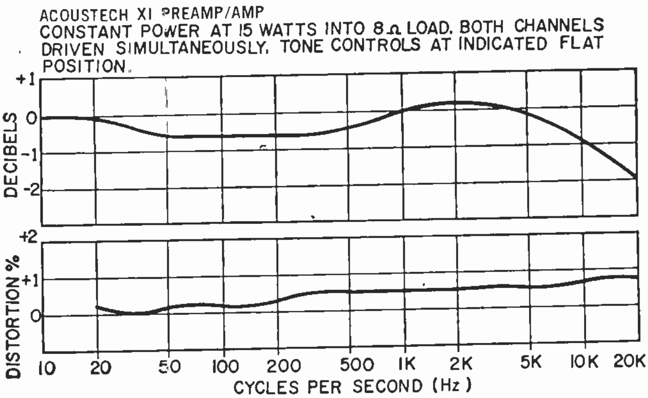
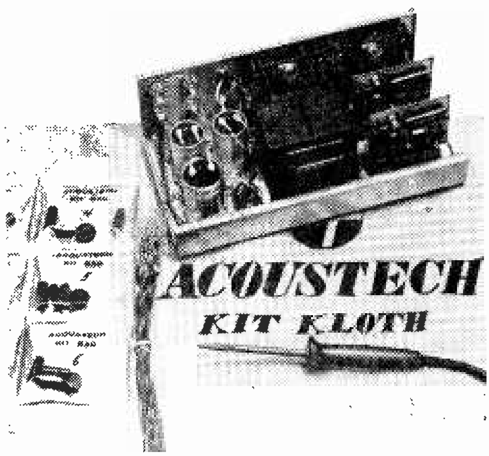


Fig. 2. With the preamp module added, the Acoustech XI becomes a first rate integrated amplifier. Curves prove that the unit can stand up against any other product on the market today. Bottom curve is for total harmonic distortion—IM distortion was buried in test-instrument noise level and cannot be measured because it is low.



receptacle is provided on the rear apron.

The volume control has a slip clutch; once each channel's gain is individually adjusted they track together. The tone controls are not "clutched' primarily because they are arranged somewhat unusual. Instead of the high and low tone controls being grouped together, the high and low tone controls for each channel are together, the right channel controls on the right side of the amplifier and the left channel controls on the left side.

The balance control is the "full gain control" type. At the center position both channels are at full gain. Rotating the control to either side reduces *only* the gain of the amplifier associated with that side. The balance control does not increase the gain of one amplifier while decreasing the other. This arrangement allows the balance control to completely mute one amplifier while leaving the other unaffected.

Typical of transistor amplifiers the total available output power per channel depends on the speaker load. Maximum power is delivered into an 8-ohm load with slight reduction when using 4 and 16-ohm loads. A switch cuts in a current limiting resistor which protects the output transistors against overload currents when the speaker load is less than 4 ohms (such as when using a multiple speaker system).

Preamp Specs. Fig. 2 shows the response (top) and distortion (bottom) at 15 watts for the completed preamp/amp. As with the amplifier test, the frequency response curve represents the input sensitivity for sustained 15 watts at all frequencies. Note that the distortion curve is at rated (15 watts) output—not *normal listening level.* As with the basic amplifier, spot checks at 35 watts output disclosed no appreciable change in performance.

Specifications for input sensitivity and tone control are shown in the table. Note that the tone control equalization is not "heavy" in the sense of fantastic high and low frequency boost. This amplifier will not compensate for serious frequency response difficiencies in inexpensive phono pickups and cheap speakers. However, the tone controls provide a *sensitive shading* to the overall tone.

Measurements for the Acoustech XI, unfortunately—no matter how good they appear to be—really fail to describe how an amplifier sounds to the ear. The Acoustech XI offers truly *magnificent* sound; the bass comes out with a bone rattling *thud* with the mid-range and highs crystal clear.

We should also point out that the Acoustech XI has lots of "reserve" power. We pushed 50-watts sine-waveform per channel with no evidence of saturation before the protective fuses blew out. The instantaneous or transient power would therefore exceed 50 watts.

Prices for the Acoustech XI, complete

(Continued on page 114)

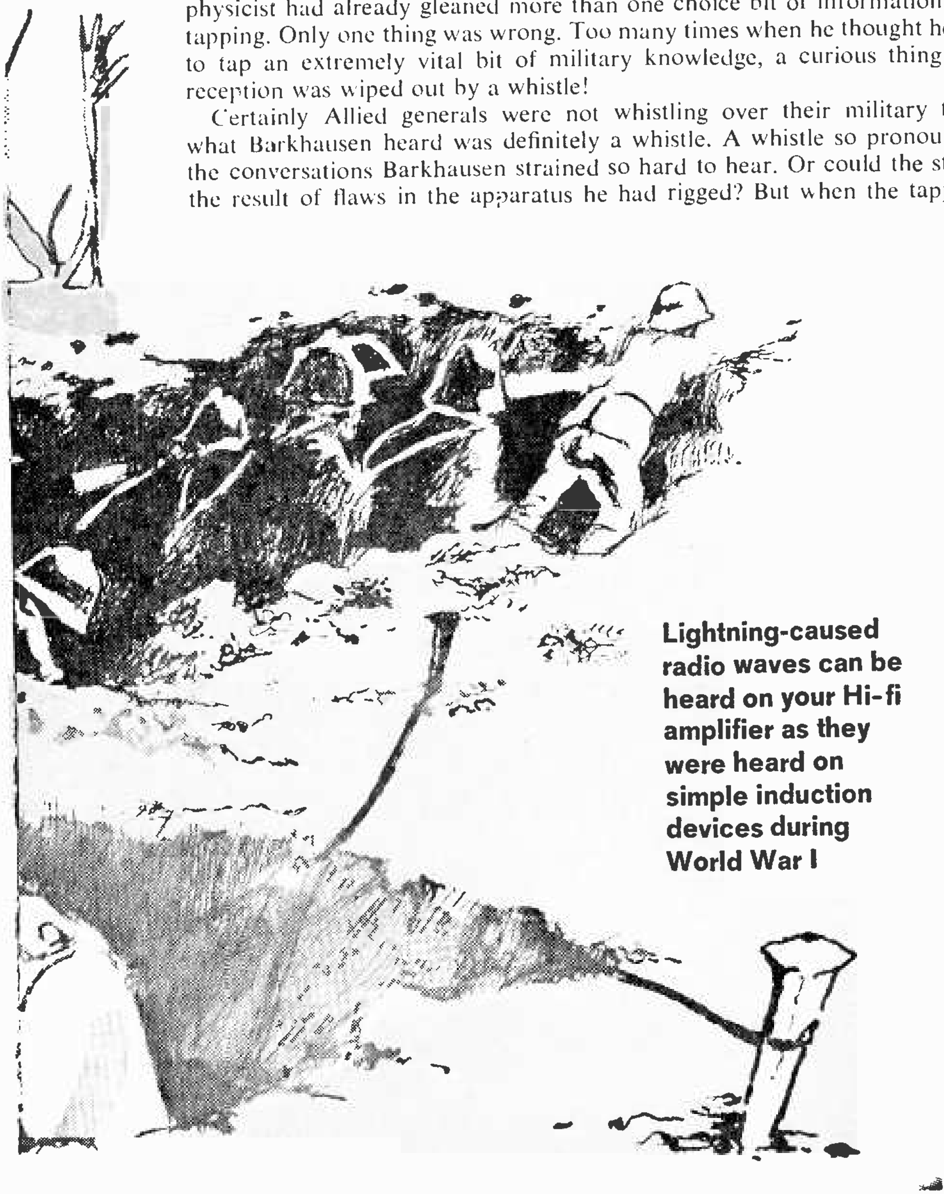
All About Whistlers!

It was close to the front, and World War I was in its climactic stages. What happened now could change the history of the world. Behind the German lines, a world famed physicist, Henrich Barkhausen, bent over to place a test prod in the ground.

A few hundred yards away he placed another. These prods he knew would pick up minute electrical currents leaking from allied telephone wires. The signals would then travel by cable to an amplifier in safer territory where Barkhausen could put on his headphones and listen to telephone conversations going on behind Allied lines.

Foiled By A Whistle. It was a crude arrangement, even for the times, but the famed physicist had already gleaned more than one choice bit of information from his crude tapping. Only one thing was wrong. Too many times when he thought he was just about to tap an extremely vital bit of military knowledge, a curious thing happened. His reception was wiped out by a whistle!

Certainly Allied generals were not whistling over their military telephones! Yet what Barkhausen heard was definitely a whistle. A whistle so pronounced it jammed the conversations Barkhausen strained so hard to hear. Or could the strange sound be the result of flaws in the apparatus he had rigged? But when the tapping device had



Lightning-caused radio waves can be heard on your Hi-fi amplifier as they were heard on simple induction devices during World War I

All About Whistlers!

been checked, and he could find no cause for interference, he could only conclude the whistle he heard must have come from nature.

As he later summed up in a scientific paper: "During the war amplifiers were used on both sides of the front in order to listen in on enemy communications. At times a very remarkable whistling note is heard in the telephone. So far as it can be expressed in letters, the tone sounded like "peou." From the physical viewpoint, it was an oscillation of approximately constant amplitude, but of very rapidly changing frequency . . . beginning with the highest audible tones, passing through the entire scale and becoming inaudible with the lowest tones . . . The entire process lasted almost a full second."

Weird Whistles 'Round the World. Soon these weird whistling sounds were heard around the world, for as radio programming amplified after the war, radio listeners heard the whistle Barkhausen had heard more and more often. And when they complained that this *woosh* of a sound interfered with pet radio programs, radio engineers set out to track down the elusive villain.

It was a long wave they found—a wave below the lowest broadcasting frequencies; in fact, so low, it fell within sound range of the human ear. To hear it all you needed was an antenna to pick up atmospheric electric oscillation, and an audio amplifier like the one in a phonograph to convert this oscillation directly to sound.

And what did they hear then? At first only clicks, the same as in broadcast bands; but after the clicks, a musical sound, sometimes a twittering, almost like music. There was one set of sounds that seemed to follow storms. Engineers labelled these the "dawn chorus."

Where from the Whistler? These early engineers theorized the effect was caused by waves bouncing back and forth between the ionosphere and the earth, or bouncing back from various layers of the ionosphere, with frequencies spread out, the highest traveling fastest, the lower ones strung out behind so that the drawn-out signal caused a whistling tone of steadily falling pitch.

But while radio listeners were perturbed a bit about a wave that seemed to freeload its way into their radio programs, Bell Laboratories had a real complaint. For in the 1920's, they found their submarine cables and long telephone lines were whistling. To further search out the mischievous wave, Bell Labs put two of their top engineers, E. T. Burton and E. M. Boardman, on the job, set up large loop antennas at Trinity, Newfoundland; Hearts Content, Newfoundland; Key West, Florida; Havana, Cuba, and at Frenchport, near Erris Head in the Irish Free States.

The Bell engineers soon found a curious clue. There was more than one whistle. And they named the new "whistlers" for the sounds they made: *the whistler, the tweek, the swish* and *the rumbler.*

The whistler they said was a whistling sound that starts at a higher frequency, speeds downward in a frequency at more or less constant rate, and then tends to rise again. A wave "known to hesitate and warble slightly before disappearing." The whistler, the Bell men said, did not seem to be affected by time of day or local weather conditions or the time of year. During some periods it could be heard frequently day and night for as long as 48 hours, and sometimes longer.

Swishes. On the other hand swishes were "hissing sounds with a broad tone quality, but no distinct pitch." The Bell men called them "musical sounds, such as sounds made by thin whips when lashed through the air." These sounds, they said, follow the same downward frequency sweep as the whistler and could be related to the whistler or could be a whistler that has been subjected to strong reverberation. For a number of swishes have been known to follow in a series, with almost perfect spacing, a train lasting as long as a few seconds.

Tweeks. Tweeks, though, according to oscillograph recordings made at the Irish outpost, start above 2000 cps, reduce rapidly toward lower frequency and have never been heard during the day, only around sunrise and sunset. The Bell Labs men thought they cited a wave they called the "rumbler" too, but found little to report on this tone.

Bell Rings Out. In 1933, improved systems ruled out whistlers in any form in cables and Bell Labs ended its research, leaving the whims of the whistler to its original discoverer Barkhausen, and to T. L. Eckersley of the Marconi Wireless Telegraph Company in England.

Barkhausen thought there could be two possible explanations. One, an electromagnetic impulse originating at the earth's surface could reach a distant receiver first over the direct path and then from various reflections. Such a series of reflections, he said, would result in a wave train of rapidly diminishing frequency, depending upon the height of the reflector.

Or, Barkhausen said, ionic refraction in the ionosphere could result in breaking up an impulse into component frequencies and a delay in transmission of lower frequencies with respect to the higher. "It gives a rate of frequency progression which varies with distance."

The Click Caper. T. L. Eckersley of Marconi Wireless thought, "these tones have a very peculiar character. The pitch of the note invariably starts above audibility, often with a click, and then rapidly decreases finally ending up with a low note of more or less constant frequency which may be of order of 300 to 1000 cycles a second. Duration varies, he says: at times lasting a very small fraction of a second; at others, 1/5 of a second.

He thought the sounds appeared seldom in the morning, increased during the day, and reached a maximum during the night. Ionic refraction could account for the phenomenon, he said, as whistlers often followed by a second or two a loud click. Or he thought the whistler could be an echo of a click returning from the ionosphere, but then he wondered, how could a click be converted into a whistler, and at the time, no one really understood what caused a click.

Lightning Watch. In the early 1950's the British Air Ministry Meteoreological offices set up four stations spaced through the United Kingdom to study thunderstorms, and inadvertently, clicks.

They soon decided that clicks were radiations from lightning strokes. From lightning within 600 miles of the stations they could hear the loud whistlers, but from points beyond 1200 miles they could not hear them at all. They could detect no echo at all from a click that originated more than 1200 miles away. The key to the problem seemed to be in determining the path of the clicks.

L. R. O. Storey, then researching at the Cavendish Laboratory at the University of Cambridge, next tried to track the whistler's path. He said when lightning strikes, it sends out radio waves in all directions, some going upward to the ionosphere. When radio waves cross the boundary between ordinary air and the ionized regions they are bent, just as a ray of light is refracted when it passes from air to some other medium. Whatever the angle at which these radio waves strike the ionosphere, all must be bent toward the vertical. And the refractive or slowing effect of the ionosphere on the waves must be very pronounced, concentrating the rays coming in from all angles into a narrow vertical beam.

But as the ray rises into the ionosphere, it tends to follow the earth's magnetic field, as this way it travels fastest, and as it travels, the pulse of the click is drawn out into a whistle.

Globe Jumper. Storey felt it was this action that caused the whistler to follow a line of magnetic force, leaping sometimes from the earth's surface in England southward crossing the magnetic equator at a height of about 7,000 miles, and coming down to earth in the Southern Hemisphere. A whistler traveling this path could be reflected from the ground and return along the same line of force to the area in England from which it came.

When a whistler is heard without a click, he thought, the wave had come from the Southern Hemisphere, was not an echo but a single trip message from a southern lightning flash. And the sound of the click had been lost traveling through lower atmosphere.

Sometimes, he said, a single click could father a whole train of whistlers, each one weaker and longer drawn out than the one before. Storey thought these could be reverberations from a single echo, bouncing back and forth like tennis balls between the two hemispheres.

For the length of the whistler seemed to be proportioned to the number of trips it had taken. In one test, whistlers were recorded bouncing back and forth, at two ends of a line of magnetic force, one in the Aleutians, the other in New Zealand, and on each trip the whistler was drawn out further.

Harnessing the Whistle. While engineers found clues to the whistler's behavior, they could not find a use for the mischievous fellow until the space age suddenly turned him into a hero. For the whistler's long trips deep into the reaches of the ionosphere are now man's first natural space probe.

Dartmouth College engineers study him from stations on earth and in space. The

(Continued on page 108)

Propagation Forecast

By C. M. Stanbury II

August/September 1966

■ This issue we have departed slightly from our previous approach. The predictions are still based on the best SWBC DX available with reasonable effort. However, because we have entered a new era in the sunspot cycle plus seasonal considerations (specifically the high noise level), we have excluded 60 and 90 meters.

On the other hand, many of the rarest catches can be found only on these static ridden lower frequencies. Thus for fanatic DX'ers (like your scribe) we have set up a second chart for 60 and 90 meters. Note that times on the main chart are for your location wherever it may be in North America (but *Standard* rather than the *Daylight* time variety). For example, if you listen from Denver, Colorado then you use MST. However, except where indicated otherwise, *all* times on that second chart are EST. ■

60 and 90 Meters
For the Fanatic DX'er

Station Area	EST
Latin America	1800-0600
Africa	2100-0300 *1600-1800
Pacific	0000-0600
Asia	0600-0900 **0700-1000

*North America East Coast only
**North America West Coast only

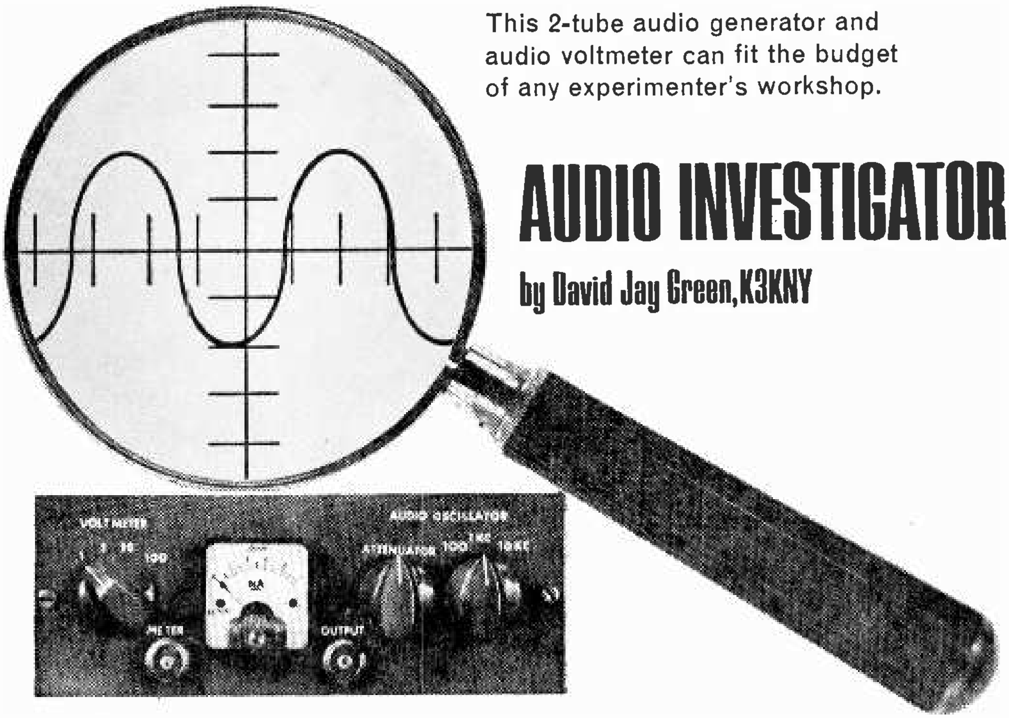
LISTENER'S TIME / STATION AREA	0000–0300	0300–0600	0600–0900	0900–1200	1200–1500	1500–1800	1800–2100	2100–2400
ASIA (except Near East)	31 & 25	31 & 25	25 & 19	25 & 19	19 (poor)	19 & 16	19 & 16	25
EUROPE, NEAR EAST & AFRICA (N. of the Sahara)	41	31 (poor)	19	19 & 16	19 & 16	25 & 19	31 & 25	41 (31)
AFRICA (South of the Sahara)	49	nil	nil	19 & 16	25 & 16	31	31	41
SOUTH PACIFIC	31	49	31 (25)	25	25	19 (16)	19 (16)	25
LATIN AMERICA	49	49	31	25 (19)	25 (19)	31	49	49

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.

This 2-tube audio generator and audio voltmeter can fit the budget of any experimenter's workshop.

AUDIO INVESTIGATOR

by David Jay Green, K3KNY



■ Ever wonder which stage in your multi-stage hi-fi amplifier isn't working, or how much gain it has? Well, with this one unit troubleshooter you can solve these problems. Using the oscillator and voltmeter sections, the gain of amplifiers can be measured. Frequency response can be spot checked—the oscillator section has output at three frequencies; low (100 cps), medium (1 kc), and high (10 kc).

Voltmeter Operation. The signal from the input jack J1 is fed through C1 to the voltage attenuator S1, and is divided down by the resistors R1 through R8 to a value less than .1 volts. The .1-volt grid signal is then amplified by the pentode section (V1A) of the 6U8. R5/C2 provides the proper DC bias for the pentode section. Amplified, the signal is then fed through C4 to the triode grid of V1B. The low-impedance cathode-follower output then feeds the signal, through C5, to the bridge rectifier circuit of milliammeter M1. R10 is adjusted for meter-scale calibration.

The Oscillator. The 6BH6 (V2) is switched, by S2, to either a Colpitts or phase-shift oscillator circuit. The 100-cycle and the 1-kc frequencies are provided by RC phase-shift oscillator circuits. The 100 cycle phase-shift network consists of R16, R17, R18, C9, C10, and C11. The 1-kc network consists of R19, R20, R21, C12, C13 and C14. The 10-kc frequency is generated by a Colpitts circuit (L1, C16, C17—coupled through R22, R23 and C15). The generator signal is fed through C6 and *Attenuator* R11 to the output jack (J2).

The Power Supply. Filament voltages and B-plus power are supplied by T1 and D5. The B-plus is filtered by R24, R25, and C18A-B-C.

Calibration. Plug the unit in, keeping the *Attenuator* (R11) at minimum, and allow the set to warm up for 5 to 10 minutes. Turn the voltmeter range switch (S1) to the 1-volt position and set the oscillator frequency (with S2) at 1 kc. Feed the output of the oscillator section (J2) to the voltmeter section input (J1) and connect a standard voltmeter of known accuracy in parallel. Adjust the oscillator output *Attenuator* (R11) so the standard voltmeter reads exactly 1 volt. Then adjust R10 (without changing the setting of *Attenuator* R11) so the voltmeter and

AUDIO INVESTIGATOR

the standard voltmeter both read 1 volt.

For rough calibration, or a quick calibration check, you can connect the center contact of J1 to pin 5 of the 6U8A or pin 3 of the 6BH6—the voltmeter should indicate about 6 volts (with the range switch set to the 10-volt position).

How To Use It. The oscillator section will supply test signals of three frequencies—100 cps, 1 kc and 10 kc. *It must be kept in mind that the voltage output varies with the frequency selected.* But the output level can be adjusted by using the voltmeter section as an indicator and adjusting the *Attenuator* for an identical reading on the voltmeter scale.

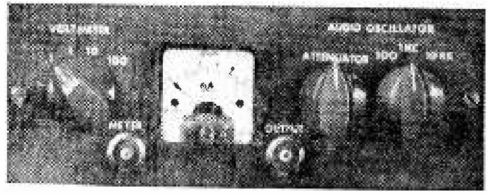
Shielded cables must be used for all connections to the voltmeter and audio oscillator jacks to prevent AC power-line pickup (hum) from influencing the test results.

Gain Measurements. The voltmeter can be used to measure the gain of a stage or as a general purpose instrument for audio troubleshooting. An audio signal from the oscillator section is fed to the input of an amplifier and the voltmeter is used to measure the signal at the input and output of each stage of the amplifier. For rough checks and troubleshooting it is best to use the 1 kc signal from the oscillator. This frequency is high enough so that it won't be confused with any AC hum that may be in the circuit and not too high that it might not be reproduced properly in inexpensive amplifiers.

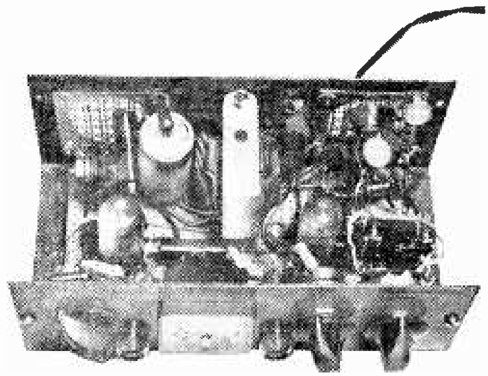
Signal Tracing. Headphones or a speaker can be connected to the meter circuit as shown in the diagram. High-impedance phones connected through a small (about .002 mf.) capacitor will not upset the meter readings while giving high level at or near full-scale readings. Higher-value capacitors will affect meter readings but give increased volume.

Connecting a speaker or low-impedance phones to the output will reduce the readings some 20% (that is a full-scale reading—.1, 1, 10 or 100—will be reduced to .08, .8, 8 or 80). Using a capacitor in series with the transformer primary will reduce the amount of change in the meter reading but the volume will be reduced considerably. The transformer can be hooked into the circuit through a jack mounted on the front panel.

Construction. Cut a 1-1/2-inch ventilation



Front panel can be less-crowded looking if you use the miniature jacks and knobs.



For all-day operation better drill more vent holes in the cover directly over V1 and V2.

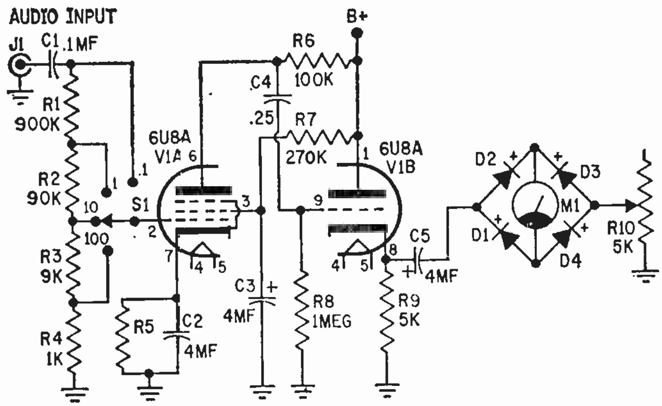
TUBE-SOCKET VOLTAGES (all readings made with VTVM)

PIN	6BH6 100 cps	6BH6 1 kc	6BH6 10 kc	6U8
1	0	0	—1.5	+150
2	+1	+1	+1.5	0
3	0	0	0	+80
4	6.3 AC	6.3 AC	6.3 AC	6.3 AC
5	+80	+80	+45	0
6	+55	+50	+45	+75
7	+3	+3	+4	+3.4
8	—	—	—	+5
9	—	—	—	+.05

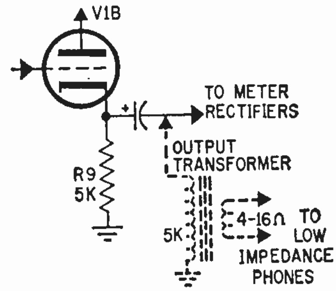
PARTS LIST FOR AUDIO "INVESTIGATOR"

C1, C7, C8—.1-mf., paper capacitor
C2—4-mf., 6-volt, electrolytic capacitor
C3, C5—4-mf., 150-volt electrolytic capacitor
C4—.25-mf., 200-volt paper disc capacitor
C6, C16, C17—.005-mf., ceramic disc capacitor
C9-C14—500-mmf, ceramic disc capacitor
C15—.001-mf., ceramic disc capacitor
C18A, B, C—20-20-20-mf., 150-volt electrolytic capacitor
D1-D4—General purpose diodes (Lafayette 19R4901 or equiv.)
D5—750-ma., 400-prv (piv) silicon diode
F1—1 ½-A, 250-volt fuse
J1, J2—Single-button microphone connector (Amphenol 75-PCIM—Lafayette 32R1908 or equiv.)
L1—100-millihenry, 100-ma RF choke (J. W. Miller 960 or equiv.)
M1—0-1-ma panel meter (Lafayette 99R5052 or equiv.)

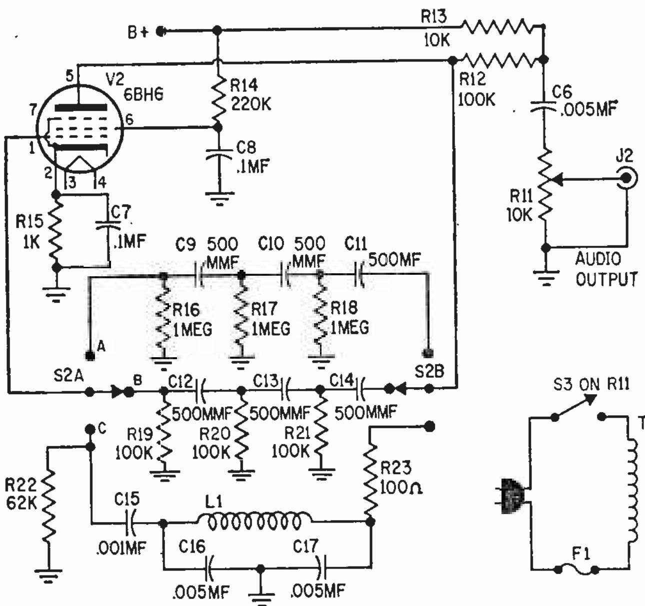
Voltmeter-section circuit (right) is a 2-stage amplifier with bridge-type meter rectifier across output. Watch polarity of C5, diodes and meter.



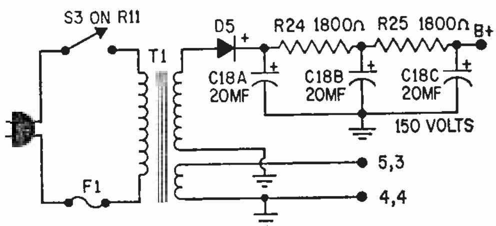
Output transformer (below) from a tube-type radio will drive a FM speaker but will upset calibration of meter.



Oscillator (left) uses but one tube. Using 3- or 4-section switch for S2 the output for each frequency can be preset for equal output. Calibration controls go in series with R11.



The power supply (below) furnishes B-plus for voltmeter and oscillator sections.

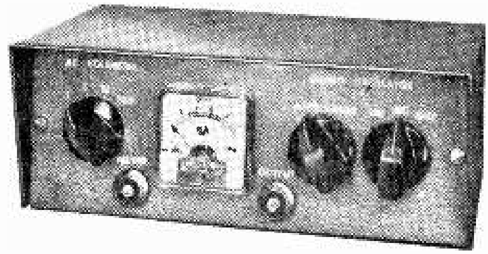


R1—900,000-ohm, 1 %, ½-watt precision resistor (Newark 13F120 or equiv.)
R2—90,000-ohm, 1 %, ½-watt precision resistor (Newark 13F120 or equiv.)
R3—9,000-ohm, 1 %, ½-watt precision resistor (Newark 13F120 or equiv.)
R4—1,000-ohm, 1 %, ½-watt precision resistor (Newark 13F120 or equiv.)
R5—3,300-ohm, resistor
R6, R12, R19, R20, R21, R23—100,000-ohm resistor
R7—270,000-ohm resistor
R8, R16, R17, R18—1,000,000-ohm resistor
R9—5,000-ohm resistor
R10—5,000-ohm potentiometer (screwdriver adjust)
R11—10,000-ohm potentiometer (screwdriver adjust)
R13—10,000-ohm resistor
R14—220,000-ohm resistor
R15—1,000-ohm resistor
R22—62,000-ohm resistor
R24, R25—1,800-ohm resistor
(all resistors ½-watt, 10 % unless otherwise specified)
S1—S.p.4-t. rotary switch.
S2—D.p.3-t. rotary switch.
S3—S.p.s.t. (part of R11)
T1—Power transformer, 125-volt, 15-ma; 6.3-volt, 6-amps.
VI—6U8A
V2—6BH6
1—Cowl-type Minibox, gray hammertone aluminum (Bud SC-2132 or equiv.)
1—Perforated-phenolic board (unclad) 3-21/32 x 6¾-inches (Lafayette 19R3606)
1—Perforated-phenolic board (unclad) 2-7/16 x 3⅜-inches
1—7-pin, top-mount printed-circuit tube socket (Lafayette 33R8712 or equiv.)
1—9-pin, top-mount printed-circuit tube socket (Lafayette 33R8713 or equiv.)
Misc.—Perforated aluminum grill; flea clips; grommets; tie strip; machine screws and nuts; brackets; AC linecord and plug; Fuse holder, etc.

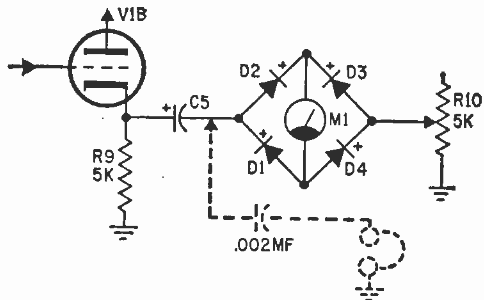
AUDIO INVESTIGATOR

hole at both ends of the back panel, centered, in 1½" from each end. On the inside of these, install a 2-inch square piece of perforated aluminum, allowing clearance for the cover. Mount the perforated-phenolic board on the bottom of the box, using spacers or extra nuts to prevent the flea clips from shorting to the case. Mount R10 in line with a hole towards the back left side of the case. Make sure, when mounting the power supply's filter capacitor and the fuse holder, that the top of the box does not short them out. Plastic electrical tape can be used to insulate the exposed terminals of the fuse holder. Coil L1 should be mounted with a nonferrous screw (brass or aluminum) on the aluminum ventilating squares. Components for the 100-cycle and 1-kc oscillators can be mounted on a small perforated board (approx. 1¼ x 2¼ inches). Place the parts for the 100 cycles on one side and those for the 1 kc on the other side. Take care in constructing this module so that shorts do not develop. The competed module is mounted on a small bracket behind S2—leave about ¼ inch between the terminals. Excess lead

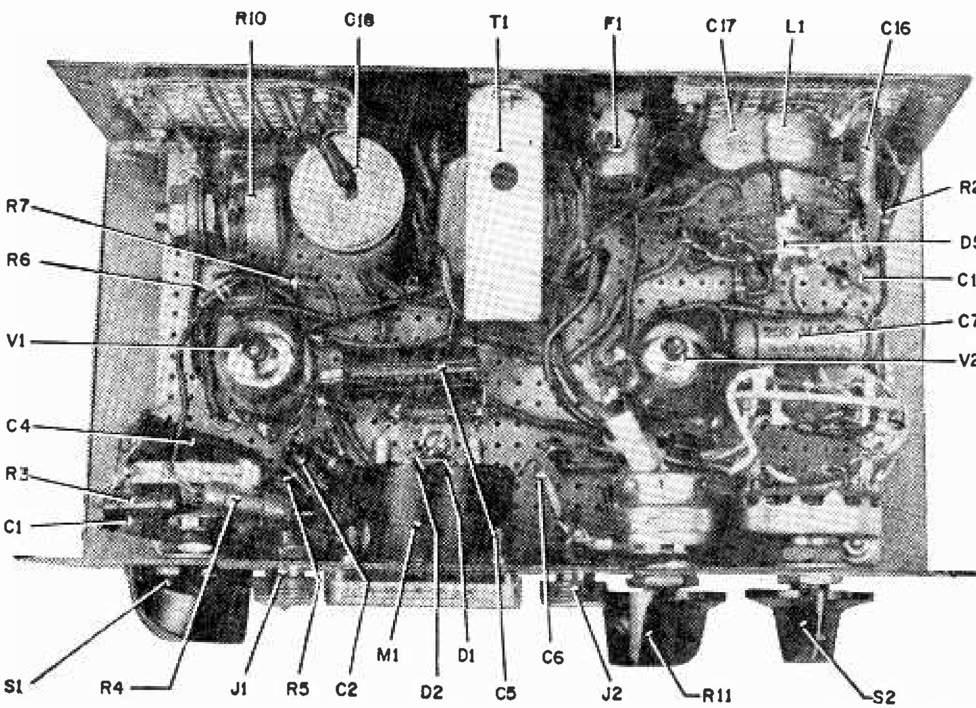
(*Continued on page 114*)



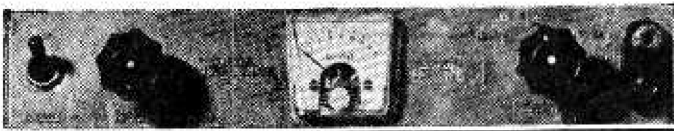
Cowl-type cabinet is a very neat-looking enclosure for most bench-top instruments.



A single earphone, or a set of high-impedance headphones, can be permanently connected to C5 through a small capacitance without upsetting the calibration of the meter.



With the cover off, most of the major components are easily located inside unit.



Test Bench Power Supply

by Donald E. Bowen

Batteries aren't everything! A good variable-DC supply can handle many shop problems for experimenter and technician.

■ One of the handiest gadgets around any electronics workbench is a variable-voltage power supply. You can test transistor radios, amplifiers, ham gear, experimental circuits and anything that needs up to 1 amp at 0-15 volts. Even if the unit you are building will be operated from batteries, it will be easier to test it using a power supply. Besides, there is no need to keep a variety of batteries around the workshop. With a test power supply, you can forget about batteries until the project is finished. It's not difficult to build this Test Bench Power Supply for your workshop.

The power supply has an output variable from 0 to 15 volts at 1 ampere with less than 2% ripple at full load, and better than 3% regulation from no load to full load. An output meter and a range selector switch permit continuous monitoring of output voltage or current. The power supply requires about 35 watts at 115 volts AC.

Circuit Description. The circuit (Fig. 1) comprises a 24-volt, unregulated DC source, a voltage-reference circuit, a two-stage current amplifier, and a output metering circuit. Transformer T1 (115 to 24 volts), bridge rectifier D1, D2, D3 and D4, and filter capacitor C1 form the DC source.

The voltage-reference circuit contains Zener diode D5, current-limiting resistor R1, and voltage-adjust potentiometer R2. Transistors Q1 and Q2, and their associated circuit components, compose the current amplifier. Both Q1 and Q2 are connected as emitter followers.

The meter circuit is conventional—a 1-milliampere meter and a switch for selecting the correct shunt or series resistor to measure output current or voltage. Switching is arranged so that the first position (fully counter-clockwise) measures output voltage (0 to 16), the second position measures current in amperes (O-1.6 A), and the remaining positions measure 160 and 16 milliamperes, respectively. These particular full-scale readings were used because the meter happened to be marked O-16.

How It Works. With switch S1 closed (Fig. 1), current flows in the primary of

Test Bench Power Supply

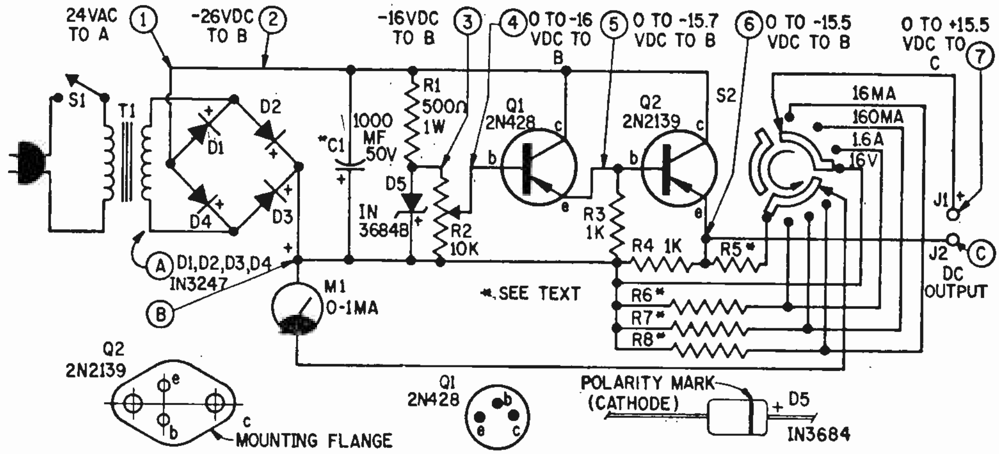


Fig. 1. It's the metering circuitry that makes the schematic diagram look so complicated.

T1, inducing 24 volts into the secondary winding. Bridge rectifier D1, D2, D3, and D4 changes the AC secondary voltage to pulsating DC. Capacitor C1 filters the DC output of the bridge rectifier. This DC voltage is the collector supply for Q1 and Q2. And for the voltage-reference circuit, Zener diode D5 is the reference diode. It maintains a constant 16 volts across potentiometer R2. Resistor R1 limits current through D5.

Voltage at the wiper of R2 can be varied from 0 to 16 volts. This is the input signal for Q1, an emitter follower. Since emitter follower Q1 has a voltage gain of approximately unity, the voltage across R3 (and, hence, at the base of Q2) is about the same as the base voltage. However, because Q1 provides power gain, Q2 base current is greater than Q1 base current. Transistor Q2 is also an emitter follower; therefore, the voltage across R4 is approximately the same as the output of Q1. But Q2 is a power transistor which will supply considerable current to an external load connected across R4. The voltage across R4, which is essentially the same value as that applied to the base of Q1, is the power supply output.

The metering circuit, connected between the base of Q2 and the output terminals, monitors output voltage or current, depending on the setting of S2. When S2 is in position 1 (fully counterclockwise), meter M1 is in series with R5 to measure the voltage between the output terminals. When S2 is in position 2, the parallel combination of R6 and the meter is in series with the output to monitor current up to 1 ampere. Positions 3 and 4 of S2 connect R7 and R8, respectively, across the meter, to monitor currents of 160 milliamperes and 16 milliamperes.

Construction. The power supply fits inside a standard 11 x 7 x 2-inch aluminum chassis. Instead of a single 1000-mf capacitor, as shown in the schematic, a bank of five 150-mf units, mounted on a phenolic board, provides 750 mf. This was merely a matter of using what was available in the parts bin. Using a single capacitor as indicated in Fig. 1 is certainly recommended. D1, D2, D3, D4 as well as R3 and R4 are also mounted on this board, as shown in the photograph. One other difference between the unit built by the author and the layout in Fig. 2 involves that part of the circuit comprising the Zener regulator and Q1. Using modular construction, these components were wired on a separate circuit board and encapsulated. However, such construction techniques are not necessary. Conventional layout and wiring can be followed in building the power supply. The pictorial diagram in Fig. 2 shows the wiring—C1 is shown as a single capacitor rather than a bank of 150 mf units.

Remember that power transistors, such as Q2, require an adequate heat sink. Use the heat sink specified in the parts list, or its equivalent. Insulate the transistor from the heat sink, as shown in Fig. 3, with a mica

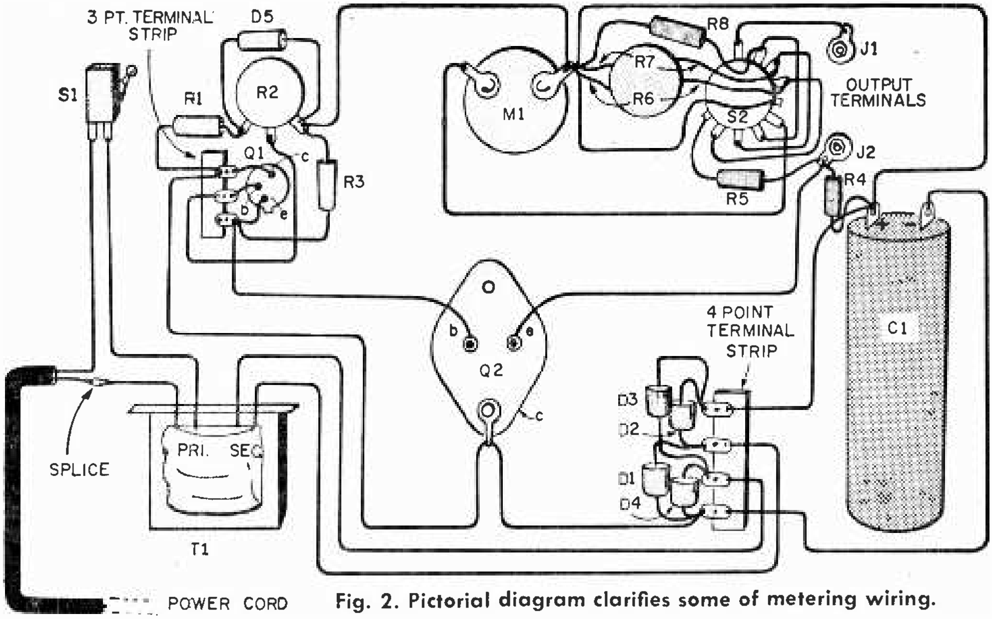


Fig. 2. Pictorial diagram clarifies some of metering wiring.

PARTS LIST

C1 -1000-mf., 50-volt electrolytic capacitor
D1, D2, D3, D4—1-amp, 100-prv (piv) silicon diode 1N3247, 1N4002, A10A, A13A2 or equiv.
D5—16-volt, ±5%, 750-milliwatt, Zener reference diode 1N3684B, 1N4745A or equiv.
M1—0-1 ma panel meter (100-ohm—see text)
Q1—Transistor, *pnp*, 2N428, SK3005, 2N599, 2N1354 or equiv.
Q2—Power transistor, *pnp*, 2N2137, 2N2138, 2N2139, SK3009 or equiv.
R1—500-ohm, 1-watt resistor
R2—10,000-ohm, potentiometer (linear taper)
R3, R4—1,000-ohm, ½-watt resistor
R5, R6, R7, R8—Meter multiplier and shunts (see text)
S1—S.p.s.t. toggle switch (contact rating 1-amp or higher)
S2—D.p. 4-t. rotary switch (contact rating 1-amp or higher)
T1—Transformer, 25.2-volt, 1-amp secondary; 115-volt primary
Heat sink (for Q2) predrilled for TO-3 (Q2) transistor, Delta NC401A or equiv. (Allied Radio 6Z501)
Misc.—Binding posts, metal chassis, linecord, phenolic board, knobs, solder terminals or barrier strip, rubber feet, etc.

Estimated construction cost: $20.00
Estimated construction time: 6 hours

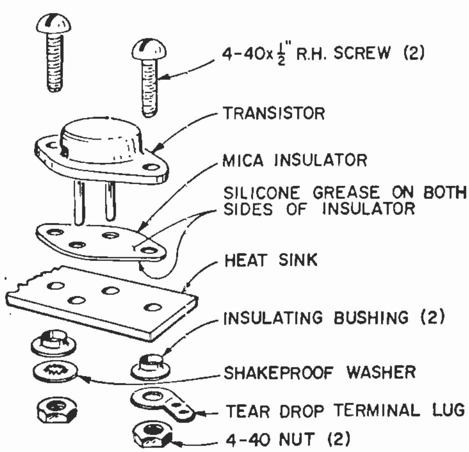
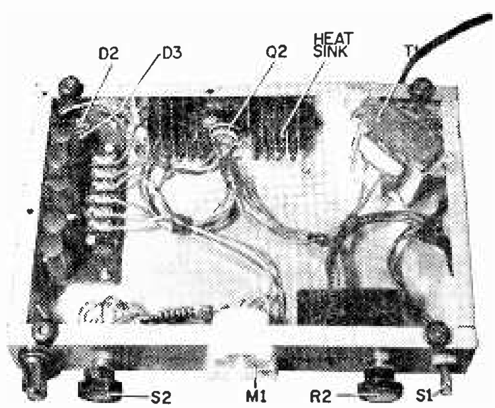


Fig. 3. Power-transistor mounting is much easier on pre-drilled heat sink—otherwise use insulating washer as a drill template.



Here the inside of DC supply is seen from bottom. There's no crowding of components. Make good solid connections for all wiring that carries current from T1 to the output.

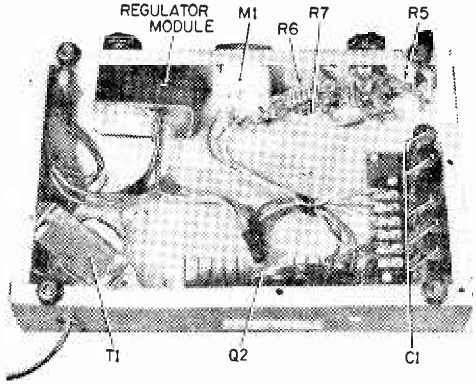
washer. Use silicone grease (Dow-Corning DC-44 or equiv.) between transistors, washer, and heat sink, to provide maximum heat transfer. Because of the high current involved, AWG 16 or 18 wire was used for all connections. Stranded wire, with polyvinylchloride (PVC) or other suitable plastic insulation, is easiest to handle.

If you prefer "bargain" transistors and diodes, by all means use them. But be sure to observe the ratings of substitute components. Rectifier diodes must handle at least 1-ampere average forward current with a peak inverse (reverse) voltage rating of not less than 80 volts. The Zener diode must be capable of at least 0.75 watt dissipation. Almost any small-signal transistor can be used for Q1; however, the collector-to-emitter rating should be at least 20 volts, and the transistor should be rated at 140 milli-

TABLE I. SHUNT-RESISTANCE WINDING DATA

Wire Size (A.W.G.)	+Resistance Ohm/1000 ft.	+Calculated Length	+Start With	Resistance Required
18	6.374	10′ 6″	12′	+0.0666 ohm* (1.6 Amps full scale)
20	10.14	6′ 7″	8′	
22	16.12	4′ 1″	5′	
26	40.75	16′ 5″	20′	0.666 ohm* (160 ma, full scale)
28	64.79	10′ 4″	12′	
30	103.0	6′ 6″	8′	

*For 100-ohm, 0-1 milliampere meter only—see text



Regulator circuit is made into a module to provide better temperature stabilization—but it's not a worry for most experimenters.

watts or more. Q2 is a 20-watt transistor with collector-to-emitter rating of 40 volts.

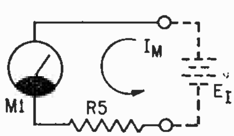
Metering Resistance. Resistors R5, R6, R7, and R8 are the only components that require special attention. These are the series and shunt resistors for the metering circuit, and the correct values depend on the meter used. Calculate the correct values as shown in Fig. 4. For example, consider R5—the series resistor for the 16-volt range. Most 0-1 milliammeters have an internal resistance of 100 ohms so: $E = 16$ volts; $I_m = 0.001$ ampere (1 milliampere); $R_M = 100$ ohms. Thus:

$$R = \frac{E - (I_m \times R_M)}{I_m}$$

$$R = \frac{16 - (.001 \times 100)}{.001} = 15{,}900 \text{ ohms}$$

If you have a resistance bridge in your workshop, you could easily find this value

$$R = \frac{E - (I_m R_m)}{I_m}$$



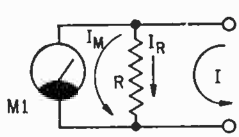
Where:

R = value of multiplier (R5)

E = desired full-scale voltage reading

I_M = current required for full-scale deflection (amps)

R_M = internal resistance of meter



$$R = \frac{I_m R_m}{(I - I_m)}$$

Where:

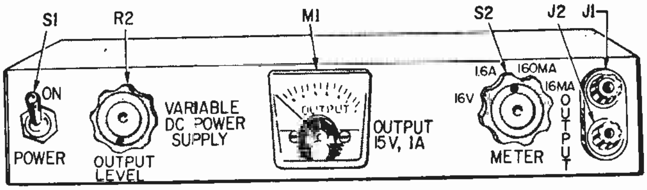
R = value of shunt (R6, R7 or R8)

R_M = internal resistance of meter

I_M = current required for full-scale deflection (amps)

I = full-scale current to be measured (amps)

Fig. 4. Mathematics required for designing metering circuitry to work with an existing meter, or a bargain-priced one, is not difficult when you do it one step at a time.



Front panel is actually side of a 2-inch deep metal chassis which is used as the cabinet.

among a handful of 15K, 10% resistors. A better bet, though, would be to use a 15.8K precision resistor for the multiplier. This is the nearest 1% value, and it will provide all the accuracy and stability required for your power supply.

Calculate the values for R6, R7, and R8. For R8, $I = 0.016$ amperes (16 milliamperes), $I_m = 0.001$ ampere, and $R_M = 100$ ohms, so that:

$$R = \frac{I_m \times R_M}{(I - I_m)}$$

$$R = \frac{.001 \times 100}{.016 - .001} = 6.66 \text{ ohms.}$$

Quick arithmetic shows that R7 will be one-tenth the value of R8, or 0.666 ohms; and R6 will be one one-hundredth of R8, or 0.0666 ohms.

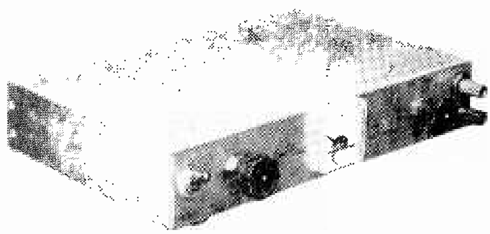
The Shunts. A 15-ohm and a 12-ohm resistor in parallel provide the correct value for R8. Use 5% resistors for this. But the remaining resistance values are less common. In fact, the odds are that the only way you can come up with these values is to make your own resistors.

One of the most abundant commodities around the home workshop is copper wire. In addition to using wire for connections, most hobbyists, at one time or another, try their skill at winding coils, and even transformers. This requires magnet wire (enamel insulation) in sizes smaller than the usual variety of hookup wire. The nominal resistance of the various sizes of solid copper wire can be found in Table 1, and the values are sufficiently accurate to provide a starting point for winding shunt resistances for the 160 milliampere and 1.6 ampere ranges.

Using the smallest-size wire available, as shown in the table, wind the shunt resistors on a dowel, spool, or almost anything handy, as long as it is a nonconductor. A short piece of broom handle is good—it is large enough to permit the use of a wood screw for mounting. Both shunts can be wound on the same dowel if desired. Since some trimming is required to calibrate the shunt, leave one end of each shunt free so that wire can be removed.

A Quick Check. At this point, check the power supply because it must be used to adjust the shunts to calibrate the milliammeter ranges. First, temporarily connect a jumper between the + terminal of C1 and the + output terminal. (Although this jumper will be removed later, tack solder it in place.) Now, measure the output voltage with a multimeter (VOM). Rotating R2, you should be able to vary the output from about 1 volt to at least 15 volts, unloaded. (If the power supply does not operate properly, make voltage checks (see Fig. 1) to isolate the trouble.

Calibration. Set the voltage to the lowest output position. Next, connect a 5-ohm, 10-watt resistor across the output. Adjust the output to 5 volts. With the power switch *off*, connect the multimeter (set to read 1 ampere—100 ma) in series with the 5-ohm resistor. Apply power and measure the current. It should be approximately 1 ampere. If the current is greater than this, reduce the setting of the *Output Level* control until the meter indicates 1 ampere.



Holes are drilled through the chassis for convection cooling of power transistor Q2. You can't have too much ventilation here.

Now, turn the power *off* and disconnect the jumper between the output terminal and C1. Without disturbing the test setup, solder the 1.6 ampere shunt between the power-supply meter and selector switch S2, as shown in the schematic. With S2 in the 1.6-ampere position, apply power again and compare the readings on the multimeter and the power-supply meter. The power-supply meter should read higher than the multimeter. If not, there is not enough wire on the shunt. (Although this is quite unlikely, it is possible. If this is the case, add a foot or so of wire to the shunt—unless, of course, you were lucky and both meters read the same.) Unwind wire from the shunt until both meters indicate the same value of current. Trim only a small length of wire at a time—one or two inches at the beginning, and less as the readings get closer. *Be sure that the power switch is off when connecting or disconnecting the shunt.*

After the 1.6-ampere shunt has been calibrated, solder the 160-milliampere shunt between the power supply meter and S2, as shown on the schematic. Load the power supply with a 150-ohm, 2-watt resistor—in series with the multimeter set to read 100 milliamperes. Apply power and adjust the power supply until the multimeter indicates 100 milliamperes. With S2 set to read 160 milliamperes, compare the power-supply meter with the multimeter. Again, the power-supply meter should read high. Trim wire from the shunt, removing an inch or two of wire at a time, until both meters indicate the same value.

