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BERNARD SMOLKOVICH, Ft. Knox, Kentucky, is a Staff Sgt. with the U.S.A. Armor & Engineering Board. "Thanks largely to the NRI diploma I hold, I am a very successful and upcoming Communications Technician. My thanks to your fine staff for their unfailing assistance during my course."

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January, 1968
Uncle Tom’s Corner
By Tom Kneitel, K2AES/KQD4552
Uncle Tom answers his most interesting letters in this column. Write him at Electronics Illustrated, 67 West 44th St., New York, N.Y. 10036.

★ Recently I took a loud hi-fi amplifier and made it even louder with a preamp. Trouble is that now I get a lot of hum and distortion at high volume levels. I’ve used shielded leads and even reversed the AC plug—but to no avail. It also distorts at high volume levels (even when the preamp volume is turned down). What can I do?

Steve Glowinski
Kenilworth, N.J.

Sounds like you’re overloading the preamp input with a high-level cartridge. You’ll never get much until you understand the difference between quality and volume.

Query Dept. One year ago, FCC Chairman Rosel Hyde stated that “eight reports involving possible violation of Section 15.11, Prohibition Against Eavesdropping, were investigated since the new rules became effective April 8, 1966. Most violations were apparently made in an effort to obtain evidence for domestic-relations proceedings.” A few months later, the FCC said that the information on the possible violations was confidential.

Six months ago, after the Freedom of Information Law went into effect, the FCC was asked to disclose details of these eight cases; they still declined, stating that “the reports . . . are considered to be internal working papers and are not required to be released to the public . . .”

If, indeed, these were only domestic-relations cases, why were they not disclosed and the violators prosecuted?

After so much time and effort went into passing anti-bugging laws the best the FCC was able to do was to turn up only eight possible violations—and these apparently centered around errant husbands and wives? What happened to organized crime’s use of bugs? What about illegal uses in industry and government?

Sen. John McClellan, head of the Senate Subcommittee on Criminal Law and Procedure, is probing into the bugging business. He already has told his committee about these goings-on. He has photostatic copies of the FCC’s mysterious denials in the investigative transcript and says he’s going to reveal the whole thing.

Is a full-scale investigation of some arbitrary FCC practices in the wind?

★ Did you ever hear of a substance known as DZ? What is it and what’s such a big secret about it?

Wardell Melwin
Frankfort, Ky.

DZ is one of the newest tools of our military’s CBW (Chemical and Biological Warfare) effort. An incapacitating gas made from LSD, DZ has been a source of great frustration since experiments with it have failed to produce desired effects. Although rumors about DZ are constantly trickling out of Ft. Detrick, Md., CBW’s test site, it’s still considered a top secret. By the way, we are now spending well over $250 million per year on CBW research. Other CBW experiments include Sarin and VX, both colorless, odorless and tasteless nerve gases; HD, a mustard gas; DM which produces violent nausea and gastric effects; and CN/CS riot control agents, which are souped-up tear gases. CS is ten times stronger than CN.

★ I have been reading your column for about two years and nothing in it has ever offended me. Could you insult me in print or something?

Mort Salter
Washington, D.C.

Sorry, you’re not important enough.

[Continued on page 10]
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★ Can you identify stations calling themselves Surfboard 13 and 14 which I hear in the 5-mc band?

Phil Raczka
South Euclid, Ohio

Where are stations that identify as Two Gun, Trust Fund, River-River, Noah's Ark, Magic Carpet?

John Shoptaw-Morehouse, Mo.

The following stations were heard at about 11.2 mc: Ocean One, F-24, and Outway. Who and what are they?

David Jones
Albany, Ga.

Whoa! Stations using these tactical call-signs number into the thousands. Operated by military units, they are located aboard ships, aircraft, tanks and even Jeeps. There is no callbook of these stations since the names they use are changed on a regular basis to maintain secrecy. Only the land-based stations seem to retain their calls. DXers sometimes can figure out the identity of specific stations by intensive monitoring and fitting together scraps of information from their transmissions. Recently-identified tactical stations are: Toreador in San Francisco and Butterfield in San Diego. These are operated by NORAD (North American Air Defense Command) on 8796.5, 12338, and 17335 kc.

★ At a used ham-auction I picked up a 6-meter rig that bears only the trade name Black Widow. Although it works like a charm it looks hideous. But it causes all manner of comments. Most people offer to buy it from me. Ever hear of it?

Burley Watkins
Tulsa, Okla.

Black Widow VHF gear is almost legendary. It appeared from California, almost mysteriously, in the mid-1950s, and won instant popularity with earnest VHF operators because of its outstanding performance. Its source was never fully explained. Nor was its circuitry or even the type numbers of some of the tubes. Ugly and hand-made looking, it was seldom advertised, difficult to purchase and vanished from the market around 1960, as suddenly and strangely as it had first appeared. Don't sell it, it's a real collector's item.

[Continued on page 12]

Electronics Illustrated
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RFD 3 Columbia, S. C. 29205

January, 1968
I have obtained an Army surplus BC-244-D receiver for radio astronomy work on 1296 mc. My friends tell me that this World War II veteran is totally useless for this purpose. What do you say?

Jan Tarsala, WN6VRN
Monterey Park, Calif.

With a little luck and patience you might hear Earth.

Inside Dept. Watch for apartment houses in large cities to begin banning electric guitars because of tenant complaints. It's already starting in New York... A home color-TV tape recorder is in the works. Costing $1,250, it will tape a full-length color film on $20 worth of regular ¼-in. recording tape... Scientists in Houston are working on a plan to harness and use electricity from hurricanes, estimated to be about 16 trillion kwh per day... Our military intelligence people have a tape recording of Israeli pilots talking about the American flag flying on the USS Liberty shortly before they attacked the ship. Reason we had the ship in such dangerous waters was to eavesdrop on both Arab and Israeli high-security radio transmissions which were being sent with highly directional beam antennas.

Recently I was given an old Atwater Kent Model 55 (from the late 1920s). It's in rather good condition but two of the tubes are missing. Since I'd like to put it into working condition could you give me any information on the set?

Al Kuntzer III
Atlanta, Ga.

The tube line-up for the 55 is: two type 24As, two 27s, two 45s running push-pull in the audio and an 80 in the power supply. Somewhere in Atlanta there must be an old radio shop that has these tube types gathering dust in the basement. Or try EI's Swap Shop column.

Thanks Dept. I want to thank the EI reader in Dallas who cut my picture from the head of this column and sent it to the FBI. Seems I bear a striking resemblance to a guy on their top-ten wanted list, being sought for murder and arson. The FBI [Continued on page 14]
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January, 1968

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people, although courteous, gave me a few white whiskers before they cleared me.

★ About three years ago I took a flight that passed over northern Canada. Somewhere north of Hudson Bay there appeared in huge letters on the ground a totally outrageous and unprintable four-letter word. The flight crew told me it had been there for years but could offer no explanation. What's the story?

Peter Praag
New York, N.Y.

An Air Force friend tells me that between 1950 and '52 a bored technician stationed at a U.S. radar installation left this monument that neither time nor government can eradicate. Using a bulldozer abandoned by the Air Force, he spent two years and great effort pushing boulders into this single word. It can still be seen from 10,000 ft. Government officials have exchanged memos full of circumlocutions (no Latin equivalent of the word exists) but failed to find a solution that wouldn't alert the press and embarrass everyone involved. So if life exists on other planets, this may be the first message received from us.

Horse's Mouth Dept. The people at Du Pont have sent me their booklet, The Anatomy of a Rumor, in answer to a couple letters in this column about the supposed toxic properties of Du Pont's Teflon at high temperatures. Here's the straight scoop as Du Pont presents it:

The most serious effect attributable to Teflon, even after 20 years of exhaustive testing, is something known as polymer-fume fever. It can occur only under special circumstances, particularly when a cigarette you are smoking contains particles of Teflon. The fever is much like a round of flu lasting from a few hours to a couple days and is without after-effects. In fact, it looks like the cigarette does you more harm than the Teflon.

Otherwise, the hazard of working with Teflon might be compared with that of paints or most common cooking oils. In industrial quantities (and only at advanced temperatures) Du Pont felt the hazard might possibly become appreciable—so they put a warning on the label. And that warning may have been what triggered the rumors in the first place.

Electronics Illustrated
★ Here's a stumper I've asked many technicians. My answers run 50-50 yes and no. A power amplifier is feeding perhaps 100 or more 3.2-ohm speakers through coupling transformers (between output transformer and speaker) of approximately 90-ohm primary and 3.2-ohm secondary. If the terminals on the secondary side of one or more of the coupling units were shorted, would the extra load damage the amplifier?

Conrad Olson
Pueblo, Colo.

I’m probably sticking my neck out but I’ll go along with the no voters. It may lower the sound level or cause some distortion but nothing short of an open transformer will damage the amplifier. Tell you what, why not build the thing and try it out? If I’m wrong—well, sorry about that.

★ For my 15th birthday my father gave me a pair of small German Army portable receivers which he brought back from the last war. They look to be in good shape but the tubes are missing. The sockets are marked L63 and OSW3106 and the rigs operate on 100 mc. Can you tell me if there are any sources of 20-year-old foreign tubes, O great supplier of trivial facts?

Frank L. Howard
Bremerton, Wash.

I suggest that you get a ham license and tune these rigs up in one of the ham bands before you find yourself the star attraction at the FCC’s version of the Nuremberg trials. Forget trying to scratch up the German tubes, you’ll find that good old Yank types 6J5 and 6V6 will do. But you may be able to shout farther than these sets will communicate.

★ As part of my hobby of DXing on the TV bands I have tried but failed to photograph some of the distant stations I have seen. I know this is possible because I’ve seen such pictures in magazines. What’s the secret?

Robert C. Bostick
Fresno, Calif.

Adjust your TV image for soft contrast and set your camera shutter for 1/25 or 1/30 sec. If you use Tri-X film shoot at f-6.3. With either Verichrome Pan or Plus-X use f-3.5. For color pictures get daylight-type high-speed Ektachrome and use a lens opening of f-2 or f-2.8. It is necessary to use a Wratten 2B or Skylight filter when shooting in color to absorb ultraviolet radiation from the picture tube.

January, 1968

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Electronic Marketplace

Bi-Elemental… The AKG D-200E is a two-way cardioid dynamic microphone. Separate elements handle high- and low-frequency ranges. The elements are connected through a 500-cps crossover network similar to those found in 2-way speaker systems. Overall frequency response is rated at 30-15,000 cps. Advantage claimed for the woofer-tweeter arrangement is linear off-axis frequency response. This is one of the first AKG products to be issued under that name in this country in some time—Norelco, which distributes AKG products, has been using its own name. The internally shock-mounted D-200E comes with stand adaptor, 15-ft. cable, connector, case. $69. AKG Microphone-Headphone Div., North American Philips Co., 100 E. 42nd St., New York, N. Y. 10017.

Rechargeable… The Life Cell is a self-contained rechargeable 1.5-V D cell that, according to the manufacturer, never will have to be replaced. The cell is in two sections and is recharged by first removing the top portion and reversing it (as indicated in the photo), exposing the male plug. This is then inserted in an AC outlet for about 24 hours. (Regular recharge schedule, such as once-a-month, is recommended.) The Life Cell can be used in any application where a D cell is required. $4.45 each; $8.45 per pair. Waldom Electronics, Inc., 4625 W. 53rd St., Chicago, Ill. 60632.
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Electronics Illustrated
By WALT HENRY

THERE'S a new and insidious invasion under way—it's on peoples' privacy. Listening in on the other guy has now become a big and often profitable sport. The other guy could be your neighbor, close friend, worst enemy, bookie, business partner or the business competition. In other words, anyone—even you!

The urge to snoop manages to hook everyone some of the time. Electronic spying, or bugging as it's popularly referred to, has potentials that are limited only by the imagination and needs of the bugger.

The sale of bugging equipment is big business. Anyone can buy the gear—for a price—and it's usually very expensive. But it need not be. Our electronic bug costs about $20 to build. It is a subminiature (as you can see on our cover) self-contained radio transmitter. Because it operates in the broadcast band, any AM radio can be used to pick up its signal. Its range is from 10 to 50 ft. depending on the construction of the building in which it is used and the length of its antenna. The range also depends on the sensitivity and selectivity of the receiver.

Construction. As you can see from the photographs, our bug has been made very small. The components specified in the Parts Lists are subminiature. If you want to save money and don't mind making the bug a bit larger, use cheaper imported components. If you want to really cut the size you could use 1/10-watt resistors.

Our bug was built on a 5/8 x 1 5/8 in. circuit board in which holes were drilled for component leads. A small plastic box makes an ideal case; ours is 2 1/4 x 1 3/4 x 5/8 in. Use a sharp drill to make the necessary holes in the board and the case and use small dots of cement to hold the coil and other parts in place. If necessary, glue
Fig. 1—Use these diagrams of the top and underside of circuit board to locate parts. Board dimensions are 5\% x 1\% in. Circles are holes through which leads pass. Negative lead of C1 and other lead of C2 go to ground.

Fig. 2—Use this pictorial only to connect parts. Position them on board as shown in diagrams in Fig. 1.
small pieces of plastic to each end of the case to support the battery contacts as shown in Fig. 5.

A small spring at one end of the case will insure good battery contact. If you prefer use snap-on battery terminals from a dead 9-V battery. These will snap on each end of the H-177 battery. An ordinary 9-V transistor-radio battery can be used if you don't mind its larger size. If there is room in your case, install a subminiature switch. Our bug is turned off by simply removing the battery.

Slug-tuned coil L1 comes with a threaded tuning shaft. You can leave the shaft on or you can remove it and the metal clip to make the coil shorter. Be sure to cut the brass shaft carefully to avoid cracking the ferrite slug. If you remove the shaft, put a thin layer of tape on the slug so that it fits snugly in the form. Drill a hole in each end of the plastic case so the slug can be pushed back and forth (for tuning) with a toothpick.

Two additional windings (L2, L3) must be wound on L1. Winding L3 is 15 turns; L2 is 30 turns. Litz wire such as Belden No. 8817 is ideal, though No. 28 or No. 30 enameled wire will work. Space the turns of each winding evenly over the length of the existing winding. L2 and L3 must be wound in the same direction.

Connect one end of L3 to the emitter of Q3. Connect the corresponding end of L2 to the junction of L1 and C8. Connect the other end of L2 to a 3 to 6 ft. length of antenna wire. Leave the loose end of L3 disconnected temporarily.

January, 1968

**PARTS LIST**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>9.8 V battery (Burgess H-177 or equiv.)</td>
</tr>
<tr>
<td>C1,C5,C11</td>
<td>2.2 µf, 20 V tantalum electrolytic capacitor (Kemet K2R2J20KS, Allied 43 E 7301. $1.34 plus postage; not listed in catalog)</td>
</tr>
<tr>
<td>C2,C3,C10</td>
<td>0.01 µf, 75 V subminiature ceramic capacitor (Lafayette 33 C 6902 or equiv.)</td>
</tr>
<tr>
<td>C4</td>
<td>22 µf, 15 V tantalum electrolytic capacitor (Sprague 150D226X901562, Lafayette 30 C 3024)</td>
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<tr>
<td>C6</td>
<td>0.032 µf, 75 V subminiature ceramic capacitor (Lafayette 33 C 6903 or equiv.)</td>
</tr>
<tr>
<td>C7,C9</td>
<td>0.1 µf, 75 V subminiature ceramic capacitor (Lafayette 33 C 6905 or equiv.)</td>
</tr>
<tr>
<td>C8</td>
<td>180 µf, 500 V dipped silver mica capacitor (Cornell Dubilier CD7F181G500, Allied 43 D 8246. 69¢ plus postage. Not listed in catalog)</td>
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<tr>
<td>D1,D2</td>
<td>1N914 diode</td>
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<tr>
<td>L1</td>
<td>High-Q ferrite antenna coil (J. W. Miller 6300, Lafayette 34 C 8705 or equiv.)</td>
</tr>
<tr>
<td>L2</td>
<td>30 turns No. 28 or No. 30 enameled wire wound on L1 (see text)</td>
</tr>
<tr>
<td>L3</td>
<td>15 turns No. 28 or No. 30 enameled wire wound on L1 (see text)</td>
</tr>
<tr>
<td>Q1</td>
<td>2N4123 transistor (Motorola)</td>
</tr>
<tr>
<td>Q2</td>
<td>2N4123 transistor (Motorola)</td>
</tr>
<tr>
<td>Q3</td>
<td>MPS3646 transistor (Motorola)</td>
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<tr>
<td>Resistors</td>
<td>¼ watt, 10% unless otherwise indicated</td>
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<tr>
<td>R1</td>
<td>180,000 ohms</td>
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<td>R2</td>
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<tr>
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<td>4,700 ohms</td>
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<td>R3</td>
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<td>R4</td>
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<tr>
<td>R5</td>
<td>150,000 ohms</td>
</tr>
<tr>
<td>R8</td>
<td>10,000 ohms</td>
</tr>
<tr>
<td>Misc.</td>
<td>Litz wire (Belden 8817, Lafayette 32 C 1485. Optional, see text), circuit board, plastic box</td>
</tr>
</tbody>
</table>
Parts layout is not critical though it is important that all component leads be kept very short. Pick a point in the circuit layout and run all ground leads directly to that one point. Arrange the parts on the board where shown in Fig. 1. Don't worry about the location of the parts in Fig. 2 not agreeing with that shown in Fig. 1. Fig. 2 is to be used only as a wiring guide and not for positioning parts.

Any moderate-impedance (1,000-2,000 ohms) dynamic microphone can be used. The Shure MC30-J we used is ideal because of its small (1/2 x 1/2 x 1/4 in.) size. The Shure MC11-J and MC20A-J are somewhat larger, less expensive and are equivalent in performance. A mike, such as the Lafayette No. 99-4567 tie-clasp mike could also be used.

Checkout. After you have completed and checked the wiring, a few other things must be done to insure that everything is working properly. First, measure the voltage from the collector of Q1 to ground. With a fresh battery it should be between 3 and 7 V. Now measure the voltage at Q3's emitter. It should be between 4.5 and 6.5 V. If either of these readings is off, slight changes in the values of R1 and R5, respectively, should be made.

Connect the open lead from L3 to the collector of Q4. (Connect a 50-ma DC milliammeter in series with the battery so current can be measured.) Turn on a radio, tune it to a quiet spot on the dial and place the radio about a foot away from the bug. Turn the volume up slightly. Tune the bug by sliding L1’s slug back and forth with a toothpick or matchstick. If everything is working properly you should hear a loud squeal when the bug is tuned to the same frequency as the radio. This squeal is caused by audio feedback from the radio speaker to the mike. Battery current should be between 5 and 7 ma with a fresh battery.

If you don't get a squeal, note the current. If it is less than 5 ma there may be a wiring error or faulty component. If the current is between 15 and 30 ma, L3's leads to Q3 and Q4 should be reversed. If this corrects the problem it is important that L2's leads be reversed also. The bug will work with L2 connected in reverse but the range will be reduced.

Check to be sure the bug will tune over the entire broadcast band. With the receiver very close, the signal will be received at several places on the dial. However, it will be strongest at only one point on the dial.

The bug will continue to work until the battery voltage drops to about 6 V. The circuit will operate continuously for about 35 hours on the battery specified.

The bug makes a good wireless mike to allow a speaker to move about freely and you can use it as a wireless phonograph. Just connect the leads from a magnetic cartridge directly to the microphone input leads.

For maximum range the antenna length can be extended to 12 ft. or more, but at this length it is important that it be kept clear of large metal objects and people. We don't guarantee that you will solve a sensational crime with the bug, but you are guaranteed hours of fun.
They say the best way to learn a language is to live in the country where it is spoken. Maybe so. But unless you're free to go globe-trotting when you feel like it you might be better off picking up a second language from the short-wave bands. It's free—and it can be fun.

On the next page you'll find a guide to the courses presently on the international broadcast frequencies. Others have been offered in the past and may return. And more may be expected to come along as time goes by. Pick one and give it a try. You may be surprised how easy it is to learn. You also may be surprised at how much a little knowledge of a second language will enhance your enjoyment of short-wave radio.

One of the most popular language courses is R. Nederland's Dutch by Radio, which is tentatively scheduled from January to June 1968 and November 1968 to April 1969. One 15-min. lesson is broadcast each week. By writing to R. Nederland you can obtain a free text which contains homework assignments that can be mailed back for correction by the station's language experts.

German lessons have been offered by the Deutsche Welle since 1954. Their Lernt Deutsch program includes two different beginner courses and two advanced courses. Text material is provided free for the beginner and the first of the advanced courses.