After both shunts have been calibrated, carefully disconnect them and seal the wire to the bobbin with varnish, epoxy, or "Q" Dope. When the sealer is dry, replace the shunts and solder them in place, exactly as they were soldered during calibration procedure.

(Note: The author salvaged shunts from an old multimeter, and trimmed them to the correct values as outlined in this procedure. These shunts are more compact than the shunts just described. Since the wire used in commercial shunts is a temperature compensated alloy, they are superior to copper-wire shunts. The inaccuracies due to temperature effects on copper-wire shunts are negligible unless the power supply is to be used in extreme environments.)

Other Meters. The values for R5, R6, R7 and R8 are for a meter marked 0-16; but the same procedure applies regardless of the scale markings. For any meter, calculate the resistance values from Fig. 4; determine the amount of wire from Table 1, and calibrate as described. A 0-20 or 0-15 scale would work just as well.

If you have to change the scale on the meter, it's easy—disassemble the meter and remove the scale. Blank out the original scale numbers (not the scale divisions) with Liquid Paper or Sno Pake (available from office supply stores), and letter in the correct numbers with a lettering pen or drafting pencil. Use a full-scale value that will coincide with the existing divisions. Spray the scale lightly with clear acrylic, and reassemble the meter. With a little care, you can make the meter face look almost like a commercial unit.

After the power supply is completely assembled, add knobs, decals, or other suitable markings to the front panel for a neat, attractive unit.

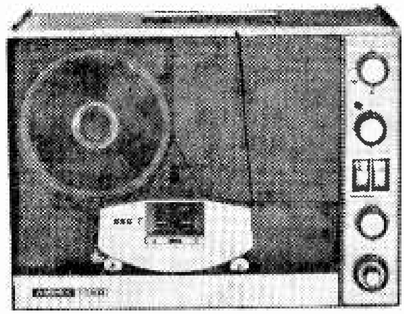
Careful construction of this handy power supply will complement the test equipment for the workshop. It is not a precision laboratory voltage source; it was not intended to be. But it is a simple, inexpensive item that will be as useful to the experimenter. ■

44–KWH Fuel Cell

■ This completely enclosed fuel cell was recently delivered to Sanders Associates to power a U.S. Navy buoy. High-energy dry chemical fuels provide 44 kilowatt hours of continuous, unattended power for periods of up to one year. Developed by General Electric's Direct Energy Conversion Operation, the cell's power density of 150 watt-hours per pound can be fitted to a variety of low-power applications—higher power can be supplied for shorter periods of unattended operation.

Look for more and more uses of this cell; in marine and land applications, for unattended beacons and buoys, remote monitoring and control equipment in isolated or otherwise inaccessible areas. ■

RADIO-TV EXPERIMENTER LAB CHECK



AMPEX MODEL 1100 SERIES
4-Track Stereo Tape Recorder with Automatic Tape Threading

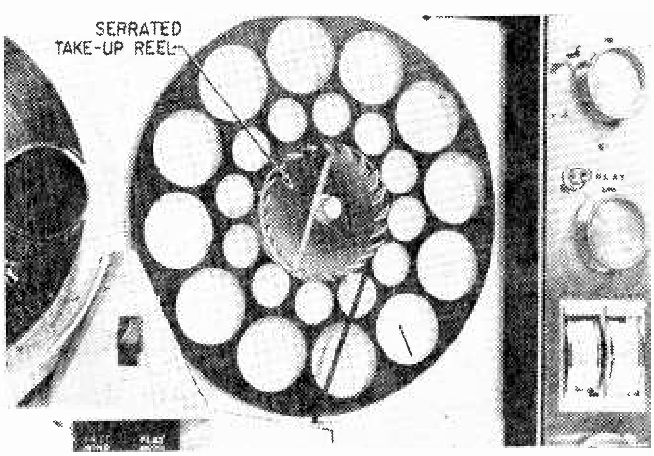
■ Now that the state of the design art has progressed to the point where they can build reasonable "hi-fi performance" into a recorder priced near $100, tape machine manufacturers are turning more and more to upgrading their machines with automation, and switching formerly restricted to recording studios. A perfect example of this recent move to super-mechanization is the Ampex 1100 series of tape recorders.

The Ampex 1100 series consist of three machines. Mechanically the transports and basic electronics are identical; the difference is the 1150 is only a tape deck with preamplifiers, the 1160 adds power amplifiers and a "bass boost" circuit, and the 1165 is the 1160 with a walnut instead of a metal enclosure. Our tests concern the Ampex Model 1160.

Design Specs. Like any modern recorder the 1160 is fully transistorized with the usual frequency response at 7½ *ips* of 50 to 15,000 Hz (cps). At 3¾ *ips* the response is limited to 50 to 7500 Hz. The 1⅞ *ips* speed is good for speech only.

The 1160 has the usual VU meters (one for each stereo channel), microphone and line inputs, line output, and speaker output. The speaker output is a 6-watt (sine-waveform) amplifier, the user supplies external speakers as the 1160 does not contain its own speakers. A monitor switch connects the power amplifiers at a sharply reduced level for low level monitoring during recording.

Individual volume controls determine the gain for both the microphone and line inputs for the left and right channels. The variable tone control is marked for the proper equalization of the three tape speeds. The record selector is the *pre-set* level type. When set to record, the VU meters indicate the recorder's input signal before the tape is driven. Only after the record safety is depressed and the play button activated does the input signal get on the tape. *(turn page)*



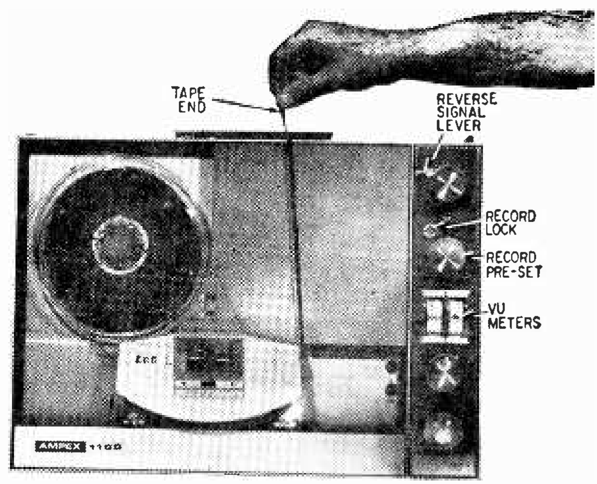
The playback take-up reel is serrated. When the tape is placed in the slot (see top of next page) it falls across the serrations. As the reel rotates, it takes up the tape—an automatic self threader.

Easy? Yes! But it's the automation that's really the "heart" of the Ampex 1160. While it records either 4-track stereo or 4-track mono there's never any reason for the user to touch the tape until it has been completely played. In normal operation the drive is reversible; when the tape is played out and only a few turns remain on the supply reel the user simply flips a switch on the transport and the drive reverses from right to left instead of the normal left to right. Simultaneously, a complete set of "reverse" heads is switched in; for example, if the 1-3 track heads are in use for stereo, reversing the tape switches in the heads for the 2-4 tracks. For 4-track mono, the drive reverse automatically changes two of the track heads, say 1 to 3; if at the end of the #3 track the drive is again reversed and the manual mode switch set to the second mono position the recorder will play the #2 and #4 tracks.

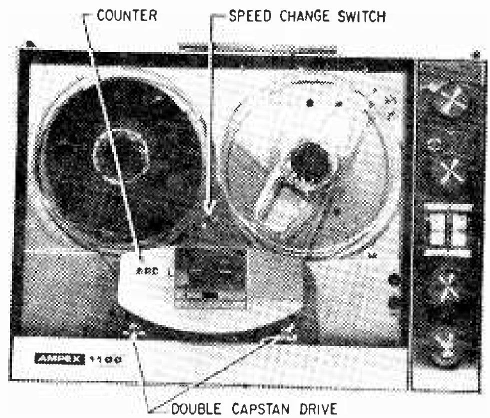
For those too lazy to throw a single switch the Model 1100 series incorporates an *electronic* reversing circuit. Note that electronic means just that; it is not necessary to cement a piece of foil to the end of the tape. The mode switch has a small lever sticking out the side. When the lever is pulled down a 20 cycle pulse (from a built-in tone generator) is recorded on the tape. (The 20 Hz [cps] pulse is filtered from the output so it's not passed onto the speakers.) If the tone is recorded at the end of a track the entire tape drive and head selection reverses at the end of the tape. Naturally, the tone pulse can be placed at anytime, anywhere on the track. The tone control signal is recorded on tracks 1 and 4; when the tape is playing tracks 2 or 3 the recorder responds to the pulse on 1 or 4.

If the tone control signal is added to a pre-recorded stereo tape the recorder will play the entire tape without interruption. For 4-track mono tapes, the user need only change the track selector switch at the end of the second track; the rest of the tape plays automatically.

Eliminates Fumbles. Another bit of automation is the automatic take-up reel. Unlike the usual recorder whereby the user threads the tape onto the take-up reel, on the 1100 series the free tape end is dropped into a slot. A serrated *hidden* (covered) take-up reel grabs the tape and starts winding as soon as the drive switch is activated. For some reason Ampex suggests the automatic reel be replaced with a standard reel for recording. We can't figure out why as using the automatic reel had no effect on frequency response or wow-and-flutter. To change reels, the user snaps off two plastic covers, removes the reel retaining screw and substitutes a spindle; the mechanism will then accept standard plastic take-up reels. Two rubber reel hold-downs are provided.



To thread the 1100, pass tape against heads and into slot. Motor starts; tape threads.



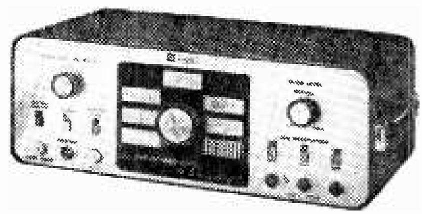
The 1100 has a double capstan drive—one for forward and one for reverse. Action is smooth.

The Ampex is normally supplied with one microphone, a blank 7 inch reel, the change-over spindle and a case to hold the mike and spindle. Optional accessories include a dust cover, microphone, accessory kit which includes a splicer, head demagnetizer, head cleaner, leader tape, splicing tape and Q-tips, and 5 speaker systems.

For further information and specifications write to Ampex Corp., Dept. RTV, Consumer and Educational Products Division, 2201 Landmeier Rd., Elk Grove Village, Illinois. ■

RADIO-TV EXPERIMENTER LAB CHECK

KNIGHT-KIT Model KG-685 Color-Bar and Test Pattern Solid-State Generator



■ The Knight-Kit KG-685 is a solid-state color bar and pattern generator that combines in a single cabinet all the test signals and conveniences needed for proper adjustment of color television receivers. To insure compatibility with all receivers the KG-685 provides for three different signal coupling methods. The primary output is a coaxial cable (terminated in alligator clips) which provides an RF test signal on channels 3, 4 or 5. Best performance is obtained by utilizing an unused channel frequency and the user determines the exact output frequency via an adjustment on the unit's rear apron.

For receivers that require a video test signal the KG-685 provides a composite video signal at a front panel jack. The composite test signal is variable from −2 to +2 volts peak-to-peak. For those sets which strip the sync signal off before the video detector, the KG-685 also provides a separate sync signal at a front panel jack.

Pop Patterns. Seven test patterns are provided: dot, cross hatch, vertical lines, horizontal lines, color bar, purity and gray scale. The purity pattern provides full screen red, green and blue when used with the gun interrupter switches (gun killers). The gray scale is used to check for optimum black-and-white adjustment of color receivers. Proper receiver adjustment is indicated when all six levels of brightness (gray scale) are reproduced in black-and-white with no trace of color tint.

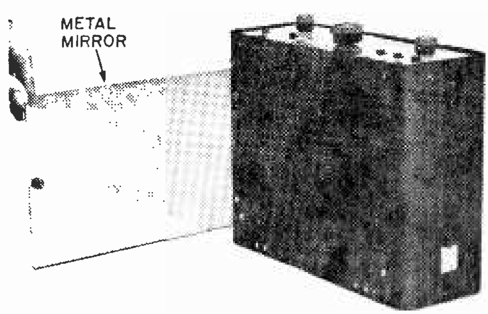
Fourteen one-raster-line-thick horizontal lines and nine visible vertical lines are provided. The intersection of the lines provides the dot pattern. Either the dot or crosshatch pattern is used for static convergence of the three color guns while the vertical and horizontal bars are used for dynamic convergence. Naturally, either the vertical and horizontal bars or the crosshatch can be used for linearity adjustments on color or B&W receivers.

Other Features. A sound carrier, which is crystal controlled exactly 4.5 mHz from the picture (video) carrier, is also provided. The sound carrier can be switched on or off, and though it is unmodulated it can be used for adjustment of the sound quadrature by adjusting the quadrature for minimum hum or buzz (absolute quiet).

The jacks for the gun killer cables and the gun killer switches are located, along with the color level control, on the front panel.

Two unusual conveniences are provided. The first is a built-in work light, actually a small pilot lamp and shield attached to a cable. The lamp is attached to a small rub-

(Continued on page 112)



Convenient feature of generator is a metal mirror that unfastens from bottom of cabinet. It permits the service technician to observe the TV screen while he makes adjustments at the rear of the receiver.

Voltage by the Numbers

by Robert Hertzberg

You've got to look your house current straight in the phase to find out why voltage soars to 234 or sags at 110. It's what happens from pole outside to fuse panel inside.

■ During the first half of the 20th Century it was pretty easy to identify the electricity furnished to most residences. If there were only two wires from the utility company's pole to the house, you could be sure that the juice was 110 volts, give or take a couple. If there were three wires, the voltage between the *neutral* ground wire and either of the other wires was still 110, and across the two outside wires it was exactly double, or 220 volts.

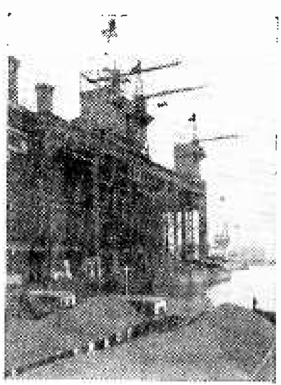
Nowadays, the situation can be confusingly different, particularly in new residential districts where central air-conditioning is as common as central heating. Instead of simple two-wire or three-wire service, you are quite likely to find *four* wires running into a house. Even three wires can be misleading, as you can tell from a quick check with a voltmeter. The reading between the neutral and either outside wire might be 120 volts, but across the two outside legs it is not 240, as you might expect, but 208! Read that again . . . 208. The same 120/208 combinations exist on the four-wire service; that is, 120 from the neutral to any of the three outside wires, and 208 between any pair of the latter. How come?

The answer lies in the nature of the electric energy produced at large generating stations. You probably know in the general way that this is alternating current. It starts flowing in one direction from zero volts, builds up to a peak value, drops back (still in the same direction) and returns to zero; then it reverses direction and goes through the same process of rising and falling. Two such *alternations* constitute a complete *cycle*, and the number of cycles that occur in one second is called the *frequency* of the current. In the United States the standard frequency for homes and most industries is 60 cycles per second.

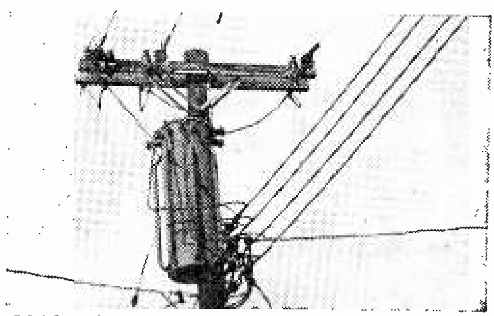
By international agreement among scientific bodies, the term *Hertz* (H_z) is replacing *cycle*, to honor Heinrich Hertz, the German physicist who is credited with demonstrating the first transmission of radio impulses through space.

Watt's 3-Phase. Alternating current that goes through two simple alternations per second is called *single-phase* AC. This is what runs every low-power electrical device in the home, from clocks to washing machines.

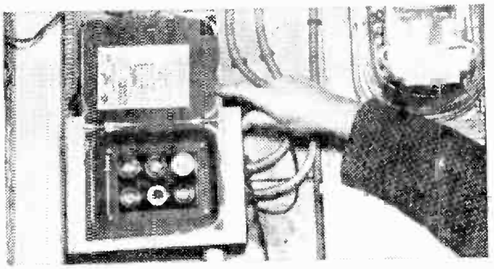
However, commercial electricity is not produced in this form at all. Instead, it comes out of large generators as *polyphase* or more specifically as *three-phase* energy. Three-phase means just that. One alternation starts; a fraction of a moment later a second



Juice starts here. Typical power generating plant is Con Edison in N.Y. Coal fed in one end comes out as walloping watts at the other.



2300-volt, 3-phase power arrives on upper wires. Pole transformer drops it to 120/208 and feeds homes via lower four wires.



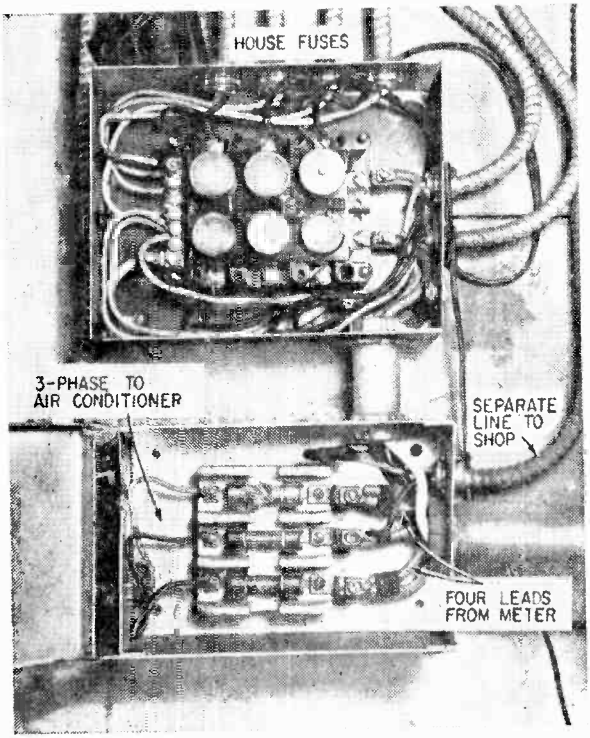
Opening fuse box gives no clue to type of power delivered into the home by utility.

gets under way; and after another interval a third begins. Each phase is timed at 60 H. (cycles per second), so during any 1/60 of a second there are parts of all three phases actively at work in a circuit.

Three-phase electricity can be generated and distributed more economically and efficiently than single-phase. It is particularly desirable for large motors, from about 2 horsepower and up,—which is why it is favored for central air-conditioning installations.

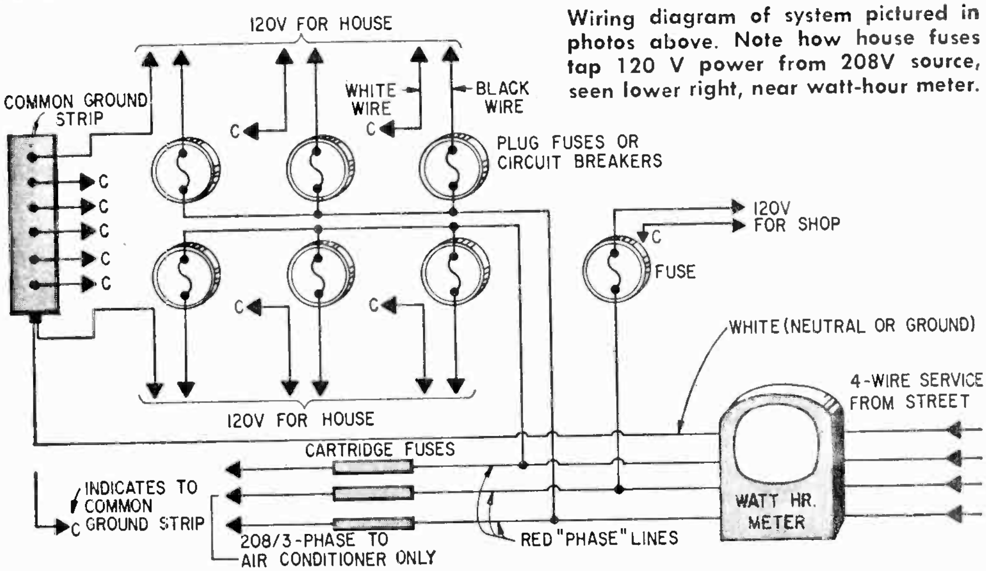
The three individual phases or currents circulate without any mutual interference whatsoever. With suitable transformers they can be extracted, as single-phase supplies, from the power line. Or all of them can be piped into a building together. In older neighborhoods the usual arrangement was to have one transformer handle one phase and to step it down from the distribution value of about 2300 volts to 110 volts (for two-wire service) or to 220 volts (for three-wire service). Such transformers were intended to feed a number of homes. Similar transformers, in adjacent areas, worked off the other

(Continued on page 109)



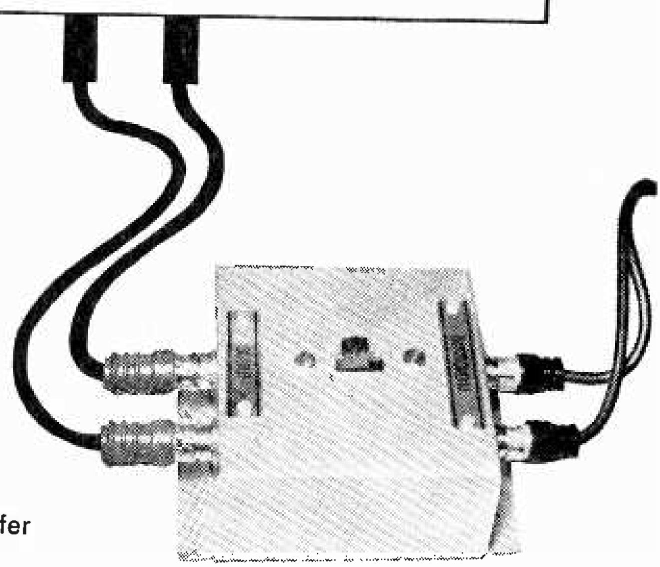
Removal of fuse-panel cover reveals details. Four wires from meter (lower right) indicate that service is full three-phase type. Big cartridge fuses in lower box are for air conditioner, top box is for regular circuits.

Wiring diagram of system pictured in photos above. Note how house fuses tap 120 V power from 208V source, seen lower right, near watt-hour meter.



Take advantage of the new solid-state pickup that needs no preamp and offers low distortion. Here's how to build a simple $4 power supply to match one to your amplifier.

Semiconductor Phono Cartridge Adapter



by Art Trauffer

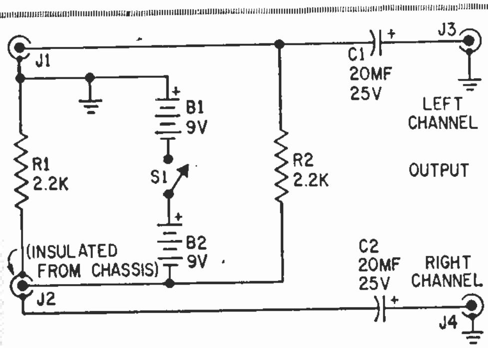


Fig. 1. Follow this schematic if you want the better circuit, which includes a phase inverter. Since it reverses the phase of one output signal, final set-up of speakers is somewhat simpler. Note that J2 must be insulated.

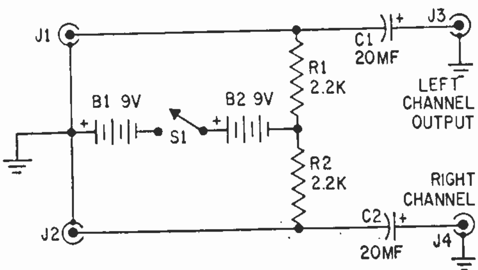
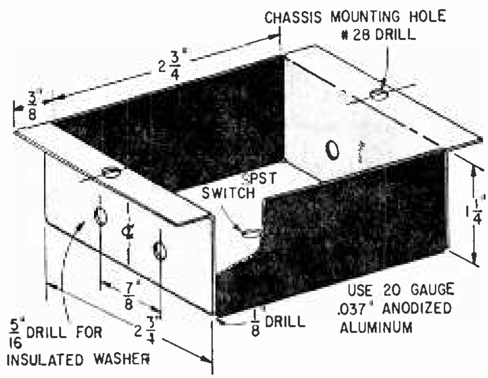


Fig. 2. This circuit does not invert phase of one signal, which must be done at amplifier output. Construction is slightly simpler since all jacks are mounted directly to chassis, with no fiber washers required for insulation.



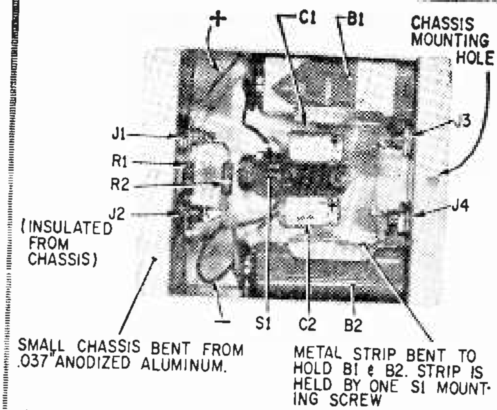
The adapter circuit may be built into a commercially available "Minibox" or you can construct your own aluminum enclosure, using the dimensions given here and instructions given in text.

■ The newly-developed Euphonics *Miniconic* semiconductor stereo phono cartridge is a remarkable device having a smooth distortionless response from DC to over 30,000 cps. The extremely small mass of the silicon semiconductor elements, and the stylus, result in fine transient response, and in a good arm the cartridge will track an unwarped record with as little as ½-gram pressure, resulting in long life for records and stylus. The low impedance of this cartridge (around 1200 ohms) makes it fine for transistor circuitry, while the high output does away with the need for preamplifiers—as used with magnetic cartridges. Since this cartridge contains no coils or magnets, there is no AC hum to pick up by induction, and no magnetic attraction (or pull) to steel turntables. And all this for about $20 (net) for the Euphonics U-15-P.

This cartridge functions as a variable-resistance, and develops no voltage of its own—it requires a DC bias voltage—from 10 to 30 volts. (The cartridge elements are tiny bits of silicon—treated to act as variable resistances that increase or decrease in resistance when subjected to pressures or strains.)

This bias voltage could be taken from the DC supply for the transistor amplifier, used with this cartridge, but for experimenters here is a neat little DC supply which can be connected between the cartridge and the amplifier.

This power supply also inverts the phase of one channel of the cartridge output because the cartridge has an out-of-phase output, thus it isn't necessary to reverse the connections to one of the speakers (or to one of the earphones of a stereo headset) to get

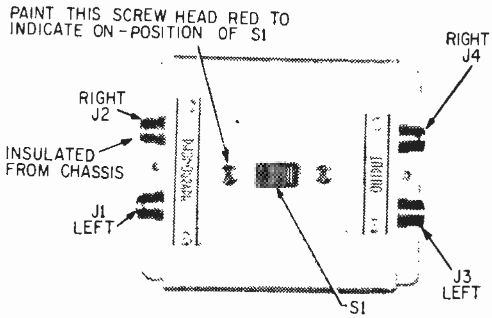


PARTS LIST

B1, B2—9-volt transistor-radio battery (VS323, 2U6, 216, NEDA 1604 or equiv.)
C1, C2—20-uf., 25-volt miniature electrolytic capacitor
J1, J2, J3, J4—Phono jack, single-hole mounted
S1—SPST switch, slide or toggle to suit.
2—Battery connectors, to fit B1, B2.
1—6 x 5¼-inch piece anodized aluminum (.037 or 20-gauge)
Misc.—Chassis box (if you don't make your own); name plates; fiber shoulder washers; mounting screws; machine screws and nuts; battery clamps; etc.

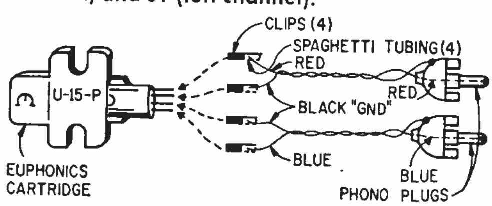
Estimated construction cost: $4.00
Estimated construction time: 2 hours

Underside view of chassis reveals layout of parts. Be sure to insulate the shell of jack J2, seen near lower left, if you follow the schematic in Fig. 1.

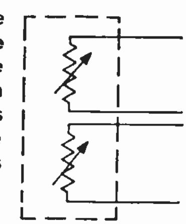


Topside view of adapter chassis. Two shielded cables from phono cartridge plug in at left. Output signals to hi-fi amplifier are taken from jacks at right.

Wiring diagram for connecting signal outputs from cartridge, to the inputs of adapter unit, which are jack J2 (right channel) and J1 (left channel).



Silicon in the cartridge can be shown as variable resistors. When needle presses silicon, resistance changes. This varies external bias voltage.



in-phase stereo reproduction.

The schematic diagram in Fig. 1 shows the circuit for the power supply and phase inverter. Note that phono jack J2 must be insulated from the chassis. Two 9-volt transistor batteries are connected in series.

The simple circuit in Fig. 2 can also be used, but this arrangement does not reverse the signal phase of one channel of the cartridge. You will have to reverse the connections to one speaker or one phone of your stereo headset. With this circuit all four of the phono jacks are connected directly to the metal chassis.

You can use a ready-made chassis box or make your own chassis. Start with a 5¼ x 6-inch piece of .037 (20 gauge) soft aluminum (like 52-ST). The cuts can be made with a hacksaw—use a fine-toothed blade. The bends can be made in a vise or with a couple blocks of wood and a clamp or two. To make the corner bends drill an ⅛-inch hole where the cuts meet—before you make the cuts, of course.

The photo shows the simple arrangement of parts and wiring for the circuit in Fig. 1. Before mounting phono jacks (J1, J3, J4) be sure to scrape off the anodized insulating coating on the surfaces of the aluminum where the jacks contact the metal. Note that the batteries are held in place with a twin-clamp bent from a 1 × 4-inch strip of tinplate or aluminum. The clamp is secured to the chassis by one of the screws which hold the slide switch (S1). Connections are made to the batteries with snap-connectors.

This phono cartridge opens up a new field for hi-fi experimentation, and the power supply provides a handy, humless means of supplying necessary bias voltage. ■

MODULATION BOOSTER

BY EDWARD A. MORRIS W2VLU

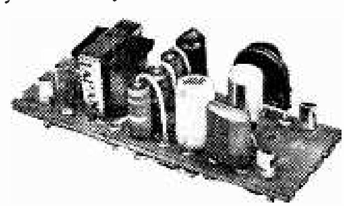
Increase the output from your present microphone for more modulation and less hum pickup when using a long mike cable.

■ If your DX contacts are few and far between, and the locals remark that your signal *sounds* weak—it *could* be your modulation.

If your first impulse is to rush out and buy a new rig, go ahead! But you can save yourself a pocketful of money—just up-grade your present rig, with this ultra simple microphone preamplifier.

Built from all new parts, the preamplifier should cost less than $4.00! That's not much more than the cost of a new crystal! Easy to construct, a beginner could do the job, from start to finish, in less than two hours!

Depending upon the construction of the stand or case used, the preamplifier can be built right into the microphone it is to be used with. Highly economical to use, a single, inexpensive, alkaline cell will last well over a year in normal service.



How it works. Audio output from the microphone is fed into the primary of impedance matching transformer T1. The output from the secondary of the transformer drives the base of transistor Q1 through coupling capacitor C1. Resistance R1 and R2 form a voltage divider network which supply a base bias for Q1.

The electrical and thermal stabilization of the preamplifier is taken care of by resistor R3. Capacitor C2 bypasses this emitter dropping resistor to prevent signal generation.

The amplified audio output of transistor Q1 appears across potentiometer R4—the collector load. The output of the preamplifier is extracted through coupling capacitor C3.

Operating power for the preamplifier is supplied by B1.

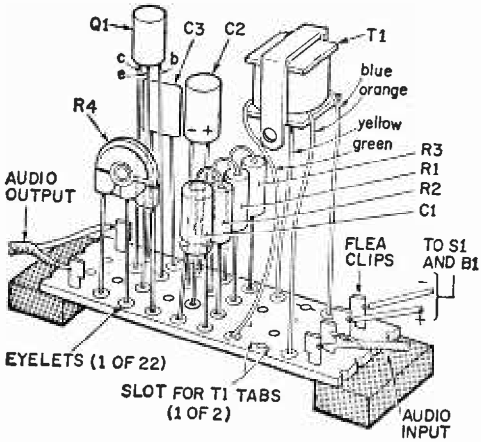
Construction. As can be seen in the photographs, the preamplifier is built on a small strip of perforated-phenolic board. Miniature eyelets and flea clips serve as parts anchors and terminal points. All parts, including resistors, were mounted up on end to conserve space. The electrolytic capacitors used are the replacement variety intended for transistor radios.

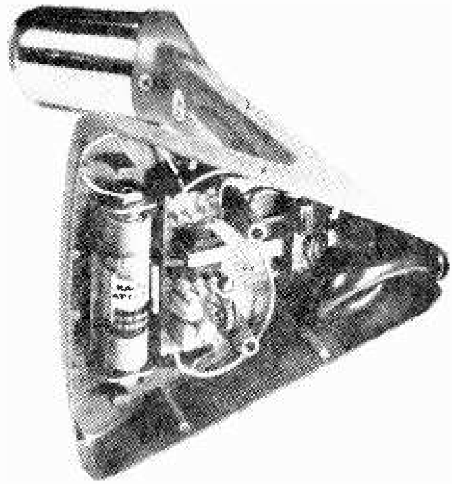
Since the components are mounted close together, the pigtail leads on the components themselves can serve as the major portion of wiring. Insulation should be slipped over those leads where there is a chance of an accidental short occurring.

Special care must be taken to insure that transistor Q1 is not damaged by excessive heat when it is soldered into the circuit. Use a suitable heat sink, a well-tinned soldering tool and complete the soldering operation as rapidly as possible.

Switch S1 is a pair of unused normally-open switching contacts on the microphone's push-to-talk switch. If your microphone won't permit such an arrangement, a miniature slide or toggle switch may be installed. Since the preamplifier has exceedingly low

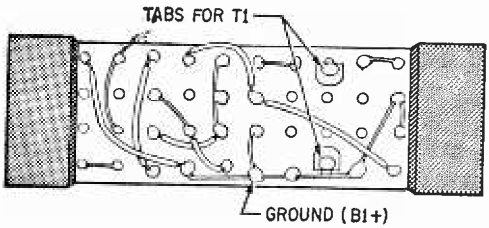
MODULATION BOOSTER





Booster, complete with dry cell, fits into base of this desk-stand microphone. Make sure you have room to accept dry cell and circuit board—just change layout to fit.

Pictorial layout (above left) shows positions of components on perforated board. A piece of self-adhesive foam weather strip is used to shock mount the Booster in base.



Wiring on underside of perforated board is with thin wire although a printed circuit could be designed. Plastic tubing is used to prevent shorts at crossover connections.

current drain, (under one milliampere) switch S1 may be eliminated entirely. (The inexpensive alkaline cell, recommended in the parts list, will continuously power the preamplifier for a period of over three months!)

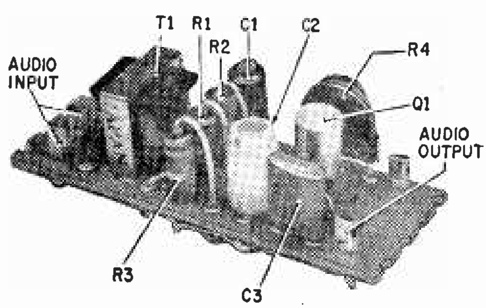
Using a somewhat different construction technique, and power source, the preamplifier can be constructed inside a common palm microphone, the type almost all CB rigs use. A single *Eveready* 625 mercury cell will power the unit for over 350 hours—that's over one year, in normal use.

Although designed to work with high-impedance microphones, the unit can be modified to operate with low-impedance units. For low-impedance microphone elements, transformer T1 is removed, and the output of the microphone is then connected directly to capacitor C1. Capacitor C3 should be replaced with a 2-mf, 12-WVDC electrolytic unit.

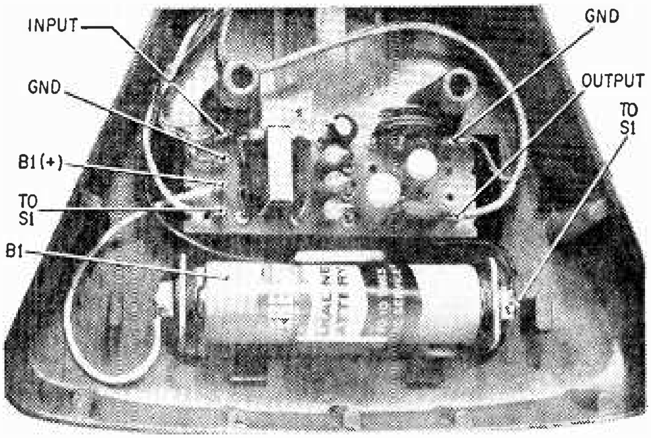
After the preamplifier has been wired, it should be rechecked against the schematic diagram for possible errors. Pay special attention to the polarity of components, when indicated, and to the wiring of the transistor. Reverse voltages can quickly ruin the miniature electrolytics or drain the dry cell. Take care with transistor and capacitor leads—too much bending or pulling can break leads at wrong point.

Adjustment and use. After the unit has been checked over for possible wiring errors, the preamplifier must be adjusted for proper operation with the transmitter it is to be used with.

With the transmitter in operation, adjust potentiometer R4, so that when speaking in a normal tone of voice, 100% modulation is



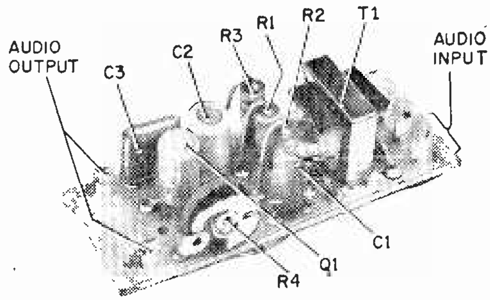
Completed perforated board showing components in place; note spaghetti on the leads.



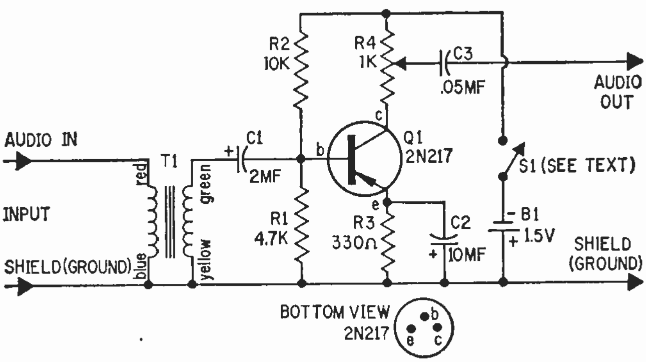
All desk-stand microphones do not have as much space in the base as this Electro-Voice. A change in the perforated-board layout may be necessary to fit components in space.

reached on intermittent voice peaks. Modulation percentage can be checked with the aid of a multipurpose CB transceiver tester, or, alternatively, with an oscilloscope. If a modulation meter is not available have a friend listen to your signal, and have him indicate to you when you have reached the optimum setting of the potentiometer.

Care must be taken to avoid setting the potentiometer too high, or overmodulation will occur. Modulation in excess of 100% will cause distortion to your signal, and interference to adjacent channels; this is in violation of the F.C.C. rules and regulations. ■



This is just about the most compact layout possible. Transformer T1 is the largest component perforated board. Resistors and capacitors could be wired flat instead.



Circuit of Booster is simple and should present few problems even as a first project. If there is too much gain in amplifier C2 can be removed.

PARTS LIST

B1—1.5-volt alkaline cell, (Eveready E91, or equiv.)
C1—2-mf., 6-wvdc, miniature electrolytic capacitor (Lafayette # 99R6070, or equiv.)
C2—10-mf., 6-wvdc, miniature electrolytic capacitor (Lafayette # 99R6074, or equiv.)
3—.05-mf., 75-wvdc, miniature ceramic capacitor (Lafayette # 99R6068, or equiv.)
Q1—Pnp transistor (2N217, SK3004, 2N316A, 2N404, 2N567 or equiv.)
R1—47,000-ohms
R2—10,000-ohms
R3—330-ohms

NOTE: All resistors are ½ watt, 10% unless otherwise specified.
R4—1,000-ohm miniature potentiometer, (Lafayette # 99R6142, or equiv.)
S1—S.p.s.t. switch, (see text)
T1—Miniature audio transformer. 100,000-ohm primary, 1,000-ohm center tapped secondary. center tap not used) (Lafayette #99R6125, or equiv.)
Misc.—Wire, solder, perforated-phenolic board, eyelets, flea clips, battery holder, etc.

Estimated construction cost: $4.00
Estimated construction time: 1 hour

Flying Showcase '66

■ Like the barnstorming Jenny of 1920, another aircraft will visit tank towns and big cities across the country. Only now it won't be a crate held together by baling wire. This ship is a sleek twin-engine Martin 202 recently converted into a high-flying showroom by International Crystal Mfg. Company. The Oklahoma-based electronics firm will touch down in 27 cities to display its products to local hams, CBers, hobbyists and dealers.

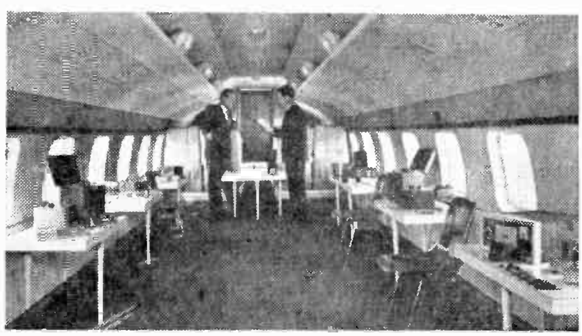
As our photos show, passenger seating has been removed to make room for exhibits and a conference room. There are special generators to operate equipment on display and a stereo background music system to lull customers into a buying mood. The company's personnel will be on hand to answer questions about crystals, alignment oscillators, filters and other components made by the firm.

If you wish to attend the exhibit, check the schedule shown in the accompanying box. (Groups, clubs and conventions are offered special showings.) But before you head for the airport, double check on the plane's arrival; it may be delayed by weather. ■

Baton Rouge, La.—June 13-14
Tuscaloosa, Ala.—June 14
Montgomery, Ala.—June 16-17
Chattanooga, Tenn.—June 18
Atlanta, Ga.—June 20-21
Jacksonville, Fla.—June 22-23
Charleston, S.C.—June 24
Greensboro, N.C.—June 25
Baltimore, Md.—June 27-28
Trenton, N.J.—June 29
New York City area—June 30-July 1
Burlington, Vt.—July 5
Rochester, N.Y.—July 6-7
Pittsburgh, Pa.—July 8-9
Columbus, Ohio—July 11
Ann Arbor, Mich.—July 12
Chicago area—July 13-14
Rockford, Ill.—July 15
Minneapolis, Minn.—July 18-19
Bismark, N.D.—July 20
Billings, Mont.—July 21
Seattle, Wash.—July 22-23
Portland, Ore.—July 25-26
San Francisco area—July 27-28
Los Angeles area—Aug. 1-2
Phoenix, Ariz.—Aug. 3
Salt Lake City, Utah—Aug. 4

Technical staff is on hand to provide you with on-the-spot information and answers.

Visitors enter the rear ramp of International's electronics-crammed airliner. Plane stops in 23 states.



Lined along either side of Martin airliner are electronic goodies for pro and amateur.

International Radio Conference signers do not necessarily abide by the regulations as agreed in 1959.

DX'ing the out-of-Band-Its

by Stanley Leinwoll

LATE IN 1959 an International Radio Conference was held in Geneva, Switzerland. The delegates to this Conference, representing close to one hundred different countries, drew up a complete set of Radio Regulations governing the entire field of wireless or radio communication.

One of the tasks performed by the delegates at the Conference was the assignment of specific bands of frequencies to be used in international broadcasting.

In spite of the fact that the conferees agreed upon some twelve separate bands to be used in high-frequency broadcasting, as shown in Table I, a number of countries, many of whom signed the Geneva Radio Regulations, now operate outside these bands, in violation of the agreement they signed.

From the point of view of the short-wave listener, these *Out-of-Band-its* offer the SWL who is interested in QSL cards an opportunity to take a fresh approach to his hobby by collecting *illegal* QSL's—that is, cards covering frequencies not allocated to broadcasting, but nevertheless used by international broadcasters. Most of the broadcasters operating out of band will readily acknowledge a verifiable report.

Who They Are. As a start, the following is a brief summary of some of the broadcasters who make it a practice to operate out of band. Frequencies given are used throughout the year, but because of seasonal propagation changes their hours of use differ from month to month.

One of the most reliable of out-of-band International Broadcasters is the British Broadcasting Corporation. In general, the BBC has tried to use the same frequencies throughout the years, and although the British were signatories to the Radio Regulations, they have continued to use a number of out-of-band frequencies even though these have been allocated to other services.

9410 kHz is one of these frequencies. This frequency is in a band allocated to the fixed services; that is, a service between specific fixed points; such a circuit would be used by the army or navy, or by commercial communications companies.

9410 kHz is generally assigned by the UK (United Kingdom) to its Middle East/African service beginning about 1800 GMT

(1300 EST) and continuing to approximately 2400 GMT (1900 EST). The power of the transmitter is about 75 kw. and it is easily heard in the Eastern United States when propagation conditions are right.

A second reliable BBC broadcast channel operating in the fixed bands is 98251 kHz. It is generally on the air to the Middle East and East Africa between 1800 and 2200 GMT. It then moves to the Latin American service between 0000 and 0300 GMT, during which time it is easily heard in the U. S.

More on BBC. Two more very reliable BBC broadcast channels are 12095 kHz, and 15070 kHz; the first is allocated to the fixed services, the latter operates in a region assigned to the aeronautical mobile service. Aeronautical frequencies are used for the transmission of information relating to air navigation, as well as the preparation for, and safety of, flight. Mobile frequencies are those used by craft in motion. Thus, the aeronautical mobile service may consist of air to ground, or air to air communication.

Operation of 12095 kHz is almost continuous throughout the day to one part of the world or another. Best reception time for this frequency is during the afternoon and early evening hours, local time.

15070 kHz can be heard throughout the daylight hours whenever propagation conditions are normal, or near normal.

The Ruskies, Too! Of all the *out-of-band-its*, Radio Moscow is perhaps the *greatest* offender. It can be found throughout the spectrum, from 5 to 20 mHz. Perhaps the strongest Radio Moscow signals over the years have come from their operation in, and adjacent to, the Amateur 40-meter band, between 7000 and 7300 kHz. This region of the radio spectrum is allocated exclusively to amateurs in North and South America. Yet, Radio Moscow uses 7150 and 7160 kHz to deliver strong signals to the Americas, which severely interferes with transmissions

(Continued on page 114)

TABLE II. *OUT-OF-BAND BROADCASTERS

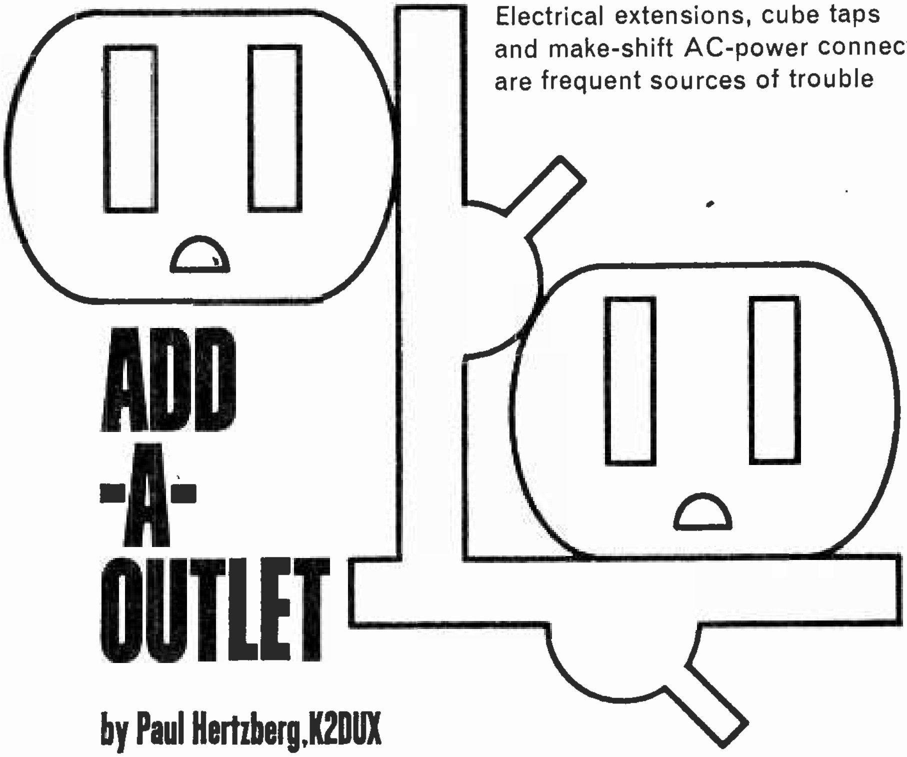
Freq. (kHz)	Broadcaster	Best Hours (GMT) N.A. Reception
6210	Red China	2000-2200
6235	Hungary	1900-2200
6270	Red China	1800-2230
6345	Red China	1800-2230
7065	Iran	0300-0600
7305	Hungary	0000-0500
7345	Czechoslovakia	0000-0400
9009	Israel	1800-2130
9388	Albania	0430-0700
9833	Hungary	0000-0500
14,520	Korea	0100-0300
15,475	Egypt (UAR)	0600-1600

* Major **Out-of-Band-its** that can be heard in North America with an inexpensive short-wave receiver and long-wire antenna.

TABLE I. HF-BROADCAST ALLOCATIONS

Frequency Range (kHz)	Remarks
3200-3400	Allocated to broadcasting in the Tropical Zones, between the Tropic of Cancer and the Tropic of Capricorn. Also allocated to fixed and mobile services in other parts of the world.
3900-3950	Broadcasting in Asia and Australia only. Amateur use in the Americas.
3950-4000	Broadcasting, shared with fixed services, in Europe, Africa, and Asia. Amateur and fixed use in the Americas.
4750-5060	Allocated to broadcasting in Tropical Zones as indicated for 3200-3400 kHz.
5950-6200	Allocated exclusively to International Broadcasting throughout the world.
7100-7300	Allocated exclusively to Amateur Radio in the Americas, and to International Broadcasting in other areas of the world.
9500-9775 11700-11975 15100-15450 17700-17900 21450-21750 25600-26100	Allocated exclusively to International Broadcasting throughout the world.

Electrical extensions, cube taps and make-shift AC-power connections are frequent sources of trouble



ADD-A-OUTLET

by Paul Hertzberg, K2DUX

■ In this era of Space-Age technology we have to have some electricity wherever we go—to power our radios, televisions and labor-saving devices, not to forget, of course, our lighting. For those items that aren't powered by their internal batteries we still need a connection to the power line. Heavy-current appliances and light fixtures are generally wired-in, directly—wall receptacles are used for portable appliances and table lamps. The best time to install the wiring for these units is before the construction work is finished.

The wall studs and door frames have been erected in your basement or home addition and now it is time to start your electrical wiring. A knowledge of the local electrical codes governing your installation and careful planning will insure a job that is neat, safe and legal. All wiring must at least conform to the National Electrical Code 1962, and any local ordinances, codes or standards. The code was originally drawn up at the turn of the century by insurance, electrical and architectural interests. Many editions and supplements have been issued down through the years to keep pace with new appliances, techniques of installation and materials. The latest copy of the code may be obtained for $1 from the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass.

Many cities prohibit work by the homeowner entirely—other communities require a permit and a plan only, while there are no restrictions at all in a few places.

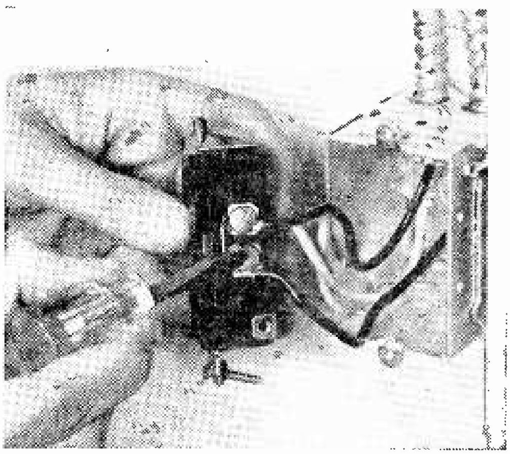
The procedure in New York City is that a *licensed* electrician must get a permit, do the work, and apply for an inspection by the Dept. of Water Supply, Gas and Electricity—who automatically sends a copy of the inspection report to the Board of Fire Underwriters.

Licensed electricians' rates are very expensive and many, many homeowners do their own work—following the Code. There are no problems with this type of installation until the insurance company refuses to pay off a claim from a fire, that they say, was caused by improper and illegal wiring that was not inspected.

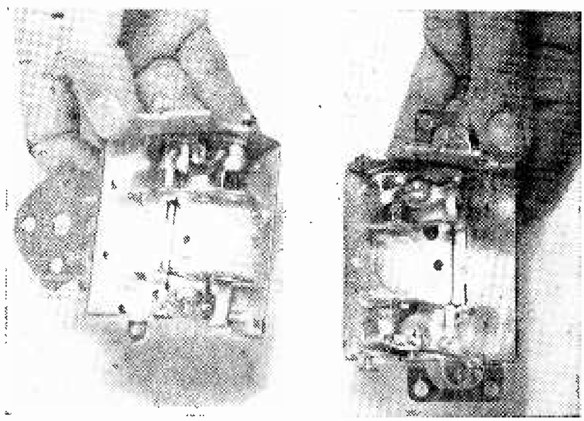
In any case, you must start with a plan.

Stand on BX and pull taut across knee. Thumb guides hacksaw blade to start cut—don't cut your knee.

Remove kraft-paper wrap but not ground lead—bend back; wrap around cable; secure in clamp.



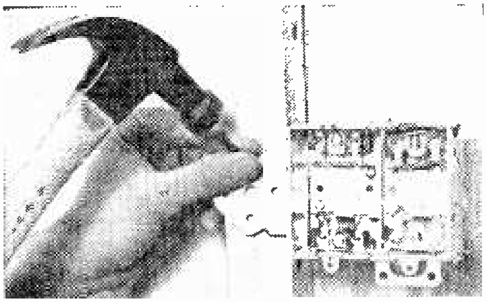
Soldered splices aren't used much any more. Circuit is completed by the connection between screw terminals.



Two or more boxes may be easily ganged to accommodate switches, outlets; loosen screw and remove side plate.