Portuguese by Radio (R. Portugal) offers a free text containing pre-ad-
<table>
<thead>
<tr>
<th>LANGUAGE</th>
<th>DAY</th>
<th>TIME (EST)</th>
<th>FREQ. (kc)</th>
<th>BROADCASTER</th>
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<td>2030</td>
<td>9590</td>
<td>Radio Nederland</td>
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<td>Box 222, Hilversum, Netherlands</td>
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<td>German</td>
<td>Sun.-Thurs.</td>
<td>2120</td>
<td>6075, 9735</td>
<td>Deutsche Welle</td>
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<tr>
<td></td>
<td>Sun., Tues.,</td>
<td>2400</td>
<td>6145, 9735</td>
<td>Postfach 344, Cologne, West Germany</td>
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<td></td>
<td></td>
<td></td>
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<td>Nippon Hose Kokai, Tokyo, Japan (or Room 3214)</td>
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<td></td>
<td></td>
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<td>220 East 42nd St., New York, N.Y. 10017</td>
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<td>Portuguese</td>
<td>Mon., Thurs.</td>
<td>2100</td>
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<td>Rua S. Marcal 1A, Lisbon, Portugal</td>
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<tr>
<td>Swedish</td>
<td>Fri.</td>
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<td>9705</td>
<td>Radio Sweden</td>
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<td>Box 955, Stockholm 1, Sweden</td>
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**LEARN A LANGUAGE VIA SHORT WAVE**

A bit farther afield—both linguistically and geographically—is Japanese. But the staff of R. Japan’s Let’s Speak Japanese program has written a textbook that takes much of the effort out of learning the basics of the language, exotic and difficult though it may seem.

Once you’ve acquired the ground rules of a language the next step is practice. Here’s where you can put SW news broadcast to work. The vocabulary and grammar of newscasts are simple and current. They generally are characterized by good pronunciation, well-modulated tones and a speed that isn’t too difficult for the beginner to follow. In addition, newscasts include many references to familiar people and places.

Some international broadcasters, such as R. Japan, have newscasts in English, as well. Try listening to both. The content generally will be the same and by comparing them you will be able to pick up many phrases and whole sentences. In selecting news broadcasts for listening practice, choose those that provide the best reception in your area. If you’re studying German, for instance, you need not stick to Deutsche Welle. Try the German-language broadcasts of Voice of America or the Canadian Broadcasting Corp. A tape recorder can be a great help in your language study (see How to Tape From Any Radio or TV, Nov. ’65 EI). Taping the lessons will enable you to review at leisure. And you can repeat difficult words and phrases until they are mastered.

The more you put into your language course the more you’ll get back, of course, so don’t give up easily. But even if you do, you’re sure to learn something. If you’re a hard-core SWL your progress can be measured by the QSLs that once would have been beyond your reach—either because you couldn’t tell what you were listening to or because you couldn’t report as effectively on what you heard. And an extra language or two are always a help if the English subtitles fall off the bottom of the screen on the Late Show.

---

dressed mailing cards for submitting homework assignments. In addition SWLs will find materials relating to Portuguese history and geography.

Swedish by Radio is a basic language course that runs for about six months. R. Sweden will send a free textbook.
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January, 1968
THE clarinetist moves up for a solo. He starts playing, flips a switch and the group instantly has a bass-clarinetist added to it. He throws another switch and adds a contra-bassoonist. It's like having two more men playing.

On the other side of the band the trombonist starts. He hits a switch and the band has a tuba. Three musicians have been added—all electronically.

Although the guitar has held the top popularity position because of electronic amplification, reverb and tremolo; saxophones, clarinets, trumpets, trombones and other wind instruments are now coming on strong. In fact they may push the guitar out of the limelight. New electronic accessories for these instruments do more than just make them louder—they produce additional octavally-related notes.

The two accessories dealt with here are made by the Conn Corp. and H. & A. Selmer, Inc. (both in Elkhart, Ind. 46514). Another accessory is made by the VOX Musical Inst. Div. of Thomas Organ Co., Sepulveda, Calif. Except for the Selmer, they add up to three octaves to the range of wind instruments.

The Conn Multi-Vider (Fig. 1 and the musician at the right, above) is a self-contained unit powered by a 9-V battery. Connected to the Conn Five Hundred amplifier—or any amplifier—it modifies the instrument's sound by...
Fig. 1—Conn pickup mike (above) is installed in clarinet. Multi-Vider (right) clips on belt. Two top switches (at left of unit) boost or attenuate treble. Third switch from top adds octave above fundamental. Switch below adds one octave below fundamental. Fifth switch down adds second octave below fundamental. Bottom switch controls power. Top knob sets instrument's basic volume. Other controls set level of added octaves. Solid-state circuitry includes filters and frequency dividers. Unit is powered by 9-V battery and its output can be fed to any high-power musical-instrument amplifier.

amplifying it and boosting or attenuating treble. That's only part of it. The really important feature of the Multi-Vider is its ability to extend the range of the instrument one octave higher and up to two octaves below its normal range.

For instance, suppose you play an A above middle C on a sax. Flip the soprano switch and you can add A, exactly one octave higher, to the fundamental. Flip the bass and sub-bass switches. You can add A one octave lower and A two octaves below the fundamental. This gives you the ability to sound four A's each an octave apart. Thus, one musician will now sound like a quartet.

The pickup mike, which is similar to the earphone from a transistor radio, is clipped on an adaptor fitted on the neck of the instrument. (On the clarinet the barrel is used, on flutes the cork tuning assembly.) The mike plugs into the Multi-Vider which produces the effects and feeds them to the amp. (Tremolo depth and intensity and echo are generated in the amplifier.)

The amplifier also has inputs for two additional instruments, such as guitars. Price of the Multi-Vider with mike and cables is $244.50; the amplifier is $339.50.

The H. & A. Selmer Co.'s accessory is called the Varitone. It can be used with the saxophone, trumpet, clarinet and the flute.

The Varitone's amplifier contains several of the circuits which produce the special effects so no other amplifier can be used. The control unit can be mounted on the lower part of the instrument (see Fig. 2 and our musician's twin—actually, it's the same chap in a composite photo), clipped on the musician's belt or hung around his neck. The pickup is built into the neck of the sax.

The control unit has switches and knobs which enable you to produce the effects. (The tremolo is activated on the control unit but its speed and depth are regulated on the amplifier.)

In addition to amplifying the instrument
Note produced by saxophone alone is shown in photo 1; it is almost a perfect sine wave. Photo 2 shows output of Varitone when it produces tone one octave lower; some fundamental is still present. Photo 3 shows output which is mixture of octave lower with additional fundamental added.

Electronic Voicing for Wind Instruments

the Varitone lets you boost or attenuate treble and turn tremolo and reverb on or off. Big feature is the Octamatic control which increases the instrument's range by producing a note one octave below the note you play.

There's an interesting effect which can be produced with the Octamatic. You blow a subtone (a light stream of air) through the instrument. This emphasizes a note an octave lower than the fundamental, which is partially suppressed. This gives you the ability to play only a bass line to accompany other instruments. The Varitone can be purchased alone or with an instrument. Alone it has a list price of $730.

Straight amplification and treble boost and attenuation are easy to achieve electronically. But how is multiplication and division of tones accomplished? Very basically, in the Varitone the note played is amplified, reshaped and fed to a divider circuit which [Continued on page 119]

Photo 4 shows complex waveform produced by saxophone. Photo 5 is waveform of octave lower (with fundamental) produced by Multi-Vider. Photo 6 is same with more fundamental. Photo 7 shows note produced two octaves lower (distorted because of fundamental). Photo 8 shows soprano. Fundamental is four major cycles; soprano is four minor cycles between major cycles. The positive peak of every other soprano cycle is mixed with positive peak of the fundamental and, therefore, appears as a distortion of top fundamental peak. If you take four major peaks, add four soprano peaks you get eight peaks—double the frequency. Due to distortion, peaks on photos don't necessarily coincide. For clarity, photos have been retouched.
Eavesdrop on Military Planes

By CHARLES GREEN, W6FFQ

LOOK up at the sky almost any time of the day, anywhere and you see a plane. It may be a small private job or a large passenger jet. And if you own a radio that tunes the 108-128-mc aircraft band, you know what excitement there is in listening to planes and control towers.

But what about those military jets that zoomed by in formation and broke the sound barrier? Were you able to tune them? Chances are you weren't since they operate on much higher frequencies. According to the U.S. Department of Commerce Sectional Aeronautical Charts, military planes operate from 236.6 to 363.8 mc.

With our three-tube superregen receiver, you can tune from about 215 to 280 mc where you'll be able to hear most of the activity of military control towers and aircraft. And you'll also be able to tune the 220 to 225-mc ham band.

If you live near an Air Force base where there's a lot of activity you've got it made. But if you don't, and a military plane passes over only once in a while, it will take patient listening as the band isn't at all as busy as the commercial-aircraft band.

Our receiver features a ground-grid Nuvisor RF stage, a Nuvisor superregen detector and two stages of audio which can drive an external 4-ohm speaker.

The Circuit

Signals from the antenna, which is connected to J1, are coupled via C1 to grounded-grid amplifier V1 where they are amplified and fed to T1. The secondary of T1 is tapped down and tuned across the band with C4. The tuned signal is detected by superregen detector V2. The audio signal is fed through the low-pass filter circuit (R6-C7) and coupled via C8 to volume control R7 and to audio amplifier V3A. Capacitor C12 couples the amplified audio signal to phone jack J2. Capacitor C11 couples the signal to the audio power amplifier which includes T3. T3 feeds audio to J3 for an external 4-ohm speaker.

B+ power for the receiver is supplied by the full-wave rectifier circuit which consists of T2, SR1 and SR2. Filtering is provided by R12, R13 and C15A,B,C. The B+ to V2 is varied by regen. control R4, which changes the gain of the superregen detector circuit.

High-impedance phones can be plugged in J2, which disconnects the input to V3B. Low-impedance phones should be connected to J3.

Construction

Our receiver is built on a 9 x 7 x 2-in. aluminum chassis on the front of which is attached a 7 x 5 3/4-in. aluminum panel. If you can't get sheet aluminum heavy enough
Underside of receiver. Because of high operating frequency, parts layout around V1, V2 and T1 is extremely critical. Keep all component leads short and direct. Note that braid on shielded wire from J1 to V1 is grounded at both ends. Power supply parts are mounted on 1½ x 2½-in. piece of perforated board.
Note uncluttered clean layout of underside of receiver. Power-supply components could be mounted on terminal strips instead of circuit board.

To duplicate our layout, use these dimensions (top of chassis) to layout your chassis. Power transformer's lead holes (lower right) are not shown.

Before mounting T1, lay it on its side and solder wire on tongue, ¾-in., from bottom. Remove rotor plate from the front of tuning capacitor C4.

January, 1968
Eavesdrop on Military Planes

To mid-position and allow a warm-up period of about 5 minutes. Adjust tuning capacitor C4 to full capacity and adjust regen. control R5 until you hear superregen hiss. This indicates that the detector stage and audio stages are working.

If you have a signal generator that covers the frequency range of the receiver, connect it to antenna jack J1 and set the generator for an output of 215 mc. Tune the receiver to about 5 on the dial’s logging scale—this should be a point slightly less than full capacity. You should hear the signal generator’s signal in the speaker. If you do not, re-solder the tap on T1 at different points until you can hear the 215-mc output of the signal generator. Now calibrate the remainder of the dial with the signal generator. Our model was calibrated at 5-mc points to 280 mc.

If you don’t have a signal generator which covers the receiver’s tuning range, try using harmonics from a lower-frequency signal generator. Or, attach an antenna to the receiver and tune for TV channel 13, that is, if there is a TV channel 13 in your area. You should adjust the tap on T1 to tune the 215.75-mc sound carrier.

For strong local stations, a short whip or length of hookup wire will work for an antenna. For best reception, an outside, coaxed 220-mc ground plane or beam is the best. Aircraft and ham signals are usually
Incoming signals are fed to V1, a grounded-grid RF stage, where they are amplified and fed to T1. Signal tuned by C4 is detected by super-regen detector V2. Audio signal is then fed via low-pass filter (R6-C7) to volume control and audio stages. Plug high-impedance phones in J2. Low-impedance phones should go into J3.

vertically or horizontally polarized.

The regen control should be adjusted for best reception of signals over the band as you tune the receiver. FM signals can be received by slope detection by tuning on either side of the carrier. You can either buy commercial antennas for this band or build antennas using the Radio Amateur's Handbook as a construction guide.

The U.S. Department of Commerce, Washington, D.C., publishes a series of Sectional Aeronautical Charts of the United States. These charts, even though they are primarily for private and commercial planes, are filled with information about frequencies. ✠

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<td>257.8</td>
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<td>FSS* for Military Aircraft</td>
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<td>Military Approach Control</td>
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*FSS-Flight Service Station

January, 1968

PARTS LIST

Capacitors: 1,000 V ceramic disc unless otherwise indicated
C1,C6—47 µf
C2,C16,C17—680 µf
C3,C8—.0047 µf
C4—2.8-16 µf variable capacitor (Hammarlund HFA-15-B, Lafayette 40 H 2841; Modified, see text)
C5—33 µf tubular ceramic
C7—1,000 µf
C9,C13—10 µf, 15 V electrolytic
C10—470 µf
C11,C12—.01 µf
C14—.02 µf
C15A,B,C—30/20/40 µf, 150 V electrolytic
(Sprague TVL-3438 or equiv.)
F1—1/2-A fuse
J1,J3—Phono jack
J2—Closed-circuit phone jack
L1—.82 µh RF choke (J. W. Miller RFC-220, Lafayette 34 H 8974 or equiv.)
Resistors: 1/2 watt, 10% unless otherwise indicated
R1—220 ohms
R2,R8—4,700 ohms
R3—6.2 megohms
R4—100,000 ohm linear-taper potentiometer
R5—47,000 ohms
R6—100,000 ohms
R7—1 megohm audio-taper potentiometer with SPST switch (S1)
R9—220,000 ohms
R10—1 megohm
R11—100 ohms
R12—1,000 ohms, 2 watts
R13—15,000 ohms, 1 watt
S1—SPST switch on R7
SR1,SR2—Silicon rectifier; minimum ratings: 400 PIV, 750 ma
T1—110-235 mc RF coil (J. W. Miller 1445, Allied 54-0094. $3.90 plus postage, not listed in catalog)
T2—Power transformer; secondaries: 250 V center tapped @ 25 ma, 6.3 V @ 1 A (Allied 54 B 2008 or equiv.)
T3—Output transformer; primary: 10,000 ohms, secondary: 4 ohms (Stancor A-3679 or equiv.)
V1,V2—6DS4 Nuvistor tube (RCA)
V3—6CM8 tube
Misc.—Vernier dial (Lafayette 99 H 2566), Flexible shaft coupling (Allied 47 B 2405), 7 x 9 x 2-in. aluminum chassis, 7 x 9-in. aluminum chassis bottom plate, 5-pin Nuvistor sockets, 9-pin tube socket, terminal board, terminal strips, RG58/U coax.
CB NIGHTMARE

IN INDIANA

By ROBERT M. BROWN  KOD2239

EVERY magazine gets letters bewailing injustices, real or imagined, from readers and non-readers alike. Last spring, EI received such a letter from a young woman in the Chicago area in which she complained about local abuses on the Citizens Band. That hardly could be called news. But there was more.

The writer said her parents had been injured seriously in an automobile accident and had tried to summon help on the transceiver in their car. But their signals were jammed purposely by other CBers, she said, and the couple had to wait until a passerby found them and called an ambulance. They were on the critical list 30 days after finally reaching the hospital, the letter went on.

The offenders, she said, called themselves Master Control and were practicing wholesale tyranny on the 11-meter band in Lake County, Indiana. They also had spawned bootleg operations in the broadcast band, as well, the letter said. She (and others) had appealed to the local FCC field office, she went on, but there still was no relief in sight.

Wouldn't EI help by telling the story?

That is when this writer was asked to go to Indiana and find out what it was all about.

Some of what I found sounds like a grade-B television plot. A typical incident runs something like this: On instructions from the Grand Dragon, seven CB-equipped hotrods race down the road at close to 100 mph, intent on arriving at a specific target in Cedar Lake, Ind. Moments later, their cars idling beside a CBer's home, three appointees climb up to an 11-meter beam antenna and reduce it to a pile of metal strips on the ground. Zany Boy arranges the fragments on the grass to spell out MC. As the cars roar again Batman decides it's time to report in. Flipping on the 80-watt linear in his trunk, he announces over channel 9, "Mission accomplished!" Grand Dragon acknowledges.

It's far from fiction. These operations take place (as this one did) in the suburban and semi-suburban communities south and southeast of Chicago. The center of operations is Hammond, Ind. (population, 115,000). Hessville, North Hammond, Woodmar and Robertsdale are all sections of Hammond. Whiting (population, 8,000) is a neighbor on Lake Michigan to the north; Lansing (21,000) is across the Illinois line to the southwest. Cedar Lake is a resort community some 15 mi. south on U.S. Rte. 41, with a summer population of about 9,000.

Within this territory MC carries out its field operations, usually between 11 p.m. and 4 a.m. Targets are CBers who dare to dispute the authority of Master Control.

Should you, even unknowingly, incur the wrath of Batman, Zany Boy or the Grand Dragon himself you'll find it impossible to operate on CB. Every transmission you make will be jammed with 250-watt carriers, obscene comments, endless hours of music. Your name will be circulated in Master Control by way of high-power broadcast-band
Towns mentioned on Master Control QSL opposite are shown here (clockwise from top): Hessville, Ind.; North Hammond, Ind.; Woodmar, Ind.; Robertsdale, Ind.; Lansing, Ill. Hammond, Whiting and Cedar Lake, all in Indiana, also are sites for Master Control operations.

stations on 550 kc. Should you continue your attempts to use CB, instructions will be issued over simulcast 160-meter stations that your home is the target of the evening. Consider yourself lucky if the antenna and feed line are all you lose.

Here are some facts about MC:

- The organization consists of 25 to 30 persons intent on establishing a growing chain of control over all radio operations in northwestern Indiana and surrounding areas.
- Membership in MC is tightly controlled. Each active member supposedly has at least four assistants helping to stir things up.
- MC operates three bootleg radio stations in the BCB: WMMO (for Whammo) in Whiting, Ind., WMML (for MC Whammo Link) in Hessville, Ind., WMOL (MC Whammo’s Little Sister, the Station for Naughty Little Boys) in Cedar Lake, Ind.
- Broadcasts, transmitted simultaneously by WMMO, WMML and WMOL, also take place in the 160-meter ham band.
- So far, the FCC has issued illegal operations citations to three persons alleged to be members of Master Control; each received a six-month license suspension.

In matching information from the area’s CBers with that from FCC citations it becomes apparent that one of the three, calling himself The Grand Dragon, received a six-month suspension of his ham license for unlicensed operation on CB. Apparently he remained active in MC, despite the suspension, using a transmitter belonging to MC’s Grand Wizard, whose own CB license was withdrawn when he proved to be under-age. (The latter retained his ham call.)

January, 1968
CB NIGHTMARE IN INDIANA

The Grand Wizard’s claim to pre-eminence in MC circles (disputed by many) stems from his use of a 250-watt transmitter on CB channel 9. His boast is that he never went off the air in spite of the FCC suspension. He has been known to play taped music on the band and ignores urgent 10-33s. He also is a key figure in the AM broadcast network.

The third (also suspended as a ham for unlicensed CB operation) calls himself the Joker. He stayed on the air during his suspension and uses his brother’s CB call occasionally when he, as he says, “feels like going legal.”

Tiger Dan is in charge of recruitment among younger people. He tends to be a wise-guy on the air.

A young friend of his appears to have no license status whatever and seemingly operates without fear of FCC action. He participates in most illegal jammings and similar stunts and is said to be a central figure in MC.

Some other members, although licensed, prefer to operate illegally by playing music and using obscene language on channel 9, employing a legitimate CB call (someone else’s, naturally). They adopt this tactic for “getting back at those who would challenge Master Control’s authority,” as has been explained by the gang. We have specific information on one who operates this way in Creve Coeur, Ill., for instance.

The CB press has not neglected the affairs of MC. One magazine has been passing on all of its considerable correspondence on the subject to the FCC in Washington.

Typical is a letter (on ruled, school-notebook paper) signed by “Tom Kontrol,” Whiting, Ind. (home of bootleg station WMMO). It suggests that “Master Control is just a great organization any young CBer wouldn’t mind being in. Not everyone is in Master Control but wouldn’t mind being in. That’s just it . . . so they say they are. That’s who does the CB signal jamming and uses foul language. Not Master Control.” Although he denies any affiliation with MC he says, later in the letter: “We don’t cut antennas, though.”

A reply to “Kontrol” went unanswered. But on the evening of June 26, 1967, WMMO broadcast the entire text of both letters. The announcer was careful not to mention “Kontrol’s” name or address but simply added that “it was sent to a member station of Master Control.” We have a tape recording of this broadcast.

Meanwhile, where is the law? Police in Cedar Lake are well aware of the harassment and particularly the speeding that take place on their highways. Yet they are frequently frustrated in efforts to apprehend the violators because of the CB intercommunication between MC cars.

From what we were told by informants in the area, FCC files in Chicago must be bulging with complaints. Still, they know of only two attempts to monitor MC. The offenders quickly suspended operations, leaving the FCC with nothing to do but issue notices to legitimate CBers in the area for such innocuous items as overmodulation and splatter. So far as we’ve been able to determine, no FCC investigation has ever been launched into AM bootleg stations WMMO, WMML and WMOL.

Numerous letters from CBers have offered assistance to FCC officials in clearing up the mess. Some have included off-the-air tapes of MC operations—tapes that the FCC, both in Chicago and in Washington, says are useless for their purpose.

One official at the Chicago office offers this advice: “In submitting specific reports, dates, times and habits are helpful. We can’t always give immediate attention to CB operations and when we are able to do so the violators may not be on the air.”

Trying to get further information on the progress of the FCC was frustrating business. Appropriate reports were unavailable or were awaiting action by some other office. One man in the Chicago office would say only: “I’d much prefer you talk to Washington on this.” Washington gave the impression that all outstanding matters had been acted on and that anything new would have to come from Chicago. Practically all I netted from several lengthy calls was the information on the three cases already mentioned.

And so Master Control goes on as the Hells Angels of the Citizens Band, enforcing its will on everyone in its area, committing outright crimes, thumbing its nose at the law. It’s a shocking case, but one which apparently no one is willing or able to do anything about.
What In The World's Going On?  
Find Out With A Heathkit® SWL Radio

NEW! Professional 10-Band Shortwave Receiver...Slices Stations Down To The Last kHz

Covers 6 shortwave bands (49, 31, 25, 19 & 16 meters) . . . 80, 40 and 20 meter ham bands . . . 11 meter CB. Includes 5 kHz crystal filter for AM, SSB and CW listening. 1.4; two circuits. 1 kHz dial calibrations — 100 kHz per dial revolution — no more guessing station frequencies. Crystal-controlled front-end for some rate tuning on all bands. Precut & aligned Linear Master Oscillator. Tuning dial controlled front-and-center for optimum CW & SSB available.

Kit SB-310, 20 lbs... no money dn., $23 mo. . . . $249.00

For The Seasoned SWL... Deluxe 5-Band Shortwave Receiver

Features 5 bands . . . 3 shortwave bands cover 2 MHz to 30 MHz, plus AM broadcast and 180 kHz to 420 kHz aeronautical & radio navigation bands. Tuned RF stage. Crystal filter for sharp selectivity. Separate product detector for SSB & CW. 6 diode, 6 tube superhet circuit. 4" x 6" speaker. Built-in code practice monitor. Switchable BFO, metal cabinet and more. Includes FREE SWL antenna.

Kit GR-54, 25 lbs... no money dn., 99 mo. . . . $87.95

Low-Cost 4-Band AM/Shortwave Receiver

Hear "live" broadcasts from around the globe, ham operators, Voice of America, ship-to-shore, CW, plus local AM on this single receiver. 4 bands . . . 3 shortwave bands cover 1 MHz to 30 MHz, plus AM broadcast. 5" speaker for crisp, bold sound. 7" slide-rule dial with logging scale. Latched bandspread tuning dial. Relative signal strength indicator. BFO control. Headphone jack. Metal cabinet and more.

Kit GR-64, 15 lbs... no money dn., 99 mo. . . . $39.95

Deluxe 10-Band AM/FM/Shortwave Transistor Portable

10 bands tune: Longwave, AM, FM and 2 MHz to 22.5 MHz shortwave. Separate AM & FM tuners and IF strips. 16 transistors, 6 diodes and 44 factory assembled and prewired circuits. 4" x 6" speaker. Earphone, time zone map, listener's guide. Build in about 10 hours. Optional converter/charger for AC operation $6.95.

Kit GR-43, 19 lbs... no money dn., $13 mo. . . . $139.95

Last Call For The "Mohican" Portable 5-Band Shortwave Receiver

Tunes 550 kHz to 32 MHz in 5 bands. Fixed-aligned IF ceramic "trans- filters" for heat selectivity. Self-contained for portability, yet can run on 117 v. AC with optional power supply $9.95. 10 transistor, 6 diode circuit. Slide-rule dial, "S" meter, BFO control, electrical bandspread. 4" x 6" speaker, headphone jack, metal cabinet and more.

Kit GC-1A, 18 lbs... no money dn., 99 mo. . . . $89.50

Turn Page For More Heathkit Values!

January, 1968
Instant Gift-Solving Guide From Heath...
Now There Are 3 Heathkit Color TV's To Choose From

Introducing The NEW Deluxe Heathkit "227" Color TV

Exclusive Heathkit Self-Servicing Features. Like the famous Heathkit "295" and "180" color TV's, the new Heathkit "227" features a built-in dot generator plus full color photos and simple instructions so you can set-up, converge and maintain the best color pictures at all times. Add to this the detailed trouble-shooting charts in the manual, and you put an end to costly TV service calls for periodic picture convergence and minor repairs. No other brand of color TV has this money-saving self-servicing feature.

Advanced Performance Features. Boasts new RCA Perma-Chrome picture tube with 227 sq. in. rectangular viewing area for 40% brighter pictures...24,000 v. regulated picture power and improved "rare earth" phosphors for more brilliant, livelier colors...new improved low voltage power supply with boosted II+ for best operation...automatic degaussing combined with exclusive Heath Magna-Shield that "cleans" the picture every-time you turn the set on from a "cold" start, and keeps colors pure and clean regardless of set movement or placement...automatic color control and gated automatic gain control to reduce color fade and insure steady, flutter-free pictures even under adverse conditions...preassembled & aligned 3-stage IF...preassembled & aligned 2-speed transistor UHF tuner and deluxe VHF tuner with "memory" fine tuning...300 & 75 ohm VHF antenna inputs...two hi-fi sound outputs...4" x 6" & 8" ohm speaker...one-piece mask & control panel for simple installation in a wall, your custom cabinet or either optional Heath factory-assembled cabinets. Build in 25 hours.

Kit GR-227, (everything except cabinet) $419.95

Kit GRA-27, (less cabinet) $19.95

New Remote Control For Heathkit Color TV

Now change channels and turn your Heathkit color TV off and on from the comfort of your armchair with this new remote control kit. Use with Heathkit GR-227, GR-295 and GR-180 color TV's. Includes 30' cable.

Kit GR-180, (everything except cabinet) $349.95

Kit GRA-180, table model cabinet & mobile cart $30.00

Deluxe Heathkit "295" Color TV

Has same high performance features and built-in servicing facilities as new GR-227, except for 295 sq. in. viewing area (industry's largest picture)...25,000 volt picture power...universal main control panel for versatile in-wall installation...6" x 9" speaker.

Kit GR-295, (everything except cabinet), 131 lbs...$489.95

Kit GRA-295, Walnut cabinet (shown above), 35 lbs...$62.95

Other cabinets from $94.50

Deluxe Heathkit "180" Color TV

Same high performance features and exclusive self-servicing facilities as new GR-227 (above) except for 180 sq. in. viewing area.

Kit GR-180, (everything except cabinet), 102 lbs...$359.95

Kit GRA-180-5, table model cabinet & mobile cart (shown above), 57 lbs...no money down, $55.00...$39.95

Other cabinets from $24.95

Deluxe 12 Transistor Portable B&W TV - First Kit With Integrated Circuit

Unusually sensitive performance. Plays anywhere...runs on household 117v. AC, any 12v. battery, or optional rechargeable battery pack ($39.95); receives all channels; new integrated sound circuit replaces 39 components; preassembled, pre-aligned tuners; high gain IF strip; Gated AGC for steady, jitter-free pictures; front-panel mounted speaker; assemblies in all 10 hours. Rugged high impact plastic cabinet measures a compact 11 1/4" H x 15 1/4" W x 9 1/4" D. 27 lbs.

Kit GR-104, 27 lbs...no money down...$110.00...$119.95

No Money Down On $25 to $300 Orders - Write For Credit Form

Electronics Illustrated
Turn Page For 11 More Solutions
Enjoy The Sounds Of Christmas With A Heathkit® Stereo System

NEW! Lowest Cost Solid-State Stereo Receiver

Features wide 18-60,000 Hz response 4% ± 1 db at full 5 watts RMS power per channel. 14 watts music power. Inputs for phono and auxiliary. Automatic speaker selector. Outputs for 4 thru 16 ohm speakers. Adjustable phase for best stereo. Flywheel tuning and compact 9" D. x 2 3/8" H. x 11 1/2" W. size. 12 lbs. Optional factory assembled cabinets (walnut $7.95, beige metal $3.50).

Kit AR-17, (less cabinet) 12 lbs., no money down, 56 mo. $72.95

Kit AR-27, (less cabinet) 56 mo. $49.95

NEW! Low Cost Solid-State FM Mono Receiver

Features cool, solid-state circuitry. 7 watts music, 5 watts RMS power. 18 to 60,000 Hz response 4% ± 1 db. Inputs for phono and auxiliary. Outputs for 4 thru 16 ohm speakers. Flywheel tuning. Front panel controls. Preassembled & aligned FM front-end. and 9 1/2" D. x 2 3/8" H. x 11 1/2" W. bookshelf size. 9 lbs. Optional Heath factory assembled cabinets (walnut $7.95, beige metal $3.50).

Kit AR-27, (less cabinet) 9 lbs., no money down, 56 mo. $49.95

World's Most Advanced Stereo Receiver

Choose Kit Or Factory Assembled

Acclaimed by owners & audio experts for its advanced features like integrated circuits and crystal filters in one amplifier section: ultra-consistent FET FM tuner; 150 watt dynamic music power; complete AM, FM and stereo listening; positive circuit protection; all-silicon transistor; "black magic" panel lighting; stereo only switch; adjustable phase control for bet stereo and many more. 34 lbs. Optional wrap-around walnut cabinet $19.95.

Kit AR-15, (less cabinet), 34 lbs., $33 down, $28 mo. $329.95

Assembled ARW-15, (less cabinet), 34 lbs., $50 down, 44 months $499.50

NEW! Exclusive Heathkit Hi-Fi Furniture...Fully Assembled And Finished

Contemporary Walnut Stereo/HF Cabinet Ensemble Complements Modern Furnishings

Masterfully crafted of fine veneers and solids with walnut finish. Statuary Bronze handles. Equipment cabinet features adjustable shelves to accommodate all makes of hi-fi components, record storage or tape recorder compartment, turntable compartment. Speaker cabinet features special Tubular-Duct Reflex design for matching 8" or 12" speakers, plus slot for a horn tweeter.

Model AE-37, equipment cabinet
no money down, $172.00

Model AE-37-1, speaker cabinet
no money down, 68 mo. each $25.00

Early American Stereo/Hf Cabinet Ensemble

Early American richness with modern component layout. Constructed of specially-selected solids and veneers finished in popular Salem-Mahogany. Statuary Bronze handles. Equipment cabinet has adjustable shelves to house any make hi-fi components, record storage or tape recorder compartment, turntable compartment. Speaker cabinet can be matched to any 8" or 12" speaker. Has slot for a horn tweeter.

Model AE-47, equipment cabinet
no money down, $135.00

Model AE-47-1, speaker cabinet
no money down, 67 months each $64.50

Mediterranean Pecan Stereo/Hf Cabinet Ensemble

Beautifully constructed of fine furniture solids and veneers with Pecan finish. Statuary Bronze handles. Equipment cabinet has adjustable shelves to house any make hi-fi components, record storage or tape recorder compartment, turntable compartment. Speaker cabinet can be matched to any 8" or 12" speaker. Has slot for a horn tweeter.

Model AE-57, equipment cabinet
no money down, 64 mo. $150.00

Model AE-57-1, speaker cabinet
no money down, 68 mo. each $74.50

January, 1968

Complete Ensemble

$244.00

Complete Ensemble

$264.00

Complete Ensemble

$299.00
Enjoy Widest Kit Selection, Easy Credit,

"Starmaker" Dual-Channel Solid-State Guitar Amplifier

Features 25 watts EIA, 60 watts peak power; two channels, each with two inputs; handles lead guitar, singer’s mike; tremolo & reverb; two 12” speakers; line bypass reversing switch for hum reduction; foot switches; black vinyl-covered wood cabinet with aluminum front panel & chrome knobs. 52 lbs.

Kit TA-19 $134.95
$115 mo.
Assembled TAW-18 $199.95
$179 mo.

NEW! Single-Channel Solid-State Guitar Amplifier

Compare To Amps Costing $175 & More! Boasts 20-watts EIA, 40 watts peak power; tremolo & reverb; two inputs for lead guitars, singer’s mike; 12” speaker; line bypass reversing switch to reduce hum; foot switches; transformer power supply; black vinyl-covered wood cabinet with aluminum front panel & chrome knobs. 35 lbs.

Kit TA-27 $89.95
$80 mo.
Assembled TAW-27 $134.95
$115 mo.

NEW! Deluxe Solid-State Combo Amplifier & Speaker System... Choose Kit Or Factory Assembled

Kit TA-17 Amplifier
$175.00
$14 mo.
(Wired TAW-17, 9275)

Kit TA-17-1 Speaker System
$120.00
$99 mo.
(Wired TAW-17-1, $950)

Kit TAS-17-2 Special Combination Offer! 2 Speaker Systems & Amplifier
Save 120
$395.00
$32 mo.
(Wired TAW-17-2, $545)

All the “big sound” features every combo wants ... tremolo, built-in “Fuzz”, brightness, reverb, separate bass and treble boost and more. Delivers a shattering 120 watts EIA music power (240 watts peak power) through two TA-17-1 speakers... or 90 watts through one TA-17-1 speaker. Features 3 independent input channels, each with two inputs. Handles lead or bass guitars, combo organ, accordion, singer’s mike, or even a record changer. All front panel controls keep you in full command of all the action.

Speaker system features two 12” woofers, special horn driver and matching black vinyl-covered wood cabinet with casters & handles for easy mobility.

Save Up To $500 On This Heathkit®/Thomas "Paramount" Transistor Theatre Organ

Kit TO-87 $995.00
(including bench)
Write for credit details

All Genuine Thomas Factory-Fabricated Parts. Features 15 manual, 4 pedal voices; instant-play Color-Glo; all solid-state circuit; 200 watts peak power; two separate speaker systems... 2-speed rotating Leslie plus main system with two 12” speakers; two 44-note keyboards; professional horeshoe console with stop tablets; 28 rows of chimes; 13-note bass pedals; selective repeat & attack percussion; reverb; stereo headset outlet; assembled walnut finish hardwood cabinet and bench; and more. 265 lbs. 7”, 33-1/3 rpm demonstration record 50c.

Order Now! Use The Handy Coupon Opposite Page

America’s Lowest Cost Solid-State Organ

Save Up To $205! Features instant-play Color-Glo; 10 organ voices; 13-note bass pedals; repeat percussion; two 37-note keyboards; 75 watt peak power; vibrato; matching preassembled walnut cabinet & bench; 5-year warranty on plug-in tone generators. 172 lbs. 7”, 33-1/3 rpm demonstration record 50c.

Kit GD-325B $394.90
$40 dn., $84 mo.

NEW! Heathkit®/Thomas Organ Accessories

Exclusive Band Box Percussion
Automatically or manually adds 10 percussion voices to any Heathkit/Thomas organ. Build & install in 12 hours.
Kit TOA-87-1, no money due...
$14 mo. $145.00

Exclusive Playmate Rhythm Maker
Adds 15 fascinating rhythm sounds to any Heathkit/Thomas Organ. Requires Band Box percussion assembly for operation.
Kit TOA-87-9, no money due...
$18 mo. $189.90

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NEW! Heathkit Jr.® Solid-State Portable Phonograph

Kit TO-68
$349.95

NEW! VOX "Jaguar" Transistor Combo Organ By Heathkit

Save Up To $150 on the world's most popular combo organ with this new Heathkit version. Features the most distinctive sound of any combo organ. Has a special bass output that gives a brilliant stereo bass effect when played through a separate or multi-channel amplifier. Complete octaves, vibrato, percussive effects and reversible bass keys. Includes hand crafted orange and black cabinet, fully plated heavy-duty stand, expression pedal and waterproof carrying cover and case. Requires a bass or combo amplifier like Heathkit TA-17 (opposite page).

Kit TO-68, 80 lbs... $35 do., $30 mo. $349.95

NEW! Amateur Novice CW Transceiver


Kit HW-16, 25 lbs... no money do., $10 mo. $99.50

NEW! Heathkit Jr.® Electronic Workshop "19"

Kit JK-27
$13.95

Ideal gift for any youngster who wants to learn electronics. Contains principles of operation & instructions for building 19 electronic projects... PA system, transistor radio, burglar alarm, etc. Spring-type connectors. Safe, flashlight battery operation. 4 lbs.

NEW! Heathkit Jr.® Guitar Amplifier

Ideal For Youngsters! Build in an evening. All solid-state. 9 watts music power. 8" speaker. Single channel, two inputs. Variable tremolo. Volume & tone controls. Red vinyl-covered wood cabinet with striped grille cloth and carrying handle. 12 lbs.

Kit JK-37, 15 lbs. $29.95

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Good Reading

By Tim Cartwright

DIRECTORY OF ELECTRONIC CIRCUITS. By Matthew Mandl. Prentice-Hall, Englewood Cliffs, N. J. 226 pages. $10.60

Almost every day (particularly when the stock market is looking for glamour electronics issues) we read claims of revolutionary circuitry and electronic breakthroughs. But most electronic design centers on well-known, well-proven workhorse circuits that are as new as the use they’re put to.

The Directory presents more than 150 such circuits, analyzed in function and application with component values and basic equations and formulas. Circuit categories include amplifier, bridge and demodulator circuits; filters, attenuators and pads; modulation, gating and combining circuits; oscillators—and many, many others. The presentation is excellent, concise and well-written. Altogether, it’s hard to think of a better working reference than this one.


Unless my memory is playing tricks, my first exposure to programmed instruction was through a Prentice-Hall text on transistors that taught me even more than I thought I wanted to know. Good thing, too, because this text, though covering much of the same ground, seems to assume much more previous knowledge of the reader than did its predecessor. So, while I’m not sure I can recommend it to the novice, it may be fine for a technician of the old school or anyone else who wants to retrace his steps and learn transistor theory painlessly.

TRANSISTOR BASICS: A SHORT COURSE. By George C. Stanley, Jr. Hayden Book Co., New York. 102 pages. $2.75

If programmed learning is not your dish of tea, there’s an alternative introductory route to the transistor. Basics offers a highly personal and lighthearted approach that begins by comparing electron storage in a transistor base with air traffic stacking over an airport. The programmed text might give you a more thorough grounding but this one will make the learning easy and pleasant all the way, just like a two-martini flight to Chicago.


This is a working guide to transistor circuit design. It covers and analyzes some of the same circuits presented in the Directory reviewed in this column. But the orientation is somewhat different and the treatment of some applications even more exhaustive and well done. This, too, is a valuable addition to any electronics reference shelf.

CATV SYSTEM MAINTENANCE. By Robert B. Cooper, Jr. TAB Books, Thurmont, Md. 193 pages. $12.95

CATV continues to grow, with its own special set of limitations and problems. This book is a comprehensive guide to day-to-day CATV maintenance procedures with emphasis on eliminating interference and radiation problems: a thorough reference.

And Make Note Of . . .

PROJECTS OF BASIC MAGNETISM. By John Potter Shields. Howard Sams, New York & Indianapolis. 96 pages. $2.25


Electronics Illustrated
VACATION usually means camping and boating—the great outdoors where there isn’t a volt of electricity. For the ham who must get on the air every day, being away from the station can bring on acute homesickness and depression. Unless, of course, he has a Lunchbox Ham Station packed along with the fishing tackle and tents.

Two recent developments combine to make our station possible. One is the drop in price of RF power transistors. The other is the trend in transistor radios to include a short-wave band. Our rig includes such a commercially-made transistor receiver. You can operate it just about anywhere. And the radio may be removed quickly and easily restored to normal operation.