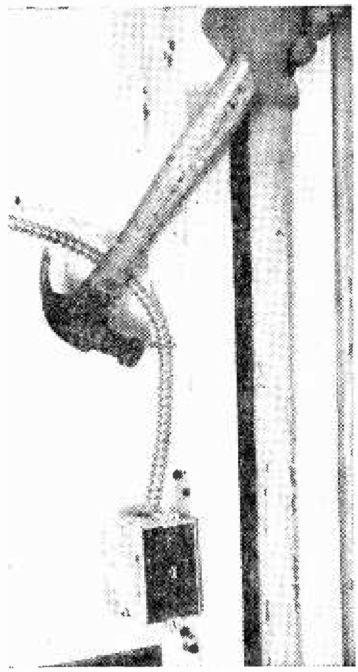
Plan not only for the present but for any possible future needs. It takes just as long to install wiring with #12 (AWG) conductors with a 20-ampere capacity as it does the slightly thinner #14 wire that will handle a maximum of 15 amperes safely. Don't put in a minimum number of outlets—thinking to save a few pennies here and there. An extra outlet never hurts and saves a great deal of wall chopping and patching at some later date. And make sure there is plenty of illumination. You can always turn off an extra light but it is very difficult to add an extra overhead light after the ceiling is finished and all the tiles are in place.

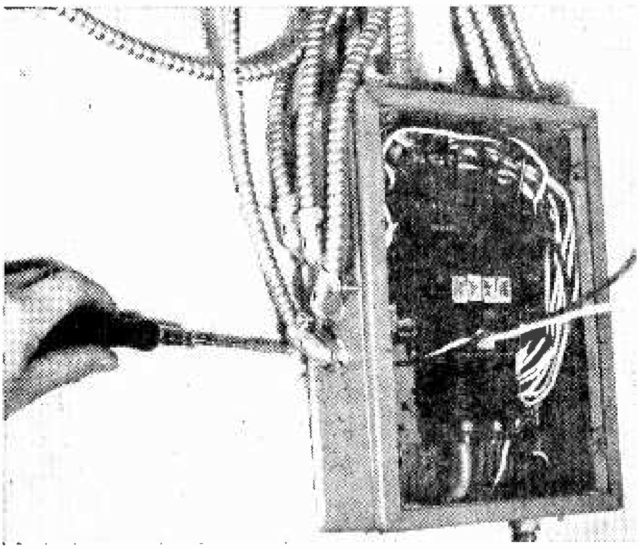
Make a plan—use a scale of ½ inch to equal 1 foot. Symbols, rather than an actual picture of an outlet or fixture, are conventionally used. These symbols are nationally understood by electricians. The lines representing the BX cable do not have to be drawn showing their actual route through the walls or floors. In actual practice the shortest route will save the cost of extra cable.



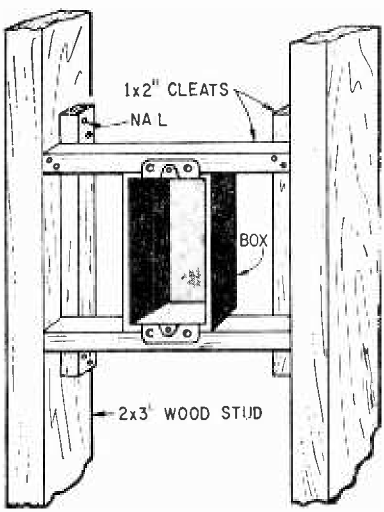
Special brackets make it a simple job to "hang" boxes for switches and receptacles. Hammer and nails are used by professionals for speedy installations while the home-owner will often use wood screws for less noise.

Cable is held in place by special BX staples that prevent cable pulling at wall box.



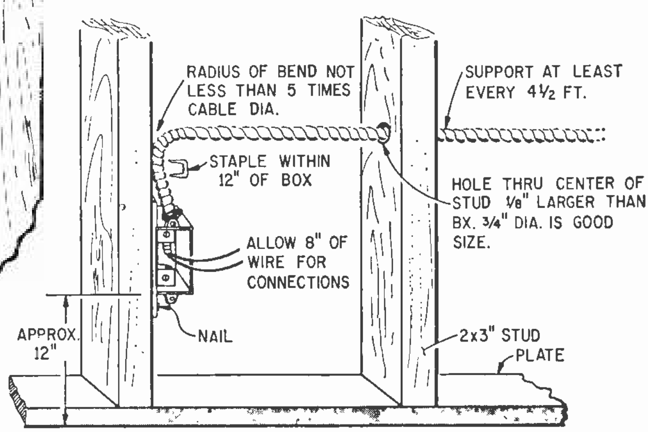


Last step is connection to circuit breaker. Wiring can't be live before; a safety step.

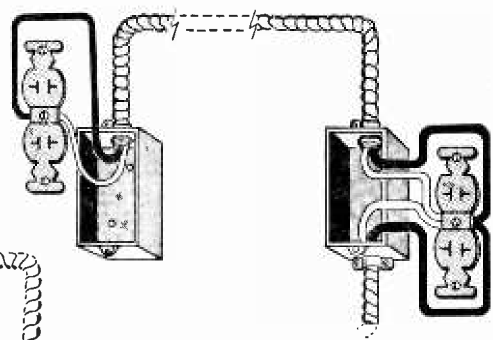


Cleats of 1 x 2-inch furring strip substitute for manufactured brackets, that are spot-welded at factory or attached with machine screws, to side or back of electrical boxes.

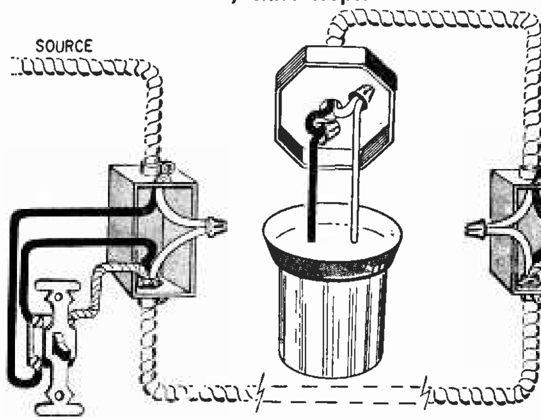
Hole for BX should not be a snug fit—it makes "pulling" cable difficult during installation and a nail (driven in after wall is closed) will not be able to penetrate cable that has freedom to move sideways. Do not drill hole close to surface.



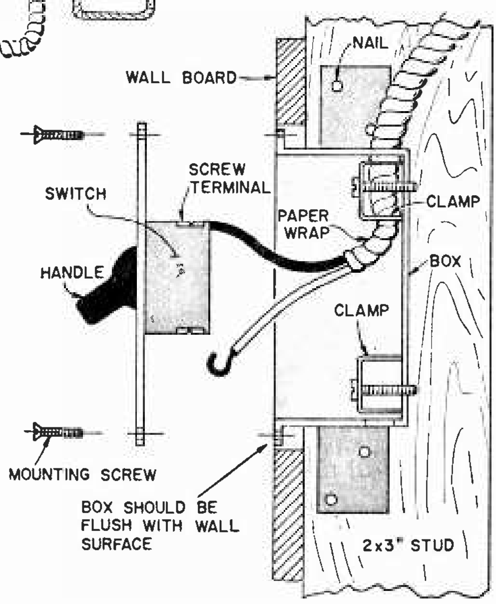
How you Add-A-Outlet depends on location of existing wiring and outlet boxes. The connections are simple. Running the cable through finished walls and ceilings can be a big problem.



Installing 3-way switch circuit adds real convenience to lighting rooms with two doorways or hallways from upstairs or down—saves many extra steps.



Machine screw tightens clamp to hold BX cable in Gem box—BX connectors are needed for square and round boxes that are used with BX or conduit (pipe) since these do not have built-in clamps of any sort.



Job Sequence.

Mark position of outlet boxes, ceiling hangers, junction boxes, switches.

Mount all boxes, hardware on their own or special brackets.

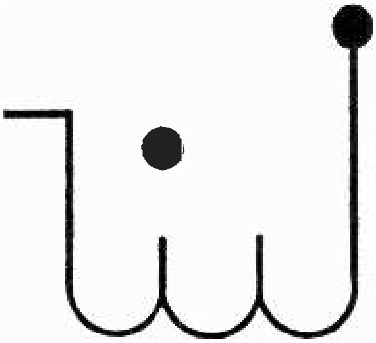
Install the cable from point to point.

Drill through studs, building members.

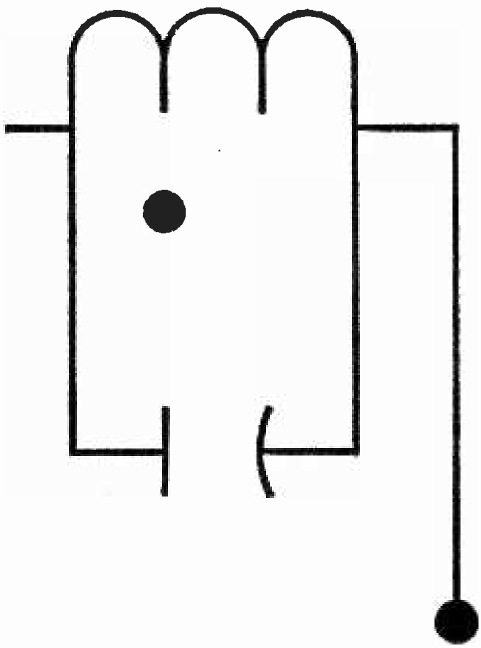
The standard technique of the building contractor is now to enclose the walls with paneling, plastering, etc., finish the floors and trim. For the do-it-yourselfer it might be advisable to skip the finishing step and do all the connecting of wires and outlets—temporarily hang ceiling fixtures and connect new circuit breakers or added fuses to activate the new wiring. This way you can test all your wiring and make any corrections *before* the walls go on.

Receptacles. Install at least one outlet for each 12-linear feet or major fraction of the perimeter side of the room. The outlets are generally placed one foot above the floor. Connect the wall receptacles to a *different* circuit (fuse or circuit breaker) than the overhead lights in the same room. Put the laundry equipment outlet on a separate circuit from the lights in the room.

Lighting. Furnish one circuit for the lighting fixtures of each 500-square feet of floor area. There is no limit to the number of overhead lights you can put in an area as long as you don't overload the fuse or circuit breaker. Just don't put in too few—you can always turn out unwanted ones—and not have to wish you had put in more. Most electrical codes require at least two 20-amp receptacle circuits each, for the laundry, kitchen, and dining-room area—and a separate lighting circuit. A separate 20-ampere circuit is recommended for every 500 square feet of floor space or a 15-amp circuit for every 375 square feet. Consider installing a separate connection for air conditioners, electric laundry dryers and electric heaters, rotisserie broilers or ironers—any appliance that draws more than 7½ to 10 amperes. ■



Oscillators: theory & practice



Take the output of an amplifier and connect it to its input and you have an oscillator—but there is more!

by Roy E. Nelson

■ The study of oscillators considers one of the most capricious-natured electronic circuits known to engineers, technicians and experimenters. "An amplifier oscillates and an oscillator amplifies," has been credited to anonymity but truly relates the oddity of this most important element of all audio and RF circuitry as we know it today.

To approach the very fundamental condition of oscillation we consider Fig. 1 in which a capacitance and an inductance are combined and to which we add, initially, electric or magnetic energy.

Suppose that capacitor C has been charged by some means. The energy stored in the capacitor is then $\frac{1}{2}CE^2$ where E is the maximum potential difference between the metallic plates of our capacitor. (E is in *volts* and the capacitance of C in *farads*.) When E is at its maximum value, the current in the circuit is zero. The presence of inductor L will allow the energy stored in the electric field of the capacitor to be transferred, and to form a magnetic field around the inductor.

As the capacitor discharges, E becomes zero and the current I becomes maximum. At the instant I is maximum, the energy in the magnetic field is $\frac{1}{2}LI^2$—all energy is stored in the magnetic field and none in the electrical field. (L is in *henrys* and I in *amperes*.)

The process now reverses, the magnetic field collapses and the energy is transferred back to the electric field of the capacitor. This process would repeat itself indefinitely if there was no loss of energy in the circuit.

Oscillators:

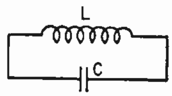


Fig. 1. Inductor L and capacitor C diagram the basic LC-tuned network.

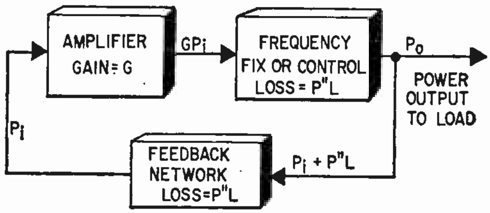


Fig. 2. The block diagram above shows one configuration of an oscillator. Feedback and frequency-control networks may be in either the input or output of the amplifier.

Since there is always some resistance associated with practical circuits and their elements, the amplitude of each successive oscillation will decrease until all of the stored energy is dissipated and the oscillations will cease.

While you have probably heard about transistor oscillators, vacuum-tube oscillators or tunnel-diode oscillators etc., these various classes (and they are as many as the active devices furnishing the gain necessary for the oscillation) tell us nothing about the nature of the oscillator.

The Basics. Fig. 1 illustrates the basic principles of oscillator function. At this point it will be helpful to examine some of the basic concepts of a sine-wave oscillator. Fig. 2 shows that an oscillator is composed of an amplifier (to provide power gain), a resonator or some device to fix the frequency of oscillation, and a feedback network to provide the reinforcing impulses (positive feedback) that create sustained oscillation. If this arrangement is to operate as a stable oscillator, the gain around the closed loop should be unity. If a gain greater than unity (one) exists, the output will decrease until the loop gain is reduced to unity, because of the limiting which occurs at high levels.

It can also be shown that the phase shift around the closed loop of Fig. 2 should be zero. Any phase shift, at the frequency of oscillation, will change the frequency a few cycles to a point where the phase shift is zero. These two conditions, of unity power gain and zero phase shift (around the loop) are known as *Barkenhausen criteria* for oscillations.

The circuit in Fig. 2 has a gain factor designated as G and the frequency-control element has a loss factor of P'_L and the feedback network has a loss factor of P''_L. When the gain G of the amplifier is greater than the combined loss of P'_L and P''_L, the P_i to the amplifier will cause it to oscillate and we will be able to utilize the output at P_o for whatever purpose our oscillator is intended.

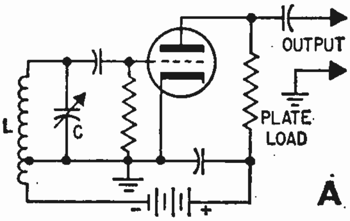
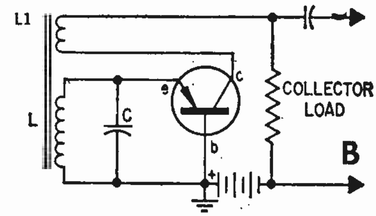


Fig. 3. In vacuum-tube oscillator (above) feedback is through induction by cathode current through bottom turns of inductor L. Common-base transistor circuit (below) has separate windings for emitter, collector circuits wound on same transformer core.



Hartley triode. Fig. 3A illustrates a Hartley oscillator in which the amplifying device is a triode. The frequency-controlling combination is *LC*—the feedback section is a part of L but not a part of the frequency controlling network. Bias requirements for the triode are set by the capacitor and resistor network indicated.

With proper voltage supplied by the battery, a sinusoidal signal will be present at the output points—the frequency set by the LC combination. The frequency will be stable if the frequency determining elements are maintained at a steady temperature. If the whole unit is encased in a metal box (with the temperature of the metal box remaining constant) and the battery voltage or power supply voltage is maintained at some constant value, the oscillator will remain as stable as any crystal-controlled oscillator.

Solid-state electronics (transistor circuitry), in Fig. 3B use the same controlling elements as the triode oscillator. The frequency-determining network is transformer winding L and capacitor C in the emitter circuit. They form the basic LC circuit of Fig. 1 and are the essentials of an oscillatory circuit.

By wiring the transistor as a common-base amplifier considerably more impedance (L1) is in the collector circuit than in the emitter circuit. Under these conditions the circuit is capable of *voltage gain.*

For *positive feedback,* the terminals of L1 must be connected to assure the transfer of positive feedback into the low impedance winding of L.

Semiconductors. Our prime concern in dealing with transistors is bias current rather than voltage, as is the case with vacuum tubes. With proper phasing of the two windings (L and L1), an induced current in the primary L can be made to flow in a forward direction. Unlike a vacuum tube, the transistor in an oscillator circuit will not necessarily see an unchanging average bias. This is because the circuit does not contain a bias capacitor as is necessary in the case of a triode vacuum-tube circuit.

When voltage is first applied, the base of the transistor is, for all practical purposes (through L) at the same potential as the emitter. At this instant, the collector current is I_{co} (which designates the *collector-cutoff current*). This current is relatively small but increases rapidly when voltage, by the battery, is first applied to the circuit. This current flows through L1 and induces a voltage in L. With the coils correctly phased, this induced voltage produces forward bias in the base-emitter circuit causing the collector current to increase from I_{co} to a slightly higher value.

This collector current increase raises the forward bias in the base circuit by the transformer action of L and L1, in turn, increasing the collector current. The collector current rises until the L and L1 transformer combination saturates and transformer action diminishes.

With the loss of transformer action the induced base-emitter current falls in intensity causing the collector current to diminish. As this current lessens in intensity, I_{co} is driven below its normal quiescent point. It quickly attempts to regain the original condition that existed when the voltage was first applied and the cycle begins again—at a frequency determined by LC. Resistor R is the collector load and the voltage drop across R is usable in some external circuit where sinusoidal waves are needed.

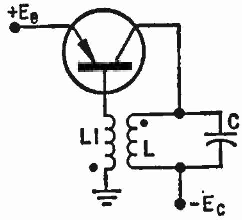


Fig. 5A. Coupling from feedback is between L and L1.

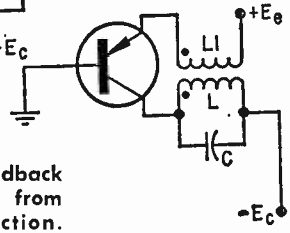


Fig. 5B. Feedback coupling is from L, L1 induction.

As is the case of the vacuum-tube oscillator circuit previously described, this audio-oscillator circuit is very stable if the voltage remains constant and the temperature of the oscillator components is maintained at a constant level. Fig. 4 illustrates, graphically, the action of this transistor oscillator.

Positive Feedback. Oscillators function in many ways—the feedback-path classes of oscillators are many. Basically they must have an external path to couple energy from the output to the input. Figs. 5A-5H give a number of circuits for transistor oscillators. All of the circuits use *pnp* transistors, but *npn* types are just as usable—changing the polarity of the voltage applied to maintain the proper bias potentials.

In Fig. 5A, the resonant circuit (LC) is in the collector and the feedback is obtained by transformer coupling from collector to base. The resonant circuit in 5B is again in the collector but the coupling is to the emitter. The transformer turns ratio in this circuit (Fig. 5B) for feedback must be greater than Fig. 5A since the input impedance of the emitter is considerably lower than the base impedance.

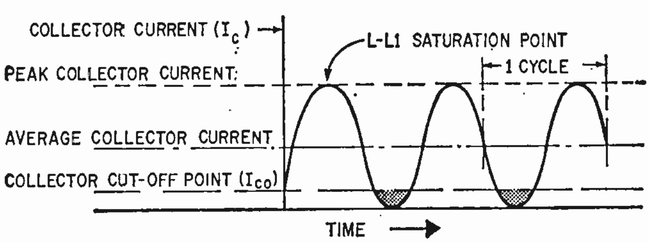


Fig. 4. Graph of the collector-current flow in circuit of Fig. 3.

Oscillators:

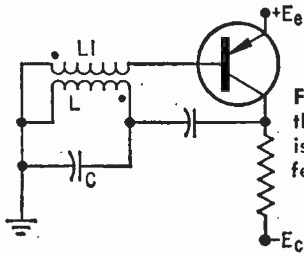
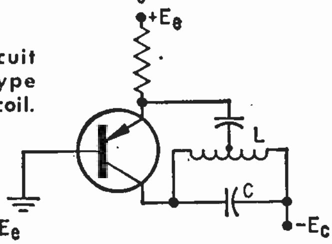


Fig. 5C. The DC through L and L1 is kept to just a few microamperes.

Fig. 5D. Circuit is Hartley type with tapped coil.



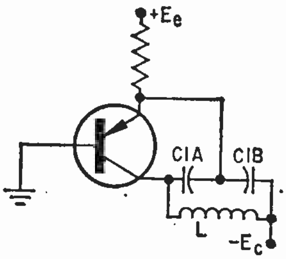


Fig. 5E. Colpitts circuit has series capacitors in LC.

Fig. 5C is basically the same as Fig. 5A except that the tank (LC) circuit is AC-coupled (shunt-fed) to the collector with a capacitor. The current in Fig. 5D can be compared to that in 5B. The autotransformer action of the tank circuit is used as the feedback circuit with capacitor C1 used to block DC between the collector and the emitter. Fig. 5E is similar to 5A and 5D except series capacitors are used, in place of a tapped inductor, to provide the feedback path.

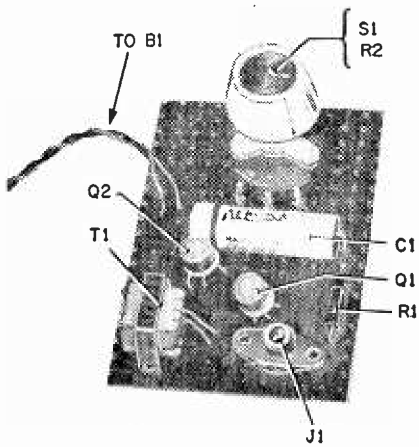
We have covered the requirements necessary for oscillation by defining, in both vacuum-tube and transistor circuitry, the component requirements and what these components do. To resolve the information presented thus far to elementary electronics theory we find that four prime factors are essential to oscillation:

Frequency Determining Network—It is necessary that an oscillator provide a self-sustained AC-voltage at a single frequency. Components must be selected to establish this frequency. In the oscillator circuits shown L and C are these determining elements.

Positive Feedback—A portion of the amplified oscillatory voltage must be returned to the frequency determining network to replace resistance and radiation losses.

Amplifier—An oscillator will not sustain its output without some form of amplification. This amplifier may be either a vacuum tube or transistor.

Automatic Bias—Proper components must be selected to establish bias that will allow for sustained oscillation at some definite level. It must allow the oscillations to start with ease and must adjust itself to maintain a constant amplitude of output signal.



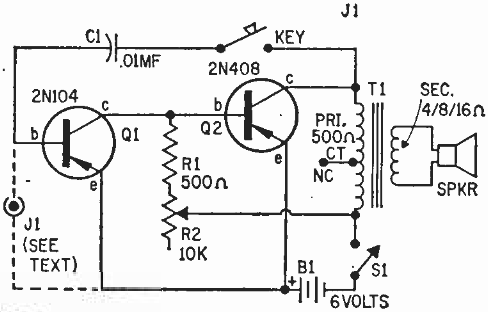


Fig. 6. Code-practice oscillator has standard parts. R2 controls volume. With key open, J1 can be used as an input to amplifier circuit.

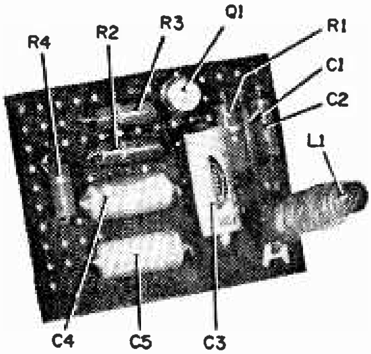
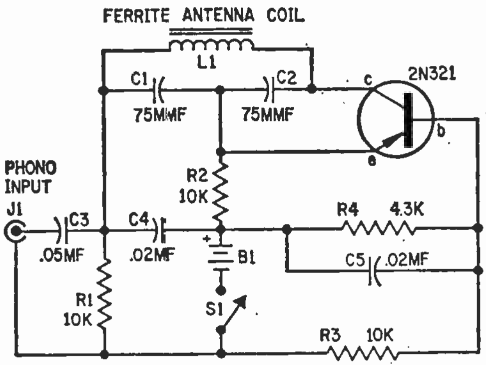


Fig. 7. Broadcaster is a phono oscillator modulated by a high-output phono cartridge. Carbon microphone or mike and preamp are needed for voice broadcasting to AM radio.



Code-Practice Oscillator. We will now consider certain specific types of oscillators and the many different applications these oscillators have in industry, the military and in our every-day life.

The schematic diagram in Fig. 6 illustrates, in a simple way, the basic statement that an oscillator amplifies and an amplifier oscillates. The connection between the collector of Q2 (through the key and capacitor C1) to the base of Q1 is the positive feedback of an oscillatory circuit. If the key and capacitor are removed and an input signal is supplied to J1 we will have an excellent two-stage audio amplifier. The volume is controlled in both cases, oscillator and amplifier, by potentiometer R2. This basic circuit, with certain refinements, is used as a preamplifier in many hi-fi sets.

Broadcaster. A wireless phonograph oscillator (Fig. 7) allows you to play records through your radio set without making any physical connection between the two units. The frequency is controlled by L1 and capacitors C1 and C2. It is a direct application of the basic circuit shown in Fig. 5E.

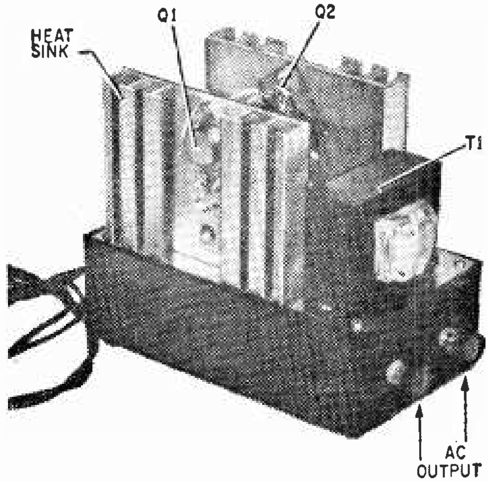
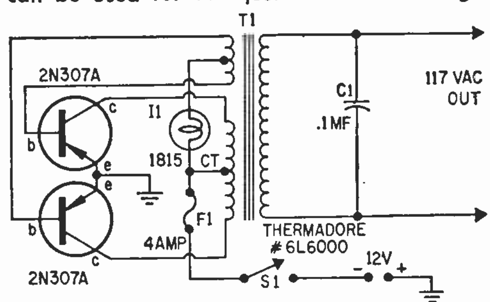


Fig. 8. Any standard inverter transformer can be used for T1—just watch the ratings.



The signals it generates can be picked up on any AM broadcast-band receiver. The antenna cannot be longer than ten feet to remain within the limitations imposed by the FCC for radiating devices.

DC Inverter. The oscillator in Fig. 8 has sufficient power output to transform the input power to a higher voltage to power some AC device such as a shaver, a small tape recorder, a radio or some other low-power appliance. Feedback—the coupling in the transformer—is introduced between the base and collector of the 2N307A's. The transistors must be mounted on a heat sink to dissipate the heat they generate.

If there is no output from the unit when it is turned on, reverse the two transformer leads to the base connections of the transistors. Be very sure that the transistors do not make any electrical connections to the metal chassis or the heat sink.

That's the basics of oscillators. Just because you've gotten this far it doesn't automatically make you an expert—but you now know more about oscillators than your friends (that haven't read as much about them as you have). ■

FIBER OPTICS

Dons Work Clothes

Tiny tube of glass threads peers inside of human body—and returns images in living color. Gives the doctor a gutsy look at what's wrong

■ Fiber optics are the spectacular new look for both industry and medicine. Although the principle has been known for a century the technique to manufacture fiber-optic tubes had not been developed until recently. Now industry and medicine have a pencil-thin tube that will let them see things that were never visible before.

Of course, the most promising aspect of fiber optics is that it allows viewing the inside of living organs—for research and diagnosis. For example, an experimental, but nonetheless alive, dog is anesthetized so that it does not feel the slim, semi-rigid tube (a catheter) being pushed through the artery in its neck . . . into its heart. Bending over the animal, the physician peers through an eyepiece and sees the rhythmic contraction and relaxation of a living heart, *seen from the inside without major surgery.*

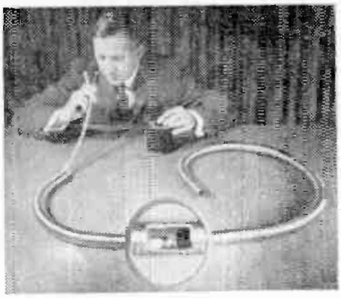
Inside the 21-inch-long tube, in a diameter half that of a cigarette, are packed 76,000 thread-like glass fibers, in two concentric bundles. The outer bundle carried light into the heart, while the thousands of fibers in the inner bundle brought back a mosaic of light and dark spots that merged into a clear image of the throbbing heart.

The instrument, which was developed by Dr. Walter J. Gamble, is one of a new generation of medical tools that is giving physicians unprecedentedly vivid glimpses of the inside of the living body. Instruments such as these take advantage of a law of optics that allows thin fibers of glass to carry beams of light the way pipes carry water—around corners or even through loops. Already very valuable for diagnosis, the fiber-optics principle also offers hope for better treatment of several conditions. And working with the American Optical Company Dr. Gamble is developing a still further improved fiber optics instrument that may be used on human heart patients.

Because the field is so new most of the work still is classified as experimental. But some fiber-optics instruments are in doctors' offices already. One is a new gastroscope—used by doctors to examine the stomach and neighboring parts of the digestive tract for possible ulcers or growths. It was developed jointly by Dr. Basil I. Hirschowitz (of the University of Alabama) and American Cystoscope Makers, Inc.

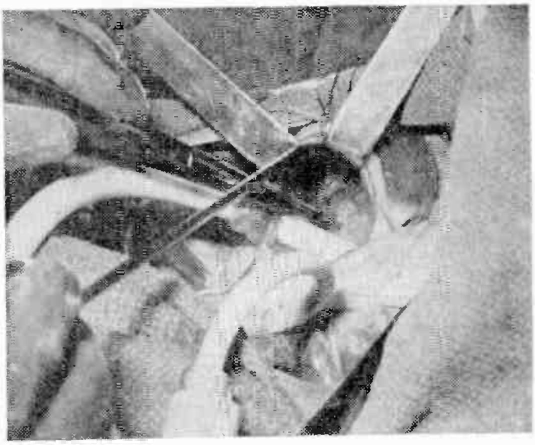
A sharp contrast to the inflexible, clumsy tube of the conventional gastroscope with its complicated system of 60 lenses, the Hirschowitz Fiberscope is slender, flexible and simple, using only four lenses. Gone is the discomfort—"Like swallowing a sword," one

Technician looks into end of fiber-optic tube which is inserted into metal coil. He can see flaws anywhere along inside of coil. Tube easily curves and can follow the coil's hidden, internal surface.



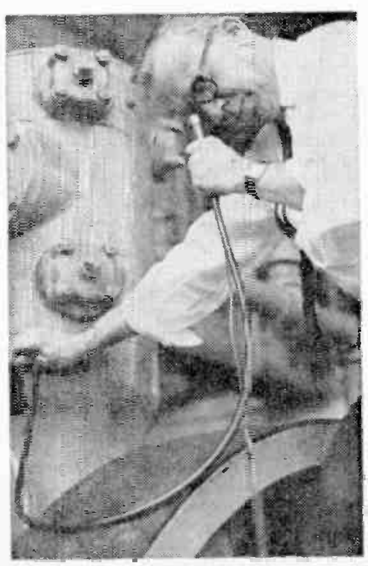
Saying "Ahhh" is easier with thin optic tube attached to dentist drill for light.

No shadows or heat will mar this delicate open-heart operation. Cool light from small fiber-optic tubes is concentrated by surgeon in precise area.



Below, model of heart and light-source unit. Tube illuminates inside of heart and reflects image back to a viewing lens held in the hand.

Auto mechanic looks inside of ailing gas tank with fiber-optic tube. Much safer than a match. Application points up value of tube in industry where inaccessible areas must be examined to head off equipment breakdown.



Peering into eyepiece of fiber-optic tube, technician is actually viewing the inside of a generator. Curving tube doesn't bother light waves one bit. They flow like water inside a garden hose.

FIBER OPTICS

doctor said of the old instrument—and the danger of damaging delicate tissues by setting off a flashbulb inside the stomach to take a picture for later study. The Fiberscope has its light on the outside, and the illumination is good enough for motion pictures. Gone, too, are the blind spots caused by the conventional gastroscope's rigidity.

Working with the 'Children's Hospital Medical Center in Boston, Dr. Gamble has used another fiber optics instrument to measure oxygen content of the blood in heart patients. Surgeons need this information to measure the seriousness of heart defects that allow oxygen-poor blood to seep through faulty heart valves or holes in the heart walls. In his tests, Dr. Gamble has found that fiber optics avoids the disadvantages of other methods of determining oxygen content.

After a fiber-optics tube goes into the heart, brief pulses of light are flashed through it. By analyzing the light that comes back, an accurate blood-oxygen content reading is obtained, up to 20 times faster than some methods, and without the continuous withdrawal of blood samples that other methods require.

In a variation on the technique, Dr. Gamble adds a dye to the blood stream to measure the heart's blood-pumping capacity. His aim is the long-sought goal of heart surgeons; instantaneous measurement of heart pumping capacity. Also, in open heart operations, fiber-optics tubes can focus light directly on the area the surgeon is working on. This is a great advantage because overhead lights are often obstructed by people or instruments. Lights close to the spot are sometimes cumbersome, and they give off heat which might cause complications. Fiber optics tubes, which draw their light from distant sources, cause no heat problems.

One of the most productive fiber optics inventors is Narinder S. Kapany, a turban-wearing native of India who works now in Palo Alto, California. Kapany is working closely with doctors at Stanford University on several fiber optics instruments for internal examinations. He's already worked out two other devices, a hypodermic microscope that uses fiber optics to examine tiny blood vessels, and an experimental fiber optics image intensifier that permits a manyfold reduction of X-ray exposure with no loss in clarity of X-ray films.

Kapany is working on a fiber-optics device that would be inserted in a patient's artery to monitor the blood stream, sending out data that would keep doctors constantly informed about the patient's condition for diagnosis or treatment. Kapany says this development 'is on the threshold.'

All fiber-optics instruments have their origin in the phenomenon of refraction—the bending of a beam of light at the boundary between materials of different densities. If light hits the boundary at a sufficiently shallow angle, it never crosses, but is reflected back. This is what happens in the fiber-optics instruments: light ricochets down the

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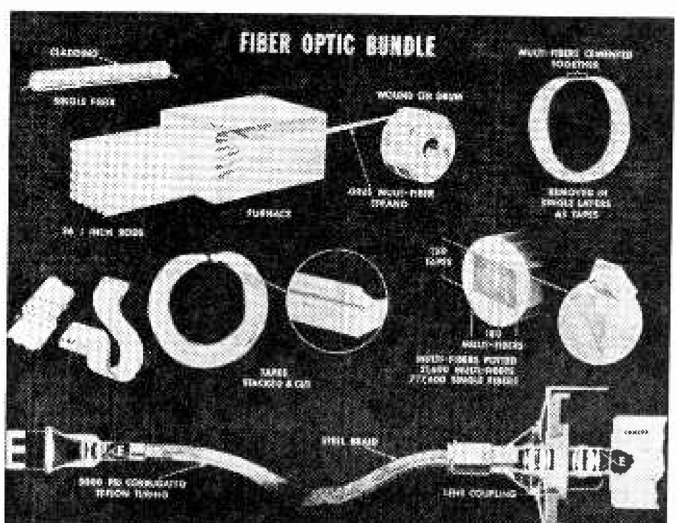

Fiber-optic tube begins life as thick glass rods (top left) which are drawn out of furnace as thin strands wound on drum. They're cemented, then stacked as tapes. Middle row shows how individual strands occur in mosaic layout. By traveling through individual fiber, light ray won't get jumbled, but continuously reflects around curves. Along bottom row is the complete system and how it would reproduce an image, represented by the letter "E" at the left.

David Sarnoff

Continued from page 42

After less than an hour, Sarnoff was convinced Zworykin's idea of a tube could be the answer to electronic television, and invested $50,000 000 in the new development before he could sell a single set.

As one associate who was close to him then said, "Everyone told Sarnoff television would never be possible. It was simply too complicated for the state of the art at that time." But as this person described it, Sarnoff paid no attention to his detractors, simply "looked up over the trees," kept on going until television, the impossible, became a reality.

Others. While the ultimate fulfillment of television was probably his greatest achievement, there were others too numerous to mention in a single article, for engineers under his dynamic leadership developed products that affected almost every area of living.

Walkie-talkies were a Sarnoff pet as was electronic air conditioning and electronic tape. He simply suggested his engineers present them as presents, for as he said, he had more faith in their abilities to create new products than they had in themselves.

For in the years serving as general manager, to chief executive, Sarnoff leadership brought a host of developments. RCA introduced the first AC operated superheterodyne radio receiver (Radiola 60), the forerunner of today's hi-fi components, (Model 104 and 104 included power amplifiers and loudspeakers), and the ancestors of today's packaged electronic circuits.

Record Player. Shortly before World War II, RCA introduced an automatic record player which played both sides of a record without turning it over. Its special tone arm had a two-headed pick-up which played the top of the record and then the bottom.

RCA, besides being an innovator, sticks to its guns when it visualizes a future potential. For example, the company made a success out of its 45-rpm phonograph record. After having develcped a clever and simple record changer plus a new kind of record to be played on it, CBS got to the market first with the 33⅓ rpm LP record. For a while it looked like RCA would give up the 45-rpm LP record which was not really new, but an improvement over Edison's long-playing record which had been shown for decades at the Edison museum. Today the record companies produce both kinds, for each fill a certain need.

In the industrial fields, RCA introduced bottle inspection machines which detect foreign particles in liquids, the electron microscope, blood analysis devices, and vehicle detectors for use in traffic signal control systems. More than ten years ago, RCA demonstrated driverless cars which could be operated safely on busy highways, developed an electronic highway that would make accidents a thing of the past.

There is hardly an application of electronics RCA has not explored. In some areas, it is undisputed leader, but it certainly does not monopolize the industry. In the land mobile two-way radio field, RCA is in third place, behind Motorola and GE. IBM is way out in front in the computer field.

Other Areas. In other areas, RCA bought the Marconi Institute from the United Wireless Telegraph Company, formed the Radio Institutes of America in 1919, where Sarnoff taught as one of its first chief instructors. Today RCA Institute ranks on the technical educational level as M. I. T. ranks tops training engineering and scientific talent.

In 1926, Sarnoff founded the first national broadcasting network, added to programming such names as Dr. Walter Damrosch, and the famed Yale President Dr. James Rowland Angell as educational counsellor at the time. Not satisfied even then, he sent his musical conductor to Italy to woo back to the United States the then retired

(Concluded overleaf)

An Editorial Note

The whole David Sarnoff story cannot be told in one magazine article, nor is it to be found in Sarnoff's recently published biography (See page 21). There is much, much more, particularly about the achievements of RCA scientists and engineers hand picked by Sarnoff or by executives under his leadership that cannot be told here because of lack of space. We are indebted to Leo G. Sands and K. C. Kirkbride for contributing their research and writing efforts to the preparation of this article and we pray the editorial preparation of text and photographs will do proper justice and praise to the man who put America *"On the air."*

Julian M. Sienkiewicz, Editor

DAVID SARNOFF'S CAREER WITH RCA

1906—Entered the employ of the Marconi Wireless Telegraph Company of America as office boy (September 30).
1907—Junior Telegraph Operator, Marconi Company.
1908—Wireless Operator at Marconi Station, Siasconset, Nantucket Island, Mass.
1909—Manager, Marconi Station, Sea Gate, New York.
1910-1911—Ship Wireless Operator.
1911-1912—Wireless Operator at Marconi Station, John Wanamaker Store, New York City.
1912—Radio Inspector for Marconi Company, and Instructor, Marconi Institute.
1913—Chief Radio Inspector and Assistant Chief Engineer, Marconi Company.
1914—Contract Manager, Marconi Company.
1915-1916—Assistant Traffic Manager, Marconi Company.
1917-1919—Commercial Manager, Marconi Company.
1919-1920—General Manager, Radio Corporation of America, which absorbed Marconi Company.
1921—General Manager, RCA (April 29).
1922—Vice President and General Manager, Radio Corporation of America (September 8).
1927—Elected Member of the Board of Radio Corporation of America (December 16).
1929—Elected Executive Vice President, Radio Corporation of America (January 1).
1930—Elected President of RCA (January 3).
1947—Elected Chairman of the Board of Directors and Chief Executive Officer of the Radio Corporation of America (July 11).
1966—Relinquished his role as Chief Executive Officer, retaining active Chairmanship of the Board of Directors.

Maestro Arturo Toscanini to conduct the newly formed NBC Symphony Orchestra.

Color. But as these early broadcasting efforts and television programming efforts matured, Sarnoff began to see visions of telecasting in color. Others were willing to settle for a mechanical television but not Sarnoff. The electronic color tube could be perfected he said, and he saw that it was. Not only perfected, but finally accepted.

It may have been this propensity for winning that earned acclaim from General Dwight Eisenhower who on November 21, 1944, nominated him for promotion from Colonel in the Signal Corps to Brigadier General. The Army General cited him for his contribution to communications of historic D Day. President Franklin D. Roosevelt awarded him the Legion of Merit for military services and he has been awarded numerous honorary doctor's degrees by colleges and universities.

One Loss. But Sarnoff will be the first one to admit he didn't always win. On April 5, 1955, he presented to President Eisenhower, a "program for political offensive against world communism," in which he urged we "win the cold war as the surest way to prevent hot war." His proposals attracted international attention, and teamed with Senator Karl Mundt's proposals for a Freedom Academy, a school to teach psychological warfare, might have saved us troubles today, if they had been thoroughly carried out.

More Boxes. Sarnoff is not a man to think of the past. He sees a future ahead full of many more "music boxes." From where he sits in his 53rd floor office in the 70-story RCA Building, guiding a two-billion-dollar company that produces giant brains, huge radars to track missiles, satellites that photograph the moon, he sees still another communication explosion ahead.

One so fantastic we will speak to anyone anywhere in the world, an international television network telecasting in color to every home in the world. And electronic medicine advances that will lengthen the lifespan of man, perhaps to a century. As he says with a broad smile, "This ancient world of ours is stirring with change." ■

"His folks have color TV, that's why . . ."

WHITE'S RADIO LOG

Volume 46, No. 1

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

In this issue of *White's Radio Log* we have included the following listings: U.S. AM Stations by Frequency, Canadian AM Stations by Frequency, U.S. Commercial Television Stations by States, U.S. Educational Television Stations by States, Canadian Television Stations by Cities, and the World-Wide Short-Wave Stations.

In Our Next Issue. October-November 1966, the *Log* will contain 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 Short-Wave Section. The short-wave listings will always be completely revised in each issue of *Log* to insure 100 percent up-to-date information.

In the DECEMBER-JANUARY 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.

Therefore, in any three consecutive 1966 issues of RADIO-TV EXPERIMENTER magazines, you will have a complete cross-reference listings of *White's Radio Log* that is always up-to-date. The three consecutive issues are a complete volume of *White's Radio Log* that offers up to the minute listings 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 the new *White's Radio Log* format an unbeatable reference. □

QUICK REFERENCE INDEX

WHITE'S RADIO LOG

U.S. AM Stations by Frequency

U. S. stations listed alphabetically by states within groups. Abbreviations: Kc., frequency in kilocycles; W.P., power in watts; d, operates daytime only; n, operates nighttime only. Wave length is given in meters.

Kc.	Wave Length	W.P.
540—555.5		
KVIP	Redding, Calif.	5000d
KFMB	San Diego, Calif.	5000
WGTO	Cypress Gardens, Fla.	50000d
WDAK	Columbus, Ga.	5000
KBRV	Soda Springs, Idaho	500d
KWMT	Ft. Dodge, Iowa	5000d
KNOE	Monroe, La.	5000
WDMV	Pocomoke City, Md.	500d
WBIC	Islip, N.Y.	250d
WETC	Wendell-Zebulon, N.C.	250d
WARO	Canonsburg, Pa.	250d
WYNN	Florence, S.C.	250d
WDXN	Clarksville, Tenn.	1000d
WRIC	Richlands, Va.	1000d
WYLO	Jackson, Wis.	250
550—545.1		
KENI	Anchorage, Alaska	5000
KOY	Phoenix, Ariz.	5000
KAFY	Bakersfield, Calif.	1000
KRAI	Craig, Colo.	1000
WAYR	Orange Park, Fla.	1000d
WGGA	Gainesville, Ga.	5000
KMVI	Wailuku, Hawaii	1000
KFRM	Salina, Kans.	5000d
WCBI	Columbus, Miss.	1000
KSD	St. Louis, Mo.	5000
KBOW	Butte, Mont.	1000
WGR	Buffalo, N.Y.	5000
WDBM	Statesville, N.C.	500d
KFYR	Bismarck, N.Dak.	5000
WKRC	Cincinnati, Ohio	5000
KOAC	Corvallis, Oreg.	5000
WHLM	Bloomsburg, Pa.	1000
WPAB	Ponce, P.R.	5000
WXTR	Pawtucket, R.I.	1000
KCRS	Midland, Tex.	5000
KTSA	San Antonio, Tex.	5000
WDEV	Waterbury, Vt.	5000
WSVA	Harrisonburg, Va.	5000
WSAU	Wausau, Wis.	5000
560—535.4		
WOOF	Dothan, Ala.	5000d
KYUM	Yuma, Ariz.	1000
KSFO	San Fran., Calif.	5000
KLZ	Denver, Colo.	5000
WQAM	Miami, Fla.	5000
WIND	Chicago, Ill.	5000
WMIK	Middlesboro, Ky.	500d
WGAN	Portland, Maine	5000
WFRB	Frostburg, Md.	1000
WHYN	Springfield, Mass.	5000
WQTE	Monroe, Mich.	500d
WEBC	Duluth, Minn.	5000
KWTO	Springfield, Mo.	5000
KMON	Great Falls, Mont.	5000
WGAI	Elizabeth City, N.C.	1000
WFIL	Philadelphia, Pa.	5000
WIS	Columbia, S.C.	5000
WHBQ	Memphis, Tenn.	5000
KLVI	Beaumont, Tex.	5000
KPQ	Wenatchee, Wash.	5000
WJLS	Beckley, W.Va.	5000
570—526.0		
WAAX	Gadsden, Ala.	5000
KCNO	Alturas, Calif.	5000
KLAC	Los Angeles, Calif.	5000
WGMS	Washington, D.C.	5000
WFSO	Pinellas Park, Fla.	500d
WACL	Waycross, Ga.	5000
WKYX	Paducah, Ky.	1000
WVMI	Biloxi, Miss.	1000d
KGRT	Las Cruces, N.Mex.	5000d
WMCA	New York, N.Y.	5000
WSYR	Syracuse, N.Y.	5000
WWNC	Asheville, N.C.	5000
WLLE	Raleigh, N.C.	500d
WKBN	Youngstown, Ohio	5000
WNAX	Yankton, S.Dak.	5000
WFAA	Dallas, Tex.	5000
WBAP	Ft. Worth, Tex.	5000
KLUB	Salt Lake City, Utah	5000
KVI	Seattle, Wash.	5000
WMAM	Marinette, Wis.	5000
580—516.9		
WABT	Tuskegee, Ala.	500d
KTAN	Tucson, Ariz.	5000
KMJ	Fresno, Calif.	5000
KUBC	Montrose, Colo.	5000
WDBO	Orlando, Fla.	5000
WGAC	Augusta, Ga.	5000
KFXD	Nampa, Idaho	5000
WILL	Urbana, Ill.	5000d
KSAC	Manhattan, Kans.	5000
WIBW	Topeka, Kans.	5000
KALB	Alexandria, La.	5000
WTAG	Worcester, Mass.	5000
WELO	Tupelo, Miss.	1000
KANA	Anaconda, Mont.	1000
WAGR	Lumberton, N.C.	500
KWIN	Ashland, Oreg.	1000
WHP	Harrisburg, Pa.	5000
WKAQ	San Juan, P.R.	5000
KOBH	Hot Springs, S.Dak.	500d
WRKH	Rockwood, Tenn.	1000d
KDAV	Lubbock, Tex.	500d
WLES	Lawrenceville, Va.	500d
WCHS	Charleston, W.Va.	5000
WKTY	LaCrosse, Wis.	5000
590—508.2		
KHAR	Anchorage, Alaska	5000
WRAG	Carrollton, Ala.	1000d
KBHS	Hot Springs, Ark.	5000d
KFXM	San Bernardino, Cal.	1000
KTHO	Tahoe Valley, Calif.	1000d
KCSJ	Pueblo, Colo.	1000
WDLP	Panama City, Fla.	1000
WPLO	Atlanta, Ga.	5000
KGMB	Honolulu, Hawaii	5000
KID	Idaho Falls, Idaho	5000
WRTH	Wood River, Ill.	1000
WVLK	Lexington, Ky.	5000
WEEI	Boston, Mass.	5000
WKZO	Kalamazoo, Mich.	5000
KGLE	Glendive, Mont.	500d
WOW	Omaha, Nebr.	5000
WROW	Albany, N.Y.	5000
WGTM	Wilson, N.C.	5000
KUGN	Eugene, Oreg.	5000
WARM	Scranton, Pa.	5000
WMBS	Uniontown, Pa.	1000
KTBC	Austin, Tex.	5000
KSUB	Cedar City, Utah	1000
WLVA	Lynchburg, Va.	1000
KHQ	Spokane, Wash.	5000
600—499.7		
WIRB	Enterprise, Ala.	1000
KCLS	Flagstaff, Ariz.	5000
KVCV	Redding, Calif.	1000
KOGO	San Diego, Calif.	5000
KZIX	Ft. Collins, Colo.	1000d
WICC	Bridgeport, Conn.	5000
WPDQ	Jacksonville, Fla.	5000
WMT	Cedar Rapids, Iowa	5000
WWOM	New Orleans, La.	1000d
WFST	Caribou, Maine	5000d
WCAO	Baltimore, Md.	5000
WLST	Escanaba, Mich.	1000d
WTAC	Flint, Mich.	1000
KGEZ	Kalispell, Mont.	1000
WCVP	Murphy, N.C.	1000d
WSJS	Winston-Salem, N.C.	5000
KSJB	Jamestown, N.D.	5000
WSOM	Salem, Ohio	500d
WFRM	Coudersport, Pa.	1000d
WAEL	Mayaguez, P.R.	1000
WREC	Memphis, Tenn.	5000
KROD	El Paso, Tex.	5000
KERB	Kermit, Tex.	1000d
KTBB	Tyler, Tex.	1000
610—491.5		
WSGN	Birmingham, Ala.	5000
KFAR	Fairbanks, Alaska	5000
KAVL	Lancaster, Calif.	1000
KFRC	San Francisco, Calif.	5000
WTOR	Torrington, Conn.	250
WIOD	Miami, Fla.	5000
WMEL	Pensacola, Fla.	500d
WCEH	Hawkinsville, Ga.	500d
KUAM	Agana, Guam	1000
WRUS	Russellville, Ky.	500d
KDAL	Duluth, Minn.	5000
WDAF	Kansas City, Mo.	5000
KOJM	Havre, Mont.	1000
KCSR	Chadron, Nebr.	1000d
WGIR	Manchester, N.H.	5000
KGGM	Albuquerque, N.Mex.	5000
WAYS	Charlotte, N.C.	5000
WTVN	Columbus, Ohio	5000
WIP	Philadelphia, Pa.	5000
KILT	Houston, Tex.	5000
KVNU	Logan, Utah	5000
WSLS	Roanoke, Va.	5000
WHPL	Winchester, Va.	500
KEPR	Kennewick-Richmond-Pasco, Wash.	5000
620—483.6		
KTAR	Phoenix, Ariz.	5000
KNGS	Hanford, Calif.	1000
KWSD	Mt. Shasta, Calif.	1000d
KSTR	Grand Junction, Colo.	5000d
WSUN	St. Petersburg, Fla.	5000
WTRP	LaGrange, Ga.	1000d
KWAL	Wallace, Idaho	1000
KMNS	Sioux City, Iowa	1000
WTMT	Louisville, Ky.	500d
WLBZ	Bangor, Maine	5000
WJDX	Jackson, Miss.	5000
WVNJ	Newark, N.J.	5000
WHEN	Syracuse, N.Y.	5000
WDNC	Durham, N.C.	5000
KGW	Portland, Oreg.	5000
WHJB	Greensburg, Pa.	1000
WCAY	Cayce, S.C.	500d
WATE	Knoxville, Tenn.	5000
KWFT	Wichita Falls, Tex.	5000
WVMT	Burlington, Vt.	5000
WWNR	Beckley, W.Va.	1000
WTMJ	Milwaukee, Wis.	5000
630—475.9		
WAVU	Albertville, Ala.	1000d
WJDB	Thomasville, Ala.	1000d
KJNO	Juneau, Alaska	1000
KVMA	Magnolia, Ark.	1000d
KIDD	Monterey, Calif.	1000
KHOW	Denver, Colo.	5000
WMAL	Washington, D.C.	5000
WSAV	Savannah, Ga.	5000
WNEG	Toccoa, Ga.	500d
KIDO	Boise, Idaho	5000
WLAP	Lexington, Ky.	5000
KTIB	Thibodaux, La.	500d
WJMS	Ironwood, Mich.	1000
KDWB	So. St. Paul, Minn.	5000
KXOK	St. Louis, Mo.	5000
KGVW	Belgrade, Mont.	1000d
KOH	Reno, Nev.	5000
KLEA	Lovington, N.Mex.	500d
WIRC	Hickory, N.C.	1000d
WMFD	Wilmington, N.C.	1000
KWRO	Coquille, Oreg.	5000d
WEJL	Scranton, Pa.	500d
WKYN	San Juan, P.R.	5000
WPRO	Providence, R.I.	5000
KMAC	San Antonio, Tex.	5000
KSXX	Salt Lake City, Utah	1000d
KGDN	Edmunds, Wash.	5000d
KZUN	Opportunity, Wash.	500d
640—468.5		
KFI	Los Angeles, Calif.	50000
WOI	Ames, Iowa	5000d
WHLO	Akron, O.	1000d
WNAD	Norman, Okla.	1000d
650—461.3		
KORL	Honolulu, Hawaii	10000
WSM	Nashville, Tenn.	50000
KIKK	Pasadena, Texas	250d
660—454.3		
KFAR	Fairbanks, Alaska	10000
KOWH	Omaha, Neb.	500d
WNBC	New York, N.Y.	50000
WESC	Greenville, S.C.	10000d
KSKY	Dallas, Tex.	1000
670—447.5		
KBOI	Boise, Ida.	50000
WMAQ	Chicago, Ill.	50000
KNBR	San Fran., Calif.	50000
680—440.9		
KNBR	San Francisco, Cal.	50000
WPIN	St. Petersburg, Fla.	1000d
WATY	N. Atlanta, Ga.	5000
WCTT	Corbin, Ky.	1000
WCBM	Baltimore, Md.	10000
WNAC	Boston, Mass.	50000
WDBC	Escanaba, Mich.	10000
KFEQ	St. Joseph, Mo.	5000
WINR	Binghamton, N.Y.	1000
WNYR	Rochester, N.Y.	250
WPTF	Raleigh, N.C.	50000
WISR	Butler, Pa.	250d
WAPA	San Juan, P.Rico.	10000
WMPS	Memphis, Tenn.	10000
KBAT	San Antonio, Tex.	50000
KOMW	Omak, Wash.	1000d
WCAW	Charleston, W.Va.	10000d
690—434.5		
WVOK	Birmingham, Ala.	50000d
KEOS	Flagstaff, Ariz.	1000
KEVT	Tucson, Ariz.	250d
KBBA	Benton, Ark.	250d
KAPI	Pueblo, Colo.	250d
WADS	Ansonia, Conn.	500d
WAPE	Jacksonville, Fla.	50000
KULA	Honolulu, Hawaii	10000
KBLI	Blackfoot, Idaho	1000d
KGGF	Coffeyville, Kans.	10000
WTIX	New Orleans, La.	5000
KTCR	Minneapolis, Minn.	500d
KSTL	St. Louis, Mo.	1000d
KEYR	Terrytown, Nebr.	1000d
KRCO	Prineville, Oreg.	1000d
WXUR	Media, Pa.	500d
KUSD	Vermillion, S.Dak.	1000d
KHEY	El Paso, Tex.	10000
KPET	Lamesa, Tex.	250
KZEY	Tyler, Tex.	5000
WCYB	Bristol, Va.	10000d
WNNT	Warsaw, Va.	250d
WELD	Fisher, W.Va.	500d
700—428.3		
WLW	Cincinnati, Ohio	50000
710—422.3		
WKRG	Mobile, Ala.	1000
KMPC	Los Angeles, Calif.	50000
KBTR	Denver, Colo.	5000
WGBS	Miami, Fla.	50000
WUFF	Eastman, Ga.	1000d
WROM	Rome, Ga.	1000d
KEEL	Shreveport, La.	50000
WHB	Kansas City, Mo.	10000
WOR	New York, N.Y.	50000
DZRH	Manila, P.I.	10000
WKJB	Mayaguez, P.Rico	1000
WTPR	Paris, Tenn.	250d
KGNC	Amarillo, Tex.	10000
KURV	Edinburg, Tex.	250
KIRO	Seattle, Wash.	50000
WDSM	Superior, Wis.	5000
720—416.4		
KUAI	Eleele, Hawaii	5000
WGN	Chicago, Ill.	50000
730—410.7		
WJMW	Athens, Ala.	1000
KSUD	W. Memphis, Ark.	250d
WLOR	Thomasville, Ga.	5000d
KLOE	Goodland, Kans.	1000d
WFMW	Madisonville, Ky	500
WMTC	Van Cleve, Ky.	1000d
KTRY	Bastrop, La.	250d
WARB	Covington, La.	250d
WJTO	Bath, Maine	1000d
WACE	Chicopee, Mass.	5000d
WVIC	E. Lansing, Mich.	500
KWRE	Warrenton, Mo.	1000d
KWOA	Worthington, Minn.	1000d
KURL	Billings, Mont.	500d
KVOD	Albuquerque, N.Mex.	1000d
WDOS	Oneonta, N.Y.	1000d
WFMC	Goldsboro, N.C.	1000d
WOHS	Shelby, N.C.	1000d
WMGS	Bowling Green, Ohio	1000d
KBOY	Medford, Oreg.	1000d
WNAK	Nanticoke, Pa.	1000d
WPIT	Pittsburgh, Pa.	5000d
WPAL	Charleston, S.C.	1000d
WLIL	Lenoir, Tenn.	1000d
KPCN	Grand Prairie, Tex.	500d
KSVN	Ogden, Utah	1000d
WPIK	Alexandria, Va.	5000d
WMNA	Gretna, Va.	1000d
KULE	Ephrata, Wash.	1000d
WXMT	Merrill, Wis.	1000d

Kc. Wave Length W.P.