The transmitter is the part you build. It’s a three-transistor job for operating CW on the 80-meter band with a General or Novice (3.7-3.75 mc) ticket. Final input power runs about 2.5 watts, which should be enough for local contacts or for longer hauls if there’s no pile-up. The output circuit permits you to use a convenient long-wire antenna which also peps up performance of the receiver. The antenna wire can be tossed out a window, if there’s sufficient height, or hung over a tree branch.

The receiver may be any transistor portable that has a short-wave band covering 3 to 4 mc. Sometimes these sets have a dial marked marine band but a closer look usually reveals that coverage is much greater than the 2-3 mc marine frequencies. The ten-transistor radio we used tunes 2 to 6 mc and thus includes the 80-meter ham band.

You say you can’t copy CW on one of these radios? This problem is licked.
Pictorial above is view looking down into station. Front panel is at bottom. BFO circuit, consisting of C6,C7,C8,R4, T1 and Q3, is mounted under circuit board. Circuit board is 6 x 3 1/4 in. and is mounted 3 1/4 in. down from top of cabinet. Photo of our model from rear is shown below. Transformer at left of board was used in earlier design. It was replaced by smaller type and mounted under board. Note positions of L5, L6 in photo.

LUNCHBOX HAM STATION

by a BFO we've included. The BFO generates a signal that beats against the incoming RF in the radio and creates a tone. Pitch is varied with a front-panel knob. The only thing missing on the radio is a bandspread dial, but careful tuning makes up for this.

Another feature in the circuit is a calibrate position of the transmit/receive switch. If energizes the transmitter's oscillator only so you can spot your signal on the receiver's dial. When you flip the transmit/receive switch to transmit, the antenna is switched from receiver to transmitter and the receiver is muted. Switch to receive and the radio comes on and BFO is energized.

Construction. The transmitter is built on a 6 x 3 1/4-in. piece of perforated board which is held in the main section of the cabinet by two L-brackets. Solder lugs are used on both brackets to serve as ground points for nearby
components. Variable capacitors C9, C14 and C15 mount on the front panel. You'll find threaded holes for No. 6 machine screws in the capacitor frames. Caution is needed here since the screws, if too long may easily jam the plates. This is easily prevented by putting a nut under the head of each ¼ in.-long screw. If there's still a problem, insert a few washers under the screw heads.

Coils L5, L6 and several other parts are supported by a terminal strip mounted at the back of C15. The strip has two terminals: the left one must not be grounded, the right terminal is also the mounting foot. Solder the foot directly to the rear of the capacitor frame and use it for the ground point for C13 and R7. Both coils are cut from the same length of coil stock mentioned in the Parts Lists.

When rotary switch S1 is mounted, be
LUNCHBOX HAM STATION

certain that the wide part of the switch wafer is horizontal. This puts the lugs into the wiring position shown.

The Receiver. There's only one wire to find in the radio and it's simple to locate. It is the red, or positive, lead that connects to the receiver's battery. Break the lead and splice two wires from the break to switch S1. Tape the splices to prevent shorts. Note that the receiver continues to operate on its internal batteries. It is now turned on and off by S1D.

To assure good receiver performance, a connection is needed from the receiver's ground to the metal case. In our radio ground was a screw at the back of the case. But such screws may not be ground potential in other radios. Here's how to check. Touch one probe of an ohmmeter to the screw or other possible ground points. Then, with the receiver turned off, touch the other probe to each of the receiver's battery terminals. When you measure zero ohms, you've found ground.

Next, the antenna connection to the receiver. In our model, there was an antenna jack from which we ran a wire to S1B. Since our whip still could touch the metal case when it was collapsed, its upper sections were unscrewed and removed. If your set has no antenna jack, make the antenna connection to the whip.

Mount the receiver with a length of aluminum strap cut short enough so the two mounting screws draw up the slack when they are tightened. Put some foam rubber or other material under the strap so you won't damage the radio case.

Checkout. To test the transmitter, hook the antenna wire to J2. Although the output network can match short antennas, try to use about 60 ft. String the antenna with as few bends and turns as possible and keep it in the clear.

Check the crystal oscillator first by turning S2 and the receiver's power switch on. Set S1 to cal. (for calibrate). Press the key and tune the receiver until you hear a rushing noise, which should be between 3 and 4 mc.

Electronics Illustrated
Crystal oscillator Q1 is activated when pressed key grounds R3, Q2, connected as emitter-follower, transforms high output impedance of Q1 to low impedance of final (Q4) and isolates Q1 from Q4 for stability. Capacitors C14, C15 tune final and match its low Z to a random-length antenna.

**Parts List**

- **B1-B8**—1.5-V battery (size C, alkaline)
- **Capacitors**: 50 V or higher ceramic disc unless otherwise indicated
- **C1, C4, C13, C16**—330 µf
- **C2, C5, C11**—0.1 µf
- **C3, C6, C12**—0.05 µf
- **C7**—500 µf
- **C8**—25 µf
- **C9, C14, C15**—14,409 µf variable capacitor (Allied 43 B 3524 or equiv.)
- **C10**—0.002 µf
- **D1**—1N60 diode
- **J1**—Phone jack
- **J2**—Phone jack or five-way binding post
- **L1, L2**—1 mh RF choke (National R-50 or equiv.)
- **L3, L4**—2.5 mh RF choke (National R-50 or equiv.)
- **L5**—Coil, 25 turns of Barker & Williamson No. 3012 Miniductor (Lafayette 40 H 1621 or equiv.)
- **L6**—Coil, 33 turns from Miniductor used for L5
- **M1**—0.1 ma DC milliammeter (Lafayette 99 H 5036 or equiv.)
- **Q1, Q2**—2N697 transistor
- **Q3**—HEP-51 transistor (Motorola)
- **Q4**—2N3053 transistor (RCA)
- **Resistors**: ½ watt, 10% unless otherwise indicated
- **R1, R7**—33,000 ohms
- **R2**—2,200 ohms
- **R3**—330 ohms
- **R4**—82,000 ohms
- **R5**—10,000 ohms
- **R6**—100 ohms, 1 watt
- **S1**—4-pole, 3-position rotary switch (Lafayette 99 H 6156 or equiv.)
- **S2**—SPST toggle switch
- **S01**—Crystal socket
- **T1**—Transistor oscillator transformer (J. W. Miller No. 2022, Lafayette 34 H 8701 or equiv.)
- **Xtal**—80-meter crystal
- **Misc.**—12 x 7 x 4-in. Minibox, radio with 3.5-3.8-mc coverage (Lafayette 17 H 7816L or equiv.), 4 battery holders (Keystone 174, Allied 18 B 5907 or equiv.), heat sink for Q4 (Wakefield Type NF207, Allied 60 B 6530 or equiv.), 60-ft. antenna wire, perforated board

Finished and ready to go on the air. Note how radio is held in cabinet with strap which is lined with piece of sponge rubber to protect case.

Turn the BFO knob until the noise turns into a steady tone. If you cannot get the tone, adjust C9 until its plates are half-meshed. Insert a fiber screwdriver into T1's slug and turn the slug until you hear the tone. This calibrates the BFO.

Due to poor shielding and crosstalk in many transistor radios, you may hear several false signals near the correct frequency. You might have to temporarily remove the receiver from the transceiver cabinet to do this. The crystal signal should be weak enough to prevent false signals from being heard.

Next, set S1 to **rec.** (for receive). If there are signals on the air, you should be able to copy them since the external antenna and BFO are now connected.

The transmitter is checked by setting S1 to **xmit** (for transmit). The receiver should now be off. Press the key and turn both **tune** and **load** variable capacitors for highest meter indication. (Some variation in antenna length is apt to change the meter indication.) If the meter goes off-scale, bring it into proper range by increasing the resistance of R7. Try to press the key for only brief periods while testing and tuning. During regular CW operation, keying action draws current from the batteries only intermittently. Nevertheless, you should use the alkaline batteries specified instead of zinc-carbon cells. The former cost a little more, but their life is many times greater than the latter.

If you wish to listen to the radio without removing it from the metal case, turn on its power switch but leave S2 off. Setting to S1 **rec.** at this time will connect the external antenna to the receiver and allow it to operate in normal fashion.
AM-FM Cartridges for Tape Players

HIGH in popularity among automobile accessories is the tape player. It’s great entertainment at first but eventually as you tire of the same music you begin to realize that a big library of cartridges costs money.

If you haven’t bought a player (or a car radio) yet, consider the Automatic Radio TapeDek Convertible player (Model GES-6394). Big thing about it is that when you tire of tapes you can slip in Automatic’s AM or FM tuner cartridges. As you see above, the FM tuner goes in just like a tape cartridge.

The player has a list price of $129.95 and is available from distributors such as Olson Electronics and Allied Radio. A $3.98 adaptor enables it to play four-track tapes. The AM and FM (mono) tuners list for $29.95 and $49.95, respectively. Both are tuned by a thumb knob on the underside and have illuminated dials. The FM tuner has AFC.

At the back of the player there’s a connector into which you plug a Y adaptor. You plug the car’s antenna and a short jumper from your car radio into the adaptor to feed the antenna to the car radio and the tuner cartridges. The signal goes to either AM or FM tuner via a contact in the player and on the side of the cartridge.

In left photo below, arrow 1 points to two contacts which pick up tuner power from the player. The tuner’s output is fed inductively (arrow 2) to the player’s tape head.

Accessories include an under-dash bracket in which the player can be locked and from which it can be quickly removed for indoor use. For home listening, Automatic has a $28.25 AC power supply and $29.95 (each) walnut bookshelf speakers.

Arrow 1 points to contacts which pick up tuner’s power. Arrow 2 points to coil which inductively feeds tuner’s output to player’s tape head.

AC power supply is at left. Controls on player are volume, tone, balance. Window at upper right (player) shows number of the track being played.
FOR the Seventh Award Period, beginning with the publication of this issue, EI is offering a brand-new Major Cities Award. This exciting addition to EI’s prized series of DX certificates makes a total of eight SWL and six Ham awards available.

To qualify for the Major Cities award you must log any 25 of the 50 most populous cities in the world.

To apply for this or any of the other DX certificates, use the Official Log at the end of this article. You may apply for as many as you want. (You may receive any Award only once, however.) QSLs may be used for more than one Award. But if you wish to apply for more you must use a separate copy of the Official Log for each. If you are applying for the DX Century, based on 100 countries, you will also need an additional copy of the Log to enter the second 50 stations.

The easiest way to get extra copies of the Log is, of course, to go out and buy extra copies of this issue. Photostatic copies are entirely acceptable, though. If you can’t get a copy by either of these methods you may make a fascimile; but please be sure it is identical in layout and size to the accompanying Log.

<table>
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<tr>
<th>CITY &amp; COUNTRY</th>
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<th>CITY &amp; COUNTRY</th>
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January, 1968
NEW DX AWARD
25 MAJOR CITIES

You'd be surprised at the amount of time that is wasted in checking over Award applications when they are submitted on irregular forms. And the Awards have become so popular that the only way we can keep within reason the time required to check them all is to make it a rule to reject all applications that are not submitted on the Official DX Log or a sufficiently close approximation.

All entries must be substantiated by a QSL card or letter. Be sure to mark which type of QSL you have received in the appropriate box on the log. DO NOT INCLUDE YOUR QSLs WITH YOUR ENTRY. We may ask you to submit them to us for inspection later.

Entries must be postmarked no later than midnight April 30, 1968. All entries postmarked later will not be eligible for this Award Period and will be returned to the sender.

If you want, you can receive a copy of EI's World DX List without charge. It lists all eligible countries, UN member nations and major cities for Award purposes. Send a stamped, self-addressed business (No. 10) envelope to: World DX List, EI's DX Club, 67 West 44th St., New York, N.Y. 10036.

Carefully fill out the DX Log, using either a typewriter or ball-point pen. Be sure to fill in all the required information. Accuracy is important. If your QSLs can't be verified the Award can't be validated. You must fill in all columns in the form: dates, times, frequencies, locations, types of QSL. Note that times called for are your local time. This makes more complex our job in checking the listings but it allows novice DXers to keep their logs without having to translate times into GMT.

Pay particular attention to the location of each transmitter you report. More Award applications are rejected because of discrepancies in this column than for any other reason. (See comments on this subject in Notes from EI's DX Club in this issue.) After completing the log, check it for errors or omissions. Then mail your Award application to:

EI's DX Club
67 West 44th St.
New York, N.Y. 10036

If all required information on your entry is accurate a DX Award similar to the ones shown on the preceding page will be mailed to you. The 8 1/2 x 5 1/2-in. awards are suitable for framing and will make an attractive addition to your listening den or shack.

<table>
<thead>
<tr>
<th>CLASS OF AWARD</th>
<th>TYPE OF AWARD</th>
<th>AWARD TYPE</th>
<th>FREQ. LIMITS</th>
<th>REQUIREMENTS</th>
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<tr>
<td>General 100 (DX Century)</td>
<td>X</td>
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<td>None</td>
<td>Reception of or two-way communications with stations in at least 100 different countries.</td>
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<td>General 50</td>
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<td>None</td>
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<td>Special</td>
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<td>BCB Stateside Special</td>
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<td>535-1605 kc</td>
<td>Reception of stations in at least 25 different states or provinces.</td>
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<td>Broadcast Band</td>
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<td>All-Continents</td>
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<td>None</td>
<td>Reception of or two-way communications with stations on all six continents.</td>
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<td>United Nations-25</td>
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<td>None</td>
<td>Reception of or two-way communications with stations in at least 25 different UN member countries.</td>
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<td>Major Cities-25</td>
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<td>None</td>
<td>Reception of or two-way communications with at least 25 of the most populated world cities. (Populations based upon 1967 Information Please Almanac published by Simon &amp; Schuster, New York, N.Y.)</td>
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</table>
**OFFICIAL DX LOG**

**INSTRUCTIONS:** PRINT neatly or use typewriter—DO NOT WRITE! Check SWL or HAM to designate type of Award and enter class of Award you are applying for (see chart on opposite page). In listing below, complete all blanks for each entry. Under Date, use figures (such as 10-1-64); all log entries must be dated January 1, 1950 or later. Under Time, use local standard time and 24-hour clock (0000 to 2359 hours). Make up identical copy of this log if you need more space. Seventh Award Period ends April 30, 1968.

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**TYPE OF AWARD**

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January, 1968

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www.americanradiohistory.com
Bedroom Stereo Control Center

By WALTER G. SALM  LIKE two automobiles a second TV set is almost as common now as two radios were many years ago. But two stereo systems are another matter. And that's unfortunate because there are often times when you want to listen to stereo, say, when you are in bed—either because of illness or simply because it's more relaxing.

No need to go out and buy another stereo system. All you have to do is add our control center to your existing system. It connects to your amplifier and enables you to control (at bedside) the volume and balance of a pair of speakers or stereo phones in your bedroom, or for that matter, any other room. When you're ready to retire you just flip a switch and your tuner, amplifier, tape recorder or record player are shut off.

How it Works

In our control center, one L-pad (R1) can be switched (with S2) to control either speaker or headphone volume. The other L-pad (R2) is optional and controls the volume of a second pair of headphones.

Note in the schematic that the two 8-ohm L-pads are connected in parallel. This means that the impedance looking into the control center is 4 ohms. Therefore, if you build the circuit shown, it cannot be used with your main speakers unless they, too, are 4 ohms. You then can connect the control center in series with your main speakers across the amplifier's 8-ohm output. Or, you connect the control center and your main speakers (4 ohms) to a DPDT switch and connect the switch to the 4-ohm output.

If you eliminate R2 and J4, the impedance looking into the control center is 8 ohms. It can then be connected with 8-ohm main speakers to the amplifier's 4-ohm output. By using a DPDT switch you can connect either your main speakers or the control center to the amplifier's 8-ohm output.

Construction

The control unit cabinet can be smaller than the one we show. The 5 x 7 x 3-in. Minibox we used provides space for future expansion. The control unit includes two L-pads, headphone switch, a remote power switch, two three-conductor phone jacks and speaker output jacks.

The power supply and AC-power relay fit in a 2¼ x 2¼ x 5-in. Minibox which goes near the stereo system. Your stereo system is plugged into SOL and the box's line cord gets
Because two 8-ohm L-pads (R1A, R2A, for example) are connected to amplifier's left-channel output, connect to amplifier's 4-ohm tap. Also connect to the left channel's 4-ohm tap. And use a DPDT switch at the amplifier to connect either the main or remote speakers to amplifier as explained in text. Switch S2 selects either remote speakers or phones; it is shown in speaker position. Signal is always fed to extra phone jack, J4.

Bedroom Stereo Control Center

plugged into an AC outlet.

Diode SR1 provides pulsating DC for the relay. If there is a little relay chatter, stretch the relay spring slightly. The 15-µf, 25-V electrolytic capacitor across the relay coil filters the DC. You can increase its size slightly if chatter is a problem.

In our model we used a double-pole switch for S3 simply because it was more readily available. One of the unused terminals provides a convenient tie point that would otherwise require a separate single-terminal lug strip.

The cable between your stereo system (vacuum-tube amplifier) and the bedroom should have five conductors. A transistor amplifier may require six conductors because of the need for separate left- and right-channel ground connections.

Impedance matching, as we said, is important. Let's consider two of the options you have:
Remote or Main Speakers. Eliminate L-pad R2 and phone jack J4. Install a DPDT switch at the amplifier to connect either your main speakers or the control center to the amplifier. Use the amplifier's 8-ohm output.

Remote Speakers Only. Use the complete circuit shown in the schematic and connect the control center to the amplifier's 4-ohm output. Disconnect your main speakers and don't use the DPDT switch at the amplifier.

Variations on the basic design are easy to make and the idea lends itself to modifications galore, depending on your particular needs. If you have never bought intercom cable, it may come as a surprise when you discover that it will be the costly part of the project. Nevertheless, the project can be built for less than $20.

PARTS LIST

- C1—10 µF, 25 V electrolytic capacitor
- J1,J2—Two-conductor phone jack
- J3,J4—Three-conductor phone jack
- R1,R2—Dual Concentric 8-ohm L-pad (Lafayette 99 C 6140 or equiv.)
- RY1—SPDT Relay, 6 VDC coil (Potter & Brumfield MR5D or equiv.)
- S1—SPST toggle or slide switch
- S2—DPDT toggle or slide switch
- S3—SPDT center-off toggle switch
- S01—AC Receptacle
- SR1—Silicon rectifier; minimum ratings: 400 PIV, 200 ma (Lafayette 19 C 5001 or equiv.)
- T1—Filament transformer; secondary: 6.3 V @ 1 A
- Misc.—7 x 5 x 3-in. Minibox, 5 x 2¼ x 2½-in. Minibox, 5-conductor cable

Inside of control unit. Wire which should be covered with tape is actually a braid in our connecting cable. It goes to ground and should be insulated so it doesn't touch jack J2. Circled numbers on L-pads are actually stamped on lugs. Switch S1 is DPDT as it came from our junkbox.

Inside of AC power-control unit. Filament transformer is at left, relay is at lower right. Space is very tight so watch out for shorts when wiring.

Inside of control center. We used large box for future additions to circuit. If you eliminate R2 and J4, you can build circuit in much smaller box.

January, 1968
Pinch-Penny Stroboscope

By RUFUS P. TURNER

SUPPOSING you have a saber saw whose blade seems to loosen or vibrate erratically when you turn it on. But you can't be sure because your eye is not fast enough to catch the action. There's only one way to be sure of what's happening—use a strobe. The flashing light will freeze regular movements of the blade; any irregular motion becomes apparent immediately.

Or supposing you want to find the true speed of that saber saw. Again, the answer is a strobe—a calibrated one.

A variable-speed flashtube strobe would solve all such problems. But they also would clean out your wallet. That's where our Pinch-Penny Stroboscope comes in. It employs a 2-V pilot lamp instead of an expensive gas-filled strobe tube. There are only seven other parts. Power is supplied by a 9-V battery.

The strobe's maximum speed is about 20 flashes per second and the slowest is about 1 flash per second. This is a wide enough range for you to check rotation, vibration and any other repetitive movement whose speed is up to 1,200 cycles per minute. Typical applications are checking the speed of motors, fans, record turntables, the balance wheel of a watch, electric razors or an auto-radio vibrator.

Construction details are covered in the pictorial's caption. The circuit is built in a 5½ x 3 x 2½ in. Minibox. The pilot lamp is enclosed in a transparent plastic container.

Transformer T1 must be connected exactly as shown or the circuit will not oscillate. The red, white and green leads, which are not used, should be clipped short and tucked out of the way.