740—405.2
WBAM Montgomery, Ala. 50000d
KUEQ Phoenix, Ariz. 1000d
KBIG Avalon, Cal. 10000d
KCBS San Francisco, Calif. 50000
KSSS Colo. Springs, Colo. 1000
KVFC Cortez, Colo. 1000d
WSBR Boca Raton, Fla. 1000
WKMK Blountston, Fla. 1000d
WKIS Orlando, Fla. 5000
KYME Boise, Idaho 500d
WVLN Olney, Ill. 1000d
KBOE Oskaloosa, Iowa 250d
WYHR Cambridge, Mass. 250d
KPBM Carlsbad, N.Mex. 1000d
WGSM Huntington, N.Y. 5000d
WMBL Morehead City, N.C. 1000d
WPAQ Mount Airy, N.C. 10000d
KRMG Tulsa, Okla. 50000
WVCH Chester, Pa. 1000d
WIAC San Juan, P.Rico 10000
WBAW Barnwell, S.C. 1000d
WIRJ Humbolt, Tenn. 250d
WJIG Tullahoma, Tenn. 250d
KTRH Houston, Tex. 50000
KCMC Texarkana, Tex. 1000
WBCI Williamsburg, Va. 500d

750—399.8
KFQD Anchorage, Alaska 10000
WSB Atlanta, Ga. 50000
WBMD Baltimore, Md. 1000d
KMMJ Grand Island, Neb. 10000d
WHEB Portsmouth, N.H. 1000d
KSEO Durant, Okla. 250d
KXL Portland, Oreg. 50000
WPOX Clarksburg, W.Va. 1000d
WHA Madison, Wis. 5000d

760—394.5
KFMB San Diego, Cal. 5000
KGU Honolulu, Hawaii 10000
WJR Detroit, Mich. 50000
WCPS Tarboro, N.C. 1000d
WORA Mayaguez, P.R. 5000

770—389.4
KUOM Minneapolis, Minn. 5000d
WCAL Northfield, Minn. 5000d
WEW St. Louis, Mo. 1000d
KOB Albuquerque, N.Mex. 50000
WABC New York, N.Y. 50000
KXA Seattle, Wash. 1000

780—384.4
WBBM Chicago, Ill. 50000
WJAG Norfolk, Neb. 1000d
WCKB Dunn, N.C. 1000d
WBBO Forest City, N.C. 1000d
KSPI Stillwater, Okla. 250d
WAVA Arlington, Va. 1000d

790—379.5
WTUG Tuscaloosa, Ala. 1000d
KCAM Glennallen, Alaska 5000
KCEE Tucson, Ariz. 5000d
KOSY Texarkana, Ark. 1000
KDAN Eureka, Calif. 5000d
KABC Los Angeles, Calif. 5000
WLBE Leesburg, Fla. 5000
WFUN Miami Beach, Fla. 5000
WYNR Brunswick, Ga. 500d
WGRA Cairo, Ga. 1000d
KONA Kealakekua, Hawaii 1000
KEST Boise, Idaho 1000d
WRMS Beardstown, Ill. 500d
KXXX Colby, Kans. 5000d
WAKY Louisville, Ky. 5000
WRUM Rumford, Me. 1000d
WSGW Saginaw, Mich. 5000
WSJC Magee, Miss. 1000d
KGHL Billings, Mont. 5000
WWNY Watertown, N.Y. 1000
WLSV Wellsville, N.Y. 1000d
WTNC Thomasville, N.C. 1000d
KXGO Fargo, N. Dak. 5000
KWIL Albany, Oreg. 1000
WAEB Allentown, Pa. 1000
WPIC Sharon, Pa. 1000d
WEAN Providence, R.I. 5000
WWBO Bamberg-Denmark, S.C. 1000d
WETB Johnson City, Tenn. 1000d
WMC Memphis, Tenn. 5000
KTHT Houston, Tex. 5000
KFYO Lubbock, Tex. 5000
KUTA Blanding, Utah 1000d
WSIG Mount Jackson, Va. 1000d
WTAR Norfolk, Va. 5000
KGMI Bellingham, Wash. 5000
KNEW Spokane, Wash. 5000
WEAQ Eau Claire, Wis. 5000

800—374.8
WHOS Decatur, Ala. 1000d
WMGY Montgomery, Ala. 1000d
KINY Juneau, Alaska 5000
KAGH Crossett, Ark. 250d
KVOM Morrilton, Ark. 250d
KUZZ Bakersfield, Calif. 250d
KDAD Weed, Calif. 1000d
KBRN Brighton, Colo. 500d
WLAD Danbury, Conn. 1000d
WSUZ Palatka, Fla. 1000d
WJAT Swainsboro, Ga. 1000d
WKZI Casey, Ill. 250d
KXIC Iowa City, Iowa 1000d
WCCM Lawrence, Mass. 1000d
WVAL Sauk Rapids, Minn. 250d
KREI Farmington, Mo. 1000d
KDBM Dillon, Mont. 1000
WKDN Camden, N. J. 5000d
KJEM Okla. City, Okla. 250d
KPDQ Portland, Ore. 5000d
WCHA Chambersburg, Pa. 1000d
WDSC Dillon, S.C. 1000d
WEAB Greer, S.C. 250d
WDEH Sweetwater, Tenn. 1000d
KDDD Dumas, Tex. 250d
KBUH Brigham City, Utah 250d
WSVS Crewe, Va. 5000d
WKEE Huntington, W.Va. 5000d
WDUX Waupaca, Wis. 5000d

810—370.2
KGO San Francisco, Calif. 50000
WATI Indianapolis, Ind. 2500d
WYRE Annapolis, Md. 250d
WJPW Rockford, Mich. 500d
WSJC Magee, Miss. 50000
KCMO Kansas City, Mo. 50000
WGY Schenectady, N.Y. 50000
WKBC N.Wilkesboro, N.C. 1000d
WCEC Rocky Mount, N.C. 1000d
WEDO McKeesport, Pa. 1000d
WKVM San Juan, P.R. 25000
WMTS Murfreesboro, Tenn. 5000d

820—365.6
WAIT Chicago, Ill. 5000d
WIKY Evansville, Ind. 250d
WOSU Columbus, Ohio 5000d
WFAA Dallas, Tex. 50000
WBAP Ft. Worth, Tex. 50000

830—361.2
KIKI Honolulu, Hawaii 250
WCCO Minneapolis-St. Paul, Minn. 50000
KOFI Kalispell, Mont. 1000
KBOA Kennett, Mo. 1000d
WNYC New York, N.Y. 1000

840—356.9
WTUF Mobile, Ala. 1000d
WRYM New Britain, Conn. 1000d
WHAS Louisville, Ky. 50000
WVPO Stroudsburg, Pa. 250d

850—352.7
WYDE Birmingham, Ala. 10000
KICY Nome, Alaska 5000
KGKO Benton, Ark. 1000d
KOA Denver, Colo. 50000
WRUF Gainesville, Fla. 5000
WEAT W. Palm Beach, Fla. 1000
KIMO Hilo, Hawaii 1000
WCLR Crystal Lake, Ill. 500d
WHDH Boston, Mass. 50000
WKBZ Muskegon, Mich. 1000
KFUO Clayton, Mo. 5000
WKIX Raleigh, N.C. 10000
WJW Cleveland, Ohio 10000
WJAC Johnstown, Pa. 10000
WEEU Reading, Pa. 1000
WABA Aguadilla, P.R. 500
WIVK Knoxville, Tenn. 50000
WRAP Norfolk, Va. 5000
KTAC Tacoma, Wash. 1000

860—348.6
WHRT Hartselle, Ala. 250d
WAMI Opp, Ala. 1000d
KIFN Phoenix, Ariz. 1000d
KOSE Osceola, Ark. 1000d
KWRF Warren, Ark. 250d
KTRB Modesto, Calif. 10000
WOWW Naugatuck, Conn. 250d
WAZE Clearwater, Fla. 500d
WKKO Cocoa, Fla. 1000d
WERD Atlanta, Ga. 1000
WDMG Douglas, Ga. 5000d
WMRI Marion, Ind. 250d
KWPC Muscatine, Iowa 250d
KOAM Pittsburg, Kans. 10000
WSON Henderson, Ky. 500d
WAYE Baltimore, Md. 1000d
WSBS Gt. Barrington, Mass. 250d
KNUJ New Ulm, Minn. 1000d
WMAG Forest, Miss. 500d
KARS Belen, N. Mex. 250d
WFMO Fairmont, N.C. 1000d
WSTH Taylorsville, N. C. 250d
KSHA Medford, Oreg. 1000d
WAMO Pittsburgh, Pa. 1000d
WTEL Philadelphia, Pa. 10000d
WLBG Laurens, S.C. 1000d
KFST Ft. Stockton, Tex. 250d
KPAN Hereford, Tex. 250d
KSFA Nacogdoches, Tex. 1000d
KONO San Antonio, Tex. 5000
KWHO Salt Lake City, Utah 1000d
WEVA Emporia, Va. 1000d
WOAY Oak Hill, W.Va. 10000d
WFOX Milwaukee, Wis. 250d

870—344.6
KIEV Glendale, Calif. 250d
KAIM Honolulu, Hawaii 5000
WWL New Orleans, La. 50000
WKAR E. Lansing, Mich. 5000d
WHCU Ithaca, N.Y. 5000
WGTL Kannapolis, N.C 1000d
WHOA San Juan, P.R. 5000
KJIM Ft. Worth, Tex. 250
WFLO Farmville, Va. 1000d

880—340.7
WCBS New York, N.Y. 50000
WRRZ Clinton, N.C. 1000d
WRFD Worthington, Ohio 5000d

890—336.9
WLS Chicago, Ill. 50000
WHNC Henderson, N.C. 1000d
KBYE Okla. City, Okla. 1000d

900—333.1
WATV Birmingham, Ala. 1000d
WGOK Mobile, Ala. 1000d
WOZK Ozark, Ala. 1000d
KPRB Fairbanks, Alaska 10000
KHOZ Harrison, Ark. 1000d
KBIF Fresno, Calif. 1000d
KGRB West Covina, Cal. 250d
WJWL Georgetown, Del. 5000d
WSWN Belle Glade, Fla. 1000d
WMOP Ocala, Fla. 1000d
WCGA Calhoun, Ga. 1000d
WCRY Macon, Ga. 250d
WEAS Savannah, Ga. 5000d
KTEE Idaho Falls, Ida. 1000d
KSIR Wichita, Kan. 250d
WFIA Louisville, Ky. 1000d
WLSI Pikeville, Ky. 5000d
KREH Oakdale, La. 250d
WCME Brunswick, Maine 1000d
WLMD Laurel, Md. 1000d
WATC Gaylord, Mich. 1000d
KTIS Minneapolis, Minn. 1000d
WDDT Greenville, Miss. 1000d
KFAL Fulton, Mo. 1000d
KJSK Columbus, Nebr. 1000d
WOTW Nashua, N.H. 1000d
WBRV Boonville, N.Y. 1000d
WKAJ Saratoga Springs, N.Y. 250d
WAYN Rockingham, N.C. 1000d
WIAM Williamston, N.C. 1000d
KFNW Fargo, N.Dak. 1000d
WCNS Canton, Ohio 500d
WFRO Fremont, Ohio 500d
WCPA Clearfield, Pa. 1000d
WFLN Philadelphia, Pa. 1000d
WKXV Knoxville, Tenn. 1000d
WCOR Lebanon, Tenn. 500d
KALT Atlanta, Tex. 1000d
KMCO Conroe, Tex. 500d
KFLD Floydada, Tex. 250d
KCLW Hamilton, Tex. 250d
WODY Bassett, Va. 500d
WAFC Staunton, Va. 1000d
KUEN Wenatchee, Wash. 1000d
WATK Antigo, Wis. 250d

910—329.5
WDVC Dadeville, Ala. 500d
KPHO Phoenix, Ariz. 5000
KLCN Blytheville, Ark. 5000d
KAMD Camden, Ark. 5000
KDEO El Cajon, Calif. 1000
KEWB Oakland, Calif. 5000
KOXR Oxnard, Cal. 5000
KPOF nr. Denver, Colo. 5000
WRCH New Britain, Conn. 5000
WPLA Plant City, Fla. 1000d
WGAF Valdosta, Ga. 5000
KBGN Caldwell, Ida. 1000d
WAKO Lawrenceville, Ill. 500d
WSUI Iowa City, Iowa 5000
KISI Salina, Kan. 500d
WLCS Baton Rouge, La. 1000
WABI Bangor, Maine 5000
WFDF Flint, Mich. 5000
WCOC Meridian, Miss. 5000
KOYN Billings, Mont. 1000d
KYSS Missoula, Mont. 1000d
KBIM Roswell, N. M. 5000
WRKL New City, N.Y. 1000
WLAS Jacksonville, N.C. 5000d
KCJB Minot, N.Dak. 1000
WBRJ Marietta, O. 5000
WPFB Middletown, Ohio 1000
KGLC Miami, Okla. 1000
KURY Brookings, Oreg. 1000d
WAVL Apollo, Pa. 1000d
WGBI Scranton, Pa. 1000
WSBA York, Pa. 5000
WPRP Ponce, P.R. 5000
WNCG North Charleston, S.C. 500d
WORD Spartanburg, S.C. 5000d
WJCW Johnson City, Tenn. 5000
WEPG S. Pittsburgh, Tenn. 500d
KNAF Fredericksburg, Tex. 1000d
KRIO McAllen, Tex. 5000
KRRV Sherman, Tex. 1000
KALL Salt Lake City, Utah 5000
WVTR White River Junction, Vermont 1000d
WRNL Richmond, Va. 5000
WHYE Roanoke, Va. 1000d
KORD Pasco, Wash. 1000d
KIXI Seattle, Wash. 1000
KISN Vancouver, Wash. 5000
WHSM Hayward, Wis. 5000d
WDOR Sturgeon Bay, Wis. 1000d

920—325.9
WCTA Adalusia, Ala. 5000
WWWR Russellville, Ala. 1000d
KARK Little Rock, Ark. 5000
KLOC Ceres, Calif. 500d
KDES Palm Springs, Cal. 5000
KVEC San Luis Obispo, Cal. 1000
KREX Grd. Junction, Colo. 5000
KLMR Lamar, Colo. 5000
WMEG Eau Gallie, Fla. 1000
WGST Atlanta, Ga. 5000
WVOH Hazelhurst, Ga. 500d
WGNU Granite City, Ill. 500d
WMOK Metropolis, Ill. 1000d
WBAA W. Lafayette, Ind. 5000
KFNF Shenandoah, Ia. 1000d
WTCW Whitesburg, Ky. 5000d
WBOX Bogalusa, La. 1000d
KTOC Jonesboro, La. 1000d
WPTX Lexington Pk., Md. 500d
WMPL Hancock, Mich. 1000d
KDHL Faribault, Minn. 1000
KWAO Wadena, Minn. 1000
KRAM Las Vegas, Nev. 1000
KOLO Reno, Nev. 1000
KQEO Albuquerque, N.Mex. 1000
WTTM Trenton, N.J. 1000
WKRT Cortland, N.Y. 1000
WGHQ Kingston, N.Y. 5000d
WIRD Lake Placid, N.Y. 1000
WBBB Burlington, N.C. 5000d
WMNI Columbus, Ohio 1000
KGAL Lebanon, Oreg. 1000
WKVA Lewistown, Pa. 1000
WJAR Providence, R.I. 5000
WTND Orangeburg, S.C. 1000d
KEZU Rapid City, S.Dak. 1000d
WLIV Livingston, Tenn. 1000d
KELP El Paso, Tex. 1000
KECK Odessa, Tex. 1000
KTLW Texas City, Tex. 1000d
KITN Olympia, Wash. 1000d
KXLY Spokane, Wash. 5000
WMMN Fairmont, W.Va. 5000
WOKY Milwaukee, Wis. 5000

930—322.4
WETO Gadsden, Ala. 1000d
KTKN Ketchikan, Alaska 5000
KAPR Douglas, Ariz. 1000d
KFGT Flagstaff, Ariz. 1000d
KHJ Los Angeles, Calif. 5000
KNGL Paradise, Calif. 500d
KIUP Durango, Colo. 5000
WKSB Milford, Del. 500d
WHAN Haines City, Fla. 1000
WJAX Jacksonville, Fla. 5000
WKXY Sarasota, Fla. 1000
WMGR Bainbridge, Ga. 5000
KSEI Pocatello, Idaho 5000
WTAD Quincy, Ill. 5000
WHON Centerville, Ind. 500d
WKCT Bowling Green, Ky. 1000
WFMD Frederick, Md. 5000
WREB Holyoke, Mass. 500d
WBCK Battle Creek, Mich. 5000
KKIN Aitkin, Minn. 1000d
WSLI Jackson, Miss. 5000
KWOC Poplar Bluff, Mo. 5000
KOFI Kalispell, Mont. 5000d
KOGA Ogallala, Nebr. 500d
WSOC Charlotte, N.C. 5000
WITN Washington, N.C. 5000
WWNH Rochester, N.H. 5000d
WPAT Paterson, N.J. 5000
WBEN Buffalo, N.Y. 5000
WIZR Johnstown, N.Y. 1000d
WEOL Elyria, Ohio 1000
WKY Oklahoma City, Okla. 5000
KAGI Grants Pass, Oreg. 5000
WCNR Bloomsburg, Pa. 1000d
KSON Aberdeen, S.D. 1000
WSEV Sevierville, Tenn. 5000d
KDET Center, Tex. 1000d
KITE San Antonio, Tex. 5000
WLLL Lynchburg, Va. 1000d
KENY Bellingham-Ferndale, Wash. 1000d
KQOT Yakima, Wash. 1000d
WSAZ Huntington, W.Va. 5000
KROE Sheridan, Wyo. 1000d
WLBL Auburndale, Wis. 5000d

WHITE'S RADIO LOG

Kc. Wave Length W.P.

940—319.0

KHOS Tucson, Ariz. 250
KFRE Fresno, Calif. 50000
WINE Brookfield, Conn. 1000d
WINZ Miami, Fla. 50000
WMAZ Macon, Ga. 50000
KAHU Waipahu, Hawaii 10000
WMIX Mt. Vernon, Ill. 5000d
KIOA Des Moines, Iowa 10000
WCND Shelbyville, Ky. 1000d
WYLD New Orleans, La. 10000
WSTI St. Ignace, Mich. 5000
WJOR South Haven, Mich. 1000d
WCPC Houston, Miss. 50000d
KSWM Aurora, Mo. 500d
KVSH Valentine, Nebr. 5000d
WFNC Fayetteville, N.C. 10000
WCND Shelbyville, N.Y. 250d
WCIT Lima, Ohio 250d
KGRL Bend, Oreg. 1000d
KWRC Woodburn, Ore. 250d
WESA Charleroi, Pa. 250d
WGRP Greenville, Pa. 1000d
WIPR San Juan, P.R. 10000
KIXZ Amarillo, Tex. 5000
KTON Belton, Tex. 1000d
KATQ Texarkana, Tex. 1000d
WNRG Grundy, Va. 5000d
WFAW Ft. Atkinson, Wis. 250

950—315.6

WRMA Montgomery, Ala. 1000d
KIBH Seward, Alaska 1000
KXJK Forrest City, Ark. 5000d
KFSA Ft. Smith, Ark. 1000
KAHI Auburn, Calif. 5000d
KIMN Denver, Colo. 5000
WLOF Orlando, Fla. 5000
WGTA Summerville, Ga. 5000d
WGOV Valdosta, Ga. 5000
KBOI Boise, Idaho 5000
KLER Orofino, Idaho 1000d
WAAF Chicago, Ill. 1000d
WXLW Indianapolis, Ind. 5000d
KOEL Oelwein, Ia. 5000
KJRG Newton, Kans. 500d
WBVL Barbourville, Ky. 1000d
WAGM Presque Isle, Maine 5000
WXLN Potomac-Cabin John, Md. 1000d
WDRL Boston, Mass. 5000d
WWJ Detroit, Mich. 5000
KRSI St. Louis Park, Minn. 1000
WBKH Hattiesburg, Miss. 5000d
KLIK Jefferson City, Mo. 5000d
WHVW Hyde Park, N.Y. 500d
WBBF Rochester, N.Y. 1000
WIBX Utica, N.Y. 5000
WPET Greensboro, N.C. 5000d
KYES Roseburg, Oreg. 1000d
WNCC Barnesboro, Pa. 500d
WPEN Philadelphia, Pa. 5000
WBER Moncks Corner, S. C. 500d
WSPA Spartanburg, S.C. 5000
KWAT Watertown, S.Dak. 1000
WAGG Franklin, Tenn. 1000d
KOSX Denison-Sherman, Tex. 500
KPRC Houston, Tex. 5000
KSEL Lubbock, Tex. 5000
WXGI Richmond, Va. 5000d
KMER Kemmerer, Wash. 1000
KJR Seattle, Wash. 5000
WERL Eagle River, Wis. 1000d
WKAZ Charleston, W.Va. 5000d
WKTS Sheboygan, Wis. 500d
KMER, Kemmerer, Wyo. 1000

960—312.3

W3RC Birmingham, Ala. 5000
WMDZ Mobile, Ala. 1000
KOOL Phoenix, Ariz. 5000
KAVR Apple Valley, Calif. 5000d
KNEZ Lompoc, Calif. 500
KABL Oakland, Calif. 5000
WELI New Haven, Conn. 5000
WGRD Lake City, Fla. 500d
WJCM Sebring, Fla. 1000d
WJAZ Albany, Ga. 5000
WRFC Athens, Ga. 5000
KSRA Salmon, Idaho 1000d
WDLM E. Moline, Ill. 1000d
WSBT South Bend, Ind. 5000
KMA Shenandoah, Iowa 5000
WPRT Prestonsburg, Ky. 5000d
KROF Abbeville, La. 1000d
WBOC Salisbury, Md. 5000
WFGM Fitchburg, Mass. 1000
WHAK Rogers City, Mich. 5000d
KLTF Little Falls, Minn. 500d
WABG Greenwood, Miss. 1000

Kc. Wave Length W.P.

KFVS Cape Girardeau, Mo. 5000
KFLN Baker, Mont. 5000d
KNEB Scottsbluff, Nebr. 1000
KWYK Farmington, N.Mex. 1000d
KRIK Roswell, N. Mex. 1000d
WEAV Plattsburg, N.Y. 5000
WAAK Dallas, N.C. 1000d
WFTC Kinston, N.C. 5000
WWST Wooster, Ohio 1000d
KGWA Enid, Okla. 1000
KLAD Klamath Falls, Oreg. 5000d
WHYL Carlisle, Pa. 5000d
WKZA Kane, Pa. 1000d
WATS Sayre, Pa. 1000d
WBEU Beaufort, S.C. 1000d
WBMC McMinnville, Tenn. 500d
KIMP Mt. Pleasant, Tex. 1000d
KGKL San Angelo, Tex. 5000
KOVO Provo, Utah 5000
WDBJ Roanoke, Va. 5000
KALE Richland, Wash. 1000
WTCH Shawano, Wis. 1000

970—309.1

WERH Hamilton, Ala. 5000d
WTBF Troy, Ala. 5000
KVWM Show Low, Ariz. 1000d
KNEA Jonesboro, Ark. 1000d
KBIS Bakersfield, Calif. 1000
KCHV Coachella, Calif. 5000
KBEE Modesto, Calif. 1000
KFEL Pueblo, Colo. 1000d
WFLA Tampa, Fla. 5000
WIIN Atlanta, Ga. 5000d
WVOP Vidalia, Ga. 5000d
KPUA Hilo, Hawaii 1000
KAYT Rupert, Idaho 1000d
WMAY Springfield, Ill. 1000
WAVE Louisville, Ky. 5000
KSYL Alexandria, La. 1000
WCSH Portland, Maine 5000
WAMD Aberdeen, Md. 500
WESO Southbridge, Mass. 1000d
WCKD Ishpeming, Mich. 5000d
WKHM Jackson, Mich. 1000
KQAQ Austin, Minn. 5000
KOOK Billings, Mont. 5000
KJLT No. Platte, Nebr. 5000d
KVEG Las Vegas, Nev. 500d
WJRZ Newark, N.J. 5000
KDCE Espanola, N. M. 1000d
WEBR Buffalo, N.Y. 5000
WCHN Norwich, N.Y. 500d
WRCS Ahoskie, N.C. 1000d
WWIT Canton, N.C. 1000d
WDAY Fargo, N.Dak. 5000
WREO Ashtabula, Ohio 5000
WATH Athens, Ohio 1000d
KAKC Tulsa, Okla. 1000
KOIN Portland, Oreg. 5000
WWSW Pittsburgh, Pa. 5000
WJMX Florence, S.C. 5000
KHFI Austin, Tex. 1000d
KBSN Crane, Tex. 1000d
KNOK Ft. Worth, Tex. 1000d
WIVI Christiansted, V. I. 5000
WYPR Danville, Va. 1000d
WANV Waynesboro, Va. 5000d
KREM Spokane, Wash. 5000
WWYO Pineville, W.Va. 1000d
WHA Madison, Wis. 5000d
WIGL Superior, Wis. 500d

980—305.9

WKLF Clanton, Ala. 1000d
WXLL Big Delta, Alaska 100
KCAB Dardanelle, Ark. 1000d
KINS Eureka, Calif. 5000
KEAP Fresno, Calif. 500d
KFWB Los Angeles, Calif. 5000
KCTY Salinas, Calif. 1000d
KGLN Glennwood Springs, Colo. 1000d
WSUB Groton, Conn. 1000d
WRC Washington, D.C. 5000
WDVH Gainesville, Fla. 5000d
WTOT Marianna, Fla. 1000d
WBOP Pensacola, Fla. 1000d
WLOD Pompano Beach, Fla. 1000d
WKLY Hartwell, Ga. 1000d
WPGA Perry, Ga. 500d
WRIP Rossville, Ga. 500d
KUPI Idaho Falls, Idaho 1000d
WITY Danville, Ill. 1000
KREB Shreveport, La. 5000d
WCAP Lowell, Mass. 1000d
WAOP Otsego, Mich. 1000d
WPBC Richfield, Minn. 5000
WAPF McComb, Miss. 5000d
KMBC Kansas City, Mo. 5000
KLYQ Hamilton, Mont. 1000d
KVLV Fallon, Nev. 5000d
KICA Clovis, N. Mex. 1000
KMIN Grants, N. Mex. 1000d
WTRY Troy, N.Y. 5000
WKLM Wilmington, N.C. 5000d
WAAA Win.-Salem, N.C. 1000d
WONE Dayton, Ohio 5000
WILK Wilkes-Barre, Pa. 5000
WAZS Summerville, S.C. 500d
WYCL York, S. C. 1000d
KDSJ Deadwood, S.Dak. 1000

Kc. Wave Length W.P.

WSIX Nashville, Tenn. 5000
KFRD Rosenberg-Richmond, Tex. 1000d
KSVC Richfield, Utah 5000
WFHG Bristol, Va. 5000
WMEK Chase City, Va. 500d
KUTI Yakima, Wash. 5000d
WHAW Weston, W.Va. 1000d
WCUB Manitowoc, Wis. 1000d
WPRE Prairie du Chien, Wis. 1000
KEND Cheyenne, Wyo. 500d

990—302.8

WEIS Center, Ala. 250
WWWF Fayette, Ala. 1000d
WTCB Flomaton, Ala. 500d
KTKT Tucson, Ariz. 10000
KKIS Pittsburg, Calif. 5000
KGUD Santa Barbara, Calif. 1000d
KLIR Denver, Colo. 1000d
WFAB Miami, Fla. 5000
WHOO Orlando, Fla. 50000
WDWD Dawson, Ga. 1000d
WGML Hinesville, Ga. 250d
KTRG Honolulu, Hawaii 5000
WCAZ Carthage, Ill. 1000d
WITZ Jasper, Ind. 1000d
WERK Muncie, Ind. 250d
KAYL Storm Lake, Iowa 250d
KRSL Russell, Kans. 250d
WNNR New Orleans, La. 250d
KRIH Rayville, La. 250d
WCRM Clare, Mich. 250d
WABO Waynesboro, Miss. 250d
KRMO Monett, Mo. 250d
KSVP Artesia, N.Mex. 1000
WEEB Southern Pines, N.C. 5000d
WJEH Gallipolis, Ohio 1000d
WTIG Massillon, Ohio 250d
KRKT Albany, Oreg. 250d
WIBG Philadelphia, Pa. 50000
WVSC Somerset, Pa. 5000d
WPRA Mayaguez, P.R. 10000
WLKW Providence, R.I. 50000
WAKN Aiken, S.C. 1000d
WNOX Knoxville, Tenn. 10000
KWAM Memphis, Tenn. 10000d
KTRM Beaumont, Tex. 1000
KAML Kenedy-Karnes City, Tex. 250d
KNIN Wichita Falls, Tex. 10000
KDYL Tooele, Utah 1000d
WNRV Narrows, Va. 1000d
WANT Richmond, Va. 1000d

1000—299.8

WCFL Chicago, Ill. 50000
WXTN Lexington, Miss. 5000d
WSPF Hickory, N.C. 1000d
KTOK Okla. City, Okla. 5000
WIOO Carlisle, Pa. 1000
WGOG Wahalla, S. C. 1000d
KSTA Coleman, Tex. 250d
KGRI Henderson, Tex. 250d
WKDE Altavista, Va. 1000d
WHWB Rutland, Vt. 1000d
WBNB Charlotte Amalie, Virgin Islands 1000
KOMO Seattle, Wash. 50000

1010—296.9

KCAC Phoenix, Ariz. 500d
KVNC Winslow, Ariz. 1000
KLRA Little Rock, Ark. 10000
KCHJ Delano, Calif. 5000
KCMJ Palm Sprgs., Calif. 1000
KSAY San Fran., Calif. 10000d
WCNU Crestview, Fla. 1000d
WBIX Jacksonville Beach, Fla. 10000d
WINQ Tampa, Fla. 50000d
WGUN Atlanta-Decatur, Ga. 50000d
KATN Boise, Idaho 1000d
WCSI Columbus, Ind. 500d
KSMN Mason City, Iowa 1000d
KIND Independence, Kans. 250d
KDLA DeRidder, La. 1000d
WSID Baltimore, Md. 1000d
WITL Lansing, Mich. 500d
WRCR Maplewood, Minn. 250d
WMOX Meridian, Miss. 10000
KCHI Chillicothe, Mo. 250d
KXEN Festus-St. Louis, Mo. 50000d
KRVN Lexington, Nebr. 25000d
WCNL Newport, N.H. 250d
WINS New York, N.Y. 50000
WABZ Albermarle, N.C. 1000d
WFGW Black Mountain, N.C. 50000d
WELS Kinston, N.C. 1000d
WIOI New Boston, Ohio 1000d
KBEV Portland, Oreg. 1000d
WUNS Lewisburg, Pa. 250d
WHIN Gallatin, Tenn. 1000d
WORM Savannah, Tenn. 250d
KBUY Amarillo, Tex. 5000
KODA Houston, Tex. 1000d
KAWA Waco-Marlin, Tex. 10000d
WELK Charlottesville, Va. 1000d
WMEV Marion, Va. 1000d

Kc. Wave Length W.P.

WPMH Portsmouth, Va. 5000d
WCST Berkeley Sprgs., W.Va. 250d
WSPT Stevens Pt., Wis. 1000d

1020—293.9

KGBS Los Angeles, Calif. 50000
WCIL Carbondale, Ill. 1000d
WPEO Peoria, Ill. 1000d
KSWS Roswell, N.M. 50000d
KDKA Pittsburgh, Pa. 50000

1030—291.1

WBZ Boston, Mass. 50000
KCTA Corpus Christi, Tex. 50000d

1040—288.3

KHVH Honolulu, Hawaii 5000
WHO Des Moines, Iowa 50000
KIXL Dallas, Tex. 1000d

1050—285.5

WRFS Alexander City, Ala. 1000d
WCRI Scottsboro, Ala. 250d
KVLC Little Rock, Ark. 1000d
KTOT Big Bear Lake, Cal. 250d
KOFY San Mateo, Calif. 1000d
KWSO Wasco, Calif. 1000d
WJSB Crestview, Fla. 1000d
WIVY Jacksonville, Fla. 1000d
WHBO Tampa, Fla. 250d
WRMF Titusville, Fla. 500d
WAUG Augusta, Ga. 5000d
WMNZ Montezuma, Ga. 250d
WDZ Decatur, Ill. 1000d
WTCA Plymouth, Ind. 250d
KUPK Garden City, Kan. 5000d
WNES Central City, Ky. 500d
KLPL Lake Providence, La. 250d
KCIJ Shreveport, La. 250d
KVPI Villa Platte, La. 250d
WMSG Oakland, Md. 500d
WQMR Silver Sprg., Md. 1000d
WPAG Ann Arbor, Mich. 5000d
KLOH Pipestone, Minn. 1000d
WACR Columbus, Miss. 1000d
KMIS Portageville, Mo. 1000d
KSIS Sedalia, Mo. 1000d
KLVC Las Vegas, Nev. 500d
WBNC Conway, N.H. 1000d
WSEN Baldwinsville, N.Y. 250d
WYBG Massena, N.Y. 1000d
WHN New York, N.Y. 50000
WFSC Franklin, N.C. 1000d
WLON Lincolnton, N.C. 1000d
WWGP Sanford, N.C. 1000d
WZIP Cincinnati, Ohio 1000d
KCCO Lawton, Okla. 250d
KFMJ Tulsa, Okla. 1000d
KEED Springfield-Eugene, Ore. 1000d
WBUT Butler, Pa. 1000d
WLYC Williamsport, Pa. 1000d
WSMT Sparta, Tenn. 1000d
KLEN Killeen, Tex. 250d
KFAZ Liberty, Tex. 250d
KCAS Slaton, Tex. 250d
WGAT Gate City, Va. 1000d
WBRG Lynchburg, Va. 1000d
WCMS Norfolk, Va. 1000d
KBLE Seattle, Wash. 5000d
WCEF Parkersburg, W. Va. 5000d
WECL Eau Claire, Wis. 1000d
WKAU Kaukauna, Wis. 1000
WLIP Kenosha, Wis. 250d
KWIV Douglas, Wyo. 250d

1060—282.8

KUPD Tempe, Ariz. 500
KPAY Chico, Calif. 10000
KLMO Longmont, Colo. 10000d
WNOE New Orleans, La. 50000
WHFB Benton Harbor-St. Joseph, Mich. 5000d
KNLV Ord, Neb. 1000
WMAP Monroe, N.C. 250d
WHOF Canton, O. 5000d
KYW Philadelphia, Pa. 50000
WRJS San German, P. R. 250
WALD Walterboro, S. C. 1000d
WPHC Waverly, Tenn. 1000d

1070—280.2

WAPI Birmingham, Ala. 50000
KNX Los Angeles, Calif. 50000
WVCG Coral Gables, Fla. 1000d
WIBC Indianapolis, Ind. 50000
KFDI Wichita, Kans. 10000
KHMO Hannibal, Mo. 5000
WHPE High Point, N.C. 1000d
WKOK Sunbury, Penn. 10000
WMIA Arecibo, P. R. 5000
WFLI Lookout Mtn., Tenn. 10000
WDIA Memphis, Tenn. 50000
KOPY Alice, Tex. 1000
KNNN Friona, Tex.
KENR Houston, Tex. 10000d
WKOW Madison, Wis. 10000

1080—277.6

WKAC Athens, Ala. 1000d

Kc. Wave Length W.P.

KSCO Santa Cruz, Calif. 10000
WTIC Hartford, Conn. 50000
WVCG Coral Gables, Fla. 10000
WFIV Kissimmee, Fla. 250
WBIE Marietta, Ga. 10000d
WJBG Pontiac, Ill.
WNWI Northwestern, Ind. 5000d
WKLD Louisville, Ky. 5000
WOAP Owosso, Mich. 1000d
KGCL East Prairie, Mo.
WUFO Amherst, N.Y. 1000d
WEWO Laurinburg, N.C. 5000d
WWDR Murfreesboro, N.C. 500d
WMVR Sidney, O. 250d
KWJJ Portland, Oreg. 50000
WEEP Pittsburgh, Pa. 1000d
WLEY Cayey, P.R. 250
KGFX Pierre, S. D. 10000d
KRLD Dallas, Tex. 50000
WKBY Chatham, Va.

1090—275.1

KAAY Little Rock, Ark. 50000
WWSD Monticello, Fla. 1000d
WBAF Barnesville, Ga.
WCRA Effingham, Ill. 250d
WGLC Mendota, Ill. 250d
KHAI Honolulu, Hawaii 5000
KNWS Waterloo, Iowa 1000d
WBAL Baltimore, Md. 50000
WILD Boston, Mass. 1000d
WMUS Muskegon, Mich. 1000d
WTAK Garden City, Mich. 250d
WBZB Selma, N. C. 1000d
WMWM Wilmington, O. 1000d
WJKM Hartsville, Tenn.
KING Seattle, Wash. 50000

1100—272.6

KFAX San Francisco, Calif. 50000
WLBB Carrollton, Ga. 10000
WHLI Hempstead, N.Y. 10000d
WKYC Cleveland, O. 50000
WGPA Bethlehem, Pa. 250d

1110—270.1

WBCA Bay Minette, Ala. 10000d
WBIB Centreville, Ala. 1000d
KRLA Pasadena, Cal. 50000
WALT Tampa, Fla. 50000d
KIPA Hilo, Hawaii 1000
WMBI Chicago, Ill. 5000d
WKDZ Cadiz, Ky.
WKRA Holly Springs, Miss.
KFAB Omaha, Nebr. 50000
WBT Charlotte, N.C. 50000
KBND Bend, Oreg. 5000
WWDS Everett, Penn. 250d
WNAR Norristown, Penn. 50000d
WVJP Caguas, P.R. 250
WHIM Providence, R.I. 1000d
WPHC Waverly, Tenn. 1000d
KDRY Alamo Heights, Tex. 1000d

1120—267.7

WUST Bethesda, Md. 250d
KMOX St. Louis, Mo. 50000
WWOL Buffalo, N.Y. 1000d
KEED Springfield-Eugene, Ore. 1000d
KCLE Cleburne, Tex. 250d

1130—265.3

KRDU Dinuba, Calif. 1000
KSDO San Diego, Cal. 5000d
KLEI Kailua, Hawaii 1000
KWKH Shreveport, La. 50000
WCAR Detroit, Mich. 50000
WDGY Minneapolis, Minn. 50000
WNEW New York, N.Y. 50000
WISN Milwaukee, Wis. 50000

1140—263.0

KRAK Sacramento, Calif. 50000
WMIE Miami, Fla. 10000
KGEM Boise, Idaho 10000
WSIV Pekin, Ill. 5000d
KPWB Piedmont, Mo.
WCLW Mansfield, O. 250d
KLPR Oklahoma City, Okla. 1000d
WITA San Juan, P.R. 10000
KSOO Sioux Falls, S.Dak. 10000
KORC Mineral Wells, Tex. 250d
WRVA Richmond, Va. 50000

1150—260.7

WBCA Bay Minette, Ala. 1000d
WGEA Geneva, Ala. 1000d
WJRD Tuscaloosa, Ala. 5000
KCKY Coolidge, Ariz. 1000
KXLR No. Little Rock, Ark. 5000
KRKD Los Angeles, Calif. 5000
KJAX Santa Rosa, Calif. 5000
KGMC Englewood, Colo. 1000d
WCNX Middletown, Conn. 1000d
WDEL Wilmington, Del. 5000
WNDB Daytona Bch., Fla. 1000
WTMP Tampa, Fla. 5000d
WFPM Fort Valley, Ga. 1000d
WJEM Valdosta, Ga. 1000d
WGGH Marion, Ill. 5000d
WJRL Rockford, Ill. 500d
KYED Burlington, Ia. 500d
KWKY Des Moines, Iowa 1000
KSAL Salina, Kans. 5000
WMST Mt. Sterling, Ky. 500d
WLOC Mumfordville, Ky. 1000d
WJBO Baton Rouge, La. 5000
WGHM Skowhegan, Maine 5000d
WHMC Gaithersburg, Md. 1000
WCOP Boston, Mass. 5000
WCEN Mt. Pleasant, Mich. 5000
KASM Albany, Minn. 1000d
KRMS Osage Beach, Mo. 1000d
KSEN Shelby, Mont. 1000
KDEF Albuquerque, N. M. 5000
WRUN Utica, N.Y. 5000
WBAG Burlington, N.C. 1000d
WGBR Goldsboro, N.C. 5000
WCUE Cuyahoga Falls, Ohio 1000d
WIMA Lima, Ohio 1000
KNED McAlester, Okla. 1000
KAGO Klamath Falls, Oreg. 5000
WHUN Huntingdon, Pa. 5000d
WYNS Lehighton, Pa. 1000d
WKPA New Kensington, Pa. 1000d
WDIX Orangeburg, S.C. 5000
WTYC Rock Hill, S.C. 1000d
WSNW Seneca, S.C. 1000d
KIMM Rapid City, S.Dak. 5000d
WAPO Chattanooga, Tenn. 5000
WCRK Morristown, Tenn. 1000
WTAW Bryan, Tex. 1000d
KCCT Corpus Christi, Tex. 1000d
KIZZ El Paso, Tex. 1000d
KVIL Highland Park, Tex. 1000d
KJBC Midland, Tex. 1000d
KPNG Port Neches, Tex. 500d
KOLJ Quanah, Tex. 500d
KBER San Antonio, Tex. 1000d
KOFE Pullman, Wash. 1000d
KAYO Seattle, Wash. 5000
KKEY Vancouver, Wash. 1000d
WABH Deerfield, Va. 1000d
WELC Welch, W.Va. 1000d
WAXX Chippewa Falls, Wis. 5000d

1160—258.5

WJJD Chicago, Ill. 50000d
KSL Salt Lake City, Utah 50000

1170—256.3

WCOV Montgomery, Ala. 10000
KCBQ San Diego, Calif 50000
KLOK San Jose, Calif. 10000
KOHO Honolulu, Hawaii 1000
WLBH Mattoon, Ill. 250d
KSTT Davenport, Iowa 1000
KVOO Tulsa, Okla. 50000
WLEO Ponce, P.R. 250
KPUG Bellingham, Wash. 5000
WWVA Wheeling, W.Va. 50000

1180—254.1

WLDS Jacksonville, Ill. 1000d
WHAM Rochester, N.Y. 50000

1190—252.0

KRDS Tolleson, Ariz. 250
KEZY Anaheim, Calif. 1000
KNBA Vallejo, Calif. 250d
WOWO Ft. Wayne, Ind. 50000
WANN Annapolis, Md. 10000d
WKOX Fram'gham, Mass. 1000d
WLIB New York, N. Y. 1000d
KEX Portland, Oreg. 50000
WRAI Rio Piedras, P.R. 500
KLIF Dallas, Tex. 50000

1200—249.9

WOAI San Antonio, Tex. 50000

1210—247.8

KZOD Honolulu, Hawaii 1000
WCNT Centralia, Ill. 1000d
WKNX Saginaw, Mich. 10000d
WADE Wadesboro, N.C. 1000d
WAVI Dayton, Ohio 250d
WCAU Philadelphia, Pa. 50000

1220—245.8

WAQY Birmingham, Ala. 1000d
WPRN Butler, Ala.
WABF Fairhope, Ala. 1000
KVSA McGehee, Ark. 1000d
KLIP Fowler, Calif. 250d
KIBE Palo Alto, Cal. 5000d
KKAR Pomona, Calif. 250d
KFSC Denver, Colo. 1000d
WDEE Hamden, Conn. 1000d
WDCJ Arlington, Fla. 1000d
WOAH Miami, Fla. 250d
WSAF Sarasota, Fla. 1000d
WCLB Camilla, Ga. 1000d
WPLK Rockmart, Ga. 500d
WSFT Thomaston, Ga. 250d
WLPO LaSalle, Ill. 1000d
WKRS Waukegan, Ill. 1000d
WSLM Salem, Ind. 5000d
KJAN Atlantic, Iowa 250d
KDUR Independence, Iowa 250d
KOFO Ottawa, Kans. 250d
WFKN Franklin, Ky. 250d
KBCL Shreveport, La. 250d
WLBI Denham Springs, La. 250d
WSME Sanford, Maine 1000d
WBCH Hastings, Mich. 250d
WAVN Stillwater, Minn. 5000d
WMDC Hazlehurst, Miss. 250d
KZYM Cape Girardeau, Mo. 250d
KBHM Branson, Mo. 1000d
WKBK Keene, N.H. 1000d
WGNY Newburgh, N.Y. 5000d
WSOQ N. Syracuse, N.Y. 1000d
WKMT Kings Mtn., N.C. 1000d
WREV Reidsville, N.C. 1000d
WENC Whiteville, N.C. 5000d
KEYD Oakes, N.Dak. 1000d
WGAR Cleveland, Ohio 50000
WERT Van Wert, Ohio 250d
KGYN Guymon, Okla. 1000d
KBLY Goldbeach, Oreg. 1000d
KAPT Salem, Ore. 1000
WJUN Mexico, Pa. 1000d
WRIB Providence, R.I. 1000d
WFWL Camden, Tenn. 250d
WCPH Etowah, Tenn. 1000d
KVLL Livingston, Tex. 250d
KZEE Weatherford, Tex. 250d
WLSD Big Stone Gap, Va. 1000d
WFAX Falls Church, Va. 5000d
KASY Auburn, Wash. 250d
KOZI Chelan, Wash. 1000d
WRNE Wis. Rapids, Wis. 500d

1230—243.8

WAUD Auburn, Ala. 1000
WJBB Haleyville, Ala. 1000
WBHP Huntsville, Ala. 1000
WNUZ Talledega, Ala. 250
WTBC Tuscaloosa, Ala. 1000
KIFW Sitka, Alaska 250
KSUN Bisbee, Ariz. 250
KAAA Kingman, Ariz. 1000
KRIZ Phoenix, Ariz. 250
KATO Safford, Ariz. 250
KINO Winslow, Ariz. 1000
KCON Conway, Ark. 250
KFPW Ft. Smith, Ark. 1000
KBTM Jonesboro, Ark. 1000
KCON Conway, Ark. 1000
KGEE Bakersfield, Calif. 1000
KWTC Barstow, Calif. 1000
KIBS Bishop, Calif. 1000
KXO El Centro, Calif. 250
KDAC Ft. Bragg, Calif. 250
KGFJ Los Angeles, Calif. 1000
KPRL Paso Robles, Calif. 1000
KRDG Redding, Calif. 250
KWG Stockton, Calif 1000
KEXO Grand Junction, Colo. 1000
KBRR Leadville, Colo. 250
KDZA Pueblo, Colo. 1000
KGEK Sterling, Colo. 1000d
WINF Manchester, Conn. 1000
WGGG Gainesville, Fla. 1000
WONN Lakeland, Fla 1000
WMAF Madison, Fla. 1000
WSBB New Smyrna Bch., Florida 1000
WNVY Pensacola, Fla. 1000
WCNH Quincy, Fla. 1000d
WJNO W. Palm Beach, Fla. 250
WBIA Augusta, Ga. 1000d
WBLJ Dalton, Ga. 1000
WXLI Dublin, Ga. 1000
WFOM Marietta, Ga. 1000
WSOK Savannah, Ga. 1000
WAYX Waycross, Ga. 1000
KBAR Burley, Idaho 1000
KORT Grangeville, Idaho 250
KRXK Rexburg, Idaho 1000
WJBC Bloomington, Ill. 1000
WQUA Moline, Ill. 1000
WHCO Sparta, Ill. 250
WJOB Hammond, Ind. 1000
WSAL Logansport, Ind. 1000
WTCJ Tell City, Ind. 1000
WBOW Terre Haute, Ind. 1000d
KFJB Marshalltown, Iowa 1000
WHIR Danville, Ky. 1000d
WHOP Hopkinsville, Ky. 1000
WMLF Pineville, Ky. 1000d
KLIC Monroe, La. 1000d
WSHO New Orleans, La. 1000d
KSLO Opelousas, La. 1000
WBME Belfast, Me. 250
WQDY Calais, Maine 1000d
WSJR Madawaska, Me. 1000
WITH Baltimore, Md. 1000d
WCUM Cumberland, Md. 1000
WMNB No. Adams, Mass. 1000d
WESX Salem, Mass. 1000
WNEB Worcester, Mass. 1000
WJEF Grand Rapids, Mich. 1000
WMPC Lapeer, Mich. 250
WSOO Slt. Ste. Marie, Mich. 1000
WSTR Sturgis, Mich. 1000d
WKLK Cloquet, Minn. 1000
KGHS Internat'l Falls, Minn. 250
KYSM Mankato, Minn. 1000
KMRS Morris, Minn. 250
KTRF Thief Riv. Falls, Minn. 1000
KWNO Winona, Minn. 1000d
WCMA Corinth, Miss. 1000
WHSY Hattiesburg, Miss. 1000
WSSO Starkville, Miss. 1000
WAZF Yazoo City, Miss. 1000
KODE Joplin, Mo. 1000
KLWT Lebanon, Mo. 250
KNCM Moberly, Mo. 1000
KBMN Bozeman, Mont. 1000d
KHDN Hardin, Mont. 1000
KXLO Lewiston, Mont. 1000
KLCB Libby, Mont. 1000
KTNC Falls City, Nebr. 100
KHAS Hastings, Neb. 1000
KELY Ely, Nev. 250
KLAV Las Vegas, Nev. 250
KCBN Reno, Nev. 250
WMOU Berlin, N.H. 1000d
WTSV Claremont, N.H. 1000
WCMC Wildwood, N.J. 100
KALG Alamogordo, N.Mex. 250
KOTS Deming, N.Mex. 250
KYVA Gallup, N. Mex. 1000
KFUN Las Vegas, N.Mex. 250
KRSY Roswell, N. Mex. 1000
WNIA Cheektowaga, N.Y. 500
WENY Elmira, N.Y. 1000
WIGS Gouverneur, N. Y. 1000
WHUC Hudson, N. Y. 1000
WLFH Little Falls, N. Y. 1000
WFAS White Plains, N. Y. 1000
WSKY Asheville, N.C. 1000
WFAI Fayetteville, N.C. 1000d
WMFR High Point, N.C. 1000
WISP Kinston, N.C. 1000d
WNNC Newton, N. C. 1000
WCBT Roanoke Rap., N. C. 1000
KDIX Dickinson, N.Dak. 250
WCPO Cincinnati, Ohio 1000
WCOL Columbus, Ohio 1000
WIRO Ironton, O. 1000
WCWA Toledo, O. 1000d
KADA N. of Ada, Okla. 250
WBBZ Ponca City, Okla. 250
KVAS Astoria, Ore. 1000
KRNS Burns, Ore. 1000
KOOS Coos Bay, Ore. 1000
KRDR Gresham, Oreg. 1000
KYJC Medford, Oreg. 1000
KQIK Lakeview, Oreg. 250
KTDO Toledo, Ore. 1000
WBVP Beaver Falls, Pa. 1000
WEEX Easton, Pa. 1000
WKBO Harrisburg, Pa. 1000
WCRO Johnstown, Pa. 1000
WBPZ Lock Haven, Pa. 1000
WTIV Titusville, Pa. 500d
WNIK Arecibo, P.R. 1000
WERI Westerly, R.I. 1000
WAIM Anderson, S.C. 1000
WNOK Columbia, S.C. 1000d
WOLS Florence, S.C. 1000
KISD Sioux Falls, S.Dak. 1000d
WAKI McMinnville, Tenn. 1000
KSIX Corpus Christi, Tex. 1000
KDLK Del Rio, Tex. 250
KNUZ Houston, Tex. 1000
KERV Kerrville, Tex. 1000
KLVT Levelland, Tex. 1000
KEEE Nacogdoches, Tex. 1000
KOSA Odessa, Tex. 1000
KHHH Pampa, Tex. 250
KSEY Seymour, Tex. 1000
KSST Sulphur Sprgs., Tex. 1000
KWTX Waco, Tex. 1000d
KMOR Murray, Utah 250
KOAL Price, Utah 1000
WJOY Burlington, Vt. 1000
WBBI Abingdon, Va. 1000d
WODI Brookneal, Va. 1000
WCFV Clifton Forge, Va. 1000
WFVA Fredericksburg, Va. 1000
WNOR Norfolk, Va. 1000
KWYZ Everett, Wash. 1000
KSPO Spokane, Wash. 1000
KREW Sunnyside, Wash. 1000
WLOG Logan, W.Va. 1000
WTAP Parkersburg, W.Va. 1000
WHBY Appleton, Wis. 1000
WCLD Janesville, Wis. 1000
WXCO Wausau, Wis. 1000d
KVOC Casper, Wyo. 1000