Operation. Connect the battery and turn on power. As R1 is turned through its range, the flash rate should vary smoothly. When operated at a speed greater than about 20 flashes per second the lamp filament will not dim completely. The effect of this is that a moving object will appear blurred instead of motionless.

The potentiometer dial can be calibrated to indicate flashes per second or per minute. At low speeds, the best way to calibrate the dial is to use a variable-speed motor and a tachometer. Paint a solid black or white dot on the motor shaft. Then run the motor and
Pinch-Penny Stroboscope

Construction is straightforward and components may be mounted anywhere. Install transistor Q1 upside down with 1-in. x 6-32 machine screws. Q1’s collector is grounded to the case via mounting screws. Circuit is a blocking oscillator whose operating frequency (flash speed) depends on values of C1, C2, R1 and inductance of TI’s primary (blue, red, brown leads). Do not use pilot lamp different from the type we have specified as the circuit’s operation depends on filament’s resistance.

PARTS LIST
B1—9 V battery (Eveready 246 or equiv.)
C1—10 µf, 12 V electrolytic capacitor
C2—1 µf, 200 V tubular capacitor (not electrolytic)
R1—2 V, 60 ma pilot lamp (No. 48 or 49)
Q1—Medium-power power transistor (Lafayette 19 R 1507. Similar to 2N155, 2N176, 2N235.)
R1—5,000 ohm miniature potentiometer with SPST switch (Lafayette 32 R 7363 or equiv.)
S1—SPST switch on R1
T1—Transistor output transformer; primary: 2,000 ohms, center tapped. Secondary: 4, 8, 16 ohms (Allied 64 U 150 or equiv.)
Misc.—5⅜ x 3 x 2⅛-in. Minibox, transistor socket, terminal strip, battery connector.

Check its speed in revolutions per minute with the tachometer.

Illuminate the spinning shaft with our stroboscope and turn R1 until the dot appears to stand still. At this point the flash speed is equal to the motor’s speed in rpm. Convert rpm into flashes per second by dividing rpm by 60. If you see more than one dot, the flash rate is slower than the motor.

For greater operating convenience and to concentrate the light, install the lamp in the reflector from a discarded flashlight and mount the reflector on the end of the box.
IT has happened so quietly. Although the arrival of devices like the IC cause a stir now and then, the basic state of the art in amplifiers and tuners has levelled off over the past two years of solid-starey. More and more manufacturers seem to be taking a common route based on well-known notions of good design.

And suddenly the bad equipment—the bomb that never worked except in the advertisements—is disappearing rapidly from the market. If you think that’s a small gain, think again. Amplifiers and tuners may look a bit gray-flannelly these days. But if you hanker for the individuality of yore, just remember the unsound (if, perhaps, ingenious) design that sometimes went with it. Chances are now overwhelming that what you buy will work and keep on working until you choose to (not have to) trade it in.

There still are some individual (if sound) designs around, though. For instance, it’s interesting to see an eminently practical manufacturer like Heath adopt a distinctly different approach to tuner design. The AR-15 is an elegant receiver that uses a combination of crystal filters, FETs and ICs to get an FM section that performs gorgeously. The crystal filters replace conventional transformer design in the IF strip and, together with two ICs, help provide near-ideal limiting and selectivity characteristics. The AR-15 is an expensive product ($329.50 as a kit, $499.50 wired), but the performance per dollar seems hard to beat right now.

Another distinctive receiver is KLH’s new Model Twenty-Seven which uses separate vernier tuning systems for AM and FM. Aside from performance, the interest here is the really different look. This probably is the first piece of audio gear that looks as if it came straight out of our electronic and computer era, though some Japanese products have suggested it. (The KLH, incidentally, sells for a mere $299.95.)

And it’s impossible to leave the subject of new receivers without noting that, at long last, Marantz has one. It’s huge by comparison with the average—but who would dream of comparing Marantz equipment with the run-of-the-mill stuff? It’s also expensive ($595). Unique feature is a built-in 1-in. scope as a tuning aid, indicating niceties like signal quality that are beyond the capabilities of a simple meter. Another feature of the design is its passive front end. This, says Marantz, bypasses problems of overload in strong signal areas and saves weak signals from swamping by powerful neighbors.

News continues to come in on the Dolby Noise Reduction System that we mentioned two columns back. Elektra Records, which has made quite an impact on the record business (and quite a bit of money, too) with its low-price Nonesuch label, has just spawned a new one, Checkmate, which will present only material originally recorded with the Dolby system. At least one other major independent label is about to announce a Dolby-only subsidiary. London Records are being made exclusively from here on from Dolbyized master tapes. And both London and Elektra’s Checkmate label are combining the Dolby system with half-speed record cutting (running both master tape and cutting lathe at half playing speed) for the best possible resolution of high frequencies.

We usually don’t use this column for personal items but we are making an exception to note that Edgar Villchur, former president of Acoustic Research and the man responsible for AR speakers and turntables, has retired from hi-fi to work on hearing-aid design. He’ll be missed. (I wonder how long it will be before we start getting word of acoustic suspension hearing aids.)

* Dropping the Bombs
* Receiver Specials
* The All-Dolby Labels
Those Cheapie Walkie-Talkies

Cups and string costs less than superregens and may work better.

By E. L. GARRETT

It takes but a brief look at what you might call the serious walkie-talkie scene to realize that the trend is toward design sophistication and higher prices. Modern rigs boast more power (up to 5 watts), features (squelch, limiters, output-power indicators) and far greater operating flexibility (6-channel operation) than were available on the typical 100-mw walkie-talkies of a few years back.

On the other hand, there also has been a big growth in the number of toy-type walkie-talkies—those three- and four-transistor superregen rigs which sell for as little as $12 a pair.

After hearing negative reports on some superregen walkie-talkies—dead batteries, defective components, short range, units which wouldn't work at all—we decided to investigate.

The majority of walkie-talkies we tested were purchased from mail-order distributors. Others came from discount stores in the New York City area. The transceivers were purchased in pairs and no attempt was made to work one brand with another. The eight we tested represent a fair sampling of what's on the market. As we opened the boxes of the lowest-cost walkie-talkies, we expected minimum performance for this money and in most cases we ended up getting just that. We did include a pair of low-cost superhets to see whether they were worth the extra price. After checking eight superregens, our conclusion is that most really are toys and shouldn't be counted on for reliable communications of more than a few hundred feet—if that. Let's see why.

While superregen receivers have high sensitivity, the front-end is as broad as a barn door. Most of those tested picked up every signal in and around the 27-mc band. This was made even worse by sunspot activity. The sunspot cycle is on the upswing and this means skip is really coming in. Thus, our reception tests were fouled up by code, teletype and other signals on top of the usual babble of CB. Superregen receivers also radiate a broad band of hash, which sounds like squeaks, whistles and hiss through a nearby receiver. This radiation can be suppressed by a well-designed RF stage but such a stage...
Those Cheapie Walkie-Talkies

Schematic diagram Lafayette model HA-70C. Three-transistor rig has one RF transistor, single RF inductor and antenna loading coil. Transmit/receive switch is shown in receive mode. Audio is amplified by two stages consisting of transistors TR2, TR3. Transmit/receive switch on one unit had to be freed.

did not exist in any of the superregens.

We found some ingenious circuitry since all transistors in most units are used for both receiving and transmitting. Switching was complex. One trick found in all the three-transistor superregens was the use of only a single tuned circuit in both receiver and transmitter. This circuit was tuned to the crystal frequency for transmit. During receive the crystal was shorted but the circuit was not retuned.

Our tests revealed that several of the single-tuned-circuit units covered everything from 26 to over 28 mc. At the high end they were pulling in signals from the 10-meter ham band. Four-transistor rigs are more likely to have separate RF transistors and different circuits for transmit and receive. An exception is the four-transistor GE, which has only a single tuned RF circuit. The extra transistor is the audio stage.

The Lafayette, Lloyd's and Sears transceivers included a schematic in the instruction book. This enabled us to measure final input power. Maximum input power permitted License-Free Band walkie-talkies is 100 mw. In our table you'll notice that the input power of the Lafayette is 80 mw, the Lloyd's is 41 mw and the Sears is 188 mw. Thus, in two units it is signal-shrinkingly low while in the third it simply is illegal. So far as other rigs are concerned we were able to make only relative measurements of output power, using a field-strength meter whose scale was calibrated arbitrarily from 1 to 10. On all other units there was no schematic and frequency was no specified on a couple. We couldn't determine it from crystals, although there was a color dot, which probably means something to somebody in Japan. We did, however, determine frequency with a frequency meter.

With such a low transistor count in most units, we didn't expect to see dummy transistors. But when we found an ad for a 7-transistor walkie-talkie for only $12.99 a pair, we had to investigate. Though this unit (Kensington) did have separate tuned circuits, we found two transistors with all leads soldered together under the circuit board. Their role assuredly was visual, not electronic.

If you see transceivers advertised as dual-crystal make sure the ad specifies superhet. It would be just as easy for a manufacturer to solder in a dummy
Schematic and inside photo of Sears, Roebuck Trans-Talk 400. Transceiver has two RF transistors; TR1 is for receiving and TR4 is for transmitting. The circuit features two tuned circuits, two stages of audio and is powered by six penlite cells. The transmit/receive switch (S1-S4) is shown in receive mode.

S1, 2, 3, 4 are ganged.

crystal as dummy transistors. In several makes we found crystal cases made of white plastic instead of metal—an unusual practice, though not necessarily either good or bad.

We did not make detailed technical analysis of each unit but some comparative tests were made. Since all transceivers came with batteries we checked to see how they had held up during the long trip from the Orient and possible long storage. We checked all batteries under a 15-ma load.

Current drain during receiving and transmitting was checked, using the same heavy-duty 9-V battery for each unit. Receive current was around 15 ma. Transmitter current ran somewhat higher and the rig that pulled 45 ma in transmit was faulty—though it showed good RF output and was on frequency.

A relative RF output-power test was made, using a field-strength meter about 8 ft. from the rigs. As you see in our table, measurements are all over the lot. Those rigs with low output could be expected to have limited range. Where there is considerable difference between the measurements of a pair of the same brand it could reflect poor tuning or poor-quality transistors. Note that the highest transmit current of a pair doesn’t necessarily coincide with best RF output. All rigs were found to be on specified crystal frequency. No attempt was made to troubleshoot or retune any units.

Construction was pretty haphazard: soldering was sloppy and components tended to lean against each other, against the antenna and even against switch frames. It’s hard to see why there weren’t many shorts. We found problems of intermittent transmit/receive switches, instances where shaking or knocking a unit would change receiver output. Sometimes receive or transmit operation changed radically when a finger touched the metal trim on the case. The receiver in the regens was somewhat sensitive with respect to how they were held. The superhet was locked on frequency by the receive crystal. Let’s look at each of the units (listed alphabetically).

Kensington was advertised as having seven transistors, but two (marked with X and located at left of transmit/receive switch and at left of battery) were dummies. As a schematic wasn’t supplied, we couldn’t determine functions of other transistors.
Those Cheapie Walkie-Talkies

SCHEMATIC DIAGRAM

Schematic and photo of inside of Lloyd's transceiver. The circuit features one RF transistor, one RF inductor and no antenna loading coil. And there's no volume control, either (that knob at the upper right is only the power switch). The fourth transistor in this transceiver is in the audio-output stage.

Fanon FCB-3A: No volume control; one RF inductor; adjustable series antenna loading coil; only transceiver having the required FCC compliance form inside case. Two transceivers with batteries and carrying cases come bubble-packed on large piece of cardboard. Instructions included.

GE Y7040: One RF inductor, no loading coil; three audio stages; battery could be inserted without opening case; both units quit receiving when subjected to moderate heat.

Kensington 5051: Advertised as seven transistors; two were dummies; no schematic but apparently separate transistors and tuned circuits for transmit and receive; three audio stages; no frequency specified; [Continued on page 105]

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SUPERREGEN WALKIE-TALKIES—SPECIFICATIONS AND MEASUREMENTS

Electronics Illustrated
A RECENT CB poll indicated that 46 per cent of those questioned were interested in becoming amateurs. This is heartening. We need more hams and fewer CBers so it's good news all around. Citizens Band, the land of 23 frustrations, is a wonderful way to break into ham radio but it is important to recognize its limitations and to use CB as a stepping stone to better things.

Admittedly, the ham bands are not all milk & honey. But they sure should come as a great relief after an apprenticeship on CB. There are plenty of spots in our bands where you can sit and talk to your friends for as long as you like with absolutely no interference. And you aren't limited to fellows around your part of town, either. You can choose from just about anywhere in the world.

The Novice license is a bit limited, to be sure, but it has the benefit of being ridiculously easy to get. In two or three days most people can memorize the code well enough to pass the required 5-wpm test. That is only 25 characters per minute or about two seconds per letter. Once you have the code memorized you can just about sort out the dashes and dots in that time. Sorry about that code—but international regulations require it, even though you plan to use phone.

Perhaps I should clue you in on a secret. There is something fascinating about CW and even though about 80 per cent of us do use phone, about 65 per cent are active on CW as well. You, too, may find you're getting a kick out of CW. Keep an open mind, anyway.

How do you get code practice? Well, if you don't have a buddy or a neighborhood ham who will give you the time you could invest in one of the recorded code courses. A few minutes a day and you'll be way past the 5-wpm level. If you have a receiver that covers the Novice bands you can get your practice from the slower Novices. This will prepare you for the many strange fists you'll run into later on the air. I like the records because they are available at any time and without all that interference from other stations.

Since you are supposed to be able to send code as well as receive it you will do well to invest in a small code-practice oscillator and hand key. Sending is simple to learn; it is receiving that takes practice. Pity, because sending is a lot more fun.

You'll be expected to pass a simple theory and regulation exam. There isn't much to it, really. The ARRL License Manual (50c) is available at just about every radio parts distributor and all mail-order houses like Allied, Lafayette, etc. This manual has the complete FCC amateur radio regulations and a question-and-answer approach to all classes of amateur license. It is, in fact, a crib sheet for ham exams. The League seems positively clairvoyant about any changes in the questions and the memorizer has little to fear.

CB equipment, I'm sorry to say, is not going to be much use to you as a Novice. Comes the day when you get the General license you can start thinking about changing the CB rig over to the amateur 10-meter band. But in all probability you'll keep the CB set for use as CB now and then.

Once you get your General license you'll go out of your mind. In the middle of writing this column I tuned the 20-meter band and had a short contact with a chap in the South Orkney Islands. Next I talked with a chap in the Seychelles. Then a friend of mine in Newfoundland called me from his car and I talked with him while he drove up to the site of Marconi's first transatlantic radio tests. The world truly gets small on the amateur bands.

Then there is always the enjoyment to be had in returning to your old neighborhood on, say, channel 7 and meeting the old gang again—the ones that couldn't cut the mustard to be hams.

For that matter, it wouldn't hurt at all for every ham to make it a point to get on the CB every now and then and see if he can interest any of the fellows in coming over to see his station and stay for a short code-practice session. How about it fellows?

EDITOR'S NOTE: Wayne wrote the foregoing column before news broke of the FCC's approval of incentive licensing rules for amateur radio. He's sure to have something to say on the subject in his next column. In the meantime, you'll find a rundown of the new format for hamming elsewhere in this issue.
You can earn more money if you get an FCC License

and here's our famous CIE Warranty that you will get your License if you study with us at home

Not satisfied with your present income? The most practical thing you can do about it is "bone up" on your Electronics, pass the FCC exam, and get your Government license.

The demand for licensed men is enormous. Ten years ago there were about 100,000 licensed communications stations, including those for police and fire departments, airlines, the merchant marine, pipelines, telephone companies, taxicabs, railroads, trucking firms, delivery services, and so on.

Today there are over a million such stations on the air, and the number is growing constantly. And according to Federal law, no one is permitted to operate or service such equipment without a Government FCC License or without being under the direct supervision of a licensed operator.

This has resulted in a gold mine of new business for licensed service technicians. A typical mobile-radio service contract pays an average of about $100 a month. It's possible for one trained technician to maintain eight to ten such mobile systems. Some men cover as many as fifteen systems, each with perhaps a dozen units.

Coming Impact of UHF

This demand for licensed operators and service technicians will be boosted again in the next 5 years by the mushrooming of UHF television. To the 500 or so VHF television stations now in operation, several times that many UHF stations may be added by the licensing of UHF channels and the sale of 10 million all-channel sets per year.

And there are other exciting opportunities in the aerospace industry, electronics manufacturing, telephone companies, and plants operated by electronic automation. Inside industrial plants like these, it's the licensed technician who is always considered first for promotion and in-plant training programs. The reason is simple. Passing the Federal Government's FCC exam and getting your License is widely accepted proof that you know the fundamentals of Electronics.

So why doesn't everybody who "tinkers" with electronic components get an FCC License and start cleaning up?

The answer is: it's not that simple. The Government's licensing exam is tough. In fact, an average of about two out of every three men who take the FCC exam fail.

There is one way, however, of being pretty certain that you will pass the FCC exam. And that is to take one of the FCC home study courses offered by Cleveland Institute of Electronics.

CIE courses are so effective that better than 9 out of every 10 CIE graduates who take the exam pass it. That's why we can afford to back our courses with the ironclad Warranty shown on the facing page: you get your FCC License upon completion of your course or your money back.

There's a reason for this remarkable record. From the beginning, CIE has specialized in electronics courses designed for home study. We have developed techniques that make learning at home easy, even if you've had trouble studying before.

In a Class by Yourself

Your CIE instructor gives his undivided personal attention to the lessons and questions you send in. It's like being the only student in his "class." He not only grades your work, he analyzes it. And he mails back his corrections and comments the same
CIE helped these men win their FCC Licenses...now they have jobs others envy

A few years ago, the men shown here had only limited prospects in Electronics. Most had no training beyond what they'd gotten on the job or in the service; one had completed only 6 weeks of high school algebra. The better jobs, they realized, were closed to them—reserved for others who had more training to offer.

But instead of complaining about their fate, these men decided to do something about it. They studied with CIE for the FCC License exam.

Today, as a result, all are licensed electronics experts—holding exciting, important jobs with salaries to match. And they are just a few of the thousands CIE has helped to success in Electronics.

If you'd like to join their ranks, see for yourself on the preceding pages how easily you can train for an FCC License the CIE way. Then mail the postpaid card for two FREE books.

Associate Customer Engineer for IBM. "Before getting out of the Air Force," says Raymond Ott, "I enrolled with CIE. The day after leaving service, I passed my FCC exam. Now I'm with IBM, working as an Associate Customer Engineer. I repair and perform preventive maintenance on computers and related electronic equipment."

Inspector for North American Aviation. Eugene Frost was "stuck" in $1.50-an-hour TV repair work before studying with CIE. But after completing his course, he was quickly hired by North American Aviation. Now he's an inspector of electronic systems, and says, "I'm working 8 hours a week less and my hourly wages have more than doubled."

Local Television Equipment Supervisor. "There's no doubt about it," says Glenn Horning. "I owe my FCC License to CIE. Your FCC course really teaches theory and fundamentals. Do I use this knowledge? You bet. We're installing more sophisticated electronic gear all the time and what I learned from CIE sure helps."

Open's His Own 2-Way Radio Station. Senior Associate Customer Engineer, Raymond Stucaynich, is now designing and building a home studio operation, which he'll equip himself. "I've passed the 2nd Class FCC test and have opened my own 2-way mobile-radio shop. We have one of the best-equipped shops in northern Oklahoma and have a real fine business and income."

Bell Telephone Office Manager. Daniel J. Smithwick studied with CIE for his FCC exam. "I was really amazed by CIE's course," he says. "I had never seen lessons so easy to understand." Within four months of winning his License, he was promoted to manager of a Bell Telephone office—a very fast promotion.

Business Grows by Leaps and Bounds. "Ours is a four-man operation," says August E. Gibbemeyer. "Before enrolling with CIE, we were involved in TV and radio repairs. Since getting the 1st Class 'ticket,' our marine and 2-way radio business has grown by leaps and bounds. We hope to enter the radar maintenance field next year."

"Swamped with Job Offers." Thomas E. Miller, Jr., trained with CIE and won his 1st Class License while in the Navy. On his discharge, he says, "My only problem was to pick easy offers, and I did! I'm an engineer with Indiana Bell Telephone. CIE made the difference between just a job and a management position."

"Theory Man" at General Dynamics. Harry J. Remmert III passed his 1st Class License exam less than 11 months after enrolling with CIE. Since then, he's had two pay raises within 10 months. And he adds, "I'm getting to be known as a theory man in my job with General Dynamics Research and Development Division."

Designs Equipment for Smith Electronics. Ted Barper took his supervisor's advice and trained with CIE for his FCC License. "Passed it on the first try!" says Ted. "I'm now designing and building all kinds of electronic equipment and I also do a lot of field testing. It's interesting, challenging work."
A FEW years ago many so-called solid-state FM tuners actually were hybrid designs. That is, the circuits included tubes and transistors. Tubes were used in the front-end because of overload and crossmodulation problems which resulted from using conventional transistors in the front-end.

The present generation of tuners uses field-effect transistors (FETs) in the front-end. Such semiconductors have solved the aforementioned problems and perform even better than the tube predecessors.

An outstanding example of solid-state tuner design and performance is the $189.95 Scott LT-112B stereo FM tuner kit. The circuit includes 23 transistors, three of which (in front-end) are FETs. Metal and walnut cabinets are extra. (The latest model is identified as the LT-112B-1 because of a change in the design of the front panel. Electrically it is the same as the LT-112B.)

Let's take a look at some of the LT-112B's important features. Stereo switching is automatic. That is, when the selector switch is in the auto-stereo position the tuner will switch into the stereo mode automatically and a front-panel light will come on when you tune in a stereo station.

The tuning meter is used for four functions, depending on position of a selector switch. In one switch position the meter indicates relative signal strength; you tune for highest indication. Set the switch to another position and the meter indicates approximately the multipath signal. (The manual has a lengthy discussion of multipath signals as well as sections on theory of operation, troubleshooting and instrument alignment.)

A third function of the meter is to indicate tuning to the center of the FM channel. The fourth meter function is as an alignment indicator.

At the back of the tuner there are three pairs of output jacks. One pair could feed a tape recorder or high-impedance phones. Another feeds the amplifier. The third pair is for connection to an oscilloscope for multipath indication. The manual contains a number of photographs of oscilloscope patterns indicating various multipath-reception conditions.

Although no mention is made of it in the manual, the tuner can be fed with either 72-ohm coax or 300-ohm twinlead without an external matching transformer.

The LT-112B is what we would consider luxury kit-building. Instructions are beautifully clear, precise and in full color. Scott, in fact, has done everything to encourage hi-fi buffs with little experience in kit building to tackle this one. Three printed-circuit boards and the front-end are supplied assembled and mounted on the chassis. The circuit boards are the IF strip, multiplex adaptor, and audio output. (On one board, two resistors had to be removed and three capacitors added.) Hookup wire is cut to

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**THE LT-112B AT A GLANCE**

<table>
<thead>
<tr>
<th>Sensitivity: 2.1 µV at 92 mc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total harmonic distortion</td>
</tr>
<tr>
<td>(1,000 µV input)</td>
</tr>
<tr>
<td>Signal-to-noise ratio (total noise)</td>
</tr>
<tr>
<td>Frequency response (cps)</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>200</td>
</tr>
<tr>
<td>400</td>
</tr>
<tr>
<td>1 kc</td>
</tr>
<tr>
<td>10 kc</td>
</tr>
<tr>
<td>15 kc</td>
</tr>
<tr>
<td>Residual 19 kc and 38 kc multiplex components</td>
</tr>
<tr>
<td>Channel separation</td>
</tr>
<tr>
<td>40 cps</td>
</tr>
<tr>
<td>400 cps</td>
</tr>
<tr>
<td>1 kc</td>
</tr>
</tbody>
</table>

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*Electronics Illustrated*
length and stripped. It and other parts are
doled out in eight numbered plastic bags,
keyed to progressive assembly steps.
There were no errors in our kit. Although
the power-supply filter capacitors seemed to
be the wrong value, those supplied appeared
on the parts list as alternates. Otherwise, our
builder never had to refer to the parts list.
Don't take too literally Scott's statement
that the kit can be assembled in six hours.
Our builder took about twice that long. He
felt that it could have been finished in six
hours by an experienced builder but our
man's deliberate way of working paid off.
When he turned on the tuner it worked per-
fecely except for one meter function. A quick
inspection turned up the trouble—a transistor
lead pulled out of its socket, probably during
assembly.
Alignment of the tuner does not require
test instruments. It is accomplished using the
tuner's meter as an indicator and interstation
noise (white noise) as the signal source. As
the tuner's front-end, IF strip and multiplex
adapter are supplied prealigned, alignment is
actually just touch-up.
The first step is to adjust the slugs of the
first IF transformer (on the front-end) for
maximum meter indication. This is followed
by adjustment of the slugs of the remaining
IF-transformers for maximum indication on
the meter.
Following the peaking of the IF trans-
formers, you proceed to the ratio detector.
To align it you use the meter as a center-
tuning indicator and adjust one of the trans-
former's slugs for center-scale indication.
After this you install the bottom plate.
The manual states that although the multi-
plex section is prealigned, you may wish to
touch it up to increase the stereo separation.
Instructions for doing this using a stereo sta-
tion's test signals are included in the trouble-
shooting section of the manual. We did not
go through this procedure. Total alignment
time was about 30 minutes.
How did the LT-112B check out after
being aligned by our builder? Quite well. IHF
sensitivity was 3.8 µV and total harmonic
distortion (THD) was 1.1 per cent. Further
touch up without instruments improved the
sensitivity and got the THD down to 0.8 per
cent.
We next instrument-aligned the tuner. As
our chart shows, we improved the sensitivity
to 2.1 µV at 92 mc, and the THD was reduced
to 0.2 per cent in the mono mode, 0.62 per
cent in the right channel and 0.54 per cent
in the left channel. The signal-to-noise ratio
was better than 65 db in the mono mode and
better than 65 db in the stereo mode.
But figures don't tell the whole story. You
must hear the sound of this tuner to really
appreciate it. Distortion is so low, and con-
sequently the sound is so clean, you would
think you're listening to music through an
open door at a live concert. We feel the
LT-112B is a kit which will give you just
about the highest performance you could
expect for your money.

Top view of tuner. Front-end is at left. Multi-
plex adaptor board is at top. IF strip is below
it and output board is in the lower-right corner.

Underside of tuner. As circuit boards and front-
end are wired and installed, remaining work is on
switches, power supply, interconnecting wiring.
earn more. These company earnings are based on B&W TV service charges. Color-TV service has already boosted these figures.

While not everyone can expect to achieve these levels, no qualified repair man need suffer. The average experienced service tech earns, in my opinion, between $5 and $10 thousand a year, depending on locale. The paychecks tend to be largest in metropolitan areas.

The paid employee, on balance, earns less than the self-employed tech with a successful operation. As a beginner you can expect about $80 a week. Until you find a niche you will help out in all the areas of service—answering the phone, helping at the bench and on outside calls, picking up parts, checking inventory, etc. Once you are familiar with the company’s routine, opportunities will start presenting themselves to you.

For instance, there are certain house calls every day that require a simple adjustment or some other obvious troubleshooting. Some of the calls might be off a road man’s regular route. You would be assigned some of these jobs. When you run into trouble you can’t handle you would call the service manager for advice. As you begin doing house calls your salary would rise to about $100 a week. Little by little, you take more responsible house calls and your salary starts climbing slowly toward about $130 a week. Then, when road calls are slow, you begin to help out on the bench. At first you simply pull apart, put together and check out completed repairs. Then you start attacking easy repairs with the backup of the regular bench man. This work brings you up to $150 a week.

As time goes by, you find you are completing repairs that looked impossible to you previously. People are starting to consider you as an expert technician even though you feel you aren’t quite that yet. Your paycheck is approximately $175. When you find you can complete every bench repair you tackle and you are doing as many house calls and bench repairs as the other journeyman techs you should be getting about $200 each week.

That is about tops as an employee. While it’s a good living, some people are never satisfied. If you are one of these you will decide you want to join the ranks of the self-employed. It requires a shop and an investment—anywhere from $500 to $10,000. The more competition there is in the area where you want to work, the more capital you will need to sink into equipment and parts in order to stand the comparison.

And it requires business ability. This, especially, is a tall order but if you have the stuff you can break through the $200-a-week level.

Despite all rationalizations and attempts to alter the situation, the service business remains exactly what the name implies—a service business. Unfortunately, fully 50 per cent of TV service requests are made after 4:00 p.m. or on Saturday. This means a TV service store must be open and taking house calls evenings and Saturdays in addition to the regular business hours if it doesn’t want to risk losing half of its business.

It’s true that lots of shops, large and small, close evenings and Saturdays. They are mindful of the loss, however. Some simply don’t care; others are service organizations handling some type of specialized work that does not require evening or week end availability.

I’d say you should be prepared to work any or all hours, however. If you are a nine-to-five man this work is not for you if you want to be a success. This goes for all skilled employees—particularly if you want to be your own man.

In order for you to be a successful electronics serviceman, you must be able to produce a completed repair job and sell it at a profit. So you will need

**A CAREER AT THE SERVICE BENCH FOR YOU?**

Electronics Illustrated
technical training to produce the completed repair, salesmanship training to sell the job to a customer and business training to be sure you are making a profit. If you fall down on any of these three items, you fail.

Assuming you are a high-school graduate (almost a universal requirement), what more do you need? If you can afford the luxury of being in no particular hurry to start earning a salary, the best approach is to enroll in a good college-level technical school. One good example is Temple Technical Institute.

Work toward an Associate of Technology degree and stay put in school until graduation. During the last two semesters of the six-semester course (as long as your grades are satisfactory) recruiters from all sorts of electronics companies will approach you with job offers. On graduation, you'll have your pick.

On the other hand, if you want to get on a payroll immediately you'll have to scratch. Get in a good, humble frame of mind and canvass the TV sales and service companies, large and small, for a job. Disregard hours, starting salary, supervisors' personalities and working conditions. The green youth has no choice; somehow, you must rack up experience. Meanwhile, in your spare time, you should enroll in a good accredited correspondence course or join an evening class in electronics at a nearby technical school. Between the schooling and the concentrated training forced on you on the job, you'll discover after a few years that you are a journeyman troubleshooter.

A third approach (and probably the best one) is to become connected with an apprentice training program. The National Electronic Association, Inc. is in the beginning stages of what they hope will become a well-known, nationwide, accredited TV troubleshooter apprentice program. They are working in conjunction with the U.S. Labor Department—at present in Columbus, Ohio and Wichita, Kansas, where they have training courses with 20 apprentices in each. The recruits are working toward a certificate as an Electronic Technician. This takes four years. The trainee works on the job in an authorized service shop and must complete 144 hours of classroom work each year as well.

Another apprentice-style approach is to apply for on-the-job training programs at RCA or any other large concern in the TV repair business. If you qualify they will provide good training and a subsequent job.

Your business training is something else again. It may surprise you but selling the job at a profit is harder than making a repair in the first place. It's a subtle difficulty and, even though it spells the difference between success and failure, the business end of TV repair is often neglected. People who are mechanically oriented are not usually business oriented. Yet to be a success you must acquire business skills.

Let's stop a moment to talk about the business end of electronics servicing. Minimum charge for a house call these days runs around $5 to $6 in most areas. A more reasonable figure might be $10 but that would scare off business even if you reduced charges for parts and other services. The problem is to balance your prices so that they will seem reasonable to your customers, bear comparison with your competition and still give you a profit. It will do that only if it pays off all your costs—and then some.

The catch is in figuring all your costs: rent, parts, payroll, insurance, advertising, utilities, supplies, depreciation, and so on. There are many items in the list that are difficult to figure or easy to overlook altogether if you are not business-oriented.

Once you have passed this hurdle you must still convince your customer that your charges are reasonable. If he has seen ads offering long lists of tubes at 39¢ each, for instance, he will want to know why you charge $4.50 for one that looks perfectly ordinary. To deal with him so that he remains a satisfied customer will take both salesmanship and a certain amount of emotional maturity.

Even while you're working on the set you must [Continued on page 108]
EAVESDROPPING ON BIG BROTHER

the past few years (as reported by a number of DXers to club bulletins).

The probable CIA stations have transmitters listed by the ITU as being in Washington, D.C. They are, in fact, about the only stations in Washington whose ownership cannot immediately be ascertained by simple checking and deduction. The next unusual thing shown by the ITU is the list of places with which the stations communicate—Swan Island, for one, where the major industry is Radio Americas (See Radio Americas and the CIA, Sept. '67 E1).

When these stations are monitored they are heard using call-signs other than that assigned to their particular frequency. The stations they are heard calling are, likewise, mysteriously missing from the ITU's records. So far, most monitored transmissions have consisted of CW or teletype broadcasts of repeating identification tapes.

A station list for the network appears on this page. You will note that the oldest of the stations made its initial appearance on Nov. 6, 1947—less than two months after the CIA was created.

When the FCC was asked about the ownership of the stations (including the unlisted ones) it confirmed that they were U.S. Government radio stations, but said “the identity of the operating agency is either classified information or available on a need-to-know basis.”

Next, let’s examine the exact geographic locations of the stations: 38° 52' N., 77° 30' W., also shown in the Berne Lists. Both the U.S. Coast and Geodetic Survey and the Department of the Interior pinpointed this as being in the cloverleaf where U.S. Route 1 joins Interstate Highway 95, about ½ mi. southeast of the Pentagon Building.

This seems to be more than a coincidence. Coordinates for the Pentagon would come out at that spot if you rounded them off to the nearest whole minute. If the stations are operated by the CIA the transmitters undoubtedly are not at CIA headquarters in Langley, Va. Interference might disturb the huge monitoring operation that runs dozens of sensitive receivers in the same building.

All this, and more, you can figure out from lists that anyone can order by mail. But don’t ask Uncle Sam about the stations—they’re all classified!

KKN35 and KKN36 are among stations curiously unidentified on Berne Lists, of which this is a portion. Note that both are listed as being in communication with Swan Island. WAR stations are operated by the U.S. Army, the NSS stations by the Navy.

<table>
<thead>
<tr>
<th>Freq. (kc)</th>
<th>Assigned Call</th>
<th>Former Call</th>
<th>Announced Call</th>
<th>First On Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>6024.5</td>
<td>?</td>
<td>KKN35</td>
<td>KKN50</td>
<td></td>
</tr>
<tr>
<td>7470</td>
<td>KKN33</td>
<td>KKN50</td>
<td>Oct. 12, '56</td>
<td></td>
</tr>
<tr>
<td>10470</td>
<td>?</td>
<td>KKN50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11095</td>
<td>KKN42</td>
<td>GKA61</td>
<td>KKN50</td>
<td></td>
</tr>
<tr>
<td>12022.5</td>
<td>KKN43</td>
<td>GKA62</td>
<td>KKN50</td>
<td></td>
</tr>
<tr>
<td>12112.5</td>
<td>KGA59</td>
<td>KKN50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13715</td>
<td>?</td>
<td>KKN51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14772.5</td>
<td>?</td>
<td>KKN51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15492.5</td>
<td>KKN35</td>
<td></td>
<td></td>
<td>Sept. 27, '55</td>
</tr>
<tr>
<td>15540</td>
<td>KKN36</td>
<td></td>
<td>KKN51</td>
<td>Sept. 27, '55</td>
</tr>
<tr>
<td>17390</td>
<td>KKN39</td>
<td></td>
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<td>Sept. 27, '55</td>
</tr>
<tr>
<td>17662</td>
<td>?</td>
<td>KKN50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18525</td>
<td>KGA60</td>
<td>KGA65</td>
<td>KKN50</td>
<td>Nov. 6, '47</td>
</tr>
<tr>
<td>18972</td>
<td>KKN47</td>
<td></td>
<td>KKN50</td>
<td>May 18, '59</td>
</tr>
<tr>
<td>20365</td>
<td>KKN48</td>
<td>KGA67</td>
<td></td>
<td>May 4, '50</td>
</tr>
<tr>
<td>23442.5</td>
<td>KGA61</td>
<td></td>
<td></td>
<td>Oct. 12, '56</td>
</tr>
<tr>
<td>23862.5</td>
<td>KKN51</td>
<td></td>
<td></td>
<td>May 17, '57</td>
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<tr>
<td>23975</td>
<td>KKN49</td>
<td>KGA68</td>
<td></td>
<td>Mar. 14, '52</td>
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<td>23982.5</td>
<td>KKN52</td>
<td></td>
<td></td>
<td>May 17, '57</td>
</tr>
<tr>
<td>26760</td>
<td>KKN50</td>
<td>KGA71</td>
<td></td>
<td>Mar. 14, '52</td>
</tr>
</tbody>
</table>

The above stations heard calling or in communication with stations KBF70, KCA30, KAZ20, KWX72. These four stations do not appear in any ITU list. Stations shown with question marks are not listed with ITU.
How do you choose your recording-tape brand? Was it recommended by someone whose judgement you trust? Was it praised in a magazine article? Did the salesman tell you it was the best on the market?

Most tape recordists are, by now, pretty well aware of the shortcomings that can plague the bargain tapes. But we got wondering how much difference there really is between the name brands. More particularly, could we detect any difference in sound between one quality brand and another?

To find out, we ran a comparison test. We went out and bought samples of every name-brand tape we could find on the shelves of dealers in the neighborhood. All the best-known names were there—and a few that are not so widely known. (RCA would probably have been in the list, too, if they had not been in the middle of a strike at their coating plant at the time.)

In order to eliminate as many variables as possible we limited ourselves to 1-mil polyester base and standard coatings—no low-noise, high-output or other special-purpose jobs. We ended up with 11 brands: American L-18M, Ampex 941, Audiotape 1861, BASF LGS-35, Brand Five 10D7M, Capitol 742, Irish 241, Reeves Soundcraft Plus-50, Robins 10A7M, Scotch 150, Sony PR-150.

To test sound reproduction qualities we made up two test tapes. The first contained 15-sec. lengths of tape from each reel, spliced together to form a 2 3/4-min. tape on which we recorded a single selection (keeping careful tally of the order in which the brands were spliced together). The second included 3-min. samples of each tape, spliced together in a different order and separated by 5-sec. leaders. Next, we recorded on each tape—straight through with a single selection on the tape containing the 15-sec. samples; with 11 repeats of another selection on the tape containing the 3-min. samples.

In order to show up any differences between tapes we wanted music that was fairly familiar and included a wide dynamic range from soft to loud with as much variety of instrumental color as possible. For the longer samples, particularly, we wanted to see how the tapes would treat individual violins or flutes or bassoons as well as groups of instruments and full orchestra. For this purpose we finally chose the overture to Smetana's The Bartered Bride, as recorded by the Prague National Theatre Orchestra on Artia ALPOS-80. For the shorter samples we used
EI TESTS THE POPULAR AUDIO TAPES

the overture to Verdi's La Forza del Destino by the Czech Philharmonic on Parliament PLPS-622.

The test would only be valid for our readers, we felt, if we used equipment similar to what they, themselves, might use. The records were played on a Benjamin Miracord B40A automatic turntable equipped with a Shure V-15II stereo cartridge. The signal was transferred via a Scott 344B stereo receiver to a Roberts 997 tape recorder, cleaned and demagnetized for the occasion but otherwise left innocent of special treatment. Consistent with common home practice, we chose to limit the tape speed (and therefore quality) to 3½ ips.

Once we had the sound on the tape with what we thought could be considered good home quality, however, we wanted to give our test listeners every opportunity to hear whatever differences there might be on the tape. That meant we would need really superior equipment for playback. We also wanted to get a room large enough to allow about a half dozen people to listen in conditions that would approximate living-room acoustics.

The playback problem was solved very neatly for us by the Asco Sound Division of Sonocraft, a Manhattan dealer in audio equipment. Asco has a penthouse listening room designed, like those in many hi-fi salons, for A/B comparison of hi-fi components, with plenty of high-quality gear to choose from. We finally picked a Revox G-36 tape recorder, a Sony stereo preamp and power amplifier and a pair of Altec Lansing speaker systems.

The next problem was to choose our listening panel. Professional musicians or audio engineers might be expected to respond most readily to subtle differences in sound. But was that what we wanted? Might they not bring to the test a set of prejudices about what constitutes good and bad sound that would be quite different from those we would expect of most of our readers?

We finally chose two panelists with musical connections: one describes himself as an inactive composer who still plays the piano, the other is an EI editor who periodically moonlights as a saxophonist. Another panelist is a hi-fi-loving housewife. The remaining two are audio-oriented EI editors—one also an amateur organist, the other has worked in recording and broadcast studios.

We quickly found that the tape with the shorter sample lengths did not make an adequate test. A quarter-minute just doesn't give you enough time to form a clear impression of the properties of the sound you are hearing unless there is something seriously wrong with it. In addition, whenever the splices were less than perfect (some of ours were) the sound was altered far more by the splice itself than by the relatively minute differences from one tape to the other. So we ended up using only the tape with the 3-min. samples.