1240—241.8

WEBJ Brewton, Ala. 250
WPRN Butler, Ala. 1000d
WULA Eufaula, Ala. 250
WOWL Florence, Ala. 1000
WARF Jasper, Ala. 1000
KVRD Cottonwood, Ariz. 250
KZOW So. of Globe, Ariz. 1000
KVRC Arkadelphia, Ark. 250
KTLO Mountain Home, Ark. 1000
KWAK Stuttgart, Ark. 250
KPLY Crescent City, Calif. 250
KOAD Lemoore, Cal. 250
KMBY Monterey, Calif. 1000
KPPC Pasadena, Calif. 100
KLOA Ridgecrest, Calif. 250
KROY Sacramento, Calif. 1000

WHITE'S

RADIO LOG

Kc.	Wave Length	W.P.
KRNO	San Bernardino, California	1000d
KSON	San Diego, Calif.	250
KSMA	Santa Maria, Calif.	250
KSUE	Susanville, Calif.	1000
KRDO	Colo. Sprgs., Colo.	1000
KDGO	Durango, Colo.	1000
KSLV	Monte Vista, Colo.	1000
KCRT	Trinidad, Colo.	250
WWCO	Waterbury, Conn.	1000
WBGC	Chipley, Fla.	1000
WLCO	Eustis, Fla.	1000
WINK	Ft. Myers, Fla.	1000
WMMB	Melbourne, Fla.	1000
WFDY	St. Augustine, Fla.	1000
WBHB	Fitzgerald, Ga.	1000
WDUN	Gainesville, Ga.	1000
WLAG	LaGrange, Ga.	1000
WBML	Macon, Ga.	1000
WWNS	Statesboro, Ga.	1000
WPAX	Thomasville, Ga.	1000
WTWA	Thomson, Ga.	250
KVNI	Coeur d'Alene, Idaho	1000
KFLI	Mountain Home, Idaho	250
KMCL	McCall, Ida.	1000
KWIK	Pocatello, Idaho	250
WCRW	Chicago, Ill.	1000
WEDC	Chicago, Ill.	1000d
WSBC	Chicago, Ill.	1000
WEBQ	Harrisburg, Ill.	1000
WTAX	Springfield, Ill.	1000
WSDR	Sterling, Ill.	500
WHBU	Anderson, Ind.	1000d
KDEC	Decorah, Iowa	1000
KWLC	Decorah, Iowa	1000
KBIZ	Ottumwa, Iowa	1000
KICD	Spencer, Iowa	1000
KIUL	Garden City, Kans.	1000
KAKE	Wichita, Kans.	250
WINN	Louisville, Ky.	1000
WFTM	Maysville, Ky.	1000
WPKE	Pikeville, Ky.	1000d
WSFC	Somerset, Ky.	1000
KASO	Minden, La.	1000
KANE	New Iberia, La.	1000
WCOU	Lewiston, Maine	1000
WMKR	Millinocket, Me.	1000
WCEM	Cambridge, Md.	1000
WJEJ	Hagerstown, Md.	1000
WHAI	Greenfield, Mass.	250
WDCB	W. Yarmouth, Mass.	1000
WATT	Cadillac, Mich.	1000
WCBY	Cheboygan, Mich.	1000
WJPD	Ishpeming, Mich.	1000
WJIM	Lansing, Mich.	1000d
WMFG	Hibbing, Minn.	1000
KPRM	Park Rapids, Minn.	1000
WJON	St. Cloud, Minn.	1000
WMPA	Aberdeen, Miss.	1000
WGRM	Greenwood, Miss.	250
WGCM	Gulfport, Miss.	1000
WMIS	Natchez, Miss.	250
KFMO	Flat River, Mo.	1000
KWOS	Jefferson City, Mo.	1000d
KODE	Joplin, Mo.	1000d
KNEM	Nevada, Mo.	250
KBMY	Billings, Mont.	1000
KLTZ	Glasgow, Mont.	1000
KBLL	Helena, Mont.	1000
KFOR	Lincoln, Nebr.	1000
KODY	North Platte, Nebr.	1000
KELK	Elko, Nev.	1000
WFTN	Franklin, N.H.	250
WSNJ	Bridgeton, N. J.	1000
KAVE	Carlsbad, N.Mex.	1000
KCLV	Clovis, N.Mex.	1000
WGBB	Freeport, N.Y.	1000
WGVA	Geneva, N.Y.	1000d
WJTM	Jamestown, N.Y.	500d
WVOS	Liberty, N. Y.	1000
WNBZ	Saranac Lake, N.Y.	1000
WSNY	Schenectady, N.Y.	1000d
WATN	Watertown, N. Y.	1000
WPNF	Brevard, N.C.	1000
WIST	Charlotte, N.C.	1000
WCNC	Elizabeth City, N.C.	1000d
WJNC	Jacksonville, N.C.	1000
WRNC	Raleigh, N.C.	1000
KDLR	Devils Lake, N.Dak.	250
WBBW	Youngstown, Ohio	1000
WHIZ	Zanesville, Ohio	1000
KVSO	Ardmore, Okla.	250
KBEK	Elk City, Okla.	250
KBEL	Idabel, Okla.	250
KOKL	Okmulgee, Okla.	1000
KFLY	Corvallis, Oreg.	1000d
KTIX	Pendleton, Oreg.	1000
KPRB	Redmond, Oreg.	250
KQEN	Roseburg, Ore.	1000
WRTA	Altoona, Pa.	1000
WHUM	Reading, Pa.	1000
WBAX	Wilkes-Barre, Pa.	1000
WALO	Humacao, P.R.	1000
WWON	Woonsocket, R.I.	1000
WKDK	Newberry, S.C.	250
WDXY	Sumter, S. C.	1000
KCCR	Pierre, S. D.	1000
WBEJ	Elizabethton, Tenn.	1000
WEKR	Fayetteville, Tenn.	1000
WBIR	Knoxville, Tenn.	1000
WKDA	Nashville, Tenn.	1000
WENK	Union City, Tenn.	1000
KVLF	Alpine, Tex.	1000
KEAN	Brownwood, Tex.	1000
KORA	Bryan, Tex.	1000
KOCA	Kilgore, Tex.	1000
KSDX	Raymondville, Tex.	250
KCKG	Sonora, Tex.	1000
KXOX	Sweetwater, Tex.	1000
WSKI	Montpelier, Vt.	1000
WSSV	Petersburg, Va.	1000
WROV	Roanoke, Va.	1000
WTON	Staunton, Va.	1000
KXLE	Ellensburg, Wash.	1000
KGY	Olympia, Wash.	1000
WKOY	Bluefield, W.Va.	1000
WTIP	Charleston, W.Va.	1000d
WDNE	Elkins, W.Va.	1000
WOMT	Manitowoc, Wis.	1000d
WIBU	Poynette, Wis.	1000d
WOBT	Rhinelander, Wis.	1000
WJMC	Rice Lake, Wis.	1000
KFBC	Cheyenne, Wyo.	1000
KEVA	Evanston, Wyo.	1000
KASL	Newcastle, Wyo.	250
KRAL	Rawlins, Wyo.	1000
KTHE	Thermopolis, Wyo.	1000

1250—239.9

Kc.	Wave Length	W.P.
WZOB	Ft. Payne, Ala.	1000d
WETU	Wetumpka, Ala.	5000d
KAKA	Wickenburg, Ariz.	500d
KFAY	Fayetteville, Ark.	1000d
KALO	Little Rock, Ark.	1000
KHOT	Madera, Calif.	500d
KTMS	Santa Barbara, Calif.	1000
KDHI	Twenty-Nine Palms, California	1000d
KMSL	Ukiah, Calif.	500d
KICM	Golden, Colo.	1000d
WNER	Live Oak, Fla.	1000d
WDAE	Tampa, Fla.	5000
WLYB	Albany, Ga.	1000d
WYTH	Madison, Ga.	1000d
WIZZ	Streator, Ill.	500d
WGL	Ft. Wayne, Ind.	1000
WRAY	Princeton, Ind.	1000d
KCFI	Cedar Falls, Iowa	500d
KFKU	Lawrence, Kans.	5000
WREN	Topeka, Kans.	5000
WNVL	Nicholasville, Ky.	500
WLCK	Scottsville, Ky.	500d
WGUY	Bangor, Maine	5000d
WARE	Ware, Mass.	1000
WXOX	Bay City, Mich.	1000
KOTE	Fergus Falls, Minn.	1000
KCUE	Red Wing, Minn.	1000d
WHNY	McComb, Miss.	5000
KFMO	Flat River, Mo.	1000
KBTC	Houston, Mo.	500d
WKBR	Manchester, N.H.	5000
WMTR	Morristown, N.J.	5000d
WIPS	Ticonderoga, N.Y.	1000d
WFAG	Farmville, N.C.	500d
WKDX	Hamlet, N. C.	1000d
WBRM	Marion, N.C.	1000d
WCHO	Washington Court House, Ohio	500d
WLEM	Emporium, Pa.	1000d
WPEL	Montrose, Pa.	1000d
WRYT	Pittsburgh, Pa.	5000
WNOW	York, Pa.	5000d
WTMA	Charleston, S.C.	5000
WCKM	Winnsboro, S.C.	500d
WKBL	Covington, Tenn.	1000d
WNTT	Tazewell, Tenn.	500d
KFTV	Paris, Tex.	500d
KPAC	Port Arthur, Tex.	5000
KUKA	San Antonio, Tex.	1000d
KTFO	Seminole, Tex.	1000d
KANN	Ogden, Utah	1000d
KVEL	Vernal, Utah	5000d
WDVA	Danville, Va.	5000
WYSR	Franklin, Va.	1000d
WEER	Warrenton, Va.	1000d
KWSC	Pullman, Wash.	5000
KTW	Seattle, Wash.	5000
WEMP	Milwaukee, Wis.	5000

1260—238.0

Kc.	Wave Length	W.P.
KPIN	Casa Grande, Ariz.	1000d
KCCB	Corning, Ark.	1000d
KBHC	Nashville, Ark.	500d
KGIL	San Fernando, Calif.	5000
KYA	San Francisco, Calif.	5000
KSNO	Aspen, Colo.	5000d
WCRT	Birmingham, Ala.	5000d
WMMM	Westport, Conn.	1000d
WNRK	Newark, Del.	500d
WWDC	Washington, D.C.	5000
WFTW	Fort Walton Beach, Florida	1000d
WAME	Miami, Fla.	5000d
WWPF	Palatka, Fla.	1000
WHAB	Baxley, Ga.	5000d
WBBK	Blakely, Ga.	1000d
WTJH	East Point, Ga.	5000d
KTEE	Idaho Falls, Ida.	5000d
KWEI	Weiser, Ida.	1000d
WIBV	Belleville, Ill.	5000d
WFBM	Indianapolis, Ind.	5000
KFGQ	Boone, Iowa	1000d
KWHK	Hutchinson, Kans.	1000
WAIL	Baton Rouge, La.	1000d
WEZE	Boston, Mass.	5000
WALM	Albion, Mich.	1000
WJBL	Holland, Mich.	5000
KRDX	Crookston, Minn.	1000
KDUZ	Hutchinson, Minn.	1000d
WGVM	Greenville, Miss.	5000d
WNSL	Laurel, Miss.	5000d
WCSA	Ripley, Miss.	500
KGBX	Springfield, Mo.	5000
KIMB	Kimball, Nebr.	1000d
WBUD	Trenton, N.J.	5000
KVSF	Santa Fe, N.Mex.	1000
WBNR	Beacon, N.Y.	1000d
WNDR	Syracuse, N.Y.	5000
WGWR	Asheboro, N.C.	5000
WCDJ	Edenton, N.C.	1000d
WDOK	Cleveland, Ohio	5000
WNXT	Portsmouth, Ohio	5000
KWSH	Wewoka-Seminole, Oklahoma	1000
KMCM	McMinnville, Oreg.	1000
WWYN	Erie, Pa.	5000
WPHB	Philipsburg, Pa.	5000d
WISO	Ponce, P.R.	1000
WMUU	Greenville, S.C.	5000d
WJOT	Lake City, S.C.	1000d
KWYR	Winner, S.Dak.	5000d
WNOO	Chattanooga, Tenn.	1000d
WMCH	Church Hill, Tenn.	1000d
WDKN	Dickson, Tenn.	1000d
WCLC	Jamestown, Tenn.	1000d
KSPL	Diboll, Tex.	1000d
KPSO	Falfurrias, Tex.	500d
KWFR	San Angelo, Tex.	1000d
KTUE	Tulia, Tex.	1000d
KTAE	Taylor, Tex.	1000d
WCHV	Charlottesville, Va.	5000
WJJJ	Christiansburg, Va.	1000d
KWIQ	Moses Lake, Wash.	1000d
WVVW	Grafton, W.Va.	500
WWIS	Black River Falls, Wis.	1000d
WEKZ	Monroe, Wis.	1000d
WOCO	Oconto, Wis.	
KPOW	Powell, Wyo.	5000

1270—236.1

Kc.	Wave Length	W.P.
WGSV	Guntersville, Ala.	1000d
WSIM	Prichard, Ala.	1000d
KBYR	Anchorage, Alaska	1000
KDJI	Holbrook, Ariz.	1000d
KADL	Pine Bluff, Ark.	5000d
KGOL	Palm Desert, Cal.	500d
KCOK	Tulare, Calif.	5000d
WNOG	Naples, Fla.	500d
WHIY	Orlando, Fla.	5000d
WTNT	Tallahassee, Fla.	5000
WKRW	Cartersville, Ga.	500d
WHYD	Columbus, Ga.	5000d
WJJC	Commerce, Ga.	1000d
KNDI	Honolulu, Hawaii	5000
KTFI	Twin Falls, Idaho	5000
WEIC	Charleston, Ill.	1000d
WHBF	Rock Island, Ill.	5000
WCMR	Elkhart, Ind.	5000
WWCA	Gary, Ind.	1000
WORX	Madison, Ind.	1000d
KSCB	Liberal, Kans.	1000
WAIN	Columbia, Ky.	1000d
WFUL	Fulton, Ky.	1000d
KVCL	Winnfield, La.	1000d
WSPR	Springfield, Mass.	5000
WXYZ	Detroit, Mich.	5000
KWEB	Rochester, Minn.	5000d
WVOM	Ioka, Miss.	1000d
WLSM	Louisville, Miss.	5000d
KUSN	St. Joseph, Mo.	1000d
KBUB	Sparks, Nev.	1000d
WTSN	Dover, N.H.	5000
WDVL	Vineland, N.J.	500d
KRAC	Alamogordo, N.Mex.	1000d
WHLD	Niagara Falls, N.Y.	5000d
WDLA	Walton, N.Y.	1000d
WCGC	Belmont, N. C.	1000
WMPM	Smithfield, N.C.	5000d
KBOM	Mandan, N.Dak.	1000
WILE	Cambridge, Ohio	1000d
KWPR	Claremore, Okla.	500d
KAJO	Grants Pass, Oreg.	5000d
WLBR	Lebanon, Pa.	5000
WBHC	Hampton, S.C.	1000d
KNWC	Sioux Falls, S.Dak.	1000
WLIK	Newport, Tenn.	5000d
KIOX	Bay City, Tex.	1000
KHEM	Big Spring, Tex.	1000d
KEPS	Eagle Pass, Tex.	1000d
KFJZ	Fort Worth, Tex.	5000
WTIO	Newport News, Va.	1000d
WHED	Stuart, Va.	1000d
KCVL	Colville, Wash.	1000d
KBAM	Longview, Wash.	5000d
WKYR	Keyser, W.Va.	5000
WRJC	Mauston, Wis.	500d
WWJC	Superior, Wis.	5000d

1280—234.2

Kc.	Wave Length	W.P.
WPID	Piedmont, Ala.	1000d
WNPT	Tuscaloosa, Ala.	5000
KHEP	Phoenix, Ariz.	1000d
KNBY	Newport, Ark.	1000d
KOAG	Arroyo Grande, Cal.	1000
KFOX	Long Beach, Calif.	1000
KCJH	San Luis Obispo, Cal.	500d
KJOY	Stockton, Calif.	1000
KTLN	Denver, Colo.	5000
WSUX	Seaford, Del.	1000d
WDSP	DeFuniak Springs, Florida	5000d
WQIK	Jacksonville, Fla.	5000d
WIPC	Lake Wales, Fla.	1000d
WYND	Sarasota, Fla.	500d
WIBB	Macon, Ga.	5000d
WMRO	Aurora, Ill.	1000d
WGBF	Evansville, Ind.	5000
KCOB	Newton, Iowa	1000d
KSOK	Arkansas City, Kans.	1000
WCPM	Cumberland, Ky.	1000d
KWCL	Oak Grove, La.	500d
WEIM	Fitchburg, Mass.	5000
WFYC	Alma, Mich.	5000d
WWTC	Minneapolis, Minn.	5000
KVOX	Moorhead, Minn.	1000
KDKD	Clinton, Mo.	1000d
KYRO	Potosi, Mo.	500d
KCNI	Broken Bow, Nebr.	1000d
KTOO	Henderson, Nev.	5000d
KRZE	Farmington, N.Mex.	5000d
WADO	New York, N.Y.	5000
WROC	Rochester, N.Y.	5000d
WSAT	Salisbury, N.C.	1000
WYAL	Scotland Neck, N.C.	5000d
WONW	Defiance, Ohio	1000
WLMJ	Jackson, Ohio	1000d
KLCO	Poteau, Okla.	1000d
KERG	Eugene, Oreg.	5000
WBRX	Berwick, P.	1000d
WHVR	Hanover, Pa.	5000
WKST	New Castle, Pa.	1000
WCMN	Arecibo, P.R.	5000
WANS	Anderson, S.C.	5000
WJAY	Mullins, S.C.	5000d
KBHB	Sturgis, S. D.	1000d
WMCP	Columbia, Tenn.	1000d
WDNT	Dayton, Tenn.	1000d
KNIT	Abilene, Tex.	500d
KWHI	Brenham, Tex.	1000d
KLUE	Longview, Tex.	1000d
KRAN	Morton, Tex.	500
KVWG	Pearsall, Tex.	500d
KNAK	Salt Lake City, Utah	5000
WYVE	Wytheville, Va.	1000d
KMAS	Shelton, Wash.	1000d
KUDY	Spokane, Wash.	5000d
KIT	Yakima, Wash.	5000
WVAR	Richwood, W.Va.	1000d
WNAM	Neenah, Wis.	5000

1290—232.4

Kc.	Wave Length	W.P.
WHOD	Jackson, Ala.	1000d
WSHF	Sheffield, Ala.	1000d
WMLS	Sylacauga, Ala.	1000d
KEOS	Flagstaff, Ariz.	1000
KCUB	Tucson, Ariz.	1000
KDMS	El Dorado, Ark.	5000d
KUOA	Siloam Sprgs., Ark.	5000d
KHSL	Chico, Calif.	5000
KPER	Gilroy, Calif.	5000d
KMEN	San Bernardino, California	5000
KACL	Santa Barbara, Cal.	500d
WCCC	Hartford, Conn.	500d
WTUX	Wilmington, Del.	1000d
WTMC	Ocala, Fla.	5000
WSCM	Panama City Beach, Florida	500d
WIRK	W. Palm Bch., Fla.	5000
WDEC	Americus, Ga.	1000d
WCHK	Canton, Ga.	1000d
WTOC	Savannah, Ga.	5000
KSNN	Pocatello, Idaho	1000d
WIRL	Peoria, Ill.	5000
WNIR	New Albany, Ind.	5000
KWNS	Pratt, Kansas	5000
WCBL	Benton, Ky.	5000d
KJEF	Jennings, La.	1000d
WHGR	Houghton Lake, Mich.	5000
WNIL	Niles, Mich.	500d
WOIB	Saline, Mich.	500d
KBMO	Benson, Minn.	500d
WBLE	Batesville, Miss.	1000d
KALM	Thayer, Mo.	1000d
KGVO	Missoula, Mont.	5000
KOIL	Omaha, Nebr.	5000
WKNE	Keene, N.H.	5000
KSRC	Socorro, N.M.	1000d
WGLI	Babylon, N. Y.	5000
WNBF	Binghamton, N.Y.	5000
WHKY	Hickory, N.C.	5000
WEYE	Sanford, N.C.	1000d

Kc. Wave Length	W.P.
WOMP Bellaire, Ohio	1000d
WHIO Dayton, Ohio	5000
KUMA Pendleton, Oreg.	5000
KLIQ Portland, Oreg.	5000d
WFBG Altoona, Pa.	5000
WICE Providence, R.I.	5000
WFIG Sumter, S.C.	1000
WATO Oak Ridge, Tenn.	5000
KBLT Big Lake, Tex.	1000d
KIVY Crockett, Tex.	500d
KRGV Weslaco, Tex.	5000
KTRN Wichita Falls, Tex.	5000
WPVA Colonial Hgts., Va.	5000d
WAGE Leesburg, Va.	1000d
WKWS Rocky Mount, Va.	1000d
WVOW Logan, W.Va.	5000
KAPY Port Angeles, Wash.	1000d
WMIL Milwaukee, Wis.	1000d
WCOW Sparta, Wis.	5000d
KOWB Laramie, Wyo.	5000

1300—230.6

Kc. Wave Length	W.P.
WBSA Boaz, Ala.	1000d
WTLS Tallassee, Ala.	1000d
WEZQ Winfield, Ala.	500d
KWCB Searcy, Ark.	1000d
KROP Brawley, Calif.	1000
KYNO Fresno, Calif.	5000
KWKW Pasadena, Calif.	5000
KVOR Colo. Sprgs., Colo.	1000
WAVZ New Haven, Conn.	1000
WRKT Cocoa Beach, Fla.	5000
WFFG Marathon, Fla.	500
WSOL Tampa, Fla.	5000d
WMTM Moultrie, Ga.	5000d
WNEA Newman, Ga.	500
WIMO Winder, Ga.	1000d
KOZE Lewiston, Idaho	5000
WTAQ La Grange, Ill.	5000
WFRX W. Frankfort, Ill.	1000d
WHLT Huntington, Ind.	500d
WAAC Terre Haute, Ind.	500d
KGLO Mason City, Iowa	5000
WBLG Lexington, Ky.	1000
WIBR Baton Rouge, La.	1000
KANB Shreveport, La.	1000d
WFBR Baltimore, Md.	5000
WJDA Quincy, Mass.	1000d
WOOD Grand Rapids, Mich.	5000
WRBC Jackson, Miss.	5000
KMMO Marshall, Mo.	1000d
KBRL McCook, Nebr.	5000d
KPTL Carson City, Nev.	5000
WPNH Plymouth, N.H.	1000d
WAAT Trenton, N.J.	5000d
WOSC Fulton, N.Y.	1000d
WMMJ Lancaster, N.Y.	1000d
WEEE Rensselaer, N.Y.	5000d
WRRC Spring Valley, N.Y.	500d
WGOL Goldsboro, N.C.	1000d
WLNC Laurinburg, N.C.	500
WSYD Mt. Airy, N.C.	5000
WERE Cleveland, Ohio	5000
WMVO Mt. Vernon, Ohio	500
KOME Tulsa, Okla.	5000
KDOV Medford, Oreg.	5000d
KACI The Dalles, Oreg.	1000d
WWCH Clarion, Pa.	500d
WTHT Hazleton, Pa.	1000d
WTIL Mayaguez, P.R.	1000
WLOW Aiken, S.C.	500d
WCKI Greer, S.C.	1000d
WKSC Kershaw, S.C.	500d
WQIZ St. George, S.C.	500d
KOLY Mobridge, S.Dak.	1000d
WMTN Morristown, Tenn.	5000d
WMAK Nashville, Tenn.	5000
KVET Austin, Tex.	5000
KKUB Brownfield, Tex.	1000d
KGNS Laredo, Tex.	1000d
KKAS Silsbee, Tex.	500d
KSTU Logan, Utah	1000
KOL Seattle, Wash.	5000
WCLG Morgantown, W.Va.	1000d
WKLC St. Albans, W.Va.	1000d

1310—228.9

Kc. Wave Length	W.P.
WHEP Foley, Ala.	1000d
WJAM Marion, Ala.	5000d
KBUZ Mesa, Ariz.	5000
KBOK Malvern, Ark.	1000d
KIOT Barstow, Calif.	500d
KPOD Crescent City, Calif.	1000d
KDIA Oakland, Cal.	5000
KTKR Taft, Calif.	1000d
KFKA Greeley, Colo.	1000
WICH Norwich, Conn.	5000
WOOO Deland, Fla.	5000d
WGKR Perry, Fla.	1000d
WAUC Wauchula, Fla.	500d
WOMN Decatur, Ga.	500
WOKA Douglas, Ga.	1000d
WBRO Waynesboro, Ga.	1000d
WBMK West Point, Ga.	1000d
KNUI Makawao, Hawaii	1000
KLIX Twin Falls, Idaho	5000
WIFE Indianapolis, Ind.	5000
KDLS Perry, Iowa	500d
KOKX Keokuk, Iowa	1000d
KFLA Scott City, Kans.	500d
WTTL Madisonville, Ky.	1000
WDOC Prestonsburg, Ky.	5000d
KIKS Sulphur, La.	500d
KUZN W. Monroe, La.	1000d
WLOB Portland, Maine	5000d
WORC Worcester, Mass.	5000
WKNR Dearborn, Mich.	5000
WCCW Traverse City, Mich.	5000d
KRBI St. Peter, Minn.	1000d
WXXX Hattiesburg, Miss.	1000d
KFSB Joplin, Mo.	5000
KFBB Great Falls, Mont.	5000
KGMT Fairbury, Nebr.	500d
WCAM Camden, N. J.	1000
KARA Albuquerque, N.M.	1000d
WVIP Mt. Kisco, N.Y.	5000d
WTLB Utica, N.Y.	1000
WISE Asheville, N.C.	5000
WKTC Charlotte, N.C.	1000
WTIK Durham, N.C.	5000
KNOX Grand Forks, N.Dak.	5000
WFAH Alliance, Ohio	1000d
KNPT Newport, Oreg.	5000
WBFD Bedford, Pa.	5000d
WGSA Ephrata, Pa.	5000d
WNAE Warren, Pa.	5000d
WDKD Kingstree, S.C.	5000d
WDOD Chattanooga, Tenn.	5000
WDXI Jackson, Tenn.	5000
WBNT Oneida, Tenn.	1000d
KZIP Amarillo, Tex.	1000d
WRR Dallas, Tex.	5000
KOYL Odessa, Tex.	1000d
KUBO San Antonio, Tex.	5000
WEEL Fairfax, Va.	5000
WGH Newport News, Va.	5000
KARY Prosser, Wash.	1000d
WIBA Madison, Wis.	5000

1320—227.1

Kc. Wave Length	W.P.
WAGF Dothan, Ala.	1000
WENN Birmingham, Ala.	5000d
KBLU Yuma, Ariz.	500d
KWHN Fort Smith, Ark.	5000
KRLW Walnut Ridge, Ark.	1000d
KHSJ Hemet, Calif.	500d
KLAN Lemoore, Calif.	1000d
KUDE Oceanside, Calif.	500
KCRA Sacramento, Calif.	5000
KAVI Rocky Ford, Colo.	1000d
WATR Waterbury, Conn.	5000
WGMA Hollywood, Fla.	1000d
WZOK Jacksonville, Fla.	5000
WAMR Venice, Fla.	500d
WHIE Griffin, Ga.	5000d
WKAN Kankakee, Ill.	1000
KNIA Knoxville, Iowa	500d
KMAQ Maquoketa, Iowa	500d
KLWN Lawrence, Kans.	500d
WBRT Bardstown, Ky.	1000d
WCLU Covington, Ky.	500d
WNGO Mayfield, Ky.	1000d
KHAL Homer, La.	1000d
WICO Salisbury, Md.	1000d
WARA Attleboro, Mass.	1000
WILS Lansing, Mich.	5000
WDMJ Marquette, Mich.	1000
WRJW Picayune, Miss.	5000d
KXLW Clayton, Mo.	1000d
KOLT Scottsbluff, Nebr.	5000
KRDD Roswell, N.M.	1000d
WWHG Hornell, N.Y.	5000d
WAGY Forest City, N.C.	1000
WCOG Greensboro, N.C.	5000
WKRK Murphy, N.C.	5000d
WEEW Washington, N.C.	500d
KHRT Minot, N.D.	1000d
WHOK Lancaster, Ohio	1000d
KWOE Clinton, Okla.	1000d
KATR Eugene, Ore.	1000d
WKAP Allentown, Pa.	5000
WGET Gettysburg, Pa.	1000
WJAS Pittsburgh, Pa.	5000
WSCR Scranton, Pa.	1000
WUNO Rio Piedras, P.R.	5000
WOIC Columbia, S. C.	5000
KELO Sioux Falls, S.Dak.	5000
WKIN Kingsport, Tenn.	5000d
WMSR Manchester, Tenn.	5000d
KVMC Colo. City, Tex.	1000d
KXYZ Houston, Tex.	5000
KCPX Salt Lake City, Utah	5000
WDMS Lynchburg, Va.	1000
WEET Richmond, Va.	1000d
KXRO Aberdeen, Wash.	5000
KHIT Walla Walla, Wash.	1000d
WAXK Superior, Wis.	1000d
WFHR Wisconsin Rapids, Wis.	5000

1330—225.4

Kc. Wave Length	W.P.
WROS Scottsboro, Ala.	1000d
KMOP Tucson, Ariz.	500d
KVEE Conway, Ark.	500d
KLOM Lompoc, Cal.	1000d
KFAC Los Angeles, Calif.	5000
KLBS Los Banos, Calif.	500d
KAHR Redding, Calif.	5000d
WARN Ft. Pierce, Fla.	1000
WWAB Lakeland, Fla.	1000d
WEBY Milton, Fla.	5000d
WMEN Tallahassee, Fla.	5000d
WMLT Dublin, Ga.	5000d
WEAW Evanston, Ill.	5000
WRAM Monmouth, Ill.	1000d
WRRR Rockford, Ill.	1000d
WJPS Evansville, Ind.	5000
KWWL Waterloo, Iowa	5000
KFH Wichita, Kans.	5000
WYGO Corbin, Ky.	5000d
WMOR Morehead, Ky.	1000d
KVOL Lafayette, La.	5000
WASA Havre de Grace, Md.	5000d
WCRB Waltham, Mass.	5000
WTRX Flint, Mich.	5000
WLOL Minneapolis, Minn.	5000
WJPR Greenville, Miss.	1000
WDAL Meridian, Miss.	1000d
KUKU Willow Springs, Mo.	1000d
KGAK Gallup, N.Mex.	5000
WEVD New York, N.Y.	5000
WPOW New York, N.Y.	5000
WEBO Owego, N.Y.	1000d
WHAZ Troy, N.Y.	1000
WUSM Havelock, N.C.	1000d
WHOT Campbell, Ohio	1000
WFIN Findlay, Ohio	1000d
WKOV Wellston, Ohio	500d
WELW Willoughby, O.	500d
KPOJ Portland, Oreg.	5000
WBLF Bellefonte, Pa.	500
WICU Erie, Pa.	5000
WLAT Conway, S. C.	5000
WFBC Greenville, S.C.	5000
WAEW Crossville, Tenn.	1000d
WTRO Dyersburg, Tenn.	500d
KMIL Cameron, Tex.	500d
KSWA Graham, Tex.	500d
KINE Kingsville, Tex.	1000d
KVKM Monahans, Tex.	5000
KZAK Tyler, Tex.	1000d
WBTM Danville, Va.	5000
WRAA Luray, Va.	1000d
WOLD Marion, Va.	1000d
WESR Tasley, Va.	5000d
KFKF Bellevue, Wash.	5000d
KCFA Spokane, Wash.	5000d
WETZ New Martinsville, W.Va.	1000d
WHBL Sheboygan, Wis.	5000
KOVE Lander, Wyo.	5000

1340—223.7

Kc. Wave Length	W.P.
WKUL Cullman, Ala.	1000
WJOI Florence, Ala.	1000
WGWC Selma, Ala.	250
WFEB Sylacauga, Ala.	1000
KIKO Miami, Ariz.	1000
KNOG Nogales, Ariz.	250
KPGE Page, Ariz.	1000
KENT Prescott, Ariz.	250
KBTA Batesville, Ark.	1000
KBRS Springdale, Ark.	1000
KATA Arcata, Cal.	1000
KWXY Cathedral City, Cal.	250
KMAK Fresno, Calif	1000
KDOL Mojave, Calif.	100
KSFE Needles, Calif.	250
KAOR Oroville, Cal.	1000
KATY San Luis Obispo, California	1000
KIST Santa Barbara, Calif.	1000
KOMY Watsonville, Calif.	1000
KDEN Denver, Colo.	1000
KWSL Grand Junction, Colo.	250
KVRH Salida, Colo.	1000
WNHC New Haven, Conn.	1000
WOOK Washington, D. C.	1000
WSLC Clermont, Fla.	250
WTAN Clearwater, Fla.	250
WROD Daytona Bch., Fla.	1000
WDSR Lake City, Fla.	1000
WTYS Marianna, Fla.	1000
WNSM Niceville-Valparaiso, Fla.	1000
WQXT Palm Beach, Fla.	500
WSEB Sebring, Fla.	250
WNSM Valparaiso-Niceville, Fla.	1000
WIGO Atlanta, Ga.	1000d
WGAU Athens, Ga.	1000
WBBQ Augusta, Ga.	1000
WGAA Cedartown, Ga.	1000
WOKS Columbus, Ga.	1000
WBBT Lyons, Ga.	1000
WTIF Tifton, Ga.	1000
KAIN Nampa, Idaho	1000
KPST Preston, Idaho	250
KSKI Sun Valley, Idaho	1000
WSOY Decatur, Ill.	1000
WJPF Herrin, Ill.	1000
WJOL Joliet, Ill.	1000
WBIW Bedford, Ind.	1000
WTRC Elkhart, Ind.	1000
WLBC Muncie, Ind.	1000
KROS Clinton, Iowa	1000
KCKN Kansas City, Kans.	1000d
KSEK Pittsburg, Kans.	1000
WCMI Ashland, Ky.	1000
KENT Prescott, Ariz.	250
WNBS Murray, Ky.	1000d
WEKY Richmond, Ky.	1000
KVOB Bastrop, La.	250
KRMD Shreveport, La.	1000
WFAU Augusta, Maine	1000
WHOU Houlton, Maine	1000
WGAW Gardner, Mass.	1000
WNBH New Bedford, Mass.	1000
WBRK Pittsfield, Mass.	1000
WLEW Bad Axe, Mich.	1000
WLAV Grand Rap., Mich.	1000
WCSR Hillsdale, Mich.	1000
WMTE Manistee, Mich.	1000
WAGN Menominee, Mich.	1000
WMBN Petoskey, Mich.	1000
WEXL Royal Oak, Mich.	1000
KVBR Brainerd, Minn.	1000
KDLM Detroit Lakes, Minn.	1000
WEVE Eveleth, Minn.	1000
KROC Rochester, Minn.	1000
KWLM Willmar, Minn.	1000
WJMB Brookhaven, Miss.	250
WAML Laurel, Miss.	250
KXEO Mexico, Mo.	1000d
KLID Poplar Bluff, Mo.	1000d
KSGM St. Genevieve, Mo.	1000
KSMO Salem, Mo.	1000
KDRO Sedalia, Mo.	1000
KICK Springfield, Mo.	1000
KCAP Helena, Mont.	1000
KPRK Livingston, Mont.	1000
KATL Miles City, Mont.	1000
KQTE Missoula, Mont.	250
KHUB Fremont, Nebr.	500
KGFW Kearney, Nebr.	1000
KSID Sidney, Nebr.	1000
KORK Las Vegas, Nev.	1000
KBET Reno, Nev.	1000
WDCR Hanover, N.H.	1000
WMID Atlantic City, N.J.	1000
KHAP Aztec, N.M.	1000d
KRRR Ruidoso, N. Mex.	1000
KKIT Taos, N.Mex.	250
KSIL Silver City, N.Mex.	1000
WMBO Auburn, N.Y.	1000
WENT Gloversville, N.Y.	1000
WKSN Jamestown, N.Y.	250
WUSJ Lockport, N.Y.	250
WMSA Massena, N.Y.	1000
WALL Middletown, N.Y.	1000
WIRY Plattsburgh, N.Y.	1000
WJRI Lenoir, N.C.	1000
WTSB Lumberton, N.C.	1000
WOXF Oxford, N.C.	1000
WOOW Greenville, N.C.	1000
WGNI Wilmington, N.C.	1000
WAIR Winston-Salem, N.C.	250
KGPC Grafton, N.Dak.	1000
WNCO Ashland, O.	1000
WOUB Athens, Ohio	250
WIZE Springfield, Ohio	1000
WSTV Steubenville, Ohio	1000
KIHN Hugo, Okla.	250
KOCY Okla. City, Okla.	1000
KTOW Sand Springs, Okla.	250
KLOO Corvallis, Ore.	1000
KWVR Enterprise, Oreg.	250
KIHR Hood River, Oreg.	250
KFIR North Bend, Oreg.	1000
WCVI Connellsville, Pa.	1000d
WSAJ Grove City, Pa.	100
WKRZ Oil City, Pa.	1000
WHAT Philadelphia, Pa.	1000
WRAW Reading, Pa.	1000
WTRN Tyrone, Pa.	1000
WBRE Wilkes-Barre, Pa.	1000
WWPA Williamsport, Pa.	1000
WUNA Aquadilla, P.R.	250
WOKE Charleston, S.C.	1000
WRHI Rock Hill, S.C.	1000
WSSC Sumter, S.C.	1000
KIJV Huron, S. D.	1000
KRSD Rapid City, S.Dak.	1000
WBAC Cleveland, Tenn.	1000
WKRM Columbia, Tenn.	1000
WGRV Greeneville, Tenn.	1000
WKGN Knoxville, Tenn.	1000
WLOK Memphis, Tenn.	1000d
WCDT Winchester, Tenn.	1000
KWKC Abilene, Tex.	1000
KTSL Burnett, Tex.	250
KAND Corsicana, Tex.	250
KSET El Paso, Tex.	250
KLBK Lubbock, Tex.	1000
KRBA Lufkin, Tex.	1000
KPDN Pampa, Tex.	250
KOLE Port Arthur, Tex.	250
KTEO San Angelo, Tex.	250
KVIC Victoria, Tex.	250
WTWN St. Johnsbury, Vt.	1000
WSTA Charlotte Amalie, V.I.	250
WKEY Covington, Va.	1000
WHAP Hopewell, Va.	1000
WJMA Orange, Va.	1000
KAGT Anacortes, Wash.	250
KGRS Pasco, Wash.	1000
KAPA Raymond, Wash.	1000
KMEL Wenatchee, Wash.	250
WHAR Clarksburg, W.Va.	1000
WEPM Martinsburg, W. Va.	1000
WMON Montgomery, W.Va.	250
WOVE Welch, W.Va.	1000
WLDY Ladysmith, Wis.	1000
WRIT Milwaukee, Wis.	1000d
KSGT Jackson, Wyo.	250
KYCN Wheatland, Wyo.	250
KWOR Worland, Wyo.	1000

WHITE'S

RADIO LOG

Kc. Wave Length W.P.

1350—222.1

WELB Elba, Ala. 1000d
WGAD Gadsden, Ala. 5000d
KLYD Bakersfield, Calif. 1000d
KCKC San Bernardino, Cal. 5000
KSRO Santa Rosa, Calif. 5000
KKAM Pueblo, Colo. 5000
WNLK Norwalk, Conn. 1000
WINY Putnam, Conn. 1000d
WEZY Cocoa, Fla. 1000
WDCF Dade City, Fla. 1000d
WCAI Ft. Myers, Fla. 1000d
WBSG Blackshear, Ga. 500d
WRWH Cleveland, Ga. 1000d
WRPB Warner Robins, Ga. 5000d
KRLC Lewiston, Ida.-Clarkston, Wash. 5000d
WXCL Peoria, Ill. 1000
WJBD Salem, Ill. 1000d
WIOU Kokomo, Ind. 5000
KRNT Des Moines, Iowa 5000
KMAN Manhattan, Kans. 500d
WLOU Louisville, Ky. 5000d
WSMB New Orleans, La. 5000
WHMI Howell, Mich. 500
KDIO Ortonville, Minn. 1000d
WCMP Pine City, Minn. 1000d
WKCU Corinth, Miss. 1000
WKOZ Kosciusko, Miss. 5000d
KCHR Charleston, Mo. 1000d
KBRX O'Neill, Nebr. 1000d
WLNH Laconia, N.H. 5000d
WHWH Princeton, N.J. 5000
KABQ Albuquerque, N.M. 5000
WCBA Corning, N.Y. 1000d
WRNY Rome, N.Y. 500d
WBMS Black Mountain, N. C. 500d
WHIP Mooresville, N.C. 1000d
WLLY Wilson, N.C. 1000d
KBMR Bismarck, N. D. 5000
WSLR Akron, O. 5000
WCSM Celina, Ohio 500d
WCHI Chillicothe, Ohio 1000d
KRHD Duncan, Okla. 250
KTLQ Tahlequah, Okla. 1000d
KRVC Ashland, Oreg. 1000d
WORK York, Pa. 5000
WWBR Windber, Pa. 1000d
WDAR Darlington, S.C. 1000d
WGSW Greenwood, S.C. 1000d
WRKM Carthage, Tenn. 1000d
KCAR Clarksville, Tex. 500d
KTXJ Jasper, Tex. 1000d
KCOR San Antonio, Tex. 5000
WBLT Bedford, Va. 1000d
WFLS Fredericksburg, Va. 1000d
WNVA Norton, Va. 5000d
WAVY Portsmouth, Va. 5000
WPDR Portage, Wis. 5000d

1360—220.4

WWWB Jasper, Ala. 1000d
WLIQ Mobile, Ala. 5000d
WMFC Monroeville, Ala. 1000d
WELR Roanoke, Ala. 1000d
KRUX Glendale, Ariz. 5000
KLYR Clarksville, Ark. 500d
KFFA Helena, Ark. 1000
KFIV Modesto, Cal. 5000
KRCK Ridgecrest, Calif. 1000d
KGB San Diego, Calif. 5000
KDEY Boulder, Colo. 500d
WDRC Hartford, Conn. 5000
WOBS Jacksonville, Fla. 5000d
WKAT Miami Beach, Fla. 5000
WINT Winter Haven, Fla. 1000d
WAZA Bainbridge, Ga. 1000d
WLAW Lawrenceville, Ga. 1000d
WMAC Metter, Ga. 500d
WIYN Rome, Ga. 500d
WLBK DeKalb, Ill. 1000d
WVMC Mt. Carmel, Ill. 500d
WGFA Watseka, Ill. 1000d
KHAK Cedar Rapids, Iowa 1000d
KRCB Council Bluffs, Iowa
KXGI Ft. Madison, Iowa 1000d
KSCJ Sioux City, Iowa 5000
KBTO El Dorado, Kans. 500d
WFLW Monticello, Ky. 1000d
KDXI Mansfield, La. 1000d
KVIM New Iberia, La. 1000d
KTLD Tallulah, La. 500d
WEBB Baltimore, Md. 5000d
WLYN Lynn, Mass. 1000d
WKYO Caro, Mich. 500d
WKMI Kalamazoo, Mich. 5000
KLRS Mountain Grove, Mo. 1000d
KWRV McCook, Nebr. 1000d
WNNJ Newton, N.J. 1000d

Kc. Wave Length W.P.

WWBZ Vineland, N.J. 1000
WKOP Binghamton, N.Y. 5000
WMNS Olean, N.Y. 1000d
WCHL Chapel Hill, N.C. 1000d
KEYZ Williston, N.D. 5000
WSAI Cincinnati, Ohio 5000
WWOW Conneaut, Ohio 500d
KUIK Hillsboro, Oreg. 1000d
WMCK McKeesport, Pa. 5000
WPPA Pottsville, Pa. 5000
WELP Easley, S.C. 1000d
WLCM Lancaster, S.C. 1000d
WBLC Lenoir City, Tenn.
WNAH Nashville, Tenn. 1000d
KRAY Amarillo, Tex. 500d
KACT Andrews, Tex. 1000d
KWBA Baytown, Tex. 1000
KRYS Corpus Christi, Tex. 1000
KXOL Ft. Worth, Tex. 5000
WBOB Galax, Va. 1000d
WHBG Harrisonburg, Va. 5000d
KFDR Grand Coulee, Wash. 1000d
KMO Tacoma, Wash. 5000
WHJC Matawan, W.Va. 1000d
WMOV Ravenswood, W.Va. 1000d
WBAY Green Bay, Wis. 5000
WISV Viroqua, Wis. 1000
WMNE Menomonie, Wis. 1000d
KVRS Rock Springs, Wyo. 1000

1370—218.8

WBYE Calera, Ala. 1000d
KHEB Heber Springs, Ark. 500
KTPA Prescott, Ark. 500d
KREL Corona, Cal. 1000
KQCY Quincy, Calif. 500d
KEEN San Jose, Calif. 5000
KGEN Tulare, Calif. 1000d
WKMK Blountstown, Fla. 500d
WWKE Ocala, Fla. 5000d
WCOA Pensacola, Fla. 5000
WAXE Vero Beach, Fla. 1000d
WLOP Jesup, Ga. 5000
WFDR Manchester, Ga. 1000d
WLOV Washington, Ga. 1000d
WPRC Lincoln, Ill. 1000d
WTTS Bloomington, Ind. 5000
WLTH Gary, Ind. 1000d
KDTH Dubuque, Iowa 5000
KGNO Dodge City, Kans. 5000
KALN Iola, Kans. 500d
WABD Ft. Campbell, Ky. 500d
WGOH Grayson, Ky. 5000d
WTKY Tompkinsville, Ky. 1000d
KAPB Marksville, La. 1000d
WDEA Ellsworth, Me. 5000
WMHI Braddocks Hts., Md. 500d
WKIK Leonardtown, Md. 1000d
WGHN Grand Haven, Mich. 500d
KSUM Fairmont, Minn. 1000
WMKT S. St. Paul, Minn. 500d
WMGO Canton, Miss. 1000d
KWRT Boonville, Mo. 1000d
KCRV Caruthersville, Mo. 1000d
KXLF Butte, Mont. 5000
KAWL York, Nebr. 500d
WFEA Manchester, N.H. 5000d
WELV Ellenville, N.Y. 500
WALK Patchogue, N.Y. 500d
WSAY Rochester, N.Y. 5000
WLTC Gastonia, N.C. 5000d
WTAB Tabor City, N.C. 5000d
KFJM Grand Forks, N.D. 1000d
WSPD Toledo, Ohio 5000
KVYL Holdenville, Okla. 500d
KAST Astoria, Oreg. 1000
WOTR Corry, Pa. 1000
WPAZ Pottstown, Pa. 1000d
WKMC Roaring Sprgs., Pa. 1000d
WIVV Vieques, P.R. 1000
WKFD Wickford, R.I. 500d
WDEF Chattanooga, Tenn. 5000
WDXE Lawrenceburg, Tenn. 1000d
WRGS Rogersville, Tenn. 1000d
KOKE Austin, Tex. 1000d
KFRO Longview, Tex. 1000
KPOS Post, Tex. 1000d
KSOP Salt Lake City, Utah 1000d
WBTN Bennington, Vt. 1000d
WHEE Martinsville, Va. 5000d
WJWS South Hill, Va. 5000d
KPOR Quincy, Wash. 1000d
WEIF Moundsville, W. Va. 1000d
WCCN Neillsville, Wis. 5000d
KVWO Cheyenne, Wyo. 1000

1380—217.3

WRAB Arab, Ala. 1000d
WGYV Greenville, Ala. 1000d
KDXE N. Little Rock, Ark. 1000d
KBVM Lancaster, Calif. 1000d
KGMS Sacramento, Calif. 1000
KSBW Salinas, Calif. 5000
KFLJ Walsenburg, Colo. 1000d
WAMS Wilmington, Del. 5000
WLIZ Lake Worth, Fla. 500d
WQXQ Ormond Bch., Fla. 1000d
WLCY St. Petersburg, Fla. 5000
WAOK Atlanta, Ga. 5000
WSIZ Ocilla, Ga. 5000d
KPOI Honolulu, Hawaii 5000

Kc. Wave Length W.P.

WWCM Brazil, Ind. 500d
WKJG Ft. Wayne, Ind. 5000
KCIM Carroll, Iowa 1000
KCII Washington, Iowa 500d
KUDL Fairway, Kan. 5000
WMTA Central City, Ky. 500d
WWKY Winchester, Ky. 1000d
WYNK Baton Rouge, La. 500d
WKTJ Farmington, Me. 1000d
WTTH Port Huron, Mich. 1000
WPLB Greenville, Mich. 1000
KLIZ Brainerd, Minn. 5000
KAGE Winona, Minn. 1000
WDLT Indianola, Miss. 500d
KWK St. Louis, Mo. 5000
KUVR Holdrege, Nebr. 500
WBBX Portsmouth, N.H. 1000
WAWZ Zarephath, N.J. 5000
WFSR Bath, N.Y. 500d
WBNX New York, N.Y. 5000
WLOS Asheville, N.C. 5000
WTOB Winston-Salem, N.C. 5000
WWIZ Lorain, Ohio 500d
WPKO Waverly, Ohio 1000d
KSWO Lawton, Okla. 1000
KMUS Muskogee, Okla. 1000
KBCH Ocean Lake, Oreg. 1000d
KSRV Ontario, Oreg. 5000
WACB Kittanning, Pa. 1000d
WMLP Milton, Pa. 1000d
WAYZ Waynesboro, Pa. 1000d
WNRI Woonsocket, R.I. 1000d
WAGS Bishopville, S.C. 1000d
WGUS N. Augusta, S.C. 1000d
KOTA Rapid City, S.Dak. 5000
KFCB Redfield, S.Dak. 500d
WYSH Clinton, Tenn. 1000d
WGMM Millington, Tenn. 500d
KJET Beaumont, Tex. 1000
KBWD Brownwood, Tex. 1000
KCRM Crane, Tex. 1000d
KTSM El Paso, Tex. 5000
KMUL Muleshoe, Tex. 1000d
KBOP Pleasanton, Tex. 1000d
WSYB Rutland, Vt. 5000
WMBG Richmond, Va. 5000
KRKO Everett, Wash. 5000
KPEG Spokane, Wash. 5000d
WMTD Hinton, W.Va. 1000d
WBEL Beloit, Wis. 5000

1390—215.7

WHMA Anniston, Ala. 5000
KDQN DeQueen, Ark. 500d
KAMD Rogers, Ark. 1000d
KGER Long Beach, Calif. 5000
KCEY Turlock, Calif. 5000
KFML Denver, Colo 5000d
WAVP Avon Park, Fla. 1000d
WUWU Gainsville, Fla. 5000d
WISK Americus, Ga. 5000d
WNUS Chicago, Ill. 5000
WFIW Fairfield, Ill. 1000
WJCD Seymour, Ind. 1000d
KCLN Clinton, Iowa 1000d
KCBC Des Moines, Iowa 1000
KNCK Concordia, Kans. 500d
WANY Albany, Ky. 1000d
WKIC Hazard, Ky. 5000d
KFRA Franklin, La. 500d
WEGP Presque Isle, Me. 5000d
KJPW Waynesville, Mo. 1000d
WCAT Orange, Mass. 1000d
WPLM Plymouth, Mass. 5000
WCER Charlotte, Mich. 5000d
KAOH Duluth, Minn. 500
KRFO Owatonna, Minn. 500d
WROA Gulfport, Miss. 1000d
WQIC Meridian, Miss. 5000d
KJPW Waynesville, Mo. 1000d
KENN Farmington, N.Mex. 5000
KHOB Hobbs, N.Mex. 5000d
WEOK Poughkeepsie, N.Y. 5000
WRIV Riverhead, N.Y. 1000d
WFBL Syracuse, N.Y. 5000
WEED Rocky Mount, N.C. 5000
WADA Shelby, N.C. 1000
WJRM Troy, N.C. 500d
KLPM Minot, N.Dak. 5000
WOHP Bellefontaine, Ohio 500d
WMPO Middleport-Pomeroy, O. 5000d
WFMJ Youngstown, Ohio 5000
KCRC Enid, Okla. 1000
KSLM Salem, Oreg. 5000
WLAN Lancaster, Pa. 5000
WRSC State College, Pa. 1000d
WISA Isabella, P.R. 1000
WHPB Belton, S.C. 1000d
WCSC Charleston, S.C. 5000
KJAM Madison, S.D. 5000d
WTJS Jackson, Tenn. 5000
KULP El Campo, Tex. 500d
KBEC Waxahachie, Tex. 500d
KLGN Logan, Utah 1000
WEAM Arlington, Va. 5000
WWOD Lynchburg, Va. 5000
WKLP Keyser, W.Va. 1000d
KBBO Yakima, Wash. 1000

1400—214.2

WMSL Decatur, Ala. 1000

Kc. Wave Length W.P.

WXAL Demopolis, Ala. 1000d
WFPA Ft. Payne, Ala. 1000
WJLD Homewood, Ala. 1000
WJHO Opelika, Ala. 1000
KSEW Sitka, Alaska 250
KCLF Clifton, Ariz. 250
KJKJ Flagstaff, Ariz. 250
KXIV Phoenix, Ariz. 1000
KTUC Tucson, Ariz. 250
KVOY Yuma, Ariz. 250
KELD El Dorado, Ark. 1000
KCLA Pine Bluff, Ark. 1000
KWYN Wynne, Ark. 1000
KPAT Berkeley, Calif. 1000
KREO Indio, Calif. 250
KQMS Redding, Calif. 250
KSLY San Luis Obispo, Cal. 250
KSPA Santa Paula, Calif. 250
KHOE Truckee, Calif. 1000
KUKI Ukiah, Calif. 1000
KONG Visalia, Calif. 1000
KRLN Canon City, Colo. 250
KDTA Delta, Colo. 250
KFTM Ft. Morgan, Colo. 250
KBZZ La Junta, Colo. 1000
WSTC Stamford, Conn. 1000
WILI Willimantic, Conn. 1000
WFTL Ft. Lauderdale, Fla. 1000
WIRA Ft. Pierce, Fla. 1000
WNVE Ft. Walton Bch., Fla. 1000d
WRHC Jacksonville, Fla. 250
WPRY Perry, Fla. 1000
WTRR Sanford, Fla. 1000
WZRH Zephyr Hills, Fla. 250
WCQS Alma, Ga. 1000
WSGC Elberton, Ga. 1000
WNEX Macon, Ga. 1000
WMGA Moultrie, Ga. 1000
WCOH Newnan, Ga. 1000
WGSA Savannah, Ga. 1000
KART Jerome, Idaho 250
KRPL Moscow, Idaho 250
KIGO St. Anthony, Ida.
KSPT Sandpoint, Idaho 1000
WDWS Champaign, Ill. 1000
WGIL Galesburg, Ill. 1000
WROZ Evansville, Ind. 1000
WBAT Marion, Ind. 1000
KCOG Centerville, Ia. 500
KVFD Fort Dodge, Iowa 1000
KVOE Emporia, Kans. 1000
KAYS Hays, Kans. 1000
WCYN Cynthiana, Ky. 250
WIEL Elizabethtown, Ky. 1000
WFTG London, Ky. 250
WFPR Hammond, La. 1000
KAOK Lake Charles, La. 1000
WRDO Augusta, Maine 1000d
WIDE Biddeford, Maine 1000
WWIN Baltimore, Md. 1000
WALE Fall River, Mass. 1000
WLLH Lowell, Mass. 1000
WHMP Northampton, Mass. 1000
WKFR Battle Creek, Mich. 1000
WJLB Detroit, Mich. 1000d
WHDF Houghton, Mich. 250
WGON Munising, Mich. 250
WSAM Saginaw, Mich. 1000
WSJM St. Joseph, Mich. 1000
WTCM Traverse City, Mich. 1000
KEYL Long Prairie, Minn. 1000
KMHL Marshall, Minn. 1000
WMIN Mpls.-St. Paul, Minn. 1000
WHLB Virginia, Minn. 1000
WBIP Booneville, Miss. 1000
WNAG Grenada, Miss. 1000
WFOR Hattiesburg, Miss. 1000
WJQS Jackson, Miss. 1000
WMBC Macon, Miss. 1000
KFRU Columbia, Mo. 1000
KJCF Festus, Mo. 1000
KSIM Sikeston, Mo. 1000
KTTS Springfield, Mo. 1000
KDRG Deer Lodge, Mont. 250
KXGN Glendive, Mont. 250
KARR Great Falls, Mont. 1000
KCOW Alliance, Nebr. 1000
KLIN Lincoln, Neb. 1000
KBMI Henderson, Nev. 250
KWNA Winnemucca, Nev. 1000
WBRL Berlin, N.H. 250
WTSL Hanover, N.H. 1000
WLTN Littleton, N.H. 250
KTRC Santa Fe, N.M. 1000
KCHS Truth or Consequences, New Mexico 250
KTNM Tucumcari, N.M. 1000
WOND Pleasantville, N.J. 1000
WABY Albany, N.Y. 1000
WYSL Buffalo, N.Y. 1000
WSLB Ogdensburg, N.Y. 1000
WBMA Beaufort, N.C. 250
WGBG Greensboro, N.C. 1000
WSHB Raeford, N.C. 1000
WSIC Statesville, N.C. 1000
WLSE Wallace, N. C. 1000
WHCC Waynesville, N.C. 1000
WCNF Weldon, N.C. 1000d
KEYJ Jamestown, N.Dak. 1000
WMAN Mansfield, Ohio 1000d
WPAY Portsmouth, Ohio 1000

Kc.	Wave Length	W.P.
KWON	Bartlesville, Okla.	1000
KTMC	McAlester, Okla.	250
KNOR	Norman, Okla.	250
KNND	Cottage Grove, Oreg.	1000d
KJDY	John Day, Ore.	1000
WEST	Easton, Pa.	1000
WJET	Erie, Pa.	1000
WFEC	Harrisburg, Pa.	1000d
WWSF	Loretto, Pa.	250
WICK	Scranton, Pa.	250
WRAK	Williamsport, Pa.	1000
WVOZ	Carolina, P. R.	500
WCOS	Columbia, S.C.	1000
WGTN	Georgetown, S.C.	1000
WHCQ	Spartanburg, S.C.	1000d
KBJM	Lemmon, S. D.	
WJZM	Clarksville, Tenn.	1000
WHUB	Cookeville, Tenn.	1000
WLSB	Copperhill, Tenn.	1000
WGAP	Maryville, Tenn.	1000d
WHAL	Shelbyville, Tenn.	1000
KRUN	Ballinger, Tex.	1000
KBYG	Big Springs, Tex.	1000
KUNO	Corpus Christi, Tex.	1000
KILE	nr. Galveston, Tex.	250
KGVL	Greenville, Tex.	1000
KEBE	Jacksonville, Tex.	1000
KIUN	Pecos, Tex.	1000
KEYE	Perryton, Tex.	250
KVOP	Plainview, Tex.	1000
KDWT	Stamford, Tex.	1000
KTEM	Temple, Tex.	1000
KTFS	Texarkana, Tex.	250
KVOU	Uvalde, Tex.	250
KIXX	Provo, Utah	250
WDOT	Burlington, Vt.	1000
WINA	Charlottesville, Va.	1000
WHHV	Hillsville, Va.	1000
WHIH	Portsmouth, Va.	1000
WHLF	So. Boston, Va.	1000
WINC	Winchester, Va.	1000
KEDO	Longview, Wash.	250
KRSC	Othello, Wash.	250
KTNT	Tacoma, Wash.	1000
WBOY	Clarkesburg, W.Va.	1000
WRON	Ronceverte, W.Va	1000
WSPZ	Spencer, W.Va.	1000
WKWK	Wheeling, W.Va.	250
WBTH	Williamson, W.Va.	1000
WATW	Ashland, Wis.	1000
WBIZ	Eau Claire, Wis.	1000
WOUZ	Green Bay, Wis.	1000
WRJN	Racine, Wis.	1000
WRDB	Reedsburg, Wis.	1000
WRIG	Wausau, Wis.	1000
KATI	Casper, Wyo.	1000
KODI	Cody, Wyo.	1000

1410—212.6

Kc.	Wave Length	W.P.
WUNI	Mobile, Ala.	5000
WRCK	Tuscumbia, Ala.	500d
KTCS	Fort Smith, Ark.	1000
KERN	Bakersfield, Calif.	1000
KRML	Carmel, Calif.	500d
KKOK	Lompoc, Calif.	500d
KMYC	Marysville, Calif.	5000
KCAL	Redlands, Calif.	5000d
KCOL	Ft. Collins, Colo.	1000
WPOP	Hartford, Conn.	5000
WDOV	Dover, Del.	5000
WMYR	Fort Myers, Fla.	5000
WBIL	Leesburg, Fla.	1000d
WONS	Tallahassee, Fla.	5000d
WGRI	Griffin, Ga.	1000d
WSNE	Cummings, Ga.	1000d
WDAX	McRae, Ga.	1000d
WLAQ	Rome, Ga.	1000
WRMN	Elgin, Ill.	1000d
WTIM	Taylorville, Ill.	1000d
WAZY	Lafayette, Ind.	1000d
KGRN	Grinnell, Iowa	500d
KLEM	LeMars, Iowa	1000d
KCLO	Leavenworth, Kans.	5000d
KWBB	Wichita, Kans.	5000
WLBJ	Bowling Green, Ky.	5000
WHLN	Harlan, Ky.	5000d
KDBS	Alexandria, La.	1000d
WDOW	Halfway, Md.	1000d
WHAG	Halfway, Md.	1000d
WOKW	Brockton, Mass.	1000d
WGRD	Grand Rap., Mich.	1000d
KLFD	Litchfield, Minn.	500d
KRWB	Roseau, Minn.	1000
WDSK	Cleveland, Miss.	1000d
WBKN	Newton, Miss.	500d
WNOP	North Platte, Neb.	1000
WHTG	Asbury Park-Eatontown, N.J.	500d
WDOE	Dunkirk, N.Y.	1000
WELM	Elmira, N.Y.	1000
WBZA	Glens Falls, N. Y.	1000d
WOTT	Watertown, N.Y	5000
WVCB	Shallotte, N.C.	500d
WEGO	Concord, N.C.	1000d
WSRC	Durham, N.C.	1000d
WING	Dayton, Ohio	5000
KPAM	Portland, Oreg.	5000d
WLSH	Lansford, Pa.	5000d
KQV	Pittsburgh, Pa.	5000
WPCC	Clinton, S.C.	1000d
WYMB	Manning, S.C.	1000d
WCMT	Martin, Tenn.	1000d
KBUD	Athens, Tex.	1000d
KBAN	Bowie, Tex.	500d
KVLB	Cleveland, Tex.	500
KXIT	Dalhart, Tex.	500d
KDOX	Marshall, Tex.	500
KRIG	Odessa, Tex.	1000
KBAL	San Saba, Tex.	500d
KNAL	Victoria, Tex.	500
WIKI	Chester, Va.	5000d
WRIS	Roanoke, Va.	5000d
WRDS	S. Charleston, W.Va.	1000d
WKBH	LaCrosse, Wis.	5000
KWYO	Sheridan, Wyo.	1000

1420—211.1

Kc.	Wave Length	W.P.
WACT	Tuscaloosa, Ala.	5000d
KHFH	Sierra Vista, Ariz.	1000
KPOC	Pocahontas, Ark.	1000d
KRDO	Colo. Sprgs., Colo.	1000
KSTN	Stockton, Calif.	5000
WLIS	Old Saybrook, Conn.	500d
WBRD	Bradenton, Fla.	1000
WDBF	Delray Beach, Fla.	5000d
WETH	St. Augustine, Fla.	1000d
WAVO	Avondale Estates, Ga.	1000d
WRBL	Columbus, Ga.	5000
WPEH	Louisville, Ga.	1000d
WLET	Toccoa, Ga.	5000d
KCCN	Honolulu, Hawaii	5000
WINI	Murphysboro, Ill.	500d
WIMS	Michigan City, Ind.	5000d
WOC	Davenport, Iowa	5000
KJCK	Junction City, Kans.	1000d
KULY	Ulysses, Kans.	1000d
WTCR	Ashland, Ky.	5000d
WHBN	Harrodsburg, Ky.	1000d
WVJS	Owensboro, Ky.	5000
KPEL	Lafayette, La.	1000
WBSM	New Bedford, Mass.	5000
WBEC	Pittsfield, Mass.	1000
WAMM	Flint, Mich.	1000d
WKPR	Kalamazoo, Mich.	1000d
KTOE	Mankato, Minn.	5000
WSUH	Oxford, Miss.	1000d
WQBC	Vicksburg, Miss.	1000
KBTN	Neosho, Mo.	500d
KOOO	Omaha, Nebr.	1000d
KSYX	Santa Rosa, N.Mex.	1000d
WALY	Herkimer, N.Y.	1000d
WACK	Newark, N.Y.	500
WLNA	Peekskill, N.Y.	1000d
WMYN	Mayodan, N.C.	500
WGAS	S. Gastonia, N.C.	500d
WVOT	Wilson, N.C.	1000
WHK	Cleveland, Ohio	5000
KYNG	Coos Bay, Oreg.	1000d
WCOJ	Coatesville, Pa.	5000
WCED	DuBois, Pa.	5000
WEUC	Ponce, P.R.	1000
WCRE	Cheraw, S.C.	1000d
WEMB	Erwin, Tenn.	5000d
WKSR	Pulaski, Tenn.	1000
KFYN	Bonham, Tex.	250d
KTRE	Lufkin, Tex.	1000
KGNB	New Braunfels, Tex.	1000d
KPEP	San Angelo, Tex.	1000d
WWSR	St. Albans, Vt.	1000d
WDDY	Gloucester, Va.	1000d
WKCW	Warrenton, Va.	5000d
KITI	Chehalis-Centralia, Wash.	1000d
KREN	Renton, Wash.	500d
KUJ	Walla Walla, Wash.	5000
WPLY	Plymouth, Wis.	500d

1430—209.7

Kc.	Wave Length	W.P.
WFHK	Pell City, Ala.	1000d
KHBM	Monticello, Ark.	1000d
KAMP	El Centro, Calif.	1000d
KARM	Fresno, Calif.	5000
KALI	San Gabriel, Cal.	5000
KJAY	Sacramento, Calif.	500d
KGNU	Santa Clara, Cal.	1000
KOSI	Aurora, Colo.	5000
WIII	Homestead, Fla.	500d
WLAK	Lakeland, Fla.	5000
WPCF	Panama City, Fla.	5000
WGFS	Covington, Ga.	1000d
WRCD	Dalton, Ga.	1000d
WWGS	Tifton, Ga.	5000
WEEF	Highland Park, Ill.	1000d
WCMY	Ottawa, Ill.	500d
WIRE	Indianapolis, Ind.	5000
KASI	Ames, Iowa	1000d
KMRC	Morgan City, La.	500d
WNAV	Annapolis, Md.	5000
WTTT	Amherst, Mass.	5000d
WHIL	Medford, Mass.	5000d
WION	Ionia, Mich.	5000d
WBRB	Mt. Clemens, Mich.	500d
WLAU	Laurel, Miss.	5000d
KAOL	Carrollton, Mo.	500d
WIL	St. Louis, Mo.	5000
KRGI	Grand Island, Nebr.	5000
WNJR	Newark, N.J.	5000
KGFL	Roswell, N.M.	5000d
WENE	Endicott, N.Y.	5000
WMNC	Morganton, N.C.	5000
WDJS	Mt. Olive, N.C.	1000d
WRXO	Roxboro, N.C.	1000d
WFOB	Fostoria, Ohio	1000
WCLT	Newark, Ohio	500d
KALV	Alva, Okla.	500
KELI	Tulsa, Okla.	5000
KGAY	Salem, Oreg.	5000d
WVAM	Altoona, Pa.	1000
WNEL	Caguas, P. R.	5000
WBLR	Batesburg, S.C.	5000d
WATP	Marion, S.C.	1000d
WBUG	Ridgeland, S.C.	1000d
KBRK	Brookings, S. Dak.	1000d
WGYW	Fountain City, Tenn.	1000d
WENO	Madison, Tenn.	5000
WHER	Memphis, Tenn.	1000
KSTB	Breckenridge, Tex.	1000d
KEES	Gladewater, Tex.	1000d
KCOH	Houston, Tex.	1000d
KLO	Ogden, Utah	5000
WIVE	Ashland, Va.	1000d
WDIC	Clincho, Va.	1000d
KBRC	Mt. Vernon, Wash.	5000
WEIR	Weirton, W.Va.	1000
WBEV	Beaver Dam, Wis.	1000d

1440—208.2

Kc.	Wave Length	W.P.
WHHY	Montgomery, Ala.	5000
KDOT	Scottsdale, Ariz.	5000d
KHOG	Fayetteville, Ark.	1000d
KOKY	Little Rock, Ark.	5000d
KVON	Napa, Cal.	1000
KPRO	Riverside, Calif.	1000
KCOY	Santa Maria, Calif.	1000
WBIS	Bristol, Conn.	500d
WABR	Winter Park, Fla.	5000d
WWCC	Bremen, Ga.	1000d
WGIG	Brunswick, Ga.	5000
WRAJ	Anna, Ill.	500d
WIOK	Normal, Ill.	1000
WPRS	Paris, Ill.	1000d
WGEM	Quincy, Ill.	5000
WROK	Rockford, Ill.	5000
WPGW	Portland, Ind.	500d
KCHE	Cherokee, Iowa	500d
KEWI	Topeka, Kans.	5000
WCDS	Glasgow, Ky.	1000d
WPDE	Paris, Ky.	1000d
WEZJ	Williamsburg, Ky.	1000d
KMLB	Monroe, La.	5000
WJAB	Westbrook, Me.	5000d
WAAB	Worcester, Mass.	5000
WBCM	Bay City, Mich.	1000
WDOW	Dowagiac, Mich.	1000d
WCHB	Inkster, Mich.	1000
KQRS	Golden Valley, Minn.	5000d
KEYL	Long Prairie, Minn.	1000
WHHT	Lucedale, Miss.	1000d
WSEL	Pontotoc, Miss.	1000d
WJLK	Asbury Park, N.J.	1000
WMVB	Millville, N.J.	1000d
WBAB	Babylon, N.Y.	1000d
WJJL	Niagara Falls, N.Y.	1000d
WSGO	Oswego, N.Y.	1000d
WBLA	Elizabethtown, N.C.	1000d
WBUY	Lexington, N.C.	5000
KILO	Grand Forks, N.D.	1000
WHHH	Warren, Ohio	5000
KMED	Medford, Oreg.	5000
KODL	The Dalles, Oreg.	1000
WCDL	Carbondale, Pa.	5000d
WNPV	Lansdale, Pa.	500d
WGCB	Red Lion, Pa.	1000d
WQOK	Greenville, S.C.	5000
WHHL	Holly Hill, S.C.	1000d
WZYX	Cowan, Tenn.	1000d
WHDM	McKenzie, Tenn.	500d
KFDA	Amarillo, Tex.	5000
KEYS	Corpus Christi, Tex.	1000
KDNT	Denton, Tex.	5000
KGVL	Greenville, Tex.	1000
KWEL	Midland, Tex.	5000d
KETX	Livingston, Tex.	5000d
WKLV	Blackstone, Va.	5000d
WHRN	Herndon, Va.	1000
KDNC	Spokane, Wash.	5000d
WHIS	Bluefield, W.Va.	5000
WAJR	Morgantown, W.Va.	5000
WJPG	Green Bay, Wis.	5000

1450—206.8

Kc.	Wave Length	W.P.
WDNG	Anniston, Ala.	1000
WYAM	Bessemer, Ala.	1000
WDIG	Dothan, Ala.	1000
WFIX	Huntsville, Ala.	1000d
WLAY	Muscle Shoals City, Alabama	1000
KLAM	Cordova, Alaska	250
KAWT	Douglas, Ariz.	250
KNOT	Prescott, Ariz.	1000
KOLD	Tucson, Ariz.	250
KENA	Mena, Ark.	250
KJWH	Camden, Ark.	1000d
KYOR	Blythe, Calif.	250
KOWN	Escondido, Calif.	250
KPAL	Palm Springs, Cal.	1000
KTIP	Porterville, Calif.	1000
KSOL	San Francisco, Cal.	1000
KVML	Sonora, Calif.	250
KVEN	Ventura, Calif.	1000
KAGR	Yuba City, Calif.	100
KGIW	Alamosa, Colo.	1000
KYOU	Greeley, Colo.	1000
WNAB	Bridgeport, Conn.	1000
WILM	Wilmington, Del.	1000
WOL	Washington, D. C.	1000
WWJB	Brooksville, Fla.	250
WMFJ	Daytona Beach, Fla.	1000
WSKP	Miami, Fla.	250
WBSR	Pensacola, Fla.	1000
WSPB	Sarasota, Fla.	1000
WSTU	Stuart, Fla.	250
WTAL	Tallahassee, Fla.	1000
WGPC	Albany, Ga.	1000
WBHF	Cartersville, Ga.	1000
WCON	Cornelia, Ga.	250
WKEU	Griffin, Ga.	1000
WMVG	Milledgeville, Ga.	1000
WBYG	Savannah, Ga.	1000
WVLD	Valdosta, Ga.	1000
KVSI	Montpelier, Ida.	1000
KEEP	Twin Falls, Idaho	1000
WVON	Cicero, Ill.	1000
WKEI	Kewanee, Ill.	500
WCVS	Springfield, Ill.	1000
WLYV	Ft. Wayne, Ind.	1000
WXVW	Jeffersonville, Ind.	1000
WASK	Lafayette, Ind.	1000
WAOV	Vincennes, Ind.	1000
KLWW	Cedar Rapids, Ia.	250
KYET	Payette, Ida.	250
KWBW	Hutchinson, Kans.	1000
WTCO	Campbellsville, Ky.	1000
WWXL	Manchester, Ky.	1000
WPAD	Paducah, Ky.	1000
WLKS	W. Liberty, Ky.	1000
KSIG	Crowley, La.	1000
KNOC	Natchitoches, La.	1000
WNPS	New Orleans, La.	250
WLKN	Lincoln, Me.	1000d
WRKD	Rockland, Maine	250
WKTQ	South Paris, Maine	1000
WTBO	Cumberland, Md.	1000d
WMAS	Springfield, Mass.	1000
WATZ	Alpena Township, Michigan	1000
WHTC	Holland, Mich.	1000
WMIQ	Iron Mtn., Mich.	250
WIBM	Jackson, Mich.	1000
WKLA	Ludington, Mich.	1000
WNBY	Newberry, Mich.	
WHLS	Port Huron, Mich.	1000
KATE	Albert Lea, Minn.	250
KBUN	Bemidji, Minn.	1000
KBMW	Wahpeton, N.D.-Breckinridge, Minn.	1000d
WELY	Ely, Minn.	1000
KFAM	St. Cloud, Minn.	1000
WROX	Clarksdale, Miss.	1000
WCJU	Columbia, Miss.	250
WJXN	Jackson, Miss.	250
WOKK	Meridian, Miss.	1000
WNAT	Natchez, Miss.	250
WROB	West Point, Miss.	1000
KFTW	Fredericktown, Mo.	1000
WMBH	Joplin, Mo.	1000
KIRX	Kirksville, Mo.	1000
KDKO	Warrensburg, Mo.	1000
KWPM	West Plains, Mo.	1000
KXXL	Bozeman, Mont.	1000
KUDI	Great Falls, Mont.	1000
KXLL	Missoula, Mont.	250
KRBN	Red Lodge, Mont.	1000
KVCK	Wolf Point, Mont.	1000
KWBE	Beatrice, Nebr.	250
KONE	Reno, Nev.	250
WKXL	Concord, N.H.	1000
WFPG	Atlantic City, N.J.	1000
WCTC	New Brunswick, N. J.	1000
KRZY	Albuquerque, N.M.	250
KLMX	Clayton, N.Mex.	1000d
KOBE	Las Cruces, N.Mex.	250
KENM	Portales, N.Mex.	1000
WCLI	Corning, N.Y.	1000
WWSC	Glen Falls, N.Y.	1000d
WHDL	Olean, N.Y.	1000
WKIP	Poughkeepsie, N. Y.	1000
WKAL	Rome, N.Y.	250
WATA	Boone, N. C.	1000
WGNC	Gastonia, N.C.	1000
WIZS	Henderson, N.C.	1000
WHKP	Hendersonville, N.C.	1000
WHIT	New Bern, N.C.	1000
WFBS	Spring Lake, N.C.	1000
KGCA	Rugby, N.Dak.	250
WTBO	Cumberland, O.	1000d
WJER	Dover, Ohio	1000
WMOH	Hamilton, Ohio	1000d
WLEC	Sandusky, Ohio	1000
KWHW	Altus, Okla.	1000
KGFF	Shawnee, Okla.	1000
KSIW	Woodward, Okla.	1000
KDRE	Eugene, Oreg.	1000
KFLW	Klamath Falls, Ore.	1000
KLBM	La Grande, Oreg.	1000
KBPS	Portland, Ore.	250
WWGO	Erie, Pa.	1000d
WFRA	Franklin, Pa.	1000
WDAD	Indiana, Pa.	1000
WPAM	Pottsville, Pa.	1000
WMPT	So. Williamsport, Pa.	250
WMAJ	State College, Pa.	1000d
WJPA	Washington, Pa.	250
WWRI	W. Warwick, R.I.	1000
WQSN	Charleston, S.C.	1000
WCRS	Greenwood, S.C.	1000
WMYB	Myrtle Beach, S.C.	1000
WHSC	Hartsville, S.C.	1000
KBFS	Belle Fourche, S. Dak.	1000

WHITE'S

RADIO LOG

Kc.	Wave Length	W.P.
KYNT	Yankton, S. D.	1000
WLAR	Athens, Tenn.	1000
WMOC	Chattanooga, Tenn.	1000
WDSG	Dyersburg, Tenn.	1000
WSMG	Greeneville, Tenn.	250
WLAF	LaFollette, Tenn.	1000
WGNS	Murfreesboro, Tenn.	1000
KAYC	Beaumont, Tex.	1000
KBEN	Carrizo Sprgs., Tex.	250
KCTI	Gonzales, Tex.	250
KMBL	Junction, Tex.	250
KCYL	Lampasas, Tex.	1000
KMHT	Marshall, Tex.	1000
KAMY	McCamey, Tex.	250
KNET	Palestine, Tex.	250
KSNY	Snyder, Tex.	1000
KURA	Moab, Utah	1000
KEYY	Provo, Utah	1000
KDXU	St. George, Utah	250
WSNO	Barre, Vt.	1000
WTSA	Brattleboro, Vt.	1000
WFTR	Front Royal, Va.	1000
WENZ	Highland Springs, Va.	250
WREL	Lexington, Va.	1000
WMVA	Martinsville, Va.	1000
KBKW	Aberdeen, Wash.	1000
KCLX	Colfax, Wash.	1000
KONP	Port Angeles, Wash.	250
KAYE	Puyallup, Wash.	1000
WPAR	Parkersburg, W. Va.	1000
KFIZ	Fond du Lac, Wis.	250
WDLB	Marshfield, Wis.	1000
WPFP	Park Falls, Wis.	1000
WRCO	Richland Center, Wis.	1000
KBBS	Buffalo, Wyo.	250
KVOW	Riverton, Wyo.	1000

1460—205.4

WFMH	Cullman, Ala.	5000d
WPNX	Phenix City, Ala.	5000
KZOT	Marianna, Ark.	500
KCCL	Paris, Ark.	500d
KTYM	Inglewood, Calif.	5000
KDON	Salinas, Calif.	5000
KVRE	Santa Rosa, Calif.	1000d
KYSN	Colo. Sprgs., Colo.	1000
WBAR	Bartow, Fla.	1000d
WZEP	DeFuniak Springs, Florida	1000d
WMBR	Jacksonville, Fla.	5000
WDYX	Buford, Ga.	1000d
WPNX	Columbus, Ga.	1000
WROY	Carmi, Ill.	1000d
WIXN	Dixon, Ill.	1000d
WRTL	Rantoul, Ill.	250d
WKAM	Goshen, Ind.	1000
WOCH	North Vernon, Ind.	1000d
KSO	Des Moines, Iowa	5000
KCRB	Chanute, Kans.	1000d
WRVK	Mt. Vernon, Ky.	500d
WXOK	Baton Rouge, La.	5000
KBSF	Springhill, La.	1000d
WEMD	Easton, Md.	1000
WBET	Brockton, Mass.	5000
WBRN	Big Rapids, Mich.	1000d
WPON	Pontiac, Mich.	1000
KDWA	Hastings, Minn.	1000d
KDMA	Montevideo, Minn.	1000
WELZ	Belzoni, Miss.	1000d
WACY	Moss Point, Miss.	1000d
KADY	St. Charles, Mo.	5000d
KRNY	Kearney, Nebr.	5000d
KENO	Las Vegas, Nev.	1000
WJJZ	Mt. Holly, N.J.	5000d
WOKO	Albany, N.Y.	5000
WVOX	New Rochelle, N.Y.	500d
WHEC	Rochester, N.Y.	5000
WFVG	Fuquay Sprgs., N.C.	1000d
WRKB	Kannapolis, N.C.	500d
WMMH	Marshall, N.C.	500d
WBNS	Columbus, Ohio	5000
WPVL	Painesville, Ohio	500d
KROW	Dallas, Oreg.	5000d
KELR	El Reno, Okla.	500
WMBA	Ambridge, Pa.	500d
WCMB	Harrisburg, Pa.	5000
WFBA	San Sebastian, P.R.	500
WDOG	Allendale, S. C.	
WBCU	Union, S.C.	1000
WJAK	Jackson, Tenn.	5000d
WEEN	Lafayette, Tenn.	1000d
KBRZ	Freeport, Tex.	500d
KLLL	Lubbock, Tex.	1000d
WACO	Waco, Tex.	1000
WPRW	Manassas, Va.	500d
WRAD	Radford, Va.	5000
WLPM	Suffolk, Va.	5000d
KYAC	Kirkland, Wash.	5000d
KIMA	Yakima, Wash.	5000
WBUC	Buckhannon, W.Va.	5000d
WRAC	Racine, Wis.	500d
WTMB	Tomah, Wis.	1000d

1470—204.0

WBLO	Evergreen, Ala.	1000d
KZNG	Hot Springs, Ark.	1000d
KBMX	Coalinga, Calif.	500d
KUTY	Palmdale, Cal.	5000d
KXOA	Sacramento, Calif.	5000
WMMW	Meriden, Conn.	1000d
WRBD	Pompano Beach, Fla.	5000
WCWR	Tarpon Springs, Fla.	5000d
WAAG	Adel, Ga.	1000d
WDOL	Athens, Ga.	1000d
WCLA	Claxton, Ga.	1000
WRGA	Rome, Ga.	5000
WMPP	Chicago Heights, Ill.	1000d
WMBD	Peoria, Ill.	5000
WHUT	Anderson, Ind.	1000d
KTRI	Sioux City, Iowa	5000
KWVY	Waverly, Iowa	1000d
KARE	Atchison, Kans.	1000
KLIB	Liberal, Kans.	500d
WSAC	Fort Knox, Ky.	1000d
KTDL	Farmersville, La.	1000d
KPLC	Lake Charles, La.	5000
WLAM	Lewiston, Maine	5000
WJDY	Salisbury, Md.	5000d
WTTR	Westminster, Md.	1000d
WSRO	Marlborough, Mass.	1000d
WNBP	Newburyport, Mass.	500d
WKMF	Flint, Mich.	5000
WKLZ	Kalamazoo, Mich.	500d
KANO	Anoka, Minn.	1000d
WCHJ	Brookhaven, Miss.	1000d
WNAU	New Albany, Miss.	500d
KGHM	Brookfield, Mo.	500d
KTCB	Malden, Mo.	1000d
WTKO	Ithaca, N.Y.	1000d
WPDM	Potsdam, N.Y.	1000d
WBIG	Greensboro, N.C.	5000
WPNC	Plymouth, N.C.	1000d
WTOE	Spruce Pine, N.C.	1000d
WOHO	Toledo, Ohio	1000
KVLH	Pauls Valley, Okla.	250d
KVIN	Vinita, Okla.	500d
KRAF	Reedsport, Oreg.	5000d
WSAN	Allentown, Pa.	5000
WFAR	Farrell, Pa.	1000d
WWML	Portage, Pa.	500d
WQXL	Columbia, S.C.	5000d
WGOO	Georgetown, S. C.	1000d
WEAG	Alcoa, Tenn.	1000d
WVOL	Berry Hill, Tenn.	5000
KRBC	Abilene, Tex.	5000
KDHN	Dimmitt, Tex.	500d
KWRD	Henderson, Tex.	500d
KCNY	San Marcos, Tex.	250d
KELA	Centralia-Chehalis, Wash.	5000d
KSEM	Moses Lake, Wash.	5000
KAPS	Mount Vernon, Wash.	500d
WWHY	Huntington, W.Va.	5000d
WBZE	Wheeling, W.Va.	500d
WBKV	West Bend, Wis.	1000d
KTWO	Casper, Wyo.	5000

1480—202.6

WARI	Abbeville, Ala.	1000d
WBTS	Bridgeport, Ala.	1000d
WIXI	Irondale, Ala.	5000d
WABB	Mobile, Ala.	5000
KHAT	Phoenix, Ariz.	500
KGLU	Safford, Ariz.	1000
KTHS	Berryville, Ark	1000
KWUN	Concord, Calif.	500d
KYOS	Merced, Calif.	5000
KWIZ	Santa Ana, Calif.	5000
KSEE	Santa Maria, Calif.	1000
KCMS	Manitou Springs, Colo.	500
KPUB	Pueblo, Colo.	1000d
WSOR	Windsor, Conn.	500d
WAPG	Arcadia, Fla.	1000d
WGNE	Panama Beach, Fla.	500d
WVCF	Windermere, Fla.	1000d
WYZE	Atlanta, Ga.	5000d
WRDW	Augusta, Ga.	5000
WGSB	Geneva, Ill.	1000
WJBM	Jerseyville, Ill.	500d
WTHI	Terre Haute, Ind.	1000
WRSW	Warsaw, Ind.	1000
KLEE	Ottumwa, Iowa	500d
KBEA	Mission, Kan.	1000
KLEO	Wichita, Kans.	5000
WKOA	Hopkinsville, Ky.	1000d
WNKY	Neon, Ky.	1000d
WTLO	Somerset, Ky.	1000d
KCKW	Jena, La.	500d
KANV	Jonesville, La.	500d
KJOE	Shreveport, La.	1000d
WSAR	Fall River, Mass.	5000
WMAX	Grand Rapids, Mich.	5000d
WIOS	Tawas City, Mich.	1000d
WYSI	Ypsilanti, Mich.	500d
KAUS	Austin, Minn.	1000
WECP	Carthage, Miss.	500d
KGCX	Sidney, Mont.	5000
KLMS	Lincoln, Nebr.	1000
KWEW	Hobbs, N. Mex.	5000
WLEA	Hornell, N.Y.	1000d
WHOM	New York, N.Y.	5000
WREM	Remsen, N.Y.	5000d
WWOK	Charlotte, N.C.	5000
WYRN	Louisburg, N.C.	500d
WMSJ	Sylva, N.C.	5000
WHBC	Canton, Ohio	5000
WCIN	Cincinnati, Ohio	5000
WTRA	Latrobe, Pa.	500d
WDAS	Philadelphia, Pa.	5000
WISL	Shamokin, Pa.	1000
WSHP	Shippensburg, Pa.	500d
WMDD	Fajardo, P.R.	5000
KSDR	Waterton, S.D.	1000d
WJFC	Jefferson City, Tenn.	500
WMQM	Memphis, Tenn.	5000d
WJLE	Smithville, Tenn.	1000d
KBOX	Dallas, Tex.	5000
KLVL	Pasadena, Tex.	1000
KAPE	San Antonio, Tex.	500d
KONI	Spanish Fork, Utah	1000d
WCFR	Springfield, Vt.	1000d
WBBL	Richmond, Va.	5000
WLEE	Richmond, Va.	5000
WBLU	Salem, Va.	5000d
KFHA	Lakewood Center, Wash.	1000d
KVAN	Camas, Wash.	1000d
WISM	Madison, Wis.	5000
KRAE	Cheyenne, Wyo.	1000d

1490—201.2

WANA	Anniston, Ala.	250
WAJF	Decatur, Ala.	1000
WRLD	Lanett, Ala.—West Point, Ga.	1000
WHBB	Selma, Ala.	1000
KYCA	Prescott, Ariz.	1000
KAIR	Tucson, Ariz.	250
KXAR	Hope, Ark.	1000
KDRS	Paragould, Ark.	1000
KOTN	Pine Bluff, Ark.	250
KXRJ	Russellville, Ark.	1000
KWAC	Bakersfield, Calif.	1000
KPAS	Banning, Calif.	250
KOWL	Bijou, Cal.	1000
KICO	Calexico, Calif.	250
KRKC	King City, Calif.	1000
KOWL	Lake Tahoe, Calif.	250
KTOB	Petaluma, Calif.	1000
KBLF	Red Bluff, Calif.	1000
KDB	Santa Barbara, Calif.	1000
KSYC	Yreka, Calif.	1000
KBOL	Boulder, Colo.	1000
KGUC	Gunnison, Colo.	250
KCMS	Manitou Springs, Colo.	500
KOLR	Sterling, Colo.	250
WGCH	Greenwich, Conn.	250
WTRL	Bradenton, Fla.	250
WJBS	Deland, Fla.	1000
WIRA	Ft. Pierce, Fla.	250
WCOF	Immokalie, Fla.	250
WMBM	Miami Beach, Fla.	250
WSRA	Milton, Fla.	1000
WPXE	Starke, Fla.	250
WTTB	Vero Beach, Fla.	1000
WSIR	Winter Haven, Fla.	500
WMOG	Brunswick, Ga.	1000
WMJM	Cordele, Ga.	1000
WMRE	Monroe, Ga.	1000d
WSFB	Quitman, Ga.	250
WSNT	Sandersville, Ga.	500
WSYL	Sylvania, Ga.	250
WRLD	W.Point, Ga.-Lanett, Ala.	250
KTOH	Lihue, Hawaii	1000
KCID	Caldwell, Idaho	1000
WKRO	Cairo, Ill.	250
WDAN	Danville, Ill.	1000
WAMV	East St. Louis, Ill.	1000
WOPA	Oak Park, Ill.	1000
WZOE	Princeton, Ill.	1000
WKBV	Richmond, Ind.	1000
WNDU	South Bend, Ind.	1000
KBUR	Burlington, Iowa	1000
WDBQ	Dubuque, Iowa	1000
KBAB	Indianola, Ia.	500
KRIB	Mason City, Ia.	1000
KKAN	Phillipsburg, Kans.	250
KTOP	Topeka, Kan.	1000
WFKY	Frankfort, Ky.	1000d
WKAY	Glasgow, Ky.	1000
WOMI	Owensboro, Ky.	1000
WSIP	Paintsville, Ky.	1000
WIKC	Bogalusa, La.	1000
KEUN	Eunice, La.	1000
KCIL	Houma, La.	1000
KRUS	Ruston, La.	1000
WPOR	Portland, Maine	1000
WTVL	Waterville, Maine	1000
WARK	Hagerstown, Md.	1000
WHAV	Haverhill, Mass.	250
WMRC	Milford, Mass.	1000
WTXL	W. Springfield, Mass.	1000
WABJ	Adrian, Mich.	1000
WMDN	Midland, Mich.	1000
WLRC	Whitehall, Mich.	1000
KXRA	Alexandria, Minn.	250
KOZY	Grand Rapids, Minn.	1000
KLGR	Redwd. Falls, Minn.	1000
WLOX	Biloxi, Miss.	1000
WCLD	Cleveland, Miss.	1000
WHOC	Philadelphia, Miss.	1000
WTUP	Tupelo, Miss.	1000
WVIM	Vicksburg, Miss.	250
KDMO	Carthage, Mo.	250
KTTR	Rolla, Mo.	1000
KDRO	Sedalia, Mo.	1000
KBON	Omaha, Nebr.	1000
WEMJ	Laconia, N.H.	1000
WLDB	Atlantic City, N. J.	1000
KRSN	Los Alamos, N.Mex.	1000
KRTN	Raton, N.Mex.	1000
WCSS	Amsterdam, N.Y.	1000
WBTA	Batavia, N.Y.	250
WKNY	Kingston, N.Y.	1000
WICY	Malone, N.Y.	1000
WDLC	Port Jervis, N. Y.	1000
WOLF	Syracuse, N. Y.	1000
WSSB	Durham, N. C.	1000
WFLB	Fayetteville, N.C.	1000
WLOE	Leaksville, N.C.	250
WRNB	New Bern, N.C.	1000
WRMT	Rocky Mount, N. C.	1000
WSTP	Salisbury, N. C.	1000
WSVM	Valdese, N.C.	1000
WHSL	Wilmington, N. C.	1000
KNDC	Hettinger, N.D.	1000
KOVC	Valley City, N. Dak.	1000
WBEX	Chillicothe, Ohio	1000
WJMO	Cleveland Hghts., O.	1000
WOHI	E. Liverpool, Ohio	250
WMOA	Marietta, Ohio	1000
WMRN	Marion, Ohio	1000
KWRW	Guthrie, Okla.	100
KBIX	Muskogee, Okla.	1000
KBKR	Baker, Oreg.	1000
KRNR	Roseburg, Oreg.	1000
KBZY	Salem, Oreg.	1000
WESB	Bradford, Pa.	1000
WAZL	Hazleton, Pa.	1000
WARD	Johnstown, Pa.	1000
WGAL	Lancaster, Pa.	1000
WBCB	Levittown, Pa.	1000
WMRF	Lewiston, Pa.	1000
WMGW	Meadville, Pa.	1000d
WNBT	Wellsboro, Pa.	1000
WSIB	Beaufort, S.C.	100
WGCD	Chester, S.C.	1000d
WMRB	Greenville, S.C.	1000
KORN	Mitchell, S.Dak.	1000
WOPI	Bristol, Tenn.	1000
WDXB	Chattanooga, Tenn.	1000
WROL	Fountain City, Tenn.	1000
WJJM	Lewisburg, Tenn.	1000
WDXL	Lexington, Tenn.	1000
KNOW	Austin, Tex.	250
KIBL	Beeville, Tex.	250
KBST	Big Spring, Tex.	1000
KHUZ	Borger, Tex.	250
KNEL	Brady, Tex.	250d
KSAM	Huntsville, Tex.	250
KVOZ	Laredo, Tex.	250
KZZN	Littlefield, Tex.	1000
KPLT	Paris, Tex.	1000
KDOK	Tyler, Tex.	250
KVWC	Vernon, Tex.	250
KVOG	Ogden, Utah	1000
WKVT	Brattleboro, Vt.	1000
WIKE	Newport, Vt.	1000
WCVA	Culpeper, Va.	1000
WVEC	Hampton, Va.	1000
WAYB	Waynesboro, Va.	1000
KBRO	Bremerton, Wash.	1000
KLOG	Kelso, Wash.	1000
KENE	Toppenish, Wash.	1000
KTEL	Walla Walla, Wash.	250
WGKV	Charleston, W.Va.	1000
WTCS	Fairmont, W.Va.	1000d
WLOH	Princeton, W.Va.	250
WSGB	Sutton, W.Va.	1000
WGEZ	Beloit, Wis.	1000d
WLCX	LaCrosse, Wis.	1000
WIGM	Medford, Wis.	1000
WOSH	Oshkosh, Wis.	1000
KIML	Gillette, Wyo.	250
KLME	Laramie, Wyo.	500
KRTR	Thermopolis, Wyo.	250
KGOS	Torrington, Wyo.	1000

1500—199.9

WFMI	Montgomery, Ala.	500d
KGMR	Jacksonville, Ark.	1000d
KBLA	Burbank, Calif.	10000
KXRX	San Jose, Cal.	10000
WFIF	Milford, Conn.	5000d
WTOP	Washington, D.C.	50000
WKIZ	Key West, Fla.	250
WGUL	New Port Richey, Fla.	250d
WSEM	Donaldsonville, Ga.	1000d
WTHN	Thomaston, Ga.	1000d
WPMB	Vandalia, Ill.	250
WZBN	Zion, Ill.	250d
WBRI	Indianapolis, Ind.	5000d
WAYK	Valparaiso, Ind.	1000d
KWRG	New Roads, La.	1000d
WVOC	Battle Creek, Mich.	1000d
WJBK	Detroit, Mich.	10000
KSTP	St. Paul, Minn.	50000
KDFN	Doniphan, Mo.	1000d
WKER	Pompton Lakes, N.J.	500
WKBX	Winston-Salem, N.C.	1000d
KOSG	Pawhuska, Okla.	5000
KPIR	Eugene, Ore.	10000d

Kc.	Wave Length	W.P.
WMNT	Manati, P.R.	250
WEAC	Gaffney, S. C.	1000d
KWFA	Merkle, Tex.	250d
KTXD	Sherman, Tex.	250
KANI	Wharton, Tex.	500

1510—199.1

KALF	Mesa, Ariz.	10000d
KASK	Ontario, Calif.	1000
KIRV	Fresno, Cal.	500d
KTIM	San Rafael, Calif.	1000d
KDKO	Littleton, Colo.	1000
WNLC	New London, Conn.	10000
WZZZ	Boynton Beach, Fla.	1000d
WWBC	Cocoa, Fla.	250d
WINU	Highland, Ill.	250d
WJRC	Joliet, Ill.	500d
WKAI	Macomb, Ill.	1000d
KIFG	Iowa Falls, Iowa	500d
KANS	Larned, Kan.	1000d
WMEX	Boston, Mass.	50000
WJCO	Jackson, Mich.	5000d
WLKM	Three Rivers, Mich.	500
WKPO	Prentiss, Miss.	1000
KCCV	Independence, Mo.	1000d
KTTT	Columbus, Nebr.	500d
WRAN	Dover, N.J.	1000
WJIC	Salem, N.J.	250d
WBRW	Brewster, N.Y.	1000d
WEAL	Greensboro, N.C.	1000d
WBZB	Selma, N. C.	500d
WPSL	Monroeville, Penn.	250d
WLAC	Nashville, Tenn.	50000
KCTX	Childress, Tex.	250d
KABH	Midland, Tex.	500d
KMOO	Mineola, Tex.	250d
KROB	Robstown, Tex.	500d
KSTV	Stephenville, Tex.	250d
KGA	Spokane, Wash.	50000
WAUK	Waukesha, Wis.	10000d

1520—197.4

KMPG	Hollister, Cal.	500
KACY	Port Hueneme, Calif.	10000
WTLN	Apopka, Fla.	5000d
WGNP	Indian Rocks Beach, Fla.	1000d
WIXX	Oakland Park, Fla.	1000d
WHOW	Clinton, Ill.	5000d
WLUV	Loves Park, Ill.	500d
WSVL	Shelbyville, Ind.	1000
KSIB	Creston, Iowa	1000d
WRSL	Stanford, Ky.	500d
KXKW	Lafayette, La.	1000
WVOB	Bel Air, Md.	250d
WKJR	Muskegon Hts., Mich.	1000d
WYNZ	Ypsilanti, Mich.	250d
KOLM	Rochester, Minn.	1000d
KMPL	Sikeston, Mo.	5000
WDSL	Mocksville, N.C.	5000
WSLT	Ocean City-Somers Pt., N. J.	1000d
KHIP	Albuquerque, N.Mex.	500d
WKBW	Buffalo, N.Y.	50000
WTHE	Mineola, N. Y.	10000d
WDSL	Mocksville, N.C.	5000
WBNO	Bryan, Ohio	500d
WINW	Canton, O.	1000d
WKNT	Kent, O.	1000d
WTTO	Toledo, O.	1000d
KOMA	Okla. City, Okla.	50000
KYMN	Oregon City, Ore.	10000
WCHE	West Chester, Pa.	250
WRAI	Rio Piedras, P. R.	250
WTGR	Myrtle Beach, S.C.	250
WBHT	Brownsville, Tenn.	250d
WIDD	Elizabethton, Tenn.	1000d

1530—196.1

WLCB	Moulton, Ala.	1000d
WCTR	Chestertown, Mo.	1530
KCAT	Pine Bluff, Ark	250d
KTMN	Trumann, Ark.	250d
KFBK	Sacramento, Calif.	50000
KRYT	Colorado Springs, Colo.	1000d
WENG	Englewood, Fla.	1000
WTTI	Dalton, Ga.	10000d
KNBI	Norton, Kan.	1000d
KWLA	Many, La.	1000d
WCTR	Chestertown, Md.	250d
WRPM	Poplarville, Miss.	1000d
WTHM	Lapeer, Mich.	5000d
WERX	Wyoming, Mich.	500d
KSMM	Shakopee, Minn.	500d
KMAM	Butler, Mo.	250
KLOL	Lincoln, Neb.	5000d
WCKY	Cincinnati, Ohio	50000
KWLG	Wagoner, Okla.	
WHYP	North East, Pa.	
WMBT	Shenandoah, Pa.	250d
WUPR	Utuado, P.R.	1000d
WASC	Spartanburg, S.C.	1000
KGTN	Georgetown, Tex.	1000d
KGBT	Harlingen, Tex.	50000
KCLR	Ralls, Tex.	5000d
WQVA	Quantico, Va.	250
KCHY	Cheyenne, Wy.	10000

1540—195.0

KPOL	Los Angeles, Calif.	50000
WBSR	Pensacola, Fla.	1000
WOGA	Sylvester, Ga.	1000d
WSMI	Litchfield, Ill.	1000d
WBNL	Boonville, Ind.	250d
WADM	Decatur, Ind	250d
WLOI	LaPorte, Ind.	250d
KXEL	Waterloo, Iowa	50000
KNEX	McPherson, Kans.	250d
KLKC	Parsons, Kans.	250d
WDON	Wheaton, Md.	1000
WMRR	Marshall, Mich.	250d
WLEF	Greenwood, Miss.	1000d
KBXM	Kennett, Mo.	250d
WPTR	Albany, N.Y.	50000
WPAW	E. Syracuse, N.Y.	1000d
WRPL	Charlotte, N.C.	1000d
WIFM	Elkin, N.C.	1000d
WBCO	Bucyrus, Ohio	500d
WABQ	Cleveland, Ohio	1000d
WNIO	Niles, Ohio	500d
WBTC	Ulrichville, O.	250
KWFS	Eugene, Ore.	1000d
WRCP	Philadelphia, Pa.	50000d
WPTS	Pittston, Pa.	1000d
WPME	Punxsutawney, Pa.	1000d
WADK	Newport, R.I.	1000d
WBFJ	Woodbury, Tenn.	500d
KCUL	Ft. Worth, Tex.	50000d
KGBC	Galveston, Tex.	1000
KEDA	San Antonio, Tex.	
WRGM	Richmond, Va.	10000
KBVU	Bellevue, Wash.	1000
WTKM	Hartford, Wis.	500d

1550—193.5

WAAY	Huntsville, Ala.	5000d
WMOO	Mobile, Ala.	50000d
KFIF	Tucson, Ariz.	50000d
KXEX	Fresno, Calif.	500d
KKHI	San Fran., Calif.	10000
KQXI	Arvada, Colo.	10000d
WEXT	W. Hartford, Conn.	1000d
WRIZ	Coral Gables, Fla.	10000d
WORT	New Smyrna Bch., Fla.	250
WYOU	Tampa, Fla.	10000d
WYNX	Smyrna, Ga.	10000
WJIL	Jacksonville, Ill.	1000d
WCSJ	Morris, Ill.	250d
WPDF	Corydon, Ind.	250d
WCVL	Crawfordsville, Ind.	250
WCTW	New Castle, Ind.	250
WKQV	Sullivan, Ind.	250d
KIWA	Sheldon, Iowa	500d
KEDD	Dodge City, Kans.	1000d
KNIC	Winfield, Kan.	250d
WIRV	Irvine, Ky.	1000d
WMSK	Morganfield, Ky.	250d
WLUX	Baton Rouge, La.	5000d
KOKA	Shreveport, La.	10000
WSER	Elkton, Md.	1000d
WNTN	Newton, Mass.	10000d
WSHN	Fremont, Mich.	1000d
WOKJ	Jackson, Miss.	50000
WSAO	Senatobia, Miss.	5000d
KBLR	Bolivar, Mo.	250
KGMO	Cape Girardeau, Mo.	5000d
KKJO	St. Joseph, Mo.	5000
KICS	Hastings, Neb.	500d
WCGR	Canadaigua, N.Y.	250
WBAZ	Kingston, N.Y.	500d
WBVM	Utica, N.Y.	1000
WPXY	Greenville, N. C.	500d
WNOH	Raleigh, N.C.	1000d
WTYN	Tryon, N.C.	1000d
WPEG	Winston-Salem, N.C.	1000d
KQWB	Fargo, N.D.	5000d
WDLR	Delaware, Ohio	500d
KMAD	Madill, Okla.	250
KREK	Sapulpa, Okla.	500d
WLOA	Braddock, Pa.	1000d
WTTC	Towanda, Pa.	500d
WKFE	Yauco, P.R.	250
WBSC	Bennetsville, S.C.	10000
WTHB	N. Augusta, S.C.	1000d
KCAN	Canyon, Tex.	1000
KWBC	Navasota, Tex.	250d
WKYE	Bristol, Tenn.	1000d
WPTN	Cookeville, Tenn.	250d
WTPI	Cookville, Tenn.	250d
WKPT	Kingsport, Tenn.	10000d
KCOM	Comanche, Tex.	250d
KWIC	Salt Lake City, Utah	10000d
WKBA	Vinton, Va.	1000d
WKVK	Virginia Beach, Va.	5000d
WXVA	Charlestown, W.Va.	500d
KOQT	Bellingham, Wash.	1000d
KGAR	Vancouver, Wash.	1000d
WMIR	Lake Geneva, Wis.	1000d
WMAD	Madison, Wis.	5000d

1560—192.3

WAGC	Centre, Ala.	1000d
KDDA	Dumas, Ark.	
KBIB	Monette, Ark.	250d
KPMC	Bakersfield, Calif.	10000
KIQS	Willows, Calif.	250d
WYSE	Inverness, Fla.	1000
WBYS	Canton, Ill.	250d
WVAK	Paoli, Ind.	250d
WRIN	Rensselaer, Ind.	250d
KSWI	Council Bluffs, Iowa	1000d
KABI	Abilene, Kan.	250d
WPHN	Liberty, Ky.	250d
WDXR	Paducah, Ky.	5000
WBGS	Sidell, La.	1000d
WSMD	LaPlata, Md.	250d
WTPS	Portage, Mich.	1000d
KBEW	Blue Earth, Minn.	1000
KQYX	Joplin, Mo.	250d
KLTI	Macon, Mo.	250d
KTUI	Sullivan, Mo.	250d
WQXR	New York, N.Y.	50000
WTNS	Coshocton, Ohio	1000d
WCNW	Hamilton, O.	5000
WTOD	Toledo, Ohio	5000d
KWCO	Chickasha, Okla.	1000
WRSJ	Bayamon, P.R.	5000
WAGL	Lancaster, S. C.	1000d
WWGM	Nashville, Tenn.	10000d
WBOL	Bolivar, Tenn.	250d
KCAD	Abilene, Tex.	500d
KHBR	Hillsboro, Tex.	250d
KGUL	Port Lavaca, Tex.	500d
KGHO	Hoquiam, Wash.	1000d
KDFL	Sumner, Wash.	250d
WGLB	Port Washington, Wis.	250d

1570—191.1

WCRL	Oneonta, Ala.	1000d
WRWJ	Selma, Ala.	5000d
KBRI	Brinkley, Ark.	250d
KBJT	Fordyce, Ark.	250d
KRSA	Alisal, Calif.	250d
KCVR	Lodi, Cal.	5000d
KACE	Riverside, Calif.	1000d
KLOV	Loveland, Colo.	250d
WTWB	Auburndale, Fla.	5000d
WFBF	Fernandino Beach, Fla.	1000d
WOKC	Okeechobee, Fla.	1000
WJOE	Ward Ridge, Fla.	250
WMES	Ashburn, Ga.	1000d
WGHC	Clayton, Ga.	1000d
WAIA	College Park, Ga.	1000d
WGSR	Millen, Ga.	250d
WOKZ	Alton, Ill.	1000d
WFRL	Freeport, Ill.	5000d
WBEE	Harvey, Ill.	5000d
WTAY	Robinson, Ill.	250d
WILO	Frankfort, Ind.	250d
WAWK	Kendallville, Ind.	250d
WNUW	New Albany, Ind.	10000d
KMCD	Fairfield, Iowa	250d
KJFJ	Webster City, Iowa	250d
KNDY	Marysville, Kans.	250d
WKKS	Vanceburg, Ky.	250d
WABL	Amite, La.	500d
KLLA	Leesville, La.	1000
KMAR	Winnsboro, La.	1000
WAQE	Towson, Md.	5000d
WPEP	Taunton, Mass.	1000d
WMLO	Beverly, Mass.	500d
WDEW	Westfield, Mass.	1000d
WMRP	Flint, Mich.	1000d
WFUR	Grand Rapids, Michigan	1000d
KUXL	Golden Valley, Minn.	1000d
WONA	Winona, Miss.	1000d
KLEX	Lexington, Mo.	250d
WAFS	Amsterdam, N.Y.	1000d
WFLR	Dundee, N.Y.	1000d
WBUZ	Fredonia, N.Y.	250d
WAPC	Riverhead, N.Y.	1000d
WTLK	Taylorsville, N.C.	500
WNCA	Siler City, N.C.	1000d
WPTW	Piqua, Ohio	250d
KTAT	Frederick, Okla.	250d
KOLS	Pryor, Okla.	1000d
KWAY	Forest Grove, Oreg.	1000d
KOHU	Hermiston, Oreg.	1000d
WPGM	Danville, Penn.	1000d
WBUX	Doylestown, Pa.	5000d
WQTW	Latrobe, Pa.	1000d
WFGN	Gaffney, S.C.	250d
WJES	Johnston, S.C.	250
WLSC	Loris, S.C.	1000d
WHLP	Centerville, Tenn.	1000d
WCLE	Cleveland, Tenn.	1000d
WTRB	Ripley, Tenn.	1000d
KZOL	Farwell, Tex.	250d
KVLG	La Grange, Tex.	250d
KTER	Terrell, Tex.	250d
WSWV	Pennington Gap, Va.	1000d
WYTI	Rocky Mount, Va.	1000d
WEER	Warrenton, Va.	1000d
WAPL	Appleton, Wis.	1000d