The panel was asked to score each tape on a scale from 1 to 4. A rating of 1 would indicate particularly good sound, 2 would be only acceptable, 3 would be substandard and 4 unacceptable.

The results, as you can see from our chart, were startlingly non-uniform. There was far more difference between panelists on any given tape than there was between tapes when an average value was taken for each. For this reason, we conclude that average values are virtually meaningless. Two brands seem to separate themselves out as being of lower sound quality than the others, in the opinion of the panel, but the rest of the findings make it clear that with so small a sampling it would be foolish to draw any conclusions from overall figures.

The test proves a point, however—and does so dramatically. If five listeners of above-average audio sophistication can differ so widely in their evaluation of these 11 brands and hear so much difference between them, they could not possibly make meaningful tape-brand recommendations for each other—or for anyone else.

A clue to why this is so showed up in the written comments that the panelists added to their reports. On one test the housewife wrote, “Too strident.” Of the same tape, the saxophonist said, “Poor bass, annoying hiss, highs good.” Both were hearing the same thing but evaluating it entirely differently.

Comments for another sample ran like this: “Best of the lot; fine pickup in all ranges.” “Woodwind highs a bit fuzzy. Good strings (cellos and violas), good tutti.”
Panelists differed so widely in scoring tapes (1 for particularly good, 2 for acceptable, 3 for substandard, 4 for unacceptable) that average values for any given tape would be meaningless. The ear that listens, it appears, makes more difference than the tape being tested so long as all are brand-name tapes.

"Somewhat dull." "Weak highs." And remember that all the panelists were hearing the same recording on the same tape played through the same equipment at the same time. Each evaluated the sound in terms of whatever was important to him.

If the tests had been run with several recorders or several recordings, the results would undoubtedly have turned up additional differences. Likewise, differences between speakers or phono cartridges or microphones or even listening rooms can affect the sound, emphasizing or hiding the qualities a particular listener wants to hear—or wants not to hear.

The most important of these variables for tape testing is the tape recorder. The coatings on our test tapes, though called standard and therefore all similar to the classic Scotch 111 coating, are not identical. For one thing, not all are designed for the same tape recorder bias setting—an element in the equation that can be critical. Likewise, tape recorder manufacturers do not all provide the same bias in the record circuit. On some of the more expensive recorders it may be corrected for the specifications of the tape you are using; more often it is awkward or impossible to adjust.

In addition to the standard coatings we tested, there are a host of special-purpose tapes developed in recent years to solve particular recording problems. Low-print tape, one of the earliest of these formulations, was designed to minimize the effect of one layer of tape on its neighbor in the reel. High-output tapes allow you to record at a higher level without increased distortion so that noise level is lower, with respect to the signal, on playback. Low-noise tape has a similar result but produces it through more careful oxide milling to reduce the noise inherent in the tape. Slow-speed tapes are designed for increased high-frequency response at low playback speeds.

Even the backing material influences tape performance. The limper the backing, the more closely the tape will wrap itself around the heads—as long as it remains strong enough to withstand the mechanical demands of the transport mechanism. The more intimate the contact between tape and head, of course, the more accurately the recorded signal will be reproduced.

Well then, how do you choose a recording-tape brand? Our answer would be: Test it. Since it's obvious that the brand that will do the best job for you will be the one that produces the results you want on your equipment no one else's tests can ever be really valid for your purposes. And a listening test is not hard to set up.

Get small reels of the type of tape you think you will need (standard or special-purpose) and make up your own test reel the way we did. If you're handy with a splicer you may want to try mixing the tapes together without intervening leader and recording straight across them. Remember our experience, though, and keep your samples at least 1 min. long. Use several samples of each brand, changing the order in which they fall so you get a direct comparison in as many combinations as possible.

But, above all, don't let a magazine article tell you what brand to buy.
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APPROVED FOR TRAINING UNDER NEW G.I. BILL
Although it took nearly a decade to happen, the CB industry is gathering its resources to help decide CB’s future. About a dozen manufacturers have welded themselves together under the banner of the EIA—the prestigious Electronic Industries Association, a Washington-based organization that speaks with a mighty voice for much of the electronics industry. A big task of the EIA is setting technical standards on everything from amplifiers to zener diodes.

The EIA’s Citizens Radio Manufacturers Section isn’t new but it’s beginning to sound off on some of CB’s pressing problems. Plumping for channel 9 is one example. It also favors type acceptance for all CB equipment. (The proposal now before the FCC would make the manufacturer—as well as user—open to punishment and fines for technical violations.)

In another move, the group took aim at a congressional committee and argued that more of the $8 CB license fee should go back into FCC coffers. This would quicken license processing and boost FCC efficiency. The CB manufacturers also are forming an engineering group to set up standards, keep the FCC up to date on the state of the art and tinker with other technical problems.

Are these developments something to cheer about? May well be! Pressure groups aren’t new to CB but few have lasted long enough to dent FCC thinking. The EIA group, on the other hand, is performing like a bunch of old pros. Of course the manufacturers are taking understandable steps to safeguard their own interests. But their goal might also coincide with that of their customers—a healthy, growing CB service.

Stretching a Line . . . A reader asks if it’s possible to run an antenna line as far as 300 or 400 ft. without losses in the coax that will eat up the signal before it reaches the antenna or without paying fancy prices for low-loss cable.

Among the best cable for long runs is open-wire line (also called ladder type). A huge air space between wires keeps losses extremely low. Trouble is that open line will not match the CB transceiver—or any standard CB antenna. CB rigs are almost always rated at about 50 ohms output, unbalanced. The open wire (Lafayette 32 H 3613, or equiv.) is a much higher—450 ohms or so impedance—and it’s balanced. There’d be serious power losses if rig or antenna are connected to an open line.

There is, however, an inexpensive device that makes everything fit together nicely. It’s called a balun (short for balanced-unbalanced). It’s nothing more than a specially wound coil that tidies up the electrical differences between rig, line and antenna.

We ordered several baluns to test the theory (Lafayette 18 H 7701, 89¢ a pair). They’re really intended for TV sets but our tests proved they work on 27 mc for CB.

The hookup is shown in the illustration. Connect side A to the antenna socket on the CB rig; side B goes to the antenna through any length of open-wire line. Note that each coil has two wires on each end. Those wires are poorly marked on the actual coils but you can easily find the right ones by tracing silver and brown wires on the coil.

Up at the antenna, you’ll need another pair of balun coils—but here side A connects to the antenna terminals, side B to the line. Put the baluns in a plastic box at the antenna so they won’t suffer from the weather.

With this system, you can put your antenna on a hilltop and still operate efficiently from down in the valley.

---

**Baluns, connected as shown here, match output of CB rig to open-wire line for distant antenna. Some configuration is used at other end but in reverse: A connects to antenna and B to open-wire line.**
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<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
<th>SUGGESTED LIST PRICE</th>
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<tr>
<td>PCA-1-9</td>
<td>1W, 9V D.C. 4 Transistor Amplifier</td>
<td>$7.20</td>
</tr>
<tr>
<td>PCA-1-14</td>
<td>2W, 14V D.C. 4 Transistor Amplifier</td>
<td>7.00</td>
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<tr>
<td>PCA-2-9</td>
<td>3/4W, 9V D.C. 3 Transistor Amplifier</td>
<td>5.90</td>
</tr>
<tr>
<td>PCA-2-14</td>
<td>1W, 14V D.C. 3 Transistor Amplifier</td>
<td>5.90</td>
</tr>
<tr>
<td>PCA-3B-18-1</td>
<td>4W/Channel Stereo Amplifier with Bass, Treble, Volume and Balance Controls</td>
<td>19.20</td>
</tr>
<tr>
<td>PCA-4-9</td>
<td>1W, 9V D.C. High Gain, 4 Transistor Amplifier for Radio, Ceramic or Crystal Phono Cartridge, etc.</td>
<td>8.30</td>
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<tr>
<td>PCA-4-9A</td>
<td>Same as PCA-4-9 with Tone Control Circuit</td>
<td>9.20</td>
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<tr>
<td>PCA-4-14</td>
<td>2W, 14V D.C. High Gain 4 Transistor Amplifier for Radio, Ceramic or Crystal Phono Cartridge, etc.</td>
<td>8.30</td>
</tr>
<tr>
<td>PCA-4-14A</td>
<td>Same as PCA-4-14 with Tone Control Circuit</td>
<td>9.20</td>
</tr>
<tr>
<td>PCA-4-18A</td>
<td>3W, High Sensitivity, 4 Transistor Amplifier with volume and Tone Controls for use as Guitar, Radio or Phono Amplifier</td>
<td>9.52</td>
</tr>
<tr>
<td>PCA-5A-14</td>
<td>2W/Channel 14V D.C. Stereo Amplifier with Balance, Tone and Volume Controls</td>
<td>15.80</td>
</tr>
<tr>
<td>PCA-6A-25</td>
<td>8-10W/Channel Stereo Amplifier with Preamp for Ceramic Phono Cartridge and Bass, Treble, Balance, and Volume Controls</td>
<td>30.10</td>
</tr>
<tr>
<td>PCA-6A-25SCS</td>
<td>Same as PCA-6A-25 with Separate Control Assembly</td>
<td>31.80</td>
</tr>
<tr>
<td>PCA-7B-18</td>
<td>Tape Cartridge Stereo Preamp with Level Set Controls</td>
<td>12.00</td>
</tr>
<tr>
<td>PCA-7C-18</td>
<td>Same as PCA-7B-18 without Level Sets; 4 Transistor</td>
<td>9.50</td>
</tr>
<tr>
<td>PCA-8-36</td>
<td>20W Mono Basic Amplifier</td>
<td>18.85</td>
</tr>
<tr>
<td>PCA-9-18</td>
<td>3W/Channel, 10 Transistor Stereo Tape Playback Amplifier with Volume, Tone and Balance Controls</td>
<td>25.30</td>
</tr>
<tr>
<td>PCR-1-9</td>
<td>9V 2 Transistor AM Tuner</td>
<td>11.30</td>
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For brochure containing complete technical data on all 18 assemblies and for name of distributor nearest you, write: Amperex Electronic Corporation, Distributor Sales Dept., Hicksville, New York 11802.
On February 3, 1966, the New York Times ran a story under the byline of its radio and TV editor, Jack Gould, reporting that the FCC was planning to remove Part 15 (unlicensed) walkie-talkies from the 27-mc Citizens Band. He said the plan was to put them on a new band between 49 and 50 mc and reduce output power and antenna length in an effort to cut transmitting range.

For the public and the trade alike there had been no word of warning. Now, the way Gould reported it, millions of the little transceivers would be forced off the air within a year after the FCC's new regulations were approved. It would be almost impossible to convert 27-mc sets for operation on the new band and the technical specifications proposed for 50 mc would mean a substantial rise in the cost of the sets. Millions of dollars spent on these units would be wasted; dealers would be stuck with inventories of the sets; manufacturers and importers would be left without a salable product.

When the Times story came out there was reaction from equipment manufacturers and CBers alike. Many called FCC offices only to be told that such a plan, if it did exist, never had been mentioned to any of the district offices. Those who called the FCC's Washington office were given varying answers, depending on the staff member they happened to reach. Some said such rules were being considered. Others called the story an out-and-out hoax. A few disclaimed any knowledge one way or the other.

Within a few days at least one manufacturer was claiming that a $1 million walkie-talkie order from a large chain had been cancelled. Dealers were trying to return the sets they had on hand, users were wondering where they stood and the FCC was doing a slow burn.

By February 16 the FCC had been so thoroughly inundated with questions that they issued a memorandum claiming that "the Commission staff is continually at work in anticipating problems, working with problems as they develop and making plans for new contingencies. In respect to walkie-talkies, difficulties had developed because of the operation of the unlicensed transmitters in the same band as Citizens Radio stations. We have been studying a number of proposals designed to help resolve the situation. We want to stress the words proposal and study. We have not gone beyond this stage."

The following day, the FCC held a Washington meeting for CB manufacturers. James Barr, FCC's Safety and Special Services Chief, acting as its primary spokesman, was emphatic in saying that much was being made of nothing. The 50-mc frequency mentioned was only one of several possibilities being tossed about among FCC personnel, he continued, and some of their informal notes might have gotten out of the FCC, been misinterpreted by people who didn't know any better and blown up out of perspective.

Barr himself had been quoted in the original Times story as acknowledging that the Commission was considering the rules. At the February 17 meeting he stated, "There is no such proposal." (A few months later, FCC attorney Richard Everett explained, "When the word was out on this prematurely, nothing had been decided. .")

In the Times story, Gould had identified as his source of information an article being prepared for the March issue of S9, a CB magazine (whose editor, Tom Kneitel, writes Uncle Tom's Corner for EI). When the March S9 came out, the story contradicted much of what the FCC had said, stating that the
change already existed in a formal document sent to the Interdepartment Radio Advisory Committee (IRAC) for approval. IRAC is a group of representatives from governmental agencies and the military. Their task is to issue frequency allocations to the radio services.

S9 claimed that walkie-talkies were to be shifted to five specific 50-mc channels (any given set to operate on only one channel) that input power would be reduced from 100 mw to 60 mw, that the antenna length would be slashed from a 5-ft. maximum to 2 ft., that superregenerative receivers would be outlawed and that all equipment was to be FCC type-approved.

Then, on April 13, the FCC issued Public Notice Number 98917. Without making reference to recent events, it spelled out a plan to move Part 15 walkie-talkies to 50 mc, almost exactly as it had been reported earlier. The one major difference was that present users of walkie-talkies on CB channels would have seven years to vacate, rather than only one.

FCC Commissioner Kenneth A. Cox shortly after the issuance of the Public Notice put out a strongly-worded statement against the proposal. “Spectrum space is far too valuable to waste the 50-mc band on walkie-talkies,” Cox said. “The 50-mc band would be far superior to the 27-mc band for... serious uses since long-distance interference problems are much less severe in this band,” he added. And equipment prices would be much higher. His alternative plan was to establish a walkie-talkie channel around 27.53-mc—above the present CB channels but still within the operating capabilities of present walkie-talkies.

The Electronic Industries Association of Japan quickly agreed, followed by the Raytheon Co. Both organizations are closely involved in the manufacture and sale of the low-cost units. The EIAJ said that, while most of the cheap sets shipped here are toys, “thousands of Americans earn substantial portions of their income directly from the importation and marketing” of Japanese walkie-talkies—$70 million worth in 1966. And the EIAJ added that it would be “impossible to produce such a device which could operate within the radiation limits of Part 15 while functioning at 49-50 mc.”

Today the plan is still being considered by the FCC. Nobody in or out of the FCC seems willing to speculate on the reasons for the FCC’s denial of the original Times/S9 story. Certainly the plan was no more controversial than many other moves of the FCC. And it seems evident that it had been formulated even before the story appeared.

We have learned that on January 13, 1966 a letter from the FCC asked IRAC to place on “an early IRAC agenda for appropriate consideration” a “Notice of Proposed Rule Making in the matter of Amendment of FCC Rules, Part 15, Subpart E—Low Power Communication Devices, to delete the band 26.97-27.27 mc and substitute therefore the band 49.9-50.0 mc.” Attached to the letter was an eight-page document that spelled out in great detail the FCC’s plan to establish the five 50-mc channels, reduce power to 60 mw, shorten antennas, and tie the whole thing to a one-year expiration date for 27-mc use by unlicensed walkie-talkies.

This sounds like something more serious than the in-house notes described by Barr. Was the FCC interested only in sounding out IRAC reaction to this one of several plans then under consideration? Unfortunately, this is one of those situations where the more answers we get, the more questions we have.
The Latest on DXing Apollo

THE Apollo receiver being designed by our engineer will actually be a converter, as we stated in our previous report.

As the range it must tune is from 2090 to 2120 mc, its local oscillator will have to operate from 2236 to 2266 mc. Its output will be fed to a balanced mixer. The 146-mc output of the mixer will be fed to a conventional 2-meter (144 mc) ham converter whose 14-18-mc output can be fed directly to the antenna terminals of a communications receiver. To date, construction has only been accomplished on the local-oscillator chain.

Because of the 30-mc tuning range (greater than the total coverage of a conventional communications receiver) the 2236-2266-mc local oscillator will be tunable. The local oscillator (it will consist of a crystal oscillator followed by frequency multipliers) will actually operate at around 200 mc. For the sake of simplicity, our engineer is going to attempt to do all of the frequency multiplying in one stage. He hopes to accomplish this by operating a 200-mc transistor oscillator at a relatively high power level (several watts). This oscillator will then drive a PIN (positive-intrinsic-negative) diode multiplier.

The output frequency of the multiplier will be 10 times higher. This arrangement yields only a few milliwatts output at 2200 mc. However, this will be sufficient to drive a balanced mixer which will use the newer-type mixer diodes.

But the design hasn't been finalized. Our engineer is considering feeding the output of the 2-meter converter into a TV set or an FM receiver. This is because a conventional high-frequency receiver has a very narrow bandwidth. And the information from the Apollo LM (Lunar Module) and its mother ship will be frequency modulated. More on Apollo in a later issue.
Cheapie Walkie-Talkies

Continued from page 76

no instructions; operation changed when one unit was shaken—big change in receive volume, also increased hand sensitivity; one battery dead, the other weak.

Lafayette HA-70C: Good instruction book with schematic; only one transistor and tuned circuit for both transmit and receive; two audio stages; one unit had poor volume control; other unit would not receive until transmit/receive knob was adjusted (its movement was restricted when case back was on).

Lloyd's 7A07B: Small but complete instruction book with schematic; full parts list with RCA transistor equivalent for Japanese transistors; single RF inductor, no loading coil; two-stage audio output with two transistors in parallel; no volume control.

Olson CB-42: No channel specified; no schematic; separate inductors for transmit and receive; two audio stages; one unit had defective transmit/receive switch when in receive mode; neat construction.

Olson RA-826: Blister packed on small card; instructions but no schematic on back; no volume control; single tuned circuit for both transmit and receive; fixed antenna loading coil.

Sears Trans-Talk 400: One unit had no transmit output at all, the other had abnormally high transmit current; separate receive and transmit transistors and tuned circuits; only transceivers which used six penlite cells; both units had relatively high receive current; schematic on instruction sheet.

As noted previously, field-tests of units in receive mode were complicated by countless CB signals, as well as by skip interference from code, teletype, short-wave phone and other signals. Thus, our tests were not really reliable in evaluating operation for most of the units at more than about 200 ft. range.

We concluded that, even as toys, super-regens are of extremely limited value except under ideal conditions. And we can't imagine where you could find such conditions. We feel it's worthwhile to spend a few extra dollars for even the simplest superhet. And beware of high transistor count and low price. If you can possibly do so, check both transmit and receive operation before buying. Also check the batteries packed with most sets.

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January, 1968
One of the best antennas for 6- and 2-meter hams is the quarter-wave ground plane. It is cheap and can be built easily from junk-box parts. And it is ideal for those SWLs who monitor aircraft and police calls in the 108-174-mc range.

The heart of the antenna is an Amphenol Type 83-1R (SO-239) chassis-mount coax connector, available from electronic parts distributors for about 50¢. The only other material you will need is heavy copper wire. If you haven’t any of this use coat hangers. But be sure you can solder to the wire before you waste time cutting it to length. Clean the wire thoroughly with steel wool or emery cloth before applying solder to it.

First thing to do is decide what frequency you want to construct the antenna for. Let’s say it is 52 mc. Using the formula, \[ \text{length (in inches)} = \frac{2808}{\text{frequency (mc)}} \], you get an answer of 54 in. This is the length you should cut five pieces of wire. Suppose you want to design the antenna for 118 mc (around the middle of the aircraft band). Using the formula again, we get \( \frac{2808}{118} \), which equals 23.7 in. For middle of the 2-meter ham band you would divide 2808 by 146. This answer is 19.2 in.

Next thing to do is solder one piece of wire in the center lug of the connector. Then attach four heavy solder lugs to the corners of the connector so when you look down on them the center lines of diagonally-opposite lugs are on a straight line (90° between lugs). Be sure to use lockwashers so the lugs won’t move. Put the remaining pieces of wire in each lug, crimp the lug and apply solder generously. Then bend each of the elements down 45°. This angle is somewhat critical. Change it to, say, about 35° and you’ll change the antenna’s impedance to 50 ohms.

Last thing to do is to make a small mounting bracket. Ours was made from a 5 x 1-in. piece of scrap aluminum. Drill a \( \frac{3}{8} \)-in.-dia. hole at one end for the connector, then bend that end 90°. Attach the bracket to a strong piece of wood, such as a 1 x 2, then fasten the wood to the highest point you can reach on your roof. Be sure the antenna is mounted so the drooping radial arms are away from metal, such as gutters. This is important because nearby metal will detune the antenna.