1580—189.2

WEYY	Talladega, Ala.	1000d
KYND	Tempe, Ariz.	50000
KPCA	Marked Tree, Ark.	250d
KFDF	Van Buren, Ark.	1000d
KMRE	Anderson, Cal.	1000d
KWIP	Merced, Calif.	500d
KDAY	Santa Monica, Cal.	50000
KHUM	Santa Rosa, Calif.	500d
KPIK	Colorado Sprgs., Colo.	5000d
WSBP	Chattachoochee, Fla.	1000d
WWIL	Ft. Lauderdale, Fla.	10000
WVGT	Mount Dora, Fla.	1000d
WCCF	Punta Gorda, Fla.	1000d
WCLS	Columbus, Ga.	1000
WLBA	Gainesville, Ga.	5000d
WKIG	Glenville, Ga.	1000d
WKKD	Aurora, Ill.	250d
WDQN	DuQuoin, Ill.	250d
WBBA	Pittsfield, Ill.	250d
WKID	Urbana, Ill.	250d
WCNB	Connersville, Ind.	250d
WJVA	South Bend, Ind.	1000d
WAMW	Washington, Ind.	250d
KCHA	Charles City, Iowa	500d
KWNT	Davenport, Iowa	500d
KDSN	Denison, Iowa	500d
WAXU	Georgetown, Ky.	10000d
WMTL	Leitchfield, Ky.	250d
WPKY	Princeton, Ky.	250d
KLUV	Haynesville, La.	250d
KLOU	Lake Charles, La.	1000
WPGC	Bradbury Hgts., Md.	10000
WJUD	St. Johns, Mich.	1000d
KDOM	Windom, Minn.	250d
WAMY	Amory, Miss.	5000d
WESY	Leland, Miss.	1000
WPMP	Pascagoula-Moss Point, Mississippi	1000d
KCGM	Columbia, Mo.	250d
KESM	Eldorado Springs, Mo.	250d
KNIM	Maryville, Mo.	250d
KAMI	Cozad, Neb.	1000d
WNJH	Hammonton, N.J.	250d
WCRV	Washington, N.J.	500d
KLOS	Albuquerque, N.M.	1000d
WPAC	Patchogue, N.Y.	10000d
WZKY	Albemarle, N.C.	250d
WKJK	Granite Falls, N. C.	500d
WPYB	Benson, N.C.	500d
WVKO	Columbus, Ohio	1000d
KLTR	Blackwell, Okla.	1000d
WCOY	Columbia, Pa.	500d
WEND	Ebensburg, Pa.	1000d
WANB	Waynesburg, Pa.	250d
WORG	Orangeburg, S.C.	1000d
WBBR	Travelers Rest, S.C.	500d
WSKT	Colonial Village, Tenn.	250d
WLIJ	Shelbyville, Tenn.	1000d
WSKT	South Knoxville, Tenn.	250
KKAL	Denver City, Tex.	250d
KGAF	Gainesville, Tex.	250d
KIRT	Mission, Tex.	1000d
KTLU	Rusk, Tex.	500d
KWED	Seguin, Tex.	1000d
KBYP	Shamrock, Tex.	250d
KBGO	Waco, Tex.	1000
WILA	Danville, Va.	1000d
WPUV	Pulaski, Va.	5000d
WTTN	Watertown, Wis.	1000d

1590—188.7

WATM	Atmore, Ala.	5000d
WBIB	Centerville, Ala.	1000d
WVNA	Tuscumbia, Ala.	5000
KPBA	Pine Bluff, Ark.	1000d
KLIV	San Jose, Cal.	5000d
KUDU	Ventura, Cal.	10000
KCIN	Victorville, Calif.	500d
WBRY	Waterbury, Conn.	5000
WOWY	Clewiston, Fla.	500d
WILZ	St. Petersburg Beach, Florida	1000d
WELE	S. Daytona Bch., Fla.	1000d
WALG	Albany, Ga.	1000
WLFA	Lafayette, Ga.	5000d
WTGA	Thomaston, Ga.	500d
WNMP	Evanston, Ill.	1000d
WAIK	Galesburg, Ill.	5000d
WGEE	Indianapolis, Ind.	5000d
WPCO	Mt. Vernon, Ind.	500d
KWBG	Boone, Iowa	1000
KVGB	Great Bend, Kans.	5000
WLBN	Lebanon, Ky.	1000d
KEVL	White Castle, La.	1000d
WETT	Ocean City, Md.	1000
WTVB	Coldwater, Mich.	5000
WSMA	Marine City, Mich.	1000d
WMIC	St. Helen, Mich.	500d
KRAD	E. Grand Forks, Minn.	1000d
WWUN	Jackson, Miss.	5000
KDEX	Dexter, Mo.	1000d
KPRS	Kansas City, Mo.	1000d
KCLU	Rolla, Mo.	1000d
WSMN	Nashua, N.H.	5000
WERA	Plainfield, N.J.	500d
WAUB	Auburn, N.Y.	500d
WEHH	Elmira Heights-Horseheads, N.Y.	500d
WGGO	Salamanca, N.Y.	5000d
WCSL	Cherryville, N.C.	500d
WVOE	Chadburn, N.C.	1000
WNCT	Greenville, N. C.	500
WNOS	High Point, N.C.	1000d
WAKR	Akron, Ohio	5000
WSRW	Hillsboro, Ohio	500d
KHEN	Henryetta, Okla.	500d
KTIL	Tillamook, Oreg.	1000

WHITE'S RADIO LOG

Kc.	Wave Length	W.P.
WZUM	Carnegie, Pa.	1000d
WCBG	Chambersburg, Pa.	5000
WEEZ	Chester, Pa.	1000
WXRF	Guayama, P.R.	1000
WYNG	Warwick, R.I.	1000d
WABV	Abbeville, S.C.	1000d
WACA	Camden, S.C.	1000d
KCCR	Pierre, S. D.	250
WSHC	Collierville, Tenn.	500d
WJSO	Jonesboro, Tenn.	5000d
WOBL	Springfield, Tenn.	1000d
KGAS	Carthage, Tex.	1000d
KERC	Eastland, Tex.	500d
KINT	El Paso, Tex.	1000d
KYOK	Houston, Tex.	5000
KCBD	Lubbock, Tex.	1000
KBUS	Mexia, Tex.	500d
KTOD	Sinton, Tex.	1000

Kc.	Wave Length	W.P.
WISZ	Glen Burnie, Md.	500
WRGM	Richmond, Va.	5000d
KLFF	Mead, Wash.	1000d
KETO	Seattle, Wash.	5000d
WIXK	New Richmond, Wis.	5000d
WSWW	Platteville, Wis.	5000
WTRW	Two Rivers, Wis.	1000d
WAWA	West Allis, Wis.	1000d
1600—187.5		
WEUP	Huntsville, Ala.	5000d
WAPX	Montgomery, Ala.	1000
KVIO	Cottonwood, Ariz.	1000d
KXEW	Tucson, Ariz.	1000
KGKO	Benton, Ark.	1000d
KGST	Fresno, Cal.	5000d
KWOW	Pomona, Cal.	5000
KHER	Santa Maria, Calif.	500d
KUBA	Yuba City, Calif.	5000
KLAK	Lakewood, Colo.	5000
WKEN	Dover, Del.	500d
WKTX	Atlantic Beach, Fla.	1000d
WKWF	Key West, Fla.	500
WHEW	Riviera Beach, Fla.	1000
WPRV	Wauchula, Fla.	500d
WOKB	Winter Garden, Fla.	5000d
WGKA	Atlanta, Ga.	1000d
WNGA	Nashville, Ga.	1000d
WRBN	Warner Robins, Ga.	1000d

Kc.	Wave Length	W.P.
WCGO	Chicago Hgts., Ill.	1000d
WMCW	Harvard, Ill.	500d
WBTO	Linton, Ind.	500d
WARU	Peru, Ind.	1000d
KLGA	Algona, Iowa	5000d
KCRG	Cedar Rapids, Iowa	5000
KMDO	Ft. Scott, Kans.	500d
WSTL	Eminence, Ky.	500d
WKYF	Greenville, Ky.	500d
KFNV	Ferriday, La.	1000d
KLEB	Golden Meadow, La.	1000d
KLVI	Vivian, La.	500d
WINX	Rockville, Md.	1000
WBOS	Brookline, Mass.	5000
WTYM	East Longmeadow, Mass.	5000d
WAAM	Ann Arbor, Mich.	5000
WTRU	Muskegon, Mich.	5000
WKOL	Clarksdale, Miss.	1000d
WFFF	Columbia, Miss.	500d
KATZ	St. Louis, Mo.	5000
KTTN	Trenton, Mo.	500d
KNCY	Nebraska City, Nebr.	500d
KRFS	Superior, Nebr.	500d
WWRL	New York, N. Y.	5000
WMCR	Oneida, N.Y.	1000d
WLNG	Sag Harbor, N.Y.	500
WXKW	Troy, N.Y.	500d
WWRL	Woodside, N. Y.	5000

Kc.	Wave Length	W.P.
WGIV	Charlotte, N.C.	1000
WIDU	Fayetteville, N.C.	1000d
WHVL	Hendersonville, N.C.	1000d
WFRC	Reidsville, N.C.	1000
WKSK	W. Jefferson, N.C.	1000d
KDAK	Carrington, N.Dak.	500d
WAQI	Ashtabula, Ohio	1000d
WBLY	Springfield, Ohio	1000d
WTTF	Tiffin, Ohio	500d
KUSH	Cushing, Okla.	1000d
KASH	Eugene, Oreg.	5000
KOHI	St. Helens, Ore.	1000d
WHOL	Allentown, Pa.	500d
WHRY	Elizabethtown, Pa.	500d
WBPR	Bayamon, P.R.	1000
WFIS	Fountain Inn, S.C.	1000d
WFNL	No. Augusta, S.C.	500d
WHBT	Harriman, Tenn.	5000d
WKBJ	Milan, Tenn.	1000d
KBBB	Borger, Tex.	500d
KBOR	Brownsville, Tex.	1000
KWEL	Midland, Tex.	1000d
KCFH	Cuero, Tex.	500d
KYAL	McKinney, Tex.	1000d
KOGT	Orange, Tex.	1000
KBBC	Centerville, Utah	1000d
WSJT	Chesapeake, Va.	1000d
WHLL	Wheeling, W.Va.	5000d
WCWC	Ripon, Wis.	5000

Canadian AM Stations by Frequency

Canadian stations listed alphabetically by call letters within groups. Abbreviations: Kc., frequency in kilocycles; W.P., power in watts; d, operates daytime only; n, operates nighttime only. Wave length is given in meters.

Kc.	Wave Length	W.P.
540—555.5		
CBK	Regina, Sask.	50,000
CBT	Grand Falls, Nfld.	10,000
550—545.1		
CFBR	Sudbury, Ont.	1,000d
CFNB	Fredericton, N.B.	50,000
CHLN	Trois-Rivières, Que.	10,000d 5,000n
CKPG	Prince George, B.C.	10,000
560—525.4		
CFOS	Owen Sound, Ont.	1,000
CHCM	Marystown, Nfld.	1,000d 500n
CHTK	Prince Rupert, B.C.	1,000d 250n
CJKL	Kirkland Lake, Ont.	5,000
CKCN	Sept-Iles, Que.	10,000d 5,000n
CKNL	Fort St. John, B.C.	1,000
570—526.0		
CFCB	Corner Brook, Nfld.	1,000
CJEM	Edmundston, N.B.	5,000d 1,000n
CKCQ	Quesnel, B.C.	1,000
CKEK	Cranbrook, B.C.	1,000
CFWH	Whitehorse, Y.T.	1,000
580—516.9		
CFRA	Ottawa, Ont.	50,000d 10,000n
CHLC	Hauterive, Que.	5,000d 2,500n
CJFX	Antigonish, N. S.	10,000
CKAP	Kapuskasing, Ont.	1,000
CKPR	Port Arthur, Ont.	5,000d 1,000n
CKUA	Edmonton, Alta.	10,000
CKWW	Windsor, Ont.	500
CKXR	Salmon Arm, B. C.	1,000
CKY	Winnipeg, Man.	50,000
590—508.2		
CFAR	Flin Flon, Man.	1,000
CKEY	Toronto, Ont.	10,000d 5,000n
CKRS	Jonquiere, Que.	1,000
CFTK	Terrace, B.C.	1,000
VOCM	St. John's, Nfld.	10,000
600—499.7		
CFCF	Montreal, Que.	5,000
CFCH	Callander, Ont.	10,000d 5,000n
CFQC	Saskatoon, Sask.	5,000
CJOR	Vancouver, B.C.	10,000
CKCL	Truro, N.S.	1,000
610—491.7		
CHNC	New Carlisle, Que.	10,000d 5,000n
CHTM	Thompson, Man.	1,000
CJAT	Trail, B.C.	1,000
CKML	Mont Laurier, P.Q.	1,000
CKTB	St. Catharines, Ont.	10,000d 5,000n
CKYL	Peace River, Alta.	10,000d 1,000n
620—483.6		
CFCL	Timmins, Ont.	10,000d 5,000n
CKCK	Regina, Sask.	5,000
CKCM	Grand Falls, Nfld.	10,000
630—475.9		
CFCO	Chatham, Ont.	10,000d 1,000n
CFCY	Charlottetown, P. E. I.	10,000
CHED	Edmonton, Alta.	10,000
CHLT	Sherbrooke, Que.	10,000d 5,000n
CJET	Smiths Falls, Ont.	10,000
CKAR	Huntsville, Ont.	1,000
CKOV	Kelowna, B.C.	1,000
CKRC	Winnipeg, Man.	10,000
640—468.5		
CBN	St. John's, Nfld.	10,000
680—440.9		
CHFA	Edmonton, Alta.	5,000
CHLO	St. Thomas, Ont.	1,000
CJCN	Grand Falls, Nfld.	10,000
CJOB	Winnipeg, Man.	10,000d 2,500n
CKGB	Timmins, Ont.	10,000
690—434.5		
CBF	Montreal, Que.	50,000
CBU	Vancouver, B.C.	10,000
710—422.3		
CJSP	Leamington, Ont.	1,000
CFRG	Gravelbourg, Sask.	5,000d
CKVM	Ville-Marie, Que.	10,000d 1,000n
CJOX	Grand Bank, Nfld.	1,000
730—410.7		
CJNR	Blind River, Ont.	1,000
CKAC	Montreal, Que.	50,000
CKDM	Dauphin, Man.	10,000d 5,000n
CKLG	North Vancouver, B.C.	10,000
740—405.2		
CBL	Toronto, Ont.	50,000
CBX	Edmonton, Alta.	50,000
790—379.5		
CFDR	Dartmouth, N.S.	5,000
CFCW	Camrose, Alta.	10,000
CKMR	Newcastle, N.B.	1,000
CKSO	Sudbury, Ont.	10,000d 5,000n
CHIC	Brampton, Ont.	1,000d 500n
800—374.8		
CFOB	Fort Frances, Ont.	1,000d 500n
CHAB	Moose Jaw, Sask.	10,000d 5,000n
CHRC	Quebec, Que.	10,000
CJAD	Montreal, Que.	50,000d 10,000n
CJBQ	Belleville, Ont.	1,000
CJLX	Fort William, Ont.	10,000d 5,000n
CKOK	Penticton, B.C.	10,000d 500n
CKLW	Windsor, Ont.	50,000
VOWR	St. John's, Nfld.	1,000
810—370.2		
CHQR	Calgary, Alta.	10,000
850—352.7		
CJJC	Langley, B.C.	1,000
CKRD	Red Deer, Alta.	10,000d 1,000n
CKVL	Verdun, Que.	50,000d 10,000n
860—348.6		
CBH	Halifax, N.S.	10,000
CFPR	Prince Rupert, B.C.	10,000
CHAK	Inuvik, N.W.T.	1,000
CJBC	Toronto, Ont.	50,000
900—333.1		
CHML	Hamilton, Ont.	5,000
CHNO	Sudbury, Ont.	10,000d 1,000n
CJBR	Rimouski, Que.	10,000
CJVI	Victoria, B.C.	10,000
CKBI	Prince Albert, Sask.	10,000
CKDR	Dryden, Ont.	1,000d 250n
CKDH	Amherst, N.S.	1,000
CKTS	Sherbrooke, Que.	1,000
CKJL	St. Jérôme, Que.	1,000
910—329.5		
CBO	Ottawa, Ont.	5,000
CFJC	Kamloops, B.C.	10,000d 1,000n
CFSX	Stephenville, Nfld.	500
CHRL	Roberval, Que.	1,000
CJDV	Drumheller, Alta.	5,000
CKLY	Lindsay, Ont.	1,000
920—329.9		
CFRY	Portage La Prairie, Man.	1,000
CJCH	Halifax, N.S.	10,000d 5,000
CJCJ	Woodstock, N.B.	1,000
CKCY	Sault Ste. Marie, Ont.	10,000d 5,000n
CKNX	Wingham, Ont.	2,500d 1,000n
930—322.4		
CFBC	Saint John, N.B.	10,000d 5,000n
CJCA	Edmonton, Alberta	10,000d 5,000n
CJON	St. John's, Nfld.	10,000
940—319.0		
CBM	Montreal, Que.	50,000
CJGX	Yorkton, Sask.	10,000
CJIB	Vernon, B. C.	10,000d
950—315.6		
CKBB	Barrie, Ont.	10,000d 2,500n
CKNB	Campbellton, N.B.	10,000d 1,000n
960—312.3		
CFAC	Calgary, Alta.	10,000
CHNS	Halifax, N.S.	10,000
CKWS	Kingston, Ont.	5,000
970—309.1		
CKCH	Hull, Que.	5,000
CBZ	Fredericton, N.B.	10,000
980—305.9		
CBV	Quebec, Que.	5,000
CFPL	London, Ontario	10,000d 5,000n
CHEX	Peterborough, Ont.	5,000
CKGM	Montreal, Que.	10,000
CKNW	New Westminster, B.C.	50,000
CKRM	Regina, Sask.	10,000d 5,000n
990—302.8		
CBW	Winnipeg, Man.	50,000
CBY	Corner Brook, Nfld.	10,000
1000—299.8		
CKBW	Bridgewater, N.S.	10,000
1010—296.9		
CBR	Calgary, Alta.	50,000
CFRB	Toronto, Ont.	50,000
1050—285.5		
CFGP	Grande Prairie, Alta.	10,000
CHUM	Toronto, Ont.	50,000
CJIC	Sault Ste. Marie, Ont.	10,000d 2,500n
CJNB	North Battleford, Sask.	10,000
CKSB	St. Boniface, Man.	10,000
1060—282.8		
CFCN	Calgary, Alta.	50,000d 2,500n
CJLR	Quebec, Que.	10,000

Kc. — Wave Length	Station	W.P.
1070—280.2		
	CBA Sackville, N.B.	50,000
	CFAX Victoria, B.C.	1,000
	CHOK Sarnia, Ont.	5,000d 1,000n
1080—277.6		
	CKSA Lloydminster, Alta.	10 000
1090—275.1		
	CHEC Lethbridge, Alta.	5,000
	CHRS St. Jean, Que.	10,000d
1110—272.6		
	CBD Saint John, N.B.	10,000
	CFML Cornwall, Ont.	1,000
	CFTJ Galt, Ont.	250d
	CHQT Edmonton, Alta.	10,000
1130—265.3		
	CKWX Vancouver, B.C.	50,000
1140—263.0		
	CBI Sydney, N.S.	10,000
	CKXL Calgary, Alta.	10,000
1150—260.7		
	CHSJ Saint John, N.B.	10,000d 5,000n
	CKOC Hamilton, Ont.	5,000
	CKTR Trois-Rivières, Que.	10,000d 1,000n
	CKX Brandon, Man.	10,000d 1,000n
1170—256.3		
	CFNS Saskatoon, Sask.	1,000
1220—245.8		
	CJOC Lethbridge, Alta	10 000d 5 000n
	CJSS Cornwall, Ontario	1,000
	CJRL Kenora, Ont.	1,000
	CKDA Victoria, B.C.	10,000
	CKCW Moncton, N.B.	10,000
	CKSM Shawinigan, Que.	1,000
1220—245.8		
	CFBV Smithers, B.C.	1,000d 250n
	CFGR Gravelbourg, Sask.	250n
	CFKL Schefferville, Que.	250
	CFPA Port Arthur, Ont.	1,000d 250n
	CHFC Churchill, Man.	250
	CKLD Thetford Mines, Que.	1,000d 250n
	CKMP Midland, Ontario	250
	CKTK Kitimat, B.C.	1,000d 250n
	CKVD Val d'Or, Que.	1,000d 250n
	VOAR St. John's, Nfld.	100
1240—241.8		
	CFLM La Tuque, Que.	1,000d 250n
	CFVR Abbotsford, B. C.	1,000d 250n
	CJAF Cabano, Que.	250
	CJAV Port Alberni, B.C.	1,000d 250n
	CJCS Stratford	500d 250n
	CJRW Summerside, P.E.I.	250
	CJWA Wawa, Ont.	1,000d 250n
	CKWL Williams Lake, B.C.	250
	CKBS St. Hyacinthe, Que.	250
	CKLS Ls Sarre, Que.	250
1250—239.9		
	CBOF Ottawa, Ont.	10,000
	CHWO Oakville, Ont.	1,000d
	CHSM Steinbach, Man.	10,000
	CKBL Matane, Que.	10,000d 5,000n
	CKOM Saskatoon, Sask.	10,000
1260—238.0		
	CFRN Edmonton, Alta.	50,000
1270—263.1		
	CFGT St. Joseph d'Alma, Que.	1,000
	CHAT Medicine Hat, Alta.	10,000
	CHWK Chilliwack, B.C.	10,000
	CJCB Sydney, N.S.	10,000
1280—234.2		
	CHIQ Hamilton, Ont.	10,000d 5,000n
	CJMS Montreal, Que.	50,000
	CJSL Estevan, Sask.	1,000
	CKCV Quebec, Que.	10,000d 5,000n
1290—232.4		
	CFAM Altona, Man.	10,000d 5,000n
1300—230.6		
	CBAF Moncton, N.B.	5,000
	CJME Regina, Sask.	1,000
1310—228.9		
	CFGM Richmond Hill, Ont.	10,000d 2,500n
	CHGB Ste-Anne-de-la-Pocatière, Que.	5,000
	CKOY Ottawa, Ont.	50,000
1320—227.1		
	CHQM Vancouver, B.C.	10,000
	CJSO Sorel, Que.	10,000d 5,000n
	CKEC New Glasgow, N.S.	5,000
	CKKW Kitchener, Ont.	1,000
1340—223.7		
	CFGB Goose Bay, Nfld.	1,000
	CFSL Weyburn, Sask.	1,000d 250n
	CFYK Yellowknife, N.W.T.	1,000
	CHAD Amos, Que.	250
	CHRD Drummondville, Que.	250
	CJLS Yarmouth, N.S.	250
	CFOM Quebec, Que.	250
	CKAR-1 Parry Sound, Ont.	250
	CKCR Revelstoke, B. C.	250
	CKOX Woodstock, Ont.	1,000d 250n
1350—222.1		
	CHOV Pembroke, Ont.	1,000
	CJDC Dawson Creek, B.C.	1,000
	CJLM Joliette, Que.	1,000
	CKEN Kentville, N.S.	1,000
	CKLB Oshawa, Ont.	10,000d 5,000n
1360—220.4		
	CKBC Bathurst, N.B.	10,000
1370—218.8		
	CFLV Valleyfield, Que.	1,000
1380—217.3		
	CFDA Victoriaville, Que.	1,000
	CKLC Kingston, Ont.	10,000d 5,000n
	CKPC Brantford, Ont.	10,000
1390—215.7		
	CKLN Nelson, B.C.	1,000
1400—214.2		
	CFLD Burns Lake, B. C.	250
	CJFP Rivière du Loup, Que.	10,000d 250n
	CKCB Collingwood, Ont.	250
	CKRN Rouyn, Que.	250
	CKSW Swift Current, Sask.	1,000d 250n
1410—212.6		
	CFMB Montreal, Que.	10,000
	CFUN Vancouver, B.C.	10,000
	CKSL London, Ont.	10,000
1420—211.1		
	CJMT Chicoutimi, Que.	1,000
	CKPT Peterborough, Ont.	1,000d 500n
1430—209.7		
	CKFH Toronto, Ont.	10,000d 5,000n
1440—208.2		
	CFCP Courtenay, B.C.	1,000
	CKPM Ottawa, Ont.	10,000
1450—206.8		
	CBG Gander, Nfld.	250
	CFAB Windsor, N.S.	250
	CFJR Brockville, Ont.	1,000d 250n
	CHEF Granby, Que.	1,000d 250n
	CHUC Cobourg, Ont.	1,000
	CJBM Causapscal, Que.	1,000d 250n
1460—205.4		
	CJOY Guelph, Ont.	10,000d 5,000n
	CKRB Ville St. Georges, Que.	10,000d 5,000n
1470—204.0		
	CFOX Pointe Claire, Que.	10,000d 5,000n
	CHOW Welland, Ont.	1,000d 500n
	CJQM Winnipeg, Man.	5,000
1490—201.2		
	CFMR Fort Simpson, N.W.T.	25
	CFRC Kingston, Ont.	100
	CHYM Kitchener, Ont.	10,000d 5,000n
	CKAD Middleton, N.S.	1,000d 250n
	CKBM Montmagny, Que.	1,000d 250n
	CFWB Campbell River, B.C.	250
1500—199.9		
	CKAY Ducan, B.C.	1,000
1510—199.1		
	CKOT Tillsonburg, Ont.	1,000
1540—195.0		
	CHFI Toronto, Ont.	50,000
1550—193.5		
	CBE Windsor, Ont.	10,000
1560—192.3		
	CFRS Simcoe, Ont.	250d
1570—191.1		
	CFOR Orillia, Ont.	10,000d 1,000n
	CHUB Nanaimo, B.C.	10,000
	CKLM Montreal, Que.	10,000
1580—189.2		
	CBJ Chicoutimi, Que.	10,000
1600—187.5		
	CJRN Niagara Falls, Ont.	10,000

U. S. Commercial Television Stations by States

U. S. stations listed alphabetically by cities within state groups. Territories and possessions follow states. Chan., channel; C.L., call letters.

Location	C.L.	Chan.
ALABAMA		
Anniston	WHMA-TV	40
Birmingham	WAPI-TV	13
	WBMG	42
	WBRC-TV	6
Decatur	WMSL-TV	23
Dothan	WTVY	4
Florence	WOWL-TV	15
Huntsville	WAAY-TV	31
	WHNT-TV	19
Mobile	WALA-TV	10
	WKRG-TV	5
Montgomery	WCOV-TV	20
	WSFA-TV	12
	WKAB-TV	32
Selma	WSLA	8
Tuscaloosa	WCFT-TV	33
ALASKA		
Anchorage	KENI-TV	2
	KHAR-TV	13
	KTVA	11
Fairbanks	KFAR-TV	2
	KTVF	11
Juneau	KINY-TV	8
ARIZONA		
Nogales	XHFA-TV	2
Phoenix	KOOL-TV	10
	KPAZ-TV	21
	KPHO-TV	5
	KTVK	3
	KTAR-TV	12
Phoenix-Mesa	KTAR-TV	12
Tucson	KGUN-TV	9
	KOLD-TV	13
	KVOA-TV	4
Yuma	KBLU-TV	13
	KIVA	11
ARKANSAS		
El Dorado-Monroe, La.	KTVE	10
Ft. Smith	KFSA-TV	5
Jonesboro	KAIT-TV	8
Little Rock	KARK-TV	4
	KATV	7
	KTHV	11
CALIFORNIA		
Bakersfield	KBAK-TV	29
	KERO-TV	23
	KLYD-TV	17
Chico	KHSL-TV	12
Concord	KCFT-TV	42
El Centro-Mexicali	XEM-TV	3
Eureka	KIEM-TV	3
	KVIQ-TV	6
Fresno	KAIL	53
	KFRE-TV	30
	KJEO	47
	KMJ-TV	24
Los Angeles	KABC-TV	7
	KCOP	13
	KHJ-TV	9
	KMEX-TV	34
	KNBC	4
	KNXT	2
	KPOL-TV	22
	KTLA	5
	KTTV	11
Oakland-San Francisco	KTVU	2
Redding	KRCR-TV	7
Sacramento	KCRA-TV	3
Sacramento	KXTV	10
	KPXL	29
Salinas-Monterey	KSBW-TV	8
San Bernardino	KITR	30
San Diego	KFMB-TV	8
	KJOG-TV	51
	KAAR	39
	KOGO-TV	10
Tijuana-San Diego	XETV	6
	XEWT-TV	12
San Francisco	KGO-TV	7
	KPIX	5
	KRON-TV	4
San Jose	KNTV	11
San Luis Obispo	KSBY-TV	6
Santa Barbara	KEYT	3
	KIHP-TV	26
Santa Maria	KCOY-TV	12
Stockton-Sacramento	KOVR	13
Visalia-(Fresno)	KICU-TV	43
COLORADO		
Colorado Springs	KKTV	11
	KRDO-TV	13
Denver	KBTV	9
	KCTO	2
	KLZ-TV	7
	KOA-TV	4
Durango	KREZ-TV	6
Grand Junction	KREX-TV	5
Montrose	KREY-TV	10
Pueblo	KOAA-TV	5
Sterling	KTVS	3
CONNECTICUT		
Hartford	WHCT	18
	WTIC-TV	3
New Britain-Hartford	WHNB-TV	30
New Haven	WTVU	59
New Haven-Hartford	WNHC-TV	8
Waterbury	WATR-TV	20
DELAWARE		
No Stations		
DISTRICT OF COLUMBIA		
Washington	WOOK-TV	14
	WDCA-TV	20
	WMAL-TV	7
	WRC-TV	4
	WTOP-TV	9
	WTTG	5

WHITE'S RADIO LOG

FLORIDA

Location	C.L.	Chan.
Clearwater	WHJR-TV	22
Daytona Beach-Orlando	WESH-TV	2
Ft. Myers	WINK-TV	11
Ft. Pierce	WTVX	34
Jacksonville	WFGA-TV	12
	WDUV-TV	30
	WJKS-TV	17
	WJXT	4
Miami	WCKT	7
	WLBW-TV	10
	WTVJ	4
Orlando	WDBO-TV	6
	WFTV	9
Palm Beach	WPTV	5
Panama City	WJHG-TV	7
Pensacola-Mobile, Ala.	WEAR-TV	3
St. Petersburg-Tampa	WSUN-TV	38
Tallahassee-Thomasville, Ga.	WCTV	6
St. Petersburg-Tampa	WSUN-TV	38
Tampa	WFLA-TV	8
Tampa-St. Petersburg	WLCY-TV	10
	WTVT	13
West Palm Beach	WEAT-TV	12

GEORGIA

Location	C.L.	Chan.
Albany	WALB-TV	10
Atlanta	WAII-TV	11
	WAGA-TV	5
	WSB-TV	2
Augusta	WJBF	6
	WRDW-TV	12
Columbus	WRBL-TV	3
	WTVM	9
Macon	WMAZ-TV	13
Savannah	WSAV-TV	3
	WTOC-TV	11

HAWAII

Location	C.L.	Chan.
Hilo	KHAW-TV	11
	KPUA-TV	9
	KHVO	13
Honolulu	KGMB-TV	9
	KHVH-TV	4
	KHON-TV	2
	KTRG-TV	13
Wailuku	KAII-TV	7
	KMAU-TV	3
	KMVI-TV	12

IDAHO

Location	C.L.	Chan.
Boise	KBOI-TV	2
	KTVB	7
Idaho Falls	KID-TV	3
	KIFI-TV	8
Lewiston	KLEW-TV	3
Twin Falls	KMVT	11

ILLINOIS

Location	C.L.	Chan.
Champaign	WCHU	33
	WCIA	3
Chicago	WBBM-TV	2
	WBKB-TV	7
	WCIU	26
	WFLD	32
	WGN-TV	9
	WMAQ-TV	5
Danville	WICD	24
Decatur	WAND	17
Freeport-Rockford	WCEE-TV	23
Harrisburg	WSIL-TV	3
LaSalle	WEEQ-TV	35
Moline	WQAD-TV	8
Peoria	WIRL-TV	19
	WEEK-TV	25
	WMBD-TV	31
Quincy-Hannibal, Mo.	WGEM-TV	10
Rockford	WTVO	39
	WREX-TV	13
Rock Island	WHBF-TV	4
Springfield	WICS	20

INDIANA

Location	C.L.	Chan.
Bloomington-Indianapolis	WTTV	4
Evansville	WEHT	50
	WFIE-TV	14
	WTVW	7
Fort Wayne	WANE-TV	15
	WPTA	21
	WKJG-TV	33
Indianapolis	WFBM-TV	6
	WISH-TV	8
	WLWI	13
Lafayette	WFAM-TV	18
Marion	WTAF-TV	31
Muncie	WLBC-TV	49
South Bend	WNDU-TV	16
	WSBT-TV	22
South Bend-Elkhart	WSJV	28
Terre Haute	WTHI-TV	10
	WTWO	2

IOWA

Location	C.L.	Chan.
Ames-Des Moines	WOI-TV	5
Cedar Rapids	KCRG-TV	9
Cedar Rapids-Waterloo	WMT-TV	2
Davenport	WOC-TV	6
Des Moines	KRNT-TV	8
	WHO-TV	13
Fort Dodge	KQTV	21
Mason City	KGLO-TV	3
Sioux City	KTIV	4
	KVTV	9
Waterloo-Cedar Rapids	KWWL-TV	7

KANSAS

Location	C.L.	Chan.
Ensign	KTVC	6
Garden City	KGLD	11
	KUPK-TV	13
Goodland	KLOE-TV	10
Great Bend	KCKT	2
Hays	KAYS-TV	7
Hutchinson-Wichita	KTVH	12
Pittsburg-Joplin, Mo.	KOAM-TV	7
Topeka	WIBW-TV	13
Wichita	KAKE-TV	10
	KARD-TV	3

KENTUCKY

Location	C.L.	Chan.
Bowling Green	WLTV	13
Lexington	WKYT-TV	27
	WLEX-TV	18
Louisville	WHAS-TV	11
	WAVE-TV	3
	WLKY-TV	32
Newport	WNOP-TV	74
Paducah	WPSD-TV	6

LOUISIANA

Location	C.L.	Chan.
Alexandria	KALB-TV	5
Baton Rouge	WAFB-TV	9
	WBRZ	2
Lafayette	KATC	3
	KLFY-TV	10
Lake Charles	KPLC-TV	7
	KIKS-TV	29
Monroe	KNOE-TV	8
New Orleans	WDSU-TV	6
	WWL-TV	4
	WWOM-TV	26
	WVUE	12
Shreveport	KSLA-TV	12
	KTAL-TV	6
Shreveport	KTBS-TV	3

MAINE

Location	C.L.	Chan.
Bangor	WABI-TV	5
	WEMT	7
	WLBZ-TV	2
Poland Spring	WMTW-TV	8
Portland	WCSH-TV	6
	WGAN-TV	13
Presque Isle	WAGM-TV	8

MARYLAND

Location	C.L.	Chan.
Baltimore	WBAL-TV	11
	WJZ-TV	13
	WMAR-TV	2
	WMET-TV	24
Salisbury	WBOC-TV	16

MASSACHUSETTS

Location	C.L.	Chan.
Adams	WCDC	19
Boston	WBZ-TV	4
	WIHS-TV	38
	WHDH-TV	5
	WNAC-TV	7
Greenfield	WRLP	32
Springfield	WWLP	22
	WHYN-TV	40
Worcester	WJZB-TV	14

MICHIGAN

Location	C.L.	Chan.
Bay City-Saginaw	WNEM	5
Cadillac-Traverse City	WWTV	9
Cheboygan	WTOM-TV	4
Detroit	WJBK-TV	2
	WWJ-TV	4
	WKBD	50
	WXON	62
	WXYZ-TV	7
Detroit-Windsor	CKLW-TV	9
Flint	WJRT	12
Grand Rapids	WZZM-TV	13
Grand Rapids-Kalamazoo	WOOD-TV	8
Kalamazoo	WKZO-TV	3
Lansing	WJIM-TV	6
Lansing-Onondaga	WILX-TV	10
Marquette	WLUC-TV	6
Saginaw-Bay City	WKNX-TV	57
Sault Ste. Marie	WWUP-TV	10
Traverse City	WPBN-TV	7

MINNESOTA

Location	C.L.	Chan.
Alexandria	KCMT	7
Austin	KMMT	6
Duluth	WDIO-TV	10
Duluth-Superior, Wis.	KDAL-TV	3
	WDSM-TV	6
Mankato	KEYC-TV	12
Minneapolis-St. Paul	WCCO-TV	4
	KMSP-TV	9
	WTCN-TV	11
Rochester	KROC-TV	10
St. Paul-Minneapolis	KSTP-TV	5
Thief River Falls	KNOX-TV	10
Walker	KNMT	12

MISSISSIPPI

Location	C.L.	Chan.
Biloxi	WLOX-TV	13
Columbus	WCBI-TV	4
Greenwood	WABG-TV	6
Jackson	WJTV	12
	WLBT	3
Laurel-Hattiesburg	WDAM-TV	7
Meridian	WTOK-TV	11
Tupelo	WTWV	9

MISSOURI

Location	C.L.	Chan.
Cape Girardeau	KFVS-TV	12
Columbia	KOMU-TV	8
Hannibal-Quincy, Ill.	KHQA-TV	7
Jefferson City	KRCG	13
Joplin	KODE-TV	12
Kansas City	KCMO-TV	5
	WDAF-TV	4
	KMBC-TV	9
Kirksville-Ottumwa, La.	KTVO	3
Poplar Bluff	KPOB-TV	15
St. Joseph	KFEQ-TV	2
St. Louis	KMOX-TV	4
	KSD-TV	5
	KPLR-TV	11
	KTVI	2
Sedalia	KMOS-TV	6
Springfield	KTTS-TV	10
	KYTV	3

MONTANA

Location	C.L.	Chan.
Billings	KULR-TV	8
	KOOK-TV	2
Butte	KXLF-TV	4
Glendive	KXGN-TV	5
Great Falls	KFBB-TV	5
	KRTV	3
Helena	KBLL-TV	12
Missoula	KGVO-TV	13

NEBRASKA

Location	C.L.	Chan.
Albion	KHQL-TV	8
Grand Island	KGIN-TV	11
Hastings	KHAS-TV	5
Hay Springs	KDUH-TV	4
Hayes Center	KHPL-TV	6
Kearney-Holdrege	KHOL-TV	13
Lincoln	KOLN-TV	10
McCook	KOMC	8
North Platte	KNOP-TV	2
Omaha	KETV	7
	WOW-TV	6
	KMTV	3
Scottsbluff-Gering	KSTF	10
Superior	KHTL-TV	4

NEVADA

Location	C.L.	Chan.
Las Vegas	KLAS-TV	8
	KORK-TV	2
Reno	KCRL	4
	KOLO-TV	8

NEW HAMPSHIRE

Location	C.L.	Chan.
Lebanon	WRLH	49
Manchester	WMUR-TV	9

NEW JERSEY

Location	C.L.	Chan.
Burlington	WKBS	41
Linden-Newark	WNJU-TV	47
Paterson	WTVE	41
Wildwood	WCMC-TV	40

NEW MEXICO

Location	C.L.	Chan.
Albuquerque	KGGM-TV	13
	KOAT-TV	7
	KOB-TV	4
Carlsbad	KAVE-TV	6
Clovis	KICA-TV	12
Roswell	KSWS-TV	8
	KBIM-TV	10

NEW YORK

Location	C.L.	Chan.
Albany	WTEN	10
	WAST	13
Binghamton	WBJA-TV	34
	WINR-TV	40
	WNBF-TV	12
Buffalo	WBEN-TV	4
	WGR-TV	2
	WKBW-TV	7
Carthage-Watertown	WWNY	7
Elmira-Corning	WSYE-TV	18
New York	WABC-TV	7
	WCBS-TV	2
	WNBC-TV	4
	WNEW-TV	5
	WOR-TV	9
	WPIX	11
Plattsburgh	WPTZ	5
Rochester	WHEC-TV	10
	WOKR	13
	WROC-TV	8
Schenectady	WRGB	6
Syracuse	WHEN-TV	5
	WSYR-TV	3
	WNYS-TV	9
Utica	WKTV	2

NORTH CAROLINA

Location	C.L.	Chan.
Asheville	WISE-TV	62
	WLOS-TV	13
Charlotte	WBTV	3
	WSOC-TV	9
	WCCB-TV	36
Durham-Raleigh	WTVD	11
Greensboro	WFMY-TV	2
Greenville	WNCT-TV	9
High Point	WGHP-TV	8
New Bern	WNBE-TV	12
Raleigh-Durham	WRAL-TV	5
Washington	WITN-TV	7
Wilmington	WECT	6
	WWAY	3
Winston-Salem	WSJS-TV	12

NORTH DAKOTA

Location	C.L.	Chan.
Bismarck	KFYR-TV	5
	KXMB-TV	12
Dickinson	KDIX-TV	2
Fargo	KTHI-TV	11
	WDAY-TV	6
Minot	KMOT	10
	KXMC-TV	13
Pembina	KCND-TV	12
Valley City	KXJB-TV	4
Williston	KUMV-TV	8

OHIO

Location	C.L.	Chan.
Akron	WAKR-TV	49
Canton	WJAN	29
Cincinnati	WCPO-TV	9
	WKRC-TV	12
	WLW-T	5
Cleveland	WEWS	5
	WRCV-TV	3
	WJW-TV	8
Columbus	WBNS-TV	10
	WLWC	4
	WTVN-TV	6
Dayton	WHIO-TV	7
	WKEF	22
	WLW-D	2
Lima	WIMA-TV	35
Springfield	WSWO-TV	66
Steubenville-Wheeling, West Va.	WSTV-TV	9
Toledo	WSPD-TV	13
	WTOL-TV	11
Youngstown	WFMJ-TV	21
	WKBN-TV	27
	WYTV	33
Zanesville	WHIZ-TV	18

OKLAHOMA

Location	C.L.	Chan.
Ada	KTEN	10
Ardmore & Sherman-Denison, Texas	KXII	12
Elk City	KSWB	8
Lawton	KSWO-TV	7
Oklahoma City	KWTV	9
	WKY-TV	4
	KOCO-TV	5
	KKOR-TV	14
Tulsa	KOTV	6
	KVOO-TV	2
	KTUL-TV	8

OREGON

Location	C.L.	Chan.
Coos Bay	KCBY-TV	11
Eugene	KEZI-TV	9
	KVAL-TV	13
Klamath Falls	KOTI	2
LaGrande	KTVR	13
Medford	KTVM	5
	KMED-TV	10
Portland	KATU	2
	KGW-TV	8
	KOIN-TV	6
	KPTV	12
Roseburg	KPIC	4

PENNSYLVANIA

Location	C.L.	Chan.
Altoona	WFBG-TV	10
Erie	WICU-TV	12
	WJET-TV	24
	WSEE	35
Harrisburg	WHP-TV	21
	WTPA	27
Johnstown	WJAC-TV	6
	WARD-TV	56
Lancaster	WGAL-TV	8
Lebanon	WLYH-TV	15
Philadelphia	WCAU-TV	10
	WFIL-TV	6
	KYW-TV	3
	WKBS	41
	WPHL-TV	17
	WIBF-TV	29
Pittsburgh	KDKA-TV	2
	WECO-TV	53
	WIIC-TV	11
	WTAE	4
Scranton	WDAU-TV	22
Scranton & Wilkes-Barre	WNEP-TV	16
	WBRE-TV	28
York	WSBA-TV	43

RHODE ISLAND

Location	C.L.	Chan.
Providence	WJAR-TV	10
	WPRO-TV	12
Providence (New Bedford, Mass.)	WTEV	6

SOUTH CAROLINA

Location	C.L.	Chan.
Anderson	WAIM-TV	40
Charleston	WCIV	4
	WCSC-TV	5
	WUSN-TV	2
	WIS-TV	10
	WNOK-TV	19
	WOLO-TV	25
Florence	WBTW	13
	WPDT	23
Greenville	WFBC-TV	4
Spartanburg	WSPA-TV	7

SOUTH DAKOTA

Location	C.L.	Chan.
Aberdeen	KXAB-TV	9
Deadwood-Lead	KDSJ-TV	5
Florence-Watertown	KDLO-TV	3
Mitchell	KORN-TV	5
Rapid City	KOTA-TV	3
	KRSD-TV	7
Reliance	KPLO-TV	6
Sioux Falls	KELO-TV	11
	KSOO-TV	13

TENNESSEE

Location	C.L.	Chan.
Chattanooga	WDEF-TV	12
	WRCB-TV	3
	WTVC	9
Jackson	WDXI-TV	7
Johnson City-Bristol-Kingsport	WJHL-TV	11
Knoxville	WATE-TV	6
	WBIR-TV	10
	WTVK	26
Memphis	WMCT	5
	WHBQ-TV	13
	WREC-TV	3
Nashville	WLAC-TV	5
	WSIX-TV	8
	WSM-TV	4

TEXAS

Location	C.L.	Chan.
Abilene	KRBC-TV	9
Amarillo	KFDA-TV	10
	KGNC-TV	4
	KVII	7
Austin	KHFI-TV	42
	KTBC-TV	7
Beaumont	KBMT	12
	KFDM-TV	6
Big Spring	KWAB-TV	4
Bryan	KBTX-TV	3
Corpus Christi	KIII	3
	KRIS-TV	6
	KZTV	10
Dallas-Ft. Worth	WFAA-TV	8
	KRLD-TV	4
El Paso	KROD-TV	4
	KTSM-TV	9
El Paso-Juarez, Mex.	XEJ-TV	5
	KELP-TV	13
	XEPM-TV	2
Ft. Worth	KTVT	11
Ft. Worth-Dallas	WBAP-TV	5
Harlingen	KGBT-TV	4
Houston	KHOU-TV	11
	KHTV	39
	KTRK-TV	13
	KPRC-TV	2
Laredo	KGNS-TV	8
Lubbock	KCBD-TV	11
	KKBC-TV	34
	KLBK-TV	13
Lufkin	KTRE-TV	9
Midland & Odessa	KMID-TV	2
Monahans	KVKM-TV	9
Odessa	KOSA-TV	7
Port Arthur-Beaumont	KPAC-TV	4
Rosenberg	KJDO-TV	58
San Angelo	KACB-TV	3
	KCTV	8
San Antonio	KENS-TV	5
	WOAI-TV	4
	KONO-TV	12
	KWEX-TV	41
Sweetwater-Abilene	KPAR-TV	12
Temple-Waco	KCEN-TV	6
Tyler-Longview	KLTV	7
Waco	KWTX-TV	10
Weslaco	KRGV-TV	5
Wichita Falls	KFDX-TV	3
	KAUZ-TV	6

UTAH

Location	C.L.	Chan.
Salt Lake City	KCPX-TV	4
	KUTV	2
	KSL-TV	5

VERMONT

Location	C.L.	Chan.
Burlington	WCAX-TV	3

VIRGINIA

Location	C.L.	Chan.
Bristol	WCYB-TV	5
Charlottesville	WINA-TV	29
Hampton-Norfolk	WVEC-TV	13
Harrisonburg	WSVA-TV	3
Lynchburg-Roanoke	WLVA-TV	13
Norfolk	WTAR-TV	3
Portsmouth-Norfolk-Newport News	WAVY-TV	10
Richmond	WRVA-TV	12
	WTVR	6
Richmond-Petersburg	WXEX-TV	8
Roanoke	WDBJ-TV	7
	WRFT-TV	27
	WSLS-TV	10

WASHINGTON

Location	C.L.	Chan.
Bellingham	KVOS-TV	12
Pasco-Kennewick-Richland	KEPR-TV	19
Richland	KNDU	25
Seattle	KING-TV	5
	KOMO-TV	4
	KIRO-TV	7
Spokane	KHQ-TV	6
	KREM-TV	2
	KXLY-TV	4
Tacoma-Seattle	KTNT-TV	11
Tacoma	KTVW	13
Yakima	KIMA-TV	29
	KNDO	23

WEST VIRGINIA

Location	C.L.	Chan.
Bluefield	WHIS-TV	6
Charleston	WCHS-TV	8
Clarksburg	WBOY-TV	12
Huntington-Charles	WHTN-TV	13
	WSAZ-TV	3
Oak Hill	WOAY-TV	4
Parkersburg-Marietta, O.	WTAP-TV	15
Weston	WDTV	5
Wheeling-Steubenville, O.	WTRF-TV	7

WISCONSIN

Location	C.L.	Chan.
Eau Claire	WEAU-TV	13
Green Bay	WBAY-TV	2
	WFRV	5
	WLUK-TV	11
La Crosse	WKBT	8
Madison	WISC-TV	3
	WMTV	15
	WKOW-TV	27
Milwaukee	WISN-TV	12
	WTMJ-TV	4
	WITI-TV	6
	WUHF	18
Rhinelander	WAEO-TV	12
Wausau	WSAU-TV	7

WYOMING

Location	C.L.	Chan.
Casper	KTWO-TV	2
Cheyenne	KFBC-TV	5
Riverton	KWRB-TV	10

GUAM

Location	C.L.	Chan.
Agana	KUAM-TV	8

PUERTO RICO

Location	C.L.	Chan.
Aguadilla-Mayaguez	WOLE-TV	12
Caguas	WKBM-TV	11
Mayaquez	WORA-TV	5
	WMGZ	16
Ponce	WSUR-TV	9
	WRIK-TV	7
	WPSJ	14
San Juan	WAPA-TV	4
	WITA-TV	30
	WKAQ-TV	2
	WRST	18

VIRGIN ISLANDS

Location	C.L.	Chan.
Charlotte Amalie	WBNB-TV	10
Christiansted, St. Croix	WSVI	8

U. S. Educational Television Stations by States

Includes Non-Commercial Stations. U. S. Stations listed alphabetically by cities in state groups. Territories and possessions follow states. Abbreviations: Chan., channel; C.L., call letters.

ALABAMA

Location	C.L.	Chan.
Birmingham	WBIQ	10
Dozier	WDIQ	2
Huntsville	WHIQ	25
Mobile	WEIQ	42
Montgomery	WAIQ	26
Mount Cheaha State Park	WCIQ	7

ARIZONA

Location	C.L.	Chan.
Phoenix	KAET	8
	KPAZ-TV	21
Tucson	KUAT	6

ARKANSAS

Location	C.L.	Chan.
Little Rock	KETS	2

CALIFORNIA

Location	C.L.	Chan.
Los Angeles	KCET	28
Redding	KIXE-TV	9
Sacramento	KVIE	6
San Bernardino	KVCR-TV	24
San Francisco	KQED	9
San Jose	KTEH	54
San Mateo	KCSM-TV	14

COLORADO

Location	C.L.	Chan.
Denver	KRMA-TV	6

CONNECTICUT

Location	C.L.	Chan.
Hartford	WEDH	24

DELAWARE

Location	C.L.	Chan.
Wilmington	WHYY-TV	12

DISTRICT OF COLUMBIA

Location	C.L.	Chan.
Washington	WETA-TV	26

FLORIDA

Location	C.L.	Chan.
Gainesville	WUFT	5
Jacksonville	WJCT	7
Miami	WSEC-TV	17
	WTHS-TV	2
Orlando	WMFE-TV	24
Tallahassee	WFSU-TV	11
Tampa-St. Petersburg	WEDU	3

GEORGIA

Location	C.L.	Chan.
Athens	WGTV	8
Atlanta	WETV	30
Chatsworth	WCLP-TV	18
Columbus	WJSP-TV	28
Savannah	WVAN-TV	9
Waycross	WXGA-TV	8

IDAHO

Location	C.L.	Chan.
Moscow	KUID-TV	12

ILLINOIS

Location	C.L.	Chan.
Carbondale	WSIU	8
Chicago	WTTW	11
	WXXW	20
Urbana-Champaign	WILL-TV	12

INDIANA

Location	C.L.	Chan.
Terre Haute	WISU-TV	57

IOWA

Location	C.L.	Chan.
Des Moines	KDPS-TV	11

KANSAS

Location	C.L.	Chan.
Topeka	KTWU	11

KENTUCKY

Location	C.L.	Chan.
Louisville	WFPK-TV	15

LOUISIANA

Location	C.L.	Chan.
New Orleans	WYES-TV	8

MAINE

Location	C.L.	Chan.
Augusta	WCBB	10
Calais	WMED-TV	13
Orono	WMEB-TV	12
Presque Isle	WMEM-TV	10

MASSACHUSETTS

Location	C.L.	Chan.
Boston	WGBH-TV	2

MICHIGAN

Location	C.L.	Chan.
Detroit	WTVS	56
Onondaga-East Lansing	WMSB	10
University Center (Bay City)	WUCM-TV	19

MINNESOTA

Location	C.L.	Chan.
Appleton	KWCM-TV	10
Duluth	WDSE-TV	8
St. Paul	KTCI-TV	17
St. Paul-Minneapolis	KTCA-TV	2

MISSOURI

Location	C.L.	Chan.
Kansas City	KCSD-TV	19
St. Louis	KETC	9

NEBRASKA

Location	C.L.	Chan.
Alliance	KTNE-TV	13
Lexington	KLNE-TV	3
Lincoln	KUON-TV	12
N. Platte	KPNE-TV	9
Omaha	KYNE-TV	26

NEW HAMPSHIRE

Location	C.L.	Chan.
Durham	WENH	11

NEW MEXICO

Location	C.L.	Chan.
Albuquerque	KNME-TV	5

NEW YORK

Location	C.L.	Chan.
Buffalo	WNED-TV	17
New York	WNDT	13
	WNYC-TV	31
Schenectady	WMHT	17
Syracuse	WCNY-TV	24

NORTH CAROLINA

Location	C.L.	Chan.
Chapel Hill	WUNC-TV	4
Charlotte	WTVI	42
Columbia	WUNB-TV	2

NORTH DAKOTA

Location	C.L.	Chan.
Fargo	KFME	13

OHIO

Location	C.L.	Chan.
Athens	WOUB-TV	20
Bowling Green	WBGU-TV	70
Cincinnati	WCET	48
Cleveland	WVIZ-TV	25
Columbus	WOSU-TV	34
Newark	WGSF	28
Oxford	WMUB-TV	14
Toledo	WGTE-TV	30

OKLAHOMA

Location	C.L.	Chan.
Oklahoma City	KETA	13
	KOKH-TV	25
Tulsa	KOED-TV	11

OREGON

Location	C.L.	Chan.
Corvallis	KOAC-TV	7
Portland	KOAP-TV	10

WHITE'S RADIO LOG

Location	C.L.	Chan.
PENNSYLVANIA		
Allentown-Bethlehem	WLVT-TV	39
Clearfield	WPSX-TV	3
Hershey	WITF-TV	33
Philadelphia	WUHY-TV	35
Pittsburgh	WQED	13
	WQEX	16
SOUTH CAROLINA		
Charleston	WITV	7
Greenville	WNTV	29
SOUTH DAKOTA		
Vermillion	KUSD-TV	2
TENNESSEE		
Memphis	WKNO-TV	10
Nashville	WDCN-TV	2
Sneedville	WSJK-TV	2
TEXAS		
Dallas-Ft. Worth	KERA-TV	13
Houston	KUHT	8
Lubbock	KTXT-TV	5
Richardson	KRET-TV	23
San Antonio-Austin	KLRN-TV	9
UTAH		
Logan	KUSU-TV	12
Ogden	KWCS-TV	18
	KOET	9
Provo	KBYU-TV	11
Salt Lake City	KUED	7
VIRGINIA		
Hampton-Norfolk	WHRO-TV	15
Portsmouth	WYAH-TV	27
Richmond	WCVE-TV	23
WASHINGTON		
Pullman	KWSC-TV	10
Seattle	KCTS-TV	9
Tacoma	KPEC-TV	56
	KTPS	62
Yakima	KYVE-TV	47
WISCONSIN		
Madison	WHA-TV	21
Milwaukee	WMVS	10
	WMVT	36
PUERTO RICO		
Mayaguez	WIPM-TV	3
San Juan	WIPR-TV	6

Canadian Television Stations by Cities

Canadian stations listed alphabetically by cities. Abbreviations: Chan., channel; C.L., call letters.