The feedline to use is 73-ohm coax, such as RG59/U; terminate it with a PL-259 connector to match the SO-239 connector.

—Stephen E. Maziarz

Electronics Illustrated
Incentive Licensing is Back

Continued from page 83

charts and the Novices' loss of 2-meter phone, all other ham bands remain exactly as they are right now. The original proposal to create special incentive sections on 2 meters has been scrapped.

At 12:01 on the morning of November 22, 1969, the full impact of the new rules will be felt. Most affected parties will be those remaining Generals who have not passed higher class exams. They will be cut to one half of the present low-band DX phone bands and lose a significant chunk of the hot CW frequencies.

And what about class-coded call-signs in all this? Nary a word. The concept had threatened to split amateur radio once and for all by isolating hams into opposing camps. Thousands of hams renounced membership in the ARRL because of their role in proposing special calls and went over to Wayne Green's newly-formed IoAR (Institute of Amateur Radio).

What Does electronics Mean To You?

As you know, this is the "electronics age." And electronics technology is changing so rapidly that the average technician's store of knowledge is highly obsolescent. He must get more education or get out of this field! He must understand fundamental principles and concepts. Only on the basis of such understanding can he easily adapt to the swift changes now occurring.

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But the FCC claims that hams can be relied on to police themselves in keeping unqualified operators off the limited-use frequencies. And so the present calls will stay. (Unofficially, the publishers of Radio Amateurs' Callbook have let it be known that they will help by adding the license class to future U.S. listings. If it does nothing else, the move is going to embarrass the Technicians who have been posing as Generals.)

From a business standpoint, the industry generally feels that after an initial slowdown (beginning right about now) has been weathered, sales of ham gear will rise to dizzy heights. The ham press solidly backs the rule-making—if for no other reason than because there finally is a decision.

For just about everybody involved, the new rules constitute a program that is not quite what they wanted but is, at least, shorn of the most offensive elements of the earlier proposal. It is, in other words, a compromise. How good a compromise remains to be seen. Even the FCC hedges to the extent of saying they may revise special frequency allocations depending on how much use they get.

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not lose sight of the business implications of what you're doing. This is not a time for puttering; nor is it a time for leaving well enough alone. You must find everything that needs fixing in the set and find it quickly. Otherwise the bill will not be large enough to pay for the time you have spent.

So it is absolutely necessary to get training that includes salesmanship, retail merchandising, bookkeeping and administration. Without this type of training you can never be more than a successful troubleshooter.

And don't forget (silly though it may sound at first) physical fitness. When you find yourself replacing a Nuvistor at the top of a 15-ft. tower in a cold drizzle or lugging a 200-lb. color TV up three flights of stairs you'll know what I mean. These physically-demanding jobs are part of the regular routine. You can't be adverse to sweating and getting your hands dirty. Troubleshooting is no desk job.

Let's see what an actual job might be like for an outside TV repair man. You are given a route of four calls to start off a rainy day.

The first call is in a trailer park. You slosh through some mud to get to the right trailer. The gentleman who admits you has a 23-in. B&W with sound but no brightness. A look at the tubes reveals that the damper tube is out cold. You change it. Brightness returns but the picture is shrunk and washed out.

The customer says, "It never looked like that before. What did you do to it?"

You replace four more tubes and each replacement does more to restore the picture until the set is playing like new. You write up the bill. It's over $20. The customer moans, "I never expected it to be that much!" However, he pays you and you go on back out into the rain.

The next call is in a small apartment house with no elevator—and the set owner lives on the fourth floor.

You puff up with tube caddy in hand and knock on the door. An older woman opens the door, apologizes for not having her teeth in and takes you into the bedroom. There are about ten cats on the bed and the room smells. The TV is 21-in. table model about five years old, mounted in the wall. The picture is shrunk in on the sides. You extricate it from its perch, place it on the floor, get down on your hands and knees and begin testing tubes. They are good and you decide the TV will have to be repaired on the bench.

You advise the customer and she gives you the okay to take the set to the shop. Now you begin to work. It takes two trips before the TV and your equipment are in the truck.

The next call is a mansion. A well-groomed woman ushers you to a paneled den and turns on the TV. There is snow in the picture. You substitute your rabbit-ear antenna for the outdoor-antenna lead-in. The snow clears. This indicates the trouble is not in the TV but in the antenna system. You climb out a second-story window onto a porch roof. The antenna is mounted atop a chimney and you see that the twinlead has come loose from the antenna. You become a combination monkey and steeple jack and reattach the wire. You charge $7.50 extra for the 15 minutes of dangerous work.

The fourth call is in a modest ranch-style home. The TV is a two-year-old color set. There is no light on the screen. You've run into this trouble many times before. You remove the back, change the 3A3, the 6JE6...
Now let's suppose you are the bench man. You arrive at work in the morning and find about 20 TVs and radios awaiting your expert presence.

You begin on a 19-in. portable with a suspected flyback. You attach your flyback tester and the meter indicates a short. Just then the phone rings. The dispatcher answers and yells over to you, "How is Mrs. Jones' TV?" It's one you finished yesterday. You answer, "All done." You pull a replacement flyback off the shelf. The phone rings again and is answered again. You keep on working and hear a customer come in the front door. The dispatcher waits on the counter. Meanwhile you are wiring in the new flyback. The dispatcher yells back, "What's a replacement for a 6EA8?" You answer, "A 6U8."

And so it goes. You must work with one ear tuned to your assistant who answers the phone, waits on the counter and countless other things.

That's a quick glance look at the career. It can be wild, hectic and profitable. It's certainly never dull and in my view it's great. You feel wanted, even needed, and at a premium all the time.

The only sour notes are the individuals who get into this business strictly for a fast buck without any real liking for electronics. Naturally everyone wants to earn as much money as possible but you must do it ethically or society descends upon you.

Every few years TV repair is singled out by a magazine or newspaper for an exposé. During the publicity, every unhappy customer you get runs to the Better Business Bureau with a complaint. All you have to do is answer the complaints and settle the situation fairly. In fact, when you do answer complaints in this way you build a reputation. For if a wary customer calls the BBB to inquire about you they'll say, "There are no unanswered complaints." That in itself is a recommendation.

You can't be too sensitive about complaints. Every business large or small is plagued by them. It's part of being in business. Just do the job right and ethically and your recommendations will swamp any complaints.
Notes from EI’s DX Club

THE ARRL has refused to credit the DXpedition of W9WNV and K11MP to Navassa Island (among other places). Since their presence on the island is not disputed, however, the EI DX Award rules will count K11MP/KC4 QSLs as Navassa.

During the new Award Period, announced elsewhere in this issue, remember that R. Nederland’s transmission to North America on 9590 kc at 2030-2120 EST is actually carried by a Trans World Radio transmitter at Bonaire, Netherlands Antilles. It therefore counts as South America—not Netherlands (Europe). This was the most common mistake during the last Award Period.

And correcting the second-most-common mistake, R. Moscow counts as European Russia unless you actually can prove the transmitter you heard was located elsewhere. Meanwhile, R. Eriven (Armenian S.S.R.) has a new transmission for the West Coast of North America every Wednesday, Thursday, Saturday and Sunday in Armenian and English at 2130-2230 EST (1830-1930 PST). Frequencies are the same as those R. Moscow uses for the West Coast. For both, the transmitters are located in Siberia (Asia) and QSLs will be credited as such.

Bob Conder (North Carolina) reports that R. Nacional de Columbia (4955 kc and other frequencies) has an interval ID consisting of three loud beats on a gong and chimes.

TIRICA (La Voz de La Victor) at San Jose, Costa Rica, has returned to the international bands. William Sparks (California) has noted strong signals on 9615 kc around midnight EST (2100 PST). This one also is heard often at 625 kc on the BCB.

R. Pyongyang, North Korea, now is using an off-band channel at 16028 kc for Spanish transmissions to Latin America around 1825 EST.

Bob LaRose (New York) reports that R. Nigeria has been testing in the 13- and 16-meter bands. Frequencies noted at 1700 EST include 21455, 21690 and 17805 kc. Tests are conducted in cooperation with Nigerian External Telecommunications, Ltd., which provides test tapes. The new transmitter reported on 4932 kc (sign-on at midnight EST) is a Midwest regional relay at Benin.

R. Togo has moved to 90 meters where they have surprisingly good signals at 0030 EST (2130 PST) sign-on. Frequency for this one is 3220 kc. They will have a lower-power transmitter on the old 5047-kc channel.

Seems YVQE (4860 kc) uses two different IDs. They call themselves both R. Mundo and R. Maracaibo. Sign-off is at 2300 EST.

What may be the V. of Kenya’s new high-power transmitter is being heard on 4915 at 2230 sign-on preceded by a flute interval signal.

The many protests received by the VOA following its announcement that QSLs no longer would be sent to U.S. residents seem to have been effective. Americans once again are treated like everyone else.

Look for R. Exitos, Santiago, Dominican Republic, on 3365 kc until midnight sign-off. As a new station, it may give special attention to reception reports.

Charles Milhans (Washington) reports reception of R. Nepal on 7105 kc at 0530 PST. According to R. Sweden, this may be a new high-power transmitter.

Propagation: Daytime conditions will continue good to excellent throughout the forecast period, with DX openings possible from 15 to 28 mc. The 10- and 11-meter bands (ham and CB) will remain open and the seldom-used 25.1- to 26.1-mc international SW band (principally used by the BBC and VOA) will be open from early morning to around midday, local time.

At night, DX will be possible from 6 to 15 mc over paths passing through the southern hemisphere, with best DX below 11 mc. BCB DX will also be good to very good during night hours with frequent openings from Europe throughout the period.
AMATEUR RADIO


HALICRAFTERS HT-9 transmitter. Will swap for ham gear. Mike Gipe, WA3GAU, 1120 Green Acre Rd., Towson, Md. 21204.

HAMMARLUND HQ-145 general-coverage receiver. Will swap for Eico 753 SSB transceiver, power supply or similar. Russ Stein, W5PYY, 1600 S. Eudora St., Denver, Colo. 80222.

CODE-PRACTICE SET. Will swap for best offer. T. G. Ireland, 79 Short Beach Rd., Branford, Conn. 06405.


GLOBE Scout 680 transmitter. Will swap for VHF gear or best offer. Bruce Hildebrand, 6090 Upland Te, Seattle, Wash. 98118.


SHORT-WAVE LISTENING

HALICRAFTERS S-200 receiver. Will swap for 30-mc receiver, tape recorder or best offer. T. G. Williams, 3120 Waco St., Memphis, Tenn. 38114.

KNIGHT Span Master receiver, headphones. Will trade for Knight R-55A or Heath GR-54. Lyle Kruchenberg, RR 2, Hazen, N.D. 58545.

LAFAYETTE HE-200. Will swap for Hallicrafters SX-100 or similar, Mike Hollis, WNN4GE, 2127 Hemlock Cir., RT. 7, Russellville, Ala. 35653.

SURPLUS BC-454 receiver, power supply. Make swap offer. Tommy Quertermous, RR 1, Great Springs, Ill. 62922.


KNIGHT R-55A receiver. Will swap for signal generator or capacitor checker. Dan Shely, 2208 Fiesta Dr., Troy, Ohio 45373.

HALICRAFTERS S-20R. Will swap for Heath TwoG or other 2-meter gear. William L. Bundy, WNRMH, 223 E. 19th St., Lork, Nebr. 68467.

KNIGHT Star Roamer. Will trade for CB transceiver or R/C gear. J. E. Downey, 7832 Sunset Dr., Elmwood Park, Ill. 60635.

HALICRAFTERS S-120. Want novice transmitter or amateur band receiver. Mike Mochizuki, 2365A Palolo Ave., Honolulu, Hawaii 96816.

KNIGHT Star Roamer. Want PA amplifier, 35-70 watts. L. Lindenbaum, 10320 Haywood Dr., Silver Spring, Md. 20902.


HEATH GR-64 with Q-multiplier. Want Lafayette HA-350 or Heath HR-10. Kevin J. Hansen, Fleming Rd., Aitkin, Minn. 56431.


SURPLUS BC-348Q receiver. Will trade for Hammarlund HQ-100AC or Drake SW-4. Gerald Aro, 2480 Rolling View Dr., Smyrna, Ga. 30080.

HALICRAFTERS S-20R receiver. Will swap for ham transmitter. W. C. Small, 2F University Ter., Columbus, Mo. 65201.

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"They wouldn't have caught me if I hadn't sold $4,300 worth of commercials."
Swap Shop

Continued from page 111

AUDIO & HI-FI
BOGEN MU-15A PA amplifier, mike. Will swap for stereo tape recorder. Dennis Adam, 657 Stewart Ct., Whiting, Ind. 46394.
THREE-WAY co-ax speakers, 12-in. Will swap for signal generator or ham gear. Bill Lee, 218 Sergeant, Joplin, Mo. 64801.
STEREO recorder, 4-track. Will swap for Lafayette or Lettine 6-meter ham gear. Vincent R. Manzione, 23 Lawrence St., Youngers, N.Y.
ROBINS VU meters, brand new. Will swap for U.S.-made microphone or snare drum with cymbal. Kelly Quan, 1249 Green St., San Francisco, Calif. 94109.
EICO RP-100 stereo tape deck. Make swap offer. R. Smucker, Box 42, Huntingdon, Pa. 16652.
AMPRO 731 stereo tape recorder. Will swap for ham gear of SW receiver with BFO. Michael A. Lee, 272 Fairbonn Rd., N.W., Atlanta, Ga. 30331.
REALISTIC Four record changer. Will swap for best offer. J. S. Collins, 2307 Lacinda, Perry, Iowa 50226.
ELECTRO-VOICE 600D dynamic microphone. Will swap for centrifugal clutch for 1/2-in. shaft. Bobby Ross, Jr., 1609 Acadia St., Durham, N.C. 27701.

CITIZENS BAND
FANON FCB-3 walkie-talkie, Will trade for transistor tape recorder or best offer. Richard Crutcher, Box 1, Chapel Hill, Tenn. 37034.
LAFAYETTE HA-70C walkie-talkie. Want Hallcrafters 5-53 or National NC-33 receiver. J. Dean, 406 49th St., New Orleans, La. 70124.
KNIGHT Ten-2 CB tester. Will trade for 1-watt walkie-talkie (Heath GW-52, Knight KN-400A or similar). Clarence A. Nelson, Rt. 2, Owensboro, Ky. 42301.
LLOYDS 100-mw walkie-talkie. Will swap for 40-meter crystal. Ricky Miller, RR 1, Box 267, Tripoli, Iowa 50676.
MIDLAND walkie-talkie. Will swap for SW receiver or best offer. Charles T. Smith, 211 Lewis Ave., Lawrenceville, Ill. 62439.

OTHER EQUIPMENT
AUDEL Electric Library, eleven volumes. Will trade for Hallcrafters SW receiver or similar. Vernon Kemplin, RR 2, Mansfield, Ill. 61854.
KNIGHT coil and flyback checker. Will swap for CB ham gear or best offer. Hershel Harmon, RR 1, Paris, Miss. 38949.
SURPLUS telephone carrier amplifier. Will swap for VTVM or cartridge tape recorder. Donald Forel, 805 N. Bradford Ave., Tampa, Fla. 33609.
LEATH VVM. Want 25-watt PA and wide-range audio generator. Roy A. Babylon, 558 Dexter Ave., Mobile, Ala. 36604.
RF PLASMA TORCH, power supply. Will trade for infrared snooper, test gear or best offer. Edward A. Miller, Jr., 12010 Telegraph, S. Rockwood, Mich. 48179.
LAFAYETTE MPI-6 intercom. Will swap for amplifier, 25 watts or more. Thomas Gailetto, 104 Panorama Way, Los Gatos, Calif. 95030.
BALDWIN type C polarized headphones. Will trade for VOM or SW receiver. D. Landesberg, 179 Marcy Ave., Brooklyn, N.Y. 11211.
HEATH Q-multiplier. Want SW preamp or best offer. Brad Swaney, 2118 H. St., Belleville, Kan. 66935.

January, 1968

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LEGAL EYE... No, it's not a new Perry Mason series. This is a real-life courtroom in Akron, Ohio, where court officials are trying out a plan to allow professional men (doctors, for instance) to give their expert testimony in advance of a trial, saving them the delays of court procedure. The closed-circuit TV equipment, set up by Olson Electronics, will be used to make test recording for evaluation by Bar Association and court officials.

Electronics in the News

In Depth... The stereopticon is back—but now it's been computerized. Geometric model, stored in the memory unit of this IBM System/360 at Brown University, produces visual display representing the subject from two slightly different viewpoints—one for each eye. The figure can be moved back and forth, up and down or revolved. Buttons control motion, the device in programmer's right hand makes changes in the object being represented.
Hideout... Harman-Kardon calls it an environment simulator. (Aw, come on, fellas!) You also could call it a cop-out coop wired for stereo. Or ducted for stereo, since the built-in speakers that provide stereo sound for its environment are located under the chair and horn-coupled to ports at ear level. Level controls and stereo separation (blend) control are located on the chair, fed by a stock H-K compact music system (at the left). It's not the first stereo chair but it's certainly the most enveloping to date. (Price for chair and ottoman is $995. Music system and its pedestal are extra.)

IR Eye... RCA is working on a walking stick that will use low-energy pulsed infrared solid-state lasers to tell the blind what lies ahead. Pulses from the two lasers are diffused by smooth ground and scattered back to photocells in the cane, keyed to the frequencies of the lasers by narrow-band filters. When an obstruction or a hole falls in the path of the laser the photocell no longer picks up the scattered infrared. When this happens, vibrating projections (one for each laser) under user's hand stop moving. Problems caused by obstructions too far to the side or too high to come within narrow laser beams remain to be solved.
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LAFAYETTE mechanical filter. Want Q-multiplier. Forrest Holland, Rt. 2, Effingham, Ill. 62401.

EICO 720. Want oscilloscope, sweep generator. O. D. Scarbrough, 708 Paulin Ave., Calexico, Calif. 92231.


HEATH HG-10 VFO. Will swap for Heath Twoer or antenna rotator. Mike Baugh, W4JEKQ, Box 191, Roy, Utah 84067.

TELEVISION service equipment. Will swap for Garrard changer. C. A. Lougee, 38 Main St., Frances-town, N.H. 03043.

SUPRO Guitar amplifier. Will swap for quality microphone or best offer. G. Horton, 1403 15th Ave. SE, Decatur, Ala. 35601.

MARINE RADIO TELEPHONE. Will exchange for CB ham or other electronic gear. Les Zoltan, 4097 MacKenzie St., Montreal 26, Que., Canada.

KNIGHT VTVM. Will swap for SW receiver. John W. Rater, Fontanello, Iowa 50846.


HEATH IT-10 transistor/diode tester. Will swap for Knight LC-1 code oscillator or similar. Mike Wierzbskowi, 31 Francis St., Cheektowlava, N.Y. 14212.

TESLA COIL, 10,000-V RF output. Will swap for Knight Star Roamer, Heath GR-64 or Heath Sixer. Mark Gutekunst, W43HMW, 27 Rorer Ave., Hatboro, Pa. 19040.

HOME-BREW 35-watt guitar amplifier. Make swap offer. Larry Finley, WB60FR, 197 Cherry Ave., Porterville, Calif. 93257.

METAL LOCATOR, transistorized. Will swap for tape recorder or best offer. Terry Ensminger, 444 Belknap Pl., Kechuk, Iowa 52632.

ASSORTED TUBES. Will swap for 7199, 6AK6 6U8 tubes or best offer. Gordo Stewart, 346 Old Willets Path, Smithtown, N.Y. 11787.

INDUSTRIAL relays, mountings. Will swap for Sony 900A tape recorder or best offer. James Williams III, RD 1, Spring Grove, Pa. 17362.


EICO 324 signal generator. Make swap offer. Tadd Bueb, 126 Navarra Dr., Santa Cruz, Calif. 95060...

Continued from page 40

Electronic Voicing

halves its frequency (octave lower).

As we did not have a service manual for the Multi-Vider, we were unable to analyze its circuit. We would venture a guess that the principle of operation is similar. To produce the octave above the note being played, there would be a filter circuit whose harmonic output (an octave above) is also fed to the amplifier.

The waveshape of the higher or lower tones is not the same as the waveshape produced by the instrument. On the third page of this article we have oscillograph photos which show waveforms produced by the instruments alone and the synthesized tones.
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