Location	C.L.	Chan.
Adams Hill, B.C.	CFCR-TV-8	11
Alticane, Sask.	CKBI-TV-1	10
Amherst, N.S.	CJCH-TV-3	8
Antigonish, N.S.	CFXU-TV	9
Argentia, Nfld.	CJOX-TV	3
Ashcroft, B.C.	CFCR-TV-2	10
Atikokan, Ont.	CBWCT-1	7
Baldy Mountain, Man.	CKSS-TV	8
Baie St. Paul, Que.	CKRT-TV-1	2
Bancroft, Ont.	CHEX-TV	2
Banff, Alta.	CKRD-TV-2	10
	CFCN-TV-2	8
Barrie, Ont.	CKVR-TV	3
Bayview, N.S.	CJCH-TV-2	6
Bon Accord, N.B.	CHSJ-TV-1	6
Bonavista, Nfld.	CJON-TV-2	10
Boston Bar, B.C.	CFCR-TV-9	5
Bralorne, B.C.	CFCR-TV-15	3
Brandon, Man.	CKX-TV	5
Brooks, Alta.	CFCN-TV-3	9
Burmis, Alta.	CJLH-TV-3	3
Burnaby, B.C.	CHAN-TV	8
Burns Lake, B.C.	CFTK-TV-3	2
Calgary, Alta.	CFCN-TV	4
Calgary, Alta.	CHCT-TV	2
Callander, Ont.	CFCH-TV	10
Campbellton, N.B.	CKCD-TV	7
Camp Woss, B.C.	CFNV-TV-1	3
Canning, N.S.	CJCH-TV-1	10
Carleton, Que.	CHAU-TV	5
Carlyle Lake, Sask.	CKOS-TV-2	7
Carrot Creek, Alta.	CFRN-TV-1	9
Castlegar, B.C.	CBUAT-2	3
Celista, B.C.	CHBC-TV-6	6
Chandler, Que.	CHAU-TV-4	7
Charlottetown, P.E.I.	CFCY-TV	13
Cherryville, B.C.	CJWR-TV-1	10
Chicoutimi, P.Q.	CJPM-TV	6
Chilliwack, B.C.	CHAN-TV-1	11
Cheticamp, N.S.	CBFCT	10
Chicoutimi, Que.	CKRS-TV-2	2
Churchill, Man.	CHGH-TV	4
Clearwater, B.C.	CFCR-TV-10	2
Clermont, Que.	CFCV-TV-1	75
Clinton, B.C.	CFCR-TV-4	9
Cloridorme, Que.	CHAU-TV-8	6
Corner Brook, Nfld.	CBYT	5
Corner Brook, Nfld.	CJON-TV-1	10
Cornwall, Ont.	CJSS-TV	8
Coronation, Alta.	CKRD-TV	10
Courtenay, B.C.	CBUT-1	9
Colgate, Saskatchewan	CKCK-TV-1	12
Cranbrook, B.C.	CBYBT	10
Crescent Valley, B.C.	CHMS-TV-1	5
Dawson Creek, B.C.	CJDC-TV	5
Deer Lake, Nfld.	CBYAT	12
Drumheller, Alta.	CFCN-TV-1	12
Drumheller, Alta.	CHCT-TV-1	8
Dryden, Ontario	CBWAT-1	9
Eastend, Sask.	CJFB-TV-1	2
Edmonton, Alta.	CBXT	5
Edmonton, Alta.	CFRN-TV	3
Edmundston, N.B.	CJBR-TV-1	13
Edson, Alta.	CFRN-TV-2	12
Elliot Lake, Ont.	CKSO-TV-1	3
Enderby, B.C.	CFEN-TV-1	5
Enderby, B.C.	CHBC-TV-5	72
Estcourt, Que.	CJES-TV-1	70
Falkland, B.C.	CFWS-TV-1	5
Flin Flon, Man.	CBWBT	10
Fort Francis, Ont.	CBWCT	5
Fort Fraser, B.C.	CKPG-TV-3	6
Foxwarren, Man.	CKX-TV-1	11
Gaspe, Que.	CHAU-TV-6	10
Gaspe West, Que. (Bechervaise Mountain)	CFGW-TV-1	6
Goose Bay, Nfld.	CFLA-TV	8
Grand Bank, Nfld.	CJOX-TV-1	10
Grand Falls, Nfld.	CJCN-TV	4
Grande Prairie, Alta.	CBXAT	10
Grande Vallee	CKBL-TV-3	11
Greenwater Lake, Sask.	CKBI-TV-3	4
Halifax, N.S.	CBHT	3
Halifax, N.S.	CJCH-TV	5
Hamilton, Ont.	CHCH-TV	11
Hixon, B.C.	CKPG-TV-1	10
Huntsville, Ont.	CKVR-TV-2	8
Invermere, B.C.	CFWL-TV-1	6
Inverness, N.S.	CJCB-TV-1	6
Jonquiere, Que.	CKRS-TV	12
Juskatla, B.C.	CFTK-TV-7	2
Kamloops, B.C.	CFCR-TV	4
Kapuskasing, Ont.	CBFOT-1	12
Kapuskasing, Ont.	CFCL-TV-3	3
Kearns, Ont.	CFCL-TV-2	2
Kemano, B.C.	CFTK-TV-5	2
Kelowna, B.C.	CHBC-TV	2
Kenora, Ont.	CBWAT	8
Keremeos, B.C.	CHKC-TV-1	5
Kildala, B.C.	CFTK-TV-4	5
Kingston, Ont.	CKWS-TV	11
Kitchener, Ont.	CKCO-TV	13
Kokish, B.C.	CFKB-TV-2	9
Labrador City, Nfld.	CJCL-TV	13
Lethbridge, Alta.	CJLH-TV	7
Lillooet, B.C.	CFCR-TV-1	11
Liverpool, N.S.	CBHT-1	12
Lloydminster, Alta.	CKSA-TV	2
London, Ont.	CFPL-TV	10
Lumby, B.C.	CHID-TV-1	5
Magdalen Islands, Que.	CBFCT-1	12
Malakwa, B.C.	CFFI-TV-1	5
Manicouagan, Que.	CKHQ-TV-1	10
Marquis, Sask.	CKMJ-TV	7
Marystown, Nfld.	CBNT-3	5
Matagami, Que.	CKRN-TV-4	7
Matane, Que.	CKBL-TV	9
Meadow Lake, Sask.	CKSA-TV-1	12
Medicine Hat, Alta.	CHAT-TV	6
Melita, Man.	CKX-TV-2	9
Merritt, B.C.	CFCR-TV-3	10
Moncton, N.B.	CBAFT	11
Moncton, N.B.	CKCW-TV	2
Mont Blanc Perce, Que.	CFGW-TV-2	8
Mont Climont, Que.	CKBL-TV-1	11
Mont-Laurier, Que.	CBFT-2	3
Mount Timothy, B.C.	CFCR-TV-6	5
Mont Tremblant, Que.	CBFT-1	11
Montreal, Que.	CBFT	2
Montreal, Que.	CBMT	6
Montreal, Que.	CFCF-TV	12
Montreal, Que.	CFTM-TV	10
Moose Jaw, Sask.	CHAB-TV	4
Moyie, B.C.	CKVS-TV-1	5
Murdochville, Que.	CKBL-TV-2	6
	CKMU-TV-1	3
Nakusp, B.C.	CJNP-TV-1	2
Nakusp, B.C.	CJNP-TV-2	4
Nass Camp (Near Lava Lake) B.C.	CFTK-TV-6	5
Nelson, B.C.	CBUAT-1	9
Newcastle, N.B.	CKAM-TV-1	7
Newcastle Ridge, B.C.	CFKB-TV-1	7
New Glasgow, N.S.	CFCY-TV-1	7
Ninkish, B.C.	CFNV-TV-2	6
Nipawin, Sask.	CKBI-TV-4	2
North Battleford, Sask.	CKBI-TV-2	7
Oliver, B.C.	CHBC-TV-3	8
Ottawa, Ont.	CBOFT	9
Ottawa, Ont.	CBOT	4
Ottawa, Ont.	CJOH-TV	13
Parry Sound, Ont.	CKVR-TV-1	11
Passmore, B.C.	CHMS-TV-2	2
Peace River, Alta.	CBXAT-1	7
Peachland, B.C.	CHPT-TV-1	5
Pembroke, Ont.	CHOV-TV	5
Penticton, B.C.	CHBC-TV-1	13
Perce, Que.	CHAU-TV-5	2
Perrys, B.C.	CHMS-TV-3	5
Peterborough, Ont.	CHEX-TV	12
Pivot, Alta.	CHAT-TV-1	4
Placentia, Nfld.	CBNT-2	12
Port Alfred, Que.	CKRS-TV-1	9
Port Arthur, Ont.	CKPR-TV	2
Port Daniel, Que.	CHAU-TV-3	10
Port Hardy, B.C.	CFKB-TV-3	3
Port Rexton, Nfld.	CBNT-1	13
Prince Albert, Sask.	CKBI-TV	5
Prince George, B.C.	CKPG-TV	2
Princeton, B.C.	CHGP-TV-1	5
Prince Rupert	CFTK-TV-1	6
Quebec, Que.	CBVT	11
	CFCM-TV	4
	CKMI-TV	5
Quesnel, B.C.	CFCR-TV-11	7
Quesnel, B.C.	CKCQ-TV-1	13
Red Lake, Ont.	CBWAT-3	10
Regina, Sask.	CHRE-TV	9
Regina, Sask.	CKCK-TV	2
Red Deer, Alta.	CKRD-TV	6
Rimouski, Que.	CJBR-TV	3
Riverhurst, Sask.	CJFB-TV-3	10
Rivière-au-Renard	CHAU-TV-7	7
Rivière du Loup, Que.	CKRT-TV	7
Riviere du Loup, Que.	CKRT-TV-3	13
Roberval, Que.	CKRS-TV-3	8
Rouyn, Que.	CKRN-TV	4
Saint John, N.B.	CHSJ-TV	4
Salmon Arm, B.C.	CHBC-TV-4	9
Saskatoon, Sask.	CFQC-TV	8
Sault Ste. Marie, Ont.	CJIC-TV	2
Savona, B.C.	CFCR-TV-7	8
Schefferville, Que.	CFKL-TV	11
Senneterre, Que.	CKRN-TV-1	7
Sheet Harbour, N.S.	CBHT-4	11
Shelburne, N.S.	CBHT-2	8
Sherbrooke, Que.	CHLT-TV	7
Sioux Lookout, Ont.	CBWAT-2	12
Smithers, B.C.	CFTK-TV-2	5
Sointula, B.C.	CFKB-TV-4	5
Squamish, B.C.	CHAR-TV-1	7
St. John's, Nfld.	CBNT	8
St. John's, Nfld.	CJON-TV	6
Ste. Marguerite-Marie, Que.	CHAU-TV-1	2
St. Quentin, N.B.	CHAU-TV-2	10
Ste. Rose du Dégelé, Que.	CKRT-TV-2	
Stephenville, Nfld.	CFSN-TV	8
Stranraer, Sask.	CFQC-TV-1	3
Sturgeon Falls, Ont.	CBFST	7
Sudbury, Ont.	CBFST-1	13
Sudbury, Ont.	CKSO-TV	5
Swift Current, Sask.	CJFB-TV	5
Sydney, N.S.	CJCB-TV	4
Temiscaming, Que.	CBFST-2	12
Temiscaming, Que.	CJTK-TV-1	3
Terrace, B.C.	CFTK-TV	3
The Pas, Man.	CBWBT-1	7
Timmins, Ont.	CFCL-TV	6
Timmins, Ont.	CBFOT	9
Toronto, Ont.	CBLT	6
Toronto, Ont.	CFTO-TV	9
Trail, B.C.	CBUAT	11
Trois-Rivières, Que.	CKTM-TV	13
Upsalquitch Lake, N.B.	CKAM-TV	12
Val D'Or, Que.	CKRN-TV-2	8
Val Marie, Sask.	CJFB-TV-2	2
Vancouver, B.C.	CBUT	2
Vernon, B.C.	CHBC-TV-2	7
Victoria, B.C.	CHEK-TV	6
Ville Marie, Que.	CKRN-TV-3	6
Waterton Park, Alta.	CJWP-TV-1	12
Westwold, B.C.	CFWS-TV-2	12
Whitecourt, Alta.	CFRN-TV-3	7
Williams Lake, B.C.	CFCR-TV-5	8
Willow Bunch, Sask.	CKCK-TV-2	6
Windsor, Dnt.	CKLW-TV	9
Wingham, Ont.	CKNX-TV	8
Winnipeg, Man.	CBWFT	3
Winnipeg, Man.	CBWT	6
Winnipeg, Man.	CJAY-TV	7
Wynyard, Sask.	CKOS-TV-3	6
Yorkton, Sask.	CKOS-TV	3
Yarmouth, N.S.	CBHT-3	11
Yuill Mountain, Balfour, B.C.	CKBF-TV-1	5

World-Wide Short-Wave Stations

■ The shortwave section of *White's Radio Log* is an exclusive feature of RADIO-TV EXPERIMENTER magazine. This is a listing of the most active and most often reported stations, as compiled from reader reports sent in to us, from published schedules of the stations listed, and from actual monitoring at the official RADIO-TV EXPERIMENTER monitoring station, DX Central.

We invite our readers to send in their loggings for inclusion in these listings. Be sure to include the following information for each station reported: approximate frequency, callsign and/or station name, and time monitored in Greenwich Mean Time (24 hour clock). Address your reports to: DX Central, White's Radio Log, RADIO-TV EXPERIMENTER, 505 Park Avenue, New York, N.Y. 10022, U.S.A.

We are indebted to the following DX reporters for making this listing possible.

Mark Colan, Peoria, Ill.
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Leonard E. Smith, Shadyside, Ohio
George Spront, Reading, Pa.
Mike Thompson, Vancouver, B. C.
Jerry Stuart, Lawton, Okla.
P. Grenier, Azusa, Calif.
Eugene Purdum, Jr., Westminster, Md.
Harry McDonald, Clay City, Ill.
Thomas Norwood, Northport, Ala.
Robert Sloat, Bangor, Me.
Michael Simons, Chicago, Ill.
William Trenbeth, Los Angeles, Calif.
Marc DeLorenzo, Hyannis, Mass.
Terry Henry, Keene, N. H.
Bill Lester, Grimstead, Va.
Max McDonald, Findlay, Ohio
Desmond Lanktree, London, Ont.
D. J. McGovern, Yorktown, Va.
Danny Littel, Milwaukee, Wisc.
David Jerome, Newton Centre, Mass.
E. J. Kauffmann, Louisville, Ky.

Note! At the request of many of our readers, and to conform with radio club publications and international broadcasting schedules, we are going to be bringing you the Shortwave Section of WHITES RADIO LOG with all times indicated in Greenwich Mean Time, 24 hour clock. "GMT" is the international time system and indicates the time at the Greenwich Observatory in England.

To aid you in converting GMT into your local time, we offer you the following chart, which you may find a handy guide around your DX shack.

GMT TIME TABLE

GMT	EST	CST	MST	PST
0000	1900	1800	1700	1600
0100	2000	1900	1800	1700
0200	2100	2000	1900	1800
0300	2200	2100	2000	1900
0400	2300	2200	2100	2000
0500	0000	2300	2200	2100
0600	0100	0000	2300	2200
0700	0200	0100	0000	2300
0800	0300	0200	0100	0000
0900	0400	0300	0200	0100
1000	0500	0400	0300	0200
1100	0600	0500	0400	0300
1200	0700	0600	0500	0400
1300	0800	0700	0600	0500
1400	0900	0800	0700	0600
1500	1000	0900	0800	0700
1600	1100	1000	0900	0800
1700	1200	1100	1000	0900
1800	1300	1200	1100	1000
1900	1400	1300	1200	1100
2000	1500	1400	1300	1200
2100	1600	1500	1400	1300
2200	1700	1600	1500	1400
2300	1800	1700	1600	1500

For conversion of GMT to U.S. Daylight (summer) time add one hour to the desired local time. In other words 0000 GMT is 1900 EST and would be 2000 EDST, 1900 CDST, etc.

The following abbreviations are used: BC- Broadcasting Company, Corporation or System; E- Emissora; R- Radio; V- Voice or Voz.

Freq. (Hz)	Call	Name	Location	GMT
2410	4XO	R. Lumiere	Les Cayes, Haiti	1000
2520	XEL	R. Capital	Mexico D.F., Mexico	0230
3250	—	Springbok R.	Paradys, S. Afr.	0405
3266	ZYR79	R. Riberao	Preto, Brazil	0100
3275	ZYR31	Bauru R. Clube	Bauru, Brazil	0200
3284	DUB2	Phil. B.C.	Manila, Philippines	1100
3306	—	Rhodesian B.C.	Salisbury, Rhodesia	0330
3315	—	ORTF	Ft. de France, Martinique	2326
3346	—	R. Zambia	Lusaka, Zambia	0353
3355	—	R. Luz	Lima, Peru	0335
3373	HCDY4	R. Iris	Esmeraldas, Ecu.	0300
3385	YVQI	R. Barcelona	Barcelona, Venez.	0440
3395	—	Rhodesian B.C.	Salisbury, Rhodesia	1500
3700	—	Royal Thai Air Force*	Bangkok, Thailand	1825

WHITE'S RADIO LOG

kHz	Call	Name	Location	GMT
3820	—	Windward I. B.C.	St. Georges, Grenada	0130
3952	MCM	BBC	London, England	0120
3980	—	R. Peking	Peking, China	1045
3985	HCER5	Escuelas R. Popular	Riobamba, Ecuador	0230
4164	—	Ankhararari Ulanbatras	Ulan Bator, Mongolia	2255
4380	—	R. Peking	Peking, China	1045
4600	—	R. Nepal	Kathmandu, Nepal	1400
4707	—	E. Mariana	Pasto, Colombia	0200

60-Meter Band—4750 to 5060 kHz

kHz	Call	Name	Location	GMT
4775	—	R. Kabul	Kabul, Afghanistan	0155
4780	YVLA	V. de Carabobo	Valencia, Venezuela	0930
4785	OAX3V	R. Horizonte	Huanuco, Peru	0030
4810	HCFA4	V. de Manabi	Manabi, Ecu.	1120
4828	—	Rhodesian B.C.	Gwelo, Rhodesia	0452
4830	—	Overseas B.C.	Bangkok, Thailand	1100
4835	—	R. Mali	Bamako, Mali	0630
	—	R. Clube Mozambique	Lourenco Marques, Mozamb.	0400
4845	—	BBC Relay	Francistown, Bechuanaland	1545
	HJGF	R. Bucaramonga	Bucaramonga, Colombia	1050
4847	HRVK	R. San Isidro	La Ceiba, Honduras	2300
4855	HJFV	R. Neiva	Neiva, Colombia	0200
4865	—	E. Regional	Azores Is.	0030
	PRC5	R. C. de Belem	Para, Brazil	0920
	—	V. de Guaranda	Colombia	0400
4870	YVKP	R. Tropical	Caracas, Venez.	0100
	—	R. du Dahomey	Cotonou, Dahomey	0545
4875	ZYZ30	R. Jornal do Brazil	Rio de Janeiro, Brazil	0830
	HCVE4	V. de Esmeraldas	Esmeraldas, Ecu.	2300
4890	—	R. Senegal	Dakar, Senegal	0630
	YVKB	R. Venezuela	Caracas, Venez.	2330
	VLT4	Austral. B.C.	Port Moresby, Papua	0900
4895	—	ORTF	Fort-de-France, Martinique	1110
4905	CR6RO	R. Clube do Bie	Bie, Angola	1825
4910	HCJMI	R. Gran Colombia	Quito, Ecuador	2300
	—	R. Peking	Peking, China	1145
	—	R. de Guinea	Conakry, Guinea	0653
4914	ZYR60	R. Cult. Araraquara	Araraquara, Brazil	0200
4915	—	R. Ghana	Accra, Ghana	0600
4916	HCAH3	R. el Trebol	Zaruma, Ecuador	0200
4920	VLM4	Austral. B.C.	Brisbane, Austral.	1245
4923	HCQRI	R. Quito	Quito, Ecuador	0000
4940	—	R-TV Ivorienne	Abidjan, Ivory Coast	2330
	HCZXI	R. Nacional	Quito, Ecuador	0330
4950	—	R. Senegal	Dakar, Senegal	0600
	YVMM	R. Coro	Coro, Venez.	0115
4955	HJCQ	R. Nacional	Bogota, Colombia	0115
4965	HJAE	R. Santa Fe	Bogota, Colombia	0500
4975	ZYV9	R. Timbira	Sao Luiz, Brazil	2140
4980	—	R. Ghana	Accra, Ghana	0600
4990	—	Nigerian B.C.	Lagos, Nigeria	0430
	YVMQ	R. Barquisimeto	Barquisimeto, Venez.	2245
4994	—	R. Omdurman	Omdurman, Sudan	0425
4995	HRQW	R. Tropico	Tegucigalpa, Honduras	2300
	ZYY2	R. Brasil Central	Goiania, Brazil	0100
5005	OAX2S	R. Jaen	Jaen, Peru	0200
5021	4VGS	R. Independence	Goinaves, Haiti	0015
5030	HIBB	V. del Papagayo	La Romana, Domin. Rep.	0332
	—	R. Lome	Lome, Togo	2100
5040	—	R. Maturin	Maturin, Venez.	2315
	—	Burma B.C.	Rangoon, Burma	1430
5050	—	R. Tanzania	Dar-es-Salaam, Tanzania	0330
	YVKD	R. Cultura	Caracas, Venez.	2200
5804	—	R. Sanaa	Sanaa, Yemen	0415
5920	—	R. Vilnus	Vilnus, USSR	2230
5930	—	R. Prague	Prague, Czech.	0105
	—	R. Cambodge	Phnom-Penh, Cambodia	0530
5942	—	Trans World R.	Bonaire, Neth. Antilles	1430

49-Meter Band—5950 to 6200 kHz

kHz	Call	Name	Location	GMT
5955	—	R. Canada	Montreal, Que.	0730
	TGNA	R. Cultural	Guatemala City, Guat.	0040
	—	R. Berlin Int'l.	Berlin, E. Germany	0345
5960	—	R. Berlin Int'l.	Berlin, E. Germany	0100
5965	YNWA	R. Mundial	Managua, Nicaragua	0200
5970	—	R. Berlin Int'l.	Berlin, E. Germany	0000
	HJVN	R. Horizonte	Bogota, Colombia	1100
5975	—	Rhodesian B.C.	Salisbury, Rhodesia	0600
5980	DMQ5	Deutsche Welle	Cologne, W. Germany	2110
5995	—	R. Andorra	Andorra	1100
6000	—	R. Americas	Swan Island	0420
6010	CJCX	CJCX	Sydney, N.S.	2115
	XEOI	R. Mil	Mexico, D.F., Mex.	0000
6020	—	Rhodesian B.C.	Salisbury, Rhodesia	0616
	—	R. Rep. Guinee	Guinee	2230
6045	HOU31	V. del Baru	Baru, Panama	0245
6050	HCJB	V. of Andes	Quito, Ecu.	0513
	GSA	BBC	London, England	0059
	—	V. America Relay	Monrovia, Loveria	0430
6055	—	V. America	Greenville, N.C.	0615
6065	XEXG	R. Mexico	Mexico, D.F., Mex.	0000
6070	CFRX	CFRX	Toronto, Ont.	0200
	—	R. Sofia	Sofia, Bulgaria	2000
6080	—	V. Liberdad	(clandestine) Algeria	0100
6095	—	RAI	Rome, Italy	0345
6097	HSK5	Overseas B.C.	Bangkok, Thailand	1300
6100	DMQ6	Deutsche Welle	Cologne, W. Germany	2110
	—	V. Malaysia	Kuala Lumpur, Malaysia	1100
	—	R. Belgrade	Belgrade, Yugoslavia	1645
	HCSP4	V. del Volante	Portoviejo, Ecuador	0510
6105	XEQM	R. Yucutan	Merida, Mex.	0200
	CE611	R. Soc. Nac. de Agric.	Santiago, Chile	0210
6115	XEUDS	R. Universidad	Hermosillo, Mex.	0121
6117	HCIQ	V. del Llano	Villavicencio, Colombia	0200
6125	—	V. America	Greenville, N.C.	0015
	ORU	R-TV Belge	Brussels, Belgium	2315
6140	HJNE	R. El Sol	Cali, Colombia	0500
6145	DMQ6	Deutsche Welle	Cologne, W. Germany	0140
	PRL9	R. Nacional	Rio de Janeiro, Brazil	0000
6160	—	R. Berlin Int'l.	Berlin, E. Germany	0000
6165	—	V. America Relay	Monrovia, Liberia	0430
	—	Swiss B.C.	Berne, Switz.	0545
6170	—	R. Havana	Havana, Cuba	0100
6176	—	V. Malaysia	Kuala Lumpur, Malaysia	1100
	DMQ6	Deutsche Welle	Cologne, W. Germany	0159
	ZYV75	R. Guarani	Belo Horizonte, Brazil	0000
6180	—	Senegalese B.C.	Ziguinchar, Senegal	0915
	TGWB	V. de Guatemala	Guatemala City, Guat.	2300
6185	ZYR77	R. Bandeirantes	Sao Paulo, Brazil	0000
	—	V. America	Delano, Calif.	1000
6195	GRN	BBC	London, England	0400
6210	TIHBG	R. Reloj	San Jose, C.R.	0000
6234	—	R. Budapest	Budapest, Hungary	0300
	—	Korean Central B.C.	Pyongyang, N. Korea	1045
6305	—	R. Tunis	Tunisia	1800
6955	—	R. Peking	Peking, China	1155
7005	—	R. Peking	Peking, China	2150
7009	—	V. Pakistan	Karachi, Pakistan	1245
7055	—	Burma B.C.	Rangoon, Burma	1430
7100	—	ORTF	Paris, France	0515
7115	—	R. Prague	Prague, Czech.	0105
7120	—	R. Kiev	Kiev, USSR	0030
	—	R. Mogadiscio	Mogadiscio, Somali	0400

kHz	Call	Name	Location	GMT
7130	BED7	V. Free China	Taipei, Formosa	0250
	—	BBC	London, England	2300
7135	—	V. America Relay	Monrovia, Liberia	2000
7150	—	R. Moscow	Moscow, USSR	2200
7175	—	Rhodesian B.C.	Salisbury, Rhodesia	0600
7185	GRK	BBC	London, England	1900
	—	R. Vilnus	Vilnus, USSR	2230
7185	HSK7	Overseas B.C.	Bangkok, Thailand	1100
7195	—	V. America Relay	Monrovia, Liberia	2330
7200	—	R. Belgrade	Belgrade, Yugoslavia	1645
7210	—	R. Moscow	Moscow, USSR	2100
7220	—	BBC	London, England	2225
7230	GSW	BBC	London, England	0340
7235	—	V. America Relay	Okinawa	1215
7255	—	Nigerian B.C.	Lagos, Nigeria	0430
	—	R. Kiev	Kiev, USSR	0515
	VUD	All India R.	Delhi, India	1945
	—	R. Sofia	Sofia, Bulgaria	2105
7260	GSU	BBC	London, England	0412
	—	Trans World R.	Monte Carlo, Monaco	1430
7265	—	V. America Relay	Monrovia, Liberia	0400
7275	—	RAI	Rome, Italy	0330
	—	R. Kiev	Kiev, USSR	2150
	—	R. S. Africa	Capetown, S. Africa	0430
7280	—	V. America Relay	Colombo, Ceylon	1300
7290	—	R. Moscow	Moscow, USSR	2300
7295	—	BBC	Francistown, Bechuanaland	1015
7335	—	R. Peking	Peking, China	2230
7345	—	R. Prague	Prague, Czech.	0105
7360	—	R. Vilnus	Vilnus, USSR	2230
8820	EIP	Shannon Aeradio*	Newmarket, Eire	0215
9380	—	Govorit Alma Ata	Alma Ata, USSR	0410
9390	—	R. Tirana	Tirana, Albania	2205
9457	—	R. Peking	Peking, China	1220

31-Meter Band—9500 to 9775 kHz

kHz	Call	Name	Location	GMT
9500	—	ORTF	Paris, France	0515
9505	—	R. Belgrade	Belgrade, Yugoslavia	1645
	PRB22	R. Record	Sao Paulo, Brazil	0000
9510	GSB	BBC	London, England	0615
9515	XEWW	V. America Latina	Mexico D.F., Mexico	0000
9520	—	R. Denmark	Copenhagen, Denmark	1030
9525	—	ORTF	Paris, France	2100
9533	OAX6Z	R. Nacional	Tacna, Peru	0500
9535	—	Swiss B.C.	Berne, Switz.	0545
9540	ZL2	R. New Zealand	Wellington, N.Z.	0700
9550	LLD	R. Norway	Oslo, Norway	0300
9555	—	R. Liberty	Munich, W. Germany	1959
9558	—	Trans World R.	Monte Carlo, Monaco	1630
9560	PJB	V. Bonaire	Bonaire, Neth. Antilles	0230
	—	ORTF	Paris, France	1915
	—	R. Australia	Melbourne, Australia	0645
9562	OAX4R	R. Nacional	Lima, Peru	0420
9565	—	R. Nacional Espana	Madrid, Spain	2000
	ZYK3	R. Jornal do Comercio	Recife, Brazil	2330
9580	—	R. Australia	Melbourne, Australia	1214
9585	ZYR56	R. Excelsior	Sao Paulo, Brazil	0200
9590	PCJ	R. Nederland	Hilversum, Netherlands	1855
9597	—	Gorovit Alma Ata	Alma Ata, USSR	1357
9600	—	R. Tashkent	Tashkent, USSR	1400
	CE960	R. Pres. Balmaceda	Santiago, Chile	0030
9605	PJB	V. Bonaire	Bonaire, Neth. Antilles	0000
	—	Nat'l. Hellenic B.C.	Athens, Greece	0900
9610	LLG	R. Norway	Oslo, Norway	0300
	VLX9	Austral. B.C.	Wanneroo, Australia	1300
9515	ORU	R-TV Belge	Brussels, Belg.	2115
9620	—	R. Sweden	Stockholm, Sweden	0900
9630	—	RAI	Rome, Italy	0112
	—	R. Canada	Montreal, Que.	2045
9635	—	V. America	Greenville, N.C.	0430
9640	YVPG	Ecos del Torbes	San Cristobal, Venez.	1230
9645	TIFC	Faro del Caribe	San Jose, C.R.	1730
9655	BED91	V. Free China	Taipei, Formosa	1000
	—	R. Havana	Havana, Cuba	0800
9660	—	R. Nacional Espana	Canary Islands	1700
9667	—	R. Ceylon	Colombo, Ceylon	1250
9685	BED73	V. Free China	Taipei, Formosa	1000
9700	—	R. Sofia	Sofia, Bulgaria	2105
	—	R. Japan	Tokyo, Japan	2000
	CE970	V. de Chile	Santiago, Chile	0233
9705	—	R. Sweden	Stockholm, Sweden	0100
9715	KGEI	V. Friendship	San Francisco, Calif.	0225
9725	—	BBC Relay	Singapore, Malaysia	0900
	—	Kol Yisrael	Jerusalem, Israel	2056
9740	ORU	R-TV Belge	Brussels, Belgium	1800
9745	HCJB	V. of Andes	Quito, Ecuador	0230
9765	—	V. Free China	Taipei, Formosa	1530
9767	OAX80	R. Amazonas	Iquitos, Peru	2300
9770	—	Osterreichischer R.	Vienna, Austria	1630
9795	—	R. Prague	Prague, Czech.	0105
9874	YDF6	V. Indonesia	Djakarta, Indonesia	1700
9915	VUD	All India R.	Delhi, India	1945

25-Meter Band—11700 to 11975 kHz

kHz	Call	Name	Location	GMT
11710	—	R. Australia	Melbourne, Australia	0645
11714	—	R. Alger	Algiers, Algeria	1700
11715	—	R. Sofia	Sofia, Bulgaria	2105
11720	—	R. Canada	Montreal, Que.	2045
11725	BED75	V. Free China	Taipei, Formosa	1530
11750	—	BBC Relay	Singapore, Malaysia	0900
11755	HCJB	V. of Andes	Quito, Ecuador	2100
11779	—	R. Clube Mozambique	Lourenco Marques, Mozamb.	0400
11780	LRY2	R. Belgrano	Buenos Aires, Argentina	2300
11785	—	R. Moscow	Moscow, USSR	1500
	—	Osterreichischer R.	Vienna, Austria	1630
11795	DMQ11	Deutsche Welle	Cologne, W. Germany	1510
11800	—	R. Peking	Peking, China	0020
11805	OIXB	Finnish B.C.	Helsinki, Finland	1000
11810	—	V. do Liberdade	(clandestine) Algiers	0015
11815	KAZXFW	(pulse transmission)*	Pullman, Wash.	1608
11820	—	R. Peking	Peking, China	0015
11825	ZYK32	R. Jornal do Comercio	Recife, Brazil	0130
	BED69	V. Free China	Taipei, Formosa	0250
11835	—	R. Tahiti	Papeete, Tahiti	2200
11840	—	E. Nacional	Lisbon, Portugal	1900
11850	LLK	R. Norway	Oslo, Norway	0300
11851	ZPA3	R. Telco	Asuncion, Paraguay	0100
11855	—	Trans World R.	Bonaire, Neth. Antilles	1830
11860	BED45	V. Free China	Taipei, Formosa	1000
	GSE	BBC	London, England	1700
11870	ORU	R-TV Belge	Brussels, Belg.	2315
11875	ETLF	R. V. of Gospel	Addis Ababa, Ethiopia	1915
11880	XEHH	R. Comerciales	Mexico D.F., Mexico	0000
	LRS	R. Splendid	Buenos Aires, Argentina	2200
	—	R. Sweden	Stockholm, Sweden	0100
11885	—	ORTF	Paris, France	1915
11900	—	V. Malaysia	Kuala Lumpur, Malaysia	1100
11905	—	BBC Relay	Cyprus	0715
11910	ETLF	R. V. of Gospel	Addis Ababa, Ethiopia	1700
	HSK9	Overseas B.C.	Bangkok, Thailand	1100
11925	ZYR8	R. Bandeirantes	Sao Paulo, Brazil	2315
11945	—	R. Peking	Peking, China	0100
11960	—	V. America Relay	Tangiers, Morocco	1945
	WRUL	R. N.Y. Worldwide	New York, N.Y.	1300
11965	—	R. Japan	Tokyo, Japan	2000
11970	WRUL	R. N.Y. Worldwide	New York, N.Y.	2130
	—	BBC Relay	Singapore, Malaysia	0900
	—	R. Havana	Havana, Cuba	2310
11990	—	R. Prague	Prague, Czech.	0105
15050	—	E. Nacional	Lisbon, Portugal	1900
15070	GWC	BBC	London, England	1400
15095	—	R. Peking	Peking, China	0000

WHITE'S RADIO LOG

kHz	Call	Name	Location	GMT
15105	—	BBC	London, England	1745
	—	V. America Relay	Honolulu, Hawaii	2215

19-Meter Band—15100 to 15450 kHz

kHz	Call	Name	Location	GMT
15110	—	R. Iran	Tehran, Iran	2000
	XERR	R. Comerciales	Mexico D.F., Mexico	1500
15125	—	E. Nacional	Lisbon, Portugal	1900
	HLK41	V. Free Korea	Seoul, Korea	0630
15130	—	ORTF	Paris, France	2100
	—	R. Naimey	Naimey, Niger	0730
15155	ELWA	R. Village	Monrovia, Liberia	2200
15160	TAU	V. Turkey	Ankara, Turkey	2200
15185	OIX4	Finnish B.C.	Helsinki, Finland	1400
15195	—	R. Sweden	Stockholm, Sweden	1230
15230	KGEI	V. Friendship	San Francisco, Calif.	2200
15240	—	R. Sweden	Stockholm, Sweden	1745
15260	—	V. America Relay	Monrovia, Liberia	0430
15265	—	R. Nationale	Tananarive, Malagasy	1630
15273	CXA18	S.O.D.R.E.	Montevideo, Uruguay	0000
15290	LRU	R. el Mundo	Buenos Aires, Argentina	1430
15300	—	R. Havana	Havana, Cuba	1500
	GWR	BBC	London, England	1700
15315	—	R. Sweden	Stockholm, Sweden	1230
15320	—	R. Canada	Montreal, Que.	2045
	—	R. Alger	Algiers, Algeria	1700
15340	—	R. Sweden	Stockholm, Sweden	1230
15345	BED49	V. Free China	Taipei, Formosa	0250
15350	—	BBC	London, England	1530
15380	—	Deutsche Welle	Kigali, Rwanda	2000
15410	ETLF	R. V. Gospel	Addis Ababa, Ethiopia	1330
15435	GWE	BBC	London, England	1300
15440	WRUL	R. N.Y. Worldwide	New York, N.Y.	1400
17730	WRUL	R. N.Y. Worldwide	New York, N.Y.	1500
17765	—	Deutsche Welle	Kigali, Rwanda	1752
17780	—	V. Free China	Taipei, Formosa	1645
17790	GSG	BBC	London, England	1530
17820	TAV	V. Turkey	Ankara, Turkey	1415
	—	R. Canada	Montreal, Que.	2045
17830	DMQ17	Deutsche Welle	Cologne, W. Germany	1555
17845	WRUL	R. N.Y. Worldwide	New York, N.Y.	1200
17850	—	ORTF	Paris, France	2100
17875	—	R. Havana	Havana, Cuba	1630
17880	—	BBC	London, England	1530
17890	BED40	V. Free China	Taipei, Formosa	1645
21485	—	V. America	Bethany, Ohio	1900
21545	—	R. Ghana	Accra, Ghana	1700
21550	GST	BBC	London, England	1430
21585	—	Vatican R.	Vatican City	1000
21670	—	V. America Relay	Monrovia, Liberia	0430
21680	—	V. America Relay	Monrovia, Liberia	1600
	—	BBC	London, England	1427
21690	—	V. America Relay	Tangiers, Morocco	1945
21740	—	V. America	Greenville, N.C.	1900

Whistlers

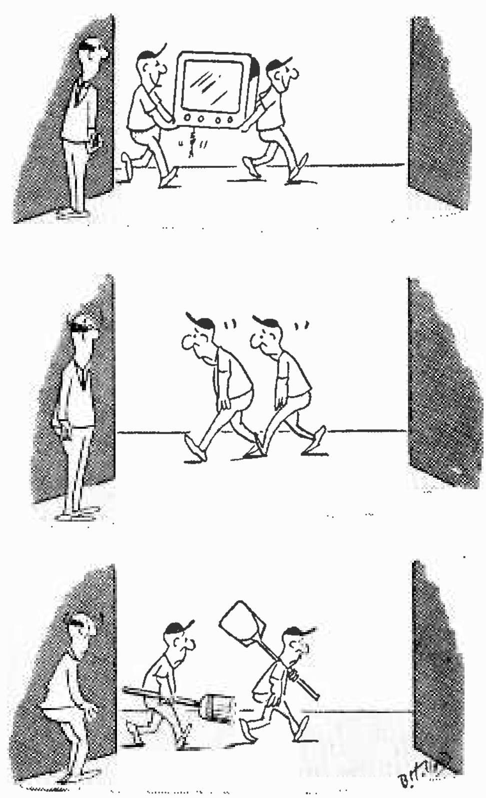
Continued from page 49

ten earth stations are spread out from Labrador to Antarctica. And last year, an OGO-C satellite blasted off from Vandenberg Air Force Base in California, to carry special radio receivers into space to record the low frequency signals of the traveling wave. And just before going to press, the Canadian satellite Alouette reported it had cited a new whistler that reaches 8,000 miles into space.

But Dartmouth men report even deeper penetration. They claim that studies of whistlers has expanded the concept of the ionosphere thousands of miles into space. Before these whistler studies, man believed atmosphere ended and space began some 1500 miles above the earth. Now conservative estimates place division at around 8,000 miles.

Recent Dartmouth studies report—even at a distance of four earth radii or 16,000 miles from the earth's surface—a whistling wave with one thousand electrons to each cubic inch of atmosphere. All of which proves space may not be as "empty" as we thought. And if engineers persist studying the whistling wave, we may be in for more surprises, perhaps even a new means of communication. ■

Drop Shipment



Fiber Optics

Continued from page 86

glass threads like a ping-pong ball caroming down a pipe. Even if the threads are looped in circles, the light will come out only at the end.

Add the Laser. One of the most exciting prospects in medical research is the union of fiber optics with lasers—devices that produce light (or energy) so powerful that it can punch holes in steel plates. Powerful as it is, laser light can be sent through a fiber-optics system. Scientists are talking about piping laser light into the body to cauterize an internal wound—an experiment Kapany has already performed with animals.

An even more revolutionary—and admittedly speculative—hope for the future is to put lasers to work against cancer. Experiments, in laboratory animals, have indicated that the laser beam is effective against some cancers. If experiments during the next couple of years are successful, it may be possible, without surgery, to focus laser light on the exact trouble spot inside the body and to burn out cancers or other growths.

A project that sounds even more revolutionary (but is closer to realization) is the literal combination of lasers and fiber optics —making the optical fibers themselves into lasers by treating them with the proper chemicals.

Short, powerful bursts of laser light are used routinely now to weld torn retinas into place in human eyes. But this method can be used only on the part of the retina that can be seen by the surgeon. Dr. Charles J. Campbell of Columbia-Presbyterian Medical Center in New York is working with an optical fiber laser to see if hidden retinal tears can be healed by focusing a laser beam against the exterior of the eye. Experiments with rabbits have been promising, and Dr. Campbell has reported that treatment of humans may be possible with a more powerful laser. Treatment is also underway to carry this cool but intense light into the inner ear.

While fiber optics offers wide horizons for experimenters, its immediate value is the better information it gives doctors about their patient's insides, information they cannot get from X-rays in many cases. Throughout medical history one of the doctor's greatest handicaps has been the wall of human tissue between him and the patient's ailment. X-rays provided the first break in that wall. With fiber optics, doctors may someday be able to look directly at almost any suspected trouble spot in the human body, and to make faster and more accurate diagnoses. And in some cases, an adaptation of the same type of instrument used for looking can be used for treating. ■

Voltage by the Numbers

Continued from page 65

phases—to equalize the load on the lines.

The venerable 110/220-volt service is outmoded and is disappearing rapidly. The *design center* for practically all modern household equipment is 115 to 117 volts; incandescent lamps, however, are marked 120 volts; those rated long-life may be marked 130 and 220 and 240-volt lamps are available. The power companies have been beefing up their generators and lines, and single-phase service is now widely 115/230 to 117/234 volts.

208 or 230. In new real-estate developments the power companies find it more expedient to run the whole three-phase system around the streets and to install transformers, as needed, on a block-by-block or even a house-by-house basis. To accommodate the multitude of ordinary appliances designed for the 115 to 117-volt range, they have settled on 120 volts; this allows for a little drop off during periods of heavy current demand. In a three-phase system the voltage *across* phase legs is 73% higher than the voltage from neutral to any one leg; 73% of 120 is 87.60, for a total of 207.6 volts, or 208 for practical purposes.

The 208-volt output obtained across any two of the phase legs of a three-phase circuit is single-phase in characteristics, like the 120-volt connection. The advantages of full three-phase service, for motor operation, are obtained when the machine is connected to all three phase legs, without the neutral.

There is enough difference between 208 and 230 volts to make the operation of 230-volt appliances on 208 volts unsatisfactory. Don't let a dealer tell you "it's all the same." Most manufacturers now offer 208-volt models of their products as a matter of course. ■

Literature Library

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

ELECTRONIC PARTS

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

★2. The new 510-page 1966 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!

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★106. With 70 million TV's and 240 million radios somebody somewhere will need a vacuum tube replacement at the rate of one a second! Get *Universal Tube Co.'s* Troubleshooting Chart and facts on their $1 flat rate per tube.

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

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

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

★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.

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

25. Unusual surplus and new equipment/parts are priced "way down" in a 32-page flyer from *Edlie Electronics*. Get one.

HI-FI/AUDIO

★26. Always a leader, *H. H. Scott* introduces a new concept in stereo console catalogs. "At Home With Stereo" the 1966 guide, offers decorating ideas, a complete explanation of the more technical aspects of stereo consoles, and, of course, the complete new line of *Scott* consoles.

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

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

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

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

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

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

99. Interested in learning about amplifier specifications as well as what's available in kit and wired form from *Acoustech?* Then get your copy of *Acoustech's* 8-page colorful brochure.

TAPE RECORDERS AND TAPE

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

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

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

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

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

HI-FI ACCESSORIES

76. A new voice-activated tape recorder switch is now available from *Kinematix*. Send for information on this and other exciting products.

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

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

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

KITS

★42. Here's a colorful 108-page catalog containing a wide assortment of electronic kits. You'll find something for any interest, any budget. And *Heath Co.* will happily send you a copy.

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

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

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★**93.** *Heath Co.* has a new 23-channel all-transistor 5-watt CB rig at the lowest cost on the market, plus a full line of CB gear. See their new 10-band AM/FM/Shortwave portable and line of shortwave radios.

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

107. Get with the mobile set with *Tram's* XL'100. The new Titan CB base station, another *Tram* great, is worth knowing about. Get complete specifications plus facts on other accessories.

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? *Amphenol Cadre Indnstries* has a booklet that answers lots of the questions you may have.

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

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

90. If two-way radio is your meat, send for *Pearce-Simpson's* new booklet! Its 18 pages cover equipment selection, license application, principles of two-way communications, reception, and installation.

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

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

102. *Sentry Mfg. Co.* has some interesting poop sheets on speech clippers, converters, talk power kits and the like for interested CB'ers, hams and SWL'ers, too.

103. *Squires-Sanders* would like you to know about their CB transceivers, the "23'er" and the new "S5S." Also, CB accessories that add versatility to their 5-watters.

SCHOOLS AND EDUCATIONAL

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

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

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

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

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.*

94. *Intercontinental Electronics School* offers three great courses: stereo radio & electronics; basic electricity; transistors. They are all described in *Inesco's* 1966, 16-page booklet.

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★**78.** A dozen tools for dozens of jobs in *Xcelite's* 99PS-50 hip pocket set. Contains plastic handle and interchangeable blades: 7 nutdrivers, 2 regular and 2 Phillips screwdrivers plus 4-inch extension. *Xcelite's* Form S1065 explains all.

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

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

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

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72. Get your 1966 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.

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70	72	73	74	76	78	90	91	92	93	94	95	96
97	98	99	100	101	102	103	104	105	106	107	108	109

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Knight-Kit Color Generator

Continued from page 63

ber-grip alligator clip so it can be clamped inside the receiver cabinet. A panel switch turns the lamp on and off.

To eliminate the need to carry an extra piece of gear, the KG-685 has a metal mirror mounted to the underside of the cabinet.

When stored under the cabinet the mirror surface is protected by the cabinet.

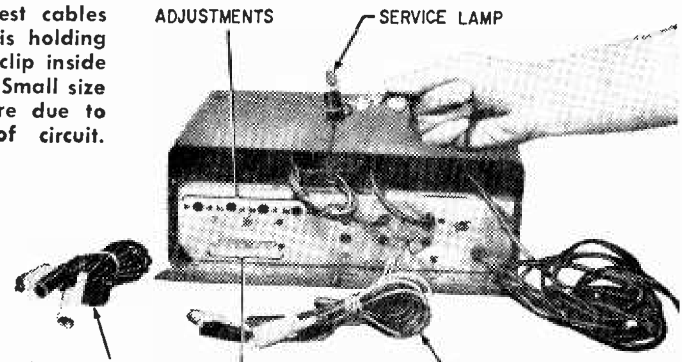
Construction. The color/pattern generator is wired on a chassis somewhat smaller than the cabinet, thereby providing more than adequate storage space for the test cables and instruction manual.

The storage compartment and the generator's rear apron which contains the adjustment controls are inside the case, and a storage compartment door completely encloses the cables and adjustments to prevent unauthorized tampering.

Though the KG-685 is a rather complex kit—22 transistors and 8 diodes—most of the circuitry including the frequency determining elements are mounted on two printed circuits, thereby reducing assembly complexity and the possibility of wiring errors.

Considering the number and nature of the output test signals and the conveniences for simplifying the service technician's adjustment procedures, the KG-685 priced at $89.50 in kit form, ranks as a first choice in color bar generators.

For additional information on the KG-685 Color Bar/Pattern Generator Kit write to Dept. 20RT, Allied Radio Corp., 100 N. Western Ave., Chicago, Illinois 60680. ■



Rear view of generator. Test cables store inside cabinet. Hand is holding the service lamp which can clip inside TV receiver for illumination. Small size and light weight of unit are due to complete transistorization of circuit.

VTVM Dry Cell Eliminator

Continued from page 30

If your VTVM requires 3 volts or more, you can replace the regulating diodes (D2, D3, and D4 in Fig. 1) with an appropriate Zener diode (also called a reverse-biased reference diode).

One more possibility exists—if the ohmmeter dry cell is returned to the same point as the filament transformer. In this case, the filament supply might be used to eliminate the added winding. Remember, however, that the added circuitry draws considerable current. *Do not overload the filament winding on the transformer.*

Whatever arrangement you use, you will find this dry-cell eliminator worth the small amount of effort required to build and install it in your VTVM. ■

"By golly, you're right! It does say, 'For Grounding, Connect Equipment to Nearby Pipe.' "

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Out-of-Band-Its

Continued from page 74

by hams in this hemisphere. 7320 and 7330 kHz are additional Radio Moscow frequencies that are used to the Americas, although these are allocated to the fixed services.

All the Russian 7 mHz channels to the Americas can be heard with little difficulty during the evening hours, between 0000 and 0500 GMT; 7 PM-Midnight, EST.

Ali Baba's Boys. Another major *out-of-band-its* is the United Arab Republic. One of the largest broadcasters in both total output as well as number of languages, the UAR also seems to have a preference for the amateur bands, with transmissions on 7050 and 7075 kHz. Transmitters carrying these frequencies are powerful, 100,000-watts each, and can be heard here in the United States during the early evening hours.

Several other Cairo frequencies worth mentioning are 9477, 9495, and 15100 kHz, which is on the edge of the 15 mHz broadcast band, but which nevertheless overlaps into the aeronautical communications band which is adjacent.

They Are Not Alone. Since the list of *out-of-band-its* is very long, it is impossible to show them all. The above has been just several of the more interesting and newsworthy of the group.

Table II lists several additional broadcasters who operate out-of-band and which are of more than passing interest. Time and frequency are given for periods when reception in the U.S. is most likely.

Since there are many other out-of-band stations, the DX'er bent on devoting his time to these illegal broadcast operations can count on many hours of stimulating and rewarding DX. ■

Acoustech XI

Continued from page 45

with metal covers are: basic solid-state XI power amplifier kit $129.50, P/M amplifier/control center kit $89.50. For additional information on Acoustech Add-A-Kit units and other fine audio products write to Acoustech, Inc., Dept. RTV, 139 Main St., Cambridge, Mass. 02142. ■

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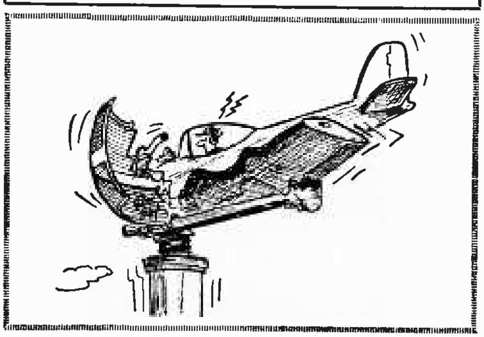

Audio Investigator

Continued from page 54

length, of the resistors mounted on S1, can cause shorts—clip them close or use spaghetti tubing.

If you have any trouble, it can be easily located by comparing the voltage readings at the tube-socket contacts with those in the table. Just because your reading doesn't exactly coincide with those given don't start ripping everything apart. Check all socket voltage readings. Remember that the resistors have a tolerance of ±10% and most VTVMs have a ±5% tolerance. So if a reading is 15 to 20% away from that given in the table don't panic—just continue to double check the voltages and circuitry.

For a quick check, to see if the unit is operating near normally, you can hear the audio tone from the oscillator with a high-impedance earphone (or head phones) connected to the center contact and J2's shell.

Connecting the center contact of J1 to pin 5 of the 6U8A or pin 3 of the 6BH6 the voltmeter should indicate about 6 volts.

Now that you've finished the Audio "Investigator" you're all set to handle most audio problems. You can signal trace, measure gain-per-stage and do signal-injection troubleshooting.

So now it's all up to you—investigate! ■

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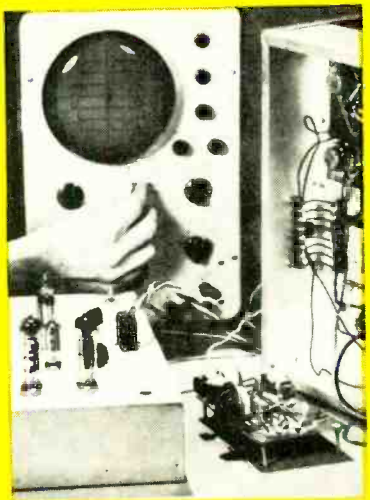

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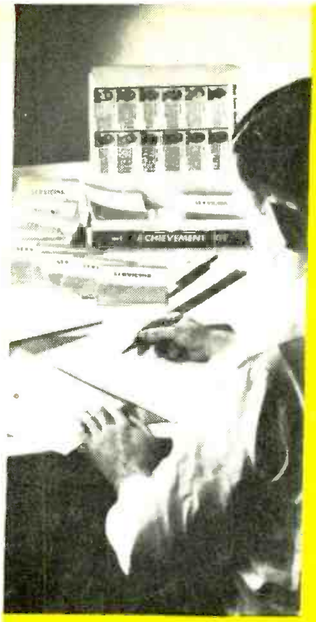

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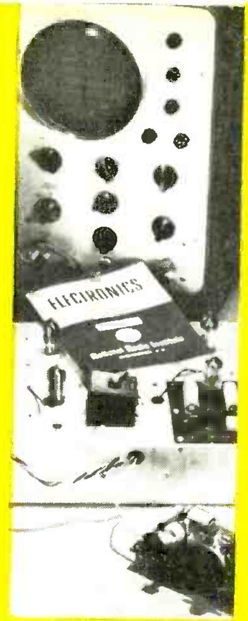

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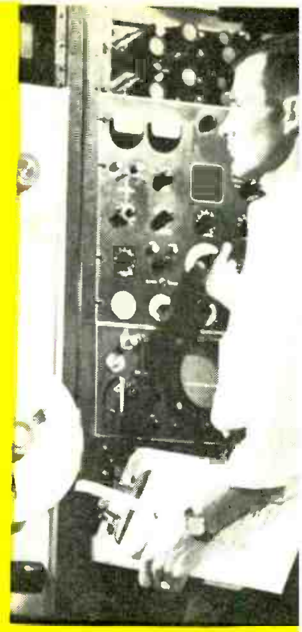

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